

OPERATIONAL-LEVEL INFORMATION SHARING BETWEEN THE U.S. NAVY AND SOUTHEAST ASIA MARITIME INSTITUTIONS

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General Studies

by

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

OPERATIONAL-LEVEL INFORMATION SHARING BETWEEN THE U.S. NAVY AND SOUTHEAST ASIA MARITIME INSTITUTIONS, by LT David C. Haertel, 140 pages.

This thesis investigates the institutional barriers to operational-level information exchange between the U.S. Navy and its ASEAN counterparts. The study emerged from a stated U.S. Department of Defense objective to facilitate maritime security in the South China Sea through regional maritime domain awareness and partner interoperability. A chief obstacle to this objective is the information sharing behavior of regional maritime institutions.

The principal research mechanism is a case study of U.S.-ASEAN information sharing during the 2014 multinational search for Malaysia Airlines flight MH370. Using theoretical propositions derived from relevant literature, the study explores the influence of five institutional factors—culture, policy, technology, relationships, and structure—on information sharing during the search. The case study demonstrated that each factor inhibited effective information exchange to varying degrees. The study also showed that the relative health of strategic-level relationships between stakeholders governed the operational-level behavior of most of these factors during the search.

Based on the case findings, this thesis recommends two lines of effort to improve regional information sharing. The first effort focuses on improving strategic-level relationships; the second focuses on development of a U.S.-ASEAN centralized command and control hub.

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ACRONYMS

ASEAN	Association of Southeast Asian Nations
MDA	Maritime Domain Awareness
SCS	South China Sea
UK	United Kingdom
U.S.	United States
UTC	Coordinated Universal Time

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CHAPTER 1

INTRODUCTION

U.S. economic and security interests are inextricably linked to developments in the arc extending from the Western Pacific and East Asia into the Indian Ocean region and South Asia, creating a mix of evolving challenges and opportunities. Accordingly, while the U.S. military will continue to contribute to security globally, *we will of necessity rebalance toward the Asia-Pacific region*. Our relationships with Asian allies and key partners are critical to the future stability and growth of the region. We will emphasize our existing alliances, which provide a vital foundation for Asia-Pacific security. We will also expand our networks of cooperation with emerging partners throughout the Asia-Pacific to ensure collective capability for securing common interests.

—U.S. Department of Defense,
Sustaining U.S. Global Leadership: Priorities for 21st Century Defense

Strategic Context

The security challenges in the Asia-Pacific region and their relevance to the United States (U.S.) are well documented. Chinese expansionism; drug and human trafficking; piracy; territorial disputes; violent extremist organizations; proliferation of weapons of mass destruction—these enduring challenges threaten stability and economic prosperity in the Asia-Pacific region and, by extension through the region’s maritime environment, the international community.¹ “Eight of the world’s 10 busiest container ports are in the Asia-Pacific region, and almost 30 percent of the world’s maritime trade transits the South China Sea [(SCS)] annually, including \$1.2 trillion in ship-borne trade bound for the United States.”² And when considering approximately two-thirds of the world’s oil supply transits through the Strait of Malacca annually, security of the Asian-Pacific maritime region is a relevant issue to the U.S. and its transnational partners.³

In its 2015 *Asia-Pacific Maritime Security Strategy*, the U.S. Department of Defense outlined a framework to manage these maritime security challenges. In particular, the Department posited that preserving security in the Asia-Pacific maritime environment required, among other mechanisms, improved collaboration between the U.S. military and its partners in the region. The Department couched this idea in various lines of effort focusing on bolstering the combined capabilities of the U.S. military and its regional partners in the maritime domain, improving their interoperability, and “strengthening the development of an open and effective regional security architecture.”⁴

These efforts to build regional collaborative capacity are embodied in the Department’s Southeast Asia Maritime Security Initiative announced by the U.S. Secretary of Defense at the May 2015 Shangri-La Dialogue and rolled out in April 2016.⁵ The Maritime Security Initiative is a five-year \$425 million program geared toward building the maritime security capacity of U.S. partners in the Association of Southeast Asian Nations (ASEAN)—Indonesia, Malaysia, the Philippines, Thailand, Vietnam, Singapore, Brunei—as well as Taiwan.⁶ The security initiative, in particular, seeks to enhance regional maritime domain awareness (MDA) through investments in specific sensing and sharing capabilities of these partners, with the ultimate goal of developing a regional common operational picture to facilitate more timely and efficient response to maritime security challenges.⁷

The Problem

The scope of the security effort in the Southeast Asia maritime region—and particularly in the SCS—is too extensive for the U.S., or any single stakeholder, to manage unilaterally.⁸ The Southeast Asia Maritime Security Initiative therefore assumes

that true maritime security can only be realized through collaboration amongst regional stakeholders—that the collective and cooperative fusion of information, military, and economic assets of regional partners affords the best chance to ensure future uninhibited, lawful and peaceful use of a globally significant space. Multinational collaboration, however, imposes certain demands on these stakeholders. The least of which, and the one of concern for this study, is the exchange of operationally relevant and potentially sensitive information: the kind of information required to realize regional MDA.⁹

Unfortunately, a number of prominent strategic-level obstacles hinder this exchange of information. First, Southeast Asia nations are intensely competitive. This “impedes collective action” and deters states from “engaging in cooperation, even when it would advance shared interests.”¹⁰ Second, states “continue to operate on a *need to know basis*, as opposed to a responsibility to share ethos.”¹¹ Sharing the type of information needed to achieve MDA, for example, risks divulging sensitive national collection capabilities and methods, and thus threatens regional relationships or expose vulnerabilities. Moreover, the requisite multinational defense agreements that enable this sharing ethos are either collectively non-inclusive or non-existent. The Philippines and Thailand, for example, “have formal treaties with the United States, but these states do not have close defense ties to each other.”¹² New “alignments” are emerging in the region, but wholly inclusive agreements do not exist amongst all stakeholders.¹³

Third, classified information distribution amongst regional states is impeded by “technological incompatibility,” or at least common perception suggests it is.¹⁴ A number of functioning multinational classified information exchange systems already exist that could serve as models for a Southeast Asia distribution network. The U.S.-South Korea

Combined Enterprise Regional Information Exchange System-Korea (CENTRIXS-K) is one example. Another is the Afghan Mission Network used by the U.S. and coalition partners in their security assistance operations in Afghanistan.¹⁵ Ostensibly, though, the strategic-level issue with classified information exchange systems is finding a technology framework that appropriately balances the aforementioned issues of trust and competition.¹⁶

Research Topic and Question

The above strategic-level issues suggest information exchange between SCS stakeholders reflects broader social behavior in the region—that the barriers to information exchange are symptoms of human tendencies, and not simply the result of technological incompatibility. And because they reflect human behavior, we can expect these barriers to transcend strictly strategic-level institutions (national leadership) and pervade lower echelon institutions, such as regional navies.

This thesis builds upon the assumption of behavioral transcendence across echelons of social institutions and steps down from the strategic level to the operational level, where naval fleet and major military staffs collaborate to execute national strategy. This study is particularly interested in the information sharing behavior of operational-level maritime organizations, since they are the principal stakeholders in SCS maritime security. As will be discussed later in this chapter, however, explicitly focused studies on human information barriers between maritime institutions in the SCS region are sparse in the literature. And since these barriers to information exchange are so foundational to U.S.-ASEAN collaborative capacity, it is necessary to study them to improve regional interoperability and MDA.

Valuing the role operational-level naval staffs play in preserving maritime security, the central research question for this thesis is: What systemic institutional factors in the SCS maritime environment inhibit effective information exchange at the operational level between the U.S. Navy and its partner navies in the region? This study seeks to fundamentally understand the unique information behavior of large multinational maritime military organizations in the SCS region to help the U.S. Navy improve interoperability with its Southeast Asian partners. Enhanced interoperability will build collaborative capacity to help preserve maritime security in the Asia-Pacific region.

Explanation of Key Elements in the Primary Research Question

The author purposefully selected the language of the primary research question to provide a well-focused framework for the thesis. The below discussion clarifies this language and is intended to assist the reader in understanding the scope of the study.

The term ‘systemic’ acknowledges the presence of both human and technological systems in interactions between organizations. Human systems, for example, may be organizational processes that facilitate decision cycles; technological systems may consist of communication infrastructure linked to computer networks. Moreover, ‘systemic’ also acknowledges that information exchange is not the result of a single component, but rather multiple complexly networked components that are part of a larger whole.

‘Institutional’ reflects the norms and standards that are firmly rooted in organizations. The term also scopes the study to focus on organizations that are firmly established in the region.

‘Effective information exchange’ attempts to capture the dependency of decision-making in maritime security applications on actionable information, not just data. Chapter 2 will derive a more useful definition for this phrase.

‘Operational level’ scopes the echelon of institutions germane to this thesis. It focuses on organizations serving as the intermediary between strategic institutions that direct national objectives, and direct-action units (tactical) that facilitate those objectives. Military communities refer to this echelon as the “operational level of war.”¹⁷

The U.S. Navy’s Southeast Asian partner navies are those of member nations within ASEAN. There are numerous international stakeholders in the SCS maritime region external to ASEAN—most notably Australia and China—but this study excludes them on account of its original motivations: the 2015 U.S. Department of Defense Southeast Asia Maritime Security Initiative.

‘Maritime environment’ refers to the “oceans, seas, bays, estuaries, islands, coastal areas, and the airspace above these, including the littorals.”¹⁸ This is significant because it further emphasizes the study’s focus on naval institutions.

Framing Questions

The primary research question builds upon several foundational questions listed below. These questions will be addressed using the literature review in chapter 2.

1. What is information and what is its function within organizations?
2. What is the meaning of ‘effective information exchange’?
3. Are there distinct behavioral factors common to all organizations that influence information exchange?

Filling the Research Gap

The preceding discussion provided the motivation and framework for this thesis. It claimed without support, however, that the relevant literature offered sparse insights to the specific thesis topic. This section provides a brief introduction to some of these sources—germane to the topic of multinational information sharing—and explains how the present study is unique and beneficial.

A Relevant Academic Study

A 2014 thesis conducted by Tran Duc Huong, a Vietnamese Army student at the U.S. Army Command and General Staff College, provided robust analysis of the collaborative potential of ASEAN. His study particularly focused on strategic-level ASEAN “military cooperative practices”; it concluded that “differences in national interest, military capability, and command and control structures and procedures still present difficulties to ASEAN’s military integration.”¹⁹ The study suggested that “the challenges associated with the design” of an effective command and control system required additional study.²⁰

Tran Duc Huong limited his work to strategic-level ASEAN applications. His findings provide contextually significant insights to the present study, but do not answer its operational-level, maritime focused research question. The results of the present thesis, however, should provide insights to aid future studies on the design of the referenced ASEAN command and control system.

Relevant Professional Studies

A number of professional studies and products covering lessons in information sharing within multinational military operations are also available for reference. Example studies include the Afghan Mission Network case study conducted by the RAND Corporation; the U.S. Navy's Task Force 50 network centric operations during Operation Enduring Freedom case study conducted by Evidence Based Research Incorporated; and the U.S. Army's handbook on multinational interoperability published by the Center for Army Lessons Learned.²¹ Moreover, entire organizations like the Multinational Interoperability Council and the North Atlantic Treaty Organization focus on understanding interoperability issues, such as information sharing, to help improve coalition operations.²² The Multinational Interoperability Council, for example, provides a publicly accessible, comprehensive and detailed *Coalition Building Guide* on the All Partners Access Network that focuses specifically on communication- and information-systems planning considerations for multinational coalitions at the strategic and operational levels.²³ The *Coalition Building Guide*, like much of the available literature, identifies commonly understood barriers to information exchange such as content classification, language, culture, and system incompatibility.²⁴

These professional studies offer niche, yet broadly significant lessons in multinational collaboration and information sharing. The studies do not, however, focus on the SCS operational environment, and thus provide little contextually relevant material to this thesis. This thesis can supplement the insights provided in these professional studies to improve the collaborative capacity of the U.S.-ASEAN maritime partnership.

Uniqueness and Relevance of Study

This thesis focuses on multinational information sharing within the SCS maritime environment, but limits its scope to the operational level. It draws upon information sharing lessons identified in strategic-level documents, like the *Coalition Building Guide*, but digs deeper into the organizational level of regional maritime institutions to understand how systemic factors like doctrine, organizational structure, and culture influence information sharing between partners. This thesis, therefore, is a study in the disciplines of organizational theory and information science with an application to maritime security in the SCS. The combination of specific elements—operational level, maritime institutions, SCS, organizational theory, and information science—to understand barriers to information exchange, make this thesis a unique study.

Research Method

The framing questions are answered in chapter 2 using relevant sources from the literature. The chapter specifically derives the meaning of ‘effective information exchange’ and adopts Chad Whelan’s five network effectiveness factors—institutional structure, culture, policies, relationships, and network technology—as the variables to test in the study.²⁵ The chapter also provides theoretical propositions for how each of these five institutional factors influences effective inter-organizational information exchange.

This thesis uses an “embedded,” single-case study of the multinational search from Malaysia Airlines flight MH370 that disappeared over the Southeast Asia maritime region in 2014.²⁶ The case provides an inclusive U.S.-ASEAN operational-level maritime example to investigate the influence of Whelan’s five institutional factors on effective information exchange in the region. The case study—designed using the theoretical

propositions derived in chapter 2—enables the application of “analytic generalization” to provide broader conclusions of the institutional barriers to effective information exchange between the U.S. Navy and its regional partners.²⁷ The case study design is developed further in chapter 3.

Limitations

The limitations of this study are addressed in greater detail in chapters 3 and 4. The principal limitation of the case study is that it only considered unclassified, open-source material. The author purposefully omitted classified information for the study to ensure widest dissemination of its findings. This limited the completeness of the study, but still provided sufficient material to gain meaningful insights on regional barriers to information exchange. The prime mitigation for this issue was a rigorously developed case-study method undergirded by the theoretical findings in chapter 2. This enabled broad application of “analytic generalization” to competently answer the primary research question of this thesis.²⁸

Moreover, the author limited the case study to a single South China Sea-focused case for several reasons. First, the case focus on the SCS made the study distinctly relevant to the primary research question. Second, a single case—instead of a multiple case design—enabled the author to focus available resources more effectively than a multiple case could allow in the available time. Though a multiple-case study would provide greater breadth of evidence from which to facilitate analytic generalization, the single case design allowed for more in-depth analysis of a particular event—to better understand the information sharing behavior of relevant actors. Finally, as chapter 3

details further, the specific case selected for the study satisfies an accepted rationale for a single-case design—that it is “an extreme or an unusual case.”²⁹

Organization of Thesis

This thesis is divided into five chapters. Chapter 1 suggested the relevance and importance of studying multinational information exchange within the strategic context of maritime security in the SCS. It also discussed the primary research and framing questions and provided a brief overview of the research method for the study. Chapter 2 reviews relevant literature in the areas of information science and organizational theory, and provides the theoretical foundation for the research method. Chapter 3 details the research method and identifies relevant hypotheses to test in the case study. Chapter 4 discusses the findings for the case study and assesses the hypotheses. Chapter 5 answers the primary research question, identifies relevant conclusions from the study, and offers suggestions for future research.

¹ U.S. Pacific Command, *Statement of Admiral Harry B. Harris Jr, Commander U.S. Pacific Command, before the Senate Armed Services Committee on U.S. Pacific Command Posture* (Washington, DC: Government Printing Office, 2016), 1-7.

² U.S. Department of Defense, *The Asia-Pacific Maritime Security Strategy: Achieving U.S. National Security Objectives in a Changing Environment* (Washington, DC: Government Printing Office, 2015), 1.

³ Ibid.

⁴ Ibid., 19-33.

⁵ Prashanth Parameswaran, “U.S. Kicks Off New Maritime Security Initiative for Southeast Asia: The Pentagon has begun implementing a new capacity-building program for states around the South China Sea,” *The Diplomat*, April 10, 2016, accessed October 15, 2016, <http://thediplomat.com/2016/04/us-kicks-off-new-maritime-security-initiative-for-southeast-asia/>.

⁶ Ibid.

⁷ U.S. Department of Defense, *Asia-Pacific Maritime Security Strategy*, 25.

⁸ Van Jackson et al., *Networked Transparency: Constructing a Common Operational Picture of the South China Sea* (Washington, DC: Center for New American Security, 2016), 3, accessed September 28, 2016, <https://www.cnas.org/publications/reports/networked-transparency-constructing-a-common-operational-picture-of-the-south-china-sea>.

⁹ U.S. Department of Homeland Security, *National Plan to Achieve Maritime Domain Awareness: for the National Strategy for Maritime Security* (Washington, DC: Government Printing Office, 2005), ii.

¹⁰ Jackson et al., *Networked Transparency*, 3.

¹¹ A. A. Amri, "Maritime Information Sharing in Southeast Asia," *Australian Journal of Maritime and Ocean Affairs* 2, no. 4 (2010): 109, accessed October 21, 2016, <http://www.tandfonline.com/doi/abs/10.1080/18366503.2010.10815664>.

¹² Jackson et al., *Networked Transparency*, 9.

¹³ Ibid.

¹⁴ Ibid., 24.

¹⁵ Chad C. Serena et al., *Lessons Learned from the Afghan Mission Network: Developing a Coalition Contingency Network* (Santa Monica, CA: RAND Corporation, 2014), iii, accessed September 4, 2016, http://www.rand.org/pubs/research_reports/RR302.html.

¹⁶ Jackson et al., *Networked Transparency*, 27-30.

¹⁷ U.S. Joint Chiefs of Staff, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: Government Printing Office, 2010), 201.

¹⁸ U.S. Joint Chiefs of Staff, Joint Publication 3-32, *Command and Control for Joint Maritime Operations* (Washington, DC: Government Printing Office, 2013), I-6.

¹⁹ Tran Duc Huong, "Transnational Security Challenges in Southeast Asia: The Need for Multinational Military Cooperation and Coordination in ASEAN" (Master's thesis, U.S. Army Command and General Staff College, 2014), iv, 87-91, accessed March 4, 2017, <http://cgsc.contentdm.oclc.org/cdm/ref/collection/p4013coll2/id/3245>.

²⁰ Ibid., 90.

²¹ Chad C. Serena et al., *Lessons Learned from the Afghan Mission Network: Developing a Coalition Contingency Network; Network Centric Operations (NCO) Case Study: U.S. Navy's Fifth Fleet Task Force 50 in Operation Enduring Freedom* (Vienna, VA: Evidence Based Research, 2006), accessed September 20, 2016, <http://www.dtic.mil/dtic/tr/fulltext/u2/a463082.pdf>; Center for Army Lessons Learned, Handbook No. 16-18, *Multinational Interoperability: Reference Guide, Lessons and Best Practices* (Fort Leavenworth, KS: Center for Army Lessons Learned, July 2016), accessed September 19, 2016, <http://usacac.army.mil/sites/default/files/publications/16-18.pdf>.

²² Michelle L. Pryor et al., "The Multinational Interoperability Council: Enhancing Coalition Operations," *Joint Force Quarterly*, no. 82 (3rd Quarter 2016): 112-117.

²³ Operations Support Multinational Interoperability Working Group, *Coalition Building Guide*, vol. 3 *Communication and Information Systems (CIS) Planning Considerations*, 3rd ed. (Washington, DC: Multinational Interoperability Council, January 2016), accessed September 2, 2016, https://community.apan.org/wg/mic/m/mic_cbg/117628.

²⁴ Multinational Interoperability Council, *Coalition Building Guide*, vol. 2, *Strategic Design and Planning*, 3rd ed. (Multinational Interoperability Council Steering Group, March 2015), accessed September 2, 2016, https://community.apan.org/wg/mic/m/mic_cbg/144297.

²⁵ Chad Whelan, *Networks and National Security: Dynamics, Effectiveness and Organization* (Burlington, VT: Ashgate, 2012), 18, accessed November 21, 2016, ProQuest Ebrary.

²⁶ Robert K. Yin, *Case Study Research: Design and Methods*, 5th ed. (Thousand Oaks, CA: Sage Publications, 2014), location 1804 of 7811, Kindle.

²⁷ *Ibid.*, location 1503 of 7811.

²⁸ *Ibid.*

²⁹ *Ibid.*, location 1763 of 7811.

CHAPTER 2

LITERATURE REVIEW

The human communication and information transfer model is significantly more complex than the essential electronic communications model Shannon proposed . . . The basic electronic model does not adequately portray all the characteristics and aspects that may influence human communication. Information possession and transmission involve a variety of processes, environmental factors and systems, which need to be taken into account when evaluating information and communication structures.

— Melanie J. Norton, *Introductory Concepts in Information Science*

Introduction

The literature selected for review in this chapter reflects the multidisciplinary nature of this thesis—it spans the subjects of military and information sciences, institutional and organizational theory and psychology, and network theory. Literature selected from these fields provides a foundational understanding of information, communication, organizational behavior, and cross-cultural collaboration. These topics provide the theoretical framework to understand how and why information is shared or not between actors. The literature review in this chapter is therefore structured to achieve two things: (1) conceptualize the nature of effective information exchange; (2) derive logical propositions regarding the influence of various systemic institutional factors on effective multinational inter-organizational information exchange.

This chapter begins with a review of relevant conceptions of information and communication, and then transitions to develop a theoretical understanding of organizations and networks. The concept of a security network—“organizational forms involving three or more organizations that work together to achieve independent and

shared goals”—provides an appropriate model to understand the arrangement and interplay of the U.S. Navy and its partner navies in the SCS in a collaborative maritime security endeavor.¹ The chapter builds upon this security network model and explores factors that influence the effectiveness of the network. This aligns with the focus of our study since, as will be shown later in the chapter, the effectiveness of a security network is necessarily a reflection of its internal ability to exchange information between network members. The chapter uses Chad Whelan’s five network effectiveness factors—culture, policy, technology, structure, and relationships—to aggregate theoretical perspectives on the institutional elements influencing effective inter-organizational information exchange.² Ultimately, the chapter adopts these five factors as the principal institutional variables to investigate in the case study designed in chapter 3. The chapter, therefore, concludes by developing propositions for how and why each of these factors influence effective multinational information sharing.

Information and Communication

The focus of this thesis is on information sharing behavior between organizations, and in particular, what institutional factors prevent these organizations from sharing information effectively. This necessarily requires a working understanding of information and communication—to derive a practical definition for ‘effective information exchange.’ It also requires understanding the genetics of the institutional factors that influence information exchange, which are actually quite dependent on the communicative behavior of the organization or network. This section, then, introduces the concepts of information and communication to facilitate a larger discussion on the institutional factors that influence effective information exchange.

Information

Information is fundamental to the human experience—“it is the link to all that we are, as beings, as creatures of societies, as members of organizations, as units in a larger universe, and as single individual generators of information.”³ And as abundant as information is in daily life, so too is its seeming variance in conception. For our purposes, information has two important and relevant definitions. First, information is a facilitator of meaning, where “meaning refers to how an object or an utterance is interpreted and understood.”⁴ Claude Shannon and Warren Weaver refer to this definition as the semantic form of information. In this form, information is “correlated according to some system with certain physical or conceptual entities,” like emotion, culture, context, and experience.⁵ In this semantic form, information is “anything that reduces the uncertainty in a situation”—because it facilitates the assigning of meaning to the uncertain situation.⁶

Second, in technical applications like communication theory, information relates less to meaning and more to uncertainty. It “relates not so much to what you do say, as to what you could say.”⁷ This suggests, then, that information expresses a level of choice in the selection of a word, symbol, number, or any other object from a set of possible objects.⁸ Choice introduces randomness and disorder to the idea of information, which allows us to relate information to well-known physical concepts like entropy.⁹ And this entropic relationship enables the use of mathematical methods to model the transfer of information from a source to a receiver, as Shannon and Weaver did in *The Mathematical Theory of Communication*. For our purposes, this technical form of information—one associating information with entropy and uncertainty—is important because it shows two things: (1) the conveyance of information is influenced by choice; (2) since objects are

selected from a bank of possible options, as in the alphabet of a language, information is necessarily influenced by context.¹⁰ Both choice and context will be addressed in greater detail later in this chapter within larger discussions on policy and culture.

Communication

The semantic and technical forms of information provide sufficient substance to now develop the idea of communication. “Information is the stuff of communication.”¹¹ Communication, then, is the process of “making information available.”¹² In its most basic description, communication is the transfer of information from one point to another. Person A, for example, tells person B there is a large white-hulled vessel traveling southbound through the SCS. Person A is taking information (semantic form) stored in his memory about the white-hulled vessel, encodes it with the appropriately descriptive words from his language (technical form), and then uses his voice to transmit those words. Person B hears the words, decodes them using words in her language to interpret them, and then stores them in her memory for use at a later time (perhaps to reduce uncertainty about an event in the SCS). This example is quite simplistic, but it demonstrates the five components Shannon posits are essential for the communication process: an “information source” (person A’s memory), a “transmitter” (person A’s voice), a “channel” (air gap between person A and B), a “receiver” (person B’s ears), and a “destination” (person B’s memory).¹³ This basic communication structure is shown in Figure 1, with a notable addition of a noise component. Noise can be anything that disturbs the transmitted signal and results in a modified received signal. In the given example, noise could be strong wind deafening person B’s ears so that person A’s speech is muffled.

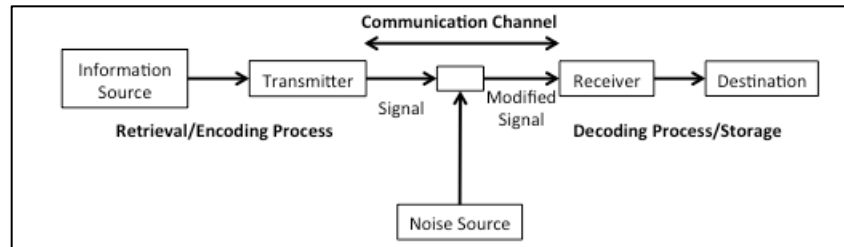


Figure 1. Basic communication system model

Source: Created by author; derived from Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana, IL: University of Illinois Press, 1949), 5.

This simple model is useful in showing that a communication system is quite vulnerable to errors—that is, the system’s ability to transfer information unhindered from source to receiver is threatened by numerous factors. Consider the coding and decoding processes, for example. If person B cannot decode the language used by person A to code the original message, then the transfer of information cannot occur. Alternatively, if person B can decode the transmitted message, some of the meaning of the source message may be lost in translation. And certainly, the transmitter or receiver may have characteristic limitations—technical- or policy-related—that preclude the transfer of information. The barriers to communication are therefore abundant and not necessarily just technical in nature.¹⁴ As our discussion of information indicated, communication is also hindered by human elements such as social context, culture, choices, meaning, and language to name a few.

Schramm posits that in human communication “we study people—relating to each other and to their groups, organizations, and societies, influencing each other, being influenced, informing and being informed, teaching and being taught, entertaining and being entertained. To understand communication we must understand how people relate

to one another.”¹⁵ This means that human communication is far more than the simple transmit and receive process described before. Human communication is intensely complex because people, and all of their complexities, are inserted into the process. Schramm argues that in the above information exchange example between person A and person B, “each participant brings a well-filled life space, funded and stored experience, against which he interprets the signal that comes to him and decides how to respond to them. If two people are going to communicate effectively, their stored experiences have to intersect over some topic of common interest.”¹⁶ This common interest defines the communication relationship between person A and person B, as well as the roles that each plays in the relationship.¹⁷ Effective human communication, then, depends on the ability of person A and person B to fulfill their social contract with each other and function appropriately in their agreed-upon collaborative roles. In this case, effective communication occurs when person A and person B exchange sufficient information with each other to reduce the uncertainty surrounding the topic of common interest to an appropriate level, perhaps enough to take an appropriate action in response to the topic of interest. You can see then that effective communication is more than just a matter of whether information is transmitted unscathed from person A to person B, as implied in the basic exchange model discussed previously. Instead, it is intensely dependent on the nature of the communication relationship between person A and person B.

Section Summary

This section explored the semantic and technical forms of information and provided their connection to the communication process. This information discussion also revealed general influences on the nature of information, such as context, choice,

emotion, and experience. Moreover, the section explored Shannon's basic communication system architecture and used it to demonstrate various barriers to the communication process. Finally, the section introduced Schramm's human communication model and showed that the effectiveness of communication depends on the nature of the communication relationship between stakeholders. It also posited that human communication is effective if information exchange between stakeholders lowers situational uncertainty to an agreeable level, or perhaps to a sufficient level to incite an appropriate response to the situation. The next section will build upon these information and communication concepts, and extend the discussion to other foundational topics germane to this thesis: organizations, networks, and network effectiveness.

Organizations and Networks

The crux of this thesis is a study of information sharing between maritime organizations, not simply exchange between individual people as the preceding section highlighted. But the communications concepts developed in the two-person model are unequivocally relevant to an investigation about organizations. The two-person communication event—known formally as dyadic interaction—is of “extraordinary significance to the organization because in terms of ‘organizing’, the dyadic level is the most fundamental level.”¹⁸ In other words, “to communicate is to organize.”¹⁹ Similarly, if we consider information sharing between two separate organizations as a dyadic interaction, then the communication between those organizations is also an organizing event that results in a basic network structure. This section builds upon these basic communication concepts and briefly explores organizational and network theory. It also develops the idea of a security network. The intent of this section, therefore, is to start

building a foundational understanding of the internal forces that drive organizational communicative behavior and how that behavior influences information sharing within security networks.

Organizations

Gerald Pepper argues, “The communication behaviors of organization members are what constitute the actual organization . . . The organization is the continuing communicative construction of its members.”²⁰ This perspective is quite relevant because, if we recall our previous discussion on communication, the organizational structure and behavior is fluid in response to a changing external environment—that organizing occurs as parties communicate to reduce their own uncertainty regarding a given interest. The roles each member of the organization plays relative to the others (structure) changes depending upon the characteristic uncertainty of the collective interest. This means, then, that the behavior of the organized-collective changes relative to the characteristics of the members and their roles in the communication relationship. This interplay of roles and behavior to reduce equivocality (uncertainty) is more concisely termed “sensemaking.”²¹ Sensemaking will be addressed in greater detail later in this chapter as a function of organizations, but it is relevant here because it introduces the idea that organizing and sensemaking are generally synonymous—they reflect communicative processes to reduce uncertainty. As Karl Weick posits, “Both organizations and sensemaking processes are cut from the same cloth. To organize is to impose order, counteract deviations, simplify, and connect, and the same holds true when people try to make sense. Organizing and sensemaking have much in common.”²² The key conclusion from the Pepper and Weick perspectives, then, is that sensemaking and

organizing are communicative processes—they are not discrete, arbitrary choices made by interested parties. And because these processes influence structure and behavior, we can learn a lot about an organization and their tendency to share or receive information simply by understanding their processes. As Weick argues:

there are processes which create, maintain, and dissolve social collectivities, that these processes constitute the work of organizing, and that the ways in which these processes are continuously executed are the organization. The same processes operate through a variety of media; they are expressed through whatever props and people are at hand, but they remain basically the same processes. Their appearance may change, but their workings do not. Thus, if you wanted to learn something about an organization, you might look for ‘interlocked behaviors that are embedded in conditionally related processes.’²³

There are, however, non-communicative perspectives on organizing germane to this thesis. Edgar Schein, for example, posits, “An organization is the rational coordination of the activities of a number of people for the achievement of some common, explicit purpose or goal, through division of labor and function and through a hierarchy of authority and responsibility.”²⁴ The idea of rational choice suggests the act of organizing is an intended action of the organizational members for a purpose or goal, not necessarily the result of a communicative process. Moreover, in Schein’s view, the structure of the organization results from its purpose, perhaps instead of in response to sensemaking processes. Francis Yammarino and Fred Dansereau similarly argue, “Organizations are clusters of individuals . . . whose members are interdependent based on a hierarchical structuring or a set of common or shared expectations.”²⁵ Though not necessarily in line with Weick or Pepper, these views are important to our understanding of security networks introduced previously: a network formed “to achieve independent and shared goals.”²⁶ When considering the interaction of large organizations like the U.S. Navy and its partner navies in the SCS region, it seems completely reasonable to accept

the purpose-driven view of organizing. Certainly, the U.S. Navy and its ASEAN counterparts could organize through uncertainty reduction information sharing, but as discussed in chapter 1, there are too many strategic-level barriers to multinational collaboration in Southeast Asia to discount the notion that large navies operating together must choose to exchange information to improve maritime security in the SCS.²⁷

Networks

The communicative and purpose driven forms of organizing provide sufficient material to now begin a more formal discussion of networks. Whelan asserts, “A network can be defined as a set of actors (or ‘nodes’) that are linked by various relationships (or ‘ties’). Actors can be individuals, units within organizations, or organizations. Relationships can be personal relationships between individuals, functional relationships between units with an organization, or strategic relationships between organizations.”²⁸ Moreover, drawing from the Committee on Network Science for future Army Applications, Ted Lewis notes that a network is described “by its structure (e.g. nodes and links), and its behavior (what the network ‘does’ as a result of the interactions among nodes and links).”²⁹ And finally, Mark Meckler suggests a “network is not an object; it is a collection of forces, activities, and dynamics.”³⁰

The concept of a security network is simply an extension of these definitions. A security network is “a network in which a set of ‘actors’ [form] ‘relationships’ to advance security-related objectives.”³¹ More formally, a security network is a “set of institutional, organizational, communal or individual agents or nodes . . . that are interconnected in order to authorize and/or provide security to the benefit of internal or external stakeholders.”³² An important function of security networks is to “provide a mechanism

for the coordination of resources”—of which, information and intelligence are the most important.³³

We can begin to see now that the ability of the U.S. Navy and its partner navies in the SCS (a security network) to share information is necessarily influenced by an emerging set of institutional considerations. The first consideration is that security networks are systems. This implies stress applied on one node of the network will necessarily influence other nodes in the network.³⁴ This systems view also implies networks are not amorphous—they have a structure defined by the nature of the relationships between member elements. The second consideration is that the relationship between members in the security network is influenced by both the communicative and purpose driven forms of organizing. The final consideration is that networks are dynamic. The function, structure, and activity of the network change based on the behavior of network elements. They also change in response to the environment.

Section Summary

This section used our prior discussion regarding information and communication fundamentals to build a framework to understand the behavior of organizing. Simply, the section showed that communicating is tantamount to organizing. The section also introduced an alternative perspective on organizing—a purpose driven form whereby actors organize to achieve a desired state. These communicative and purpose driven forms propped a sequential discussion on networks, their behavior, and the function of security networks like the nominal U.S.-ASEAN maritime security collective in the SCS. This launched a more relevant discussion about various institutional considerations influencing the ability of security networks to share information—like member

relationships, structure, and the external environment. These considerations will be refined in the next section to more formal and discrete institutional factors that will ultimately shape the theoretical propositions used in the selected research method for this thesis.

Network Effectiveness

The purpose of this section is to define network effectiveness in relation to information sharing, and then introduce the institutional factors influencing that effectiveness. The premise of this section is that a logical relationship exists between the effectiveness of a security network and its ability to share information internally—that the same institutional factors that influence network effectiveness necessarily influence effective information exchange within the network. This is a transitional section that builds upon the communication and organizational theory discussed previously to begin a more focused discussion on five institutional factors that shape the information exchange environment within a security network. The section introduces Whelan’s network effectiveness model, and the five factors he posits influences that effectiveness.

Defining Network Effectiveness

In Whelan’s conception of a security network, effectiveness is “defined generally as ‘the attainment of positive network-level outcomes that could not be achieved by individual organizational participants acting independently.’”³⁵ This follows the Schein view of purpose driven organizing since it suggests “actors may enter networks for their own benefits as well as the benefit of the network.”³⁶ Note that this definition of network effectiveness is similar to our earlier-derived definition of dyadic communication

effectiveness: the point in which sufficient information is exchanged to reduce uncertainty surrounding a topic of interest to an appropriate level. Though the root motivation—process or purpose driven—of these two definitions is different, the end state is the same: the parties arrive at some improved state as a result of the interaction.

The Five Factors

Whelan's first factor influencing network effectiveness is institutional structure. He posits that "information sharing takes place in institutional networks on the basis of 'formal' mechanisms designed to facilitate the exchange of information between organizations," and that "formal networks 'seek to harness the power of informal 'knowledge networks' through the creation of integrated structures that act as connecting platforms."³⁷ Fatemeh Nooshinfard and Leila Nemati-Anaraki support this view of structure as an effectiveness factor.³⁸ Colin Silverthorne similarly supports this view.³⁹

Whelan's second effectiveness factor is institutional culture. He notes, "Network cultures are the differing cultures that exist in each network and may be identified at the organizational and sub-organizational levels."⁴⁰ He further suggests, "If cultural differences are not managed they are likely to have a substantial adverse impact on network effectiveness."⁴¹ Silverthorne, Fatemeh Nooshinfard, and Leila Nemati-Anaraki all support this view of culture as an effectiveness factor.⁴²

Whelan's third factor influencing network effectiveness is network policy as it relates to "network control."⁴³ Regarding 'network control', he offers Partick Kenis' and Keith Provan's definition: "the use of mechanisms by actors to monitor the actions and activities of organizational networks to enhance the likelihood that network-level goals

can be attained.”⁴⁴ Specific mechanisms that influence network control are “policies and procedures used to prescribe courses of action to actors in networks.”⁴⁵

Whelan’s fourth factor influencing network effectiveness is network technology. He posits that “network technologies form an ‘infrastructure’ that supports networks. As networks are usually information-intensive forms of organization, this infrastructure is directly related to the effectiveness of most networks.”⁴⁶ Fatemeh Nooshinfard and Leila Nemati-Anaraki support this view of network technology as an effectiveness factor.⁴⁷

Whelan’s fifth factor influencing network effectiveness is network relationships. He argues that “network relationships shape the operation of networks in many different ways,” and that “the nature of relationships may matter more than the nature of resources in networked environments.”⁴⁸ Closely associated with relationships is the concept of trust. Whelan suggests trust is both an “interpersonal and inter-organizational” level quality that influences relationships in the network.⁴⁹

Section Summary

This section defined network effectiveness and correlated it to effective information sharing. It also briefly reviewed Whelan’s five factors influencing this effectiveness—which are generally consistent with the larger body of literature reviewed for this thesis, and align well with the author’s experience as a naval officer operating in the Western Pacific. These five institutional factors—structure, policy, culture, technology, and relationships—therefore form the theoretical framework within which the case study discussed in chapter 3 will be analyzed. The following sections discuss each of these factors in greater detail and conclude with relevant theoretical propositions

about how each of these factors should be expected to shape the information exchange environment found within the case study.

Organization and Network Structure

The purpose of this section is to develop a foundation for understanding how both organizational structure and network structure influence information exchange between organizations. The section begins by focusing on the individual organization—treating it as a single node within a network—and linking its structure to sensemaking processes. This will build a broader picture of how organizational structure, as a reflection of sensemaking, influences communication between organizations. The section then discusses network structure and its influence on internal information exchange between nodes.

Structure: A Reflection of Organizational Sensemaking

We previously associated sensemaking with organizing—that the two are communicative processes designed to reduce uncertainty. However, the frame of our previous discussion on organizing and sensemaking as uncertainty reduction processes was principally at the dyadic level of analysis, not at the organizational level. To elevate the level of analysis and understand how organizations establish “a workable level of certainty” through sensemaking, we need to briefly establish a framework for how to think about the evolution of individual certainty to organizational certainty through sensemaking.⁵⁰ This framework will connect sensemaking to organizational structure.

Weick identifies “three levels of sensemaking ‘above’ the individual level of analysis.”⁵¹ Only two of these levels are relevant to our discussion. The first is the

intersubjective level: where “individual thoughts, feelings, and intentions are merged or synthesized into conversations during which the self gets transformed from ‘I’ into ‘we’.”⁵² He further notes, “Intersubjectivity is emergent upon the interchange and synthesis of two, or more, communicating selves.”⁵³ The next level of sensemaking is that of the organizational level in which a shift occurs between “intersubjectivity to generic subjectivity.”⁵⁴ At this level, “concrete human beings, subjects, are no longer present. Selves are left behind at the interactive level. Social structure implies a generic self, an interchangeable part—as filler of roles and follower of rules—but not concrete, individual selves.”⁵⁵ Weick further argues of the organization, “Interactions that attempt to manage uncertainty are a mixture of the intersubjective and the generic subjective,” and that this interplay between levels is “something of a hallmark of organizational sensemaking in general.”⁵⁶ As these levels relate to organizational structure, Weick suggests

organizations are adaptive social forms. As intersubjective forms, they create, preserve, and implement the innovations that arise from intimate contact. As forms of generic subjectivity, they focus and control the energies of that intimacy . . . Thus, organizational forms are the bridging operations that link the intersubjective with the generically intersubjective.⁵⁷

These organizational forms are the structures that manage the balance between the intersubjective and generic subjective levels. These structures are necessarily then the sensemaking processes an organization employs to arrive at a collective level of unequivocalty. They “consist basically of patterned activity developed and maintained through continuous communication activity, during which participants evolve equivalent understandings around issues of common interest.”⁵⁸ And they function to minimize the

“loss of understanding” that always occurs when the “intersubjective is translated into the generic.”⁵⁹

Throughout the literature, these organizational forms or structures are closely associated with terms like “process” and “interlocked behavior.” Pepper, for example, posits, “Process is the premise that as humans coordinate their beliefs, behaviors, and so forth with one another, a coordination occurs that we can point to and identify as structure.”⁶⁰ Pepper, again, suggests, “Interlocked behavior constitutes the organizational structure that is in actuality the communicative balancing of organization members.”⁶¹ Weick notes, “Each process involved in organizing contains sets of interlocked behaviors that may remove some equivocality from information that is fed into that process.”⁶² He further equates organizational structure with interlocked behavior and says, “The structure that determines what an organization does and how it appears is the same structure that is established by patterns of interlocked behavior.”⁶³

Structure provides both the arrangement and processes to manage organizational uncertainty. The influence of this structure on information flow necessarily derives from how the structure is designed to manage uncertainty. As Weick posits,

The amount of equivocality in an information input determines the degree of equivocality of a process. If information is high in equivocality, few rules will be activated to assemble a process, and the process will therefore be equivocal. If information flow is low in equivocality, many rules will be activated to assemble a process, and the process will be unequivocal. What we have, then, is a direct relationship between information and processes. The more equivocal the input, the more equivocal the process . . . And the number of rules in turn affects the entire way that process is assembled and applied, and what the condition of the information will be once the steps in the process have been completed.⁶⁴

To this end, Karl Weick and Kathleen Sutcliffe suggest that “if you want to cope successfully with a wide variety of inputs, you need a wide variety of responses . . . Wise

practices either reduce environmental complexity or increase system complexity . . . Our recommendation boils down to this advice: make your system more complicated.”⁶⁵ We can expect, then, that in the highly complex and uncertain operating environment of the SCS, maritime security organizations will necessarily employ highly complex processes and organizational structures that will shape what information can be shared, as well as the form of that information once it is shared.

Network Structure

Turning our discussion now to networks, this chapter previously associated networks with systems. This means networks have a definite form and their independent elements (nodes and links) are affected by changes to other elements in the network. Lewis adds, “A network forms by the autonomous and spontaneous action of independent nodes that ‘volunteer’ to come together (link), rather than through central control or central planning.”⁶⁶ He also adds that a network’s “function follows form,” and that “structure and function arise out of chaos, more as a result of serendipity than determinism.”⁶⁷ Lewis’ arguments follow Schein’s purpose driven form for organizing discussed previously. In the Lewis view, then, organizations (nodes) join a network by choice. That choice is driven largely by a desire to improve the organization’s position—that is, there is some expectation of receiving a benefit from network membership. As organizations join or leave a network, the network structure necessarily changes and so does its behavior. In this system relationship, the individual behavior of the nodes changes in response to changed expectations of the network derived from the network changes.

The key conclusion from this network structure discussion is that the information sharing behavior of a security network—as a function of network form—will necessarily change based on the behavior of individual network nodes (security organizations) in response to a changing environment. As the external environment changes, individual nodes will change their behavior relative to the network based on their updated perception of benefit from network membership. This necessarily influences the network form and, therefore, the behavior of other network members since, as Weick suggests, “The type of network in which members operate could influence the choices they make about what to do with retained content.”⁶⁸

Section Summary

This section reviewed the influence of organizational and network structure on information sharing. It suggested the information sharing capacity of an organization necessarily reflected its sensemaking-derived structure. The section then further developed the conception of a network and showed that the information sharing behavior of a network reflected the dynamic nature of its structure. The following theoretical proposition about the relationship between institutional structure and effective information sharing emerges from this discussion: institutional structure influences effective information exchange because it determines the amount and distribution of available information. This follows from the expectation that complex organizational sensemaking processes (structure)—formed in response to a dynamic external environment—necessarily filter shareable information. This proposition also follows from the expectation that the behavior of security network nodes in response to the environment necessarily influences the behavior of other network nodes and their

willingness to share information with the network. The next section will develop the impact of organizational and network culture on information sharing.

Organizational and Network Culture

Organizational culture is a well-studied topic replete with differing conceptions on its meaning and nature. Schein, for example, argues that “culture is both a ‘here and now’ dynamic phenomenon and a coercive background structure that influences us in multiple ways. Culture is constantly reenacted and created by our interactions with others and shaped by our own behavior.”⁶⁹ Lilach Sagiv, Shalom Schwartz, and Sharon Arieli suggest that culture “consists of sets of assumptions, beliefs, and values.”⁷⁰ And Whelan posits that culture is “defined as shared beliefs, values, and attitudes across members of a network.”⁷¹ This thesis simply adopts each of these perspectives as the collective understanding of culture and moves forward to answer three basic questions regarding its influence on information sharing: (1) How does culture influence the willingness to share information or at least enter into a sharing relationship?; (2) How does culture influence effective information exchange?; (3) How does culture influence multinational collaboration? The first two questions are oriented to the organizational level, while the third is oriented to the network level. This section is arranged to answer each of these questions sequentially.

Culture: Influence on Information Sharing Relationships

Regarding the first question, the previous section showed how organizational sensemaking processes—as uncertainty reduction mechanisms—influenced information flow. It also showed how purpose-driven behaviors in organizations influenced network

information flow by changing the network structure. These discussions, however, omitted a deeper inquiry to how an organization understands what is uncertain about the environment, or what motivates purpose-driven behavior. The answer resides in organizational culture. Silverthorne notes, “The underlying values in a culture map out the ways that individuals evaluate their world, their self, and others.”⁷² Similarly, Schein argues organizations learn “that certain beliefs and values, as initially promulgated by prophets, founders, and leaders, ‘work’ in the sense of reducing uncertainty in critical areas of the group’s functioning.”⁷³ Culture, therefore, provides a reference point from which organizations can compare accepted norms against the external environment to arrive at some understanding of what is uncertain. This means that culture shapes sensemaking processes and, thus, information flow.

Culture also influences expectations organizations have of the external environment, as well as their perceived identity. Weick and Sutcliffe, for example, suggest that culture “[affects] both what people expect from one another internally (these expectations are often called norms) and what people expect from their dealings with the external environment of customers, competitors, suppliers, shareholders, and other stakeholders.”⁷⁴ And Schein argues, “[Culture] provides its members with a basic sense of identity and defines the values that provide self-esteem. Cultures tell their members who they are, how to behave toward each other, and how to feel good about themselves.”⁷⁵ Organizational identity and expectations are, therefore, shaped by basic underlying assumptions stitched into the fabric of the organization. Together, the organization’s expectations and identity drive how it interacts with the world—whether it perceives a need to join an information sharing relationship to improve its positional

standing in the environment, as well as the nature of its role in that relationship. This necessarily influences the quantity and type of information shared.

Culture: Influence on Effective Information Exchange

Regarding the second question, this chapter used uncertainty reduction as the metric to gage the effectiveness of information exchange. But this metric is unavoidably tied to the ability of the information to reduce uncertainty. This requires the information received by a stakeholder to have a recognizable value—that is, it must have meaning. The meaning attached to information is inextricably linked to culture, which supplies the language needed to even assign meaning.⁷⁶ This suggests, then, in multinational applications the effectiveness of information exchange will necessarily be hindered by differences in culture.

Culture: Influence on Multinational Collaboration

Regarding the third question, Norton argues that “a fundamental principle of human communication is that exchange of ideas occurs most frequently between individuals who are alike, or homophilous.”⁷⁷ Additionally, Pepper notes that “informal information flow will most likely be culture controlled,” and that there “will be greater tendency to share . . . with individuals who we assume also share our viewpoints—that is members of our cultures.”⁷⁸ Cross-cultural collaboration, then, seems dependent on the level of cultural similitude. This follows closely with our previous discussions on organizational identity, expectations, and meaning. Again, the underlying cultural assumptions of an organization drive perceptions of what an organization can expect from another stakeholder—in terms of information requirements and trust—and the

amount and type of information that needs to be shared with that stakeholder. It seems logical, then, that the higher the level of similarity in any of these features, the more likely information exchange will occur between organizations. However, it is unreasonable to expect that organizations will definitively not share information with culturally dissimilar organizations—this is not what we see in military or diplomatic practice. In multinational security networks, then, we should expect culturally dissimilar organizations to share information and collaborate in varying degrees with the different network nodes. The exact collaborative behavior between these organizations can be understood by applying principles discussed by Sagiv, Schwartz, and Arieli.⁷⁹ A detailed discussion of these principles is beyond the scope of this section.

Section Summary

This section reviewed the cultural implications on information sharing within a security network. It showed the underlying cultural assumptions of an organization shape perceptions that influence decisions to share information. In addition, the section linked the effectiveness of information exchange to organizational culture—that culture shapes the perceived meaning of information. The following theoretical proposition about the impact of culture on effective information sharing derives logically from these ideas: institutional culture influences effective information exchange because it determines the amount and distribution of available information, and assigns meaning to that information. The next section explores the influence of organizational and network policy on information sharing.

Organization and Network Policy

The section discusses the influence policy has on organizational and network level information exchange. The discussion at the organizational level will focus largely on the impetus for sharing policies; at the network level, the discussion will focus on the impact network policy has on effective sharing. It seems quite obvious that policy prohibiting the sharing of information will necessarily impede network collaboration. This section attempts to avoid such basic considerations and, instead, focuses on developing a better understanding of why organizational sharing policy is shaped the way it is, and how network sharing policies function to control effective information exchange throughout the network.

Organizational Information Sharing Policy

The formation of information sharing policy at the organizational level is an extension of the cultural and sensemaking considerations discussed previously. First, policy reflects the choice an organization makes in sharing information, whether to improve its relative position in the external environment or reduce equivocality. Weick terms this “rationality”—that the actions an organization makes “are intended, thought about, planned, calculated, or designed for a purpose.”⁸⁰ Christine Williams et al. formally label this concept the “rational choice perspective.” “Rational choice theorists,” they say,

view the organization as having control regarding its future: that is, they are able to operate on their environment to a greater extent than the environment influences them. Thus external factors play a secondary role: their presence shapes action by producing evidence, but the organization retains the ability to make decisions it sees as best to reach its desired outcomes.⁸¹

Second, policy also reflects—in contrast to the rational choice perspective—the influence the external environment has on the organization. Williams et al. label this the “institutional perspective,” in which organizations “incorporate socially-mandated (institutionalized) structures to achieve legitimacy, and may do so regardless of the impact on efficiency.”⁸² We see, then, that organizational policy is both control- and legitimacy-seeking. This suggests the quantity and form of information shared is determined by the following: (1) how that information reduces uncertainty and improves organizational control over the external environment; (2) whether sharing behavior aligns with cultural norms.

Network Information Sharing Policy

At the network level, network membership and operation are the principal policy considerations for effective information exchange.⁸³ Membership policy influences the diversity and quantity of sharable information by regulating the sources of available information. The diversity and quantity of information necessarily derive from the number of members linked to the network, as well as their individual sharing policies. Moreover, policies concerning network operation specify, for example, how “certain forms of information are to be shared.”⁸⁴ This may stovepipe information and prevent its use by network members. Therefore, both membership and operation policies have the collective effect of constraining the level of unequivocal member nodes can achieve through information exchange. This means, then, that network policies can limit the effectiveness of network information exchange.

Section Summary

This section reviewed the implications of both organizational and network policy on effective information exchange. The organizational level discussion explained the motivation for information sharing policies using rational choice and institutional perspectives. And the network level discussion showed how policy constrains the level of achievable certainty for member nodes. Two theoretical propositions regarding the influence of policy on effective information exchange emerge from these discussions. First, institutional policy influences effective information exchange because it determines the amount and distribution of available information. Second, institutional policy influences effective information exchange because it determines the type of shareable information. The next section discusses the influence of network technology on information sharing.

Network Technology

Network technology—or, more broadly, information technology—generally refers to the collective mass of hardware and software that facilitate organizational and network communication. Technology functions to connect, store, and retrieve information—it is the backbone of our modern conception of an information system. Though we often consider technology as a communication enabler, it seems generally understandable that cross-network information exchange requires information systems at different nodes to be interoperable. A lack of interoperability “limits [an information system’s] capacity to process and manage information.”⁸⁵ This section acknowledges interoperability issues as common impedance to information exchange and addresses less

common ideas of how information technology influences effective information exchange within both organization and network settings.

Technology: Influencing Complexity and Discoverability

The literature revealed two insightful ideas of how information technology inhibits effective information exchange at both the network and organizational level. The first idea complements an earlier discussion on structure. Kara and Zellmer-Bruhn argue that the “inherent structural characteristics of the technology itself affect interaction patterns among individuals.”⁸⁶ Jessica Lipnack and Jeffrey Stamps similarly suggest, “Technology, particularly information technology, also influences organizational architecture.”⁸⁷ Just as organizational sensemaking processes and structure patterns create potentially complex and turbulent information paths, so too can information systems. Often, technology architecture is a reflection of organizational and network processes. It seems reasonable, though, to expect the opposite is possible—that organizational and network processes reflect the available technology. So, to the extent supporting technology infrastructure is complex, so too are the resulting supported sensemaking processes.

Second, technology can rapidly increase the amount of information available and lead to an overload situation. Whelan notes that “increased investment in information technology is likely to exacerbate the difficulty of distinguishing ‘noise’ from relevant information.”⁸⁸ Uncertainty reduction processes clearly need information to work, but to function properly they need the right information. By providing too much information, technology can inhibit the discovery needed in a communication event to build a better organizational understanding of the external environment. Therefore, information

technology can potentially inhibit effective information exchange in two ways: (1) adding unnecessary complexity to sensemaking processes; (2) making useful information undiscoverable.

Section Summary

This section reviewed technological impacts on effective organizational and network information exchange. It briefly acknowledged the potential interoperability issues associated with information systems, and discussed two insightful ideas on technology impedance discovered in the literature. Two theoretical propositions concerning the influence of technology on effective information exchange derive from this discussion. First, technology influences effective information exchange because it determines the amount and distribution of available information. Second, technology influences effective inter-organizational information exchange because it impacts the discoverability of information. The next section reviews the final factor influencing effective information exchange: relationships.

Network Relationships

This section briefly explores influences on the maintenance and creation of inter-nodal network relationships, or links. A broken or non-existent link prevents the flow of information, so effective information exchange between nodes is only possible if a relationship exists. This section is organized along three common conceptions in the literature of what drives the formation of relationships in a network—trust, relevance, and homophily. Moreover, the discussion will generally be constrained to the network level.

Some of the previous organizational level topics will reemerge in this section, but the focus will remain on the network.

Trust

The first relational element found throughout the literature is trust. Whelan offers that trust in a network context can be defined as “a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behavior of another.”⁸⁹ ‘Vulnerability’ seems to be the critical component in this definition. Vulnerability is most visible in a security network, for example, when organizations consider whether to share classified information. The very nature of classified information suggests a level of sensitivity to the information—that if exchanged to the wrong stakeholder, may leave the information owner vulnerable to some sort of effect. Naturally, then, organizations will only establish a classified information exchange relationship with those they trust. Peter Monge et al. add that the amount of information exchanged in this relationship necessarily increases with increased levels of trust.⁹⁰

Relevance

The second relational element found in the literature is relevance. Monge et al. argue that an organization’s “key collaborators . . . [are] the partners with information resources that are most critical to” the organization.⁹¹ Whelan similarly suggests, “What matters in the network is that . . . you have information with which to trade.”⁹² Therefore, information exchange relationships likely exist between stakeholders that have relevant information to share with each other. And Monge et al. add that as long as both

members of the relationship contribute their relevant information, the exchange relationship will likely continue to exist.⁹³

Homophily

The third relational element found in the literature is homophily—the idea that relationships tend to form between similar stakeholders.⁹⁴ The culture discussion earlier in this chapter addressed the influence of cultural similarity on information exchange. Those general arguments are relevant here. Organizations that are similar in nature tend to understand each other better. This means they share similar identities and have similar expectations of what each organization should provide in an information exchange relationship. This necessarily means barriers to information exchange lower between organizations of similar cultures.

Section Summary

This section reviewed three generally pervasive elements affecting relationship building found throughout the literature. The central assumption of this section was that without an existing relationship between network nodes, information exchange could not happen. Therefore, the focus of the section was on common elements driving the maintenance and creation of inter-nodal relationships. The following theoretical proposition regarding the influence of network relationships on information exchange emerges from this discussion: relationships influence effective information exchange because they shape the amount and distribution of available information.

Conclusion

This chapter reviewed a spectrum of literature representative of the multidisciplinary nature of this thesis. The work of Karl Weick, Claude Shannon, Warren Weaver, Wilbur Schramm, Chad Whelan, Gerald Pepper, and Edgar Schein provided significant intellectual capital to leverage in crafting this chapter. Their work also helped to meaningfully satisfy the two principal objectives of the chapter: (1) conceptualize the nature of effective information exchange; (2) logically derive theoretical propositions concerning the influence of Whelan's five systemic institutional factors on effective information exchange within a security network. This section concisely summarizes the primary findings of this chapter.

The chapter found that human communication is deeply complicated. Though Shannon and Weaver's mathematical construct of communication proved useful for understanding the nature of and barriers to human communication, Schramm's work helped fully develop it. Ultimately, the chapter showed that communication is an uncertainty reduction mechanism, and that effective information exchange can generally be described as a communication event that results in reducing uncertainty to an appropriate level.

The chapter then adopted Pepper's and Weick's conception of organizing as a communicative process driven by sensemaking activities geared toward reducing uncertainty in response to a changing external environment. The chapter also used Schein's work to provide an alternative perspective on organizing—one that suggested organizing is goal or purpose-driven. This dialectic between sensemaking and purpose-driven forms of organizing provided a useful framework from which to launch a

more germane discussion about the institutional factors shaping the information-sharing environment within a security network.

Whelan's work on security networks provided a useful theoretical model to develop the institutional factors influencing effective information exchange between the U.S. Navy and its partner navies in the SCS region. The chapter simply adopted Whelan's five institutional factors influencing security network effectiveness and posited that these same factors necessarily impact effective information exchange within the network. Following a detailed discussion of these factors, the following five consolidated theoretical propositions emerged regarding their influence on effective information exchange:

1. Institutional structure influences effective information exchange because it determines the amount and distribution of available information.
2. Institutional culture influences effective information exchange because it determines the amount and distribution of available information; it shapes the meaning of information.
3. Institutional policy influences effective information exchange because it determines the amount and distribution of available information; it determines the type of shareable information.
4. Technology influences effective information exchange because it determines the amount and distribution of available information; it impacts the discoverability of information.
5. Relationships influence effective information exchange because they shape the amount and distribution of available information.

The next chapter develops the case study protocol used to answer the primary research question of this thesis. The above theoretical propositions will be applied to the case—the 2014 multinational search for Malaysia Airlines Flight 370—as a lens through which to view the collaborative behavior of the case participants. As will be discussed in greater detail in the case study design, using the theoretical propositions in this manner allows for generalized conclusions to be drawn about the systemic institutional communication barriers that exist between the U.S. Navy and its partner navies in the SCS region at the operational level.

¹ Chad Whelan, *Networks and National Security: Dynamics, Effectiveness and Organization* (Burlington, VT: Ashgate, 2012), 141, accessed November 21, 2016, ProQuest Ebrary.

² Ibid., 18.

³ Melanie J. Norton, *Introductory Concepts in Information Science* (Medford, NJ: Information Today, 2000), 20-21.

⁴ Mats Alvesson, “Organizational Culture: Meaning, Discourse, and Identity,” in *The Handbook of Organizational Culture and Climate*, ed. Neal M. Ashkanasy, Celeste P.M. Wilderom, and Mark F. Peterson (Thousand Oaks, CA: Sage Publications, 2011), 14.

⁵ Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana, IL: University of Illinois Press, 1949), 3.

⁶ Wilbur Schramm, *Men, Messages, and Media: A Look at Human Communication* (New York: Harper and Row, 1973), 38.

⁷ Shannon and Weaver, *The Mathematical Theory of Communication*, 100.

⁸ Ibid.

⁹ Ibid., 103.

¹⁰ Ibid., 117.

¹¹ Schramm, *Men, Messages, and Media*, 38.

- ¹² Norton, *Introductory Concepts in Information Science*, 48.
- ¹³ Shannon and Weaver, *The Mathematical Theory of Communication*, 4-6.
- ¹⁴ Gerald L. Pepper, *Communicating in Organizations: A Cultural Approach* (New York: McGraw-Hill, 1995), 8.
- ¹⁵ Schramm, *Men, Messages, and Media*, 3-4.
- ¹⁶ *Ibid.*, 43.
- ¹⁷ *Ibid.*, 56.
- ¹⁸ Pepper, *Communicating in Organizations*, 14.
- ¹⁹ *Ibid.*, 3.
- ²⁰ *Ibid.*
- ²¹ *Ibid.*, 19.
- ²² Karl E. Weick, *Sensemaking in Organizations* (Thousand Oaks, CA: Sage Publications, 1995), 82.
- ²³ Karl E. Weick, *The Social Psychology of Organizing* (Reading, MA: Addison-Wesley Publishing Company, 1969), 1-2.
- ²⁴ Edgar H. Schein, *Organizational Psychology* (Englewood Cliffs, NJ: Prentice-Hall, 1965), 8.
- ²⁵ Francis J. Yammarino and Fred Dansereau, "Multilevel Issues in Organizational Culture and Climate Research," in *The Handbook of Organizational Culture and Climate*, ed. Neal M. Ashkanasy, Celeste P.M. Wilderom, and Mark F. Peterson (Thousand Oaks, CA: Sage Publications, 2011), 51.
- ²⁶ Whelan, *Networks and National Security*, 141.
- ²⁷ Van Jackson et al., *Networked Transparency: Constructing a Common Operational Picture of the South China Sea* (Washington, DC: Center for New American Security, 2016), 3, accessed September 28, 2016, <https://www.cnas.org/publications/reports/networked-transparency-constructing-a-common-operational-picture-of-the-south-china-sea>.
- ²⁸ Whelan, *Networks and National Security*, 11.
- ²⁹ National Research Council, Committee on Network Science for Future Army Applications, *Network Science* (Washington, DC: The National Academies Press, 2005),

27, accessed April 7, 2017, <https://www.nap.edu/download/11516>; Ted G. Lewis, *Network Science: Theory and Practice*, (Hoboken, NJ: John Wiley and Sons, 2009), 6, accessed November 21, 2016, ProQuest Ebrary.

³⁰ Mark Meckler, “Links and Synchs: Organizations and Organizational Culture from a Network Point of View,” in *The Handbook of Organizational Culture and Climate*, ed. Neal M. Ashkanasy, Celeste P.M. Wilderom, and Mark F. Peterson (Thousand Oaks, CA: Sage Publications, 2011), 444.

³¹ Whelan, *Networks and National Security*, 19.

³² B. Dupont, “Security in the Age of Networks,” *Policing and Society* 14, no.1 (2004): 76-91, quoted in Whelan, *Networks and National Security*, 19.

³³ *Ibid.*, 21.

³⁴ David Easley and Jon Kleinberg, *Networks, Crowds, and Markets: Reasoning about a Highly Connected World* (New York: Cambridge University Press, 2010), 4.

³⁵ *Ibid.*, 17.

³⁶ *Ibid.*

³⁷ Whelan, *Networks and National Security*, 22.

³⁸ Fatemeh Nooshinfard and Leila Nemati-Anaraki, “Success Factors of Inter-Organizational Knowledge Sharing: A Proposed Framework,” *The Electronic Library* 32, no. 2 (2014): 248.

³⁹ Colin P. Silverthorne, *Organizational Psychology: In Cross-Cultural Perspective* (New York: New York University Press, 2005), 217.

⁴⁰ Whelan, *Networks and National Security*, 34.

⁴¹ *Ibid.*

⁴² Silverthorne, *Organizational Psychology*, 217; Nooshinfard and Nemati-Anaraki, “Success Factors of Inter-Organizational Knowledge Sharing: A Proposed Framework,” 248.

⁴³ Whelan, *Networks and National Security*, 35.

⁴⁴ Patrick Kenis and Keith G. Provan, “The Control of Public Networks,” *International Public Management Journal* 9, no. 3 (2006): 228, accessed April 7, 2017, <https://pure.uvt.nl/portal/files/768168/control.pdf>.

⁴⁵ Whelan, *Networks and National Security*, 35.

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- ⁴⁷ Nooshinfard and Nemati-Anaraki, "Success Factors of Inter-Organizational Knowledge Sharing: A Proposed Framework," 249.
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- ⁵⁵ Wiley, "The Micro-Macro Problem in Social Theory," 258, quoted in Weick, *Sensemaking*, 71.
- ⁵⁶ Weick, *Sensemaking*, 71.
- ⁵⁷ Ibid., 72-73.
- ⁵⁸ Ibid., 75.
- ⁵⁹ Ibid.
- ⁶⁰ Pepper, *Communicating in Organizations*, 9.
- ⁶¹ Ibid., 248-249.
- ⁶² Weick, *Social Psychology*, 54.
- ⁶³ Ibid., 43.
- ⁶⁴ Ibid., 87.

⁶⁵ Karl E. Weick and Kathleen M. Sutcliffe, *Managing the Unexpected: Resilient Performance in an Age of Uncertainty* (San Francisco: Jossey-Bass, 2007), 113.

⁶⁶ Lewis, *Network Science: Theory and Practice*, 20.

⁶⁷ Ibid.

⁶⁸ Weick, *Social Psychology*, 99.

⁶⁹ Edgar H. Schein, *Organizational Culture and Leadership*, 4th ed. (San Francisco, CA: Jossey-Bass, 2010), 3.

⁷⁰ Lilach Sagiv, Shalom H. Schwartz, and Sharon Arieli, "Personal Values, National Culture, and Organizations: Insights Applying the Schwartz Value Framework," in *The Handbook of Organizational Culture and Climate*, ed. Neal M. Ashkanasy, Celeste P.M. Wilderom, and Mark F. Peterson (Thousand Oaks, CA: Sage Publications, 2011), 516.

⁷¹ Whelan, *Networks and National Security*, 34.

⁷² Silverthorne, *Organizational Psychology*, 27.

⁷³ Schein, *Organizational Culture and Leadership*, 26.

⁷⁴ Weick and Sutcliffe, *Managing the Unexpected*, 115.

⁷⁵ Schein, *Organizational Culture and Leadership*, 29.

⁷⁶ Ibid., 3.

⁷⁷ E. Rogers, *The Diffusion of Innovation* (4th ed.) (New York: The Free Press, 1995), 286, quoted in Norton, *Introductory Concepts in Information Science*, 46.

⁷⁸ Pepper, *Communicating in Organizations*, 178.

⁷⁹ Lilach Sagiv et al., "Personal Values, National Culture, and Organizations," 515-533.

⁸⁰ Weick, *Social Psychology*, 9.

⁸¹ Christine B. Williams et al., "The Formation of Inter-Organizational Information Sharing Networks in Public Safety: Cartographic Insights on Rational Choice and Institutional Explanations," *Information Polity: The International Journal of Government and Democracy in the Information Age* 14, no. 1/2 (2009): 16.

⁸² Ibid., 17.

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- ⁸⁴ Ibid., 23-24.
- ⁸⁵ Ibid., 24.
- ⁸⁶ Aycan Kara and Mary Zellmer-Bruhn, "The Role of Organizational Culture and Underlying Ideologies in the Success of Globally Distributed Teams," in *The Handbook of Organizational Culture and Climate*, ed. Neal M. Ashkanasy, Celeste P.M. Wilderom, and Mark F. Peterson (Thousand Oaks, CA: Sage Publications, 2011), 542.
- ⁸⁷ Jessica Lipnack and Jeffrey Stamps, *The Age of the Network: Organizing Principles for the 21st Century* (New York: John Wiley and Sons, 1994), 20.
- ⁸⁸ Whelan, *Networks and National Security*, 24.
- ⁸⁹ D. Rousseau et al., "Not So Different After All: A Cross-Discipline View of Trust," *Academy of Management Review* 22, no. 3, (1998): 393-404, quoted in Whelan, *Networks and National Security*, 37.
- ⁹⁰ Peter R. Monge et al., "Production of Collective Action in Alliance-Based Interorganizational Communication and Information Systems," *Organization Science* 9, no. 3 (May-June 1998): 421.
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- ⁹² Whelan, *Networks and National Security*, 21.
- ⁹³ Monge et al., "Production of Collective Action in Alliance-Based Interorganizational Communication and Information Systems," 421.
- ⁹⁴ Easley, *Networks, Crowds, and Markets*, 78.

CHAPTER 3

RESEARCH METHOD

Whatever the field of interest, the distinctive need for case study research arises out of a desire to understand complex social phenomena. In brief, a case study allows investigators to focus on a “case” and retain a holistic and real-world perspective—such as in studying individual life cycles, small group behavior, organizational and managerial processes, neighborhood change, school performance, international relations, and the maturation of industries.

— Robert K. Yin, *Case Study Research: Design and Methods*

Introduction

A case study is “an empirical inquiry about a contemporary phenomenon (e.g. a ‘case’), set within its real-world context.”¹ It seeks to address either a “descriptive question—‘What is happening or has happened?’—or an exploratory question—‘How or why did something happen?’”² A case study, then, allows us to intimately probe a phenomenon to learn something broader, more foundational about its behavior. And if we view that behavior through the lens of theory, we may also begin to generalize lessons from one phenomenon to other, yet related phenomena—termed “analytic generalization.”³ This thesis chose the case study method precisely for this ability to extend conclusions from a single complex event to broader applications. In particular, a case study provides a real world data set in which to apply the theoretical findings from literature reviewed in chapter 2 and generalize conclusions about the barriers to effective information exchange within the SCS maritime environment.

Other social research methods are also appropriate for this study. Surveys, for example, are well suited to answer research questions—similar to the central question of this thesis—that ask ‘what’ instead of ‘why or how’.⁴ And social network analysis

provides a method for “studying social relations and their structuring”—which is quite germane to this thesis.⁵ These methods, however, require access to resources and a relevant pool of actors that are not readily available within the time horizon of this study. Therefore, surveys and network analysis are deferred to future research endeavors.

This chapter details the methodology—an “embedded,” single-case study—to be used to answer the primary research question of this thesis.⁶ The chapter uses Robert Yin’s five elements of case study design as a framework for the research method.⁷ The chapter first discusses the appropriateness of the case study method to address the primary research question. It then defines the case, derives the elements of analysis, and then discusses the theoretical propositions and hypotheses to be used during data gathering and analysis. The chapter concludes with the general strategy for data analysis, and provides basic criteria for interpreting the findings of the study.

Study Design

This section is divided along Yin’s five elements of case study design. It, therefore, serves to describe the research instrument of this thesis—to not only document the mechanics of the study process, but also introduce the underlying rigor in its design.

Research Question

The primary research question of this thesis asks: What systemic institutional factors in the SCS maritime environment inhibit effective information exchange at the operational level of war between the U.S. Navy and its partner navies in the region? This question clearly asks ‘what’ as opposed to, for example, ‘why’ or ‘how.’ Yin argues, however, that case study research is best suited for research questions that ask ‘how’ or

‘why’ because “such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence.”⁸ These “operational links,” though, are precisely the target of this thesis. Asking ‘what systemic institutional factors inhibit effective information exchange’ is not merely an attempt to identify or quantify factors. In part, this is the focus. But the crux of the question seeks to understand the complexity of the informational links between maritime partners to better understand how the U.S. Navy can improve institutional interoperability. To the extent that a case study is expected to help uncover these informational complexities, it is appropriate to use this method to answer the primary research question of this thesis.

Propositions and Hypotheses

Propositions

Chapter 2 introduced Chad Whelan’s five factors influencing security network effectiveness: structure, culture, policy, technology, and relationships. It used these variables as an aggregating framework for the literature reviewed, and adopted them as the principal institutional factors to investigate in the case study. Accordingly, the chapter derived the following propositions to focus the case study data collection and analysis:

1. Institutional structure influences effective information exchange because it determines the amount and distribution of available information.
2. Institutional culture influences effective information exchange because it determines the amount and distribution of available information; it shapes the meaning of information.

3. Institutional policy influences effective information exchange because it determines the amount and distribution of available information; it determines the type of shareable information.

4. Technology influences effective information exchange because it determines the amount and distribution of available information; it impacts the discoverability of information.

5. Relationships influence effective information exchange because they shape the amount and distribution of available information.

Hypotheses

From the literature review and the above propositions, the following hypotheses—concerning barriers to effective information exchange between the U.S. Navy and its partner navies in the SCS region at the operational level—emerge to be tested in the case study:

1. Hypothesis 1: Institutional culture inhibits effective information exchange because it shapes a potentially divergent understanding of shareable information amongst collaborative partners.

2. Hypothesis 2: Technology inhibits effective information exchange because it limits the discoverability of information by non-interoperable collaborative partners.

3. Hypothesis 3: Institutional policy inhibits effective information exchange because it constrains the type of shareable information amongst collaborative partners. It also limits the quantity of available information by controlling the number of available information sources.

4. Hypothesis 4: Network relationships—those characterized by distrust—inhibit effective information exchange because they limit the distribution of shareable information amongst collaborative partners.

5. Hypothesis 5: Institutional structure inhibits effective information exchange amongst collaborative partners because it limits the distribution of shareable information.

Elements of Analysis

Unit of Analysis

The unit of analysis for the study is ‘systemic institutional factors in the SCS maritime environment.’ This is consistent with Sonja Foss and William Waters who argue, “The unit of analysis should be a concept, idea, or action that illuminates the significant features of [the] data so that the question [asked] can be answered.”⁹ They further suggest that if the “research question is about the kinds of questions teachers ask in classrooms that stimulate . . . discussion among students, [the] unit of analysis is the types of questions asked by teachers.”¹⁰ Since the focus of this thesis is on understanding the systemic institutional factors that inhibit effective information exchange, the appropriate unit of analysis is ‘the institutional factors’—not the U.S. Navy or any of its partners in the SCS region.

Yin generally agrees with Foss and Waters’ concept of unit of analysis, but uses the terms ‘unit of analysis’ and ‘case’ almost interchangeably when describing case study design.¹¹ To avoid confusion, this thesis treats these terms as distinct—it defines the unit of analysis as ‘systemic institutional factors’; the case—the 2014 multinational search for Malaysia Airlines Flight 370—as the “real-life phenomenon” that provides a venue to investigate the unit of analysis.¹² The case will be developed later in this section.

Level of Analysis

The level of analysis for the study is the operational level of war—or more generally, the operational level. The operational level is the intermediary between the strategic and tactical levels. It “links strategy and tactics by establishing operational objectives needed to achieve the military end states and strategic objectives. The focus at this level is on the planning and execution of operations . . . to develop strategies, campaigns, and operations to organize and employ military forces by integrating ends, ways, and means.”¹³ The operational level is where synchronized multinational maritime security efforts are planned and coordinated. This is the level of war where true MDA can actually occur—where information from multinational partners can be fused in a meaningful manner for decision-making and force employment. Therefore, in the continuum between the strategic and tactical echelons, the operational level is the most appropriate to study information exchange amongst multinational partners in the SCS.

Units of Interest

Since the human relationships at the operational level of war are generally between naval fleets and major military staffs, the particular units of interest to this study are the U.S. Navy’s Seventh Fleet and the equivalent-level maritime organizations from the ASEAN. Seventh Fleet, for example, is responsible for maritime security in the Western Pacific and Eastern Indian Oceans, and is thus the principal operational collaborator with SCS maritime stakeholders. Sub-units like ships and aircraft are also relevant to collaboration within an operational-level context. These units tend to be the collectors and executors of information that flows through operational channels, and are thus critical to the performance of operational-level information sharing.

Case Description

The specific case to be studied is the multinational search for Malaysia Airlines flight MH370 that disappeared over the Southeast Asia maritime region in 2014. The search involved ships and aircraft from seven of the ten member states of the ASEAN, as well as the U.S., Australia, and a host of other countries. It, therefore, provides a contemporary and largely inclusive example of maritime collaboration amongst relevant U.S. naval partners and stakeholders in the SCS region. And though this particular case is not strictly related to maritime security, it provides an example of multinational coordination commensurate in scope and scale to maritime security events in the SCS at the operational level.

Formal Study Description

The designed study is an embedded, single-case. The “embedded” descriptor accounts for the investigation of the unit of analysis at multiple levels—the tactical, operational, and strategic levels. Though the focus of the case is principally the operational level, the study uses information spanning these three levels to help develop the phenomenon (the multinational search effort) of the case. This also allows inclusion of both the units and sub-units of interest into the analysis to better understand the information life cycle at the operational level.

The single-case descriptor accounts for the analysis of a single case—the multinational search for flight MH370. This thesis chose a single-case design instead of a multiple-case design because the selected case satisfies an accepted rationale for a single-case design—that it is “an extreme or an unusual case.”¹⁴ The large scale, multinational search for a missing commercial airliner is not a normal occurrence. In this form, the case

“may reveal insights about normal processes,” and thus become generalized—when viewed through a theoretical lens—for wider application in answering the primary research question of this thesis.¹⁵

Strategy for Connecting Data to Propositions

The general strategy for linking data to the stated propositions will involve what Yin terms “relying on theoretical propositions.”¹⁶ This simply means the propositions for each of the five institutional factors—derived from the chapter 2 literature review—will serve as a lens through which to view the data sources. This strategy helps to treat the data using various perspectives, and aggregate it for finer analysis.

The anticipated techniques to be used in the data analysis include “pattern matching,” “explanation building,” and “time-series analysis.”¹⁷ Pattern matching is a comparative method that evaluates predicted behavior relative to observed behavior.¹⁸ Whelan’s security network effectiveness theory, for example, suggests technology can inhibit effective information sharing by saturating the information environment and making relevant information undiscoverable.¹⁹ The pattern matching technique would seek explicit examples of this cause-and-effect relationship in the data—and, if found, would help validate the theory. For this thesis, the pattern matching technique would help test the validity of the stated hypotheses.

Explanation building is an extension of pattern matching—it begins with the same causal analysis of pattern matching, but uses an iterative process to develop a refined explanation of the case. Yin offers that the objective of explanation building is “to analyze the case study data by building an explanation about the case” through iterative examination of the data and sequentially refined propositions.²⁰ If done correctly, this

technique can provide fairly useful insights about the unit of analysis within the single case that can help validate or invalidate the hypotheses of the overall study.

Time-series analysis uses statistical evaluation of observed trends within the data to yield some statistically significant insight about the case and unit of analysis.²¹ Such trends may not exist in the flight MH370 search case, but this technique is considered here simply to bring awareness to its usefulness and help cue a search for quantitatively assessable data within the case.

The data analysis can be structured in a way that links information sharing behavior to a chronology of information events in the case. Yin refers to this as the “chronological sequence” technique and suggests it is a form of time-series analysis.²² For our purposes, a chronology will help understand how the five institutional factors influenced key decisions and information sharing behavior in the case. Chapter 4 provides greater detail on how the study splits the case along three distinct information periods. It also describes how the study uses those periods to assess the influence of the various institutional factors on information exchange between relevant actors in the multinational search effort.

Criteria for Interpreting Results

In the absence of statistically relevant analyses, Yin suggests testing the hypothesis of a case study by addressing “rival explanations for [the] findings.”²³ Based on literature reviewed in chapters 1 and 2, appropriate rival explanations for this study include:

1. Technology and institutional policy are the sole inhibitors of effective information exchange at the operational level—institutional culture, relationships, and structure have neutral influence.

2. Transnational competition and non-collaborative ethos at the strategic level inhibit effective information exchange at the operational level because they limit access to shareable information.

Data Sources

The volume of open source and unclassified data on the Flight 370 search is extensive. Though classified information relevant to this case is available, only unclassified sources will be considered in order to ensure widest dissemination of this study. The following sources of information, then, will be explored:

1. Direct observations from crews of U.S. Navy ships and aircraft conducting the search, as available in the Navy Lessons Learned Database.

2. Archival records—including flight MH370 search after action reports, documents, and lessons—available in the Navy Lessons Learned Database.

3. Open source documents, such as news articles, case studies, and both written and video reports of the Flight 370 search.

Study Questions

The following questions provide a framework to help meaningfully engage the data sources and extract relevant information about the behavior of the unit of analysis within the case. They are intended to be questions—in addition to the stated propositions—for the researcher to consider when analyzing sources.

1. What organizational structure was in place for the Flight 370 search? What was the basis to this structure? Did it impede information flow? If so, how?

2. What information and communication technology infrastructure did the multinational team use while conducting the search? Were there technology interoperability issues amongst the search teams?

3. Who were the relevant players and what did they contribute to the search? Where did they send information obtained during the search?

4. What limitations did these players self-impose during the search? Why? Did these limitations, or policies, prohibit sharing information with other nations involved with the search effort?

5. How was information shared during the search? Was there a common collaborative environment available amongst the multinational search partners to share and evaluate information?

6. What did the search members say inhibited information exchange?

7. Did the Seventh Fleet staff share information with other multinational fleet staffs? Were there restrictions on the type of information authorized to share?

8. Was there evidence of distrust amongst the search partners?

9. Were cultural spanning mechanisms—“boundary spanners”—employed throughout the search?²⁴ Did Seventh Fleet ensure partners assigned the appropriate meaning to information shared?

Conclusion

This chapter briefly discussed the nature of case-study research and provided an overview of the method to be used to answer the primary research question of this thesis.

Ultimately, the chapter showed that an embedded, single-case study of the multinational search for Malaysia Airlines flight MH370 in the Indo-Asia region provided an appropriate vehicle to investigate institutional barriers to information exchange in the SCS maritime environment at the operational level. Chapter 4 discusses the relevant theoretical findings—those that define effective information exchange—from the literature review conducted in chapter 2, and provides analysis of the case study.

¹ Robert K. Yin, *Applications of Case Study Research* (Thousand Oaks, CA: Sage Publications, 2012), 4.

² Ibid., 5.

³ Robert K. Yin, *Case Study Research: Design and Methods*, 5th ed. (Thousand Oaks, CA: Sage Publications, 2014), location 1503 of 7811, Kindle.

⁴ Ibid., location 806 of 7811.

⁵ Christina Prell, *Social Network Analysis: History, Theory, and Methodology* (Los Angeles, CA: Sage Publications, 2012), 1.

⁶ Yin, *Case Study Research*, location 1804 of 7811.

⁷ Ibid., location 1246 of 7811.

⁸ Ibid., location 810 of 7811.

⁹ Sonja K. Foss and William Waters, *Destination Dissertation: A Traveler's Guide to a Done Dissertation*, 2nd ed. (Lanham, MD, Rowman and Littlefield, 2016), 243.

¹⁰ Ibid.

¹¹ Yin, *Case Study Research*, location 1304 of 7811.

¹² Ibid., location 1368 of 7811.

¹³ U.S. Joint Chiefs of Staff, Joint Publication 1, *Doctrine for the Armed Forces of the United States* (Washington, DC: Government Printing Office, 2013), I-8.

¹⁴ Yin, *Case Study Research*, location 1763 of 7811.

- ¹⁵ Ibid.
- ¹⁶ Ibid., location 3506 of 7811.
- ¹⁷ Ibid., location 3637 through 3929 of 7811.
- ¹⁸ Ibid., location 3637 through 3656 of 7811.
- ¹⁹ Chad Whelan, *Networks and National Security: Dynamics, Effectiveness and Organization* (Burlington, VT: Ashgate, 2012), 24, accessed November 21, 2016, ProQuest Ebrary.
- ²⁰ Yin, *Case Study Research*, location 3749 to 3799 of 7811.
- ²¹ Ibid., location 3841 to 3852 of 7811.
- ²² Ibid., location 3906 of 7811.
- ²³ Ibid., location 1411 of 7811.
- ²⁴ Gerald L. Pepper, *Communicating in Organizations: A Cultural Approach* (New York: McGraw-Hill, 1995), 180.

CHAPTER 4

DATA ANALYSIS

U.S. Navy Captain Mark Matthews, who is in charge of the U.S. Towed Pinger Locator (TPL), told journalists at Stirling Naval Base near Perth that the lack of information about where the plane went down seriously hampers the ability to find it.

— Matt Siegel and Rujun Shen, *Reuters*, March 30, 2014

Introduction

Chapter 1 of this thesis identified a maritime security need to cultivate improved collaborative capacity between the U.S. Navy and its partner navies in the SCS region. This motivated an examination of the institutional barriers to effective information exchange between these organizations at the operational level. Chapter 2 provided the theoretical framework within which to study these barriers. In particular, the chapter conceptualized ‘effective information exchange’ as human communication that lowers the level of uncertainty in a situation to an acceptable level, or at least to a level that enables action. The chapter also adopted Chad Whelan’s five security network effectiveness factors—structure, culture, policy, technology, and relationships—as the study variables for this thesis.¹ It then provided theoretical propositions for how each of these institutional factors influences effective inter-organizational information sharing. Chapter 3 designed a research method—an “embedded,” single-case study of the multinational search for Malaysia Airlines flight MH370 that disappeared over Southeast Asia in 2014—to investigate these five factors in the SCS maritime information environment.² The chapter also provided various hypotheses, along with relevant rivals, to test in response to the research.

This chapter provides the results of the case study. It begins with a review of the case and its relevance to the central research question of the thesis. It then presents a chronology of case events (detailed in Appendix A) as an information story divisible into several distinct periods—as a framework to facilitate pattern matching and explanation building analytical techniques to more richly explore the influence of the five factors on effective information sharing during the case. The chapter concludes by assessing the five hypotheses identified in chapter 3 using the case findings. This allows us to subsequently employ “analytic generalization” in chapter 5 to answer the primary research question of this thesis and provide meaningful insights to improve multinational interoperability in the SCS maritime environment.³

General Considerations and Caveats

The following discussion highlights various considerations and limitations of the case study. These issues necessarily shape the appropriateness of generalizing the study’s conclusions to answer the primary research question of this thesis.

In an effort to maximize dissemination of this thesis, the author only considered unclassified, open-source material easily found via the Internet for the case study. The one exception to this is an unclassified public affairs briefing provided to the author by the U.S. Navy’s Seventh Fleet.⁴ Therefore, the data sources consulted were predominantly news articles, government reports from relevant state actors in the case, and official reports of international organizations. Travel restraints prevented conducting personal interviews of case participants. These constraints clearly influence the completeness of the study, but do not necessarily inhibit drawing meaningful conclusions

regarding the institutional barriers to effective information exchange in the SCS maritime region.

Australia and China are prominently featured in the case study—their participation and influence in the multinational search for flight MH370 are inescapable. Though this thesis excluded these countries from consideration in the case design, their information behavior throughout the case is critical to more fully developing the SCS information environment.

Appendix B provides a non-inclusive overview of the many stakeholders involved in the multinational search for flight MH370. To some extent, this list demonstrates the structural complexity associated with operational-level multinational collaboration in this region—and perhaps the tortuous path through which information must flow within a U.S.-ASEAN maritime security network. More importantly, the graphic in Appendix B clearly demonstrates that maritime security in this region is not just the responsibility of naval forces. Rather, it is the responsibility of numerous civilian and military organizational stakeholders, both internal and external to a U.S.-ASEAN security network. As we will see in the case, the information interplay between these stakeholders reflected Whelan’s five-factor security network effectiveness model. The action or inaction of these stakeholders—and hence the efficacy of the multinational search effort—resulted principally from the influence of the five institutional factors on effective information exchange between stakeholders.

Appendix B also shows that each ASEAN country participated, in some measure, with the search effort. The data concentrates, though, on a fraction of these countries—Malaysia and Thailand, in particular. This clearly limits our ability to fully investigate the

information sharing behavior of the ASEAN maritime security complex. It also limits the utility of the case in fully answering the primary research question of this thesis. Chapter 5 will recommend the use of a social network analysis in future studies of the U.S.-ASEAN partnership to avoid these limitations and more definitively assess the institutional barriers to effective information exchange.

The data is quite critical of Malaysia's behavior during the search effort. This is reasonable considering the prominent role the country played in the case. The chapter, though, uses the Malaysia critique as evidence of broader informational themes—of particular cultural and policy influences on the distribution of available information.

Case Overview

The multinational search for flight MH370—which bizarrely disappeared over the Gulf of Thailand in the early morning hours of March 7, 2014 (Coordinated Universal Time)—exhausted the available human and technological capital of more than 26 countries for a period of weeks, and for some countries, years. The search extended from the SCS and the Gulf of Thailand, to the Malacca Strait and the southern Indian Ocean, and integrated human and technological systems operating in the space, air, surface and subsea domains. For this thesis, the relevant story of the multinational search is not about the fact flight MH370 remains undiscovered today. Rather, it is about how the network of multinational systems influenced the use and distribution of available information to guide the search over the period of March—April 2014.

The study of the search for flight MH370 is appropriate for this thesis because it provides a contemporary, nearly inclusive example of the U.S. Navy operating with its ASEAN counterparts in the general SCS region. Though the case has a definite search

and rescue flavor, and is not focused on a specific maritime security issue, it plays out on a geographic and organizational scale commensurate to that expected for operational level, maritime security collaboration between the U.S. Navy and its ASEAN partners. Moreover, the interplay between relevant case-stakeholders evidenced in open-sourced data threads provides sufficient data to uncover broad-based themes in information sharing behavior in the region.

Timeline

Appendix A (Table 1) provides a detailed chronology of information events for the flight MH370 search during the period between March 7, 2014 and April 30, 2014. The study focused on these seven weeks, instead of the entirety of the nearly three-year search that ended in January 2017, because it provided an appropriately sized event window to investigate the information exchange behavior of relevant actors for this thesis. Inside this window, most ASEAN actors made contributions to the search; beyond this window, the opposite was true.

This seven-week period also contains distinct transition points in the multinational search effort that reflect key decisions made in the location and type of search conducted. To the extent that effective information exchange influences decision-making, these transition points provide convenient locations to divide the period—to allow for in-depth, critical analysis of the information behavior that either led to a critical decision or influenced actions taken during the days leading to the transition. The three information periods in this window follow: (1) the multinational search around the Malay Peninsula (March 7–March 15); (2) search and rescue operations in the southern Indian Ocean

(March 17–March 30); and (3) flight data recorder ping detection and initial subsea search (March 31–April 30).

The next few sections of this chapter are organized using this three-phase framework. Each phase will contain relevant commentary about the general activity and information behavior of the period. The influence of the five institutional factors on the information behavior in each phase will then be explored to better understand how each factor influenced decision-making and search activity.

Phase 1: Multinational search around the Malay Peninsula (March 7–15)

This phase began with the departure of flight MH370 from Kuala Lumpur International Airport at 1642 (Coordinated Universal Time, UTC) on March 7; it ended with the Prime Minister of Malaysia deciding to suspend the multinational search effort on the eastern and western sides of the Malaysian Peninsula on March 15. Key information elements in this period were civilian and military radar data showing the behavior of flight MH370—specifically, the disparity between the data and the delay in sharing critical pieces of this information with relevant organizations.⁵ Other key information elements in this phase were Inmarsat satellite data—and, particularly, the delay in its analysis and subsequent action on—showing the aircraft flew for a number of hours after its initially-reported disappearance from civilian air traffic control radar at 1721 (UTC) on March 7.⁶

Cultural Influences

The prominent cultural influence on information exchange during this phase was the delay in sharing between key civil-military institutions in Malaysia. Appendix B

shows that civil air control radars last recorded contact on flight MH370 in the vicinity of waypoint IGARI over the Gulf of Thailand on March 7 at 1721 (UTC). Later data analysis suggested civil aviation radar sources likely held subsequent contact on MH370 flying westward over the Malaysian Peninsula, but in situ, the 1721 (UTC) radar recordings were the last observed civil data on flight MH370.⁷ The Royal Malaysian Air Force primary search radar, however, tracked flight MH370 deviating from its intended path to Beijing, altering its course towards the west and flying over the Peninsula. Malaysia military radar held continuous contact on flight MH370 until March 7 at 1822 (UTC), when the aircraft disappeared from radar in the vicinity of waypoint MEKAR over the Malacca Strait.⁸

Malaysia civil aviation authorities were unaware of this information until 1430 (UTC) on March 8 when the air force disclosed it to them. Until this disclosure, civilian authorities focused search planning and execution in the Gulf of Thailand where their information streams suggested the flight disappeared. After this disclosure, Malaysian authorities deployed multinational search assets to both the eastern and western sides of the Malay Peninsula.

The roughly 17-hour delay between Malaysian civil authorities activating the Kuala Lumpur Aeronautical Rescue Coordination Centre at 2130 (UTC) on March 7 (in response to failed attempts to locate the aircraft) and the air force sharing information with them may reflect the time needed for the military to interpret its radar data. News articles and other reports, however, suggest a more pervasive civil-military coordination issue in Malaysia—and in other countries in Southeast Asia—that stems from cultural influences. In a March 20, 2014 *Aviation Week Network* article, Adrian Schofield, Jeremy

Torr, and Bradley Perrett indicate a “major issue in Southeast Asia is the degree of autonomy enjoyed by the various services of specific countries”—that “the army, air force, navy, internal security agencies and air navigation service providers (ANSP) do cooperate, but often not as closely as elsewhere in the world.”⁹ A 2015 International Civil Aviation Organization report draws a similar conclusion, and states in relation to the flight MH370 search that “a week or more was lost in the initial search because of poor civil/military cooperation.”¹⁰

This civil-military coordination issue interestingly reveals an internal (intra-national, inter-organizational) cultural barrier to information sharing in select ASEAN countries. From our study in chapter 2, this communication barrier likely reflects disparity in institutional identity and homophily. This means the delay in information delivery to civilian authorities resulted either from the military’s lack of perceived need to share information (identity-related), or from a perceived absence of commonality between the institutions (homophily-related). And though this barrier appears to be an internal one between ASEAN civilian and military organizations, it seems reasonable to expect similar behavior in multinational applications.

Policy Influences

During this phase, key policy decisions on the retention and application of shareable satellite information unquestionably delayed the shift in search operations from the Malay Peninsula to the more likely flight MH370 crash site in the southern Indian Ocean. Three days following the announced disappearance of flight MH370, the United Kingdom (UK)-based Inmarsat company completed analysis of aircraft-to-satellite handshake timing data for the flight.¹¹ The analysis indicated the aircraft continued flying

for an additional six hours following the last military radar contact over the Malacca Strait, and that its likely termination point was within a north-south corridor—based on a positional arc derived from the timing of the aircraft’s last recorded handshake with the Inmarsat satellite covering the region—extending from the southern Indian Ocean to South Asia.¹² Malaysian officials received this analysis by March 12, yet a decision to shift the search to the southern Indian Ocean was not made until March 15.

News reports containing interviews of relevant ‘government officials’ provide conflicting explanations for the delay, but offer potential insight to how Malaysia controlled the sharing of information. A March 20 *Wall Street Journal* article, for example, quoted the Malaysia Prime Minister suggesting Malaysian officials openly shared the Inmarsat data with its “international partners”—as if to suggest the delayed decision did not result from, in some way, a tightly controlled information sharing policy.¹³ The same article then quoted other “government officials” positing that “Malaysia was cautious about revealing and acting on the data because” they did not “want to upset anybody with round after round of confusing information.”¹⁴

The true Malaysia sharing policy for the Inmarsat information may be best derived from statements made by other government officials regarding different, yet related, events during this period. Regarding the release of flight MH370’s official transcript—after Malaysia had to publicly correct the inaccurately released last words of the aircraft’s pilot—and demonstrating how Malaysia controlled the release of relevant information for the search, an April 1 *Al Jazeera* report quoted a Malaysia official indicating “the transcript was initially held as part of the police investigation.”¹⁵ Moreover, in a testy March 12 exchange with families of flight MH370 passengers, who

demanded greater transparency in military radar information, a Malaysian official declared that the information was “at a high level”—likely because the government was not ready to release it yet.¹⁶ And in a report to the International Civil Aviation Organization, Japan suggested Malaysia withheld information from them about where co-members of the multinational Malay Peninsula search team were operating and what they discovered in their searches.¹⁷

The preceding three examples, in aggregate with reports attempting to explain Malaysia’s delayed decision-making, demonstrate an information sharing policy pattern that fits well with our chapter 2 discussion on policy. From these examples, we see that Malaysia likely implemented a control-centric information sharing policy. This was in contrast to a seemingly overt legitimacy-seeking information sharing policy China employed in the early moments of the search: characterized by a hasty release of erroneous satellite imagery and constant badgering of Malaysian officials.¹⁸ Unlike China, who governed the majority of the flight MH370 passenger families and likely needed to appear aggressive in its search for the aircraft, Malaysia seemed undeterred by external influence to handle information sharing more transparently. Their information sharing policy behavior during this phase, therefore, fit the mold provided by the “rational choice perspective” discussed in chapter 2.¹⁹

Ultimately, the Malaysia example shows that institutional policy influenced the conduct of the multinational search effort by limiting the distribution of available information. By tightly controlling critical satellite information, and hesitating to take action on it, Malaysia’s policy decisions seemingly nullified the timely influence of information shared with them by their partners, and thus hindered the search effort. In so

far as we can draw broad-based conclusions from this example, we can reasonably expect that effective information exchange at the operational level will be hindered—perhaps unintentionally—by the institutional policies of ASEAN countries.

Relationship Influences

Much of the news reporting during this phase, as well as in the subsequent two, focused on the influence of strategic-level relationships on the collaborative behavior of the multinational search network. The previously mentioned March 20 *Aviation Week Network* article, for example, suggested the existing territorial disputes in the SCS between China and a number of ASEAN countries made “full and immediate disclosure of the [flight MH370] radar data, surveillance levels and intelligence capability less than likely.”²⁰ Moreover, a March 14 *Guardian* article alternatively noted some cooperation between Vietnam and China on the use of airspace for the search.²¹

The influence of strategic-level relationships between search participants is unavoidable in the data for this case—it arguably dominates the data threads and potentially covers operational-level issues. Some of these strategic-level relational issues are important to the information story of the multinational search, however. The below discussion addresses these influences on information exchange during this phase, and introduces some operational-level examples.

A prominent example illustrating the influence of strategic-level distrust on information sharing in this phase and others is the behavior of the U.S. in relation to China—and, in particular, the U.S. allegedly excluding China from information obtained from intelligence assets. The author found no primary evidence confirming the U.S. intentionally withheld relevant information from China, but secondary sources certainly

suggest it. In the same March 14 *Guardian* article introduced previously, Tania Branigan reported that U.S. intelligence sources independently confirmed flight MH370 flew for a number of hours following its last recorded military radar contact. As Branigan noted, it is unclear whether the U.S. shared this information with Malaysia or China.²² But a March 18 *Diplomat* report noted China declaring the U.S. had “access to vital information and should ‘have done a better job’ sharing it” with them.²³

Absent definitive proof the U.S. intentionally withheld intelligence from the Chinese during this phase, this example undergirds information sharing behavior observed throughout the case that indicates the U.S. confided intelligence information only to select actors during the search—namely, Australia and the UK. We see in this example, then, that strategic-level relationships likely permeated operational-level information sharing practices of relevant actors in the search. More importantly, the example starts a larger story of how strategic-level relationships stovepiped information to within certain channels, instead of opening it to the broader multinational search team.

At the operational level, the clearest example demonstrating the influence of institutional relationships on information sharing occurred in the opening stages of the search effort. Similar to the information sharing behavior referenced previously between Malaysian civil aviation authorities and the Royal Malaysian Air Force, the Thai military delayed sharing critical radar information with Malaysian authorities for 10 days. The Thai military’s reasoning for the delay was simple: “it wasn’t asked.”²⁴ Additionally, in a March 19 *Washington Post* article, Adam Taylor reported that the Thai military delayed sharing radar data because Malaysia’s initial request for the data “had been too vague.”²⁵ The ‘vague’ comment may indicate culturally influenced information meaning disparity,

but its condescending tone suggests a relationship issue between the two countries and its institutions.

We learn from these examples, then, that distrust begets distrust across the strategic- and operational-level continuum in this region. Information sharing at the operational level does not behave in a strategic-level vacuum, nor is it neutral to operational-level relationships. Countries that do not trust each other at the strategic level are not going to share information at the operational level. The broader implication of this behavior in this region is consistent with the literature reviewed in chapter 2—that information either remains with a single actor in a network, or it is stovepiped amongst select trusted nodes.

Structural Influences

The tortuous information flow path suggested by Appendix B notwithstanding, few data sources directly indicated how institutional structure influenced information sharing during this phase. The one notable example came from the same March 20 *Wall Street Journal* article discussed previously. In the article, Pasztor et al. describe the exchange path the Inmarsat data traveled through to get to Malaysian officials. Specifically, the article noted:

Inmarsat officials . . . became concerned the data weren't being acted upon quickly enough to help overhaul the search. . . . It turned last Wednesday to U.K. security officials to more quickly disseminate the data . . . Malaysia Airlines, in turn, instructed [a Swiss information technology company] to use the U.K. Air Accidents Branch as the primary conduit for Inmarsat's data.²⁶

It is unclear if this was the exact path the Inmarsat data followed to Malaysian officials, but the example reinforces the idea conveyed by the graphic in Appendix B—that, consistent with the literature, the sheer volume of multinational stakeholders

involved in the search undoubtedly added complexity to the institutional structure through which information flowed from source to decision-maker. And this complexity either stovepiped or delayed shareable information for the multinational search network. So, to the extent, we can draw broader conclusions from this example, it seems reasonable to expect institutional structure will have the same effect on future operational-level information sharing endeavors in this region.

Network Technology Influence

The author did not discover data threads that addressed the influence of network technology on effective information sharing in this phase. The absence of this data does not necessarily suggest technology was not an inhibitor of information exchange in the case. It merely indicates the relevant indicators that would facilitate these insights, such as testimony from stakeholders describing information system interoperability issues, were not found in the data. This is a particular area where future social network analyses can explore further.

Phase 2: Search and rescue operations in the southern Indian Ocean (March 17–30)

This phase began with the appointment of the Australian Maritime Safety Authority as the lead operational coordination hub for the multinational search in the southern Indian Ocean; it ended with the designation of the Joint Agency Coordination Centre as Australia’s communication nucleus for the search effort.²⁷ Key information elements for this phase were satellite imagery and radar data—sourced from a number of different stakeholders—that refined the general search area for flight MH370 in the southern Indian Ocean. This phase continued a number of ‘institutional influence’ themes

from the previous phase, while introducing a few others. Ultimately, this phase exhibited maturation of the institutional barriers to information exchange discussed in phase 1, and showed that institutional relationships, policies, and culture were the principal influencers on the aggregate information performance of the ad hoc search network.

Cultural Influence

News reports published during this phase continued many of the same cultural themes revealed in phase 1, particularly regarding the civilian-military cooperation issues in Malaysia.²⁸ But a March 19 *New York Post* article provided additional relevant insight to the Malaysia culture. The article highlighted some of the complaints US officials expressed following their interaction with Malaysian officials: that “Malaysia was slow to share radar data and [did] not [welcome] the range of resources that the [U.S.] can offer.”²⁹ More insightfully, the article quoted a U.S. law enforcement official who said of Malaysians, “What you see from the Malaysians is, ‘Hey, we’re a sovereign nation. We’re capable. We’ve got this.’”³⁰

This example further demonstrates the influence of cultural identity on information sharing—that Malaysia seemingly perceived sharing information with or receiving certain information from other countries was unnecessary. This may reflect a level of national stubbornness or pride—as suggested by the article’s notion of Malaysian sovereignty and self-determined capability—but it had important implications for the search effort. The U.S. was a key member of the five-nation Joint Investigation Team, which served as an analytical body that prescribed refined search areas to the Australia Maritime Safety Authority. Excluding the U.S. from sharing opportunities undoubtedly influenced the efficacy of the Joint Investigation Team, and hence the search effort.

Policy Influence

Much of the data in phase 2 continued to highlight the persistent tension—briefly mentioned in phase 1 when discussing China’s legitimacy seeking information behavior—between China and Malaysia that stemmed from Malaysia’s control-seeking information sharing policies.³¹ A March 23 *Wall Street Journal* article, however, introduced a particularly interesting policy insight regarding how Australia handled information shared with it by the U.S.³²

In the article, Andy Pasztor and Rachel Pannett report on a March 23 Australian announcement discussing the role that U.S. and UK intelligence services played in narrowing the search area in the southern Indian Ocean. Apparently, this was the “first public” disclosure of U.S. intelligence involvement in the search.³³ Previous Australian announcements regarding information used to refine the multinational search area were vague on the sources of information—and, in fact, “didn’t fully identify the origin of the [information] or initially mention any U.S. or UK involvement.”³⁴ Sam Bateman of the Australia’s University of Wollongong calls Australia’s tendency to closely guard U.S. intelligence the “Ultra Syndrome”—after the Allied code word used in World War Two for information obtained from decrypting German radio traffic.³⁵ Bateman suggests Australia is “hyper-protective of U.S. intelligence and its sources,” which explains why it delayed revealing the U.S. as a source for the imagery used to further refine the search area in the southern Indian Ocean.

Although Australia is not an ASEAN country, its policy to closely guard U.S. intelligence products further reinforces a relationship theme discussed in phase 1—namely, that strategic-level relationships ultimately stovepiped information streams

during the search. In this case, Australia’s close strategic relationship with the U.S. influenced a policy decision—reflective of the chapter 2 legitimacy-seeking pattern behavior—to not disclose certain intelligence sources. There are a number of implications for this policy on the efficacy of the search effort, but the most important for this thesis is the fact that it clearly suggests that key information was withheld from certain stakeholders of the search network. And more broadly, it suggests this same information behavior is likely to continue in future U.S.-ASEAN collaborative efforts.

Relationship Influences

News reports during this phase continued to feature the strong U.S.-Australia information sharing relationship discussed in phase 1, as well as the mistrust between U.S. and China.³⁶ A March 28 *Wall Street Journal* report also emphasized the growing mistrust between Malaysia and the U.S. during this period.³⁷ Similar to the *New York Post* article discussed previously in the cultural influences section, the report highlighted the growing frustration of U.S. officials on the Joint Investigation Team in response to a lack of information flowing to them from Malaysia. More interestingly, the report indicates Malaysia avoided sharing information with the U.S. because of “information leaks they [believed were] occurring more frequently” in the U.S.—expressing concern about uncontrollably disclosing the sources of their information.³⁸

Here, in this Malaysia example, we see a microcosm of the broader collaboration struggles a U.S.-ASEAN security network may encounter in future settings. On the one hand, Malaysia lacked confidence in the security of an information sharing relationship with the U.S. They were unquestionably concerned about the potential disclosure of information that could reveal the true nature of their intelligence capability. And on the

U.S. side, there seemed to be an expectation of information reciprocity—a give-and-take paradigm, of sorts, that required Malaysia to share information in exchange for U.S. services or intelligence. These are operational-level, institutional relationship tensions seemingly influenced by strategic-level imperatives (i.e. Malaysia’s concern about preserving any semblance of comparative advantage in a fiercely competitive regional setting). And, in so far as we can extend these insights to future applications, it seems completely reasonable to expect these same misgivings will be present in future U.S.-ASEAN collaborative maritime security settings.

Structural Influences

The data available for this phase provided little direct insights to the influence of institutional structure on effective information exchange during the search. The one notable exception to this was a *Wall Street Journal* article referencing a March 27 decision made by the Australia Maritime Safety Authority to abruptly shift the primary search location in the southern Indian Ocean approximately 1,100 km northeast.³⁹ The shift occurred about ten days after the first surface search operations commenced in the southern Indian Ocean, and resulted principally from refined analysis provided to the Safety Authority by the Joint Investigation Team in Malaysia. In the article, Andy Pasztor and Jon Ostrower attributed the delay to a lack of collaboration between two independent analysis teams, presumably within the Joint Investigation Team.⁴⁰ The teams reportedly evaluated separate types of data (radar, aircraft parametrics, satellite timing, etc.), but were unable to refine the search area until they fused their analyses.

The structural arrangement of two separate analysis efforts within the Joint Investigation Team is a prime example of the organizational sensemaking behavior

discussed in chapter 2. Although an ad hoc organization, the Joint Investigation Team established separate analysis teams, parsed along different data sets, to help reduce the uncertainty of the flight MH370 crash location. In this case, the observed reduction in uncertainty occurred only after the teams collaborated. What is unclear, however, is why exactly the two teams did not collaborate earlier. Pasztor and Ostrower suggested this behavior was a consequence of Malaysian culture: that “officials didn’t feel it was their role to ensure that foreign experts were sharing refined data among themselves.”⁴¹

Perhaps it was the result of the policy or relationship issues within the Joint Investigation Team discussed previously. Regardless of the true reason for the delay, this example further extends our understanding of how the complex multinational structure shown in Appendix B influenced effective information sharing during the search. The troubles within the Joint Information Team are illustrative of the many potential structural issues resident within any number of the stakeholder organizations shown in Appendix B. The aggregate effect—and what we can reasonably expect to experience in a U.S.-ASEAN maritime security network replete with a similar number of stakeholders—is a limitation on the distribution of available information resulting from stovepiping.

Network Technology Influences

The data threads provided limited insights to the influence of network technology on the distribution and availability of information during this period. The data threads did, however, suggest the large amounts of data made available through network technology—from intelligence agencies, independent companies, or the public at-large—required significant processing time.⁴² This “big data problem” may be a symptom of the ‘information discoverability’ barrier discussed within the network technology section in

chapter 2.⁴³ It seems, though, to be a separate, yet closely related problem inherent to network technology: that the availability of large quantities of data made available by network technology in a multinational setting like a future U.S.-ASEAN security network, may inhibit effective information exchange simply because it demands too many resources to make sense of it all.

Phase 3: Flight data recorder ping detection and
initial subsea search (March 31–April 30)

This phase began with the commissioning of Australia’s Joint Agency Coordination Centre on March 31, 2014; it ended with the departure of the U.S. Navy’s principal surface search platforms on April 30, 2014. The key information elements for this period were the pings detected by Chinese and U.S.-Australian subsea acoustic sensors. Unfortunately, the unclassified, open-source data streams for this phase were sparse of material germane to this case study—they either lacked additional insights to the influence of the five institutional factors on effective information exchange during the case, or they profiled stakeholders (i.e. Australia and China) that were outside the principal scope of the case design. This likely reflected the meager participation of ASEAN countries in this phase of the search.

The only relevant insight discovered during this phase was evidence of misalignment in “operational tempo”, or battle rhythm, between the U.S. Navy’s Seventh Fleet public affairs office and the Joint Agency Coordinate Centre.⁴⁴ In all of the data scoured for the case study, this very simple example is the only evidence of conflict between cyclical institutional sensemaking processes. The disconnect between these processes indicates potential ‘de-synchronization’ of information cycles and creation of

barriers to information flow between organizations. This is a structural implication, then, on effective information exchange that limits the distribution of available information. And though additional evidence of this issue in the case is unavailable, we can at least infer it has the potential to exist in future regional maritime security settings.

Evaluation of Hypotheses

The preceding study evaluated the influence of five systemic institutional factors—culture, policy, relationships, structure, and network technology—on the effectiveness of information exchange during the first seven weeks of the multinational search for Malaysia Airlines flight MH370. The study created an information story using a “chronological structure” to show the relationships, where possible, between the factors and various key events in the case.⁴⁵ It predominantly used pattern matching and explanation building techniques, along with references to relevant theory explored in chapter 2, to develop a picture of how the factors influenced the exchange of operationally relevant information between search partners.

This section assesses the five principal hypotheses (identified in chapter 3) using the findings discussed throughout the case.⁴⁶ Again, the hypotheses emerged from the literature reviewed in chapter 2 and posit how each of the five institutional factors predominantly influences effective multinational information exchange at the operational level. Where appropriate, the section will discuss rival explanations to further test the hypotheses.

Hypothesis 1: Institutional Culture

The first hypothesis posits that institutional culture inhibits effective information exchange because it shapes a potentially divergent understanding of shareable information amongst collaborative partners. This assertion accounted for the cultural influences on meaning-making—that the understanding of shareable information reflects the meaning a particular culture assigns to it. Instead of confirming that cultural biases influenced network meaning-making, the study showed that institutional culture inhibited information exchange by limiting the distribution of available information. This was particular evident in phase 2 with the information sharing friction—as a symptom of cultural identity—between Malaysia and the U.S.⁴⁷ This finding supports one of the derived theoretical propositions from chapter 2, which suggested that culture influences effective information exchange because it determines the amount and distribution of available information. It also refutes a potential rival explanation, which suggests institutional policy and technology are the sole inhibitors of information exchange; and culture has neutral influence.

Hypothesis 2: Network Technology

The second hypothesis posits that network technology inhibits effective information exchange because it limits the discoverability of information by non-interoperable collaborative partners. This assertion accounted for the need of coalition communication systems to be interoperable in order to exchange information between systems. It also accounted for potential over-saturation of data—which reduces discoverability of useful information—that can result from well-connected coalition communication systems.

The case data sources contained insufficient information to corroborate this hypothesis. The available data for phase 2 did suggest members of the search operation were overwhelmed with data—that it created, for example, an analysis backlog that delayed refining the search area in the southern Indian Ocean—but there were no substantive examples demonstrating issues with interconnectivity. The author’s professional experience, however, operating within maritime organizations in this region does suggest interconnectivity issues exist in a U.S.-ASEAN setting. This is also supported by other recently completed professional studies.⁴⁸

Hypothesis 3: Institutional Policy

The third hypothesis posits that institutional policy inhibits effective information exchange because it constrains the type of shareable information amongst collaborative partners. It also limits the quantity of available information by controlling the number of available information sources. The first part of this assertion accounts for information classification policies; the second part accounts for how individual network stakeholders can withhold critical information from the rest of the network based on these policies. Generally, the findings of the case study support these claims. The reported U.S. policy, for example, to share sensitive intelligence information only with the UK and Australia demonstrates both tenets.⁴⁹ More broadly, the case findings show that institutional policy inhibits effective information exchange because it limits the distribution of shareable information—it seems to enable information to be stovepiped within certain channels of the network.

Hypothesis 4: Network Relationships

The fourth hypothesis posits that network relationships—those characterized by distrust—inhibit effective information exchange because they limit the distribution of shareable information amongst collaborative partners. This assertion reflects the need for a link to exist between network stakeholders before information can flow between them. The link, however, can only exist if there is mutual trust between the stakeholders.

There was ample evidence in the study to support this claim. We observed operational-level mistrust between multinational institutions in the case, such as Thailand's delay in sharing critical radar information with Malaysian civil aviation authorities in phase 1 of the search.⁵⁰ But the bulk of the relational issues stemmed from strategic-level relationships—as evidenced, for example, by mistrust between the U.S. and Malaysia during phase 2 of the search.⁵¹ These relationships deeply influenced operational-level information exchange in the study—and, in particular, caused significant stovepiping of information. The study, therefore, also supports a rival explanation, which suggests transnational and non-collaborative ethos at the strategic level inhibit effective information exchange at the operational level because they limit access to shareable information. This result may reflect the types of sources used for the study, but it nonetheless highlights that information exchange between operational-level institutions is deeply rooted in the information behavior of their strategic counterparts.

Hypothesis 5: Institutional Structure

The last hypothesis posited that institutional structure inhibits effective information exchange because it limits the distribution of shareable information. This accounted for the tortuous path through which information flows within and between

networked organizations. The data generally supported this hypothesis. Appendix B suggests that institutional structure in the Southeast Asian maritime setting is likely to be complex—largely because of the number of anticipated stakeholders aligned with SCS maritime security. And as observed with the information sharing behavior of the Joint Investigation Team in phase 2, this structural complexity results in information stovepiping that limits the distribution of shareable information.⁵²

Conclusion

The chapter documented a case study of the 2014 multinational search for Malaysia Airlines flight MH370 that disappeared over the Southeast Asia maritime region. The study provided a vehicle to more intimately explore the influence of institutional policy, relationships, structure, culture, and network technology on effective information exchange at the operational level between the U.S. Navy and its SCS maritime partners. Constraining the study, however, to predominantly unclassified, open-sourced data limited the completeness of its findings and likely contributed to a number of non-findings. The data, for example, was unable to corroborate the technology hypothesis, which posited that network technology inhibits effective information exchange because it limits the discoverability of information. Interviews or surveys of relevant stakeholders that might confirm issues with interconnectivity between stakeholders—which was a primary consideration for the hypothesis—were simply not found in the data threads. A similar result emerged for the cultural hypothesis, which focused on the influence of meaning-making on effective information exchange.

Despite limitations in the data sources, the study confirmed several hypotheses. In particular, the study confirmed that institutional policy, relationships, and structure all

inhibit effective information exchange by limiting the distribution of available information. It additionally confirmed that policy inhibits effective information sharing because it limits the type of shareable information.

The data also afforded two supplemental findings. First, the data suggested institutional culture limited the distribution of available information. This supported a theoretical proposition identified in the literature. Second, the data showed that strategic-level relationships had significant influence on operational-level information exchange in the case. In particular, the study found strategic-level relationships inhibited effective operational-level information exchange because they encouraged stovepiping: they limited the distribution of shareable information between network stakeholders.

The results of this assessment will be used in chapter 5 to answer the primary research question of this thesis using “analytical generalization.”⁵³ The process of generalizing broadens the findings of the study to characterize the behavior of the SCS maritime information environment, and provide meaningful insights to improve the collaborative capacity of the U.S.-ASEAN operational-level maritime partnership.

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CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Given the size of the Asian maritime domain, no coastal state can provide effective maritime domain awareness on its own. This is why DoD is working closely with partners in the Asia-Pacific region to encourage greater information sharing and the establishment of a regional maritime domain awareness network that could provide a common operating picture and real-time dissemination of data.

— U.S. Department of Defense, *Asia-Pacific Maritime Security Strategy*

Introduction

This thesis investigated the institutional barriers to effective information exchange between the U.S. Navy and its maritime partners in the SCS region. This study topic emerged in chapter 1 in response to a stated U.S. Department of Defense objective to improve the collaborative capacity of its maritime partners in Southeast Asia. It also resulted from observed social behavior in the region indicating intense competition and notable levels of distrust between ASEAN countries, as well as paucity in wholly inclusive information sharing agreements between these regional stakeholders. These two subject threads combined to motivate a study focusing on the information sharing capacity between U.S.-ASEAN operational-level maritime institutions.

Chapter 2 explored relevant literature in organizational theory and psychology, network theory, and information science to provide a theoretical foundation for the principal research method of this thesis: a case study of the multinational search for Malaysia Airlines flight MH370 that disappeared over the Southeast Asia maritime region in 2014. The chapter also answered the three framing questions identified in chapter 1, which undergird the primary research question.

For the first question, chapter 2 adopted a principally semantic definition of ‘information’ and posited it was an uncertainty reduction mechanism that motivated organizational behavior. This implies organizations result from and influence—by consequence of various institutional factors—communicative events that reduce uncertainty in a situation. This shaped the answer to the second question, which defined effective information exchange as a communication event that reduces situational uncertainty to a sufficient level to enable appropriate action or decision-making. Finally, in response to the third framing question, the chapter adopted Chad Whelan’s five organizational factors that impact security network effectiveness—structure, policy, culture, relationships, and technology—as the behavioral factors common to all institutions that impact inter-organizational information exchange.¹ The chapter concluded with theoretical propositions for how each of these factors influences the effectiveness of that exchange.

Chapter 4 detailed the findings of the case study—designed in chapter 3—of the multinational search for flight MH370. The case offered a contemporary and inclusive example of U.S.-ASEAN collaboration on a scale commensurate to expected operational-level maritime security operations in the SCS. The study explored the information sharing behavior in the Southeast Asia maritime environment, using the five institutional factors identified in chapter 2 as its focus variables. The chapter concluded by assessing the hypotheses proposed in chapter 3 against the case findings.

This chapter will use the findings from both chapters 2 and 4 to answer—through “analytic generalization”—the primary research question of this thesis.² The chapter will then offer relevant recommendations on improving the collaborative capacity of the

U.S.-ASEAN maritime partnership and building MDA in the SCS region. It concludes with suggestions for further research.

Answering the Primary Research Question

The primary research question of this thesis asks: what systemic institutional factors in the SCS maritime environment inhibit effective information exchange at the operational level between the U.S. Navy and its partner navies in the region? The case study showed that any of the five institutional factors identified in chapter 2 inhibit effective information exchange between these organizations. The relative severity of each factor's influence is certainly situational, but we at least now have some insight to how each should be anticipated to inhibit the exchange of operationally relevant information between maritime institutions. And this may better inform potential solutions to regional interoperability.

Institutional Culture

The case study demonstrated that institutional culture inhibits effective information exchange in this region because it limits the distribution of available information. In the case, cultural paradigms within the Malaysian and Thai armed forces prevented the timely distribution of radar information to civilian authorities. This behavior coincided with the literature—notably, that the seeming unwillingness to share information resulted from issues of cultural identity and homophily. More broadly, this suggests information will likely be channeled (stovepiped) between culturally similar maritime institutions in this region.

The literature review provided additional insight—which the case data offered no examples to support—to how culture should be expected to inhibit information exchange. Generally, institutional culture will shape the meaning assigned to shared information. This is the semantic offspring of our definition for effective information exchange, but it logically suggests culture can inhibit effective sharing of information because two or more parties may arrive at different interpretations of the available information, simply because institutional cultures shape meaning differently.

These cultural barriers of homophily and semantics suggest the U.S. Navy needs some method, as Gerald Peppers offers, of “boundary [spanning].”³ This often occurs via foreign staff officer exchange programs to ensure the U.S. has a liaison on either side of the relational link. But, as the case showed, realizing MDA and improving the willingness of regional partners to share sensitive information may require more than just liaisons. Instead, it will require some method of building a sense of common identity between partners—some way of spanning the homophily divide to make it seem that each side of the relational link is less distinct than the other. In the author’s view, this means creating a common U.S.-ASEAN culture—similar to the North Atlantic Treaty Organization—where each member is viewed as a SCS security partner instead of a member of the U.S. Navy, the Republic of Singapore Navy, the Royal Malaysian Navy, or similar.

Network Technology

The case study showed that the effectiveness of information sharing may degrade by consequence of data saturation made possible by highly connected network systems. The case offered multiple examples of critical information being delayed on account of

data processing lead times. Though this did not necessarily demonstrate issues with connectivity between stakeholders, it did supplement a theoretical proposition offered in chapter 2, which posited: network technology influences effective information exchange because it limits the discoverability of relevant information. This results because increasingly complex network systems stovepipe information. These systems also connect institutions to an overwhelming amount of data for which it seems they are ill prepared to process in a timely manner.

The author's personal experience operating with maritime organizations in this region also suggests connectivity between these institutions remains an issue. Other professional studies support this observation.⁴ We can expect then that network technology will also influence the distribution of information.

These technology issues of connectivity and data saturation suggest the U.S. Navy needs to work with its ASEAN counterparts to develop a common information system architecture, as well as a robust collective data analysis body. The Center for a New American Security offers keen insights to the architecture problem.⁵ The data analysis body will likely require a closely integrated structure similar to a multinational task force—a U.S.-ASEAN combined task force located at a common geographical location (like Singapore's Information Fusion Centre).⁶

Institutional Policy

The case study had clear examples showing institutional policy inhibiting the distribution of available information. Malaysia's control-seeking policies, which closely guarded information until the government or investigation teams were ready to release it, inhibited timely sharing with search partners and the public at-large. Further, the U.S.

policy to share information principally with the UK and Australia similarly stovepiped information threads. These findings are theoretically supported in chapter 2.

The literature review offered one additional method in which policy inhibits information sharing. The findings in chapter 2 suggested policy determines the type of shareable information, and thus limits (based on relationships) which network stakeholders have access to various forms of information. Though this was not a major finding in the case study, we can infer from the U.S. information sharing behavior with the UK and Australia that it is a reasonable proposition. We, therefore, see that institutional policies of maritime institutions in this region will control the type and distribution of available information.

The policy issues of information type and distribution suggest the U.S. Navy—and, really, the U.S. departments of state and defense—needs to drive the creation of a common U.S.-ASEAN information sharing agreement. This clearly requires improved levels of trust between regional partners, but a collective agreement (if possible) would place partners on equal footing to share sensitive information with a common U.S.-ASEAN body that forges security in the region's maritime domain.

Network Relationships

The case study provided ample evidence showing that relationships rooted in distrust inhibited intra-network information sharing. Though distrust between operational-level institutions was evident in the case, the primary relational barriers were born from the strategic level. This means strategic-level relationships inhibited effective information exchange at the operational level—principally by stovepiping available information. The strong strategic-level relationship between the U.S. and Australia, for

example, motivated a policy that enabled sharing of sensitive information between the two, but limited the distribution of this information to other network stakeholders.

The case findings corroborate a theoretical proposition in chapter 2, which posited that relationships influence effective information exchange because they shape the amount and distribution of available information. The key update to this proposition from the case study findings is the powerful influence of strategic-level relationships on the availability and distribution of operational-level information. This suggests that a significant barrier to operational-level information exchange between U.S. and ASEAN maritime institutions will be the level of trust between their parent stakeholders at the strategic level.

The relationship issue of trust suggests the U.S. Navy needs to continue working with its ASEAN counterparts on cooperative exercises, for example, that promote interoperability and improved collaboration. These types of activities strengthen ties with regional partners by creating immersive situations that force improved understanding of the stakeholders involved. But, this sort of cooperation still requires improving strategic-level relationships between relevant actors. The U.S. Navy can help facilitate these improved relationships through key leader engagements and other strategic-level maritime dialogue events, but relationship building at the strategic level requires continued positive engagement between national leaders in the region.

Institutional Structure

The case data offered limited insights to the influence of institutional structure on effective information exchange. The evidence demonstrated, however, that maritime security at the operational level in the SCS region is not strictly the business of the U.S.

Navy or its ASEAN counterparts. Rather, the case showed maritime security has numerous civilian and government agency stakeholders with their own institutional structures. A few examples from the case—such as the delayed sharing of relevant radar, satellite, and aircraft parametric data between distinct elements of the Joint Investigation Team—revealed that these various structures inhibited information sharing by developing information stovepipes.

The theoretical foundations derived from the literature support these findings. In general, analysis of the literature revealed that institutional structure influences effective information exchange because it determines the amount and distribution of available information. This finding results from the fact organizational structure morphs in response to a changing external environment—as the derivative of sensemaking processes designed to reduce uncertainty. It is reasonable to conclude, then, that regional maritime institutions will continue to limit the distribution of available information on account of increasingly complex organizational structures and processes resulting from an increasingly complex external maritime environment.

These structural issues suggest the U.S. Navy should work with its ASEAN counterparts to develop a central regional coordination center—an information or command and control hub that forces information to channel to it for analysis and decision-making. A central, geo-located decision or information analysis body would fold in relevant stakeholders from U.S. and ASEAN civilian and military agencies, and eliminate potentially competing sensemaking structures.

Recommendations

In the author's view, solutions that address each of the five institutional barriers independently do not facilitate the comprehensive improved information-sharing ethos needed between U.S. and ASEAN stakeholders to achieve MDA in the SCS. This is because discrete solutions neglect the networked and varying interplay between each of the factors—like the intuitive influence of relationships on policy, or policy on technology. The recommendations of this thesis therefore divide along two broader efforts that attempt to address the aggregate influence of the five institutional factors on information exchange.

The first effort is straightforward: U.S. and ASEAN maritime stakeholders need to continuously pursue improved strategic-level relationships. If we consider, holistically, the base stimuli shaping how many of the institutional factors influenced organizational behavior in the case study, we see that the health of strategic-level relationships undergirded how each of those factors inhibited information sharing between operational-level stakeholders. Trust is key to everything—it shapes the nature of policies; it determines which stakeholders have interoperable information systems; and it drives lower-level institutional relationships. Healthy strategic-level relationships remove many institutional barriers to effective information exchange and open the doors to improved regional collaborative capacity.

Recent U.S. activities, though, threaten to erode strategic-level relationships with its ASEAN counterparts. The nationalistic rhetoric of President Trump's new administration, and its January 2017 withdrawal from the Trans-Pacific Partnership free trade accord, for example, signal U.S. reclusion from its partners in Southeast Asia and

open the door for other global powers (like China) to more readily influence regional relationships—in a way that is potentially detrimental to U.S. interests.⁷ Cambodia’s April 2017 ousting of a U.S. Navy Seabee construction battalion is a clear example of this issue.⁸

This thesis is not poised—nor is it intended—to be a critique of the Trump administration, but if the U.S. is serious about building partner capacity and achieving maritime domain awareness in the SCS, this thesis argues the U.S. cannot neglect its ASEAN partners on account of politics. In some legitimate and meaningful way, the administration needs to signal its commitment to its Southeast Asia partners—to rekindle eroding strategic-level relationships. This may come in the form of bilateral trade agreements with these countries, as the Trump administration suggested upon its withdrawal from the Trans-Pacific Partnership, or through wholly-inclusive information sharing agreements with its ASEAN partners—which convey trust.⁹ Whatever the mechanism, the U.S. needs to behave as a demonstrably better alternative to its regional competitors in order to cultivate strategic-level relationships in Southeast Asia that facilitate improved information sharing in the region.

The second effort is the development of a common U.S.-ASEAN command and control node—a single geo-located command center (like Singapore’s Information Fusion Centre) with an agreed-upon command structure, standard operating procedures, and information systems.¹⁰ This builds upon a key recommendation from a 2014 thesis completed by Tran Duc Huong, which advocates “forming a standing [ASEAN] military body . . . [that] would function as a central command and control cell in charge of coordinating joint military cooperative efforts under existing or future ASEAN military

cooperation frameworks.”¹¹ This recommendation is also consistent with a 2016 proposal from the Center for Strategic and International Studies calling for the creation of a “Joint Task Force for Maritime Security” in the western Pacific to help the U.S. realize its burgeoning posture in the region and facilitate maritime security.¹² Though the focus of a U.S.-ASEAN coordination hub would be to specifically facilitate SCS maritime security via a multinational approach, the idea for a hub is an extension of the U.S. joint maritime task force concept.

A common command and control center solves a number of institutional information barriers. First, member nations would all have a stake in the performance of the center: it would place each stakeholder on equal footing with equal demands to provide information and security. This would likely force the creation of a common U.S.-ASEAN information sharing agreement, which would help remove policy barriers to stakeholder collaboration. Moreover, the central hub—as a cooperative venture—would help lower cultural barriers to information sharing by fostering a collaborative ethos and forging a common U.S.-ASEAN maritime security identity. Of course there are potential pitfalls to this arrangement—notably, that institutional relationship barriers can emerge if stakeholders fail to shoulder their share of the burden, as perceived in similar institutions like the North Atlantic Treaty Organization.¹³

Second, a common control center with U.S.-ASEAN information systems can potentially lower many of the technology barriers to information sharing by providing common architecture standards, protocols, and hardware. Again, the Center for a New American Security offers robust analysis of the challenges and opportunities to realize a common information infrastructure in the region.¹⁴ Finally, a common control center can

employ standardized decision-cycle processes that will lower structural barriers between institutions. The Multinational Interoperability Council's *Coalition Building Guide* offers example strategies to develop this standardized framework.¹⁵

Singapore—as a founding member of ASEAN; as Asia's largest financial center; and with the region's "best trained" and "most advanced" military—is well-positioned to lead the creation of an ASEAN command and control hub.¹⁶ This means it has both the capacity and regional influence to assist the U.S. in forging baseline information sharing agreements with ASEAN; spanning cultural divides to bring regional stakeholders together in a common security collective; leading the pooling of resources to materialize a coordination hub; and creating an organizational framework that optimizes data analysis and sensemaking for more timely decision-making. This small island city-state is in fact already demonstrating its capacity to service many of these roles. Singapore, for example, is sponsoring—alongside the U.S.—an information sharing working group to share best practices and foster the development of a regional collaborative ethos in Southeast Asia.¹⁷ And its Information Fusion Centre, as a potential hub location, already facilitates annual information sharing exercises with the U.S. and other SCS stakeholders.¹⁸ This thesis therefore recommends that the U.S. leverage its strategic partnership with Singapore to facilitate the creation of a U.S.-ASEAN command and control hub.

Suggestions for Further Research

A principal limitation in the research method employed in this thesis is an inability to provide fidelity in the behavioral nature of each institutional factor for a given network pairing—how institutional structure, for example, exactly influences information

sharing between the U.S. Navy and its Singaporean counterpart. The case study method provides ample detail to generalize conclusions about a given research topic, but is limited in its ability to provide detailed link analysis for network stakeholders—to better understand the institutional barriers to information exchange between actors. The findings of this thesis can certainly be refined, then, by conducting a social network analysis of the U.S.-ASEAN maritime security network. Christina Prell offers insights to how to conduct such a study.¹⁹

The creation of a centralized U.S.-ASEAN command and control hub is undoubtedly no small undertaking. The *Coalition Building Guide* and North Atlantic Treaty Organization provide example frameworks for how such a hub may materialize and function, but they may not be the best models for Southeast Asia. Additional studies in the feasibility and design of a U.S.-ASEAN centralized command center would advance the findings of this thesis, and help chart a course to improving the information sharing behavior in the region.

Finally, the recommendation to develop a centralized U.S.-ASEAN command and control hub to solve many of the barriers to information sharing between maritime institutions in the region unintentionally suggests ASEAN is the only appropriate regional body to partner with to achieve MDA in the SCS. The case study showed numerous other countries and maritime institutions have a stake in the SCS—like Japan, Australia, and the UK. The author posits ASEAN offers a good starting body for the U.S. to partner with to achieve maritime security—through improved U.S.-ASEAN information sharing—in the SCS, but suggests future studies explore the validity of this position and assess alternatives that include other Asia-Pacific stakeholders.

Conclusion

This thesis materialized from a desire to understand how the U.S. Navy can achieve improved interoperability with its ASEAN counterparts to facilitate future maritime security and MDA in the SCS region. We in military institutions often first consider technological barriers to interoperability, but fail to consider other issues that may have equally significant influence. This thesis looked specifically at the issue of multinational information sharing—a foundational element of collaboration between stakeholders—and explored the institutional barriers to interoperability. These barriers are the human contribution to collaborative struggles on an international stage that must be considered if concepts like regional MDA will ever come to fruition. Improving U.S.-ASEAN strategic-level relationships and developing a central SCS command and control center are suggested methods to remove these institutional barriers.

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³ Gerald L. Pepper, *Communicating in Organizations: A Cultural Approach* (New York: McGraw-Hill, 1995), 180.

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⁷ The Straits Times, “U.S. Exit from TPP: What it Means and What Could Happen Next,” February 1, 2017, accessed May 10, 2017, <http://www.straitstimes.com/world/united-states/5-things-to-know-about-trans-pacific-partnership-tpp-free-trade-pact>.

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¹¹ Tran Duc Huong, “Transnational Security Challenges in Southeast Asia: The Need for Multinational Military Cooperation and Coordination in ASEAN” (Master’s thesis, U.S. Army Command and General Staff College, 2014), iv, 88-89, accessed March 4, 2017, <http://cgsc.contentdm.oclc.org/cdm/ref/collection/p4013coll2/id/3245>.

¹² Michael Green et al., *Asia-Pacific Rebalance 2025: Capabilities, Presence, and Partnerships, An Independent Review of U.S. Defense Strategy in the Asia-Pacific* (Washington, DC: Center for Strategic and International Studies, 2016), 199, accessed April 26, 2017, <https://www.csis.org/analysis/asia-pacific-rebalance-2025>.

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¹⁵ Multinational Interoperability Council, *Coalition Building Guide*, vol. 1, *Military Strategic Overview, Version 1.3*, 3rd ed. (Washington, DC: Multinational Interoperability Council Steering Group, March 2015), accessed April 8, 2017, https://community.apan.org/wg/mic/m/mic_cbg/144296.

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¹⁷ U.S. Department of Defense, *Asia-Pacific Maritime Security Strategy*, 28.

¹⁸ Prashanth Parameswaran, “U.S., ASEAN States Launch Maritime Exercise in Singapore: SEACAT Kicked off on August 22,” *The Diplomat*, August 25, 2016,

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APPENDIX A

MALAYSIA AIRLINES FLIGHT MH370 SEARCH AND RESCUE TIMELINE

Table 1 provides a timeline of significant information events during the first seven weeks of the multinational search for Malaysia Airlines flight MH370. The table is divided along three information periods that correspond to distinct shifts in the search behavior, which emerged in response to analysis of available aircraft and sensor information.

Table 1. Timeline of Key Information Events: March 7-April 30, 2014	
Phase 1: March 7 -15	
Date, Time (UTC)	Event
7 Mar 2014, 1642	MH370 departed Kuala Lumpur International Airport (Malaysia) destined for Beijing (People’s Republic of China). ¹
7 Mar 2014, 1719	Kuala Lumpur Air Traffic Control Centre “instructed MH370 to contact Ho Chi Minh Air Traffic Control Centre” (Vietnam) as part of the air traffic control transfer process between the two control centers; MH370 acknowledged with its last recorded radio transmission, “Good night Malaysia Three Seven Zero.” ²
7 Mar 2014, 1720	The Lumpur primary air traffic control radar tracked MH370 passing through waypoint IGARI (the air traffic control transfer point approximately midway between Kuala Lumpur and Ho Chi Minh City over the Gulf of Thailand); MH370 subsequently dropped from the Lumpur primary radar. ³
7 Mar 2014, 1721	MH370 dropped from the Lumpur secondary air traffic control radar. ⁴ This was the last ‘in situ-observed’ civilian radar contact on MH370. Royal Malaysian Air Force military radar, however, showed the aircraft “making a constant left turn to a [southwestern] direction.” ⁵ Civil aviation authorities were unaware of this fact.
7 Mar 2014, 1739	Ho Chi Minh Air Traffic Control Centre—having no radio communication with or radar contact on MH370—“queried [Kuala Lumpur Air Traffic Control Centre] on the whereabouts of MH370.” ⁶

7 Mar 2014, 1802	Royal Malaysian Air Force military radar held contact on MH370 over Pulau Perak, a “small island [in] the Straits of Malacca.” Civil aviation authorities were unaware of this fact. ⁷
7 Mar 2014, 1822	Royal Malaysian Air Force military radar lost contact on MH370 approximately 20 km west of waypoint MEKAR in airway N571 over the Malacca Strait. ⁸ The Air Force maintained continuous contact on MH370 from its abrupt westward turn over the Gulf of Thailand to MEKAR. Civil aviation authorities were unaware of this fact.
7 Mar 2014, 2130	After hours of failed attempts to determine the location of MH370 via collaboration with Malaysia Airlines and other regional civilian air traffic control centers, Kuala Lumpur Air Traffic Control Centre “activated” the Kuala Lumpur Aeronautical Rescue Coordination Centre. ⁹ The Coordination Centre initiated notification procedures to relevant regional agencies and began planning the initial search effort in the vicinity of MH370’s last known civilian radar position over the Gulf of Thailand. ¹⁰
8 Mar 2014, 1430	Malaysian Royal Air Force notified Kuala Lumpur Aeronautical Rescue Coordination Centre of MH370’s western flight path across the Malay Peninsula, as well as its last military radar position over the Malacca Strait. While weighing the certainty of this information, Malaysian authorities directed multinational search assets to areas straddling the Malay Peninsula. ¹¹
15 Mar 2014, -	The Prime Minister of Malaysia suspended search and rescue operations east and west of the Malay Peninsula. The multinational search effort, instead, shifted focus to a north-south search corridor in the Indian Ocean. ¹² The suspension of operations in the original search areas resulted from data analysis conducted by the Joint Investigation Team indicating MH370 flew for an additional six hours following the last military radar contact over the Malacca Strait. The new search corridor reflected a supposed southerly course maneuver over the Andaman Sea, “aircraft performance limitations,” and the most likely crash location defined by the positional arc calculated from the “Burst Timing Offset” of MH370’s last Inmarsat satellite handshake. ¹³
Phase 2: March 17-30	
17 Mar 2014, -	The Australian Maritime Safety Authority becomes the lead coordination authority for the newly refined multinational search corridor: a 600,000 km ² area located 2,500 km west of Perth and referred to as areas S1, S2, and S3 (shown in figure 2). ¹⁴
18 Mar 2014, -	The Australian Maritime Safety Authority launches initial air search of areas S1, S2, and S3. ¹⁵ The Kuala Lumpur Aeronautical Rescue Coordination Centre and the Indonesian National Search and Rescue Agency (BASARNAS) also reportedly coordinated multinational air search assets in these areas. ¹⁶

20 Mar 2014, -	Based on “expert assessment” of imagery captured by a commercial satellite organization on 16 Mar 2014, the Australian Maritime Safety Authority redirected air search assets to search for potential aircraft debris in a location south of S1, S2, and S3. ¹⁷
23 Mar 2014, -	The People’s Republic of China provided satellite imagery to the Australia Maritime Safety Authority showing potential aircraft debris within S1, S2, or S3. ¹⁸ The Kuala Lumpur Aeronautical Rescue Coordination Centre and the Indonesian National Search and Rescue Agency (BASARNAS) also reportedly end their joint coordination of multinational search assets in areas S1, S2, and S3. ¹⁹
24 Mar 2014, -	Citing information provided by Inmarsat, the Malaysian prime minister officially declared flight MH370 ended in the southern Indian Ocean. ²⁰
26 Mar 2014, -	The Malaysia Remote Sensing Agency provided the Australia Maritime Safety Authority with satellite imagery of potential aircraft debris within S1, S2, or S3. ²¹
27 Mar 2014, -	The Australia Maritime Safety Authority revised the size and location of the search area based on refined data analysis provided by the Joint Investigation Team in Malaysia. The new area—named S4 and S5 (shown in figure 3)—reflected refined aircraft parametric data, as well as increased confidence in Malaysian radar data. ²² The combined S4/S5 search area is approximately 1,100 km northeast of areas S1, S2, and S3; encompasses a 319,000 km ² area. ²³
28 Mar 2014, -	The Australian Maritime Safety Authority commenced “surface search” operations in the S3 and S4 overlap region. ²⁴
Phase 3: Mar 31 – Apr 30	
30 Mar 2014, -	The Australian Prime Minister established the Joint Agency Coordination Centre as a communications hub for media, families, and relevant multinational agencies. ²⁵ The Australian Maritime Safety Authority continued tactical level coordination of multinational search assets. ²⁶
31 Mar 2014, -	“[The Joint Agency Coordination Centre] becomes operational.” ²⁷ The multinational search “transitioned from a search and rescue operation to an investigation phase.” ²⁸
1 Apr 2014, -	The Joint Investigation Team in Malaysia provided the Australia Transport Safety Bureau and the Australia Maritime Safety Authority revised MH370 flight analysis. This resulted in shifting the most likely impact area north to within search areas S4 and S5. ²⁹
2 Apr 2014, -	The Australia Maritime Safety Authority commenced surface search operations in areas S4 and S5. ³⁰

3 Apr 2014, -	The Chinese Maritime Safety Administration vessel (MV <i>Haixun</i> 01) detected 37.5 kHz acoustic pulses in search area S4. This frequency correlates with the transmission frequency of the Dukane DK100 acoustic beacons packaged with the flight data recorders installed aboard MH370. ³¹
4 Apr 2014, -	The Chinese Maritime Safety Administration vessel (MV <i>Haixun</i> 01) detected an additional set of 37.5 kHz acoustic pulses approximately three km west of the previous day's reception location. ³² However, the crew of MV <i>Haixun</i> 01 were reportedly unable to record this detection event, or the previous, for future analysis. ³³
5 Apr 2014, -	The Australian Defence Vessel <i>Ocean Shield</i> (ADV-OS) detected 33 kHz acoustic pulses while operating a U.S.-provided towed pinger locator in search areas S4 and S5. ³⁴ The Joint Agency Coordination Centre confirmed the Chinese Maritime Safety Administration (MV <i>Haixun</i> 01) detected acoustic pulses on 3-4 Apr, but could not verify the origin of the signals. ³⁵
8 Apr 2014, -	The Australian Defence Vessel <i>Ocean Shield</i> (ADV-OS) detected 33 kHz acoustic pulses with the U.S.-provided towed pinger locator. ³⁶
11 Apr 2014, -	Based on analysis conducted by the Joint Acoustic Analysis Centre, the Joint Agency Coordination Centre reported that the signals detected by the Australian Defence Vessel <i>Ocean Shield</i> (ADV-OS) on 5 April were unlikely to be from MH370. ³⁷
14 Apr 2014, -	The Australia Maritime Safety Authority commenced undersea search operations with a Bluefin-21 autonomous underwater vehicle deployed from the Australian Defense Vessel <i>Ocean Shield</i> (ADV-OS). ³⁸ Despite analysis suggesting the 33 kHz acoustic pulses detected by <i>Ocean Shield</i> were unlikely to be from MH370's flight data recorders, the Safety Authority decided to deploy the Bluefin-21 in the detection area to search for the aircraft. The acoustic signals were the best available data on MH370's likely resting location. ³⁹
30 Apr 2014, -	Commander, U.S. Navy Seventh Fleet recalled its remaining aircraft and support ship from the MH370 search in the southern Indian Ocean and reassigned them to other national tasking. ⁴⁰

Search areas for flight MH370 in southern Indian Ocean

Figure 2 shows the initial multinational search areas (S1, S2, and S3) in the southern Indian Ocean. These areas resulted from analysis of regional radar and

aircraft-INMARSAT satellite handshake timing data. Figure 3 shows refined search areas (S4 and S5) north of these original search locations, which emerged from additional analysis of aircraft performance and radar data.

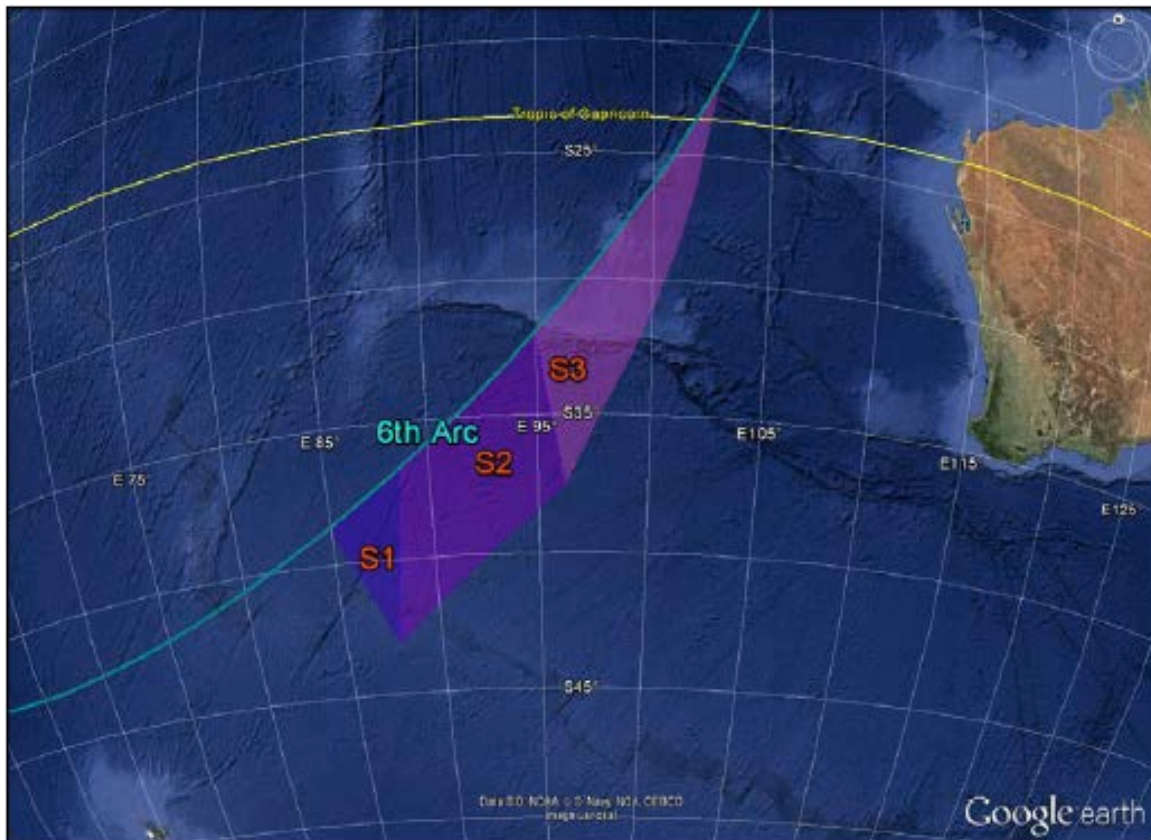


Figure 2. Initial multinational search areas for flight MH370 in the southern Indian Ocean (revealed by the Joint Investigation Team on March 17, 2014)

Source: Australian Government, *Australian Transport Safety Report: MH370—Definition of Underwater Search Areas* (Canberra: Australian Transport Safety Bureau, July 30, 2015), 5, accessed March 11, 2017, http://www.atsb.gov.au/media/5668327/ae2014054_mh370__search_areas_30jul2015.pdf.

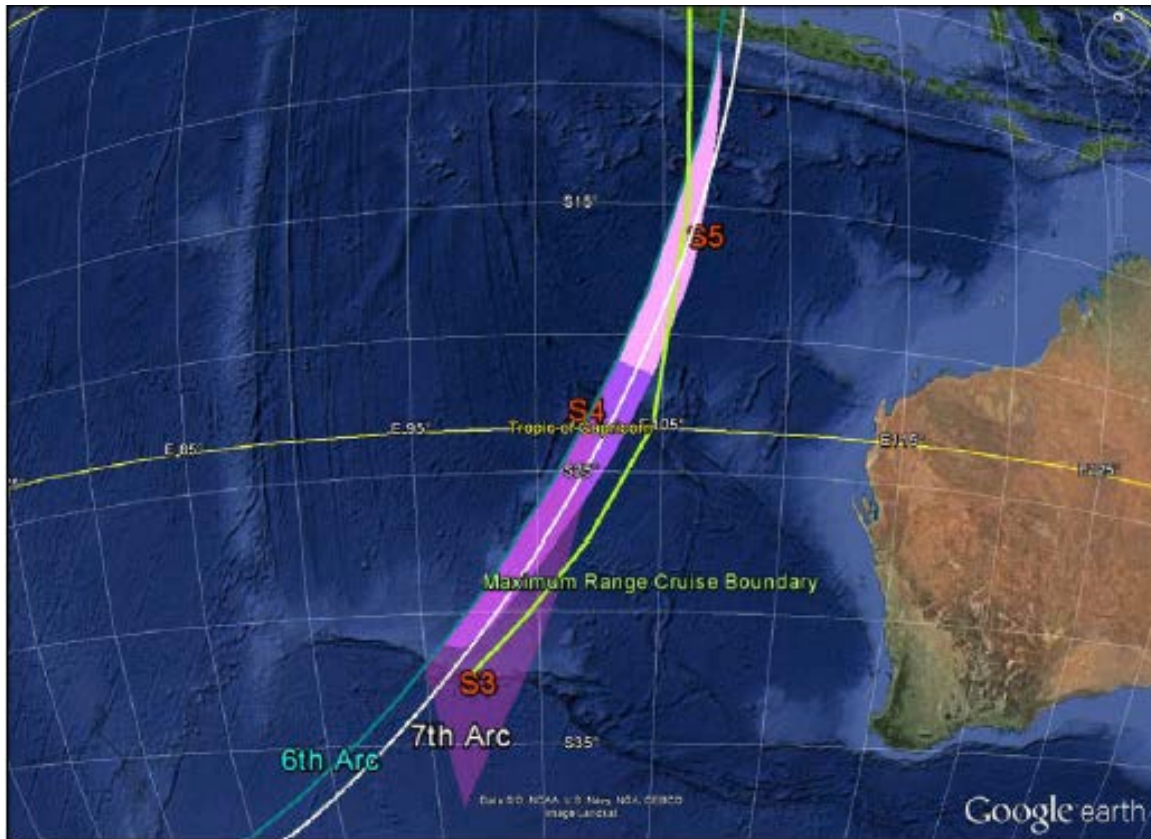


Figure 3. Refined multinational search areas for flight MH370 in the southern Indian Ocean (updated by Joint Investigation Team on March 27, 2014).

Source: Australian Government, *Australian Transport Safety Report: MH370—Definition of Underwater Search Areas* (Canberra: Australian Transport Safety Bureau, July 30, 2015), 6, accessed March 11, 2017, http://www.atsb.gov.au/media/5668327/ae2014054_mh370__search_areas_30jul2015.pdf.

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⁴ Malaysia Ministry of Transport, *Factual Information*, 2.

⁵ Ibid., 2-3.

⁶ Ibid., 2.

⁷ Ibid., 3.

⁸ Ibid., 3.; Australian Government, *Australian Transport Safety Report: MH370—Definition of Underwater Search Areas* (Canberra: Australian Transport Safety Bureau, July 2015), 38, accessed March 11, 2017, http://www.atsb.gov.au/media/5668327/ae2014054_mh370__search_areas_30jul2015.pdf.

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¹⁰ International Civil Aviation Organization, *MH370 Search and Rescue Operations and Lessons Learnt*, 3.

¹¹ Ibid., 4.

¹² Ibid.

¹³ Australian Transport Safety Bureau, *MH370—Definition of Underwater Search Areas*, 5, 16-21.

¹⁴ Ibid., 5.

¹⁵ Australia Government, *Media Release: Search Operation for Malaysian Airlines Aircraft: Update 2* (Canberra: Australian Maritime Safety Authority, March 18, 2014), accessed March 21, 2017, <http://www.amsa.gov.au/media/documents/18032014MH370Update2.pdf>.

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²³ Australian Transport Safety Bureau, “Timeline of AMSA’s involvement.”

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³⁰ Ibid.

³¹ Ibid., 11.

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³⁵ Australian Government, *Media Reporting on Chinese Detection of Electronic Pulse Signals* (Perth: Joint Agency Coordination Centre, April 5, 2014), accessed March 21, 2017, <http://jacc.gov.au/media/releases/2014/april/mr010.aspx>.

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³⁹ Australian Transport Safety Bureau, *MH370—Definition of Underwater Search Areas*, 14.

⁴⁰ James Kimber, “U.S. Navy Aircraft, Ship Recalled from Search for Malaysia Airlines Jet,” *Stars and Stripes*, April 30, 2014, accessed March 22, 2017, <http://www.stripes.com/news/pacific/us-navy-aircraft-ship-recalled-from-search-for-malaysia-airlines-jet-1.280677#.WnK5tRiZNo5>.

APPENDIX B

KEY STAKEHOLDERS IN MALAYSIA AIRLINES FLIGHT MH370 SEARCH

Figure 4 provides a non-inclusive list of stakeholders involved in the multinational search for Malaysia Airlines flight MH370. It is included principally to illustrate the breadth and complexity of the multinational search structure. The names of these organizations materialized as the author reviewed relevant literature for the case study. Though not attributed to any particular source, most of these names were found in literature cited in the notes for chapter 4, as well as in the bibliography.

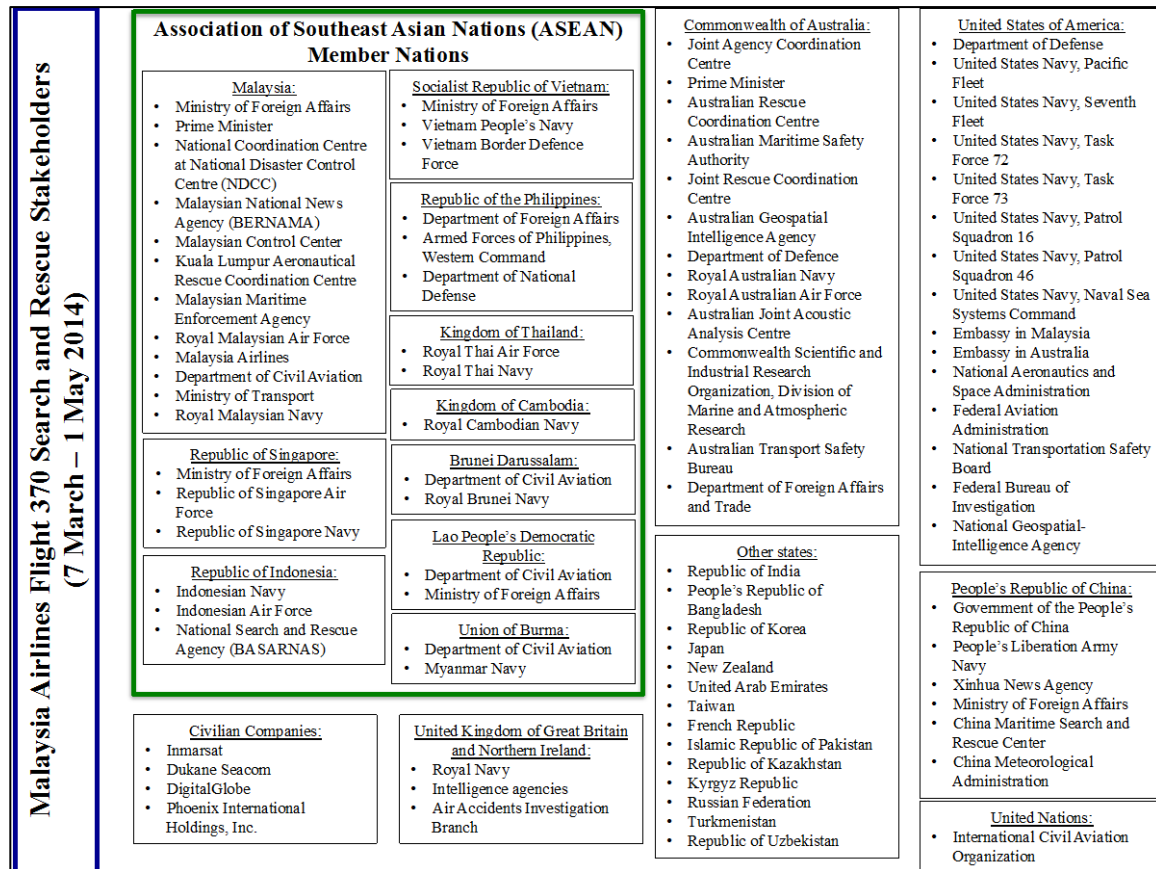


Figure 4. Institutional stakeholders involved with the multinational search for Malaysia Airlines flight MH370

Source: Created by author.

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