15th ICCRTS: The Evolution of C2

The Global Maritime Partnership: Networking Challenges and Opportunities

Track 4: Collective Endeavors

Mr. George Galdorisi
Dr. Stephanie Hszieh
June 23, 2010
“Buying the right systems may give us enormous advantages if we understand how to fight the new way. If we buy the new systems but not the tactical style that goes with them, we will lose capability, even against those who have not invested in similar equipment.”

Dr. Norman Friedman

Network-Centric Warfare
Outline

▼ Background

▼ Perspective

▼ The Challenge of Naval Coalition Networking

▼ Tell It To The Labs: Achieving Coalition Networking

▼ A Way Forward
Background
“The International Seapower Symposium we held in Newport last year was attended by 102 countries and 92 chiefs of navy, the largest gathering of navy chiefs in history. This Symposium emphasized the importance of the global maritime partnership and how it continues to grow.”

Admiral Gary Roughead
Chief of Naval Operations
Remarks at the Navy League Sea-Air-Space Exposition
May 03, 2010
“To function effectively, the 1,000-ship Navy will not only require high levels of international political support to foster the necessary levels of cooperation, but also will be heavily technologically dependent.”

Dr. Chris Rahman

*The Global Maritime Partnership Initiative: Implications for the Royal Australian Navy*

Papers in Australian Maritime Affairs
International navies that must work together to secure the global commons have a rich history of cooperation at sea

This successful cooperation in peace & war has raised the bar for future levels of cooperation

This naval cooperation has become instantiated in the nascent global maritime partnership

Challenges to this enhanced cooperation are many and are dependent on effective C4ISR
Perspective
“Most think that bigger, faster, and more is best when talking about providing technology to naval forces. But this is not always the case. What matters in not how much you communicate, but rather getting the right information to the right people at the right time.”

Professor Nicholas Rodger
Exeter University
Keynote Address
2007 King Hall Conference
“When John Fisher became First Sea Lord in 1904, his main pledge was to solve this intractable problem … Fisher in effect invented picture-based warfare. He created a pair of war rooms in the Admiralty, one built around a world (trade) map, the other around a North Sea map.”

Dr. Norman Friedman  
“Netting and Navies: Achieving a Balance”  
*Sea Power: Challenges Old and New*
Perspective

▼ Modern naval communications and can be traced back at least as far back as First Sea Lord Fisher’s Admiralty War Rooms in 1904

▼ Rapid advances in technology, beginning at the dawn of the 20th Century, have ushered in exciting possibilities for faster, better, and more effective naval communication

▼ Navies wishing to effectively network at sea will likely make substantial investments in technology, what is crucial is ensuring that these technologies enhance, not impede, networking

▼ The fact navies have led land forces in networking sometimes obscures technological challenges
Naval Coalition Networking: How Big A Challenge?
“In this age, I don’t care how tactically or operationally brilliant you are, if you cannot create harmony — even vicious harmony — on the battlefield based on trust across service lines, across coalition and national lines, and across civilian/military lines, you really need to go home, because your leadership in today’s age is obsolete.”

General James M. Mattis
Commander, Joint Forces Command Remarks at the Joint Warfighting Symposium May 13, 2010

“Is there a place for small navies in network-centric warfare? Will they be able to make any sort of contribution in multinational naval operations of the future? Or will they be relegated to the sidelines, undertaking the most menial of tasks, encouraged to stay out of the way—or stay at home... The need for speed in network-centric operations places the whole notion of multinational operations at risk.”

Professor Paul Mitchell
“Small Navies and Network-Centric Warfare: Is There a Role?”
Naval War College Review June 23, 2010
“Information sharing is a fundamental requirement for meeting most of the current challenges to international maritime security. The notion of a regional partnership in the American continent and the Caribbean demands effective information-sharing capabilities in order to become a reality.”

Dr. David Alberts
Director of Research
Assistant Secretary of Defense for Networks Information Integration
U.S. Department of Defense

Commander Alberto Soto, Chilean Navy

“Maritime Information-Sharing Strategy”
7th International Command and Control Research and Technology Symposium
Naval War College Review
Summer 2010

September 2002
Naval Coalition Networking: How Big a Challenge?

- Effective coalition networking depends on mutually compatible C4ISR technology
- Rapid technology advances and insertion have often impeded effective coalition networking
- Coalition partners often ask the question: “What is the price of admission to network effectively”
- But the right question is: “What is the price of omission if we cannot network together”
- Coordinated technological development in parallel offers one promising solution
- This sounds great in theory, but who will provide stewardship for this parallel development?
Tell It To The Labs:
Achieving Coalition Networking
“We will win – or lose – the next series of wars in our nation’s laboratories.”

Admiral James Stavridis
SOUTHCOM Commander
“Deconstructing War”
U.S. Naval Institute Proceedings
December 2005
“The Technical Cooperation Program (TTCP), a longstanding forum for defence science and technology cooperation between Australia, Canada, New Zealand, the United Kingdom and the United States, has, for example, established an initiative to consider the ‘FORCEnet Implications for Coalition Partners.’”

Dr. Chris Rahman

*The Global Maritime Partnership Initiative: Implications for the Royal Australian Navy*
Tell it to the Labs:
Achieving Coalition Networking

- Effective nation-to-nation defense laboratory cooperation has been going on for over a half-century under the auspices of The Technical Cooperation Program (TTCP) and other entities.

- TTCP leadership has recognized the challenges to effective coalition networking at sea.

- In 2001, the TTCP Maritime Systems Group commissioned a team to address this issue.

- This five-nation cooperative effort has completed two three-year efforts and future work is planned.

- We are sharing our results as one best-practices model for all nations represented here.
Our “Beta-Test” Under the Auspices of The Technical Cooperation Program: One Path to “Building the Networks”

One Model for International Defense and Networking Cooperation: MAR AG-1/AG-6
MAR Action Group 1:
“Maritime Network Centric Warfare”
Maritime Network Centric Warfare
- Open ended

Focus on “bounding the problem”
- Good product

Proof of concept through multilateral analysis

Warfighting scenarios with traction for all

Two Studies
- Broad Issues: First Principles of NCW
- Tactical Level Analysis: MIO/ASW/ASuW
AG-1 Membership

Chairman

Mr. R. Christian (US)

Australia

Dr. C. Davis (NL)
Ms. S. Andrijich (M)
Ms. M. Hue (M)
Dr. I. Grivell (M)
Dr. D. Sutton (M)
Dr. M. Fewell (M)

Canada

Mr. P. Sutherland (NL)
Mr. R. Burton (M)
Mr. M. Hazen (M)
Mr. B. Richards (M)

New Zealand

Dr. D. Galligan (NL)
Mr. C. Phelps (M)

United Kingdom

Mr. A. Sutherland (NL)
Mr. P. Marland (M)
Mr. R. Lord (M)

United States

Mr. J. Shannon (NL)
Dr. R. Klingbeil (M)
Dr. S. Dickinson (M)
Mr. G. Galdorisi (M)*

Notes: NL = National Leader
M = Member

June 23, 2010
Two Component Studies

Study B (Tactical Level)
- TACSIT-based analysis (relevant, littoral)
- Sense- Decide- Respond
- Connectivity dependence
- Tactical MOEs/ MOPs

Study A (Broad Issues)
- First Principles in NCW
- Quantitative analysis of alternative networking options in ISR/Operational Planning, as related to Study B TACSITS

Coalition Force Configuration

Equal Partnership

Unequal Partnership

Short Decision Time Scale Long
MAR AG-1 Study B
Tactical Level Analysis
1. **Arrival Pattern** describes the input to the queuing system and is typically specified by arrival rate or interarrival time.

2. **Service Pattern** is described by service rate or service time.

3. **Loss Processes** describe how customers can be lost (balking and reneging).

4. **Queue Discipline** describes how a customer is selected for service once in queue (FIFO, priorities, etc.).

5. **System Capacity** is the maximum size of a queue; finite or infinite.

6. **Service Channels** are the number of elements available to provide a given function.

7. **Service Stages** is the set of end-to-end processes for completion of service.

**Key Queueing Metrics:**
- Probability of a customer acquiring service
- Waiting time in queue until service begins
- Loss rate due to either balking or reneging

Queueing Theory interrelates key system characteristics and can be used to identify where investment should be made to improve performance and effectiveness.
ASW TACSIT Analysis

Improving ASW Effectiveness – CASW Concepts and Hypotheses

False Target Reduction Concept

- Use sensor correlation across all appropriate platforms in a task group to reduce the number of non-target contacts presented to sensor operators.
- Reduce non-object false contacts, such as reverberation spikes and wrecks, by using acoustic models, in situ data, and local data bases.

- Congestion of sonar, high workload
- Time to investigate false contacts
- Reduction of effective search rate
- Missed detections of targets
- Information is essential
- System to remove specified sensor contacts
- Can possibly lower detection threshold
- Increased probability of target detection

Metric for SSA Concept Analysis

PDET * PCLASS * PLOC * PATT

= PACQCLASS * P(T|t)

= probability that the target acquires classification service
= probability of recognizing the target contact as the actual target of interest (experimental data required)
= THREAT DECISION
= true target

Effect Of Improved SSA and Service Time on PACQCLASS

Improved SSA reduces the arrival of false contacts which increases the probability of successful target classification
ASuW/Swarm TACSIT Analysis

Study has used MANA agent based model to represent the Swarm’s dynamic tactics, with four levels of Blue networking capability.

**Sample Results:** (30 knot FIAC)

- Intermediate and High levels of networking increase Force survivability versus Type 1 FIAC by factor of \(\approx 9\).
- Full results include dependencies on Red

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**Diagram:**

- **NO COMMS**
- **BASELINE**
- **INT NCW**
- **HIGH NCW**

**Axes:**
- **Swarm Size**
- **Probability of Leaker (%)**

**Legend:**
- NCW Gain

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**Map:**

- TRADE ROUTE
- FIAC
- FISHING
- CONVOY
AG-1 Study “Takeaways”

Any analysis must begin with the recognition that there will likely be a significant networking capability gap between U.S. and coalition partners. This analysis must evaluate the impact of technology insertion on a networked coalition naval force. Networking would most benefit coalition naval forces in planning and re-planning, training, and reach-back to better intelligence. More study is needed....
MAR Action Group 6: “FORCEnet Implications for Coalitions”
MAR AG-6 Direction and TOR

▼ Leverage AG-1 work

▼ Build on AG-1 work but add:
  ▪ More specificity regarding ops and force structure
  ▪ More granularity to analysis and modeling

▼ Work within a realistic operational scenario that all member nations would participate in

▼ Produce a product that informs national leadership and acquisition officials
AG-6 Membership

Chairman
Mr. Don Endicott

Canada
- Mr. R. Mitchell (NL)
- Mr. M. Maxwell (M)
- Dr. M. Lefrancois (M)

New Zealand
- Dr. D. Galligan (NL)*
- LCDR W. Andrew (M)

United Kingdom
- Mr. A. Sutherland (NL) *
- Mr. P. Marland (M) *
- Mr. M. Lanchbury (M)

United States
- Mr. D. Endicott (NL)
- Mr. G. Galdorisi (M)*
- Mr. P. Shigley (M)
- Ms. M. Gmitruk (M)
- Mr. T. McKearney (M)
- Ms. M. Elliott (M)

NL = National Leader
M = Member
* = Former AG-1 member
What is FORCEnet?

FORCEnet is an “...operational construct and architectural framework for naval warfare in the information age, integrating warriors, sensors, command and control, platforms, and weapons into a networked, distributed combat force.”

Admiral Vern Clark
Former Chief of Naval Operations (2000-2005)
U.S. Naval Institute Proceedings
October 2002
Premises

FORCEnet will empower warfighters at all levels to execute more effective decision-making at an increased tempo, which will result in improved combat effectiveness and mission accomplishment.

The warfighting benefits of FORCEnet in a coalition context can be assessed through analysis and quantified to provide input to national balance of investment studies of the five member nations.

It is necessary that FORCEnet address current and near term information system requirements that support operations in the joint and coalition environments. **Coalition Communications was the clear number one priority** of all numbered fleet commanders and is a critical enabler in leveraging coalition partners in the GWOT.
Hypothesis

Conducting modeling and simulation and detailed analysis to demonstrate the enhanced warfighting effectiveness of coalition partners (in this case – the AUSCANNZUKUS nations) netted in a FORCEnet environment can help inform national naval C4ISR acquisition programs.
### Notional Coalition Order of Battle

<table>
<thead>
<tr>
<th>Australia</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ 2 ANZAC Frigates</td>
<td>▼ 1 LPH/LPD</td>
</tr>
<tr>
<td>▼ 2 FFG</td>
<td>▼ 2 LSD</td>
</tr>
<tr>
<td>▼ 1 AWD</td>
<td>▼ 1 Replenishment Ship</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Canada</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ 1 Destroyers</td>
<td>▼ 3 Amphibious Assault Ships</td>
</tr>
<tr>
<td>▼ 2 Frigates</td>
<td>▼ 1 Cruiser</td>
</tr>
<tr>
<td>▼ Replenishment Ship</td>
<td>▼ 2 Destroyers</td>
</tr>
<tr>
<td>▼ Submarine</td>
<td>▼ 3 Littoral Combat Ships</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New Zealand</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ 2 ANZAC Frigates</td>
<td></td>
</tr>
<tr>
<td>▼ 1 Replenishment Ship</td>
<td></td>
</tr>
<tr>
<td>▼ 1 Attack Submarine</td>
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</table>
Operational Scenario

Disaster Relief/Humanitarian Assistance
Dealing with Terrorist Insurgency
Conflict with Southeast Asian Military
Operational Scenario

Operational Vignettes
1. Assembly, training, planning & rehearsal
2. Littoral transit versus FIAC
3. ASW against Kilo's
4. Amphibious offload
5. Naval fires
6. MIO versus insurgent resupply
## Initial Modeling Results - Summary

<table>
<thead>
<tr>
<th>Summary</th>
<th>Operational Impact</th>
<th>MoE Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assembly</strong></td>
<td>Network capability limits time required to build force</td>
<td>Force can plan in advance of rendezvous, training time reduced</td>
</tr>
<tr>
<td><strong>FIAC</strong></td>
<td>Networking with increased ISR, flexible ROE enhances ability to counter</td>
<td>Gain in reducing probability of FIAC “leaker” attacking HVU</td>
</tr>
<tr>
<td><strong>ASW</strong></td>
<td>Increased networking impacts in both planning and common operational picture</td>
<td>Gains realizes in better networking of sensors and ISR assets (MPA, helo)</td>
</tr>
<tr>
<td><strong>Offload</strong></td>
<td>Networking shared landing craft resources speeds delivery of on-call relief supplies</td>
<td>Flexibility in delivering supplies to beach as HA mission unfolds</td>
</tr>
<tr>
<td><strong>Fires</strong></td>
<td>Call-For- Fire process evolves from voice to digital data exchange</td>
<td>Reduced time allows for improved initial accuracy, less chance of targets escaping</td>
</tr>
<tr>
<td><strong>MIO</strong></td>
<td>Range of networked capabilities for detection, tracking, and search of CCOIs have potential for improved</td>
<td>Better CCOI tracking through enhanced planning, asset management. Boarding party tools for personal safety and</td>
</tr>
</tbody>
</table>
Summary of Key Findings

FORCEnet improves military performance in every vignette assessed.

Improvements primarily in process time, decision making, information availability and planning.

Force effectiveness higher when all coalition units operate at same FORCEnet level.

Differential levels >1 among coalition units degrade force effectiveness.
TTCP MAR “AG-Next”…
A Way Forward?
One of the most essential ingredients of a globalized system is a regulated maritime commons. Protecting the maritime commons is the job of navies.”

Vice Admiral Nigel Greenwood
Assistant Chief of the Maritime Staff
Canadian Navy
Keynote Address
2010 Maritime Security Challenges Conference
Victoria, BC, Canada April 27, 2010
Haiti showed us once again that we must be interoperable to be effective.”

Vice Admiral Adam Robinson
Chief, Bureau of Medicine and Surgery
Remarks at the Navy League of the United States Sea-Air-Space Symposium
May 4, 2010
A Way Forward

The rich history of naval cooperation to secure the global commons offers good examples of how our navies can cooperate today while raising the bar for how these navies work together in the future.

Today, globalization and a wide range of challenges mean that no navy stands alone and all navies must work together even more closely in peace and in war.

Networking navies effectively via C4ISR technologies concurrently developed is a necessary condition for mutual security and prosperity via an effective global maritime partnership.

The AUSCANNZUKUS example of naval cooperation under the auspices of The Technical Cooperation Program offers one example of how to begin to tackle C4ISR interoperability.
Since 2002, the Technical Cooperation Program has used the efforts of its Maritime Systems Group (MSG) “Networking Maritime Coalitions” and “FORCEnet and Coalitions Implications.” The MSG has become an important link among national naval C4ISR acquisition programs ... For that very reason these [Latin American and Caribbean nations] should tenaciously strive to become involved in initiatives like MSG.”

Commander Alberto Soto, Chilean Navy “Maritime Information-Sharing Strategy” Naval War College Review Summer 2010
Questions?