Developing a Technology Strategy for a Maritime Theater

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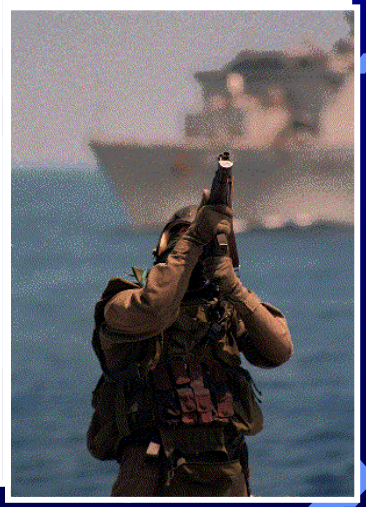
COMPACFLT



SHAPING

through

FORWARD

PRESENCE

CONDUCTING

RESPONDING

to

CRISES

21st CENTURY

Geography

1/2 the world's surface

Demographics

- 56% of world population

"CENTURY OF THE PACIFIC"

Economics

3% of U.S. two way trade

Security

- The 6 largest militaries

METRICS FOR CPF SUPPORT

- Purpose
  - Increased capabilities
  - Cost savings
- Motivation for investment
  - Transformational concept of operation
  - Technology opportunity
  - Capability gap
- Value proposition:
  - **Cost**
  - **Reduced time-to-market (fielding)**

TECHNOLOGY FOCUS AREAS
(Where the Gaps Are)

- Anti-submarine Warfare
- Maritime Interdiction Weapons
- Mine Warfare and Mine Countermeasures
- Countering Small Boat Swarm
- Countering Threats to Home Land Security/defense
- Data Fusion of Multi-sensors, From Multi-missions Across Service, Agency and Coalition Boundaries
- Systems/techniques for Reducing Manning

Strategy for a Way Ahead

Maximizing Our Advantages

- Exploit U.S. asymmetric strengths
  - Information superiority, persistence, precision, mobility, stealth, reach, speed, lethality, and *people*
- Fully leverage international domain
  - Empower *joint* warfighting across the full extent of a *unified* battlespace

Technologies to Enhance Warfighting Capabilities

SA's Gap Summary Thus Far

FORCEnet
All
Stand-Alone Prototype Integration

ASW
Fully integrated ASW COMMS

ASW – AT/FP
Improved Weapon Systems Fusion; cross-service, agency, coalition

Sea Shield
ASW
False Contact Reduction

ASW
Mini, Effective But Low Cost NA Sensors

ASW
Wide Area Surveillance Improvement

ASW
Automated, Autonomous Environmental Compliance

ASW
Remotely Guide Weapon Systems

Sea Shield
ASW
Sensor / Weapon Automation

Sea Shield
MIW / MCM
C4I

Sea Base/ Strike
MI
Improved Weapon Systems

AT / FP
Small Boat Swarms

AT / FP
* Torpedo Defense

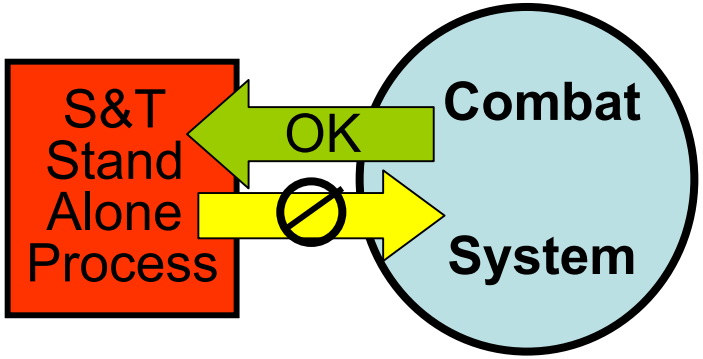
AT / FP
* Missile Defense

Sea Enterprise
Man and Train
Support Reduced Manning Automation

Stand Alone S&T Prototypes to Legacy Combat Systems

apability Gap: FORCEnet: All: ASW e.g.

eet forces need automated means to tegrate stand-alone technology into the Net nd then into the CEC/ combat system



Square Peg in a Round Hole

Previous Attempts/ Solutions (if applicable)

- ARPDD: latency renders output potentially less effective for CV protection
- S-IPS: Stand alone requires human interface to enable legacy combat action
- Distant Thunder: Total stand-alone system and Comms
- TUSWC: Zero integration into theater combat systems
- Others?

dditional Information:

New precision in GPS enabled sensor rototypes could enable rapid counter-fire with recision weapons, if information can be gested into weapon systems in timely anner.

Automated conversion to actionable inputs rmats through available input ports.

Technology (s):

- Output products of ONR and other Agency developed technology proves the MOP for basic function, but needs to be connected to weapons Combat Systems for M2M speed and ease of integration
- Develop middle ware that innovatively manipulates non-standard prototype's output through a surrogate ingestion matrix that mimics an acceptable legacy format for input.
- Reduction of display output to M2M

apability Gap: Sea Shield: ASW: ntegrated FORCEnet C4I structure to nclude submarines at speed and depth.

Time delays between detecting potential rgets, classification and steering capable eapons delivery systems is too long for uccessful cue-to-kill scenarios.

Previous Attempts/ Solutions (if applicable)

•MPA over the horizon network capability (such as BLOOM) too slow for full data exchange with on site aircraft.

•Under water PAGERS and COMMS at Speed and Depth are still in their BW and reliability infancy.

•Innovative CONOPS to surge capability as needed. (?X-glider, UUVs, UAVs)

apability Gap (Cont.) or Additional nformation:

FORCEnet grid to at least 100 Kbits per econd to keep near real time picture vailable to all participants. Includes netting ompressed platform sensor data fro fusion other sites.

Technology (s) Needed :

•All data systems need to be tightly integrated (link management technology) to ensure blue defenders have full ASW picture.
•Automated means of acoustic/other channel sensing and optimization and organization
•Acoustic, E/O and RF or directed energy links to enable uninterrupted data streams between all participants.

Sensors, multi-missions across agencies, services and coalitions

Problem Description (Capability Gap):

- Maritime security and defense forces lack he capabilities and capacities to provide timely nd accurate maritime situational awareness
- Lack automatic tools to identify and rioritize relevant and actionable information to void information overload
- Inability to acquire, fuse and manage isparate information limits timely cueing and ocus

Information sharing (technical, cultural) arriers limit the effectiveness of partner ations

Previous Attempts/ Solutions (if applicable)

- CENTRIXS
- CMA ACTD
- Biometrics collaboration
- CVTSC upgrade
- CFn
- DT
- LAMP

Capability Gap (Cont.) or Additional nformation:

Networks to collect data to fusion enters Persistent Surveillance to feed data

Technology(s) Needed:

- Cross domain data mining and inferencing tools
- Inter-agency data exchange via Service Oriented Architecture
- New fusion tools
- Anomaly detection

ASW
Top Technology Gaps for

Commands Represented (Science Advisors):

PACFLT (Doug Backes), FASWC (Fred McMullen), SUBPAC (Hans Widmer), SUBLANT (Stuart Dickinson)

19 April 2005

Detection & Localization in Shallow & Deep Water (1)

Capability Gap: Sea Shield: ASW: False Contact Reduction

Operational requirement is for rapid cuing and DCL. False contacts causes useless expenditures of assets, sensors and weapons and most importantly time.

Specific search rate needed for given force structure and CONOPS not being met:

Previous Attempts/ Solutions (if applicable)

- ARCI improvements to Submarine, Ship and MPA passive displays improves classification (still have high Pfa).
- Surface ship 'suitcase' mods…Improved Performance Sonar (IPS) and Scaled IPS (SIPS). Active displays allow better target to back ground noise separation, (getting better Pfa)
- Integrated displays merge Radar and Active in overlay fashion (manual Pfa reduction).
- Legacy and developmental dual phenomenology DCL systems (MPA, DADS) (beginning to achieve goal)

Gap (Cont.) or Additional Information:

Not achieving less than one false contact per day per platform sensor or per notional equivalent areas search module for offboard sensors.

Or, netted approach with additional technology to automatically adjudicate false alarms (UAVs, orthogonal sensors, etc., and reserve / increase Pd and search rate.)

Technology (s) Needed:

- Automation and fusion in Integration with active/passive and other NA sensor data to correlate sensor data and further reduce false contact rates to to acceptable levels.

- Automaton needed recognizing reduced manning directives and speed to return search rates (consequent Speed of Advance or multiple COAs for sea base movement or ultimately complete clearing of extended

Detection & Localization in Shallow & Deep Water (2)

Capability Gap: Sea Shield: ASW: Wide Area Surveillance/ Search

Coverage is totally inadequate for assured ittoral waters assured access (order of nagnitude)
Search Rate Metrics for Open Ocean are ot applicable to littoral waters operations factor of 2 to5 times worse)
Need seamless conversion to loose track CONOPS and technology
Extremely fast (on order of overland TST) to equired AOU for rapid attack weapons

Previous Attempts/ Solutions (if applicable)

- IUSS (SOSUS, SURTASS (+LFA), ADS)
- MSS
- RDSS
- TSS
- LCS
- STRAP
- LAMP
- Vol array
- DADS
- TFASW

Capability Desired (Cont.) or Additional Information:

Need alternative to enabling Force on Force approaches
CONOPS to date are highly defensive in nature.
Battle rhythm variability tolerant (Contact ates from one per several days to loose rack (one per few hours) (enables flexible power saving / manpower reduction –factor

Technology(s) Needed:

- Just in time delivery technology that does not exceed total cost that is 2x that of cargo.
- Multiple mission capable automated sensor for surface and subsurface threat (ships, small vessels, USVs submarines, UUVs)
- Automation to a factor of ten.
- On demand search rate increase to factor of ten
- Automated system management tools
- Automated external data assimilation and fusion tools

Law Compliance (1)

Capability Gap: Sea Shield: ASW: Automated Marine mammal mitigation integration in all active sensors and weapons.

USN getting further and further hamstrung by shifting environmental protection law and reactive NDOD policy
Multiple ASW training and experimentation events cancelled each year and problem increasing.
ASW proficiency is suffering and ASW transformation is slowing

Previous Attempts/ Solutions (if applicable)

- NUWC Marine Mammal Risk Model
- A4I / S-IPS MFA marine mammal tracking S/W
- Current ONR LWAD procedures
- Current Fleet observation and Avoidance Procedures

Capability Gap (Cont.) or Additional Information:

an in stride automated detection, tracking nd sonar adjustment / ping timing systems o enable uninterrupted sonar operations in eacetime as well as war

Technology(s) Needed:

- Fleet environmental planning, sensors and risk mitigation tools and automated reporting
- Automation of marine mammal detection systems (interactive to legacy and new sonar systems)
- Mid-Freq sonar S/W, augmented LFA H/W and S/W, modified distributed multi-static sonars for same capability with record and MMM assessment
- Biomimetic sonars (PRN), biomimetic

Detection & Localization in Shallow & Deep Water (3)

Capability Gap: Sea Shield: ASW: Expand the development of Non-Acoustic Sensors

Submarines will continue to evolve ability to exploit acoustic environment to the disadvantage of conventional ASW search sensors.
Ability of acoustic sensors to improve Pd and search rate w/O increasing Pfa in question.

Previous Attempts/ Solutions (if applicable)

•ARPDD (on MPA and surface) is beginning to exploit periscope detection and give automatic alertment (Environmental sensitivity needs improvement).
•Some success with magnetic, RF E/O and lasers but not reliable in high sea and littorals
•Concepts of cascaded sensor delivery (UVs) not seriously accepted by NWDC, operationally scoped or have properly cost analysis

Capability Gap (Cont.) or Additional Information:

Detection augmentations to visual frequency spectrum (i.e. automated IR/visual digital detection). (automation)

Add ASW capabilities across other legacy active/passive systems on each platform (i.e. automated TMA from ESM to ASW fire control)

Technology (s) Needed :

•Miniaturization technology for expendable UAV CONOPS
•Detection capabilities which are both effective in wider range of environmental conditions and as covert as possible.
•Automated fusion of multiple sensors t o increase detection opportunities and reduce false alarms

Detection & Localization in Shallow & Deep Water (4)

apability Gap: Sea Shield: ASW: utomated detection and reporting from set and forget' sensors.

Shallow water environments, and counter etection (proximity to threat forces erritory)) can limit the effectiveness of manned' platforms to give near real time pper information about approaching ASW argets.
There are no Navy OTH links developed for his need!

Previous Attempts/ Solutions (if applicable)

•DADS and other systems have rudimentary capabilities to automatically detect and report target feature data.
•LAMPS has architecture for capability but using link that will only be available to 2012-14.
•ONR FASTLink KSA FNC project would have produced link but was cancelled – leaving sensor programs orphaned and years behind schedule.

Gap (Cont.) or Additional Information:

No Technical / Operational and Cost ssessment of effectiveness of unattended ensors; value of powered mobility/ tationarity vs. greater distribution of lesser ost drifting schemes,
Low cost reliable OTH links (> 1000nm) for 2 or data exchange from near sea surface ensors. Min 2.4 kbs

Technology (s) Needed :

•Make the sensors semi-automated (less B/W) and more reliable (i.e. reduce false alerts, etc),
•reduce local physical observability issues (I.e. HF RF/Acoustic comms, presence of large buoys, etc), covert survivability and capable of covert/ low observable delivery
•OTH data link for small sensors

Problem Sea Shield: ASW: Improved weapons and related systems

Most ASW weapons are fire and forget with very little correction capability once the weapon is separated from shooting platform. Target maneuvers and decoys can render even well placed weapons ineffective.

Previous Attempts/ Solutions (if applicable)

•MK-48 ADCAP and MK-54 LWT have started using digital inputs to expand their search and detection capabilities. [Net-Torp Net SAT provide nascent capability]
•ASUW has taken tack to the target weapon to GPS position to turn on - at last minute to reduce CM time and focus weapon smart DCA.

Capability Gap (Cont.) or Additional Information:

Weapons not 'smart' enough so once separated from platform updates it can understand the tactical situation and adjust. Also, delivery platform needs an 'over-ride' capability to steer the weapon when it becomes obvious that the tactical situation has changed (i.e. target makes radical maneuver, etc) beyond the weapon's ability

Technology (s) Needed :

•Expand weapon/fire control system capabilities to include understanding of environment, full understanding of target parameters (depth, course, speed, inc) and capability for decoy avoidance.
•Technology for integration of all source data - fused to provide best steer.

Countermeasures C4I (1)

Problem: Sea Shield: MCM: Ability to Automate DC(I)L and Network Sensors for Rapid Clearing

Current open ocean MCM POR too slow in estricted littoral waters – particularly in multi hreat environment
MCM surveillance in last 1000 yards urrently immature in netting and ffectiveness assessment.
Breaching technology immature or ndiscriminant

Previous Attempts/ Solutions (if applicable)

- **LMRS**
- **RMS**
- **OMCM**
- **E/O surveillance**
- **Surf Zone robotics**
- **JDAM clearing**

Gap (Cont.) or Additional Information:

f warranted for use, carpet bombing breach ffectiveness difficult to measure.

Technology(s) Needed:

- Intelligence and surveillance systems for MIW detection (unattended sensors)
- Automation and reliable netting of MCM and external ISR
- MEDAL enhancements to support using additional netting and automation
- Obstacle avoidance/mapping sonar and control
- Netted Multi-static acoustic sonars
- Low collateral damage/disturbance clearance technology

(MI) Weapons (1)

Capability Gap:Sea Strike:SUW: Coordinated All Weather, MI in a Crowded / High Anti-air Threat, Littoral Environment

Maritime Interdiction has deficiencies in all weather environment and PTI required ROE. This is complicated in a high-anti aircraft threat which may require stand-off weapon attack.
TST may be required and forward area operations may require an all sea-based response

Previous Attempts/ Solutions (if applicable)

- JSOW C Block II
- SLAM –ER
- Affordable Weapon System
- JDAM ER
- AMSTE

Capability Gap (Cont.) or Additional Information:

- Long range, smart weapons may be too large or too few to enable operations from the sea base against anticipated target sets
- Available precision weapons require independent and netted PTI combine with PNT not currently available for maritime task.

Technology(s) Needed: Using Navy assets:

- Maritime environment and navy Force structure requires augmentation / alternatives to over-land methods.
- Technology to provide gridded mensuration in the anticipated at-sea battlespace (buoys, Uvs
- Netted unmanned mobile or unattended sensors to provide positive identification data
- Netted linking of external platform and

Boat Swarm (1)

apability Gap: Discrimination of threat warms from non-threat clutter and recision munitions with reduced ollateral damage

Operating in restricted waters without SA on otential threat
Separation of threat and non-threat white hipping / fishing recreation vessel.
Targeting for many multiple vessel packs; ounter vessel and counter weapon echnology

Previous Attempts/ Solutions (if applicable)

- **CIWS**
- **LOCASS**
- **CMA ACTD**
- **ARPDD**
- **Micro / Tactical UAVs**
- **FEL**
- **Spartan Scout**

apability Gap (Cont.) or Additional nformation:

Stand-off beyond threat weapon range

Technology(s) Needed:

- Sensors and software to detect swarm forming behavior.
- Technology transfer with international partners
- COAs TDAs
- Lethal and Non Lethal FP weapons
- UVs with anti-boat anti personnel weapons for stand-off

Reducing Manning (1)

Capability Gap: Sea Enterprise: Manning and Training

Platform sensors manning is being reduced without sufficient automation to continue legacy and adjunct sensing with fewer operators

Addition of offboard sensors and unmanned vehicle technology puts additional pressure on remaining personnel.

Previous Attempts/ Solutions (if applicable)

- SAT
- EAST
- CEC
- Automated Logistics tracking
- CFn
- USWDSS
- IASW
- LAMP
- DADS
- ARPDD

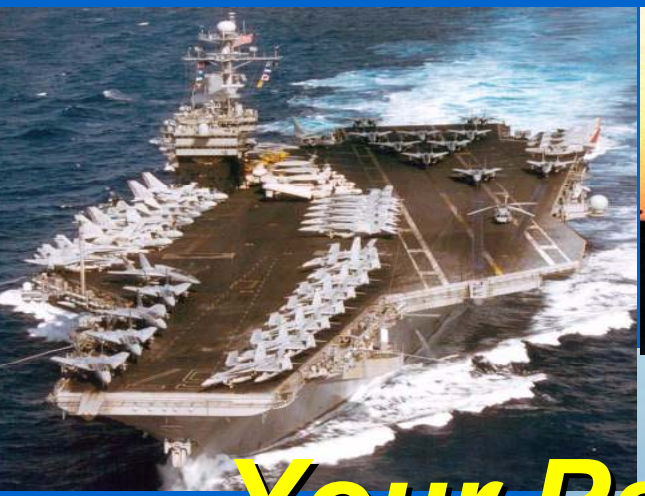
Capability Gap (Cont.) or Additional Information:

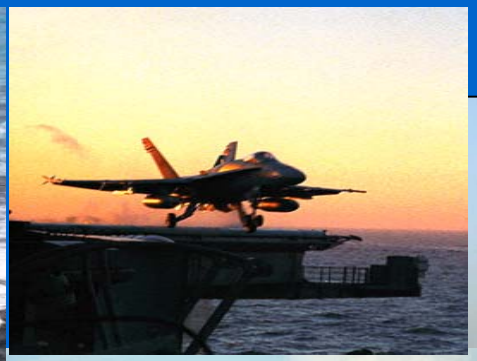
There is a relationship between long range sensing and difficulty to automate DCL.
There is a relationship between reducing sensor size and distributing and requirement for more delivery vehicles and manning for that.
It is hypothesized that automation can relieve both manning and training requirements

Technology(s) Needed:

- At the applied science level: Models of this process need to be made to create an understandable technology trade space.
- Automation as a specific technology metric need to be developed that are applied to all sensor and weapon work.
- Goals also need to be established as limits of automation to establish and maintain fail safe human control (e.g. EMCON, weapons ROE; Blue on Blue prevention) including IO vulnerability

ENABLING THE WARFIGHTER





Your Pacific Fleet at Work