NAVAL OPEN ARCHITECTURE

Adopting Open Architecture Practices in Military Systems

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TODAY'S AGENDA

- Our changing landscape
- Preparing for these changes by adopting open architectures
- Improving delivery to the warfighter

Our landscape is changing

- New threats
- Expanding missions
- New net-enabled technologies
- New approaches to solution design

New threats…

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drones

anti-ship missiles

improvised explosive devices

small arms fire

rocket propelled grenades

explosively formed projectiles

…and more

Flood of intelligent weapons

- Some 32 nations are developing or manufacturing more than 250 models of drones, according to the DOD's UAV Roadmap

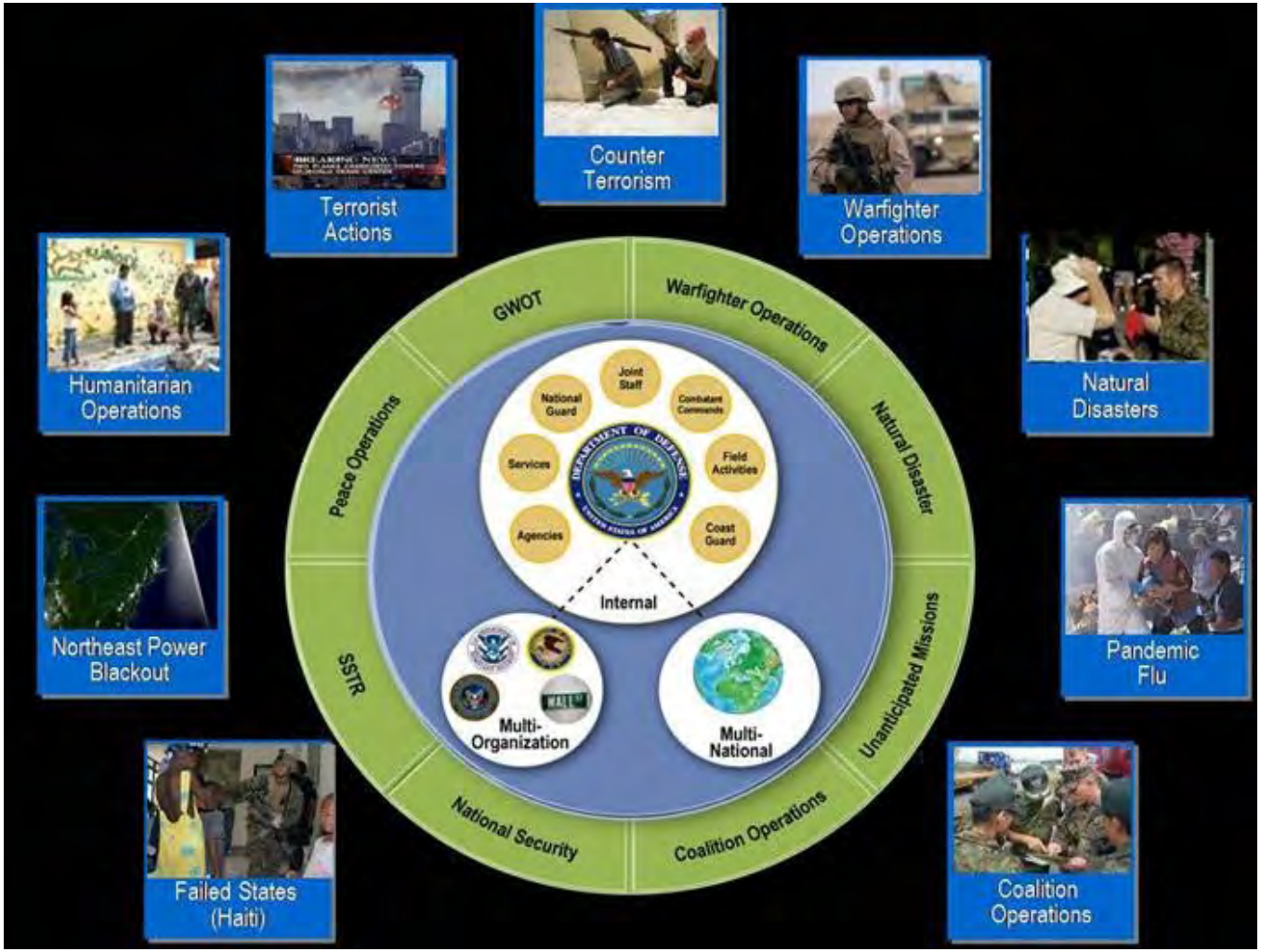
Easy access to technologies and weapons

- Terrorist groups are acquiring sophisticated anti-ship missiles in their arsenals. During the Israeli / Hezbollah War, the Israeli corvette Hanit was hit by a C-802, an Iranian-made variant of a stealthy, turbojet-powered, Chinese anti-ship missile. The missile was fired from a truck-mounted launcher and cued by a coastal radar installation, which provided data for the initial launch.
- High-precision, low cost manufacturing machines, that can make sophisticated parts for ships, planes and weapons, can now be located nearly anywhere and owned by anyone. This raises the specter in which rogue nations could sell weapons of mass destruction or missiles as digital files to anyone with a portable Computer Numerically Controlled factory to build their own weapons.

Asymmetric – unconventional warfare

- In Operations Iraqi Freedom and Enduring Freedom, rocket propelled grenades, mines, improvised explosive devices, and small arms fire have been responsible for a significant number of casualties.

...expanding missions



Source: Hon John Grimes, ASD(NII)/ DOD CIO, http://www.defenselink.mil/cio-nii/

New net-enabled technologies…

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High Performance Computing	**Multiple CPU cores into a single module** • Tightly coupling it with high speed cache memory
IPv6	**Enhanced Proliferation of IP-addressed applications/devices, and "comm on the move"**
VOIP	**Increased flexibility/capacity through broadband Internet connection** • Allows for converged voice and data on the same network
Mobile / Satellite Communications	**Real time connectivity, high data rate, ISR ex-filtration, and communication on the move**
IA / Security	**Secured DoD information, systems, and information infrastructure**
...and more	

…new approaches to solution design

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- Service Oriented Architecture
- Model-Driven Architecture ™
- Open Standards
- Open Source
- Virtualization
- …and more

Easy-to-use services to access, share, reuse, and collaborate

Separated designs from architecture

- Design addresses the functional requirements
- Architecture provides the infrastructure through which non-functional requirements like scalability, reliability and performance are realized

Advancements toward commonality

- Enable interoperability of technologies
- Encourage innovativeness and healthy competition
- Increases consumer choice and opens entirely new markets

Platform and Resource Virtualization

- Enables dynamically reconfigurable grid computing
- A single physical resource appear to function as multiple logical resources
- Multiple physical resources appear as a single logical resource

Fundamental shift from "walls and patches" to "secure from the start"

Preparing for these changes by adopting open architectures

Adopting Open Architecture Practices

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Naval Open Architecture (OA) is the confluence of business and technical practices yielding modular, interoperable systems that adhere to open standards with published interfaces.

Business Practices	Technical Practices
❑ Disclose design artifacts	❑ Modularize systems
❑ Negotiate required data rights	❑ Publish interfaces
❑ Increase enterprise collaboration	❑ Isolate proprietary components
❑ Institute reviews of solutions	❑ Use widely adopted standards
❑ Develop new business models	❑ Reuse software components
❑ Increase competition	❑ Build interoperable applications
❑ Change contracts	❑ Ensure secure data exchange
❑ Design for lifecycle affordability	

Building modular architectures…

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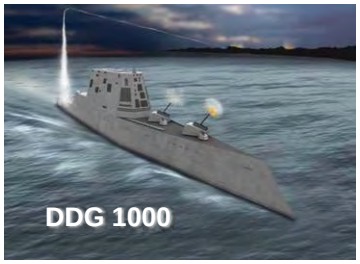
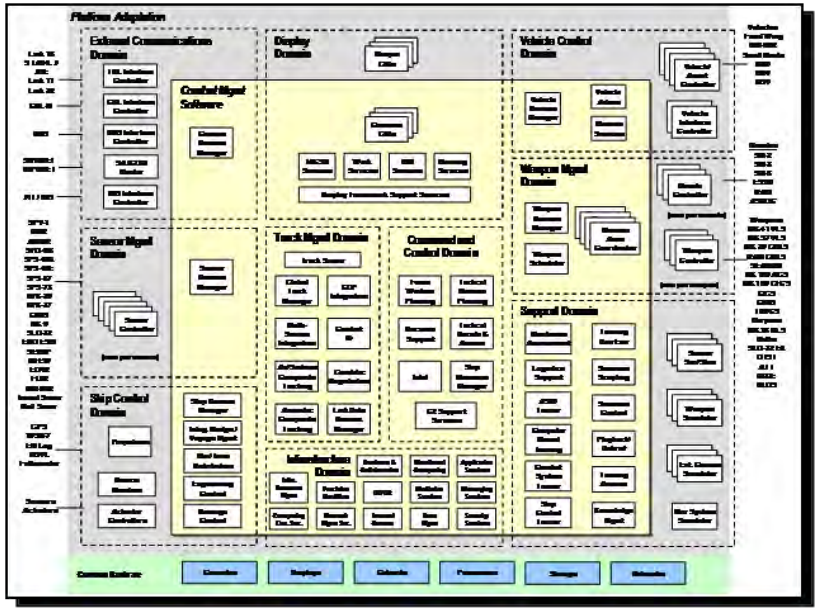
Aligning platform combat systems…



…to 1 Common Open Objective Architecture…



…to achieve commonality across multiple ship classes where business case supports

…and changing how we design them

Developing new business models…

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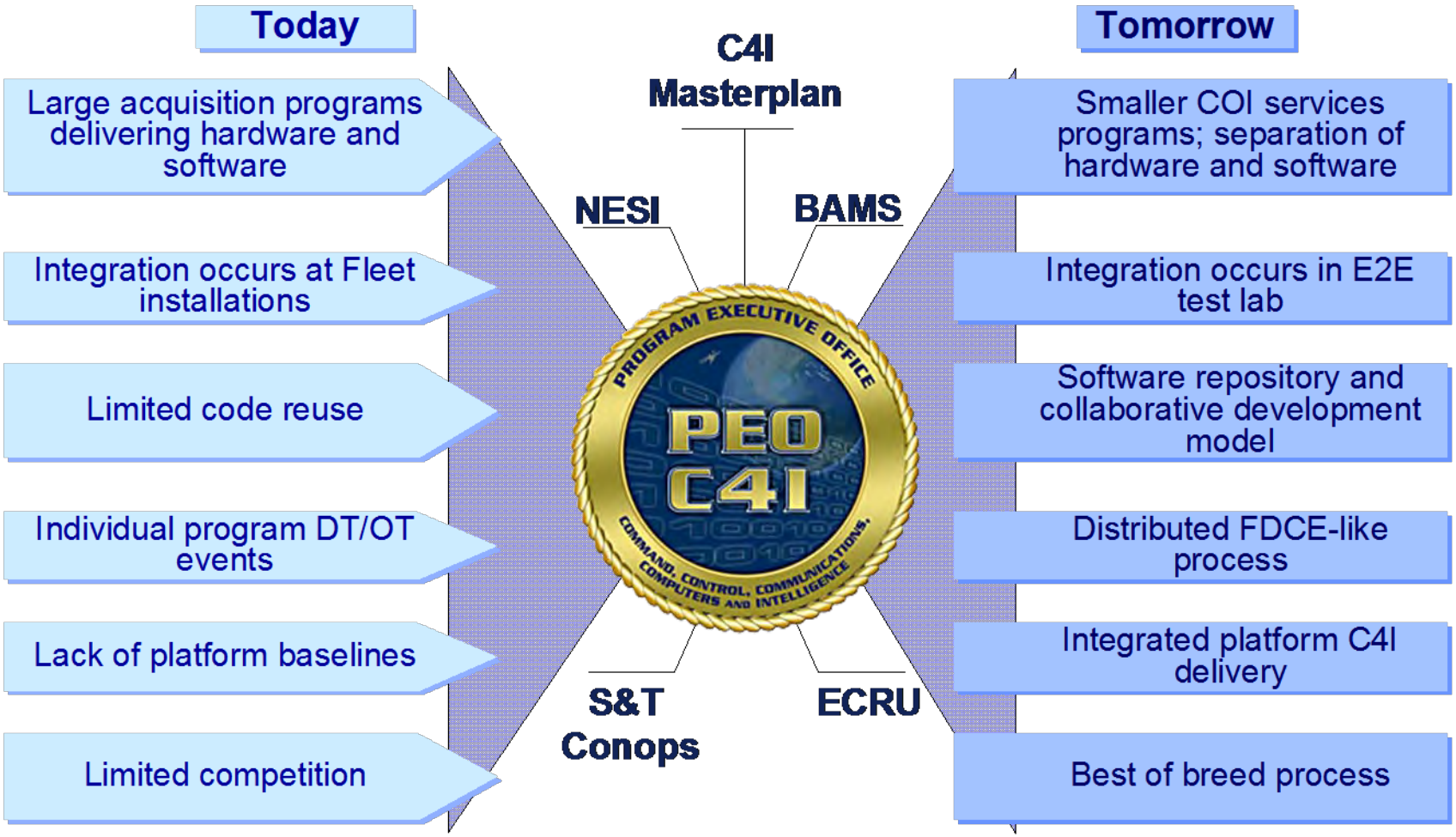

…to prevent vendor lock-in

Changing our contracts to include OA

- **Contract Language**
  - Leveraging language in OA Contract Guidebook to mandate adoption of OA principles
  - In FY 07, 36 contracts incorporated OA language

- **Contract Award Evaluations**
  - Openness of proposed architecture for Ground/Air Task Oriented Radar was evaluated as a contract award selection criteria

- **Contract Incentives**
  - P8-A contract includes OA compliance as a specific award fee criteria
  - 30% of $261M award fee pool tied to technical criteria

Exercising Intellectual Property Rights

- A key aspect to implementing OA is for the Government to ***exercise*** the intellectual property rights (IPR) it acquires

- Under the Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS):
  - The Government gets **Unlimited Rights** in both Technical Data (TD) and Computer Software (CS) for noncommercial items **developed exclusively at the Government's expense**.
  - For noncommercial items developed with **mixed funding**, the Government gets **Government Purpose Rights (GPR)** in TD and CS.

- If a contractor asserts more restrictive rights over a system/component's IP and the Government fails to challenge such an assertion by exercising its rights, the contractor obtains the asserted rights

- It is imperative that the Government assert and exercise the IPR it acquires because it may lose the right to challenge after a period of time

Reusing software to lower costs

The P-8A re-uses 68% of mission software (over 2.5M software lines of code). The program is leveraging existing proven software from critical mission areas.

The Marine Air Ground Task Force Command and Control (MAGTF C2) incorporates components from eight DOD programs

Disclosing designs to foster innovation

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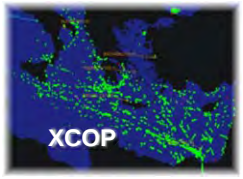
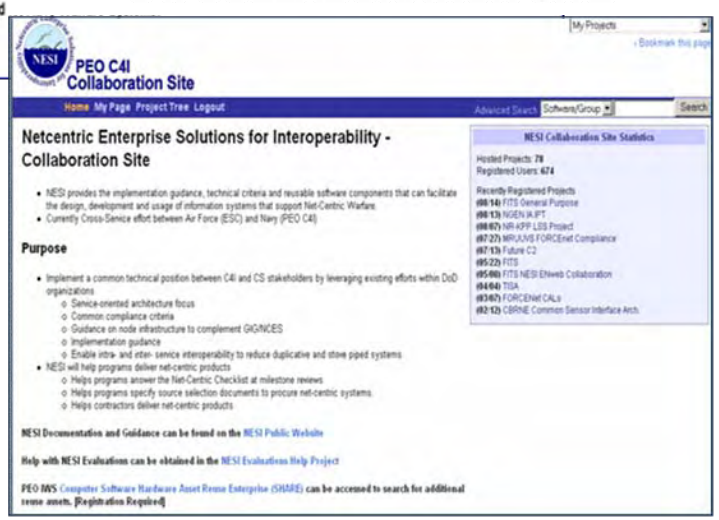
- Design artifacts from AEGIS, LCS, DDG 1000, SSDS, SIAP, IABM are available to qualified vendors in the IWS repository

IWS SHARE REPOSITORY

- Project artifacts from CLIP, XCOP, and NITES-Next are available to qualified vendors in the C4I NESI collaboration site



C4I COLLABORATION SITE



and improve interoperability

Improving delivery to the warfighter through OA

- Fielding new capabilities
- Reducing time to field
- Improving interoperability
- Improving performance

Fielding new capabilities

- One common Submarine Radio Room

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Requirement

- 1 common communications center for all submarine classes

OA Implementation

- Modular architecture
- Re-use of common communications components **for all submarine classes** such as antennae, transceivers, terminals and networks

Results

- 1 Common Submarine Radio Room
- Increased lifecycle affordability
- Full Rate Production granted Aug 07
- Successful OPEVAL on SEAWOLF, SSGN and SSBN platforms
- Successfully deployed on SSN21
- Investigating to extend this concept to all Naval vessels

Reducing time to field capabilities

thru the Submarine Warfare Federated Tactical System (SWFTS)

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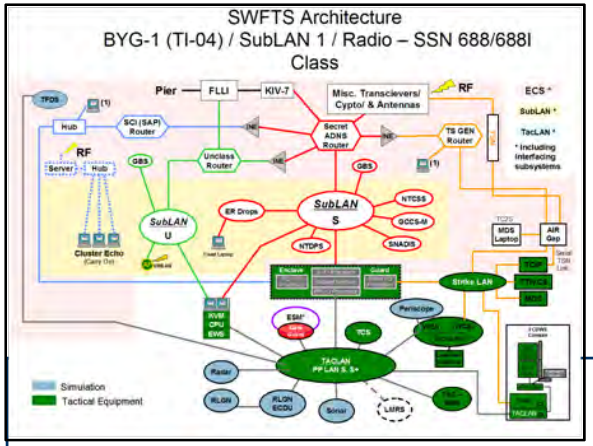
Requirement

- Implement enterprise business strategy with technical solutions



OA Implementation

- Apply an Open, Network Centric Architecture with Services and Applications
- Eliminate stovepipe, obsolete hardware and software
- Coordinate the development and definition of HW/ SW Infrastructure Tech Insertion Baselines across SWFTS subsystems and platforms (currently used by BYG-1, ARCI, and Imaging)

Results

- Approximately 12-15 Platform Upgrades / Year
- Minimized number of configurations requiring support
- No maintenance actions required at sea (either planned or corrective)
- Integrated training approach (train like you fight)
- Development effort paces threat environment and technology evolution

Improving interoperability and expanding the battle space for NIFC-CA

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Requirement

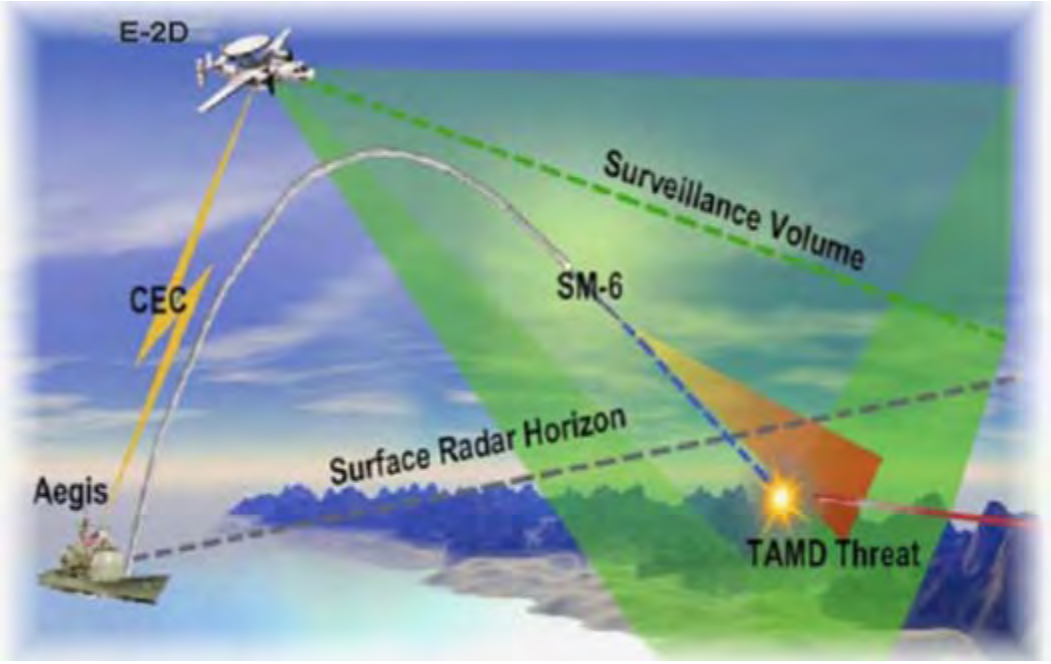
- Develop a **Naval Integrated Fire Control** (NIFC-CA) capability to expand battle space

OA Implementation

- Established peer reviews among multiple vendors
- Developed modular architecture
- Wide use of common-off-the-shelf products
- Widely accepted standards

Results

- Integrated capabilities and technologies across multiple platforms from cooperative engagement capability, Aegis, SM-6, and E-2D
- Expanded battle space to maximum kinematic range of SM-6 missile



Improving operator performance

by doubling the bandwidth on the George Washington Carrier

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Requirement

- Increase Bandwidth to Ships at sea

OA Implementation

- Modular architecture / published interfaces
- Re-used a DISA certified Army off-the-shelf component

Results

- Doubled an Aircraft Carrier's SHF capacity to 4 megabytes per second by using an enhanced Bandwidth Efficient Modem (EBEM) with ADNS IIA

Future Plans

- Re-use EBEM as part of a Rapid Deployment Capability (RDC) Program, Commercial Broadband Satellite Capability (CBSP) – (planned in FY08)
- Re-use ADNS for the E2-C platform (for airborne networks) and for NCTAMS PAC (shore site) in FY08

Summary

"We live in a changing security environment, and we cannot afford to rest on our laurels and expect to achieve future success. Our ships, our submarines, our aircraft, our networks, our weapon systems must stay ahead of potential adversaries. ***The cost of future systems and the speed of technological innovation will challenge our ability to deliver a balanced force.*** *Therefore, we must be exacting in our requirements, mindful of the factors that increase costs, disciplined in our process to be effective and efficient, and timely in delivering future capability while simultaneously maintaining our current readiness."*

~ Remarks by CNO ADM Gary Roughead, October 2007