



Game Report



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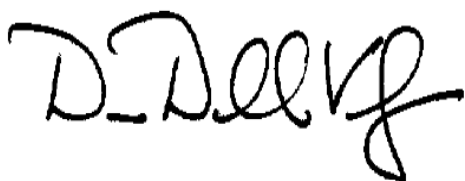
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The War Gaming Department of the U.S. Naval War College hosted the Maritime Domain Awareness (MDA) Operational Game 18-23 July 2010. The following document was prepared by the War Gaming Department faculty and has been reviewed by the appropriate game sponsor staff personnel. The findings in this report reflect the observations, insights and recommendations that were derived from the participants during game play.

The War Gaming Department conducts high quality research, analysis, gaming, and education to support the Naval War College mission, prepare future maritime leaders, and help shape key decisions on the future of the Navy. The War Gaming Department strives to provide interested parties with intellectually honest analysis of complex problems using a wide range of research tools and analytical methodologies.

Game reports are developed for the game sponsor; however, the game report and related data may be available on an as-requested basis. For additional information please contact the Chairman, War Gaming Department, Naval War College, 686 Cushing Road, Newport, RI 02841 or via electronic mail at wargaming@usnwc.edu. Further information may be found on our website, located at www.usnwc.edu/wargaming.



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I. EXECUTIVE SUMMARY

A. Game Background.

The War Gaming Department of the U.S. Naval War College hosted the Maritime Domain Awareness (MDA) Operational Game on 18-23 July, 2010. Game sponsor was OPNAV N2/N6 on behalf of the Chief of Naval Operations, ADM Gary Roughead.

B. Game Purpose.

To enhance information sharing with international partners for Maritime Domain Awareness in order to support International Seapower Symposium XX.

C. Game Objectives.

- i. Examine regional MDA related relationships and networks in order to identify key elements of success, commonalities, and best practices.
- ii. Expose impediments to effective information sharing.
- iii. Identify options for broad based international maritime information sharing.

D. Player information.

- i. MDA and MDA related information sharing experience was the primary criteria for CNO selection as a participating nation.
- ii. 38 players represented 12 invited nations.
 1. Participating nations were: Bahrain, Brazil, Colombia, India, Italy, Japan, Pakistan, Singapore, South Africa, Sweden, United Kingdom, United States

E. Commonalities discovered during the game.

- i. Maritime Domain Awareness is an accepted term with the following definition. "The effective understanding of anything associated with the maritime domain (on, below, or above the sea) that could impact security, safety, economy, or environment of a nation.
- ii. Reasons for sharing information
 1. Receive information through reciprocal sharing
 2. Improve capacity of sharing partners to take actions which support one's own national objectives (e.g., to interrupt in their own territory smuggling operations which affect both countries).
- iii. Interoperability within an information sharing coalition
 1. Information sharing must be voluntary in nature.
 2. Rules for sharing must be equally applied to all members.
 3. Information assurance must be resolved to the satisfaction of each member.
- iv. Impediments to information sharing.
 1. Lack of interagency process creates internal and external information sharing impediments.
 2. Integration of legacy systems and technologies has been a significant internal challenge.
 3. Domestic legal and policy restrictions inhibit internal and external sharing.

F. Technology Integration.

- i. Each delegation expressed their preference to retain their current systems (regional) instead of adopting a new, common (Global) system. However, integrating extant systems into a global information sharing network was welcomed by all of the players.
- ii. Ideally, this multi-layer information-sharing architecture would be sufficiently adaptable and flexible, to cover new technologies over time and permit integration of legacy systems.
- iii. Players recommended taking an international approach to examining technical communication and networking interoperability between regional systems.
- iv. Identification of an information sharing structure - Analysis of the game and thousands of in-game sharing decisions surfaced four key elements of an acceptable international information sharing structure.
 1. A common commitment to share. Under this construct, governments would endorse statements of principle in support of maritime safety and security through information sharing. An outcome of this activity would be that trust and confidence between governments endorsing these principles would increase; this increased trust and confidence was noted by the players as a necessary first step toward building any functional information sharing system.
 2. Global sharing. The term refers to a sharing network or federations of networks that is global in scope and which carries information of the lowest sensitivity, namely ship characteristics and location data such as that broadcast on the Automated Identification System (AIS). Game results indicated that this structure provides the highest possible volume of sharing for this low level information due to the large number of members. In order to achieve the large membership that is critical to the effectiveness of this structure, the barriers to entry to join must be very low, permitting any government, agency, non-governmental organization or commercial entity to join. This produces an environment where information is shared nearly universally at a sensitivity level low enough to allay security concerns.
 3. Formal sharing. This element provides a mechanism for the sharing of more detailed and sensitive information within smaller groups of participants. The key characteristic of this type of sharing is the presence of a formal agreement between the members that provides a legal or policy framework for the sharing of information.
 4. Ad-hoc sharing. This type of sharing occurs where there is no formal agreement in place. It allows for gaps between formal agreements to be filled and may often be the only possibility for

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sharing with certain organizations due to political or diplomatic constraints.

G. Recommendations.

- i. Initiate and support an initiative leading to a common commitment to share and which leads to endorsement of sharing principles by multiple countries.
- ii. Move forward with a structure for Global sharing either by creating a new arrangement to link existing MDA networks or greatly expand those networks that are already quite robust.
- iii. Move forward with the creation of formal sharing groups.
- iv. Work toward coalescing similar bilateral agreements into sharing groups in order to take advantage of the additional sharing volume inherent in group-based sharing.
- v. Build Ad-Hoc sharing relationships into more formal sharing agreements by capitalizing on the trust and confidence built during an Ad-Hoc event.

II. INTRODUCTION

A. Overview

The Wargaming Department of the U.S. Naval War College hosted the Maritime Domain Awareness (MDA) Operational Game on 18-23 July, 2010. The game was sponsored by OPNAV N2/N6 on behalf of the Chief of Naval Operations, ADM Gary Roughead. The game was held in McCarty Little Hall at the Naval War College in Newport, Rhode Island.

The MDA Operational Game featured 94 participants including 38 players representing 12 countries, all of which were selected based on their widely dispersed locations as well as their previous MDA and MDA-related information sharing experience. The following nations participated: Bahrain, Brazil, Colombia, India, Italy, Japan, Pakistan, South Africa, Singapore, Sweden, the United Kingdom and the United States.

B. Background

As declared in the U.S. Maritime Strategy, A Cooperative Strategy for 21st Century Seapower and affirmed at the 19th International Seapower Symposium (ISS XIX) in October 2009, cooperative relationships between nations contribute to a secure and stable maritime domain. A focus of ISS XIX was the improvement of Maritime Domain Awareness (MDA) and the broadening of information sharing between nations and navies in support of it.

In an effort to share ideas and initiatives that have been developed independently across the globe, the U.S. Chief of Naval Operations (CNO), Admiral Roughead, stated during ISS XIX that an international game would be held at the Naval War College to explore the operational implications of MDA.

C. Purpose for this Study/Objectives

The purpose of the game was to enhance information sharing with international partners for Maritime Domain Awareness in order to support ISS XX. In support of this purpose, there were three objectives:

- Examine regional MDA related relationships and networks in order to identify key elements of success, commonalities, and best practices.
- Expose impediments to effective information sharing.
- Identify options for broad based international maritime information sharing.

D. Research Questions

In order to better understand the type of information that is shared across the various international information sharing structures, the MDA Operational game sought to deductively answer the following research question: “Based on the information sharing models that were employed in this game, what is the preferred structure for international information sharing that provides each entity with the most volume and detail of maritime information?”

A supporting research question for this game was: “To what extent do interagency challenges within a country impact the ability to share information with other countries?”

E. Identification of Hypotheses

The MDA Operational game examined four specific hypotheses (H1-H4) and a null hypothesis (H0) on the subject of international maritime information sharing. These hypotheses were crafted after reviewing scholarly literature in the area of Maritime Domain Awareness, interviewing experts in the fields of MDA and international maritime information sharing, and examining existing international maritime information structures. The hypotheses studied in this one-sided game were framed from a multinational perspective. These were as follows:

H1: – In the Global unrestricted information sharing model, players will share a high volume of information with low detail.

H2: – When compared with the Global unrestricted information sharing model, players using the Coalition Model will share a high volume with more detail.

H3: - In the Bilateral Model, players will share the lowest volume of information, but the information that they do share will be the most detailed.

H4: – The structure of information sharing that provides the most volume and detail will be a combination of models.

H0: – Null: There is no relationship between the information sharing models employed and the volume and detail of information that is shared among maritime partners.

III. GAME DESIGN & RESEARCH METHODOLOGY

A. Discussion of Game Design

The week-long Maritime Domain Awareness Operational Game was conducted in two distinct phases.

i. Phase One: Idea Sharing

Each player delegation presented a brief describing its nation’s internal MDA activities, external MDA information sharing efforts, and its expectations for the game. As each country delegation presented its brief, the other delegations had the opportunity to observe the successes and processes described in order to determine if their own country has experienced the same.

Each brief lasted approximately 35 minutes long and was followed by a 10 minute question and answer period. While a template for this brief was provided to the player delegations by the game development staff, the national delegates were free to ignore the template and develop the brief as best fit their desires and presentation requirements. The recommended elements of the briefing template are outlined below:

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- National Maritime Informational Sharing
 - Terms and Processes
 - Objectives
 - Participants
 - Successes and Challenges
- Regional and Global Information Sharing Networks
 - Information Sharing Agreements
 - Objectives
 - Cooperative Efforts
 - Content
 - Successes and Challenges
 - The Way Ahead

ii. Phase Two: Information Sharing Game

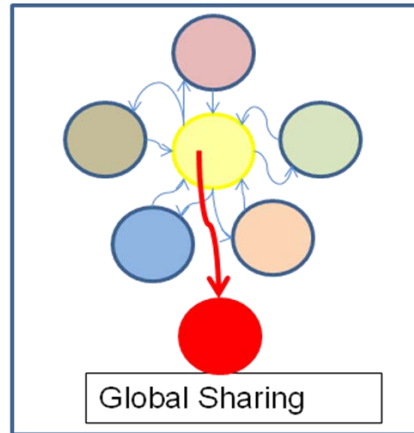
The intent of the game was to further explore impediments to information sharing while considering options for international maritime information sharing structures that maximize the volume and detail of shared information. Players were placed in an environment in which they had to make decisions on whether information could be shared with other countries. The MDA Operational game consisted of three moves played over a two-day period. During each of the game's three moves, a different information sharing model was used:

Move 1: Global Information-Sharing Model: In the Global information sharing model, all player cells were assumed to have voluntarily joined an information sharing structure which was open to a wide variety of entities: any other nation, agency, commercial interest, non-governmental organization, and even organizations acting as fronts for illicit actors. Information was exchanged through a central unrestricted access data repository. Each participating entity was required to share some data into the central repository in order to have access to the information therein. It was assumed that there were extremely low barriers to membership in this sharing group, leading to a very large membership pool.

Key characteristics of the Global Information-Sharing Model were:

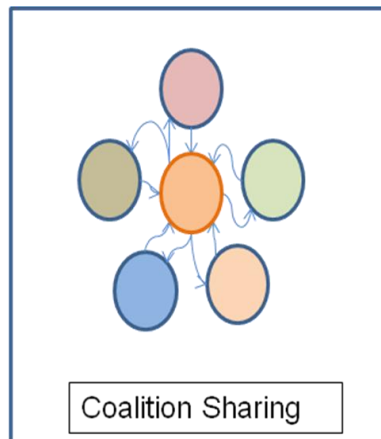
- All nations and organizations can participate
- Membership requires a minimal sharing commitment
- Barriers to participation are low or non-existent
- Members cannot prevent any other nation from participating
- Any information that is shared is shared equally with all members

The Global Information-Sharing Organization Model



Move 2: Coalition Information-Sharing Model: In the Coalition Information Sharing model, information is shared among members of a coalition that had formally agreed to share information in support of MDA activities (although the limits of this agreement were purposefully left undefined). The formal agreement was further understood to be in the nature of a treaty or memorandum of understanding (MOU) with legal standing between governments or agencies. The information is exchanged through a central data repository to which access is restricted exclusively to members. Only those countries that belong to the coalition are granted access to the data. For purposes of this game, all 12 participating nations were considered to be members of the coalition.

The Coalition Information-Sharing Organization Model



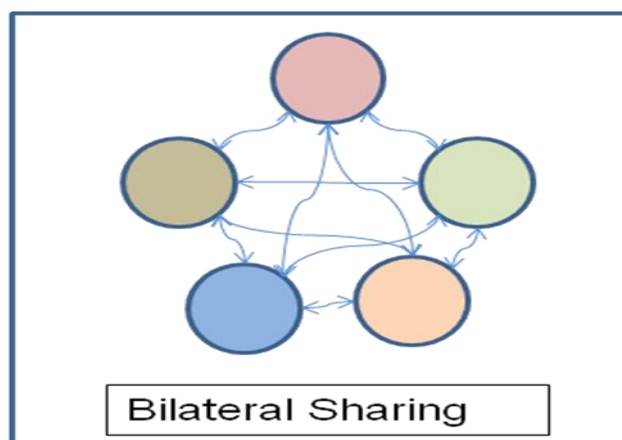
Key characteristics of the Coalition Information-Sharing Model are:

- Membership is limited. Current coalition members must agree before a new member is allowed to join.
- Information shared within the coalition model is secure. All sharing is conducted with information assurance measures in place that were suitable to all members.
- Any information that is shared is shared equally with all members of the coalition

- Non-members do not have access to shared information.

Move 3: Bilateral Information-Sharing Model: In the Bilateral Information-Sharing model, information was only exchanged between two countries. There was no multi-lateral organization and no central data repository. Further, there was no formal sharing agreement assumed or provided to the players. Beyond the few players whose nations have pre-existing real-world sharing agreements, all information sharing was considered to be ad hoc in nature.

The Bilateral Information-Sharing Organization Model

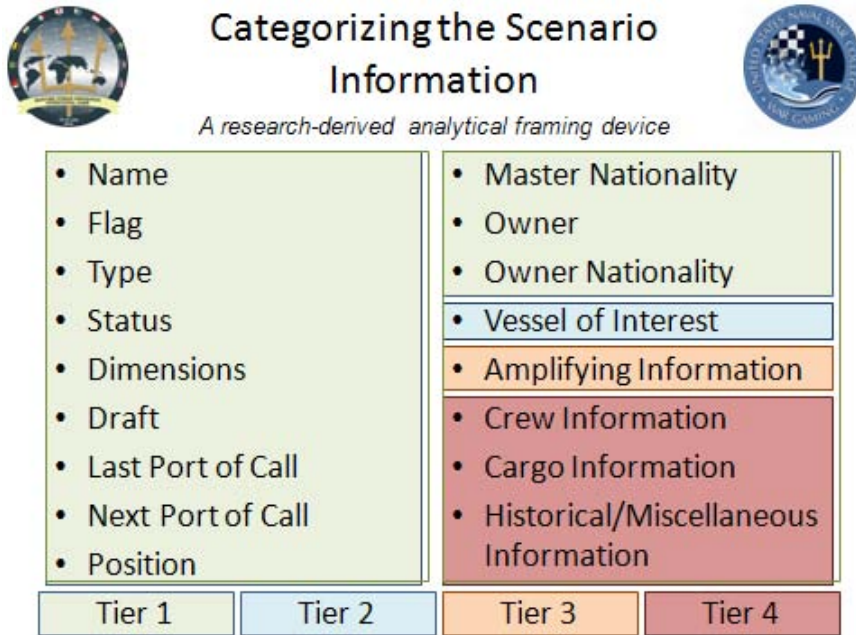


Key characteristics of the Bilateral Information-Sharing Model are:

- Information is shared with one other nation at a time
- No formal bi-lateral sharing agreement is to be assumed for the game unless it exists in the real world.
- Information-sharing arrangements may be long-term or may be made before each information transaction
- Participants can request that partners do not share further share information that they have provided, but they have no official means of enforcing that request.

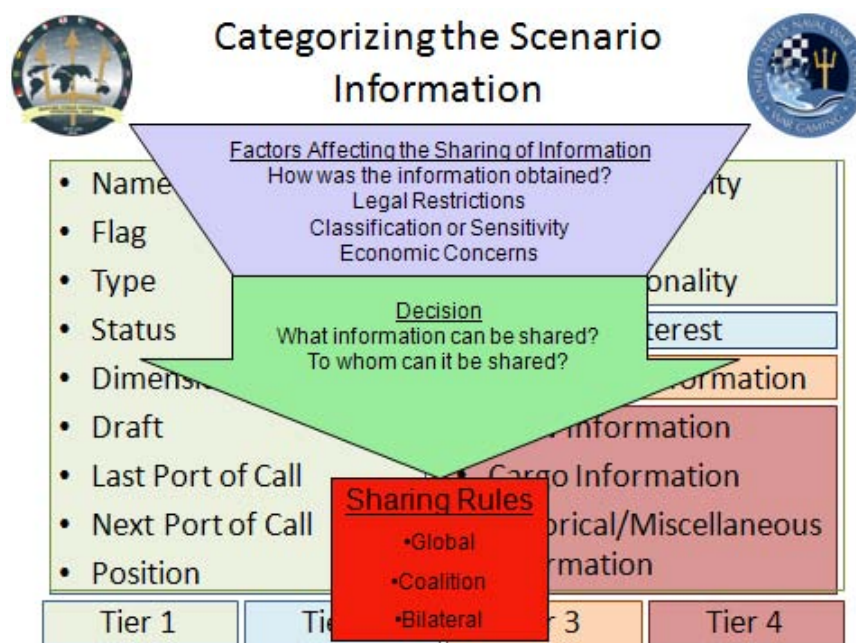
iii. The Decision to Share:

The key player activity was deciding whether or not to share a given piece of data. Each national cell was provided a set of 20-25 vessel reports, or “tracks,” which consisted of data elements ranging from basic ship characteristic and location information up to actionable details of illicit activity or detailed listings of crew or cargo as shown in the figure below. For game purposes, the information was categorized into four tiers as shown, with Tier 1 being the lowest sensitivity and Tier 4 being the highest sensitivity.



Making the decision to share information consisted of three main steps. First, the players needed to review the data to ensure that they understood the nature of the vessel. Second, they needed to put the vessel information in the context of their national policies and determine if there were prohibitions against sharing certain portions of the data. For example, would domestic privacy laws prohibit sharing crew lists or similar information? Other factors that the players needed to consider are listed in the figure below. After reviewing these factors, the players would decide what information could be shared and with which national cells it could be shared. The third step was then to apply this filtered data to the rules implicit in the sharing model in play for that move. For example, in move 1 or 2 when sharing to any one country required that the information be made visible to all countries, a decision by the first country to share to a second country could be overruled by the requirement that the information not be viewed by a third. Similarly, in the third move with the Bilateral model in play, the players could choose to share with only a single country and exclude all of the others. Analysis of the outcome of these thousands of sharing decisions was to provide the data to support accomplishment of the game's objectives.

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B. Game Design Assumptions

The MDA Operational Game was designed based on a few key assumptions: 1) the maritime security environment is cooperative, not competitive (because improved maritime security is a stated objective of each of the countries represented in this game); 2) sharing, rather than withholding of information, is beneficial in achieving individual maritime objectives; 3) players were to assume that the maritime data used during the game was accurate and free from manipulation; 4) players were to assume that the information sharing network used during the game was secure and met their own information assurance requirements.

Additionally, the game was conducted under a strict policy of non-attribution in order to ensure that conversations between players and moderators were as unrestricted as possible. For this reason, statements or comments that identify a specific player or nation will not be found in this report.

C. Analytic Framing:

In order to maximize the credibility of the analysis for this game, the analysis team sought to employ a variety of analytic tools. The chief methodology used in this game to take advantage of multiple techniques was triangulation, which uses three sources or methods which are analyzed for commonality. This approach allowed game analysts to inductively derive the same or very similar conclusions using different datasets or methods. Consistent with this approach, the nine data streams collected during this game incorporated a variety of research procedures into analysis. A brief description of each analytic tool can be found in the Data Collection and Analysis Plan (Appendix D); along with a summary and figure representing the overarching triangulation approach.

D. Collection Approach:

The data collection protocol for the MDA Operational Game ensured that four specific areas are considered for analysis. These were:

- The type of information the players decided to share over the course of the game.
- The reasons players decided to share or not share information.
- The implications derived from the types of information players decided to share or not share.

During the game, four major data streams were examined by the Data Collection and Analysis Team (DCAT) at the conclusion of each move. Those data streams consisted of the following: post-move track database summary graph, post-move sharing decision survey summary graph, Likert Scale and open-ended responses from the post-move player surveys.

Members of the DCAT individually examined each data stream and then came together to discuss initial findings for the move. The common themes that emerged from the overall real-time data sets during the move were then provided to the facilitator in support of the post-move plenary session following the move.

i. Sharing-Decision-Surveys

Before the country cell releases information to their country representative located in the "trading cell", a survey of questions relating to the player's decision to share and their assessment of the information displayed, prompting a response from the players. Specifically, these questions were designed to capture the impediments to sharing and the player's decision-making process associated with that specific track. The DCAT looked across each country's database to identify common themes and issues that would feed directly into the post-move plenary discussions. Details of the Sharing-Decision-Surveys are in Appendix D.

ii. Construct Validity for Questionnaires/Survey Instruments

In addition to these deliverables, each of the country player cells had the opportunity to provide direct, functionally-oriented insights into the broader aspects of international information sharing. At the conclusion of each move, players from each cell completed surveys via InRelief focusing on the cell's specific activities (i.e., why the cell ultimately made their decision to share or not to share the information) as well as overarching issues germane to their efforts to share information. The surveys were administered using each of the network terminals located inside each of the country cells and trading cell.

All questions included in the post-move surveys were pre-tested (along with assessing overall instrument efficacy) during the Alpha and Beta tests with a small sample of individuals from the Naval War College. Great care was taken to ensure survey questions did not presuppose a desired outcome on the part of the researchers or "skew the agenda". Please see the Data Collection and Analysis Plan (Appendix D) for a full in-depth description of the survey questions.

E. Players

This game was designed for an optional national delegation of four players. These were to be two representatives from the navy, one from that nation's foreign service, and one from a non-navy user or provider of MDA-related information. However, some player delegations were, for a variety of reasons, incomplete by this standard. As described in Appendix A, the players were predominantly from their nation's navies and there were several delegations that did not have foreign service or non-navy representation. The impact of this is that the ability of the analysis team to draw conclusions about interagency issues from game results is limited as those conclusions are heavily based on navy-only opinions.

IV. ANALYSIS & RESULTS

Highlights of the two phases of the game are presented below as an introduction to the issues which lead to the themes, insights and recommendations which are discussed later in this report. A more in-depth description of player activities and results can be found in Appendices E and F.

A. Idea Sharing Phase

In the Idea Sharing Phase, national delegates presented briefings on their own nation's MDA systems, successes and best practices, MDA-related impediments to information sharing, and their future expectations for regional and global MDA-related information sharing. During the game several key characteristics of successful MDA sharing enterprises were identified. The first was that successful MDA information sharing was characterized by a large number of participants who had achieved a degree of trust and confidence with each other to enter into sharing commitments. Numerous sharing relationships, discussed in the first phase of the game, were all founded on mutual trust and confidence.

These successful sharing relationships were characterized by one of three main structures for sharing. The first structure used a centralized data server located in a single country which each participating country could connect to for the purposes of contributing and retrieving data. The VRMTC, VRMTC-A, ReMIX and MSSIS systems follow this model. In comparison to this structure stood the concept of connecting domestic information servers using secure internet tunnels such as employed in the Scandinavian SUCBAS system, which allowed each nation to retain physical possession of the storage of their information. The third major concept employed is the liaison officer based model such as in Singapore's regional Information Fusion Center. This model permits nations to rapidly respond to regional crises through cooperative, face-to-face sharing of information.

Players exhibited several key common understandings which indicate that expanded international maritime information sharing is possible. First, players agreed nearly unanimously that the definition of MDA presented for the game was suitable. This definition was: Maritime Domain Awareness is the effective understanding of anything associated with the maritime domain (on, below, or above the sea) that could impact security, safety, economy, or environment of a nation. A second significant common thread was the acknowledgement of a

need for a legal framework. Lastly, players identified two pragmatic reasons for sharing: First, to receive information through reciprocal sharing, and second, to improve the capacity of sharing partners to take actions which support one's own national objectives (e.g., to interrupt in their own territory smuggling operations which affect both countries).

B. Summary of the Information Sharing Game

In summary, the post-game analysis supported hypotheses 1, 2, and 4, and partially rejected hypothesis 3. The volume of information shared was lowest in the Bilateral model, as predicted. Shared detail was found to increase from the Global model to the Coalition model as expected, but did not increase further in the Bilateral model, contrary to the premise of Hypothesis 3. For detailed results of each move, see Appendix F.

V. GAME DERIVED THEMES & INSIGHTS

These themes, insights and player recommendations were derived from analysis of actual information sharing conducted during the game, player commentary during plenary sessions, sharing decision survey results and post-move survey results.

A. The Relationship between Trust & Confidence and International Information Sharing

Observations

- Trust and confidence within each model became extremely influential in the decision-making process, particularly in the Coalition Model. The players released more information, and were willing to share a greater percentage of information released as a result of the increased security of a coalition environment.
- Player statements indicated that trust enables sharing agreements, while at the same time manifesting them.
- Various players noted that the coalition model is key to “opening the door” to greater information sharing. However, development of trust occurs over a period of time and must begin with very basic unclassified data.

Insights

- As expressed by the players during numerous plenary discussions, the importance of establishing trust and the willingness to share are the fundamental factors that enhance awareness and build partnerships.
- Trust is also influenced by the level of confidence one nation has in another in their ability to safeguard and protect information, and also act responsibly with that information.
- Overwhelmingly, players noted that respect and acceptance of individual nation's sovereignty, policies, and culture is vital to a successful maritime information sharing initiative.

Player Recommendations

- Revitalize and improve regional partnership building initiatives in order to enhance trust and confidence among international maritime partners beginning with very basic agreements.

B. The Relationship between “Push” and “Pull” Information Sharing Strategies

Observations

- Throughout game play, players often noted the various “push” and “pull” factors associated with information sharing. Players “pushed” information for several reasons. Some pushed information to get more in return. Some players only pushed non-sensitive or Tier 1 information, while others pushed more sensitive information (e.g., Tier 2-4) because they perceived it to be in the common interest of the international community.
- Players did not push information when they perceived that there was too much data to review for release. They did not feel comfortable pushing out data without at least reviewing it for sensitivity and security issues.
- Other players noted that push strategy works well only if it is possible for the recipient to search and filter the data in an effective way. Pushing large quantities of information and highlighting “interesting data” could represent a compromise solution.
- Some information was not released or shared until it was requested (pulled) by another player. Players believed that pulling information works better in a bi-lateral or regional sharing relationship.
- One of the major disadvantages of pulling noted by several players was the concept that “you don’t know what you don’t know” meaning that a pull strategy would not be successful in finding unknown threats.

Insights

- These two strategies were employed differently during each move in the game. Push was used more in situations with high trust, such as in the Coalition model or where real world sharing relationships existed. Pull was used where there was an evident lack of a pre-existing sharing agreement.
- The application of the push strategy in the Coalition model was the key factor to convert the trust inherent in that model’s relationships into high volume and detail of sharing.

C. Interagency Coordination and its Impact on International information Sharing

Observations

- Players noted throughout the event that individual nations need to solve their interagency information sharing issues before they can be counted upon to be able to share the full spectrum of maritime information.

Insights

- Information that is shared internationally through specific domestic channels (i.e., customs or law enforcement) must be fused and analyzed through an interagency process. Only then will MDA be achievable.
- The UK is dealing with the interagency challenge through the development of a single agency which will handle consolidation and sharing of all maritime information.
- Nations identified navies as key players in Maritime Domain Awareness; but as one small “piece to the larger MDA Puzzle”.
- In order to better understand a navy’s role in Maritime Domain Awareness, a robust understanding of the interagency process and the roles, responsibilities and capabilities of each domestic organization is imperative.

Player Recommendations

- An internal examination of individual interagency processes and procedures and their relationship to external sharing is needed in each respective nation.

D. An International Legal Framework

Observations

- Legal and policy challenges emerged both during the country briefings and throughout the game as the major impediments to international information sharing.
- The presence of a legal framework in the Coalition model was cited as the major contributing factor that led to that model supporting high volume and the greatest detail of information shared.
- Creation of an international legal and policy working group was proposed as a mechanism for developing widely acceptable legal structures.

Insights

- Sharing could be facilitated by an international legal body empowered to establish and govern international data standards and protocols. ICAO was offered as a possible model.
- Leverage existing international law (e.g., UNCLOS, SUA, UNCR) to encourage formal agreements. The Regional Co-Operation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (a Singapore led initiative) was discussed as an ideal model.
- Some players stated that they would view these initiatives more favorably if a United Nations (UN) chartered body like the International Maritime Organization (IMO) was involved.
- There are many existing maritime and non maritime information sharing models that currently exist. Each of these models is comprised of a unique legal, technical and

operational framework that supports information sharing within a sharing group. Many of these models include but are not limited to:

Virtual Regional Traffic Center (VRMTC), Maritime Safety and Security Information System (MSSIS), Trans-Regional Maritime Network (TRMN), Sea Surveillance and Co-Operation Baltic Sea (SUCBAS), Regional Maritime Information Exchange System (ReMIX), Regional Co-Operation Agreement on Combating Piracy and Armed Robbery against Ships in Asia, Interpol, International Criminal Police Organization; ASEAN, Association of Southeast Asian Nations; and the PSI, Proliferation Security Initiative.

Player Recommendations

- An international legal and policy working group dedicated to examining these issues would be valuable.
- While many cooperative-sharing models exist, leveraging on-going efforts from regional and trans-regional maritime and non-maritime information should be enhanced.

E. Fusion and Analysis

Observations

- Players realized that the capacity to perform fusion and analysis on maritime data was a critical element in the ability to share maritime information and build maritime partnerships. Many players noted that possessing high quantities of data is only valuable if you can make sense of it.
- Moreover, players discussed that much of the technology used to fuse and analyze data with their respective regional systems is in early developmental stages and may not support integration with other networks.
- Various robust commercial off-the-shelf tools and software that may offer some capabilities to fuse and analyze large amounts of disparate information were discussed.

Insights

- Numerous entities, including some which participated in the game, have demonstrated fusion and analysis systems that would address the integration and sense-making limitations raised by the players.

Player Recommendations

- A technology feasibility study was suggested to examine functionality and compatibility of fusion and analysis tools.

F. Regional Partnership Building

Observations

- Players agreed that some nations are unable to participate in information sharing due to inadequate or non-existent technical, legal or operational infrastructure.
- Player described regional partnership building efforts focused on increasing partner capacity as having been fruitful, but will need to be improved in order to expand information sharing globally.

Insights

- Many nations, including some in attendance for the game, support less capable nations in achieving the means to contribute to an information sharing initiative. This assistance has come in the form of technology (such as radars, sensors, servers and systems), manpower, training, or financial assistance.
- Regional maritime collaboration events have helped educate and break down barriers within nations and regions. However, many of these efforts are duplicative and uncoordinated.

Player Recommendations

- The international community should endorse a multinational outreach and coordination group, headed by regional maritime leaders, dedicated to education and the integration of regional Maritime Domain Awareness and information sharing efforts.

G. Supporting Capabilities in an Information Sharing System

Observations

- Player responses to a survey question requesting that they identify tools that would be useful parts of an international sharing network are listed below:

Geographical Display	89%
Chat Function	89%
Web Based Sharing	72%
File Sharing	33%
Data Fusion & Analysis	50%
Electronic Mail (E-Mail)	67%
International Unclassified News Feeds	42%
Integrate information from other systems & sensors	58%
Cargo, People, History Database	67%
Alert System	64%

Ship Information "Wiki" or information database 50%

- In addition to the tools listed above, a significant number of players indicated that a capability for combined chat, VTC and voice communications would be useful. The players identified the commercial service Skype as a potential model for this capability.
- The InRelief.org website, a US Navy sponsored non-classified enclave intended to increase the speed of collaboration for immediate responders to humanitarian relief or disaster response operations, was used extensively during the game. This website proved to be very versatile and was praised by the players for its ease of use, collaborative tools and flexibility.

Player Recommendations

- Incorporate the above listed capabilities in future information sharing networks.

H. A Comprehensive Global Maritime Information Structure

In the Information Sharing Game, players were divided into cells that were each tasked to evaluate a set of maritime data provided by the game controllers, determine if any of that information could be shared and then act on those decisions to share information with the other national cells. Analysis of the outcome of these thousands of sharing decisions provided the data to support accomplishment of the game's objectives. The structure outlined here serves to meet the objective of the game to identify an option for wide-spread international information sharing structure. More specifically, this comprehensive structure is arranged to obtain the maximum possible volume and detail of information sharing for all participants using the results of the game as a guide. The proposed information sharing structure consists of four elements.

A Commitment to Share: The first element can best be described as a common commitment to share. Under this construct, governments would endorse statements of principle in support of maritime safety and security information sharing. An outcome of this activity would be that trust and confidence between governments that had endorsed these principles would increase; this increased trust was noted by the players as a necessary first step toward building any functional information sharing system. The impact of widespread endorsement of these principles would be four-fold. First, pairs or groups of nations which have endorsed the information sharing principles would be more likely to enter into sharing agreements with each other because the endorsement would serve as a rudimentary legal framework for sharing. Second, endorsing nations would be more likely to enact domestic legislation in support of the sharing of maritime information. Third, changes to international law and other international legal frameworks in support of maritime information sharing would be more likely. Last, development of international working groups for technical, legal or policy matters related to information sharing could be accomplished under the umbrella of these endorsements.

Throughout the game, players emphasized all of these factors as critical to the expansion of information sharing. Promotion of widespread information sharing in support of MDA will require efforts to create an environment that provides individual nations, leaders and organizations with the confidence to enter into sharing relationships. As was repeated frequently throughout the game, the development of trust was a key component in this confidence. In

addition to trust and confidence, all relationships, whether local, regional or global, require some framework upon which to begin the discussion which leads to a relationship.

Lastly, this regime would offer the legal framing which the players repeatedly noted as a necessary condition for sharing. For strategic level decision makers who are the ones developing formal and enduring information sharing agreements and for operational level decision makers who are most likely to engage in ad hoc information sharing, their government's endorsement of information sharing in principle can weigh heavily on the decision to share, especially if the intended sharing partner has also endorsed.

Additionally, a structure of this type could be used as the backbone for necessary leadership, planning and working groups which would work to facilitate the initiation of sharing agreements at all levels. For example, during the game players repeatedly called for the ability to work together to solve technical or networking problems, policy or legal problems, or even to collaboratively work together to find ways to improve basic MDA capabilities. Groups of endorsing nations would be more likely to initiate and maintain these working groups.

Global Sharing: The second element of the game-derived information sharing structure, entitled Global sharing, is a single sharing network or federated group of networks that is global in scope and which carries information of the lowest sensitivity, namely ship characteristics and location data such as that broadcast on AIS (characterized as Tier 1 in this game). Game results indicated that this structure provides the highest possible volume of sharing for Tier 1 information due to the large number of members. In order to achieve the large membership that is critical to the effectiveness of this structure, the barriers to entry to join must be very low, permitting any government, agency, non-governmental organization or commercial entity to join. This produces an environment where information is shared nearly universally at a sensitivity level low enough to allay security concerns. Sharing at this level is premised on the idea that the massive volume of information received and disseminated globally has more value than the small amount of information that finds its way to bad actors. The last component of the structure at this level would be a series of focused working groups to resolve issues specific to the operation of this network. One solution to shorten the technology development process may be to expand existing MDA sharing networks to form the Global Sharing network. This would also serve to support national desires that legacy systems be integrated into newer sharing networks and not replaced wholesale.

While some players even shared more detailed information at a high volume using this sharing model, this was limited to a minority. The fact that not all players were willing to share information above Tier 1 in the global model is evidence in support of limiting the scope of this portion of the information sharing structure to Tier 1. Maximizing volume of information sharing is prioritized over increased detail of information because it is the number of members and contributors that gives information sharing its power. While consummating a sharing arrangement with nations that are willing to share detailed information very widely would at first appear to be beneficial, the reality would be that a majority of nations and organizations would choose not to join such an organization because of their own restrictions against sharing detailed information, thereby reducing the number of members and therefore the overall volume.

Formal Sharing: Building on the sharing achieved at the very low levels of sensitivity, the third element of the comprehensive sharing structure is named Formal Sharing and it

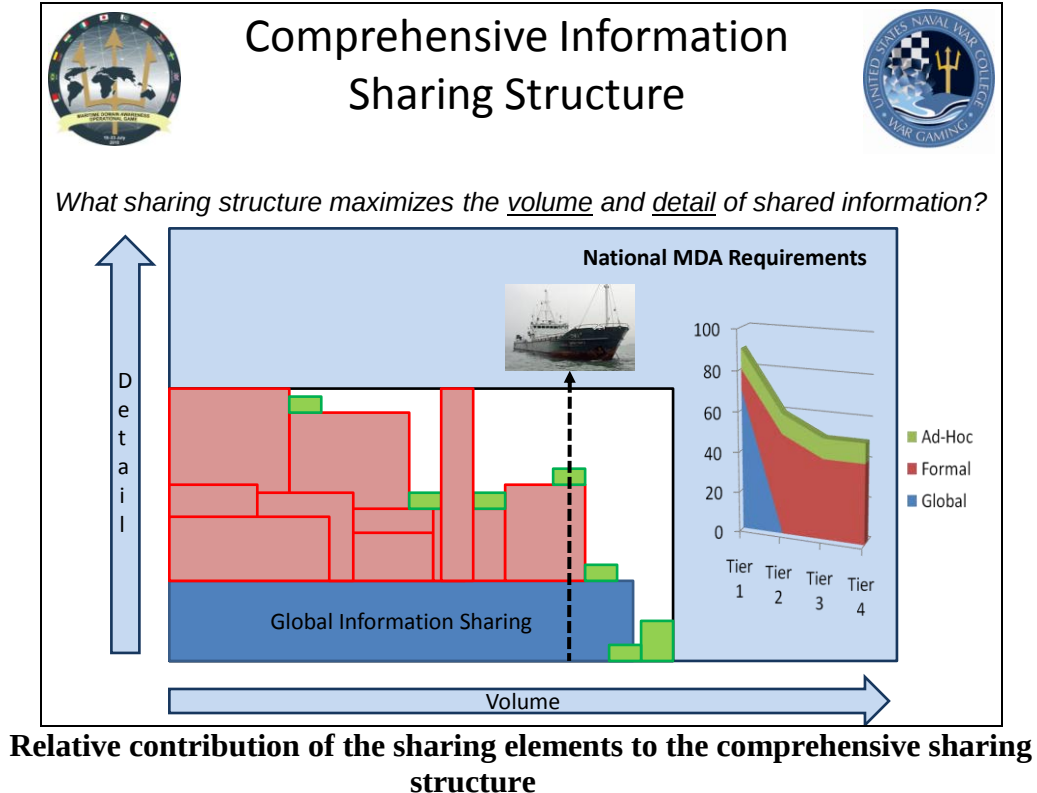
provides a mechanism for the sharing of more detailed and sensitive information within smaller groups of participants. The key characteristic of this type of sharing is the presence of a formal agreement between the members that provides a legal or policy framework for the sharing of information. Players noted that this type of formal agreement “opened the door” to information sharing. Another important factor is that membership to a sharing group can be limited in order to exclude undesirable recipients and permit the sharing of more sensitive data. Finally, because players recognized that the pragmatic benefits of sharing came not only from the receipt of information provided by a partner, but also in the improved readiness of all partners which is achieved through the widespread dissemination of information, it was determined that the size of the group must be as large as possible in order to keep the volume of sharing high enough to be effective. This second benefit can only be realized through the higher volumes achieved when partners that share bilaterally come together as a group to ensure that the available information spreads completely to all partners.

In using the coalition model in the game, players shared information widely within the group at all levels of detail. As has been pointed out in the discussion of the results, the coalition model had, for any single nation, the highest component of volume sharing (each cell shared the highest amount of information at each tier) as well as the highest detail of sharing (the highest degree of sharing Tiers 2-4). For Tier 1 information, this model was less efficient than the global model both in terms of globally disseminating information because fewer participants would receive the information, and in terms of the amount of information received by any individual participant. This drawback can be negated if this type of sharing is used in conjunction with a global sharing type arrangement for less sensitive data.

Ad-Hoc Sharing: Because it would be impossible for all nations to participate in large formal sharing agreements due to political, diplomatic or legal restrictions, each nation will find gaps in its ability to share MDA information with other nations. These gaps can occur where no sharing agreement exists or where the sensitivity of the information exceeds the limits of an existing sharing agreement. A structural element to meet these shortfalls is voluntary Ad-Hoc Sharing. Ad-Hoc sharing events occur when there is no formal agreement in place to share the specific bit of data. This type of sharing can only augment Formal Sharing agreements because it produces the lowest volume of sharing and no more detail than Formal Sharing as observed in this game. While this type of sharing is a minor contributor when compared to Global Sharing and Formal Sharing, it should not be overlooked as it may often be the only possibility for sharing with certain entities due to political or diplomatic constraints. Further, sharing arranged in this manner can often lead to higher trust and confidence and eventually to a formal sharing agreement with a new partner.

Summary: Hypothesis 4, which stated that a combination of sharing models would be needed to maximize volume and detail of sharing, has been supported by game play. This can be restated to say that in order for a single country to maximize the contribution that international information sharing makes to their overall MDA efforts, they must participate in multiple sharing activities which individually possess characteristics of one or more of the sharing models presented in the game. The information sharing structure described above will not fill the entirety of MDA requirements for any nation, but instead is assessed to be the best that can be done given the constraints and possibilities observed in this game. Any nation must remember that any

MDA requirements not met through international information sharing must be met through domestic MDA efforts.



Next Steps: There are several steps for nations to take that would bring the above described structure into reality. First, any country could initiate and support an initiative leading to a common commitment to share and which leads to endorsement of sharing principles by multiple countries. Second, countries should move forward with a structure for Global Sharing by creating a new sharing arrangement, linking existing MDA networks, or greatly expanding those networks that are already quite robust. Any country can move forward with the creation of formal sharing groups, but all should work toward coalescing their similar bilateral agreements into sharing groups in order to take advantage of the additional sharing volume inherent in group-based sharing. Lastly, any nation can work to build Ad-Hoc sharing relationships into more formal sharing agreements by capitalizing on the trust and confidence built during the Ad-Hoc event.

Appendix A: Demographics

I. Demographics. The MDA Operations Game featured 76 participants as follows:

- 37 Players from 12 Nations
- 13 Cell Facilitators
- 2 Plenary Facilitators
- 10 Technology Support Team members
- 6 Control Cell Team members
- 8 Data Collection and Analysis Team members

Country	# of Participants		Years of Service	Years of MDA	Age
Bahrain	2	Mean	20.97	3.86	42.14
Brazil	3	Median	21	2	42
Colombia	4				
India	3	Male	36		
Italy	4	Female	1		
Japan	4				
Pakistan	2	Civilian	7		
Singapore	3	Military	30		
South Africa	2				
Sweden	4	Graduate Degree	22		
United Kingdom	3	Non-Graduate Degree	14		
United States	3				
Total	37				

- A. There were a total of 37 participants from 12 countries involved in the game. The average participant was approximately 42 years old, had approximately 21 years of service, and had four years of experience with MDA. The participants were overwhelmingly male (36 of 37) and were predominantly military (30 of 37). All were college graduates with 22 of the 37 reporting graduate degrees.
- B. In addition to basic demographic information, each participant was asked a series of five survey questions with responses on a six-point Likert scale (ranging from 6 – Strongly Agree to 1 – Strongly Disagree). The five questions follow:

Q1: Maritime Domain Awareness is defined as the effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of a nation. I feel that this statement closely matches my country's interpretation even if we use a different term.

Q2: When working in a team environment, I tend to assume a leadership role.

Q3: When making difficult decisions, relying on my experience is just as important in my deliberation as available data.

Q4: When making decisions, I tend to rely on instinct rather than analysis.

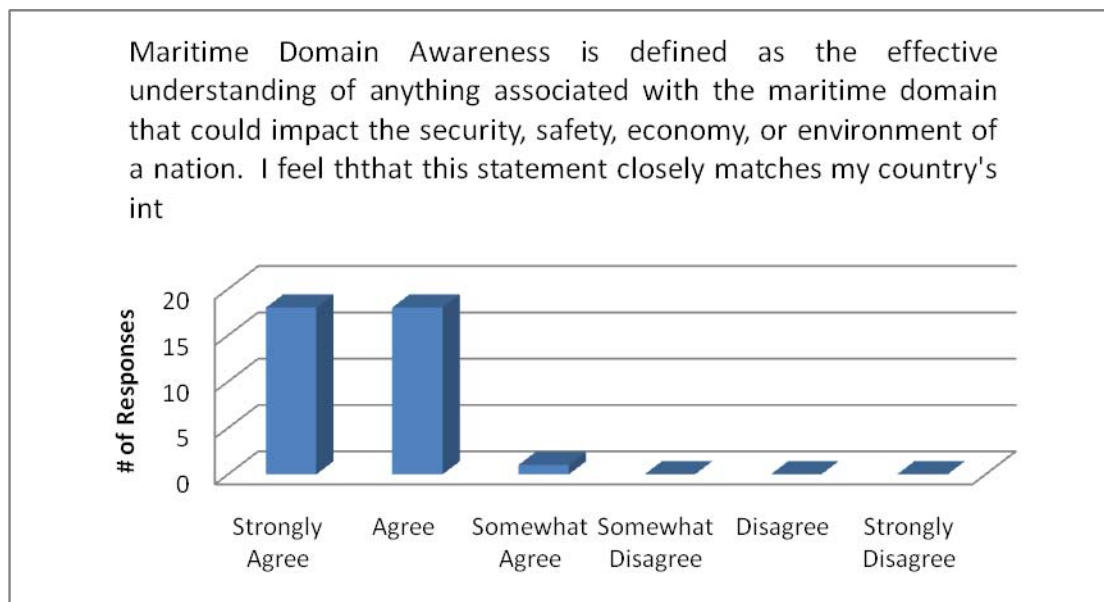
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Q5: Based on my knowledge and experience of MDA, I believe that I have a sufficient understanding to assist my country team in achieving meeting the objectives set in the game.

The basic summary statistics to the survey questions are presented in the table below:

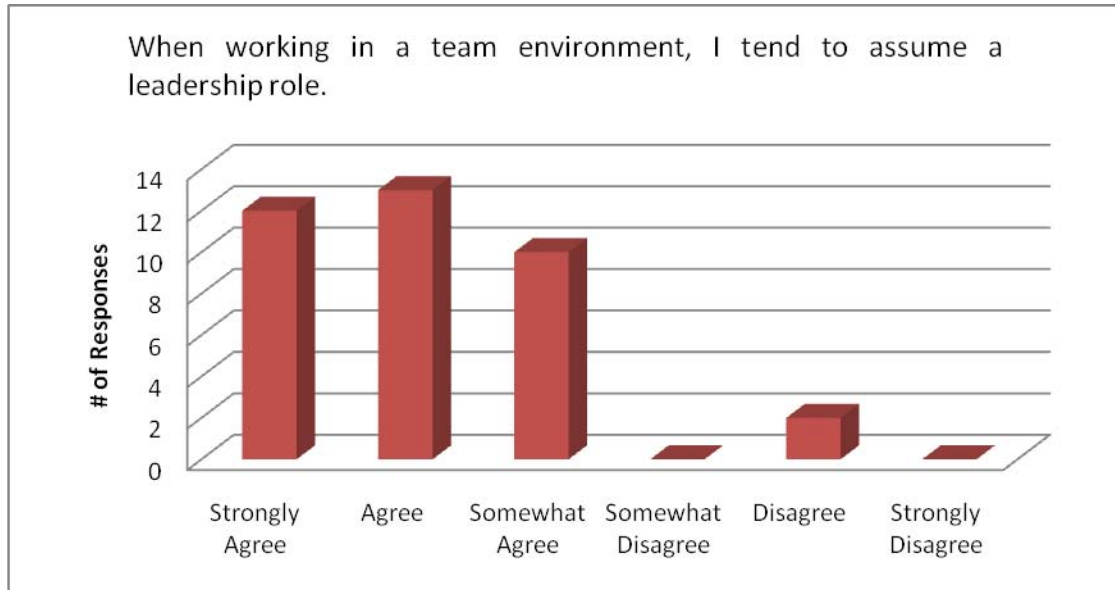
	Q1	Q2	Q3	Q4	Q5
Mean	5.46	4.89	4.81	3.08	5.27
Median	5.00	5.00	5.00	3.00	5.00
Mode	6.00	5.00	5.00	4.00	5.00
Std Dev	0.56	1.05	0.97	1.32	0.65

The frequency of responses for each of the five questions is presented in the following frequency distribution charts.

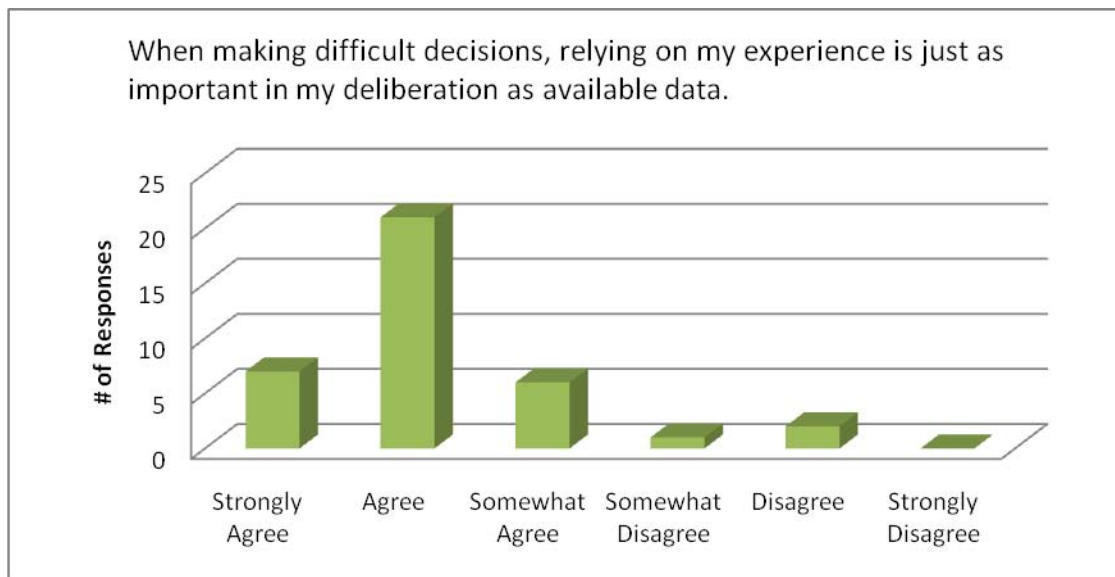


Based on participant responses, we conclude that all players agree on the basic working definition of Maritime Domain Awareness.

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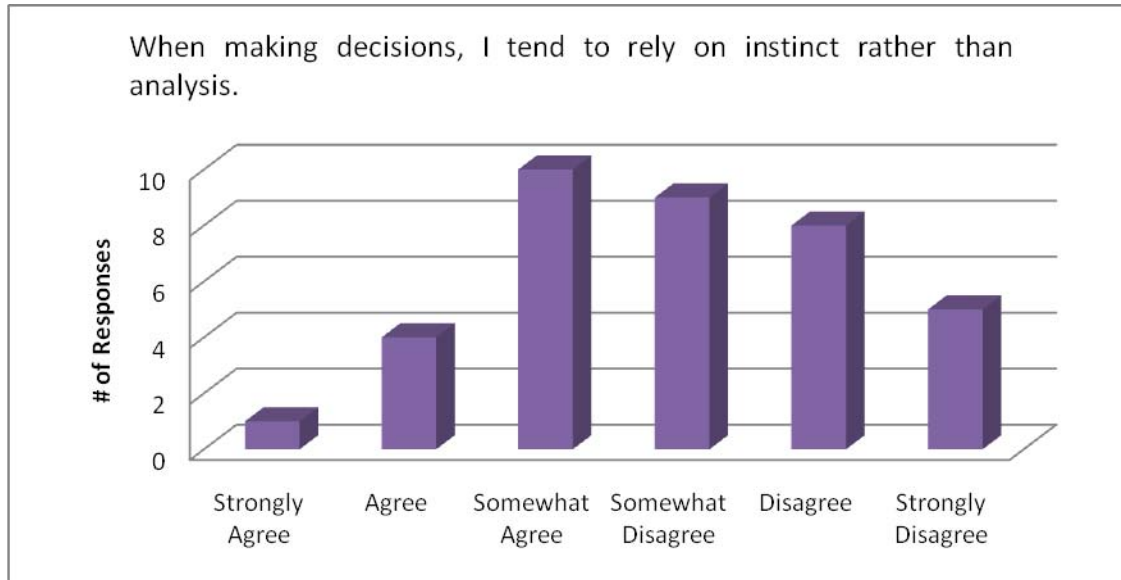


Based on participant responses, we conclude that the vast majority of players tend to assume a leadership role when working with a team. This is important in the context of the game because all players should contribute to the team decision-making process.



Based on participant responses, we conclude that most players agree that experience is an important part of the decision-making process.

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Based on participant responses, we conclude that most players disagree that instinct is an important part of the decision-making process.



Based on participant responses, we conclude that all players agree that they are capable participants in the MDA war game.

Appendix B: Glossary of Key Terms

I. Definition of Key Terms

Information Tiers: An artificial analytic construct developed for this game derived from pre-game research. This structure facilitates the segregation of data into sensitivity levels for ease of comparison.

Tier 1: Lower sensitivity information such as that broadcast over AIS. Data fields for this tier are: name, flag, type, status, dimensions, draft, last port of call, next port of call, position, master nationality, owner, and owner nationality.

Tier 2: Identification of a vessel as a vessel of interest (VOI).

Tier 3: Brief identification of the reasoning for a VOI designation. For example, a VOI is suspected of human trafficking activity.

Tier 4: Information of the highest sensitivity to include detailed or actionable descriptions of illicit activity, detailed crew lists or detailed cargo manifests.

Scenario types: A minimum of one track from each of the below scenario types was presented to every national cell for sharing in each move.

Own State Military – a military vessel from the sharing country

Foreign Military – a military vessel from a country with which the sharing country does not have an existing partnership.

Partner State Military – a military vessel from a country with which the sharing country has an existing maritime, military or information sharing partnership.

Own State Law Enforcement – a vessel engaged in law enforcement (fisheries, EEZ, smuggling patrol etc) from one's own country.

Foreign Flagged Law Enforcement – a vessel engaged in law enforcement (fisheries, EEZ, smuggling patrol etc) from a country with which the sharing country does not have an existing partnership.

Own State Merchant – a commercial vessel from the sharing country

Partner State Merchant – a commercial vessel from a country with which the sharing country has an existing maritime, military or information sharing partnership.

Foreign Flagged Merchant - a commercial vessel from a country with which the sharing country does not have an existing partnership.

Own State Owned Merchant / Foreign Flagged – a commercial vessel which is owned in the sharing country but which is flagged elsewhere (i.e., flag of convenience)

Trafficking: Each national cell had two of the below four types of trafficking for each move.

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NARCO: a vessel engaged in narcotics trafficking.

HUMAN: a vessel engaged in human trafficking or smuggling.

PRODUCT: a vessel engaged in the smuggling of goods in order to avoid customs duties or to transport prohibited goods.

WEAPONS: a vessel engaged in smuggling weapons.

WMD Proliferation: a vessel engaged in materials related to WMD proliferation (knowingly or unknowingly)

Terrorism Personnel or Equipment: a vessel engaged in transporting terrorism related personnel or materials, knowingly or unknowingly.

Polluter: a vessel associated with illegal pollution.

Fisheries Violator: a vessel associated with illegal fishing.

Piracy Vessel: a vessel engaged in piracy.

Piracy Victim: a vessel that is known to have been captured or attacked by pirates.

Own State HADR Support: a vessel which is supporting humanitarian assistance or disaster relief and is associated with the sharing country either through flag, ownership or charter.

Foreign Flagged HADR Support: a vessel which is supporting humanitarian assistance or disaster relief from a country with which the sharing country does not have an existing partnership.

Health Contagion Risk: a vessel connected to outbreaks of deadly, highly contagious diseases (Hemorrhagic fever, SARS, Swine Flu, Bird Flu etc.).

AIS Non-Squawker: a vessel which is observed to meet the requirements to transmit on AIS, but which is observed not to be doing so.

Volume: In this game, volume is defined as the number of vessel reports that are shared with other countries multiplied by the number of recipients. Said another way, it is a measure of how widely maritime information is disseminated. As this applies to the models used in the game, a single vessel report shared with others increases from the bilateral model (a vessel is shared to one country... a factor of one) to the coalition model (a vessel is shared automatically to all eleven participants... a factor of eleven) and finally to the global model (a vessel is shared to all of the undefined recipients that are participating in the global model, assumed to be 3-10 times greater than the number in the coalition model... therefore for the purposes of these calculations, a factor of 33-110).

Detail: Detail is defined as a measure of the sensitivity of the information shared for each vessel report. The data given to the players was organized into tiers by sensitivity with the least sensitive information being the name and flag of a vessel and the most sensitive being detailed information on a vessel's crew, cargo, association with illicit activity, or historical data.

Appendix C: Game Mechanics

I. Game Mechanics

During each move of the game, each country was presented with a set of fictitious maritime data managed through a game-specific Web Tool located on the internal unclassified game network. In the real world, this information would have come from a variety of sources, such as domestic agencies or intelligence services, regional networks, open source information, or Automated Identification System reports. However, because the object of the game was to determine how much information would be shared and not to identify how a specific country handled classified or sensitive information, the source or method of obtaining that data was not provided to the players during the game. Further, the game design deliberately avoided asking the players or opening a discussion regarding information sources and methods because it was feared that this would suppress the free flow of discussion that was vital to the success of the game.

Additionally, each country was provided a set of vessel related questions to answer. These questions could only be answered by receiving the necessary information from members of the other country cells. The scenario questions are designed to stimulate game play by providing an incentive to gather information. During game play, players were able to identify how many questions they had correctly answered and to determine the “scores” that had been obtained, but not which cells had attained which scores. This gave players motivation to pursue additional information in order to answer additional questions if behind, but not the ability to freeze information going to cells that were in the lead. In this game, correctly answering a question was roughly analogous to achieving an operational objective through MDA.

Cell Organization

Each nation’s participants were assigned to their country’s National Cell, located separately from the other participating nations. One member of each national contingent played alongside other multinational members to form a separate Multinational Information Trading Cell. Each national team also had access via telephone and an electronic collaboration tool with their Home Country Operations Center.

National Cells

The National Cell reviewed the track database, answered questions, and determined what, if any, information was shared with other teams. The National Cell communicated directly with its representative on the Trading Cell and had internet-based access to various resources, including personnel and information sources within their home country. Members of the National Cell were able to contact personnel in their home nation for clarification and guidance.

The National Cell was not able to communicate directly with any other national team. Discussions within the National game cells during game play were kept private. The only information that was shared with other countries was that of which each trader specifically designated for sharing. All communications with other teams were conducted through the National Cell’s representative on the Multinational Information Trading cell.

Key tasks of the National Cell were:

- Review tracks
- Answer scenario questions
- Answer sharing decision surveys about the decision to share
- Answer queries from team member on the Information Trading Cell
- Determine what data can be released
- Release data for sharing by Information Trading Cell

Multinational Information Trading Cell

The Multinational Information Trading Cell is where all information exchanges occurred during the game. The Information Trading Cell was comprised of 12 members, one from each participating nation. The sharing of data among the various countries was done by using the internal game tool, designed specifically for this game. Traders were able communicate with their National Cells via Chat. Communications between traders within the Trading Cell were done via person-to-person or e-mail.

Key tasks of the Information Trading Cell were:

- Request data from National Cell members
- Share data with other cell members (via the Web Tool)

Home Operations Center

In addition to the personnel who traveled to Newport, each participating nation had the opportunity to support this event through connectivity with existing policy, command or operations centers. Connectivity between the National Cell and its home-based organizations was accomplished through email, telephone or chat. To this end, internet connectivity was provided in each game cell and a telephone center was established for the use of the players.

Cell Connectivity

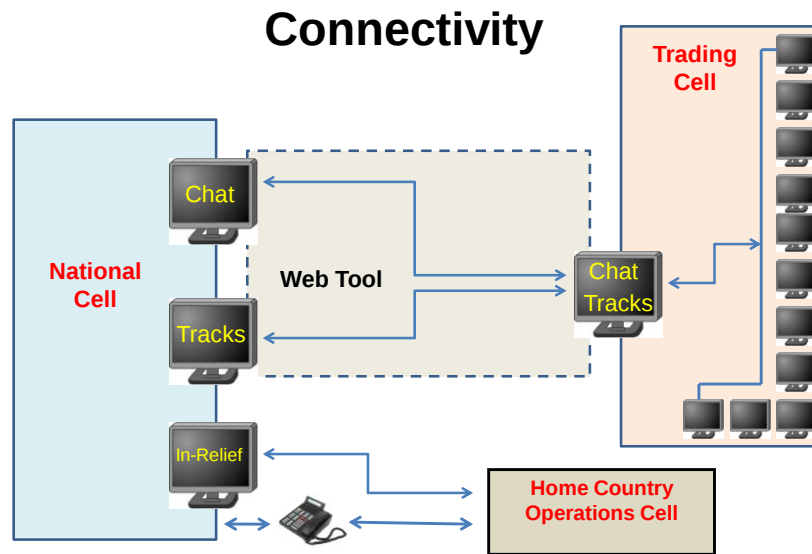
The National Cells were connected to their representative on the Trading Cell and to personnel and information sources at home. Communications between members of the National Cell and their representative on the Trading cell were by via a chat function on the game's Web Tool. The track database will be available to the National Cells and the Trading Cell on the Web Tool.

Each National Cell had three computer workstations in their game room. Two were used for the game Web Tool (one for chat, the other for the track database) and the third terminal was used for InRelief.org connectivity and internet access. National Cell members were able to contact their colleagues in their home countries via internet or telephone.

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Each member of the Trading Cell had a single computer workstation that allowed him to view the track database and communicate with his National Cell via chat. The Figure below depicts the Communications pathways within the Game Cells.

During the game, one additional communications path was added. Because some cells did not have a full complement of players, it was decided to permit the trading cell representative to consult with the national cell and support deliberations on information releasability for 15 minutes per hour during game moves.



Track Database

The foundation of the game is the Web Tool track database. The Naval War College created a dedicated Web Tool specifically for use in the MDA Operational Game. Participants were provided role-based log-ins and passwords to access the tool. Participants received training on the Web Tool during Move 0 prior to the actual start of the Information-Sharing Game. The complete database includes more than 900 individual tracks. Each national team received approximately twenty tracks at the beginning of each of the game's three moves. Each country's vessel tracks were distinct from each other and within each move. During the course of each move, as teams shared track data, the number of tracks viewable by each team increased.

The database consisted of fictitious track information for various vessels, including merchant ships, government vessels, fishing vessels, and pleasure vessels. The database has the following fields:

- Vessel Name
- Flag
- Call Sign

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- Ship Type (cargo/tanker/fishing/sailing/etc.)
- Dimension (draft/length/width/tonnage)
- Status (underway/in port)
- Last Port of Call
- Next Port of Call
- Location (South China Sea/Western Indian Ocean/etc.)
- Master's Nationality
- Owner's Nationality
- Amplifying Information

With the exception of the information-sharing model in use, each of the three game moves was structured identically in terms of the four distinct steps, and player tasks that each cell was required to complete.

Task 1: Review track data and decide whether information is releasable to other cells

The key task for this game is for each player cell to evaluate the information they receive at the start of the move and determine whether and to what extent that information can be shared with other cells. Initially, the players must examine the information that they have been given in order to fully understand the nature of the report and any associated scenarios. They will then need to identify if the vessel and scenario information is affected by some factor that makes the information unshareable. For example, some players may be unable to share crew lists because of privacy law in their country. After the players have determined if their national laws and policies permit them to share a given piece of information, they must similarly determine if any player cell should be excluded from receiving the information. All player cells were expected to use their real world policies to do this with the exception that in the global and coalition models, the player cells were placed into sharing constructs which do not exist in reality. In these situations, the players were to treat the other player cells as they would a country with which they do have a similarly constructed sharing agreement in reality. Finally, players needed to determine if the sharing rules would permit them to share information in ways that did not violate their national policies. For example, if their policies permitted them to share with another specific country, but also specified that a second country must be excluded, then in the global and coalition models, the players needed to decide if they could share in order to provide the first country with the information, or if they needed to withhold the information in order to prevent the second country from receiving it.

It is important here to note that the players were not provided with any information regarding the sources and methods used to obtain the information or regarding classification or sensitivity. The players were asked to review the information and use their experience to determine how the information would have been obtained or would be handled in their country or organization. Again, the game design deliberately avoided requesting that the players provide information about this assessment because of the belief that players would negatively react to being asked to discuss such sensitive issues in an unclassified, international forum. Instead, the players asked to use that internally generated and private assessment guide their decisions with regard to releasability and sharing. For example, if, in the player's experience, a specific type of

information is shared only in certain situations or to certain partners, then their activities in the game should mirror those situations.

As player cells made the determination whether they could share information associated with a given vessel, they were asked to answer a brief survey about their decision. The structure of this survey is further discussed in Section IV-B of the report.

Task 2: Answer Scenario Questions

As teams reviewed their track data, they searched for answers to a list of scenario questions that were provided at the beginning of the move. The answers to these questions could only be found by receiving data from other cells. A typical scenario question might be: *Is M/V Explorer associated with any illicit activity? If so, what?*

Task 3: Request Information

Player cells had several mechanisms to request the answers to their scenario questions from other player cells. The first means was to send the request via chat to their representative in the trading cell who was then able to discuss the request face to face or via chat with the trading representatives from all other cells. Second, the player cell could enter the request into a site on the InRelief.org website where the information request would be visible to all other players.

Task 4: Share Information

After a player cell determined that a given piece of information could be shared with other cells and released it to the trading cell representative, that information could be shared through the Web Tool. Sharing in this game is a two step process with the trading cell representative holding the final authority to share any information. This allowed the cell and the trading cell representative to select between a “push” or “pull strategy for sharing information.

Appendix D: Data Collection and Analysis Plan

I. Introduction

One of the most important functions of war gaming is to answer timely research questions posed by our sponsors. In order to do so, effective data capture germane to the research area of interest is critical. Successful data capture enables useful analysis, ensuring a symbiotic relationship between game design and subsequent findings. To ensure that data collection methods and analytic techniques are relevant to the game objectives for the Maritime Domain Awareness (MDA) Operational Game, the following Data Collection and Analysis Plan (DCAP) is provided in this document.

II. Game Purpose

The purpose of the unclassified MDA Operational Game is to enhance Maritime Domain Awareness through the sharing of information with international partners in order to inform the Global Maritime Partnership Game (October 2010), which in turn supports International Sea Power Symposium (ISS) XX. Specifically, this game examines the impediments and best practices to effective information sharing within regional and global MDA related relationships and networks, as well as identifies options for broad based international maritime information sharing.

In the United States, Maritime Domain Awareness (MDA) is defined by *National Security Presidential Directive 41 / Homeland Security Presidential Directive 13 (NSPD41/HSPC13)*, *Maritime Security Policy*, “as the effective understanding of anything associated with the global maritime domain that could impact the security, safety, economy or environment of the United States.” Several nations have also undertaken MDA programs under various names, including, but not limited to Maritime Domain Awareness, Maritime Situation Awareness and Maritime Awareness. Effective MDA requires international collaboration that supports the maritime awareness requirements of each participant. Therefore, many uses of the terms “MDA,” “Maritime Domain Awareness,” or “Maritime Awareness” do not refer specifically to the United States, but rather: “The effective understanding of anything associated with the global maritime environment that could impact safety, security, the economy and the environment.”

The objectives explored in this game are consistent with the U.S. Chief of Naval Operations (CNO), Admiral Roughead’s statement during the International Sea Power Symposium 19, in which he stated that an international game would be held at the Naval War College to explore the operational implications of MDA. The MDA Operational Game will serve as preliminary research for the Global Maritime Partnership Game scheduled for October 2010. Furthermore, Admiral Roughhead asserted that:

“Maritime security supports the free flow of commerce for all nations. Maritime Domain Awareness is knowing what is moving below, on, and above the sea. Without a high level of Maritime Domain Awareness the free flow of commerce is jeopardized. The goal of Maritime Domain Awareness is to establish a level of security regarding vessels approaching our coastlines, while not infringing upon each nation’s sovereignty or sharing inappropriate information.”

III. Overarching Research Question and Hypotheses

In order to better understand the type of information that is shared across the various international information sharing structures, the MDA Operational game seeks to deductively answer the following research question: “Based on the information sharing models that will be employed in this game, what is the preferred structure for international information sharing that provides each entity with the most volume and detail of maritime information?” In this game, volume is defined as the amount or quantity of data shared and is measured by the percentage of information shared throughout the game. Detail is defined as the specificity of information that is embedded in the scenario track. Accordingly, this information is measured by four tiers of information sensitivity. As the numbered tiers increase, the amount of detailed information associated with that track also increases. For example, Tier 1 consists of the basic AIS Shipping Data (i.e., ships position, flag, owner, etc.) whereas Tier 4 provides all of the known information provided in Tier 1 through 3 plus detailed information on the ship’s crew, cargo and history.

In order to understand the best practices and impediments to effective international information sharing, this game seeks to inductively answer the following research question: “To what extent do interagency challenges within a country impact the ability to share information with other countries?”

At a more structural-level, the MDA Operational game examines four specific hypotheses (H1-H4) and a null hypothesis (H0) on the subject of international maritime information sharing. These hypotheses were crafted after reviewing scholarly literature in the area of Maritime Domain Awareness, and examining existing international maritime information structures. The hypotheses studied in this game are framed globally, not from a U.S. perspective, whereas each of the country cells is represented by Blue against a notional, one-sided red embedded scenario. The hypotheses are as follows:

H1: – In the Global unrestricted information sharing model, players will share a high volume of information with low detail.

H2: – The Coalition Model will enable players to share a high volume with more detail.

H3: - In the Bilateral Model, players will share the lowest volume of information, but the information that they do share will be the most detailed.

H4: – The structure of information sharing that provides the most volume and detail will be a combination of one or more models.

H0: – Null: There is no relationship between the information sharing models employed and the volume and detail of information that is shared among maritime partners.

IV. Game Design as a Catalyst for Effective Post-Game Analysis

This game is designed to enhance players’ understanding of the impediments to effective information sharing and regional MDA related relationships and networks, as well as identify options for broad based international maritime information sharing in order to raise awareness and increase Navies’ participation in maritime domain awareness.

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To foster this environment, the game has been organized into two phases. Phase One of the game will take place during the first two days. Each country will provide a briefing focused on maritime information sharing in their respective country. The main topics that will be covered in the player briefing are: a) descriptions of internal (national) and external (regional and global) MDA information sharing efforts; b) descriptions of MDA successes, challenges, and best practices; and, c) each country's expectations for the game.

Phase two consists of a one-sided game, in which each country cell evaluates the information that is provided and determines-- based upon their respective laws, policies and information sharing agreements--whether and to what extent, that information can be shared with other countries. Each team will consist of two Navy members, one Foreign Service representative and one other MDA provider. Three members of the country cell will work together in a cell independently from the other countries. The fourth member of each country cell will represent its team in a separate cell, known as the "trading cell" where the sharing of information from country to country will actually occur.

The country teams will be presented with a set of fictitious maritime data. In the real world, this information will have come from a variety of sources, such as domestic agencies or intelligence services, regional networks, open source information, or Automated Identification System reports. However, due to the sensitivity of sources and methods, the source from which these data were collected from, will not be provided during the game. At the beginning of each game, each country will be provided a set of vessel related questions that they will need to answer. These questions can only be answered by receiving the necessary information from members of the other cells. The scenario questions are designed to stimulate game play and serve as the victory conditions for the players. Each cell will be measured by the amount of scenario questions it was able to answer correctly. During game play, scores of each country will be displayed on the screen without attribution to a particular country. Three serial games (moves) will be conducted over the course of two days. Each move will utilize a different information sharing model, as follows:

A. MOVE ONE: The GLOBAL MODEL allows for the exchange of maritime information between countries by use of a central unrestricted access data repository. Once the information is in the central data repository, everyone can see it--there are no, or extremely low, barriers to membership in this sharing group.

B. MOVE TWO: The COALITION MODEL allows for the exchange of MDA information between countries by use of a central restricted access data repository. Only those countries that belong to the "coalition" are granted access to the data. For the purpose of this game, all of the countries participating are, by default, members of this fictional coalition. During this game "Move" there are no "bilateral" sharing relationships allowed and there is no "Global" unrestricted access central data repository.

C. MOVE THREE: The BILATERAL MODEL will be used in the last move and allows for the exchange of information between two countries only. There is no central data repository; the information is stored exclusively for those two countries.

V. Identification of Key Variables

The independent (or x) variable in this game is the type of information sharing model employed while the dependent (or y) variable is the volume and detail of information that is shared among the players. Essentially, Phase One (i.e., player briefings) of the event is designed to capture each country's successes, solutions and challenges to information sharing (such as political, legal, and cultural) in order to educate each of the partner nations. Phase Two, Game Play, will examine the volume and detail of information shared among the participants when applied to different information sharing models and identify the major impediments to international information sharing.

VI. Game Play: Country Cell Deliverables

During Phase One of the game, each country will provide a briefing focused on maritime information sharing in their respective country. At the end of each briefing there will be approximately 15 minutes available for broader discussions among the participants. Subsequently, there will be two open plenary sessions held at the conclusion of day one and two, respectively. During both of these periods, environmental recorders will be employed in order to capture the insights derived from group discussions. Responses to these questions will be captured via an unclassified laptop, and routed to the DCAT for analysis.

During game play, each player cell will develop the following core products:

- Release of information track by the country cell to the country lead inside of the "trading cell" (submitted via MDA Information Database and captured via UNCLAS GAMENET).
- Release of information track by the country lead to the other players inside of the "trading cell" (submitted via MDA Information Database and captured via UNCLAS GAMENET).
- Electronic Communiqués between players inside of the "trading cell" for information (submitted via Microsoft Outlook and captured via UNCLAS GAMENET).
- Before the country cell releases information to their country representative located in the "trading cell", a set of sharing decision survey questions will be displayed, requiring a response. Specifically, these questions are designed to capture the impediments to sharing and the player's decision-making process associated with that specific track. The DCAT and cell facilitators will look across each country's database to identify common themes and issues that would feed directly into the post game group plenary. Throughout game play, before releasing the information, players will be prompted to the following "Sharing decision survey" questions:

For the information you have chosen not to share in this track, why have you decided not to share it? (check all that apply)

- ☐ Legal
- ☐ Policy
- ☐ Political
- ☐ Economic
- ☐ Cultural
- ☐ Sensitivity of Information
- ☐ Other: _____

For the categories selected, please elaborate: _____

Information in this track would regularly be: (check all that apply)

- shared within the organizations represented in my cell.
- released to other organizations in my country.
- released to other countries.
- received from other countries.
- of High Medium or Low interest to my country.

For the categories selected, please elaborate: _____

In addition to these deliverables, each of the country player cells will have the opportunity to provide direct, functionally-oriented insights into the broader aspects of international information sharing. Specifically, information sharing surveys will be administered up to three times (i.e., at the end of each move) during the game. This survey is designed to capture the thoughts and opinions of the players allowing for open-ended responses to the following questions:

As you read through each question, think about your country's current information agreements, the structure of the information sharing model used in this move, and those impediments which influenced or restricted your cells ability or willingness to share information.

9. What were the major factors that ***restricted your country cell's ability*** to share information during this move? Of these, what were the most common?

10. What were the major ***legal*** impediments that influenced or restricted your country cell's ability or willingness to share information during this move?

11. What were the major ***policy*** impediments that influenced or restricted your country cell's ability or willingness to share information during this move?

12. What were the major ***cultural*** impediments that influenced or restricted your cell's ability or willingness to share information during this move?

13. During this move, what information was your cell unwilling to share with other countries?

a) Why were you unwilling to share this information?

14. What were the major things that ***influenced your country cell's willingness*** to share information during this move? Of these, what were the most common?

15. During this move, what information was your country cell unable to share with other countries?

a) Why were you unable to share this information?

16. What information did your country cell share during this move that you normally ***would not*** share with other countries? Please explain why you shared it.

17. What issues during this move that would be worthy of future study?

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Table 1 also provides the eight Likert-scale questions asked of each country cell's players as part of their post-move surveys that are directly tied to the four hypotheses studied in this game.

-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	1. The <i>total amount of tracks</i> my country cell received from other countries during this move influenced my cell's decision making.
-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	2. The level of detail my country cell received from other countries during this move influenced my cell's decision making.
-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	3. During this move, my country cell made decisions that were contrary to existing domestic information sharing policies or agreements.
-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	4. During this move, my country cell made decisions regarding situations which are not covered or governed by domestic policies or guidance.
-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	5. Based on the decisions my country cell made in this move, existing domestic policies and agreements need further examination.
-3 Strongly Disagree	-2 Disagree	-1 Somewhat Disagree	+1 Somewhat Agree	+2 Agree	+3 Strongly Agree	6. The information made available to my country cell during this move would help support my country's national security objectives.

Appendix E: Analysis of Idea Sharing Phase

- I. Player Briefings & Plenary Discussions Results and Observations
 - a. Common definitions: Maritime Domain Awareness (MDA) was a commonly accepted and understood term used by many of the participating nations. Over 90% of the participating nations defined MDA as the effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of a nation. Over 50% of the players noted that MDA also provides a platform from which countries can establish bilateral and cooperative agreements. However, the United Kingdom described Maritime Security Awareness (MSA) as a law enforcement function, rather than a military function, which in turn is a key enabler to conducting MDA.
 - b. Participation in Information Sharing: All of the participating nations are presently members of a regional coalition. Over 90% of these are connected by means of a secure network. Of the countries that currently do not participate in a formal regional coalition network, players noted geopolitical impediments to forming such coalitions among neighboring countries. There was player consensus that the lack of a formalized internal/interagency MDA information sharing structure makes the sharing of information internally cumbersome and often inadequate to support objectives.
 - i. All of the players described the following issues as important to maritime awareness: safety and security, commerce and trade, sustainment and preservation of natural resources, managing and controlling of illegal migration, the detection and deterrence of illegal trafficking of humans, drugs and proliferation, pollution prevention, counter-piracy and search and rescue.
 - ii. Players identified the following national maritime information objectives: strengthen alliances, promote an interagency approach to MDA, ensure maritime surveillance systems are integrated, provide peace and stability within the region, early warning of anomalous activities and provide efficient and safe maritime travel.
 - iii. The following domestic organizations were listed by players as direct contributors to MDA: Coast Guard, Police, Customs, Fishery Administration, Environmental Protection Agency, Transport Agency, Civil Contingencies Agency, Weather services, Armed Forces. The use of a steering committee which provides guidelines for information management was also noted as a contributor to successful MDA.
 - iv. Successful MDA was defined by all participating national delegations as ability to reduce the number of illicit activities and to save lives. Every nation that belongs to a regional information sharing coalition described a significant improvement to its own MDA as a result of information sharing among its partners.
 - v. The establishment of trust and communication were cited as the greatest challenges to MDA information sharing. Players noted that establishing a global initiative to create an integrated maritime information sharing environment would be a significant challenge due to these issues. Various

countries noted that pushing past organizational cultural impediments and integration of legacy systems and technologies has been a significant internal challenge.

- vi. Players achieved consensus that information sharing is initiated for two pragmatic reasons: first, to receive information through reciprocal sharing and, second, to improve the capacity of sharing partners to take actions which support one's own national objectives (e.g., to interrupt in their own territory smuggling operations which affect both countries). By receiving shared information a nation improves its own maritime awareness which in turn supports national defense, law enforcement and other national interests. When sharing is employed in a functional or regional coalition, it also provides for efficient use of resources in achieving coalition objectives. The group agreed that no single country has the means and resources required to monitor the vast amount of traffic that transit global waters.
- vii. Over 75% of the national briefings described information sharing as a means to providing increasing maritime security and situational awareness in order to deter terrorist and criminal organizations from exploiting international and interagency loopholes conducting illicit activities. Nations also discussed trans-regional maritime information sharing as a means to protect and safeguard maritime commerce.

Appendix F: Analysis of Game Moves

A. Summary and Analysis of Game Moves

In summary, the post-game analysis supported hypotheses 1, 2, and 4, and partially rejected Hypothesis 3. Global sharing occurred at a high volume for Tier 1 information while sharing under the Coalition model was at a high volume for all tiers. The detail of information shared increased when moving from a Global unrestricted information-sharing model to a Coalition model. The volume of sharing in the Bilateral model was indeed the lowest of all models, but, contrary to the premise of Hypothesis 3, the shared detail was less than that of the Coalition model.

In each move of the game, each country controlled the data for at least one track of each scenario type (Listed in Appendix B). The results of this detailed analysis of participant actions at the scenario type level confirm previous conclusions. On a per country basis, players shared the most track data (volume and detail), in the Coalition model, the least amount of data in the Global model, and the Bilateral model resulted in sharing levels that fell in between the two. There are two noteworthy items contained in these detailed result panels.

First, during the plenary sessions, several participants noted that they would be unwilling to share track data on their own state military vessels in a Global unrestricted information-sharing network, but would be more willing to share this data in a Coalition information-sharing network. Further, in a Bilateral information-sharing network, players noted that this data would only be shared when requested (“pulled”). Collected data supports these comments. Track data on own-state military vessels was shared 31% of the time in the Global model, 71% of the time in the Coalition model, and 37% of the time in the Bilateral model. Similar patterns exist across most of the sensitive track fields (amplifying information, crew specifics, etc.).

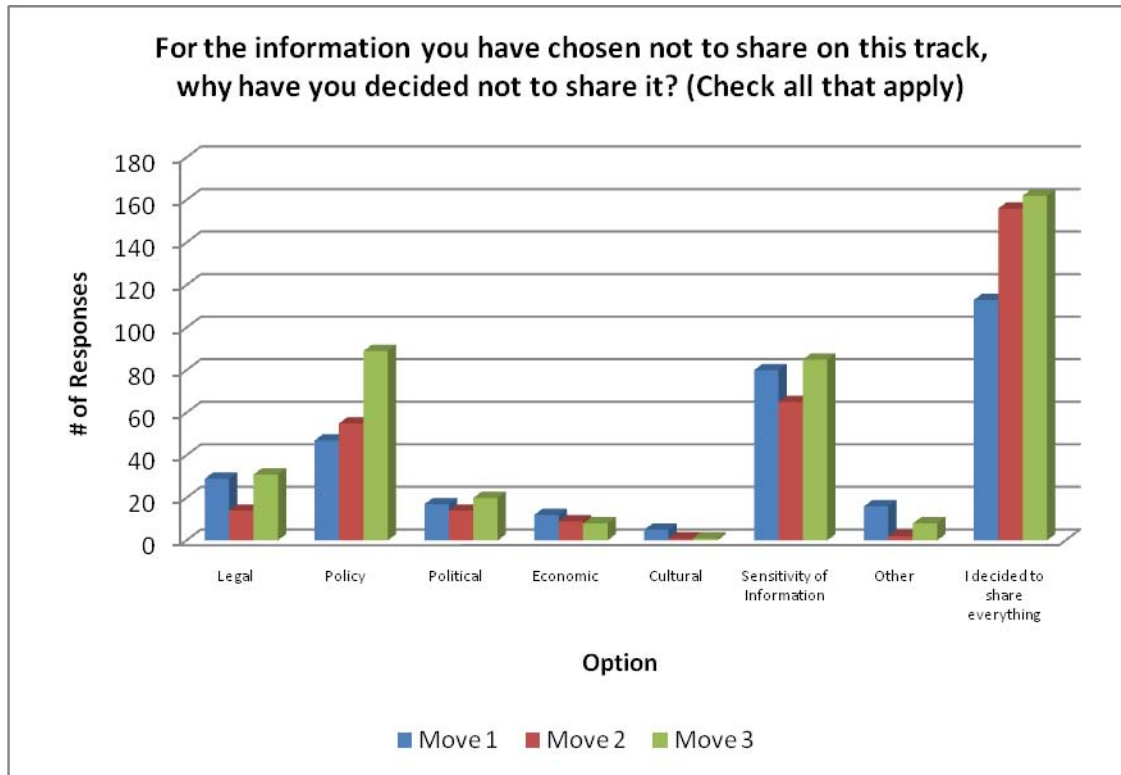
Second, the most critical track type identification classes were considered to be traffickers and WMD proliferators. Surprisingly the same pattern exists for sharing of track information on these critical contacts of interest. The volume and detail of data shared peaked in the Coalition model where data was shared on virtually 100% of these contacts compared to approximately 35% in the Global unrestricted model and 75% in the Bilateral model. A similar, but less extreme pattern is observed in the “common good” track types (piracy victims, HADR vessels, and health contagion risks). It was hypothesized that information on these critical contacts would be shared most freely in the Bilateral model and this did not prove to be the case. (See Appendix for detailed panel data).

Throughout the game, owner, owner nationality, and master nationality were not shared as highly as other Tier 1 information. Players stated that this was due to legal and policy restrictions on sharing privacy-related and commercial information. This created a subset of Tier 1 information that was not shared as extensively.

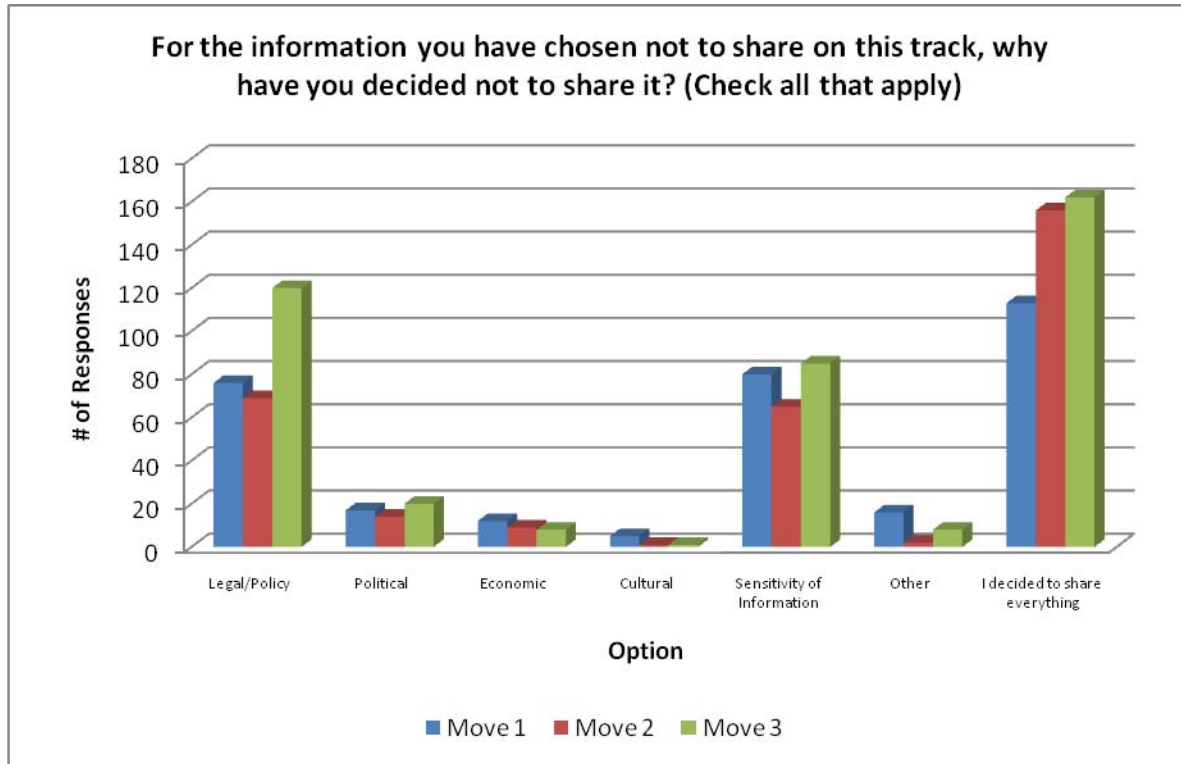
During the game each trader was asked to answer a sharing decision survey after every track was considered for sharing. The analysis of player actions and post-move survey data shed light on the overall behavior during each of the moves while the sharing decision survey

questions attempt to ascertain specific motivations for sharing (not sharing) associated with individual tracks.

After national cell had completed a sharing transaction, they were asked: “For the information you have chosen not to share on this track, why have you decided not to share it? (Check all that apply.)” The response options were: legal, policy, political, economic, cultural, sensitivity of information, other, and I decided to share everything. The results of this survey question are presented below:



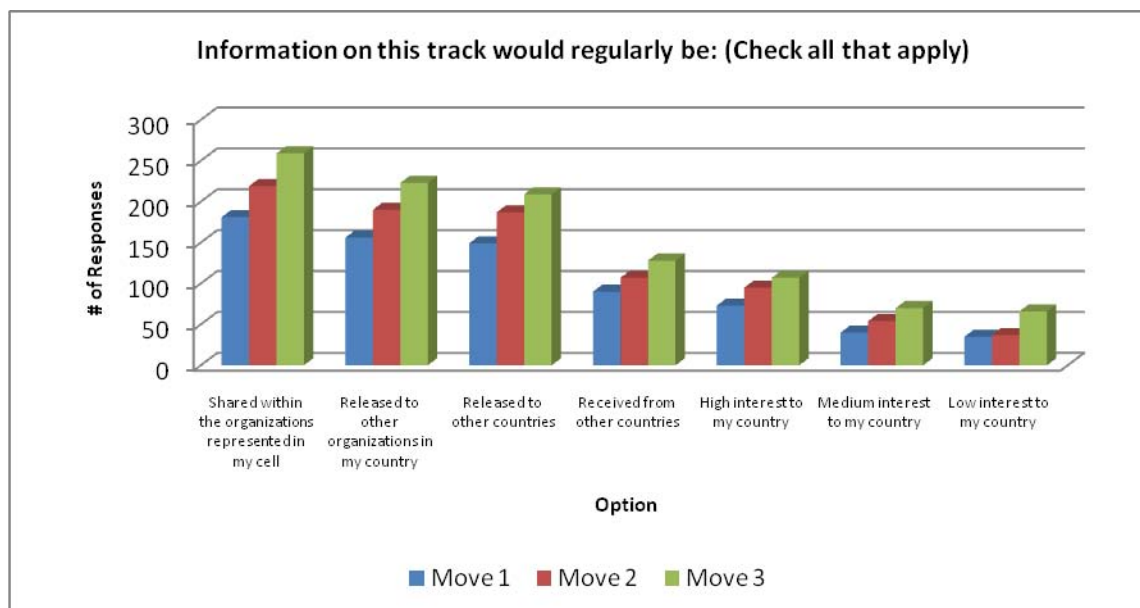
These results indicate that, in general, players’ motivation for not sharing data on a particular track was fairly consistent across all three moves. There are two notable exceptions to this trend that relate directly to the game hypotheses. First, the amount of information that was not shared due to policy concerns was dramatically higher within the Bilateral information-sharing model framework than it was for either the Global or Coalition information-sharing model frameworks. To control for the possible bias in the data, we aggregated the legal and policy responses together. The same trend was observed.



The second significant observation from the trends of responses to sharing decision survey Question 1 is related to the sensitivity of information responses. The supposition under hypothesis 3 is that the Bilateral information-sharing model would create the environment that is most conducive to sharing detailed (sensitive) information. As predicted, sensitivity of information was less of a concern during the Move 2 Coalition information-sharing model. Unexpectedly, sensitivity of information was more of a concern during the Move 3 Bilateral information-sharing model framework than both the Coalition and Global unrestricted information sharing model frameworks. This result serves to correlate the interpretation of the sharing results that refuted the second element of Hypothesis 3.

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The second sharing decision survey question asked: “Information on this track would regularly be: (Check all that apply.)” The response options were: shared within the organizations represented in my cell, released to other organizations in my country, released to other countries, received from other countries, high interest to my country, medium interest to my country, and low interest to my country. The results of this survey question are presented below:



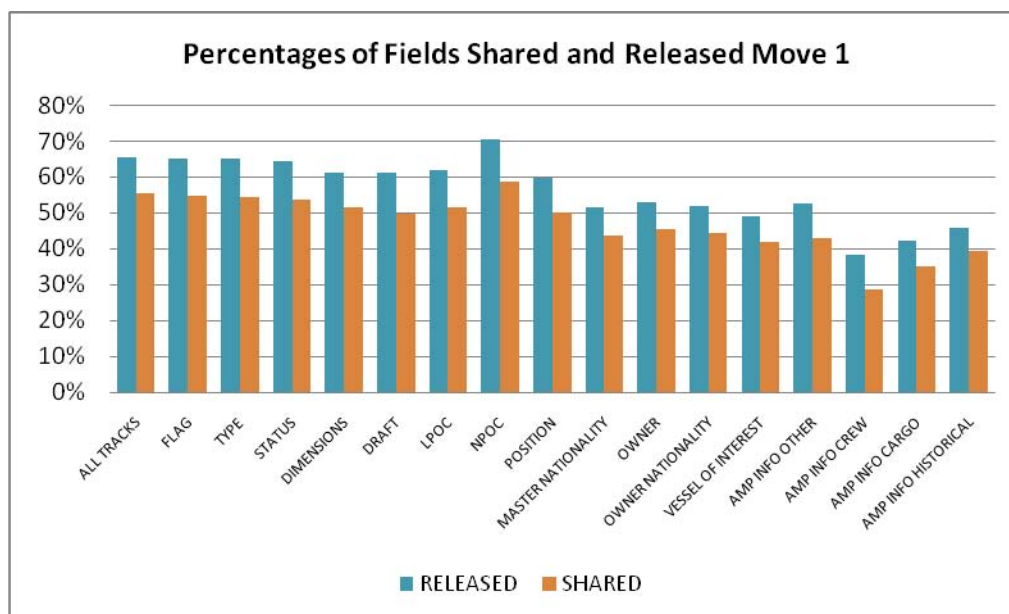
Players discussed ways to work around impediments to sharing in a coalition model. One technique offered was to provide as much detail as possible to help the partner react, but without compromising the source of the information. Another player noted that the downside to this technique is that not knowing the source of the information made it more difficult to evaluate the value of the information shared. Several players agreed that a new maritime domain awareness coalition would benefit from a review or change of individual member national policies with respect to sensitive information sharing. In this move, players were willing to share more, but still would not share information pertaining to military vessels and privacy concerns.

In the Coalition Model the overall amount of information released and shared increased. Specifically, the most significant increase occurred in the sharing of the “Tier 4 information.” Another player suggested that the best way to achieve Maritime Domain Awareness is to use all three models of information sharing: the global model to share non-sensitive info; the coalition model for sharing within common interests; and the bi-lateral model to share more sensitive information.

Move 1: Global Information Sharing Model

The first move used the Global information sharing model. Hypothesis 1 was supported with evidence from game play during Move 1. During this move, country teams were allowed to release and share various data related to a total of 264 tracks. The data fields of vessel of interest, general amplifying information, amplifying information on the crew, amplifying information on the cargo, and historical amplifying information were considered to be the sensitive information

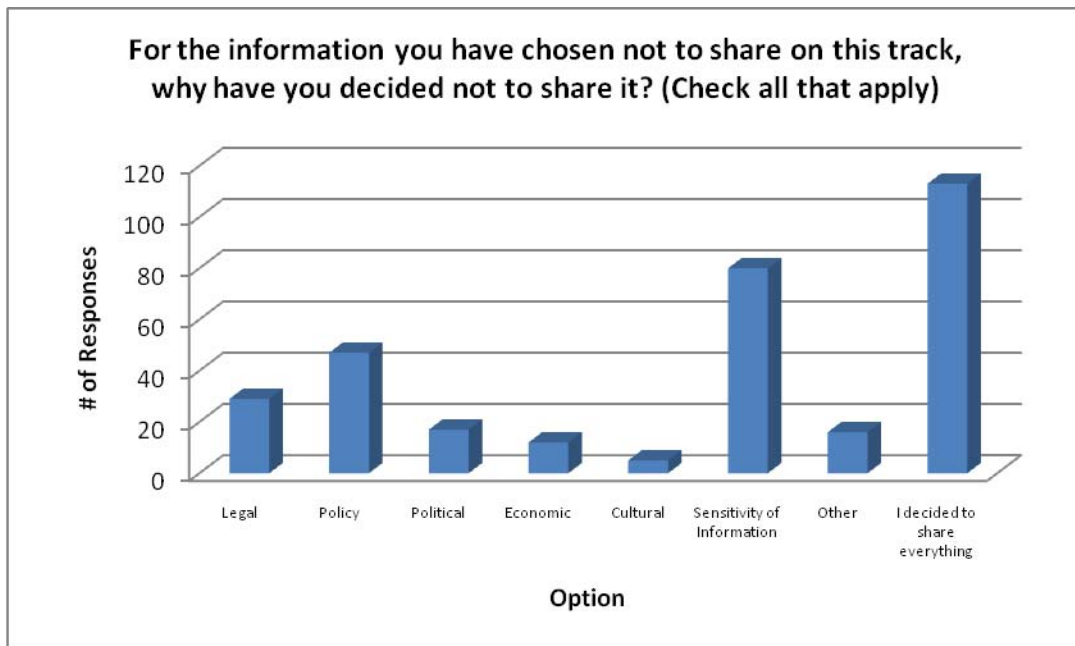
that would indicate willingness on the part of the player to share detailed information. Because not all tracks had data available for each of the data fields, the analysis focused on the percentage of available data fields that was released (shared) by the players. The results are presented below:



More than 50% of the tracks that were available to be shared within the Global unrestricted information-sharing model were shared on the Global network. The figure above also shows that, as the level of sensitivity of the data increases, the players' willingness to share that information decreases. The percentage of data shared for the five fields considered to be indicative of willingness to share detailed data (vessel of interest and amplifying information) is much lower than the total percentage of tracks shared for the less sensitive Tier 1 fields (in the range of 38-52% as opposed to 60-70%). The analysis of participant actions during Move 1 of the game supports the hypothesis that players will share a high volume of track data but share lower amounts of detailed data in the Global unrestricted information-sharing model framework.

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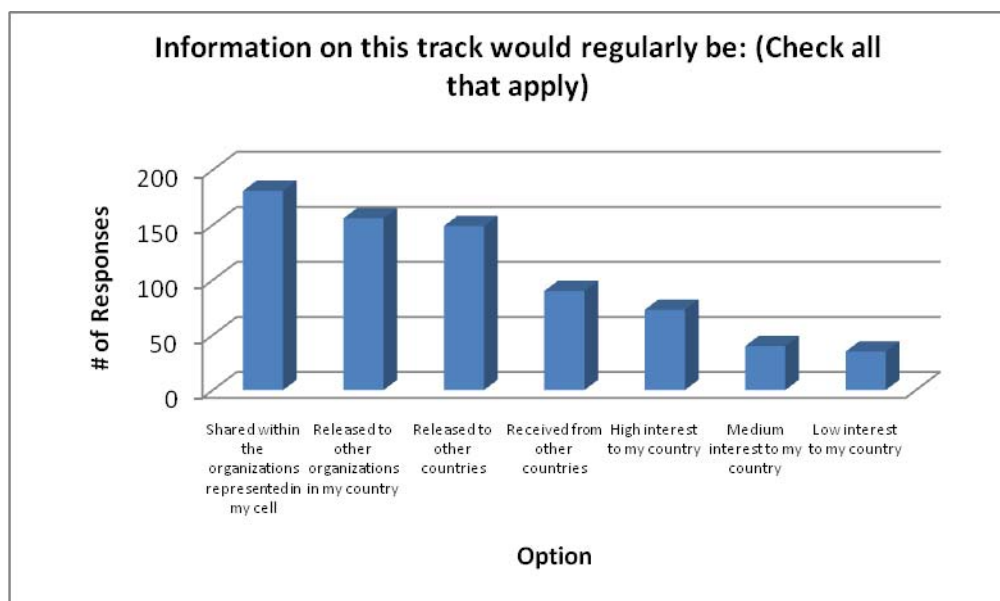
After the trader completed a transaction related to a track, sharing decision survey Question 1 asked: “For the information you have chosen not to share on this track, why have you decided not to share it? (Check all that apply.)” The response options were: legal, policy, political, economic, cultural, sensitivity of information, other, and I decided to share everything. The results of this survey question are presented below:



During Move 1, players indicated that legal and policy restrictions as well as the sensitivity of the information were the primary reasons for not sharing information in the Global information-sharing model. This further supports the hypothesis that more sensitive information would not be shared in this model.

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During Move 1, sharing decision survey Question 2 asked: “Information on this track would regularly be: (Check all that apply.)” The response options were: shared within the organizations represented in my cell, released to other organizations in my country, released to other countries, received from other countries, high interest to my country, medium interest to my country, and low interest to my country. The results of this survey question are presented below:



The survey question shown above demonstrates that players indicated that for information similar to that presented during Move 1, they have a high degree of intradepartmental and interagency sharing and that they receive similar information less often than they share it, indicating that they tend to rely more on domestic activities than international information sharing to meet their MDA requirements. Lastly, the results in this survey that show that the information in this move was of higher interest confirm that the information provided to the players during this move was relevant and reflective of reality.

At the conclusion of each move, the players were asked to complete a survey explaining their actions during the move. The first eight questions were Likert scale questions that lend themselves to some degree of quantitative analysis and will be discussed in detail in the conclusion where move behavior is compared. The remaining questions were open-ended and specific to the individual move. The analysis of the open-ended, qualitative questions involved examination in the survey responses as well as discussions that occurred during the post-move plenary sessions. Prior to being asked the survey questions, participants were given the following directions: “As you read through each question, think about your country’s current information agreements, the structure of the information sharing model used in this move, and those impediments which influenced or restricted your cell’s ability or willingness to share information.”

The results for Move 1 survey questions 1-8 are aggregated with the results from moves 2 and 3 and are found in the appendix.

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Question 9 asked: “What were the major factors that restricted your country cell’s ability to share information during this move. Of these, what were the most common?” The concerns expressed during the post-move survey and plenary following Move 1 shared some common themes. In determining criteria for releasing and sharing information, players cited sensitivity to criminal activity, ongoing investigations, and relationship of information to national security. Alternatively, if the information was needed for a humanitarian relief operation, participants were more willing to share more detailed and sensitive information. Among the impediments to sharing, the players acknowledged legal, policy, and cultural barriers to sharing. Specifically, several players noted that they would not share information if it jeopardized a legal prosecution effort or investigation. Also, they did not openly share cargo data or sensitive commercial shipping data for fear of giving a competitive advantage to other shipping companies.

Question 10 asked: “What were the major legal impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” Over one-third of the players responded “none” or indicated that they lacked sufficient legal experience to render an opinion. Of those who did answer, the sensitivity of the information due to classification and/or the protection of privacy related information were the two common impediments. Moreover, some of the respondents implied that once an investigation was initiated in their home country, the lead agency for the investigation then took responsibility for deciding (legally) what information could be legally released to whom.

Question 11 asked: “What were the major policy impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” The results from the post-move survey and plenary following Move 1 follows. While there were fewer “none” or other responses that indicated players lacked sufficient expertise to render opinions (than there were for the legal impediments question), none of the participants exhibited a broad understanding of all of the policy impediments that restricted their ability to share information. Considering that most players represented the interests of their navies and/or coast guards, they seemed to limit their application of policy-based sharing impediments to those related to military vessels and privacy related information.

Question 12 asked: “What were the major cultural impediments that influenced or restricted your cell’s ability or willingness to share information during this move?” During the post-move survey and plenary following Move 1, the majority of the players responded “none” to this question. Those few who did answer cited the (lack of) trust necessary that the information shared would be properly protected.

Question 13 asked: “During this move, what information was your cell unwilling to share with other countries? Why were you unwilling to share this information?” During the post-move survey and plenary following Move 1, players seemed reluctant to provide comprehensive answers. Most of the players appeared to focus on what type of information that their country was unwilling to share. Some of the more common responses were: information that was generally classified, military vessel information, privacy sensitive information like crew lists, and economically sensitive information like cargo manifests.

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Question 14 asked: “What were the major factors that influenced your cell’s willingness to share information during this move? Of these, what were the most common?” The most common response was that players were more willing to share information when they perceived it to be in support of the common good.

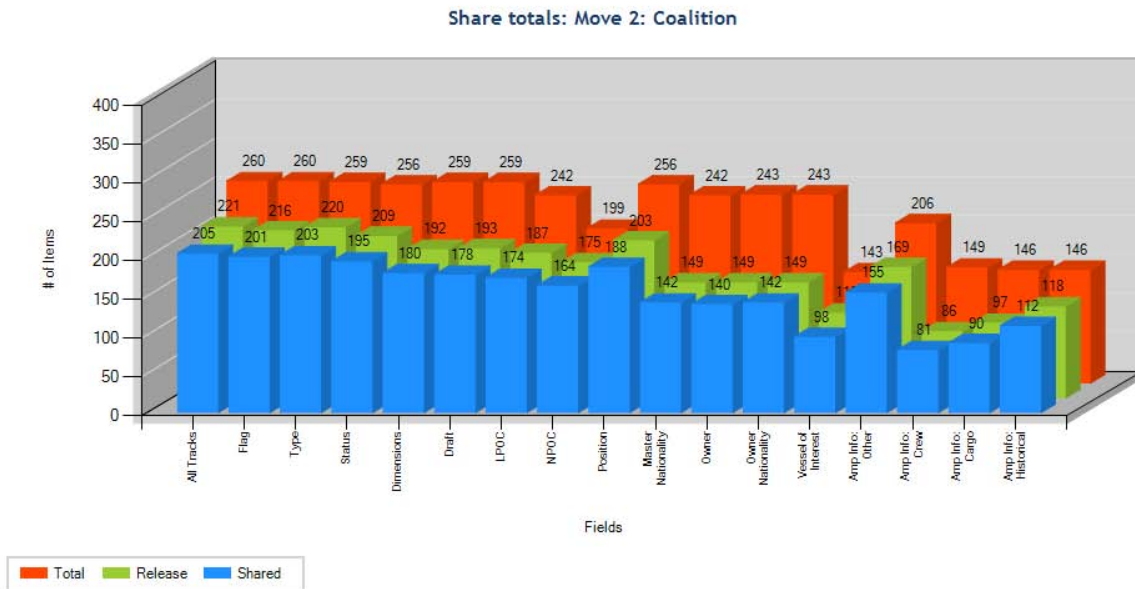
Question 15 asked: “During this move, what information was your country cell unable to share with other countries? Why were you unable to share this information?” During the post-move survey and plenary following Move 1, similar to Question 13, most of the players appeared to focus on only one type of information that their country was unable to share. Some of the more common responses were: information that was generally classified, military vessel information, privacy sensitive information like crew lists and economically sensitive information like cargo manifests. Few cited the specific reason they were unable likely because they had just cited the reasons in the preceding questions.

Question 16 asked: “What information did your country cell share during this move that you normally would not share with other countries? Please explain why you shared this information.” During the post-move survey and plenary following Move 1, there was consensus that the vast majority of players did not share information during the move if they felt as if they would be unable/unwilling to share it in the real world.

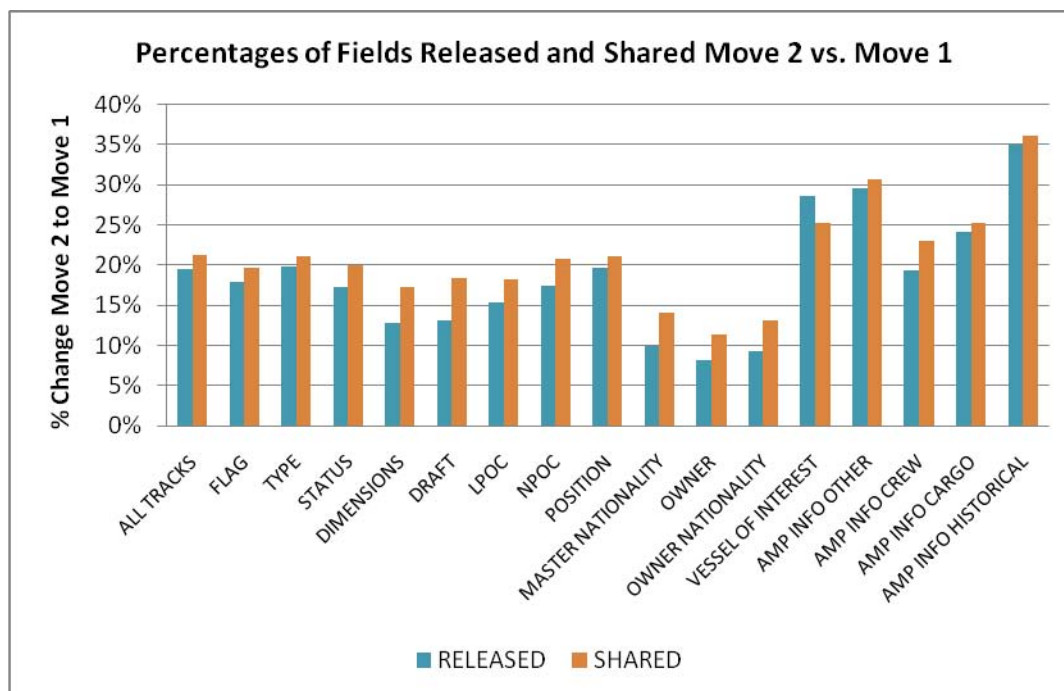
Question 17 asked: “What issues during this move would be worthy of future study?” During the post-move survey and plenary following Move 1, there was no consensus. Given the wide disparity in experience levels and expertise at this game, it is no surprise that many different issues were highlighted as worthy of future study. No central theme was identifiable. Protecting the source, limiting distribution away from potential hostile entities and capacity limitations were the three primary impediments to the global sharing model identified by the participants.

Move 2: Coalition Information Sharing Model

The second move employed the Coalition information sharing model. Hypothesis 2 is supported with evidence from game play during Move 2 and Move 1. During this move, country teams were allowed to release and share various data related to a total of 260 tracks. The sharing results from move 2 are below:

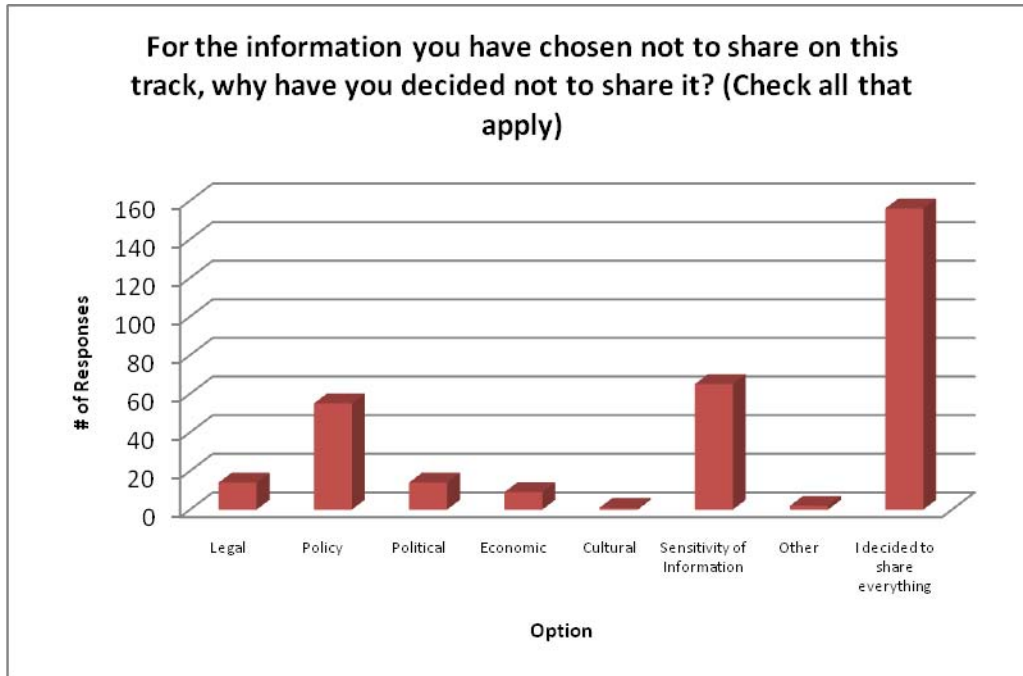


The differences between percentages of tracks released (shared) during Move 2 compared to percentages released (shared) in Move 1 are presented in Figure 2:



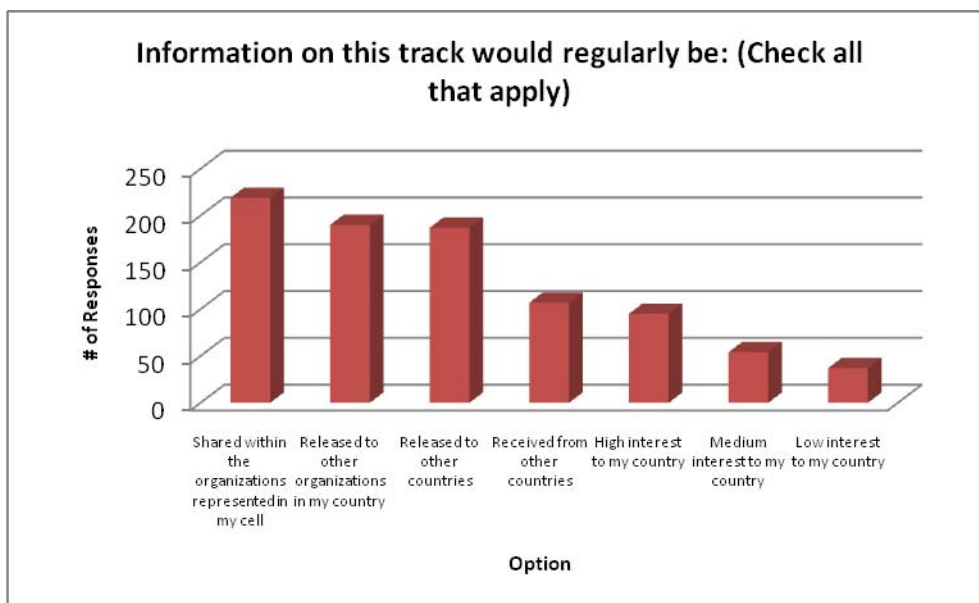
The figure above shows that players shared a higher percentage of track information (higher volume) for every possible data field in the Coalition information-sharing framework than they shared in the Global unrestricted information-sharing framework. Additionally, the percent of increases in the amount of data shared for the five sensitive data fields (Tiers 2-4) is dramatically more pronounced than the increase in data shared for the less sensitive AIS-type (Tier 1) data. These results tend to support the hypothesis that players will share a high volume with more detail in a Coalition information-sharing model when compared to the Global unrestricted information-sharing model.

Sharing decision survey Question 1 asked: “For the information you have chosen not to share on this track, why have you decided not to share it? (Check all that apply.)” The response options were: legal, policy, political, economic, cultural, sensitivity of information, other, and I decided to share everything. The results of this survey question are presented below:



During Move 2, players indicated that legal and policy restrictions as well as the sensitivity of the information were the still reasons for not sharing information in the Coalition information-sharing model, but the proportion of “I decided to share everything” responses increased.

Sharing decision survey Question 2 asked: “Information on this track would regularly be: (Check all that apply.)” The response options were: shared within the organizations represented in my cell, released to other organizations in my country, released to other countries, received from other countries, high interest to my country, medium interest to my country, and low interest to my country. The results of this survey question are presented below:



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The survey results shown above are consistent with those for Move 1.

Prior to being asked the survey questions, participants were given the following directions: “As you read through each question, think about your country’s current information agreements, the structure of the information sharing model used in this move, and those impediments which influenced or restricted your cell’s ability or willingness to share information.”

The results for Move 2 survey questions 1-8 are aggregated with the results from Moves 1 and 3 and are found in the appendices.

Question 9 asked: “What were the major factors that restricted your country cell’s ability to share information during this move. Of these, what were the most common?” Following Move 2, the players indicated that they released more info, and were willing to share a greater percentage of information released as a result of security in coalition and better gamesmanship. Several players agreed that the coalition model of sharing was easier to use because they already had a common framework and common interests from which to evaluate their decisions to share information. Additionally, there was a sense among the players that they were willing to share information more readily in a coalition model even when their own policies were not clear or known because of the existence of a game-specific legal structure. Another 25 percent of the players said that they shared information in Move 2 even though it went against the policies of their respective governments. Players assumed more trust in their coalition partners and pushed more information and with greater detail. Players also responded that they increased sharing of sensitive information but still withheld military or law enforcement information in most cases. One player noted that the existence of the game-specific coalition was critical to opening the door to sharing. During this move, players noted types of information that would likely limit sharing. These were: military and law-enforcement related vessels and reports, information that could embarrass friendly nations that were not necessarily part of the coalition, and the last and next ports of call for any specific vessel. One player noted that better gamesmanship led them to push all information except for military and sensitive information.

Question 10 asked: “What were the major legal impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” Following Move 2, similar to Move 1, over one third of the players cited no major legal impediments that influenced their ability or willingness to share information in a Coalition information-sharing model framework. Of those players who commented, over half cited “privacy” issues over personnel, both crew and passengers, and cargo as the major legal impediments to sharing information. Several players noted that “legal and law enforcement actions” were legal impediments as well. One player noted that they felt that there were fewer impediments to sharing in the coalition model.

Question 11 asked: “What were the major policy impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” The three major policy impediments identified in Move 2 were National Security Policy over military sensitive information, privacy policy for personnel and commercial information, and the need to

protect intelligence sources. One player also cited the need to respect host nation policy for a vessel in a foreign port.

Question 12 asked: “What were the major cultural impediments that influenced or restricted your cell’s ability or willingness to share information during this move?” Following Move 2, most players again noted that no cultural impediments to information sharing. The only caveat was that one player cited information that was potentially showing insensitivity to neighboring countries as being a cultural impediment to sharing information in the coalition model.

Question 13 asked: “During this move, what information was your cell unwilling to share with other countries? Why were you unwilling to share this information?” Following Move 2, the majority of players cited at least some reason for their unwillingness to share with other countries. Similar to Move 1, many players cited types of information that they did not share such as military vessel information, personnel and crew manifest privacy information, and ongoing law enforcement activities and/or investigations. Several specific responses included not sharing information about a submarine in order to protect an intelligence source and a merchant ship operating in the EEZ, even though that was considered to be international water.

Question 14 asked: “What were the major factors that influenced your cell’s willingness to share information during this move? Of these, what were the most common?” Following Move 2, players cited several common factors that influenced their willingness to share information in the coalition model. Being a part of the coalition was cited by a third of the players, and they amplified their comments by emphasizing the increased cooperation and trust that a formal agreement and associated framework engendered. In addition to identifying the usefulness of having common objectives, some players said that they also viewed safety as a common goal to coalition and non-coalition players. Most were willing to share information based upon this “common good” justification. Of note, one player also noted that the UN-convention represented a larger coalition and reason to share safety related information.

Question 15 asked: “During this move, what information was your country cell unable to share with other countries? Why were you unable to share this information?” Following Move 2, one quarter of the players responded that there was no information that they could not share in Move 2. The players who identified information that they were unable to share cited the common reasons military and privacy sensitivities, similar to their responses in Question 13. A possible skew in the data with this question may be related to the fact that some players did not seem to understand the difference between “unwilling to share” and “unable to share” as asked in Question 13 and Question 15 of the survey.

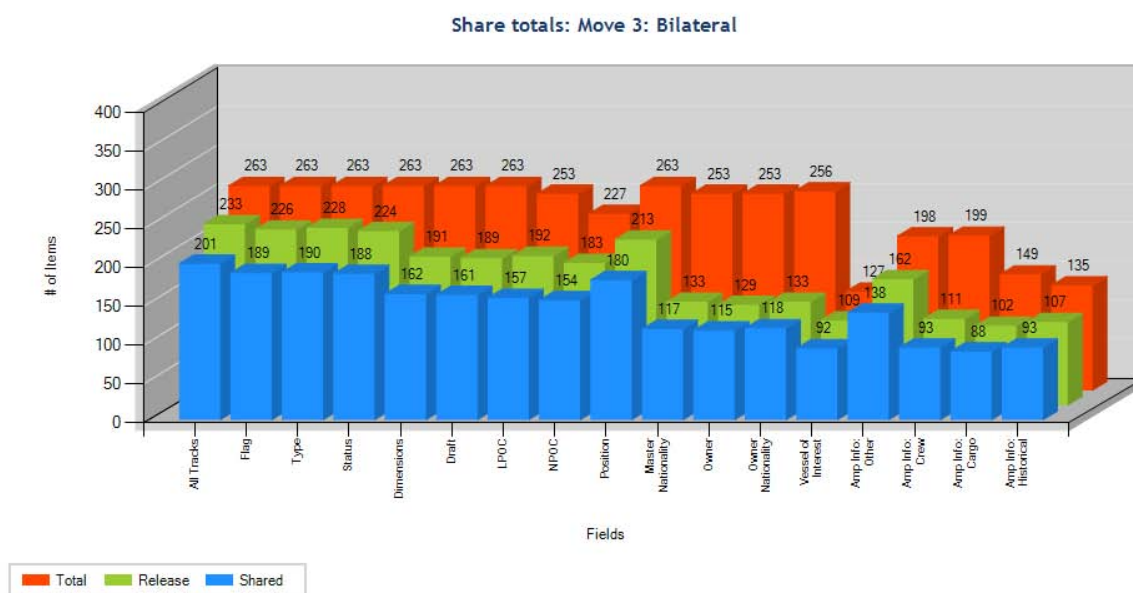
Question 16 asked: “What information did your country cell share during this move that you normally would not share with other countries? Please explain why you shared this information.” Following Move 2, less than half of the players said there was no information shared that they normally would not share. Players who came from nations with an existing regional MDA sharing network emphasized that they routinely shared the types of information available during this move through those networks, thereby confirming that the scenario information that was provided to the players was reasonably realistic and supported game

objectives adequately. Several players commented that they shared or amplified more sensitive data such as vessel locations, terrorist information, and illicit activities because they were in a coalition.

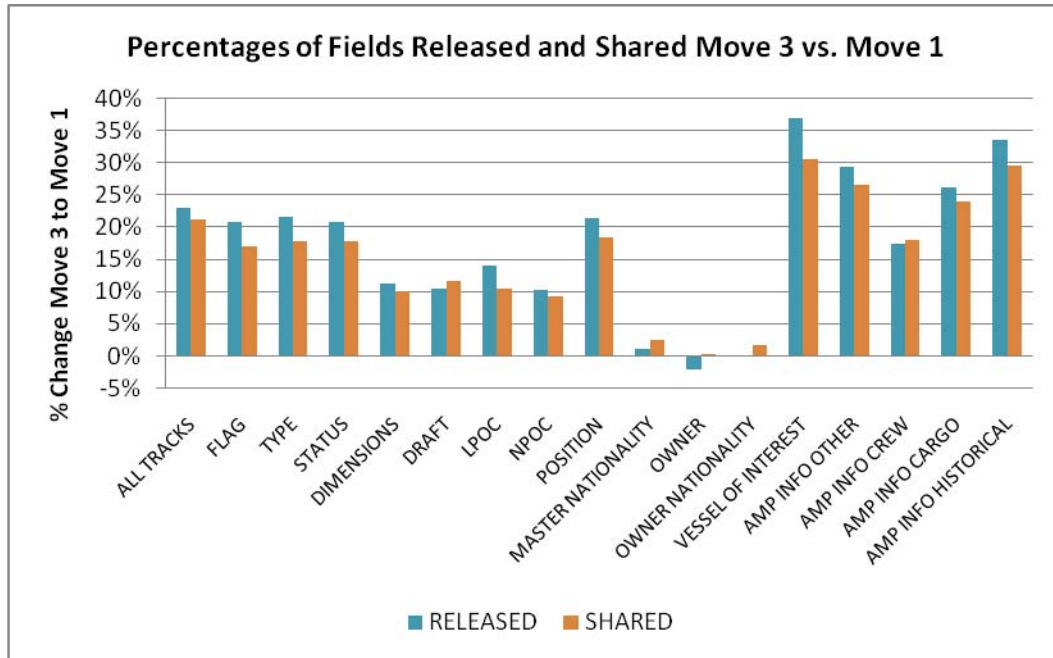
Question 17 asked: “What issues during this move would be worthy of future study?” As with the Move 1 post-move survey and plenary, there was no consensus.

Move 3: Bilateral Information Sharing Model

The last move in the game used the Bilateral information sharing model. In this structure, information was only exchanged bi-laterally. The sharing results from this move are displayed below:

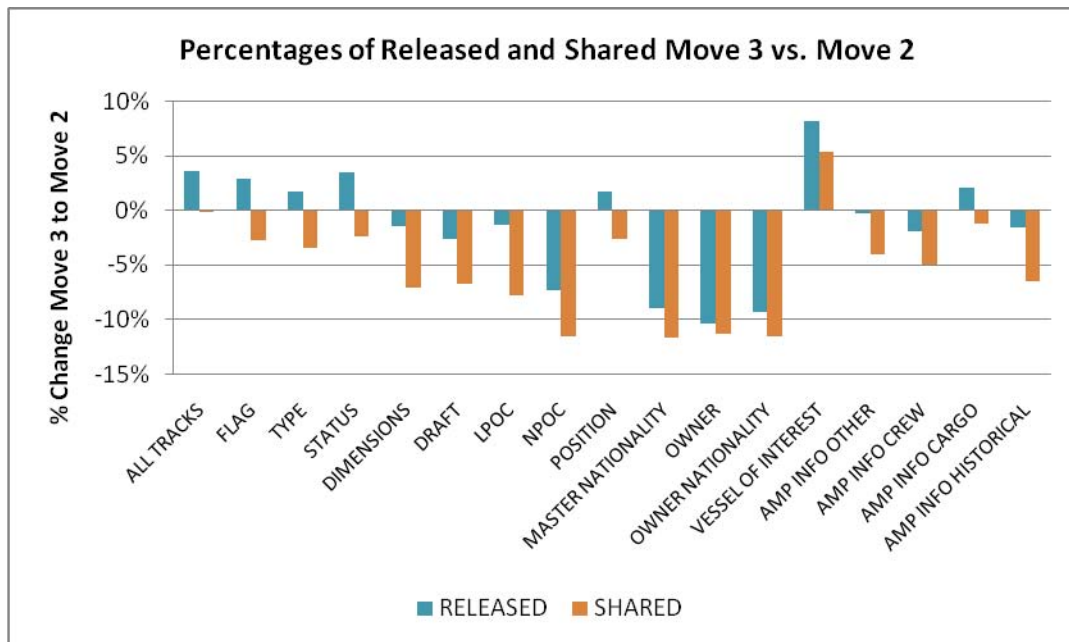


Hypothesis 3 is not supported with evidence from game play during Move 3 compared to results from Move 1 and Move 2. During this move, country teams were allowed to release and share various data related to a total of 263 tracks. The differences between percentages of tracks released (shared) during Move 3 compared to percentages released (shared) in Move 1 are presented below:



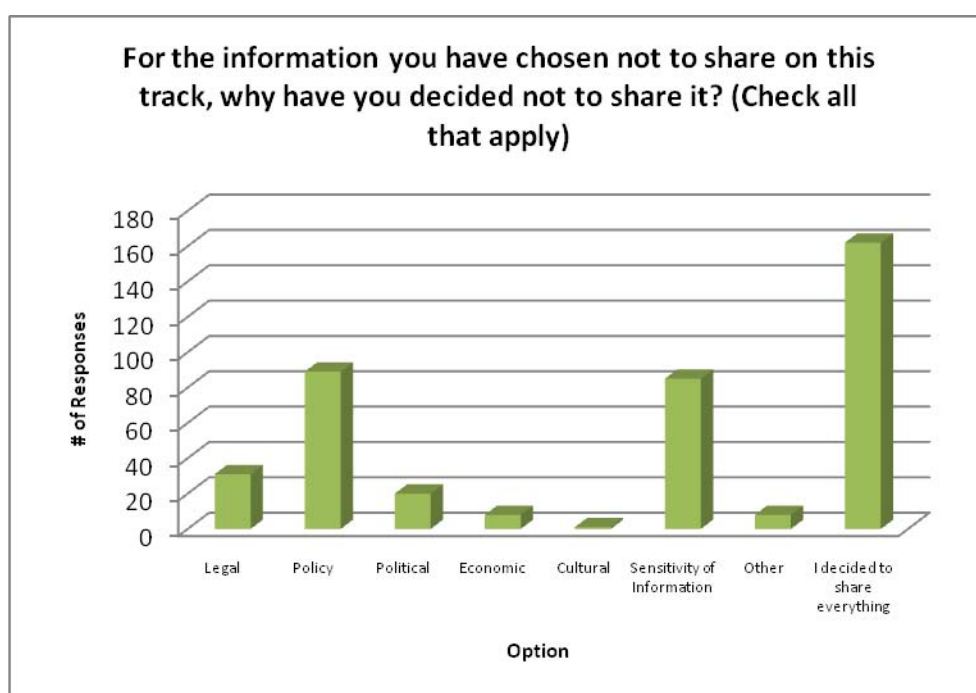
Players shared a higher percentage of track data on a per country basis within the Bilateral information sharing model framework than they did within the Global unrestricted information-sharing model framework. However, when the number of recipients is factored in, the overall volume is significantly lower, supporting the first element of H3.

The differences between percentages of tracks released (shared) during Move 3 compared to percentages released (shared) in Move 2 are presented below:



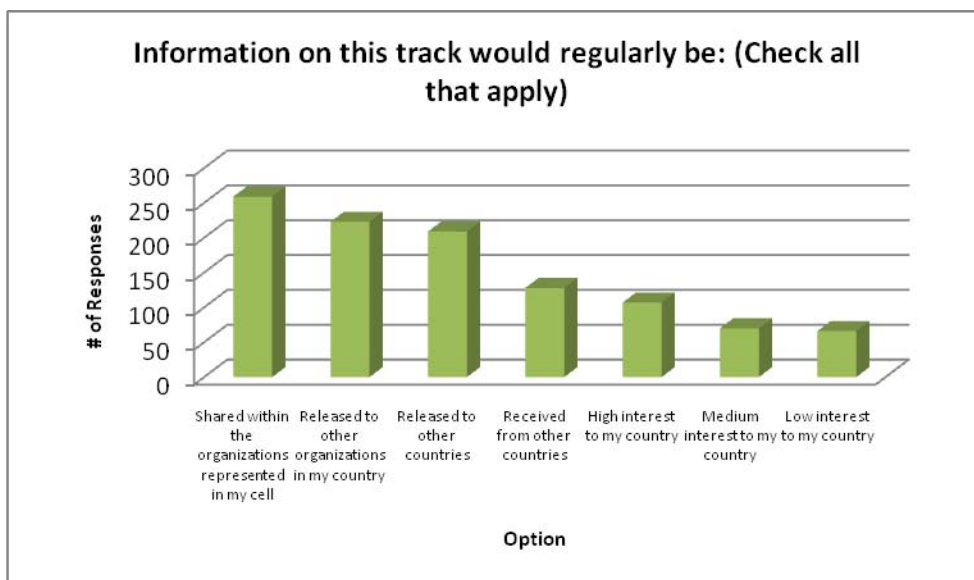
Players shared an equal or lower percentage of detailed track data within the Bilateral information-sharing model framework than they did within the Coalition information-sharing model framework for all track fields except one (vessel of interest). This result would refute the second contention of H3 that supposes that players will share the highest amount of detailed information in the Bilateral information sharing model.

The following points examine the two Sharing Decision Survey questions the player's responded to during this move. Sharing decision survey Question 1 asked: "For the information you have chosen not to share on this track, why have you decided not to share it? (Check all that apply.)" The response options were: legal, policy, political, economic, cultural, sensitivity of information, other, and I decided to share everything. The results of this survey question are presented below:



During Move 3, players indicated that legal and policy restrictions as well as the sensitivity of the information were the still reasons for not sharing information in the Bilateral information-sharing model, but the proportion of "I decided to share everything" responses increased.

Sharing decision survey Question 2 asked: "Information on this track would regularly be: (Check all that apply.)" The response options were: shared within the organizations represented in my cell, released to other organizations in my country, released to other countries, received from other countries, high interest to my country, medium interest to my country, and low interest to my country. The results of this survey question are presented below:



The results for Move 3 post-move survey questions 1-8 are aggregated with the results from moves 1 and 2 and are found in the appendices.

Prior to being asked the survey questions, participants were given the following directions: “As you read through each question, think about your country’s current information agreements, the structure of the information sharing model used in this move, and those impediments which influenced or restricted your cell’s ability or willingness to share information.”

Question 9 asked: “What were the major factors that restricted your country cell’s ability to share information during this move. Of these, what were the most common?” Following Move 3, many players commented that because each and every bilateral relationship is different, it was hard to make generalizations. But, most agreed that when a bilateral relationship was formed on the foundation of shared objectives with privacy and trust, the most sensitive information could/would be shared. Some players commented on the shift from a “push” to a “pull” strategy. Some believed this was in some ways attributable to game design and that it might not in all cases reflect reality. The incentive to win the game encouraged players to not “push” information and adopt a “if they ask”....and if we’ve either got an existing bilateral relationship.... or if the forming of a bilateral relationship would not violate any of our laws or policies, “we’ll give” mentality.

Question 10 asked: “What were the major legal impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” Following Move 3, as with Moves 1 and 2, over one third of the players cited no major legal impediments that influenced their ability or willingness to share information during Move 3. It is unclear, however, if this answer resulted from an extensive understanding and analysis of their legal environment or if they just didn’t have enough of a legal background to render an informed opinion. Of those players who commented, over half cited “privacy” issues over crew, passengers, and cargo as the major legal impediments to sharing information. Several players noted that “legal and law enforcement actions” were legal impediments as well. One player felt

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that there were fewer impediments to share in the bilateral model and another noted what he believed to be a lack of understanding - by other participants - on the boundaries of the bilateral agreements that had been established. Two players cited NATO rules as legal impediments influencing or restricting their ability to share information and two other players cited lack of confidentiality agreements as legal impediments, indicating they may not have understood that the Bilateral information sharing model was designed to provide players with the flexibility to establish –for the purposes of the game- confidentiality agreements as long as they were in accordance with their own laws and policies.

Question 11 asked: “What were the major policy impediments that influenced or restricted your country cell’s ability or willingness to share information during this move?” During Move 3, slightly more than one third of the players cited no major policy impediments to sharing under the bilateral information sharing model. Of those who identified policy impediments, restrictive policies on the sharing of information on military vessels were the most common. Other policy impediments included NATO policies and a lack of Memoranda of Understanding (MOU) again indicating they may not have understood that the Bilateral information sharing model was designed to provide players with the flexibility to establish (for the purposes of the game) MOU’s as long as they were in accordance with their own laws and policies.

Question 12 asked: “What were the major cultural impediments that influenced or restricted your cell’s ability or willingness to share information during this move?” As in Moves 1 and 2, most players noted no cultural impediments to information sharing. The exception being one player who cited the potential for showing insensitivity to neighboring countries as being a cultural impediment to sharing information.

Question 13 asked: “During this move, what information was your cell unwilling to share with other countries? Why were you unwilling to share this information?” Similar to Move 1 and Move 2, many players noted that they were specifically unwilling to share military vessel information and, in some cases, provided amplifying details to specify the types of military information they were unwilling to share (i.e., own country military, other nations military, naval vessels not on international deployments, etc.). Other players identified cargo information, personnel and crew manifests, other privacy information and ongoing law enforcement activities and/ or investigations as examples of information they were unwilling to share. Very few provided the reason behind their lack of willingness to share although those who did often cited sensitivity and classification.

Question 14 asked: “What were the major factors that influenced your cell’s willingness to share information during this move? Of these, what were the most common?” As opposed to Moves 1 and 2, where the players cited several common factors that influenced their willingness to share information, in the Bilateral model, the factors were wide and varied with no perceptible common theme. Examples of factors listed included: winning the game, trying to share as widely as possible, the principle of reciprocity, quid pro quo, and need to know.

Question 15 asked: “During this move, what information was your country cell unable to share with other countries? Why were you unable to share this information?” Similar to Move 1

and Move 2, many players noted that they were specifically unable to share military vessel information and in some cases provided amplifying details to specify the types of military information they were unable to share (i.e., own country military, other nations military, naval vessels not on international deployments etc.). Other players identified cargo information, personnel and crew manifests, other privacy information and ongoing law enforcement activities and/ or investigations as examples of information they were unable to share. Very few provided the reason behind their inability to share although those who did often cited sensitivity and classification. This may indicate once again that they may not have understood the Bilateral information sharing model was designed to provide players with the flexibility to establish –for the purposes of the game- confidentiality agreements with mutually agreed upon protocols that allowed for the sharing of sensitive information as long as they were in accordance with their own laws and policies.

Question 16 asked: “What information did your country cell share during this move that you normally would not share with other countries? Please explain why you shared this information.” Two thirds of the players responded “none.” Of those who provided examples of information they shared during the game that they would not normally share, military vessel information and sensitive criminal information were the two most often cited.

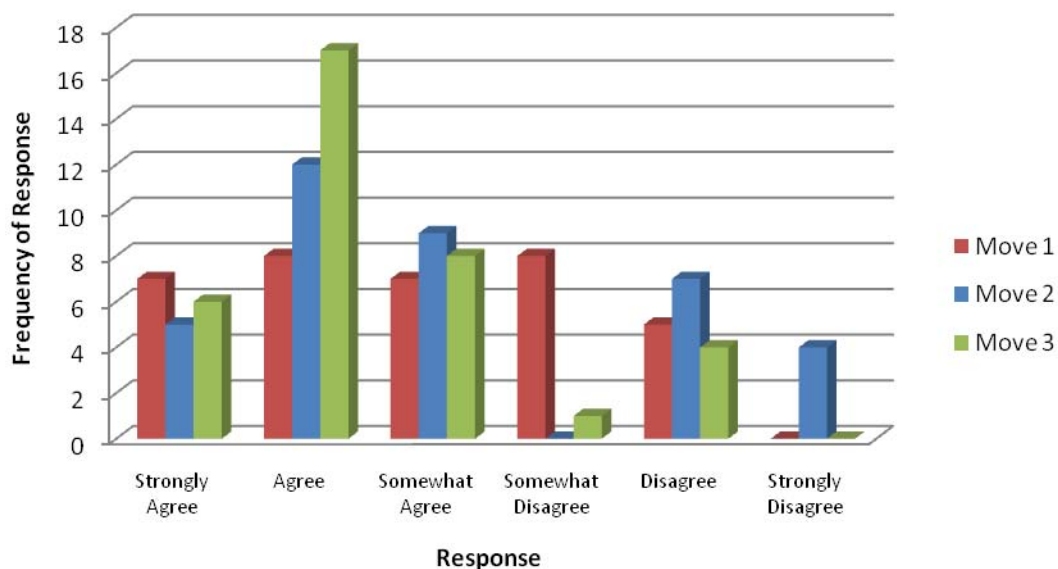
Question 17 asked: “What issues during this move would be worthy of future study?” As with the post-move surveys and plenary sessions for Move 1 and 2, there was no consensus.

Move 1-3 Aggregated Post-Move Survey Results, Questions 1-8:

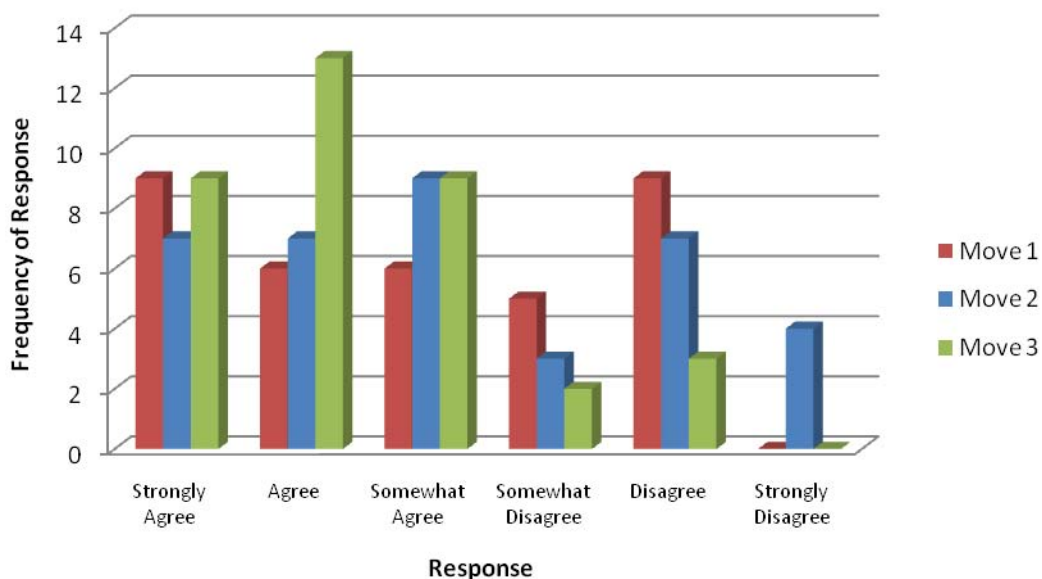
At the end of each move, each participant was required to complete a survey consisting of eight questions. The analysis of these surveys tends to support the conclusions drawn from the analysis of participant actions during each of the game moves. The first six survey questions were on a six-point Likert scale (ranging from 6-Strongly Agree to 1-Strongly Disagree). The last two questions were on a four-point Likert scale (ranging from 4-High to 1-None). Frequency distributions for each of the questions across each of the three moves are presented in the following figures:

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Q1. The total amount of tracks my country cell received from other countries during this move influenced my cell's decision making.

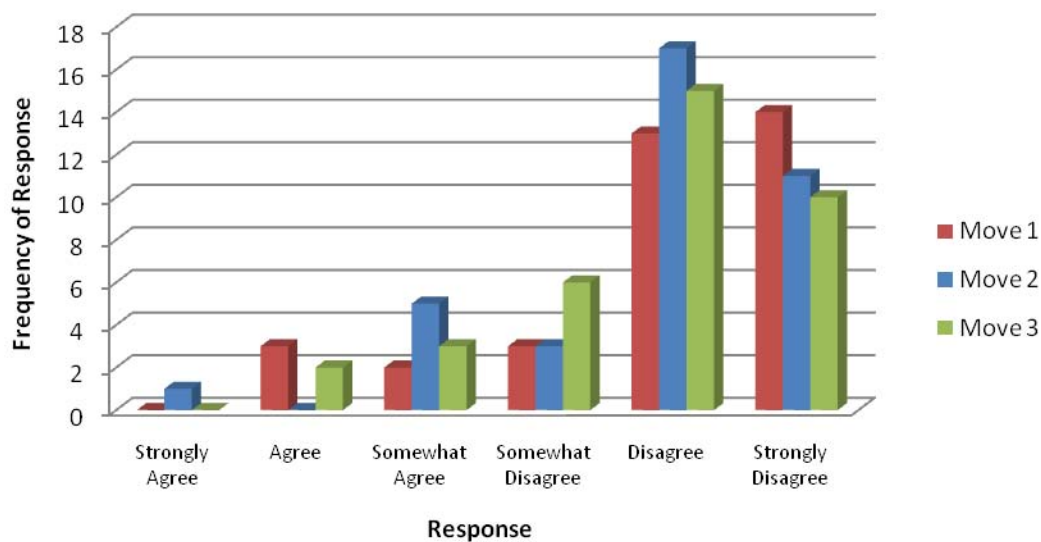


Q2. The level of detail my country cell received from other countries during this move influenced my cell's decision making.

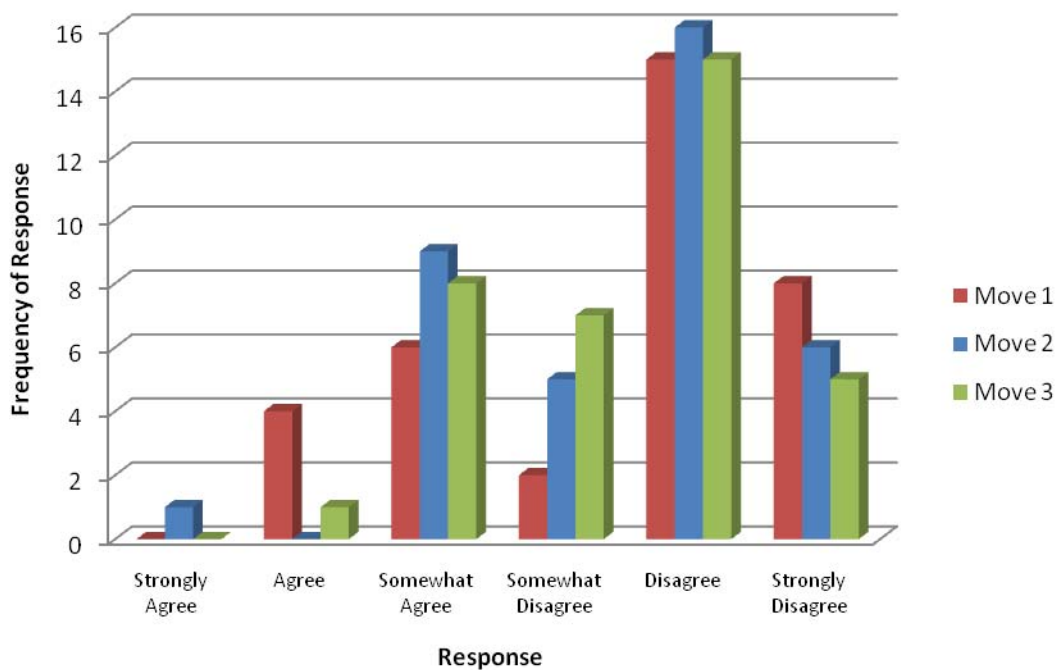


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Q3. During this move, my country cell made decisions that were contrary to existing domestic information sharing policies or agreements.

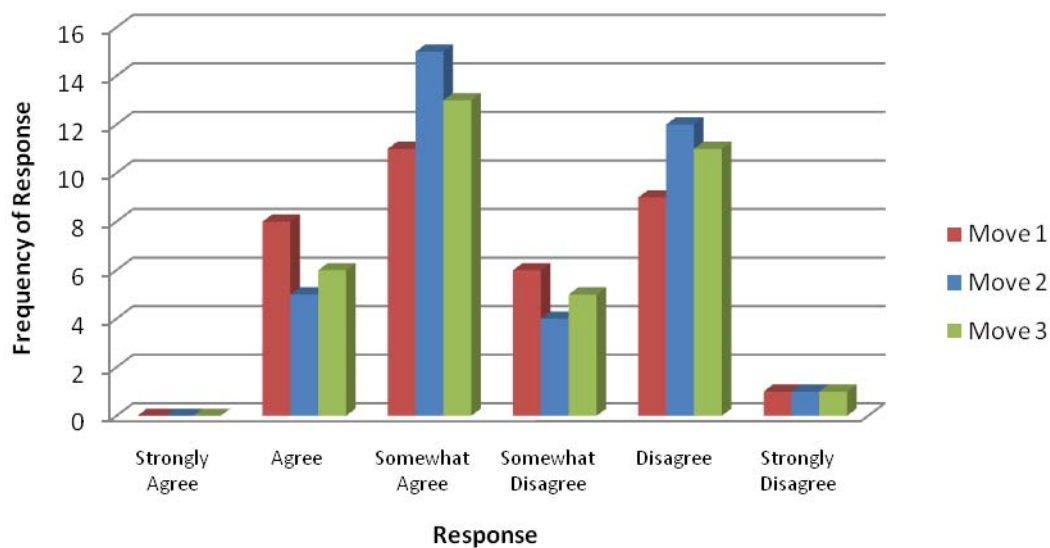


Q4. During this move, my country cell made decisions regarding situations which are not covered or governed by domestic policies or guidance.

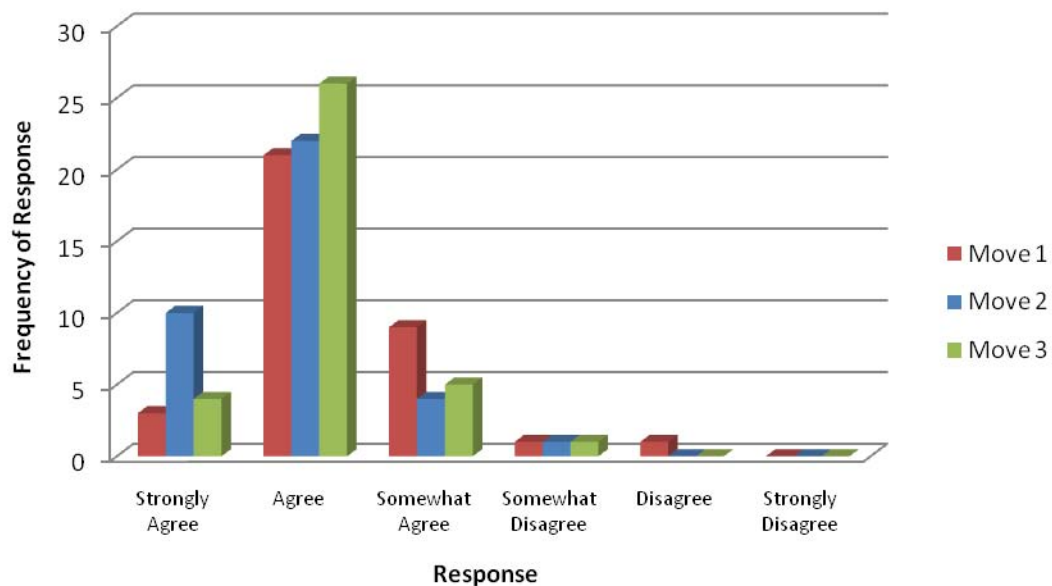


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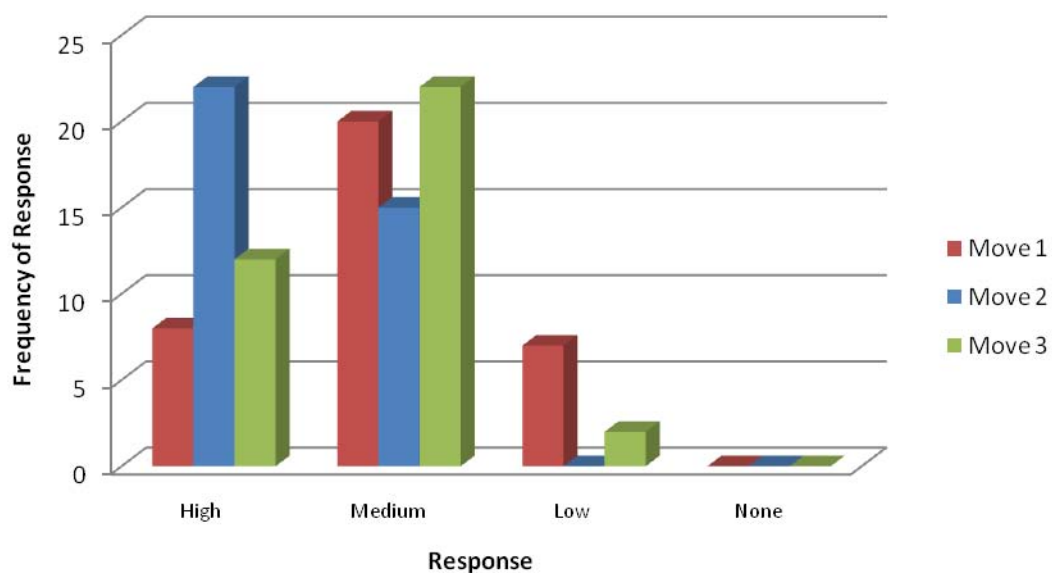
Q5. Based on the decisions my country cell made in this move, existing domestic policies and agreements need further examination.



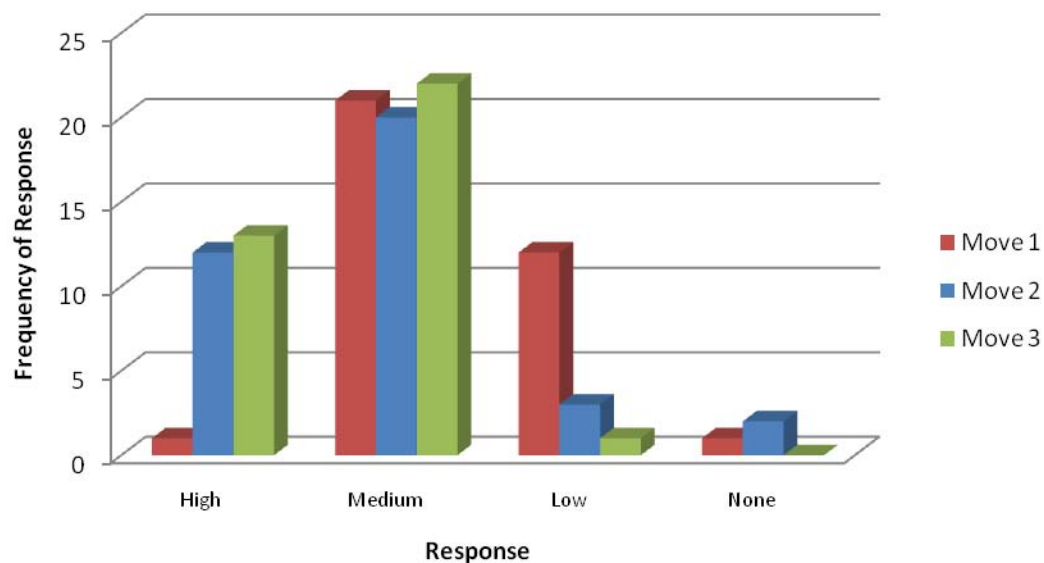
Q6. The information made available to my country cell during this move would help support my country's national security objectives.



Q7. Overall, the Global (Coalition, Bilateral) Information Sharing model enabled my country cell to share a low, medium, or high amount of information held by my country.



Q8. Overall, the Global (Coalition, Bilateral) Information Sharing model enabled my country cell to share information that was of low, medium or high sensitivity.



General trends in responses to the survey questions can be observed in the frequency distributions presented above. Further analyses were performed to determine if the participant answers to these questions varied from move to move. Basic statistics (mean, median, mode, and standard deviation) are presented in Table 1:

Table 1: Summary Statistics For Survey Answers								
Move 1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Mean	4.11	4.03	2.06	2.51	3.46	4.69	3.03	2.63
Median	4	4	2	2	4	5	3	3
Mode	5	6	1	2	4	5	3	3
Standard Deviation	1.37	1.56	1.24	1.34	1.20	0.80	0.66	0.60
Move 2	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Mean	3.89	3.78	2.16	2.57	3.30	5.11	3.59	3.14
Median	4	4	2	2	4	5	4	3
Mode	5	4	2	2	4	5	4	3
Standard Deviation	1.62	1.66	0.98	1.07	1.16	0.68	0.50	0.81
Move 3	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Mean	4.56	4.64	2.22	2.58	3.33	4.92	3.28	3.33
Median	5	5	2	2	4	5	3	3
Mode	5	5	2	2	4	5	3	3
Standard Deviation	1.15	1.17	1.14	1.09	1.18	0.58	0.57	0.54

Statistical significance tests were performed to determine whether the answers to the survey questions varied from move to move. The difference in means tests using a *t*-statistic with a 95% significance level indicates that respondents answered with statistically significant differences in five of the eight questions as measure by this test statistic.

Question 1 asks participants to respond to the following statement: “The total amount of tracks my country cell received from other countries during this move influenced my cell’s decision making.” The mean response on a scale of 1 to 6 in Move 3 (mean=4.56) was significantly higher than the mean response in Move 2 (mean=3.89). Question 2 asks participants to respond to the following statement: “The level of detail my country cell received from other countries during this move influenced my cell’s decision making.” Again, the mean response in Move 3 (mean=4.64) was significantly higher than the mean response in Move 2 (mean=3.78). These statistically significant differences reflect the fact that players were much more involved in direct negotiations and *quid pro quo* arrangements during the Bilateral information-sharing model framework than they were during the Coalition information-sharing model framework. The survey results from these two questions may partially explain why the level of detailed information was less during Move 3 than it was during Move 2 contrary to the supposition offered in H3.

Question 6 asks participants to respond to the following statement: “The information made available to my country cell during this move would help support my country’s national security objectives.” The results of the analysis of these responses to this question may also help to explain why H3 was not supported. The mean response on a scale of 1 to 6 in Move 2 (mean=5.11) was statistically significantly higher than the mean response in Move 1 (mean=4.69), but there was no statistically significant difference between either of those and

Move 3 (mean=4.92). The inference here would be that moving from a Global unrestricted information-sharing model to a Coalition information-sharing model creates an environment where shared information is perceived to be a significant incremental benefit. While the mean response to the question following Move 3 is higher than the mean response after Move 1, the difference is not as pronounced as it is during Move 2 (and statistically insignificant at the 95% confidence level).

Question 7 asks participants to respond to the following statement: “Overall, the Global (Coalition, Bilateral) Information Sharing model enabled my country cell to share a low, medium, or high amount of information held by my country.” The mean response on a scale of 1 to 4 in Move 2 (mean=3.59) was statistically significantly higher than the mean response in Move 1 (mean=3.03) and higher than the mean response in Move 3 (mean=3.28). Based on these survey results, the amount of information that players perceive themselves as able to share peaks within the Coalition information-sharing model framework. These results support H2 (Coalition model has more volume than Global model) and also help reject H3 (lowest volume and most detail in the Bilateral model).

Finally, Question 8 asks participants to respond to the following statement: “Overall, the Global (Coalition, Bilateral) Information Sharing model enabled my country cell to share information that was of low, medium or high sensitivity.” The mean response on a scale of 1 to 4 in Move 1 (mean=2.63) was statistically significantly lower than the mean response in Move 2 (mean=3.14) and Move 3 (mean=3.33). These results tend to contradict observations of player actions during the game as well as some of the earlier survey questions. Here, respondents seem to indicate that the Bilateral information-sharing model is the framework where they were best able to share sensitive data.



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