National Defence / Défense nationale

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ICCRTS Paper 103

Anti-submarine Warfare (ASW) Capability Transformation:

Strategy of Response to Effects Based Warfare.

LCdr David Finch SC, SSM, CD

- **32yrs Naval Experience – 18 yrs at Sea – 16 yrs with Towed Arrays [Tactical – Strategic]**
- **Operations Analysis – Tactical - SHAREM 90-93; CFMWC93-96; Operational - ADFWC 97- 00; Strategic - NDHQ J7**
- **Most recent ASW experience – SNFL SASWO 02/03; Cdr CANDET NOPFWI 05 - 09**

Opinions expressed here are those of the author/presenter
And are UNCLASSIFIED

Canada

Briefing Outline

- Introduction
  - Historical context
  - Modern – current Threat
- Application of Effects Based Construct
  - ASW EBO Principles
  - Platform to Task Group
  - OEG 51
  - Sensor MOPs/MOEs
- MARKOV Chain
  - Basics
  - Capability implications
  - Tactical example
- Conclusion

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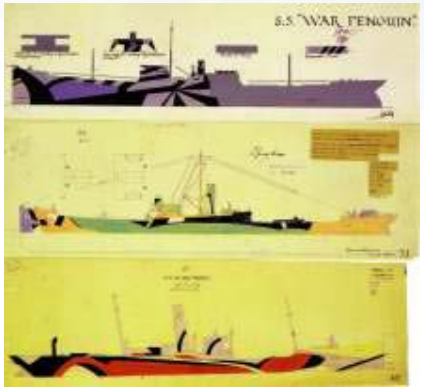

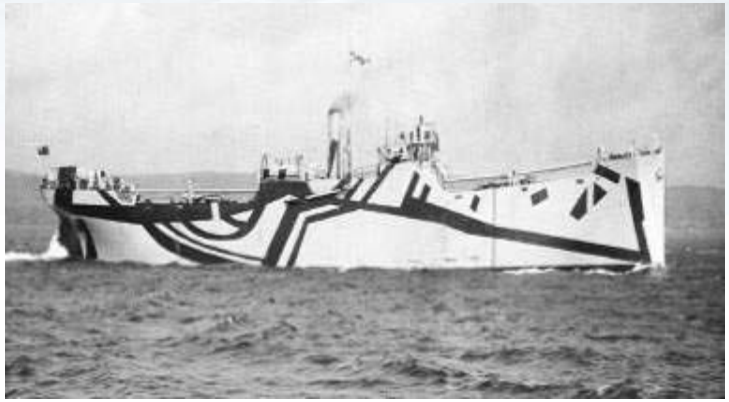

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“There is no single or inexpensive answer to meeting the problem. It requires the close teamwork of all ASW forces – surface, subsurface, air and space – served by an effective worldwide network of intelligence and communications,”

Burke, Arleigh; House Appropriations Committee hearing 86:1:1, 23 January 1959

“We must look at ASW as an overarching system, analyzed and procured with a mind toward overall capability vice that of individual platforms. The best ASW system is one that can detect, target and neutralize well outside of the adversary submarine’s sphere of influence on our forces afloat or ashore.”

Littoral Anti-submarine Warfare Concept, Naval Doctrine Command 1998.

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Rarely
Seen
Threat
Platform

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Unmanned Stationary Target vs Modern ASuW/ASW Torpedo

Power of the Mk 48 Torpedo

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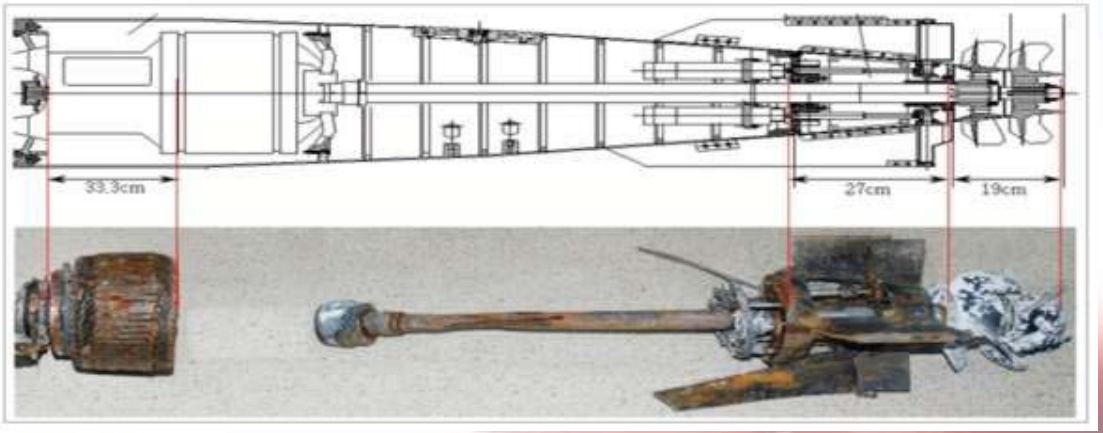
Modern Manoeuvrable/ing Warship

Sunk by a probable - not so modern Torpedo



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Asymmetric MDA

Asymmetric UDA

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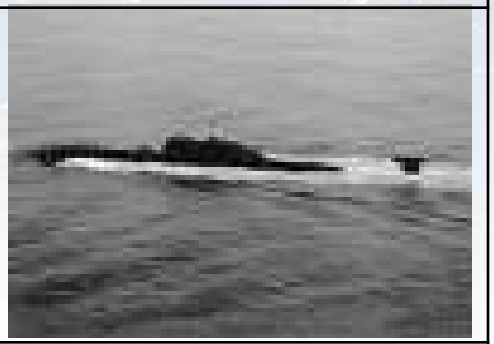
EDITORIAL The Sinking of the Cheonan Published: May 20, 2010	Chinese Submarine Fleet Is Growing, Analysts Say By DAVID LAGUE Published: February 25, 2008	Russian Subs Patrolling Off East Coast of U.S. By MARK MAZZETTI and THOM SHANKER Published: August 4, 2009
		
North Korean Submarine	Song Class Submarine	Akula Class Submarine

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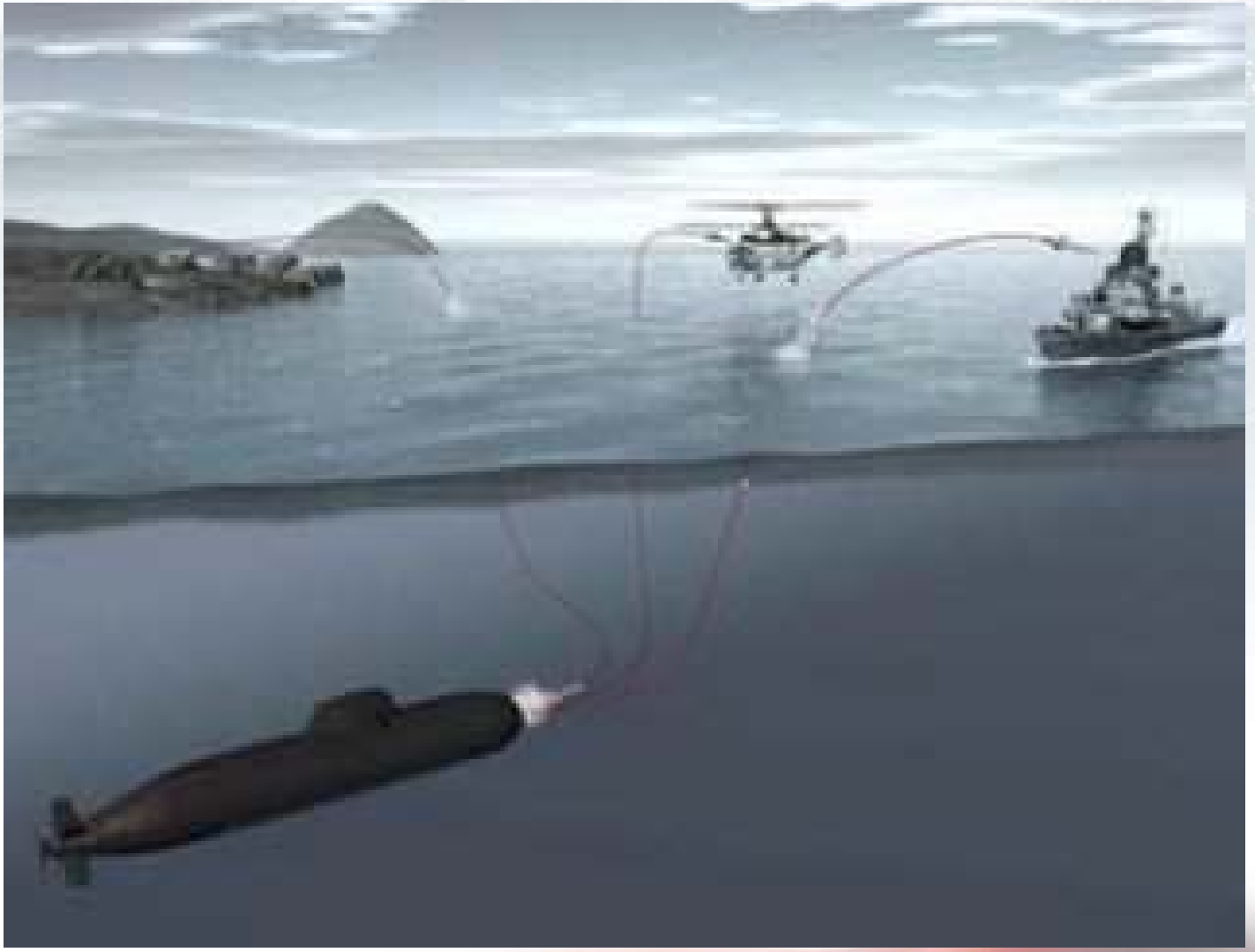

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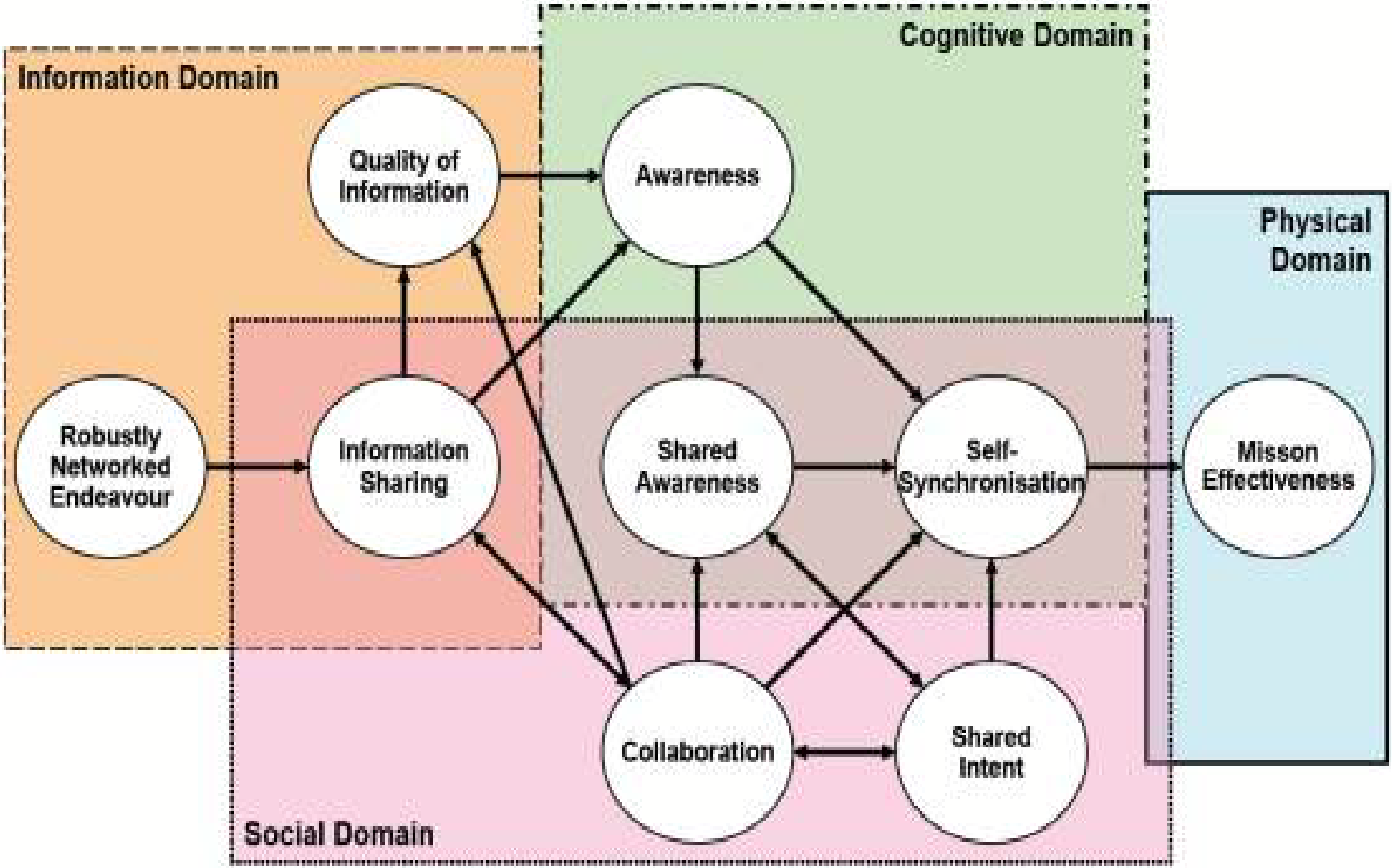

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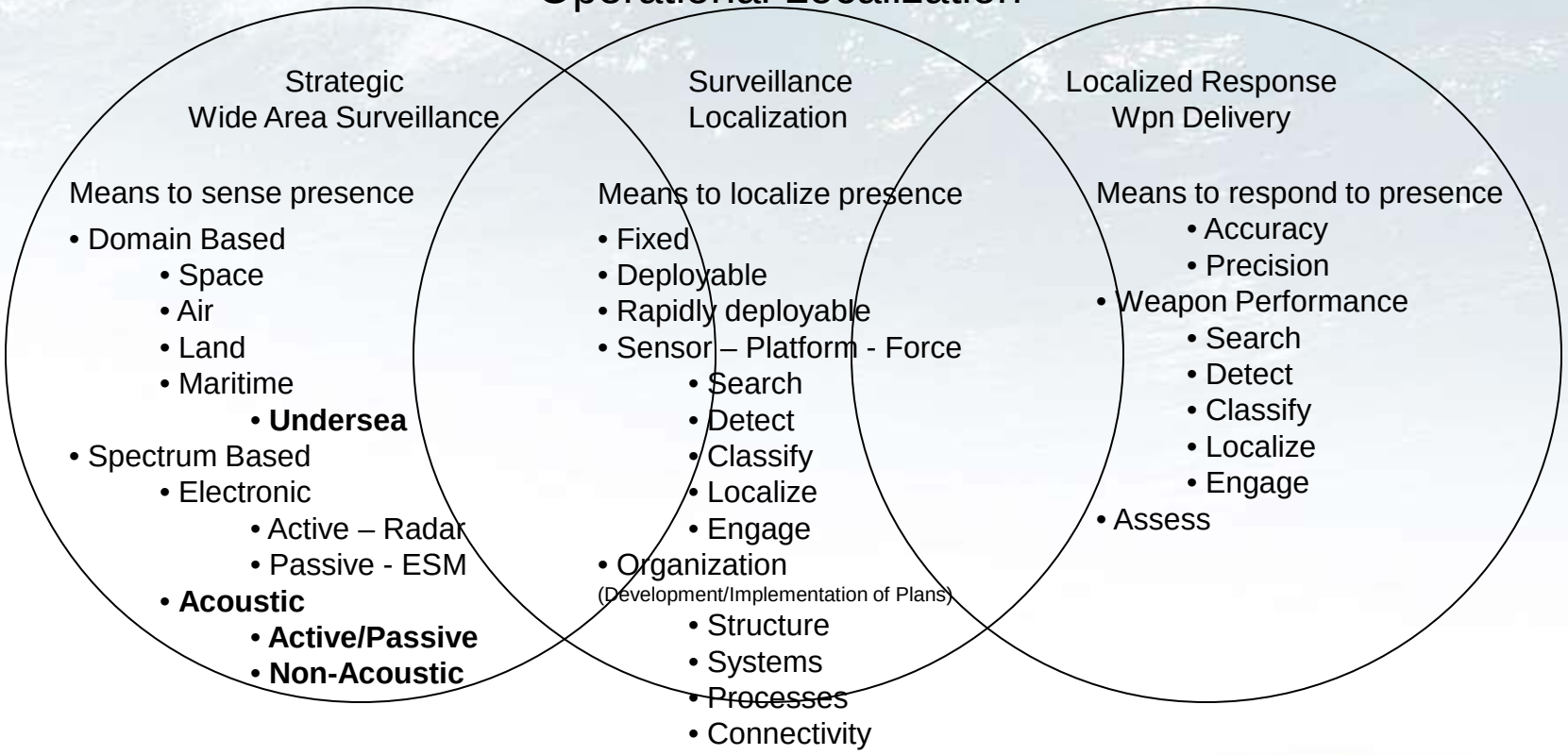
Strategic Surveillance

Tactical Engagement

Operational Localization



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Effects Based Principles

Strategic	**Eliminate perceived stealth of Submarines Transparency of World's Oceans to detect adversary platforms while maintaining freedom of manoeuvre and stealth for own subsurface capabilities**
	Persistent Undersea Domain Awareness
Operational	**Prevent Submarines from obtaining position of influence maximizing: sensor surveillance effectives; weapons effectiveness.**
	Deployable, Rapidly deployable UDA sensing, regionally supporting persistent infrastructure
Tactical	**Achieve FC solution on threat submarine**
	Ability to counter threat weapon systems if fired upon
	Self Defensive sensing of Deployable Platforms

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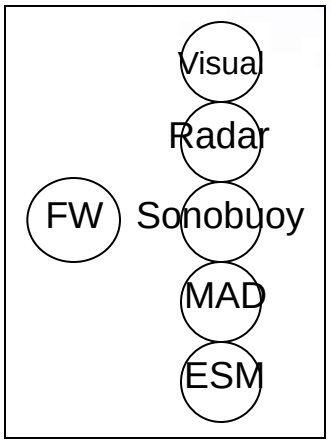
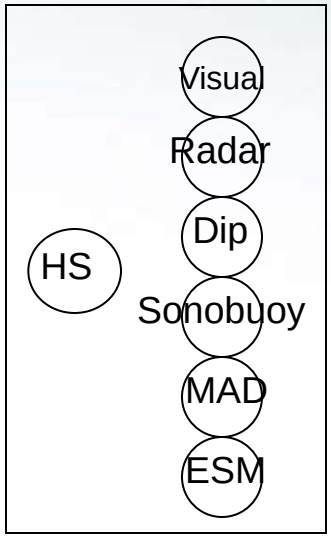
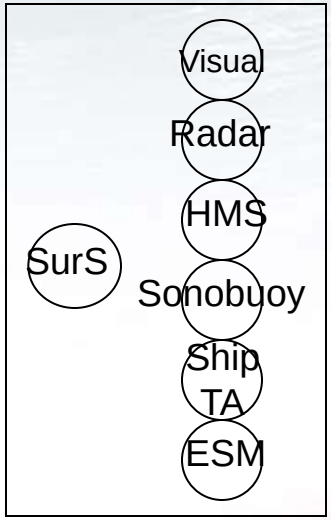
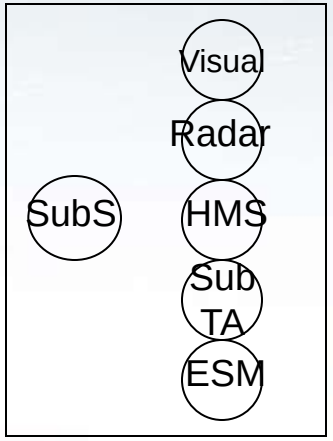
Platforms

Fitted Sensors









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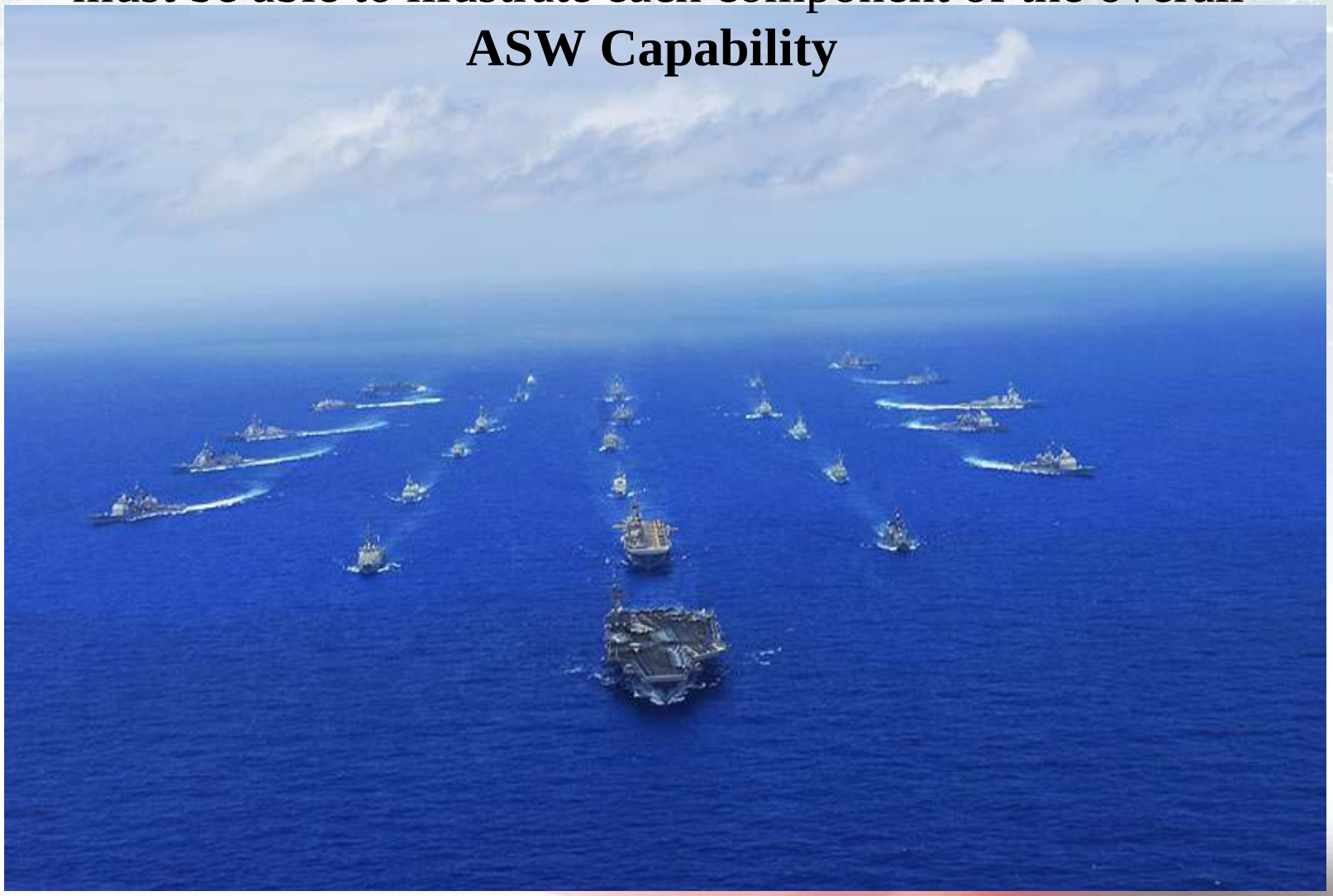
All to often capability development pits 1 platform against another component of the overall capability

Sensor – Platform – Task Group – Task Force
must be able to illustrate each component of the overall
ASW Capability



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Unifying Objectives

- **Detect, locate threat/adversarial undersea platforms**
- **Development of tactical procedures to permit decisive ASW manoeuvre**
- **Integrate ASW systems enhance probability of neutralizing UDA threats**
- **Increase operator proficiency**
- **Incorporate leading edge technologies**
- **Leadership decision making processes to optimize capitalization and employment of UDA equipment**

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Report No. 51
of the
Operations Evaluation Group

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OEG REPORT No. 51

ANTISUBMARINE WARFARE IN WORLD WAR II

Measures of Effectiveness	
1.	Probability that ASW forces accomplish their ASW Mission
2.	Probability that submarine fail to accomplish their mission

Measures of System Level Performance
ASW Detection
1. Probability of detection as a function of lateral range 2. Cumulative probability of detection as a function of range
ASW Classification
1. Probability that a contact classified POSSUB is valid 2. Probability of correct classification given a valid contact 3. False contact rate 4. Time from detection to correct classification
ASW Localization
1. Probability of successful localization given valid contact 2. Time form detection/classification to localization 3. Probability of localization as a function of lateral range 4. Cumulative probability of localization as a function of range
ASW Attack
1. Probability of successful attack 2. Time from localization to attack
ASW Vulnerability
1. Probability of counter detection versus lateral range 2. Cumulative probability of counter detection versus range 3. Cumulative probability of torpedo detection versus range 4. Cumulative probability of torpedo classification versus range 5. Cumulative probability of torpedo hit versus range
ASW System Material Reliability
1. Operational availability 2. Reliability 3. Maintainability 4. Operation to specification

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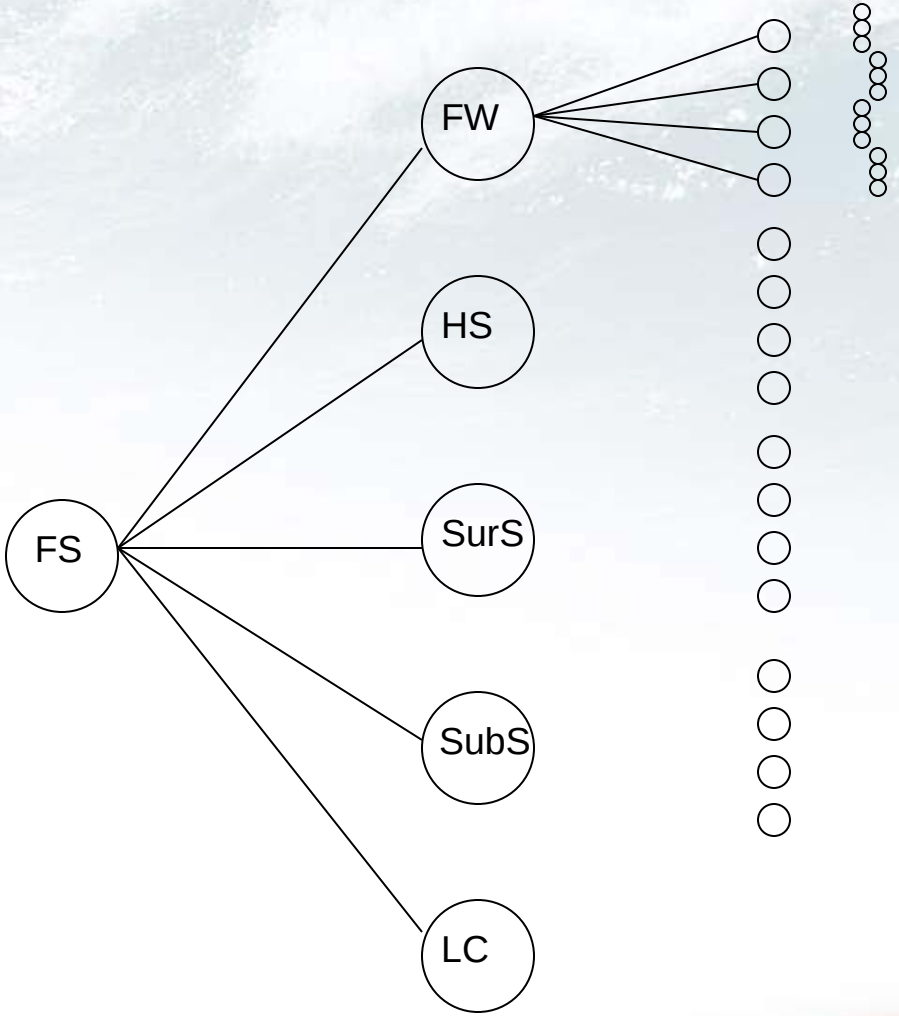
UNDERSEA DOMAIN AWARENESS
EFFECTS BASED ARCHITECTURE
MARKOV CHAIN



Each chain of events sequenced from surveillance to resolution as achievement of Attacked Criteria (AC) or Lost Contact (LC)

FS = Fixed Sensing – Strategic Wide Area (IUSS)
FW = Fixed Wing Sensing
HS = Helo Sensing
SurS = Surface Ship Sensing
SubS = Submarine Sensing
LC = Lost Contact [contact lost before localization resource redetected contact]
AC = Attack Criteria

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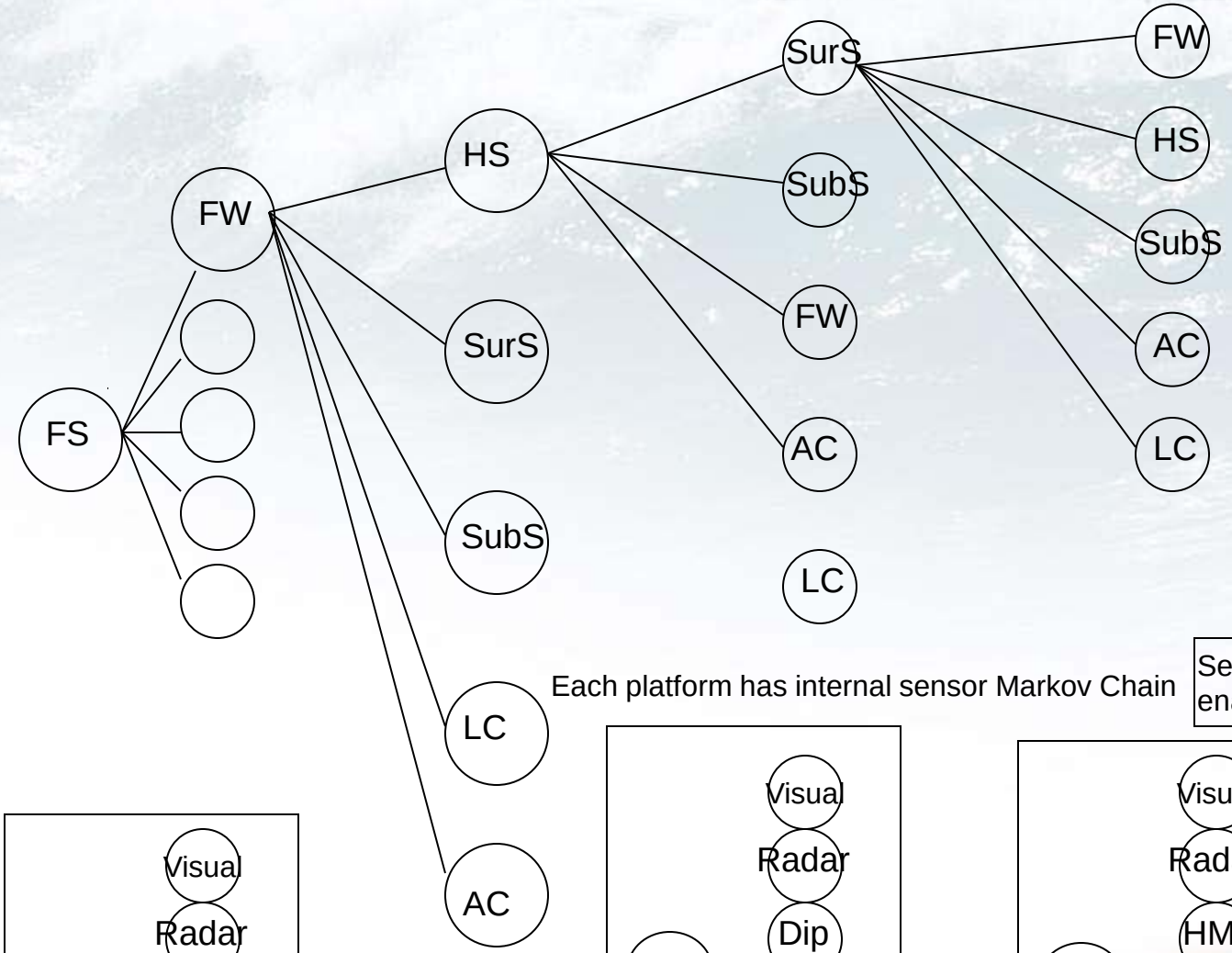
MARKOV CHAIN for PLATFORM EFFECTS BASED ASW

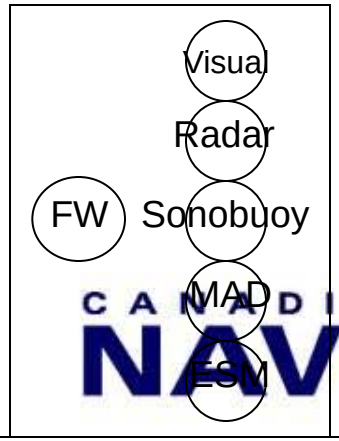


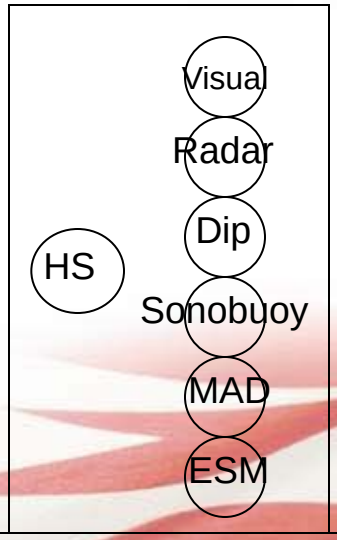
Chain continues until AC achieved or LC

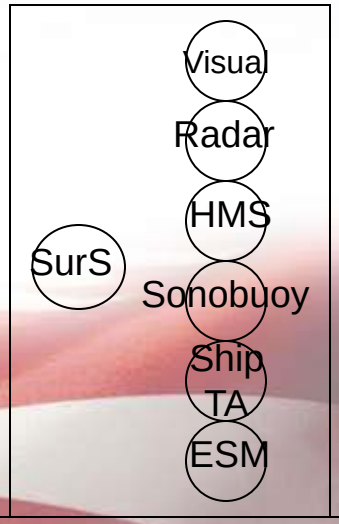
Chain sequence excludes return leap to FS as FS has no means to achieve AC

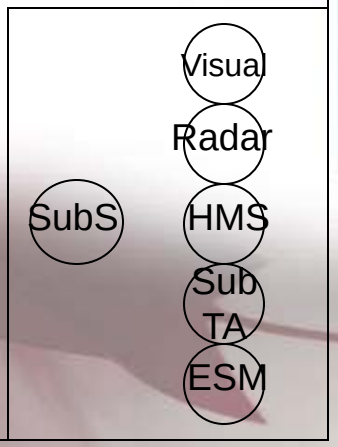
Each platform has internal sensor Markov Chain

Sensor level performance analysis enables platform Quantification









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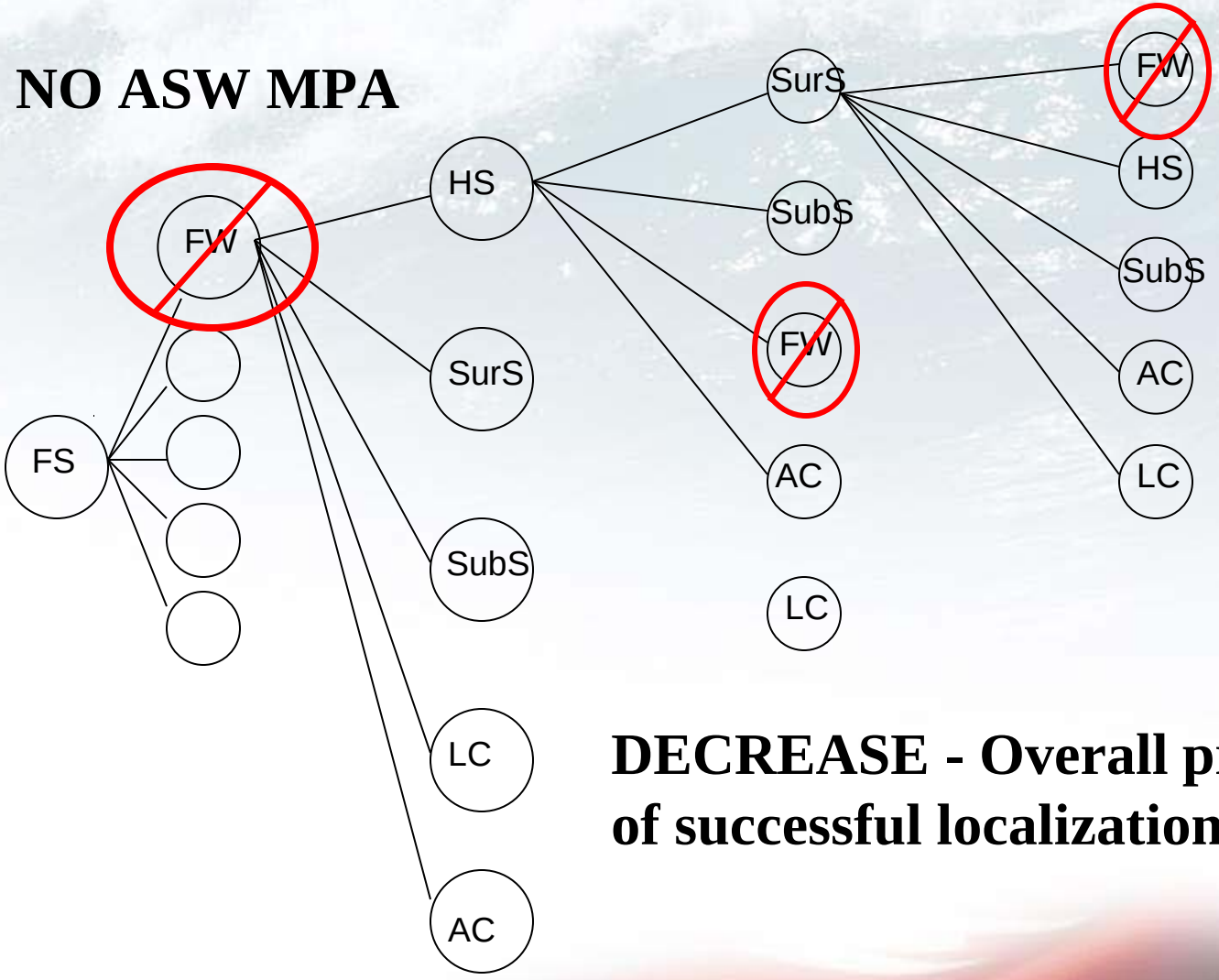
NO ASW MPA



DECREASE - Overall probability of successful localization

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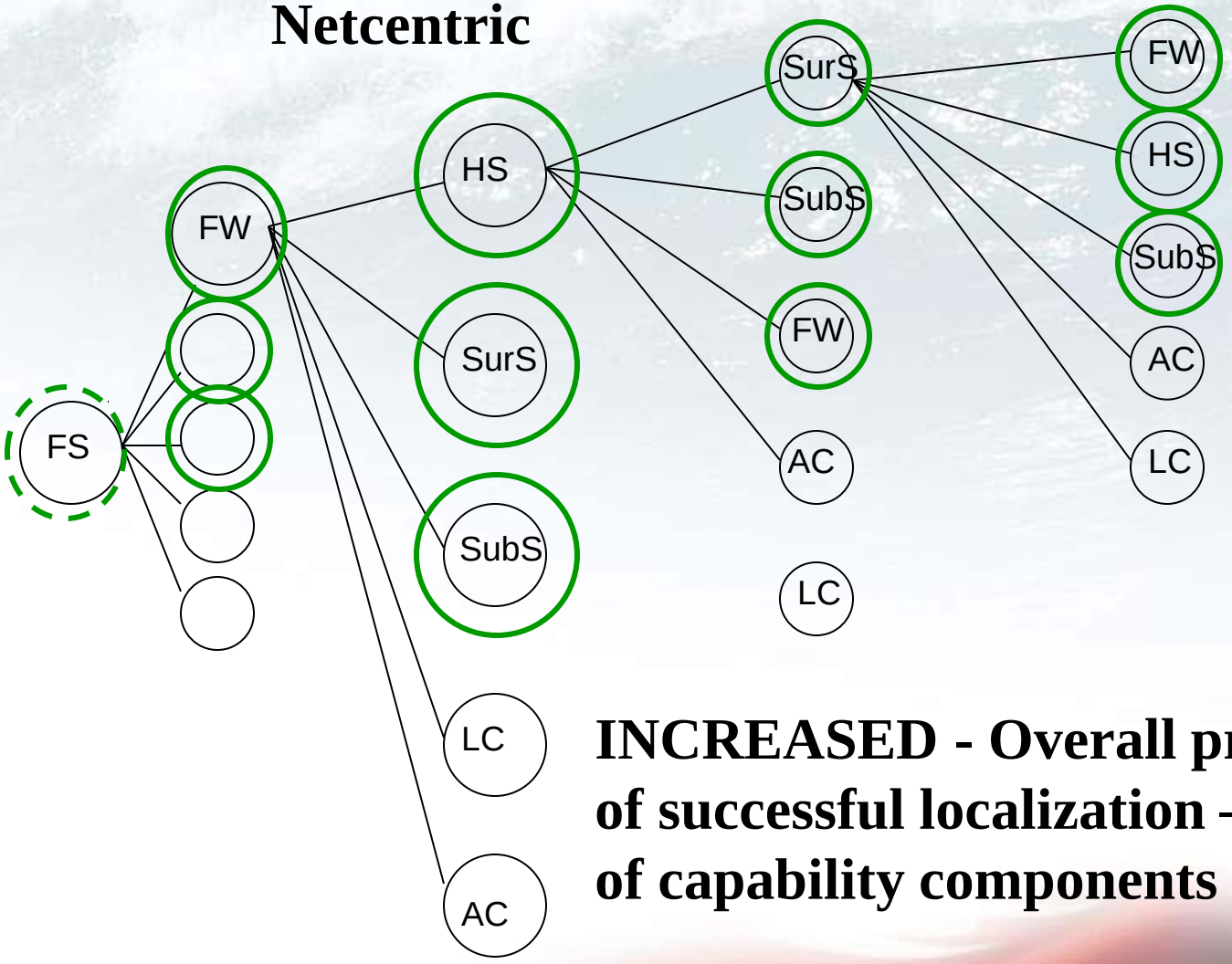
Shift to LFA Bistatic/Multistatic Netcentric



INCREASED - Overall probability of successful localization – integration of capability components

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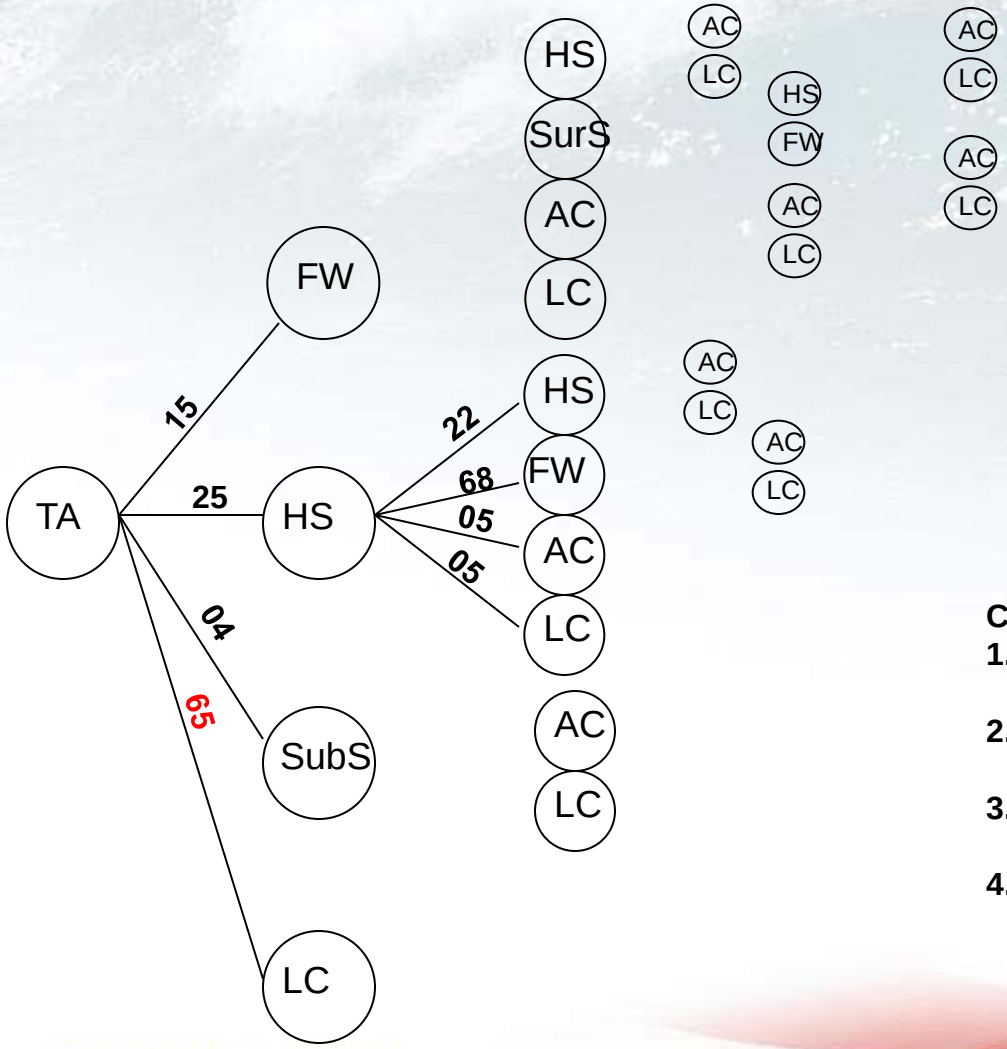
Possible Sequence of Events Initial TA Detection to Attack Criteria



Chain illustrates 4 critical elements

1. **Strategic Surveillance – Fixed UDA**
   Detection (D)
2. **Operational – Tactical Surveillance**
   Localization (L)
3. **Attack localization platforms [MPA – Helo]**
   Engagement (E)
4. **Performance of Wpn**
   Wpn repeats highly localized D – L – E

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Sensor

Shooter

	EBO Tenet	System Performance (S-D-C-L-A)	Balanced Platform Capabilities
Strategic	Eliminate perceived stealth of Submarines	S – D – C – L	Fixed Sensing ACINT IUSS, ELINT, SIGINT
Operational	Prevent Submarines from obtaining position of influence maximizing: sensor surveillance effectives; weapons effectiveness.	S – D – C – L	Localization capabilities with means to achieve attack criteria
Tactical	Achieve FC solution on threat submarine	D – C – L – A	Position of advantage
	Ability to counter threat weapon systems if fired upon	A	

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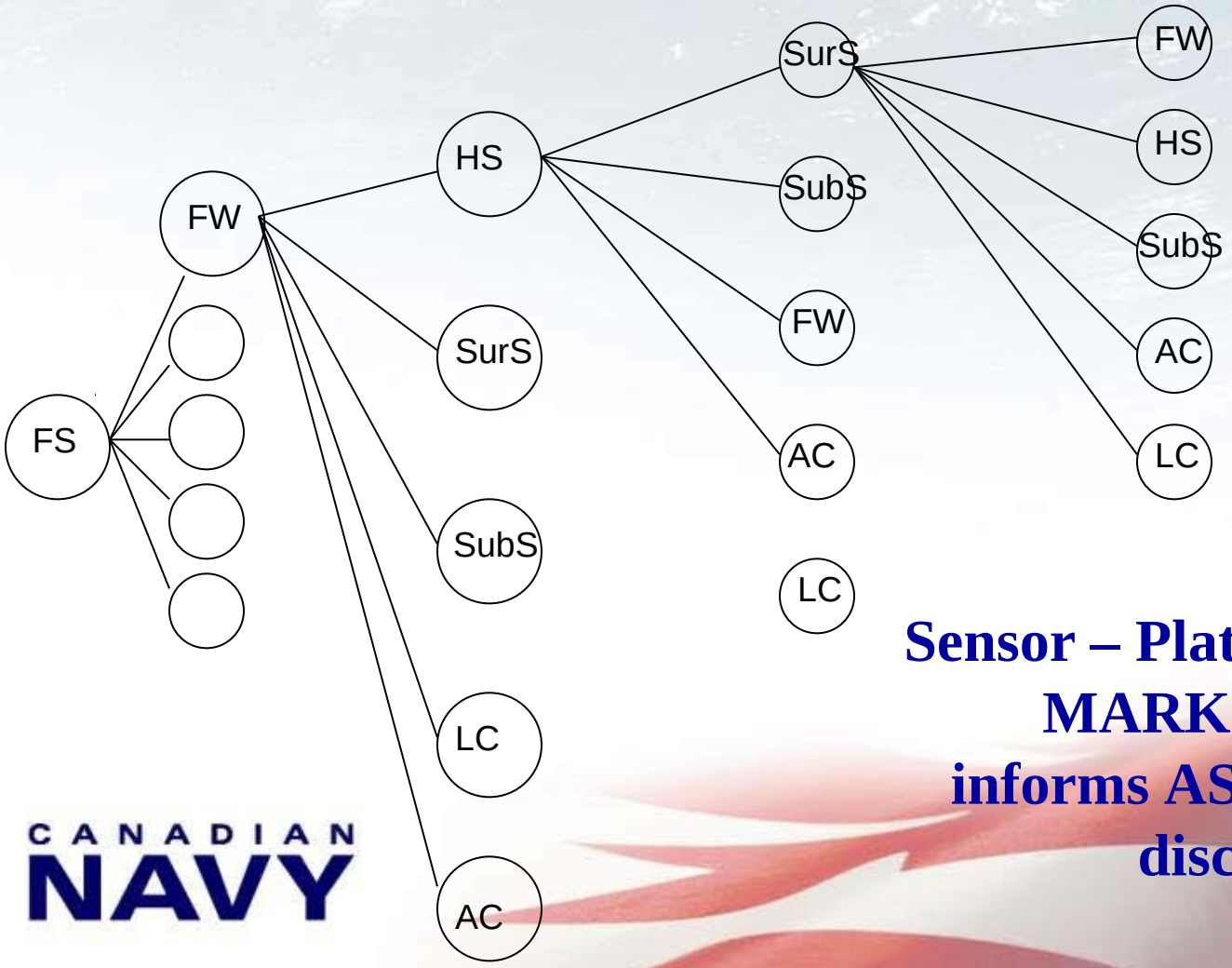
*"We must look at **ASW** as an overarching system, analyzed and procured with a mind toward **overall capability** vice that of individual platforms. The best ASW system is one that can detect, target and **neutralize well outside of the adversary submarine's sphere of influence** on our forces afloat or ashore."*



Sensor – Platform capability MARKOV Chain informs ASW Capability discussion

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Anti-submarine Warfare (ASW) Capability Transformation: Strategy of Response to Effects Based Warfare.

Questions?

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