



15<sup>th</sup> ICCRTS: The Evolution of C2

# The Global Maritime Partnership: Networking Challenges and Opportunities

Track 4: Collective Endeavors

Mr. George Galdorisi  
Dr. Stephanie Hsieh  
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

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- ▼ 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*



# Background

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- ▼ 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 is 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

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- ▼ 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 20<sup>th</sup> 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?

“Is there a place for small navies in network-centric warfare? 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 and contribution in multinational naval operations of the future? Or will they be relegated to the sidelines, across service lines, across coalition and national lines, and across civilian/military lines, you really need 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.”

General James M. Mattis  
Professor Paul Mitchell

Commander, Joint Forces Command  
Small Navies and Network-Centric Warfare: Is There a Role?  
Remarks at the Joint Warfighting Symposium  
May 13, 2010  
*Naval War College Review*





“In today’s world, nothing significant can get done outside of a coalition context. We have been humbled by the challenges of a regional maritime 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  
Commander Alberto Soto, Chilean Navy

U.S. Department of Defense  
“Maritime Information-Sharing Strategy”  
7th International Command and Control  
Naval War College Review

Research and Technology Symposium  
Summer 2010

September 2002



# Naval Coalition Networking: How Big a Challenge?

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- ▼ 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 can not 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

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- ▼ 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”



# MAR AG-1 Direction and TOR

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- ▼ 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)



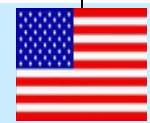
**New Zealand**

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

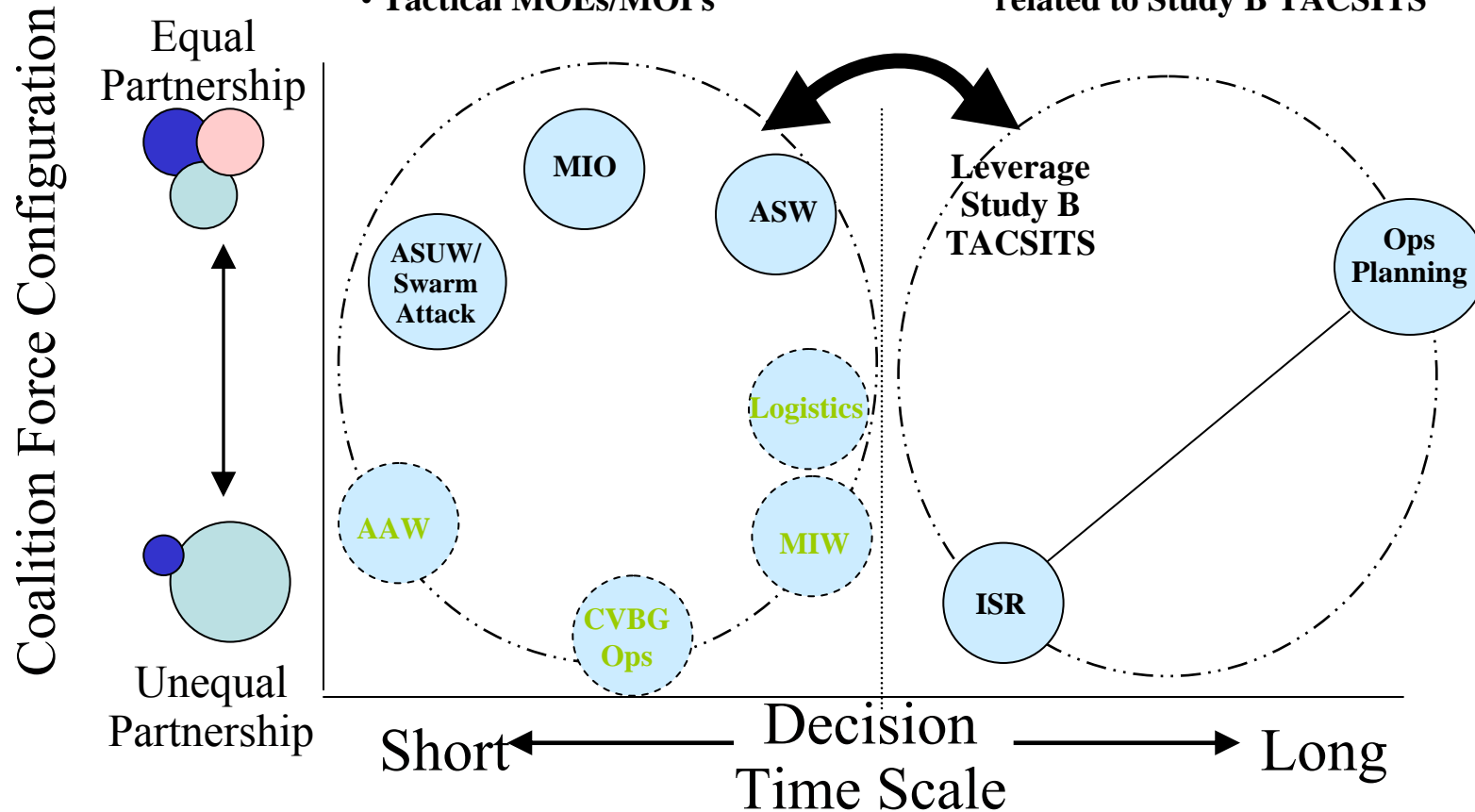
# Two Component Studies

## Study B (Tactical Level)

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

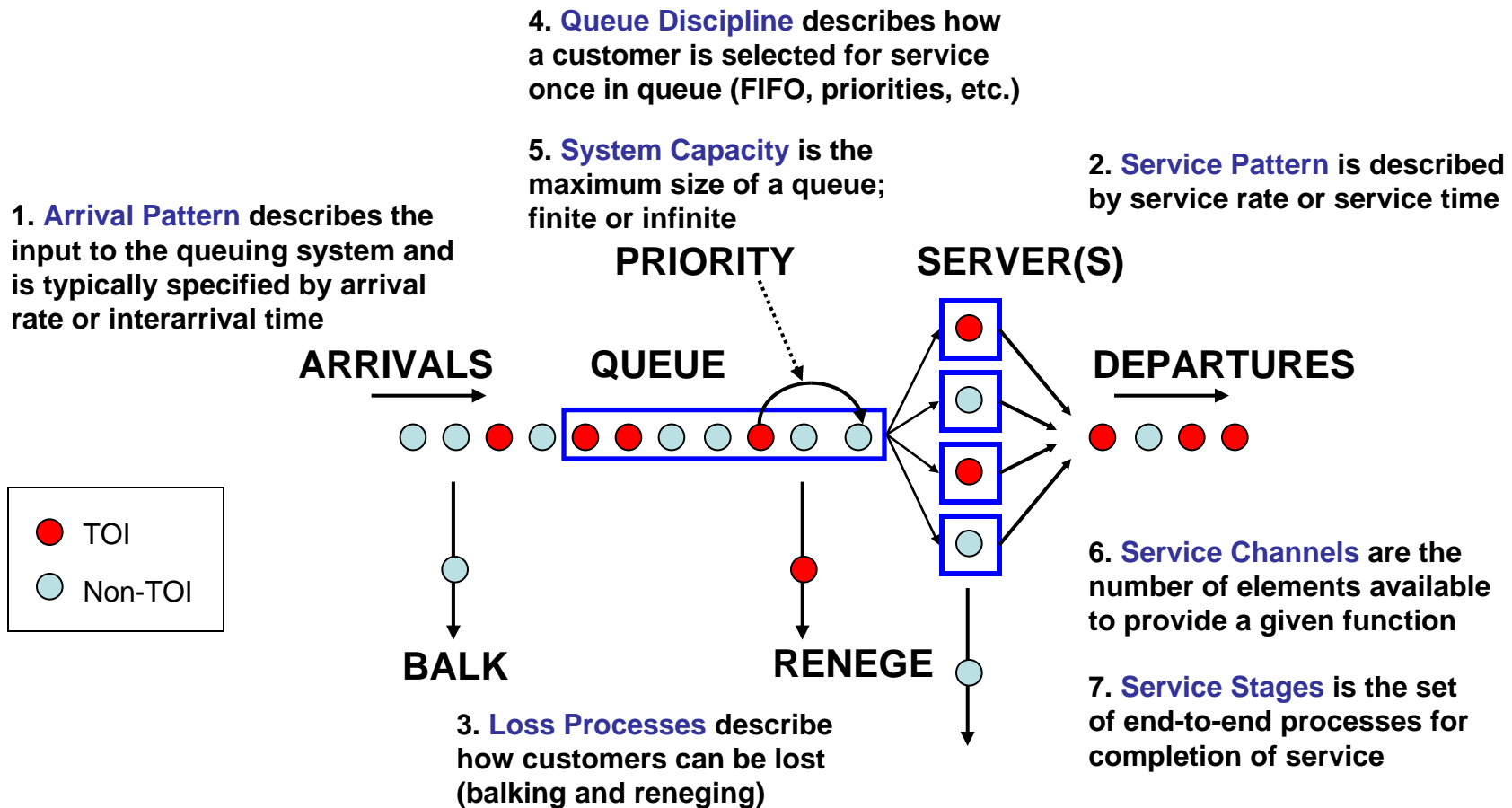
## Study A (Broad Issues)

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



# MAR AG-1 Study B Tactical Level Analysis

# Queuing System for MIO



## KEY QUEUEING METRICS:

- Probability of a customer acquiring service
- Waiting time in queue until service begins
- Loss rate due to either balking or renege

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

### and Situational Awareness (SSA)

Network-enabled Shared Situational Awareness (SSA) can reduce contact loading thereby increasing ASW effectiveness.

### Cooperative Information Environment (CIE)

ASW operators in a network-enabled collaborative environment can reach-back to ASW experts to improve target and non-target classification performance.

Theory can provide an intuitive mathematical and physical model for the analysis of any military system or operation that can be characterized as a “waiting line” or a “demand-for-service.”

### Metric for SSA Concept Analysis

Reduction of false contact loading on the ASW system by using Shared Situational Awareness (SSA)

$$P_{DET} * P_{CLASS} * P_{LOC} * P_{ATK}$$

$$= P_{ACQ CLASS} * P(T|t)$$

= 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

## False Target Reduction Concept

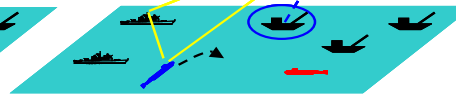
PLATFORM-CENTRIC ASW (LIMITED SSA)



Submarine's search track plan is interrupted due to false contact investigation

- Congestion of sonar, high workload
- Time to investigate false contacts
- Reduction of effective search rate
- Missed detections of targets

NETWORK-CENTRIC ASW (IMPROVED SSA)

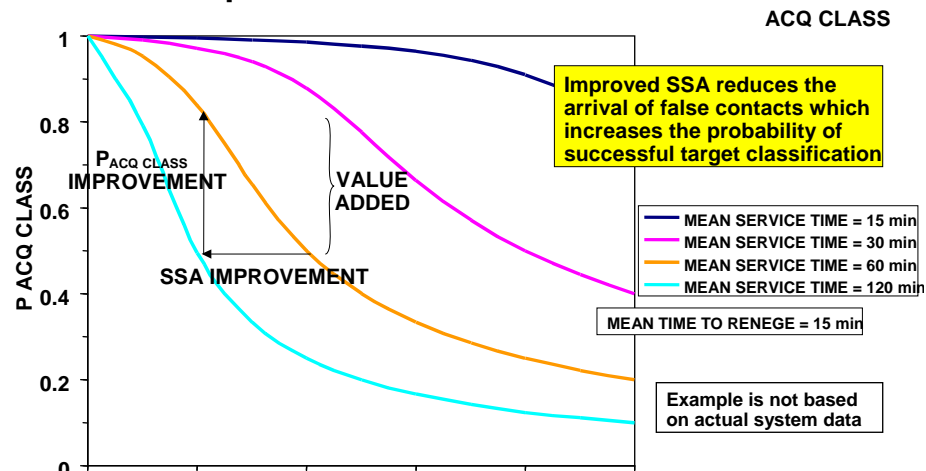


Submarine avoids unnecessary false contact investigation due to SSA

- Information is essential
- System to remove specified sensor contacts
- Can possibly lower detection threshold
- Increased probability of target detection

- 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.

## Effect Of Improved SSA and Service Time on P

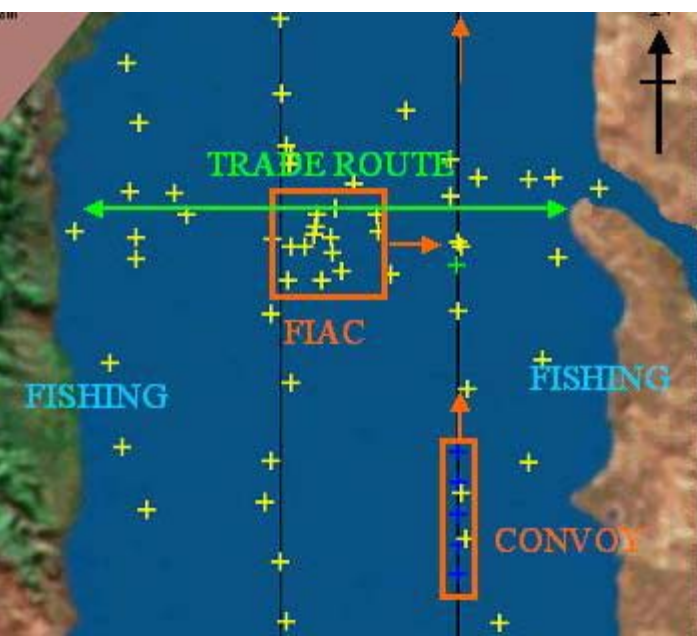




# ASuW/Swarm TACSIT Analysis

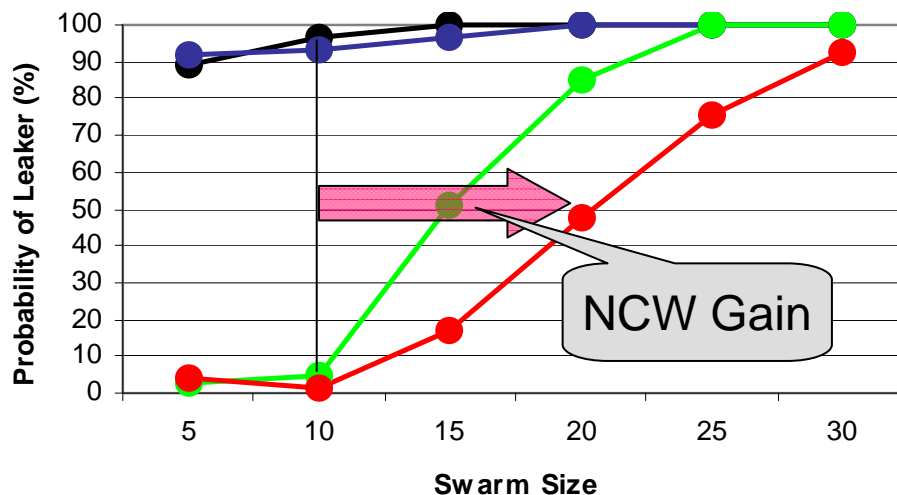
Blue force in restricted sea room is attacked by a swarm of FIAC. Network enabled Blue shared situational awareness and distributed targeting reduces the number of 'leakers.'

Probability of one or more FIAC reaching target position against HVU. Fractions of FIAC destroyed, and of Blue escorts damaged. Collateral damage.



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

## AG-1 Study “Takeaways”

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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....

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# MAR Action Group 6: “FORCEnet Implications for Coalitions”

# MAR AG-6 Direction and TOR

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- ▼ 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



**Australia**



**Canada**



**New Zealand**



**United Kingdom**



**United States**

Mr. R. Mitchell (NL)  
Mr. M. Maxwell (M)  
Mr. P. Shigley (M)  
Ms. M. Gmitruk (M)

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

Dr. D. Galligan (NL)\*  
LCDR W. Andrew (M)

Mr. A. Sutherland (NL) \*  
Mr. P. Marland (M) \*  
Mr. M. Lanchbury (M)

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?

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

Admiral Vern Clark

Former Chief of Naval Operations (2000-2005)

*U.S. Naval Institute Proceedings*

October 2002

# Premises

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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

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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.

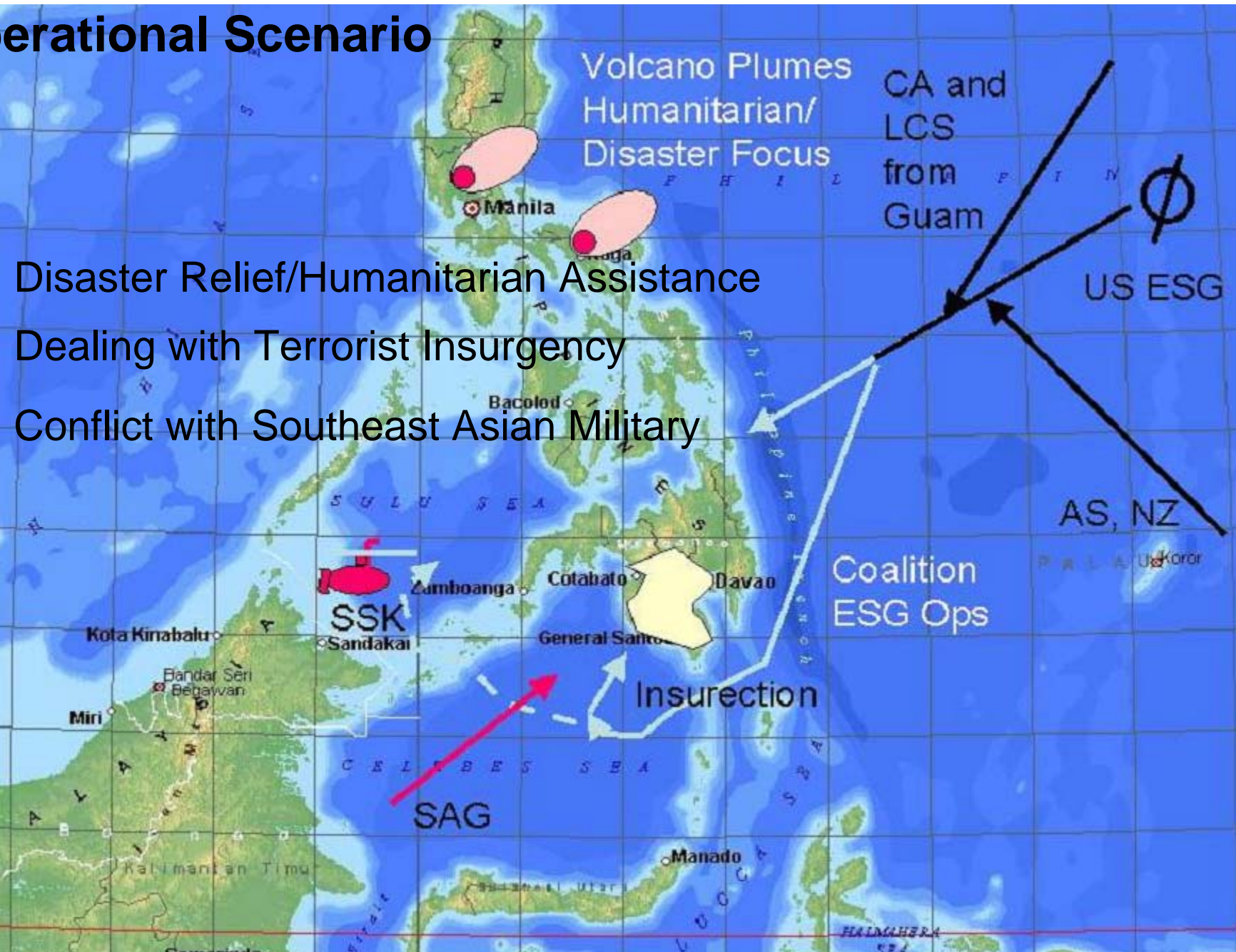


# Notional Coalition Order of Battle

Australia	United Kingdom
<ul style="list-style-type: none"> <li>▼ 2 ANZAC Frigates</li> <li>▼ 2 FFG</li> <li>▼ 1 AWD</li> </ul>	<ul style="list-style-type: none"> <li>▼ 1 LPH/LPD</li> <li>▼ 2 LSD</li> <li>▼ 1 Replenishment Ship</li> </ul>
Canada	United States
<ul style="list-style-type: none"> <li>▼ 1 Destroyers</li> <li>▼ 2 Frigates</li> <li>▼ Replenishment Ship</li> <li>▼ Submarine</li> </ul>	<ul style="list-style-type: none"> <li>▼ 3 Amphibious Assault Ships</li> <li>▼ 1 Cruiser</li> <li>▼ 2 Destroyers</li> <li>▼ 3 Littoral Combat Ships</li> </ul>
New Zealand	<ul style="list-style-type: none"> <li>▼ 1 Attack Submarine</li> </ul>
<ul style="list-style-type: none"> <li>▼ 2 ANZAC Frigates</li> <li>▼ 1 Replenishment Ship</li> </ul>	

# Operational Scenario

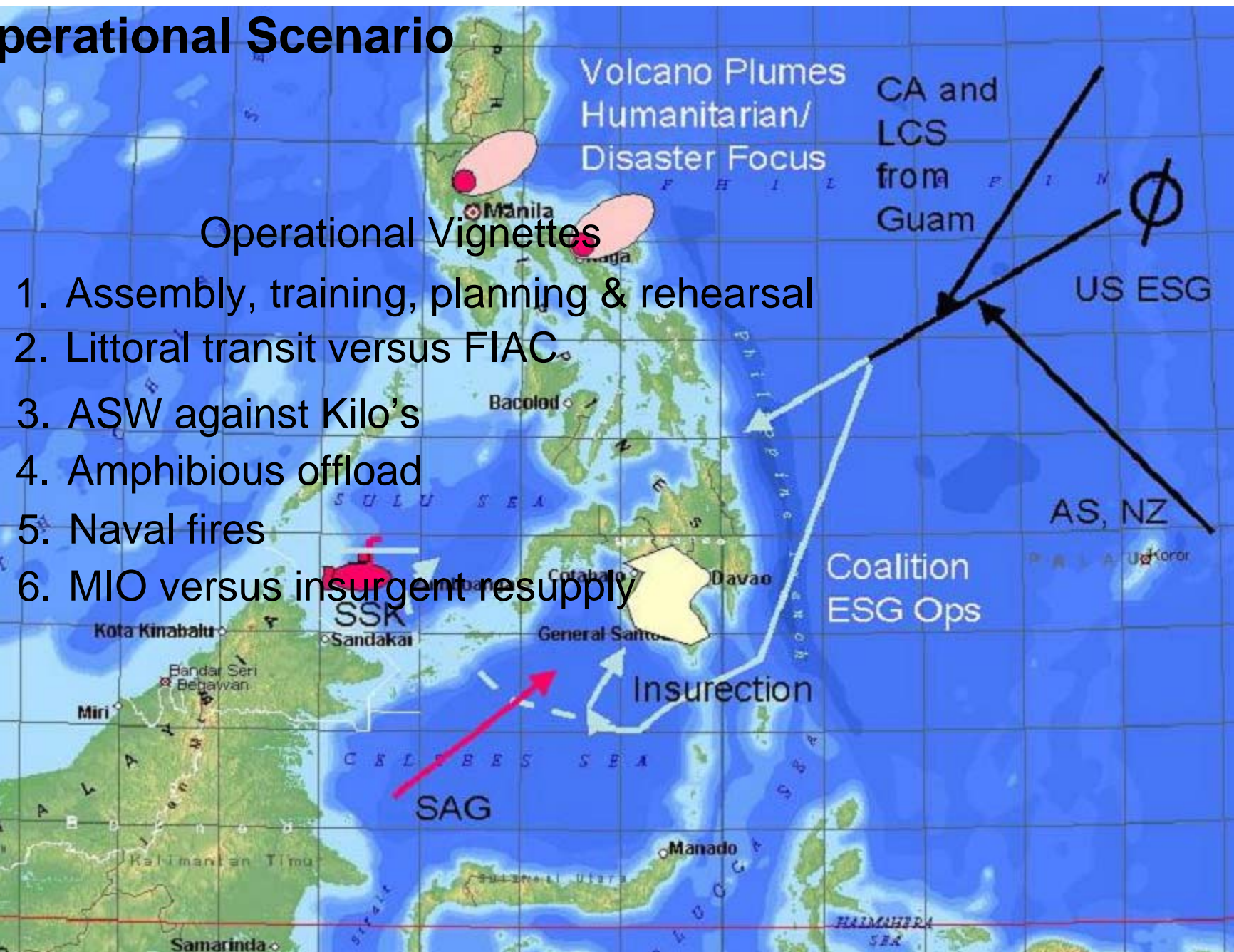
- Disaster Relief/Humanitarian Assistance
- Dealing with Terrorist Insurgency
- Conflict with Southeast Asian Military



# 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

	Summary	Operational Impact	MoE Analysis
Assembly	Network capability limits time required to build force	Force can plan in advance of rendezvous, training time reduced	Total force at Fn Level1 reduced time required "in company" from 3 to 1 day
FIAC	Networking with increased ISR, flexible ROE enhances ability to counter	Gain in reducing probability of FIAC "leaker" attacking HVU	Fn level 0 or 1 little impact, Level 2 doubles size of swarm that can be countered
ASW	Increased networking impacts in both planning and common operational picture	Gains realized in better networking of sensors and ISR assets (MPA, helo)	Fn Level 1 allowed OTH sensor monitoring and increase in predicted HVU survivability from .55 to .85.
Offload	Networking shared landing craft resources speeds delivery of on-cal relief supplies	Flexibility in delivering supplies to beach as HA mission unfolds	Fn Level 3 produced impact as all landing craft assets were able to service any supplying ship
Fires	Call-For- Fire process evolves from voice to digital data exchange	Reduced time allows for improved initial accuracy, less chance of targets escaping	Time to engage reduced from 55 min (Fn Level 0) to 2 min (Fn Level 3)
MIO	Range of networked capabilities for detection, tracking, and search of CCOIs have potential for improved	Better CCOI tracking through enhanced planning, asset management. Boarding party tools for personal safety and	Probability of acquiring CCOI increased from .1 to .7 with Fn Level 1. Fn Level 2 needed for enhanced database tool and ISR

# Summary of Key Findings

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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?

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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





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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

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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

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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

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Questions?