



NAVAL
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Assessing Technologies using Campaign Analysis and War Gaming: The Warfare Innovation Continuum at NPS

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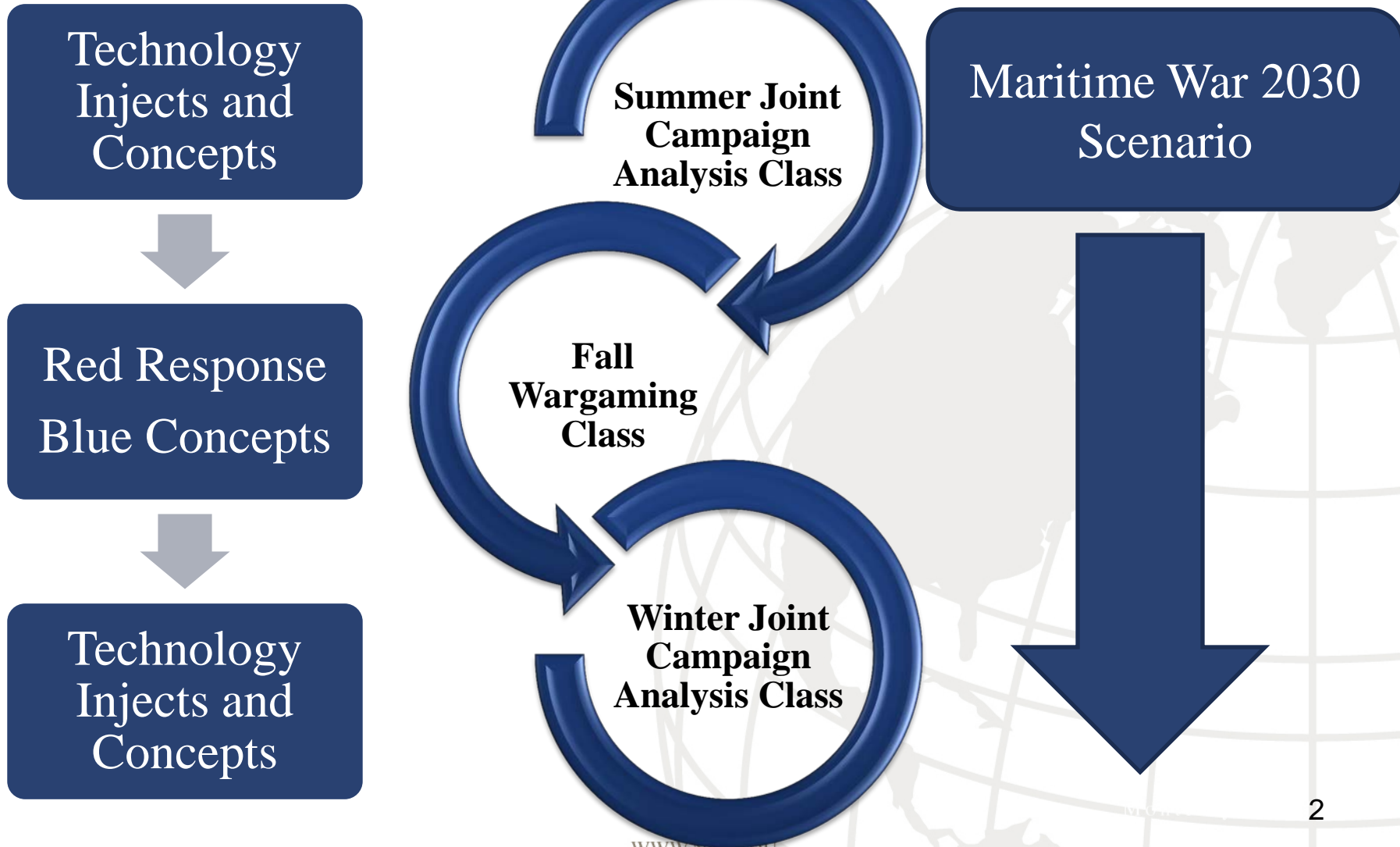
Naval Postgraduate School

Monterey, California

WWW.NPS.EDU



Joint Campaign Analysis and Wargaming Connection

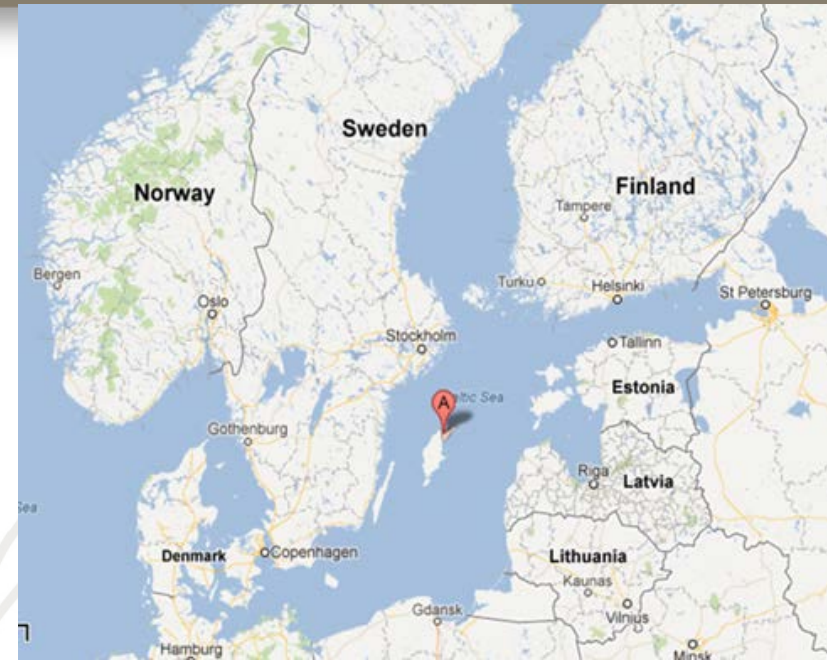




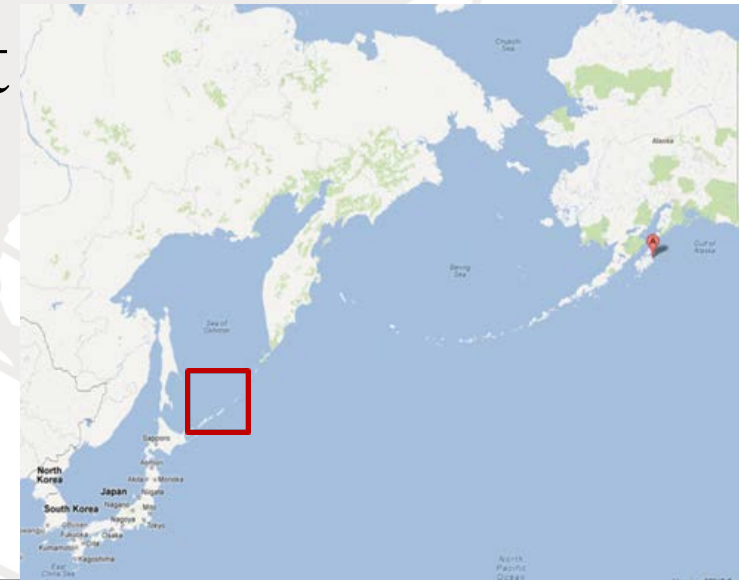
Scenario: Maritime War 2030

- Expansionist Russia:

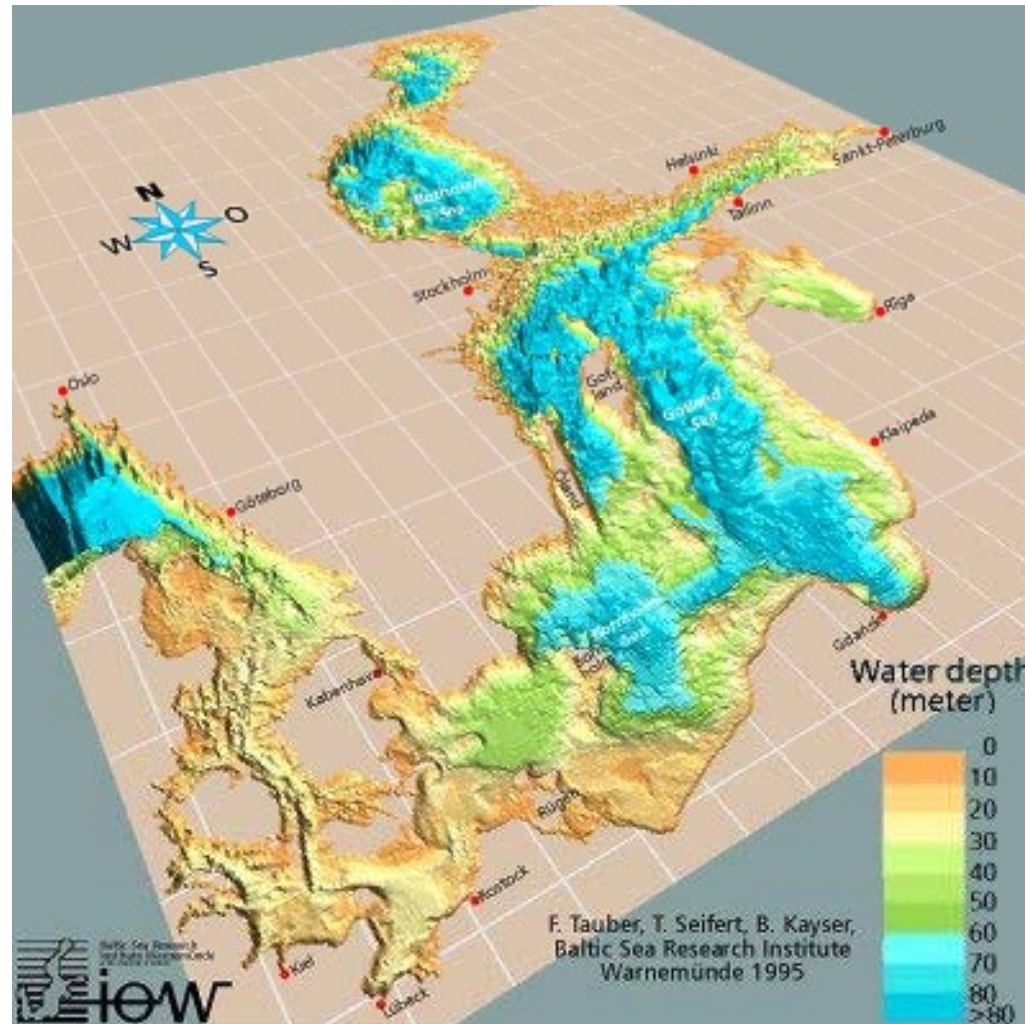
- Baltic
- Kuril Islands Pacific
- Arctic Ocean



- South China Sea Conflict



Understanding the area



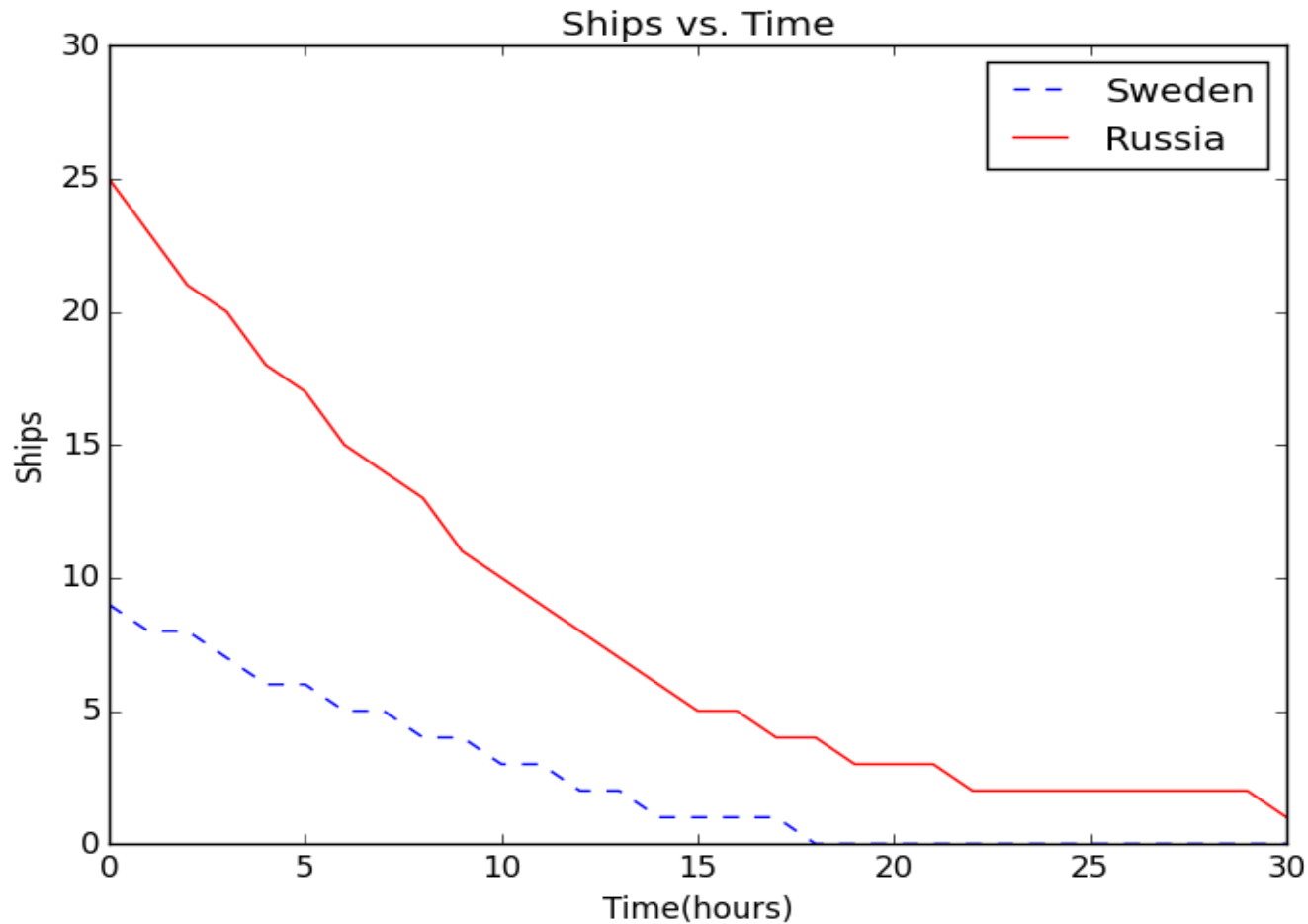


Concept of Operations

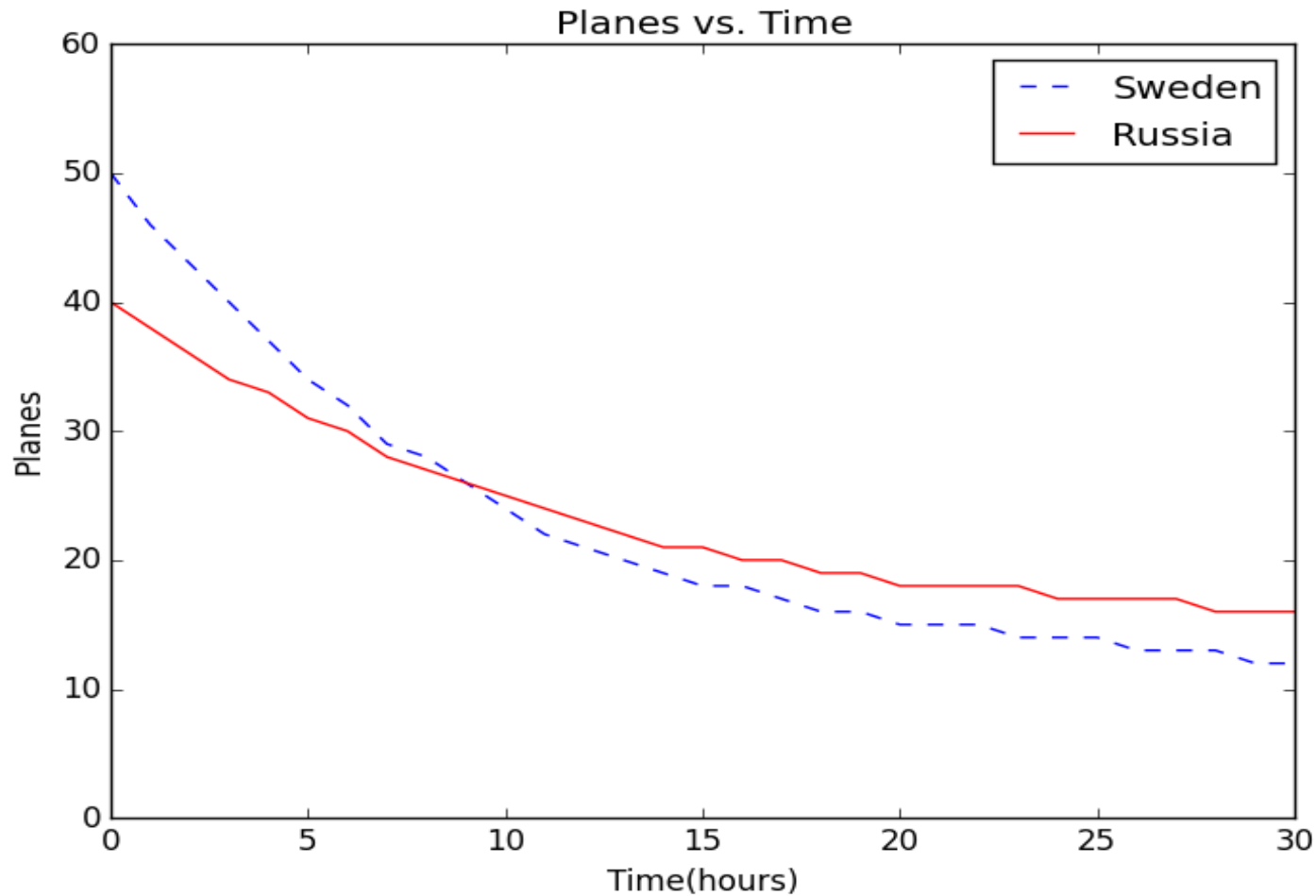


Swedish Defensive

- **Results (w/o TI): Possibly high ship losses both sides**



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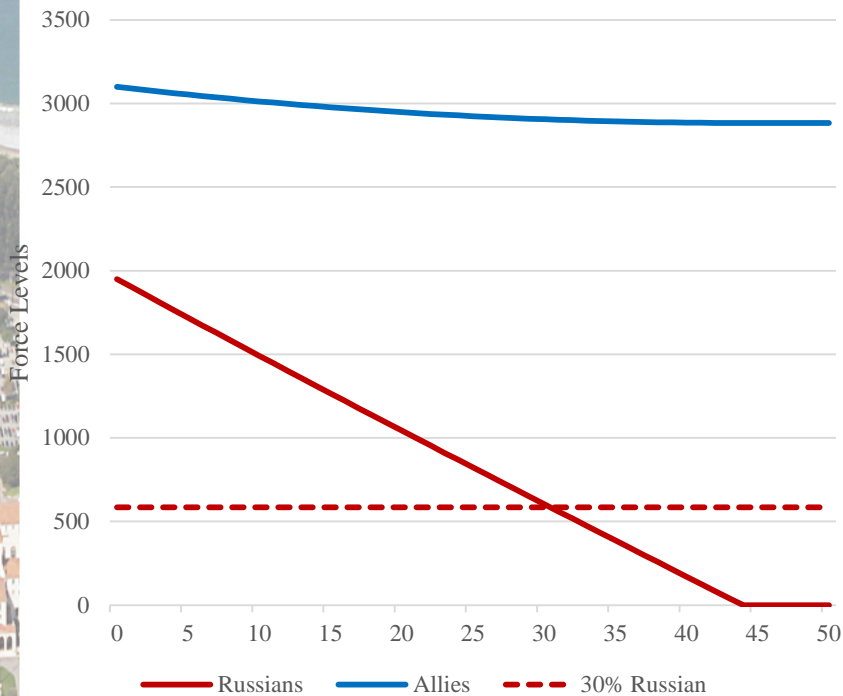




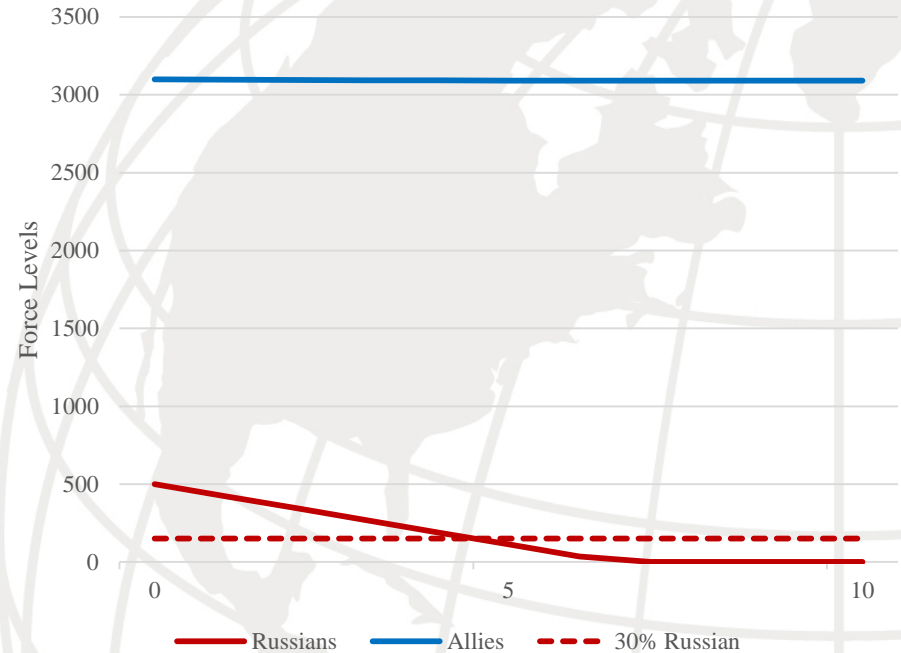
Swedish Land Forces Benefit Greatly From Finnish Support

Both Benefit From Distributed Lethality

Swedish & Finish Forces:
No Technical Inject

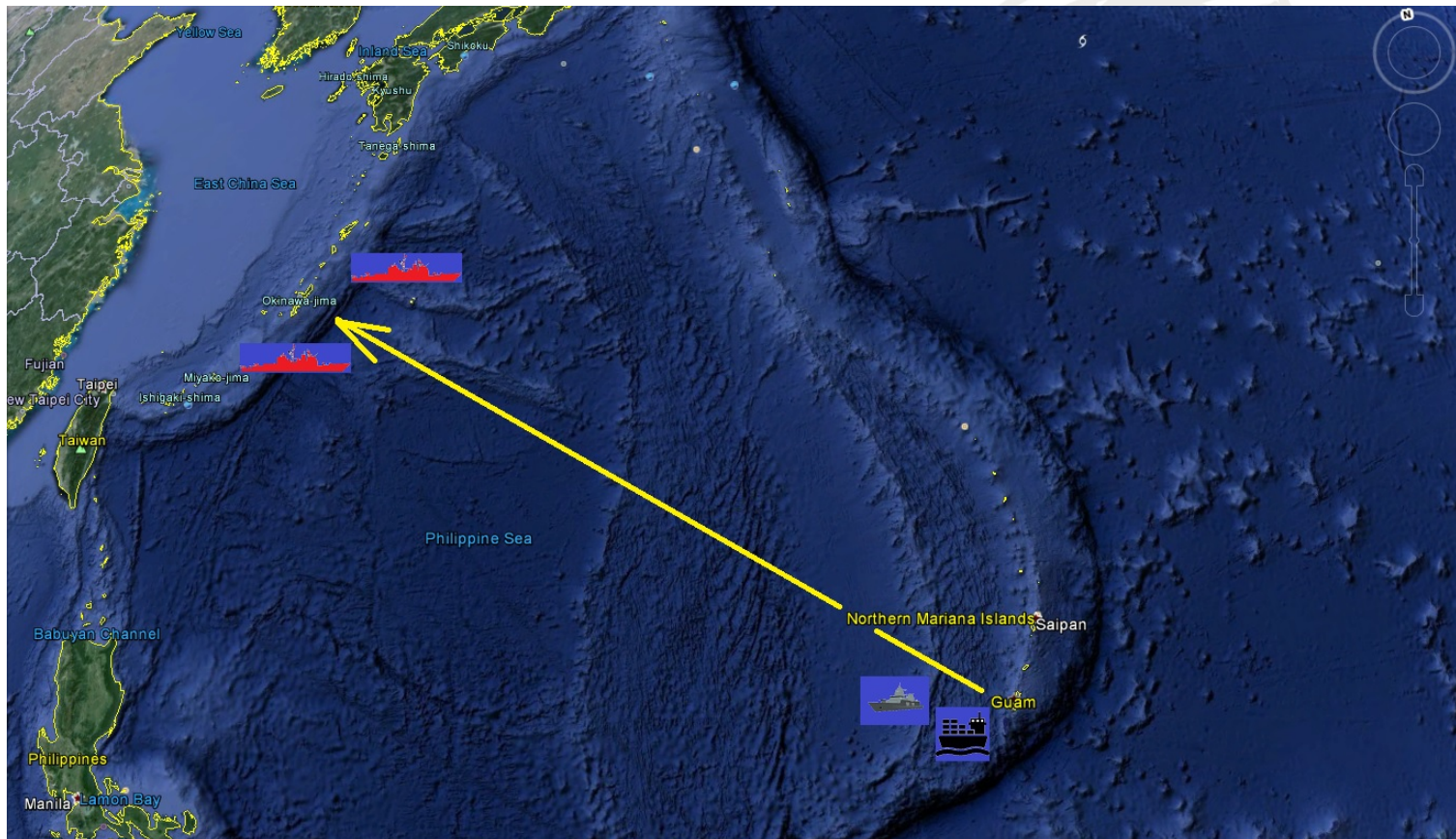


Swedish & Finnish Forces With Distributed
Lethality Capability



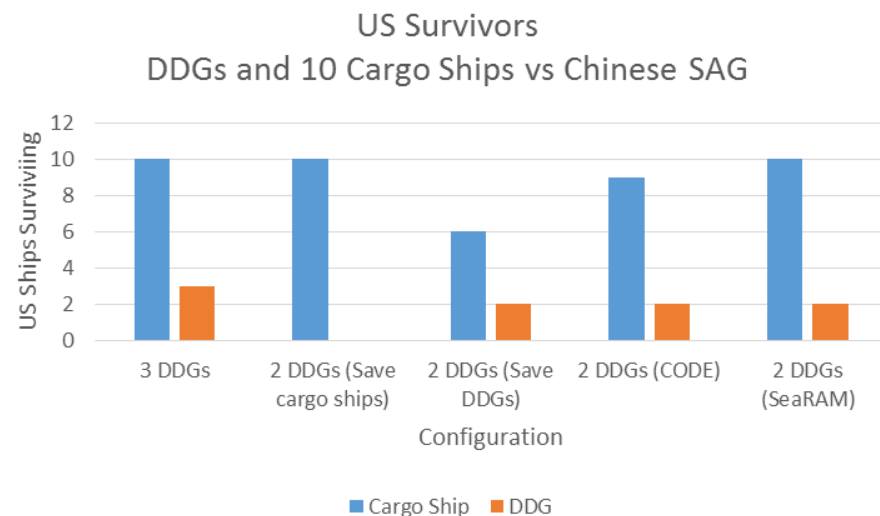
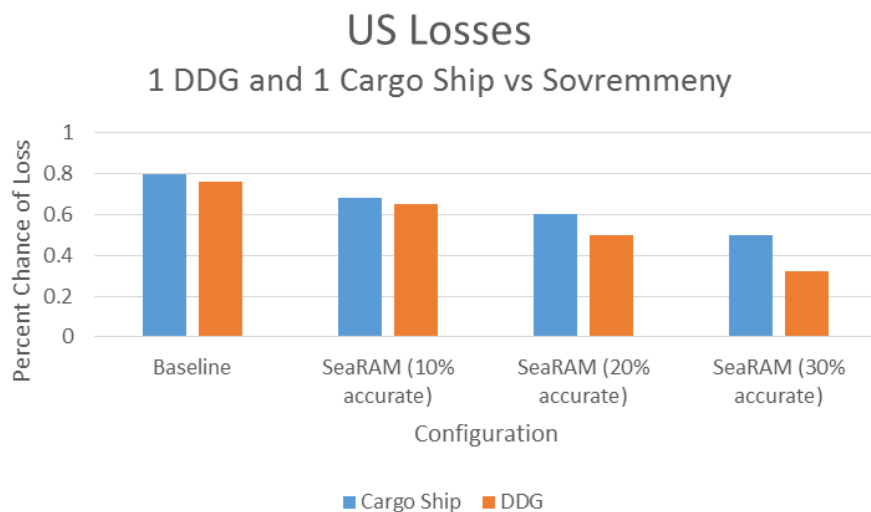
Maritime War 2030 The Scenario

The Chinese Navy has instituted a blockade of Okinawa to impose a weapons and fuel quarantine of the island. The United States has sent destroyers to escort commercial shipping from Guam to Okinawa in an attempt to break the blockade.



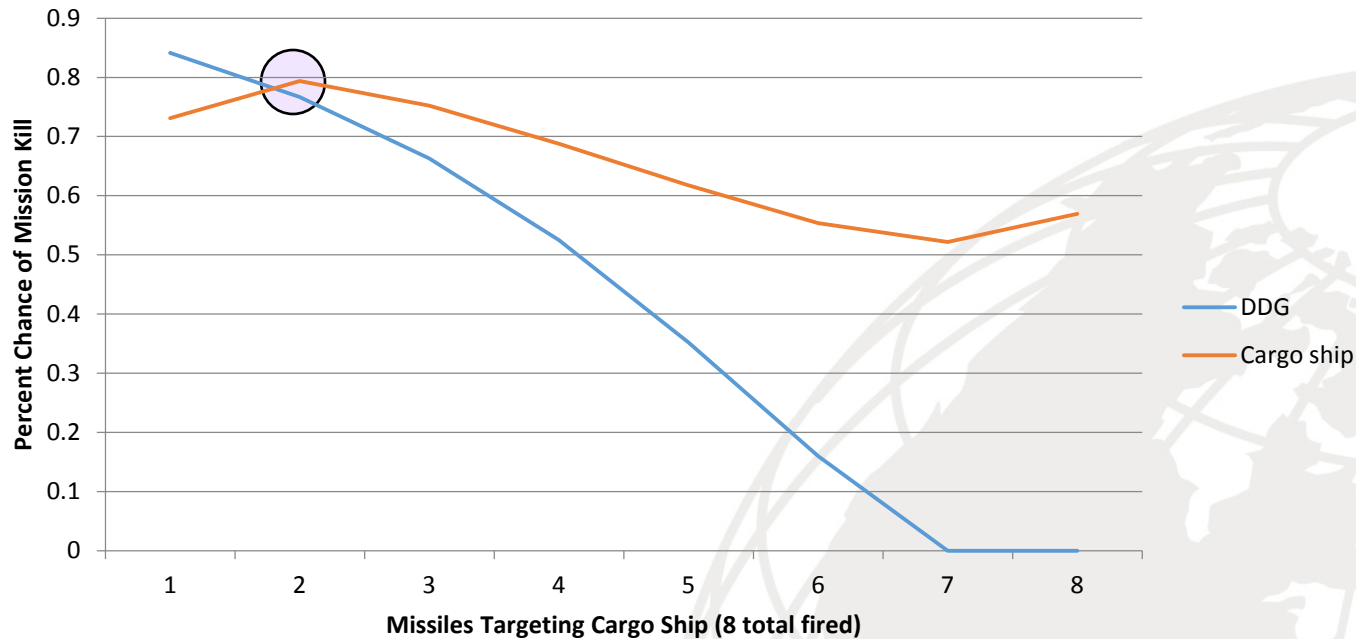


- A single Chinese combatant poses a significant threat but convoy tactics with mutual area defense is a viable strategy for deterring aggression
- The addition of CODE offers some improvement to fleet defense
- Installing SeaRAM on cargo ships improves the survivability of the cargo ships and lessens the number of required escort DDGs



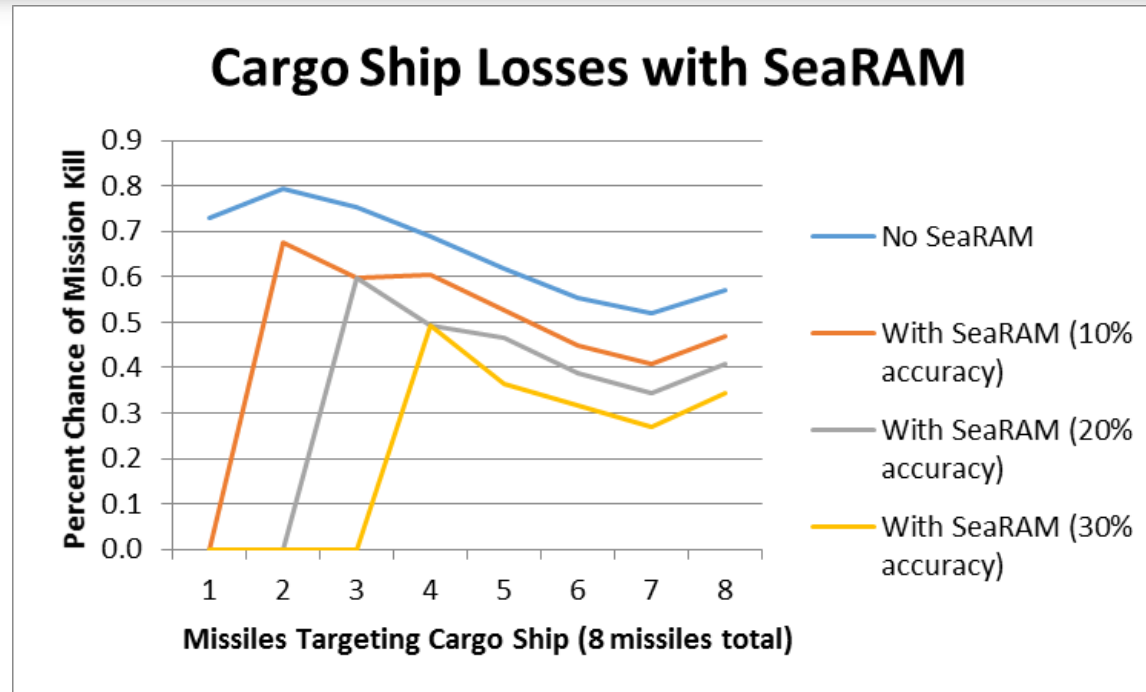
Scenario 1: Single Attacker, Defender, and Cargo Ship

U.S. Losses



- **The best missile employment tactics for the Chinese is to use six missiles to attack the destroyer and then two missiles in a follow-up attack on the cargo ship.**
- **These findings validate a two phase missile employment strategy by the Chinese to first disable an escort and to then attack the cargo ship**
- **In any missile employment strategy, the Chinese have a better than 50% chance of sinking the cargo ship. This suggests additional defensive measures are required.**

Scenario 1: Cargo ship with SeaRAM



- The addition of SeaRAM improves the chance of the cargo ship to survive by 10% regardless of Chinese missile employment strategy.
- Each additional 10% improvement to SeaRAM accuracy is an 8% improvement in survivability

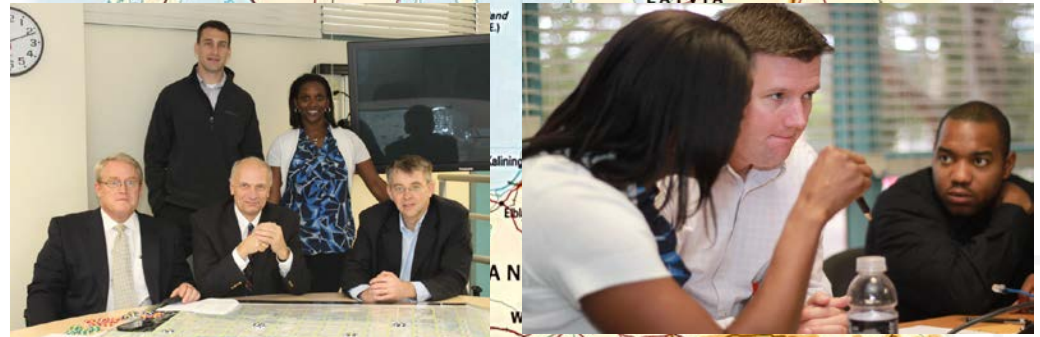


Fall 2012 Capstone Game

Littoral Flotilla



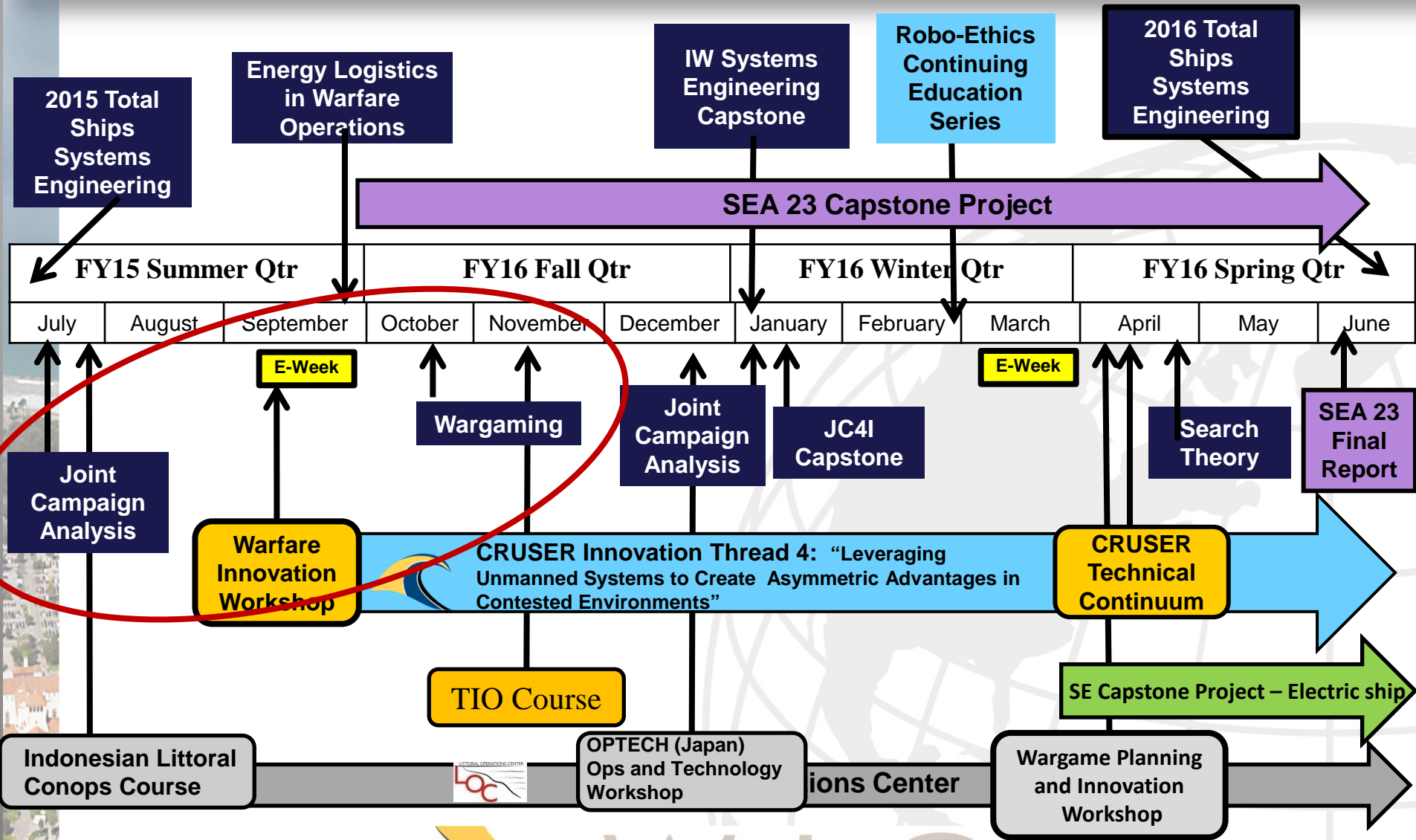
Littoral Flotilla is an exploration into the application of innovative joint and combined naval formations conducting combat operations in the littoral environment. The goal of the project is to foster international cooperation in the development of Littoral Warfare and to expand awareness of the challenges associated with operations in the global littorals.



Littoral Operations Center stood up at NPS (2014)



"Creating Asymmetric Warfighting Advantages"





Creating Asymmetric Warfighting Advantages

21-24 September 2015

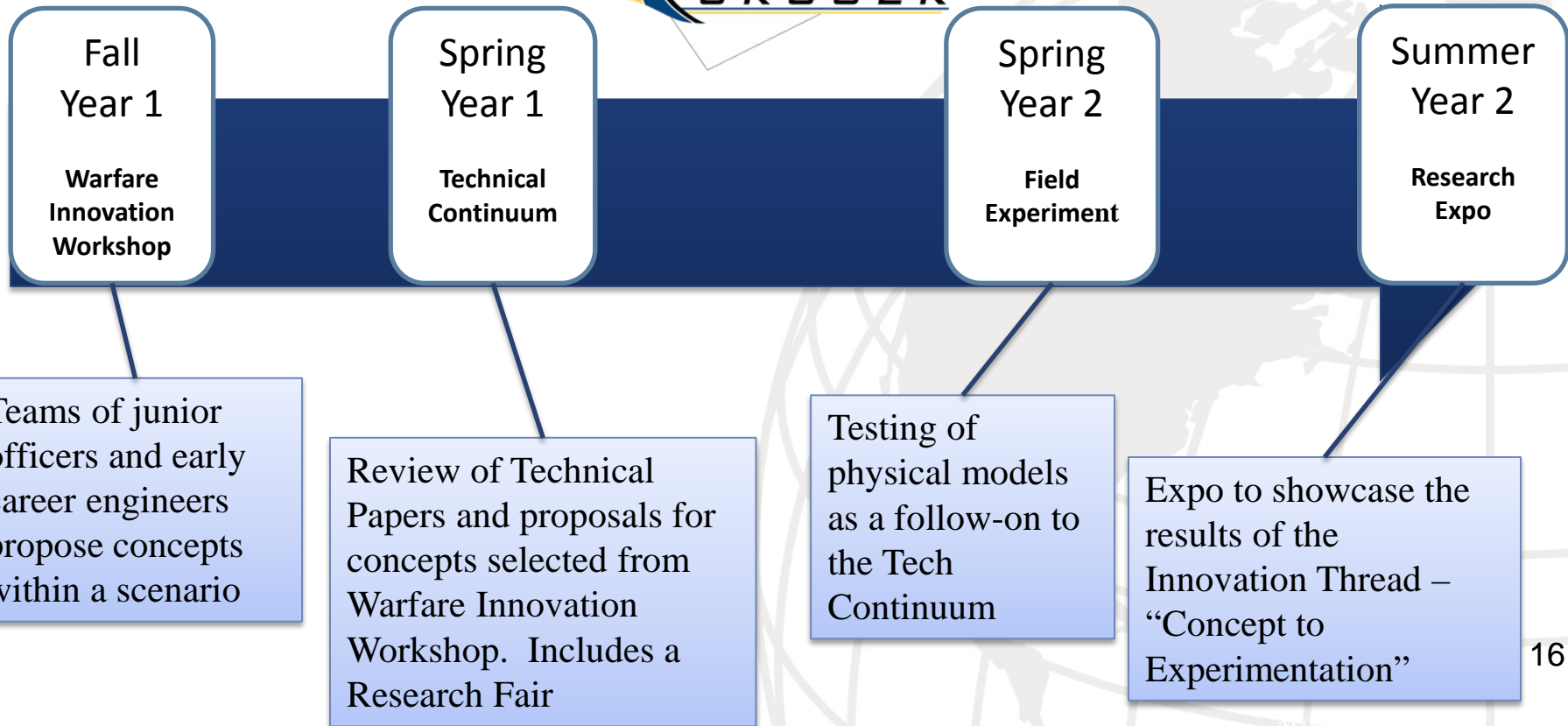
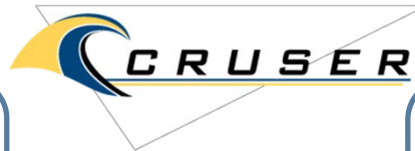
“Will emergent technologies (unmanned systems, advanced computing power, automation, advanced sensor capabilities, laser weapons etc.) allow us to fight effectively in the complex and an electromagnetically contested littoral environment against sea denial forces?”





CRUSER Innovation Thread

A two-year event thread begins with a Warfare Innovation Workshop (WIW) and culminates with a research presentation at ONR showcasing the results



2011

2016

2011 – 2013

Thread #1 – UxS Employment in Naval Operations

WIW
(SEP 11)

TechCon
(APR 12)

Field Exp.
(APR 13)

2012 - 2014

Thread #2 - Advancing the Design of Undersea Warfare

WIW
(SEP 12)

TechCon
(APR 13)

Field Exp.
(APR 14)

2013-2015

Thread #3 - Distributing Future Naval Air and Surface Forces

WIW
(SEP 13)

TechCon
(APR 14)

Field Exp.
(APR 15)

2014-2016

Thread #4 - Warfare in a Contested Littoral

WIW
(SEP 14)

TechCon
(APR 15)

Field Exp.
(APR 16)

2014-2016

Thread #5 – Creating Asymmetric Warfighting Advantages

WIW
(SEP 15)



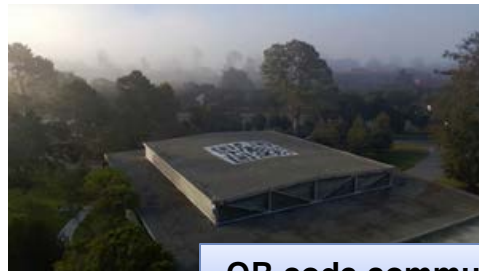
Prior Outcomes and Related work

Swarm vs. Swarm UAS concepts

Network Optional Warfare



Achieved swarm of 50 networked UAVs on 27 August 2015



QR code communications

Undersea Garages (stowed power)





BACKUP AND DISCUSSION



Okinawa Methods, Models and Tools

Scenario 1 – Single Attacker, Defender, and Cargo ship

- **A single DDG escorting a cargo ship is attacked by a Chinese Sovremenny.**
- **Two phases of combat:**
 - **Phase 1 – The Sovremenny fires at the DDG to try and destroy the “shield”**
 - **Phase 2 – The Sovremenny fires at the cargo ship**



Okinawa Methods, Models and Tools

Scenario 2 – SAG vs SAG

- **A Sovremenny, two Type-52 and two Type-54 attack three DDGs escorting a 10 cargo ship convoy**
- **Two phases of combat:**
 - **Phase 1:**
 - **The Chinese SAG fires at the DDGs**
 - **The DDGs fire some SM-2 in self defense**
 - **The DDGs fire some SM-2 at the Chinese SAG**
 - **Phase 2:**
 - **The remaining Chinese ships fire at the cargo ships**
 - **The DDGs fire remaining SM-2 at the incoming missiles**



Okinawa Methods, Models and Tools

Data Analysis

- **A binomial model was used to determine attrition during each phase of combat**
- **Optimization software found the Chinese tactics for number of missiles to target the escorts vs the cargo ships. In addition, various US tactics were tested as counter-measures.**



Constraints and Limitations

- **Constraint 1 – The engagement is restricted to US and Chinese forces**
- **Limitation 1 – Only surface ships on a single route were considered in the model**
 - **Extending the types of platforms on multiple routes made target assignment intractable**
- **Limitation 2 – Solving the missile allocation is a non-linear problem**
 - **Different starting values were used for each run**



Assumptions

- **Assumption 1 – All ships are within range of all other ships**
- **Assumption 2 – Threat axis is known and all DDG's are placed in front of the convoy**
- **Assumption 3 – DDGs can provide covering fire for themselves and all other ships**
- **Assumption 4 – All Chinese missile types can be represented by a single missile type**
- **Assumption 5 – Sufficient time exists for all defensive missiles to fire**
- **Assumption 6 – Chinese are aware of US doctrine and act optimally in response**
- **Assumption 7 – Chinese missiles are uniformly distributed among all cargo ships**



Excursion 1

CODE

- **CODE allows for a network of UAVs to operate under the control of a single operator who approves their actions. These UAVs would autonomously act to collect targeting information under established rules of engagement.**
- **In this model, CODE increased the probability of hit for SM-2 targeting both Chinese ships and incoming missiles.**





Excursion 2

SeaRAM



- **The SeaRAM combines the radar and electro-optical system of the Phalanx CIWS with an 11-cell RAM launcher to provide an autonomous system which can be fitted to any class of ship.**
- **Scenarios 1 and 2 were rerun with one SeaRAM system installed on each cargo ship.**