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Networked Security in the Western Pacific: A Web Without a Spider?

by

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Synopsis

The pursuit by the United States military and its allies of network-centric operations and the resulting 'effects-based' approach to warfighting drives the growth and expansion of the physical digital information infrastructure network that is its critical enabler. The thesis argues, drawing on 'actor-network theory', that such physical infrastructure is best understood as a co-actant in a material-semiotic actor-network which has grown and evolved to become durable relationally as co-actants. Network semiotics refers to the meanings associated with the digital and networked age, networked operations and effects-based warfare, and 'networked security'. These meanings circulate around the material-semiotic actor-network as referents which are consumed, altered, and reused. The thesis argues that since the end of the Cold War in the Western Pacific, the structural evolution of this actor-network among the US and its major allies Japan and Australia exhibits the 'hub' features of a 'scale-free network' model. These are exhibited via inscriptions which identify circulating networked security references within the material-semiotic actor-network; these are growth, preferential attachment, competition for fitness connectivity product, and the structural formation of network hubs. These network hubs, in turn it is argued, present situated and co-productive agents, understood in the discipline of International Relations (IR) to be state actors, with an altered set of incentives and constraints compared with particular reductive, anthropocentric structural perspectives informing the IR tradition of structural realism. The thesis concludes that a model of network-centric operations as a material-semiotic actor-network offers academics and policy makers a new critical perspective and tool set with which to develop explanations

and predictions of strategic dynamics in East Asia driven increasingly by the pursuit of 'effects -based' network-centric operations.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed _____

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Abbreviations

A2/AD	Anti-access/Area denial
ADF	Australian Defence Force
ADIZ	Air Defence Identification Zone
AEWAC	Aerial Early Warning and Control
ASAT	Anti-satellite
ASB	Air-Sea Battle
ASEAN	Association of South-East Asian Nations
ASW	Anti-Submarine Warfare
AUSMIN	Australia-United States Ministerial Consultations
BMD	Ballistic-Missile Defence
C4	Command, control, computers, communications
CCP	Chinese Communist Party
CEC	Cooperative Engagement Capability
CPGS	Conventional Prompt Global Strike
CSL	Cooperative Security Location
DARPA	Defense Advanced Research Projects Agency
DBK	Dominant Battlespace Knowledge
DoD	US Department of Defense
EEZ	Exclusive Economic Zone
FONOP	Freedom of Navigation Operation
FOS	Forward Operating Site
FPDA	Five Power Defence Arrangements
GIG	Global Information Grid
GPR	Global Posture Review
GVC	Global Value Chain

ICBM	Intercontinental Ballistic Missile
ICT	Information and communication technology
ISR	Intelligence, Surveillance, Reconnaissance
JAXA	Japan Aerospace Exploration Agency
JSDF	Japanese Self-Defense Force
JSF	Joint Strike Fighter
MRC	Major regional contingency
MTR	Military-technical revolution
NCW	Network-centric Warfare
NIFC-CA	Naval Integrated Fire Control-Counter Air
OODA loop	Observe, Orient, Decide, Act
PLA	People's Liberation Army
QDR	Quadrennial Defense Review
RMA	Revolution in Military Affairs
SCS	South China Sea
SIPRNET	Secure Internet Protocol Router Network
SLOC	Sea-line of communication
SOFA	Status of Forces Agreement
SSA	Space Situational Awareness
SSBN	Nuclear powered ballistic missile submarine
SSN	Nuclear powered submarine
UAV	Unmanned Aerial Vehicle

Island chains

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Introduction

This thesis argues that the evolution of the security system of the Western Pacific[1], if understood from an actor-network approach, has developed structural features consistent with those of a scale-free network model. It aims to show that the incorporation of digital networking technologies into the military affairs of the United States and its key pacific allies in Japan and Australia over the past three decades has driven this shift. The actor-network approach allows for a flattened ontology, which enables the incorporation of these technologies to be understood as shifts in the processual relations of people and their environments, rather than merely instrumentally. States in the context of traditional IR theory are actors in these processual relations whose circumstances have been fundamentally altered by the onset of the digital age – a dynamic yet to be adequately understood. The thesis aims to contribute a probationary framework to remedy this, drawing on Actor-Network Theory and formal network theory to develop a theory of networked security.

[1] To be understood as interchangeable with maritime East Asia and incorporating the sub-regions of North-East and South-East Asia, inclusive of Oceania and the Eastern Indian Ocean. Literature on the topic is extensive, for example see Aaron L. Friedberg, *A Contest for Supremacy: China, America, and the Struggle for Mastery in Asia* (WW Norton & Company, 2011); Michael D. Swaine, *America's Challenge: Engaging a Rising China in the Twenty-First Century* (Carnegie Endowment, 2011); Rosemary Foot and Andrew Walter, *China, the United States, and Global Order* (Cambridge University Press, 2011); Lyle J. Goldstein, *Meeting China Halfway: How to Defuse the Emerging US-China Rivalry* (Georgetown University Press, 2015); Jeffrey A. Bader, *Obama and China's Rise: An Insider's Account of America's Asia Strategy* (Brookings Institution Press, 2013); Toshi Yoshihara and James Holmes, *Red Star Over the Pacific: China's Rise and the Challenge to U.S. Maritime Strategy* (Naval Institute Press, 2011); James Steinberg and Michael E. O`Hanlon, *Strategic Reassurance and Resolve: U.S.-China Relations in the Twenty-First Century* (Princeton, New Jersey: Princeton University Press, 2014); Hugh White, *The China Choice: Why America Should Share Power* (Black Inc., 2012), http://www.amazon.com/The-China-Choice-Hugh-White/dp/1863955623; Edward N. Luttwak, *The Rise of China vs. the Logic of Strategy* (Harvard University Press, 2012); Zalmay Khalilzad et al., *The United States and Asia: Toward a New US Strategy and Force Posture* (Rand Corporation, 2001), http://www.dtic.mil/dtic/tr/fulltext/u2/a391864.pdf.

John Law defines actor-network theory (ANT) as 'a disparate family of material-semiotic tools, sensibilities and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located.'[2] In network theory, the scale-free model was developed by Albert-László Barabási, who described a structure found within the network known colloquially as a 'web without a spider', or a set of organising principles hosted by systems of a certain type that evolve in accordance with those principles without design or intervention.[3]

Application of an actor-network approach and identification of 'scale free structures' in US security systems departs from 'traditional' IR and strategic studies. The thesis explores the possibilities of a non-anthropocentric IR, where humans and non-humans, or 'actants', interact in a network and take the form they do as a result of their interactions. An actor-network approach simultaneously maps relationships between things (material) and concepts (semiotics). The thesis introduces the term 'networked security', by which is meant freedom from or resilience to potential harm from external forces which derive from the 'value centrality' and position of nodes in non-static, material-semiotic network structures. When this candidature began in 2013 the growing number of science disciplines working broadly with 'network theory' applications had made only a niche contribution to the Discipline of International Relations (IR). Scholars in sociology and economics made fascinating use of the insights of network theory which are, it is argued, of potential interest to IR, as did complexity and systems theorists, physicists and mathematicians.[4] But a gap

[2] John Law, "Actor Network Theory and Material Semiotics," in *The New Blackwell Companion to Social Theory* (John Wiley & Sons, 2009), 141–59.
[3] Albert-László Barabási, *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life* (Plume, 2003).
[4] Jacqueline Best and William Walters, "'Actor-Network Theory' and International Relationality: Lost (and Found) in Translation," *International Political Sociology* 7, no. 3 (2013), https://academic.oup.com/ips/article-abstract/7/3/332/1866441; Stuart Koschade, "A Social Network Analysis of Jemaah Islamiyah: The Applications

existed in the literature regarding a subject that intrigued me: If we apply an 'actor-network' approach to IR, how do the fundamentally distinct structural features of a scale-free network model change the way we describe the evolving US security system in the Western Pacific? [5]

My first inroads into network theory as a post-graduate student were in military affairs. It was clear that though strategic thinkers during the 2000s, led invariably by the US, were immersed deeply in leveraging the structural power of networks, much of the literature in the public domain focused almost exclusively on tactical and operational issues, often with a

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to Counterterrorism and Intelligence," *Studies in Conflict & Terrorism* 29, no. 6 (2006): 559–575; Marlene E. Burkhardt and Daniel J. Brass, "Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power," *Administrative Science Quarterly*, Special Issue: Technology,Organizations, and Innovation, 35, no. 1 (March 1990): 104–27; James E. Rauch, "Does Network Theory Connect to the Rest of Us? A Review of Matthew O. Jackson's Social and Economic Networks," *Journal of Economic Literature* 48, no. 4 (December 2010): 980–86, http://dx.doi.org/10.1257/jel.48.4.980; James R. Golden, "Economics and National Strategy: Convergence, Global Networks, and Cooperative Competition," *The Washington Quarterly* 16, no. 3 (1993): 88–113; Emilie Marie Hafner-Burton and Alexander H. Montgomery, "Globalization and the Social Power Politics of International Economic Networks," *Available at SSRN 1306648*, 2008, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1306648; Austin R. Benson, David F. Gleich, and Jure Leskovec, "Higher-Order Organization of Complex Networks," *Science* 353, no. 6295 (July 8, 2016): 163–66, https://doi.org/10.1126/science.aad9029; Roger J. Nemeth and David A. Smith, "International Trade and World-System Structure: A Multiple Network Analysis," *Review (Fernand Braudel Center)* 8, no. 4 (1985): 517–560; Michael D. Ward, Katherine Stovel, and Audrey Sacks, "Network Analysis and Political Science," *Annual Review of Political Science* 14, no. 1 (2011): 245–64, https://doi.org/10.1146/annurev.polisci.12.040907.115949; Moira V. Faul, "Networks and Power: Why Networks Are Hierarchical Not Flat and What Can Be Done About It," *Global Policy*, December 1, 2015, https://doi.org/10.1111/1758-5899.12270.

[5] Thucydides, *History of the Peloponnesian War*, ed. M. I. Finley, trans. Rex Warner, Revised edition (Harmondsworth, Eng., Baltimore: Penguin Classics, 1972); S. A. Lloyd, *Hobbes Today: Insights for the 21st Century* (Cambridge University Press, 2013); John H. Herz, *Political Realism and Political Idealism: A Study in Theories and Realities* (University of Chicago Press, 1951); Jack Donnelly, "Realism," in *Theories of International Relations*, 5th ed. (Palgrave Macmillan, 2013), 32–56; William A. Callahan, "Remembering the Future — Utopia, Empire, and Harmony in 21st-Century International Theory," *European Journal of International Relations* 10, no. 4 (December 1, 2004): 569–601, https://doi.org/10.1177/1354066104047849; Ken Booth, Michael Cox, and Tim Dunne, *The Eighty Years' Crisis: International Relations 1919-1999* (Cambridge University Press, 1998); Tim Dunne, Lene Hansen, and Colin Wight, "The End of International Relations Theory?," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 405–25, https://doi.org/10.1177/1354066113495485; Peter Hopkirk, *The Great Game: The Struggle for Empire in Central Asia* (Kodansha International, 1994); Reinhold Niebuhr, *The Structure of Nations and Empires: A Study of the Recurring Patterns and Problems of the Political Order in Relation to the Unique Problems of the Nuclear Age* (Scribner, 1959); Andrew Phillips, "War, Religion and Empire: The Transformation of International Orders" 17 (2011), http://espace.library.uq.edu.au/view/UQ:258376.

distinctly technical focus.[6] The resulting Network-Centric Warfare was an outgrowth of a philosophical and doctrinal shift from 'attrition-based' to 'effects-based' models of military conflict. Of the key progenitors of effects-based warfare and the quest to leverage its effects at a strategic level, the influence of John Boyd's body of unpublished work was unrivalled.[7] His vision of the timely and surgical delivery of effects aimed squarely at causing the de-cohesion of systems required networks of connected capabilities. Many of Boyd's tenets later found their way into non-military disciplines such as organisational and business strategy, litigation, and law enforcement. Nonetheless, connections between Boyd's work and thinking about the structural features of networks, and pathways connecting to traditional thinking about structure in IR, were indistinct. IR and security studies treated technology as either instrumentalist or essentialist binary opposites. As a researcher I felt there was a blockage, rather than a gap, in the IR and security studies literature which I thought was worth exploring further by treating the technological as an actant in an evolving Western Pacific security order described as a material-semiotic relationship. .

[6] See for example Paul T. Mitchell, *Network Centric Warfare: Coalition Operations in the Age of US Military Primacy* (Routledge, 2006); Paul T. Mitchell, *Network Centric Warfare and Coalition Operations: The New Military Operating System* (Routledge, 2009); Paul T. Mitchell, "Small Navies and Network-Centric Warfare: Is There a Role?," *Naval War College Review* 56, no. 2 (2003): 83–99; David S. Alberts et al., *Understanding Information Age Warfare*, n.d.; Arthur K. Cebrowski, "The Implementation of Network-Centric Warfare," *Office of Force Transformation, Department of Defense*, 2005; David S. Alberts and Richard E. Hayes, "Power to the Edge: Command and Control in the Information Age" (DTIC Document, 2003), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA457861; Vice Admiral Arthur K. Cebrowski and John J. Garstka, "Network-Centric Warfare - Its Origin and Future," U.S. Naval Institute, 1998, http://www.usni.org/magazines/proceedings/1998-01/network-centric-warfare-its-origin-and-future; John J. Garstka, "Network Centric Warfare: An Overview of Emerging Theory," *Phalanx* 33, no. 4 (2000): 1–33; Joseph M. Ladymon, "Network Centric Warfare and Its Function in the Realm of Interoperability," *Acquisition Review Quarterly*, 2001, 115; Carlo Kopp, *NCW101: An Introduction to Network Centric Warfare* (Air Power Australia, 2008), http://www.ausairpower.net/NCW101-First-Ed-2009.html.

[7] Boyd's unpublished work available at http://dnipogo.org/john-r-boyd/. For discussion and analysis of Boyd's influence see Ian Brown, "Opening the Loop: A Look inside the Mind of John Boyd," *Marine Corps Gazette*, June 2015, https://www.mcafdn.org/gazette/2015/06/opening-loop; Grant Hammond, *The Mind of War: John Boyd and American Security* (Smithsonian Institution, 2012); Frans P. B. Osinga, *Science, Strategy and War: The Strategic Theory of John Boyd* (Routledge, 2007).

I identified the effects of treating the technological as a 'social actor' as the 'circulating reference' of assemblages associated with 'networked security', offering a depiction of the structure of the system's evolution. My intellectual exchanges between traditional strategic studies in IR and the actor-network approach was contextualised by growing strategic rivalry between China and the US from the late 2000s, which galvanized the attention of strategic and security studies communities in Asia.[8] A more sanguine outlook during the early 2000s seemed to be giving way to something more foreboding at the end of the decade.[9] While militaries fixated on the East Asian littorals spoke of a 'battle of networks' in their operational concepts, US diplomats and officials spoke of a network of alliances and partnerships to accommodate China's rise.[10] Perhaps because of these contexts, the term

[8] Andrew Tan, "East Asia's Military Transformation: The Revolution in Military Affairs and Its Problems," *Security Challenges* 7, no. 3 (Spring 2011): 71–94; Richard A. Bitzinger and Haris Vlavianos, eds., *Emerging Critical Technologies and Security in the Asia-Pacific*, 1st ed. (UK: Palgrave Macmillan, 2016); Richard A. Bitzinger, "Come the Revolution: Transforming the Asia-Pacific's Militaries" (DTIC Document, 2005), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA521122; Aaron L. Friedberg, "Ripe for Rivalry: Prospects for Peace in a Multipolar Asia," *International Security*, 1993, 5–33; Ashley J. Tellis, Alison Szalwinski, and Michael Wills, *Strategic Asia 2015-16: Foundations of National Power in the Asia-Pacific* (National Bureau of Asian Research, 2015); Paul Dibb, "The Revolution in Military Affairs and Asian Security," *Survival* 39, no. 4 (1997): 93–116.

[9] Peter Navarro, *Crouching Tiger: What China's Militarism Means for the World*, 1St Edition edition (Amherst, New York: Prometheus Books, 2015); Peter W. Navarro and Greg Autry, *Death by China: Confronting the Dragon - A Global Call to Action*, 1 edition (Upper Saddle River, N.J: Pearson FT Press, 2011); Alastair Iain Johnston, "Is Chinese Nationalism Rising?," *International Security* 41, no. 3 (2017): 7–43; Bernard Cole, *The Great Wall at Sea, 2nd Edition: China's Navy in the Twenty-First Century* (Naval Institute Press, 2012); James Holmes, "The Two Words That Explain China's Assertive Naval Strategy," *Foreign Policy* (blog), accessed June 15, 2015, http://foreignpolicy.com/2015/06/03/the-two-words-that-explain-chinas-naval-strategy-active-defense/; Joshua Kurlantzick, *Charm Offensive: How China's Soft Power Is Transforming the World* (Yale University Press, 2007); Barry Buzan, "China in International Society: Is 'Peaceful Rise' Possible?," *The Chinese Journal of International Politics* 3, no. 1 (March 20, 2010): 5–36, https://doi.org/10.1093/cjip/pop014; Amitav Acharya, "China's Charm Offensive in Southeast Asia," *International Herald Tribune* 8 (2003); Thomas J. Christensen, "Chinese Realpolitik," *Foreign Affairs*, 1996, 37–52; Wang Xiangsui and Qiao Liang, *Unrestricted Warfare* (Beijing: PLA Literature and Arts Publishing House, 1999).

[10] Andrew S. Erickson and Carnes Lord, "Bases for America's Asia-Pacific Rebalance," The Diplomat, accessed May 6, 2014, http://thediplomat.com/2014/05/bases-for-americas-asia-pacific-rebalance/; John F. Tanalega, "A Sling for Goliath," *Proceedings Magazine*, February 2016, http://www.usni.org/magazines/proceedings/2016-02/sling-goliath; Daniel R. McAuliffe, "Aiming Airsea Battle: An Operational Concept To Counter China's Maritime Area Denial Capabilities" (DTIC Document, 2011), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA545640; General Norton A. Schwartz and Jonathan W. Greenert, "Air-Sea Battle: Promoting Stability in an Era of Uncertainty," *The American Interest* 20 (2012): 60; Jan Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept" (Washington: Center for Strategic and Budgetary Assessments, May 2010),

'network' became either banal, as in overused and devoid of meaning, or 'black-boxed', as in used to obfuscate its potential utility. Could a different understanding of network structures using non-traditional approaches offer IR and strategic studies something new? Starting with the premise that descriptions of the generative effects of human and non-human structural relationships in networks were understood only partially by IR, the broad research aim was to find a conceptual bridge between what militaries were thinking about and doing in network security in operational terms and what scientists were discovering in network theory, which, its most general use breaks the world into information systems consisting of dynamic relationships among nodes and connections. Network theory is concerned with the growth and structural evolution of information systems. The term 'networked security' seemed to incorporate the potential cross-over as a work-in-progress concept. Late in my candidature I acquired a more definitive characterisation. At this point I explored the possibilities of Actor-Network Theory and its description of material and conceptual relations in network centric systems as 'actants'.

Given that IR scholars interested in structure are most concerned with relations between structure and agency and interactions with power, actor-network theory seemed to offer insights into the way power is transformed and translated into action as it circulates around networks among increasingly connected states, thereby changing simultaneously structures

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http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/; Toshi Yoshihara and James R. Holmes, "Asymmetric Warfare, American Style," *Proceedings Magazine*, April 2012, http://www.usni.org/magazines/proceedings/2012-04/asymmetric-warfare-american-style; Christopher J. McCarthy, "Chinese Anti-Access/Area Denial: The Evolution of Warfare in the Western Pacific," May 3, 2010; Dennis G. Scarborough, "Deterring the Dragon: Air-Sea Battle and the US-Japan Alliance" (DTIC Document, 2011), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA545431; Stephen Biddle and Ivan Oelrich, "Future Warfare in the Western Pacific: Chinese Antiaccess/Area Denial, US AirSea Battle, and Command of the Commons in East Asia," *International Security* 41, no. 1 (2016): 7–48; Robbin F. Laird, Edward Timperlake, and Richard Weitz, *Rebuilding American Military Power in the Pacific: A 21st-Century Strategy* (ABC-CLIO, 2013).

and agents, captured by the concept of 'circulating reference' introduced by Latour.[11] ANT, arguably, avoided entanglement in the agent/structure and levels of analysis problems. Combining it with insights from the more formalised network (graph) theory offered a different way of depicting incentives and constraints not captured by existing IR paradigms, particularly bargaining-based models.[12] For this the thesis draws on Barabási's immensely influential scale-free network model.[13] Its depiction of self-organising non-static structural forms whose growth and evolution are defined by how they change over time were being discovered with remarkable frequency by scientists studying both nature and the human-made world of artificial things. Scale-free networks were showing up on both micro- and macro-scales.[14] The three defining features of growth, preferential attachment, and fitness create a distinct networked structure of hubs. Much of my research prior to engaging with network theory focused on the incorporation of digital information and communication technologies in military affairs after the Cold War, with both a discursive and extra-discursive focus on the US-led alliance system in the Western Pacific, with Japan and

[11] Bruno Latour, "Circulating Reference," in *Pandora's Hope: Essays on the Reality of Science Studies* (Harvard University Press, 1999).

[12] Referring primarily to the neo-realist vs. neo-liberal debates about the structural basis of conflict and cooperation, Kenneth Neal Waltz, *Man, the State, and War: A Theoretical Analysis* (Columbia University Press, 2001); Kenneth N. Waltz, *Theory of International Politics* (McGraw-Hill, 1979); Kenneth N. Waltz, "The Emerging Structure of International Politics," *International Security* 18, no. 2 (October 1, 1993): 44–79, https://doi.org/10.2307/2539097; John J. Mearsheimer, *The Tragedy of Great Power Politics.* (WW Norton & Company, 2001); Robert Jervis, "Cooperation Under the Security Dilemma," *World Politics* 30, no. 2 (1978): 167–214, https://doi.org/10.2307/2009958; Robert M. Axelrod, *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration* (Princeton University Press, 1997); Stephen M. Walt, *The Enduring Relevance of the Realist Tradition* (W.W. Norton Company, 2002); Stephen M. Walt, *The Origins of Alliance* (Cornell University Press, 2013).

[13] Albert-Laszlo Barabasi, "Linked: How Everything Is Connected to Everything Else and What It Means," 2003, http://www.citeulike.org/group/1766/article/105595; Ginestra Bianconi and Albert-Laszlo Barabasi, "Competition and Multiscaling in Evolving Networks," *EPL (Europhysics Letters)* 54 (May 1, 2001): 436, https://doi.org/10.1209/epl/i2001-00260-6; Newman, Barabasi, and Watts, *The Structure and Dynamics of Networks*.

[14] Norman Biggs, E. Keith Lloyd, and Robin J. Wilson, *Graph Theory, 1736-1936* (Clarendon Press, 1976); Kenneth G. Wilson, "Renormalization Group and Critical Phenomena. I. Renormalization Group and the Kadanoff Scaling Picture," *Phys. Rev. B* 4 (November 1, 1971), https://doi.org/10.1103/PhysRevB.4.3174; Kenneth G. Wilson, "Renormalization Group and Critical Phenomena. II. Phase-Space Cell Analysis of Critical Behavior," *Physical Review B* 4 (November 1, 1971): 3184–3205, https://doi.org/10.1103/PhysRevB.4.3184.

Australia as its northern and southern hubs, and their partial incorporation of the concepts and materials of network-centric warfare during the 2000s.[15] What stood out in my research was the cumulative growth in the connectivity between the background digital information infrastructure and systems critical to networked military operations and the concept of effects-based warfare.[16] This led me to explore other US-centric alliance structures such as NATO, which was also a site of significant uptake of digital networked technologies related to warfare. The question was whether the thesis should focus on all US-centric alliance structures in addition to the Western Pacific. Limitations on research time and space, and

[15] Adam Cobb, "All the Way with the RMA? The Maginot Line in the Mind of Australian Strategic Planners," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), 57–80; Michael Evans, "Australia's Approach to the Revolution in Military Affairs, 1994-2004," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), 23–56; David Fulghum, "Australia's New Defense Strategy: Surveillance, Comm Links Dominate Upgrade Plan," *Aviation Week and Space Technology* 50 (August 25, 1997); Australian Defence Force, "Force 2020" (Department of Defence, 2002), http://www.defence.gov.au/publications/f2020.pdf; Australian Defence Force, "Joint Operations for the 21st Century" (Department of Defence, 2007), http://www.defence.gov.au/publications/docs/FJOC.pdf; Department of Defence, "NCW Roadmap 2009" (Commonwealth of Australia, 2009), http://www.defence.gov.au/capability/_pubs/NCW%20Roadmap%202009.pdf; Sugio Takahashi, "Counter A2/AD in Japan-US Defense Cooperation: Toward 'Allied Air-Sea Battle,'" *Project 2049 Institute*, 2012, http://indianstrategicknowledgeonline.com/web/Counter%20A2AD%20in%20Japan.pdf; Office of Strategic Studies, Defense Policy Division, Defense Policy Bureau, and Japan Defense Agency, *Info-RMA : Study on Info-RMA and the Future of the Self-Defense Forces* (Tokyo: Office of Strategic Studies, Defense Policy Division, Defense Policy Bureau, Japan Defense Agency, 2000); Kyle Mizokami, "Japan and AirSea Battle," *Japan Security Watch* (blog), accessed December 12, 2014, http://jsw.newpacificinstitute.org/?p=10787; Alessio Patalano, "Japan as a Seapower: Strategy, Doctrine, and Capabilities under Three Defence Reviews, 1995–2010," *Journal of Strategic Studies* 37, no. 3 (April 16, 2014): 403–41, https://doi.org/10.1080/01402390.2014.904788; Toshi Yoshihara and James R. Holmes, "Japan's Emerging Maritime Strategy: Out of Sync or Out of Reach?," *Comparative Strategy* 27, no. 1 (February 6, 2008): 27–43, https://doi.org/10.1080/01495930701839654; Daniel M. Kliman, *Japan's Security Strategy in the Post-9/11 World: Embracing a New Realpolitik* (Greenwood Publishing Group, 2006); Corey J. Wallace, "Japan's Strategic Pivot South: Diversifying the Dual Hedge," *International Relations of the Asia-Pacific* 13, no. 3 (September 1, 2013): 479–517, https://doi.org/10.1093/irap/lct011.

[16] Guy Duczynski, "Effects–Based Operations between Australia and the United States: Achieving Interoperability at the Strategic Level through Shared End–States," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1Duczynski.pdf; Booz-Allen and Hamilton, "Measuring the Effects of Network-Centric Warfare. Volume 1," April 28, 1999; Edward A. Smith Jr., "Effects-Based Operations," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1Smith.pdf; Brett T. Williams, "Effects-Based Operations: Theory, Application and the Role of Airpower" (US Army War College Strategic Research Project, April 9, 2002), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA400990; David Connery, "Effects-Based Approaches and Australia's Security: Headed for the 'Too Hard Basket'?," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1Connery.pdf; Joshua H. Ho, "Waging Effects-Based Operations," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1Ho.pdf; Justin Kelly and David Kilcullen, "Chaos Versus Predictability: A Critique of Effects-Based Operations," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1KellyandKilcullen.pdf.

indeed the dominant focus of Australia's national security, intelligence, and defence academic and policy making communities on East Asia, made the Western Pacific case study an obvious and manageable choice. Moreover, whatever the outcome of efforts to realise fully networked military operations and the viability of effects-based warfare, which are both highly contested concepts, [17] the military's digital information infrastructure had grown into a densely connected super-network crossing national borders, continents and oceans. Intuitively, the evolution of the network's structures had to be having implications for strategic thinking. I was reflecting on how to think systematically about the strategic implications of the growth of the military's network in relation to China's re-emergence as a military power, but felt that IR's existing paradigms did not offer a coherent model to describe the implications. The actor-network approach and Barabási's scale-free network model offered a two-way approach to 'clearing the blockage'. First, it depicted the security system as a material-semiotic landscape defined by it processual and relational flows. Secondly, it depicted a set of laws by which this landscape, as a network structure, could be expected to evolve, thereby presenting the network's agents with incentives and constraints.

All of the analyses of discourse and extra-discursive practice, which are the 'inscriptions' substantiating the actor-network, are offered in support of the hypothesis. However, the thesis has a broader aim of opening pathways for research in IR to incorporate network

[17] For example see Kelly and Kilcullen, "Chaos Versus Predictability: A Critique of Effects-Based Operations"; Joint Staff, "Commander's Handbook for an Effects-Based Approach to Joint Operations," Joint Concept Development and Experimentation Directorate (Standing Joint Force Headquarters: Joint Warfighting Center, February 24, 2006), http://www.au.af.mil/au/awc/awcgate/jfcom/ebo_handbook_2006.pdf; Edward A. Smith Jr., *Effects Based Operations: Applying Network Centric Warfare to Peace, Crisis, and War* (DOD-CCRP, 2002); Zoltan Jobbagy, "Effects-Based Operations and the Age of Complexity," *Militaire Spectator* 175 (January 1, 2006): 235–42; Peter Nicholson, "Effects-Based Strategy: Operations in the Cognitive Domain," *Security Challenges* 2, no. 1 (2006), https://www.regionalsecurity.org.au/Resources/Files/vol2no1Nicholson.pdf; Duczynski, "Effects–Based Operations between Australia and the United States: Achieving Interoperability at the Strategic Level through Shared End–States."

theory in thinking about the structure of international relations; to tackle old puzzles in IR with a fresh perspective, explain anomalies not captured by existing paradigms, and to generate new research programmes to improve the explanatory power of the Discipline. An added advantage of network theory is its capacity to provide policy-makers with a model with which more effective policy can be constructed to not only cope with but thrive in the Western Pacific in particular and in a rapidly changing international landscape in general.

The thesis proposes the following hypothesis: That the military security system in the Western Pacific, understood as a network of human and non-human actants,[18] exhibits the features of a scale-free network model. The presence of the defining features of this model are growth, preferential attachment, and competition for fitness, and its distinctive structural evolution into hubs, are observable via inscriptions produced by the network's actants . The networks actants, which are a hybrid matrix of human and non-human, and material-semiotic assemblages, are captured by an actor- network approach. Analysis centres on translation zones associated with the increasing digital connectivity required to link the information systems that enabled the pursuit of fully networked, US-led coalition operations since the late 1990s. As development of fully networked operations is ongoing the thesis makes no assumptions about their ultimate viability. A critical feature for assessing viability is successful circulation of security references between heterogeneous actants within networks. References are made observable by inscriptions composed of the

[18] The word 'actant', borrowed from semiotics, is used throughout the thesis interchangeably with 'actor', to signify the emphasis on the process of emergence in regard to agency, as opposed to the depiction of the agent or actor as a fully formed 'component' as it enters or exits interactions with structure, which is also never fully formed. It is also used to reflect the emphasis in ANT of the equivalence of the non-human. See Bruno Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Harvard University Press, 1999), 303.

discourse and extra-discursive practices of the militaries and associated industries and institutions of the United States, Japan and Australia.

To explore the hypothesis, the thesis adopts an actor-network approach, combining discourse analysis with empirical analysis of extra-discursive practices which are the 'inscriptions' that 'translate' developments in operational level military affairs into strategic level changes to the structure of the Western Pacific's regional security system. Following Banta, the approach to method in the thesis accepts that "discourse may be studied as a causal mechanism in the generation of events — and one relationally connected to mechanisms of differing kinds."[19] In other words, studying what epistemic strategic and security communities write and say about the world is relationally connected to what they do in the world. Their 'doings' are their discourse and extra-discursive practices, which take the form of the inscriptions suggested by Latour and Callon, whose work substantiates the actor-network approach. These inscriptions are described as evidence of the type of structural evolution depicted by the scale-free network model. The thesis proposes a theoretical model developed through empirical and discursive analysis. Its premises are falsifiable by further critical discourse analysis and its implications are falsifiable by further empirical and theoretical work.

Thesis body

The remainder of the Introduction conducts a literature review of theories of structure and systems in IR. It assesses critically how structure and systems are understood in IR utilising a broad set of conceptual tools associated with network theory. The Introduction concludes

[19] Benjamin Banta, "Analysing Discourse as a Causal Mechanism," *European Journal of International Relations* 19, no. 2 (June 1, 2013): 379, https://doi.org/10.1177/1354066111428970.

with a review of the existing international relations literature produced by scholars deploying an actor- network approach. .

Chapter I introduces the basics of actor- network approach and explains the basics of network (graph) theory, with specific reference to the growth, preferential attachment, and fitness connectivity of the scale-free network model. It proposes an ontology of networks developed for regional security and compares and contrasts its tenets with those of existing structural theories in IR. The concept of networked security is defined and effects-based warfare and information warfare are discussed. The Chapter concludes with the emergence of a networked security dilemma.

Chapter II explores the growth of the digital medium. It reviews and analyses the discourse and extra-discursive practices relating to the concept and pursuit of information dominance by the US and its allies, Japan and Australia, in the Western pacific since the mid-1990s. The operational concept of network-centric warfare is introduced and explained. The chapter argues that the growth of a digitally enabled precision-strike regime and associated global information grid of sensors and communications, supporting the operational concept of network-centric warfare, is a primary feature identifying the growth of the scale-free network model.

Chapter III explores the idea of preferential attachment, and the discourse and extra-discursive practices relating to political questions around the growth and expansion of network-centric warfare concepts and practices. Traditional IR perspectives on state incentives and constraints under a bargaining paradigm are assessed critically using Snyder's alliance security dilemma. The chapter argues as the militaries of US allies strived to keep pace with the growth of the increasingly complex network-centric system the

political exigencies of 'interoperability' were revealed by the 'preferential attachment' which is a feature of a developing scale-free network model.

Chapter IV explores discourse and extra-discursive practices relating to the idea of 'fitness' in networks . It analyses the organisational challenges faced by militaries incorporating 'disruptive' technological innovation. The chapter argues that militaries which are better able to adapt to deep organisational change are best placed to reap the advantages of technological innovation, while those less capable face not only relative decline in traditional metrics of military competitiveness, but also the network effect of being 'locked out' of further innovation, compounding the disadvantage. Following Horowitz, this depiction of organisational adaptability is presented as an example of competitive processes for fitness connectivity products featured in the scale-free network model.

Chapter V asks whether there is a 'battle of networks' associated with the US military's effort to achieve greater joint warfighting capability. The origins of Air-Sea Battle concept, which became 'Joint Concept for Access and Manoeuvre in the Global Commons' (JAM-GC) in January 2015, and its application in the Western Pacific as a counter to China's 'Anti-Access/Area Denial (A^2/AD) strategy are discussed and the key debates highlighted. The features of the information infrastructure supporting the joint warfighting regime associated with 'competition-fitness' are also highlighted and discussed.

Chapter VI focusses on Japan's I incorporation of digital information and communication technologies associated with networked-centric warfare and operations. The Chapter argues that Japan's well known domestic political restrictions on offensive military capabilities have not delimited the growth of Japan's interconnectivity in the digital

information space. Growth in and preferential attachment to US systems reflects the structural evolution of hubs in the scale-free network model.

Chapter VII focusses on Australia's incorporation of the digital information and communication technologies associated with networked operations, and critically assesses the Australia Defence Force's (ADF) operational level progress toward networked operations. . The Chapter argues that the ADF was an early proponent of the efficiencies of network-centric warfare and pursued capabilities in the information space and operational concepts in line with the broader goal of deepening and consolidating its interoperability with the US military. As with Japan, this process reflected the structural evolution of hubs in the scale-free network model.

Conclusion – reviews the evidence offered by the thesis with regard to its hypothesis and examines the implications of the scale-free network model on the key areas of interest regarding regional security in the Western Pacific. Concludes the scale-free network model and the structural power inherent in networks has significant strategic implications under-explored by mainstream IR and by security scholars focused on the Western Pacific interested in Sino-American regional relations. It suggests the growth in digital connectivity over the past twenty-five years can be seen as a strategic end in itself. The self-organizing properties of the scale-free network suggest that the United States commitment to formal ties, alliances, rule-making, international institutions, and leadership should all be expected to decline.

Literature review

1. Structures, strategies, and games in international relations

Perhaps the ultimate indication that the networked world is upon us and must be attended to by scholars of international relations came when Henry Kissinger, the archetypal chess player on the international stage, warned of the dangers of not understanding a world of horizontal connections.

> The pervasiveness of networked communications in the social, financial, industrial, and military sectors has revolutionized vulnerabilities. Outpacing most rules and regulations (and indeed the technical comprehension of many regulators), it has, in some respects, created the state of nature… the escape from which, according to Hobbes, provided the motivating force for creating a political order… [A]symmetry and a kind of congenital world disorder are built into relations between cyber powers both in diplomacy and in strategy… Absent articulation of some rules of international conduct, a crisis will arise from the inner dynamics of the system.[1]

Such a reorientation in thinking has been no easy thing. Networks are not just differing structures in relation to the hierarchical world IR theory and analysis are typically situated in. Rather, network theory forces us to consider and give greater salience to the ways and means by which power flows in a horizontal plane, and thereby, greater consideration of not only the human but the non-human actants in these flows. Applying network analysis to IR is to usher in a non-anthropocentric orientation toward causation and agency. This is why Actor-Network Theory, to be explained below, was needed to approach such a reorientation.

[1] Henry Kissinger, *World Order: Reflections on the Character of Nations and the Course of History* (Penguin UK, 2014), p. 347.

The traditions of IR accommodate a way of thinking about the structure of the world that is both highly contested and remarkably enduring. Its seminal account emerges from the fifth century BCE, the time of the Peloponnesian War between Sparta and Athens. Written by Athenian Historian and General Thucydides at the time of the war, *History of the Peloponnesian War*[2] offers a detailed chronological account of the rising tensions between two Empires over shipping, trade, and expansion that spilled into a twenty-seven-year war. Thucydides believed his account to be a timeless depiction of relations between states as inescapably motivated by fear and self-interest. The Melian Dialogue, Thucydides' dramatization of the meeting between the invading Athenians and the rulers of Melos, is thought of as one of the earliest accounts of political realism. It depicts the primacy of material power, as expressed through Athenian military might, over morality, as expressed through the Melian's appeal to Athenian decency. Here we find the maxim 'the strong do what they can and the weak suffer what they must.' In the *Dialogue* we glimpse not just reference to the primacy of power. Critically it depicts the primacy of the structures that emerge spontaneously from the conditions human beings live in. These conditions are defined, for most of human history, by the political units that form as the territorially organised entities of an animal that lives on the ground in groups. The systemic relationships between these units constrain and enable the agency of the group and of the individuals living within the group. That these structures exist and take primacy over agency is the common ground most subsequent definitions and iterations of realism share, though most are at pains to eschew any charge of determinism. Most realists think structures push

[2] Thucydides, *History of the Peloponnesian War*, ed. M. I. Finley, trans. Rex Warner, Revised edition (Harmondsworth, Eng., Baltimore: Penguin Classics, 1972).

states in certain directions – they do not mechanically determine outcomes.[3] But whether emphasising the primacy of structure or agent, the locus and boundary of these forces are anthropocentric. Non-human material forces and objects are regarded either as background or as instrument in human affairs, never as actants in their own right. The IR tradition can be augmented by bringing these backgrounds forward, and understanding how materials, in this case digital networked technologies, can be agents too.

The academic field of International Relations references Thucydides as the birthplace of a tradition of realism that is later expressed most famously in the 16th and 17th centuries by Machiavelli and Hobbes.[4] Hobbes' emphasis on sovereignty as a response to the inevitable internal anarchy and self-interest of human political life became the reference point for modern thinking about political order. The sovereign territorial state and its monopoly on violence transferred the problems of egoism and anarchy to the realm of international relations. The Treaty of Westphalia in 1648 marked the entry point of a system of states, which shifts the primary concerns of realists to order *between* states over order *within* states and allows them to begin to think systematically about the 'international'. Egoism and anarchy in international relations combine to produce one of its most troublesome features. The 'security dilemma', a term first coined by John Herz in 1951,[5] describes how the actions taken by each state to increase its own security can spiral into a decrease in security for all, just as Thucydides had observed. As the primary units of political life evolved from empires to states to nation-states, realism treated them as fully formed entities and remained primarily concerned with the inherent structural constraints the system imposed and the

[3] Jack Donnelly, "Realism," in *Theories of International Relations,* 5th ed. (Palgrave Macmillan, 2013), 32–56.
[4] Niccolo Machiavelli, *The Prince* (Cambridge University Press, 1988); Thomas Hobbes, *Leviathan* (Penguin UK, 2003).
[5] John H. Herz, *Political Realism and Political Idealism: A Study in Theories and Realities* (University of Chicago Press, 1951).

possibilities of overcoming them. The 'great debates' associated with the tradition, however mythical,[6] proceed on the foundation of this treatment of structure. Two catastrophic systemic wars of the first half of the 20th century, and their legacy of enduring tension in the Cold War, provided rich subject matter for realists including Reinhold Niebuhr, Hans Morgenthau, E.H. Carr, George Kennan, Kenneth Waltz, John Mearsheimer, and Stephen Walt.[7] Morgenthau and Carr are often described as classical realists. Their work retains a role for the features of the agent, the human being, that make a conflictual state of affairs in political life unavoidable that is juxtaposed with but ultimately subordinate to the structure of the system it is a part of.[8] Others, led by Kenneth Waltz, furthered the realist emphasis on the structure of the system and worked to develop a formulaic theory of the international system that removed any reference to the various human proclivities retained by classical realists. For this Waltz reached across fields into economics for what became his theory of structural (neo-) realism.[9] For Waltz, the fundamental organising principle of international affairs was anarchy.

[6] The 'great debates' in IR, of which some believe there are five, are generally considered to be self-referential narratives within the tradition that may serve the purpose of intellectual orientation rather than discrete events that actually happened. See Wilson in Ken Booth, Michael Cox, and Tim Dunne, *The Eighty Years' Crisis: International Relations 1919-1999* (Cambridge University Press, 1998), 1–15.

[7] For overviews of these authors contribution to the discipline of realism see Harry R. Davis and Robert C. Good, *Reinhold Niebuhr on Politics: His Political Philosophy and Its Application to Our Age as Expressed in His Writings* (Wipf and Stock Publishers, 2007); Michael Williams, *Realism Reconsidered: The Legacy of Hans Morgenthau in International Relations* (OUP Oxford, 2007); M. Cox, *E.H.Carr: A Critical Appraisal* (Springer, 2016); Wilson D. Miscamble, *George F. Kennan and the Making of American Foreign Policy, 1947-1950* (Princeton University Press, 1993); Kenneth N. Waltz, *Theory of International Politics* (McGraw-Hill, 1979); Kenneth Neal Waltz, *Man, the State, and War: A Theoretical Analysis* (Columbia University Press, 2001); John J. Mearsheimer, *The Tragedy of Great Power Politics.* (WW Norton & Company, 2001); Stephen M. Walt, *The Enduring Relevance of the Realist Tradition* (W.W. Norton Company, 2002).

[8] Hans Joachim Morgenthau and Kenneth W. Thompson, *Politics Among Nations: The Struggle for Power and Peace* (McGraw-Hill, 1985); Edward Hallett Carr, *The Twenty Years' Crisis, 1919-1939: An Introduction to the Study of International Relations* (Harper & Row, 1964).

[9] Waltz, *Theory of International Politics*; Kenneth N. Waltz, "The Origins of War in Neorealist Theory," *The Journal of Interdisciplinary History* 18, no. 4 (April 1, 1988): 615–28, https://doi.org/10.2307/204817; Kenneth N. Waltz, "The Emerging Structure of International Politics," *International Security* 18, no. 2 (October 1, 1993): 44–79, https://doi.org/10.2307/2539097; Kenneth N. Waltz, "Structural Realism after the Cold War,"

Waltz took the tradition of structuralism to its logical extreme. In *Theory of International Politics* and, earlier, *Man, The State, and War,* Waltz reduces the realist depiction of the world to one of largely monochrome units interacting in a system in which their survival depends on a struggle for power, even in the absence of any propensities for aggression.[10] Sovereign competition for survival in a self-help world being an inescapable condition derived from anarchy, and the unequal distribution of capabilities determining which states survived, Waltz counselled that the best way to reduce the incidence of conflict was for states to seek a stable 'balance of power'. The ordering of the system would be organized according to a hierarchy of capabilities. A state's capabilities determine its position in the hierarchy, thus international politics was captive to the shifting fates of great powers. The number of great powers present in the system at any time, and therefore its basic structure as unipolar, bipolar, or multipolar, determines how the international order should be organized as well as the likelihood of instability and conflict. Statecraft is therefore the art of determining one's place in the hierarchy and pursuing strategies of 'balancing' or 'band-wagoning' in accordance with shifts in the distribution of capabilities and power.

While Waltz had stripped much from the world of the classical realists, whose 'Great Game' was played out by British and Russian elites for control of Central Asia in the 19th century,[11] his reductive approach to international relations left statecraft as a high-stakes 'game' of anticipating and responding to inherently unpredictable conditions within a highly constrained structural environment. Waltz stressed that nothing was deterministic about his depiction; states would remain in the condition of having to navigate their path forward. In

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International Security 25, no. 1 (July 1, 2000): 5–41, https://doi.org/10.1162/016228800560372; Waltz, *Man, the State, and War*.

[10] Waltz, *Theory of International Politics*, 62–63.

[11] See Peter Hopkirk, *The Great Game: The Struggle for Empire in Central Asia* (Kodansha International, 1994).

its parsimony and formula, nonetheless, Waltz posited a chessboard-like international domain, populated by units with like features of which little more needed to be learned in order to understand the basic functioning of the system. In doing so, as Epstein argues, Waltz's contribution was to carve out the 'international' as a distinct site of political analysis.[12]

All states in the world Waltz described were security seekers, but realists diverged over what strategies of survival they should adopt. John Mearsheimer's *The Tragedy of Great Power Politics*[13] argues that great powers were compelled by the system to maximize their relative gains in power at all times, despite the risks of exacerbating the security dilemma. This required an approach of *offensive realism,* where only a condition of hegemony can truly provide the state with the security it seeks. Stephen Walt and Robert Jervis argued the risks of always seeking to maximize relative gains through hegemony outweigh the benefits. States can never achieve such a condition because of the prevalence of uncertainty and the constraints of geography and technology.[14] Great powers should seek to maximize security by looking to offset the likelihood of gains by other powerful states by strategizing between relative and absolute gains with an approach underpinned by *defensive realism*. These approaches are all attempts to reconcile the conflict-prone structure of the system with the fact that states must find a way to live and thrive. While states cannot hope to transform the system, and cannot, as Lord Palmerston averred, rely permanently on help from others, they must conduct statecraft by bargaining. The theoretical basis for interstate bargaining

[12] Charlotte Epstein, "Constructivism or the Eternal Return of Universals in International Relations. Why Returning to Language Is Vital to Prolonging the Owl's Flight," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 499–519, https://doi.org/10.1177/1354066113494669.
[13] Mearsheimer, *The Tragedy of Great Power Politics.*
[14] Walt, *The Enduring Relevance of the Realist Tradition*; Stephen M. Walt, *The Origins of Alliance* (Cornell University Press, 2013); Robert Jervis, "Cooperation Under the Security Dilemma," *World Politics* 30, no. 2 (1978): 167–214, https://doi.org/10.2307/2009958.

was spelled out by Thomas Schelling in 1960 with *The Strategy of Conflict* and its depiction of Game Theory.[15] Jervis used Game Theory concepts derived from 'Stag Hunt' and 'Prisoner's Dilemma' to describe how under an approach of defensive realism states could cooperate to ameliorate the worst effects of the security dilemma.[16]

Liberal international relations theory accepts the basic structural account of the anarchic self-help system found in realism, but diverges in its account of the emergence of the state's preferences.[17] Where realists extrapolate the condition of states as security seekers from anarchy, liberal theorists seek other explanations for state behaviour. The core assumption of liberal theory is that state preferences are derived from domestic and transnational social pressures. Institutions operating across these levels can provide states with opportunities and incentives to cooperate and mitigate the security dilemma.[18] These views were developed further in the 1980s and 90s into what became known as liberal institutionalism.[19] Realists and liberal theorists hotly debated the conditions under which cooperation was possible and the strategies for how and when it should be pursued.[20] By expanding the range of influences on state preferences, however, liberalism undeniably placed states in a multi-causal model of behaviour in which the instruments of statecraft extend well beyond the capacity to make war. Andrew Moravcsik later took liberal

[15] Thomas C. Schelling, *The Strategy of Conflict* (Harvard University Press, 1980).
[16] Jervis, "Cooperation Under the Security Dilemma."
[17] For overview see Whittle Johnston, *Realism and the Liberal Tradition: The International Relations Theory of Whittle Johnston* (Springer, 2016).
[18] Robert Owen Keohane and Joseph S. Nye, *Power and Interdependence* (Longman, 2011); Robert Owen Keohane, *Institutionalist Theory and the Realist Challenge after the Cold War* (Center for International Affairs, Harvard University, 1992); Robert O. Keohane and Helen V. Milner, *Internationalization and Domestic Politics* (Cambridge University Press, 1996).
[19] Robert Keohane, "Twenty Years of Institutional Liberalism," *International Relations - INT RELAT* 26 (June 8, 2012): 125–38, https://doi.org/10.1177/0047117812438451.
[20] Joseph M. Grieco, "Anarchy and the Limits of Cooperation: A Realist Critique of the Newest Liberal Institutionalism," *International Organization* 42, no. 03 (1988): 485–507, https://doi.org/10.1017/S0020818300027715; Joseph M. Grieco, Robert Powell, and Duncan Snidal, "The Relative-Gains Problem for International Cooperation," *American Political Science Review* 87 (September 1, 1993), https://doi.org/10.2307/2938747.

institutionalism further by developing a theory of multi-causality under globalisation that nudged liberalism a step closer to understanding causality as a disaggregated network.[21]

After the Cold War, international relations theory underwent its 'constructivist turn.'[22] Waltz's depiction of interstate relations as defined by the distribution of material power had not given scholars the tools to predict the breakdown of bipolarity after the Soviet Union's collapse in 1991.[23] In response, constructivism rejected the basic components which the strategies and games of conflict and cooperation took as *a priori*. Nicholas Onuf's *World of Our Making*[24] is considered to have defined constructivism for IR. Onuf positioned constructivism not as radically *post-structuralist* – rather as able to provide a middle ground from which to better explain the origins of structure in a world that was particular, contingent, and historically situated. To understand international relations required scholars to delve back into the monochrome units of structural realism to find out how the structures of opportunity and constraint which produce anarchy and the security dilemma emerge from the co-production of agent and structure.[25] The constructivist turn produced an abundance of new research perspectives in IR, many of which attempted to explain the emergence of the very structures realism takes as given. [26]

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[21] Andrew Moravcsik, "The New Liberalism," in *The Oxford Handbook of International Relations*, 1st ed. (Oxford University Press, 2008), https://doi.org/10.1093/oxfordhb/9780199219322.001.0001.
[22] Jeffrey T. Checkel, "The Constructivist Turn in International Relations Theory," *World Politics* 50 (January 1, 1998): 324–48, https://doi.org/10.1353/wp.1998.0002.
[23] Richard K. Ashley, "The Poverty of Neorealism," *International Organization* 38, no. 02 (1984): 225–86, https://doi.org/10.1017/S0020818300026709.
[24] Nicholas Greenwood Onuf, *World of Our Making: Rules and Rule in Social Theory and International Relations* (Routledge, 2012).
[25] Alexander E. Wendt, "The Agent-Structure Problem in International Relations Theory," *International Organization* 41, no. 03 (1987): 335–70, https://doi.org/10.1017/S002081830002751X; Alexander Wendt, "Anarchy Is What States Make of It: The Social Construction of Power Politics," *International Organization* 46, no. 02 (1992): 391–425, https://doi.org/10.1017/S0020818300027764; Alexander Wendt, "Constructing International Politics," *International Security* 20, no. 1 (July 1, 1995): 71–81, https://doi.org/10.2307/2539217.
[26] Alexander Wendt, "Collective Identity Formation and the International State," *The American Political Science Review* 88, no. 2 (June 1, 1994): 384–96, https://doi.org/10.2307/2944711; Paul Schroeder, "Historical Reality vs. Neo-Realist Theory," *International Security* 19, no. 1 (July 1, 1994): 108–48,

Alexander Wendt's *Social Theory of International Politics*[27] forwards an explanation of the structure of the international world that emerges from the identities of its exclusively human actors. Wendt's is a social theory of 'structuration' that attempts to account for the emergence of non-static 'cultures of anarchy' within states, in turn undermining the materially-based and static accounts of Waltz and others. But with the rejection of a parsimonious and formulaic structure, constructivism traded its capacity (and willingness) to provide a blueprint with enough commonality to be taken up in realism's place, let alone a tool-set which policy-makers could use as a basis for statecraft. As critics such as Guzzini have argued, much of what passed for constructivist theory in the field of IR has merely claimed that ideas, meanings, and symbols influence world politics.[28] The debate, particularly in North America, tended to pit evidence supporting the role of 'ideas' under the approach of constructivism against evidence supporting the role of 'material' factors under the approaches of Realism or Liberalism. This dualistic treatment of what is, for objectivism, a single reality, was never more fruitful than the insights that were gleaned from within each distinct approach. The debates within IR that took place on a foundation of structuralism were superseded by debates *about* those very foundations as the field embraced analytical eclecticism.[29] Neither approaches, however, looked beyond this anthropocentric world for evidence of agency.

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https://doi.org/10.2307/2539150; Thomas Risse-Kappen, "Ideas Do Not Float Freely: Transnational Coalitions, Domestic Structures, and the End of the Cold War," *International Organization* 48, no. 02 (1994): 185–214, https://doi.org/10.1017/S0020818300028162; Ethan B. Kapstein, "Is Realism Dead? The Domestic Sources of International Politics," *International Organization* 49, no. 04 (1995): 751–74, https://doi.org/10.1017/S0020818300028502; Onuf, *World of Our Making*.

[27] Alexander Wendt, *Social Theory of International Politics* (Cambridge University Press, 1999).

[28] Stefano Guzzini, "A Reconstruction of Constructivism in International Relations," *European Journal of International Relations* 6, no. 2 (June 1, 2000): 147–82, https://doi.org/10.1177/1354066100006002001.

[29] Rudra Sil and Peter J. Katzenstein, "Analytic Eclecticism in the Study of World Politics: Reconfiguring Problems and MechaniAndrew Bennett, "The Mother of All Isms: Causal Mechanisms and Structured Pluralism in International Relations Theory," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 459–81, https://doi.org/10.1177/1354066113495484.

After a brief respite, IR in the post-Cold War era regained its historically conflictual bias. IR theory oscillated.[30] Charles Krauthammer proclaimed the extraordinary structural condition of unipolarity as the US dominated the distribution of capabilities in both economic and military domains.[31] The strategic question of what the US ought to do with its oversized advantage hung in the air. Liberal internationalists glimpsed *The End of History*[32] and prepared for the rise and rise of economically motivated cooperation between states, the expansion of a zone of democratic peace, and the prevalence of institutionalism at the international level to which the archaic and warlike state would take a back seat. Joseph Nye and Robert Keohane explained how the development of 'soft power' through institutionalism could not only secure but extend the benefits of the system.[33] John Ikenberry saw the US triumph extending long into the future, with the US playing the role of stabilizer and manager of a system that could even endure the inevitable decline of American power.[34] Realists such as Mearsheimer eschewed institutionalism as a false promise[35] and looked to Europe, China and the developing world for the signs of fracture

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sms across Research Traditions," *Perspectives on Politics* 8, no. 2 (2010): 411–431; David A. Lake, "Theory Is Dead, Long Live Theory: The End of the Great Debates and the Rise of Eclecticism in International Relations," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 567–87, https://doi.org/10.1177/1354066113494330.

[30] Christine Sylvester, "Experiencing the End and Afterlives of International Relations/Theory," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 609–26, https://doi.org/10.1177/1354066113494322.

[31] Charles Krauthammer, "The Unipolar Moment," *Foreign Affairs*, January 1, 1990, https://www.foreignaffairs.com/articles/1991-02-01/unipolar-moment.

[32] Francis Fukuyama, *The End of History and the Last Man* (Simon and Schuster, 2006).

[33] Keohane and Nye, *Power and Interdependence*; Keohane, *Institutionalist Theory and the Realist Challenge after the Cold War*.

[34] G. John Ikenberry, *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars* (Princeton University Press, 2001); G. John Ikenberry, *America Unrivaled: The Future of the Balance of Power* (Cornell University Press, 2002); G. John Ikenberry, *Liberal Leviathan: The Origins, Crisis, and Transformation of the American World Order* (Princeton University Press, 2012).

[35] John J. Mearsheimer, "The False Promise of International Institutions," *International Security* 19, no. 3 (December 1, 1994): 5–49, https://doi.org/10.2307/2539078.

and shifting power that realism predicts.[36] Constructivists and the various eclectic research programmes with an eye on international affairs saw trouble brewing in the corners of the world kept off centre stage by the overwhelming weight of the Cold War, brought to light most notably by Chalmers Johnson.[37] Mary Kaldor highlighted the new forms of violence and new sources of insecurity that emerged to challenge the monopoly that had been assumed by the state for the duration of the living memory of people who woke up on the morning of September 11, 2001.[38] *A Clash of Civilizations* was Huntington's deflection of Fukuyama. It depicted the subversion of the state's centrality in international political life for something much larger and potentially more sinister.[39] Huntington's critics, though, claimed he had reached too far in appealing to a sweeping vision of civilizational unrest.[40] This discontinuity reflected the fact that IR at the beginning of the 2000s had become a field of study defined more by its epistemic, methodological, ideological, and geographic conflicts than by its intellectual commonalities.[41]

[36] Michael Mastanduno, "Preserving the Unipolar Moment: Realist Theories and US Grand Strategy after the Cold War," *International Security* 21, no. 4 (1997): 49–88; John J. Mearsheimer, "China's Unpeaceful Rise," *Current History* 105, no. 690 (April 2006): 160–62.

[37] Chalmers Johnson, *Blowback: The Costs and Consequences of American Empire* (Henry Holt and Company, 2007); Chalmers Johnson, *The Sorrows of Empire: Militarism, Secrecy, and the End of the Republic* (Henry Holt and Company, 2007); Chalmers Johnson, *Nemesis: The Last Days of the American Republic* (Henry Holt and Company, 2007).

[38] Mary Kaldor, *New and Old Wars: Organised Violence in a Global Era* (John Wiley & Sons, 2013).

[39] Samuel P. Huntington, *The Clash of Civilizations and the Remaking of World Order* (Simon and Schuster, 2007).

[40] See Jonathan Fox, "Paradigm Lost: Huntington's Unfulfilled Clash of Civilizations Prediction into the 21st Century," *International Politics* 42 (December 1, 2005), https://doi.org/10.1057/palgrave.ip.8800116; Alina Mungiu-Pippidi and Denisa Mindruta, "Was Huntington Right? Testing Cultural Legacies and the Civilization Border," *International Politics* 39 (June 1, 2002): 193–213, https://doi.org/10.1057/palgrave.ip.8897387; Bruce M. Russett, John R. Oneal, and Michaelene Cox, "Clash of Civilizations, or Realism and Liberalism Déjà Vu? Some Evidence," *Journal of Peace Research* 37 (September 1, 2000), https://doi.org/10.1177/0022343300037005003.

[41] See Andrew Bennett, "The Mother of All Isms: Causal Mechanisms and Structured Pluralism in International Relations Theory," *European Journal of International Relations* 19, no. 3 (September 1, 2013): 459–81, https://doi.org/10.1177/1354066113495484; Colin Wight et al., "International Theory in a Post-Paradigmatic Era: From Substantive Wagers to Scientific Ontologies," *European Journal of International Relations* 19, no. 3 (2013), https://doi.org/10.1177/1354066113495482.

By embracing eclecticism, however, IR was coming into contact with other fields whose subject matter had also become indistinguishable from the 'international', caused by the latest wave of globalisation transforming the world since the 1970s, and the growing awareness that social relations had in some sense become global. By no means confined to the IR discipline, the imperative to 'open the social sciences' was codified by the *Gulbenkian Commission* held by Stanford University in 1996.[42] Sociologist John Urry explored this new global terrain in terms of 'scapes' defined more by the 'informational and communicational' than by the 'social'.[43] Urry and others saw the world of discrete units and structures fundamentally 'disorganizing' into new representations of space and time that were non-static and mobile.[44] Manuel Castells' trilogy on the *Information Age* saw these new representations forming networks that were already transforming the very nature of social life.[45] Sociologists were rethinking the foundations of sociology at the turn of 21st century and a new methodology for 'social network analysis', first established as a field of academic inquiry by Harrison White at the Harvard sociology department.[46] Robert Axelrod's seminal work on cooperation in 1997 used a new methodology of 'agent-based modelling' to expand the possibilities in understanding global politics.[47] As the 'global' was seen as both cause and effect of these changes, scholars of all stripes sought to escape the static confines of linearity imposed on them by the tenets of classical science.

[42] I. Wallerstein, "Open the Social Sciences: Report of the Gulbenkian Commission on the Restructuring of the Social Sciences" (Stanford, California: Stanford University Press, 1996), https://www.scribd.com/document/306323901/Wallerstein-Open-the-Social-Sciences-pdf.
[43] Scott M. Lash and John Urry, *Economies of Signs and Space* (SAGE, 1993); John Urry, *Consuming Places* (Routledge, 2002); John Urry, *Sociology Beyond Societies: Mobilities for the Twenty-First Century* (Routledge, 2012).
[44] Scott Lash and John Urry, *The End of Organized Capitalism* (John Wiley & Sons, 2014).
[45] Manuel Castells, *The Information Age, Volumes 1-3: Economy, Society and Culture* (Wiley, 1999).
[46] Excellent overview in Christina Prell, *Social Network Analysis: History, Theory and Methodology* (SAGE, 2012).
[47] Robert M. Axelrod, *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration* (Princeton University Press, 1997).

Out of these exploratory fields rose a new discipline that dealt with the science of complexity. Initially developed in the field of economics, complexity theory applied theoretical models to explain the non-linear growth, evolution, and structure of complex systems.[48] Advances in data sciences as the digital age matured were providing researchers with greater empirical awareness of the patterns and forms observable in the real world of agents, further driving the demand for explanatory theoretical models.[49] This data has quickly multiplied on an exponential scale, opening up an extraordinary range of possibilities for its use.[50] Complex systems in the real world accommodate interactions between agents and other variables that linear scientific modelling of causality could not account for. These interactions were found to produce emergent phenomena as they scale up through levels of complexity. These emergent phenomena were found in many cases to have properties that resembled repeatable structures in nature not accounted for by reductionist models.[51] The discovery of theoretical models that could account for and explain emergent properties in complex systems opened up entirely new avenues of research. Complexity theory offered new avenues for explaining structures in complex systems that are disorderly but not simply chaotic. Network theory is related to but distinct from complexity theory in that the structures found in complex networks are not presented as strictly 'emergent'. The two fields share a methodology in computer modelling, but the structures present in networks are forms the causality of which can be identified in classical terms.

[48] Literature on complexity science is vast, see for example George A. Cowan, David Pines, and David Elliott Meltzer, *Complexity: Metaphors, Models, and Reality* (Addison-Wesley, 1994); James Gleick, *Chaos: Making a New Science* (Open Road Media, 2011); Neil Johnson, *Simply Complexity: A Clear Guide to Complexity Theory* (Oneworld Publications, 2009); Steven Johnson, *Emergence: The Connected Lives of Ants, Brains, Cities, and Software* (Simon and Schuster, 2012).
[49] See Duncan J. Watts, *Six Degrees: The Science of a Connected Age* (Random House, 2004).
[50] Fernando Iafrate, *From Big Data to Smart Data* (John Wiley & Sons, 2015); Patrick Tucker, *The Naked Future: What Happens in a World That Anticipates Your Every Move?* (Penguin, 2014).
[51] Didier Sornette, "Dragon-Kings, Black Swans and the Prediction of Crises," *International Journal of Terraspace Science and Engineering* 2, no. 1 (July 24, 2009): 1–18.

For the discipline of international relations caught in a multiplicity of theoretical starting points, an offering appeared which, with a few notable exceptions, was not wholeheartedly taken up. The 'international', carved out by a long tradition of structural theory and codified, however controversially by Waltz, has added a suite of explanatory tools over the last twenty years. The new tools enable two divergences; first, from the realist conception of the discrete, static chessboard of material capabilities organised under anarchy; and, secondly, from the constructivist depiction of particularism and contingency. On offer is a view of structures whose growth and evolution is a property of the self-organising interactions of its agents, many of which are not human beings. This thesis takes up the offering. Network theory, to be introduced in detail in Chapter I, can be thought of as a sub-field of the science of complexity emerging out of this quest to reveal a non-anthropocentric structure of use to IR scholarship.

2. Networks as structures for IR

The leading contemporary international relations scholar recognising the rise of the network and its implications for the field is Anne-Marie Slaughter. She declared in 2016 that: "The United States, for its part, needs a grand strategy that pursues American interests and values in the web as well as on the chessboard."[52] Slaughter was referring to what scholars in a range of other fields had been aware of for some time and, indeed, what IR scholarship had been particularly laggard in acknowledging. We have come to be in what pioneer Manuel Castells described as a "Network Society"[53] living in what futurists Ito and Howe

[52] Anne-Marie Slaughter, "How to Succeed in the Networked World: A Grand Strategy for the Digital Age," *Foreign Affairs*, December 2016, https://www.foreignaffairs.com/articles/world/2016-10-04/how-succeed-networked-world.
[53] Manuel Castells, "Materials for an Exploratory Theory of the Network Society," *The British Journal of Sociology* 51, no. 1 (2000): 5–24.

describe as the "Network Age."[54] Joshua Cooper Ramo has written of an "Age of Network Power" that is giving rise to an "Age of the Unthinkable", as new networked power structures wipe out incumbent institutions with astonishing rapidity.[55] Ramo counselled a radical shift in US strategy-making based on what he called "hard gatekeeping", an approach to the competitive struggle in a networked world of digital "gatelands" based on influence over the network's topology. Ramo's gatelands can be understood as emergent features of Scott Malcomson's *Splinternet*[56] – a world of increasingly jealously guarded sub-sections of what, to the technologists of the early 2000s, was supposed to be a borderless globally connected digital playing field supporting and nourishing a global citizenry.[57] Adrienne Lafrance has referred to an "Age of Entanglement" in which policy-makers and strategists should think like biologists studying the infinite complexity of the networked interdependent living world.[58] Parag Khanna has flagged a new field of study he labels "Connectography", taking an approach to understanding global systems recast as networks driven more by mega-cities and the connections between them than by nation-states.[59] In *The Square and the Tower*, historian Niall Ferguson has traced the historical tension between the network and the hierarchy, depicting this tension as a driving force of history and warning against hubris about the age of the network. Networked age or not, for

[54] Joi Ito and Jeff Howe, *Whiplash: How to Survive Our Faster Future* (New York and Boston: Grand Central Publishing, 2016).
[55] Joshua Cooper Ramo, *The Seventh Sense: Power, Fortune, and Survival in the Age of Networks* (New York: Little, Brown and Company, 2016); Joshua Cooper Ramo, *The Age of the Unthinkable: Why the New World Disorder Constantly Surprises Us and What to Do about It* (Little, Brown, 2014).
[56] Scott Malcomson, *Splinternet: How Geopolitics and Commerce Are Fragmenting the World Wide Web* (OR Books, 2016).
[57] Jack L. Goldsmith and Tim Wu, *Who Controls the Internet?: Illusions of a Borderless World* (Oxford University Press, 2006), http://ebookcentral.proquest.com.ezproxy.flinders.edu.au/lib/flinders/reader.action?docID=281168.
[58] Adrienne LaFrance, "The Age of Entanglement," *The Atlantic*, August 8, 2016, https://www.theatlantic.com/technology/archive/2016/08/entanglement/494930/.
[59] Parag Khanna, *Connectography: Mapping the Future of Global Civilization* (Random House Publishing Group, 2016); Michele Acuto and Parag Khanna, "Nations Are No Longer Driving Globalization—cities Are," *Quartz* (blog), May 3, 2013, https://qz.com/80657/the-return-of-the-city-state/.

Ferguson hierarchy is necessary for humans to live with a semblance of order. To believe otherwise is to invite endless revolution.[60] For these thinkers the static map of the world of 190-odd nation-states, engaged in bargaining across adversarial, allied, or neutral binaries and multiplicities, stag-hunts and prisoner's dilemmas,[61] is what Lakatos might have described as a degenerative research program.[62] It was no longer a paradigm through which better explanations of the world were possible. Nor was it generating novel research puzzles that could lead to more and improved knowledge.[63]

For Slaughter, IR and foreign policy orthodoxies are mired in a vision of the world miscast as a chessboard that increasingly obfuscates their capacity to understand how it works.[64] 'The State' as a monolithic entity has gradually disaggregated into partially overlapping social, political, economic, and security 'webs' that now harbour the emergent properties that their fundamental architecture as networks gives rise to.[65] Authors attempting a reconciliation of the chessboard and the web, as Slaughter has advised, are few. Patrick's *Sovereignty Wars* argues the United States cannot treat sovereignty as absolute even as threats to it are on the rise.[66] In a Hobbesian compromise, sovereignty must be traded for benefits that strengthen America's influence in a networked world without eroding the

[60] Niall Ferguson, "Networks and Hierarchies," *The American Interest* (blog), June 9, 2014, https://www.the-american-interest.com/2014/06/09/networks-and-hierarchies/; Niall Ferguson, "The False Prophecy of Hyperconnection," *Foreign Affairs*, August 15, 2017, https://www.foreignaffairs.com/articles/2017-08-15/false-prophecy-hyperconnection; Niall Ferguson, *The Square and the Tower: Networks, Hierarchies and the Struggle for Global Power* (Penguin UK, 2017).
[61] Schelling, *The Strategy of Conflict*.
[62] Imre Lakatos, "Falsification and the methodology of scientific research programmes." In: Lakatos, Musgrave eds. (1970), pp. 91–195.
[63] On this debate see John A. Vasquez, "The Realist Paradigm and Degenerative versus Progressive Research Programs: An Appraisal of Neotraditional Research on Waltz's Balancing Proposition," *The American Political Science Review* 91, no. 4 (December 1, 1997): 899–912, https://doi.org/10.2307/2952172; Colin Elman and Miriam Fendius Elman, "Lakatos and Neorealism: A Reply to Vasquez," *The American Political Science Review* 91, no. 4 (December 1, 1997): 923–26, https://doi.org/10.2307/2952175.
[64] Anne-Marie Slaughter, *The Chessboard and the Web: Strategies of Connection in a Networked World* (Yale University Press, 2017).
[65] See Anne-Marie Slaughter, *A New World Order* (Princeton University Press, 2009).
[66] Stewart M. Patrick, *The Sovereignty Wars: Reconciling America with the World* (Brookings Institution Press, 2017), https://www.cfr.org/book/sovereignty-wars.

centrality of the concept as the foundation stone of the international system and, indeed, order itself. Slaughter herself has described a networked world defined more by the presence or absence and density or scarcity of connectivity as opposed to a chessboard world defined more by separation and proximity. Scholars in the world of cyberwar add further to Slaughter's picture.[67] A hyper-connected world of digital network architecture exponentially shrinks space and time. Proximity is almost meaningless if one is attacking an adversary via the Internet, while spatial and geographic constraints return partially when cyberattacks must cross the air gap.[68] Cyberspace is defined also by anonymity. The enemies of nation-states are at once everywhere in space and time and nowhere, and their identities are obstructed.[69]

International relations scholarship could plausibly be described as caught somewhere in the midst of a Kuhnian paradigm shift.[70] It remains heavily influenced for its imagery and conceptual framework by the discrete chessboard and vertical hierarchy, while the physical and institutional world it strives to understand has transformed itself into the splintered gatelands of horizontal networks. The discipline has dabbled with formal network theory in the past with limited success – most of the literature has an economic focus and emerges from the era prior to the explosion of digital information technologies of the early 2000s.[71]

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[67] Gregory Conti and David Raymond, *On Cyber: Towards an Operational Art for Cyber Conflict* (Kopidion Press, 2017); Lucas Kello, *The Virtual Weapon and International Order* (New Haven, London: Yale University Press, 2017).

[68] John B. Sheldon, "Geopolitics and Cyber Power: Why Geography Still Matters," *American Foreign Policy Interests* 36, no. 5 (2014): 286–293.

[69] Martin C. Libicki, "Cyberwar as a Confidence Game," *Strategic Studies Quarterly* 5 (2011), http://elastic.org/~fche/mirrors/www.cryptome.org/2013/07/cyber-war-racket-0012.pdf.

[70] For debate see Bennett, "The Mother of All Isms," 462–64.

[71] Steven J. Brams, "Transaction Flows in the International System," *American Political Science Review* 60, no. 04 (1966): 880–898; Steven J. Brams, "The Structure of Influence Relationships in the International System," *International Politics and Foreign Policy: A Reader in Research and Theory*, 1969, 583–599; Kjell Skjelsbaek, "Peace and the Structure of the International Organization Network," *Journal of Peace Research* 9, no. 4 (1972): 315–330; Roger J. Nemeth and David A. Smith, "International Trade and World-System Structure: A Multiple Network Analysis," *Review (Fernand Braudel Center)* 8, no. 4 (1985): 517–560; David Snyder and

Scholars in the 1960's and 70's attempted to import the tools of network analysis to international relations with varying results.[72] The main contribution of network analysis has since been on transnational networks of activism, trade, diplomacy, and intergovernmental organisations.[73] Network analysis has also been imported to study the structural features of inequality and uneven development.[74] More recently, the study of dark networks comprised of international terrorist cells has re-emerged in response to the rise of violent fanaticism.[75] The US military has also found itself embroiled in counter-terrorism and counter-insurgency operations since 2001, elevating the study of network dynamics to new levels.[76]

As Hafner-Burton *et al.* contend, the importing of these tools to international relations remains problematic.[77] How do we understand the levels of analysis problem when shifting to the domain of states? Are these network effects between states occurring in a social

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Edward L. Kick, "Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions," *American Journal of Sociology*, 1979, 1096–1126; James R. Golden, "Economics and National Strategy: Convergence, Global Networks, and Cooperative Competition," *The Washington Quarterly* 16, no. 3 (1993): 88–113; Matthew O. Jackson and Alison Watts, "The Evolution of Social and Economic Networks," *Journal of Economic Theory* 106 (2002): 265–95.

[72] See I. Richard Savage and Karl W. Deutsch, "A Statistical Model of the Gross Analysis of Transaction Flows," *Econometrica: Journal of the Econometric Society*, 1960, pp. 551–72; Steven J. Brams, "Transaction Flows in the International System," *American Political Science Review* 60, no. 04 (1966): pp. 880–98; Steven J. Brams, "The Structure of Influence Relationships in the International System," *International Politics and Foreign Policy: A Reader in Research and Theory*, 1969, pp. 583–99; Kjell Skjelsbaek, "Peace and the Structure of the International Organization Network," *Journal of Peace Research* 9, no. 4 (1972):pp. 315–30.

[73] See for example Margaret E. Keck and Kathryn Sikkink, "Transnational Advocacy Networks in the Movement Society," *The Social Movement Society: Contentious Politics for a New Century*, 1998, pp. 217–38; Margaret E. Keck and Kathryn Sikkink, "Transnational Advocacy Networks in International and Regional Politics," *International Social Science Journal* 51, no. 159 (1999): pp. 89–101; Peter J. Spiro et al., *Nonstate Actors in Global Politics* (JSTOR, 1998), http://www.jstor.org/stable/2998158.

[74] Roger J. Nemeth and David A. Smith, "International Trade and World-System Structure: A Multiple Network Analysis," *Review (Fernand Braudel Center)* 8, no. 4 (1985): pp. 517–60; David Snyder and Edward L. Kick, "Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions," *American Journal of Sociology*, 1979, pp. 1096–1126.

[75] Valdis E. Krebs, "Mapping Networks of Terrorist Cells," *Connections* 24, no. 3 (2002): pp. 43–52; Stuart Koschade, "A Social Network Analysis of Jemaah Islamiyah: The Applications to Counterterrorism and Intelligence," *Studies in Conflict & Terrorism* 29, no. 6 (2006): pp. 559–75.

[76] Stanley A. McChrystal, "It Takes a Network," *Foreign Policy* (blog), accessed November 16, 2015, https://foreignpolicy.com/2011/02/21/it-takes-a-network/; Travis Douglas Wheeler, "It Still Takes a Network: Defeating the Progeny of Al-Qaeda in Iraq," Fletcher Forum of World Affairs, July 31, 2014, http://www.fletcherforum.org/2014/07/31/wheeler/.

[77] Emilie M. Hafner-Burton, Miles Kahler, and Alexander H. Montgomery, "Network Analysis for International Relations," *International Organization* 63, no. 03 (July 2009): p. 584.

world? English School and World Systems theorists contend that they are, and the sociological turn in international relations has unearthed a plethora of insights into state action.[78] But the structural constraints and opportunities imposed by networks are likely to affect states differently to individuals or non-government entities. When importing these tools, how do we best account for the differences? These levels of analysis puzzles perhaps best explain why the undoubted potential of network analysis as applied to international relations has lagged behind other fields. Miles Kahler compiled a volume of applied network science in 2009 with *Networked Politics*, in which contributors treated networks as both structures and actors.[79] Zeev Maoz used agent-based modelling to develop a theory of networked international politics in 2010. As Hafner-Burton *et al.* explain "Network analysis aims to identify patterns of relationships, such as hubs, cliques, or brokers, and to link those relations with outcomes of interest. Structural relations are as important as, if not more important than, attributes of individual units for determining such outcomes."[80] Actor-Network Theory, to be outlined below, provides the theoretical and methodological response to these queries.

In military affairs after 2001 network theorists applied their tools to terrorist networks.[81] Less formal theoretical approaches to thinking about IR in a networked information age, such as the concept of 'Noopolitik' introduced in 1999 by John Arquilla,[82] did not catch on with mainstream security studies. Much of the research, one suspects, branched into more

[78] Barry Buzan, Charles A. Jones, and Richard Little, *The Logic of Anarchy: Neorealism to Structural Realism* (Columbia University Press, 1993); Hedley Bull and Adam Watson, *The Expansion of International Society* (Oxford University Press, USA, 1984); John Gerard Ruggie, "What Makes the World Hang Together? Neo-Utilitarianism and the Social Constructivist Challenge," *International Organization* 52, no. 04 (1998): pp. 855–85.
[79] Miles Kahler, *Networked Politics: Agency, Power, and Governance* (Cornell University Press, 2015).
[80] Hafner-Burton, Kahler, and Montgomery, "Network Analysis for International Relations," p. 561.
[81] Krebs, "Mapping Networks of Terrorist Cells"; McChrystal, "It Takes a Network."
[82] John Arquilla et al., *The Emergence of Noopolitik: Toward An American Information Strategy* (Rand Corporation, 1999).

specialized and classified environments particularly in relation to information warfare. The unclassified information warfare literature exploded around the mid-1990s.[83] Martin Libicki has been prolific in this space. Libicki saw with stunning clarity in 1998 the basic strategic tension between the quest led by the US to "illuminate the battlefield" via the digital information revolution and the possibility that information warfare, enabled by the very network of connected things that does the illuminating, could increase the risk of confrontation.[84] To re-read Libicki and Arquilla in 2018 leaves no-one in doubt that far-sighted strategic thinkers saw our current cyber predicament coming. The implications for traditional IR, security studies, and the chessboard view should be clear. According to Scott: "The power shift has gone from a focus on kinetic controls to an all-out battle for the psychological core of the global population."[85] The traditional elements of power in a military sense, or the capacity to control pockets of air, land, sea, and space using the threat of kinetic force, while remaining relevant in all circumstances, are now penetrated by the elements of cyber-power which, though largely non-kinetic, retain a capacity to disrupt which should not be underestimated.[86] Cyber-power can tear the very fabric of society because society is a complex interdependent network. Yet as cybersecurity scholar Lucas Kello has observed, IR is a realm of inquiry "whose intellectual fashion is to reject deep change in the states system as an outcome before it is even conceived as a theoretical

[83] Eliot A. Cohen, "Strategic Information Warfare: A New Face of War," *Foreign Affairs; New York* 75, no. 4 (August 1996): 142; Cohen; Paul A. Strassmann, "New Weapons of Information Warfare," *Computerworld; Framingham* 37, no. 48 (December 1, 2003): 41; John Michael Fabry, "Information Warfare: Expanding the Paradigm" (Rutgers The State University of New Jersey - New Brunswick, 1998), https://search.proquest.com/docview/304453551/abstract/1D00BD1F4AA1468FPQ/1; John Arquilla, "Can Information Warfare Ever Be Just?," *Ethics and Information Technology; Dordrecht* 1, no. 3 (1999): 203–12.
[84] Martin C. Libicki, "Information War, Information Peace," *Journal of International Affairs* 51, no. 2 (1998): 411.
[85] Scott, 1.
[86] Sheldon, "Geopolitics and Cyber Power."

premise."[87] The field of cyber studies nonetheless is merging gradually with IR out of sheer necessity.

If IR scholarship is to inform policy it cannot linger in this transitory phase. As Slaughter asserts, it must be able to develop strategies which "integrate statecraft with webcraft, the art of designing, building, and managing networks."[88] The themes that have long informed statecraft – the geopolitics of the chessboard – must evolve into the emergent themes of webcraft. Central to this craft is the competitive tension between open and closed networks. Is the openness of a networked society a fundamental structural advantage to which a closed network will inevitably succumb? Leading network theorist and physicist Albert-László Barabási's work on 'scale-free networks' has shown why this might be the case.[89] Or will open networks trade off their capacity to grow for a catastrophic loss in internal security? These must be the questions for IR scholars. As Hafner-Burton *et al.* forewarn, as tempting as it is to plunge into the application of network analysis to burgeoning military networks, production of cogent testable claims requires careful adaptation of the tools to the specific problems of the security sphere.[90]

The digital age created previously absent persistent levels of connectivity which are an efficient medium for the transmission of power. Alec Ross, technologist, futurist, and former US State Department official, provides substance with which to build the bridge to IR in *The Industries of the Future*.[91] Ross writes of an "open/closed axis" akin to the 20th century binary of capitalism/communism. Ross's money is on the open. But how do we reconcile

[87] Kello, *The Virtual Weapon and International Order*.
[88] Slaughter, "How to Succeed in the Networked World."
[89] Albert-László Barabási, *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life* (Plume, 2003).
[90] Hafner-Burton, Kahler, and Montgomery, "Network Analysis for International Relations," pp. 584–586.
[91] Alec Ross, *The Industries of the Future* (Simon and Schuster, 2016).

Ramo's gatelands and the reality of Malcomson's splinternet with the advantages in scale and innovation offered by Ross's and Slaughter's openness? Much care in the infusion of statecraft with webcraft will be required to make an understanding of these contours available to policy makers, let alone for an open world to come to pass. Is what Slaughter describes as a "golden mean" of openness - not too much and not too little - possible? IR scholarship has every incentive to lead research which advises policy makers in this direction. All this sounds promising and, following the lead of Slaughter, Kissinger and others, quite urgent. But how might we approach developing a methodology which incorporates networks into the discipline of IR? Is it even possible or just another episode of 'import syndrome'?

3. Actor-Network Theory and IR

Actor-Network Theory (ANT) offers IR a different way of thinking theoretically about its subject. Perhaps most importantly in relation to the preceding discussion, ANT expressly abandons the dichotomy between the material and ideational, the very split that kept constructivism and realism/liberalism from a fruitful settlement. ANT reclaims the material for the constructionist,[92] and shows the materialist how objects not only acquire their meanings, but can transfer meaning to humans.[93] An 'actor network' is a non-static assemblage of human and non-human things, a "productive tension, putting structure and agency into an intimate relationship in which the network is made up of actors who are, in turn, the effects of the network."[94] This 'productive tension' distinguishes ANT from traditional approaches to IR, which as described above has always accommodated a distinct

[92] Daniel H. Nexon and Vincent Pouliot, "'Things of Networks': Situating ANT in International Relations," *International Political Sociology* 7, no. 3 (September 1, 2013): 344, https://doi.org/10.1111/ips.12026_4.
[93] Vincent Pouliot, "The Materials of Practice: Nuclear Warheads, Rhetorical Commonplaces and Committee Meetings in Russian–Atlantic Relations," *Cooperation and Conflict* 45, no. 3 (September 1, 2010): 294–311, https://doi.org/10.1177/0010836710377487.
[94] Best and Walters, "'Actor-Network Theory' and International Relationality," 332.

hierarchy between theory and evidence. Empirical case studies are considered in relation to their capacity to confirm, refute, or illuminate the claims about society, politics, economics, or security that are preconceived components of the theoretical lens in use. It has tended to deny or ignore the ways in which empirical research can itself be theoretically generative. IR's insistence on, and indeed preoccupation with, debates over distinct theoretical paradigms has, for the ANT approach, got things exactly backwards. The controversies generated by the events, problems, and shifting landscapes of the international domain should be taken as opportunities to pause, revise, and think differently, not as anomalies to be explained away and threats defended against.[95]

Andrew Barry contends that Actor-Network Theory, while not explicitly associated with the discipline of IR, accommodates a distinct set of affinities with the "open spaces" inherent to the study of the international domain since its earliest inception. He argues that the emphasis in ANT on the concept of 'translation', and in particular 'translation zones',[96] explained in chapter I, were inherently literary, political *and* geographical in scope. Citing Bruno Latour's *Science in Action* and his earlier *How to Write the Prince for Machines as well as for Machinations*,[97] early ANT could be conceived of as "an account of the relations between knowledge and empire",[98] thus in no way inimical to the content and tradition of IR. Nonetheless, some deeply problematic translations of ANT and its 'translations', as it were, have to be made if it is to be considered a useful analytical and theoretical toolset for the IR scholar. This task, to an extent limited to the purpose, scope,

[95] This argument from Bruno Latour and Peter Weibel, *Making Things Public: Atmospheres of Democracy* (ZKM/Center for Art and Media in Karlsruhe, 2005).
[96] Emily Apter, *The Translation Zone: A New Comparative Literature* (Princeton University Press, 2006).
[97] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Harvard University Press, 1987); Bruno Latour, "How to Write the Prince for Machines as Well as for Machinations," in *Technology and Social Process* (Edinburgh University Press, 1988).
[98] Barry, "The Translation Zone," 415.

and justification of ANT applied in this thesis, is taken up in chapter I. For now we take a brief look at the controversies and insights offered in the application of ANT to the discipline of IR in the existing literature.

It is not accurate to say that ANT was 'imported' into IR scholarship. Rather, scholars in IR sought to draw on ANT as a set of fruitful provocations, controversies, possibilities, as much as a set of 'tools'. Best and Walters describe ANT as a multiplicity, "an influential current within the sociology of science and technology; a relational and anti-essentialist form of materialism; an insistence that notions of agency not be confined to human subjects but embrace objects, devices, and other non-human entities; and much else besides."[99] Nexon and Pouliot identify a number of ways ANT can supplement other IR related perspectives which share a focus on processes. As IR has imported social network analysis, post-structuralism, practice theory, and relational realism,[100] ANT can offer useful directives to all. Nexon and Pouliot argue that ANT is particularly useful in tempering the tendencies of these approaches to treat subjects as static things, rather than "an analytical description of apparently stable, but fundamentally dynamic transactions and doings."[101]

In similar vein, Porter employs ANT to focus attention on the role of objects, power, and science in global finance.[102] ANT's focus on the 'tracing of associations' between human and non-human things is a powerful "corrective to the common tendency to see global finance

[99] Best and Walters, "'Actor-Network Theory' and International Relationality," 332.
[100] Patrick Thaddeus Jackson and Daniel H. Nexon, "Relations Before States:: Substance, Process and the Study of World Politics," *European Journal of International Relations* 5, no. 3 (September 1, 1999): 291–332, https://doi.org/10.1177/1354066199005003002; Emilie M. Hafner-Burton, Miles Kahler, and Alexander H. Montgomery, "Network Analysis for International Relations," *International Organization* 63, no. 03 (July 2009): 559–592; Pouliot, "The Materials of Practice"; Emanuel Adler and Vincent Pouliot, "International Practices," *International Theory* 3, no. 1 (February 2011): 1–36, https://doi.org/10.1017/S175297191000031X.
[101] Nexon and Pouliot, "'Things of Networks,'" 342.
[102] Tony Porter, "Tracing Associations in Global Finance," *International Political Sociology* 7, no. 3 (September 1, 2013): 334–38, https://doi.org/10.1111/ips.12026_2.

as involving large, powerful, unstoppable forces operating independently of humans."[103] In addition, ANT's sensitivity to the materiality of finance, a burgeoning scholarly discourse,[104] is invaluable. International finance is increasingly carried out by machines, acting autonomously or in rapidly evolving hybrids with human actors. ANT brings tangible reality back to a discourse that can uncritically dehumanize the very reality in which human beings are situated, a world of "electronic flows of money, invisible structural or market forces which operate independently of actual humans and objects, or relational qualities such as reputation or credibility."[105] This 'tracing of associations' is captured by the ANT concept of 'circulating reference', as explained in chapter I.

Beuger directs attention to the many ways in which ANT overlaps with, reinforces, and complements recent imports to IR in terms of methodologies and theories of representation.[106] Beuger suggests that ANT offers IR scholars a path out of the frustrations and blockages related to the conventions, dualisms and dilemmas of the traditional social sciences.[107] It offers this by way of an alternative conceptual vocabulary combined with a determined empirical stance aimed squarely at the actual practice of science. This forces IR scholarship back into the proximity of its subject, not only from a methodological perspective, but from the distance at which theory, and the demise of the 'great debates' about theory described above, left the field. This empirical proximity challenges the IR scholar, accustomed to speaking at arm's length about the 'state', 'anarchy', 'national interests', into a close inspection and perhaps some renewed doubt about the empirical

[103] Porter, 335.
[104] Anna Leander, "Theorising International Monetary Relations: Three Questions about the Significance of Materiality," *Contexto Internacional* 37, no. 3 (December 2015): 945–73.
[105] Porter, "Tracing Associations in Global Finance," 335.
[106] Christian Bueger, "Actor-Network Theory, Methodology, and International Organization," *International Political Sociology* 7, no. 3 (September 1, 2013): 338, https://doi.org/10.1111/ips.12026_3.
[107] Bueger, 338–39.

existence of these 'quasi objects'. By abandoning *a priori* assumptions about these phenomena, whether they are micro- or macro-, transcendent or immanent, natural or social, ANT reveals the way in which borders are policed and, of great interest to the IR scholar, where and how power is transmitted. Beuger's point that this is where the discipline was heading anyway, in its analytically eclectic phase described above, is well made.

ANT is miscast as theory, paradigm, or 'ism'. It is really an approach, an attitude,[108] a way of engaging with the world,[109] a set of principles or concepts open to being adjusted in response to the experience of empirical research.[110] Latour describes ANT as an 'infra-language' as opposed to the 'meta-language' of Classical or Newtonian science.[111] He suggests ANT connects the three sources, the sites of agency emerging from the history of science of the natural, the social, and the semiotic, without accepting the trap of trying in vain to differentiate them.[112] Since the early 1980's ANT has undergone multiple transformations in its encounters with various materials and histories, while maintaining its resistance to the over-determination of evidence by theory.[113] This embrace of multiplicities, drawing from across fields of philosophy, anthropology, sociology, science and technology is not unlike developments in IR after the Cold War (referred to above) in which its boundaries, approaches, and limitations were contested. ANT is not another 'school',

[108] Christopher Gad and Casper Jensen, "On the Consequences of Post-ANT," *Science Technology & Human Values* 35 (January 1, 2010): 55–80, https://doi.org/10.1177/0162243908329567.
[109] Annemarie Mol, "Actor-Network Theory: Sensitive Terms and Enduring Tensions," *Kölner Zeitschrift Für Soziologie Und Sozialpsychologie* 50 (January 1, 2010).
[110] Barry, "The Translation Zone," 418.
[111] Latour, *Reassembling the Social*.
[112] Bruno Latour, "On Actor-Network Theory: A Few Clarifications," *Soziale Welt* 47, no. 4 (1996): 369–81.
[113] See for example Bruno Latour, *Politics of Nature* (Harvard University Press, 2009); Isabelle Stengers, *Cosmopolitics II* (University of Minnesota Press, 2011); Latour, *Pandora's Hope*; Annemarie Mol, *The Body Multiple: Ontology in Medical Practice* (Duke University Press, 2002); Donald A. MacKenzie, Fabian Muniesa, and Lucia Siu, *Do Economists Make Markets?: On the Performativity of Economics* (Princeton University Press, 2007).

another 'theory' to be imported to IR. When Barry suggests that "actor-network theory cannot simply be applied to international relations, but must be adjusted and reconfigured in response to the problems that the field itself poses",[114] we can agree and pose the symmetrical question "what are the problems that our current reality poses to the field of IR, and how might an ANT approach allow us to adjust, reconfigure, and respond fruitfully to them?"

The 'problem', as described above, is that of the challenge to IR of the networked age. Put generally, how are the assemblages of power to which IR has always directed itself being transformed by the accelerated materiality of the digital age?[115] The researcher taking cues from many of the eminent IR scholars mentioned above is immediately attracted to ANT because of its origins in science and technology studies,[116] its willingness to 'flatten' and 'extend' the social world to a network of human and non-human actants,[117] to trace their associations and translations, capture the emergence and evolution of meaning via 'circulating reference', and to allow us to trace their marks on the world as heterogeneous 'inscriptions'.[118] No other approach in the field of IR allows the researcher to stare straight

[114] Barry, "The Translation Zone," 429.
[115] For approaches to the impacts of technology in general using ANT, see Arthur Tatnall, *Actor-Network Theory and Technology Innovation: Advancements and New Concepts* (IGI Global, 2010); Arthur Tatnall, *Technological Advancements and the Impact of Actor-Network Theory* (IGI Global, 2014).
[116] John Law, *A Sociology of Monsters: Essays on Power, Technology, and Domination* (Routledge, 1991); Bruno Latour, *Aramis, or, The Love of Technology* (Harvard University Press, 1996); Michel Callon, Arie Rip, and John Law, *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World* (Springer, 1986); Michel Callon, "Society in the Making: The Study of Technology as a Tool for Sociological Analysis," in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (MIT Press, 1987); Bruno Latour, "Technology Is Society Made Durable," *The Sociological Review* 38, no. 1_suppl (May 1, 1990): 103–31, https://doi.org/10.1111/j.1467-954X.1990.tb03350.x.
[117] Nexon and Pouliot, "'Things of Networks.'"
[118] Best and Walters, "'Actor-Network Theory' and International Relationality"; Nexon and Pouliot, "'Things of Networks'"; Bueger, "Actor-Network Theory, Methodology, and International Organization"; Carl Knappett and Lambros Malafouris, *Material Agency: Towards a Non-Anthropocentric Approach* (Springer Science & Business Media, 2008); Latour, "Technology Is Society Made Durable."

at his/her subject in this way. We *have* to use ANT if we are to speak of an IR for the networked age.

As Barry contends, while pledging to 'follow the actors', ANT has been criticised for its contentment with analysing the 'surface' of things.[119] This would appear to be a terminal failing in relation to the world of IR, in which, taken as a whole, the problem of access to information is a constant obstacle to empirical research. But IR 'as a whole' is only a *whole* if its definition as an intellectual 'discipline' is supposed to be anything other than a convenient label for a myriad of researchers applying themselves to a more-or-less shared set of research interests. The subject matter here is the heterogeneous inscriptions which emerged from several decades of digital ICT application to military affairs. Without doubt, we do not have access to everything governments and militaries say and do on the matter. But enough of the inscriptions traverse the public spaces visible to us. As the chapters unfold, it is increasingly difficult to see how any 'hidden' set of inscriptions we missed could subvert the much larger body of inscriptions that form the actor-network we are concerned with,[120] and even more difficult to see how it would impact on the hypothesis in which ANT is being deployed as methodology to test, not as evidence. The evidence offered in support of the hypothesis is the inscriptions themselves, and is explained in chapter I.

In sum, the challenges presented to ANT by IR would only prevent it being applied as an approach if, first, ANT is taken to be a discrete, static and bounded approach, which it is not, and secondly if IR is taken to be a coherent, discrete, and bounded field of enquiry, which it is not either. On the usefulness of ANT to the discipline of IR, Nexon and Pouliot

[119] Barry, "The Translation Zone," 426–27.
[120] For supporting argument see Jacqueline Best and William Walters, "Translating the Sociology of Translation," *International Political Sociology* 7, no. 3 (September 1, 2013): 346–47, https://doi.org/10.1111/ips.12026_5.

state, “Regardless of the specifics, we think it is clear that (i) actor-network theory describes a collection of theories that have significant synergies with other relational and processual approaches; and (ii) its insights should be taken seriously by the broader community of scholars interested in relational and processual theories.”[121] Beuger states: “ANT-inspired studies promise to provide major insights for understanding the worlds of international relations.”[122] From Best and Walters, “there is much in ANT that can help us understand the international, (and) even as we seek to draw inspiration from these ideas, we need to remain attuned to their limits and gaps—to pay attention to what gets lost (and found) in translation.”[123] The thesis’ treatment of both ANT and formal network theory is explained in the first chapter.

[121] Nexon and Pouliot, “‘Things of Networks,’” 344.
[122] Bueger, “Actor-Network Theory, Methodology, and International Organization,” 338.
[123] Best and Walters, “‘Actor-Network Theory’ and International Relationality,” 334.

Chapter I. Network theory (Actor and Graph) [1]

1. Introduction

Actor-Network Theory offers an approach to the subject matter which, by way of its flattened ontology, enables formal network theory (otherwise known as graph theory) to be subsequently taken up as a way of depicting the structural evolution of the international security system of the Western Pacific. This chapter explains and justifies how this approach can be applied in subsequent chapters. It begins with a brief explanation of how and why it became critical to understand networks as ubiquitous structures of contemporary international relations. Section 3 introduces the basic tenets of Actor-Network Theory deployed by this thesis, while sections 4 and 5 explains some of the basics of graph theory and the theoretical and experimental development of the scale-free network model. These sections identify the three main features of the model highlighted throughout the remainder of the thesis: growth, preferential attachment, and fitness connectivity product. Section 6 explains the ontology and methodology of networks as applied to the discourse and extra-discursive practices of networked security, and section 7 compares and contrasts a network structure approach to international relations with Waltzian structure. Finally, section 8 defines networked security and network strategy, and introduces and discusses the origins and implications of the networked security dilemma.

[1] 'Graph Theory' is more commonly referred to as Network Theory with origins in mathematics, 'graph' and 'network' are terms used interchangeably. Both are kept distinct from 'Actor-Network Theory' with origins in the Sociology of Science and Science & Technology Studies.

2. Why networks?

Networks are everywhere. Any system that supports the transmission of information can be described as a network. Networks are created by the flow of information and are agnostic regarding the physical facts that support its transmission. Social networks, corporations, and living organisms are more similar than previously thought and their properties as networks are the reason why.[2] Information in the human world can flow via oral tradition (increasing flows with the evolution of language), the written word (increasing flows with the printing press), and in our time, the electromagnetic spectrum (increasing flows with the digital information revolution). Natural constraints imposed by space, time, and technology kept networks small and easily disrupted prior to sedentary forms of civilization arising. On their own, human words and actions do not spread very far at all. The invention of the printing press in the 15th century caused an explosion in the flow of information and dramatically altered the social and organisational lives of people, the effects of which were felt for the next three centuries.[3] With the hyper-connectivity of the digital age, beginning in the 1970s with the evolution of solid-state electronics, microprocessors, and complex integrated circuits, the network has made a comeback that is again challenging both the hierarchy and the marketplace as the dominant form of social organisation that reached their respective zeniths after WWII. History can be viewed as the ebb and flow of the tension between types of social organisation – though any dichotomies are ultimately false.[4] A hierarchy is a peculiar type of network with distinctively vertical, persistent, and forcibly controllable

[2] Albert-László Barabási, *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life* (Plume, 2003).

[3] David John Harvey, *The Law Emprynted and Englysshed: The Printing Press as an Agent of Change in Law and Legal Culture 1475-1642* (Bloomsbury Publishing, 2015); Elizabeth L. Eisenstein, *The Printing Press as an Agent of Change* (Cambridge University Press, 1980); Joanne Mattern, *The Printing Press: An Information Revolution* (The Rosen Publishing Group, 2003); Samuel Willard Crompton, *The Printing Press: Transforming Power of Technology* (Infobase Publishing, 2004).

[4] See Niall Ferguson, *The Square and the Tower: Networks, Hierarchies and the Struggle for Global Power* (Penguin UK, 2017).

information flows that entrench discrepancies in power. The transactions in a marketplace lack persistent flows but are flexible. Networks defy both types.[5] They support persistent flows through interdependence but are nimble enough to adapt to change. The salience of the network as an organisation structure rises and falls as the persistence of connectivity and the presence of change. As the network becomes a more persistent and effective medium for actions the laws it harbors are revealed.

Network theory divides a system into nodes and connection (or links) for clarity. But in many systems that involve the transmission of information, such as the chemical reactions in living cells for example, the physical separation between the node and the connection might be indistinct. In this way the components of networks described by network theory are not intended to be absolute, they merely offer a useful way of describing systems and their ontology is rarely problematic. Networks have always existed, so why study them now? As the thesis will show in chapter II the age of digital networked information and communications as applied to military affairs has been approaching for some time and is now upon us. Simply put, the rise in persistent digital networked connectivity of militaries as well as the societal complexes they are situated in has created a more effective medium for the transmission of actions and influence. The rise in utility and ubiquity of the digital medium is directly related to the influence of the actions it supports. If the digital medium were to fade away and the connectivity it supports were to regress back to pre-digital age levels, so would the influence of the effects it supported. The thesis makes the uncontroversial observation that it's worth studying networks in what is unmistakably the digital networked information age. As we will see, network theory offers a lot more than

[5] Walter Powell, "Neither Market nor Hierarchy : Network Forms of Organization," *Research in Organizational Behavior* 12 (November 30, 1989).

novelty. It offers a way to understand and analyse the world that brings forth its non-static evolving structure that can help us construct better explanations.

3. Actor-Network Theory

3.1. Background

Actor-Network Theory (ANT) began as a collaborative development at the Centre de Sociologie de l'Innovation in Paris in the early 1980s between Bruno Latour, Michael Callon, and the visiting John Law.[6] ANT was initially developed to analyse processes of innovation and knowledge production in science and technology via the interactions between actors and their networks.[7] In this it was an out-growth of the interdisciplinary field of Science and Technology Studies (STS). Following Thomas Kuhn's 1962 *The Structure of Scientific Revolutions*, during the 1960s and 70s STS developed as a broad research program seeking an understanding of how society, politics, and culture affect the processes of scientific research and technological innovation, and vice versa.[8] In the mid-1980s, two seminal works highlighted the impact of society on technological design, and thus provided a concerted rebuttal of technological determinism: the idea that technology (and science) proceeded along neutral, ahistorical and apolitical paths, separated from human proclivities. *Social*

[6] Actor-Network approach began in earnest with three documents: Bruno Latour, *The Pasteurization of France* (Harvard University Press, 1988); Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay," in *Power, Action, and Belief: A New Sociology of Knowledge?* (Routledge & Kegan Paul, 1986); John Law, "On the Methods of Long Distance Control: Vessels, Navigation, and the Portuguese Route to India," in *Power, Action, and Belief: A New Sociology of Knowledge?* (Routledge & Kegan Paul, 1986).

[7] For early introduction to conceptual framework see John Law and Peter Lodge, *Science for Social Scientists* (Springer, 1984); Michel Callon and Bruno Latour, "Unscrewing the Big Leviathan: How Do Actors Macrostructure Reality?," in *Advances in Social Theory and Methodology (RLE Social Theory): Toward an Integration of Micro- and Macro-Sociologies* (Routledge, 1981).

[8] Many of the antecedents for STS were introduced in 1981 by Ludwik Fleck, *Genesis and Development of a Scientific Fact* (University of Chicago Press, 2012).

Shaping of Technology and *The Social Construction of Technological Systems*[9] reflected a decisive "turn to technology" in the field of STS.[10] Expanding on its insights and reflecting a strong affiliation with French post-structuralism (and an implicit critique of the dominant school associated with Pierre Bourdieu), ANT drew also on the study of semiotics by Algirdas Julien Greimas,[11] the philosophy of Michel Serres,[12] and the *Annales School* of history.[13] Given this eclectic genealogy,[14] a cautious definition of Actor-Network Theory is offered by John Law as follows –

> Actor-network theory is a disparate family of material-semiotic tools, sensibilities and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations. Its studies explore and characterise the webs and the practices that carry them. Like other material-semiotic approaches, the actor-network approach thus describes the enactment of materially and discursively heterogeneous relations that produce and reshuffle all kinds of actors including objects, subjects, human beings, machines, animals, 'nature', ideas, organisations, inequalities, scale and sizes, and geographical arrangements.[15]

In ANT, the 'actor' refers to an entity whose existence is produced by a network of associations within a shifting, heterogeneous field of relations rather than an individual

[9] Donald A. MacKenzie and Judy Wajcman, *The Social Shaping of Technology: How the Refrigerator Got Its Hum* (Open University Press, 1985); Wiebe E. Bijker et al., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (MIT Press, 2012).
[10] Steve Woolgar, "The Turn to Technology in Social Studies of Science," *Science, Technology, & Human Values* 16, no. 1 (January 1, 1991): 20–50, https://doi.org/10.1177/016224399101600102.
[11] Algirdas Julien Greimas, *The Social Sciences, a Semiotic View* (University of Minnesota Press, 1990); Algirdas Julien Greimas and Jacques Fontanille, *The Semiotics of Passions: From States of Affairs to States of Feeling* (U of Minnesota Press, 1993).
[12] Michel Serres and Bruno Latour, *Conversations on Science, Culture, and Time* (University of Michigan Press, 1995); Michel Serres, *Genesis* (University of Michigan Press, 1997).
[13] See "Annales. Histoire, Sciences Sociales on JSTOR," accessed April 10, 2018, http://www.jstor.org/journal/annahistscisoc.
[14] An extensive bibliography of ANT can be found at the Actor Network Resource website, http://wp.lancs.ac.uk/sciencestudies/the-actor-network-resource-thematic-list/
[15] Law, "Actor Network Theory and Material Semiotics."

agent.[16] The network of associations is in a constant process of assembly and disassembly, and does not regard human-to-human associations as having any sort of privileged place.[17] Associations are constantly occurring between people, objects, and events. It eschews the tendency of social theorists, social scientists and political scientists to stake out a privileged place for certain types of associations in advance. Instead, it directs the analyst to the very controversies that exist between these *a priori* privileges. For the tradition of IR these controversies are well known and generally understood in terms of the 'levels of analysis' problem and/or the 'agent-structure' problem. In short, should we be studying individuals or groups? And which individuals and which groups? And how do the actors in these two categories of analysis interact with each other? The conventional wisdom in the field holds that theories should move among these levels based upon criteria of explanatory efficiency.[18]

The ANT approach, described succinctly by Hexon and Pouliot, suggests instead "that we disaggregate when empirical circumstances make participants aware of the compositional character of an entity—when its nature as a system of elements becomes manifest via internal conflict, breakdown, or other processes that render it less reified."[19] To these controversies ANT makes additions rather than subtractions. Where, at times, these two species of 'problem' were quite debilitating for IR, ANT adds more to the matrix of human and non-human actors. It is the associations occurring within these networks, the way meaning is 'inscripted' into and out of materiality, 'translated' into and out of beliefs, knowledge, actions, and institutions, and distributed via 'circulating reference', that ANT

[16] Barry, "The Translation Zone," 414.
[17] See for full discussion Knappett and Malafouris, *Material Agency*.
[18] Nexon and Pouliot, "'Things of Networks.'"
[19] Nexon and Pouliot, 343.

directs the researcher toward. This thesis provides responses to the way associations occur in networks via the ANT concepts of 'translation', 'inscriptions', and 'circulating reference', explained below.

3.2. Translation

To translate is to "establish relationships of equivalence between ideas, objects, and materials that are otherwise different."[20] For Latour:

> In its linguistic and material connotation, it (translation) refers to all the displacements through other actors whose mediation is indispensable for any action to occur. In place of a rigid opposition between context and content, chains of translation refer to the work through which actors modify, displace, and translate their various and contradictory interests.[21]

These mediations produce 'inscriptions' (see below), and occur in social/technological territories, which are the 'translation zones'[22] where the locus of power resides. After Foucault, with the illusion of power radiating out from a fixed centre more difficult to sustain, social theory gravitated toward an account of power derived instead in terms of heterogeneous assemblages, distributed networks and circuits. These of course are zones in which the translation process is imperfect, incomplete, corrupted, and transformed by its actants. ANT treats the locales of controversy within a field of enquiry as precisely the places to which the researcher's attention should be directed, rather than a 'problem' to be mitigated or ignored.[23] Apter's translation zones are not simply locales where translation is successful but where translation failures occur.[24] Such zones give us the ability to map the

[20] Best and Walters, "'Actor-Network Theory' and International Relationality," 333.
[21] Latour, *Pandora's Hope*, 311.
[22] Apter, *The Translation Zone*, 5.
[23] Latour, *Reassembling the Social*, 21–27.
[24] Apter, *The Translation Zone*, 5.

network of actors and to focus research on where power and meaning are transmitted. Translation is thus the very processes of discourse and extra-discursive practice to which the thesis is attentive, while also 'translating' these empirics into the depiction of network structure introduced below.

3.3. Inscriptions

Latour defines an inscription as:

> A general term that refers to all the types of transformation through which an entity becomes materialized into a sign, an archive, a document, a piece of paper, a trace… they are usually two-dimensional, superimposable, and combinable… they allow new translations and articulations while keeping some types of relation intact… they are 'immutable mobiles' that when cleverly aligned produce the 'circulating reference'.[25]

The centrality of inscriptions to ANT is in their role of 'enrolling' other actors into the project, agenda, or worldview, in this case of 'networked security', to which the inscriptions are a party. Critically, inscriptions also play a role in obfuscating and streamlining the complex and detailed work of mediation. As Best and Walters explain: "The ultimate goal of those producing such inscriptions is to render the ideas and practices contained in them commonsensical - to translate them into a black box that no one seeks to examine too carefully."[26] This is not to suggest that to write about black box mediations is to err. As Law explains: "An actor is always a network of elements that it does not fully recognise or know: simplification or 'black-boxing' is a necessary part of agency."[27] This concept of 'black-boxing' is crucial for this thesis. It argues that the inscriptions produced by the mediations involved in the application of digital ICTs to military affairs caused, at the strategic level, the

[25] Latour, *Pandora's Hope*, 306–7.
[26] Best and Walters, "'Actor-Network Theory' and International Relationality," 332.
[27] Law, "Actor Network Theory and Material Semiotics."

black-boxing of the motives, intent, mediations, and aspirations for network effects in the international system to which traditional IR approaches remain largely unable to contend.

3.4. Circulating reference

As noted above, the success of the inscriptions in enrolling actors can be understood as a measure of the success of the 'circulating reference'. Latour describes 'reference' as "the many practices that end up articulating propositions",[28] a 'proposition' in the sense of what actants offer to other actants via a chain of events rather than as a bridge judged externally to mediate between world and word. The possibility of an articulated proposition, the transmission of meaning, is literally "the quality of the chain of transformation, the viability of its circulation."[29] Circulating reference thus describes the modification and displacement of interests, transformed through materialisation into and out of inscriptions, made persistent and durable while constantly shifting in the process of assembly/disassembly.

4. Network (Graph) theory basics

4.1. Centrality

Broadly speaking, the three most important attributes of nodes in networks are degree centrality, betweenness centrality, and closeness centrality.[30] Degree centrality describes the number of 'edges' a node has. Edges are the connections radiating out to other nodes. A high degree centrality is associated with the sociability of the node, or the number of relationships with other nodes indicated by the edges. Betweenness centrality describes the level of information that has to pass through a given node to get to other nodes. Betweenness is like a measure of what the node is on the way to. Nodes with high betweenness centrality may not have high degree centrality; that is,. not many connections,

[28] Latour, *Pandora's Hope*, 310.
[29] Latour, 310.
[30] For full summary of network basics see Mark Newman, *Networks: An Introduction* (OUP Oxford, 2010).

but the connections they do have are important ones. Finally, closeness centrality describes the number of 'steps' a given node must take to connect to all other nodes. It measures how far a node must travel to access other information in other nodes. High closeness centrality means a node has good access to information, assuming the information is widely distributed. Taken together, these three features of networks can be used to determine the importance of any given node in a network. High measures of all degrees and betweenness would generally identify a node as a hub.

4.2. Weak ties

Weak ties[31] refer to the connector nodes, or nodes with low measures of degree and closeness, but that form bridges between hubs that otherwise have very few connections between them. In social terms, these nodes might be associated with acquaintances or random meetings rather than close friends, work mates or family. The essential role these nodes play in connecting disparate networks leads to the observation that 'weak ties are strong.' An absence of weak ties between hubs can lead to higher levels of fragmentation, slowing down the transmission and natural variation in information flows. Connectors usually have high betweenness centrality and are critical components in the structure of network as a whole.

5. The scale-free network model

5.1. Hubs

The topology of most networks in the real world is not random.[32] In fact, topologies with network hubs, or rare but highly connected nodes sufficient to keep the network together

[31] Mark S. Granovetter, *The Strength of Weak Ties*, 1999.

[32] The theory of random networks was pioneered by Paul Erdos and Alfred Renyi. Their work treated networks as abstract mathematical structures and formed the foundations of network theory but had little application in

as a whole, were a defining feature of networks in the real world. In the late 1990s scientists studying networks across fields as diverse as cell biochemistry, neural networks in animals, the Internet and the World Wide Web, and social networks discovered remarkably similar non-random network topologies, creating a huge buzz in the world of network science and causing something of a renaissance in network theory.[33] Complex networks across all mediums appeared to share properties that caused them to organize themselves in certain ways. The structures that caught the most attention were hubs. Networks that self-organise in the real world form a small number of densely connected hubs. These hubs turn out to be integral to the connectivity of entire networks. This network topology was observed across fields of inquiry and it confounded previous attempts to explain how and why networks organised.[34] If topology was random, hubs would be rare or unlikely to form at all. If dense clustering was common, such as is observable in social life, many clusters would form but connectivity between disparate sub-sections should reduce to almost zero, resulting in highly fractured networks. However the entire human population, famously, is separated by less than six degrees of separation.[35] The 'distance' between any two humans is small, meaning the human tendency to form clusters does not lead to splintered and disparate human populations at all. Across observations, network topology with a large number of nodes with few connections and a small number of nodes with many connections was ubiquitous.

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the real world. See Ronald Lewis Graham and Jaroslav Nesetril, *The Mathematics of Paul Erdös I* (Springer Science & Business Media, 2012).

[33] For overview see Barabási, *Linked*, 1–55.

[34] An excellent overview of historical literature related to networks in Norman Biggs, E. Keith Lloyd, and Robin J. Wilson, *Graph Theory, 1736-1936* (Clarendon Press, 1976).

[35] Stanley Milgram, "The Small World Problem," *Psychology Today* 2 (1967): 60–67.

5.2. Scale-free

Node connectivity in networks with hubs exhibits a particular mathematical distribution. The contrast with random network theory which had dominated for decades is stark. The connectivity of nodes in a hypothetical randomly distributed network was thought to follow a bell-curve. Most nodes would have a similar number of connections, very few nodes would deviate far from this number. This characteristic of nodes, their closeness to the norm, is their 'scale'. But in observations of real-world networks, nodes did not follow a bell-curve. They follow instead a 'power-rule distribution'. This is when a high number of nodes have very few connections and a small number of nodes have many connections. There is no in-between. A medium number of nodes with a medium number of connections does not exist in complex networks in the real world. In networks that follow a power law there are no 'characteristic' node and thus no scale. Barabasi coined the term 'scale-free' network to describe this underlying feature of networks in the real world.[36] Barabasi's discovery of the power laws behind hubs spurred on the quest to understand the mechanisms driving the growth and evolution of networks

5.3. Phase transitions

Hubs following power laws form in networks that are growing and where nodes tend to attach to already well-connected nodes. In 1971 physicist Kenneth Wilson showed why power laws signalled how nature transitions from disorder to order.[37] Everywhere science looked at subsequently at atomic scales , power laws were found operating in the transition from disorder to order, or 'phase transitions'. When liquids turned into gas, when water

[36] Barabási, *Linked*, 70–71.

[37] Kenneth G. Wilson, "Renormalization Group and Critical Phenomena. I. Renormalization Group and the Kadanoff Scaling Picture," *Phys. Rev. B* 4 (November 1, 1971), https://doi.org/10.1103/PhysRevB.4.3174; Kenneth G. Wilson, "Renormalization Group and Critical Phenomena. II. Phase-Space Cell Analysis of Critical Behavior," *Physical Review B* 4 (November 1, 1971): 3184–3205, https://doi.org/10.1103/PhysRevB.4.3184.

freezes, when metals cool, when anything undergoes a phase transition, power laws were observed as the hidden signatures of self-organization in complex systems. But why were power laws showing up in the hubs researchers were observing in social networks, the World Wide Web, and other macroscopic systems? If power laws were acting, these systems must be undergoing something analogous to the phase transitions explained by Wilson. But in what way does a social network or the Internet undergo a phase transition? The answer, discovered by Barabasi and Albert, was published in 1999.[38] The processes occurring in real world networks analogous to the disorder-to-order phase transitions observed at atomic scales were identified as having two basic properties; growth and preferential attachment. Real world networks undergo the equivalent of phase transitions from which power laws emerge when, first, nodes are added (growth) and, secondly, added nodes tend to attach to existing nodes with the most connections (preferential attachment). But these networks were not transitioning from disorder to order as hypothesised. The power law causing hubs was simply a feature of each stage of the network formation process.

5.4. Growth and preferential attachment

Barabasi and a number of other scientists across physics, mathematics, computer science and biology, as well as sociology, went on to tinker with the scale-free network model, striving to adjust it to most closely resemble real world networks. For example, real networks sometimes add more links internally, reconfigure existing connections, lose nodes and connections, or slow their growth.[39] Most subsequent explorations were incorporated into the basic scale-free network model, and none have led to its falsification. As long as the network is growing with preferential attachment, hubs and the power laws they invoke

[38] Albert-László Barabási and Réka Albert, "Emergence of Scaling in Random Networks," *Science* 286, no. 5439 (October 15, 1999): 509–12, https://doi.org/10.1126/science.286.5439.509.
[39] Barabási, *Linked*, 89–90.

emerge as well. The model explains the structural evolution of networks at all scales, and hence the ubiquitous observation of hubs in most real systems. It describes self-organising phenomena that go beyond the particulars of the individual systems. The particulars of individual systems, however, could influence the structural evolution of the network. To truly describe the real world, the scale-free network model would have to incorporate the fact that the likelihood of a node attracting new connections goes beyond the value of its existing number of connections. Nodes in the real world are different, and when the network environment is competitive, they work hard to differentiate themselves to compete for connections. Barabasi and Bianconi named these extra features the 'fitness connectivity product' of individual nodes, meaning their attractiveness *in addition to* the number of existing connections.[40]

5.5. Fitness connectivity product

The scale-free model with the features of growth and preferential attachment alone does not allow for something that was observed frequently. Sometimes second-movers of late-comers gain an advantage.[41] Sometimes they quickly overtake or 'leapfrog' incumbent nodes in the network, turning first-movers into laggards. As Rigdon explained: "If an attacker is smart, he can steal a market away from a pioneer with better timing, marketing, technology innovations, or – easiest of all - any one of those, piggybacked on a major shift in technology or industry standards that catches the pioneer unawares."[42] The marketplace is littered with examples of second-mover advantage and first-mover decline. Before Google's launch in 1997, the market for search engines was dominated by AltaVista and Inktoni.

[40] Ginestra Bianconi and Albert-Laszlo Barabasi, "Competition and Multiscaling in Evolving Networks," *EPL (Europhysics Letters)* 54 (May 1, 2001): 436, https://doi.org/10.1209/epl/i2001-00260-6.
[41] See for detailed study of second-movers Joan Indiana Rigdon, "The Second-Mover Advantage," *Red Herring Magazine*, September 1, 2000, http://www.joanrigdon.com/clips/secondmover.html.
[42] Rigdon.

Google's search engine was a late-comer which quickly became dominant when in 2000, Yahoo! switched from Inktoni's search engine to Google's. Around the same time, Dell changed the rules of the retail game when it pulled its computers out of stores, shifting to online sales and taking market share away from the previously dominant Compaq. The first company to sell a diet decaffeinated cola was Royal Crown Cola. Over and over first-movers, for whom the scale-free model suggests an increasingly dominant position in the network, were usurped by late-comers whose fitness connectivity product overcame the forces of growth and preferential attachment. Barabasi and Bianconi discovered that when fitness was factored into the scale-free model, some networks would succumb to a 'winner takes all' dynamic that overtakes the structural evolution of hubs. In most networks, however, the competition for fitness between nodes remained compatible with the scale-free model.[43] Late-comers could leverage fitness to compete with and overcome incumbent nodes, but they were likely to become hubs themselves in dynamic competition with others, producing an endless hierarchical chain of a few large hubs surviving fitness competition in networks with many nodes sparsely connected. In other words, the power law-driven hubs were still the most common network topology. The scale-free model was likely to survive in all but a very few real cases.

6. Ontology and methodology

6.1. An ontology for nodes

Who and what are the nodes in international networks? Is this a levels of analysis problem? Network theory offers insights into the way in which power is transmitted across a structure that is alien to traditional IR thinking. Actor-Network Theory allows us a level of agnosticism about node identity. Degree, betweenness and closeness centrality are the

[43] Barabási, *Linked*, 106.

most important positional features of nodes in network theory, and growth and preferential attachment are the primary structural features of the scale-free network model, all of which are agnostic of identity. However, when we come to examine fitness connectivity product in relation to the scale-free model, we are interested in the extra features of the node that make it attractive to connect to, which brings identity in. Nonetheless, whether the agent is an individual, corporation, state or whatever, we are first interested in its centrality values from a positional perspective, and whether the network is growing with preferential attachment from a structural perspective. As Slaughter explains, we primarily want to understand how "different actors are connected to other actors, how different patterns of connection form different types of networks, and how the position of specific actors within a network, together with the quantity and quality of their ties to other actors, determines power, influence, and the fragility of nodes within a network and of the network as a whole."[44]

Recall that the thesis is interested in material-semiotic actor-networks associated with connectivity in the military affairs of the US, Japan and Australia in the Western Pacific. These actor-networks host the circulating reference that when present produces inscriptions which form node clusters and, as the thesis argues, the hubs of the scale-free model. To think of militaries as the discrete armed forces wing of the modern nation-state, though, would be woefully incomplete, so we cannot merely posit the state as the key 'inscriptor' in our network model. The state and the military are situated amongst an increasingly disaggregated cohort of stakeholders over whom they do not retain uncontested control. In this vein a number of scholars offer much broader and more useful

[44] Anne-Marie Slaughter, *The Chessboard and the Web: Strategies of Connection in a Networked World* (Yale University Press, 2017), 40.

characterisations of the state in late 20th and early 21st century international relations. Expanding on the familiar 'military-industrial complex' described by Eisenhower, Linda Weiss updated the term 'National Security State' first coined by Daniel Yergin in 1978.[45] She depicts a uniquely American *quid pro quo* between the imperatives and resources of the state with the indispensable capacities for innovation and efficiency of the commercial high-tech sector. Increasingly since WWII, these imperatives, resources and incentives reflect a 'spin-around' dynamic as opposed to more familiar depictions of a 'spin on/–'spin off' relationship. Shane Harris talks of a 'military-Internet' complex, and James Scott a 'corporate-nation-state-censorship-collective' to describe the cyber age, the mass-surveillance age, the age of information warfare and the extraordinary power of America's big data behemoths.[46]

For our purposes, we observe that the genesis of digital connectivity in military affairs is led by the United States.[47] The primary government drivers and beneficiaries are the Pentagon, the military services, intelligence agencies, and research and development wings. The State Department, the White House, the Judiciary, Congress, the Federal Reserve and various other agencies influence trajectories as well, as do private corporations, big financial institutions, large influential cities and think-tanks, all of which often harbour close informal government relationships. All of these actors are actants producing the inscriptions we observe, and they constitute clusters of nodes in our network topology. The modern day

[45] Linda Weiss, *America Inc.?: Innovation and Enterprise in the National Security State* (Cornell University Press, 2014), Daniel Yergin, *Shattered Peace: The Origins of the Cold War and the National Security State*, A. Deutsch, 1978.
[46] Shane Harris, *@War: The Rise of the Military-Internet Complex* (Houghton Mifflin Harcourt, 2014); James Scott, *Information Warfare: The Meme Is the Embryo of the Narrative Illusion* (Institute for Critical Infrastructure Technology, 2018), http://icitech.org/wp-content/uploads/2018/02/CCIO-Information-Warfare-The-Meme-is-the-Embryo-of-the-Narrative-Illusion.pdf.
[47] For historical genesis see Scott Malcomson, *Splinternet: How Geopolitics and Commerce Are Fragmenting the World Wide Web* (OR Books, 2016).

military, though, remains a highly connected and influential cluster of actants, situated in relational interdependence within these larger clusters.

This is the focus of the thesis. It forwards the term 'military-industrial-commercial-Internet' complex as a loose descriptor for the actor-networks in node clusters described below. . Japan and Australia accommodate vastly smaller but nonetheless analogous complexes of inscriptions and actants. For the sake of parsimony the thesis will continue to use the term 'state' when referring to the military-industrial-commercial-Internet complex.

6.2. An ontology for connections

As mentioned above, that network theory itself has become a provisional tool for international relations analysis is entirely due to the growth of persistent digital networks over the last twenty years. This growth created a medium across which influences and actions are more efficiently transmitted that was simply 'invisible' to researchers prior to the age of digital computing.[48] The medium is comprised of digital information and communications technologies hosting information in the form of binary data. This data is transmitted and stored via the electromagnetic spectrum (EMS). The infrastructure hosting (EMS)is comprised of overland and underwater fibre optic cables, satellites and satellite ground stations, network hubs, data centres, switchers, routers, complex integrated circuits, microprocessors and mobile connected devices. The term most commonly used for this medium of persistent connectivity is cyberspace. In addition to data transiting or residing in cyberspace, the ontology of connections includes the more abstract range of formal and informal agreements, contracts, licenses, meetings, non-digital communications and relationships common to the business of militaries and states. Ultimately, whether digital or

[48] Duncan J. Watts, *Six Degrees: The Science of a Connected Age* (Random House, 2004), 59.

analogue, all the meaningful and persistent connections referred to in this thesis connect at some point to people. Like node ontology, these connections are actor-networks of human and non-human actants.

6.3. Methodology

The thesis does not attempt to quantitatively model the system under analysis, though such a research path is open to future pursuit using agent-based modelling, as pursued by a number of scholars crossing over into complexity and network theory.[49] It presents analysis of the discourse and extra-discursive practices related to the application of digital networked information and communication technologies to tactical and operational level military affairs, with a focus on the United States as a coalition leader of allies in the Western Pacific. The thesis claims we can see evidence of the three defining features of the scale-free model at work – growth, preferential attachment and competition for fitness. The thesis then turns to an analysis of the discourse and extra-discursive practices relating to the growth and expansion of digital networked information systems in case studies of Japan and Australia, which the thesis claims represent further evidence of the scale-free model and its characteristic structural features of hubs. Conclusions are then extrapolated from the analysis regarding the implications of the study on international relations theory and existing discourse regarding regional security in the Western Pacific.

[49] Robert M. Axelrod, *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration* (Princeton University Press, 1997); Zeev Maoz and Ben D. Mor, *Bound by Struggle: The Strategic Evolution of Enduring International Rivalries* (University of Michigan Press, 2002); Zeev Maoz, *Networks of Nations: The Evolution, Structure, and Impact of International Networks, 1816–2001* (Cambridge University Press, 2010); Lars-Erik Cederman, *Emergent Actors in World Politics: How States and Nations Develop and Dissolve* (Princeton University Press, 1997).

7. Crossing the gap

7.1. Organizing principles

Waltz's theory of structural realism posits anarchy as the single most important organizing principle of the international system. From anarchy Waltz derives a struggle for survival in a system of like units, a hierarchy of material capabilities especially among great powers, the basic structure of the system as unipolar, bipolar or multipolar, and the need to manage a balance of power through bargaining. Anarchy thus does not determine a state's fate but represents the primary source of the forces acting on it. We can think of the scale-free network model as commensurate with Waltz's model in a number of ways. In scale-free networks, the primary organizing principle is growth. As explained above, growth gives rise to a structure dominated by hubs as long as nodes added to the network tend to attach to already well-connected nodes, known as preferential attachment. In conditions of competition for connections, and differentiation between nodes, the 'fitness' of nodes will exert an influence on the distribution of connection density, but rarely enough to disrupt the basic structural evolution of hubs. Thus the realist's world depicted by Waltz of states as static and discrete units on a competitive hierarchical chessboard under the organizing principle of anarchy is not incommensurate with Barabasi's scale-free model of non-static node connectivity in a network with competition for preferential attachment under conditions of growth.

Understanding the world as a complex adaptive system of networks is to see it as constantly changing according to self-organizing principles and a few basic incentives and constraints. Waltz's model provided a basis for understanding the incentives and constraints on states through the lens of bargaining strategies among monochrome states under anarchy while denying his was a deterministic model of state behaviour. It gave states reason to be

pessimistic about the future, nervous about security, sceptical about cooperation and cunning when it came to bargaining, but offered them little more. So can network theory provide a basis for understanding incentives and constraints in the networked age through the lens of connectivity strategies of nodes for degree, betweenness, and closeness centrality under the binary of connectivity v. isolation. Under the organizing principle of growth, however, the scale-free model allows states to develop strategies of preferential attachment and competition for fitness among differentiated nodes in the context of the predictable structural evolution of hubs. The scale-free network model thus provides more explanatory power using a structural approach to IR while remaining non-deterministic and open to change.

7.2. Contrasting crafts

In the introduction to her book *The Chessboard and the Web*, Anne-Marie Slaughter identifies two recent examples of US foreign policy statecraft that highlight the disparity between the two ways of thinking about international relations.[50] Both occurred under the Obama Administration. In June 2015, China and a group of forty-nine other states created the Asian Infrastructure Investment Bank (AIIB). The AIIB was seen as a challenge to both the Asian Development Bank and the global institutions of the International Monetary Fund and the World Bank, all of which had been established by the United States and its allies and partners in the period after WWII. The AIIB was an attempt by China to put itself at the hub of a new network of financial and monetary relations, with the purview of servicing the gap in infrastructure investment and development identified regionally and beyond. The Obama Administration urged its allies across Asia and Europe not to participate. By August 2016 all bar Japan had either joined or applied to join the AIIB, and Japan has since not ruled out

[50] Slaughter, *The Chessboard and the Web*, 1–5.

joining. US partners had ignored the urgings of the White House. The move to oppose the AIIB was seen by Slaughter as a basic misunderstanding of the contours of the networked age. Blocking the AIIB was a classic chess move that fell completely and somewhat embarrassingly flat. In the networked age, the influence of the US and its partners would have been much better served by doing the exact opposite. Network influence happens from the inside.

When the Syrian conflict began to escalate in 2011, the Obama Administration was at pains to communicate its acceptance that the US had 'no dog in this fight'. Obama had campaigned and governed strongly on the premise that the US ought to acknowledge that not all problems in the world were America's to solve. For Obama, the Bush administration's war in Iraq was a stark demonstration that the time for prudence had come in US foreign policy.[51] Obama made an exception to this in Libya in 2010 with a swift intervention, but was determined not to be drawn again. The subsequent collapse of order in Libya and the expansion of the conflict in Syria quickly spread across the region. Refugees flowed across the Mediterranean into Europe, insurgencies and terrorist groups of all stripes flowed into a patchwork of ungoverned spaces across the Middle East and Africa, and out of this vacuum emerged ISIS which was quickly able to gain territory, organise itself, and spread its brand of terror across the region and the globe. In the chessboard mentality of separation and proximity, Obama was correct to assert the absence of US interests. Though they would gradually draw US interests into dangerous proximity with Russia's, a much larger set of forces were unleashed across Northern Africa, the Middle East and beyond due to the fundamental interconnectedness of these regions with the wider world. The prudent chess

[51] Thomas J. Christensen, "Obama and Asia," Foreign Affairs, accessed August 26, 2015, https://www.foreignaffairs.com/articles/asia/obama-and-asia; Jeffrey Goldberg, "The Obama Doctrine," *The Atlantic*, April 2016, https://www.theatlantic.com/magazine/archive/2016/04/the-obama-doctrine/471525/.

player had missed the potent threat posed by a network of forces now ensnaring the US and a host of other countries in a series of dangerous and unpredictable confrontations that shows no sign of abating.

7.3. Is the scale-free network model evidence of design and intervention?

The question of whether and how the American strategic community was thinking about network effects as systemic structural forces at the strategic level is difficult to answer from an unclassified viewpoint. Without question, the influence of John Boyd's work, in its more strategic level iteration, is interwoven through the tactical and operational level discourse on networked warfare.[52] The thesis does not argue one way or the other on Boyd's impact on actual strategic policy formulation and decision making. A handful of excellent biographies and accounts of Boyd's contribution are available for perusal, as is Boyd's unpublished work, which at times can be impenetrable to outsiders.[53] In addition, until his death in 1997, Boyd's work was subject to constant updating and refinement.[54]

Notwithstanding the subsequent limits on the researcher in the public domain making empirical claims which are difficult to confirm, is the depiction of networked security forwarded here akin to a strategic theory? More specifically, can a strategic theory be non-anthropocentric, or a generative effect of the self-organising principles of a system? As Osinga points out: "Strategy abhors a vacuum: if the strategic function is lacking, strategic effect will be generated by the casual, if perhaps unguided and unwanted accumulation of tactical and operational outcomes."[55] One might wish to make the claim that the strategic vacuum, the absence of a single, all-embracing formula, was precisely Boyd's fundamental

[52] Osinga, *Science, Strategy and War*, 4.
[53] Robert Coram, *Boyd: The Fighter Pilot Who Changed the Art of War* (Hachette UK, 2002); Osinga, *Science, Strategy and War*; Hammond, *The Mind of War*.
[54] Osinga, *Science, Strategy and War*, 6–7.
[55] Osinga, 10.

strategic point, somewhat obfuscated amidst the overwrought attention to the tactical and operational aspects of his more famous OODA loop (Observe, Orient, Decide, Act).[56] In such a case, the linkage between the self-organising properties of the scale-free network, its manifestation as a strategic policy framework via networked security, and Boyd's strategic thought would be a feasible claim, though, again it is not the focus of this thesis.

The question of authorship and ownership of the phenomena described in this thesis may be simply a tautology. As the military-industrial complex described by Eisenhower evolved into the military-industrial-commercial-internet complex of the 21st century, the range of stakeholders and agendas expanded naturally. In 2018, the disparate collective flies nonetheless as birds of a feather. The imperatives stakeholders face to compete in the digital network age impose incentives and constraints acting as self-organising principles. Command economies, mixed economies, and the capacity of states to 'steer' market forces have given way to the 'soft-edged state',[57] competing for survival and advantage as a series of nodes within a much larger node cluster which are together co-producing new structural influences. The organising principles inherent in the structure of the network emerge and become visible as the network grows with preferential attachments alongside the influence of fitness, as driven by the power laws driving the scale-free model. The thesis suggests that the self-organizing scale-free network is a *strategic force in its own right* and none of its components need be the architect. The scale-free model has no architect. As Barabasi writes, it is a 'web without a spider'.[58] This may be its fundamental strength. Attempts at control disrupt its most important property; that of its circulating reference. But, crucially,

[56] Brown, "Opening the Loop: A Look inside the Mind of John Boyd."
[57] See Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Warner Books, 1994), 242–43.
[58] Barabási, *Linked*, 219–27.

circulating reference is precisely the result of the assemblage of associations between human and non-human actants that form the substance of the actor-network. Networked security might thus be described not as a strategy, but as a way of doing things, an attitude, a thought process, captured by circulating references generating strategic effects. Again we glimpse perhaps the essence of Boyd's message that strategic theory is not really theory. It is more a set of propositions, hypotheses and models. Theories resulting in successful outcomes in conflictual circumstances get replicated and emulated, forcing the theorist to shift, adjust and reformulate for a reasonable expectation of success. They are constantly moving and not receptive therefore to parsimonious enunciation. As more information about the structural evolution of the network comes to light in the years ahead, more analytical rigour can be applied to assessing the validity of the model.

7.4. From hub-and-spokes to scale-free

The US-centric hub-and-spoke model well known to IR scholars, combining formal treaty-based bilateral alliances and quasi-official security guarantees, was the defining structure of the Western Pacific security system for the duration of the Cold War. It was a system of discrete, exclusive, highly asymmetric alliances with the Republic of Korea, the Republic of China and Japan in East Asia, Thailand, the Philippines and Singapore in South-East Asia, and separately, Australia and New Zealand as a distant southern anchor.[59] As the overwhelmingly dominant actor the US enjoyed an oversized influence in a model based on Waltzian bargaining. The US assured its alliance partner of support in the event of conflict and, in return, the US gained autonomy or influence over the junior partner's foreign policy decision-making process. The hub-and-spokes model differed significantly from other US

[59] Victor D. Cha, "Powerplay Origins of the U.S. Alliance System in Asia," *International Security* 34, no. 3 (2009): 158–96.

alliance relationships, most notably the much more elaborate and multilateral NATO arrangement. . According to Victor Cha, the strictly bilateral structure of the system in the Western Pacific was due to US desires in the post-war era to retain tight control in a region both ripe for rivalry[60] and susceptible to communist takeover.[61] Cha's 'Powerplay' theory depicts a classic case of a senior alliance partner motivated predominantly by the desire to avoid entanglement while retaining maximum strategic advantage via the extension of its foreign influence.[62] The system of spokes, rather than NATO-style multilateralism or deep enmeshment, was the imperfect but clear American preference. The extensive San Francisco treaties reflected the belief post-war that of all of East Asia's states, Japan harboured the most near-term great power potential.

When the Cold War ended, the United States reluctantly accepted the emergence of a series of multilateral security fora, envisioned by their proponents as supplementing rather than replacing the incumbent system.[63] Much of the discussion regarding China's re-emergence was cast in the shadow of a debate about a regional security structure that retainsed the basic features of hub-and-spokes.[64] However, as the examination of US military transformation in chapter IV shows, the post-Cold War era was defined by a little-acknowledged contrast. The US military reduced its 'footprint' worldwide while at the same time embarking on a new era of increasing global connectivity. The rise of persistent

[60] Aaron L. Friedberg, "Ripe for Rivalry: Prospects for Peace in a Multipolar Asia," *International Security* 18, no. 3 (1993): 5–33, https://doi.org/10.2307/2539204.
[61] For full explanation see Victor D. Cha, *Powerplay: The Origins of the American Alliance System in Asia* (Princeton University Press, 2016).
[62] See D Scott Bennett, "Testing Alternative Models of Alliance Duration, 1816-1984," *American Journal of Political Science* 41 (July 1, 1997), https://doi.org/10.2307/2111677.
[63] James A. Baker III, "America in Asia: Emerging Architecture for a Pacific Community," *Foreign Affairs*, December 1, 1991, https://www.foreignaffairs.com/articles/asia/1991-12-01/america-asia-emerging-architecture-pacific-community.
[64] Alastair Iain Johnston, *Social States: China in International Institutions, 1980-2000* (Princeton University Press, 2014); G. John Ikenberry, "The Rise of China and the Future of the West: Can the Liberal System Survive?," *Foreign Affairs*, January 2008, http://www.foreignaffairs.org/20080101faessay87102/g-john-ikenberry/the-rise-of-...

networks of connections enabled by the growth of digital information and communication technologies created an overlay of systems that transmitted influence. The hub-and-spokes model was superseded, but not for the most popular reasons in foreign policy discourse, which is dominated by binary opposites. . On one side are the declinists who fear the US is losing influence to a resurgent China. To these thinkers, the US over-reached, under-invested, strategised poorly if at all, succumbed to distraction, and was out-foxed by China.[65] The US was best served by re-committing to the consolidation of its bilateral relationships, starting with the material reassurance of its allies. To others, the China threat is overblown. The US continues to benefit from the order it created after WWII even as the relative distribution of power shifts.[66] The US can cede strategic space to China and play an 'offshore-balancing' role. Another group takes the view that US influence can be extended by a foreign policy shift toward embracing deeper multilateral enmeshment in the Western Pacific, which is a region of high strategic value.[67] Only by shedding its distaste for

[65] Jeremy Adelman, "Donald Trump Is Declaring Bankruptcy on the Post-War World Order," *Foreign Policy* (blog), November 20, 2016, https://foreignpolicy.com/2016/11/20/this-is-how-seven-decades-of-prosperity-and-tolerance-end-donald-trump-globalization/; Stephen M. Walt, "Lax Americana," *Foreign Policy* (blog), accessed October 27, 2015, https://foreignpolicy.com/2015/10/23/lax-americana-obama-foreign-policy-retreat-syria-putin-ukraine/; P. Edward Haley, *Strategies of Dominance: The Misdirection of U.S. Foreign Policy* (Woodrow Wilson Center Press, 2006); Steven Simon and Jonathan Stevenson, "The End of Pax Americana," Foreign Affairs, accessed October 21, 2015, https://www.foreignaffairs.com/articles/middle-east/2015-10-20/end-pax-americana; Antoinette Burton, "The Folly of Empire," Foreign Affairs, November 25, 2015, https://www.foreignaffairs.com/articles/united-kingdom/2015-11-25/folly-empire; Christopher Layne, "This Time It's Real: The End of Unipolarity and the Pax Americana," *International Studies Quarterly* 56, no. 1 (2012): 203–213; Hugh White, *The China Choice: Why America Should Share Power* (Black Inc., 2012), http://www.amazon.com/The-China-Choice-Hugh-White/dp/1863955623.

[66] Joseph S. Nye Jr, "The Future of U.S.-China Relations," March 10, 2015, http://www.chinausfocus.com/foreign-policy/the-future-of-us-china-relations/; Joseph S. Nye Jr, "The Misleading Metaphor of Decline," *Wall Street Journal*, February 14, 2011, http://www.wsj.com/articles/SB10001424052748704358704576118673650278558; Arvind Subramanian, "The Inevitable Superpower," *Foreign Affairs* 90, no. 5 (2011): 66–78; Salvatore Babones, "American Hegemony Is Here to Stay," Text, The National Interest, accessed June 26, 2015, http://nationalinterest.org/feature/american-hegemony-here-stay-13089; Michael Beckley, "China's Century? Why America's Edge Will Endure," *International Security* 36, no. 3 (December 28, 2011): 41–78, https://doi.org/10.1162/ISEC_a_00066.

[67] Victor D. Cha, "Complex Patchworks: U.S. Alliances as Part of Asia's Regional Architecture," *Asia Policy* 11, no. 1 (February 2, 2011): 27–50, https://doi.org/10.1353/asp.2011.0004; Evelyn Goh, *The Struggle for Order: Hegemony, Hierarchy, and Transition in Post-Cold War East Asia* (Oxford University Press, 2013).

entanglement and the needless husbanding of proprietary capabilities will the US retain its edge. This group is deeply concerned about the apparent shift toward the quasi-isolationist stance they see emerging with the Trump administration.

This thesis forwards an alternate view. he Western Pacific security system must be viewed as a scale-free network accommodating its own organizing principles which lowers the salience of traditional bargaining perspectives. The overwhelming motivating factors for states in the scale-free model are incentives of growth, preferential attachment, and fitness captured by the presence of the circulating reference. The self-organizing growth of the scale-free network since the late 1990s allowed the US to invest less in formal and politically binding agreements, and in the material reassurance of allies and partners. The structural evolution of the network, the 'stickiness' of hubs and the nominally organic uptake of the circulating reference s incentivised US partners against defection from the US-led regional order. An increasingly untangled US used this flexibility to benefit from engagement with China economically without taking the risk that China's growing geo-economic power would result in the need for a grand strategic bargain or a cascade of regional defectors. China's growing military capability was instrumentalised as a narrative supporting auxiliary US goals as well as those related directly to the fitness connectivity product of US nodes and, thus, the network's continued growth. The much debated risk of China 'salami-slicing' its way to a position of regional coercive dominance under the threshold of US military intervention, where regional states face a slow-moving bargaining binary between band-wagoning and balancing, is recast as a contest between networks for attachment in which no amount of Chinese 'fitness' could overcome the US's lead in preferential attachment. The late-comer would not have its day. The perceived imperative

for the US to enmesh itself in East Asia's much maligned multilateral fora could basically be ignored. Lastly and perhaps most controversially, the scale-free model suggests that the untangling of the US from formal commitments is a feature, not a bug, of US strategy going forward.

The binary opposite motivating states is connectivity versus isolation in the networked environment they cannot escape. This perspective argues for a shift away from the binaries that dominated thinking about the East Asian order of engagement or hedging, containment or co-habitation, multilateralism, bilateralism, or unilateralism, and confrontation or appeasement.[68] Where persistent digital connectivity in military affairs has grown over the last twenty years we find networks are found to be increasingly efficient transmission mediums for influence. The US-led alliance system of the Western Pacific since the Cold War, is a locus of the growth and expansion in digital networked information systems related to military affairs. These military-led systems extend throughout society as the full digitisation of political economies deepens. The fundamental networked binary of connectivity versus isolation harbours severely reduced levels of volition for states not willing or able to pursue strategies of connectivity. Its effects are not able to be quarantined

[68] Graham Palmer, "Engage and Hedge: US Policy towards Asia-Pacific Since 1990," *East Asia Research Programme* (blog), December 16, 2015, http://earp.in/en/engage-and-hedge-us-policy-towards-asia-pacific-since-1990/, earp.in/en/engage-and-hedge-us-policy-towards-asia-pacific-since-1990/; Deng Zhenghui, "Is America Trying to Contain China?," Text, The National Interest, accessed April 7, 2015, http://nationalinterest.org/blog/the-buzz/america-trying-contain-china-12555; Cha, "Complex Patchworks"; Peter Navarro, *Crouching Tiger: What China's Militarism Means for the World*, 1St Edition edition (Amherst, New York: Prometheus Books, 2015); Edward N. Luttwak, *The Rise of China vs. the Logic of Strategy* (Harvard University Press, 2012); Jim Mann, *About Face: A History of America's Curious Relationship with China, from Nixon to Clinton* (Taylor & Francis, 1999), http://www.tandfonline.com/doi/pdf/10.1080/10803920.1999.10392009; Lyle J. Goldstein, *Meeting China Halfway: How to Defuse the Emerging US-China Rivalry* (Georgetown University Press, 2015); Jeffrey A. Bader, *Obama and China's Rise: An Insider's Account of America's Asia Strategy* (Brookings Institution Press, 2013); Toshi Yoshihara and James Holmes, *Red Star Over the Pacific: China's Rise and the Challenge to U.S. Maritime Strategy* (Naval Institute Press, 2011); James Steinberg and Michael E. O`Hanlon, *Strategic Reassurance and Resolve: U.S.-China Relations in the Twenty-First Century* (Princeton, New Jersey: Princeton University Press, 2014); White, *The China Choice*.

to the sub-sector of military affairs, as forewarned in the literature of the mid-1990s on cyber and information warfare. . A high-tech conventional military capability that is not part of a scale-free network structure is a wasted resource that will produce diminishing returns in the networked age. The disaggregation of states paradoxically enmeshes them in an ever-deeper system of constraints whose source is the system's evolving structure. This enmeshment leads us to the concept of networked security.

8. Networked security

8.1. Definitions

We define networked security in the context of international relations as: The freedom from or resilience against potential harm from external forces derived from the centrality value and position of nodes in a non-static network structure. Further, a network strategy in international relations is defined as: *The extraction of strategic effect from the self-organizing structural evolution of the network.*

Networked security is an alternative conceptual framework for analysing the structural forces producing the incentives and constraints on states in the network age. It applies the framework in a preliminary assessment of the security system of the Western Pacific, arguing the features of the scale-free network model are observable. The network's structure has an observable effect on the regional security system while lacking the authorship of any of the system's actors. Understanding the scale-free network's self-organizing principles is a first step to understanding how policy-makers informed by the concept might harness their potential, as Slaughter has advised.[69]

[69] Slaughter, *The Chessboard and the Web*, 159–233.

8.2. Networked security dilemma

As security and strategy in Waltz's world were in constant tension with the security dilemma, so is there a fundamental tension within the concept of networked security and strategy. Freedom from or resilience against potential harm from external forces derived from the centrality value and position of nodes in a non-static network structure results in a dilemma. The degree of security is reliant completely on the existence and forbearance of the network itself. As detailed above, 'the network' is the persistent digital connectivity of cyberspace that creates the medium for transmission of network effects in the first place. If the medium itself can be disrupted, distorted, manipulated or destroyed, so can the capacity to extract security and strategic advantage from it be denied. Furthermore, the networked digital medium and the information it supports in transit and storage could be turned into a weaponised platform from which to attack societies which, via the expansion of the digital medium, are completely reliant on it. In other words, networked security is appositely networked insecurity. It is a networked security dilemma.

In 1998 in 'Information War, Information Peace', Libicki explained this important and under-recognised paradox. The quest to "illuminate the battlefield"[70] with a globally situated and connected digital sensor grid, which would expedite US and allied networked operations and make adversary military aggression harder to prosecute, could be undermined and repurposed as a ubiquitous medium for the propagation of information warfare and a greater likelihood of violent confrontation.[71] Either an illuminated and therefore less violent battlefield, or an insecure substrate of interconnected vulnerabilities, could be the outcome of digitally networked military capabilities which cannot be quarantined from the civilian

[70] Martin C. Libicki, *Illuminating Tomorrow's War* (DIANE Publishing, 1999).
[71] Martin C. Libicki, "Information War, Information Peace," *Journal of International Affairs* 51, no. 2 (1998): 411.

domain. Libicki said of the dilemma: "Some systems make it easier for nations to resolve their differences and trust one another; others, by their nature, exacerbate suspicion."[72] In 1998 ago Libicki wrote that the US had a "fundamental choice" between these two national defence paths.[73] The agency implied in this conception may have been overwrought.

8.3. Everything as a system

As H.R. McMaster said: "There are basically two ways to fight the US military: asymmetrically and stupid."[74] The adversary gets a vote. One measure of a national defence pathway can be observed in what it's actual and potential adversaries do in response. Both Russia and China viewed the widening American operational military edge in 1991 with alarm. As reflected in the discourse analysed in this thesis, there was no shortage of publicly available Pentagon and U.S. think tank literature debating the next phase of development and military-technical consolidation for them to peruse. Global ramifications flow from what the United States decides to do in military affairs. No 'meme' goes ignored, and so it was with battlefield illumination and the pursuit of network-centric warfare. Perhaps most alarming, though, from the perspective of US competitors and adversaries was the concept of 'effects-based operations' as the overall approach to warfare that underpinned these development paths.

In 1999 the consulting firm Booz-Allen and Hamilton prepared a report for the Office of the Secretary of Defense, Office of Net Assessment at the Pentagon entitled *Measuring the Effects of Network-Centric Warfare*.[75] The report recommended a fundamental shift in the

[72] Libicki, 411–12.
[73] Libicki, 411.
[74] McMaster quoted by Allison Schrager, "The Four Fallacies of Warfare, According to Donald Trump's New National Security Advisor," *Quartz* (blog), February 21, 2017, https://qz.com/915438/the-four-fallacies-of-warfare-according-to-national-security-advisor-hr-mcmaster/.
[75] Booz-Allen and Hamilton, "Measuring the Effects of Network-Centric Warfare. Volume 1."

way the military assessed the effectiveness of new operational concepts in warfare. It suggested that the traditional models based on attrition of the individual components of an adversary's forces and measuring the destructiveness of discrete physical events were insufficient to capture the effectiveness of networked warfare concepts.[76] The new model for measuring effectiveness was designed to capture the degradation of adversary systems as a whole rather than the components of the system. It was based on the observation that it is the *cohesion* of military systems that determines their effectiveness in warfare. By disrupting cohesion with surgical-like precision, the disorganisation and disunity of adversary systems could be measured as an overall effect not unlike the physical property of entropy. Entropy is a specific property of a closed system in the science of thermodynamics, but applied generally it is thought of as a measure of a system's transition from order to disorder. The consulting firm trademarked its approach as 'Entropy-Based Warfare',[77] aimed at the time primarily at the US Navy. The de-coherence of adversary forces as whole systems became an underlying tenet of the goals at the operational level of network-centric warfare. This emphasis on 'effects' over 'attrition' led to the adoption of the term 'effects-based operations' and was taken up across the services and led top-down in the US by Joint Command.[78] The Australian journal *Security Challenges* devoted a special issue to the

[76] Booz-Allen and Hamilton, 2.

[77] Mark Herman, "Entropy-Based Warfare: Modeling the Revolution in Military Affairs," *Joint Force Quarterly*, Autumn/Winter -99 1998, http://www.dtic.mil/dtic/tr/fulltext/u2/a426666.pdf.

[78] Joint Staff, "Commander's Handbook for an Effects-Based Approach to Joint Operations"; Smith Jr., "Effects-Based Operations"; Jobbagy, "Effects-Based Operations and the Age of Complexity"; T. Williams, "Effects-Based Operations"; Duczynski, "Effects–Based Operations between Australia and the United States: Achieving Interoperability at the Strategic Level through Shared End–States"; Guy Duczynski, "Getting to Purposeful Information Operations: The Application of Effects-Based Approaches," *Journal of Information Warfare* 4, no. 3 (December 2005), https://www.jinfowar.com/tags/effects%E2%80%93based-operations; Zoltan Jobbagy, "Scrutinising Effects-Based Operations," *AARMS* 7 (January 1, 2008): 167–74; James N. Mattis, "USJFCOM Commander's Guidance for Effects-Based Operations," *Parameters*, Autumn 2008, http://ssi.armywarcollege.edu/pubs/parameters/Articles/08autumn/mattis.pdf.

subject in 2006.[79] The concept of effects-based operations attracted adherents and critics as passionate in their views as each other. We find here a bridge between operational and strategic level implications. Effects-based operations took the entire national entity as its subject. Smith Jr. noted: "They treat national power as a whole and consider its application not just to military operations but across the *entire spectrum of competition and conflict* from peacetime deterrence, to crisis response, to hostilities in all their varied forms, to the restoration of peace."[80] Moreover, he is explicit regarding the total dissolution of boundaries:

> Operations focus on a 'behaviour' end state that is scalable from the tactical to the geo-strategic level and applicable to diplomatic, political, military, and economic efforts arenas. And, the 'behaviour' considered is as much that of friends and neutrals as it is of the foe. In short, effects-based operations are basically a stimulus and response approach to operations that spans an entire national response, the full spectrum of competition and conflict, and actors from the individual through the state.[81]

8.4. Information warfare

As the US military engaged in various types of 'mud warfare' post-Cold War, the emphasis given to effects-based operations inevitably spawned an insidious set of asymmetric attack vectors in the shape of information warfare.[82] In 1995 Libicki wrote of information warfare as follows: "All forms of struggle over control and dominance of information are considered essentially one struggle, and the techniques of information warfare are seen as aspects of a

[79] Accessed at https://www.regionalsecurity.org.au/page-1858606
[80] Smith Jr., "Effects-Based Operations," 43; Smith Jr., *Effects Based Operations*.
[81] Smith Jr., "Effects-Based Operations," 46.
[82] Roger C. Molander et al., *Strategic Information Warfare: A New Face of War* (Rand Corporation, 1996); Martin C. Libicki, "What Is Information Warfare?," *Strategic Forum*, no. 28–31 (May 1, 1995), https://www.questia.com/library/journal/1G1-129891565/what-is-information-warfare; Winn Schwartau, *Information Warfare: Chaos on the Electronic Superhighway* (Thunder's Mouth Press, 1995); Dorothy Elizabeth Robling Denning, *Information Warfare and Security* (ACM Press, 1999); Robert Helms Anderson, Anthony C. Hearn, and United States Defense Advanced Research Projects Agency, *An Exploration of Cyberspace Security R&D Investment Strategies for DARPA: "The Day After-- in Cyberspace II"* (Rand, 1996).

single discipline."[83] These techniques could be divided into seven overlapping sub-categories, all involving the protection, manipulation, degradation, and denial of information; range from the analogue to the digital, be transmitted via anything from carbon to silicon, and could manifest in the oldest forms of conflict to the newest technologies.[84] This taxonomy reflected a unique puzzle regarding information warfare that persists: If f it can be everything at once, what is it not? In what sense and under what terms does it have a beginning and an end? Would battle be joined deliberately or by accident? This enduring puzzle produces another unhelpful problem. If information warfare is essentially indefinable, the definition that does tend to stick will be the one imposed on it, often by a single constituency or the most motivated actor. In many ways, this is the case with information warfare since the mid-1990s. It eluded a definitive form until something arose for it to oppose and therefore reflect. Toffler and Toffler foresaw this predicament in *War and Anti-War* in 1993.[85] Viewing the history of warfare as essentially reflecting the incumbent society's mode of production, the ubiquitous information age would inevitably be the age of unrestricted information war. [86] But as Libicki pointed out, it was not clear which form and path information war would take, nor how it would interact with the

[83] Martin C. Libicki, "What Is Information Warfare?" (National Defense University: Center for Advanced Concepts and Technology, Institute for National Strategic Studies, August 1995), x, http://www.dtic.mil/dtic/tr/fulltext/u2/a367662.pdf.
[84] Libicki, x.
[85] Toffler and Toffler, *War and Anti-War*.
[86] Martin C. Libicki, *Conquest in Cyberspace: National Security and Information Warfare* (Cambridge University Press, 2007); Brandon Valeriano and Ryan C. Maness, *Cyber War versus Cyber Realities: Cyber Conflict in the International System* (Oxford, New York: Oxford University Press, 2015); Martin C. Libicki, "Cyberwar as a Confidence Game," *Strategic Studies Quarterly* 5 (2011), http://elastic.org/~fche/mirrors/www.cryptome.org/2013/07/cyber-war-racket-0012.pdf; John B. Sheldon, "Deciphering Cyberpower Strategic Purpose in Peace and War," *Strategic Studies Quarterly: SSQ; Maxwell Air Force Base* 5, no. 2 (Summer 2011): 95–112; John B. Sheldon, "Geopolitics and Cyber Power: Why Geography Still Matters," *American Foreign Policy Interests* 36, no. 5 (2014): 286–293; Gregory Conti and David Raymond, *On Cyber: Towards an Operational Art for Cyber Conflict* (Kopidion Press, 2017).

structural power of networks.[87] While many pathways were available, most had to do with confidence.

Perhaps the most telling characterization of the gross impact of effects-based operations via cyber and information warfare since the 1990s , was its effect on confidence.[88] The breaching of the civil-military divide in information operations destroyed confidence in information in general. It turned 21st century strategic competition into a confidence game. Given the high levels of mutual vulnerability involved, it might at first glance be unclear who stands to benefit strategically. It might be characterised accurately as a contest between societies better able to survive and adapt to high levels of uncertainty, disunity, disorganisation and disruption or, indeed, entropy. But those societies better able to adapt and pursue a network strategy, or the – extraction of strategic effect from the self-organizing structural evolution of the network, may be better positioned to survive entropy.

This is where the potential of the scale-free network model, with its features of growth, preferential attachment and fitness, comes to the fore as a policy-making instrument. Even in a world of mutual vulnerability based on an insecure digital medium, network actors strategising for high centrality as nodes in hub formations in growing networks with preferential attachment have a much greater chance of prevailing. In short, in the network age the bigger, better connected, fitter and faster growing network offers its participants the resources they will need to cope with the entropy associated with rapid and unpredictable change. Smaller networks with less potential for growth, fewer connections, slower growth rates, and inferior fitness will be disadvantaged in the resources they can

[87] Libicki, "What Is Information Warfare?," 3.
[88] Libicki, "Cyberwar as a Confidence Game."

commandeer to deal with the same vulnerabilities. Outliers, moreover, will have little chance at all.

Using Libicki's 1998 characterisation, the US and its allies took two national defence paths simultaneously. The latter path of information warfare which exploits the vulnerability of the cyber and cognitive domains and destroys confidence in information across military and civilian domains was only reluctantly joined by the US. In 2011 Libicki argued: "The United States, for its part, generally has little interest in creating chaos or ruining the authority of other institutions, even if some regimes deserved as much. Societies that depend on cyber systems understand the risks of starting *that* fight."[89] Unfortunately, "that" fight is, in 2018, out of control.[90] Was it simply inevitable, as Libicki's observations seem to infer, that effects-based operations would bleed into the strategic realm via the temptation of information warfare? Or was it driven by the perception held by US adversaries that this was a strategic pathway open to inevitable US exploitation? The reason for this is a subject for further research. For our purposes here, the network security dilemma is a fact of life in the network age. We observe that the network that makes states vulnerable is also the network that enables other strategic effects, so far largely ignored by IR scholars. With the use of the scale-free model these effects can be explained using the basic structural features of growth, preferential attachment and competition for fitness. The task now of the thesis is to

[89] Libicki. Emphasis original.

[90] James Scott, *Information Warfare: The Meme Is the Embryo of the Narrative Illusion* (Institute for Critical Infrastructure Technology, 2018), http://icitech.org/wp-content/uploads/2018/02/CCIO-Information-Warfare-The-Meme-is-the-Embryo-of-the-Narrative-Illusion.pdf; James Scott, "Metadata: The Most Potent Weapon in This Cyber War – The New Cyber-Kinetic-Meta War" (Institute for Critical Infrastructure Technology, July 2017), http://icitech.org/wp-content/uploads/2017/07/ICIT-Brief-Metadata-The-Most-Powerful-Weapon-in-This-Cyberwar1.pdf; James Scott et al., "Next Generation Defenses for a Hyper Evolving Threat Landscape: An Anthology of ICIT Fellow Essays Volume I" (Institute for Critical Infrastructure Technology, June 2017), http://icitech.org/wp-content/uploads/2017/06/ICIT-Anthology-Volume-I-Next-Generation-Defenses-for-a-Hyper-Evolving-Threat-Landscape1.pdf; Conti and Raymond, *On Cyber: Towards an Operational Art for Cyber Conflict*; Lucas Kello, *The Virtual Weapon and International Order* (New Haven, London: Yale University Press, 2017).

show that the security system in the Western Pacific can first be understood in terms of the scale-free network model that has evolved according to these principles to give IR theory a way to return to structure in the production of better explanations.

9. Conclusion

This chapter introduced Actor-Network theory and the scale-free network model. Its three main features of growth, preferential attachment, and fitness connectivity product are critical to the analysis in the remainder of the thesis. A network approach to IR was contrasted with Waltzian structuralism, arguing that commensurate themes are available to scholars making the cross-over. It argued the scale-free network model offers the reorientation of a traditional IR understanding of the US's Cold War hub-and-spokes model in the Western Pacific. The concept of networked security was defined and the networked security dilemma was presented in relation to information warfare and its associated themes. The following three chapters argue that the three features of the scale-free model are exhibited in the discourse and extra-discursive practices related to the growth of digital connectivity in information systems that underpin the quest to stand up fully networked coalition forces of the US military and its partners.

Chapter II. Growth of the digital medium

1. Introduction

The primary organising principle of the scale-free network model is growth. Discourse related to the pursuit of the concept of information dominance, as the key driver of growth in the digital domain as an effective medium for the transmission of influence over the last twenty years, is analysed in this chapter. It shows how the capacity to gather and exploit information consolidated at the centre of the contemporary US warfighting regime. This consolidation is anchored usefully in the emergence of the guided-munitions era, outlined in section 2. Literature addressing the impact of precision-guided munitions and the integrated battle networks that support them on the evolution of warfare is extensive and comprehensive. Barry Watts' *Six Decades of Guided Munitions and Battle Networks: Progress and Prospects; The Evolution of Precision Strike;* and *The Maturing Revolution in Military Affairs* is prescient.[1] Since 1945, with increasing intensity from the mid-1970s, each service within the US military independently pursued modernisation programs with similar themes relating to the growing importance of information, networks and connectivity.[2] Andrew Krepinevich's *The Military-Technical Revolution: A Preliminary Assessment*[3] in 1992 brought the revolution in military affairs (RMA) to the centre of mainstream US strategic

[1] Barry D. Watts, *Six Decades of Guided Munitions and Battle Networks: Progress and Prospects* (Center for Strategic and Budgetary Assessments Washington, DC, 2007), http://www.csbaonline.org/wp-content/uploads/2011/06/2007.03.01-Six-Decades-Of-Guided-Weapons.pdf; Barry D. Watts, "The Evolution of Precision Strike" (Center for Strategic and Budgetary Assessments, 2013), http://www.csbaonline.org/publications/2013/08/the-evolution-of-precision-strike/; Barry D. Watts, "The Maturing Revolution in Military Affairs" (Center for Strategic and Budgetary Assessments, 2011), http://www.csbaonline.org/publications/2011/06/the-maturing-revolution-in-military-affairs/.
[2] Mitchell, "Freedom and Control," p. 29.
[3] Andrew F. Krepinevich, *The Military-Technical Revolution: A Preliminary Assessment* (Center for Strategic and Budgetary Assessments, 1992), http://www.csbaonline.org/4Publications/PubLibrary/R.20021002.MTR/R.20021002.MTR.pdf.

discourse, with the Centre for Strategic and Budgetary Affairs (CSBA) and Andrew Marshall's Office of Net Assessment (ONA) in the Pentagon its centre of gravity. Publications focus on the tactical, operational, technical, doctrinal, and organisational aspects bought to warfare and its planning by these developments, and form the foundation of understanding of these aspects on which the discourse analysis proceeds. Network-centric warfare (NCW) is introduced in section 3, the evolution of which reflected the quest to capitalise on the tactical and operational advantages offered by the guided-munitions regime, and further elevated the status of information networks. Section 4 considers the contemporary quest by the US to maintain its military-technical edge in the form of a 'Third Offset Strategy', before concluding in section 5 with a focus on the critical elements of information dominance, raising the prospect of the strategic implications on alliance dynamics and deterrence in the Western Pacific that will provide a segue into the following chapters.

2. The evolution of precision strike

2.1. Conventional guided munitions

A guided munition is a projectile, bomb, missile, torpedo, or other weapon that actively homes in on its target after being fired, launched or released.[4] This is most often achieved using active and passive radar, infra-red sensors and laser guidance. The first combat successes using guided munitions occurred in 1943 when German Navy U-boats reportedly employed passive acoustic-homing torpedoes to sink merchant shipping, shortly followed by their US Navy counterparts hunting and sinking German and later Japanese submarines with weapons of the same type.[5] In the air, US Navy patrol aircraft first used an air-dropped

[4] Christopher J. Bowie cited in Watts, *Six Decades of Guided Munitions and Battle Networks*, p. 1.
[5] Ibid., p. 3.

acoustic-homing "mine" to sink U-boats,[6] and German bombers used radio-controlled guided glide bombs to attack the Italian fleet.[7] These new classes of weapons represented a turning point. Prior to the advent of guidance, militaries compensated for the lack of accuracy with sheer mass, with the majority of unguided munitions expected to completely miss their targets. Commanders would seek to condense forces at the point of attack to achieve numerical superiority and thus to maximize success.[8] While these early trials of guided munitions exerted little influence on the outcome of WWII, their emergence nonetheless sparked an era in which their further development and exploitation steadily became the dominant military paradigm. To quote Colonel Phillip Meilinger, Commander of the US Air Force's School of Advanced Airpower Studies, "There is no logical reason why bullets or bombs should be wasted on empty air or dirt".[9] Notwithstanding this significant shift, guided munitions remained too unreliable or not sufficiently accurate for the best part of the next three decades. For war-fighters, their uptake was decidedly variegated, with those that manoeuvred in three dimensions such as submarines and fighter aircraft the most drawn to their potential.[10] In contrast, fighters in platforms operating predominantly in two dimensions, such as tanks, were less enthralled. In fact, US Army and US Marine Corps currently still rely primarily on aimed fire for tank-on-tank engagements.[11] Early radar guided air-to-air and surface-to-air missiles deployed by the US during the 1960's campaigns

[6] Robert Work and Shawn Brimley, *20YY: Preparing for War in the Robotic Age* (Washington: Center for a New American Security., 2014), p. 10.
[7] Brendan McNally, "The Sinking of the Battleship Roma and the Dawn of the Age of Precision Guided Munitions," *Defense Media Network*, accessed February 19, 2015, http://www.defensemedianetwork.com/stories/the-sinking-of-the-battleship-roma-and-the-dawn-of-the-age-of-precision-guided-munitions/.
[8] Shawn Brimley, "Offset Strategies & Warfighting Regimes," *War on the Rocks*, accessed October 16, 2014, http://warontherocks.com/2014/10/offset-strategies-warfighting-regimes/.
[9] Cited in Richard P. Hallion, "Precision Guided Munitions and the New Era of Warfare," *Air Power Studies Centre*, accessed February 19, 2015, http://www.fas.org/man/dod-101/sys/smart/docs/paper53.htm.
[10] Watts, *Six Decades of Guided Munitions and Battle Networks*, pp. 4–5.
[11] Ibid., p. x.

in South-East Asia yielded disappointing results or were relatively easily countered. In contrast, the accuracy of laser-guided air-to-ground munitions, employed to cut key highway and railroad bridges during North Vietnam's invasion of South Vietnam in 1972, was assessed as 33-50 times greater than unguided bombs.[12] For air-to-ground strike operations at least, this was a harbinger of the future that engendered voluntary changes in US Air Force operational doctrine. In short, greater accuracy and less dependence on mass meant fewer sorties would need to be flown for that particular mission, freeing up resources and man-power. In Barry Watts' words, the concept of *targets per sortie* began to replace *sorties per target* in the minds of operational planners.[13]

The key breakthrough in the reliability of air-air missiles came with the growing application of solid-state electronics[14] to military systems in the mid-1970's. The production of the AIM-7F missile in 1976, using solid-state instead of vacuum tube electronics, significantly improved the success rate of the missile and the confidence of US Air force pilots in its use.[15] Despite their emerging successes, the uptake of guided munitions remained hesitant across the services. Cultural and organisational inertia, including rules-of-engagement as well as the legitimate fear of fratricide in early beyond-visual-range engagements,[16] played significant roles here. Slowly, however, the impetus behind the emerging guided munitions regime shifted from the services to the Advanced Research Projects Agency[17] (later the Defense Advanced Research Projects Agency, DARPA) in the Pentagon and the associated

[12] Ibid., p. 9.
[13] Ibid., p. 260.
[14] Solid-state electronics are those circuits or devices built entirely from solid materials in which the electrons, or other charge carriers, are confined entirely within the solid material.
[15] For overview of the impact of solid-state electronics on weaponry see Watts, *Six Decades of Guided Munitions and Battle Networks*, 2007, pp. 109–113.
[16] Ibid., p. 134.
[17] Later to be renamed Defense Advanced Research Projects Agency (DARPA).

contractors and agencies.[18] Together, the concept of reconnaissance-strike complexes linking guided munitions and advanced sensors with real-time command and control was gaining momentum in the late 1970's. The first coherent expression of this regime was the DARPA's *Assault Breaker* program. By 1982 *Assault Breaker* had demonstrated the feasibility of using reconnaissance-strike systems to attack Soviet follow-on forces "deep" behind the front lines, in the event of a Warsaw Pact ground invasion of Western Europe.[19] In turn, by the early 1980s, Soviet military authorities and theorists had identified the emerging precision-strike regime as a growing concern.[20] They worried about its potential to undermine the conventional Soviet advantage in mass armour and firepower across the Fulda Gap and, more broadly, the growing disparity it represented between Soviet and US conventional capabilities.[21]

2.2. Sensors and networks

The ability to bring a guided munition to bear on its target is dependent on the ISR systems that locate, identify, and track it. In practice, this requires the enabling of information technologies that can facilitate timely collection and dissemination of data essential in acquiring and attacking targets from long-range.[22] This makes advanced wide-area sensors and the information technology enabled battle networks that integrate them with shooters the essence of the precision-strike regime. Further, the efficacy of a given guided-munition

[18] Richard H. Van Atta et al., "Transformation and Transition: DARPA's Role in Fostering and Emerging Revolution in Military Affairs, Volume 1, Overall Assessment" (DTIC Document, 2003), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA437248.
[19] Watts, "The Evolution of Precision Strike," p. 7.
[20] William E. Odom, "Soviet Force Posture - Dilemmas and Directions," *Problems of Communism* 34, no. 4 (1985): pp. 1–14; Mary C. FitzGerald, *Marshal Ogarkov on the Modern Theater Operation* (Center for Naval Analysis, November 1986).
[21] The Fulda Gap, on the East/West German border, was the likely locus of a Warsaw Pact/Nato ground war. The Warsaw Pact forces had a roughly three-to-one advantage in tanks, artillery, and armoured personnel carriers over NATO forces.
[22] Christopher J. Bowie, Robert P. Haffa, Jr., and Robert E. Mullins, "Future War: What Trends in America's Post-Cold War Military Conflicts Tell Us About Early 21st Century Warfare" (Northrop Grumman Corporation, 2003), p. 32.

increases with the number and variety of sensors it can plug into. The late Admiral Arthur Cebrowski intimated as much in a 2002 interview:

> We are seeing warfare dominated more by sensors than perhaps any other piece of equipment. The ability to sense the environment, to sense the enemy and to be networked enough to transmit that critical data to all who require it, is a trend line emerging from current operations… so we are shifting from a weapons game to a sensor game.[23]

The first recognisable information-gathering battle network was the system of radar transmitters and receivers the Royal Air Force (RAF) used in 1940 during the Battle of Britain. It enabled the RAF to detect and respond to incoming German air raids, concentrating their limited resources when and where they were needed most. In the ensuing decades, US ISR network design and development was driven by the singular requirement of providing weapons-grade track to guided munitions of increasing sophistication. This sophistication essentially would justify building a real-time tableau of the battlespace from which these weapons would draw their aim-points.[24] In the 1990s, the regime made a significant advancement with the coupling of a constellation of satellites, able to provide precise location-and-timing information anywhere around the globe, day or night, regardless of weather, with a relatively inexpensive munition[25] guided by coordinates received via satellite. Debuting during NATO's air-campaign against Serbia in 1999, the Joint Direct Attack Munition (JDAM) combined with the Navigation System Using Timing and Ranging (NAVSTAR) Global Positioning System (GPS)[26] was assessed to have been delivered

[23] Admiral Arthur Cebrowski cited in Watts, *Six Decades of Guided Munitions and Battle Networks*, 2007, p. 252.
[24] Martin C. Libicki, *Illuminating Tomorrow's War* (DIANE Publishing, 1999), p. 3.
[25] The unit-production cost of a JDAM with a Mark-84 warhead and fuze has averaged less than US$33,000.
[26] For overview of GPS see Scott Pace et al., "The Global Positioning System" (Rand Corporation, 1995), http://www.rand.org/pubs/monograph_reports/MR614.html.

with a nearly 90% success rate to an accuracy of less than thirteen metres.[27] GPS, which was designed and developed as a military system to serve the needs of the US Department of Defense and US allies for *en-route* navigation, made its wartime debut in the 1991 Gulf War, where its impact on the operational efficacy of US forces was remarkable.[28] Space systems had, nonetheless, supported US military planning and operations before in Libya in 1986, Panama in 1989 and the Persian Gulf in 1987, but the limited scope and duration of these operations meant the system's potential was not fully apparent.[29] In the course of its development, GPS expanded from primarily a military to an international commercial resource, making it a truly 'dual-use' technology. Controversy over the dual-use nature of satellite imagery continues to complicate the commercial space effort.[30] It also signifies the unique and superior utility of space-based ISR over other forms.

The US space effort had from 1957 to 1991 concentrated primarily on the pre-conflict aspects of a nuclear exchange with the Soviet Union over Eastern Europe. The precise navigation provided by satellites enabled US Navy ballistic-missile submarines and US Air Force strategic bombers to get a more accurate fix on their positions before they launched their weapons. Operation Desert Storm in 1991, moreover, demonstrated how space-based surveillance could contribute to the real-time enhancement of on-going conventional military operations.[31] The contributions made by space-based ISR to ground forces during

[27] 509th Bomb Wing, "Operation Allied Force," PowerPoint presentation, August 1999, slide 23, cited in Watts, *Six Decades of Guided Munitions and Battle Networks*, p. 13.
[28] Pace et al., "The Global Positioning System," p. 2.
[29] United States Space Command, "United States Space Command Operations Desert Shield and Desert Storm" (Secret/Noforn, 1992), p. 2, http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB39/document10.pdf.
[30] See Patricia Moloney Figliola, Carl E. Behrens, and Daniel Morgan, "U.S. Space Programs: Civilian, Military, and Commercial" (Congressional Research Service, June 13, 2006), pp. 4–5, http://www.fas.org/sgp/crs/space/IB92011.pdf.
[31] Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment* (Center for Strategic and Budgetary Assessments, 2001), p. 1, http://www.csbaonline.org/4Publications/PubLibrary/R.20010201.The_Military_Use_o/R.20010201.The_Military_Use_o.pdf.

Desert Storm were so significant that it is often referred to as the first "Space War."[32] The procurement of thousands of commercially produced hand-held GPS receivers allowed US ground forces to successfully navigate otherwise featureless desert terrain, accurately target enemy positions, and reduce fratricide by keeping out of each other's way (known as Blue Force tracking). The Air Force used GPS to guide strike aircraft to their targets through poor weather, and the Navy used it to clear mines in the Persian Gulf and to improve fire-control solutions for their land-attack cruise missiles.[33] After the war, receivers were added to nearly every ship, aircraft, and vehicle in the US inventory. Space-based ISR systems such as GPS and other electro-optical and radar reconnaissance military satellites now form the heart of US reconnaissance-strike complex. They are the key enablers of American global power-projection. Their enormous cost and technical sophistication are the primary reasons the US maintained such a significant margin in the precision-strike regime, an edge that is increasing in importance as some of the components of the regime, such as guided munitions, proliferated on the global arms market. At the beginning of the 21st century, the US intelligence community, US Space Command, the US Air Force, and other elements of the DoD all assessed that the United States was the preeminent in near-earth space, and should strive to remain so.[34] Appreciating the potential military benefits of such a distributed space-based ISR, the Air Force, DARPA and National Reconnaissance Office (NRO) launched an

[32] Andrew Krepinevich and Robert O. Work, *A New Global Defense Posture for the Second Transoceanic Era* (Washington, DC: Center for Strategic and Budgetary Assessments, 2007), p. 145, http://www.csbaonline.org/site/wp-content/uploads/2011/02/2007.04.20-New-Global-Defense-Posture.pdf.
[33] United States Space Command, "United States Space Command Operations Desert Shield and Desert Storm," pp. 26–28.
[34] United States Space Command, *Long Range Plan, Implementing USSPACECOM Vision for 2020* (US Space Command, 1998).

advanced research and development program in 1998 called 'Discoverer II,'[35] which has subsequently been subject to funding cuts.

The archetypal modern version of the information-gathering-sharing battle network is the US Navy's Cooperative Engagement Capability (CEC). CEC integrates the SPY-1 radar used in the Aegis weapon system on board each Aegis-equipped surface combatant (cruisers and destroyers), combined with available radar from other platforms such as the airborne E2-C *Hawkeye*, into one shared air-defence picture available to all users in the CEC network, whether they are sensing or not,[36] across an automatic computer-to-computer data link known as Link 16.[37] This provides enhanced situational awareness to each platform, thus increasing the capacity for defensive measures to be taken against incoming threats such as attack aircraft and cruise missiles. Indeed, the genesis of CEC can be traced to the US Navy's major concern about the threat of mass coordinated anti-ship cruise missile attacks, launched from Soviet bombers and/or submarines, which could overwhelm the defensive capabilities of stand-alone surface combatants.[38] Such measures incorporate the precision-guided SM-2 interceptor missile to engage threats, which is provided initial and mid-course target tracking by the integrated radar system out to beyond the 370 km range of the SPY-1 alone.[39] The SM-3 (mid-course) and SM-6 (terminal) interceptors are used to engage ballistic-missiles at various stages of flight. Originating in 1995, CEC forms the centre-piece of the US Navy's NIFC-CA (Naval Integrated Fires Concept – Counter Air) operational concept, first deployed in 2015, and is the exemplar of network-enabled operations that

[35] Michael Vickers and Robert Martinage, "Future Warfare 20XX Wargame Series: Lessons Learned Report" (Center for Strategic and Budgetary Assessments, 2001), p. 64.
[36] William D. O'Neil, *The Cooperative Engagement Capability "CEC" Transforming Naval Anti-air Warfare* (Center for Technology and National Security Policy, 2007), p. 3.
[37] Ibid., p. 13.
[38] Ibid., p. 25.
[39] Norman Polmar, *The Naval Institute Guide to the Ships and Aircraft of the US Fleet* (Naval Institute Press, 2005), p. 546.

extend the potential of the reconnaissance-strike complex.[40] While conceived before net-centric warfare, CEC nonetheless moulded well into the NCW framework.[41] CEC has encountered difficulties and delays in development and deployment and a modest rise in cost per unit that remains less than US$17 million.[42]

CEC is not the only technical development incorporating the power of the network. The US military sought advantage from the opportunities offered by the digital information and communications revolution to enhance connectivity in the form of its Defense Message System, backed up by the Secret Internet Protocol Routing Network (SIPRNET). SIPRNET introduced a series of digital networked applications such as e-mail, "chat rooms" and web pages, significantly changing the way operations are planned and conducted.[43] First evident during operation “Allied Force” in 1999, it had the effect of turning labour intensive manual tasks into rapid electronic ones via the digitisation of hard copy planning during the bombing campaign.[44] In addition, video teleconferencing emerged as a useful way to bring together geographically dispersed staff, eliminating the need to collocate and mitigating the loss of commander intent. Together, these technologies pursue enhanced information flows and better communication.

2.3. A revolution in military affairs?

The Soviet literature from the late 1970’s on the emergence of reconnaissance-strike complexes suggested a military-technical revolution might be the harbinger of something

[40] Watts, *Six Decades of Guided Munitions and Battle Networks*, p. 251.
[41] O’Neil, *The Cooperative Engagement Capability “CEC” Transforming Naval Anti-air Warfare*, p. 14.
[42] Government Accountability Office, “Assessments of Selected Major Weapon Programs” (GAO-05-301, March 2005), p. 39; Selected Acquisition Report, “Cooperative Engagement Capability (CEC) As of FY 2015 President’s Budget” (Defense Acquisition Management Information Retrieval, December 2013), p. 32.
[43] William R. Pope, “US and Coalition Command and Control Interoperability for the Future” (DTIC Document, 2001), pp. 9–10, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA390627.
[44] Mitchell, “Small Navies and Network-Centric Warfare,” p. 6.

greater; a revolution in military affairs.[45] In pursuit of this idea, director of the Pentagon's Office of Net Assessment, Andrew Marshall, asked then Army Lieutenant Colonel and Harvard graduate Andrew F. Krepinevich to direct his attention to critical analysis of the Soviet contention that the impact of advances in solid-state electronics on sensors, avionics, computation, the accuracy of conventional munitions, and communications would revolutionize the conduct of war.[46] Marshall himself had intimated at this conclusion previously in 1987.[47] The 1992 report, titled *The Military-Technical Revolution: A Preliminary Assessment*, generated a great deal of interest within the US national security establishment precipitating a broader discussion of the revolution in military affairs throughout the 1990's. Despite the emphasis on technology, Marshall believed an RMA would not be realised through technological advances alone. Rather, a revolution would require these advances to be integrated with innovative operational concepts and adaptive changes in military organisation to be truly revolutionary.[48] As Krepinevich argued in 1994, an RMA is

> what occurs when the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptation in a way that fundamentally alters the character and conduct of conflict… by producing a dramatic increase—often an order of magnitude or greater—in the combat potential and military effectiveness of armed forces.[49]

And from Marshall in 2003:

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[45] William E. Odom, "Soviet Military Doctrine," *Foreign Affairs* 67, no. 2 (1988): pp. 114–34, doi:10.2307/20043776.
[46] Ibid., p. 124.
[47] A.W. Marshall, "Future Security Environment Working Group: Some Themes for Special Papers and Some Concerns" (ONA memorandum for Fred Iklé, September 1, 1987), p. 2.
[48] Andew Marshall, "Some Thoughts on Military Revolutions" (ONA memorandum for record, July 27, 1993), p. 1.
[49] Andrew F. Krepinevich, *Cavalry to Computer: The Pattern of Military Revolutions* (National Affairs, 1994), p. 30, http://people.reed.edu/~ahm/Courses/Reed-POL-359-2011-S3_WTW/Syllabus/EReadings/02.2/02.2.Krepinevich1994Cavalry.pdf.

> The reason that large changes in warfare take several decades is that it takes a good deal of time to develop new concepts of operations, to create the new military organizations that are required to execute these new concepts, for new skills to be acquired, and perhaps for new military careers and specialties to be created. All of these things take time, and . . . it may require generational change within the military establishment for the new ideas and new ways of fighting to establish themselves fully.[50]

For the US defence establishment in a post-Cold War world, anticipating the rise of one or more competitors who might seek to exploit the military-technical revolution in their own favour was the upshot of these assessments. How the US might avoid or win such competition, and how it might remain at the helm of the revolution while dealing with formidable niche competitors became prescient questions.[51] While the advantages in technological and military systems in terms of continued US dominance were obvious, the tone of caution in Krepinevich's work is conspicuous: "In a revolutionary epoch, long-term U.S. military dominance is not preordained."[52] Much ink has been spilt on the question of defining and recognising a revolution in military affairs.[53] Whether it occurred is a question about which this thesis is ambivalent. As Colin Gray argues, "the concept of a 'revolution in military affairs' is essentially an interpretation placed on the unfolding of events, as opposed

[50] Andrew Marshall in Emily O. Goldman and Leslie C. Eliason, *The Diffusion of Military Technology and Ideas* (Stanford University Press, 2003), pp. xiii–xiv.
[51] Tim Benbow, *The Magic Bullet?: Understanding the Revolution in Military Affairs* (Brassey's, 2004), p. 30.
[52] Krepinevich, *Cavalry to Computer*.
[53] Of particular note, in addition to those already cited, Williamson Murray and MacGregor Knox, "Thinking about Revolutions in Warfare," *The Dynamics of Military Revolution* 1, no. 5 (2001); Dima P Adamsky, "Through the Looking Glass: The Soviet Military-Technical Revolution and the American Revolution in Military Affairs," *Journal of Strategic Studies* 31, no. 2 (2008): 257–94, doi:10.1080/01402390801940443; Colin S. Gray, "Strategy for Chaos: Revolutions in Military Affairs and the Evidence of History (Paperback) - Routledge," Text, accessed December 7, 2014, http://www.routledge.com/books/details/9780714684833/?utm_source=adestra&utm_medium=email&utm_campaign=sbu1_lan_4mx_8cm_1pol_00000_colingrey; Peter Warren Singer, *Wired for War: The Robotics Revolution and Conflict in the Twenty-First Century* (Penguin, 2009).

to an objectively verifiable occurrence with a time and place attached to it."[54] The upshot, which is of primary interest here, is a broad consensus that truly transformative military-technical changes reside not in the procurement of advanced technology alone but in the knowledge-based, organisational and operational systems-integration required to produce enhanced combat effect under warfighting conditions. Stephen Biddle argued along the lines that the critical variable determining the outcome of armed conflict in the modern age is the capacity of a belligerent to manage the complexity of an ever-expanding battle-space.[55] The ubiquitous and increasing importance of access to and control of the information domain inherent in advanced operational concepts that leverage the reconnaissance-strike complex is thus prescient for this discussion.

3. Network-centric warfare

3.1. Network-enabled operations

According to its progenitors, "NCW envisioned interconnected communications networks with standardized machine-to-machine, man-to-machine, and man-to-man interfaces allowing the rapid sharing of information between strategic, operational, and tactical users, resulting in shared awareness and increased speed of command."[56] As Carlo Kopp explains, the concept of networking became the dominant paradigm of our time, with digital computer networks pervading all aspects of life. All technology is inevitably applied sooner or later to the business of war, and so it is with NCW.[57] Kopp describes it as the military equivalent, though far more challenging, of the digitisation and networking drive observed

[54] Colin S. Gray, "Recognizing and Understanding Revolutionary Change in Warfare: The Sovereignty of Context." (Strategic Studies Institute, U.S. Army War College, 2006).
[55] Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton University Press, 2010).
[56] Cebrowski and Garstka, "Network-Centric Warfare - Its Origin and Future."
[57] Carlo Kopp, *NCW101: An Introduction to Network Centric Warfare* (Air Power Australia, 2008), http://www.ausairpower.net/NCW101-First-Ed-2009.html.

in advanced economies between 1985 and 1995.[58] Raising the enabling capacities of networks seeking to capitalise on the ongoing maturation of the precision-strike regime was a logical extension, though the concept remains under much doctrinal and operational development.

At its most basic, the concept of NCW promises to speed up the tempo of operations to the detriment of the adversary.[59] This is achieved by compressing the Observe, Orient, Decide, Act (OODA) loop,[60] via the timely communication of targeting information across a ubiquitous network, which links sensor and shooter across geographically dispersed forces with command and control. Time is the critical factor here. High-speed error-free information processing can reduce the amount of time taken to perform each step of the OODA loop, presenting an adversary with a rapidly changing set of conditions. It is also the flexibility inherent in the network that explains its attractiveness. As Mitchell explains: "The importance of any given node on the network stems not from its function or features, but from its ability to contribute to the goals established by the network. Theoretically, nodes can be added or deleted from network architectures as their importance changes, or as the missions alter."[61] In this way it makes sense to describe the enhanced combat effect as truly 'enabled' by the network, though the term 'network-centric' became the US preferred norm.[62] We can also glimpse the truly revolutionary aspect of NCW when considering what it is replacing; platform-centric warfare or the emphasis on what each individual capability can bring to the fight when agglomerated. Seminal figures in the American NCW conception

[58] Carlo Kopp, "Understanding Network Centric Warfare," *Australian Aviation*, January 1, 2005, http://www.ausairpower.net/TE-NCW-JanFeb-05.html.
[59] Kopp, *NCW101*, p. vi.
[60] Originally a theory of achieving success in air-to-air combat attributed to military strategist John Boyd. See John R. Boyd, *Destruction and Creation* (US Army Comand and General Staff College, 1976), http://goalsys.com/books/documents/DESTRUCTION_AND_CREATION.pdf.
[61] Mitchell, "Freedom and Control," p. 37.
[62] Author conversation with Air Vice-Marshal Peter Nicholson, AO.

include Admiral Arthur Cebrowski, John Gartska, David S. Alberts and Richard E. Hayes among many others. In Australia and Canada Carlo Kopp and Paul Mitchell have written prolifically.[63]

The literature describing, defining, and critiquing NCW since the late 1990's is extensive and global. Three publications form the central canon. *Network Centric Warfare: Developing and Leveraging Information Superiority*, written jointly by Garstka, Director of Research and Strategic planning for the Office of the Undersecretary of Defense David S. Alberts and retired US Army Colonel Frederick P. Stein, published in 1999; *Understanding Information Age Warfare*, by Alberts, Garstka, Richard E. Hayes and David A. Signori, published in 2001; and *Power to the Edge: Command and Control in the Information Age*, by Alberts and Hayes, which was published in 2003.

It is fair to say that some portion of the literature on NCW and its prospects is over-wrought, particularly its earliest examples, and is recognised most acutely as such by analysts with practical knowledge, if not war-fighters themselves with experience of its significant challenges.[64] Nonetheless, after the demonstration of the enhanced combat effect of the reconnaissance-strike complex, applied during Operation Desert Storm in 1991 against the industrial age Iraqi military applying the associated tactics of aimed fire and mass effects,

[63] Cebrowski and Garstka, "Network-Centric Warfare - Its Origin and Future"; David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, 2nd ed. (DoD C4ISR Cooperative Research Program, 2000); Kopp, *NCW101*; John J. Garstka, "Network Centric Warfare: An Overview of Emerging Theory," *Phalanx* 33, no. 4 (2000): pp. 1–33; Paul T. Mitchell, *Network Centric Warfare and Coalition Operations: The New Military Operating System* (Routledge, 2009).

[64] See for example C. Kopp, "Fifteen Constraints on the Capability of High-Capacity Mobile Military Networked Systems," July 2007, http://search.informit.com.au/documentSummary;dn=090370892216290;res=IELENG; Lescher, "Network-Centric: Is It Worth the Risk?"; Michael K. Lauren, "Some Non-Technical Limitations on NEC/NCO Concepts," accessed February 5, 2015, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.296.8253&rep=rep1&type=pdf; Dave Majumdar, "The Fog of War Just Got Thicker: U.S. Warplanes Have Trouble Communicating with Each Other," Text, *The National Interest*, accessed January 8, 2015, http://nationalinterest.org/feature/the-fog-war-just-got-thicker-us-warplanes-have-trouble-11975.

the realisation of network-centric operations from concept to reality was on-in-earnest within the US military. The reconnaissance-strike complex was refined and updated into the *Joint Multidimensional Battle Network.*[65] Desert Storm precipitated the shift of focus for US space forces away from their Cold War strategic focus and toward the support and enhancement of the conventional US power-projection mission.[66] In turn, observers both aligned and non-aligned with the United States reacted. Australia, attracted to the NCW promise of enhanced combat effect based on smaller forces with high technical sophistication and an emphasis on information superiority, was particularly quick to embrace the concept. China, perhaps from another perspective, became acutely aware of the threat 'informatised' warfare posed to their industrial-era forces in 1991.[67]

3.2. Dominant Battlespace Knowledge

To be enabled by the network is to have an enhanced relationship with information gathering and exploitation. A superior ability to operate in the information domain provided war-fighters with a new type of information advantage, where they possess a significantly improved capability for sharing and accessing information. In addition, using the advantage in terms of combat effect is heavily dependent on the ability to understand and exploit it. For example, as Alberts *et al.* explain, "they need to know the overall situation, the commander's intent, the current and planned positions, and the intended actions of other battlespace entities, including neutral actors."[68] Leveraging the network for information superiority, therefore, means achieving superior *access to* and *use of* that information, or

[65] Andrew Krepinevich and Robert O. Work, *A New Global Defense Posture for the Second Transoceanic Era* (Washington, DC: Center for Strategic and Budgetary Assessments, 2007), p. 145, http://www.csbaonline.org/site/wp-content/uploads/2011/02/2007.04.20-New-Global-Defense-Posture.pdf.
[66] Watts, *The Military Use of Space*, p. i.
[67] Robert Farley, "What Scares China's Military: The 1991 Gulf War," Text, *The National Interest*, accessed November 24, 2014, http://nationalinterest.org/feature/what-scares-chinas-military-the-1991-gulf-war-11724.
[68] Alberts, Garstka, and Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, p. 119.

what Libicki and Johnson dubbed Dominant Battlespace Knowledge (DBK).[69] *Access to* information may be thought of in relation predominantly to the *observe* step of the OODA loop, while *use of* information may be thought of in relation to *orient, decide* and *act.* The combat effectiveness of the OODA loop is dependent on both aspects, while deficiency in either may be debilitating. Overall, DBK is a descriptor of the exploitation of information superiority. Twenty years of technological advance and operationally focused thinking in the US armed forces, with information superiority as its basis, was distilled in 1996 with the release of *Joint Vision 2010*.[70]

The central importance of information in war-fighting is, of course, nothing new. Sun Tzu held that better information was the key to leveraging the advantage of surprise, knocking an enemy off balance. Clausewitz, on the other hand, despite knowing that eventually, "knowledge must become capability,"[71] thought the inevitable 'friction' and 'fog of war' rendered something like information superiority negligible in the tumult of combat. History lends support to both views.[72] The 'fog of war', however, is essentially the degradation of access to and understanding of information. There is no *in principle* reason why it must exist. John Arquilla, writing in 1994 in *The Strategic implications of Information Dominance,* argued that throughout history, "knowing more" provided the necessary conditions for success in armed conflict, without providing the sufficient conditions for victory to be assured. Information dominance, therefore, had, "hovered in the wings of warfare's stage",

[69] Martin C. Libicki and Stuart E. Johnson, eds., "Dominant Battlespace Knowledge" (National Defense University, October 1995).
[70] Joint Chiefs of Staff, "Joint Vision 2010" (Department of Defense, 1996), http://webapp1.dlib.indiana.edu/virtual_disk_library/index.cgi/4240529/FID378/pdfdocs/2010/Jv2010.pdf.
[71] Michael Howard and Peter Paret, trans., *On War*, Book Two (Princeton: Princeton University Press, 1976), 147.
[72] Michael Handel, "Sun Tzu and Clausewitz Compared" (Carslisle Barracks, PA: Strategic Studies Institute, 1991), p. 40–59.

according to Arquilla.[73] The maturing precision-strike regime, with its increase in accuracy, control and destructiveness over an ever-widening battlefield, was the catalyst for information to emerge at the centre stage of war-fighting and winning.[74] The expansion of the battle-space and the globalisation of US defence tasks forced greater coordination between services as a matter of necessity, and thus communications and planning for integrated operations doubled-down on the centrality of information. Missions such as close air support, the suppression of enemy air defences, missile defence and deep strike operations all require unprecedented close coordination among geographically separated force elements, many of them crossing traditional service, theatre, and command boundaries.[75] On this view, the conduct of warfare is not ergodic. The emerging centrality of information represents a genuine paradigm shift in the conduct of war, requiring consideration of the consequences not just at the tactical and operational levels but also at the strategic level.

The commitment of the Pentagon to a network-centric vision of future warfare for the United States might be best indicated by its ongoing development of the Global Information Grid (GIG) as the underlying supportive architecture. Under the plan in 2018, full implementation of the GIG is expected in 2020 under the GIG Convergence Master Plan (GCMP).[76] Described as a "private world wide web",[77] the GIG is a "globally interconnected, end-to-end set of information capabilities for collecting, processing, storing, disseminating, and managing information on demand to war-fighters, policy makers, and support

[73] John Arquilla, "The Strategic Implications of Information Dominance" (Calhoun Institutional Archive of the Naval Postgraduate School, 1994), p. 25.
[74] Ibid.
[75] Mitchell, "Freedom and Control," p. 36.
[76] Defense Information Systems Agency, "GIG Convergence Master Plan 2012 (GCMP 2012) Volume I" (DoD, August 2, 2012), http://www.disa.mil/Audience/~/media/Files/DISA/About/GCMP-2012-Volume-I.pdf.
[77] Phrase used by Assistant Secretary of Defense for Networks and Information Integration John Stenbit in testimony before the US House of Representatives Armed Services Committee in 2004.

personnel."[78] The GIG is to be realised through four related programs: the Global Information Grid Bandwidth Expansion, the Transformation Communications System, Network Centric Enterprise Services, and the Cryptological Transformational Initiative.[79] Among the long-term objectives of the GCMP is the shift away from the current common-user intranet found among the US services towards a more complete set of cloud-based service offerings across DoD platforms.[80] For unclassified data, this shift will involve a commercial-government hybrid cloud with the government maintaining the identity provider role.[81] The secure execution of DoD applications within a commercial cloud environment is the end goal, with cost-reduction via the competitive process the driving motivation. The GCMP is an incredibly complex undertaking. It is clear however that the US DoD is prepared to make the transformation from platform to network-centric military operations a reality. The establishment of the functions and protocols of the emerging Joint Information Environment across the military services is a step in that direction.

Both NCW advocates and critics are at pains to point out that flooding war-fighters with greater amounts of data without the accompanying mechanisms to understand and exploit it is counter-productive at best.[82] Nonetheless, the ability to gather and share a larger portion of information about the battle-space is fundamental to the greater situational awareness available to the networked war-fighter. As Martin Libicki surmises bluntly: "What militaries *really* want is the ability to see a target precisely enough to ascertain its location

[78] Author not supplied, "Global Information Grid - NSA/CSS," *National Security Agency Central Security Service*, accessed September 3, 2015, https://www.nsa.gov/ia/programs/global_information_grid/.
[79] Mitchell, "Freedom and Control," p. 36.
[80] Defense Information Systems Agency, "GIG Convergence Master Plan 2012 (GCMP 2012) Volume I," p. 3.
[81] Ibid.
[82] See for example Maryann Lawlor, "Technology Takes Flight," *SIGNAL Magazine*, June 2006, http://www.afcea.org/content/?q=technology-takes-flight.

within the lethal radius of whatever munitions best kills it."[83] In practice, significant constraints on the *use of* the information aspect in direct relation to kinetic combat effect suggest that enhancement across all phases of the OODA loop will not be uniform. Indeed, at the tactical and operational level, a delicate balance is required for the power of the network to be leveraged at all. Alberts *et al.* explain that:

> Shared battlespace awareness requires that the information collected by sensors be put in a form that makes it possible for other battlespace entities (but not necessarily all others) to fuse appropriate information, place it in context, and understand its implications… the ability to move up and down levels of abstraction without introducing distortions distinguishes effective from ineffective utilization of knowledge.[84]

This places the highest value on knowledge-based systems integration including everything from software, training, doctrine, organisational structure, and service culture in the achievement of the promise of NCW. Arguably the acquisition of advanced platforms and weaponry, seen proliferating on the global arms market, constitutes the mere component parts, offering buyers not the enhanced combat effectiveness promised by NCW but a *hollow* RMA instead. This strongly suggests a techno-centric view of proliferation trends in conventional warfare, while the accompanying threat to US military predominance, dramatically undervalues and underestimates the edge the US accommodates as it moves incrementally closer to realising even the partial potential of NCW, or the *real* RMA. Further, continuing US dominance in accessing and exploiting the information background, upon which high-intensity 21st century warfare inexorably depends, offers a strategic level advantage that may be under-appreciated.

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[83] Martin Libicki, "DBK and Its Consequences," in *Dominant Battlespace Knowledge* (National Defense University, 1995), p.5. (Emphasis added)

[84] Alberts, Gartska, and Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, p. 118.

3.3. Limitations and challenges

The mathematics that expresses the power of networking and, thus, the much lauded potential for its military application is derived from Metcalf's Law. It states that the "total value of a network to its users grows as the square of the total number of its users. Thus, the ratio of value to cost of adding one more network user grows disproportionately as the network grows larger."[85] In other words, adding nodes delivers exponential 'value' because of the increase in the number of potential connections between nodes as the network grows. So, ostensibly, we can see how the concept of linking sensors and shooters with command and control across a widening network of military platforms will capitalise on Metcalf's Law, creating a combat effect greater than the sum of its parts, as it were. As Carlo Kopp explains, however, many NCW advocates simply took Metcalf's Law and assumed it applies to military 'utility'.[86] This is not the case for a number of reasons. The most important reason may be the issue of 'queuing', arising in the *decision, action* phases of the OODA loop. The queuing problem is represented by Amdahl's Law[87] – "increasing the number of assets in the system increases the achieved work or effect at best only by the number of assets added."[88] To demonstrate; in the decision phase, a commander must utilise information gained in the *observe* and *orient* phases to decide on the best course of action to take. This involves conferring with colleagues, superiors, and subordinates within the military chain-of-command and necessarily consumes time as information flows up and down the chain in a linear fashion, with each link waiting on the last before it can make the necessary decision, or, like waiting in a queue. Next, the *action* phase is similarly

[85] Author not supplied, "What Is Metcalfe's Law? Definition and Meaning," *BusinessDictionary.com*, accessed March 2, 2015, http://www.businessdictionary.com/definition/Metcalfe-s-Law.html.
[86] Kopp, "Understanding Network Centric Warfare."
[87] Author not supplied, "Amdahl's Law," *Wolfram Demonstrations Project*, accessed March 2, 2015, http://demonstrations.wolfram.com/AmdahlsLaw/.
[88] Kopp, "Understanding Network Centric Warfare."

constrained. A commander deploying assets to affect an engagement is burdened by the basic logistics of manoeuvring those assets into position, clearing the way for their deployment, guarding against friendly fire and the like. As Kopp explains, "all of these events involve one entity waiting for another."[89] Such fundamental limitations temper the effects of Metcalf's Law on military operations.

Where Metcalf's Law and the utility of networking *can* be expressed is in the *observe* and *orient* phases of the OODA loop. Here, the prospect of adding nodes in the form of sensors to the ISR network of a military system is not fundamentally constrained by the queuing problem. Rather, the addition of valid, timely and relevant information can significantly enhance the situational awareness of the war-fighter. Therefore, the utility supposed by Metcalf's Law is limited to these two phases of the loop only. The broader NCW promise of increased operational tempo, in turn, is dependent on the extent to which extant operational tempo is constrained by a paucity of situational awareness. As Kopp surmises:

> The mathematical bottom line in NCW is a very simple one: networking can permit a significant improvement in operational tempo, where a shortage of targeting information is the bottleneck to achieving a high operational tempo, but networking itself has very little impact on the absolute ability of a force to deliver weapons against targets, that being constrained by the capabilities and number of combat platforms in use.[90]

This means that the essence of networking is really in its capacity to improve ISR and communication. Notwithstanding these caveats, the advantages conveyed on military operations by knowing the situation better than an adversary should not be underestimated.

[89] Ibid.
[90] Ibid.

On the technical side, a number of significant obstacles and challenges remain for network-centric operations to be further realised, though a full account of these is beyond the scope of this thesis. The best available literature regarding this aspect remain Carlo Kopp's *Fifteen Constraints on the Capability of High-capacity Mobile Military Networked Systems, NCW101: an introduction to network centric warfare* and, for a wider discussion on the disruptive potential of computing power, *Exponential Growth Laws in Basic Technology and Capability Surprise*.[91] A brief summary of the key technical issues is provided by Kopp as follows in *Understanding Network Centric Warfare:*

> 1. Security of transmission – the wireless digital links used for NCW must be made difficult to eavesdrop and must be encrypted to prevent interception.
>
> 2. Robustness of transmission – the link must be able to withstand environmental as well as adversarial threats, such as bad weather and enemy jamming.
>
> 3. Transmission capacity – the link must be capable of supporting very large amounts of data such as video feeds and imagery. Spikes in user demand as well as link security measures all put demands on bandwidth availability.
>
> 4. Message and signal routing – platforms in the network must be able to direct relevant communication to specific destinations flexibly.
>
> 5. Signal format and communications protocol compatibility – extant military communications systems are extremely heterogeneous, where mutual compatibility is essential.

In addition, US and allied development of NCW does not occur in a vacuum. According to Kopp, Russia actively markets digital datalinks, long-range counter-ISR missiles, and high-

[91] Kopp, "Fifteen Constraints on the Capability of High-Capacity Mobile Military Networked Systems"; Kopp, *NCW101*; Carlo Kopp, "Exponential Growth Laws in Basic Technology and Capability Surprise," *IO Journal*, December 2010, http://www.nxtbook.com/nxtbooks/naylor/JEDQ0410/index.php?startid=27#/20.

powered jamming equipment, designed to both take advantage of and disrupt networked-warfare.[92] Disruption is enabled by the diffusion of commercially produced computing and networking systems available to anyone with the means to acquire them. China became Russia's second-largest arms-export market in 2013,[93]while Moscow flagged a preparedness to export some of its most sophisticated weapons systems to China, including the SU-35 fighter and the S-400 air-and missile-defence system.[94] Though one may argue that Russia is selling the world a hollow RMA, the proliferation and availability of these technologies represents a wholly different set of circumstances from those found during the Cold War, when the US and its allies were largely successful at quarantining disruptive military technologies inherent in the precision-strike regime from their Soviet counterparts.

4. Offset strategies

4.1. US predominance

The quest for military-technical predominance by the United States since WWII can be condensed into what are described as two main offset strategies. The first was brought about by the advent of nuclear weapons and their associated delivery systems. In 1945, with the emergence of guided munitions still in its embryonic phase, the promise of massive destructive power inherent in a nuclear blast obviated the need for much accuracy. Delivery of a single nuclear warhead was enough to be assured of a devastating effect on the target.[95] This initially enabled the US to deter the Soviet Union from marching across the Fulda Gap, where, as mentioned, it enjoyed a roughly three-to-one advantage in conventional military forces. The technological edge in nuclear weaponry enabled the US to

[92] Kopp, "Understanding Network Centric Warfare."
[93] Dov S. Zakheim, "Restoring American Supremacy," Text, *The National Interest*, accessed March 2, 2015, http://nationalinterest.org/feature/restoring-american-supremacy-12325.
[94] Ibid.
[95] Brimley, "Offset Strategies & Warfighting Regimes."

'offset' the massive quantitative overmatch of the Warsaw Pact forces, under President Eisenhower's "New Look" strategy of the 1950's. Quickly, however, it became apparent to US military planners that the tactical use of nuclear weapons in a ground war scenario in Eastern Europe was deeply problematic. And as the Soviets approached basic parity in the nuclear balance, confidence in the strategic advantage inherent in the doctrine of 'massive retaliation' faded, as reflected in NSC 162/2:

> Although Soviet fear of atomic reaction should still inhibit local aggression, increasing Soviet atomic capability may tend to diminish the deterrent effect of US atomic power against peripheral Soviet aggression. It may also sharpen the reaction of the USSR to what it considers provocative acts of the United States. If either side should miscalculate the strength of the other's reaction, such local conflicts could grow into general war, even though neither side seeks nor desires it.[96]

NSC 162/2 still advocated the maintenance of massive offensive nuclear strike capabilities, but also required "US and allied forces in readiness to move rapidly initially to counter aggression by the Soviet bloc forces and to hold vital areas and lines of communication."[97] In this way, as argued by Robert Martinage, nuclear weapons were envisioned as a cost-effective "back stop" for outnumbered conventional forces rather than a wholesale replacement of them.[98] Nonetheless, the utility of the US's nuclear arsenal as an 'offset' to Soviet conventional overmatch was strategically in question. Doubt existed as to whether the US would risk nuclear retaliation against its homeland to defend West Germany, and

[96] The Executive Secretary, "NSC 162/2" (Washington, 1953), p. 4, https://fas.org/irp/offdocs/nsc-hst/nsc-162-2.pdf.
[97] Ibid., p. 5.
[98] Robert Martinage, "Toward a New Offset Strategy: Exploiting U.S. Long-Term Advantages to Restore U.S. Global Power Projection Capability" (Center for Strategic and Budgetary Assessments, 2014), p. iii, http://www.csbaonline.org/publications/2014/10/toward-a-new-offset-strategy-exploiting-u-s-long-term-advantages-to-restore-u-s-global-power-projection-capability/.

whether West Germany would de-couple from the alliance once the use of tactical nuclear weapons began on its soil to slow a Soviet invasion.

The second offset strategy came roughly a quarter-of-a-century later in the form of the precision-strike regime outlined in this chapter. As mentioned, manifest in *Assault Breaker* and associated with Albert Wohlstetter, William Perry and Secretary of State Harold Brown, it provided the US with an edge in conventional military capabilities that did not suffer the same obstacles to tactical deployment as did nuclear weapons, and forced Soviet force planners into a serious reconsideration of the utility of their numerical advantage.[99] Combined with a number of other factors, the American lead in the precision-strike regime is attributed widely to forcing the eventual retrenchment of Soviet strategy in the mid-1980's, leading to the end of the Cold War and the subsequent break-up of the USSR in 1991.[100] Critical to the second offset strategy was the capacity of the US and its allies to isolate the Soviet bloc from the rapid growth of transnational production chains, on the back of which the microprocessor revolution, and its consequences for the precision-strike regime, emerged.[101]

This strategic success notwithstanding, the US security community was already anticipating the erosion of its precision-strike edge, or 'guided munitions parity', even before it was fully conceived in the early 1990's.[102] While advanced technologies during the Cold War stemmed largely from government-directed national security research and development strategies, guided munitions parity was expected to arrive earlier because the key enabling

[99] Brimley, "Offset Strategies & Warfighting Regimes."
[100] See for discussion Stephen G. Brooks and William C. Wohlforth, "Power, Globalization, and the End of the Cold War: Reevaluating a Landmark Case for Ideas," 2006, http://www.mitpressjournals.org/doi/pdf/10.1162/016228800560516.
[101] Lynn Mytelka, "Crisis, Technological Change and the Strategic Alliance," *Strategic Partnerships and the World Economy*, 1991, pp. 16–20.
[102] Work and Brimley, *20YY*, p. 5.

technologies, such as advanced computing and small but high-density power systems, were largely evolving in the thriving commercial computing and robotics sectors on a global scale.[103] Reflecting this, US Department of Defense war-gaming during the 1990's was dominated by a hypothetical peer competitor wielding commensurate reconnaissance-strike complexes.[104] That the US had not encountered a peer competitor by 2018 with anything resembling precision-strike parity on the battlefield is an outcome not widely anticipated.[105] The inherently competitive nature of military security creates a powerful systematic bias towards equalisation among states.[106] As Watts surmises, "although the People's Liberation Army is certainly developing long-range precision-strike capabilities, no other nation has yet come close to approaching the capacity of the American military to mount high-volume reconnaissance-strike operations in distant or overseas theatres."[107]

The primary reasons for this unanticipated slack in parity are twofold. First, while the technical capacity has existed for a long time in Russia and Europe, for example, no other nation accommodates the global interests to compel the sort of investment in long-range reconnaissance-strike necessary, as reflected in the US experience.[108] This basic lack of compulsion played some role in precluding the expected catch-up dynamics observed in previous disruptive military-technical-tactical changes, particularly the *Blitzkrieg* example.[109] Put simply, Russian and Allied forces adapted to, adopted, and improved upon *Blitzkrieg* because they *had to*.

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[103] Ibid., p. 6.
[104] See Vickers and Martinage, "Future Warfare 20XX Wargame Series: Lessons Learned Report."
[105] Watts, "The Evolution of Precision Strike," p. 11.
[106] Goldman and Eliason, *The Diffusion of Military Technology and Ideas*, p. 5.
[107] Watts, "The Evolution of Precision Strike," p. 11.
[108] Ibid.
[109] *Blitzkrieg* combined airPlanes, tanks, supply trucks, and radio communications into a fast-moving war machine that surprised and overran Poland, France, and much of Russia in the early stages of WWII. Ibid., pp. 9–10.

The second primary reason is the sheer complexity and difficulty inherent in deploying long-range reconnaissance-strike battle networks.[110] The post-Cold War era saw the US military-industrial complex spurred onward in the NCW effort by the extant operational challenges posed in its military expeditions. The challenges of mobile, real-time targeting networks were prescient. In 1991, finding and destroying Iraq's mobile scud-missile launchers highlighted not only the difficulty of such operations, but also the extent of US deficiency.[111] The post-2001 global 'War on Terror' raised the problem of target location, identification and tracking to new levels, forcing further technical and operational development. Contrary to some perceptions, the MTR did not die in the dust of Iraq and Afghanistan, as the US military focussed in on counter-insurgency and counter-terrorist operations.[112] Work and Brimley suggest that irregular warfare, as opposed to the high-intensity 'battle of networks' envisioned by DoD's *Future Warfare 20XX* series, saw the fundamentals of NCW tested and refined:

> As terrorists and insurgents began hiding among the people and in complex and urban terrain, they were hounded by a patient and relentless man-hunting campaign, facilitated by sophisticated human tracking sensor grids, a highly integrated interagency C3 (Command, Control, Communications) and targeting grid, and an effects grid including special operations forces and progressively smaller guided munitions capable of striking individuals accurately with very little collateral damage.[113]

The US experience demonstrated that cultural and organisational inertia, network integration and resilience, and joint operations under combat conditions present

[110] Ibid., p. 12.
[111] Barry D. Watts and Thomas A. Keaney, "Effects and Effectiveness," *Gulf War Air Power Survey* 2, no. Part II (1993): pp. 330–32.
[112] Greg Jaffe, "U.S. Model for a Future War Fans Tensions with China and inside Pentagon," *Washington Post*, accessed June 10, 2014, http://www.washingtonpost.com/world/national-security/us-model-for-a-future-war-fans-tensions-with-china-and-inside-pentagon/2012/08/01/gJQAC6F8PX_story.html.
[113] Work and Brimley, *20YY*, p. 17.

monumental technical and practical challenges,[114] as Marshall and Krepinevich foresaw in their early assessments of the MTR. The upshot is these pressures spurred the US effort forward in ways no other nation can attest to.[115] According to Robert Farley, the various "wars on terror" the US embroiled itself in since 2001 "illuminated key concepts, provided the opportunity for training under fire, and forced the various elements of the U.S. military machine to figure out how to work together. This is experiential, tacit knowledge, and it sets functional military organizations apart from ones that look good but have never been tested under fire."[116] Particularly important is the "manner in which information from a wide variety of sources is processed and fused for both air and ground based forces, thus permitting mid-course weapons updates, engagement zones and moving target options, as well as cockpit target imaging for pilots."[117] In sum, the reasons for the lag in reconnaissance-strike parity are to be found in the variegated sets of *pressures* that can be identified as existing for the US but lacking for others. Michael C. Horowitz elucidated this dynamic in his *adoption-capacity theory,* highlighting the financial and organisational pressures that govern the uptake of military innovation.[118]

4.2. Third Offset Strategy

Delays in parity notwithstanding, the inevitable if gradual erosion of US predominance in reconnaissance-strike appears to be more-or-less widely accepted.[119] Specifically, the

[114] Stanley A. McChrystal, "It Takes a Network," *Foreign Policy*, accessed November 16, 2015, https://foreignpolicy.com/2011/02/21/it-takes-a-network/.
[115] Watts, "The Evolution of Precision Strike," p. 12.
[116] Robert Farley, "Just How Strong Will China's Military Be in 2025?," Text, *The National Interest*, (July 2, 2015), http://nationalinterest.org/feature/just-how-strong-will-chinas-military-be-2025-13244.
[117] Bryan Bender, Kim Berger, and Andrew Koch, "Afghanistan's First Lessons," *Jane's Defence Weekly*, December 19, 2001.
[118] Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton, N.J: Princeton University Press, 2010).
[119] See for discussion Randy Huiss, "Proliferation of Precision Strike: Issues for Congress" (Congressional Research Service, May 14, 2012), http://fas.org/sgp/crs/nuke/R42539.pdf; James Hasik and Alex Ward, "Third Offset Strategy, Second Adversary," *Atlantic Council*, accessed November 20, 2014,

proliferation and uptake of guided rockets, artillery, mortars and missiles (G-RAMM)[120] and UAV's[121] concerned defence analysts as the early harbingers of coming technical parity. At least 75 countries are investing in unmanned systems.[122] By sheer numbers, the largest drone maker in the world is China's DJI.[123] Moreover, China's military modernisation and the proliferation of weapons systems more broadly under the A2/AD mantra precipitated the quest for a 'Third Offset Strategy' as a means to continue US military-technical predominance. In a keynote speech in September 2014, US Secretary of Defense Chuck Hagel outlined the problem:

> Disruptive technologies and destructive weapons once solely possessed by only advanced nations, have proliferated widely, and are being sought or acquired by unsophisticated militaries and terrorist groups. Meanwhile, China and Russia have been trying to close the technology gap by pursuing and funding long-term, comprehensive military modernization programs. They are also developing anti-ship, anti-air, counter-space, cyber, electronic warfare, and special operations capabilities that appear designed to counter traditional U.S. military advantages – in particular, our ability to project power to any region across the globe by surging aircraft, ships, troops, and supplies.[124]

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http://www.atlanticcouncil.org/blogs/defense-industrialist/third-offset-strategy-second-adversary; Ankit Panda, "Sailing Through the 'Fog of Peace,'" *The Diplomat*, February 5, 2015, http://thediplomat.com/2015/02/sailing-through-the-fog-of-peace/? Sydney J. Freedberg Jr., "The End Of Advantage: Enemies May Catch Up With US Technology — Or Surpass It," *Breaking Defense*, accessed July 1, 2014, http://breakingdefense.com/2012/12/the-end-of-advantage-enemies-may-catch-up-with-us-technology/; James R. Holmes, "America's Undersea Advantage Is Eroding," *The Diplomat*, November 23, 2013, http://thediplomat.com/2013/11/americas-undersea-advantage-is-eroding/.

[120] Sydney J. Freedberg Jr., "Smart Weapons Spread Undercuts Need For Army Combat Vehicle," *Breaking Defense*, accessed March 4, 2015, http://breakingdefense.com/2012/03/spread-of-smart-weapons-undercuts-case-for-army-ground-combat-ve/.

[121] Gil Hoffman and Joanna Paraszczuk, "Hezbollah Drone Photographed Secret IDF Bases," *Jerusalem Post*, accessed March 4, 2015, http://www.jpost.com/Defense/Hezbollah-drone-photographed-secret-IDF-bases.

[122] P.W. Singer, "The Global Swarm," *Foreign Policy*, accessed March 5, 2015, http://foreignpolicy.com/2013/03/11/the-global-swarm/.

[123] Hasik and Ward, "Third Offset Strategy, Second Adversary."

[124] Chuck Hagel, "'Defense Innovation Days' Opening Keynote," *U.S. Department of Defense*, September 3, 2014, http://www.defense.gov/Speeches/Speech.aspx?SpeechID=1877.

In November 2014 Hagel spoke before the second Reagan National Defense Forum, where he officially launched the quest for a third offset strategy.[125] Subsequently, the Pentagon announced the new Long-Range Research & Development Planning Program to be headed by Under Secretary of Defense for Acquisition, Technology, and Logistics Frank Kendall. It also released a memorandum outlining the Defense Innovation Initiative (DII) to be overseen by Deputy Secretary of Defense Bob Work.[126] Between them, Work and Kendall were charged by DoD with identifying a third offset strategy that will "pursue innovative ways to sustain and advance our military superiority for the 21st Century and improve business operations throughout the department."[127] Commentary since referred to Hagel's speech as the most important by a Secretary of Defense in recent years. Further, it reflects "a firm belief that robotics, miniaturization, computing, and additive manufacturing are changing the art of the possible in military matters, and that force structure and investment must adjust to reflect reality."[128] Kendall weighed in, warning that: "Our technological superiority is very much at risk, there are people designing systems [specifically] to defeat us in a very thoughtful and strategic way, and we've got to wake up, frankly."[129] While by no means intended as an exhaustive list, in his November 2014 speech Hagel identified "robotics, autonomous systems, miniaturization, big data, and advanced manufacturing, including 3-D printing" among the areas in which DoD saw significant potential. Not

[125] Sydney J. Freedberg Jr., "Hagel Lists Key Technologies For US Military; Launches 'Offset Strategy,'" *Breaking Defense*, accessed November 17, 2014, http://breakingdefense.com/2014/11/hagel-launches-offset-strategy-lists-key-technologies/.
[126] Chuck Hagel, "SecDef Hagel Innovation Memo - 2014-11-15 OSD013411-14" (Department of Defense, November 15, 2014), https://www.scribd.com/doc/246766701/SecDef-Hagel-Innovation-Memo-2014-11-15-OSD013411-14.
[127] Ibid.
[128] Hasik and Ward, "Third Offset Strategy, Second Adversary."
[129] Frank Kendall cited in Sydney J. Freedberg Jr., "'We've Got To Wake Up': Frank Kendall Calls For Defense Innovation," *Breaking Defense*, accessed August 7, 2014, http://breakingdefense.com/2014/08/weve-got-to-wake-up-frank-kendall-calls-for-defense-innovation/; See also John Grady, "Kendall: U.S. Needs to Get Faster at Developing Revolutionary Weapon Systems," *USNI News*, accessed January 30, 2015, http://news.usni.org/2015/01/28/kendall-u-s-needs-get-faster-developing-revolutionary-weapon-systems.

mentioned by Hagel, but also very much a part of the techno-centric offset strategy discussion, are cyber warfare, electric weapons, and conventional long-range strike.

4.3. Robotics and autonomous systems

Robotics and autonomous systems refer to war machines that are not only unmanned, but able to assess situations and make decisions on their own without a 'human-in-the-loop' as is currently the case with many unmanned and robotic systems.[130] Envisaged as operating across all domains and services and the full range of military tasks, increasingly autonomous systems are extremely attractive as the costs of personnel and the development of traditional crewed combat platforms are increasing at an unsustainable pace.[131] In addition, the prospect of autonomy could offset the increasing capability of adversaries to disrupt, jam, or hack into communication links between C2 (Command and Control) and individual platforms. Current examples in development stages include Northrop Grumman's X-47 unmanned combat aerial system (UCAS)[132] and BAE Systems' *Taranis*.[133] Lockheed Martin's Low Cost Autonomous Attack System (LOCAAS) was a "miniature, autonomous powered munition capable of broad area search, identification, and destruction of a range of mobile ground targets."[134] It received funding during the early 2000's, was in its final system development phase in 2006, but was subsequently cancelled. According to Watts, "the main barrier to the fielding of truly autonomous robotic strike systems by the US military does not seem to be technological maturity. It may not even be unit cost. Instead it appears to lie in a disinclination to turn attack decisions over to software algorithms, even within an area as

[130] Freedberg Jr., "Hagel Lists Key Technologies For US Military; Launches 'Offset Strategy.'"
[131] Work and Brimley, *20YY*, p. 6.
[132] Author not supplied, "X-47B UCAS," *Northrop Grumman*, accessed March 5, 2015, http://www.northropgrumman.com/Capabilities/x47bucas/Pages/default.aspx.
[133] Author not supplied, "Taranis," *BAE Systems*, accessed March 5, 2015, http://www.baesystems.com/enhancedarticle/BAES_157659/taranis.
[134] Author not supplied, "Low Cost Autonomous Attack System (LOCAAS)," *Federation of American Scientists*, accessed January 27, 2015, http://fas.org/man/dod-101/sys/smart/locaas.htm.

small as 50 square kilometres".[135] Indeed, current DoD guidelines direct that a human be in the loop for offensive lethal force decisions.[136] An emerging approach to resolving these tensions, in fact one that extends back to early theorisations on the prospects of computing power in general,[137] is the teaming of humans with machine intelligence of varying levels of autonomy.[138] Computers replacing human decision-makers, or full autonomy, are out of the question, as research identifying the "irony of autonomy" makes clear.[139] The ability to get a job done remains reliant on the "intrinsic interdependencies" between people and technologies.[140] The research found that introducing automation into systems can result in unintended consequences. For example, manual human operator skill atrophies quickly when automation is introduced. When operator intervention in an automated system is inevitably required, problems arise. To monitor a system sufficiently, an operator needs to be able to diagnose a problem, and decide what course of action to take. The net effect is that a more highly skilled and resource dependent operator is required to keep an automated system running, hence the 'irony of autonomy'. These issues are typically magnified in a combat environment.

4.4. Miniaturization

The shift to unmanned platforms clears the way for miniaturization, as the removal of bulky human beings and the associated supportive and defensive materials offers numerous

[135] Watts, *Six Decades of Guided Munitions and Battle Networks*, 2007, pp. 283–284.
[136] Department of Defense, "Autonomy in Weapon Systems, Directive 3000.09," November 21, 2012, http://www.dtic.mil/whs/directives/corres/pdf/300009p.pdf.
[137] J.C.R. Licklider, "Man-Computer Symbiosis: IRE Transactions on Human Factors in Electronics," March 1960, http://groups.csail.mit.edu/medg/people/psz/Licklider.html.
[138] Adam Elkus, "Man, the Machine, and War," *War on the Rocks*, November 11, 2015, http://warontherocks.com/2015/11/man-the-machine-and-war/.
[139] Gordon Baxter et al., "The Ironies of Automation: Still Going Strong at 30?," in *Proceedings of the 30th European Conference on Cognitive Ergonomics*, ECCE '12 (New York, NY, USA: ACM, 2012), pp. 65–71, doi:10.1145/2448136.2448149.
[140] Ibid., p. 65.

efficiencies in platform design.[141] Ever smaller electronic and mechanical devices and systems are emerging from new manufacturing and fabrication techniques. In turn, combat effect can be delivered by 'swarms' of smaller, lighter, more cost effective if not expendable platforms that blur the distinction between sensor, delivery system and warhead, akin to what the LOCAAS program envisioned.[142] Swarms of low-cost robotic systems have the potential to overwhelm enemies, saturating their defences[143] which would see the guided munitions era return to the concept of mass in order to reverse the decades-long trend of rising costs and shrinking quantities.[144] Smaller, lighter, stealthier platforms that use fuel more efficiently can also take full advantage of the ability to loiter unobserved in geographic areas for long periods, providing superior situational awareness.[145] Switchblade, which is "a back-packable, non-line-of-sight precision strike, ISR package" that can be launched from a variety of air and ground platforms is an extant example.[146]

4.5. Big data and computing

The explosion in the amount of data available in many competitive domains, not least the military, is making analysis of large data sets, known as 'big data', an increasing point of focus. Currently, the US military relies on costly, man-power intensive methods of processing, exploitating and disseminating data flooding in from various platforms.[147] Higher and higher computation speeds are making tapping into and making sense of big data

[141] Freedberg Jr., "Hagel Lists Key Technologies For US Military; Launches 'Offset Strategy.'"
[142] Paul Scharre, "America's Secret Weapon for Battlefield Dominance: Build the Swarm," Text, *The National Interest*, accessed November 3, 2014, http://nationalinterest.org/feature/americas-secret-weapon-battlefield-dominance-build-the-swarm-11588.
[143] John Arquilla, "Killer Swarms," *Foreign Policy*, accessed March 5, 2015, http://foreignpolicy.com/2012/11/26/killer-swarms/.
[144] Scharre, "America's Secret Weapon for Battlefield Dominance."
[145] Work and Brimley, *20YY*, p. 26.
[146] Author not supplied, "Switchblade : UAS Advanced Development Center," *AeroVironment, Inc.*, accessed March 6, 2015, https://www.avinc.com/uas/adc/switchblade/.
[147] Sydney J. Freedberg Jr., "Navy Cyber Chief: Budget Crunch Will Drive Innovation, Force Jointness," *Breaking Defense*, accessed March 5, 2015, http://breakingdefense.com/2013/02/navy-cyber-budget-innovation-sequester-cr/.

possible in ways hitherto unforeseen.[148] Future advances, expected to aid human decision making in complex and rapidly changing environments offered by advanced computation, will have discontinuous effects in the military realm. Algorithms could be employed to sort through the information overload, identify patterns and anomalies, and only pass what matters on to human analysts,[149] which could dramatically enhance the *use of* information required to speed up operational tempo. To this end, in early 2014 DARPA announced the Distributed Battle Management program, which aims to address these challenges by "developing control algorithms and demonstrating robust decision-aid software for battle management at the tactical edge."[150] Again, discovering the optimum way to organise and fuse human-machine teaming is the priority here.

4.6. Advanced manufacturing

Traditional manufacturing involves designing something once, prototyping and then mass producing it, a laborious and often time-consuming process integral to defence contracting.[151] Advanced manufacturing techniques create objects out of almost any material through a sequential layering process, known as 3-D printing. 3-D printing offers the prospect of much more rapid and flexible design and prototyping, as well as rapidly scalable manufacturing.[152] For a military shifting towards miniaturization and mass, this could be a vital enabler. In addition, 3-D printing could help a service such as the US Navy, whose logistical requirements are burdensome, to reduce its reliance on vulnerable logistical support and resupply vessels. The ability to print replacement parts for key

[148] See Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution That Will Transform How We Live, Work, and Think* (Houghton Mifflin Harcourt, 2013); Patrick Tucker, *The Naked Future: What Happens in a World That Anticipates Your Every Move?* (Penguin, 2014).
[149] Freedberg Jr., "Navy Cyber Chief."
[150] Author not supplied, "DARPA Seeking Automated Decision Aids for Pilots and Battle Managers in Contested Environments," *DARPA*, February 21, 2014, http://www.darpa.mil/NewsEvents/Releases/2014/02/21.aspx.
[151] Freedberg Jr., "Hagel Lists Key Technologies For US Military; Launches 'Offset Strategy.'"
[152] See Chris Anderson, *Makers: The New Industrial Revolution* (Random House, 2012).

equipment sets while underway could also affect deployment and operational tempos, lengthening the time between necessary port calls, reducing operating costs in peace-time, and freeing up operational independence in war-time.[153]

4.7. Cyber warfare

The US military as a whole looks very hard at the perils and potentials of its dependence on computer networks, or cyber-space.[154] Beyond the desktop computer and physical vulnerability of the network it plugs into, the rise of wireless computing and communications introduces a new complex of threats and vulnerabilities. [155] Cyberspace and the electromagnetic spectrum have merged as critical mediums for the flow of information.[156] As such, they represent both threat and opportunity to influence, coerce, and even destroy enemy capabilities with a range of tools that stop short of a kinetic war. The quest to protect and leverage these domains is incorporated under the heading of Electromagnetic Spectrum Manoeuvre Warfare (EMMW) by the US Navy.[157] Like in the air, sea and land domains, the purpose of this emerging concept is to alter an adversary's perception of and ability to manoeuvre in the electromagnetic spectrum and to take advantage of this to full combat effect. This is to be achieved by infiltrating, spoofing and jamming an adversary's networks, sensors and transmitters while defending one's own from the same. The insecurity of the digital substrate in which modern warfare will play out and

[153] Work and Brimley, *20YY*, p. 26.
[154] Clarence A. Robinson Jr., "Cybersecurity Strategy Keeps Networks Viable," *Defense Media Network*, accessed June 23, 2015, http://www.defensemedianetwork.com/stories/cybersecurity-strategy-keeps-networks-viable/.
[155] Sydney J. Freedberg Jr., "Gen. Hoss Cartwright Talks Immigration, Cyber, China & Afghans With iPhones," *Breaking Defense*, accessed April 21, 2015, http://breakingdefense.com/2013/03/gen-hoss-cartwright-talks-immigration-cyber-china-and-afghans-w/; See also Sydney J. Freedberg Jr., "Cyberwar: What People Keep Missing About The Threat," *Breaking Defense*, accessed April 21, 2015, http://breakingdefense.com/2014/01/cyberwar-what-people-keep-missing-about-the-threat/.
[156] Adm Jonathan Greenert, "Adm. Greenert: Wireless Cyberwar, The EM Spectrum, And The Changing Navy," *Breaking Defense*, accessed May 27, 2014, http://breakingdefense.com/2013/04/adm-greenert-wireless-cyber-em-spectrum-changing-navy/.
[157] Branch, "Electromagnetic Spectrum Maneuver Warfare."

the race by DARPA and others to secure it combined with the doubt in critical systems it forces on US competitors is arguably the central strategic contest of the third offset. As previously discussed, Martin Libicki described the strategic aspect of cyberwar as a 'confidence game':

> (A) strategic rationale for the United States' developing cyber weapons is to make other states think twice about going down the road toward network-centric warfare as the United States is doing, thereby extending its lead in this area. Cyber weapons do so by making other states – already lacking confidence in their ability to handle high technology – doubt that their systems will work correctly when called upon, particularly if used against the United States or its friends.[158]

4.8. Electric weapons

The maturing of the precision-strike regime and its proliferation among state and non-state actors alike is manifestly offence dominated. The cost of sea-based integrated air and missile defence, for example, reflected in not only the unit cost of the interceptor missiles but also in the Aegis system and the platforms being defended, is exceedingly high in ratio to the cost of attacking those platforms with land, air and sea-based cruise and ballistic missiles. This cost imbalance is primarily what is driving the military's quest to utilise both kinetic and non-kinetic electrical weapons. In addition, replacing conventional air and missile defence with electrical weapons would free up a ship's vertical launch cells for the offensive strike role.[159] Directed-energy (DE) weapons (lasers), which produce "a beam of concentrated electromagnetic energy or atomic or subatomic particles",[160] have been a high

[158] Martin C. Libicki, "Cyberwar as a Confidence game", *Strategic Studies Quarterly*, 5, 2011, http://elastic.org/~fche/mirrors/www.cryptome.org/2013/07/cyber-war-racket-0012.pdf.
[159] James R. Holmes, "Lasers! What Are They Good For?," *The Diplomat*, accessed December 15, 2014, http://thediplomat.com/2014/12/lasers-what-are-they-good-for/.
[160] Author not supplied, "Department of Defense Dictionary of Military and Associated Terms" (Joint Publication 1-02, November 8, 2010), http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.

priority for the US military for some time. In the mid-1990s and early 2000s, it experimented with ground and air-based chemical laser weapons.[161] These were logistically burdensome due mainly to the storage of chemicals and the size of the magazines, which were depleted quickly. Earlier prominent DE programs failed to deliver on highly touted capabilities, resulting in a degree of institutional reluctance to fund the next generation.[162] Nonetheless, next-generation electrically powered solid-state lasers are offering pathways to development of laser weapons that can be mounted on large mobile platforms such as surface naval vessels. The USNS *Ponce* deployed to the Persian Gulf has a 30kW Laser Weapon System (LaWS) operational and certified for use since September 2014. At US$0.59 a shot,[163] the LaWS can defend the *Ponce* against small attack craft and UAVs at line-of-sight ranges.[164] The Navy has plans for 100-150kW LaWS, which would be capable of targeting much larger threats including incoming missiles.[165] Other electrical weapons being pursued aggressively by the US military include electromagnetic rail guns, that fire a low cost-per-shot projectile at up to Mach-6 at a range of 100+ nautical miles,[166] and electromagnetic pulse and high-power microwave weapons that disrupt adversary electronics.[167]

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[161] Eric Schechter and Dave Majumdar, "Lasers Are No Longer a 'Star Wars' Fantasy," *Wall Street Journal*, accessed July 22, 2014, http://online.wsj.com/articles/erik-schechter-and-dave-majumdar-lasers-are-no-longer-a-star-wars-fantasy-1405892997.

[162] Mark Gunzinger and Chris Dougherty, *Changing the Game: The Promise of Directed-Energy Weapons* (Center for Strategic and Budgetary Assessments, 2012), p. x, https://info.aiaa.org/tac/pc/DESPC/Shared%20Documents/CSBA_ChangingTheGame_online.pdf.

[163] Discounting the cost of infrastructure such as generators, auxiliary gear like coolant pumps, and the device itself.

[164] Sydney J. Freedberg Jr., "Star Wars At Sea: Navy's Laser Gets Real," *Breaking Defense*, accessed December 10, 2014, http://breakingdefense.com/2014/12/star-wars-at-sea-navys-laser-gets-real/.

[165] See Gunzinger and Dougherty, *Changing the Game*; Sydney J. Freedberg Jr., "Are Missile Defense Lasers On The Verge Of Reality?," *Breaking Defense*, accessed March 6, 2015, http://breakingdefense.com/2015/02/are-missile-defense-lasers-on-the-verge-of-reality/.

[166] Author not supplied, "Electromagnetic Railgun," *Office of Naval Research*, accessed March 6, 2015, http://www.onr.navy.mil/media-center/fact-sheets/electromagnetic-railgun.aspx.

[167] Author not supplied, "High-Power Microwave (HPM) / E-Bomb," *Global Security*, accessed March 6, 2015, http://www.globalsecurity.org/military/systems/munitions/hpm.htm.

4.9. Long-range strike

Since 2003 the US Air Force and DARPA have been pursuing the capability to strike targets anywhere on Earth in as little as an hour using a hypersonic glide delivery vehicle that could deploy on a modified ballistic-missile fired from either land or sea.[168] DoD has argued this would give the US the capability to deter or defeat an adversary via the ability to strike at "high value" or "fleeting" targets in a short space of time.[169] In 2008 Congress created a single, combined fund to support research and development of what became the Conventional Prompt Global Strike (CPGS) mission, and has supported it since with $65.4 million in FY2014 and $95.6 million in FY2015. The Obama Administration requested $78.8 million for FY2016.[170] In addition to CPGS, the US Navy is pursuing its own long-range strike capabilities via the development of the Unmanned Carrier Launched Airborne Surveillance and Strike (UCLASS) project,[171] as well as its next generation Long Range Anti-Ship Missile (LRASM).[172] In the interim, the Navy has tested an anti-ship variation on its existing Tomahawk cruise-missile with a range of 1000 miles, a capability considered urgent by US forces in PACOM.[173]

[168] See for full discussion Amy F. Woolf, "Document: Report to Congress on U.S. Long Range Strike," *USNI News*, accessed September 10, 2014, http://news.usni.org/2014/09/09/document-report-congress-u-s-long-range-strike.
[169] Ibid., p. 1.
[170] Amy F. Woolf, "Document: Report to Congress on U.S. Long Range Strike," *USNI News*, pp. 21–30, accessed September 21, 2014, http://news.usni.org/2014/09/09/document-report-congress-u-s-long-range-strike.
[171] J. Randy Forbes, "UCLASS and The Future of Naval Power Projection," Text, *The National Interest*, accessed July 17, 2014, http://nationalinterest.org/feature/uclass-the-future-naval-power-projection-10889.
[172] Marina Malenic, "Navy League 2015: Lockheed Martin, USN in LRASM Contract Negotiations," *IHS Jane's 360*, accessed April 21, 2015, http://www.janes.com/article/50692/navy-league-2015-lockheed-martin-usn-in-lrasm-contract-negotiations.
[173] Sam LaGrone, "WEST: Bob Work Calls Navy's Anti-Surface Tomahawk Test 'Game Changing,'" *USNI News*, accessed March 6, 2015, http://news.usni.org/2015/02/10/west-bob-work-calls-navys-anti-surface-tomahawk-test-game-changing.

5. Information dominance

5.1. Strategic implications

As reflected above, and perhaps unsurprisingly, much of the discussion of the emerging third offset strategy is decidedly techno-centric. Somewhat in the background, however, are the second and third order effects precipitated by this ongoing technical evolution. These effects are caused by the quest for 'information dominance', and refer specifically to the emergence of the information domain as site of strategic leverage. A key distinction needs to be made here. The digital information revolution and the rise of networked computing power added cyber-space and outer-space as war-fighting domains to the traditional set of air, land, and sea. Information, moreover, as a vital medium of exchange in the political contest that defines warfare, is anything but novel. What marks information dominance with the potential for strategic leverage is the importance of *access to* and *exploitation of* information that fundamentally underpins the maturing precision-strike regime described in this chapter. In other words, the evolution of precision-strike as the cutting-edge war-making paradigm is elevating information to a hitherto unprecedented value. The prospect, then, arises that *dominance* in the information domain (access *and* exploitation) represents strategic value to the war-fighter and war-planner which is easily overlooked when the popular focus is on tactical level, techno-centric components of current and future regimes. Put simply, information may go beyond being a key medium of exchange in warfare to become the vital currency of dominance under certain conditions. Further, these prospects are long reflected in various aspects of US strategic planning. As the Third Offset Strategy discussion matures, the impetus to look beyond technological

wizardry and leverage networked information flows to enable allied and partnered capabilities grows.[174]

5.2. Space-based surveillance

According to Dean Cheng, American forces "rely on space assets for weather information, positioning and navigation assistance, communications, time synchronization, and tactical and strategic intelligence and warning."[175] For a long time the exclusive preserve of the American and Soviet governments, the high resolution imagery provided by space-based surveillance satellites is available increasingly to numerous states, corporations and individuals. More than 60 actors operate approximately 1,100 satellites in space.[176] As of 31 January 2015 the US had 528 satellites in orbit, compared to China's 132 and Russia's 131.[177] The US' military use of space itself underwent a radical shift after Desert Storm, signified most notably by the declassification of the National Reconnaissance Office (NRO) in 1992.[178] The NRO was veiled in secrecy during the Cold War, given its role in Soviet focussed intelligence, surveillance and reconnaissance activities. It was forced into the open in order to defend its budget share, which was justified on the back of the shift to supporting conventional joint operations as well as its increasing civilian use.[179] The military advantage the US derives from its constellation of military-use satellites is of course dependent on a wide spectrum of technical and practical expertise not immediately available nor ultimately attainable to all who nonetheless benefit from this access. Indeed, significant obstacles,

[174] Jensen, "Think Bigger."
[175] Dean Cheng, "China's Space Program: A Growing Factor in U.S. Security Planning," *The Heritage Foundation*, accessed April 13, 2015, http://www.heritage.org/research/reports/2011/08/chinas-space-program-a-growing-factor-in-us-security-planning.
[176] Spring, "Acquisition of the New 'Space Fence' Will Improve Security."
[177] Johnson-Freese, "Escalating U.S.-Sino Military Space Rhetoric."
[178] Melissa Healy, "Secret Spy-in-the-Sky Agency Disclosed : Intelligence: Pentagon Acknowledges National Reconnaissance Office, the Brain Center of the Nation's Data Gathering Satellite Network.," *Los Angeles Times*, September 19, 1992, http://articles.latimes.com/1992-09-19/news/mn-606_1_national-reconnaissance-office.
[179] Ibid.

ranging from the technical to the organisational, suggest that the US's margin of dominance in leveraging the advantages of orbital technologies is subject to erosion.[180] The cost of acquiring an indigenous space launch capability is indicative.[181] Although the US is overall leader and investor in the space arena, its global dominance is slowly eroding. The Futron Space Competitiveness Index (SCI) shows the US SCI ranking gradually decreasing about one percent each year, with a four percent total drop from 2008 to 2012.[182]

The 2006 Quadrennial Defense Review is explicit in regarding the importance of US predominance in space, demanding a space-based Command, Control, Communications, and Intelligence (C3I) architecture that is "at least one generation ahead of any foreign or commercial space power." In addition, it requires "the joint force to develop improved space control measures to ensure the future joint force will *always* enjoy space superiority."[183] Further, the intent to retain a margin of dominance in space-based systems is spelled out in USSPACECOM's four official roles and capabilities. They are:

> 1. Space support, which includes launch activities and the control of military satellites; 2. Force enhancement, which encompasses military satellite communications, navigation aids such as the GPS constellation, threat warning and attack assessment, environmental monitoring, the collection of geospatial and classified information, and surveillance and reconnaissance; 3. Space control, which spans space surveillance, battle management, and

[180] Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment* (Center for Strategic and Budgetary Assessments, 2001), p. 2, http://www.csbaonline.org/4Publications/PubLibrary/R.20010201.The_Military_Use_o/R.20010201.The_Military_Use_o.pdf.

[181] Dana J. Johnson and Ariel E. Levite, eds., *Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers* (RAND, 2003), p. ix, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA416914.

[182] Under Secretary of Defense for Acquisition, Technology, and Logistics, "Annual Industrial Capabilities Report to Congress" (DoD, October 2013), p. 35, http://www.acq.osd.mil/mibp/docs/annual_ind_cap_rpt_to_congress-2013.pdf.

[183] Department of Defense, "Quadrennial Defense Review Report" (DoD, February 6, 2006), pp. 55–56, (emphasis added).

> ensuring US use of space while *denying such use to adversaries*; and, 4. Force application, which currently means treaty-compliant research into ballistic-missile defence.[184]

Tracking objects in space, or the acquisition of Space Situational Awareness (SSA), is a critical task of the US Air Force Space Command (USAFSC). The number of objects in orbit, including satellites and space debris, is increasing and these objects need to be tracked in order to reduce the risk of collisions. In addition, exploiting superior SSA could be a critical factor in the event of a hostile act in space, whereby the attribution of a given act to a specific actor is key to retribution and therefore deterrence.[185] To this end, since 1961 SSA has operated the Air Force Space Surveillance System (or Space Fence), which consists of a line of very-high-frequency radar sites stretching across the southern United States.[186] Subject to budget cuts in 2013, the full operation of the Space Fence was discontinued while a planned upgrade was postponed. Alternate measures were implemented by USAFSC to maintain SSA in the interim.[187] The next-generation Space Fence was slated initially to be composed of up to three S-band radars[188] able to detect, track and measure more than 100,000 objects the size of a softball orbiting in space as well as monitor satellite break-ups, collisions or unexpected manoeuvres.[189] That number has been revised down to just one large S-band radar at Kwajalein Atoll in the Marshall Islands, with an option for a second, to be complimented by twenty-nine ground-based space surveillance initiatives between US DoD and privately/foreign owned radar and optical sensors, at seventeen locations

[184] Watts, *The Military Use of Space*, p. 3, (emphasis added).
[185] Cheng, "China's Space Program."
[186] Mike Gruss, "With Current System Slated for Closure, Air Force Defers Next-Gen Space Fence," *SpaceNews.com*, accessed April 13, 2015, http://spacenews.com/36919with-current-system-slated-for-closure-air-force-defers-next-gen-space/.
[187] US Air Force, "Air Force Space Command to Discontinue Space Surveillance System," accessed April 13, 2015, http://www.af.mil/News/ArticleDisplay/tabid/223/Article/466832/air-force-space-command-to-discontinue-space-surveillance-system.aspx.
[188] Notionally in Australia, Ascension Island in the south Atlantic, and Kwajalein Atoll in the Marshall Islands.
[189] US Air Force, "Air Force Space Command to Discontinue Space Surveillance System."

worldwide,[190] including those pursued with both Australia and Japan, which are outlined in chapters VI and VII.

Adjuncts to the SSA effort receiving increasing focus within DoD are weapons and measures described as 'offensive space control' or 'active defense',[191] most of which fall under classification. According to Krepinevich and Martinage: "Potential US investments might include micro-/mini-satellite constellations comprising small, cross-linked satellites that are individually less susceptible to attack and relatively easy to replace, jam-proof laser uplinks and downlinks, enhanced on-orbit satellite manoeuvring capability to complicate an adversary's tracking and targeting challenge; and terrestrial substitutes for space-based capabilities."[192] This focus is reflected in spending on space control as part of the Space Security and Defense Program that is *not* classified, which rose from $9.5 million in 2013 to $30.7 million requested in 2016.[193] This is a small portion of the $5.5 billion to be spent between 2015 and 2020 on securing America's space architecture both in space and on the ground.[194] In a summary of his remarks prepared for the media from a classified session at the Space Symposium in April 2015, Deputy Defense Secretary Bob Work cited "increasing threats" against America's satellites, and the need to be able to respond "in an integrated, coordinated fashion" to threats to both classified and unclassified space assets to preserve

[190] Defense Industry Daily staff, "Dont Touch Their Junk: USAFs SSA Tracking Space Debris," *Defense Industry Daily*, accessed April 13, 2015, http://www.defenseindustrydaily.com/air-force-awards-first-phase-of-next-generation-space-fence-05511/.
[191] Sydney J. Freedberg Jr., "US Can't 'Stick Our Heads In The Sand' On Space Threats: Gen. Shelton," *Breaking Defense*, accessed April 20, 2015, http://breakingdefense.com/2014/07/us-cant-stick-our-heads-in-the-sand-over-rising-threats-to-space-gen-shelton/.
[192] Krepinevich and Martinage, "Dissuasion Strategy," 35.
[193] Colin Clark, "US Presses Russia, China On ASAT Tests; Space Control Spending Triples," *Breaking Defense*, accessed April 19, 2015, http://breakingdefense.com/2015/04/space-control-spending-triples/.
[194] Ibid.

US dominance in the "ultimate high-ground."[195] At the June 2015 GEOINT Symposium, Work reiterated that:

> [W]e are going to develop the tactics, techniques, procedures, rules of the road that would allow us … to fight the architecture and protect it while it's under attack. The ugly reality that we must now all face is that if an adversary were able to take space away from us, our ability to project decisive power across transoceanic distances and overmatch adversaries in theaters once we get there … would be critically weakened.[196]

In addition, the Pentagon is reportedly working hard on setting up a new joint coordination and planning cell, which will receive data from satellites belonging to all US government agencies.[197] While the classified nature of these developments makes the specific identification of motives and intentions difficult, a consensus within the commentary surrounds recent Chinese anti-satellite tests[198] and Russian 'aggression'[199] as primary drivers of the US space posture.

5.3. Exploiting superior ISR

Roy Sach, an Australian expert on orbital systems and Australia's first director of Defence Space Engagement, surmises that: "A capacity to control or influence space-sourced data and its associated services can enhance international prestige while conferring geopolitical power."[200] US forces are able to collect data from a great number of sensors, with space-

[195] Colin Clark, "DepSecDef Work Invokes 'Space Control;' Analysts Fear Space War Escalation," *Breaking Defense*, accessed April 19, 2015, http://breakingdefense.com/2015/04/depsecdef-work-invokes-space-control-analysts-fear-space-war-escalation/.
[196] Cited in Franz-Stefan Gady, "Star Wars: The US Gets Ready to Battle China and Russia in Space," *The Diplomat*, accessed June 26, 2015, http://thediplomat.com/2015/06/star-wars-the-us-gets-ready-to-battle-china-and-russia-in-space/.
[197] Ibid.
[198] Colin Clark, "Chinese ASAT Test Was 'Successful:' Lt. Gen. Raymond," *Breaking Defense*, accessed April 20, 2015, http://breakingdefense.com/2015/04/chinese-asat-test-was-successful-lt-gen-raymond/.
[199] Clark, "US Presses Russia, China On ASAT Tests; Space Control Spending Triples."
[200] Roy Sach, "Containing Space Warfare in the Early Decades of the Twenty-first Century" (Dissertation, University of New South Wales, August 2014), p. 1.

based surveillance as the superior standard. Libicki observes that: "Stand-off sensors can detect electro-optical, infrared, passive microwave, and reflected real or synthetic aperture radar. Close-in sensors can detect pressure, magnetic fields, gravity differentials, sounds, and certain chemicals."[201] This regime of advanced, multi-dimensional sensors is known as the Global Command and Control System (GCCS). The GCCS is described as an 'info-sphere', consisting of distributed global networks, computer hardware and software, space-based C2 support, and other related support systems.[202] In 1996 it replaced the World-Wide Military Command and Control System (WWMCCS), a cumbersome Cold War era system of proprietary mainframe computers dating from the 1960's.[203] It was designed to "aid in threat identification and assessment, strategic planning, course of action development, execution, planning, implementation, and monitoring, risk assessment, and the development of common tactical pictures."[204] Not receptive to the emerging joint architecture, however, the GCCS was in the process of being replaced by the network-centric Joint Command and Control capability (JC2) since the early 2000's.[205] The JC2 will introduce standard Joint applications and protocols, designed specifically to make "the sharing of information in US Joint Multidimensional Battle Networks that much more seamless and effective."[206]

The superior capacity to collect data is only the beginning of information dominance. Because no information gathering system can collect everything of interest to the required

[201] See Martin Libicki, "DBK and Its Consequences," in *Dominant Battlespace Knowledge* (National Defense University, 1995), pp. 6–7.
[202] Author not supplied, "GCCS - Global Command and Control System," *Federation of American Scientists*, accessed June 18, 2015, http://fas.org/nuke/guide/usa/c3i/gccs.htm.
[203] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 144.
[204] Author not supplied, "GCCS - Global Command and Control System."
[205] Author not supplied, "Joint Command and Control (JC2)," accessed June 23, 2015, http://www.globalsecurity.org/intell/systems/jc2.htm.
[206] Clarence A. Robinson Jr., "Information Technology," *The Year in Defense (Tampa. FL: Faircount Publications)*, 2006, p. 118.

detail all at once, it has to rely on cuing, filtering and pinpointing. Further, the ability to see more does not necessarily constitute knowledge. In some instances, the simple presence of a tank or weapon in a particular location is sufficient to discern its intent. In others, no such intent is easily discernible and the picture provided by the sensor needs to be supplemented most likely by big data, if not by human intelligence, in order to form a military response. As mentioned above, the application of algorithms to help humans sort large data streams is already happening. Further, figuring out how best to distribute elements of relevant and useable available information, at times of spiking demand, is a major challenge for command and control.[207] This complex process, from raw data to useful understanding, is described by Jeffrey Cooper as a cognitive hierarchy.[208]

In total, the exploitation of superior data collection capabilities to achieve DBK is a function of systems integration techniques and technologies, software enabled by advances in computing power, as well as new concepts in the structure and operation of command and control.[209] The development of these exploitative measures was foreseen by Marshall and Krepinevich in the early 1990's as the real substance of the prospective RMA, and given the scale of the task was expected to take decades to realise.[210] In 1994, Arquilla recognised the information technology sphere from which these measures would emerge as the site of the "greatest American comparative advantage," which could provide an "incomparable edge in military effectiveness."[211] With much focus on the proliferation of the guided-munitions regime and the fact that its component parts can be easily bought, copied or stolen by

[207] See Captain Eileen F. MacKrell, "Network-Centric Intelligence Works," *U.S. Naval Institute*, accessed January 4, 2015, http://www.usni.org/magazines/proceedings/2003-07/network-centric-intelligence-works.
[208] Jeffrey Cooper, "Dominant Battlespace Awareness and Future Warfare," in *Dominant Battlespace Knowledge* (National Defense University, 1995), p. 39.
[209] See David S. Alberts, "The Future of Command and Control with DBK," in *Dominant Battlespace Knowledge* (National Defense University, 1995).
[210] Marshall, "Some Thoughts on Military Revolutions"; Krepinevich, *The Military-Technical Revolution*.
[211] Arquilla, "The Strategic Implications of Information Dominance," p. 25.

America's competitors, it is prescient to remember that knowledge-based systems integration remains the vital enabler of the regime. Its success "depends on complex questions of organizational cultures and adaptability, which are inherently difficult for outsiders to predict."[212]

Perhaps the greatest obstacle of all hindering the exploitation of information dominance is the traditional and pervasive reluctance to share information. As will be explored ahead, the level of sharing that must underpin any networked security model has been something of anathema in terms of Cold War-era thinking about security partnering in the US. According to Nye and Owens, two presumptions supported this reluctance; "first, that providing too much of the best information risked disclosing and perhaps even losing the sources and methods used in obtaining it, and second, that sharing information would disclose what the United States did not know and reduce its status as a superpower."[213] These presumptions, however, have ceased to carry the same weight in light of the emergence of the networked age. They reflect a paradigm of thinking about regional and international security that is dated. If they continue to inform security thinking in the very states that are building the networked security architecture of the future, the opportunities afforded by the information revolution and the associated networked age will be under-realised at best. Nye and Owens foresaw this imperative in 1996, arguing

> whether another nation decides to make a race out of the information revolution depends on how the United States uses its lead. If America does not share its knowledge, it will add

[212] Cooper, "Dominant Battlespace Awareness and Future Warfare," p. 46.
[213] Joseph S. Nye and William A. Owens, "America's Information Edge," *Foreign Affairs* 75 (1996): pp. 20–36.

incentives to match it. Selectively sharing these abilities is therefore not only the route of coalition leadership but the key to maintaining U.S. military superiority.[214]

6. Conclusion

This chapter linked the concept of information dominance with the dawn and expansion of the guided-munitions era. It argued that the rise of a new class of weapons, along with the associated sensor and communication networks that provide these weapons with their critical location, identification and tracking data together constitute the growth of the digital medium applied to military affairs. Reconnaissance-strike complexes, as the Soviets first dubbed them, had the effect of elevating information to a level of centrality and practical utility in warfare that was unprecedented. This elevation was enabled by technological advances, particularly in computing power and solid-state electronics. It was driven by the ubiquitous desire of combatant to *know more* and to be able to take advantage of knowing more. The quest to exploit the tactical and operational advantages offered by the guided-munitions regime drove its evolution into NCW, which was in turn been enabled by progress in networking, digital data-processing, sensors, and wireless technologies, all of which are expressed in military platforms large and small being fielded by the US, and to an increasing extent its allies, partners and competitors. Put simply, the abundance of information now delivered by an array of advanced sensors provided the impetus for information sharing and the rise of the network. The emphasis on information sharing brought information assurance to the forefront. From its inception, the guided-munitions regime increasingly leveraged superior situational awareness provided by orbital, aerial and terrestrial sensor technologies, which became pivotal components of the US military-technical dominance which saw the end of the Cold War. Dominance of the information

[214] Ibid.

background underpinning its lead subsequently informed US strategic thinking, perhaps latent for much of the 1990's while it wrestled with its unipolar moment. Since the late 1990s, the challenge to US military pre-dominance reflected broadly in the slow and variegated global trend toward guided-munitions parity, and particularly in China's military modernisation in the Western Pacific, [215] revealed the pursuit of information superior and assured dominance as the driver of strategic advantage, as perceived by its early proponents. The effects are visible through the prism of the US's key alliance partnerships with Japan and Australia in the Western Pacific, which made, as we shall see, ongoing and significant contributions to the illumination of the battlefield and the extension of US operational reach. In these developments we see the growth of a discourse and set of extra-discursive practices centred on the potential benefits of digital networked warfighting and the imperative to contest and control the flow of information. This growth is the foundational feature of the scale-free network model. Having established its existence we move on to the observable features of preferential attachment in the discourse occurring concurrently.

[215] Sam LaGrone, "Global Guided Missile Expansion Forcing U.S. Navy to Rethink Surface Fleet Size," *USNI News*, accessed April 22, 2015, http://news.usni.org/2015/04/21/global-guided-missile-expansion-forcing-u-s-navy-to-rethink-surface-fleet-size.

Chapter III. Preferential attachment

1. Introduction

After growth, the second defining organising principle of the scale-free network model is preferential attachment: nodes attaching to the network will tend to attach to the better connected existing nodes. This chapter introduces the concept of 'vertical alliances' as a means of thinking about how the growth of digital connectivity between military forces at the tactical and operational levels played out politically. Section 2 provides an overview of the evolution of US alliance making, focussing on the Cold War and early post-Cold War eras. For this overview the chapter relies most heavily on two particular works, *A New Global Defense Posture for the Second Transoceanic Era,* and *Overseas Basing of U.S. Military Forces: An Assessment of Relative Costs and Strategic Benefits.*[1] The substance of these studies is US forward basing overseas incorporated with allied and partner political arrangements regarding access. Hand-in-hand with basing and access requirements come the force structures supporting the posture. It is argued that the end of the Cold War saw the US undergo a slow, uncertain, variegated, and largely conservative approach to what was nonetheless a transformation. The exigencies of war and other military contingencies had a huge influence on the process, at times delaying and obstructing change, and at others driving and catalysing it. The shock of 9/11 can be seen as the catalyst that drove the US military beyond making cautious prescriptions for the new era and into the beginnings of their real implementation. But the 'Global War on Terror' and the contingencies in

[1] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*; Michael J. Lostumbo *et al., Overseas Basing of U.S. Military Forces: An Assessment of Relative Costs and Strategic Benefits* (USA: Rand Corporation, 2013).

Afghanistan and Iraq are presented here not as the drivers of change, but as complications adjunct to an emerging range of needs. Underpinned most profoundly by the biggest shift in the strategic landscape since WWII, from the Atlantic to the Pacific, proliferation of the guided-munitions regime put the long-held US freedom of access in question. Planned changes to US military posture had to give equal salience to fighting the "Long War"[2] as well as hedging against any long-term worsening in US-China relations.[3] The seminal question of *what* the US would choose to do with its military power post-Cold War was very quickly complicated by the dilemma of *how* it could be achieved. This question is still in the process of being answered, and is the focus of section 3. Section 4 discusses the traditional view of the alliance security dilemma, providing a platform from which the vertical alliance model is introduced and assessed in section 5. The vertical alliance concept, explained in section 4, is assessed alongside the emerging proclivities of the new strategic era manifest in the US posture which acts as both driver and enabler of the revised framework.

2. "Strange and ill-fitting clothes"

2.1. Pre-war distaste for entanglement

Rajan Menon in *The End of Alliances* describes the extensive US alliance system during the Cold War as "an exception and a stark departure for a country that has traditionally been chary of long-term military commitments."[4] With the exception of the 1778 alliance with France, the new American republic, from its inception, exhibited a strong distaste for what Thomas Jefferson described as "entangling alliances",[5] something associated with the sordid politics of the "old world" or "old Europe", to which US Secretary of Defense Donald

[2] The term "long war" is used in the first sentence of the 2006 QDR, and prominently throughout the remaining report. See Department of Defense, "Quadrennial Defense Review Report."
[3] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, 193.
[4] Rajan Menon, "The End of Alliances," *World Policy Journal* 20, no. 2 (2003): p. 1.
[5] Thomas Jefferson, "First Inaugural Address 4 March 1801" (Boston: Little, Brown, and company, 1919., n.d.).

Rumsfeld controversially referred in 2003.[6] The physical separation supplied by the stopping power of two oceans allowed this ideological distaste to be married with pragmatism for the best part of 150 years.[7] The Industrial Revolution and the mechanisation of warfare shrank the space in which the United States found comfort, however, and the First World War drew it into alliances which were just as quickly shed as "strange and ill-fitting clothes" in the inter-war years.[8]

2.2. Post-war necessities

At the end of World War II, the United States had bases around the globe left over from its fight against the Axis powers. They were immediately put to use hemming in the Soviet Union. The strategic context of "containment" animated the American embrace of alliances post-WWII, beginning first with the Rio Pact (1947) which committed the US to the defence of 24 Central and South American countries, followed by NATO (1949) which expanded from the original 12 to 15 signatories, before expanding globally to fill strategic gaps into which Soviet influence was deemed certain to flow. ANZUS (1951) with Australia and New Zealand, SEATO (1954-1977) in South-East Asia, and bilateral treaties with Japan (1952), South Korea (1953), and Taiwan (1955-1979) followed. The traditional animus toward alliance entanglements, while remaining a quintessential thread running through the US polity, was surpassed by the need to counter the Soviet Union[9] with the help of "force multipliers" in far flung places.[10] Bilateral alliances of a less formal nature were established in the Middle East, the Persian Gulf, South Asia, Africa and Latin America as bulwarks against Soviet

[6] John Hooper and Ian Black, "Anger at Rumsfeld Attack on 'Old Europe,'" *The Guardian*, accessed June 4, 2015, http://www.theguardian.com/world/2003/jan/24/germany.france.
[7] Menon, "The End of Alliances," p. 1.
[8] Ibid.
[9] See The Executive Secretary, "NSC 162/2."
[10] Kurt M. Campbell, "The End of Alliances? Not so Fast," *The Washington Quarterly* 27, no. 2 (March 1, 2004): 151, doi:10.1162/016366004773097768.

influence. . Reflecting the variegated nature of the Cold War US alliance network, in many of these places US forces have never fought side by side with their partners, and no formal security arrangements exist. Nevertheless, at various times "the US government has resupplied partners during combat, sought to send strong messages of deterrence to would-be aggressors, and made it clear Washington would not allow them to coerced."[11] In addition to formal and informal alliances and partnerships, the US "established military training and cooperation programs, security dialogues, and other limited exchange programs with many of the world's remaining countries."[12] In sum, according to Michael Beckley, the US is obligated legally to defend nations spanning five continents, containing some 25 percent of the world's population and counting for nearly 75 percent of global economic output.[13] In the process it enacted Status of Forces Agreements[14] (SOFA) which outline the legal rights of US personnel living or operating in host States.

Underpinning these political arrangements was a standard model of US military power projection configured around forward basing both inside partner countries, as well as on US soil or that of its protectorates. The forward presence served a range of ends from rapid response and surge capacity to 'trip-wire' deterrence, as a local security presence, and as critical logistical and supply chain support for the carrier warfare that distinguishes the American model.[15] In 1985, at the height of the Cold War, the US had 358,000 military

[11] Ibid., p. 155.
[12] Ibid.
[13] Michael Beckley, "The Myth of Entangling Alliances: Reassessing the Security Risks of U.S. Defense Pacts," *International Security* 39, no. 4 (Spring 2015): p. 7.
[14] R. Chuck Mason, "Status of Forces Agreement (SOFA): What Is It, and How Has It Been Utilized?" (Congressional Research Service, March 15, 2012), https://www.fas.org/sgp/crs/natsec/RL34531.pdf.
[15] Carnes Lord and Andew Erickson, "Introduction," in *Rebalancing US Forces: Basing and Forward Presence in the Asia-Pacific* (Annapolis, Maryland: Naval Institute Press, 2014).

personnel deployed in Europe, 125,000 in East Asia, and 9,000 in the Persian Gulf.[16] Lord and Erickson note how largely underappreciated and taken for granted the extensive system of post-war overseas basing is to the US polity and public alike.[17] In addition, they argue that the presence of military forces on foreign soil, while often problematic for host populations and their governments,[18] "has become accepted by them as a natural and legitimate expression of America's geographical situation as well as its long-established role as the world's chief security provider."[19]

2.3. A cautious change in emphasis

With the imperatives of containment removed, the US alliance system in the post-Cold War era was slowly transformed as it adapted to new exigencies. According to Krepinevich and Work, "the reorientation of the US military posture had been going on since the fall of the Berlin Wall in 1989, albeit without any clear central idea about the desired end State."[20] The first post-Cold War defence review, called the *Base Force Review*, was "less about re-orienting national security strategy and more about establishing a floor below which the post-Cold War military should not be allowed to fall."[21] Nonetheless, in the first half of the 1990's nearly 300,000 US military personnel were withdrawn from overseas, and some 60 percent of overseas bases were closed or turned over to host governments.[22] During the 1990s the United States also closed large military facilities in the Philippines, Spain, and

[16] Ryan Henry, "Transforming the US Global Defense Posture" (DTIC Document, 2006), p. 17, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA519802.
[17] Lord and Erickson, "Introduction," p. 2.
[18] Host nation support, often referred to as "offset payments", have been particularly contentious in places like Germany, Japan, and South Korea. Nonetheless, these agreements continued to provide important financial support to the US exterior basing network. See also Catherine Lutz, *The Bases of Empire: The Global Struggle Against U.S. Military Posts* (NYU Press, 2009).
[19] Lord and Erickson, "Introduction," p. 2.
[20] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. ii.
[21] See Lorna S. Jaffe, "The Development of the Base Force 1989-1992" (DTIC Document, 1993), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA276236.
[22] Lord and Erickson, "Introduction," p. 2.

Panama.[23] Those that remained, under the Clinton administration's policy of "engagement and enlargement", were put to use to provide regional stability and help "shape" the international security environment.[24] For US defence planners, many threats competed for their attention while none stood above all. The overall response to this strategic uncertainty and competing visions of the future was one of conservatism.

It is important, also, to note the impact the First Gulf War in 1990-91, commonly referred to as operation *Desert Storm*, had on US strategic planning. As the war which marked the abrupt shift from one era to the next, it left an indelible mark on the new era of US strategic thinking for two main reasons. First, it provided some conservative justification for the overlap of a quasi-Cold War era forward-presence. The military's primary concern was the possibility of fighting two "major regional contingencies" (MRC), which *Desert Storm* represented, and which also included possible contingencies on the Korean Peninsula and Taiwan. This was only slightly removed from the Cold War emphasis on *at least* two multi-theatre wars centred on Eastern Europe and North-East Asia, but considered likely to spill-over into other regions of the globe.[25] Second, though precision-guided munitions only accounted for approximately 7 percent of munitions deployed during *Desert Storm*, their contributions to the US victory appeared to confirm their value.[26] They were seen as the critical variable that would enable the US to fight two MRC's while at the same time reducing its overall military footprint. Reflecting this, in four of the next five US military

[23] Henry, "Transforming the US Global Defense Posture," p. 17.
[24] Kurt M. Campbell and Celeste Johnson Ward, "New Battle Stations?," *Foreign Affairs* 82, no. 5 (2003): pp. 95–103.
[25] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 140.
[26] Ibid., p. 142.

engagements between 1995 and 1999 conventional guided munitions accounted for between 69 and 100 percent of all weapons used.[27]

The significance of some regions, in terms of US national security, had clearly diminished. The US security presence and strategic engagement in Latin America was reduced, and no formal security ties exist between the US and countries in sub-Saharan Africa.[28] In contrast, common security interests in the Balkans and the Persian Gulf saw Cold War allies continue to provide key military bases and access agreements after the removal of the Soviet threat. Taken together, the post-war model of alliance making based on a known threat from a traditional rival State acting globally, and the need to position forces to respond rapidly to aggression but largely to fight in place, was replaced slowly by a more variegated military posture and alliance regime. This steady transformation was reflected in a major review of the entire US military presence world-wide under Secretary of Defense Donald H. Rumsfeld during the first President George W. Bush administration. Known as the Global Posture Review (GPR), it was summarised in a September 2004 Pentagon report titled *Strengthening U.S. Global Defense Posture*.[29] In an editorial for the US Department of Defense website, then secretary Rumsfeld wrote:

> We have entered an era of enemies without country or conscience, who operate in small cells scattered across the globe. Yet our forces continue to be arranged essentially to fight large armies, navies, and air forces. The world has changed, and so must we.

Describing the State of the US force posture at the time, and the drivers and enablers of the transformation, Rumsfeld added:

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[27] Michael G. Vickers and Robert C. Martinage, *The Revolution in War* (Center for Strategic and Budgetary Assessments Washington, DC, 2004), p. 16, http://csbaonline.org/wp-content/uploads/2011/03/2004.12.01-Revolution-in-War.pdf.

[28] Henry, "Transforming the US Global Defense Posture," p. 27–28.

[29] For authoritative account of the GPR see Henry, "Transforming the US Global Defense Posture."

> Today, our forces are still situated in large part as if little has changed for the last 50 years - as if, for example, Germany is still bracing for a Soviet tank invasion across its northern plain. In South Korea, our troops have been virtually frozen in place where they were when the Korean War ended in 1953… The old reliance on presence and mass reflects the last century's industrial-age thinking… Precision weapons have greatly expanded our capability, while significantly reducing the number of weapons needed… we will likely not need a full-time carrier strike group presence in every critical region.[30]

The GPR reflected the transformative emphasis found in both the 2001 and later 2005-6 Quadrennial Defense Reviews (QDR). Rumsfeld wanted the services to focus on *how an adversary might fight* and less on *whom an adversary might be*, anticipating capabilities rather than identifying threats,[31] and as such moved away from the familiar MRC focus.

2.4. 'Ad hoc coalitions'

One of the consequences of the changing nature of the global threat environment is that the new system of alliances is more fluid, and as noted by Lord and Erickson, its clandestine nature and the sensitivities of partner nations especially in the Middle East made it more difficult to ascertain a full understanding of associated basing and political arrangements.[32] For example, the actual texts summarising the applicability of individual SOFA's between the US and Kuwait, Qatar, the U.A.E. and Oman are classified.[33] Nonetheless, Kurt Campbell's conceptualisation of alliances into three categories, based on their respective "closeness" in the relationship with the US, offers a foundation for understanding the new system. Campbell divided US alliance relations during the Cold War into the "nuclear family, the

[30] Rumsfeld, "Positioning America's Forces for the 21st Century."
[31] Henry, "Transforming the US Global Defense Posture," p. 35.
[32] Lord and Erickson, "Introduction," p. 12.
[33] Mason, "Status of Forces Agreement (SOFA): What Is It, and How Has It Been Utilized?," pp. 28–29.

extended family, and friends and acquaintances."[34] The nuclear family was comprised of an 'inner circle' of States such as "NATO members, Japan, South Korea, the Philippines, and Australia. The extended family included Israel, Egypt, Saudi Arabia, Bahrain, Singapore, Thailand, Indonesia, Pakistan, Taiwan, Colombia, and South Africa." Friends and acquaintances included transitory relations with Latin American States such as Chile. Campbell says that despite a focus on the 'inner circle' evident in the lead up to the 2000 US Presidential election, the September 2001 attacks and subsequent 'Global War on Terror' catalysed the "pre-existing proclivities" of the post-Cold War global security environment.[35]

These proclivities revolved around the US attributing more value to those alliance partners that could support US interests in counter-terrorism, help curtail the spread of weapons of mass destruction, and "participate decisively in coalitions of the willing."[36] The emergent security challenges of the post-9/11 world, as well as the shock of that event itself,[37] produced a change in emphasis and in priority regarding US alliances. Some inherited partnerships, even in the 'inner circle' such as NATO, received a lower priority as a whole under the Bush administration to widespread criticism and the associated charge of 'unilateralism'. Other groupings looked decidedly *ad hoc*, incorporating features of the inner circle and of individual members of NATO with "new friends". According to Campbell, a new international cohort that worked closely with the US in the new security environment included Great Britain, Australia, Poland, Spain, Romania, Bulgaria, the Czech Republic and Japan.[38] This list was largely reiterated by Andrew Krepinevich, adding India and the

[34] Campbell, "The End of Alliances?," p. 156.
[35] Ibid., p. 158.
[36] Ibid.
[37] Henry, "Transforming the US Global Defense Posture," p. 18.
[38] Campbell, "The End of Alliances?," p. 158.

Philippines, in 2015.[39] The new, smaller 'nuclear family' was likely to contain states sharing the "values and views" of the US, , and were willing to take the "steps required" to remain in that category.[40]

3. New features

3.1. "Lily pads"

Amidst this shift in emphasis and priority was the Pentagon's GPR, unveiled by secretary Rumsfeld in 16 August 2004. Planned changes to the location of bases, the arrangements between Washington and host countries, troop and ship deployments, and theatres of operation would "constitute the most sweeping changes in the US military posture abroad in half a century."[41] The shifts were informed by the compelling military logic of increased flexibility, agility and readiness, and the political exigencies of stationing troops in places more likely to be on-side with US policies. In addition, the strategic imperative to extract more value from its global alliance network in an environment of constrained defence spending underpinned Pentagon thinking since the end of the Cold War.[42] Some of the changes envisioned included the establishment of small, lightly staffed facilities outfitted with supplies and equipment to rapidly accommodate larger forces as jumping-off points in a crisis. Linking these "lily pads" to a few large, heavy-infrastructure bases (such as Ramstein in Germany and Misawa and Yokosuka in Japan), with increased access rights and prepositioned equipment on land and at sea, was in aid of the need for military forces that

[39] Andrew F. Krepinevich, "The Future of U.S. Defense Strategy and the Japan-U.S. Alliance" (Sasakawa Peace Foundation, June 23, 2015), pt. approx. 1:02 mins., http://csbaonline.org/2015/06/23/the-future-of-u-s-defense-strategy-and-the-japan-u-s-alliance/.
[40] Campbell, "The End of Alliances?," p. 159.
[41] Campbell and Ward, "New Battle Stations?"
[42] Lostumbo et al., *Overseas Basing of U.S. Military Forces*, p. 256.

are deployed to strike rapidly in unexpected places.[43] The 2006 Quadrennial Defense Review continued the themes of the GPR:

> …the United States will continue to adapt its global posture to promote constructive bilateral relations, mitigate anti-access threats and off set potential political coercion designed to limit U.S. access to any region. The United States will develop capabilities that would present any adversary with complex and multidimensional challenges and complicate its offensive planning efforts. These include the pursuit of investments that capitalize on enduring US advantages in key strategic and operational areas, such as persistent surveillance and long-range strike, stealth, operational manoeuvre and sustainment of air, sea and ground forces at strategic distances, air dominance and undersea warfare. These capabilities should preserve US freedom of action and provide future Presidents with an expanded set of options to address all of the QDR focus areas and a wide range of potential future contingencies. The aim is to possess sufficient capability to convince any potential adversary that it cannot prevail in a conflict and that engaging in conflict entails substantial strategic risks beyond military defeat.[44]

Remotely piloted drones, special operations forces, and a joint expeditionary posture would comprise the new look presence,[45] in what Krepinevich and Work describe as a US "Leasehold Empire."[46] Moreover, the shift away from what the GPR called "main operating bases" accommodating significant numbers of US military personnel and their families in favour of "forward operating sites" (FOS) with a smaller presence and "cooperative security locations" (CSL) with little or no permanent presence describes the essence of these moves.[47] The critical difference between the emerging military posture of the US in the post-Cold War era and that of the Cold War can be summed up as follows: The geographical

[43] Campbell and Ward, "New Battle Stations?"
[44] Department of Defense, "Quadrennial Defense Review Report," pp. 30–31.
[45] Lord and Erickson, "Introduction," p. 3.
[46] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. iii.
[47] Henry, "Transforming the US Global Defense Posture," p. 23.

location of US forces at any given time in the post-Cold War era is an increasingly poor indication of where they might actually be preparing to fight. This is an expeditionary posture. The main operating bases would serve as "strategic trampolines" for projecting US forces into other theatres, supported by small, unobtrusive FOS's and CSL's with prepositioned equipment and war reserve material, as well as command and control facilities.[48]

3.2. Consolidation

In passing, as Lord and Erickson note, these changes were not envisioned as representing the end of a substantial overseas US military presence. It was well understood that a significant presence of US troops in Europe and in East Asia was still required to buttress the credibility of the US commitment to allies, as well as to sure up regional stability.[49] Changes were slated to unfold over a number of years, and the impact of rapid and unexpected changes were forewarned.[50] In addition, the massive US military presence overseas related to the conflicts in Afghanistan and Iraq which increased after the GPR, involving the construction of numerous semi-permanent military facilities of various kinds,[51] has had the effect of concealing the effects of the GPR to some extent. In fact, according to Krepinevich and Work, the net result was that the US retained, via consolidation rather than change, its Cold War military posture in the Western Pacific, while it updated and augmented its *Desert Storm* basing into the permanent network.[52] The term "lily pads" was recently I included again in the vernacular regarding US military tactics in the fight against

[48] Ibid., p. 47.
[49] Lord and Erickson, "Introduction," p. 3.
[50] See Campbell and Ward, "New Battle Stations?"
[51] Not only Afghanistan and Iraq but also in Kuwait, Qatar, UAE, Uzbekistan, and Kyrgyzstan. Djibouti is also home to a significant facility in the fight against extremism across northern sub-Saharan Africa.
[52] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 156.

the so called 'Islamic State' in Iraq and Syria.[53] In December 2015 the Pentagon proposed a new plan to "build up a string of military bases in Africa, Southwest Asia and the Middle East which could be used for collecting intelligence and carrying out strikes against the terrorist group's far-flung affiliates."[54] The *New York Times* reported that "senior military officials told the White House that the bases would serve as hubs for Special Operations troops and intelligence operatives who would conduct counter-terrorism missions for the foreseeable future," and that it was "meant primarily as a re-examination of how the military positions itself for future counter-terrorism missions,"[55] reflecting perhaps the next phase of the evolving regional posture. Secretary of Defense Ashton Carter explained in a speech in October 2015:

> Because we cannot predict the future, these regional nodes – from Morón, Spain to Jalalabad, Afghanistan – will provide forward presence to respond to a range of crises, terrorist and other kinds. These will enable unilateral crisis response, counter-terror operations, or strikes on high-value targets. But they're about more – they'll also allow us to enable partners to respond to a range of challenges. To pre-position equipment for ourselves and our partners. And to provide important opportunities to innovate, to develop new command-and-control structure, new ways to manage the force, new capabilities, and new operational concepts.[56]

The 'nodes' or 'hubs' would be small; to range in size from about 500 to 5,000 personnel and to cost several million dollars a year, mostly in personnel expenses, according to

[53] Barbara Starr and Alexandra Jaffe, "Pentagon 'Lily Pad' Strategy Could up Troops in Iraq," *CNN*, June 11, 2015, http://www.cnn.com/2015/06/11/politics/military-considers-replicating-taqaddam-Plan/index.html.
[54] Mark Mazzetti and Eric Schmitt, "Pentagon Seeks to Knit Foreign Bases Into ISIS-Foiling Network," *The New York Times*, December 10, 2015, http://www.nytimes.com/2015/12/11/us/politics/pentagon-seeks-string-of-overseas-bases-to-contain-isis.html.
[55] Ibid.
[56] Ashton Carter, "Remarks on Receiving the Woodrow Wilson Award," *U.S. Department of Defense*, October 29, 2015, http://www.defense.gov/News/Speeches/Speech-View/Article/626736/remarks-on-receiving-the-woodrow-wilson-award.

Pentagon officials.[57] They also required the approval of the host nation, making a new batch of SOFA's necessary.

In Europe, the drawdown of Cold War garrisons triggered a consolidation of European exterior bases, without a major shift in the locations or operations of US bases. US Naval Forces Europe and US Air Forces Europe consolidated their presence from 25 bases during the 1990's down to just five.[58] Similarly, US bases along the Demilitarized Zone between South and North Korea and near the capital of Seoul were to be consolidated into two major hubs in the central and southern parts of the country.[59] Plans for South Korea's Joint Chiefs of Staff to assume wartime control over South Korean military units, on the agenda since 2006 and initially slated for April 2012, was yet to be implemented in 2018, perhaps reflecting the increasingly precarious situation there.[60] The US presence on the Korean Peninsula can also be seen as an important potential bargaining chip with Beijing over North Korea. Changes to basing arrangements with Japan are reflected in the plan to shift 8000 US Marines from Okinawa to Guam,[61] while the military relationship was augmented by increased exercises and training between the two forces. In sum, though the very large Cold War presence in terms of numbers of troops was reduced significantly, the early post-Cold War posture remained largely a shrunken version of that era.[62] It was not until after 9/11 and the proclivities of the GPR that a posture of flexibility and capabilities reflecting the

[57] Mazzetti and Schmitt, "Pentagon Seeks to Knit Foreign Bases Into ISIS-Foiling Network."
[58] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 191.
[59] See Carnes Lord and Andrew S. Erickson, eds., *Rebalancing U.S. Forces: Basing and Forward Presence in the Asia-Pacific* (Annapolis, Maryland: Naval Institute Press, 2014), chap. 3.
[60] Author not supplied, "U.S., S. Korea Agree to Delay Wartime Control Transfer," *The Japan News*, accessed October 28, 2014, http://the-japan-news.com/news/article/0001666262.
[61] Lord and Erickson, *Rebalancing U.S. Forces*, chap. 1; Martin Fackler, "U.S. and Japan Agree on Returning Okinawa Land," *The New York Times*, April 5, 2013, http://www.nytimes.com/2013/04/06/world/asia/us-and-japan-reach-deal-on-returning-okinawa-land.html.
[62] Stephen Schwalbe, "Overseas Military Base Closures," *Air & Space Power Journal Online Chronicles* 18 (2007), http://www.airpower.maxwell.af.mil/airchronicles/coj/cc/schwalbe2.html.

departure from the vestiges of the Cold War era, and one striving to account for the realities of the new, emerged. This was referred to as a "presence without permanence".[63] The overhang of forward presence notwithstanding, Lostumbo *et al*. assert that the US response to any substantial contingency, beyond its initial stages, would now come primarily from forces deployed from bases inside the US. [64]

3.3. Access and lift

In terms of military capability, the new posture is fundamentally contingent on the operation of joint, pre-integrated, and networked forces armed with real time situational awareness supplied by intelligence, surveillance and reconnaissance platforms with global reach. These force structures must be supported by a global *en route* infrastructure consisting of facilities, access agreements, fuel storage and pre-positioned equipment.[65] This infrastructure must, in turn, be flexible and resilient in light of increasing global threats to access. It needs to consist of multiple access routes to support critical air-and-sea-lift capabilities enabling its effectiveness. This operational capability is underwritten by the network-centric warfare concept described in the previous chapter. To reiterate, the contemporary and updated incarnation of the early reconnaissance-strike complexes, that summoned the attention of the Soviets in the 1970's, are the *Joint Multidimensional Battle Networks* developed by the US. These networks combine critical capabilities in space, comprising an "information sphere" known as the Global Command and Control System (GCCS), with software and hardware that links systems together during operations. The GCCS provides the information background for "joint networks and joint systems that are fully interoperable across air, sea, space and ground environments, otherwise known as 'C4I

[63] Henry, "Transforming the US Global Defense Posture," p. 27.
[64] Lostumbo et al., *Overseas Basing of U.S. Military Forces*, p. xxi.
[65] Ibid.

for the Warfighter' (Command, Control Communications, Computers, and Intelligence (C4I)."[66] The essence of the design of these networks was to provide better targeting data for guided weapons and evolved to incorporate the information-centric domains of outer-space, cyber-space and the electro-magnetic spectrum as legitimate warfighting domains.

3.4. Anti-access, Area denial (A2AD) "bubbles"

This capability is also fundamentally contingent for its reach, timeliness, logistics, force multiplication and general political support on the active participation of allies. One of five major themes that emerged from the GPR was for the US to "strengthen allied roles and build new partnerships," defined as "help our allies and friends modernize their own forces, strategies, and doctrines" and enhancing "collective defense capabilities."[67] The new posture remains fundamentally committed to the prevention of a quick victory by an adversary that changes the security situation before significant US combat power can arrive.[68] A key pillar of deterrence and of assurance within the alliance relationship, the new posture designates more responsibility to the allied role in rapid response. The ability to convince a potential adversary that its initial military objectives in any given contingency are not achievable is essential. The global surge capacity of the US can sit in what Andrew Krepinevich, speaking in Japan at the *Sasakawa Peace Foundation*, called "operational reserve to allied A2AD bubbles." These bubbles enable an in-theatre ally to "deny an aggressor control of the air, control of the sea, and control of the electro-magnetic spectrum that it would need to conduct offensive operations."[69] Below the level of offensive operations, these bubbles also need to be able to counter acts of coercion. As Lostumbo *et*

[66] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 144.
[67] Henry, "Transforming the US Global Defense Posture," p. 20.
[68] Lostumbo et al., *Overseas Basing of U.S. Military Forces*, p. xxi.
[69] Krepinevich, "The Future of U.S. Defense Strategy and the Japan-U.S. Alliance," sec. 45–47 mins.

al. explain, certain sets of capabilities offer a match for certain types of threats.[70] The prevention of a quick victory by an adversary seeking a *fait accompli* can include a role for forward-deployed US forces, but may be deterred as, if not more, effectively by enhancing the air and missile defence capabilities of the in-theatre ally. By removing the objective of a quick *fait accompli*, US forces can remain in operational reserve. As missile defence relies heavily on American space-based ISR for early warning, the vertical component of the relationship emerges not only at the operational level but also in deterrence. It is under this rubric that we encounter the evolving roles being assigned to the 'nuclear family' or 'inner circle' of trusted alliance members mentioned above. 'Jointness' and interoperability, not only across the services within the US military but across the armed services of allies is the ultimate 'force multiplier'. Shared situational awareness that brings about an "information edge" or dominant battlefield knowledge, as discussed in the previous chapter, is one of the critical enablers of allied joint operations and is therefore the focus of the following case studies.

Flagging caution about these prospects in a conference report on space cooperation prospects for small and middle powers in 2001, Levite and Johnson forewarn that

> "interoperability among coalition partners, especially in space, is likely to be difficult to achieve, largely because of existing restrictions from technology transfers and export control laws and regulations; technology differences; cultural factors; language barriers; and differing levels of readiness, training, and personnel among the coalition partners…. The United States adheres to certain legal mechanisms, including export control laws and regulations, that guide and shape cooperation and planning for the use of air and space capabilities in bilateral and multilateral relationships. A number of considerations need to be kept in mind when considering the transfer of key technology to support the formation of a

[70] Lostumbo et al., *Overseas Basing of U.S. Military Forces*, p. xxi.

> coalition, including the effect of technology transfer upon regional stability and whether the coalition partner can operationally employ the capabilities offered by the United States in pursuit of coalition objectives."[71]

The other key enabler here is what Michael Horowitz described as organisational adaptability, which is most visible at work in the capacities of states to embrace and implement interoperability. This is addressed in chapter IV. In order to understand how these two critical enablers might interact, this chapter offers the concept of vertical alliances after a brief overview of the traditional alliance security dilemma.

4. The Alliance Security Dilemma

4.1. The traditional view

In 1984 Glen Snyder introduced the topic of the security dilemma in alliance politics as one lacking in attention from international relations scholars.[72] More attention, according to Snyder, was paid traditionally to arms races and adversarial politics in the study and discourse surrounding the security dilemma. Moreover, the manipulation of power via alliance relations was a key factor in the study of international security, and needed to be understood better. Snyder divided the security dilemma in alliance relations into primary and secondary forms. The primary form described why states seek alliances in the first place, which is because the structural anarchy of the international system gives rise to the pressures states are responding to when considering alliance prospects. States are compelled to seek alliances because they result in a net increase in the state's security in relation to its adversaries, and because they fear the defection of other states to the adversary's alliance system. This balance/bandwagon dynamic was identified by Walt in *The*

[71] Johnson and Levite, *Toward Fusion of Air and Space*, p. x.
[72] Glenn H. Snyder, "The Security Dilemma in Alliance Politics," *World Politics* 36, no. 4 (July 1984): p. 461.

Origins of Alliances in 1987.[73] The dilemma emerges because when all significant state actors do this, the net gain in security is nullified. Which state to ally with is largely indeterminate, though "interests, conflicts, affinities, and the internal political make-up of states"[74] provides some guide.

The secondary form of the alliance security dilemma concerns considerations of how much commitment and support will be enacted by states toward their alliance partners and in what combination of circumstances.[75] Here we find the dynamics, on one hand, of fears of entrapment versus fears of abandonment[76] and, on the other, concerns about control and entanglement versus considerations of burden sharing, especially when dealing with deeply asymmetric alliances. States can be expected to weigh up the cost and benefits of all of these factors in calibrating their alliance commitments.

Snyder's secondary form is treated here as very much a traditional view of alliance dynamics. This chapter argues that the familiar parameters forwarded by this view are distorted, if not subverted, by the emergence of digital information networks, feeding into interstate relations, both allied and adversarial, via the ongoing inculcation of digital information and communication technologies by militaries.

4.2. Fear of entrapment

States that entered into a formal security alliance did so either because they saw an opportunity for a gain in net security or in order to hedge against a reduction in net security by not doing so. Nevertheless, the broader interests of allies are never identical, and shared

[73] Walt, Stephen. *The Origins of Alliances,* Cornell University Press, Ithaca and London, 1987.
[74] Snyder, "The Security Dilemma in Alliance Politics,", pp. 465–66.
[75] Ibid., p. 466.
[76] First introduced by Michael Mandelbaum, *The Nuclear Revolution: International Politics before and after Hiroshima* (Cambridge University Press, 1981).

interests may be valued to different degrees..[77] In addition, interests are subject to change over time. So even within the alliance relationship, states may harbour very good reasons to fear that changes both internal and external to the alliance could trap them in unwanted circumstances. Most commonly, entrapment was manifest when relationships between allies and a third party state were valued differently, or deteriorated over time in relation to the other. The state that valued a third party relationship more, worried about the deterioration and in particular the expectations of its ally if the relationship become adversarial.[78] If an ally was engaged in a coercive relationship with the third-party state, a good exo-alliance relationship might become seriously complicated, as the state finds itself instrumentalised by either protagonist.[79] Further, if the relationship between ally and third party state deteriorates to the level of conflict, the fear of entrapment is fully realised, and the state must weigh up the costs and benefits of the security alliance versus those of the third party relationship.[80] Often this was a predominantly economic relationship, and it is something of a given in international relations that states, if pushed, will favour strategic security over economic advantage on most occasions.[81] The choice was often not without significant cost and is something states seek to avoid. Third party states watch closely the dynamics between alliance partners, and will seek to play both sides against each other to constrain, disrupt or even end the capacity of the alliance to function. Third party sensitivities over military security cooperation within alliances were particularly acute and

[77] Snyder, "The Security Dilemma in Alliance Politics," p. 467.
[78] See 'Imbalance of threat' in Matteo Dian, *The Evolution of the US-Japan Alliance: The Eagle and the Chrysanthemum* (Chandos Publishing, 2014), p. 14.
[79]See Matteo Dian, *The Evolution of the US-Japan Alliance: The Eagle and the Chrysanthemum* (Chandos Publishing, 2014), p. 4.
[80] See Filippo Andreatta, "The Politics of Symmetry. European Integration and Trans Atlantic Relations," *NATO Fellowship Report*, 1997.
[81] See John J. Mearsheimer, *The Tragedy of Great Power Politics.* (WW Norton & Company, 2001); Edward N. Luttwak, *The Rise of China vs. the Logic of Strategy* (Harvard University Press, 2012); Evan A. Feigenbaum and Robert A. Manning, "A Tale of Two Asias," *East Asia Forum*, accessed June 2, 2015, http://www.eastasiaforum.org/2012/12/04/a-tale-of-two-asias/.

increase the more visible and overt form this cooperation takes. Perceptual costs matter a great deal, heightening entrapment dynamics. For one example, according to Matteo Dian, Japan feared entrapment into US-led conflicts throughout the Cold War and in the Vietnam War in particular.[82]

4.3. Fear of abandonment

Alternatively,, states that entered into a formal alliance may have good reasons, under similar conditions of uncertainty and change, to question the commitment of the partner to the alliance. Even formal alliances are never set-in-stone.[83] As external conditions change, the interests of one ally in continuing the alliance may change, resulting in variations in the level of commitment and expected contributions to the relationship, ranging from a reduction in contracted goods to outright abrogation.[84] Alliances always incur costs, and the balance of those costs versus the value of the relationship is always in flux. Snyder argued that abandonment is less likely in a bi-polar international system, where the cost of defection to the other side counts heavily as a benefit of the alliance, all other costs and benefits considered.[85] This constraint opens the way for free-riding by alliance partners who feel more secure that abandonment is unlikely.[86] However, working against this is the risk that a contracted good may or may not be fulfilled fully. This is one of the most relevant ways to coerce allies into cooperating.[87] Like the entrapment dynamic, the risk of abandonment is determined by conditions both internal and external to the alliance. The

[82] Matteo Dian, "Hosts and Hostilities: Base Politics in Italy and Japan," in *Italy and Japan: How Similar Are They?*, ed. Silvio Beretta, Axel Berkofsky, and Fabio Rugge, Perspectives in Business Culture (Springer Milan, 2014), p. 312, http://link.springer.com/chapter/10.1007/978-88-470-2568-4_18.
[83] See Brett Ashley Leeds, "Alliance Reliability in Times of War: Explaining State Decisions to Violate Treaties," *International Organization* 57, no. 4 (2003): 801–827.
[84] Snyder, "The Security Dilemma in Alliance Politics," p. 466.
[85] Ibid., 483–85.
[86] For discussion of free-riding costs and benefits see John A. C. Conybeare, "The Portfolio Benefits of Free Riding in Military Alliances," *International Studies Quarterly* 38, no. 3 (September 1, 1994): pp. 405–19, doi:10.2307/2600739.
[87] Dian, *The Evolution of the US-Japan Alliance*, p. 15.

emergence of a common external threat may lower the fear of abandonment, as might an increase in an ally's capacity to make useful contributions to the alliance. Variations between alliance partners in threat perception can raise the risk, as can the emergence of a favourable alternative security partner; more likely in a multi-polar system, though still rare. A partner's lack of willingness or capacity to contribute goods may not result in abrogation, but may see a decline in the tangible value of the alliance as reciprocation is undermined. The importance of the internal dynamic means states which fear abandonment have some agency in reducing the risks of abrogation. This is often seen through the mechanism of increases in military contributions.[88] The existence of the external security dilemma means that where this intra-alliance military cooperation can be less visible and overt, the better. The Republic of Korea-US relationship accommodated an undulating example of the fear of abandonment for much of its existence.[89]

4.4. Controlling entanglement

Fear of abandonment and entrapment are most acutely felt by a junior partner in an asymmetric alliance.[90] In such alliances, a senior partner is the more powerful of the two, and is better able to co-opt, set agendas, and coerce and command other states. Entering into an alliance with such an ally is a risky proposition for the junior partner, which can be offset only by large pay-offs in goods received and mitigated by perceptions of aligned interests. Junior partners may make tenuous assumptions about value and identity overlap. The capacity to influence the preferences of the senior partner exists on the back of this overlap, but most likely only within a frame that is ultimately determined by the state with

[88] Ibid., p. 17.
[89] See Leon Whyte, "Evolution of the U.S.-ROK Alliance: Abandonment Fears," *The Diplomat*, accessed June 23, 2015, http://thediplomat.com/2015/06/evolution-of-the-u-s-rok-alliance-abandonment-fears/.
[90] For discussion see Dian, *The Evolution of the US-Japan Alliance*, chap. 1.

more capacity in other power conversion categories such as agenda setting and command. Nonetheless, a senior ally in an unbalanced alliance must balance its own interests and risks in relation to its junior partner. This balance is played out between the desire to share more of the costs of the security goods the alliance exists to provide versus the need to retain control over junior partner behaviour.[91]

Allying with a more powerful partner may embolden other states, growing more confident in their external environment in the wake of the senior partner's deterrence value. Such boldness may lead to hubris, and entangle the senior partner in conflict in which it has little or no interest outside its alliance commitments.[92] Senior alliance partners are very wary of this, and may seek to constrain a junior partner in a number of ways. Consultation is the first port of call. Failing that, any number of carrots and sticks are available. In the military sphere, the withholding of certain military materials and services provides good leverage. However, in a world of increasing access to proliferated weapons and systems this form of control is likely becoming more elusive.

4.5. Burden sharing

For a senior partner with global responsibilities such as the US, the costs of its commitments were an ongoing concern. The utility of each alliance and partnership is therefore subject to constant reappraisal and specific financial and political pressures fluctuate over time though never disappear. The desire to get allies to take more of the cost burden was ever-present. Senior partners look for ways to sustain or increase the utility and effectiveness of the security good provided by the alliance while reducing its cost. Getting a junior partner to spend more of its domestic budget on military affairs was one way, but it

[91] For thorough discussion of control dynamics see Dian, "Hosts and Hostilities."
[92] For the counter-thesis that US alliances have not led to significant entanglement see Beckley, "The Myth of Entangling Alliances: Reassessing the Security Risks of U.S. Defense Pacts."

entailed a cost in risks such as regional arms races, militarisation and an overall loss in net security. In addition, a better armed and more emboldened junior ally could be more of a problem down the track.

There is therefore an acute tension between the risks of further burden sharing and the benefits in reducing costs for the senior partner. A junior partner developing an independent high-tech military production capacity will likely find it *harder* to resist external pressure to cooperate in terms of burden sharing and participation in military activities, including conflict.[93] Moreover, the military effectiveness of a junior ally in long term decline may be at odds with the long term plans of the senior partner to offload more burden when the time is right.[94] The domestic political concerns of junior states are always a factor, as are the concerns about retention of key military technologies and the prevalence of free-riders. Political pressure to take more of the burden is a common instrument, but is commonly ineffective. The case of the US Futenma Marine Corps Air Station on Okinawa illustrates the tensions often inherent when a strategically critical base is in a geographic location conflicting with the determined opposition of a local community.[95]

5. The rise of vertical alliances

5.1. Background

The origin of the concept of vertical alliances is found in the corporate world.[96] It describes a business-level strategic relationship between a firm and its suppliers or distributors aimed at improving competitive advantage. Vertical alliances deepen relationships between the firm and its suppliers and distributors through the exchange of knowledge and commercial

[93] Dian, *The Evolution of the US-Japan Alliance*, p. 10.
[94] Ibid., p. 194.
[95] See Glenn D. Hook, *Contested Governance in Japan: Sites and Issues* (Routledge, 2005).
[96] R. Duane Ireland, Robert Hoskisson, and Michael Hitt, *Understanding Business Strategy: Concepts and Cases* (Cengage Learning, 2008), p. 173.

intelligence to mutual benefit. When a supplier or distributor agrees to work exclusively with a firm, it can bring about a 'lock out' dynamic that further enhances the firm's competitive advantage by denying valuable commercial intelligence to rivals.[97] Suppliers benefit by becoming actively involved in product design and distribution arrangements. A supplier might only agree to being 'locked in' if it sees for itself a strategic advantage in doing so, for example where a firm might have a powerful market position or, better yet, a monopoly. Indeed, choosing the right partner is an important factor in the success of the strategy, making common intentions and compatible visions of the business a must. In the business world, actors considering a vertical alliance analyse each other's corporate cultures to map learning opportunities and avert communication problems.

This thesis co-opts the corporate concept of the vertical alliance for use in the military/political sphere. In 1995, Martin Libicki discussed the prospects of information dominance and its potential corollaries in the way the US and partnered militaries might interact in the future. Libicki used the term "vertical coalitions" to describe the way US air power and expeditionary forces was used commonly in the past in combination with a beleaguered ally which was expected to provide the bulk of ground forces.[98] In contrast, a "horizontal coalition" involves two or more brigades fighting side-by-side in combined operations. Libicki thought that future coalitions would be decidedly more vertical and that the emerging concept of information dominance would be the critical enabler. The vertical alliances concept explained here is an expanded and updated version of these earlier concepts. Vertical alliances are a way of thinking about how political power flows around increasingly networked, information-centric allied or partnered military configurations

[97] See Yves L. Doz and Gary Hamel, *Alliance Advantage: The Art of Creating Value Through Partnering* (Harvard Business Press, 1998), p. 4.
[98] Libicki, "DBK and Its Consequences," p. 13.

based on US-led military-technical systems and architectures. Though we are interested in Australia and Japan in the geographical context of East Asia and the Western Pacific, the concept is applicable elsewhere. The term "alliance" is favoured over "coalition" because "an alliance", according to The Joint Chiefs of Staff in 2013, "is the relationship that results from a formal agreement between two or more nations for broad, long-term objectives that further the common interests of the members. Coalitions are typically ad hoc, formed by different nations, often with different objectives, usually for a single event or for a longer period while addressing a narrow sector of common interest."[99] The most critical enabler beyond the military-technical was Horowitz's conception of organisational adaptability.[100] A vertical alliance model, as discussed below, has the potential to reduce fears of entrapment and abandonment, give the senior ally more control while at the same time spreading the burden, and reduce unwanted entanglements. It is a political model appropriate for the contingencies of the scale-free network model. All these factors are nonetheless contingent on external circumstances in which the model plays out and are subject to complexities with the potential to introduce a broad range of unpredictable features.

5.2. How they would work

Libicki's conception of the future vertical military coalition was that local forces would provide the forces and the firepower, while the US would provide the *information*. The increasing dependence of the maturing guided-munitions regime on the ISR that animated it meant that US dominance in the information domain enabled it to act as a 'gatekeeper' to that critical factor. As we saw in the tone of the GPR, a lighter 'footprint' was enabled in

[99] Joint Chiefs of Staff, "Multinational Operations" (DoD, July 16, 2013), p. I-1, http://www.dtic.mil/doctrine/new_pubs/jp3_16.pdf.
[100] Horowitz, *The Diffusion of Military Power*.

terms of US forces on the ground and, significantly, in harm's way. In addition, control of the information required to animate the regime would, ideally, translate to better control on the ground. From Libicki in 1995:

> We would supply overall intelligence on the whereabouts and movements of distant echelons. Our overhead systems (both space and air breathing) would permit pinpointing of enemy platforms. Our distributed sensor systems would be put in place to operate, analyze, and convert data into fire-control solutions. This would permit friendly forces to take precise measure of the enemy, providing them with real-time one-shot, one-kill capability. We might even control the targeting once they have fielded the weapon.[101]

Further enhancing control, the guidance systems on the weapons themselves could be designed to respond to encrypted information supplied externally by US data, making them unusable sans that information.[102] These early views of the potential for this type of model were highly speculative and certainly optimistic. For example:

> In some cases, the United States might be able to tilt the contest to one side without unambiguous proof that we had intervened at all. The use of stand-off sensors as a substitute for forces also frees us from the necessity of overseas bases; they permit more operations to be Planned and conducted from international waters.[103]

In addition, the US offered partner states a *quid pro quo*. As the predominant actor in the information domain, the US was in a position to provide access to otherwise unavailable information to partner states needed to manage their spatial environments. In this way the ISR regime was highly scalable. It did not apply only to the contingencies of high-intensity warfare. The US provided information on everything from environmental degradation, law

[101] Libicki, "DBK and Its Consequences," p. 13.
[102] Ibid.
[103] Ibid.

enforcement particularly in the maritime domain, transportation, transnational crime, disaster relief and so forth.[104] In return, US sensor systems requiring access to such entities as open skies, extant monitors and databases, supply lines and logistics would be granted. Libicki thought that such an arrangement was contingent on the provision of information at such a level of detail that the US could not be accused of only giving access to information supporting only its objectives.[105] Nonetheless, the US provider status had a subtle but pervasive effect on what partners saw when they plugged into the system. It guarded US sensitivities, emphasised strengths and acted as a powerful moderator of adventurism, given that all participants were acutely aware of their own transparency. Broadly speaking, Libicki enunciated a vision of the 'illumination' of the battle space and the 'unbundling' of that illumination to include allies and partners with the potential to keep alliances and coalitions together, drive down risk and mistrust caused by opacity, and increase cooperation on the back of common goods. The desire to concentrate on the information background and lift while others do the fighting, moreover, was not a US monopoly. Similar hopes were expressed by officials in Australia in 1997.[106] The critical point here is the significance of the path-dependencies that US dominance in the information domains imputes on allies and partners.

There is plenty of scope to mount a serious critique of this optimism, particularly in light of the apparent efficacy of this model as applied to counter-terrorist and counter-insurgent operations in Iraq and Afghanistan after 2001. Libicki noted as much in 1995 regarding the reliance of the model on capable allies, when he stated that "multiplying zero force still

[104] Martin C. Libicki, "Information War, Information Peace," *Journal of International Affairs* 51, no. 2 (1998): p. 422.
[105] Ibid., p. 423.
[106] David A. Fulghum, "Surveillance, Comm Links Dominate Upgrade Plans: Combat Aircraft on Hold as Australia Builds a 21st-Century Central Nervous System for the Military," *Aviation Week & Space Technology* 147, no. 8 (August 25, 1997), http://search.proquest.com/docview/206554803/abstract/16E37F1CC4084F57PQ/2.

equals zero."[107] Much was critiquing the capacity of air-power to impact significantly these types of operations, and the debate is ongoing in relation to US operations in the Middle East after 2015.[108] But this aspect aside, the vertical alliance model when applied to the traditional inter-State relations making up the East Asian security dynamic took a completely different character. The two contexts should not be conflated. What is consistent is the vertical structure of military/technical relationships and the importance of the information sphere. Arguing in 2013 for the development of bilateral partnerships in the Asia-Pacific based on ISR cooperation, Col. Andrew A. Torelli of the USAF said this type of partnership would give

> the service's strategists and planners a tool to design an operational ISR framework with foreign partners that will inform and guide the development of *broader strategies and plans.* In turn, those studies will build a foundation for better visualizing and *actively framing security problems,* reassessing the situation, and reframing the issue in a volatile, uncertain, complex, and ambiguous environment.[109]

Torelli elucidated the way in which the vertical flow of information acts as a basis for increased operational and strategic influence for its provider. In addition, allies such as Australia and Japan exhibited features more in line with the five key themes of the GPR compared to US partners in the Middle East. This includes their requisite technical

[107] Libicki, "DBK and Its Consequences," p. 14.
[108] See for example Barry R. Posen, "The Case for Doing Nothing in Iraq," *POLITICO Magazine*, June 6, 2014, http://www.politico.com/magazine/story/2014/06/the-case-for-doing-nothing-in-iraq-107913.html; Fred Kaplan, *The Insurgents: David Petraeus and the Plot to Change the American Way of War* (New York: Simon and Schuster, 2013); Matthew Schofield, "Iraq Changed U.S. Military Tactics – Think Quick and Small," *McClatchy DC*, March 18, 2013, http://www.mcclatchydc.com/2013/03/18/186227/iraq-changed-us-military-tactics.html; Watts and Keaney, "Effects and Effectiveness."
[109] Col Andrew A. Torelli, USAF, "Building Partnership Capacity by Using MQ-9s in the Asia-Pacific," *Air & Space Power Journal*, August 2013, p. 62, http://www.airpower.maxwell.af.mil/digital/pdf/articles/Jul-Aug-2013/F-Torelli.pdf. emphasis added.

capabilities, aligned views and values,[110] and the demonstrated willingness of governments to take necessary steps, to be detailed in the subsequent chapters.

Moreover, vertical alliances are much more than the application of air-power while a partner fights on the ground. They encompass the integration of military capabilities across the spectrum, while preserving the key US roles of ISR 'gatekeeper', and preferred if not exclusive provider of military materials and services. While it is empirically the case that US political objectives in the Middle East were stymied, the military nonetheless learned important operational lessons that apply directly to the implementation of network-centric warfare in other theatres and contexts.[111] Operations in the Middle East may turn out to be the exception that proves the rule in terms of the efficacy of vertical alliances. It suggests strongly that Michael Horowitz's emphasis on organisational capacity and adaptability in the adoption and implementation of disruptive military technology was the critical variable. However, it fared noticeably badly in the Middle East, though subsequent developments in Remote Advise and Assist capabilities between US Special Forces and Iraq's Special Operations Forces made significant progress.[112] The salience of the organisational capacity of alliance partners in configuring the vertical alliance takes the focus of this thesis beyond Libicki's early conception of the operational verticality it envisioned.

5.3. Vertical alliances in a Joint Expeditionary era

The post-Cold War overlapping assumption of assured regional access; defined as the ready availability of prepared forward airfields and deep draft, prepared ports in benign

[110] Henry, "Transforming the US Global Defense Posture," p. 20.
[111] Robert Work and Shawn Brimley, *20YY: Preparing for War in the Robotic Age* (Washington: Center for a New American Security., 2014), p. 17.
[112] See Christopher Thielenhaus, Pat Traeger, and Eric Roles, "Reaching Forward in the War against the Islamic State" (PRISM, December 7, 2016), p. 98, http://cco.ndu.edu/Portals/96/Documents/prism/prism_6-3/Theielenhaus.pdf?ver=2016-12-06-101057-593.

conditions, I which assumed would accompany any MRC's, was eroding by the mid-1990's. The emphasis was on improving the *mobility* of reinforcements rather than on the *operational manoeuvre* of forces. Expressed in Secretary of Defense William J. Perry's 1996 Annual Report to Congress,[113] as well as in the outcome of the *Integrated Amphibious Operations and USMC Air Support Requirements Study,*[114] they pointed "toward a Strategic Military Transportation System optimized for the delivery of reinforcements and forces through *established theatre infrastructures* in Southwest and Northeast Asia."[115] In addition, the experiences of the US military in the early post-Cold War era encouraged little urgency to overhaul assumptions. During *Desert Storm*, for example, "96 percent of all cargo delivered over the sea went through just two seaports, and 78 percent of all cargo delivered by airlift went through just five airfields, *none of which were attacked by Iraq*."[116] As Krepinevich and Work explain, one of the first posture moves post-Cold War by the US Navy was to *reduce* its ability to conduct naval manoeuvre and forcible entry operations from the sea, both otherwise critical to support operational access and freedom of movement.[117] By 1997, these assumptions were beginning to be questioned, reflected in the independent National Defense Panel's (NDP) critique of the 1997 Quadrennial Defense Review. It charged the DoD with underestimating the challenge of gaining forward access in the future.[118]

The shift to a more austere forward-deployed presence by the GPR presented significant challenges for the operation of Joint Multi-dimensional Battle Networks. They needed to be

[113] William J. Perry, "Annual Report to the President and the Congress." (DTIC Document, 1996), chap. 21, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA307329.
[114] See Matthew T. Robinson, *Integrated Amphibious Operations Update Study (DON Lift 2+): A Short History of the Ambhibious Lift Requirement* (Alexandria VA: Center for Naval Analyses, 2002), pp. 24–29.
[115] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 162.
[116] Ibid.
[117] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 156.
[118] National Defense Panel, "Transforming Defense: National Security in the 21st Century" (Washington DC: National Defense Panel, 1997), p. 12.

capable of supporting joint operations with little established forward infrastructure at short notice, or with severe constraints on freedom of movement. Dealing with the contingencies of the new *Joint Expeditionary Posture,*[119] such as the demands it places on sea- and air-lift capabilities, its increasingly heavy reliance on the GCCS and the maturing guided-munitions regime, brought the concept of 'jointness' to the absolute forefront. If the services were to think, plan and act as single stand-alone entities that only came together for specific missions in wartime, they would simply be incapable of fulfilling the tasks set them by the GPR in the new era. In addition, the proliferation of advanced guided-munitions, increasingly by US competitors, was set to complicate the operational environment, further engendering the imperative to improve joint operations.[120]

By engineering the expansion of truly joint operations not only across the US combat services and domains but across a grid that included the armed services of allied and partnered states, the strategic pay-off from the shift to a Joint Expeditionary Posture could be exponential. To do this in a constrained operational environment, the *allied* Joint Multidimensional Battle Networks of the new expeditionary era had to return to a focus on operational access and freedom of manoeuvre. This meant a premium was placed on *in theatre* allies with the wherewithal, financial and organisational capability, and will to support their US ally. Foreshadowing this, subsequent to the 1997 NDP was the US *Commission on National Security in the 21st Century.*[121] It raised the prospect of a future in which the US would find it's exterior basing network increasingly constrained because the

[119] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 152.
[120] For authoritative overview see Mark Gunzinger and Bryan Clark, "Sustaining America's Precision Strike Advantage" (Center for Strategic and Budgetary Assessments Washington, DC, 2015).
[121] Gary Hart and Warren B. Rudman, "New World Coming: American Security in the 21st Century," *United States Commission on National Security*, September 1999.

abiding tendency of the future security environment would be of "uncertain neutrals and doubtful allies." The Commission wrote:

> Political changes abroad, economic considerations, and the increased vulnerability of US bases around the world will increase pressures on the United States to reduce substantially its forward military presence in Europe and Asia. In dealing with security crises, the 21st century will be characterized more by episodic "posses of the willing" than the traditional World War II-style alliance systems. The United States will increasingly find itself wishing to form coalitions but increasingly unable to find partners willing and able to carry out combined military operations.[122]

The Commission's prognosis and the NDP's concerns were prescient. Many of these concerns were manifest during the 1999 Operation *Allied Force* campaign in Kosovo, mainly involving issues surrounding strategic air-lift, mobility and politically sensitive access.[123]

5.4. Distractions, irritants, and the Long War

As mentioned, something of a faint in the Joint Expeditionary Era occurred after 2001. The 2001 invasion of Afghanistan, known as Operation *Enduring Freedom,* was a stark example of the new realities of the Joint Expeditionary Era. The US was required to project power to a distant theatre where no substantial basing infrastructure existed, where new access agreements were hastily put together, using special operations forces and leveraging guided-munitions to fight an irregular opponent. In contrast, the 2003 invasion of Iraq, known as Operation *Iraqi Freedom,* reflected the dramatic effects of the 9/11 shock. The US was pre-empting a non-traditional threat by confronting a state actor and leveraging the operational familiarity of permissive US basing in the Persian Gulf. For this it had no

[122] U.S. Commission on National Security/21st Century, "Seeking a National Strategy: A Concert for Preserving Security and Promoting Freedom: The Phase II Report on a US National Security Strategy for the 21st Century.," April 15, 2000, http://www.au.af.mil/au/awc/awcgate/nssg/phaseII.pdf.
[123] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, pp. 166–168.

patience with "uncertain neutrals and doubtful allies". The US required greater freedom of action, the freedom to act 'unilaterally' in order to defend itself, and it needed the global posture flexibility to suit. The US was greatly surprised and deeply troubled when Turkey, long a reliable US ally, refused to allow the US 4th Infantry Division access to its territory, throwing a spanner in the works of its war planning.[124] While not pivotal to *Iraqi Freedom*, and not in any way absent from the Cold War era, the Turkish example was taken as a clear warning: In a world not marked by a common international perception of a clear ideological threat, access to basing was likely to become less assured.

Whether defined as the fear of entrapment by US partners and allies, or more immediate and transitory political and practical concerns, uncertainty around basing access accompanying the emergent Joint Expeditionary Era spurred the US to seek new models of engagement with allies serving a commonality of ends. In this way, the transformation of the US global military posture pending since 1989, spearheaded by Rumsfeld in 2001 and encountering entrenched institutional inertia if not outright internal opposition, received its catalyst for change. As Krepinevich and Work attest, "the 'Long War' was changing attitudes in the military in ways only an extended war can."[125] Part of the search took an obvious route within the US military of a unilateral focus on improving forced entry from the sea.[126] But where the impediment to access included maturing A2/AD environments proliferating in key regions such as the Western Pacific and to a lesser extent the Persian Gulf, the value of capable and willing *in theatre* allies increased.[127] The two threads, of forcible entry from the sea and in-theatre allied participation, converged in 2009 in the emergence of the Air-Sea

[124] Gregory Fontenot, Edward J. Degen, and David Tohn, *On Point: The United States Army in Operation Iraqi Freedom* (Naval Institute Press, 2004).
[125] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 187.
[126] Murray Williamson, "The Operational Issues of Sea Basing in the Twenty-first Century" (Washington D.C.: DoD, 2003), pp. 14–18.
[127] Dian, *The Evolution of the US-Japan Alliance*, p. 192.

Battle concept, subsequently re-labelled in 2015 as the *Joint Concept for Access and Manoeuvre in the Global Commons* (JAM-GC), as discussed below.

5.5. Self-reliance and dependence

Under the rubric of the Joint Expeditionary Era, then, the US faced a novel task in negotiating the basing access rights and political arrangements fundamentally required to support the new posture. In the words of Krepinevich and Work, two of the US' most senior national security figures (non-government and government), *"it had to persuade foreign countries that it was in their interests to support a global posture optimized for unfettered US global action."*[128] Why would allies do that? Under the new posture, a state may be persuaded to negotiate an access agreement which was linked only tenuously to its own territorial security.[129] For the vertical alliance model to manifest itself, this is the critical question. The answer is to be found in the cases of Japan and Australia, two of Kurt Campbell's post-9/11 'inner circle' States, in the desires of each for an historically elusive level of military *self-reliance*. Paradoxically for both, in stark reality self-reliance, always engendered a measure of *dependence.* As will be shown in subsequent chapters, each traversed unique and separate paths in the quest for self-reliance, and were animated by divergent motivations in very different security environments. Nonetheless, their quest for self-reliance exhibited similarities in what they mean for the vertical military relationships with the United States. As Dian explains, the procurement of military materials and services from an ally, particularly if it involved the transfer of sensitive technology, was much more than a mere form of trade or purchase.[130] It is a powerful form of control for the senior partner. In return, Japan and Australia became privy to an unfurling of military-technical

[128] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 190.
[129] Ibid., p. 233.
[130] Dian, *The Evolution of the US-Japan Alliance*, p. 10.

development in ways that few states can attest. For the US, the desires of Japan and Australia's meant the critical enablers of the Joint Expeditionary Era, in terms of allied political will and military-technical capacity, were in place. Moreover, the exigencies of strategic security in the Western Pacific drove alliance configurations. Ballistic Missile Defence (BMD) cooperation with Japan, and the development of Australia's new expeditionary posture, are among those key exigencies analysed in chapters VI and VII.

The final piece of the puzzle is the organisational capacity and adaptability of states to implement changes. Within the US military, this emerged with the move to stand up the Joint Task Force, first detailed in the *Joint Task Force Planning Guidance and Procedures* in 1999.[131] In addition, the evolution of relationships in the Western Pacific region were defined increasingly in the post-Cold War era by the economic and military re-emergence of China. As an external factor, this was an agenda-driving influence which strengthened the case for the vertical alliance model. The agenda encouraged Australia and Japan to take on more burden as active agents in favour of the regional security *status quo*.[132] In sum, the aforementioned traditional alliance security dilemma commonly exhibited in asymmetric alliance relationships was distorted by a range of factors accommodated under the rubric of the vertical alliance model. The fears of entrapment common to junior alliance partners were overwhelmed by the desire for self-reliance amidst a new global and regional threat environment. They were further assuaged by the expeditionary posture adopted by the senior partner, delivering a "less visible" military presence.[133] Military materials and services were forthcoming as part of the ongoing negotiating process, which is detailed in the

[131] Joint Chiefs of Staff, "Joint Task Force Planning Guidance and Procedures (Joint Pub 5-00.2)" (DoD, January 13, 1999), http://www.bits.de/NRANEU/others/jp-doctrine/jp5_00_2%2899%29.pdf.
[132] Dian, *The Evolution of the US-Japan Alliance*, p. 192.
[133] Henry, "Transforming the US Global Defense Posture," p. 40.

relevant chapters. The fear of abandonment diminished as areas of concern to the junior partners converged with the critical strategic thoroughfare of the senior partner.[134] Fears of entanglement for the senior partner were mitigated by this convergence, but also by the level of control found in the role of 'gatekeeper'. Lastly, burden sharing rose commensurate with the rise in regional security concerns shared broadly by participants.[135] Financial obstacles certainly remained, but are more a sticking point in practice than in principle. Indeed, economic efficiencies were created when governments, defence firms and the commercial sector[136] shared research and development, gained access to innovative foreign technologies and openned up two-way flows of information,[137] very much akin to the corporate vertical alliance model outlined at the beginning of this section. Favouring US technology, international consortium projects such as the one producing the F-35, and the focus on interoperability and intelligence sharing critical to joint operations are also detailed in subsequent chapters.

6. Conclusion

The US military posture of the Joint Expeditionary Era retained many of the elements of eras past, while arguably emerging as unique among the Great Powers.[138] International relations post-Cold War led to a shuffling of the political arrangements underpinning alliances, perhaps understandable considering the transformed strategic environment. A picture emerged of a more specialised alliance regime, in which the organising principle of

[134] Michael Wesley, *There Goes the Neighbourhood: Australia and the Rise of Asia* (Sydney: University of New South Wales Press, 2011), chap. 2.
[135] See for comprehensive overview Yuki Tatsumi, ed., *US-Japan-Australia Security Cooperation Prospects and Challenges* (Stimson, 2015), http://www.stimson.org/images/uploads/research-pdfs/US-Japan_Australia-WEB.pdf; Brad Williams and Andrew Newman, eds., *Japan, Australia, and Asia-Pacific Security* (Routledge, 2006).
[136] See Linda Weiss, *America Inc.?: Innovation and Enterprise in the National Security State* (Cornell University Press, 2014).
[137] Dian, *The Evolution of the US-Japan Alliance*, p. 11.
[138] Krepinevich and Work, *A New Global Defense Posture for the Second Transoceanic Era*, p. 196.

preferential attachment was identified. The exigencies of the Cold War were replaced by a threat environment more dispersed and less predictable, and an alliance regime less defined and predictable. An 'inner circle' of allies, some new, some not, defined by a confluence of interests, capabilities, will, geography and threat perceptions populate the new regime. Alongside them, however, is a "Leasehold Empire" in which the number of Status of Force Agreements entered into by the US and its partners rose to over 100, more than double the number at the end of the Cold War.[139] While the US military footprint declined globally during this period, its connectivity in key regions increased. Equally transformative was the maturing of the guided-munitions regime and the associated military-technology. What it meant for the US's ability to project military power as the leader of the regime , and also for its competitors which might seek to hinder that projection, was anticipated. In addition, access to the regime's cutting-edge was deeply attractive to junior partners. Beyond financial and technical prerequisites, the organisational capacity that truly animates military development, to be found in the US military experience and training on offer, was a powerful co-option strategy for the senior partner and the driving force of preferential attachment. Access to the US-led information sphere, characterised by its superior space-based ISR network and the systems-integration know-how needed to exploit information dominance offered the prospect of a novel, vertical alliance configuration with a number of under-explored features. Several aspects of these features were raised in this chapter, particularly in relation to the distortion of the traditional alliance security dilemma.

What must be mentioned here is the extent to which these dynamics are almost completely absent when discussing China. Robert Farley surmises that "China's biggest problem with respect to the military balance with the United States may be its almost complete absence

[139] Mason, "Status of Forces Agreement (SOFA): What Is It, and How Has It Been Utilized?"

of allies."[140] Only Pakistan and North Korea resemble reliant military clients, and little prospect exists for the emergence of a Sino-centric alliance configuration to rival that described in this chapter. Indeed, as Farley and others argue, a Sino-phobic configuration may already be well underway.[141] Nonetheless, the size and quality of Chinese military exports is growing, as is the list of eager customers which is expected to continue.[142] Buying Chinese military platforms means to some extent locking in Chinese upgrades, resupply and maintenance. Converting this into political and strategic influence will be one of Beijing's biggest challenges. This dynamic brings to light the third organising principle of the scale-free model: fitness connectivity product.

[140] Farley, "Just How Strong Will China's Military Be in 2025?"
[141] Richard Javad Heydarian, "Made in Beijing: An Anti-China Alliance Emerges," Text, *The National Interest*, accessed June 15, 2015, http://nationalinterest.org/feature/made-beijing-anti-china-alliance-emerges-13104; Farley, "Just How Strong Will China's Military Be in 2025?"
[142] These include the possible sale of submarines to Thailand, and JF-17 fighters to Argentina.

Chapter IV. Fitness connectivity product

1. Introduction

The incorporation of a disruptive military-technical innovation, represented by information-centric networked security, into effects at the strategic level involves a complex of variables. Beyond the tendency for new nodes attaching to the network in patterns based on existing connectivity, the concept of a node's 'fitness' introduces the third organising principle of the scale-free network model. Michael Horowitz developed an "adoption-capacity" theory in pursuit of a model that captures the critical variables influencing how and why military-technical innovations make their way, or not, around the international arena.[1] Horowitz calls this the 'diffusion' of military power and argues that two variables, organisational adaptability and financial capacity, are critical. He argues that an innovation presenting increasingly high barriers to adoption in both financial and organisational terms will be taken up by fewer actor. High barriers make alliance making an increasingly attractive option to offset such difficulties. Under Horowitz's model, being rich is good, but being organisationally nimble may be just as important. His framework is highly analogous with the scale-free model and the concept of 'fitness connectivity product'.[2] For this thesis, specific features of military-technical innovation, defined broadly under the allied network-centric warfare rubric, influence the dynamics of allied interactions. In this way, the vertical alliance political model is dependent on a confluence of factors including, perhaps most critically, the internal organisational conditions for such a configuration to manifest in the

[1] Horowitz, *The Diffusion of Military Power*.
[2] Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton, N.J: Princeton University Press, 2010).

first place. This is where the networked imperative of fitness operates. The long-term viability of a political vertical alliance hinges on this confluence of internal factors.

The thesis describes the rise of information as a critical enabler for modern network-centric warfare and the quest for joint operations under the emergent post-Cold War US military posture and strategy. These developments correspond with growth and preferential attachment in the scale-free network model. It now turns to examining the concept of organisational capacity in delivering or constraining transformative military-technical innovation. The corresponding feature of scale-free network evolution is fitness. In section 2, the chapter analyses how military organisations themselves inculcate innovation, and secondly, in section 3, how these factors shape the multinational operational environment. Sections 4 and 5 pay particular attention to constraints on the flow of information and the mechanisms by which sensitive information is disseminated at the operational level relevant to NCW. Section 6 examines how the capacity for vertical alliances to enable allied NCW is underpinned by their ability to leverage increasingly globalised supply chains and, significantly, the knowledge on which they depend. The organisational capacity of actors to capitalise on this is identified as pivotal.

2. Disruption and military organisations

2.1. Innovation and military culture

Disruptive technical innovations force organisations to adapt. If they fail to adapt, the innovation may never live up to its potential. The preliminary assessment made of the burgeoning RMA, driven in the US by Andrew Marshall at the Office of Net Assessment and authored by Andrew Krepinevich, produced this basic finding.[3] Krepinevich and Marshall

[3] See Krepinevich, *The Military-Technical Revolution*.

concluded in 1992 that nothing like a 'revolution' was in process until a disruptive military-technical innovation, in this case the guided-munitions regime and its associated operational concepts, were integrated into the military at an organisational level. This belied the fact that, as Elting Morison pointed out in 1950, that: "Military organizations are societies built around and upon the prevailing weapons systems."[4] While military technology determines only a portion of what is possible in warfare, once accepted, a given technology has the effect of setting the boundaries of opportunity and constraint within the warfighting community. Further, as Andrew Hill suggests: "Militaries are bureaucracies that depend on standardization of tools, training, methods, and organization."[5] Any disruptive military-technical innovation must be understood in the context of these constraints. Militaries are large, structured bureaucracies accommodated by even larger social communities. They exhibit typical human proclivities which produce and are reproduced by the values, norms, and identities of their time. This is why, as asserted by Hill, it can be said that for "modern militaries, innovation is not a scientific or technical problem; it is an organizational challenge."[6]

2.2. The ideal combatant

Much thought, beyond efficacy in warfare, goes into the acceptability of significant military-technical innovation. Its candidacy is inextricable from what is termed the "cultural concept of the ideal combatant."[7] While the "ideal combatant" accommodates an extensive complex of ideas, Hill brings forward three themes particularly relevant when culture is met with the prospect of an innovative change. The success or failure of integrating an innovation is, to

[4] Elting Morison, "A Case Study of Innovation," *Engineering and Science* 13, no. 7 (1950): p. 8.
[5] Andrew Hill, "Military Innovation and Military Culture," *Parameters* 45, no. 1 (Spring 2015): p. 85, http://www.strategicstudiesinstitute.army.mil/pubs/Parameters/Issues/Spring_2015/10_HillAndrew_Military%20Innovation%20and%20Military%20Culture.pdf.
[6] Ibid.
[7] Ibid., p. 88.

some extent, determined by the level of dissonance between the existing concept of the ideal combatant and the imagined new concept ushered in by the innovation. Simply put, the higher the dissonance the greater the level of obstruction to its inculcation. The three themes Hill considers in relation to a prospective change that matters to the war fighter are, first, is it honourable? How well does an innovation align with ideas about honourable war? The notions of physical courage, fairness, morality, and justice are central to military cultures. The question of physical courage, for instance, is particularly pertinent as militaries embrace the rise of unmanned weapons systems.[8] In air forces worldwide, the unmanned era represents a significant disruption in otherwise unbroken links between pilots from the inception of air power to its current fifth generation. The prospect of sudden, violent death that unites all military pilots does not apply, for example, to drone operators.[9] Accordingly, the debate about the manned-unmanned mix appropriate for the future of the US Air Force is polarising,[10] and the operational and strategic efficacy of unmanned platforms, particularly in counter-terrorism, is fiercely contested.[11] All that said, while the reduction, if not elimination, of physical risk may carry ambiguous cultural capital for the war-fighter, the decision maker and the politician quite clearly see it differently. This tension will become increasingly acute as warfare enters the age of robotics and autonomy.

[8] See for discussion Mark Bowden, "The Killing Machines," *The Atlantic*, September 2013, http://www.theatlantic.com/magazine/archive/2013/09/the-killing-machines-how-to-think-about-drones/309434/.

[9] Hill, "Military Innovation and Military Culture," p. 90.

[10] Peter Warren Singer, *Wired for War: The Robotics Revolution and Conflict in the Twenty-first Century* (Penguin, 2009), pp. 253–254; Thomas P. Ehrhard and Robert O. Work, *Range, Persistence, Stealth, and Networking: The Case for a Carrier-Based Unmanned Combat Air System* (Center for Strategic and Budgetary Assessments, 2008); Sam LaGrone, "Mabus: F-35 Will Be 'Last Manned Strike Fighter' the Navy, Marines 'Will Ever Buy or Fly'," *USNI News*, accessed April 20, 2015, http://news.usni.org/2015/04/15/mabus-f-35c-will-be-last-manned-strike-fighter-the-navy-marines-will-ever-buy-or-fly.

[11] David Kilcullen and Andrew McDonald Exum, "Death from Above, Outrage down below," *New York Times* 16 (2009): pp. 529–35; Michael J. Boyle, "The Costs and Consequences of Drone Warfare," *International Affairs* 89, no. 1 (2013): pp. 1–29; James I. Walsh, "The Effectiveness of Drone Strikes in Counterinsurgency and Counterterrorism Campaigns" (DTIC Document, 2013), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA586443.

2.3. Effects on command and control

Secondly, to what extent will a prospective innovation disrupt decision-making and command and control? Next to honour, justice and morality, obedience to authority and the chain-of-command are central pillars of military culture. A delicate balance exists between the hierarchical oversight of the leadership structure and its communication channels with the exigencies of operational efficacy, which often requires the exercise of some level of individual initiative. This balance is known as "command by negation."[12] It flows from the fact that the top of the chain-of-command understands that the bottom possesses the best information about a given tactical situation, and is not only better situated, but trusted, to respond effectively within its means.[13] Technical innovations, most notably in the connectivity ushered in alongside the information technology revolution, threatened to disrupt this balance. The central premise of network-centric warfare of flattened, less stove-piped, and more rapid and responsive communication protocols, while envisioned to increase combat effectiveness, risks placing too much oversight in the hands of command, and, as a corollary, too much reliance on decision-making up the chain. If a common operational picture is offered by innovative technologies, while an inappropriately centralised command system remains in place, the efficacy offered by "knowing more" will be stifled.[14] The flood of information across the command structure also means the decision maker has a much wider audience than before, potentially affecting leadership.[15] NCW promises better, but far from perfect, information for the commander. The leadership

[12] See James E. Higgins, "Future Warfare and the Viability of Command by Negation." (USA: Naval War College, February 12, 1996).
[13] Lieutenant Commander Larry LeGree, "Will Judgment Be a Casualty of NCW?," *U.S. Naval Institute*, accessed January 4, 2015, http://www.usni.org/magazines/proceedings/2004-10/will-judgment-be-casualty-ncw.
[14] See David S. Alberts and Richard E. Hayes, "Power to the Edge: Command and Control in the Information Age" (DTIC Document, 2003), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA457861.
[15] LeGree, "Will Judgment Be a Casualty of NCW?"

structure remains the primary mechanism through which a military deals with the human proclivity to *expect* perfect information. A common operating picture has deleterious effects on these expectations, interfering with the mechanism. As LeGree warns: "Tactical transparency changes the incentive structure of a military commander, particularly one who is averse not only to difficult decisions but also to criticism."[16]

2.4. Effects on standardisation

Thirdly, how much does innovation disrupt uniformity? Militaries favour predictability in the function and utility of assets and systems and, by extension, the training preparing people to use them. The need for predictability makes standardisation and substitutability across the board core features. A 2009 US Department of Defense directive committed DoD as a matter of policy to ensuring "that systems, units, and forces shall be able to provide and accept data, information, materiel, and services to and from other systems, units, and forces and shall effectively interoperate with those of allies and coalition partners."[17] To this end DoD maintained a single, integrated Defense Standardization Program to promote standardization of materiel, information technology, facilities and engineering practices.[18] A significant military-technical innovation, particularly one on the cutting edge, , is by definition not standard and likely to make its way piecemeal into military inventories, adding an extra layer of complexity to its inculcation. The wariness of leaders, used to relying on standardisation, means a staged adoption is inevitable. In addition, the effects and implications of innovations are not always completely understood in advance, further stultifying their embrace. Field experimentation is a crucial part of this process. The more

[16] Ibid.
[17] Department of Defense Instruction, "Materiel Interoperability and Standardization with Allies and Coalition Partners" (DoD, November 29, 2009), p. 1, http://www.dtic.mil/whs/directives/corres/pdf/201006p.pdf.
[18] Department of Defense Instruction, "Defense Standardization Program (DSP)" (DoD, July 13, 2011), http://www.dtic.mil/whs/directives/corres/pdf/412024p.pdf.

novel the weapon or tactic, the more experimentation is needed. As iterated by Colonel Peter Faber of the US Air Force:

> Revolutions in Military Affairs are not mere forms of modernization, revitalization or adaptation. They involve order-of-magnitude improvements in military capability. They primarily require sustained and determined conceptual, technological, and organizational innovations over time. They secondarily require deliberate experimentation and an ability to learn from experience.[19]

Even the successful demonstration of an innovation via experimentation, however, may not guarantee its adoption if standardisation cannot be realised. In the case of joint forces, where operations need to be planned and executed across an even broader array of assets and systems, the requirements for uniformity only increase as the diversity and divergence does in kind. As Hill explains: "The more interconnected a combatant or unit is with a broader system of resources, the less tolerant is the organization for departures from standard equipment and procedures."[20] This is the basic paradox of joint operations. Not surprisingly, the term "interoperability" has been a military buzzword for some time and when applied not only across services within a military organisation, but across the military organisations of nation-states, its central importance is manifest. As Cebrowski noted, "not being interoperable means that you are not on the net; so you are not in a position to derive power from the information age."[21]

[19] Cited by Pietrucha, "The Search for the Technological Silver Bullet To Win Wars."
[20] Hill, "Military Innovation and Military Culture," p. 93.
[21] Cited in Peter Howard, "The USN's Designer of Concepts," *Jane's Defence Weekly*, October 3, 2001.

3. The organisational challenge of joint operations

3.1. Multinational mission partners

The three themes above regarding the inculcation of innovation into military culture are manifest acutely in the quest for joint operations. As outlined in the previous chapter, the US military embarked on a Joint Expeditionary Posture in the post-Cold War era. The posture's greater emphasis is on flexibility and rapid response in bringing sustainable, survivable force to bear in a proliferating number of locations and scenarios with little or no prepositioned architecture and *ad hoc* accessibility. The strategic environment is characterized by uncertainty, complexity, and rapid change.[22] The posture is fundamentally reliant on space-based ISR and communications, and on an unprecedented level of 'jointness' between the services within the US military organisation as a whole.[23] The sheer difficulty from an organisational point-of-view inherent in the realisation of 'jointness' is expressed by Robert Farley:

> In every war, the U.S. armed services grow closer together, developing the procedures and communications techniques they need in order to perform as an effective team. In every peace, the U.S. armed services grow farther apart, as each pursues internal, parochial goals at the expense of joint training, procurement, and planning.

Farley nonetheless suggests some progress is evident because

> the serious problems of inter-service conflict suffered by the U.S. military in Iraq (1991), Afghanistan, and Iraq (2003) were less consequential, and less dangerous, than those suffered in Korea, Vietnam, or the brushfire operations of the late 1970s and early 1980s.[24]

[22] Joint Chiefs of Staff, "Joint Operations" (DoD, August 11, 2011), I-2, http://www.dtic.mil/doctrine/new_pubs/jp3_0.pdf.
[23] See Joint Chiefs of Staff, "Unified Action Armed Forces (UNAAF)" (DoD, July 10, 2001), http://www.bits.de/NRANEU/others/jp-doctrine/jp0_2.pdf.
[24] Farley, "Just How Strong Will China's Military Be in 2025?"

In addition to cross-service and cross-domain synergy, capable and willing allies and partners are the force multipliers of the post-Cold War posture, becoming increasingly indispensable in the second decade of the 21st century.[25]

Political and diplomatic efforts must spur an alliance into action before the effort to create a coalition and build a multinational task force can begin. The capabilities such an effort bring, however, require the laborious task of engineering the level of interoperability, standardisation and uniformity needed to realise its potential. The list of issues holding up this effort is extensive. It includes, according to Boardman and Shuey: "bilateral agreements, foreign disclosure restrictions, data standard differences, language difficulties, host nation technology, limited coalition infrastructure, varied proliferation of information technology and user familiarity, 'release-ability' and availability of US devices, and arms transfer/technology release via direct commercial sales/foreign military sales."[26] In addition, according to a Congressional Report, "different participants in the coalition have different tolerances for risk, and therefore will determine rules of engagement, or 'caveats' that can constrain the ability of military commanders from employing military force as they see fit. While navigable, all these factors can make it considerably more difficult to consolidate gains and achieve campaign success."[27]

This is a multi-decade effort led by the United States. In contrast, Farley suggests that "there's not much indication that the land forces of the PLA, the Second Artillery, the PLAAF, and the PLA Navy have engaged in the work necessary to make them function as a coherent

[25] Author not supplied, "Federated Defense Project: Concept Overview."
[26] Jill L. Boardman and Donald W. Shuey, "Combined Enterprise Regional Information Exchange System (CENTRIXS): Supporting Coalition Warfare World-Wide" (DTIC Document, 2004), p. 11, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA466528.
[27] Kathleen J. McInnis, "Coalition Contributions to Countering the Islamic State" (Congressional Research Service, November 18, 2015), p. 7, http://news.usni.org/wp-content/uploads/2015/12/R44135.pdf#viewer.action=download.

whole." More broadly, Paul Mitchell has written widely on the progress and effects of US led military transformation on Canada's armed forces, and Farrell *et al.* have done the same regarding NATO.[28] Mitchell's work emphasises the underlying political impediments to a fully realised allied NCW model. Similarly, Farrell *et al.* present a picture of a gap in military-technical transformation between the US and its European allies marked by variegation, contingent on a complex mix of international and local drivers. Professional military education programmes also heavily feature research on networking in the multinational environment.[29] The literature is predominantly pessimistic. Nonetheless, the door to the realisation of allied NCW remains somewhat ajar, contingent on the alignment of variables reflected here in the vertical alliance model.

Broad-based scepticism brings Hill's three themes of military values, command and control, and standardisation in coping with innovative changes into stark relief. Truly joint operations across multinational partnerships are the capstone innovation incorporating subordinate innovations which began with the emergence of the guided-munitions regime and its maturation into network-centric warfare. Allied joint operations, leveraging these innovations, underpinned by a global space-based ISR infrastructure providing critical information background, may be on the verge of being realised in 2018. The critical enabler is the organisational capacity of allies operating within the vertical alliance configuration. In response to the challenges of the Joint Expeditionary Era, the US Department of Defense released *Joint Task Force Planning Guidance and Procedures* in 1999.[30] Its stated purpose was to set forth doctrine and tactics, techniques and procedures to govern the activities of

[28] Mitchell, *Network Centric Warfare*; Mitchell, "Small Navies and Network-Centric Warfare"; Farrell, Terry, and Frans, *A Transformation Gap*.
[29] Com Barbara A. Geraghty (USN), "Will Network Centric Warfare Be the Death Knell for Allied/Coalition Operations?" (Newport RI: Department of Joint Military Operations, US Naval War College, May 17, 1999); Pope, "US and Coalition Command and Control Interoperability for the Future."
[30] Joint Chiefs of Staff, "Joint Task Force Planning Guidance and Procedures (Joint Pub 5-00.2)."

US Armed Forces in joint operations and provide the doctrinal basis for US military involvement in multinational and interagency operations.[31] It predicts that the Joint Task Force should expect to participate as part of a multinational force in most future military endeavours throughout the range of military operations.[32]

The document provides insights into the scale and complexity of organising military operations across a multinational task force. Its emphasis nonetheless is clearly focused on command and control protocols and structures, rules of engagement and intelligence sharing, and logistical and organisational requirements. Considerations regarding the multinational component of the Joint Task Force are littered throughout the document and several others of its type, most of which were updated continually with current iterations.[33] The following applies Hill's three themes with regard to innovation adoption within a single military culture to multinational operations.

3.2. Reconciling military values

National honour and prestige may be as important to a nation contributing to a multinational task force as combat capability.[34] The trust and confidence essential to underpin multinational joint operations may depend on these variables, and the US joint literature lists a number of key 'tenets' to be observed in the multinational environment. Among them are respect, rapport, knowledge of partners, and patience.[35] Beyond these concerns, the presence of a military partner in a multinational force can assume a certain

[31] Ibid., p. i.
[32] Ibid., p. ix.
[33] See Joint Chiefs of Staff, "Doctrine for Joint Operations" (DoD, September 10, 2001), http://www.fs.fed.us/fire/doctrine/genesis_and_evolution/source_materials/dod_joint_ops_doctrine.pdf; Joint Chiefs of Staff, "Joint Doctrine for Logistic Support of Multinational Operations" (DoD, September 25, 2002), http://www.globalsecurity.org/military/library/policy/dod/joint/jp4_08_2002.pdf; Joint Chiefs of Staff, "Joint Doctrine for Multinational Operations" (DoD, April 5, 2000), http://www.bits.de/NRANEU/others/jp-doctrine/jp3_16.pdf; Joint Chiefs of Staff, "Unified Action Armed Forces (UNAAF)."
[34] Joint Chiefs of Staff, "Multinational Operations," p. I-3.
[35] Ibid.

level of political alignment and capabilities are already in place. Mission requirements, doctrine, tactics, and specified roles are things that militaries are predisposed to responding to, so a basic level of commensurability is safe to assume at the level of military culture as well. Much of what matters most to individual militaries within a joint operation will be hammered out with regard to command and control structures, rules of engagement, and mission assignment. To a certain extent, then, militaries engaged in joint operations come to the table as pre-packaged entities. Divergent values and cultural preferences are important for the force command to manage, but are largely expected to be subordinate to practicalities in planning and operations. Nonetheless, joint operations are themselves a very significant innovation, and the only substitute for extensive exercising and training prior to the assembly of a Joint Task Force is the deployment itself. Again, this is where a Joint Task Force sourced from an allied relationship is overwhelmingly preferable to that of a coalition. Issues of divergent military values and culture are likely to have been smoothed out well up stream.

3.3. The 1000 ship Navy

It is the case that some services within the military are more predisposed to collaboration than others. The US Navy, for example, considers itself as having a longstanding tradition of internationalism, based on the observation that seafarers share experiential legacies derived from unique hardships and opportunities that pre-dispose them to cooperation.[36] Such sentiments were expressed most recently in a 2014 article by Admiral Greenert and Rear Admiral Foggo of the US Navy, titled *Forging a Global Network of Navies*.[37] In 2005,

[36] Lawrence, "Tailoring the Global Network for Real Burden Sharing at Sea," p. 1.
[37] Adm Jonathan Greenert and Rear Admiral James M. Foggo III, "Forging a Global Network of Navies," *Proceedings Magazine* 140, no. 5 (May 2014), http://www.usni.org/magazines/proceedings/2014-05/forging-global-network-navies.

fuelled by the common interest of global stability and economic prosperity, Vice and Rear Admirals Morgan and Martoglio of the US Navy introduced the concept of a "1000 ship Navy",[38] later endorsed by Admiral Mike Mullen.[39] The Navy formally articulated its outlook on the provision of collaborative security in the maritime commons in 2007's *A Cooperative Strategy for 21st Century Seapower*,[40] which has since been endorsed in more recent iterations.[41] The US Navy is not alone in this vision. For example, in 2014 the Sea Power Centre of Australia published the results of a six-year inter-laboratory consortium involving Australia, Canada, New Zealand, United Kingdom, and the United States known as The Technical Cooperation Program (TTCP).[42] The program is a forum for defence scientists and engineers from the five countries to collaborate on science and technology issues, and it focused on the C4ISR challenges involved in networking navies to secure the global commons. The publication declares that "while these nations and navies are aligned through doctrine, operating practice, tactics, techniques and procedures to work and network together at sea, the technical means to realise the promise of 'network-centric warfare' throughout coalitions remains elusive."[43] Part of the problem lies in convincing navies of the need to invest in new levels of integration, when for many years they have found ways to communicate to some degree.[44] Technical interoperability during the Cold War often

[38] Vice Admiral John G. Morgan Jr. and Rear Admiral Charles W. Martoglio, "The 1000 Ship Navy: Global Maritime Network," *Proceedings Magazine* 132, no. 11 (November 2005), http://www.usni.org/magazines/proceedings/2005-11/1000-ship-navy-global-maritime-network.
[39] Admiral Mike Mullen, "What I Believe: Eight Tenets That Guide My Vision for the 21st Century Navy," in *Proceedings*, vol. 13, 2006, http://www.navy.mil/navco/speakers/speakersnotes/18dec06SNspeeches/MullenTenetsJan2006.pdf.
[40] US Navy, US Marine Corp, and US Coast Gaurd, "A Cooperative Strategy for 21st Century Seapower" (US Navy, October 2007), http://ise.gov/sites/default/files/Maritime_Strategy.pdf.
[41] US Navy, US Marine Corp, and US Coast Gaurd, "Forward, Engaged, Ready: A Cooperative Strategy for 21st Century Seapower" (US Navy, March 2015), http://www.navy.mil/local/maritime/150227-CS21R-Final.pdf.
[42] Stephanie Hszieh et al., *Networking the Global Maritime Partnership*, Sea Power Series 2 (Sea Power Centre Australia, 2014), http://www.history.navy.mil/content/dam/nhhc/research/publications/Publication-PDF/SPS2_Networking_Global_Maritime_Partnership.pdf.
[43] Ibid., pp. v-vi.
[44] Ibid., p. 51.

amounted to ensuring the correct cryptographic keys and radio frequencies were used that navies could securely communicate with one another. The emerging digital environment has complicated this picture significantly.[45] Other obstacles reside in how high-ranking naval officers in the US get used to state-of-the-art equipment as commanding officers of carrier strike groups. Their experiences are not the norm in a multinational setting, and are certainly not akin to those of most coalition members working from the other side of relationship.[46] The alignment of these nations, bound as they are also at the strategic level by the 1946 UKUSA intelligence-sharing relationship, nonetheless represents the foundation of their organisational capacity and the critical platform from which the technical aspects of NCW and naval collaboration, as TTCP suggests, can be pursued.

3.4. Multinational command and control structures

The Joint literature states "Although nations will often participate in multinational operations, they rarely, if ever, relinquish national command of their forces.[47] As such, forces participating in a multinational operation will always have at least two distinct chains of command: a national chain of command and a multinational chain of command."[48] Further, the interaction between these two basic command structures for multinational operations fall into one of three types: integrated, lead nation, or parallel command.[49] The hybrid nature of these interactions gives rise to the need for workaround strategies to help ensure as smooth as possible coordination. To this end, the establishment of a network of liaisons across the command chains is imperative, as is the existence of multinational staffed coordination centres to facilitate cooperation in planning and operations. A robust liaison

[45] Mitchell, *Network Centric Warfare*, p. 58.
[46] Hszieh et al., *Networking the Global Maritime Partnership*, p. 51.
[47] As Commander in Chief, the US President always retains and cannot relinquish national command authority over US forces.
[48] Joint Chiefs of Staff, "Multinational Operations," p. x.
[49] For definitions see Ibid., pp. II-4 – II-7.

structure can mitigate the anticipated differences in doctrine, organisation, equipment, training, and national law, as well as be a valuable source of information to the multinational force commander. The specific nature and structure of the command relationships will vary from example to example; the appropriate configuration is ultimately determined by such factors as the mission, the size and nature of the operating environment, the size of the forces, and risks, duration, and rules of engagement.[50] Political considerations are fully understood to weigh heavily. Where interests collide, compromise is sought.[51] The US joint doctrine is explicit,

> Nations do not relinquish their national interests by participating in multinational operations. This is one of the major characteristics of operating in the multinational environment. Commanders should be prepared to address issues related to legality, mission mandate, and prudence early in the planning process. In multinational operations, consensus often stems from compromise.[52]

Integrated or lead nation command structures are the most favourable, given the existence of a single force commander and its capacity to achieve unity of effort. Significantly, *ad hoc* coalitions are the most likely to have either a lead nation or parallel command, whereas alliances carefully developed over extended periods of time and with a high degree of stability and consensus are likely to accommodate integrated or lead nation command structures, due mainly to the higher level of consensus and standardisation present.[53] These attributes mean they are used to the "maximum practical extent."[54] The 2005 *Inquiry into Australia's Defence Relations with the United States* highlighted Australia's unique status in

[50] Ibid., p. II-2.
[51] Joint Chiefs of Staff, "Joint Doctrine for Multinational Operations," p. II-6.
[52] Joint Chiefs of Staff, "Multinational Operations," p. II-4.
[53] Ibid., p. II-7.
[54] Ibid.

the area, stating "Defence places particular emphasis on personnel exchange and liaison positions with the US. Australia is one of the few nations whose military personnel can be fully integrated with US forces and who have been entrusted with operational control of US military personnel."[55]

3.5. Standardisation and interoperability across militaries

Rapid technological change has and will continue to reach nations unevenly. As outlined above in relation to the stultified inculcation of innovations within a single military, this variegation is amplified across national services and has actually impeded the effective networking of multinational groupings.[56] A recent study of how effectively the Canadian Navy has been able to communicate with the US Navy during its frequent deployment alongside a carrier strike group found while significant progress had been made, much work remains to be done.[57] This persistent gap between the US and its allies has been blamed variously on "inadequate capital investment in information and communications technologies (ICT), or on a failure of US technological developments to facilitate high levels of allied interoperability."[58] In addition, the need to update ICTs using commercial off-the-shelf systems can turn two or three times inside the cycle of other military systems.[59] These are valid and ongoing concerns. The efforts to build interoperability across multinational groupings are best documented at the technical level, and can be found in the offerings of not only the US joint literature but of each individual service, and across a number of allied

[55] Department of Defence Submission, "Inquiry into Australia's Defence Relations with the United States" (Department of Defence, May 2005), p. 5.
[56] Hszieh et al., *Networking the Global Maritime Partnership*, p. 1.
[57] Mitchell, "Small Navies and Network-Centric Warfare."
[58] Mitchell, "Freedom and Control," 43.
[59] Michael E. O'Hanlon, *Technological Change and the Future of Warfare* (Brookings Institution Press, 2011).

militaries.[60] Upcoming chapters on Australia and Japan, also, are concerned largely with identifying and cataloguing these efforts, so a generalised discussion here would be superfluous. Suffice to say here that allies and partners face a two-pronged challenge of getting "on the net". Obstacles arise either from the incompatibility of their own forces or from the design of the network by its administrator.[61]

4. Power and information flows

4.1. SIPRNET

Even the privileged access of a close ally might not compensate for the likelihood that the multinational task forces of the future will, as expected, be "dynamic coalitions" formed rapidly and with little warning to deal with crisis situations. Detailed, prearranged plans and doctrine are likely to be scarce or, according to Paul Mitchell, entirely absent.[62] In addition, resistance to intelligence sharing is a ubiquitous feature of international military relationships. US military primacy privileges America's own national secret level network, the SIPRNET (Secure Internet Protocol Router Network), over other nations' smaller ones, and military networks remain unlike the civilian internet in that the existence of unbreakable barriers is imperative.[63] SIPRNET is the Department of Defense's "largest network for the exchange of classified information and messages at the SECRET level. It supports the Global Command and Control System, the Defense Message System, and numerous other classified war fighting and planning applications. Although SIPRNET uses the same communications procedures as the Internet, it has dedicated and encrypted lines

[60] See for example Joint Chiefs of Staff, "Multinational Operations"; Australian Defence Force, "Joint Operations for the 21st Century" (Department of Defence, 2007), http://www.defence.gov.au/publications/docs/FJOC.pdf; Pope, "US and Coalition Command and Control Interoperability for the Future"; Hszieh et al., *Networking the Global Maritime Partnership*; Lawrence, "Tailoring the Global Network for Real Burden Sharing at Sea."
[61] Pope, "US and Coalition Command and Control Interoperability for the Future," p. 10.
[62] Mitchell, "Small Navies and Network-Centric Warfare."
[63] Mitchell, "Freedom and Control," p. 28.

that are separate from all other communications systems."[64] The primacy of SIPRNET has implications for the US military analogous with the advantages afforded Microsoft Corporation on the back of the Windows Operating System.[65] In this area the Global Information Grid Convergence Master Plan (GCMP) is working towards the extension of DoD information sharing platforms to provide improved services for 'coalition enclaves'.[66] The distinction between intelligence sharing and information sharing must also be understood. Intelligence is only a subset of information, which also can include data from sensors, information about plans, and situational awareness, which are not necessarily subject to the same level of sensitivity. Much of the efficacy offered by networking can be derived from the better enabled assembly of existing information in warfare. The success of multinational operations, therefore, in theory, need not necessarily be hostage to the high intolerance of participants to the sharing of secrets. In practice, however, these political concerns manifest as technical obstacles related to categories of information, and protocols about sharing that heavily favour security.

4.2. SIPRNET and the war on terror

For example, when the exclusive US SIPRNET was first brought online in the late 1990's during NATO campaigns, US Defense Information Systems Agency (DISA) developed a fix called the Coalition Wide Area Network (CWAN) to link the United States to its coalition partners.[67] CWAN quickly became overloaded and was not able to support the flow of information through the NATO information grid. In addition, during the Kosovo operation it

[64] Gheorghe Boaru and Benedictos Iorga, "Common Communications Architecture in Combat Support Operations - Afghan Mission Network," in *The International Annual Scientific Session Strategies XXI*, vol. 3 (Bucharest, Romania: "Carol I" National Defence University, 2014), pp. 22–30, http://search.proquest.com/docview/1528149411/abstract?.
[65] Mitchell, *Network Centric Warfare*, pp. 7–8.
[66] Defense Information Systems Agency, "GIG Convergence Master Plan 2012 (GCMP 2012) Volume I," p. 4.
[67] Joseph M. Ladymon, "Network Centric Warfare and Its Function in the Realm of Interoperability," *Acquisition Review Quarterly*, 2001, p. 114.

was unable to pass along high-fidelity digital data. This meant that it was unable to support the rapid exchange of precision-target data and continuous precision updates from sensor-to-shooter until the targets were destroyed, placing addition stress on air assets as a result.[68] These and many other technical difficulties plagued these early efforts at networked allied operations, and they derive from the essential tension between the need to share, and the need to secure. SIPRNET supporting networked combat operations arguably came of age during operations in Afghanistan and Iraq after 2001,[69] as efforts "focused on speeding the development and implementation of intelligence interoperability solutions for warfighting operations."[70] The CWAN's that performed analogous functions for coalition members became CENTRIXS (Combined Enterprise Regional Information Exchange System) after 2003, with the establishment of the CENTRIXS Program Office in January 2002. The broad coalition associated with Operation Enduring Freedom "accelerated deployment of the CENTRIXS environment at USCENTCOM Headquarters and in the USCENTCOM area of responsibility."[71] The expected expansion of Operation Enduring Freedom into other areas of responsibility, as well as the global nature of the war on terror, led to additional CENTRIXS gateways in US Pacific Command (USPACOM) and US European Command (USEUCOM).[72] In this way, the Global War on Terror has acted as an incubator for these innovations. However, CENTRIXS enclaves reportedly offered only a fraction of the total situational awareness the US enjoyed through SIPRNET, to the continued frustration of coalition members.[73]

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[68] Ibid., p. 115.
[69] T. E. Zelibor, "FORCEnet'is Navy's Future: Information Sharing from Seabed to Space," *Armed Force Journal*, December 2003, pp. 48–50.
[70] Boardman and Shuey, "Combined Enterprise Regional Information Exchange System (CENTRIXS)," p. 6.
[71] Ibid.
[72] Boardman and Shuey, "Combined Enterprise Regional Information Exchange System (CENTRIXS)," p. 6.
[73] Mitchell, *Network Centric Warfare*, p. 59.

4.3. Proceeding despite scarcity

In sum, the quest to realise networked operations across multinational partnerships is a work in progress. Commentary and analysis is split between pessimists and optimists regarding the ultimate realisation of allied NCW, but there can be little doubt of the enthrallment and commitment to the concept among the US and selected allies. This section is not intended to add another speculative voice. Rather, its intention is to identify the central importance of these organisational issues. As we have seen, the technical blurs into the organisational with regard to the components of command and control structures, or communication and information sharing systems. This is precisely the point. The technical components of the quest for allied NCW cannot be distilled from their political, financial, and social contexts. It's safe to suggest that scarcity will continue to characterise the technical and political aspects of interoperability. The most current efforts on the US side are documented in the GCMP, now in its third generation, and involve the design of parallel secure systems for classified and unclassified information, based on a cloud-computing model.[74] As NCW operations in a multinational setting does "ultimately hinge on information sharing rules, and the ability to send information between networks with different security classifications,"[75] these systems are absolutely key. DoD's embracing of cloud-computing marks a significant departure from the net-centrism of previous models. It represents an ambitious effort to consolidate and standardise DoD and military-service ICT and networks with allied interoperability, and is an ongoing effort under the banner of the Joint Information Environment. DoD's 2013 *Strategy for Implementing the Joint Information*

[74] Defense Information Systems Agency, "GIG Convergence Master Plan 2012 (GCMP 2012) Volume I."
[75] Mitchell, "Small Navies and Network-centric Warfare," p. 9.

Environment states an interest in expanding efforts in the Pacific Region as a major focus of the next increment.[76]

4.4. Vertical networked alliances

This multi-decade effort to transform military operations is also transformative in terms of the accompanying alliance dynamics. As this section has shown, the bar is incredibly high and scarcity is the defining feature. And as Paul Mitchell has suggested, "There would seem to be a limit on how far the United States is willing to go to solve some of these connectivity issues."[77] Ultimately, however, the biggest obstacles may be political rather than technical, which is why the examination of the way power flows across these new configurations is pertinent. According to Mitchell, and reflecting this, the biggest complaint to be heard among coalition partners is about the protocols regulating information release.[78] A level of agnosticism, also, on the ultimate realisation of allied NCW ought not to preclude us from examining the effects it is likely to induce on those alliances and on the strategic implications hence. Mitchell intimates as much saying "the ability to take advantage of the network is dependent on the 'pattern of power present in the structure of the network.'"[79] The pattern of power in this case is defined by the information flow; this dynamic has been heightened by the elevation of the 'information domain' in modern NCW as shown in chapter II. The rise of the information network, as well, is fundamentally altering traditional power dynamics within alliances. The traditional 'actor centric' hierarchy is being

[76] Department of Defense, "The Department of Defense Strategy for Implementing the Joint Information Environment" (DoD, September 18, 2013), http://dodcio.defense.gov/Portals/0/Documents/JIE/2013-09-13_DoD_Strategy_for_Implmenting_JIE_%28NDAA_931%29_Final_Document.pdf.
[77] Paul T. Mitchell, *Network Centric Warfare and Coalition Operations: The New Military Operating System* (Routledge, 2009), p. 50.
[78] Mitchell, *Network Centric Warfare*, p. 54.
[79] Manuel Castells, *"Informationalism, Networks, and the Network Society: a Theoretical Blueprint" in I M. Castells: The Network Society. A Cross-cultural Perspective* (Cheltenham: Edward Elgar, 2004), p. 12 cited in Mitchell, "Freedom and Control."

superseded by the centrality of the network. As put cryptically by Manuel Castells, this means that "The power of flows takes precedence over the flow of power."[80] The network begins to resemble an automaton, existing in order to carry out whatever project it was designed to achieve, and subordinating the interests, and sovereignty, of the actors (nodes) that populate it. The 'designer' of these networks ultimately gives up centrality in the traditional sense, but retains a critical level of control via its role as network administrator, or what Castells labels the 'switcher', capable of assigning goals to the network by controlling the flow of information.[81] I've previously referred to this as the 'gatekeeper' role.

The suggestion here is that the multinational military groupings of the near future will accommodate the familiar obstacles derived from both the organisational and the technical, and any federated defence model will be marked by variegation. However, within the broader grouping exists a select few for whom the alignment of the financial, technical, organisational, and political has progressed much further than the mean. These few have entered into the vertical alliance model with the United States and are presented with the opportunity to reap the strategic advantages of inclusion, and exclusion, that follow. The effusion of power within this exclusive grouping is structurally defined by the networked flow of information, bringing to the fore the US lead in space-based information gathering and its dissemination and exploitation via SIPRNET and the evolving GIG. The leading candidates already taking up this model in the Pacific are Australia and Japan.

[80] Manuel Castells, "Materials for an Exploratory Theory of the Network Society," *The British Journal of Sociology* 51, no. 1 (2000): p. 20.
[81] Ibid., p. 16.

5. Building the Joint Information Environment

5.1. The Mission Partner Environment

Between 1991 and 2006, no fewer than 16 federal studies and commissions called for major reform of the US intelligence community, as for the past half century its basic structure had remained essentially unchanged.[82] This left the US military with a complex layering of multiple networks with overlapping, duplicative roles and responsibilities, and as stated by the Commander of CYBERCOM, the current network was "not defendable."[83] The effort to retool the electronic infrastructure of the US intelligence community, that received such an awakening in 2001, has direct consequences for the issues related to allied access. Progress in the building of the new US architecture is apparent, with the Joint Information Environment under development by the Department of Defense reportedly at a critical stage of its formation.[84] The new open-source-based capability, called Defense Collaboration Services (DCS), is being rolled out by DISA. It began transitioning internal collaboration sessions and processes from the predecessor system in late 2014.[85] DCS is available to DoD employees worldwide with a common access card on the unclassified NIPRNET (Non-secure Internet Protocol Router Network) or to anyone with a SIPRNET token on the classified network. DISA worked with US Cyber Command directing the configuration of local networks across the department, and by February 2015 the entire department reportedly had the ability to access DCS.[86] DISA is also responsible for the development and

[82] David E. Kaplan and Kevin Whitelaw, "Remaking U.S. Intelligence" (US News and World Report, March 11, 2006), http://www.werzit.com/intel/archive/Remaking%20U.S.%20Intelligence%20-%20US%20News%20and%20World%20Report.pdf.
[83] Department of Defense, "The Department of Defense Strategy for Implementing the Joint Information Environment," p. 28.
[84] See Department of Defense, "The Department of Defense Strategy for Implementing the Joint Information Environment."
[85] Cheryl Pellerin, "DISA Rolls out Defense Department Online Collaboration Tool," *Japan Stripes*, February 6, 2015, http://japan.stripes.com.
[86] Ibid.

implementation of projects dedicated to coalition information exchange, or the Mission Partner Environment (MPE), under the Multinational Information Sharing (MNIS) portfolio.[87] Its stated end goal is to collapse today's multiple encrypted network enclaves (NIPRNET, SIPRNET, Coalition, etc.) into a single, integrated network.[88] In FY 2015, DISA planned to reprioritize "MNIS investments to address PACOM near-term requirements for expanded Coalition connectivity in their AOR," for which it has requested a budget of US$53.5 million.[89]

Beyond this general description it is practically impossible to keep track of what is happening where and when. Nonetheless, a general overview of basic problems that need solving is possible.[90] How do you deliver enhanced situational awareness, via the secure and uninterrupted flow of information, across traditionally siloed systems run by different teams and monitored and managed by different products? First, the various systems that make up the entire IT architecture, including the ISR systems, must be identified. These include devices such as servers, databases, storage devices, network machines and applications components, as well as other non-standard IT devices such as high-definition cameras and sensors. These devices are located either at the tactical edge, within a data centre, or somewhere in between. All must be able to be managed and monitored to have confidence in their proper functioning, making data network optimisation a key capability. To do that, a

[87] MNIS includes Combined Enterprise Regional Information Exchange System (CENTRIXS), Combined Federated Battle Lab Network (CFBLNet), Pegasus, Unclassified Information Sharing Service - All Partner Access Network (UISS-APAN), and Common Mission Network Transport (CMNT).
[88] Defense Information Systems Agency, "Strategic Plan 2015-2020" (DISA, June 2015), http://www.disa.mil/~/media/Files/DISA/About/Strategic-Plan.pdf.
[89] Alex Rossino, "Enabling the JIE: A Look at the Mission Partner Environment," June 24, 2014, https://iq.govwin.com/index.cfm?fractal=blogTool.dsp.blog&blogname=PUBLIC&alias=Enabling-the-JIE-A-Look-at-the-Mission-Partner-Environment.
[90] See Joel Dolisy, "Enhancing Situational Awareness Throughout an IT Infrastructure," *SIGNAL Magazine*, November 6, 2015, http://www.afcea.org/content/?q=Blog-enhancing-situational-awareness-throughout-it-infrastructure.

higher level, single view across the entire infrastructure must be implemented that understand which systems are operational, how the information flows, and where the problems exist. In addition, the capacity to not only respond to but also predict where data flow problems may occur is critical. Where the siloing of certain systems is unavoidable, knowledge of how these systems are managed is crucial to be able to respond to interruptions. Cross-department visibility must be incorporated as part of the higher-level view to ensure this is possible. Understanding the relationships between the components of the system is key to pinpointing the problem.

5.2. Australia and SIPRNET

Australia's controversial involvement in the US-led wars in Afghanistan and Iraq from 2001 yielded it a significant prize. It furthered it's long-standing access to the highest levels of intelligence with the United States, and experienced the use of these networking technologies for the first time. The aforementioned 2005 *Inquiry* stated Australia's "air combat assets, P-3 and C-130 aircraft, ships, Special Forces and land forces have all integrated effectively into larger US force elements."[91] And on intelligence sharing, from the Department of Defence in 2004,

> At the strategic level, as well as at the operational and tactical levels, Australia and the US have engaged in defence intelligence sharing activities, to mutual benefit. This has most recently been demonstrated during military operations in Afghanistan and Iraq, where intelligence sharing between Australia and the US directly contributed to the success of ADF operations. During operations, the US provided Australia with unprecedented access to its intelligence and intelligence systems.[92]

[91] Department of Defence Submission, "Inquiry into Australia's Defence Relations with the United States," p. 6.
[92] Department of Defence Submission, "Joint Standing Committee On Foreign Affairs, Defence And Trade Inquiry onto Australia – United States Defence Relations" (Department of Defence, February 2004), p. 2.

In July 2004, President Bush signed a directive stipulating that Australia and Britain would no longer be subject to laws preventing foreign powers from seeing highly classified intelligence. Some of the classified information on SIPRNET has a caveat – "NOFORN" – not releasable to foreign nationals.[93] A one-page Executive Order to the US Department of Defense and Central Intelligence Agency instructed them to upgrade intelligence cooperation and access for Australia to the status of Intelligence Partner.[94] Australia had, in 2002, been able to negotiate the installation of a SIPRNET terminal for a limited duration on *HMAS Manoora*. It was installed in a compartment of the ship crewed exclusively by US personnel, but was a significant coup much to the chagrin of the Canadians, who were not to participate in the Iraq war.[95] The US and Australia signed a joint statement indicating a new level of intelligence sharing and an agreement to further the pursuit of interoperability at the 2004 AUSMIN meeting.[96] The agreement was reportedly supposed to grant Canberra access to all levels of raw US intelligence, US assessments of that intelligence, and real time operational information and planning.[97] Resistance from inside the Pentagon, however, delayed the process, with reports that the Pentagon had been creating a new, 'separate SIPRNET' later made public in Bob Woodward's *State of Denial*.[98] Direct appeals by Prime Minister Howard to the White House later saw the situation rectified, with Howard saying in

[93] Bob Woodward, *State of Denial: Bush at War, Part III*, First Edition (New York: Simon & Schuster, 2006), pp. 318–319.
[94] Drew Davis, "The U.S. – Australian Intelligence Sharing Relationship" (Pax Americana Institute, Spring 2009), p. 9, http://www.paxamerica.org/wp-content/uploads/2010/06/THE-U.S.-AUSTRALIA-INTELLIGENCE-SHARING-RELATIONSHIP.pdf.
[95] Mitchell, *Network Centric Warfare*, p. 60.
[96] Government of Australia and Government of United States, "Australia-United States Ministerial Consultations Key Outcomes from AUSMIN 2004," *Department of Foreign Affairs and Trade*, accessed September 12, 2015, http://dfat.gov.au/geo/united-states-of-america/ausmin/Pages/australia-united-states-ministerial-consultations-key-outcomes-from-ausmin-2004.aspx.
[97] Greg Sheridan, *The Partnership: The Inside Story of the US-Australian Alliance Under Bush and Howard* (UNSW Press, 2006), pp. 98–100.
[98] Woodward, *State of Denial*, pp. 318–319.

2006 "I am now advised the flows are occurring that are meant to occur."[99] Problems reportedly still existed with the NOFORN classification, however, and the bespoke coalition networks such as CENTRIXS, of which there has been some 70[100] in existence used by allies to access SIPRNET, were cumbersome.[101]

5.3. CENTRIXS

CENTRIXS is a collection of separate, classified coalition networks that enable information sharing through the use of email and Web services, instant messaging or chat. The CENTRIXS network for much of the last decade has included 7 sub domains,[102] ('enclaves' or 'communities of interest') defined by the coverage area or operational support, and information on each has differing levels of 'release-ability'. Each enclave accesses SIPRNET through a securely administered 'gateway'. According to Farrell *et al*, there are "concentric circles of access" that favour the British as the US' closest ally, followed by Australia and Canada.[103] In addition, data had to be manually transferred from collocated CENTRIXS and SIPRNET terminals because of security concerns. In a given multinational setting, these enclaves were not seamlessly connected to one another. Rather, their connectivity was subject to *ad hoc* procedures that consumed time and labour.[104] Often in past examples, only CENTRIXS Five Eyes was interoperable, albeit slowly, with SIPRNET, in turn requiring the

[99] Dennis Shanahan, "PM Slams Pentagon Spy Delays," *The Australian*, October 4, 2006, http://www.theaustralian.news.com.au/story/0,20867,20521642-601,00.html.
[100] Col Roman Hund, USAF, "Mission Partner Environment DISA Multinational Information Sharing," May 13, 2014, http://www.afcea.org/events/jie/14/documents/DISA_MissionPartnerEnvironment_Hund--Final.pdf.
[101] Farrell, Terry, and Frans, *A Transformation Gap*, p. 38.
[102] CENTRIXS Four Eyes for US, UK, Canada and Australia, CENTRIXS - J for the United States and Japan, CENTRIXS - K for the United States and South Korea, CENTRIXS - ISAF (International Security Assistance force) in Afghanistan, CENTRIXS - GCTF for TCN (third country nationals) contributing troops to the global war on terror, CENTRIXS - CMFC for combined maritime forces, and CENTRIXS - CMFP for combined maritime forces in Pacific.
[103] Farrell, Terry, and Frans, *A Transformation Gap*, p. 38.
[104] Rear Adm. D.C. Curtis and Cmdr. Dawn M. Maskell, "Coalition Interoperability Achieves Unprecedented Success at RIMPAC 2004," *CHIPS*, March 2005, http://www.doncio.navy.mil/CHIPS/ArticleDetails.aspx?ID=3249.

cumbersome dissemination of information to other participants, if at all.[105] The prevalence of these circumstances was outlined in a 2004 report, reflecting the manner in which technical solutions to the underlying political problem of information sharing were not yet sufficient.

> This separation of networks is required to prevent inadvertent release of data to nations who are not part of specific information sharing arrangements. Until sufficient guarding technology exists, nations participating in multiple networks will have to maintain separate networks tunnelling through existing communications paths to ensure information integrity and confidentiality. Once an adequate guarding solution is available, the vision is these separate CENTRIXS networks will be connected (by COCOMs under supervision of a national level executive agent) to form a global CENTRIXS network.[106]

The problem here was clearly not one of under-recognition. These issues had been on the agenda since 1996, with the release of Director of Central Intelligence Directive 1/7, which sought, for example, to eliminate the caveats and control markings on information that complicate and jeopardise military collaboration between the US and its allies.[107] More recently, the MNIS has condensed these services down to five CENTRIXS enclaves.[108]

5.4. Pegasus

While CENTRIXS is an operational network, 'Pegasus', formerly known as 'Griffin' (FY2010), by contrast is a secret-level wide-area network that permits collaborative planning at the strategic level of command between the Five Eyes.[109] Pegasus provides capabilities and services under the MNIS portfolio whose stated purpose is "to improve secure information

[105] Ibid.
[106] Boardman and Shuey, "Combined Enterprise Regional Information Exchange System (CENTRIXS)," p. 3.
[107] Director of Central Intelligence Directive 1/7, "Security Controls on the Dissemination of Intelligence Information," June 15, 1996, http://fas.org/irp/offdocs/dcid1-7.html.
[108] ISAF, GCTF and three bi-laterals. See Hund, USAF, "Mission Partner Environment DISA Multinational Information Sharing."
[109] Mitchell, *Network Centric Warfare*, p. 57.

sharing between Five Eyes nations by connecting national SECRET networks through national gateway proxy servers."[110] Pegasus is governed by the Combined Communication Electronics Board (CCEB).[111] The CCEB is the forum through which the United States and its principal Western allies tackle the problems associated with information exchange. Since 2004, the CCEB has endeavoured to move its members away from multiple bi-lateral network connections and toward a single coalition domain.[112] Pegasus has worked toward these goals in a staged approach, first delivering email improvements, followed by two-way web browsing, secure voice transmission, various command and control applications, and chat room applications. In the case of Australia, these have rolled out progressively since 2009.[113] As a permanently deployed network (unlike CENTRIXS enclaves), Pegasus allows for proper accreditation of users and a greater level of standardisation, as well as a higher bandwidth permitting rapid information sharing.[114] It remains to be seen what further progress the GCMP will achieve in this area. It is clear, nonetheless, that the design of its new architecture is geared toward the incremental reconciliation of the paradox of NCW; the tension between sharing and security in the allied environment.

5.4. Japan and SIPRNET

Japan does not currently have access to SIPRNET,[115] though as described above there has existed a CENTRIXS - J 'enclave' designation, primarily utilised during RIMPAC exercises.[116] The familiar issues of time wasting, communication difficulties, and out of date or

[110] Hund, USAF, "Mission Partner Environment DISA Multinational Information Sharing."
[111] The CCEB member nations are Australia, Canada, New Zealand, the United Kingdom, and the United States. The CCEB Board consists of a senior C4 representative from each member nation.
[112] Mitchell, *Network Centric Warfare*, p. 55.
[113] Hund, USAF, "Mission Partner Environment DISA Multinational Information Sharing."
[114] Mitchell, *Network Centric Warfare*, p. 57.
[115] Asia-Pacific Center for Security Studies Honolulu, "Enhancing Trilateral Disaster Preparedness and Relief Cooperation Between Japan, U.S. and Australia: Approaches from Various Civil-Military Perspectives Joint Research" (APCSS, July 2013), p. 110.
[116] Mitchell, *Network Centric Warfare*, p. 57.

contradictory information caused by incompatible information systems was recently manifest during Operation Tamodachi, the US HA/DR response following the 2011 earthquake and tsunami in north-eastern Japan.[117] Several recent developments, however, suggest this situation is evolving. The upcoming chapter detailing Japan's progress in these areas will provide a thorough overview. For now, perhaps the most compelling indication of an impending move in this direction is a recent report citing planned modifications to the combat system on JMSDF ships that would enable them to fight as part of the US Navy's NIFC-CA concept.[118] This is accompanied by the public broaching of combined US Navy/JMSDF patrols in the South China Sea.[119] Further evidence that components of the JMSDF could be folded into NIFC-CA is suggested by Japan's interest in several other of the components that are accommodated under the NIFC-CA concept. Briefly, this includes its interest in buying four E-2D Advanced Hawkeye ISR aircraft for the JASDF, the upgrade of two of its Atago-class destroyers to Aegis Baseline-9 for ballistic-missile defence, as well as its 2011 decision to select the F-35 JSF as its next generation fighter.[120] All these platforms and capabilities have significant roles in NIFC-CA, which is itself essentially a networking concept that would fundamentally require greater JSDF access to real-time information sharing. Apart from NIFC-CA, Japan's cooperation with the US on ground and sea-based

[117] Asia-Pacific Center for Security Studies Honolulu, "Enhancing Trilateral Disaster Preparedness and Relief Cooperation between Japan, U.S. and Australia: Approaches from Various Civil-Military Perspectives Joint Research."

[118] Sam LaGrone, "Planned Japanese Self Defense Force Aircraft Buys, Destroyer Upgrades Could Tie Into U.S. Navy's Networked Battle Force," *USNI News*, accessed June 15, 2015, http://news.usni.org/2015/06/10/Planned-japanese-self-defense-force-aircraft-buys-destroyer-upgrades-could-tie-into-u-s-navys-networked-battle-force.

[119] Franz-Stefan Gady, "Japan's Top Military Officer: Joint US-Japanese Patrols in South China Sea a Possibility," *The Diplomat*, accessed June 26, 2015, http://thediplomat.com/2015/06/japans-top-military-officer-joint-u-s-japanese-patrols-in-south-china-sea-a-possibility/; Sam LaGrone, "U.S. 7th Fleet CO: Japanese Patrols of South China Sea 'Makes Sense,'" *USNI News*, accessed January 30, 2015, http://news.usni.org/2015/01/29/u-s-7th-fleet-co-japanese-naval-forces-patrol-south-china-sea.

[120] LaGrone, "Planned Japanese Self Defense Force Aircraft Buys, Destroyer Upgrades Could Tie Into U.S. Navy's Networked Battle Force."

BMD is significant and expanding,[121] as is its interest and progress in amphibious warfare in a joint, networked environment with the USMC.[122] The political and economic components of Japan's evolving security posture are also aligning.[123] The recently updated Guidelines for Japan-U.S. Defense Cooperation explicitly iterate the shift. It states

> Recognizing that common situational awareness is essential, the two governments will enhance intelligence cooperation and information sharing at all levels, including the national strategic level. In order to enable robust intelligence cooperation and information sharing, the two governments will continue to promote cooperation in strengthening policies, practices, and procedures related to the protection of classified information. The two governments also will explore opportunities for cooperation with partners on information sharing.[124]

There is also reference to improving "real-time information exchange."[125] These developments are presented here to suggest that Japan's access to and integration with US ICT's as represented by SIPRNET may be set to increase more on par with that of the Five Eyes. Again, the new architecture underpinning the US' GCMP will provide a clearer picture as it begins to roll out.

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[121] Franz-Stefan Gady, "US and Japan Successfully Test Ballistic Missile Killer," *The Diplomat*, accessed June 15, 2015, http://thediplomat.com/2015/06/us-and-japan-successfully-test-ballistic-missile-killer/; Staff writer, "Japan Test Fires Its First Raytheon-Built Standard Missile-3," *Space War*, December 20, 2007, http://www.spacewar.com/reports/Japan_Test_Fires_Its_First_Raytheon_Built_Standard_Missile_3_999.html.
[122] Franz-Stefan Gady, "Meet Japan's Newest Aircraft for Defending the Senkaku Islands," *The Diplomat*, accessed May 7, 2015, http://thediplomat.com/2015/05/meet-japans-newest-aircraft-for-defending-the-senkaku-islands/; Benjamin Schreer, "Japan's Emerging Amphibious Capability" (Australian Strategic Policy Institute, June 3, 2013), http://www.aspistrategist.org.au/japans-emerging-amphibious-capability/.
[123] See chapter: Japan.
[124] Ministry of Defense, "The Guidelines for Japan-U.S. Defense Cooperation" (Government of Japan, April 27, 2015), p. 23, http://www.us.emb-japan.go.jp/english/html/Guidelines_for_Japan_US_Defense_Cooperation.pdf.
[125] Ibid., p. 6.

5.5. Not another NATO

As an outside observer of the ongoing process, one can only conclude that while the new JIE architecture being built to support the MNIS portfolio is new, its security structure is largely consistent with that prior. CENTRIXS that access the SIPRNET via a secure gateway appear to remain the method through which all non-US entities get 'on the net' at an operational level, while improvements in the way information is identified and categorised may be realised via artificial intelligence and the use of automated 'tear lines'. These efforts are consistent with the ongoing enterprise now well over a decade old, reflected here in a 2004 report, "CENTRIXS dissemination capabilities must become even more robust as the trend to move more command and control operations to the coalition networks continues. CENTRIXS is designed to one day form a single, common, global, multinational data network."[126] The transmission of information from SIPRNET to enclaves may also be sped up by the move to a cloud computing model. The same report states "a certified security technology solution to allow confidential, multi-level information sharing over a single network is desperately needed. Security technology to allow separate, simultaneous communities of interest across common network transport is key to future coalition networking."[127] Whether or not cloud-computing is that 'certified security technology solution' remains to be seen. The Combined Federated Battle Laboratories Network (CFBLN) is the primary forum through which the Five Eyes continue to evaluate the shortfalls in multinational information sharing. Unlike CENTRIXS it provides continuously available network infrastructure to test the latest technologies for easier transitions into the coalition network environment. The primacy of the Five Eyes nations as integrated 'first receivers' of whatever enhanced networking and sharing capabilities realised by the MNIS is also implied by the CFBLN. All things considered,

[126] Boardman and Shuey, "Combined Enterprise Regional Information Exchange System (CENTRIXS)," p. 2.
[127] Ibid.

it appears safe to assume the evolution of the fundamental information-sharing capabilities that underpin a vision of allied NCW continues. The technical solutions to enhanced connectivity continue to develop in confluence with the political constraints that make them necessary. The new digital architecture, and the security structures it features, appears to be designed to mitigate the 'clunkiness' of the incumbent system of networks. A revolutionary attitude to information sharing protocols by the US is not on the cards. If anything, these moves reflect the perceptions of naval officers serving in the Persian Gulf as reported by Mitchell, who thought that the US "did not want to get into a 'NATO-type situation' where everything from strategic policy to operational planning and tactical targeting had to be negotiated in advance."[128]

The analysis presented here is included to reinforce the emergent centrality of the information domain in direct relation to the military effectiveness it supports under the NCW rubric. It also highlights how the technical and political factors converge in shaping the relationships between actors in the networked environment. As the new digital architecture rolls out, it is shown here how it is increasingly apparent that a very small group of actors appear capable of capitalising on the advantages that allied NCW offers. The already privileged access of the Five Eyes looks to be incrementally improving, while the access and connectivity of broader coalition nations may improve as a result of this rather than directly. The evidence indicates these efforts are accelerating. A memo in February 2015 was sent by the deputy commanders of five US regional commands urging Defense Department officials to step up the pace on fielding the department's interoperable coalition warfighting

[128] Mitchell, *Network Centric Warfare*, p. 60.

network.[129] The memo called for the Mission Partner Environment common network to have initial operational capability by the end of fiscal year 2016, and for the permanent network architecture in place by 2021. The relevance for this thesis is that in the Western Pacific, the vertical alliance model is advancing in the case of Australia, with significant progress reportedly made on interoperability during Talisman Sabre 2015. For Japan, its progress is less advanced, but accelerating, for a number of reasons to be discussed, while its trajectory is in accord.

5.6. Blockchain

One technology set that could offer significant opportunity to advance expedited information sharing in secure coalition environments is distributed ledgers, known as blockchains.[130] Blockchain emerged as the technology underpinning the digital currency Bitcoin in 2009. Bitcoin uses a distributed public ledger system to record and verify digital Bitcoin transactions by a network of uses without the need for identity or for a centralized verifying authority. This is achieved by two protocols: Consensus and Proof of Work. Nodes in the network can download a record of every transaction ever recorded. These transactions have been separated into 'blocks', and each new block, if verified as correct by more than half of the network (consensus), is then encrypted using the one-way hash SHA-256 and linked to the next block. 'Miners' compete using computing power to complete a complex mathematical problem which does the 'work' of verifying the block. The winning miner receives Bitcoin as payment. Once hashed, the block and its digitial contents cannot be altered in any way without the brute force computing power of more than half of the

[129] George I. Seffers, "Becoming Proactive on International Interoperability," *SIGNAL Magazine*, December 1, 2015, http://www.afcea.org/content/?q=Article-becoming-proactive-international-interoperability.
[130] For comprehensive overview of blockchain technology see Hexayurt Capital, 'Building the Hyperconnected Future on Blockchains', *World Government Summit*, February 2017, https://worldgovernmentsummit.org/api/publications/document?id=c5717dc4-e97c-6578-b2f8-ff0000a7ddb6

network. Thus consensus and Proof of Work secure the blockchain. Proof of Work is resource heavy and has issues with scalability. A range of alternative protocols are being explored by a rapidly expanding blockchain community, and Bitcoin's original concept is being rapidly expanded and evolved.[131] Ethereum emerged in 2013 with a multi-purpose blockchain that can support endless developer-led blockchain applications, and the Ethereum Enterprize Alliance emerged in early 2017 with a consortium of tech companies, banks, and other stakeholders to further the development and uptake of blockchain technology.[132] Ethereum has been described as a 'World General Purpose Computer', and as the 'Internet 2.0.'[133] It represents a paradigm shift from *network* security to *information* security with distinct application to information security in the coalition environment.

Blockchain has the potential to accelerate the operational consolidation of NCW, and thereby usher in a new paradigm of networked security. It offers a level of security and assurance in digital information systems so far conspicuously absent. Blockchain's potential must be understood in the aforementioned context of these inherent vulnerabilities. It offers to neutralize an entire vector of cyber-attack – code injection – and deliver standards of immutability and verification of digital data systems.[134] The scope of its potential cross-sector applications is limitless. An IBM survey in 2016 of 200 government leaders across 16 countries found that 14 per cent expected to have blockchain-based systems in place by the end of 2017. Mass adoption was expected by 2018, with late comers using the technology

[131] Graydon, Carter. 'Bitcoin's Future: Proof-of-stake vs Proof-of-work', *CryptoCoinsNews, https://www.cryptocoinsnews.com/bitcoins-future-proof-of-stake-vs-proof-of-work/*
[132] Popper, Nathaniel. 'Business Giants to Announce Creation of a Computing System Based on Ethereum', *The New York Times,* https://www.nytimes.com/2017/02/27/business/dealbook/ethereum-alliance-business-banking-security.html
[133] Joseph Lubin, *Blockchain Summit*, Adelaide, 3 March 2017.
[134] Vince Alcazar, "Blockchain Technology Could Minimize Risk from Data Attacks," C4ISRNET, December 22, 2016, http://www.c4isrnet.com/articles/blockchain-technology-could-minimize-risk-from-data-attacks.

by 2020.[135] IBM and Microsoft are in the process of building entire blockchain ecosystems.[136] A bipartisan Blockchain Caucus was formed last year in the US Congress that includes the President's pick for Director of Office of Management and Budget, a long time blockchain advocate, Rep. Mick Mulvaney.[137] Across North America, Europe, Asia, the Middle East, and elsewhere, state and private entities are positioning themselves.[138] As militaries enter the digital age, blockchain technology is un-ignorable.

Public appreciation of this is in its infancy. A handful of unclassified publications citing the potential of blockchain in military applications exist.[139] Indicators of its impending significance are nonetheless bountiful. In 2016 DARPA solicited proposals under its Small Business Innovation Research Program for a Secure Messaging Platform using blockchain technology.[140] DARPA also awarded a $1.8 million contract to U.S. company Galois in 2016 to formally verify Estonian company Guardtime's Keyless Signature Infrastructure product with

[135] Jerry Cuomo et al., "Building Trust in Government: Exploring the Potential of Blockchains" (IBM Institute for Business Value, 2016), 3, http://www.the-blockchain.com/docs/IBM%20Report%20-%20Blockchain%20-%20%20Building%20Trust%20in%20Government.pdf.
[136] Thor Olavsrud, "IBM Building Blockchain Ecosystem," CIO, December 6, 2016, http://www.cio.com/article/3147358/it-industry/ibm-building-blockchain-ecosystem.html; Michael del Castillo, "Microsoft Unveils Project Manifest, A Plan For Blockchain Product Tracking," CoinDesk, January 25, 2017, http://www.coindesk.com/microsoft-unveils-project-manifest-a-plan-for-product-tracking-via-blockchain/.
[137] Jessie Willms, "New Bipartisan Blockchain Caucus Will Promote the Use of Bitcoin and Blockchain Technology," Bitcoin Magazine, September 28, 2016, http://bitcoinmagazine.com/articles/new-bipartisan-blockchain-caucus-will-promote-the-use-of-bitcoin-and-blockchain-technology-1475074123/.
[138] Jon Southurst, "Chinese Government Publishes Blockchain Financial Whitepaper," *Bitcoin News* (blog), October 19, 2016, https://news.bitcoin.com/chinese-government-blockchain-whitepaper/; Noelle Acheson, "Blockchain as a Geopolitical Tool," CoinDesk, February 6, 2017, http://www.coindesk.com/blockchain-as-a-geopolitical-tool/; Michael del Castillo, "Global Banks Test Ripple's Digital Currency in New Blockchain Trial," CoinDesk, October 20, 2016, http://www.coindesk.com/global-banks-test-ripples-digital-currency-new-blockchain-trial/; Matthew Sorell, "What Australia Can Learn about E-Government from Estonia," The Conversation, October 6, 2015, http://theconversation.com/what-australia-can-learn-about-e-government-from-estonia-35091.
[139] Neil B. Barnas, "Blockchains in National Defense: Trustworthy Systems in a Trustless World" (Blue Horizons Fellowship Air University, June 2016), http://www.dtic.mil/doctrine/education/jpme_papers/barnas_n.pdf; Sanatan Kulshrestha, "Military Applications of Blockchain Technology," Centre for Land Warfare Studies, November 23, 2016, http://www.claws.in/1666/military-applications-of-blockchain-technology-sanatan-kulshrestha.html.
[140] Author not supplied, "Secure Messaging Platform," SBIR, accessed February 26, 2017, https://www.sbir.gov/sbirsearch/detail/1144411.

a view to securing critical weapons systems using blockchain technology.[141] NATO's NCI Agency, charged with developing its secure networked information infrastructure, in 2016 held an Innovation Challenge which included a request for proposals under the 'military applications of blockchain' heading.[142] Clearly, applications of blockchain technology in the defence space are set to grow rapidly across a variety of areas where security in the storage and transfer of information is critical.

Its impact on the consolidation of networked coalition operations needs highlighting. Its apparent from DISA's multiyear efforts and the publicly available evidence cited above that fundamental issues surrounding the expeditious flow of information across classification systems and levels is hampered by a combination of technical, organisational, and political obstacles. 'Tear lines', NOFORN[143] classifications, and inefficient gateways are among a range of issues contributing to the inefficiency of information flows in the coalition environment. All boil down to the tension between security and sharing, which in turn acts as a brake on truly networked operations. Moreover, its well understood that the operational imperatives of information security standards are variegated in any coalition environment, depending on a number of variables. Over-classification for the given circumstances may occur frequently, while under-classification is an unacceptable security risk. This over/under risk can be expedited because blockchain encryption can be modulated. Flexible information security standards offered by this rheostat feature of blockchain technology could help consolidate gains in the efficacy of networked coalition

[141] Martin Ruubel, "Galois and Guardtime Federal Awarded $1.8M DARPA Contract to Formally Verify Blockchain-Based Integrity Monitoring System," guardtime, September 13, 2016, https://guardtime.com/blog/galois-and-guardtime-federal-awarded-1-8m-darpa-contract-to-formally-verify-blockchain-based-inte.
[142] NCI Agency, "Innovation Special," *Communicator*, 2016, https://www.ncia.nato.int/About/Communicator/NCI%20Agency%20Communicator%202016%20Issue%202%20Special%20Innovation%20Edition.pdf.
[143] Not for release to foreign nationals.

operations. In short, blockchain has the potential to expedite new levels of military cooperation between allies and partners based on verifiable mathematical certainty.

6. Networking production and knowledge

6.1. Leveraging the global value chain

The organisational capacity of states seeking enhanced security to align under a vertical alliance model could hinge on their ability to bring the significant productive resources at their disposal together. Further, the above emphasis on standardisation and interoperability requires the production and delivery of good and services supporting these ends. The business-to-business relationships among these providers, criss-crossing the public/private spheres as well as international boundaries, represent the architecture underpinning any such effort. These imperatives reflect much broader trends in the global economy. The falling cost of trade and the lowering of restrictions on the movement of knowledge have led to the emergence of complex production networks enabled by information technologies known as global value chains (GVC).[144] The UN's 2013 *World Investment Report* notes GVC's coordinated by transnational corporations account for 80 per cent of global trade.[145] GVC's are those networks in which "intermediate goods and services are traded in fragmented and internationally dispersed production processes."[146] Their success is heavily dependent on their ability to harness dispersed and specialised knowledge that incumbent production chains had made less accessible. Firms that can adapt to take advantage of GVC's stand to reap significant benefits in efficiency, resilience, and productivity. The agility required to

[144] Scott Miller et al., "Project Brief: Harnessing the Opportunity for Defense Integration in Global Value Chains" (Center for Strategic & International Studies, May 14, 2014), http://csis.org/publication/project-brief-harnessing-opportunity-defense-integration-global-value-chains.
[145] UN Conference on Trade and Development, "World Investment Report 2013: Global Value Chains: Investment and Trade for Development" (New York and Geneva: United Nations, 2013), p. x, http://unctad.org/en/PublicationsLibrary/wir2013_en.pdf.
[146] Ibid.

compete amidst this latest wave of globalisation also forces a discipline on firms that in turn makes them even more effective at conducting business via GVC's, in something of a virtuous circle. The defence industrial-commercial base that will supply any allied NCW model is operating in this dynamic environment,[147] while at the same time the international arms market gets increasingly competitive.

6.2. Defence industry liberalisation

Since roughly the end of the Cold War, the US lead in leveraging proprietary technology to maintain a margin of military-technical dominance has steadily eroded. The defence industrial base has been slower to adapt to the emerging environment than other industries, largely due to the inherent restrictions associated with the security-sensitive knowledge in which it trades. The capacity to access emerging technologies, such as those associated with the third offset strategy outlined in chapter I, is threatened by this lag. To counter this, greater defence industry integration into GVC's is imperative. This involves a shift away from the old model in which the state relies on the defence industrial base to be largely self-sufficient, to one which includes the more extensive use of licensing and partnership arrangements. The embracing and leveraging of commercial-off-the-shelf technologies will also play an increasingly important role, as we have already seen in critical components of the emerging digital architecture supporting the Joint Information Environment as well as in space.[148] The US DoD has made its intention to pursue rectification

[147] See Weiss, *America Inc.?*

[148] Patricia Moloney Figliola, Carl E. Behrens, and Daniel Morgan, "U.S. Space Programs: Civilian, Military, and Commercial" (Congressional Research Service, June 13, 2006), pp. 5–7, http://www.fas.org/sgp/crs/space/IB92011.pdf; Colin Clark, "Elon's SpaceX Gets Certified For National Security Launches; Can You Say Disruption?," *Breaking Defense*, accessed May 30, 2015, http://breakingdefense.com/2015/05/elons-spacex-gets-certified-for-national-security-launches-can-you-say-disruption/.

in this area clear.[149] The 2013 DoD *Annual Industrial Capabilities Report to Congress* states, "Now, more than ever, we must accept that DoD does not control the supply chain that supports production."[150] The advantages to be gained by adopting an 'open innovation' model, which leverages the innovative capacity of huge networks of small and medium enterprises that are eager to license and sell their intellectual property, rather than relying on internal research and development infrastructure, are simply too compelling to ignore, not to mention urgent.[151] While DoD is not in a position to fully adopt open innovation due to the inherent security risks, the commercial dynamism of GVC's are widely understood to be under-utilised under the extant arrangements, putting DoD "directly at odds with commercial reality."[152] The imperative for gains in efficiency is further compelled by the tightening budget scenario.[153]

6.3. Allied GVC's

The CSIS as part of its Federated Defense Project released a study, *Leveraging Global Value Chains for a Federated Approach to Defense,* in December 2014.[154] It addresses many of these issues and plots the path ahead. One of the key areas identified by the study was the potential for the US to reduce or remove barriers to cooperation with allies and international partners regarding value chain integration. It found that DoD can achieve "significant gains by easing restrictions on global business-to-business interaction in the

[149] Freedberg Jr., "'We've Got To Wake Up'"; Grady, "Kendall"; Claudette Roulo, "Defense.gov News Article: DoD Seeks Next-Generation Technologies, Kendall Says," accessed November 20, 2014, http://www.defense.gov/news/newsarticle.aspx?id=123355.
[150] Under Secretary of Defense for Acquisition, Technology, and Logistics, "Annual Industrial Capabilities Report to Congress," p. 1.
[151] "Thirty-Eight Think Tank Experts Urge Defense Reform," *CSBA*, April 29, 2015, http://csbaonline.org/2015/04/29/thirty-eight-think-tank-experts-urge-defense-reform/.
[152] Scott Miller et al., "Leveraging Global Value Chains for a Federated Approach to Defense" (Center for Strategic & International Studies, December 29, 2014), p. v, http://csis.org/publication/leveraging-global-value-chains-federated-approach-defense.
[153] Miller et al., "Project Brief: Harnessing the Opportunity for Defense Integration in Global Value Chains."
[154] Miller et al., "Leveraging Global Value Chains for a Federated Approach to Defense."

defense industry wherever feasible," and these gains can "best be delivered by a cadre of suppliers, innovators, and producers that includes the industries of the United States' trusted partners and allies."[155] It further argues that allied GVC's enabled by a bottom-up market approach to innovation will be *essential* to the realisation of military-technical interoperability. On this model, the commercial sector drives innovation; governments are the critical enablers when they can reduce barriers to cooperation. In addition, this level of enforced adaption can unleash further efficiencies and advantages for each of the nodes within such a network. The cost of being a connection in a network of knowledge and production such as this is driven down relative to the cost of being excluded. A GVC with US DoD at its nexus would be a commercial vertical alliance defined, primarily, by the size and scope of DoD. If it has been slow to move in taking advantage of GVC's, it is not as if another actor has moved in advance. Nor do the US' primary global security competitors in Russia and China boast the network of allies who will form the fundamental architecture of a security federation of this type.

7. Conclusion

The perceived strategic need for a particular innovation is a powerful driver, even when technologies have not fully matured. This was reflected, for example, in the history of ballistic-missile defence, which continues to be pursued while arguably remaining a step behind the capabilities associated with offensive strike.[156] While the debate over the operational efficacy of BMD was decades old in 2018, the consensus is that it faces ongoing technical and financial obstacles which will only steepen with time. Nonetheless, the BMD, a military-technical innovation for which very few retain a sanguine outlook, has been, since

[155] Ibid., p. v.

[156] For comprehensive overview see Davies and Lyon, "Ballistic Missile Defence: How Soon, How Significant, and What Should Australia's Policy Be?"

its inception, one of the most important factors influencing strategic studies. It was pivotal arguably in the Cold War and was fundamental in strategic developments in Europe and Asia in the ensuing era. The pursuit of allied NCW can be thought of in an analogous way.

As this chapter highlighted, its realisation is dependent on a host of variables about which the literature so far resides across a spectrum ranging from the cautiously sanguine to the outright hostile. Allied NCW nonetheless represents a body of military-technical innovations that are both driving and being driven by strategic imperatives. The effects on alliance dynamics are significant. Here we see the network organising principle of fitness at work. From Mitchell: "If smaller powers wish to have any part in the military operations influencing the current strategic environment, they must seek greater interoperability with America's new military operating system. If they do not do so, they risk becoming irrelevant."[157] Moreover, the effect of the emergence of allied networks of combat power, enabled by the requisite level of alignment across the technical, financial, organisational, and political domains, have strategic implication for those outside the network that are only beginning to be understood. Here we see the principal binary of the network age of connectivity vs. isolation at work. Information 'release-ability' protocols, therefore, have an abiding centrality not only in immediate operational matters by in a long-term strategic sense as well. This chapter has shown how these protocols are not merely technical matters.

The primary constraints on the realisation of allied NCW are to be found under the rubric of organisational capacity, which is a catch-all term for the fitness connectivity product of the scale-free network model. This chapter touched on the impacts of innovation on organisational culture in militaries. It applied those parameters to the organisation of

[157] Mitchell, *Network Centric Warfare*, p. 71.

multinational military groupings, finding those impacts magnified. NCW as an extant example of a significant military-technical innovation is making its way incrementally into the tactical, operational and strategic levels of international military partnering. It is forcing organisational adaption on those actors with the will and capacity to remain connected, and the bar is set extremely high. The United States, as lead actor and administrator of the emerging network retains the role of 'switcher' or 'gatekeeper', enabled most importantly by its superiority in the gathering, exploitation and dissemination of information. This chapter highlighted how this is manifest at the level of operational information sharing via SIPRNET. But the US is also racing so quickly and so far ahead of its allies in the realisation of NCW that it risks opening up an insurmountable gap, as cautioned by Paul Mitchell.[158] Mitchell left the door ajar, however. Blockchain technology is identified as a potential game-changer. By highlighting the critical enabling aspects of organisational capacity, this chapter sought to pry the door open in order to reveal the machinations that underlie constraints. It finds that an alignment of organisational variables required to realise allied NCW resides under the vertical alliance concept introduced in chapter III.

Finally, the chapter highlights the importance of the productive capacity on which any military-technical innovation rests. With the level of standardisation and interoperability required for success being so high, existing modes of production typical of the US defence industrial base are insufficient. Globalisation of chains of not only production but knowledge ushered in by the IT revolution offer a level of efficiency and dynamism that, while attractive, is fundamentally at odds with the defence industry status quo. The ability to leverage aspects of the GVC appropriate for defence projects has a significant bearing on the realisation of allied NCW. In addition, these value chains are networks that exhibit

[158] Ibid., pp. 71–73.

similar lock-in/lock-out dynamics as the operational networks they produce the components for. Strategic competition in the networked information age can thus be described as a battle of networks.

Chapter V. A battle of networks?

1. Introduction

This chapter addresses the discourse and extra-discursive practices associated with the US-led effort to incorporate the operational concepts of joint warfighting and apply them to the Western Pacific region. It argues that such efforts took place under a military-strategic orientation predicated on the traditional hub-and-spokes view of the region with some minor amendments, concealing and at times conflicted with the growth and evolution of the scale-free network model which remains unacknowledged. Tensions between the two orientations are observable nonetheless in debates and in some cases controversies over the US approach to the region across tactical, operational and strategic levels. Actor-Network Theory encourages us to focus on these controversies, as they are sites of undesignated and unsanctioned insight. Section 2 overviews the ongoing historical effort to achieve greater 'jointery' across the US's military services and the emergence of Air-Sea Battle as a joint operational concept. Section 3 discusses critiques and limitations of the concept at both the operational and strategic levels. Section 4 highlights how the pursuit of these concepts is further evidence of the competition for fitness connectivity product playing out within both the US military services and the those of its allies in the Western Pacific.

2. The operational level – *a battle of connection*

2.1. The challenge of 'jointery'

Within the US military, the desire to leverage the power of the network gave rise to the need for separate services operating disparate platforms and communication technologies

to pursue joint interoperability. From there, such a model could be extended to incorporate the military forces of its allies. Achieving the joint interoperability to function as a single networked force has been a work in progress for over two decades, and is ongoing. In May 1992 Commander at the National War College, later to become Admiral, James Stavridis released a paper titled *A New Air Sea Battle Concept: Integrated Strike Forces*.[1] The paper implores the US armed services of the need to think about "organizing, training, deploying, and employing integrated air and sea power"[2] in response to the evolving threat environment. Stavridis defines the threat environment at the time in terms of the dissolution of the Soviet Union, the proliferation of advanced weaponry, and ongoing instability particularly in the Third World, in which the US and its allies harboured increasing interests in relation to markets and resources.[3] According to the paper, this environment would see the US responding to multiple threats, geographically and politically isolated from existing bases and alliance structures, in a wide variety of demanding and unpredictable scenarios.[4] The paper recommends the strategic requirement could be facilitated by the development and implementation of a military concept comprised of "immediately deployable, highly capable, and fully integrated forces."[5]

The concept of more deeply integrating the services of the US armed forces was certainly nothing new. For much of the Cold War, US military strategy was dominated by the threat of

[1] James Stavridis, "A New Air Sea Battle Concept: Integrated Strike Forces" (DTIC Document, 1992), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA436862.
[2] Stavridis, 3.
[3] Stavridis, 2.
[4] Ibid., 3; See also leaked version of 1992 Defence Planning Guidance, Patrick E. Tyler, "U.S. STRATEGY PLAN CALLS FOR INSURING NO RIVALS DEVELOP," *The New York Times*, March 8, 1992, sec. World, http://www.nytimes.com/1992/03/08/world/us-strategy-plan-calls-for-insuring-no-rivals-develop.html.
[5] Stavridis, *A New Air Sea Battle Concept*, p. 3.

a Soviet land invasion on the plains of Europe, and the Air Land Battle Doctrine[6] was the centrepiece. The essence of the concept involved Air Force strike aircraft, Army indirect fires, and Special Forces conducting rear-area attacks and interdicting second-echelon forces far behind the forward edge of the battle area, thereby disrupting the capacity to bolster enemy forces and creating an advantage for US and allied forces.[7] For this, Army and Air Force would need to cooperate, and the doctrinal shift was expressed in the concept of Air Land Battle. While initially only Army and not Air-Force doctrine, cooperation increased in 1983 when the chiefs of each Service signed a formal memorandum of understanding to embed the commitment to jointly conduct the Air Land Battle doctrine. Later that year a second memo promised to "explore thirty-one specific initiatives regarding air-ground operations associated with Air Land Battle".[8] Despite these commitments and successes, the effort remained highly constrained and problematic, and served as a reminder of how difficult inter-service cooperation can be.[9]

The Goldwater-Nichols Department of Defense Reorganisation Act of 1986 compelled the military services, by force of law, to interact jointly. The Act "solidified the joint requirements for education and promotion, created the position of vice-chairman of the Joint Chiefs of Staff, and vested the power to conduct military operations solely with the combatant commanders, who now report directly to the Secretary of Defense and the President."[10] Though a successful piece of legislation and now in its third decade, it was by

[6] Major Thomas J. Gill, "The Air Land Battle - The Right Doctrine For The Next War?," accessed June 27, 2014, http://www.globalsecurity.org/military/library/report/1990/GTJ.htm.
[7] Taken from the outline of Air Land Battle in Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept," 6.
[8] The memo can be accessed at http://www.history.army.mil/books/dahsum/1984/appA.htm.
[9] Summary from Harold R. Winton, "Partnership and Tension: The Army and Air Force Between Vietnam and Desert Shield," *Parameters* 26 (1996): pp. 100–119.
[10] James Stavridis, "Incoming: A Handful of Heretical Thoughts," SIGNAL Magazine, December 1, 2015, http://www.afcea.org/content/?q=Article-incoming-handful-heretical-thoughts.

itself insufficient to build a compelling basis for joint collaboration, integration, and interdependence.[11] A glaring example of the 'stove piping' between air and sea forces was evident in the 1991 Gulf War, when strike plans had to be flown between carriers at sea and airbases ashore due to the incompatibility of the two services' transmission systems.[12] Of Goldwater-Nichols, Stavridis commented in 2015, "It shook us up but might not have taken us far enough down the road to truly joint interagency and international/coalition operations—which collectively represent the future of security in these turbulent times."[13] Three converging trends emerged at the end of the first decade of the 21st century that help explain how the quest for joint interoperability gathered renewed impetus. First, the decision to draw down US commitments in Iraq and Afghanistan were put on a definitive timeline by the Obama administration.[14] In November 2011, President Obama announced that the US "presence and mission in the Asia-Pacific a top priority."[15] Second, the unanticipated economic recession caused by the global financial crisis in 2008, and the consequential restrictions it placed on US defense spending.[16] The Department of Defense, as a consequence, would not only have to be judicious with its spending, but it would have

[11] Rich Ganske, "Joint Action: A Personal Theory of Power," May 28, https://medium.com/the-bridge/joint-action-a-personal-theory-of-power-94288c828e61.
[12] Sydney J. Freedberg Jr., "DoD Sheds First Clear Light On AirSea Battle: Warfare Unfettered," *Breaking Defense* (blog), accessed June 13, 2014, http://breakingdefense.com/2013/06/dod-document-sheds-first-new-light-on-airsea-battle-warfare-unfettered/.
[13] Stavridis, "Incoming."
[14] NBC, msnbc.com, and News Services, "Obama: All US Troops out of Iraq by End of Year," msnbc.com, accessed June 30, 2014, http://www.nbcnews.com/id/44990594/ns/world_news-mideast_n_africa/t/obama-all-us-troops-out-iraq-end-year/; Steve Holland, "Obama Plans to End U.S. Troop Presence in Afghanistan by 2016," *Reuters*, May 27, 2014, http://www.reuters.com/article/2014/05/27/us-usa-afghanistan-obama-idUSKBN0E71WQ20140527.
[15] President Barack Obama, "Text of Obama's Speech to Parliament," The Sydney Morning Herald, accessed May 22, 2014, http://www.smh.com.au/national/text-of-obamas-speech-to-parliament-20111117-1nkcw.html.
[16] See Mark Thomson, "What's Happening to the US Defence Budget?," The Strategist, February 19, 2013, http://www.aspistrategist.org.au/whats-happening-to-the-us-defence-budget/; Sydney J. Freedberg Jr., "Cartwright Targets F-35, AirSea Battle; Warns of $250B More Cuts," *Breaking Defense* (blog), accessed June 30, 2014, http://breakingdefense.com/2012/05/cartwright-savages-f-35-airsea-battle-warns-of-250-billion-mo/.

to find ways to do more with the same or less available forces.[17] And third was the startlingly rapid pace of China's military modernization. China's acquisition of advanced technology and weapons,[18] over the decade prior focused the attention of the US strategic establishment.[19] If the United States and China were to go to war, it would be conflict unlike anything the experienced with the Iraqi military in 1991 and 2003.[20]

Enhanced integration required the breaking down of long-standing barriers between the four armed services of the US Army, Navy, Air-Force, and Marines, and the barriers across domains such as sub-surface, surface, land, air, cyber, and space.[21] Accordingly, the central concept is an unprecedented level of joint integration, of 'warfare unfettered',[22] leading to "air and naval forces that can launch networked, integrated attacks-in-depth to disrupt, destroy, and defeat an adversary's capabilities."[23] Ultimately, it seeks a 'pre-integrated' joint force through shared training, doctrine, and organisation, flowing into interoperability of materials and facilities,[24] and complementary and habitual relationships that provide a joint force commander with a full range of options faced with a capable adversary.[25] The basic idea of integrating modern systems is to create an offensive-defensive matrix that can

[17] Pete Shoemaker, *Who's on First? Command and Control in AirSea Battle* (DTIC Document, 2012), p. 1, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA564005.
[18] Navy Capt. Philip Dupree and Air Force Col. Jordan Thomas, "Air-Sea Battle: Clearing the Fog," accessed June 13, 2014, http://www.armedforcesjournal.com/air-sea-battle-clearing-the-fog-2/.
[19] Sydney J. Freedberg Jr., "The End Of Advantage: Enemies May Catch Up With US Technology — Or Surpass It," *Breaking Defense* (blog), accessed July 1, 2014, http://breakingdefense.com/2012/12/the-end-of-advantage-enemies-may-catch-up-with-us-technology/; Schwartz and Greenert, "Air-Sea Battle."
[20] Mark Perry, "The Pentagon's Fight Over Fighting China," POLITICO Magazine, accessed June 25, 2015, http://www.politico.com/magazine/story/2015/06/pentagon-air-force-navy-fight-china-119112.html.
[21] See Defense Officials, "Defense.Gov Transcript: Background Briefing on Air-Sea Battle by Defense Officials from the Pentagon," accessed July 8, 2014, http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4923; Freedberg Jr., "DoD Sheds First Clear Light On AirSea Battle."
[22] Freedberg Jr., "DoD Sheds First Clear Light On AirSea Battle."
[23] Dupree and Thomas, "Air-Sea Battle: Clearing the Fog."
[24] Harry Kazianis, "Air-Sea Battle Defined," accessed March 13, 2014, http://nationalinterest.org/commentary/airsea-battle-defined-10045.
[25] Philip Ewing, "DoD: 'Pre-Integration' Is the Key to Air-Sea Battle," DoD Buzz, accessed July 2, 2014, http://www.dodbuzz.com/2012/06/05/dod-pre-integration-is-the-key-to-air-sea-battle/.

operate as a cohesive whole.[26] Cross-domain integration seeks this by exploiting advantages in one or more domains in order to disrupt, defeat, or destroy capabilities in another domain. The idea is to give US forces the capacity to "create pockets or corridors of local domain superiority to penetrate the enemy's defenses and maintain them as required to accomplish the mission."[27] This means that US forces need not always employ 'symmetrical' approaches, such as shooting missiles down with missiles, or sinking submarines with other submarines, to counter each threat.[28] Rather, 'jointness' compliments symmetrical means with asymmetrical means,[29] using cross-domain and cross-service capabilities to defeat threats.[30]

2.2. A joint concept for the Western Pacific

Responding to these trends in 2009, and specifically a set of war-games known as *Pacific Vision* conducted in 2008 that featured emerging PLA capabilities,[31] US Secretary of Defense Robert Gates directed Chief of Naval Operations Admiral Gary Roughead and Air Force Chief of Staff General Norton Schwartz to explore how air and naval forces could cooperate to meet new threats.[32] In September of 2009, Roughead and Schwartz signed a classified Memorandum of Agreement endorsing the plan.[33] This joint team interviewed each

[26] Robbin F. Laird, "Game Changer: The F-35 and the Pacific," The Diplomat, accessed June 10, 2014, http://thediplomat.com/2013/04/game-changer-the-f-35-and-the-pacific/.
[27] Joint Chiefs of Staff, "Joint Operational Access Concept (JOAC)" (DoD, January 17, 2012), http://www.defense.gov/pubs/pdfs/JOAC_Jan%202012_Signed.pdf.
[28] Adm Jonathan Greenert and Gen Mark Welsh, "Breaking the Kill Chain," *Foreign Policy*, May 16, 2013, http://www.foreignpolicy.com/articles/2013/05/16/breaking_the_kill_chain_air_sea_battle?wp_login_redirect=0.
[29] Kelly, "Overview of the Air-Sea Battle Concept," p. 4.
[30] Greenert and Welsh, "Breaking the Kill Chain."
[31] Richard Halloran, "War Game Prepares US Forces for next Threat," Taipei Times, October 25, 2008, http://www.taipeitimes.com/News/editorials/archives/2008/10/25/2003426904/1.
[32] Christopher P. Cavas, "USAF, US Navy to Expand Cooperation," *Defense News* 9 (2009).
[33] Kyle D. Christensen, "Strategic Developments In The Western Pacific: Anti-Access/Area Denial And The Airsea Battle Concept," *Journal of Military and Strategic Studies* 14, no. 3 & 4 (2013): 10, http://ww.jmss.org/jmss/index.php/jmss/article/view/481.

combatant commander to better understand the threats.[34] The 2010 Quadrennial Defense Review provided the first official acknowledgement from the DoD that it was working on the Air-Sea Battle (ASB) concept,[35] and of its scope and purpose. It directs the development of the ASB concept to

> [Defeat] adversaries across the range of military operations, including adversaries equipped with sophisticated anti-access and area denial capabilities. The concept will address how air and naval forces will integrate capabilities across all operational domains - air, sea, land, space, and cyberspace - to counter growing challenges to U.S. freedom of action.[36]

While Pentagon officials had been at pains to point out the ASB concept is not directed at any country or region in particular,[37] independent explorations of the concept were less reticent.

The first think tank to tackle the subject was Andrew Krepinevich's Centre for Strategic and Budgetary Assessments (CSBA). In 2010 the CSBA released *Why AirSea Battle?* which focused primarily on the nature of the A2AD challenge posed by the PRC and to a lesser extent, Iran. The CSBA subsequently released their follow up, *AirSea Battle: A Point of Departure Operational Concept* later in 2010. It focused on the offsetting of rival A2AD forces, making the think tank the de-facto go-to source for information and analysis on the ASB concept. China is mentioned some 400 times in the second paper.[38] In January 2012 the

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[34] Jose Carreno et al., "What's New About the AirSea Battle Concept? | U.S. Naval Institute," accessed June 23, 2014, http://www.usni.org/magazines/proceedings/2010-08/whats-new-about-airsea-battle-concept.
[35] Bryan McGrath, "Five Myths about AirSea Battle," *War on the Rocks* (blog), accessed June 30, 2014, http://warontherocks.com/2013/07/five-myths-about-airsea-battle/.
[36] U. S. DoD, *Quadrennial Defense Review Report* (Washington DC: US DoD, 2010).
[37] Christopher P. Cavas, "Air-Sea Battle Office a Nexus of Networking," Defense News, accessed June 30, 2014, http://www.defensenews.com/article/20111109/DEFSECT01/111090301/Air-Sea-Battle-Office-Nexus-Networking.
[38] For example see Krepinevich, "Why AirSea Battle? | CSBA," 10–11, " the major challenge (from a "peer" competitor) is emanating from the People's Republic of China, while the second-order challenge (from a "non-peer" competitor) is most clearly represented in the military activities of Iran ."

DoD released its *Joint Operational Access Concept,* which sits in a by-now well populated hierarchy of strategic documents that explain how 'jointness' will contribute to 'access' being generated and sustained. It is one of several supporting concepts approved by the Chairman of the Joint Chiefs of Staff,[39] is to be complemented by the Joint Concept for Entry Operations,[40] and is guided by the *Capstone Concept for Joint Operations: Joint Force 2020*,[41] also released by the DoD in 2012. These are complemented by the 2012 Defense Strategic Guidance which, under Secretary Panetta, referenced ASB, and downplayed preparation for expansive, land-based, Army-centric military campaigns. A plethora of articles, analyses, arguments, opinions and blogs were written debating ASB, which sits beneath the joint architecture*,* until May 2013 when the Air-Sea Battle Office itself published an unclassified summary version of the concept titled *Air-Sea Battle: Service Collaboration to Address Anti-Access & Area Denial Challenges*.[42]

While the operational details of ASB remained classified, examples of cross-service, cross-domain collaborative responses to these common challenges may include a range of the following, according to Marsh and Jones.[43] Air Force fighters may "assist with combat air patrol for Navy warships. Navy attack submarines could launch cruise-missile attacks against enemy airfields and air defence sites using targeting data provided by Air Force aircraft." [44] Submarines could deploy Special Forces teams to attack enemy A2AD systems. Air Force bombers could "conduct maritime strike and minelaying operations as Navy fighters escort

[39] Dupree and Thomas, "Air-Sea Battle: Clearing the Fog."
[40] Joint Chiefs of Staff, "Joint Concept for Entry Operations", April 7, 2014, http://www.dtic.mil/doctrine/concepts/joint_concepts/jceo.pdf accessed 2/7/14.
[41] Joint Chiefs of Staff, "Capstone Concept for Joint Operations: Joint Force 2020" (DoD, September 10, 2012), http://www.dtic.mil/doctrine/concepts/ccjo_jointforce2020.pdf.
[42] Kelly, "Overview of the Air-Sea Battle Concept."
[43] See Kevin Marsh and Christopher M. Jones, "From Rivals to Partners: AirSea Battle and the US Air Force–Navy Relationship," *Defense & Security Analysis*, July 13, 2015, 1–14.
[44] USAF F-22 Raptors have been equipped to transmit targeting data to Navy submarines and surface warships to facilitate cruise missile strikes.

them to their targets."[45] The effective implementation of ASB is therefore heavily dependent on interoperability across the two services. Progress is being pursued via various "integrated exercises to practice data sharing, transmitting of targeting information, and joint command and control procedures," examples of which include the "*Valiant Shield* exercise in the Pacific, *Razor Talon* off the North Carolina coast, and the Navy-led *Global 13* exercise – and training and education via the Marine Corps *Expeditionary Warrior*, Army *Unified Quest*, Navy *Global*, and Air Force *Unified Engagement* war games which all featured ASB-related objectives in 2012."[46] Sticking points remain. The Air Force's top 5th generation platform, the F-22 Raptor, cannot currently communicate with legacy aircraft in the Navy's carrier air-wing. The F-35's that are being incorporated into each service will need to seamlessly communicate not only with each other but with various legacy platforms and weapons systems across each of the services.[47] Beyond interoperability, the operational concepts of each service need to be fully integrated. The Navy's NIFC-CA concept needs to be able to communicate and share operational information with Air Force concepts currently under development. In short, this requires institutions "to develop and implement an integrated philosophy of air warfare that is a noteworthy break from tradition."[48]

2.3. Inter-service rivalry

Aside from the external controversy regarding just who ASB was being aimed at, a subsequent and perhaps even greater stir had been caused inside the US military. The explicit focus on "air and naval forces" notably excluded the Army. The centrality of the

[45] USAF B-1 bombers are capable of carrying the Long-range Anti-Ship Missile as well as naval mines.
[46] USS George Washington Public Affairs, "Exercise Valiant Shield Kicks Off," America's Navy, September 15, 2012, http://www.navy.mil/submit/display.asp?story_id=69600.
[47] Dave Majumdar, "The Fog of War Just Got Thicker: U.S. Warplanes Have Trouble Communicating with Each Other," Text, The National Interest, accessed January 8, 2015, http://nationalinterest.org/feature/the-fog-war-just-got-thicker-us-warplanes-have-trouble-11975.
[48] Marsh and Jones, "From Rivals to Partners," p. 8.

proud American ground forces in fighting its future wars was under siege, and the ASB concept reportedly pitted Army Chief of Staff Gen. Ray Odierno against his Joint Chiefs of Staff colleagues in a bitter dispute over future funding for their respective services.[49] Critics of ASB saw it as little more than a cynical budget grab.[50] Other have attacked the concept as needlessly provoking China, ignoring the risks of nuclear escalation, being vulnerable to asymmetric disruption, and being unaffordable.[51] Compounding the tension, the Army was set to be pared down in size - from 570,000 in 2011 to 450,000 in 2017,[52] and its recent experiences in Afghanistan and Iraq fuelled the perception that the days of large-scale deployment of American ground troops, particularly in a counter-insurgency capacity, may have passed. The Navy and Air Force, in contrast, had been institutionalising deeper integration since the 1990's, particularly in joint air operations. While never clear of inter-service feuding, the swapping of air crews, tacticians, and intelligence officers began to smooth out institutional differences.[53] During the first several months of *Operation Enduring Freedom* in southern Afghanistan, carrier-based aircrews became dependent on Air Force tanker refuelling capabilities for operations. The evident success of this closer integration in the early 2000's provided the ASB concept with enhanced credibility, and laid the foundations for further collaboration. In addition, the Air Force and Navy shared similar concerns about the potential of China's hardening A2AD regime to fundamentally interfere with what each of them do.

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[49] Perry, "The Pentagon's Fight Over Fighting China."
[50] McGrath, "Five Myths about AirSea Battle."
[51] David Gompert and Terrence Kelly, "Escalation Cause," *Foreign Policy*, August 2, 2013, http://www.foreignpolicy.com/articles/2013/08/02/escalation_cause_air_sea_battle_china?page=full; Shawn W. Lonergan Erica D. Borghard, "Will Air-Sea Battle Be 'Sunk' by Cyberwarriors?," Text, The National Interest, accessed December 8, 2014, http://nationalinterest.org/feature/will-air-sea-battle-be-sunk-by-cyberwarriors-11802; Freedberg Jr., "Cartwright Targets F-35, AirSea Battle; Warns of $250B More Cuts."
[52] Army Times Staff, "Interview: Gen. Ray Odierno, US Army Chief of Staff," Defense News, October 12, 2014, http://archive.defensenews.com/article/20141012/SHOWSCOUT04/310130013/Interview-Gen-Ray-Odierno-US-Army-Chief-Staff.
[53] Perry, "The Pentagon's Fight Over Fighting China."

Formed in August 2011, the tiny Air-Sea Battle Office tasked with implementation of the concept was comprised of only 17 staff: Eleven uniformed officers plus six civilian contractors.[54] The number of Army staff totalled one.[55] The writing by now was on the wall for the Army, and if it could not delegitimise ASB it would fight for a much larger Army stake in its future. Eschewing a zero-sum outlook on ASB, numerous voices have since written the role of land-power back into American thinking about the predominantly maritime theatre of the Western Pacific. Republican Congressman J. Randy Forbes has advocated for the Army to shift more resources towards creating new, offensive, land-based ballistic and cruise missile forces, more mobile and capable air-and-missile defences, and sees the Army as the ideal service to pursue enhanced regional partner collaboration.[56] In similar vein, James Holmes and others have commented on the geographic advantages available to the US in prosecuting a version of 'reverse A2AD' on the PLA Navy, using ground-based anti-ship fire-power stationed along Japanese and other Pacific island chains to bottle up PLA forces.[57] Consequently, in something of a victory for the Army in the inter-service battle, late 2014 saw DoD announce a review of the ASB concept, with commentators pointing to the need to better incorporate all four warfighting services. Frank Kendall also spoke of the need to push harder on service integration.[58] In early 2015 the Pentagon released a memo announcing

[54] McGrath, "Five Myths about AirSea Battle."
[55] No author supplied, "Military Creates Air-Sea Battle Office," Stars and Stripes, accessed June 30, 2014, http://www.stripes.com/news/military-creates-air-sea-battle-office-1.160382.
[56] J. Randy Forbes, "The U.S. Army's Asia Opportunity," Text, The National Interest, accessed May 16, 2014, http://nationalinterest.org/feature/the-us-armys-asia-opportunity-10325.
[57] Yoshihara and Holmes, "Asymmetric Warfare, American Style"; James R. Holmes, "Defend the First Island Chain," *Proceedings Magazine*, April 2014, http://www.usni.org/magazines/proceedings/2014-04/defend-first-island-chain.
[58] Author not supplied, "Pentagon Looks To Revise Air-Sea Battle Concept To Increase Jointness," CSBA, October 15, 2014, http://www.csbaonline.org/2014/10/15/pentagon-looks-to-revise-air-sea-battle-concept-to-increase-jointness/.

that the Air-Sea Battle tag was to be dropped.[59] Despite rumours of its death,[60] the concept was absorbed into a broader multiservice effort to develop a Joint Concept for Access and Manoeuvre in the Global Commons, or JAM-GC, which has henceforth proven an unpopular tag. The effect has been that public commentary and analysis on the topic has since decreased significantly. JAM-GC remains in support of and subordinate to the Joint Operational Access Concept.[61]

Service parochialism and organisational culture present persistent threats to the ongoing success of an ASB construct, nor is ASB immune to the budget pressure and politics in Washington. Sustained budget pressure could see the Air Force and navy relapse into their default positions of competing hard to protect their respective favoured programs. Conversely, when combined with the confluence of threats each service face from the global proliferation of A2AD capabilities, they may find that combining forces to protect respective budget shares is a better bet than going it alone. Self-interest may indeed favour greater collaboration in such an environment.[62]

[59] David Goldfein, "Document: Air Sea Battle Name Change Memo," *USNI News* (blog), accessed January 21, 2015, http://news.usni.org/2015/01/20/document-air-sea-battle-name-change-memo.
[60] J. Randy Forbes, "RIP Air-Sea Battle?," Text, The National Interest, accessed January 30, 2015, http://nationalinterest.org/feature/rip-air-sea-battle-12147.
[61] Terry S. Morris et al., "Securing Operational Access: Evolving the Air-Sea Battle Concept," Text, The National Interest, February 11, 2015, http://nationalinterest.org/feature/securing-operational-access-evolving-the-air-sea-battle-12219.
[62] Marsh and Jones, "From Rivals to Partners," p. 10.

3. Opposing Air-Sea Battle

3.1. Offshore Control

Since 2012 one author in particular, T.X. Hammes, wrote a number of articles admonishing both the strategic and operational weaknesses of ASB and proposed an alternative under the label of 'Offshore Control'.[63] The main tenets of Offshore Control are as follows:

- ASB is too expensive, risks nuclear escalation, is not a strategy; the US needs a low cost way of maintaining influence and presence in the Western Pacific.
- Partner with Asia-Pacific nations to ensure US ability to interdict maritime trade in and out of China while protecting allies and partners.
- Use geographical advantage to deny access inside the First Island Chain while controlling air and sea beyond.
- Envisions no strategic bombing campaign, penetration of Chinese air-space, or associated attacks on Chinese mainland; instead favours a strategy of economic strangulation.
- No attacks on Chinese soil seen as mitigating excessive physical destruction and the risk of nuclear escalation, and makes war termination easier.

Critics of Hammes have subsequently argued that Offshore Control cedes too much to China. They argue that from the assumption of continued pursuit of US strategic primacy in

[63] T. X. Hammes, "Sorry, AirSea Battle Is No Strategy," Text, The National Interest, August 7, 2013, http://nationalinterest.org/commentary/sorry-airsea-battle-no-strategy-8846; T. X. Hammes, "Offshore Control vs. AirSea Battle: Who Wins?," Text, The National Interest, August 21, 2013, http://nationalinterest.org/commentary/offshore-control-vs-airsea-battle-who-wins-8920; T. X. Hammes, "Offshore Control Is the Answer," US Naval Institute, December 2012, http://www.usni.org/magazines/proceedings/2012-12/offshore-control-answer; T. X. Hammes, "Offshore Control: A Proposed Strategy for an Unlikely Conflict" (Institute for National Strategic Studies (INSS), June 2012), http://ndupress.ndu.edu/Portals/68/Documents/stratforum/SF-278.pdf.

East Asia, a strategy that cedes primacy in favour of denial inside the First Island Chain is insufficient. The US should expect a major re-shuffling of its alliances and partnerships in the region as a result, ultimately limiting its capacity to pursue its interests in turn.[64] The pivotal assumption here of course is that of US intentions around strategic primacy. Exactly what degree of variegation in physical control of the commons is equivalent to an acceptable loss of primacy? Is any loss of primacy acceptable? No jury has yet convened to settle this pivotal question.[65] In lieu of such an answer, a closer look at China's capacity to control the commons beyond its shores is essential to understand exactly what the threat to US primacy in the Western Pacific might be in the first place.

3.2. A2AD and it limitations

US military primacy has for seventy years hinged on what Barry Posen termed "command of the commons", often referred to alternatively as 'sea control': The ability to deny an area on and under the sea and in the air above 15,000 feet to an adversary, while being able to freely use that space oneself. As outlined previously, observers are now largely in agreement that US command of the commons is eroding in pockets around the world due partly to the proliferation of a regime of weapon systems, sensors, guidance and communications technologies under the A2AD banner. China is by far the most advanced actor in this regime, and the Western Pacific is the most strategically significant 'pocket'. ASB as detailed above is essentially designed to confront and roll back A2AD capabilities, which would include deep strikes inland targeting mobile missile launchers, air-defence systems, and their related infrastructure. Offshore Control, in contrast, eschews deep strike

[64] Elbridge Colby, "The War over War with China," Text, The National Interest, August 15, 2013, http://nationalinterest.org/commentary/the-war-over-war-china-8896.
[65] Barry R. Posen, "Command of the Commons: The Military Foundation of U.S. Hegemony," *International Security* 28, no. 1 (July 1, 2003): 5–46, https://doi.org/10.1162/016228803322427965.

in favour of the less escalatory, less expensive maritime interdiction mission. The assumption inherent in both responses, and one less well acknowledged in current literature on the subject,[66] is that Chinese A2AD capabilities do in fact pose an expanding zone of exclusion for US forces that will eventually reach the First Island Chain, Second Island Chain, and beyond, ranges measured in the thousands of nautical miles. Biddle and Oelrich argue that this assumption is open to rebuttal,[67] with significant implications for how the US and its regional allies and partners should think about not only the strategic utility of ASB, but about strategy in the Western Pacific broadly.

3.3. Radar, target acquisition, and range

The concern of most analysts lies not in the current capabilities fielded by the PLA, but in the projection of these capabilities on roughly equivalent trajectories decades into the future. Biddle and Oelrich, however, highlight a number of fundamental limitations that will constrain these capabilities in future, emerging primarily from geography and technology.[68] The pivotal constraint is in regard to target acquisition and the range and survivability of airborne radar. While the PLA already fields a number of weapon systems with nominal ranges over 1000 nautical miles, the actual effectiveness of these weapons to deny access to the US Navy or threaten allied shipping routes is fundamentally dependent on target acquisition. The capacity of the A2AD regime to extend PLA military influence beyond even

[66] Important exceptions include Owen R. Cote, "Submarines In The Air Sea Battle (U)" (STS2010, John Hopkins University Applied Physics Laboratory, 2010), http://web.mit.edu/ssp/publications/conf_reports/3coteorPAD3.pdf; Owen R. Cote, "Assessing the Undersea Balance Between the US and China" (Cambridge, United States: MIT Center for International Studies, February 2011), http://www.isn.ethz.ch/Digital-Library/Publications/Detail/?ots777=0c54e3b3-1e9c-be1e-2c24-a6a8c7060233&ots591=0c54e3b3-1e9c-be1e-2c24-a6a8c7060233&lng=en&id=127154; Christensen, "Strategic Developments In The Western Pacific"; Thomas J. Christensen, "Posing Problems without Catching Up: China's Rise and Challenges for U.S. Security Policy," *International Security* 25, no. 4 (2001): 5–40; Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept."

[67] Biddle and Oelrich, "Future Warfare in the Western Pacific."

[68] The authors also cite variables such as PLA inexperience, uncertainty over future economic and demographic trajectories, the state of US-China relations, and technological shocks as potentially significant factors influencing the analysis.

the First Island Chain, and to eventually erode US command of the commons in any holistic way, is therefore contingent on PLA capacity to survey, reconnoitre, and provide weapons grade tracking to its weapon systems over thousands of square miles of the ocean surface. The critical detection function for these purposes remains radar.[69]

The most critical constraint on radar range is the Earth's horizon. Radar is a line-of-sight sensor, meaning radar waves propagate in straight lines. Over the horizon radar systems exist, such as Australia's JORN, and work by reflecting low-frequency radar waves off the Earth's ionosphere, extending their potential range over hundreds of kilometres. These frequencies are, however, too low to provide the resolution needed for weapons grade tracking. They are useful as early-warning systems only, and their ground-based large aperture fixed arrays are inherently vulnerable to attack. This means that radar attached to airborne platforms are the primary method militaries use to overcome the Earth's horizon, known as Airborne Early Warning and Control systems (AEWAC). AEWACs usually come in the form of modified passenger or cargo planes and operate at altitudes suitable for such aircraft of about 8 miles. This elevation yields a radar horizon about 400 kilometres away. Platforms that are able to fly at higher altitudes are constrained by an inherent trade-off between altitude and payload. The higher the altitude, the smaller the radar they are able to carry and operate. In practice, this means 400 kilometres is approximately the limit in range for airborne radar in use by the US and other countries, including China.[70]

In addition, these lumbering platforms mean airborne radar is vulnerable to attack and must be defended either by ground or ship-based air-defence systems or by accompanying fighter

[69] Biddle and Oelrich, "Future Warfare in the Western Pacific," p. 23.
[70]For details of China's airborne radar capabilities see Peter Dutton, Andrew S. Erickson, and Ryan Martinson, "China's Near Seas Combat Capabilities (China Maritime Study, Number 11)" (DTIC Document, 2014), pp. 87–96, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA612569.

planes, all of which have inherent physical limits. Also, as an active emitter who only 'sees' a target after the radio wave has been emitted and returned, an AEWAC emitting radio waves is 'seen' by the target prior to the target's location being disclosed, exposing it to attack using anti-radiation missiles. These factors and others considered, Biddle and Oelrich estimate the maximum range under the most aggressive of tactics for airborne radar to acquire sustained weapons grade tracking of vessels traversing the surface of the open ocean to be between 400-600 kilometres (or 250-370 miles).[71] China fields and is investing in space-based radar, but heavy physical trade-offs exist in orbit also, diminishing the effectiveness, survivability, and indeed the viability of space-based ocean surveillance via satellite.[72] The estimate, then, of maximally effective 400-600 kilometres of target acquisition, using radar under existing and prospective best-case conditions for PLA capabilities in the near future, puts a solid limit on the future coercive impact of China's A2AD regime. Its implications for ASB are discussed below.

3.4. What purpose primacy?

A line 400-600 kilometres from China's coast would extend perhaps to the Paracel Islands, but does not extend to the Spratly Islands or to the Philippines. Chinese A2AD is thus a geographically and technologically limited threat, an assertion not commonly acknowledged among security scholars. China's post-2014 artificial island building on Subi, Mischief, and Fiery Cross Reefs, even with additional military capabilities in future, is isolated and suffers from exposed logistical support lines. Biddle and Oelrich conclude from their analysis that it will be "very hard for China to use A2AD to underwrite true military hegemony in the

[71] Biddle and Oelrich, "Future Warfare in the Western Pacific," p. 28.
[72] US and Soviet experiences with space-based radar are instructive here, see Asif Siddiqi, "Staring at the Sea-The Soviet RORSAT and EORSAT Programmes," *Journal of the British Interplanetary Society* 52 (1999): 397–416.

region."[73] Nonetheless, while its effectiveness diminishes quickly the further it is pushed out from a defended coastline, nearer to shore it presents a formidable challenge.[74] US command of the commons is thus already eroding in certain pockets of the globe, an outcome predicted by the Pentagon more than two decades ago as previously described. ASB, nonetheless, promises the complete roll-back of coastal A2AD capabilities and the restoration of freedom of movement for US forces, all the way up to Chinese territory and beyond. Operationally, a pre-emptive attack is the only feasible way this would be achieved.

How real, and then how necessary, is it for the US and its allies to hold this level of coercive threat over decision-makers in Beijing? Firstly, ASB would face the same set of target acquisition problems just described for A2AD. Locating, identifying, and tracking mobile targets such as air-defence systems, command centres, and ballistic-missile launchers (Transporter-Erector-Launcher, TEL) is more difficult over land. The land environment provides a multitude of cover, platforms move more quickly and frequently, and radar waves are less effective against complex backgrounds. Secondly, what plausible political interest would the United States have in pre-emptively attacking Chinese territory in depth, if pre-emption is, as argued, an operational imperative? Other critics of ASB have questioned its strategic intent. What exactly would be achieved with total American and allied control of the commons up to and over China? Preparation for a ground invasion? Forced regime change? No-one in the security/strategic communities discussing China is entertaining these fantasies. These ripostes add weight to the criticism that ASB seems like an operational concept absent a strategic purpose. It does not suffice to suggest, as some

[73] Biddle and Oelrich, "Future Warfare in the Western Pacific," 41.
[74] Thomas Shugart, "China's Artificial Islands Are Bigger (And a Bigger Deal) Than You Think," War on the Rocks, September 21, 2016, http://warontherocks.com/2016/09/chinas-artificial-islands-are-bigger-and-a-bigger-deal-than-you-think/.

have,[75] the strategy is continued primacy, because primacy in terms of uncontested command of the commons is already subject to variegation.

Biddle, Oelrich, and others[76] have extrapolated from their analysis that the judicious development of a 'reverse A2AD' strategy that capitalises on US and allied geographic advantage, using similar coastal defences such as anti-ship missiles and air defences outside of China's A2AD zone, could be used to deter further Chinese expansion, with naval and air power further outside the range of A2AD acting in operational reserve.[77] These allied A2AD 'bubbles' could be scaled up or down, to allow for reinforcement of allied and US forces in theatre within China's A2AD zone. The primary operational purpose behind US and allied planning is to prevent a *fait accompli* by PLA forces. This means having a 'dog in the fight' from the very start of any conflict. In turn, this is expected to impress on the minds of decision makers in Beijing that a quick military victory in pursuit of a limited political interest is likely to become a protracted conflict in which said political objectives are not achieved. In addition, allies would have more reason to be assured by this approach than either ASB, which is seen as too aggressive and over-shooting the problem, or by Offshore Control, which is seen as exposing them to coercion.[78]

This analysis suggests that Air-Sea Battle as originally conceived and widely understood by think tanks and commentators alike from 2010 is neither economically feasible nor strategically appropriate for the Western Pacific theatre. Its re-absorption under the JAM-

[75] Colby, "The War over War with China."
[76] See for example Andrew F. Krepinevich, "The Future of U.S. Defense Strategy and the Japan-U.S. Alliance" (June 23, 2015), http://csbaonline.org/2015/06/23/the-future-of-u-s-defense-strategy-and-the-japan-u-s-alliance/.
[77] Bryan Clark and Jesse Sloman, "Advancing Beyond the Beach: Amphibious Operations in an Era of Precision Weapons" (Center for Strategic and Budgetary Assessments, 2016), http://csbaonline.org/research/publications/advancing-beyond-the-beach-amphibious-operations-in-an-era-of-precision-wea/publication.
[78] Mac Thornberry and Andrew F. Krepinevich, "Preserving Primacy," *Foreign Affairs*, August 3, 2016, https://www.foreignaffairs.com/articles/north-america/2016-08-03/preserving-primacy.

GC label in 2015 and subsequent decline in public interest may reflect this. The Pentagon, US services, and US military-industrial-commercial contractors continue to pursue a range of technologies, platforms, and operational concepts premised on the need for US forces to generate and sustain access in the global commons. But these efforts post-2015 have been commonly couched in a broader discussion more associated with the Pentagon's Third Offset Strategy than the one ASB engendered when it emerged in 2010. The reasons for this are open to interpretation. What this chapter seeks to highlight is the fact that the capabilities, technologies, platforms, and operational concepts associated with ASB are supported by more deeply integrating and leveraging a networked information background. While the noise around the high-end capability set of ASB might have ceased, the building of a networked information background for the enhanced situational awareness it promises continues. These efforts represent an undesignated emphasis on the organising principles inherent in the scale-free network model of growth, preferential attachment, and fitness. The strategic implications of the effort to build this network are of interest regardless of the fate of ASB. We might also glimpse the threads of an answer we sought regarding the debate about US primacy in the Western Pacific. The scale-free network structure underpinning the components of networked operations could represent the foundation of sustained American influence, even while traditional debates around primacy, selective engagement, strategic retrenchment and the 're-balance' are had.

4. The strategic level – *a battle for connection*

4.1. First mover, preferred partner

Libicki thought that a network of 'Systems', if it were to become the core of the system used by US allies and partners, could "diminish many of the boundaries between them."[79] Nonetheless, trade-offs would always exist in relation to the sharing of information. Information superiority would likely remain the strong-suit of the US, so why give it away? The answer emerges in the realisation that needlessly husbanding capabilities that derive a tactical advantage may actually diminish a longer-term advantage in the strategic realm.[80] In the scale-free network model, growth is the defining feature. Moreover, a systems architect may assume long-term advantages because of the simple fact that information systems are difficult and costly to build, but subsequently easy to replicate. As we have seen, few states accommodate the forces that drive nations to invest in, develop, build, and maintain the apparatus of global power projection found in the United States' military. Late-comers are much more likely to seek to connect to existing nodes. Here we glimpse the scale-free network feature of preferential attachment at work. In addition, an initial architect is likely to be first in line for the development and iteration of all subsequent systems, imbuing it not only with a first mover's advantage but with the deepest understanding of the contest for fitness, the third feature of the scale-free model. It reiterates the resounding fact that purchasing the components of a military-technical revolution does not deliver the combat effect that those components may promise. The essence of the desired effects is in knowledge-based, experience-based, human focussed systems integration that is not available for purchase on the global arms market. They are hard won, and cannot be stolen,

[79] Martin C. Libicki, "Information War, Information Peace," *Journal of International Affairs* 51, no. 2 (1998): p. 421.
[80] Libicki, 424.

copied, or otherwise selectively obtained. This reflects the assertion that "those who master constantly rising levels of complexity will be the winners of tomorrow's conflicts."[81] Balance sheets depicting laundry lists of military capabilities are next to meaningless.

The definitive information network hosting many of these dynamics is SIPRNET. As mentioned, SIPRNET is the US Department of Defense's largest network for the exchange of classified information and messages at the SECRET level. The network accommodates a host of protocols and procedures administered by the US. Its architecture reflects the preferences of its owner, in the form of dedicated and encrypted lines that are separated from the rest of the system, and in the gated structure of its coalition enclaves. The US controls the flow of information across the network, but in addition it is the primary source of that information, that it is able to derive from the various systems that make up the Global Information Grid. None of the US' allies or partners, let alone its competitors, are in the business of building such architecture that can be selectively made available to partners. As the guided-munitions regime has matured, and been taken up by every advanced military on the globe, it is increasingly reliant on the exploitation of the information background in which the US is the dominant provider. When acting collaboratively, the system over which that information is disseminated is also US dominated. The "easy availability of certain analytical tools, the availability of presentation templates, the differential opportunities for collaboration, and the way knowledge is organized and indexed all influence the way the world is perceived."[82] In addition to being lead proprietor of much (if no longer all) of the technologies that enable the system, the US military-industrial-commercial-Internet complex is the overwhelmingly dominant repository of the knowledge and experience

[81] An assertion most associated with Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton University Press, 2010).
[82] Libicki, *Illuminating Tomorrow's War*, p. 109.

critical to the functioning of the system. It is the scale-free network's largest, oldest, and fittest hub.

4.2. Fitness in space

The opportunity to control information and services that are desired by others is a potent avenue to power and influence and, naturally, one deeply seductive to states. The race to develop and extract the potential of orbital systems in outer space, that supercharged the space-race in the early Cold War era, is a peerless example. The mid-course flight paths of the first US and Soviet ballistic missiles inexorably linked the terrestrial atmosphere with outer-space in the 1950's, having been pioneered by Germany before and during the Second World War. At the same time, the capacity to place satellites in orbit opened up a plethora of applications military, non-military, and commercial in nature that the two superpowers were eager to exploit. Perhaps typical of disruptive competitive innovations, but also testament to the potency of the opportunity, technological developments out-paced attempts by governments and the international community to conceive of, design, and implement some form of regulatory risk mitigation on the process. Before long, the spectre of mutually assured destruction (MAD) associated with a conflict involving nuclear-armed ballistic missiles suffused the regulatory void. A very uneasy equilibrium prevailed, until the end of the Cold War presented a moment of opportunity in which several attempts at treaty-based regulation had some success. Throughout the period, however, the prospect and development of ballistic-missile defence systems threatened the validity and duration of any equilibrium. MAD was never ceded by strategic planners on either side. Hence, in 1972 the first treaty seeking to constrain ballistic missile defences was signed;[83] a regulatory

[83] *Treaty between the United States of America and the Union of Soviet Socialist Republics on the limitation of anti-ballistic missile systems*, Moscow, 26 May 1972, entry into Force, 3 October 1972.

breakthrough that illustrated how prone to being undermined MAD was. The Anti-Ballistic Missile Treaty lasted thirty years. On 13 December 2001 the US advised Russia of its intention to unilaterally withdraw.

Pre-dominance in the exclusive or near-exclusive capacity to supply a network with otherwise unattainable information provides a massive advantage as the era of information-centric warfare proliferates. No winner-takes-all structure is likely to accrue to any late-comers. Allies and partners capable of supporting components of the system, particularly ground stations associated with retaining superior space-situational awareness, and as key thoroughfares in the early-warning phase of BMD, are critical enablers and become more densely connected hubs in their own right. If militaries are to be capable of reacting to transient data, timely delivery of imagery to the field is crucial.[84] Japan and Australia are pertinent examples here. In addition, the willingness of nations such as Australia to buy into the US Wideband Global Satcom system helps to spread the cost while the US remains its fundamental authority. According to Barry Watts it is "conceivable, then, that the United States could retain something close to its current margin of advantage for years, if not several decades."[85] As the associated technology becomes more affordable and available, other groups and nation-states may manage to more rapidly shrink the technical divide and compete as hubs. But short of some unforeseen windfall in fitness connectivity product unavailable to the United States, the scale-free network model will endure.

Text located at US Department of State http://www.state.gov/t/avc/trty/101888.htm

[84] Martin C. Libicki, *Illuminating Tomorrow's War* (DIANE Publishing, 1999), p. 9.

[85] Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment* (Center for Strategic and Budgetary Assessments, 2001), p. 2, http://www.csbaonline.org/4Publications/PubLibrary/R.20010201.The_Military_Use_o/R.20010201.The_Military_Use_o.pdf.

4.3. Fitness in system assurance and exploitation

More advanced and widely available commercial technologies mean state and non-state actors are increasingly able to deploy capabilities that threaten US forces. As the sophistication of adversary capabilities grows, automated decision-making aids are expected to become vital. The US led networks of systems interacting over satellite and tactical communications links, create an enormous information management challenge.[86] Interoperability between different orbital and air-breathing systems has thus become an imperative, with constraints on available bandwidth, frequencies, and on-board processors becoming pertinent.[87] The relationship between the cueing and pinpointing of data can be extremely complex, without even considering the addition of human intelligence.

In addition, the communication environment much of the existing battle management systems rely on may not be assured. The potential degradation of critical communications capabilities, essential for coordination and shared situational awareness, is forcing DARPA to pursue information technologies that can function in such environments.[88] It began soliciting research proposals in this area in February 2014.[89] As militaries enter the networked age, there's little doubt capabilities such as those being pursued by various agencies in managing the information environment, especially in contested electromagnetic conditions,

[86] GCN Staff, "DARPA Seeks to Automate Battlefield Decision Aids," GCN, February 24, 2014, http://gcn.com/articles/2014/02/24/darpa-distributed-battle-management.aspx.
[87] Cyndi Thomas, "Looming Challenges in 2016 for the C4ISR Market," SIGNAL Magazine, December 10, 2015, http://www.afcea.org/content/?q=Blog-looming-challenges-2016-c4isr-market.
[88] Martin C. Libicki et al., "Ramifications of DARPA's Programming Computation on Encrypted Data Program" (National Defense Research Institute: RAND Corporation, 2014), http://www.rand.org/content/dam/rand/pubs/research_reports/RR500/RR567/RAND_RR567.pdf.
[89] Author not supplied, "DARPA-BAA-14-17, Distributed Battle Management Program," Federal Business Opportunities, March 7, 2014, https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=3639054acc4cb20f5e979c1106075807&_cview=0.

will represent the cutting edge of the networked era.[90] Allies and partners making the leap to NCW will be drawn to these capabilities, and the US can again expect to reap the advantages of its first mover, architect, and administrator status. Of course, the days of large-scale government-funded programs are over, replaced by others that overcame or narrowed the gap via alternate routes. Also, the often derided culture of seeking 'silver bullet' remedies for complex problems is in decline. Industries that create new business models that can support capability development, where optimizing existing technology can be as-or-more effective than the integration of wholly new capabilities, populate the path forward. The changes required to the way the US does research, development, and procurement in order for it to stay ahead of the pack seems to have sunk in.[91]

6. Conclusion

The discourse and extra-discursive practices highlighted in the chapter show how the ongoing effort to achieve a joint warfighting capability within the US military played out as competition for fitness connectivity product consistent with the scale-free network model. Its political and organizational ramification were discussed in relation to inter-service rivalry, while its viability as a strategic concept for the Western Pacific was critiqued. The bottom line in these discussions is the growth and expansion of the underlying digital information infrastructure with preferential attachment and competition for fitness. Air-Sea Battle and the associated joint warfighting concepts were utilised partially as political instruments of debatable utility aimed at both domestic and international audiences from time to time, while the growth of the digital medium is the most important strategic element. Its growth

[90] Department of Defense, "Artificial Intelligence, Big Data and Cloud Taxonomy" (Department of Defense, November 2017), http://www.govini.com/research-item/dod-artificial-intelligence-and-big-data-taxonomy/.
[91] For in-depth discussion of these changes see Linda Weiss, *America Inc.?: Innovation and Enterprise in the National Security State* (Cornell University Press, 2014).

exhibited the features of the scale-free network model, the strategic level implications of which remain obscured. If acknowledged by a military-strategic community in the US still oriented more-or-less under a hub-and-spokes construct, albeit emphasising networks at the operational level, how might thinking about the imperatives of close-in primacy fare? The thesis now examines in detail the evolution of Japan and Australia as network hubs situated within the presented in this chapter.

Chapter VI. Japan – the northern hub

1. Introduction

In traditional geopolitical thinking, Japan is uniquely subjected to the 'perils of proximity'[1] when considering the implications of China's re-emergence. However, this chapter argues that the growth and expansion of Japan's military connectivity since the 1990s saw it emerge as the northern hub of the Western Pacific's scale-free security network. All the features of growth, preferential attachment, and fitness connectivity product are evident from a close inspection of Japan's military-related activities, associated inscriptions, translations and circulating reference, as the digital networked age progressed. While its conventional warfighting capacities remained limited by constitutional law, Japan was highly adept at thinking in network terms and used its privileged position as network hub to great advantage. Without explicit acknowledgement, much of Japan's strategic behaviour is reflective of an implicit understanding of the dynamics at work in the scale-free network.

Its contemporary security concerns accommodate a distinct territorial component as well as expansive sea-lane security incorporating the Indo-Pacific. A legacy of the 1951 San Francisco Treaties, but also an ongoing reflection of its concerns, the Japanese archipelago hosts a share of US military forces unmatched anywhere in the Asia-Pacific.[2] Roughly 50,000 military personnel, over eighty facilities under US control, the only carrier strike group

[1] Richard C. Bush, *The Perils of Proximity: China-Japan Security Relations* (Brookings Institution Press, 2010).
[2] The 'San Francisco System' specifically refers to two treaties, the 'Treaty of Peace with Japan' and the 'U.S.-Japan Security Treaty',both signed in 1951. It defined the political, legal, and military make-up of northeast Asia in the post-war era, as Japan re-entered the world as a sovereign state after nearly seven years of US occupation. The treaties dealt with the post-war settlement, reparations, compensation, the status of former Japanese territories including in Taiwan and Korea and Manchuria in north-eastern China, the status of American forces in Japan, and the beginning of the security relationship between the US and Japan that continues to this day.

permanently forward-deployed outside the United States, the 5th Air Force, and the III Marine Expeditionary Force reside there.[3] Japan is clearly concerned with the pace, scope and direction of China's military modernisation and growth. Political and societal relations are somewhat captive to domestic political dynamics regarding outstanding territorial disputes between the two governments, but also more broadly over the legacies of Japanese aggression and occupation since the first Sino-Japanese War of 1894.[4] To quote John Dower: "Deeply discordant historical narratives, kept alive by the potent machinery of manipulated memory, thus blight contemporary Sino-Japanese relations in especially harmful ways."[5]

After a brief historical orientation, section 2 brings the reader up to date with Japan's contemporary responses to its deteriorating security environment. Sections 3 and 4 detail Japan's recent procurement trends and developments in networked operations. As Japan is compelled to respond to a high-level territorial threat, its potential involvement in conventional deterrence and access generation and sustainment under the Air-Sea Battle rubric is highlighted in section 5. Driven and enabled by models of information dominance and networked warfare, an emerging networked information-centric strategy designed to buttress the spectrum of Japan's security imperatives is the result, dovetailing with the post-Cold War trajectory of US strategy for the Western Pacific. Obstacles attain and are highlighted, while Japan's status as the indispensable northern anchor of a burgeoning security network is emphasized.

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[3] Carnes Lord and Andrew S. Erickson, *Rebalancing US Forces: Basing and Forward Presence in the Asia-Pacific* (Annapolis, Maryland: Naval Institute Press, 2014), p. 42; See also "US Forces Japan | Official Military Website," accessed July 23, 2014, http://www.usfj.mil/.

[4] These dynamics extend well beyond this period also, see Shogo Suzuki, *Civilization and Empire: China and Japan's Encounter with European International Society* (Routledge, 2009).

[5] John W. Dower, "The San Francisco System: Past, Present, Future in U.S.-Japan-China Relations," *The Asia-Pacific Journal* 12, no. 8 (February 24, 2014), http://apjjf.org/2014/12/8/John-W.-Dower/4079/article.html.

2. Japan's strategic orientation

2.1. Limited and small scale

Japan's status as an archipelagic maritime trading nation renders the security of its sea lanes and surrounding waters fundamental to national security. The links between the security of the maritime system to trade, and thus the enduring vulnerability of the economy to disruption at sea, were made by Kōsaka Masataka in 1964.[6] The 1976 National Defense Programme Outline (NDPG)[7] a decade later closed the loop on sea lane security as the guiding principle of Japan's Cold War military orientation. The bi-polar strategic structure of North-East Asia during the Cold War meant, at the time it was published, that orientation was envisioned to serve "the maintenance of a full surveillance posture in peacetime and the ability to cope effectively with situations up to the point of limited and small-scale aggression" within Japan's territory, neighbouring sea, and air-space.[8] As Alessio Patalano explains, the "basic assumption was that Soviet naval forces engaging in commerce-raiding on the high seas could severely endanger the flow of goods to and from Japan without necessarily incurring the reaction of American forces."[9] That structure also meant Japan's strategy for control of the sea was confined to tactics largely based around anti-submarine warfare (ASW) at the vital points of transit of its maritime trade[10] utilizing surface, sub-surface and land-based air assets. In 1978, the adoption of the Guidelines for US-Japan Defence Cooperation added a legal framework to the NDPG, to support Japanese forces

[6] Masataka Kosaka, "Kaiyo Kokka Nihon No Koso, (The Vision of Japan as a Maritime State)" *Chūō Kōron* 9 (1964): pp. 48–80.
[7] National Defense Council, "National Defense Program Outline" (Database of Japanese Politics and International Relations Institute of Oriental Culture, University of Tokyo, October 29, 1976), http://www.ioc.u-tokyo.ac.jp/~worldjpn/documents/texts/docs/19761029.O1E.html.
[8] Ibid.
[9] Alessio Patalano, "Japan's Maritime Strategy," *The RUSI Journal* 156, no. 2 (April 1, 2011): p. 85, doi:10.1080/03071847.2011.576479.
[10] Alessio Patalano, "Japan as a Seapower: Strategy, Doctrine, and Capabilities Under Three Defence Reviews, 1995–2010," *Journal of Strategic Studies* 37, no. 3 (April 16, 2014): p. 406, doi:10.1080/01402390.2014.904788.

operating alongside their American counterparts and gaining invaluable experience and expertise in the process. In terms of strategy, Japan's defence from aggression for the duration of the Cold War period and beyond was built around the capacity to rebuff an aggressor, until such time that US forces could arrive. The Japan Maritime Self-Defence Force (JMSDF) remained largely designed for that role; As a niche filling appendage to the US Navy in the post-Cold War era, even as Japan's international security environment became increasingly complex. The ongoing instability in the Middle East as a vital energy supplier, as well as the unresolved flashpoints of cross-strait relations in Taiwan, tensions on the Korean Peninsula, and lingering issues in the East China Sea furnished the widening scope of Japan's threat environment after the end of the Cold War.

2.2. From national to international security

Since the beginning of the 2000's Japan has begun to make significantly greater contribution to international security. Japan's role as a US partner in the global war on terror saw it take part in operations ranging from logistical support, naval patrols, reconstruction efforts in Iraq and counter-proliferation operations on the high seas.[11] Its response to the Boxing Day 2004 tsunami in South-East Asia demonstrated Japan could match its political will to take on more responsibility with the military/dual-use capabilities to do so. In October 2004 a private advisory group formed by then Japanese Prime Minister Junichiro Koizumi, the Council on Security and Defense Capabilities (CSDC), issued a report that flagged remediating the "international security environment as important to Japanese national security as the physical defence of the nation itself."[12] The report acknowledged the expansion of Japanese security interests and recent activity into non-traditional areas, and

[11] Toshi Yoshihara and James R. Holmes, "Japan's Emerging Maritime Strategy: Out of Sync or Out of Reach?," *Comparative Strategy* 27, no. 1 (February 6, 2008): pp. 27–43, doi:10.1080/01495930701839654.
[12] Ibid.

asserted that “this new reality” should be “reflected in the government’s official strategy and policies.”[13] The CSDC set the tone for the 2004 NDGP released later in December.[14] The NDPG affirmed the shift toward thinking about Japanese national security through the lens of broader international security. The new approach was reinforced by the “Joint Statement: The Japan-US Alliance of the New Century”[15] negotiated in Washington mid-2006 and found momentum and expression into 2007 with Japan, the US and Australia inaugurating their “Trilateral Strategic Dialogue” to address global security issues. In March 2007 Japan and Australia signed a ground-breaking defence agreement that institutionalized “cooperation and combined exercises related to counterterrorism, counter-proliferation, peace operations, maritime security, and humanitarian relief operations.”[16]

2.3. The two-track challenge

The rising capabilities of the PLA Navy that Japan faces across the Yellow Sea present it with a new set of circumstances. At the high end of the combat spectrum, the A2/AD strategy of the PLA has altered the regional military balance.As stated in The Military Balance 2013, “at the lower end China’s continued maritime activity around the disputed Senkaku/Diaoyu Islands, and build-up of naval capabilities has generated concern that Beijing might seize outlying Japanese islands in a *fait accompli*. Japanese policymakers have watched with considerable interest China’s attempt to intimidate ASEAN states in the South China Sea and

[13] Council on Security and Defense Capabilities Report, “Japan’s Visions for Future Security and Defense Capabilities” (Government of Japan, 2004), http://www.kantei.go.jp/jp/singi/ampobouei/dai13/13siryou.pdf.
[14] Ministry of Defense, “National Defense Program Guideline FY 2005” (Government of Japan, December 10, 2004), http://japan.kantei.go.jp/policy/2004/1210taikou_e.html.
[15] Bureau of Public Affairs Department Of State. The Office of Electronic Information, “The Japan-US Alliance of the New Century,” accessed November 28, 2014, http://2001-2009.state.gov/p/eap/rls/68464.htm.
[16] Ministry of Foreign Affairs of Japan, “Japan-Australia Joint Declaration on Security Cooperation” (Government of Japan, 2007), http://www.mofa.go.jp/region/asia-paci/australia/joint0703.html.

are keen to avoid the same happening to Japan."[17] On the sea, the inherently defensive organisation of the JMSDF into "escort flotillas" home ported at bases in Yokosuka and Sasebo, supported by only five combat logistics ships, had made its ability to rebuff an overmatched aggressor without US support severely limited.[18] Indeed, expert commentators have repeatedly suggested the absence of a broader strategic plan that responds to the new circumstances has left Japan facing a gap between its expanding policy ambitions and its actual capabilities at sea.[19] At the sub-military level, in March 2014 James Holmes reported the JMSDF was being "run ragged" in the East China Sea as China's navy, coast guard, and fishing fleet tries to wrest control of the Senkakus and adjoining waters away from Tokyo.[20] These activities have remained continuous while episodic. Holmes and Yoshihara predicted these very circumstances six years earlier, dissenting from a view that Japan's maritime security remained relatively unproblematic in 2008.[21] What Holmes described as China's "small stick diplomacy",[22] others have referred to as "tailored coercion",[23] "opportunistic creeping expansion",[24] "salami-slicing tactics,"[25] and "cabbage-wrapping."[26] All refer to the practice of slow, incremental changes in the status quo in the maritime domain remaining below the level of military engagement, designed to stretch the resources of smaller

[17] Author not supplied, "Chapter Six: Asia," in *The Military Balance 2013* (Routledge, 2013), 266, http://dx.doi.org/10.1080/04597222.2013.757002.
[18] James R. Holmes, "Japan's Cold War Navy," *The Diplomat*, accessed November 15, 2014, http://thediplomat.com/2012/10/japans-cold-war-navy/.
[19] Yoshihara and Holmes, "Japan's Emerging Maritime Strategy"; Toshi Yoshihara and James R. Holmes, "Japanese Maritime Thought: If Not Mahan, Who" (DTIC Document, 2006), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA520373.
[20] James R. Holmes, "How China Strengthens Japan's Navy," *The Diplomat*, accessed October 28, 2014, http://thediplomat.com/2014/03/how-china-strengthens-japans-navy/.
[21] Yoshihara and Holmes, "Japan's Emerging Maritime Strategy," p. 39.
[22] Holmes, "How China Strengthens Japan's Navy."
[23] Cronin et al., "Tailored Coercion."
[24] Sugio Takahashi, "Counter A2/AD in Japan-US Defense Cooperation: Toward 'Allied Air-Sea Battle,'" *Project 2049 Institute*, 2012, p.13, http://indianstrategicknowledgeonline.com/web/Counter%20A2AD%20in%20Japan.pdf.
[25] Chellaney, "China's Salami-Slice Strategy."
[26] Jeff Himmelman and Ashley Gilbertson, "A Game of Shark and Minnow," *The New York Times*, October 24, 2013, http://www.nytimes.com/newsgraphics/2013/10/27/south-china-sea/.

regional states whilst raising doubts about US commitment. According to Cronin, "because so many of its neighbours lack the quality and quantity of Chinese coast guard, law-enforcement, and other paramilitary forces, it has been relatively easy to stake a claim in these often disputed areas."[27]

2.4. Japan's response

Adapting to the new strategic reality in East Asia within the broader framework of the Japan-US alliance was prioritised by the National Defence Program Guidelines (NDPG) released in 2010. JMSDF involvement in the extra-regional activities implied in its burgeoning trilateral relationships is obvious, and the demands and stresses on the MSDF promise to multiply.[28] Avoiding a "geographical opening" or a "gap in time" in the operational posture guided the main manifestations of the new policy direction.[29] The document "prioritises pursuit of enhanced intelligence, surveillance and reconnaissance capabilities to increase operational performance, readiness and responsiveness."[30] And further, "These characteristics will be reinforced by advanced technology based on the trends of levels of military technology and intelligence capabilities."[31] The NDPG also seeks a coordination of military, diplomatic and economic measures. Responses thus far have come in the form of the 2013 inaugural Japanese National Security Strategy, in which the reform driven Japanese Prime Minister Shinzo Abe made clear he seeks a strengthening of the Japan-US alliance as well as greater alignment with other maritime democracies to balance

[27] Patrick M. Cronin, "How to Deal with Chinese Assertiveness: It's Time to Impose Costs," Text, *The National Interest*, accessed December 8, 2014, http://nationalinterest.org/feature/how-deal-chinese-assertiveness-its-time-impose-costs-11785.
[28] Yoshihara and Holmes, "Japan's Emerging Maritime Strategy."
[29] Patalano, "Japan as a Seapower," p. 413.
[30] Ministry of Defense, "National Defense Program Guidelines FY 2011 and beyond" (Government of Japan, December 17, 2010), pp. 6–7, http://www.tr.emb-japan.go.jp/T_06/files/National_Defense_Program_FY2011.PDF.
[31] Ibid., p. 7.

a rising China.[32] 2013 also saw the creation of the National Security Council, with the aim of "establishing a forum which will undertake strategic discussions under the Prime Minister on a regular basis."[33] The updated NDPG in late 2013 introduced the concept of "a Dynamic Joint Defense Force," emphasizing the SDF's "joint operations and interoperability capability at sea, in the air and on land."[34] It also sought to "bolster the nation's defensive posture in the southwest, in particular the Nansei island chain that includes Okinawa and the disputed Senkaku/Diaoyu islands in the East China Sea."[35] These measures reflect the reality that Japan's new security outlook and orientation involve intensively nautical missions requiring surface ships, embarked helicopters, and maritime patrol aircraft,[36] networked and interoperable with allies and partners to an unprecedented extent. Japan's operational outlook remains predicated on the imperative to defend and control its near seas if necessary. These operational and doctrinal developments continue even while social, legal, and political obstacles litter the present and near horizon. Media commentary in turn has taken to the question of Japan's return as a 'normal' country.[37] Particular focus surrounds the re-interpretation of Article 9 of Japan's pacifist Constitution.[38]

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[32] Green, "Japan Is Back."
[33] Ministry of Foreign Affairs of Japan, "Japan's Security Policy" (Government of Japan, July 3, 2014), http://www.mofa.go.jp/policy/security/.
[34] Tsuyoshi Takasawa, "Ground, Maritime, Air SDF Exploring Ways to Cooperate," *The Japan News*, accessed November 28, 2014, http://the-japan-news.com/news/article/0001744607.
[35] Kosuke Takahashi, "Shinzo Abe's Nationalist Strategy," *The Diplomat*, accessed February 16, 2014, http://thediplomat.com/2014/02/shinzo-abes-nationalist-strategy/.
[36] Yoshihara and Holmes, "Japan's Emerging Maritime Strategy," p. 30.
[37] Doug Bandow, "A New 'Normal': Time for Japan to Defend Japan," Text, *The National Interest*, accessed September 22, 2014, http://nationalinterest.org/feature/new-normal-time-japan-defend-japan-11025; Lionel Pierre Fatton, "Is Japan Now Finally a Normal Country?," *The Diplomat*, December 27, 2013, http://thediplomat.com/2013/12/is-japan-now-finally-a-normal-country/; Zheng Wang, "Clash of Dreams: Becoming a 'Normal Country' in East Asia," *The Diplomat*, accessed February 5, 2014, http://thediplomat.com/2014/02/clash-of-dreams-becoming-a-normal-country-in-east-asia/.
[38] Norihiro Kato, "Japan's Break With Peace," *The New York Times*, July 16, 2014, http://www.nytimes.com/2014/07/17/opinion/norihiro-kato-japans-break-with-peace.html; Adam P. Liff, "Japan's Article 9 Challenge," Text, *The National Interest*, accessed November 16, 2014, http://nationalinterest.org/blog/the-buzz/japans-article-9-challenge-10766.

2.5. Re-interpreting Article 9

Article 9 of the Constitution states "the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as means of settling international disputes."[39] This has been interpreted as prohibiting the use of force overseas, and banning the rear-line support of other nations involved in fighting overseas. This interpretation does not permit collective self-defence, or even the use of force to defend an ally under attack. This means, for example, that "Japan is legally unable to shoot down a missile targeting the United States, and cannot come to the aid of an allied ship that is under attack."[40] Throughout the post-war period Japan's definitions and interpretations of Article 9 have played a crucial role in how it thinks about military forces. The re-interpretation of various components of Article 9 is nothing new. While unchanged, the actual wording of Article 9 and its interpretation has evolved according to external conditions, weapon technologies, and domestic politics.[41] For example, after the Korean War, Tokyo effectively re-interpreted the definition of the term "war potential," which according to Article 9 "will never be maintained,"[42] to allow "that which does not exceed the minimum necessary level for self-defense." This paved the way for the establishment of the Self-Defense Forces in 1954.

In late 2013, an Advisory Panel on Reconstruction of the Legal Basis for Security was set up by the Abe government to consider revisions to the interpretation of Article 9. By May 2014 the main focus of the panel was to "recommend that the government change its

[39] Government of Japan, "The Constitution of Japan" (Government of Japan, November 3, 1946), http://japan.kantei.go.jp/constitution_and_government_of_japan/constitution_e.html.
[40] Jeremy A. Yellen, "Shinzo Abe's Constitutional Ambitions," *The Diplomat*, accessed November 17, 2014, http://thediplomat.com/2014/06/shinzo-abes-constitutional-ambitions/.
[41] Liff, "Japan's Article 9 Challenge," p. 9.
[42] Government of Japan, "The Constitution of Japan."

constitutional interpretation to allow Japan to exercise the right to collective self-defence."[43] According to news reports, consideration was also being given to allow Japanese Self-Defence Forces (JSDF) members to "provide rear-line support, such as transport and medical care, to multinational forces fighting overseas under missions sanctioned by the United Nations."[44] In order to do so, the panel sought to revise the interpretation of the phrase "international disputes" in favour of "international disputes *to which Japan is a party*", thereby removing constitutional restrictions on JSDF members deploying overseas.

2.6. Shinzo Abe's "active pacifism"

While the revision of Japan's pacifist constitution may have long been a personal quest for Abe,[45] the logic of the move to shift Japan's self-imposed restrictions is derived directly out of its changing circumstances. As noted by one member of Abe's advisory panel, the "government fears that if Japan does not show a broader willingness to fight alongside the US, then Washington might abandon its commitment to defend the disputed Senkaku/Diaoyu Islands in the event of a clash with China."[46] Further, Japan's continuing reluctance could eventually threaten the future of the Japan-US alliance, its most important security relationship. From the US perspective, "a one-way alliance is not much of an alliance at all."[47] For Abe, described as Japan's most conservative post-war leader,[48] the revisions are one component of a swathe of measures to reinvigorate the self-confidence and patriotism of the Japanese public, free it from its post-war shackles, and prevent the

[43] Katsuhisa Kuramae and Koji Sonoda, "Abe Panel Considers Move That Could Pave Way for SDF to Use Force Abroad," *AJW by The Asahi Shimbun*, accessed April 14, 2014, http://ajw.asahi.com/article/behind_news/politics/AJ201404120053.
[44] Ibid.
[45] Yellen, "Shinzo Abe's Constitutional Ambitions."
[46] Ibid.
[47] Sean Mirski, "Japan's Constitutional Reinterpretation: A Tug of War between Strategy and Memory," Text, *The National Interest*, accessed November 23, 2014, http://nationalinterest.org/feature/japan%E2%80%99s-constitutional-reinterpretation-tug-war-between-11713.
[48] Takahashi, "Shinzo Abe's Nationalist Strategy."

erosion of the US security commitment. In 2013 the government enacted a controversial secrecy law, tightening the confidentiality of Japan-US intelligence sharing.[49] In January 2014 it "revised textbook screening guidelines to give Japanese children a more patriotic take on modern Japanese history and to better reflect the government's view on territorial issues such as the Senkaku Islands."[50] In May 2014 the self-imposed blanket ban on weapons exports was lifted, paving the way for Japan to participate in joint development and production of defence equipment.[51] According to Mirski, some of Abe's moves have "spurred charges of historical revisionism and even revanchism. In 2013, he cast doubt on the 1993 Kono Statement, an apology by Japan for its sexual enslavement of Korean women during World War II. Abe also visited the controversial Yasukuni Shrine, a Shinto shrine that honours those who died in service of the Japanese Empire, including several war criminals."[52]

2.7. Collective self-defence

While stopping short of stating the JSDF could directly use force, under the revised interpretations members would be allowed to engage in such activities as the transport of soldiers and equipment of other military forces in combat areas, provide medical care for injured soldiers, and the clearing of mines in foreign waters.[53] In addition, it would enable Japan to take defensive action even when the intended target of an attack is unclear, such

[49] Justin McDonnell, "Japan's State Secrets Bill Polarizes Society," *The Diplomat*, accessed November 21, 2014, http://thediplomat.com/2013/11/japans-state-secrets-bill-polarizes-society/.
[50] Takahashi, "Shinzo Abe's Nationalist Strategy."
[51] Agence France-Presse, "Japan Lifts Own Blanket Arms Export Ban," *Defense News*, accessed November 21, 2014, http://www.defensenews.com/article/20140401/DEFREG03/304010013/Japan-Lifts-Own-Blanket-Arms-Export-Ban.
[52] Mirski, "Japan's Constitutional Reinterpretation."
[53] Kuramae and Sonoda, "Abe Panel Considers Move That Could Pave Way for SDF to Use Force Abroad."

as in a North Korean ballistic missile launch scenario.[54] Moreover, rear-line support in combat is often difficult to distinguish from fighting. The nature of these re-interpretations would leave the door ajar for future administrations to expand the role of the JSDF, and to facilitate Japan's participation in joint defence capabilities development. Amidst a storm of controversy mostly inside Japan,[55]and much wrangling within the ruling coalition itself, on July 1 2014 Abe's cabinet adopted a resolution outlining the shift. It contained the following key passage.

> the Government has reached a conclusion that not only when an armed attack against Japan occurs but also when an armed attack against a foreign country that is in a close relationship with Japan occurs and as a result threatens Japan's survival and poses a clear danger to fundamentally overturn people's right to life, liberty and pursuit of happiness, and when there is no other appropriate means available to repel the attack and ensure Japan's survival and protect its people, use of force to the minimum extent necessary should be interpreted to be permitted under the Constitution as measures for self-defense in accordance with the basic logic of the Government's view to date.[56]

The provision of logistical support for US forces in the Western Pacific theatre, participation in missile defence for US naval vessels, and mine sweeping operations are just a few of the roles and responsibilities potentially conferred on the JMSDF in an alliance context.[57] Further, these roles may be critical components of the Air-Sea Battle operational concept.

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[54] David Letts and Hitoshi Nasu, "Japanese Constitutional Re-Interpretation: Much Ado about Nothing?," *Canberra Times*, accessed November 17, 2014, http://www.canberratimes.com.au/comment/japanese-constitutional-reinterpretation-much-ado-about-nothing-20140704-zsw7j.html.
[55] Kato, "Japan's Break With Peace."
[56] Ministry of Foreign Affairs of Japan, "Cabinet Decision on Development of Seamless Security Legislation to Ensure Japan's Survival and Protect Its People" (Government of Japan, July 1, 2014), http://www.mofa.go.jp/fp/nsp/page23e_000273.html.
[57] Thomas G. Mahnken and Dan Blumenthal, *Asia in the Balance: Transforming US Military Strategy in Asia* (American Enterprise Institute, 2012).

Japanese strategic thinkers have coined the phrase "Allied Air-Sea Battle",[58] and discussion about the specific roles and expectations of the JMSDF is central to ruminations underpinning the updated defence guidelines. Sugio Takahashi suggests Japan's strategy must contend with countering effects at both the low and high ends of the combat spectrum, seeking a "balance of activities" designed to support a strategic equilibrium with the PRC.[59] The constitutional re-interpretations to allow for collective self-defence have direct and specific consequences for the JMSDF's roles in these efforts.

2.8. The revisions and the Japan-US alliance

Of the move by the Japanese government, former US Secretary of Defense Chuck Hagel said at the time in a statement

> This decision is an important step for Japan as it seeks to make a greater contribution to regional and global peace and security… The new policy also complements our ongoing efforts to modernize our alliance through the revision of our bilateral guidelines for defense cooperation… The United States has an enduring interest in the Asia-Pacific's peace and prosperity, and our alliance with Japan is critical to our strategy in the region.[60]

There is strong support for re-interpretation of Article 9 in Washington, where it has for decades been seen as a stumbling block to deeper alliance cooperation.[61] The decision to update the 1997 Guidelines for Japan-US Defence Co-operation was taken at a "2+2" Japan-US Security Consultative Committee at Tokyo in October 2013. Japan's National Security Strategy (NSS), the first of its kind, released December 2013 states the updates will address "the concrete manner of defense cooperation and basic concepts of bilateral roles,

[58] Takahashi, "Counter A2/AD in Japan-US Defense Cooperation."
[59] Ibid., p. 13.
[60] Author not supplied, "Hagel Welcomes Japan's New Collective Self-Defense Policy," *U.S. Department of Defense*, July 1, 2014, http://www.defense.gov/news/newsarticle.aspx?id=122591.
[61] Liff, "Japan's Article 9 Challenge," p. 9.

missions, and capabilities (RMC), while ensuring consistency with various policies in line with the Strategy."[62] In October 2014 the two allies released an interim report outlining the progress being made on the update to the guidelines. A media note released by the US Department of State suggested the finished guidelines would likely emphasize

- seamless and effective whole-of-government Alliance coordination;
- taking measures to prevent the deterioration of Japan's security;
- enhancing bilateral cooperation to generate a more peaceful and stable international security environment;
- cooperation in space and cyberspace in an Alliance context; and
- mutual support in a timely and effective manner.[63]

A delay to the initial end-of-2014 timeline had been considered likely for some time,[64]and was made official around the same time as Japan's decision to dissolve the Lower House of Representatives and hold a snap election for December 14 2014 was announced.[65] Additional time, especially in light of the controversial revisions to Article 9 and the ongoing debate within the ruling coalition, was needed to work out exactly how the JSDF would contribute to US military plans.[66] In addition, commentators suggested the snap election would give the Abe government the clear political air in early 2015 to pursue its two main

[62] National Security Council, "National Security Strategy" (Government of Japan, December 17, 2013), p. 22, http://www.cas.go.jp/jp/siryou/131217anzenhoshou/nss-e.pdf.
[63] Bureau of Public Affairs Department Of State. The Office of Website Management, "Interim Report on the Revision of the US- Japan Guidelines for Defense Cooperation," Press Release|Media Note, *US Department of State*, (October 8, 2014), http://www.state.gov/r/pa/prs/ps/2014/10/232694.htm.
[64] Clint Richards, "A Delay Could Strengthen the US-Japan Defense Guidelines," *The Diplomat*, accessed October 28, 2014, http://thediplomat.com/2014/10/a-delay-could-strengthen-the-u-s-japan-defense-guidelines/.
[65] Ricky Hough, "US-Japan Defense Guidelines Likely to Be Delayed," *The Diplomat*, November 26, 2014, http://thediplomat.com/2014/11/us-japan-defense-guidelines-likely-to-be-delayed/?
[66] See Benjamin Schreer, "Japan and America: Forging a Global Alliance?," Text, *The National Interest*, accessed November 11, 2014, http://nationalinterest.org/blog/the-buzz/japan-america-forging-global-alliance-11539.

non-economic issues; the updated guidelines and the legislation that will codify the constitutional re-interpretations.[67] While the details and final wording of the guidelines are worked through with the US, several components of the close bilateral military relationship continue to undergo further development. In particular, the transfer of advanced military hardware from the US to Japan has accelerated since 2012.

3. Hardware and technology upgrades by domain

3.1. Surface/Sub-surface

At the end of 2010, the JMSDF consisted of a range of high-end and versatile platforms, with surface-to-surface, surface-to-air, and anti-submarine capabilities able to operate at sea for extended periods of time.[68] The fleet was officially restructured in 2007 from four flotillas, each flotilla comprised of eight destroyers[69] and eight embarked helicopters, into smaller and more versatile escort divisions, whereby the 32 vessels were reorganised into eight escort divisions. Further restructuring after 2010 continued this trend toward a more flexible and responsive fleet designed to fulfil duties both within and beyond Japan's home waters. The 2014 NDPG projects a near term JMSDF fleet comprised of 54 Destroyers, including 8 Aegis equipped, with 22 diesel powered air-independent submarines and 170 combat aircraft.[70] Complementing Japanese forces, two US Aegis equipped guided missile destroyers (DDG), the USS *Benfold* and USS *Milius*, will be home-ported at Yokosuka Naval Base in Japan by 2015 and 2017 respectively.[71] By early 2016 USS Barry replaced USS *Lassen*

[67] Clint Richards, "How an Election Gives Abe the Upper-Hand on Collective Self-Defense," *The Diplomat*, accessed November 28, 2014, http://thediplomat.com/2014/11/how-an-election-gives-abe-the-upper-hand-on-collective-self-defense/.
[68] Patalano, "Japan as a Seapower," p. 431.
[69] Two guided missile destroyers (DDG), five destroyers (DD), and one helicopter destroyer (DDH).
[70] Ministry of Defense, "National Defense Program Guidelines for FY 2014 and beyond" (Government of Japan, December 17, 2013), p. 31, http://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/20131217_e2.pdf.
[71] Erik Slavin, "2 Ballistic Missile Defense-Equipped Ships Moving to Yokosuka," *Stars and Stripes*, accessed October 19, 2014, http://www.stripes.com/news/pacific/2-ballistic-missile-defense-equipped-ships-moving-to-yokosuka-1.308622.

at Yokosuka. All three DDG's will receive upgrades in the most advanced version of the Aegis combat system, known as Baseline 9, which covers air, surface and undersea warfare, in addition to missile defence.[72] The aircraft carrier (CVN) USS George Washington, first deployed to Japan in 2008, was replaced in 2015 by the newer CVN USS Ronald Reagan as the centrepiece of the US Navy 7th Fleet and as part of the stated effort to bring the highest level of capability to the Western Pacific theatre.[73]

3.2. Air

According to the 2014 NDPG the JASDF will consist in the near term of 28 air warning squadrons, and 13 fighter aircraft squadrons, comprising some 360 combat aircraft in total.[74] For early-warning and command and control, Japan has US-made aircraft including four E-767 airborne warning and control system aircraft, and thirteen E-2C Hawkeye airborne early-warning aircraft.[75] In addition, the JASDF is set to acquire the E-2D Hawkeyes to respond to new threats. Well trained and regarded by their peers, "Japanese pilots practice ground attack against invading forces on Japanese territory and anti-shipping missions against enemy transports and fleets."[76] They regularly attend the US Air Force Red Flag exercises.[77] From the US, Carrier Air Wing 5 based at Naval Air Facility Atsugi in Japan will be unchanged by the CVN swap as part of the 7th Fleet. Notwithstanding, in 2012 the air wing received a new squadron of Electronic Warfare Aircraft when the aging EA-6B Prowlers were

[72] Ibid.
[73] Author not supplied, "Navy Aircraft Carrier Moves Underscore Pacific Rebalance Strategy," accessed November 17, 2014, http://www.navy.mil/submit/display.asp?story_id=78601.
[74] Ministry of Defense, "National Defense Program Guidelines for FY 2014 and beyond," p. 31.
[75] Kyle Mizokami, "Top Guns: The Most Lethal Air Forces on the Planet," Text, *The National Interest*, accessed December 9, 2014, http://nationalinterest.org/feature/top-guns-the-most-lethal-air-forces-the-Planet-11814.
[76] Ibid.
[77] Red Flag is the Air Force's premier air-to-air combat training exercise. Participants often include both US and allied nations' combat air forces. The exercise gives pilots the experience of multiple, intensive air combat sorties in the safety of a training environment.

replaced with the newer EA-18G Growlers, which are based on the F-18 airframe.[78] The air wing also received 24 upgraded F/A-18E Super Hornet fighters in 2011, making the Carrier Air Wing in Japan the most capable in the US Navy.[79] 2013 saw the fleet of P-3 Orion ASW aircraft based at Atsugi replaced by the newer P-8 Poseidon, bringing enhanced capabilities in ASW.[80] Six P-8's were moved to Kadena Air Base on Okinawa during 2014.[81] The P-8 is also designed to work with the recently unveiled Triton surveillance drone to be based at Andersen Air Base on Guam.[82] Early in 2014 the US Air Force announced twelve F-22 Raptor fighter jets would be sent on a rotational deployment to Okinawa, having done so in mid-January of 2013.[83] Looking to the near future, Air Force Gen. Herb "Hawk" Carlisle has indicated that after achieving Initial Operating Capability (IOC), the first US Air Force deployments of the F-35 Joint Strike Fighter would most likely be to Misawa and Kadena Air Bases in Japan, among others.[84] The US Marines on Okinawa received the F-35B with IOC at the end of 2015.[85]

[78] Erik Slavin, "New Squadron Coming to Yokosuka-Based Carrier This Spring," *Stars and Stripes*, accessed November 17, 2014, http://www.stripes.com/news/new-squadron-coming-to-yokosuka-based-carrier-this-spring-1.167828.
[79] Ibid.
[80] Erik Slavin, "Navy Adding Surveillance Plans, Drones to Its Asia-Pacific Fleet," *Stars and Stripes*, accessed November 17, 2014, http://www.stripes.com/news/navy-adding-surveillance-Planes-drones-to-its-asia-pacific-fleet-1.186006.
[81] Jeremy Page, "As China Deploys Nuclear Submarines, U.S. P-8 Poseidon Jets Snoop on Them," *Wall Street Journal*, October 24, 2014, http://online.wsj.com/articles/as-china-deploys-nuclear-submarines-u-s-p-8-poseidon-jets-snoop-on-them-1414166686?tesla=y.
[82] Sydney J. Freedberg Jr., "Triton, Poseidon, & UCLASS: The Navy's ISR Balancing Act," *Breaking Defense*, accessed October 2, 2014, http://breakingdefense.com/2014/10/triton-poseidon-uclass-the-navys-isr-balancing-act/.
[83] Pacific Air Forces, "F-22s Deploy to Kadena," *Kadena Air Base*, January 15, 2013, http://www.kadena.af.mil/news/story.asp?id=123332491.
[84] Colin Clark, "China Will Soon Face Arc Of US F-35s, Other Fighters, Bombers," *Breaking Defense*, accessed October 8, 2014, http://breakingdefense.com/2013/07/china-will-soon-face-arc-of-us-f-35s-other-fighters-bombers/.
[85] Amy Butler, "Pentagon Acquisition Chief Doubts USMC's July F-35 IOC Target," *Aviation Week*, October 29, 2014, http://aviationweek.com/defense/pentagon-acquisition-chief-doubts-usmc-s-july-f-35-ioc-target.

3.3. Space

Japan-US cooperation in space has also seen significant development. New guidelines for the Japan Aerospace Exploration Agency (JAXA) will see it shift its mandate from the "peaceful utilization of space" to "monitor foreign military satellites and information gathering satellites that can be used for military purposes."[86] US Deputy Assistant Secretary of State for Space and Defense Policy Frank Rose said space cooperation will become a "key element" of the updated Japan-US defense guidelines, with Japan set to create a special space surveillance unit as part of the JSDF after 2018.[87] According to Rose, the moves were in line with increasing US concern about China's anti-satellite capabilities and the fact that "budget cuts in recent years have left US space surveillance capabilities in East Asia insufficient."[88] In May 2014 Tokyo agreed to provide surveillance data obtained by JAXA to the US Strategic Command's Joint Space Operations Center. In turn the US military has provided Japan with classified information on space security since 2013.[89] Increased intelligence sharing between JAXA, which conducts space surveillance from radar and optical telescope facilities in Okayama Prefecture, and the US military will be critical in countering attacks against satellites and ensuring space security.[90]

[86] Richards, "A Delay Could Strengthen the US-Japan Defense Guidelines."
[87] Takashi Watanabe and Yusuke Fukui, "Japan, US to Strengthen Cooperation in Space Under Revised Defense Guidelines," *AJW by The Asahi Shimbun*, accessed November 17, 2014, http://ajw.asahi.com/article/behind_news/politics/AJ201410220039.
[88] Ibid.
[89] Ibid.
[90] For official statement see Bureau of Public Affairs Department Of State. The Office of Website Management, "Joint Statement from the Second Meeting of the Japan-US Comprehensive Dialogue on Space," Press Release|Media Note, *US Department of State*, (May 12, 2014), http://www.state.gov/r/pa/prs/ps/2014/05/225990.htm.

4. Key networking operations and platforms

4.1. Ballistic missile defence

The revisions of JAXA's orientation reflect longer trends in Japan's legal framework away from its post-war constraints that have expanding ramifications. In 2008 the 'Basic Space Law' entered into force, effectively removing the ban on the use of space for defensive purposes.[91] This change further paved the way for Japan's participation in Ballistic Missile Defence (BMD), an issue brought into stark repose when North Korea tested its Taepodong-1 ballistic missile in August 1998. North Korea's withdrawal from the Nuclear Non-Proliferation Treaty (NNPT) in 2003 and its continued nuclear weapons development convinced Tokyo, under Prime Minister Junichiro Koizumi, of the need to pursue BMD. On December 19 2003 the cabinet released 'On Introduction of Ballistic Missile Defense System and Other Measures',[92] signalling BMD as a top national security priority. Tokyo moved quickly, modifying its National Defense Program Guidelines in 2005 that had prevented Tokyo from participating in the joint development and production of weapons or transferring weapon parts to foreign countries. Pyongyang's July 2006 missile launches and October 2006 nuclear tests were clear drivers.[93] As of January 2009 Tokyo has deployed a multi-layered missile defence system that consists of Aegis sea-based midcourse missile defence and Patriot Advanced Capabilities-3 (PAC-3) ground-based terminal phase missile defence. By March 2011 PAC-3 missiles were deployed at 16 fire units around Japan's major

[91] Hirotoshi Kunitomo, "JAXA | The Office of National Space Policy and the Development of the Quasi-Zenith Satellite System," accessed November 18, 2014, http://global.jaxa.jp/article/special/michibiki/kunitomo_e.html.
[92] Government of Japan, "Statement by Chief Cabinet Secretary Yasuo Fukuda on Japan's Preparedness to Respond to National Emergencies," *Statements and Announcements by Chief Cabinet Secretary*, December 19, 2003, http://japan.kantei.go.jp/tyokan/2003/1219danwa_e.html.
[93] Masako Toki, "Missile Defense in Japan," *Bulletin of the Atomic Scientists*, accessed September 25, 2014, http://thebulletin.org/missile-defense-japan.

cities.[94] Missile defence capabilities were further enhanced in late 2012 when the two allies announced an agreement for the US to station a second early warning radar system in Japan, complimenting and expanding the scope of the existing sea-based system.[95] Delivered in October 2014 to the Japanese city of Kyoto, the X-Band Radar System "will allow for much deeper, sustained and granular radar penetration into China for the US and Japan from a terrestrial based platform."[96] China voiced its disapproval, with a Foreign Ministry spokeswoman saying at the time, "Neighbouring countries pushing forward the deployment of anti-missile systems in the Asia-Pacific and seeking unilateral security is not beneficial to strategic stability and mutual trust in the region."[97] From a Chinese strategic perspective, the south-western thrust of Japanese air and missile defence warning systems, integration with US space-based warning capacities and US and Japanese Aegis-class ships, constitutes a significant counter to Chinese missile threats to Taiwan.[98]

4.2. AEGIS

The US Navy's Aegis Weapon System is the lynchpin for regional missile defences in Asia.[99] As ship-based defence against cruise and ballistic missiles has increased in importance in the Western Pacific region, so has the focus on Aegis BMD cooperation, interoperability and integration between Japan and the US. The US moved Aegis destroyers equipped with ballistic missile defense systems closer to north-east Asia, and dispatched a Theater High-

[94] Ibid.
[95] Associated Press, "US to Install Second Early Warning Radar System in Japan," *The Guardian*, September 17, 2012, sec. World news, http://www.theguardian.com/world/2012/sep/17/us-install-early-warning-radar-japan.
[96] Clint Richards, "X-Band and THAAD as Good as Anti-China Trilateral Defense Agreement?," *The Diplomat*, accessed November 18, 2014, http://thediplomat.com/2014/10/x-band-and-thaad-as-good-as-anti-china-trilateral-defense-agreement/.
[97] Megha Rajagopalan, "China Criticizes US Missile Defense Radar in Japan," *Reuters*, October 23, 2014, http://www.reuters.com/article/2014/10/23/us-china-japan-usa-idUSKCN0IC16P20141023.
[98] Desmond Ball and Richard Tanter, "The Transformation of the JASDF's Intelligence and Surveillance Capabilities for Air and Missile Defense," *Security Challenges* 8, no. 3 (2012): p. 55.
[99] Robert Holzer and Scott Truver, "Aegis, Missile Defense and the US Pivot," *The Diplomat*, accessed September 1, 2014, http://thediplomat.com/2014/07/aegis-missile-defense-and-the-us-pivot/.

Altitude Area Defense (THAAD) battery to Guam after North Korea launched two ballistic missiles in March 2014.[100] Tokyo in turn authorized BMD forces to attempt to intercept any incoming North Korean missile.[101] As of mid-2014 the JMSDF had six Aegis-equipped ships in its fleet, four of which are BMD capable. In November 2013 Japan announced plans to "procure two additional Aegis destroyers and equip them as well with the Aegis BMD system, which will produce an eventual Japanese force of eight BMD-capable Aegis destroyers."[102] Seamless interoperability is the ultimate goal. Aegis systems share common radar. Long-standing Japan-US collaboration on the improved Block IIA version of the SM-3 Standard anti-air missile interceptor used with Aegis enhances this integration.[103] US Chief of Naval Operations (CNO) Adm. Jonathan Greenert told a Center for a New American Security event in 2013 "Think carrier strike group with JMSDF… think BMD patrols together, Japan and the United States, with collective self-defense… We need to reconcile our BMD capacity and capability over there."[104] Greenert also flagged the importance of development in cross-domain networking, "We're doing a nice job undersea-to-undersea, surface-to-surface, air-to-air. We need to get that *across* the fleet. And we have an opportunity to do that in the future." (Emphasis added).

4.3. Anti-submarine warfare

Japan's traditional focus on its near seas and sea-lines-of-communication mean its ASW capabilities have been in steady decades-long development. In 1995 Japan fielded the most

[100] Agence France-Presse, "US Pacific Fleet Chief Says N. Korea Is Top Security Concern," *Defense News*, accessed November 18, 2014, http://www.defensenews.com/article/20140122/DEFREG02/301220027/US-Pacific-Fleet-Chief-Says-N-Korea-Top-Security-Concern.
[101] Holzer and Truver, "Aegis, Missile Defense and the US Pivot."
[102] Ronald O'Rourke, "Document: Report to Congress on Navy Aegis Ballistic Missile Defense," *USNI News*, pp. 13–14, accessed November 21, 2014, http://news.usni.org/2014/11/20/document-report-congress-navy-aegis-ballistic-missile-defense.
[103] Staff writer, "Japan Test Fires Its First Raytheon-Built Standard Missile-3."
[104] Admiral Jonathan Greenert, *Asia-Pacific Rebalance: Strengthening Regional Maritime Security and Partnerships*, CNAS Audios, 2013, http://www.isn.ethz.ch/Communities-and-Partners/Partner-Network/Detail/?lng=en&id=172249.

powerful anti-submarine warfare capabilities east of Suez.[105] Organised into four escort flotillas comprising the first Aegis destroyers, three large oceangoing fast combat support ships, sixteen quiet submarines, and nearly 100 P-3C Orion maritime patrol aircraft,[106] it defended the Sea of Japan and the ECS but reached no further. Today Japan-US cooperation in ASW is a critical and expanding aspect of allied operational capacity. US submarines pose the greatest threat to the PLA Navy's growing naval fleet, and with US submarine technology the most advanced in the world, China's ability to prevent penetration into its territorial waters, or surrounding waters it wants to control, is lacking. Until approximately the mid-2000's finding Chinese subs was relatively easy.[107] They deployed the older diesel-powered models that required frequent 'snorkelling' to run the engines that charge their electric batteries. China's earlier nuclear-powered boats were also extremely noisy, making their detection with passive sonar detection systems relatively easy. In recent years China "has made advances in quieting its diesel subs, many of which use technology that lets them run their engines for long periods on liquid oxygen without surfacing for air."[108] These improvements were demonstrated in 2006, when a Chinese diesel-powered Song-class submarine surfaced within torpedo range of the USS Kitty Hawk, without being detected in advance by the aircraft carrier's roughly dozen escorting warships.[109] Further complicating the ASW challenge, the littoral seas within the First Island Chain are host to a noisy undersea environment, increasing the submarine detection challenge using legacy ISR methods and means. These large underwater areas are also increasingly being surveyed for the purpose

[105] Patalano, "Japan's Maritime Strategy," p. 85.
[106] Ibid.
[107] Page, "As China Deploys Nuclear Submarines, U.S. P-8 Poseidon Jets Snoop on Them."
[108] Ibid.
[109] Axe, "China's Overhyped Sub Threat."

of "environmental monitoring, oceanographic research, and exploitation of offshore resources."[110]

The post-Cold War shift away from the North-Western Pacific and toward the East China Sea focus Japan's ASW capabilities on supporting US Navy carrier strike groups in the seas surrounding Japan.[111] The JMSDF has been introducing the Kawasaki XP-1 maritime patrol aircraft to replace its fleet of Lockheed Martin P-3C Orions,[112] as well as upgraded SH-60K sub-hunting helicopters and next-generation 3,300-ton *Soryu*-class submarines.[113] In 2009 and 2011 it commissioned two new third-generation 20,000 ton *Hyuga*-class helicopter destroyers (DDH), each capable of deploying 11 helicopters. The primary mission of both destroyers is ASW, but they are also anti-air capable and can conduct command-and-control functions for multiple mission sets.[114] In August 2013 Japan unveiled the first of two planned 27,000-ton helicopter destroyers. The *Izumo*-class ship can carry 15 helicopters.[115] Both the *Hyuga* and the *Izumo*-class bear a strong resemblance to traditional aircraft carriers, with a full-length flight deck, aircraft elevators, and a hangar.[116] Japan has publicly stated that the ships will not embark the F-35B short take off vertical landing (STOVL) variant, though this is technically possible,[117] and rumours abound.[118] Japan is currently prohibited from deploying aircraft carriers, and other countries such as Australia are also discussing deploying the F-35

[110] Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept," 26.
[111] Paul Kallender-Umezu, "Japan Quietly Builds Limited Counter-A2/AD Capabilities," *Defense News*, accessed November 27, 2014, http://www.defensenews.com/article/20130917/DEFREG03/309170019/Japan-Quietly-Builds-Limited-Counter-A2-AD-Capabilities.
[112] Claire Apthorp, "Anti-Submarine Warfare," *Defence Review Asia*, March 19, 2012, http://www.defencereviewasia.com/articles/155/anti-submarine-warfare.
[113] Kallender-Umezu, "Japan Quietly Builds Limited Counter-A2/AD Capabilities."
[114] Ibid.
[115] Ibid.
[116] Eric Wertheim, *The Naval Institute Guide to Combat Fleets of the World*, 16th ed. (Naval Institute Press, 2013).
[117] Kyle Mizokami, "Asian Carriers By the Numbers," *USNI News*, accessed November 30, 2014, http://news.usni.org/2013/08/29/asian-carriers-by-the-numbers.
[118] Ricky Hough, "Japan Takes Another Step in Building Marine Force," *The Diplomat*, accessed December 2, 2014, http://thediplomat.com/2014/12/japan-takes-another-step-in-building-marine-force/.

B from similarly sized ships.[119] The DDH's are flagships for Japan's escort flotilla, while a feature of this class is that it can provide dual-use capabilities for Japan in terms of low end, steady-state operations such as humanitarian relief as well, providing the "balance of activities" platform sought by its strategic outlook. At the high end, these capabilities allow the JMSDF to help clear the way for the US Navy to enter inside the first island chain in the sub-surface domain. Broadly speaking the essentially defensive nature of ASW, and the focus on steady-state activities in Japan's near seas and territorial waters, make it an area of allied cooperation open to expansion given the still restrictive legal and operational confines Japan finds itself in. Evidence of the depth and scale of allied cooperation in the area of underwater hydrophone sensing was recently revealed by scholars Ball and Tanter.[120] What cannot be overstated is the importance of ASW in the opening exchanges of a crisis scenario in which US forces supported by their regional partner in Japan are compelled to react.

4.4. Amphibious landing

More evidence of Japan's careful shift towards "active deterrence" can be identified in the area of amphibious warfare capabilities. The JMSDF has had amphibious vessels in the form of three 14,000-ton Oosumi-class dock landing ships since the late 1990s. However, "until recently the JMSDF did not train for amphibious landings and so far has resisted the urge to create a marine corps."[121] This began to change in 2012. The focus on Japan's offshore islands that developed over the decade prior provided the impetus, as did the increasing tension with China over the Senkaku/Diayou islands since 2012. Twenty islands lie south of

[119] Steve George, "LHD and F-35B: The Debate Opens Up," *The Diplomat*, accessed November 30, 2014, http://thediplomat.com/2014/11/lhd-and-f-35b-the-debate-opens-up/.
[120] Colloquially known as the 'Fish Hook', refers to an unbroken chain of hydrophone sensors extending from the Sea of Japan through maritime East Asia and ending in the Andaman and Nicobar Islands. Desmond Ball and Richard Tanter, *The Tools of Owatatsumi: Japan's Ocean Surveillance and Coastal Defence Capabilities* (ANU Press, 2015).
[121] James Hardy, "Japan's Navy: Sailing Towards the Future," *The Diplomat*, accessed November 28, 2014, http://thediplomat.com/2013/01/japans-navy-steaming-towards-the-future/.

Okinawa, known as the Sakishimas, scattering the East China Sea to within a hundred miles of the coast of Taiwan.[122] Japan's Ground Self Defense Forces (GSDF) rangers took part in landing training with US Marines at Guam in 2012, and the GSDF has conducted more frequent landing drills since that time. Japanese troops travelled to California in 2013 for training with US Marines on retaking invaded islands.[123] The two previously mentioned Japanese helicopter destroyers, according to James Hardy "could quite easily double up as the kind of light aircraft carrier that the US Marine Corps uses for expeditionary operations."[124] In November 2014 some 37,700 Japanese personnel and roughly 10,000 US soldiers participated in the bilateral military exercise with the US dubbed "Keen Sword,"[125] held east of Japan's major southern island of Kyushu. Exercises like Keen Sword reflect the increasing importance placed on island defence capabilities by Japan.[126] The 2014 exercise was also reportedly the first time a Japanese officer had been the sea combat commander in what is known as a 'free play' exercise; A less structured and less pre-planned form of training.[127] Further, Japan's annual *Defense White Paper* released in August 2014 indicated its intention to create a marine-like amphibious brigade, and to acquire amphibious assault vehicles in 2015.[128] November 2014 also saw the Japanese Ministry of Defense announce the

[122] Eric Sayers, "Coastal Defense in Japan's Southwestern Islands: Force Posture Options for Securing Japan's Southern Flank" (Project 2049 Institute, January 7, 2013), p. 1, https://project2049.net/documents/1301_ryukyu_futuregram_sayers.pdf.
[123] Erik Slavin, "As Keen Sword Grows, so Do Japan's Security Ambitions," *Stars and Stripes*, accessed November 28, 2014, http://www.stripes.com/news/as-keen-sword-grows-so-do-japan-s-security-ambitions-1.315001.
[124] Hardy, "Japan's Navy."
[125] "Keen Sword" is a biannual exercise that began in 1986. Richards, "A Delay Could Strengthen the US-Japan Defense Guidelines."
[126] Kiyoshi Takenaka, "US, Japan to Conduct Joint Military Drill for Island Defense," *Reuters*, October 21, 2014, http://www.reuters.com/article/2014/10/21/us-usa-japan-defence-idUSKCN0IA1BL20141021.
[127] Slavin, "As Keen Sword Grows, so Do Japan's Security Ambitions."
[128] Seth Robson, "Japan Concerned Pacific Security Situation Getting Worse," *Stars and Stripes*, accessed November 29, 2014, http://www.stripes.com/news/pacific/japan-concerned-pacific-security-situation-getting-worse-1.296803.

procurement of 17 MV-22 Osprey through 2015-2018.[129] The Osprey functions as a dual-use, tilt-rotor aircraft that can both hover as aircraft and fly like a conventional airplane. It can be deployed on the new DDH's and will eventually become the centrepiece of the new marine force.[130] Reports suggest the "Osprey will likely be deployed in significant numbers around Japan's remote southern islands, including Kyushu and Okinawa."[131]

4.5. Air defence

Japan's 2014 *Defense White Paper* states the Japanese Air Self Defense Force (JASDF) scrambled fighter jets to intercept foreign aircraft, mostly Russian and Chinese planes, on more than 800 occasions in 2013.[132] This is reportedly a rate comparable to that at the height of the Cold War.[133] In November 2013 Beijing unilaterally established an Air Defence Identification Zone (ADIZ) over the East China Sea. The ADIZ covers the Senkaku/Diayou islands, "extends more than 300 miles from Chinese territory, and overlaps with nearly 50 percent of an existing Japanese ADIZ in the area."[134] In 2014, Chinese SU-27 fighter aircraft came within less than 200 feet of Japanese military reconnaissance aircraft in the ECS ADIZ on two occasions.[135] Air incursions involving Chinese aircraft around Japan increased 78 percent in the six months between October 2013 and March 2014, compared to the previous six-month period.[136] Responding to these events, in April 2014 Japan began

[129] Author not supplied, "Japan Picks MV-22 Osprey for Tilt-Rotor Aircraft Purchase," *Stars and Stripes*, accessed December 2, 2014, http://www.stripes.com/news/japan-picks-mv-22-osprey-for-tilt-rotor-aircraft-purchase-1.315374.
[130] Hough, "Japan Takes Another Step in Building Marine Force."
[131] Ibid.
[132] Ministry of Defense, "Defense of Japan 2014" (Government of Japan, 2014), http://www.mod.go.jp/e/publ/w_paper/2014.html.
[133] Robson, "Japan Concerned Pacific Security Situation Getting Worse."
[134] Roncevert Almond, "Troubled Skies Above the East China Sea," *The Diplomat*, accessed November 25, 2014, http://thediplomat.com/2014/11/troubled-skies-above-the-east-china-sea/.
[135] U.S.-China Economic and Security Review Commission, "2014 Annual Report to Congress" (Washington, November 20, 2014), pp. 238–39, http://origin.www.uscc.gov/sites/default/files/annual_reports/Complete%20Report.PDF.
[136] Almond, "Troubled Skies Above the East China Sea."

construction on a forward-based monitoring station on Yonaguni Island. The small tropical island is barely 70 miles from the east coast of Taiwan, and just 93 miles south of the Senkaku/Diayou islands. The radar station could extend Japanese monitoring to the Chinese mainland and track Chinese ships and aircraft circling the islands in dispute. It will also provide early warning on missile launches. The first ground-based military expansion of its kind in some 40 years, the Japanese Defense Minister Itsunori Onodera told reporters, "I want to build an operation able to properly defend islands that are part of Japan's territory."[137] Bolstering its surveillance capabilities, Japan's Defense Ministry introduced the RQ-4 Global Hawk unmanned reconnaissance aircraft into the ASDF fleet in 2015.[138] Estimates assert the Global Hawk operates at an altitude of between 15km and 19kms and can loiter on station for more than 24 hours,[139] making it an ideal platform for the type of steady-state ISR operations Japan needs to survey its many offshore islands. Moreover, as Ball and Tanter detail, Japan's ground and air-based signals "intelligence and radar systems have been extensively upgraded and integrated into a single complex over the last decade." [140] In addition, the integration and data sharing with the US has been significantly enhanced. According to Ball and Tanter, by the end of 2012 the cooperative situation, in which Japan had for decades sought to maintain a level of operational autonomy,[141] had been completely transformed. JASDF airspace intelligence and surveillance information is now shared with the USAF in exchange for data from satellites and X-band radar. Its aircraft and missile

[137] Nobuhiro Kubo, "Japan Expands Army Footprint for First Time in 40 Years, Risks Angering China," *Reuters*, April 19, 2014, http://www.reuters.com/article/2014/04/19/us-japan-military-yonaguni-idUSBREA3I05X20140419.
[138] Keck, "Japan to Deploy Global Hawk Spy Drone by 2015."
[139] Ibid.
[140] Ball and Tanter, "The Transformation of the JASDF's Intelligence and Surveillance Capabilities for Air and Missile Defense."
[141] A wariness of entrapment in US strategy likely motivated this. Japan's embrace of BMD, and the subsequent necessity of integration into US ISR systems mean Japan is now more deeply embedded with US strategy than before.

warning and tracking data is now automatically exchanged with data from JMSDF and US Navy Aegis-class ships. This feeds into its air defence and BMD systems at the Bilateral Air Operations Coordination Centre located at the HQ of the 5th US Air Force at Yokota Air Base west of Tokyo.[142] The nervous system of interoperable and pre-integrated systems has been laid. This technical-military integration strongly suggests that, according to Australian analyst Benjamin Schreer, "China's growing assertiveness has led Japan to abandon its concerns about entrapment."[143]

As mentioned above the Aegis air defense system, secured by the JMSDF in 1986 as the first foreign purchaser, was the key to Japan's anti-air warfare for each of its four escort flotillas. The JMSDF is replacing two Hatakaze-class guided-missile destroyers with the latest Atago-class ship; An Aegis equipped version of the US' Arleigh Burke-class destroyer. According to Alessio Patalano, "Japan is buying into lots of hardware that can be used for fleet air and missile defense. The new Aegis ships have highly advanced capabilities that are essential for these missions."[144] As important as Aegis is for standalone fleet air and missile defence, it is the coupling of the system with the imminent arrival of the Lockheed Martin F-35 Lightning II that has the potential to significantly multiply Japan's capabilities in both an alliance and independent context. Linking the F-35's stealth and ISR range with Aegis' SM-3 missile engage/launch-on-remote greatly expands the defence of land and sea central to Japan's maritime security strategy. According to Robbin F. Laird, "These F-35-Aegis offense and defense bubbles can be networked throughout the Pacific to enhance the capacity of individual nations. They represent a prime example of how one country's assets can

[142] Ball and Tanter, "The Transformation of the JASDF's Intelligence and Surveillance Capabilities for Air and Missile Defense," p. 55.
[143] Benjamin Schreer, "Planning the Unthinkable War: 'AirSea Battle' and Its Implications for Australia," *ASPI*, 23, accessed July 14, 2014, https://www.aspi.org.au/publications/planning-the-unthinkable-war-airsea-battle-and-its-implications-for-australia.
[144] Quoted in Kallender-Umezu, "Japan Quietly Builds Limited Counter-A2/AD Capabilities."

contribute to the reach of others, together establishing a scalable capability for a honeycombed force."[145]

4.6. F-35 Lightning II Joint Strike Fighter

The Japan Ministry of Defense announced its selection of the Lockheed Martin F-35 Lightning II as the JASDF's next generation fighter aircraft on 19 December 2011, following the F-X competitive bid process.[146] Japan's 2012 *Defense White Paper* contains a thorough explanation of the decision.[147] Commentary at the time and since has debated the suitability of the F-35 for Japan's requirements, the main alternatives to the F-35 such as the Eurofighter Typhoon, and the economic and political factors at play.[148] In its F-X competition, Japan was looking for an air superiority fighter to replace its ageing Mitsubishi/McDonnell Douglas F-4EJ Phantom IIs.[149] While not designed for the traditional air-to-air role,[150] the F-35's stealth and beyond-visual-range (BVR) interdiction capabilities combined with its unprecedented sensor package, software, and networking capacity mean it is designed to dominate the air.[151] The general consensus was that these attributes alongside Japan's long-standing political and industrial allegiance to the US secured the success of the F-35.[152] In

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[145] Robbin F. Laird, "The Long Reach of Aegis," *US Naval Institute*, January 2012, http://www.usni.org/magazines/proceedings/2012-01/long-reach-aegis.
[146] Author not supplied, "Global: Participation: Japan," *F-35 Lightning II*, accessed October 2, 2014, https://www.f35.com/global/participation/japan.
[147] See Ch.3, section 5, Ministry of Defense, "Defense of Japan 2012" (Government of Japan, 2012), http://www.mod.go.jp/e/publ/w_paper/2012.html.
[148] See Gareth Jennings, "Japan's F-35 Choice Questioned," *The Diplomat*, accessed October 8, 2014, http://thediplomat.com/2011/12/japans-f-35-choice-questioned-2/; Author not supplied, "Japan Offically Selects F-35," *The Diplomat*, accessed September 25, 2014, http://thediplomat.com/2011/12/japan-offically-selects-f-35/; Jeremy Bender, "Japan's F-35s Could Give It A Big Advantage Over China," *Business Insider Australia*, May 9, 2014, http://www.businessinsider.com.au/f-35s-give-japan-big-advantage-over-china-2014-5.
[149] Jennings, "Japan's F-35 Choice Questioned."
[150] It been noted that the F-35's relatively small wing area will translate into high wing loadings during a turning dogfight. Such loadings aren't good in an air-to-air combat scenario as they severely limit manoeuvrability. As such, questions have been raised over the F-35's ability to match the manoeuvrability of Chinese types such as the J-10 and J-11 during close-in aerial combat. Ibid.
[151] See Laird, "Game Changer."
[152] Jennings, "Japan's F-35 Choice Questioned."

addition, the nature of the F-35 alongside Aegis as multiple stakeholder projects involving the US' global partners in the procurement, production, and maintenance cycles adds an extra layer of political and economic incentive. Indeed, in April 2014 the Japanese Defense Ministry proposed that Japan host a maintenance hub in the Asia-Pacific region for the F-35, a move in line with the Abe government's efforts to lift restrictions on the transfer of military technology more broadly.[153] A maintenance, repair, and operations facility in Japan would assist in the government's hopes to revitalize the flagging defence industry amid domestic budgetary constraints. Reports indicate that Mitsubishi Heavy Industries Ltd. "will be involved in work on aircraft bodies, Mitsubishi Electric Corp. on mission-related avionics, and IHI Corp. on engines."[154] Moreover, "Japan is currently in the early stages of developing its own indigenous stealth fighter, so any expertise that can be gained from industrial participation in F-35 production would be welcomed."[155]

An agreement to buy up to 42 fighters by 2021 was signed in June 2012. The F-35 Joint Strike Fighter will enable Japan to establish and maintain air superiority over crucial areas surrounding the country, and its procurement is consistent with Japan's goals of achieving greater interoperability with the US military. Japan's 2013 NSS flagged these goals, stating

> Japan will strive to enhance the deterrence and response capability of the Japan-US Alliance through the following efforts: advancing joint training, joint intelligence, surveillance, and reconnaissance (ISR) activities, and joint/shared use of facilities by the SDF and the US forces; working closely with the US on operational cooperation and policy coordination on issues such as response to contingencies and the medium- to long-term strategy;

[153] Author not supplied, "Japan Eyes F-35 Maintenance Hub under New Arms Export Rules."
[154] Author not supplied, "Japans Next F-X Fighters: F-35 Wins Round 1," *Defense Industry Daily*, 1, accessed December 3, 2014, http://www.defenseindustrydaily.com/f22-raptors-to-japan-01909/.
[155] Jennings, "Japan's F-35 Choice Questioned."

> strengthening its security cooperation with the US in such broad areas as BMD, maritime affairs, outer space, cyberspace and large-scale disaster response operations…
>
> Japan will advance multilayered initiatives with the US such as defense equipment and technology cooperation and personnel exchanges.[156]

Alongside the Aegis missile defense system, the F-35 is one of the key nodes in a network-enabled concept of operations. The platform on its own provides Japan with the air-power to deny an adversary use of Japanese air-space. Where the F-35 departs from its fourth-generation predecessors however is in its unprecedented package of sensors, software, and networking capabilities that link each individual platform together. As Robbin Laird explains, "understanding the real value of the F-35 one must consider its operation as a fleet, not simply as an individual aircraft."[157] Japan's procurement of the F-35 must be understood in this context. It is one of the key functional components envisioned to furnish the network-enabled operational concepts of which Air-Sea Battle is the flagship, and on which Japan's vision of "allied Air-Sea Battle" will operate.[158] Seen in the context of Gen. Michael Hostage's "combat cloud" which describes the "ability of the planes to work with each other over a secure distributed battlespace,"[159] the F-35 procurement by Japan has to be seen as more than a state-of-the-art replacement for legacy aircraft. Rather, it signals not only Japan's concern over the severity of the regional security situation but also its engagement with a US led multi-partnered joint concept-of-operations designed to mitigate it. As Hostage explains, "the advantage of the F-35 is the nature of the global fleet. Allied and American F-35s (can) talk with one another and set up the distributed operational system. Such a

[156] National Security Council, "National Security Strategy," p. 22.
[157] Laird, "Game Changer."
[158] Takahashi, "Counter A2/AD in Japan-US Defense Cooperation."
[159] Robbin F. Laird, "Why Air Force Needs Lots Of F-35s: Gen. Hostage On The 'Combat Cloud,'" *Breaking Defense*, accessed August 11, 2014, http://breakingdefense.com/2013/01/why-the-air-force-needs-a-lot-of-f-35s-gen-hostage-on-the-com/.

development can allow for significant innovation in shaping the air combat cloud for distributed operations in support of the Joint Force Commander."[160] Japan celebrated the roll-out of its first F-35A in September 2016.[161]

4.7. Missile systems

A further area of recent defence investment is Japan's cutting-edge missiles systems. Apart from those under development as part of BMD, Japan has "considerable expertise in developing air to surface, surface-to-air and surface-to-surface systems. Mitsubishi Heavy Industries are currently developing the ASM-3, an air-to-surface missile with a range of 200km and which some consider Japan's answer to China's 'carrier killer' anti-ship missiles."[162] Other systems include both the 'Type-96' and 'Middle-Range' multipurpose missile systems, designed for targeting armoured vehicles and likely planned to act as part of ground-based littoral defences. These systems could be utilised in support of a ground-based 'counter-A2/AD' campaign conducted from the Ryukyu Islands chain for example.[163] Japanese and US forces could create 'no go zones' for PLA forces in the Yellow and East China Seas, with the capacity to hold at risk submarines, aircraft, and surface vessels transiting into the Pacific in the event of a conflict.[164] Indeed, Japan's 2010 NDPG report directs the Ground Self-Defense Force (GSDF) to permanently station units on undefended south-western islands.[165] In November 2011 the GSDF deployed several units armed with

[160] Ibid.
[161] Author not supplied, "Japan Celebrates F-35 Rollout," *Australian Defence Magazine*, September 28, 2016, http://www.australiandefence.com.au/news/japan-celebrates-f-35-rollout/utm_medium/twitter.
[162] Gavan P. Gray, "Japan's Defence Build-up and Its Meaning for Asia" (European Institute for Asian Studies, 2013), p. 12, http://eias.eu/sites/default/files/EIAS_Briefing_Paper_2013-3_Gray.pdf.
[163] See Yoshihara and Holmes, "Asymmetric Warfare, American Style."
[164] For outline of Japan's options here see Sayers, "Coastal Defense in Japan's Southwestern Islands: Force Posture Options for Securing Japan's Southern Flank."
[165] Ministry of Defense, "National Defense Program Guidelines FY 2011 and beyond."

Type 88 anti-ship cruise missiles (ASCMs), which can strike warships at sea from sites well inland from a range of 110 miles, to the northern end of the Ryukyus.[166]

5. Dynamic deterrence

5.1. High/low mix

Japan's concept of "dynamic deterrence" and its desire to build a "Dynamic Joint Defense Force" in line with making a "proactive contribution to peace"[167] requires a set of responses at both the high and low ends of the conflict spectrum. Japan has flagged its concern with "grey zones" also, identifying how the changes in its security environment expressed by the increasing number and frequency of incidents in the air and at sea typically occupy the space between the two extremes. At the high end, BMD, ASW, and air defence comprise the challenges that face Japan in a national security sense. They represent the importance of two of the key axis relating to sea control; air superiority and undersea denial. As described above, the upgrades and ongoing development of the JSDF in key areas are geared directly to these goals, with the procurement of advanced US technology a feature. At the low end, enhanced ISR capabilities, a more flexible and responsive configuration of forces on the sea and in the air, the expansion of joint exercises and training, cooperation in space, and the development of an amphibious landing capability comprise Japan's response. These challenges derive from both the geography of Japan's maritime domain and the emergence of a more capable actor in that domain whose intent it is to stretch the JSDF. Dynamic deterrence in the grey zones therefore is comprised of increased "steady state" capabilities in ISR and a greater presence that is scalable up and down the conflict spectrum. These capabilities are enhanced and supported by joint integration across services and across the

[166] Yoshihara and Holmes, "Asymmetric Warfare, American Style."
[167] Ministry of Defense, "National Defense Program Guidelines for FY 2014 and beyond," pp. 5–6.

alliance. The foundation of this framework is the networked fusion of timely and useable information. Capabilities in terms of platforms and systems that "plug in" to this network are determined by the threat level, and the perceived need to either deny or punish an aggressor.

5.2. Japan's information technology RMA

Adapting elements of the RMA to best suit Japan's unique strategic circumstances has been a feature of its engagement with the RMA discourse.[168] As such, Japan's overtly defensive orientation has informed its uptake of ideas from the RMA, with both constitutional and voluntary restraint on display in relation to what the RMA offers Japan and its resource allocation. Indeed, Japan has tended to define its interests in the RMA largely around what it does *not* mean to Japan, particularly in comparison to US-centric concepts that centre on power projection. As Japan's strategic circumstances have changed, however, and its threat profile has extended and dispersed the geographic area of concern southward, some of the key features of the RMA present attractive opportunities. 1999 marked an increase in the JSDF's interest in the RMA. In September 2000 the Office of Strategic Studies in Japan Defense Agency released *Info-RMA: Study on Info-RMA and the Future of the Self-Defense Forces,* which outlined seven principles guiding Japan's engagement with the RMA: "information, jointness, speed and mobility, efficiency, flexibility, protection, and interoperability."[169] The paper is sanguine about Japan's RMA prospects, and it highlights a number of obstacles including issues with information sharing, technical feasibility, systems failure, and the need for wider organisational and doctrinal transformation. Nevertheless, it

[168] See Sugio Takahashi, "The Japanese Perception of the Information Technology-Revolution in Military Affairs: Toward a Defensive Information-Based Transformation," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), pp. 81–95.

[169] Office of Strategic Studies, Defense Policy Division, Defense Policy Bureau, and Japan Defense Agency, *Info-RMA : Study on Info-RMA and the Future of the Self-defense Forces* (Tokyo: Office of Strategic Studies, Defense Policy Division, Defense Policy Bureau, Japan Defense Agency, 2000), p. 7–9.

concludes that the JSDF should "adopt and utilize positively the fruits of the IT revolution" and recommend further study into the RMA.[170]

Moreover, Japan's subsequently increasing role in missile defence, amphibious operations, ASW, and air defence are missions and operations that leverage enhanced capabilities in networking, ISR, communications, and command and control that a network-centric concept of operations provides. Indeed, as Takahashi asserts, the essential elements of BMD, for example, such as the gathering and sharing of information from satellites and other sensors, sharing it among units across high-speed networks and advanced hit-to-kill interceptors, are identical to those of the information-based RMA.[171] BMD cooperation with the US may mark Japan's first significant step down the RMA path. The emphasis on interoperability with US forces, particularly in the digitisation of communications between JGSDF units and with US Marines described above, also provides a clear growth path for the JSDF toward NCW. In addition, Japan's status as one of the world's leading technological innovators and its extensive industrial base make it a prime candidate, with its efforts to dovetail with the Pentagon's Third Offset.[172] The loosening of Japan's strict defence technology export restrictions will be a key enabler here. Japan's defence industry has not been a part of the post-Cold War transnational expansion,[173] but its potential in NCW related dual-use information technologies is extensive. Further, the promise of NCW away from mass warfare and toward precision and efficiency is an attractive prospect for the particularly

[170] Ibid., p. 13.
[171] Takahashi, "The Japanese Perception of the Information Technology-Revolution in Military Affairs," p. 90–91.
[172] Yuki Tatsumi and Pamela Kennedy, "Leveraging the Third Offset Strategy in the US-Japan Alliance," *The Diplomat*, October 28, 2016, http://thediplomat.com/2016/10/leveraging-the-third-offset-strategy-in-the-us-japan-alliance/.
[173] Joint research and development with the US is the exception.

casualty-averse Japanese public.[174] Finally, perhaps the most prescient influence on Japan's stance toward the uptake of RMA related capabilities and more specifically NCW, is China's military expansion and modernisation over the last decade. Emblematic of this, writing in 2004 Sugio Takahashi recommended a *partial* RMA path for the JSDF, in line with its extant circumstances and the expected costs and benefits, versus a more comprehensive *full* RMA transformation. His recommendation, however, included the following caveat. "If the modernisation of China's armed forces includes a rapid development of amphibious capabilities, and Sino-Japanese relations sour, the JDA (Japan Defense Agency) may need to consider full-scale RMA."[175] The aforementioned rise in tensions around the Senkaku/Diayou islands alone, and the associated decline in relations, makes this an accurate description of the ensuing ten years. In addition, the further Japan embarks down this path, the more capability it will have to offer other existing and prospective members of an Indo-Pacific security network, cross-braced sufficiently to absorb and survive any wavering of American commitment.

5.3. Japan's role in Air-Sea Battle

It has to be noted at the outset that the above mentioned re-interpretations of Article 9, and the subsequent practical ramifications of the shift to collective self-defence, have yet to be codified at the time of writing. Officially, Japan remains incapable of formulating its defence strategy and policy for ASB-based combined offensive operations with the US, due to its own constitutional constraints.[176] This means, for example, it would not be able to deploy its Aegis equipped destroyers or use its F-35's to engage BVR if Japan were not under

[174] Takahashi, "The Japanese Perception of the Information Technology-Revolution in Military Affairs," p. 86.
[175] Ibid., p. 95.
[176] Masahiro Matsumura, "The Limits and Implications of the Air-Sea Battle Concept: A Japanese Perspective," *Journal of Military and Strategic Studies* 15, no. 3 (2014): p. 26, http://www.jmss.org/jmss/index.php/jmss/article/view/544.

direct attack. It would not be permitted to support US forces engaged outside Japan's territorial waters and airspace beyond rear-area/logistical support and intelligence sharing. These restrictions of course assume that in a conflict involving the US and China, over any number of contingencies including Taiwan, the PLA does not attack the various US military installations spread across Japanese territory. Air bases on Okinawa, Iwakuni, the naval base at Sasebo, as well as many of the JSDF bases in western Japan are within range of PLA weapon systems. Therefore, for the purposes of analysing the potential role of Japanese forces under an ASB construct, the following two assumptions are forwarded. Firstly, any major conflagration in the western Pacific involving the US and China would involve US forces deployed from these bases, making an attack on them by PLA forces highly likely.[177] Indeed, extensive analysis of PLA writings suggests it places a premium on degrading or destroying these assets.[178] This immediately trips Japan's constitutional constraint on self-defence, paving the way for JSDF engagement in an allied Air-Sea Battle construct. Secondly, the recommendations adopted by the Abe cabinet on collective self-defence are (as widely expected)[179] likely to be codified in the near term into the doctrine and rules-of-engagement of the JSDF that reflect those recommendations. Specifically, an armed attack on a close ally of Japan that threatens its security would be judged as meeting the criteria of self-defence,[180] and thus removes legal obstructions to the participation of the JSDF in combat operations hence forth. Either way, Japan's defence planners would be compelled to consider the worst-case scenario and respond accordingly. Reinforcing the hypotheticals,

[177] Jake A. Douglas, "Why Washington Can't Restrain Tokyo," *The Diplomat*, accessed March 5, 2014, http://thediplomat.com/2014/03/why-washington-cant-restrain-tokyo/.
[178] See for discussion of these writings, Cliff et al., "Entering the Dragon's Lair."
[179] Michael Mazza, "Is Collective Self-Defense in Japan's Future?," Text, *The National Interest*, accessed May 21, 2014, http://nationalinterest.org/feature/collective-self-defense-japans-future-10491.
[180] Ministry of Foreign Affairs of Japan, "Cabinet Decision on Development of Seamless Security Legislation to Ensure Japan's Survival and Protect Its People." 2014.

Japanese authors have begun to engage with the contingencies of participation in an Air-Sea Battle concept.[181] Finally, given its geo-strategic interest in the status quo in Taiwan, there is little doubt Tokyo has a stake in the success of the Air-Sea Battle concept.[182]

To the contrary, several alternative scenarios are nonetheless plausible. For example, in an effort to limit a conflict the PLA may choose not to attack Japanese territory.[183] Intense pressure via economic and armed suasion could eventually force Japan toward rapprochement with Beijing, limiting US use of bases as staging points. Over time, the cost of US commitments to regional allies and partners could become excessively high, forcing an American retrenchment.[184] These scenarios notwithstanding, military planners designing a set of operational concepts in support of a strategy to deny sea control to PLA forces are not subject to the luxury of speculation. They are responding to extant capabilities and utilising available political, economic, and military tools to bring about desired effects. As such, Air-Sea Battle clearly accommodates a critical role for in-theatre forces at the outset of a crisis. Japan's proximate geography, the strength of the alliance, and the threat of China's force modernisation are fundamental. In addition, according to Mazza, "Japan's current leadership knows that Japanese interests extend far beyond the southern Ryukyu Islands, whether it is to ensure continued freedom of navigation or to protect the status quo East Asian order."[185] There is a strong impression emerging from Japan that its post-war

[181] Takahashi, "Counter A2/AD in Japan-US Defense Cooperation"; Matsumura, "The Limits and Implications of the Air-Sea Battle Concept."
[182] Schreer, "Planning the Unthinkable War," p. 25.
[183] For outline of this scenario, see Hammes, "Offshore Control: A Proposed Strategy for an Unlikely Conflict," 7.
[184] See Gordon G. Chang, "Appeasing China," *The National Interest*, March 19, 2014, http://nationalinterest.org/commentary/appeasing-china-10073?page=2; Harry J. Kazianis, "If China and Japan Went to War: What Would America Do?," Text, *The National Interest*, (June 21, 2014), http://nationalinterest.org/blog/the-buzz/if-china-japan-went-war-what-would-america-do-10722.
[185] Mazza, "Is Collective Self-Defense in Japan's Future?"

'isolationist' posture, if not its 'pacifist' identity, has reached its shelf-life.[186] Finally, the perceptual force of allied commitment has an effect in and of itself, something apparently not lost on Shinzo Abe himself.[187] The following analysis proceeds under the monition of all these factors.

5.4. Laying the foundations

Analysing Japan's potential role in an ASB construct can best be done by piecing together the gap in capabilities Japan could be expected to fill with the procurement evidenced in the preceding sections. From an American perspective, the defence of Japan is both a strategic and an operational imperative. The CSBA's seminal ASB document is unequivocal regarding Japan's strategic value.

> (I)t seems likely that in order to sustain the viability of US power-projection operations in the Western Pacific Theater, particularly in the northeast Asia sub-region, the United States will be dependent to some degree upon Japan's active support. Japan offers a measure of strategic depth in its northern and eastern regions, while the geography of the Ryukyus island chain may prove particularly advantageous for anti-submarine warfare (ASW) operations, for example. Were Japan to cease being a US ally or opt to stay neutral in the event of a Sino-US clash, the ability to execute an AirSea Battle concept would be made more difficult. Absent Japan's support, a successful defense of Taiwan or South Korea would be problematic, at best.[188]

The same document identifies the key operational gap the ASB concept must address. The maturing A2AD capabilities fielded by the PLA in the western Pacific increase the possibility,

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[186] See Daniel M. Kliman, *Japan's Security Strategy in the Post-9/11 World: Embracing a New Realpolitik* (Greenwood Publishing Group, 2006).
[187] See Abe, "Asia's Democratic Security Diamond"; Ankit Panda, "Shinzo Abe's 'Quadrilateral Initiative': Gone and Forgotten?," *The Diplomat*, accessed May 12, 2014, http://thediplomat.com/2014/05/shinzo-abes-quadrilateral-initiative-gone-and-forgotten/.
[188] Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept," p. 14.

and indeed the temptation, that PLA forces could strike out for and seize sea-control quickly and without warning. Presenting the region with a *fait accompli*,[189] US and allied forces would then face the prospect of overturning Chinese sea-control, an altogether different proposition from that of competing for it in the first place. Otherwise, the regional military balance-of-power would have made a significant shift in Beijing's favour, upon which layers of resilience could be further added. The key factors driving this possibility are distance and time. These physical constraints are what make Japan's potential role so critical.

Japan's proximity in theatre is the key geographical factor. The capacity of US forces to respond and contest a PLA sea-control effort inside the first island chain is increasingly constrained by PLA area denial platforms such as its Integrated Air Defense Systems (IADS), fourth and fifth-generation combat aircraft, surface and sub-surface combatants, and short/medium range cruise and ballistic missile threats. With the freedom of movement of US forces inside the denied zone restricted, the PLA's ability to contest and win control of the air, sub-surface, and eventually the surface domains in the initial phases of a conflict will depend heavily on the influence the JSDF exert on proceedings. In addition, early US reinforcement of Japanese defences is critical in preventing Japan from being forced out of the fight.[190] In the early phases these influences would be centred on absorbing and minimising the initial PLA ground and air-based missile onslaught and must include:

- **Ground and sea-based air and missile defense** - Upon warning, US and Japanese AEGIS ships would proceed to pre-assigned BMD stations.[191] The objective would be to complicate PLA planning by reducing the effectiveness of the missile barrage,

[189] Ibid., pp. 20–21.
[190] Ibid., p. 55.
[191] Ibid.

creating uncertainty as to that effectiveness, and to cause PLA forces to expend more missiles as a result.

- **Base hardening and rapid repair** – a corollary of the above is the necessity for selected base hardening and other passive defensive measures and work-arounds. The objective would be to improve the survivability of assets stationed on the ground and to maintain or quickly regain functionality.
- **Undersea and aerial ASW** - US and Japanese submarines would move to forward stations and commence ASW operations (including operations inside the first island chain and across the Ryukyus island chain and Luzon Strait).[192] The objective would be to deny the undersea domain to PLA submarines, force them back inside Chinese territorial waters, and conduct missions against undersea infrastructure targets.
- **Air superiority** – Extended-range air defense of Japan would be a key Air-Sea Battle mission at the onset of a conflict. Japanese fourth and fifth-generation fighters including the F-35 would protect Japanese air-space and free up US fighters to conduct offensive missions[193] and aerial ASW inside the first island chain. "The bulk of Japanese and US fighters would operate from bases in eastern Japan, since bases further west would be more vulnerable to PLA attacks."[194]
- **Maritime ISR** - Japan would use its highly sophisticated and networked ISR structure to detect and track hostile air and ballistic-missile activities. Fully integrated with US ground, sea, air, and space based sensors, a common operating picture of the maritime domain would be essential to joint operations.

[192] Ibid.
[193] Schreer, "Planning the Unthinkable War," p. 23.
[194] Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept," p. 69.

6. Conclusion

Committing JSDF capabilities to these five key areas, as part of a broader network-enabled operational concept, has the potential to deny PLA forces a quick sea-control victory should a conflagration prove unavoidable. PLA planners are compelled to consider the prospect of, first, not achieving initial aims and, secondly, engaging in protracted conflict with allied forces escalating beyond its initial intent and involving unknown costs. More importantly, Japan's commitment to such a role may deliver a deterrent that achieves effects greater than the sum of its parts. Japan's long trending procurement of the components of the digital information infrastructure supporting a network-enabled warfare concept, in close cooperation with the US in technology and intelligence exchanges, exercises, training and doctrine lays the foundations for such a deterrent. Built from the 'inside out' with the technical-operational components as key enablers, a regional scale-free security network is taking shape with Japan as its indispensable northern hub. Other domestic and regional political, legal, economic and social enablers will be pivotal, though Japan's capacity to overcome political opposition and commit necessary resources is questioned. However, a scale-free security network in the maritime domain that undercuts the traditional dynamics of Snyder's zero-sum inter-state relations is Japan's premier strategic pathway. Japan's capacity to 'cross-brace' a US-led network of security clients in the Indo-Pacific region with well-honed diplomatic and political acumen, and in partnership with Australia, will be invaluable to the US.

Chapter VII. Australia – the southern hub

1. Introduction

Australia's national security strategy after 1990 increasingly reflects, while undesignated, the organising principles of the scale-free network model. The tenets of growth, preferential attachment, and fitness long reflected the foundations of Australia's strategic outlook. With similarities to Japan, all these features are evident from a close inspection of Australia's national security, intelligence and defence activities, and associated inscriptions, translations and circulating reference, as the digital networked age progressed. With its low mass but world class conventional warfighting capacities well known and highly active, Australia's armed forces are adept at thinking in network terms, using its privileged position as regional network hub to advantage. Without explicit acknowledgement, much of Australia's strategic behaviour is reflective of an implicit understanding of the dynamics at work in the scale-free network.

In December 1941, immediately following the Japanese attacks on Pearl Harbour and in South-East Asia, Australian Prime Minister John Curtin described the US as the keystone of Australian defence. In an article published in the *Melbourne Herald* of 27 December 1941, he stated:

> Without any inhibitions of any kind I make it quite clear that Australia looks to America, free from any pangs as to our traditional links or kinship with the United Kingdom.

> …we shall devote all our energies towards the shaping of a plan, with the United States as its keystone, which will give to our country some confidence of being able to hold out until the tide of battle swings against our enemy.[1]

So began an era in which an independent Australian defence strategy was built in juxtaposition with the military strength, technological sophistication and geo-political interests of the US. [2] The last official iteration of this juxtaposition was described in the Strategic Outlook section of the 2016 Defence White Paper (DWP).[3] Its historical foundation derived from the physical reality that Australia is unable to defend its immense geography and small population against all threats, and instead must seek security through political, military and technical cooperation with powerful allies.[4] Institutionally, these conditions mean Australia benefits from and actively pursues the building and maintenance of a rules-based international and regional order.[5] Australia's strategic trajectory since the late 1990s expressed the organising principles of the scale-free network via its drive to increase its military's digital connectivity capabilities with the US.

Section 2 of this chapter provides a background to Australia's strategic orientation and thinking about its security. The central historical importance of information and intelligence sharing with the US and others are highlighted in section 3, bringing the reader up to date with the most recent developments via regular AUSMIN meetings and DWPs. A brief overview of recent and future military-technical acquisitions by the ADF relating to themes

[1] Cited in David Black, "In His Own Words: John Curtin's Speeches and Writings," *Paradigm Books, Curtin University, Perth. John Curtin* 106 (1995): p. 194–195.
[2] See for extensive detail Stephan Frühling, "A History of Australian Strategic Policy since 1945," *Canberra: Defence Publishing Services*, 2009, http://defence.gov.au/Publications/docs/StrategicBasis.pdf.
[3] Department of Defence, "2016 Defence White Paper" (Commonwealth of Australia, 2016), p. 14, http://www.defence.gov.au/Whitepaper/Docs/2016-Defence-White-Paper.pdf.
[4] Christopher Hubbard, *Australian and US Military Cooperation: Fighting Common Enemies* (Gower Publishing, Ltd., 2005), p. 3.
[5] Department of Defence, "2016 Defence White Paper," p. 15.

of information dominance and networked warfare is provided in section 4. Section 5 traces the ADF's interest in and ongoing pursuit of transformation into a networked fighting force and joint interoperability with US forces. Section 6 details particular operational areas where the ADF is progressing down a distinctly networked path. Australia's potential role in high-end operations related to Air-Sea Battle is discussed.

2. Australia's strategic orientation

2.1. ANZUS and UKUSA

The alliance framework, evoked by the ANZUS treaty, has since the early 1950's provided a level of security in the form of assurances about American extended deterrence in the unlikely event of aggression from the Soviet Union or China. Assurances that are, nonetheless, remarkably difficult to quantify.[6] Australian force structure planning during the Cold War was oriented toward deterring the Suharto regime in Jakarta, as well as addressing modest alliance expectations for the provision of frontline assets to be used in any major NATO-Warsaw Pact contingency.[7] In return for its assurances, though not directly sought by the Australian government as a matter of policy,[8] Australia provided the US with defence, communications and intelligence installations critical to its global strategic programs and operations. The post-war UKUSA agreement codified in 1947-48 the signals intelligence (SIGINT) relationship which also included the United Kingdom, Canada and New Zealand. Originally signed by representatives of the London Signals Intelligence Board and its American counterpart in March 1946, the UKUSA Agreement is "without parallel in the Western intelligence world and formed the basis for co-operation between the allies

[6] See for discussion Richard Tanter, "'Just in Case': Extended Nuclear Deterrence in the Defense of Australia," *Pacific Focus* 26, no. 1 (2011): p. 113–36.
[7] Carlo Kopp, "Australia's Capabilities Versus the Region," *Defence Today* 9, no. 5 (2012): p. 2.
[8] See Australian Strategic Analysis and Defence Policy Objectives (September 1976) in Frühling, "A History of Australian Strategic Policy since 1945," p. 604.

throughout the Cold War."[9] According to Richelson and Ball, UKUSA (or Five Eyes) remains "the most important international agreement to which Australia is a party."[10]

The stationing of "joint facilities"[11] for SIGINT on Australian soil under a series of agreements beginning in the 1960's, most notably at North-West Cape in Western Australia, and Pine Gap and Nurrungar in central Australia, likely made these facilities high-priority targets in the event of a nuclear exchange between the US and Soviet Union.[12] The sharing of intelligence and access to the military technical expertise, equipment, and training of its senior partners has nonetheless informed the strategic calculus of successive Australian governments, as has the obscured but critical role Australian participation played in Cold War strategic stability.[13] The urge for self-reliance, moreover, was fundamentally tempered by the realities of maintaining the high-technology focus, underpinned by the 'knowledge edge',[14] of Australian defence strategy. Remarkably little public discussion of this calculus has occurred in Australia at the time or since,[15] perhaps best explained by the sensitive nature of the joint facilities themselves, but also in part due to the ambiguity inherent in US extended deterrence.

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[9] Author not supplied, "Newly Released GCHQ Files: UKUSA Agreement," Text, *The National Archives*, accessed January 19, 2015, http://www.nationalarchives.gov.uk/ukusa/.

[10] Jeffrey Richelson and Desmond Ball, *The Ties That Bind: Intelligence Cooperation between the UKUSA Countries-the United Kingdom, the United States of America, Canada, Australia and New Zealand* (Allen & Unwin London, 1985), chap. 7.

[11] More than twenty US military, intelligence, scientific and space facilities were identified by Desmond Ball, *A Suitable Piece of Real Estate: American Installations in Australia* (Hale & Iremonger Sydney, 1980), p. 19. Of these, North-West Cape, Pine Gap, and Nurrungar were vital nodes in the US strategic nuclear posture.

[12] Ball, "The Strategic Essence," p. 238.

[13] See W. G. Hayden, "Uranium, the Joint Facilities, Disarmament and Peace," *(Canberra: Australian Government Publishing Service, 1984)*, p. 15.

[14] See Stephan Fruhling, James Goldrick, and Rory Medcalf, "Preserving the Knowledge Edge: Surveillance Cooperation and the US–Australia Alliance in Asia," *ASPI*, accessed December 14, 2014, https://www.aspi.org.au/publications/preserving-the-knowledge-edge-surveillance-cooperation-and-the-usaustralia-alliance-in-asia.

[15] See Richard Tanter, "Back to the Bases," *Arena Magazine (Fitzroy, Vic)*, no. 117 (2012): p. 26; Richard Tanter, "The 'Joint Facilities' Today: Desmond Ball, Democratic Debate on Security and the Human Interest," *Arena Journal*, no. 39/40 (January 1, 2012): p. 88.

2.2. Forward Defence

The doctrine of defending Australia via supporting first British and then American forces wherever and whenever they fought, had remained at the centre of Australian defence thinking, even after the fall of Singapore.[16] The concept of 'Forward Defence' that animated Australian security after the failure of this earlier strategy in 1941, however, is distinct. 'Forward Defence' focused on the main approaches to maritime South-East Asia, Australia's own region, and specifically on the Malay Peninsula. It involved Australian forces fighting in Korea and Vietnam alongside the United States, as well as in Borneo during the Confrontation and in Malaya with the British.[17] As early as 1964, however, with the potential spectre of communism in Indonesia on Australia's doorstep, a measure of self-reliance was an inescapable imperative for Australian defence strategy. This was a reflection of hard reality, when in 1967 the British Government decided to withdraw its forces east of Suez, and the 1969 statement by President Nixon that America's Pacific allies had to prepare themselves to defend against all but a major attack. It was not until the late 1960s and the 1970s that the beginning of an independent strategy, with the anticipated changes in the level and nature of US and UK involvement in South-East Asia, would come to pass.[18] 'Forward Defence' gave way to the 'Defence of Australia' which became formalised in the 1987 and 1994 *White Papers.*[19]

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[16] Stephan Fruhling, "What Is 'Forward Defence' These Days?," accessed January 27, 2015, http://www.lowyinterpreter.org/post/2010/07/21/What-is-Forward-defence-these-days.aspx.
[17] Paul Dibb, "Chapter 1. The Self-Reliant Defence of Australia: The History of an Idea," accessed January 27, 2015, http://press.anu.edu.au/sdsc/hap/mobile_devices/ch01.html.
[18] Allan Hawke, "Address - 'Australia's Defence Policy - From Dependence to Independence in Our Strategy,'" accessed January 27, 2015, http://www.defence.gov.au/media/speechtpl.cfm?CurrentId=1423.
[19] Commonwealth of Australia, Australian Defence (Canberra: Australian Government Publishing Service, 1976); Commonwealth of Australia, The Defence of Australia 1987, (Canberra: Australian Government Publishing Service, 1987); Commonwealth of Australia, Defending Australia: Defence White Paper 1994 (Canberra: Australian Government Publishing Service, 1994).

2.3. The Defence of Australia

The vast expanses of Australia's northern approaches, combined with its relatively small population confined mainly to the south-eastern corner, and approximately 36,000 kilometres of coastline,[20] present Australian defence planners with the tyranny of range and scale with a scarcity of resources (human and financial).[21] Australia is a significant power in its own adjacent region, but its capacity for combat effect fades rapidly into niche capabilities as they move away from Australia's shores.[22] Australia has the largest area of ocean jurisdiction of any country on earth.[23] Long-range command and control, long-range ISR systems, and long-range weapons and platforms are a fundamental requirement if Australia is to penetrate the opaqueness of its external geography. Australia's northern frontier, nonetheless, provides it with great strategic depth if it could be made transparent with persistent, effective, real time surveillance.[24]

The mid-1970's saw the emergence of a greater desire for defence self-reliance as a priority for the Australian government, couched as it was within a broader US alliance framework. The 1973 *Strategic Basis of Australian Defence Policy* asserted,

> A fundamental change in our position is that while Australia may still look to its major allies, particularly the US, for strategic support in circumstances going beyond those they will expect us to handle ourselves, it must now assume the primary responsibility for its own defence against any neighbourhood or regional threats. This need for greater self-reliance

[20] Geoscience Australia, "Border Lengths - States and Territories," May 15, 2014, http://www.ga.gov.au/scientific-topics/geographic-information/dimensions/border-lengths.
[21] Adam Cobb, "All the Way with the RMA? The Maginot Line in the Mind of Australian Strategic Plannerss," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), p. 58.
[22] Hubbard, *Australian and US Military Cooperation*, p. 151.
[23] Department of the Environment, "Introduction, Description of Australian Marine Regions, Description of Map Themes, Base Map Details," accessed January 31, 2015, http://www.environment.gov.au/system/files/resources/4295ab1f-68af-4f07-bfc5-7f95c7cce24e/files/nat-atlas1.pdf.
[24] Office of the Minister for Defence, "Australia's Strategic Policy" (Commonwealth of Australia, December 2, 1997), http://www.defence.gov.au/minister/sr97/s971202.html.

> and the ability to act independently call for the maintenance at all times of defence strength which is adequate for immediate purposes and may be expanded if necessary.[25]

The desire to meet credible regional contingencies with Australia's own technical capabilities, however, accommodated something of a paradox.[26] By the mid-1980's, as the technical and operational requirements of self-reliance were articulated in the 1986 *Review of Australia's Defence Capabilities*[27] and 1987 *Defence White Paper*,[28] it became abundantly clear "only the United States could provide Australia with the intelligence, defence technology and professional military expertise which would enable it to independently handle regional threats."[29] For example, US maritime surveillance systems maintained the integrity of the air and sea lines of communication that Australia depends on.

2.4. Australia's post-Cold War threat environment

The strategic certainty of the Cold War period in Australia's region has been overturned. Australia's strategic, economic, and political environment has been profoundly transformed by Asia's economic and military rise, in turn reshaping its threat perceptions. For the first time in the post-war era, the epicentre of great power interaction has entered Australia's maritime periphery, shifting it from "down under" to "top center" in terms of geopolitical import.[30] Indeed, as Michael Evans argues, "Australia's geopolitical position is being transformed through the emergence of a complex global-regional nexus in statecraft and

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[25] Strategic Basis of Australian Defence Policy (June 1973) in Frühling, "A History of Australian Strategic Policy since 1945," p. 481.
[26] See for discussion, Ross Babbage, *A Coast Too Long: Defending Australia Beyond the 1990s* (Allen & Unwin, 1990).
[27] Paul Dibb, *Review of Australia's Defence Capabilities: Report to the Minister for Defence* (Australian Government Publishing Service, 1986).
[28] Department of Defence, "The Defence of Australia" (Commonwealth of Australia, 1987), http://www.defence.gov.au/Publications/wpaper1987.pdf.
[29] Desmond Ball, "The Strategic Essence," *Australian Journal of International Affairs* 55, no. 2 (2001): p. 236.
[30] See Iskander Rehman, "From Down Under to Top Center: Australia, the United States and This Century's Special Relationship'," *Transatlantic Academy Paper Series*, 2011.

strategy."[31] Long-beholden to a Pacific-centric view, Australia's 2013 *Defence White Paper* diverts attention to the emergence of an "Indo-Pacific Strategic Arc that connects the Indian Ocean and Pacific Oceans through Southeast Asia."[32] The principal focal points in regional capability growth have been in air power and sea power, via the proliferation of modern long range combat aircraft, precision guided munitions, and submarines in East Asia.[33]

The reach of the modern weapon systems proliferating throughout Asia presents Australian defence planners with unprecedented challenges. As Carlo Kopp explains, the sea-air gap to Australia's north-west can now be penetrated un-refuelled by any number of tactical aircraft in service in East Asian countries, including variants of the Sukhoi Flanker, and the new stealthy Russian Sukhoi T-50 PAKFA and Chinese Chengdu J-20 fighters.[34] In 2011, Indonesia, Australia's most important regional relationship, signed a contract with South Korea's Daewoo Shipbuilding and Marine Engineering for the procurement of three Type 209/1200 diesel-electric attack submarines by 2020.[35] The regional focus on maritime power has spread throughout East Asia, with nations increasingly investing in high-end naval platforms.

As Richard Bitzinger explains,

> militaries in the Asia-Pacific are acquiring greater lethality and accuracy at greater ranges, improved battlefield knowledge and command and control, and increased operational manoeuvre and speed. Modern submarines, surface combatants, amphibious assault ships,

[31] Michael Evans, "The Closing of the Australian Military Mind: The ADF and Operational Art," *Security Challenges* 4, no. 2 (2008): p. 105.
[32] Department of Defence, "2013 Defence White Paper" (Commonwealth of Australia, 2013), p. 7, http://www.defence.gov.au/whitepaper/2013/docs/wp_2013_web.pdf.
[33] Kopp, "Australia's Capabilities Versus the Region," p. 2.
[34] Carlo Kopp, "Air Superiority Game Changers: T-50 PAK-FA and J-20," *Defence Today* 9, no. 4 (2012): pp. 34–35.
[35] Jim Thomas, Zack Cooper, and Iskander Rehman, "Gateway to the Indo-Pacific: Australian Defense Strategy and the Future of the Australia-US Alliance," *Center for Strategic and Budgetary Assessments, Washington DC*, 2013, p. 5.

> air-refuelled combat aircraft, and transport aircraft have extended their range of action, and standoff precision-guided weapons, such as cruise and ballistic missiles and terminal-homing (such as GPS or electro-optical) guided munitions, have greatly increased combat firepower and effectiveness. Advanced reconnaissance and surveillance platforms have expanded their effectiveness in the maritime domain. Additionally, stealth and active defences such as missile defence and longer-range air-to-air missiles are adding survivability and operational effectiveness to regional forces. Consequently, conflict in the region, should it occur, would likely be more "high-tech" than in the past—faster, longer in reach, and yet more precise and perhaps more devastating in its effect. [36]

The post-1970's consensus on the ADF's basic force structure under the Defence of Australia construct, designed to address credible threats to Australia's backyard first and its neighbourhood second, is again under strain. According to Evans, "the impact of the changing security environment can perhaps best be appreciated by the fact that between 1999 and 2005, Australia deployed a total of 68,000 ADF personnel globally, including contingents to East Timor, Bougainville, Afghanistan, Iraq and the Solomon Islands."[37] This flurry of expeditionary operations, driven by the rapidly changing post-2000 global-regional security environment, had the effect of eclipsing much of the content of the 2000 *Defence White Paper,* even as the ink was drying. Three *Defence Updates* in 2003, 2005 and 2007 respectively focused on the need to "create an ADF with the capacity to meet the growing demands of the global-regional nexus in Australian strategy."[38] As the 2007 *Defence Update* states, Australia is at once a 'security contributor' to global stability and a 'security leader' in the immediate region.[39] This nexus is the animating feature of contemporary Australian

[36] Richard A. Bitzinger, "Come the Revolution: Transforming the Asia-Pacific's Militaries" (DTIC Document, 2005), pp. 43-44, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA521122.
[37] Evans, "The Closing of the Australian Military Mind," p. 119.
[38] Ibid.
[39] Department of Defence, "Australia's national security: a defence update 2007," Text, *Australian Policy Online*, (July 6, 2007), p. 31–32, http://apo.org.au/node/4471.

defence planning. Three publications: *Force 2020* (2002), *Future Warfighting Concept* (2003), and *Joint Operations for the 21st Century* (2007)[40] represent the shift from a continental Defence of Australia construct to an expeditionary-manoeuvre focussed approach to warfare for the ADF. The post-2000 concept of manoeuvre is squarely situated in the Revolution in Military Affairs-Transformational architecture of network-centric warfare.[41] Measured as an independent entity, then, the strategic thrust of Australia's combat potential based on its 'Defence of Australia' structure was in long term relative decline in Asia.[42] Measured in context with shifting US strategic interest in East Asia, combined with an expeditionary focus and a 'technology bias'[43] for the ADF, a different picture emerges.

2.5. AUS-US strategic convergence

From an American perspective, a report by the Center for Strategic and Budgetary Assessments (CSBA) states, "Australia appears ideally positioned to act as gatekeeper to the Indo-Pacific commons, keeping watch over increasingly contested waters and fulfilling a central role in the preservation of crisis stability in Asia."[44] Both countries governments assess the Indo-Pacific as an important theatre for future joint operations,[45] and Australia's strategic geography and regionally superior capabilities makes it's value a notable growth element in the partnership with the United States. Washington views Australia as a vital

[40] Department of Defence, Force 2020 (Canberra: Public Affairs and Corporate Communications, 2002); Department of Defence, Future Warfighting Concept (Canberra: Policy Guidance and Analysis Division, 2002); Department of Defence, Joint Operations for the 21st Century (Canberra: Strategic Policy Division, 2007).
[41] Evans, "The Closing of the Australian Military Mind," p. 120.
[42] See Hugh White, "A Middling Power: Why Australia's Defence Is All at Sea," Text, *The Monthly*, (September 6, 2012), http://www.themonthly.com.au/issue/2012/september/1346903463/hugh-white/middling-power.
[43] Department of Defence, "Force 2020," p. 11, accessed January 23, 2015, http://www.defence.gov.au/publications/f2020.pdf.
[44] Thomas, Cooper, and Rehman, "Gateway to the Indo-Pacific," p. 1.
[45] David J. Berteau et al., "US Force Posture Strategy in the Asia Pacific Region: An Independent Assessment" (DTIC Document, 2012), p. 31, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA563866.

"bridging power" in Asia, whose deepening ties with rising democratic powers, such as India and Indonesia, stand to perform an increasingly important role in mitigating against the future of regional instability.[46] The 2016 DWP once again commits Australia to "broaden and deepen" its alliance with the United States.[47] Positioned between the Indian Ocean and Western Pacific theatres, Australia can contribute to enabling naval forces to shift between the two oceans. With American air and naval bases in South Korea, Japan, and Guam, forces are concentrated well east and north of the Indo-Pacific epicentre. In peacetime, this places additional wear and tear on forces patrolling the thoroughfare of South-East Asia. In crisis or wartime, it means US forces could be delayed or blockaded attempting to transit the Luzon, Malacca, Lombok and Sunda straits.[48] The geographical constraints are augmented by the extant and growing threat to the access to and safety of US basing in northeast Asia represented by the PLA's cruise and ballistic missile arsenal.[49] These factors underpin the increasing American interest in the development of and access to Australian basing and facilities.[50] To be sure, Australia has its drawbacks, such as the distance from theatre that comes with sanctuary, as well as the current opposition to hosting some US Navy nuclear-powered platforms.[51] It does however align with stated US basing objectives for a more even regional distribution, for durability and survivability to support a range of operations, and

[46] See David Wroe, "Hillary Clinton Encourages Australia-India Relationship," *The Sydney Morning Herald*, accessed January 27, 2015, http://www.smh.com.au/federal-politics/political-news/hillary-clinton-encourages-australiaindia-relationship-20121113-29aw9.html.
[47] Department of Defence, "2016 Defence White Paper," p. 15.
[48] Toshi Yoshihara, "Resident Power: The Case for an Enhanced US Military Presence in Australia," *Strategic Snapshots, July*, 2011, p. 2.
[49] See Cliff et al., "Entering the Dragon's Lair"; Yoshihara and Holmes, *Red Star Over the Pacific*; Lord and Erickson, *Rebalancing U.S. Forces*.
[50] See Prashanth Parameswaran, "US May Base Warships in Australia," *The Diplomat*, accessed February 12, 2015, http://thediplomat.com/2015/02/us-may-base-warships-in-australia/.
[51] Rebecca Seales, "Australia Risks Harming American Ties by Refusing to Base US Air Carrier," *Mail Online*, accessed February 5, 2015, http://www.dailymail.co.uk/news/article-2183066/Australia-risks-harming-American-ties-refusing-base-US-air-carrier.html.

for the political acceptance of the host nation. Indeed, a 2011 poll by the Lowy Institute found 55 per cent of Australians in favour of basing US military forces in Australia.[52]

2.6. Australia's SLOC security

From the Australian perspective, any protracted future conflict unfolding within Australia's regional maritime zone of interest, in which it seeks to retain a credible independent deterrence posture, would overlap with the vital interests of its critical alliance partner.[53] The chief threat to Australia's security interests arising from China's military modernisation derives not from a territorial threat to the Australian mainland.[54] It derives from the capacity of a coastal state with increasing control of the air and sea lines of communication Australian trade relies on, to use this control to coerce the Australian government as well as its regional allies and partners.[55] As mentioned, the same basic SLOC threat animates the concerns of all states whose economic lifelines traverse the South China Sea and its associated choke points.[56] The threat, however, of the deliberate use of maritime interdiction by a coastal state as a coercive tool is, at present, decidedly remote. China relies as or more heavily on the safety and security of trade through the critical and unavoidable transit zones of maritime East Asia as all do.[57] Comprehensive SLOC security is global, not regional. Controlling a bubble of security, even one extending up to Biddle's maximum of 600km from coastal China into the SCS, is not a sufficient level of control from which to

[52] Fergus Hanson, "The 2011 Lowy Institute Poll," *Lowy Institute for International Policy*, accessed February 5, 2015, http://www.lowyinstitute.org/publications/2011-lowy-institute-poll.
[53] See Bruce Vaughn, "Australia and the U.S. Rebalancing to Asia Strategy" (Congressional Research Service, 2012).
[54] Department of Defence, "2016 Defence White Paper," pp. 71–72.
[55] Ibid., p. 70.
[56] The majority of Australia's shipping takes routes in and out of maritime East Asia via the Sunda and Lombok Straits. Much of this shipping travels west of Malaysia and up the western coast of the Philippines. Shipping to and from Australia's east coast travels west of Papua New Guinea and enters the SCS also via the Luzon Strait.
[57] Greg Austin, "4 Reasons Why China Is No Threat to South China Sea Commerce," *The Diplomat*, accessed May 29, 2015, http://thediplomat.com/2015/05/4-reasons-why-china-is-no-threat-to-south-china-sea-commerce/.

enact a maritime interdiction campaign whose potential political benefits outweigh its costs. However, the linking of a consolidated area of control to several others along the SLOCs of the Indo-Pacific arc could eventually lead to a sufficient level of control in which a protagonist could quarantine itself from the damaging costs arising from any interdiction and subsequent sea-lane insecurity.[58] Whether or not such a strategy is among China's intentions is widely debated.[59] This means though that the primary site of strategic contestation between the United States and China in maritime East Asia is that of regional political alignment. It is essentially a political contest with attending military and economic themes. Hence the overlapping interests in a military conflict in the region that threatens to upset or undermine alignment. Australia is strategically aligned with the regional status quo. However remotely plausible, an East Asia accommodating Australia's vital SLOCs that dovetail with vital US Navy transit points that undergoes a significant process of political realignment toward China over the years and decades to come, places the Australian government under the threat of political coercion deriving from that realignment. It would significantly increase the risk of political coercion via SLOC interdiction and the capacity to curtail American military access. Such a shift would force a massive shift in Australian security thinking.

Alternatively, a crisis further north over Taiwan, the Korean Peninsula, or the East China Sea, which given its proximity would be unlikely to involve the ADF in a combat scenario, would

[58] Discussed under China's 'String of Pearls' strategy, see Gurpreet S. Khurana, "China's 'String of Pearls' in the Indian Ocean and Its Security Implications," *Strategic Analysis* 32, no. 1 (2008): pp. 1–39; Christopher J. Pehrson, "String of Pearls: Meeting the Challenge of China's Rising Power across the Asian Littoral" (DTIC Document, 2006), http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA451318.
[59] Phillips, "China's Real Goal"; Aaron L. Friedberg, "Menace," Text, *The National Interest*, accessed June 4, 2014, http://nationalinterest.org/greatdebate/dragons/menace-3818; Robert S. Ross, "Myth," Text, *The National Interest*, accessed June 4, 2014, http://nationalinterest.org/greatdebate/dragons/myth-3819; Amitai Etzioni, "Overstating the China Threat?," *The Diplomat*, accessed April 11, 2014, http://thediplomat.com/2014/04/overstating-the-china-threat/; Lyon, "What Keeps Asia up at Night."

nonetheless involve Australia's keen interest there in the preservation of the status quo, and thus would engender the ADF in critical basing, logistics, and intelligence support for US forces.[60] The paradox of the urge for self-reliance, coupled with the dependence for capabilities on the US, may be devolving into a false dichotomy. The global geopolitical power-shift from West to East, reflected in the rising economic and military weight of East Asia, may mean this "strategic overlap" is likely to become a permanent feature of the ANZUS alliance.[61] In addition, as outlined by a recent Center for Strategic and International Studies assessment, an "enhanced US defence presence in Australia would expand potential opportunities for cooperation with Indonesia, other South-East Asian countries, and India, and it would complement parallel US initiatives such as rotationally deploying Littoral Combat Ships in Singapore and increased US military access to the Philippines."[62] Even as some Australian officials express "concerns of abandonment because of American distraction in the Middle East and failure to implement the pivot, other Australian officials reveal a deep concern about entrapment by the United States in a conflict with China."[63] A networked strategy leveraging dominance in the information domains, capable of distributing non zero-sum trust across allied configurations without being counterproductively provocative, is what Australia needs. The legacy of Australia's engagement in intelligence and information sharing with the US is formative.

[60] Paul Dibb and John Lee, "Why China Will Not Become the Dominant Power in Asia," *Security Challenges* 10, no. 3 (2014): p. 20–21.
[61] Thomas, Cooper, and Rehman, "Gateway to the Indo-Pacific," p. 10.
[62] David J. Berteau et al., *U.S. Force Posture Strategy in the Asia Pacific Region: An Independent Assessment*, June 27, 2012, p. 32.
[63] Michael J. Green et al., "The ANZUS Alliance in an Ascending Asia" (Center for Strategic & International Studies, July 2015), p. 7, http://ips.cap.anu.edu.au/sites/default/files/COG%20%2323%20Web.pdf.

3. Keeping watch

3.1. North-West Cape

The world's largest and most powerful very low frequency (VLF) radar at North-West Cape naval communications station was established in 1963 and commissioned in 1967.[64] On 20 September 1968, the station was officially renamed US Naval Communication Station Harold E. Holt in memory of the late former Prime Minister of Australia. For the better part of two decades it was used by the US Navy to relay command and control signals to its strategic forces in the Western Pacific and Indian Ocean. These forces consisted primarily of US Navy *Polaris* nuclear-powered ballistic missile submarines and some surface vessels.[65] The range of the *Polaris* missile made the Western Pacific and Indian Ocean key strategic thoroughfares in the context of a potential nuclear exchange with the Soviet Union, and as such the North-West Cape a vital relay station for communications to and from Washington. The *Polaris* submarines were retired from the Pacific in 1982 and replaced with the *Ohio* class armed with the *Trident* ballistic missile. The *Trident's* improved range meant the *Ohio's* would operate mostly in the northern Pacific, relying primarily on Jim Creek in Washington for VLF communications.[66] While the US Navy continued to use North-West Cape to communicate with its nuclear-powered attack submarines in the region, and the facility was augmented with satellite communications critical to supporting an expanding range of US

[64] Parliament of Australia, "United States Naval Communication Station Agreement Act 1963," *Federal Register of Legislation*, accessed December 1, 2016, https://www.legislation.gov.au/Details/C1963A00030/Html/Text, http://www.legislation.gov.au/Details/C1963A00030.
[65] Richard Tanter, "North by North West Cape: Eyes on China," in *Austral Policy Forum*, 2010, http://nautilus.wpengine.netdna-cdn.com/wp-content/uploads/2012/06/NW-Cape-tanter-bases.pdf; See also Brian Humphreys, *Calls to the Deep: The Story of Naval Communication Station Harold E. Holt, Exmouth, Western Australia* (Defence Publishing Service, 2006).
[66] Ball, "The Strategic Essence," p. 239.

global military and intelligence operations from its inception,[67] the Navy's interest in the base waned after 1982.

Scholarship by Desmond Ball suggests that for the majority of this period, the Australian government had "no control over or even any right to be informed about the communications passing through the station, including possible commands to launch nuclear missiles."[68] The Yom Kippur War of 1973 was a significant example, when North-West Cape was used to communicate the general nuclear alert level (DefCon) to US military forces in the Western Pacific and Indian Oceans without the knowledge of the Australian government.[69] As a consequence, the agreement was renegotiated in 1974 by the Whitlam Labor government. However, no significant amendment bar a change of name (US dropped)[70] and a promise to keep the government informed of such "oversights" in future, was made,[71] with Australian personnel given base technical and maintenance roles at the site. By way of explanation, the Chairman of the Joint Chiefs of Staff Admiral Thomas H. Moorer told an Australian delegation led by Minister for Defence Lance Barnard in January 1974 he had not considered 'DefCon 3' as "going on alert", as US forces in South-East Asia had been on 'DefCon 3' since 1965.[72]

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[67] See Desmond Ball, *Code 777: Australia and the US Defense Satellite Communications System (DSCS)*, 56 (Strategic and Defence Studies Centre, Research School of Pacific Studies, Australian National University, 1989).
[68] Ibid., p. 238.
[69] Ball, *Code 777*, p. 183.
[70] Department of Foreign Affairs, "Exchange of Notes Constituting an Agreement between the Government of Australia and the Government of the United States of America Further Amending the Agreement Relating to the Establishment of a United States Naval Communication Station in Australia of 9 May 1963 (NW Cape)," *Australian Treaty Series*, accessed January 19, 2015, http://www.austlii.edu.au/au/other/dfat/treaties/1975/2.html.
[71] For excellent insight into the relationship regarding the facilities at the time see Assistant Secretary of Defense, "Document 45 - Foreign Relations of the United States, 1969–1976, Volume E–12, Documents on East and Southeast Asia, 1973–1976," *U.S. Department of State, Office of the Historian*, accessed January 19, 2015, https://history.state.gov/historicaldocuments/frus1969-76ve12/d45.
[72] Ibid.

By 1992, the Royal Australian Navy (RAN) was the main user of the facility and the RAN took over full command in 1999 while US involvement and funding continued.[73] The RAN used the facility to communicate with its own submarines while the US Navy has retained access to three or four out of five communication channels there.[74] The site's role as part of the US Defense Satellite Communication System (DSCS) continued, providing a direct communications link between US command and control headquarters in Honolulu and Washington with its forces north and west of Australia. In 2002, the RAN handed operation of the station to Defence Material Organisation. In 2014 the site's role evolved again, in the form of ground-based space surveillance with the arrival of a C-band space-surveillance radar dish and in 2016 an advanced space telescope, to be jointly maintained and operated by US Air Force Space Command and the RAAF.

3.2. Pine Gap

Pine Gap, located in the Northern Territory near Alice Springs, is home to the Joint Defence Facility Pine Gap, known before 1988 as Joint Defence Space Research Facility. Agreed to in 1966 and operational in 1970, the facility began as a control station for geostationary[75] SIGINT satellites monitoring signals emanating from the eastern hemisphere.[76] A range of terminals communicate with these satellites for command and control, tracking, telemetry, and SIGINT data.[77] The facility has grown in size, from hosting two satellite terminals in 1968-69 to sixteen terminals in 2000,[78] as has the array and sophistication of the satellites it

[73] Tanter, "North by North West Cape."
[74] Tanter, "Back to the Bases," p. 29.
[75] A geostationary orbit is a circular orbit 35,786 kilometres above the Earth's equator and following the direction and speed of the Earth's rotation. An object in geostationary orbit appears motionless to ground observers.
[76] Desmond Ball, *Pine Gap: Australia and the US Geostationary Signals Intelligence Satellite Program* (Allen & Unwin Sydney, 1988).
[77] Ball, *Code 777*, p. 160.
[78] Ball, "The Strategic Essence," p. 239.

communicates with.[79] While initially orientated toward space-based surveillance of Soviet missile telemetry, advanced weapons systems, and the interception of microwave signals including long-range telephony, Pine Gap's missions were expanded in the post-Cold War era.[80] The main reason for this is straight forward: Space-based SIGINT is the most productive source of intelligence available to governments and their defence establishments. Further to that expansion is the increasing collection capabilities of the new SIGINT satellites.[81] The numbers of both civilian and military personnel working at the site, including larger proportions of Australians, subsequently increased.[82] Also located near Alice Springs is the Joint Geological and Geophysical Research Station, "originally established to monitor nuclear explosions during the Cold War. It continues to monitor such explosions as part of the International Monitoring System of the Comprehensive Test Ban Treaty. It also monitors earthquakes, and is jointly operated by Geoscience Australia and the US Air Force."[83]

3.3. Nurrungar

The satellite ground station at Nurrungar in northern South Australia, established in 1969, was a key communications link between elements of the US ballistic missile early warning system, US Defense Support Program (DSP) satellites, and the Continental United States,[84] which provided early-warning detection of Soviet ballistic-missile launches, monitored

[79] See Ball, *Code 777*.
[80] See Desmond Ball, *Signals Intelligence in the Post-Cold War Era: Developments in the Asia-Pacific Region* (Institute of Southeast Asian Studies, 1993).
[81] See Ball, *Code 777*; Ball, "The Strategic Essence," for details.
[82] "Staff Increases At Joint Defence Facility Pine Gap, Thursday February 6, 1997.," accessed January 20, 2015, http://www.defence.gov.au/media/1997/03497.html.
[83] Minister for Defence, "Ministerial Statement on Full Knowledge and Concurrence," *Department of Defence Ministers*, n.d., http://www.minister.defence.gov.au/NelsonMintpl.cfm?CurrentId=6375.
[84] Ball, *Code 777*, p. 133.

nuclear detonations, and other ballistic-missile developments in the eastern hemisphere.[85] The DSP satellites used infra-red photographic technology to detect missile launches, first demonstrated successfully in 1963.[86] Instead of using radar to bounce signals off a missile in flight, infra-red sensors pick up the heat emitted by rocket fuel used in the launch stage. These capabilities supported the more public rationale underpinning the facilities in Australia; of the pursuit of arms control and non-proliferation during the Cold War.[87] The rationale endured in the post-Cold War era, with the facility in Nurrungar providing the first early-warning detection of Iraqi Scud missile launches in 1991,[88] as well as monitoring ballistic missile tests in India, Pakistan, Iran, China and North Korea.[89] The facility closed in 1999, while Australian involvement with US DSP satellite control continued with the ongoing transition to its successor, the Space-Based Infra-Red System (SBIRS),[90] and the construction of the associated ground station at the Pine Gap facility, meaning Pine Gap now monitors SBIRS equipped satellites detecting ballistic-missile launches.[91]

3.4. Jindalee

Australia's first Over-the-Horizon-Radar (OTHR) was installed at Alice Springs in 1974 under a Defence Science and Technology Organisation research program. It detected its first ship in early 1983 and its first aircraft was automatically tracked in early 1984.[92] The development of the Jindalee Operational Radar Network (JORN) followed the release of the *Review of Australia's Defence Capabilities* in 1986 by Paul Dibb, which recommended that

[85] Ball, "The Strategic Essence," p. 238.
[86] See Jeffrey T. Richelson, *America's Space Sentinels: DSP Satellites and National Security* (Lawrence, Kan.;[Great Britain]: University Press of Kansas, 1999), http://library.nsa.gov.ng/handle/123456789/394.
[87] Hayden, "Uranium, the Joint Facilities, Disarmament and Peace," p. 15.
[88] Dr. Richard Brabin-Smith, "Australia and Ballistic Missile Defence: Our Policy Choices" (ASPI, 2004), p. 3.
[89] Ball, "The Strategic Essence," p. 238.
[90] Jeffrey Richelson, "Space-Based Early Warning: From MIDAS to DSP to SBIRS," 2013, http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB235/20130108.html.
[91] Dr. Richard Brabin-Smith, "Australia and Ballistic Missile Defence: Our Policy Choices" (ASPI, 2004), pp. 2–3.
[92] Royal Australian Air Force, "Jindalee Operational Radar Network Fact Sheet," *Airforce.gov*, https://www.airforce.gov.au/docs/JORN_Fact_Sheet.pdf.

"Australia abandon the remaining elements of the Forward Defence policy and concentrates its military resources on the geographic areas relevant to defending the country and its economic interests from direct attack."[93] Dibb's recommendations were adopted by the 1987 *Defence White Paper*, and Joint Project 2025 was initiated to build a further two OTHRs in collaboration with partners including Lockheed Martin. Today, Australia's northern approaches are covered by the three OTHR systems comprising JORN which forms part of a an expanding and layered surveillance network. Constantly upgraded and further integrated, the JORN radars comprise the basic element of a national air defence and airspace control system with a reported operating range of 1000–3000km.

3.5. The AUSMIN announcements

The growth of the SIGINT relationship between Australia and the US has been extensive over the last decade. At the annual Australia-United States Ministerial Consultations (AUSMIN) in 2007, a new Australian Defence Satellite Communications Station at Kojarena near Geraldton, WA was announced.[94] Kojarena is a major signals interception station operated by the Defence Signals Division, and contributes to the worldwide Echelon[95] system. The new joint Kojarena facility will play a key role in the Pentagon's Global Information Grid. Under an agreement initiated in 2007, Australia gained access in 2010 to the principally US-funded constellation of at least seven high-capacity global communications satellites.[96]

[93] Dibb, *Review of Australia's Defence Capabilities*.
[94] Minister for Defence, "Ministerial Statement on Full Knowledge and Concurrence."
[95] ECHELON, originally a code-name, is now used in global media and in popular culture to describe the SIGINT collection and analysis network operated on behalf of the five signatory nations to the UKUSA agreement (Five Eyes).
[96] Tanter, "After Obama – the new joint facilities," pp. 15–16.

As mentioned above, AUSMIN 2008 and 2010 saw new joint facilities announced at the Naval Communications Station Harold E. Holt at North-West Cape. The Harold E. Holt Treaty, signed in 2008, sets out the terms and conditions for the joint use of the station by Australia and the US for the next 25 years, extending the existing cooperation there. The associated Australia-United States Space Situational Awareness Partnership, entered in 2010, allows the US to build facilities including ground-based sensors at North-West Cape as part of the US Space Surveillance Network, directly linked to the US Joint Space Operations Centre under the US Air Force Space Command.[97] A C-Band Space Surveillance Radar delivered to Australia in June 2014 with the help of the US Air Force is being installed at North-West Cape with final operational capability expected in 2016.[98] The two countries also agreed to "work toward the relocation of an advanced US space surveillance telescope that would complement the C-Band radar system, as well as establish a Combined Communications Gateway for the Wideband Global Satellite constellation of communications satellites to improve military networks in the Western Pacific."[99] As of late 2016, DARPA's Advanced Space Surveillance Telescope was on its way to Harold E. Holt Naval Communication Station to be jointly maintained and operated by the US Air Force Space Command and the RAAF. Described as a "giant leap forward in space cooperation between the United States and Australia," US Air Force Maj. Gen. Nina Armagno said the move "benefits each of our respective nations [and] anyone who uses space across the globe. The United States simply

[97] Department of Foreign Affairs and Trade, "Australia-United States Space Situational Awareness Partnership Fact Sheet" (Commonwealth of Australia, 2010), http://dfat.gov.au/geo/united-states-of-america/ausmin/Pages/australia-united-states-space-situational-awareness-partnership.aspx.
[98] Department of Defence, "US Space Radar at Exmouth," *Defence Materiel Organisation*, 2014, http://www.defence.gov.au/dmo/NewsMedia/DMOBulletin/US-Space-Radar-at-Exmouth.
[99] Jim Thomas, Zack Cooper, and Iskander Rehman, "Gateway to the Indo-Pacific: Australian Defense Strategy and the Future of the Australia-US Alliance," *Center for Strategic and Budgetary Assessments, Washington DC*, 2013, p. 22.

can't do anything that we do in space without our allies, and the value of these partnerships will only continue to grow in the future."[100]

Reflecting this trajectory, the 2009 Defence White Paper states

> Counter-space technologies will pose an increasing risk to the networked space-based systems on which we rely so heavily on for operational success. The emergence of counter-space technologies that can deny, disrupt and even destroy space-based capabilities will make space mission assurance and survivability increasingly important.
>
> Our strategic capability advantage depends on our ability to access space, gain the benefits of space-based systems and protect ourselves from foreign exploitation by space-based capabilities.[101]

The 2013 DWP announced Canberra's intention to increase the number of space-trained personnel "in order to maximize the benefit of such investments in space and cooperation with the United States."[102] The 2016 DWP states "Additional investment is planned in ADF space capability, including space-based and ground-based intelligence, reconnaissance and surveillance systems."[103]

The 2010 *Exchange of Letters* that ratified the Harold E. Holt Treaty contained an arrangement for the "full knowledge and concurrence"[104] of the Australian government in relation to the activities performed at the station. Taken together, the AUSMIN announcements and the steady expansion of global communications and intelligence

[100] Cheryl Pellerin, "Advanced Space Surveillance Telescope Has Critical Military Applications," *U.S. DEPARTMENT OF DEFENSE*, October 22, 2016, http://www.defense.gov/News/Article/Article/983007/advanced-space-surveillance-telescope-has-critical-military-applications.
[101] Department of Defence, "Defending Australia in the Asia Pacific Century: Force 2030" (Commonwealth of Australia, 2009), p. 85, http://www.defence.gov.au/whitepaper/2009/docs/defence_white_paper_2009.pdf.
[102] Department of Defence, "2013 Defence White Paper" (Commonwealth of Australia, 2013), p. 81, http://www.defence.gov.au/whitepaper/2013/docs/wp_2013_web.pdf.
[103] Department of Defence, "2016 Defence White Paper," p. 88.
[104] For definition see Minister for Defence, "Ministerial Statement on Full Knowledge and Concurrence."

integration at Pine Gap represent deepening Australian involvement in and commitment to what Richard Tanter summarises as the "rapid technical and organisational developments in the global US signals intelligence interception system,"[105] tying Australia to US military operations worldwide. In addition, new or increased US access to a number of existing facilities including the Bradshaw Field Training Area (2004), Shoalwater Bay (2004), and Delamere Air Weapons Range (2005) in the Northern Territory, the Joint Combined Training Centre (2004), and the Yampi Sound Training Area in WA has been established.[106] These mostly relate to ADF-US military interoperability and training access. Indeed, these training ranges accommodate a high level of instrumentation and electronic networking,[107] illustrating both the ADF's and US military's emphasis on the development of joint operational capabilities.[108] Combined exercises and training include *Talisman Saber*, a major biennial Australia-US readiness and interoperability exercise using ADF training facilities in the Northern Territory and Queensland. The ADF also participates in major PACOM-hosted exercises such as RIMPAC and Pacific Partnership.[109] Speculation about increased US Navy access to HMAS Stirling south of Perth, and a potential UAV base on Australian territory at Cocos Islands, has accompanied recent AUSMINs. HMAS Stirling offers "direct blue water access to the Indian Ocean, an extensive offshore exercise area and underwater tracking range, submarine facilities including a heavyweight torpedo maintenance centre, and the only submarine escape training facility in the southern hemisphere."[110] The proximity of Cocos Islands to the Bay of Bengal and the approaches to the Malacca Straits make it an

[105] Tanter, "North by North West Cape."
[106] Ibid. See also http://www.nautilus.org/publications/books/australian-forces-abroad/defence-facilities.
[107] Tanter, "After Obama – the new joint facilities," p. 10.
[108] See "Australia's Defence Relations with the United States Inquiry Report," sec. 4.19, 4.20, accessed January 22, 2015, http://www.aph.gov.au/parliamentary_business/committees/house_of_representatives_committees?url=jfadt/usrelations/report/fullreport.pdf.
[109] Berteau et al., "US Force Posture Strategy in the Asia Pacific Region," p. 32.
[110] Berteau et al., "U.S. Force Posture Strategy in the Asia Pacific Region," pp. 32–33.

ideal location for basing of ISR platforms, though extensive upgrading would be required. In sum, Australia's increasing role in reconnoitring the Indo-Pacific and providing strategically significant mutual advantages in the space and cyber domains underpins the AUSMIN announcements, supplements Australia's unique geography, and builds on the decades of close ISR cooperation with the United States.

When President Obama visited Australia in 2011, he and then Australian Prime Minister Gillard announced a new level of military cooperation between the United States and Australia, couched in the context of the US 'rebalance' to the Asia-Pacific.[111] The public centre-piece of the Obama visit was the planned deployment of a United States Marine Air-Ground Task Force of some 2,500 US personnel to Robertson Barracks in Darwin, including the prepositioning of associated equipment and supplies, with the full contingent expected to be in place by 2016. Commentary has focussed on the political significance of the announcement, particularly regarding Australia's relationship with China,[112] and to a lesser extent, Indonesia.[113] As important as the Marine's posting is it represents only a small, more visible expression of a security relationship based on the ever-increasing importance of the information domain, and the intention to leverage strategic advantage by dominating it. Of the Marines' announcement, Bruce Vaughn reflected in a 2012 report to the US Congress, "anticipated future expansion of US and Australian naval and air cooperation could be strategically more important."[114]

[111] Obama, "Text of Obama's Speech to Parliament."
[112] Joshua Philipp, "China Declares Australia a Military Threat Over US Pact," *The Epoch Times*, accessed August 18, 2014, http://www.theepochtimes.com/n3/877760-china-declares-australia-a-military-threat-over-u-s-pact/.
[113] James Grubel, "Yudhoyono Proposes Australia-U.S.-Indonesia Exercises," *Reuters*, accessed February 11, 2015, http://ca.reuters.com/article/topNews/idCABRE86207M20120703.
[114] Vaughn, "Australia and the U.S. Rebalancing to Asia Strategy," p. 1.

3.6. The Five Power Defence Arrangements

The Five Power Defence Arrangements (FPDA) are a series of loose consultative arrangements including the UK, Australia, Singapore, Malaysia, and New Zealand. They were signed in 1971 in response to the UK's decision to withdraw its forces from South-East Asia from 1967, and initially related to regional fears about Indonesia's political and military trajectory after the period of Confrontation (1963-1966). They commit the member States to "consultation" only and include no commitment of military forces should any member States come under attack. Considered a somewhat innocuous grouping, the arrangements nonetheless provide the ongoing basis for annual joint air and sea exercises, dialogue and the exchange of information and views between Defence chiefs, and the Integrated Air Defence System based in RMAS Butterworth, Malaysia, headed by an Australian Air Vice-Marshal 2-star. The grouping's utility has grown in recent years to include expanded ship-based area defence, cooperation on counter-terrorism and HA/DR, as well as intelligence sharing and interoperability.[115] The continued relevance of the FDPA is supported by its operational responsibility for the air defence of Malaysia and Singapore amidst regional uncertainty about the role and trajectory of China's military capabilities. The FPDA is the 'quiet achiever'[116] of Australia's defence commitments and could be considered a miniature proof-of-concept of the non-provocative utility of information-based regional networking, scalable as an A2/AD bubble with the United States to act in operational reserve should the regional environment deteriorate. While Malaysia's military contribution to the grouping

[115] Tim Huxley, "The Future of the Five Power Defence Arrangements," *The Strategist*, November 8, 2012, https://www.aspistrategist.org.au/the-future-of-the-five-power-defence-arrangements/.
[116] Carlyle A. Thayer, "The Five Power Defence Arrangements: The Quiet Achiever," *Security Challenges* 3, no. 1 (February 2007): pp. 79–96.

has lagged, Australia and Singapore have recently inked agreements on intelligence sharing, training, and interoperability that mark the health of the ongoing relationship.[117]

3.7. Operation *Gateway*

The Soviet invasion of Afghanistan in 1979 alerted the Australian government to the USSR's capacity to project power into the Indian Ocean, and thus threaten Australian and South-East Asian SLOC. Operational planning commenced on 18 February 1980 when the Australian government decided to increase surveillance of the Indian Ocean, included a long term detachment of P-3 Orion aircraft to RAAF Base Butterworth in Malaysia.[118] A detachment of Orions and staff were stationed out of Butterworth from 1981 to monitor Soviet submarine activity, the beginning of Operation *Gateway.*[119] The P-3 was used to "detect, localise, track, and identify ('prosecute')" Soviet submarines transiting the Strait of Malacca, handing them off to US Navy aircraft and ships as they left the area.[120] The FPDA continued to provide Australia a forward presence at Butterworth after the Cold War, from which RAAF aircraft conduct surveillance of the maritime approaches to Australia.

4. Hardware and technology upgrades

4.1 Air Warfare Destroyer

The Royal Australian Navy (RAN) is replacing its four (originally six) Guided Missile Frigates (FFG) with three new Air Warfare Destroyers (AWD), which strictly speaking belong to the

[117] Jermyn Chow, "Singapore, Australia ink landmark pact to boost ties in security, trade and arts," Text, *The Straits Times*, (May 6, 2016), http://www.straitstimes.com/singapore/singapore-australia-ink-landmark-pact-to-boost-ties-in-security-trade-and-arts; Rob Taylor, "Singapore, Australia Expand Military Partnership With Eye on China," *Wall Street Journal*, May 6, 2016, sec. World, http://www.wsj.com/articles/singapore-australia-expand-military-partnership-with-eye-on-china-1462519648.
[118] Author not supplied, "#162 Operation Gateway: Prosecuting Soviet Naval Movements in the Cold War," *Pathfinder*, August 2011, http://airpower.airforce.gov.au/Publications/Details/463/162-Operation-Gateway-Prosecuting-Soviet-Naval-Movements-in-the-Cold-War.aspx.
[119] Ibid.
[120] Ibid.

category Guided Missile Destroyer.[121] The *Hobart* class AWDs will provide air defence for accompanying ships, in the form of the Aegis Combat System incorporating the state-of-the-art phased array radar in combination with the SM-2 missile, capable of engaging enemy aircraft and cruise missiles at ranges in excess of 150km.[122] The 2009 *Defence White Paper* states the AWD's will also be equipped with the SM-6 as they enter service, with greater range and capability, as well as the Cooperative Engagement Capability system.[123] The AWDs are capable of both surface and anti-submarine warfare (ASW). The surface warfare function will include long range anti-ship missiles and a naval gun capable of firing extended range munitions in support of land forces. For ASW the *Hobart* class will be equipped with modern sonar systems, decoys, surface-launched torpedoes and an array of effective close-in defensive weapons.[124] Adelaide-based ASC is building the AWD in partnership with Defence Material Organisation and Raytheon Australia, with handover of the first vessel due in 2016 and the final vessel by 2019.[125] In addition to the AWD, nine new future frigates optimised for ASW will be introduced into the fleet from the late 2020s, replacing the existing eight Anzac class frigates.[126]

4.2. Amphibious Assault Ship

The *Canberra* class Amphibious Assault Ship, also known as a Landing Helicopter Dock (LHD), is the largest ship ever built for the Royal Australian Navy. Two LHDs are being built with collaboration between Spanish company Navantia, who won a tender process in 2007, and

[121] David McDonough, "Debating Australia's Air Warfare Destroyers | The Strategist," accessed January 28, 2015, http://www.aspistrategist.org.au/debating-australias-air-warfare-destroyers/.
[122] Royal Australian Navy, "Air Warfare Destroyer (AWD)," accessed September 25, 2014, http://www.navy.gov.au/fleet/ships-boats-craft/awd.
[123] Department of Defence, "Defending Australia in the Asia Pacific Century: Force 2030," p. 71.
[124] Royal Australian Navy, "Air Warfare Destroyer (AWD)."
[125] Patrick Walters, "It's Time to Review the AWD | The Strategist," accessed January 28, 2015, http://www.aspistrategist.org.au/its-time-to-review-the-awd/.
[126] Department of Defence, "2016 Defence White Paper," p. 93.

BAE Systems - Maritime.[127] These 27,000 ton ships will be able to land a force of over 1,000 personnel by helicopter and water craft, along with all their weapons, ammunition, vehicles and stores.[128] The LHD's flight deck allows it to operate a range of ADF rotary wing aircraft, though the prospect of embarking the F-35B short take-off vertical-landing (STOVL) variant of the Joint Strike Fighter has been discussed.[129] In addition to embarking forces and equipment, the stated purpose of the LHD is to carry out and support humanitarian missions.[130] The first vessel HMAS *Canberra* was commissioned in November 2014, with the second, HMAS *Adelaide* expected in 2016. Supplementing these ships is the 16,000 ton Bay Class Landing Ship Dock HMAS *Choules,* which entered service in 2011. *Choules* has the capacity to transport up to 32 Abrams tanks or 150 light trucks, carries up to 700 troops, and is designed to operate over the horizon using helicopters and landing craft.[131]

4.3. *Collins* class replacement submarine

Australia currently has a fleet of six *Collins* class submarines that date mostly from the mid-1990s. Only one third of the *Collins* fleet is generally seaworthy.[132] Due to leave service after 2025, planning to replace the *Collins* class began in 2007 with the commencement of defence acquisition project SEA 1000. Concept work was to start in 2009, with a design identified by 2013, design work completed by 2016, and construction completed before 2025. Ongoing delays have scuttled this Plan. Throughout 2014, there was increasing speculation that the Australian government would purchase twelve *Sōryū*-class submarines

[127] Royal Australian Navy, "Amphibious Assault Ship (LHD)," accessed January 28, 2015, http://www.navy.gov.au/fleet/ships-boats-craft/lhd.
[128] Ibid.
[129] See George, "LHD and F-35B."
[130] Royal Australian Navy, "Amphibious Assault Ship (LHD)."
[131] Peter Dean, "Australia's Emerging Amphibious Warfare Capabilities," *The Diplomat*, accessed January 28, 2015, http://thediplomat.com/2014/08/australias-emerging-amphibious-warfare-capabilities/.
[132] Philip Radford, "A Farewell to Nuclear Submarines, for Now | The Strategist," accessed January 29, 2015, http://www.aspistrategist.org.au/a-farewell-to-nuclear-submarines-for-now/.

from Japan,[133] skipping any tendering processes and ignoring previous commitments to build the boats in Australia.[134] This prompted a series of unsolicited offers from European submarine builders, and the government announced a Competitive Evaluation Process.

The uniqueness of Australia's geography requires a submarine with unique capabilities. A range of operation extending over 9000 nautical miles, climate conditions that span the extremes, and a focus on surveillance in the regions littorals meant an off-the-shelf design was unlikely to meet Australia's criteria.[135] Operationally, the Australian submarines' primary missions are the "strategic denial of key regional shipping lanes and chokepoints, ambushing hostile surface shipping and submarines, and mining sea lanes, chokepoints and port entrances,"[136] with secondary missions of "gathering intelligence through the interception of electronic communications by foreign nations, and the deployment/retrieval of Special Forces operatives."[137] This makes a very large, conventionally powered diesel-electric attack submarine the preferred choice, as does the cultural/political opposition to nuclear propulsion evident in Australia.[138]

Politically, an agreement in July 2014 between Australian Prime Minister Tony Abbott and his Japanese counterpart Shinzo Abe to enhance bilateral security and defence co-operation

[133] See Clint Richards, "Australia May Buy 'Off-The-Shelf' Japanese Subs," *The Diplomat*, accessed January 28, 2015, http://thediplomat.com/2014/09/australia-may-buy-off-the-shelf-japanese-subs/; Clint Richards, "Australia Wants Japanese Sub Propulsion," *The Diplomat*, accessed November 24, 2014, http://thediplomat.com/2014/11/australia-wants-japanese-sub-propulsion/.
[134] Brendan Nicholson, "New Subs to Be Built in Adelaide Whatever the Pick," *TheAustralian*, accessed January 29, 2015, http://www.theaustralian.com.au/national-affairs/defence/new-subs-to-be-built-in-adelaide-whatever-the-pick/story-e6frg8yo-1225824141618.
[135] Maryanne Kelton, *More Than an Ally?: Contemporary Australia-US Relations* (Ashgate Publishing, Ltd., 2008), p. 105.
[136] Carlo Kopp, "Defining Australia's Future Submarine Fleet," *Defence Today* 9, no. 5 (2012 2012): pp. 16–18.
[137] Andrew Fowler, "'Are Leaky Collins Class Subs All Washed up?' 7.30 Report (Australian Broadcasting Corporation)," accessed January 29, 2015, http://www.abc.net.au/7.30/content/2003/s792830.htm.
[138] For a good summary of the nuclear option debate see Radford, "A Farewell to Nuclear Submarines, for Now | The Strategist."

saw discussions rapidly move from drive train technology[139] to senior-level talks on a full build in Japan.[140] The Australian ship-building industry simply does not have the capacity to take on the design and build of a new submarine on its own. Indeed, a 2011 third-party study into indigenous submarine design capabilities by RAND Corporation highlighted that even if all Australian draftsmen and engineers with experience in submarine construction were available, they would constitute less than 52 per cent of the peak demand requirements of a local design and build.[141] The sub-plot to the multi-faceted submarine debate in Australia is the long-standing US interest in defence technology cooperation and in particular, systems interoperability between and with two of its closest regional allies. Australia has established an extensive relationship with the US Navy in the areas of submarine operations and support, particularly in weapons and combat systems. For example, the *Sōryū* option would necessarily involve modifications to include the AN/BYG-1 combat management system, Australian-specified sensors, and the Mk 48 Mod 7 CBASS heavyweight torpedo jointly developed by the US and Australia.[142]

To the surprise of many observers, France's DCNS was announced the winner of the $50 billion Future Submarine contract in April 2016.[143] The Shortfin Barracuda Block 1A is a slightly smaller, conventionally-powered derivative of the French Navy's nuclear-powered Barracuda attack submarine. DCNS will build 12 boats for Australia at ASC shipyard in Adelaide, South Australia, while the first two boats might be built in France. The 2016 DWP

[139] Richards, "Australia Wants Japanese Sub Propulsion."
[140] Julian Kerr, "Analysis: European Yards Face Soryu-Shaped Hurdle to Replacing Collins Class - IHS Jane's 360," accessed January 28, 2015, http://www.janes.com/article/44933/analysis-european-yards-face-soryu-shaped-hurdle-to-replacing-collins-class.
[141] See John Birkler et al., "Australia's Submarine Design Capabilities and Capacities," Product Page, (2011), http://www.rand.org/pubs/monographs/MG1033.html.
[142] Kerr, "Analysis: European Yards Face Soryu-Shaped Hurdle to Replacing Collins Class - IHS Jane's 360."
[143] Nigel Pittaway, "Australia Chooses French Design for Future Submarine," *Defense News*, April 26, 2016, http://www.defensenews.com/story/defense-news/2016/04/26/australia-chooses-french-design-future-submarine/83532778/.

states the first of the new submarines are likely to begin entering service in the early 2030s, with construction of all 12 extending beyond 2050.[144] The government will need to keep a close eye on developments in ASW and other technologies, particularly in unmanned underwater platforms, rapidly entering the sub-surface domain.

4.4. Joint Strike Fighter

On 25 November 2009 approval of Stage 1 of Phase 2A/B of the New Air Combat Capability (NACC) project was announced, which comprised acquisition of "Australia's first 14 Conventional Take-Off and Landing F-35A Joint Strike Fighter (JSF) aircraft, and the infrastructure and support required for initial training and testing, with delivery commencing in 2014."[145] Stage 2 was approved in 2014 for an additional 58 F-35A fighters, bringing the total on order to 72 aircraft. The government plans to eventually acquire 100 aircraft.[146] Stage 1 and 2 will replace all 71 F/A-18A/B Hornet multi-role fighters in service. The government decided in 2013 to buy 12 new Boeing EA-18G Growler variants, based on the F/A-18 airframe for electronic jamming, to supplement the existing 24 F/A-18F Super Hornets currently in service with the RAAF. The Department of Defence states the JSF will "provide the core of Australia's air combat capability for the next 30 years or more", and will "significantly enhance our network-centric warfare capability and coalition contribution."[147] In January 2015 the Pentagon announced "Australia would be the regional hub for heavy maintenance for the JSF for the Southern Pacific, with Japan to take responsibility for the

[144] Department of Defence, "2016 Defence White Paper," p. 91.
[145] Asia Pacific Defence Reporter, "Joint Strike Fighter Aircraft — AIR 6000 Phase 2A/B," *APDR*, accessed January 30, 2015, http://www.asiapacificdefencereporter.com/top-30-projects-joint-strike-fighter-aircraft-air-6000-phase-2a-b.
[146] Department of Defence, "New Air Combat Capability," *Defence Material Organisation*, n.d., http://web.archive.org/web/20080806011147/http://www.defence.gov.au/dmo/lsp/JSF_NACC_Flyer.pdf.
[147] Department of Defence, "JSF - Australia's Next Generation Air Power," *Defence Material Organisation*, March 5, 2008, http://web.archive.org/web/20080305085238/http://www.defence.gov.au/dmo/lsp/Joint%20Strike%20Fighter%20(JSF.cfm.

fleet in the Northern Pacific region."[148] BAE Systems Australia and Tasman Aviation Enterprises won the contracts in a boon for local industry.[149] The first RAAF F-35A Lightning II pilot commenced conversion training in the US in early 2015.[150]

4.5 AEW&C

Project WEDGETAIL refers to Project AIR 5077, established to acquire an Airborne Early Warning and Control (AEW&C) capability.[151] The AEW&C capability provides the RAAF with an enhanced long-range airborne radar surveillance capability in the broad expanse of the Australian north. First delivered in 2009,[152] six modified Boeing 737 NGs are currently in service, accommodating a "sophisticated mission systems and radars that increase Australia's surveillance and air combat capability, provide air defence support for the RAN fleet, and perform other civil operations and missions such as border protection and search and rescue."[153] In addition, "AEW&C aircraft also serve as a mobile communications relay point, enhancing the ability of widely-spread units to communicate with each other."[154] The Wedgetail can combine information from many sources to form a single picture of the operational situation, greatly increasing the 'situational awareness' and providing a key capability in a network-centric warfare model. Recently the Wedgetail set an Australian air combat record during operations in Iraq. Its mission entailed the command and control of

[148] Andrew McLaughlin, "Australia Chosen as Preferred F-35 Global Support Location | Australian Aviation," accessed February 12, 2015, http://australianaviation.com.au/2014/12/australia-chosen-as-preferred-jsf-global-support-location/.
[149] Author not supplied, "BAE Systems, TAE Win JSF Regional Support Depot Contracts," *Australian Aviation*, accessed February 12, 2015, http://australianaviation.com.au/2015/02/bae-systems-tae-win-jsf-regional-support-depot-contracts/.
[150] Author not supplied, "First RAAF F-35 Pilot to Begin Conversion Training," *Australian Aviation*, accessed January 30, 2015, http://australianaviation.com.au/2015/01/first-raaf-f-35-pilot-to-begin-conversion-training/.
[151] Department of Defence, "AIR 5077 - Project Wedgetail," *Defence Material Organisation*, February 11, 2008, http://web.archive.org/web/20080211200500/http://www.defence.gov.au/dmo/dceod/air5077/air5077.cfm.
[152] Author not supplied, "Boeing Delivers 2 Wedgetail AEW&C Aircraft to Royal Australian Air Force," *Boeing*, November 26, 2009, http://boeing.mediaroom.com/index.php?s=20295&item=960.
[153] Department of Defence, "Wedgetail AEW&C Aircraft," *Royal Australian Air Force*, March 3, 2008, http://web.archive.org/web/20080303034455/http://www.defence.gov.au/Raaf/aircraft/wedgetail.htm.
[154] Department of Defence, "AIR 5077 - Project Wedgetail."

large numbers of Coalition aircraft operating in Iraqi airspace as part of the multi-national air campaign, and extended to beyond 16 hours airborne.[155]

4.6. P-8 Poseidon

Replacing its fleet of 19 four-decades-old AP-C3 Orions, the Australian government announced the acquisition of eight P-8A Poseidon maritime surveillance aircraft and approved an option for a further four aircraft subject to the outcomes of the *Defence White Paper* review in February 2014.[156] DWP 2016 announced an additional three taking the total to fifteen aircraft by the late 2020s.[157] Under the Air 7000 Phase 2B - Maritime Patrol Aircraft Replacement Project,[158] the first aircraft will be delivered in 2017, with eight aircraft expected to be fully operational by 2021.[159] Like the Orion, the P-8A has "advanced sensors and mission systems including advanced multi-mode radar, a high definition electro-optic camera, and an acoustic system that has four times the processing capacity of the current AP-3C Orion's system."[160] Its huge fuel capacity, and ability to re-fuel mid-air, gives it the range and persistence to boost Australia's monitoring of its maritime approaches, in concert with other high-altitude unmanned aerial vehicles.[161] The P-8A can conduct low-level anti-submarine warfare, search and rescue, and maritime strike missions using torpedoes and

[155] Robbin F. Laird, "Iraq And The Transformation of the Royal Australian Air Force," *Breaking Defense*, accessed February 3, 2015, http://breakingdefense.com/2015/02/iraq-and-the-transformation-of-the-royal-australian-air-force/.
[156] Prime Minister and Minister for Defence, "P-8A Poseidon aircraft to boost Australia's maritime surveillance capabilities," Text, *Prime Minister of Australia*, (February 21, 2014), http://www.pm.gov.au/media/2014-02-21/p-8a-poseidon-aircraft-boost-australias-maritime-surveillance-capabilities.
[157] Department of Defence, "2016 Defence White Paper," p. 94.
[158] Department of Defence, "Defence Infrastructure Division - Air 7000 Phase 2B - Maritime Patrol Aircraft Replacement Project," *Department of Defence*, accessed January 30, 2015, http://www.defence.gov.au/id/Air7000Phase2B/CommunityConsultation.asp.
[159] Royal Australian Air Force, "P-8A Poseidon," *Royal Australian Air Force*, accessed January 21, 2015, http://www.airforce.gov.au/Boeing-P8-A-Poseidon/?RAAF-Z4PUOpGXH/eLtWmc6qxYl9xYycb+rKng.
[160] Ibid.
[161] Consideration has also been given to the MQ-4C Global Hawk.

Harpoon missiles.[162] Complementing the P-8A in an extended maritime ISR capability for the ADF will be seven unmanned high altitude MQ-4C Tritons from the early 2020s.[163]

4.7. Tanker-Transport

Arguably the most critical link in Australia's air power system is its capacity to support operations over the extended distances required with aerial re-fuelling. Beginning in 2009, the five Boeing 707 tanker transport aircraft in service with the RAAF have been replaced by five KC-30A Multi-Role Tanker Transports.[164] KC-30As are capable of refuelling the F/A-18 Super Hornets, Wedgetails, Joint Strike Fighters, P-8s, and C-17A Globemaster III heavy transport aircraft, as well as transporting troops domestically or internationally.[165] DWP 2016 states two additional KC-30As will be added by the end of the decade, with consideration of two more, bringing the total to nine.[166] In addition, recent deployment in Iraq has seen the KC-30A certified with aircraft from five other countries, including the United States, France, Britain, Canada and Saudi Arabia.[167] Advanced mission systems are also fitted. They include "the Link 16 real-time data-link, military communications and navigation suites, and an electronic warfare self-protection system for protection against threats from surface-to-air missiles."[168] Tanker support is particularly vital in extending the combat radius of the RAAF's air defences, particularly over the vast expanses of the sea-air gap off Australia's north-west.[169] The RAAF's strategic airlift capability has also received a

[162] Prime Minister and Minister for Defence, "P-8A Poseidon aircraft to boost Australia's maritime surveillance capabilities."
[163] Department of Defence, "2016 Defence White Paper," p. 94.
[164] Royal Australian Air Forc, "KC-30A Multi Role Tanker Transport," *Royal Australian Air Force*, accessed January 31, 2015, http://www.airforce.gov.au/Technology/Aircraft/KC-30A/?RAAF-mqVOdY4RK4Yc3QG06xtPhhp7asTRVUyC.
[165] Ibid.
[166] Department of Defence, "2016 Defence White Paper," p. 96.
[167] Laird, "Iraq And The Transformation of the Royal Australian Air Force."
[168] Royal Australian Air Forc, "KC-30A Multi Role Tanker Transport."
[169] Carlo Kopp and Brian H. Cooper, "KC-33A: Closing the Aerial Refuelling and Strategic Air Mobility Gaps," *Air Power Australia Analyses* 2, no. 2 (2005): p. 1.

massive boost recently, adding the Boeing C-17A Globemaster III to its fleet in 2006 replacing the C-130 Hercules. RAAF currently operates six C-17's, with two additional ordered in 2014 and the potential for two more in the Government's plans. Capable of carrying up to 77 tonnes, Australia's capacity to rapidly deploy troops, supplies, combat vehicles, heavy equipment and helicopters anywhere in the world has been significantly enhanced.[170] Recent RAAF operations in Iraq saw the strike force flown from Australia to the Middle East using its own tankers and transport, marking the first time Australia self-deployed an air combat package, equipment and personnel over such a long distance and in such a short period of time.[171] In addition, 10 smaller battlefield air lifters in the form of the C-27J Spartan, which can access over 1900 regional airfields compared to around 500 for its bigger cousins, entered the fleet in 2015 with IOC expected in late 2016.[172]

5. Australia's interest in network-centric warfare

5.1. Force multiplier

The Australian government's enthusiasm for military transformation and the RMA was made explicit by the publication of Australia's Strategic Policy 1997.[173] The pursuit of the 'knowledge edge' as a 'force multiplier' was rationalised according to five extant conditions. First, various RAAF and RAN platforms were moving into the later stages of their operational lives. Second, the military modernisation of many nations in the Asia-Pacific region was receiving increased funding and attention. Third, information technology would be vital in maximising the limited-in-size but technically sophisticated ADF. Fourth, if Australia's vast

[170] Royal Australian Air Force, "C-17A Globemaster III," *Royal Australian Air Force*, accessed February 4, 2015, http://www.airforce.gov.au/Technology/Aircraft/C-17-Globemaster/?RAAF-h0719xJ/eXjMFO8eLULT2D7U+C9pXnFB.
[171] Laird, "Iraq And The Transformation of the Royal Australian Air Force."
[172] Royal Australian Air Force, "C-27J Spartan," *Royal Australian Air Force*, accessed July 7, 2015, http://www.airforce.gov.au/Technology/Future-Acquisitions/C-27J-Spartan-Battlefield-Airlifter/?RAAF-X+uk8a9VAAM3WxS8ueGxVwnuL3bxuN6b.
[173] Office of the Minister for Defence, "Australia's Strategic Policy."

northern approaches could be made transparent to surveillance they would confer great strategic depth. And fifth, Australia's strong information-technology base paired with privileged access to cutting edge US military systems and know-how represented a significant advantage to be exploited.[174] The document envisioned an integrated ISR system that would address Australia's geographical burden by networking space-based surveillance, long-range UAVs, over-the-horizon radar and airborne early warning and control to provide real-time battle-space awareness.[175] Summed up by Andrew Davies, the "basic idea of NCW is that the ADF will use advances in communication and computer technology to take advantage of the sensors and systems of its various components, wherever they are located, and be able to draw the collective data together into common operating pictures that can be used by local commanders."[176] In other words transmitting, deciding, and acting on information in near real-time to enable the timely, precise delivery of combat effect. An Office of the Revolution in Military Affairs was established in 1999 to "review technological developments and explore strategies for implementing an Australian RMA."[177] In 2004, the Office of the Revolution in Military Affairs was replaced by the Network Centric Warfare Program Office.[178] By 2006, according to Hall and Wylie, "Australian defence PLA planners had relinquished some of the more grandiose RMA notions in favour of a more evolutionary concept of network-centric warfare."[179] It is clear that over the last two decades the

[174] Ibid., p. 55.
[175] Ibid., p. 60.
[176] Andrew Davies, "The Networked ADF - C4ISR Capability Summary 2010," *ASPI*, p. 3, accessed February 3, 2015, https://www.aspi.org.au/publications/the-networked-adf-c4isr-capability-summary-2010-by-andrew-davies.
[177] Department of Defence, "Defence 2000 - Our Future Defence Force" (Commonwealth of Australia, 2000), 108, http://www.defence.gov.au/publications/wpaper2000.pdf.
[178] Andrew Tan, "East Asia's Military Transformation: The Revolution in Military Affairs and Its Problems," p. 83, accessed February 2, 2015, http://www.securitychallenges.org.au/ArticlePDFs/vol7no3Tan.pdf.
[179] Peter Hall and Robert Wylie, "The Revolution in Military Affairs and Australia's Defence Industry Base, 1996-2006," *Security Challenges Volume 4, Number 4 (Summer 2008), p.* 57, accessed February 2, 2015, http://www.securitychallenges.org.au/ArticlePages/vol4no4HallandWylie.html.

informal, service-driven debate about the RMA and the 'knowledge edge' in Australia has evolved and been refined, culminating in the formal adoption and gradual implementation of NCW.[180]

The ADF's embrace of network-centric warfare as a key enabler of the future force is detailed in the Network Centric Warfare Roadmaps of 2005, 2007 and 2009.[181] In addition, in 2002 *Force 2020* formally introduced a 'technology bias' into Australian warfighting concept development based on "using networking and effects-based operations to create a seamlessly integrated force".[182] ADF combat effect would be developed under the auspices of three grids: "a sensor grid (for detection); a command and control grid (for decision-making) and an engagement grid (for precision engagement)."[183] In a similar vein in 2003, *Future Warfighting Concept* introduced Multidimensional Manoeuvre (MDM) as a new overarching concept to continue the transition of the ADF from a joint construct to an integrated force over the next two decades.[184] In mid-2007, *Joint Operations for the 21st Century* designated MDM as the Future Joint Operating Concept (FJOC) from which Australian forces by 2030 are to be "constructed as a hardened, networked, deployable joint force capable of performing across the full spectrum of operations."[185] It also reveals

> our deepening interdependence with the forces of our allies and the global military–industrial system means that *self-reliance* will increasingly not mean *self-sufficiency*. The ADF

[180] Michael Evans, "Australia's Approach to the Revolution in Military Affairs, 1994-2004," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), p. 48.
[181] Department of Defence, "NCW Roadmap 2005" (Commonwealth of Australia, 2005), http://www.defence.gov.au/capability/_pubs/NCW_Roadmap%20%28Released%206%20Oct%2005%29.pdf; Department of Defence, "NCW Roadmap 2007" (Commonwealth of Australia, 2007), http://www.defence.gov.au/capability/ncwi/docs/2007NCW_roadmap.pdf; Department of Defence, "NCW Roadmap 2009" (Commonwealth of Australia, 2009), http://www.defence.gov.au/capability/_pubs/NCW%20Roadmap%202009.pdf.
[182] "Force 2020," p. 11.
[183] Ibid.
[184] Australian Defence Force, "Future Warfighting Concept" (Department of Defence, 2003), p. 19, http://www.defence.gov.au/publications/fwc.pdf.
[185] Australian Defence Force, "Joint Operations for the 21st Century," 6.

> will operate with support from multiple global sources, in the form of enabling capabilities such as intelligence, surveillance and reconnaissance, communications and the supply of essential war stocks and sustainment.[186]

The Rudd government's 2009 *White Paper* noted the need for the ADF "to integrate information from its various information and surveillance assets and, as a matter of priority, to develop a defence-wide information architecture that includes ISR linkages with its principal ally, the United States."[187]

5.2. Current NCW progress

The *NCW Roadmaps* represent a clear joint vision for the implementation of NCW within the ADF. While patchy at first,[188] the coherence of the transformation effort is increasing. Australian Strategic Policy Institute's (ASPI) 2010 ADF capability summary[189] reports substantial progress toward a NCW capacity across the services. Key sticking points in the development of achievable capabilities range from the technical to the practical. Dr Carlo Kopp divides the technical into two groups of constraints: 1. Hard limits imposed by the physics of radio signal propagation and the mathematical properties of networked systems, and 2. Impairments resulting from hostile actions, and human constraints on the system.[190] More broadly, practical obstacles include the integration of new information technologies with legacy platforms, inter-service and inter-alliance connectivity, compatibility, and band-width availability, delays in key platform delivery (such as Wedgetail, P-8), as well as the constant pressure of extant operational priorities. Other challenging aspects emerging

[186] Ibid., p. 7. (emphasis added)
[187] Australia Department of Defence, *Defending Australia in the Asia Pacific Century: Force 2030* (Commonwealth of Australia, 2009), p. 81–82.
[188] Adam Cobb, "All the Way with the RMA? The Maginot Line in the Mind of Australian Strategic Planners," in *The Information Revolution in Military Affairs in Asia* (Palgrave Macmillan, 2004), pp. 57–80.
[189] Davies, "The Networked ADF - C4ISR Capability Summary 2010."
[190] C. Kopp, "Fifteen Constraints on the Capability of High-capacity Mobile Military Networked Systems," July 2007, p. 1, http://search.informit.com.au/documentSummary;dn=090370892216290;res=IELENG.

involve the structural dissonance that exists between the military and commercial worlds.[191] As the military seeks to leverage the cutting edge of commercial technology, it finds not only the pace of change but also the contrasting economies of the two sectors as problematic.[192] Nonetheless, progress is evident and a convergence of sorts seems inevitable given the advantages that accrue from a much wider skills base and ease of development. Some slippage in the *NCW Roadmap* timeframes is occurring, but the ASPI report is largely positive about the ADF's capacity and intent to address the challenges. The 2007 Roadmap reported "Information networks are already used to link assets into functional systems, and a degree of connectivity has already been established. Capabilities such as Satellite Communications, Tactical Information Exchange links and the Command Support Environment are being progressively rolled out."[193] Looking ahead, the delivery of several key platforms outlined above including the JSF, Wedgetail, and AWD in the near future is expected to provide a big boost in networking capability in terms of both data collection and dissemination and their ability to act as network hubs.[194]

The operational priorities of the ADF represent opportunities as well as constraints. For example, the RAAF's Wedgetail has repeatedly set world records for time-on-station in its deployments over Iraq and Syria, the latest record a 17.1 hour operational mission.[195] Along with a RAAF KC-30A Multi-Role Tanker Transport and six F/A-18A Hornets, the Australian aircraft participated in airborne command and control, precision strike operations, close air support, and air-to-air refuelling in Iraq and Syria as part of the international coalition. In

[191] See Leland Joe and Phillip M. Feldman, "Fundamental Research Policy for the Digital Battlefield" (RAND, 1998).
[192] Davies, "The Networked ADF - C4ISR Capability Summary 2010," p. 4–5.
[193] Department of Defence, "NCW Roadmap 2007," p. 12.
[194] Davies, "The Networked ADF - C4ISR Capability Summary 2010," p. 11.
[195] Royal Australian Air Force, *RAAF E 7A Wedgetail Sets Record Flight*, 2015, https://www.youtube.com/watch?v=bstlk9rj4X0.

addition, the RAAF has for a decade been making extensive use of Link-16. This connectivity and experience will be further enhanced by the addition of upcoming acquisitions such as the JSF, P-8, Super Hornet, Growler, and the MQ-4C Triton.[196] The operational intricacies of deploying a networked force are immense, and the hands-on learning provided by actual deployment is invaluable. This has reportedly led to some acceleration in the progress toward NCW. The stated goal of the current NCW Roadmap is for the individual services to be fully networked in 2020, and the entire ADF by 2030. However, according to Kym Bergmann, the amount of integration taking place has increased exponentially, and these targets may be achieved ahead of time.[197]

In addition, the ability of the ADF to operate in a networked environment is heavily dependent on space-based sensors and communications. Arguably the most important of these systems to the ADF is the US Wideband Global Satcom (WGS) system. Australia signed a Memorandum of Understanding with the US in 2007 to gain access to the WGS, which launched its first satellite that year,[198] and the ADF gained operational access by June 2010.[199] In August 2013, the sixth satellite in a seven satellite (potentially nine) constellation, paid for by Australia but owned by the United States, was launched into orbit. It was fully operational in February 2014.[200] Through this agreement, Australia provided the funding for the procurement, sustainment, and launch costs associated with the sixth WGS satellite. In

[196] Kym Bergmann, "The Pace of NCW Connectivity Growing Rapidly," *Asia Pacific Defence Reporter*, November 2015, p. 23, http://apdr.realviewtechnologies.com/#folio=22.
[197] Ibid.
[198] Department of Defence, "Defence Annual Report 2007-08" (Defence Material Organisation), accessed November 25, 2015, http://www.defence.gov.au/annualreports/07-08/vol2/ch3_02_wgs.htm.
[199] Author not supplied, "Australian Defence Satellite Communications Station, Kojarena," *Nautilus Institute for Security and Sustainability*, accessed November 25, 2015, http://nautilus.org/publications/books/australian-forces-abroad/defence-facilities/australian-defence-satellite-communications-station-kojarena/.
[200] Kym Bergmann, "Satellite Project Failing to Deliver," *Asia Pacific Defence Reporter*, November 2015, p. 26, http://apdr.realviewtechnologies.com/#folio=26.

return, the ADF receives assured bandwidth across the WGS 1-6 satellites.[201] The constellation is able to provide near complete global coverage in the X and Ka bands,[202] and other nations including Canada, Denmark, Luxemburg, Netherlands and New Zealand pay for access to the system. These satellites are in geo-stationary orbit some 38,000 kilometres above the earth. The WGS is anchored by the supporting ground-based infrastructure, which in Australia is based in Geraldton, Western Australia, and at HMAS Harman in Canberra. Still under construction, the ADF has relied on interim satellite anchor systems on its western and eastern seaboards, as well as offshore in Hawaii and Germany.[203] The ground station at Kojarena, near Geraldton, is currently planned to be delivered to Defence in late 2016, and the upgrade to HMAS Harman by late 2017.[204] The ADF has acquired 51 medium aperture transportable land terminals[205] that will be fed by the data from the WGS, and is in the process of transitioning them into operations and sustainment.[206] Of the WGS access for Australia, then Minister for Defence Brendan Nelson commented

> Essentially we get the security of working with the United States, we get the confidence of the US military experience with satellites and we also know that if we do have failure of one of the six satellites that we will continue to be covered through the other five. This is a win-win for Australia, it's a win-win for the Australia-US alliance and it also means that our capability, flexibility and security is greatly enhanced for the next decade and beyond.[207]

[201] Author not supplied, "ULA's Delta IV Sends USAF's WGS-6 Skywards," *Milsat Magazine*, September 2013, http://www.milsatmagazine.com/story.php?number=2018813730.
[202] The shorter wavelengths of the X band allow for higher resolution imagery from high-resolution imaging radars for target identification and discrimination. The Ka band allows higher bandwidth communication. The two bands are instantaneously switchable in the WGS.
[203] Bergmann, "Satellite Project Failing to Deliver," p. 26.
[204] Ibid.
[205] Defence Material Organisation, "Defence Portfolio Budget Statements 2015-16" (Department of Defence), accessed November 25, 2015, http://www.defence.gov.au/budget/15-16/2015-16_Defence_PBS_06_DMO.pdf.
[206] Bergmann, "Satellite Project Failing to Deliver," p. 26.
[207] Department of Defence, "ACF1348.doc," October 3, 2007, http://www.defence.gov.au/minister/2007/ACF1348.doc.

5.3. The human dimension

A feature of the Australian discussion on NCW, its benefits and implementation, that distinguishes it from its analogues, particularly in the US, is its overt acknowledgement of the centrality of the human dimension. *NCW Roadmap* 2007 identifies the changes required in doctrine, training and education to prepare Defence personnel for operating in a NCW environment as fundamental.[208] It also acknowledged that work to date had focussed primarily on the technical and equipment aspects of NCW, and that considerable growth potential existed on the human development side. The way the human element utilises access to the enhanced situational awareness provided by the network is critical in its translation into combat effect. It places human decision-making and battle direction at the heart of weapons and systems.[209] The ADF has emphasised a 'learning by doing' approach in this area.[210] To this end, the ADF has developed a Joint Combined Training Capability and a Joint Integrated Simulation Project to achieve an environment that integrates live, virtual and constructive entities for focused operational training.[211] The professional mastery of this side of NCW can be overshadowed by the technical components, but it is arguably the pivotal element.

6. Emerging network-enabled capabilities

6.1. Amphibious warfare

The Defence of Australia construct was essentially a sea-denial strategy, concentrating air and sea power to defend the sea-air gap to Australia's north, with little emphasis on the ability to project force into the near region. The logic underpinning this construct remains compelling. Force projection by sea and air requires for its successful implementation either

[208] Department of Defence, "NCW Roadmap 2007," p. 48.
[209] Department of Defence, "NCW Roadmap 2009," p. 47.
[210] Ibid., p. 47–49.
[211] Ibid., p. 49.

a permissive environment in which deployment can be undertaken safely, or, in a contested or hostile environment, the capacity to attain and enforce sea-control upon which amphibious force projection can proceed safely.[212] The Defence of Australia sea-denial emphasis proceeded on the extant knowledge that Australia neither had nor was likely to attain the capacity for sea-control in its maritime periphery. Therefore, under the auspices of self-reliance, expeditionary capacity took a back seat to typical sea-denial platforms and tactics. This was largely based around deterring and denying Australia's northern approaches to hostile surface combatants using submarines, and airborne surveillance and strike for anti-submarine and anti-surface warfare. Marking this bias, the 1999 Australian led United Nations INTERFET operation in East Timor found the ADF woefully understrength in amphibious craft.[213] And with the current proliferation of long-range undersea and aerial platforms and weapons in Australia's region, sea-control is an increasingly impracticable concern for the ADF, as argued by Hugh White.[214] Yet the huge investment in the AWD and LHD alone represent evidence of the ADF's shift to an expeditionary footing.

Arguments in favour of this move highlight the fact that the ADF expects to be operating in permissive environments, particularly those environments it expects to encounter on lower-intensity operations like stabilisation missions and disaster relief.[215] In a similar practical vein, the RAN understands Australia's intense reliance on the safety and security of shipping in peacetime, and high-end platforms like the AWD provide deterrence and presence at this level. As James Goldrick argues, sea-control has, since the invention of the torpedo, been at

[212] See Jeff Moore, "Essay: The New Strategic Realities of U.S. Carrier Operations," *USNI News*, accessed February 18, 2015, http://news.usni.org/2015/02/17/essay-new-strategic-realities-u-s-carrier-operations.
[213] Dean, "Australia's Emerging Amphibious Warfare Capabilities."
[214] Hugh White, "Why LHDs and AWDs Are a Bad Investment," *The Strategist*, November 2013, http://www.aspistrategist.org.au/why-lhds-and-awds-are-a-bad-investment/.
[215] Thomas Lonergan, "Amphibious Capability Is Exactly What Australia's Maritime Strategy Needs | The Strategist," accessed January 28, 2015, http://www.aspistrategist.org.au/amphibious-capability-is-exactly-what-australias-maritime-strategy-needs/.

best a nebulous concept.[216] While Hugh White contends that if this were the case, a smaller, faster, more lightly armed and more numerous platform would serve the RAN's needs,[217] Goldrick makes reference to perhaps the critical factor in these acquisition choices. He highlights the RAN will not be working alone, rather it will be in concert with other elements of the ADF as well as with alliance and coalition partners who share a common interest in the safety and security of maritime commerce.[218] In addition, they will support regional confidence building through military diplomacy, for which these platforms are well suited. Australia's emerging amphibious capabilities, then, supported by platforms such as the AWD and LHD, must be viewed in the context of robust alliance operations in anything above the most permissive of environments. The rotation of US Marines through Darwin provides ample opportunities for training and combined operations with the US military also. As cited above, "*self-reliance* will not mean *self-sufficiency*."[219] By inference, this means the sea-control effort in Australia's environs at higher intensities of conflict might be expected to fall more squarely on the US Navy and Air-force, with an Australian amphibious capability acting as a force multiplier.

Further to the logic underpinning the shift in emphasis from sea-denial to force projection; sea-denial in the age of precision-strike is arguably as network-dependent as the forces it would likely be challenged by. Discussion of A2/AD and its counter-measures conclude that it would likely resemble a 'battle of networks',[220] or a war on information, sensors, and communications, as well as platforms, particularly at the outset of hostilities. This makes a

[216] James Goldrick, "As Long as We Use Ships to Move Cargo, the Navy Will Need to Control the Sea," *The Age*, October 29, 2013, http://www.theage.com.au/comment/as-long-as-we-use-ships-to-move-cargo-the-navy-will-need-to-control-the-sea-20131029-2wdb1.html.
[217] White, "Why LHDs and AWDs Are a Bad Investment."
[218] Goldrick, "As Long as We Use Ships to Move Cargo, the Navy Will Need to Control the Sea."
[219] Australian Defence Force, "Joint Operations for the 21st Century," p. 7.
[220] Zachary Keck, "A U.S.-China War: A Battle between Networks," Text, *The National Interest*, accessed November 27, 2014, http://nationalinterest.org/blog/the-buzz/us-china-war-battle-between-networks-11745.

nation that commits to sea-denial as much a 'hostage to fortune' as its opponent.[221] The ADF's multidimensional manoeuvre concept marks a keen awareness of this reality, and an unwillingness to remain passive in the midst of rapidly changing operational environments. It marks what Peter Dean describes as the emergence of an Australian maritime strategy.[222] The key link between this strategy and emerging amphibious operations is the development of NCW capabilities in close conjunction with the US.

From a US perspective, the expansion of interest in amphibious operations in the Asia-Pacific, not just with Australia but amongst a host of willing participants, benefits the US Marine Corps in several ways. It creates more useful partners to conduct combined operations with, builds partner capacity and confidence, draws allies and partners closer and, according to Colonel Grant Newsham (Retired), "creates a web of unstated but practical alliances that complicates an adversary's efforts to assert itself one-on-one against regional nations," that can "jump-start the tactical and operational development of joint capabilities in partner-nation militaries."[223] This trend toward partner militaries augmenting shortfalls in US presence, while plugging in to the systems, doctrines, and force models of its services is spread across the spectrum of capabilities that are of increasing importance in the region. The creation of these webs of capabilities, or 'cross-braces' linking spoke-to-spoke in an evolution of the hub-and-spokes model, are envisioned as having effects that migrate from the tactical sphere to the strategic. This emerging model of networked, scalable security at the tactical level means an actor challenging it cannot expect to be able to isolate or distil its interactions with regional states at the strategic level.

[221] Goldrick, "As Long as We Use Ships to Move Cargo, the Navy Will Need to Control the Sea."
[222] Dean, "Australia's Emerging Amphibious Warfare Capabilities."
[223] Grant Newsham, "'Amphibiosity' in the Asia-Pacific," *Proceedings Magazine* 141/11/1, 353 (November 2015): p. 32, http://www.usni.org/magazines/proceedings/2015-11/amphibiosity-asia-pacific.

6.2. Integrated air and missile defence

The ballistic-missile threat to the Australian mainland is remote, while the capability exists.[224] Nonetheless, as referred to above, future ADF participation in coalition maritime operations would likely centre on, or be contiguous with, the issue of access. Threats to access are emerging across multiple axes, with ballistic and cruise missile capabilities of particular concern for the ADF, and in particular the RAN, embarking upon a force projection posture. This makes anti-air warfare and ballistic-missile defence (BMD) key operational contingencies confronting the RAN, requiring a comprehensive program of state-of-the-art defensive capabilities. The potential for increased BMD cooperation was again raised at the 2013 AUSMIN meetings, having been on the agenda of the three prior.[225] As raised in the 2011 AUSMIN Joint Communiqué,

> Australia noted and will continue to consult with the United States as it develops the phased adaptive approach to BMD outlined in the U.S. BMD Review, which will allow missile defense to be adapted to the threats unique to the Asia-Pacific. We are continuing our cooperation to build a more detailed understanding of regional ballistic missile threats; cooperative research on systems to counter such threats; and options for practical cooperation in this area.[226]

The issue has lingered for a lot longer. Formal cooperation was signified in 1995 with the exchange of letters between the Australian Defence Science and Technology Organisation (DSTO) and the US Ballistic Missile Defence Organization (BMDO). Collaboration began in November 1995 with the planning and execution of a three year joint project, The

[224] See Tom Mueller, *The Royal Australian Navy & Theatre Ballistic Missile Defence / Tom Mueller*, Working Paper (Australia. Royal Australian Navy. Sea Power Centre) ; No. 12. (Canberra: RAN Sea Power Centre, 2003).
[225] Nathan Church, "Ballistic Missile Defence and Australia," accessed February 10, 2015, http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/FlagPost/2013/December/Ballistic_missile_defence_and_Australia.
[226] Kevin Rudd, "Australia-United States Ministerial Consultations 2011 Joint Communiqué," 2011, http://www.dfat.gov.au/geo/us/ausmin/ausmin11-joint-communique.html.

Midcourse Space Experiment (MSX), which demonstrated "the ability to provide real-time target track and sensor fusion information via satellite communication systems."[227] In September 1997 DSTO and BMDO collaborated on the Down Under Early-warning Experiment (DUNDEE). It was conducted in the remote north-west, investigating the potential of using over-the-horizon radar, surface-wave radar and space-borne sensors in early warning detection of Theatre Ballistic Missile type targets. MSX provided the primary space-based platform, with JORN as the OTHR backup. Data and modelling from these early joint experiments have played an important role in the further development of the US SBIRS program,[228] and they established a broad framework for cooperation. In 2004 Australia signed a BMD Framework Memorandum of Understanding with the US, facilitating further policy collaboration and information sharing.[229]

The specific technologies, components, systems, and subsystems the RAN acquires to make the aforementioned platform investments as capable as possible will dictate its relevance as a fighting force for decades to come.[230] As identified, the AWD's currently under construction will be equipped with the Aegis Weapon System *Baseline 7.1*, which addresses the threat of attack aircraft and air-breathing cruise missiles to the RAN's surface fleet using the SM-2 interceptor.[231] Aegis ships can acquire the capability to conduct BMD operations by incorporating changes to the Aegis system's computers and software, and by arming the

[227] Australian National Committee for Space Science, "Australian Space Research 1996-1998" (Australian Academy of Science, 1998), p. 61.
[228] Ibid., p. 62.
[229] Ian E. Rinehart, Steven A. Hildreth, and Susan V. Lawrence, "Ballistic Missile Defense in the Asia-Pacific Region: Cooperation and Opposition" (DTIC Document, 2013), p. 11, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA590776.
[230] Edward Feege and George Galdorisi, U.S. Navy (retired), "Air Warfare Destroyer | Australian Defence News & Articles | Asia Pacific Defence Reporter," accessed February 9, 2015, http://www.asiapacificdefencereporter.com/articles/230/Air-Warfare-Destroyer.
[231] George Galdorisi, "Air Warfare Destroyers: New Capabilities for a New Era," 2014, p. 22, http://search.informit.com.au/documentSummary;dn=185668742222570;res=IELBUS.

ships with BMD interceptor missiles.[232] The next step for the RAN and the Australian government would be to upgrade the AWD's with a sea-based mid-course Aegis BMD configuration, utilising the SM-3 interceptor, joining its key regional partners Japan and potentially Republic of Korea[233] in the US led enterprise. Alternatively, a variant of the SM-6 missile would provide the RAN with terminal phase ballistic-missile interception capabilities.[234] Cost may be the determining factor here. Currently under development and first deployed from 2015 as part of the US NIFC-CA program,[235] Aegis *Baseline 9* (also known as Advanced Capability Build 12) will allow Aegis warships to simultaneously perform both the fleet air *and* BMD missions, which under previous configurations in the US Navy are either/or.[236] *Baseline 9* also includes an open architecture that will more easily facilitate additional system upgrades in future.

In addition, widely used in the US Navy's fleet of Aegis equipped vessels, as well as its E-2D Hawkeye aircraft (analogous with the RAAF's Wedgetail) is the Cooperative Engagement Capability (CEC), an advanced fire-control system enabling enhanced situational awareness and control. The development of CEC has incorporated over-the-horizon and other non-line-of-sight air as well as third party off-board cueing engagements. This would entail combining satellite surveillance feeds from coalition partners with that available from Australian assets such as JORN, P-8, UAV, JSF, and AEW&C aircraft.[237] According to Tom Mueller, the

[232] Ronald O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress* (DIANE Publishing, 2011), p. 3.
[233] RoK currently does not use the SM-3 interceptor.
[234] Feege and Galdorisi, U.S. Navy (retired), "Air Warfare Destroyer | Australian Defence News & Articles | Asia Pacific Defence Reporter."
[235] Richard Scott, "Live Fire Tests Demonstrate Aegis Baseline 9, NIFC-CA Capability," *IHS Jane's 360*, accessed February 11, 2015, http://www.janes.com/article/40745/live-fire-tests-demonstrate-aegis-baseline-9-nifc-ca-capability.
[236] Feege and Galdorisi, U.S. Navy (retired), "Air Warfare Destroyer | Australian Defence News & Articles | Asia Pacific Defence Reporter."
[237] Mueller, *The Royal Australian Navy & Theatre Ballistic Missile Defence / Tom Mueller*, p. 16.

capabilities for the coordination of Australian and allied sensors with those of its naval assets exist at the Pine Gap facility.[238] Clearly, the decision to acquire BMD and CEC for the RAN would significantly enhance its NCW capabilities. At the same time, it would enmesh the RAN further in an emerging regional security architecture that, by 2020, will consist of at least 18 Aegis-equipped surface vessels across the Japanese, South Korean, and Australian navies, supplemented by and integrated with the US Navy.[239] In addition, the Australia-US Defense Trade Cooperation Treaty of 2007[240] will facilitate "defence industrial collaboration by permitting the license-free export of defence goods and services between the Australian and US governments and Australian and US companies that meet security and regulatory requirements."[241] The preceding analysis suggests virtually all the technical and operational components for BMD are more-or-less in place or within reach for the ADF, making the final decisions to go ahead manifestly fiscal and political. Consistent throughout the political BMD discussion in Australia has been the strategic risk theatre and national level BMD systems pose in undermining the small nuclear deterrence posture maintained by the PLA, among a great many associated issues.[242] On the fiscal side, US Missile Defense Agency (MDA) states that an in-service Aegis ship with no BMD capability can be given a Phase I BMD capability for about US$10 million to US$15 million.[243] MDA states SM-3 Block IA, IB, and IIA interceptors have an estimated unit procurement cost between US$9 million and

[238] Ibid.
[239] Galdorisi, "Air Warfare Destroyers," p. 22.
[240] Government of Australia and Government of United States, "Treaty Between the Government of Australia and the Government of the United States Concerning Defense Trade Cooperation," *Australian Treaty Series*, 2007.
[241] Berteau et al., "US Force Posture Strategy in the Asia Pacific Region," p. 32.
[242] See for example Hon Giz Watson, Hon Ed Dermer, and Hon George Cash, "United States-Australian Joint Military Bases and Port Visits by US Warships, Ban" (Parliament of Western Australia, November 2001), http://www.parliament.wa.gov.au/Hansard%5Chansard.nsf/0/185924895f725708c82575700014cba2/$FILE/C36%20S1%2020011115%20p5580b-5587a.pdf.
[243] MDA briefing to congressional staff, March 2011, cited in O'Rourke, "Navy Aegis Ballistic Missile Defense (BMD) Program," p. 3.

US$24 million respectively.[244] The Australian government may see a future upgrade to *Baseline 9*, providing the AWD with an unprecedented sea-based integrated air-and-missile defence capability, as the most economical and practical option. The 2016 DWP states "Australia and the United States have established a bilateral working group to examine options for potential Australian contributions to integrated air and missile defence in the region."[245]

6.3. Australia and Air-Sea Battle

The US security community views Australia as a long-standing, committed, and capable regional ally, whose interests in the security status quo and the ongoing stability of the military balance in East Asia overlap with its own. Indeed, that Australia, along with Japan, would be an "active US ally" in a hypothetical Sino-US conflict is one of the stated 'critical assumptions' in the CSBA's seminal ASB document.[246] Absent an official remark on the specific subject, it is fair to say the current US administration shares this view. Article IV of the ANZUS treaty binds Australia to "act to meet the common danger" of an armed attack on a treaty ally in the Pacific, and Article V states that an armed attack on a treaty ally includes an attack on its "armed forces, public vessels or aircraft in the Pacific," not to mention "island territories under its jurisdiction" (Guam).[247] For these reasons, the question of Australia's role in ASB is far from trivial. Notwithstanding, public reference to Australia and an ASB role is limited, with the CSBA papers, ASPI's Benjamin Schreer, Kokoda's Ross

[244] O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program*, p. 4.
[245] Department of Defence, "2016 Defence White Paper," p. 96.
[246] Jan van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept | CSBA," p. 51, accessed June 27, 2014, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/.
[247] Department of External Affairs, "Security Treaty between Australia, New Zealand and the United States of America [ANZUS]" (Australian Government Publishing Service, 1952), http://australianpolitics.com/topics/foreign-policy/anzus-treaty-text.

Babbage, and Hugh White among the most prominent US and Australian analysts to broach the topic.[248]

A general summary of these views is possible, with Hugh White as the notable dissenter. The CSBA, ASPI, and Kokoda support the basic strategic overlap thesis. They recognise the need for a robust American and allied response that deters Chinese adventurism in its near seas, while also recognising the need for a set of responses at the low end of the conflict spectrum in which the ASB concept is not applicable. They see the potential for an Australian combat role under an ASB construct as limited, with Babbage in particular reserving the space for development in this area in the near future, subject to changes in the strategic environment.[249] The Australian BMD debate is pertinent here, as is the potential for Australian-US joint development of a long-range strike capability. Nonetheless, all see a significant role for Australia in the areas of basing, in-theatre and out-of-theatre logistical support for US forces, integrated C4ISR with space surveillance a particularly important feature, and further joint interoperability across services and allied forces as key. Given its geographic position, Australia's capabilities may be most effectively employed in the Indian Ocean Region, where its undersea, surface, and airborne platforms may perform a strategic denial role, with accompanying operational and tactical level adjuncts, or 'back-filling'[250] to US operations described under the ASB construct. The upshot of these discussions is that while the ASB concept has Australia's strategic support, the major nodes of Australian involvement are largely already in place or under development, and do not require a major statement either way. As noted by Richard Tanter, "Signals short of war in

[248] Van Tol et al., "AirSea Battle: A Point-of-Departure Operational Concept"; Krepinevich, "Why AirSea Battle?"; Schreer, "Planning the Unthinkable War"; Ross Babbage, "Australia's Strategic Edge in 2030" (Kokoda Foundation, 2011); No-one's ocean: the pointlessness of "AirSea Battle" in Asia- Hugh White, October 15, 2012, https://www.youtube.com/watch?v=mumC_AhZOSU&feature=youtube_gdata_player.
[249] Babbage, "Australia's Strategic Edge in 2030,"pp. 71–75.
[250] Schreer, "PLA Planning the Unthinkable War," p. 35.

diplomacy don't come much bigger than enthusiastic building of military bases"[251] in any case. Even more so, this thesis argues, is the closeness of the space-based SIGINT and ISR relationship. The more than two decades of Australian investment in NCW capabilities is enabled by its more than five decades of support for and integration with the US in the quest for information dominance, of which the recent AUSMIN developments described in this chapter are a notable reflection.

7. Conclusion

Australia was able to quietly pursue a policy of strategic connectivity since the late 1990s, as its region became home to an increasing array of uncertainties. This pursuit was reflected in the inscriptions, translations and circulating reference associated with digital networked capabilities. In 2006, Defence Minister Brendan Nelson remarked on the relationship between technological development and strategic opportunity by stating:

> "Looking forward, the level of practical cooperation between Australia and the US will continue to grow over coming years, largely because of technology. Technology offers us new opportunities to work together, and to deepen our defence cooperation in many areas. It also provides new imperatives to achieve closer integration and interoperability of our defence capabilities and systems. In an era of high technology warfare the Alliance needs systems that can deliver operational levels of detail in real time."[252]

Interoperability with US forces and the ability to contribute to multinational coalitions are long standing central themes in Australia's defence policies, acquisition programs and training plans. The post-Cold War environment deepened strategic overlap with the US, so Australia's engagement with networked warfare aligned with these themes. Australia

[251] Tanter, "North by North West Cape."
[252] Brendan Nelson, "Address to the Bradfield Forum 'The Anzus Alliance,'" *Australian Government, Department of Defence Home Page*, September 8, 2006, http://www.defence.gov.au/minister/51tpl.cfm?CurrentId=5986.

emerged as the southern hub of a Western Pacific scale-free security network. The traditional, but somewhat ambiguous, concept of extended deterrence characterising the alliance is being replaced slowly by what might be termed networked deterrence, fitting more broadly into post-Cold War trends pursued by the Pentagon on both a regional and global scale. Information is at the heart of these trends, and Australia's long-standing engagement with the US, representing a foundational legacy, was documented in this chapter. Australia was in a position to align itself with the features of a networked security strategy supporting strategic stability in its region, even as that strategy was itself taking shape. Given Australia's substantial interests in the regional status quo, and its demonstrated capacity and willingness to share the burden of defending a favourable regional alignment, further engagement, integration and capacity building in the information domains with like-minded allies and partners made strategic sense. Questions regarding the commitment and staying power of the US to security in the Western Pacific overlook the fact that the most favourable path to sustaining a US-led regional alignment is in the hands of regional states for which that alignment is critical, and which was quietly building connectivity with its alliance partner even while traditional discussions around commitment and assurance were had.

The foundations of a Western Pacific security network are well established, with numerous advantages derived by defenders of the status quo. The FPDA is a working proof-of-concept. As Japan and Australia continue to expand and deepen their security relationship, and other critical regional actors such as India and Indonesia seek enhanced security, particularly in the maritime domain, the scale-free network offers a fundamentally new and promising architecture compared to the traditional model. The maritime domain of the Indo-Pacific

endears itself to scalability in security ties. States with an interest in safety and security in the maritime domain can plug into a superior information background provided by the enhanced connectivity of the digital information age. Connectivity can in turn quantify into sinews of distributed trust, acting as a security foundation from which states pursue individual economic interests with a high degree of autonomy without needing to or being required to pay a high cost in security.

Conclusion

The thesis has argued that the security system in the Western Pacific, understood as a material-semiotic actor-network, observable via the inscriptions and translations circulating reference to what we defined as 'networked security', exhibits the features of the scale-free network model. Its defining features of growth, preferential attachment, and competition for fitness connectivity product, and the structural evolution of network hubs, have been identified using analysis of the discourse and extra-discursive practices associated with the military development of the United States, Japan and Australia over the last twenty years.

Growth was identified as the primary organizing principle of the scale-free network model. Its prevalence was highlighted with reference to the growth and expansion of the digital medium under the auspices of the pursuit of network-centric warfare and the associated effects-based approach to warfighting led by the United States. Chapter III traced this pursuit to the emergence and development of the precision-strike regime enabled by the application of digital information and communication technologies to warfighting. While these operational concepts and approaches to warfare were debated in the discourse, the key feature of the process for the thesis was the observable growth and expansion of the digital information infrastructure, and the convergence of strategic and military thinking it enabled after the Cold War.

Preferential attachment was identified as a corollary of the American lead in the technologies and knowledge-based concepts of the digitization of warfare that occurred under the precision-strike regime and the shift to effects-based operations. Military affairs follow a distinct follow-the-leader dynamic, and this meant after the Cold War the margin of

US dominance reflected the direction it decided to go in military affairs would determine the scope and nature of how military competition between states would play out over the ensuing decades. These dynamics had ramifications for US allies, partners, and neutrals, as much as for competitors and adversaries. Chapter IV focused on how the effort to build a joint force structure better able to take advantage of the growth of the digital medium, and how the effort to extend and leverage this advantage via coalition military networking, had political ramifications. It contrasted these ramifications with those depicted by traditional bargaining based international relations perspectives. It found that preferential attachment was a strong structural influence on the behaviour of national security, intelligence, and defence communities after the Cold War.

Fitness connectivity product was identified as a key feature of the structural forces driving organizational change as militaries, seeking to take advantage of the digitization of warfare, struggled to adapt to its exigencies. The flow of information around coalition environments was identified as a key sticking point and site of competition for fitness connectivity product. Chapter V showed how the effort to incorporate military-technical innovation in a network structure exhibits the type of competition for fitness associated with the scale-fee network model. The ultimate success of militaries to fully incorporate the new regimes of warfighting was shown as a struggle for network position. Debates and controversies surrounding the 2009 US military's Air-Sea Battle concept showed evidence of disconnection between the dominating incumbent orientation of strategic communities in the US, for whom East Asia remained a hub-and-spokes system with some minor updates, and the actual growth and evolution of the scale-free network. The overall effect remained the

growth and preferential attachment features of the scale-free model, seen playing out at the level of information infrastructure as highlighted in chapter VI.

Hubs as the defining structural forms associated with the scale-free network model were identified in chapters VII and VIII. Japan and Australia have exhibited the features of the scale-free model as they have embraced and pursued to varying degrees their versions of the US-led digital networked regime. Most important for the thesis was the depiction of the growth and expansion of both countries capabilities and awareness in the digital information infrastructures that enmesh their own discrete defence imperatives with the extended operational reach and awareness of the US military. These dynamics show strong features of growth, preferential attachment, and fitness and suggest the structural power of the network, in particular its central binary of connectivity vs. isolation, are key forces acting on state incentives and constraints not well captured by traditional bargaining perspectives. It showed the incentives of connectivity for Japan and Australia under the US-led regime have strongly influenced state behaviour while regional security dynamics evolved over the last twenty-five years.

The thesis forwards the following observations on the basis of its core claim. The scale-free network model and the structural power inherent in networks has significant strategic implications under-explored by mainstream IR and by security scholars focused on the Western Pacific interested in Sino-American regional relations. It suggests the growth in digital connectivity over the past twenty-five years can be seen as a *strategic end in itself*. If this is so we might offer some predictions that could be taken up by scholars now or when more empirical information can be gathered. The self-organizing properties of the scale-free network suggest that the United States commitment to formal ties, alliances, rule-making,

international institutions, and leadership should all be expected to decline. The salience of these approaches to international competition emerged from and belongs in a world of bargaining states under the organizing principle of anarchy depicted by Waltz. In the network age the organizing principle shifts to connectivity and growth. States face imperatives defined by the connectivity/isolation binary, meaning many of the instruments that helped them to bargain have diminished in their capacity to produce favourable outcomes. Strategies of connection have taken precedence. The traditional imperatives of statecraft take a back seat to the networked imperatives of growth, preferential attachments, and fitness. The two classes of imperatives intermingle, but the former can no longer stand alone without the latter if IR scholars are to construct better explanations of the world they study. States will weigh their connectivity position and fitness against their bargaining fitness and hierarchical position. The scale-free network model suggests US commitment to the growth and expansion of *connectivity* in the information domains should be expected to continue to increase. It suggests agnosticism about whether connectivity occurs under formal or informal ties. This is likely to be observable in the political and economic realms. Fitness is the feature of networked security most likely to preserve the role of traditional imperatives such as diplomacy, but fitness is translatable as much through informal ties as it is in formal ties. Nonetheless, fitness in military ties might be one of the pivotal features of the evolution of networked security, because militaries still sit at the nexus of the military-industrial-commercial-Internet complex. Militaries that get this right will have a big advantage in their capacity to grow the network and out-compete others, hence their ongoing importance to and support from state bureaucracies. The basic imperatives of growth and preferential attachment in scale-free networks should inform strategic analysts about the intentions of the United States going forward.

In addition, the depiction of US strategy as a scale-free network model might help us analyse and predict the reactions of America's allies, neutrals, and enemies. As the thesis showed, US allies will be incentivised by their already close relationships to take advantage of their privileged position to become regional network hubs focused on growth, preferential attachment, and fitness, regardless of changes in political leadership positions. This should be expected to take place with a much higher tolerance for political and even economic uncertainty. Neutrals will face increasing incentives to connect with the biggest network, particularly as it grows and as the cost of isolation becomes clearer. Attractive alternatives will diminish in a networked age. Like close US allies, neutrals will be primarily motivated by the binary of connection vs. isolation that diminishes the salience of traditional political or economic motivations.

The adversaries of the US-led network face the starkest choice. In a networked age, connectivity is ubiquitous, unavoidable, and representative of survival, as are the network's effects. If joining the network is politically unacceptable, opposing the network alone or in a small cluster is unsustainable, and opting out is impossible, two options remain. Option one is to build a big network to compete with the incumbent and attempt to leverage fitness connectivity products to grow faster than the incumbent. We might see evidence of this strategy in China – particularly its Belt and Road Initiatives. Beijing wants to be a hub connecting the eastern flank of the Eurasian continent with Europe, Central and South Asia, and the Middle East. The scale of this strategy is matched only by its ambition. Option two is to attack the incumbent network at its most vulnerable points and hope it collapses – or at least slow its inevitable domination. Option two pits an outlier node cluster against the mathematically proven self-organizing structure of the scale-free model. The vulnerability it

attacks can be found in cyberspace and in the cognitive biases of populations. The problem is this approach cuts both ways, and may only lead to further isolation in the networked age as its efficacy recedes over time. Bigger is better – and growth is imperative. These are structural maxims for the network age.

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