ONR 31 S&T Programs

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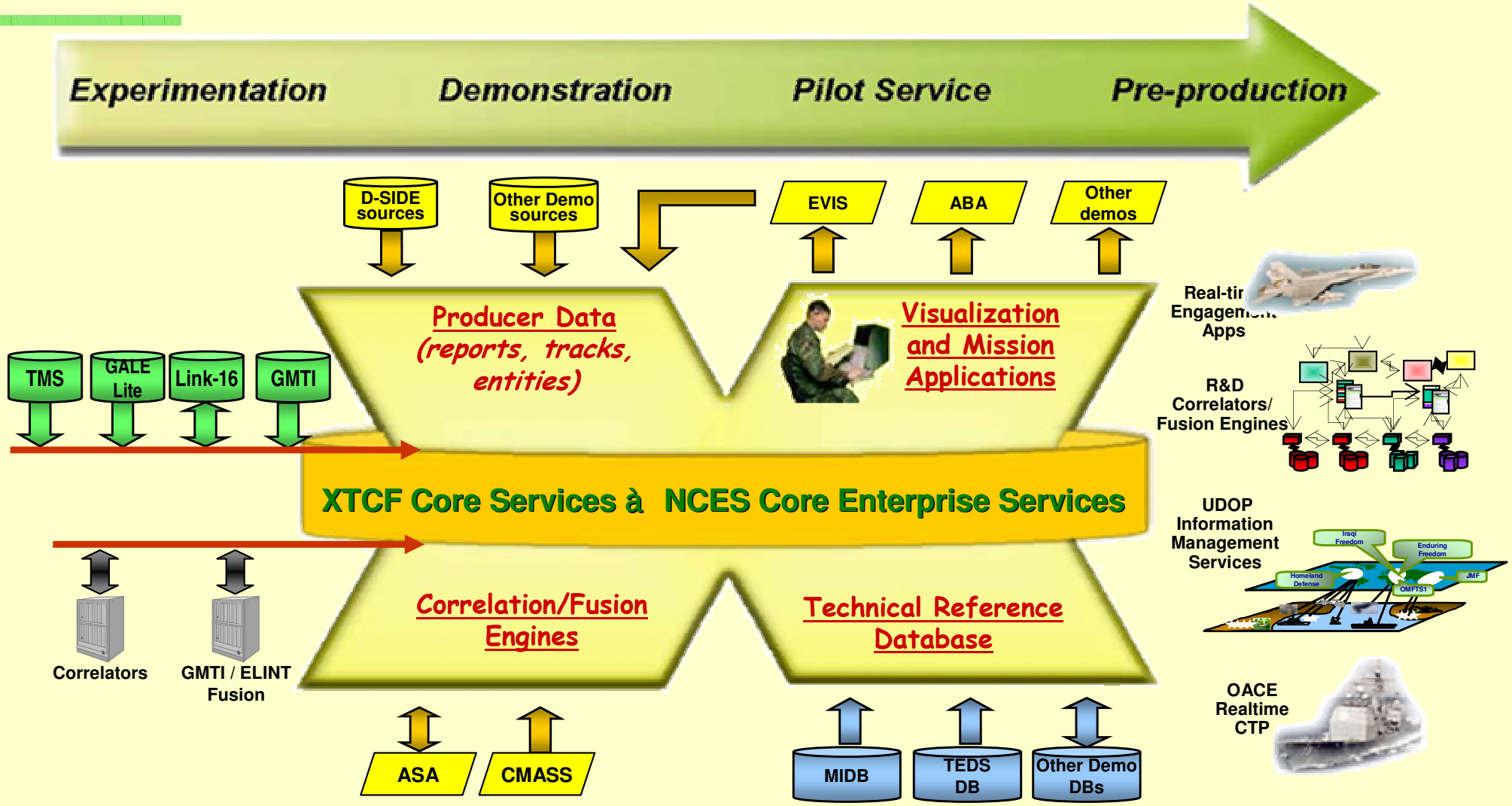
Key Thrusts

- FORCEnet (Network Centric Warfare)
- Persistent, Pervasive Surveillance
- RF Digital Technology and Advanced Aperture Concepts
- Electronic Warfare
- GPS Vulnerability Technology
- Nanoelectronics

FORCEnet Strategic Investment Areas

- Rapid, precise decision-making
- Pervasive and persistent sensing
- Dynamic, mission-focused communications and networks
- Information assurance technologies
- Human factors (Code 34)

eXtensible Tactical C4I Framework

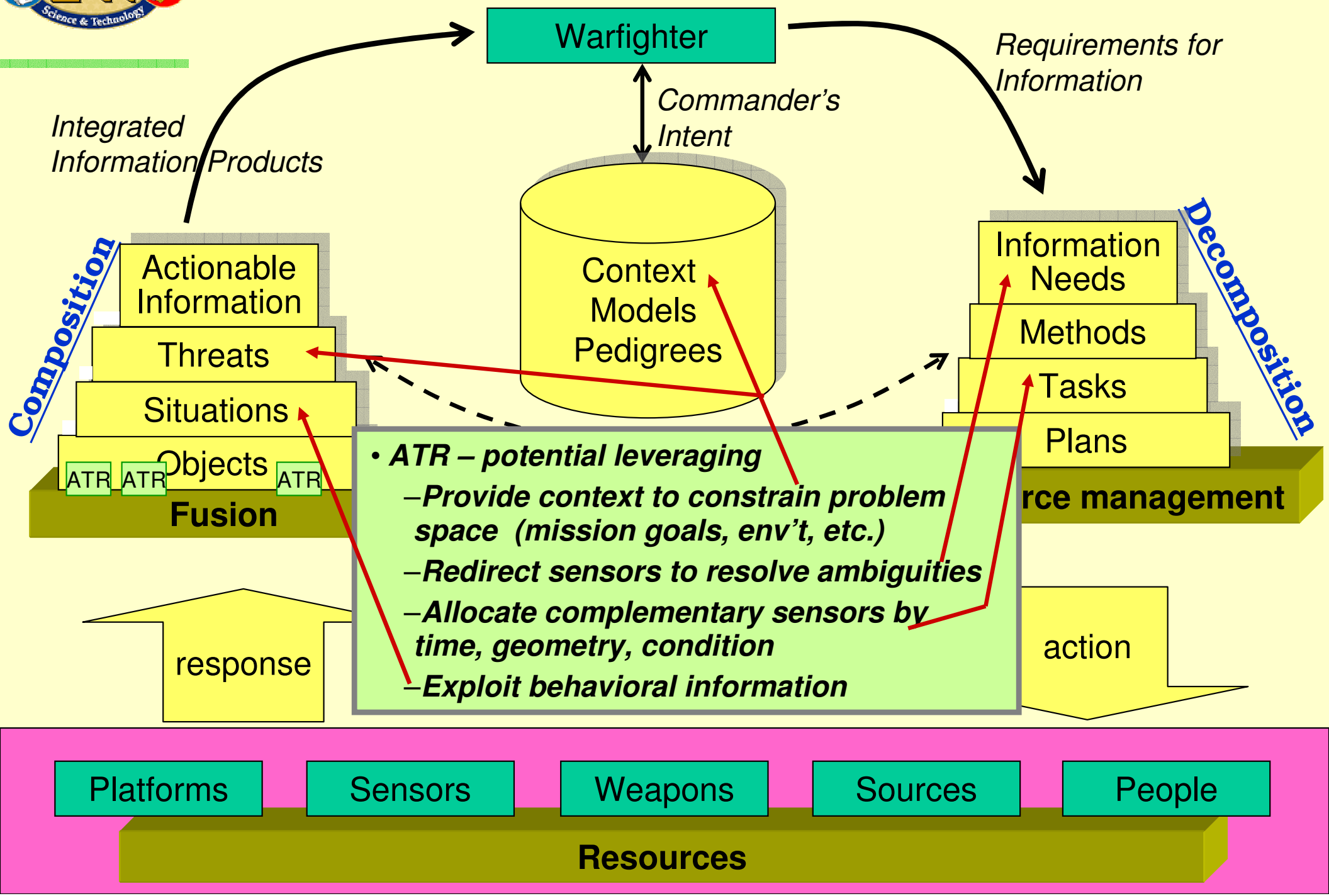


FY04 Sea Trial:
XTCF for Battlegroup plus ASW Applications

Horizontal Fusion 04:
Strategic SA plus Global Strike COP plus Regional Force Protection

FY05-09 ACTD:
Joint Realtime Coordinated Engagement Transition to JC2 / NCES

Integrated Information Framework



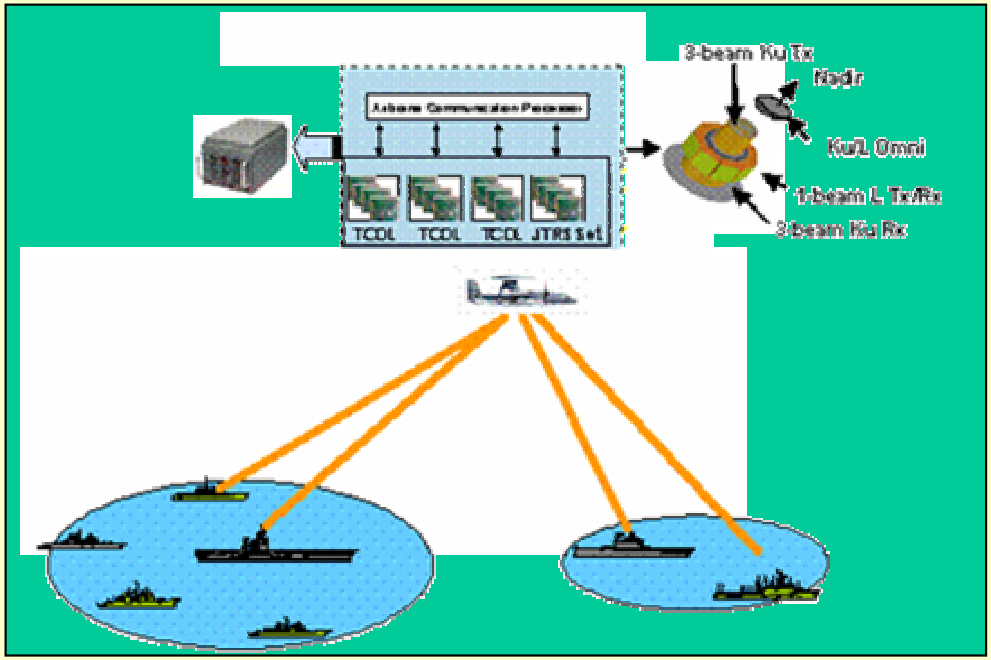
Airborne Communications Package (ACP)

Product Description:

An Airborne Communications Package (radio and antenna) that provides OTH relay of TCDL and ISR data and extends organic networking capability OTH using JTRS (surrogate).

Sea Strike/ Sea Shield/FORCEnet: Improves the effectiveness of Naval/Joint tactical IP networks.

TRL at Start: 3 TRL at Transition: 7



Planned Demos/Deliverables/Transitions

- Air-to-air demonstration in FY05
- Sea Trial Demo FY06
- Transitions to FIRESCOUT, PMA 263, in FY06.
- Potential Transition to BAMS

Warfighting Payoff:

- Over The Horizon networking and relaying of ISR/ TCDL (Tactical Common Data Link).
- Extends penetrating surveillance range (greater than 100nm) .
- Broad Area Maritime Surveillance with reduced reliance on SATCOM.

Demos-Transitions-

FY03 FY04 FY05 FY06 FY07

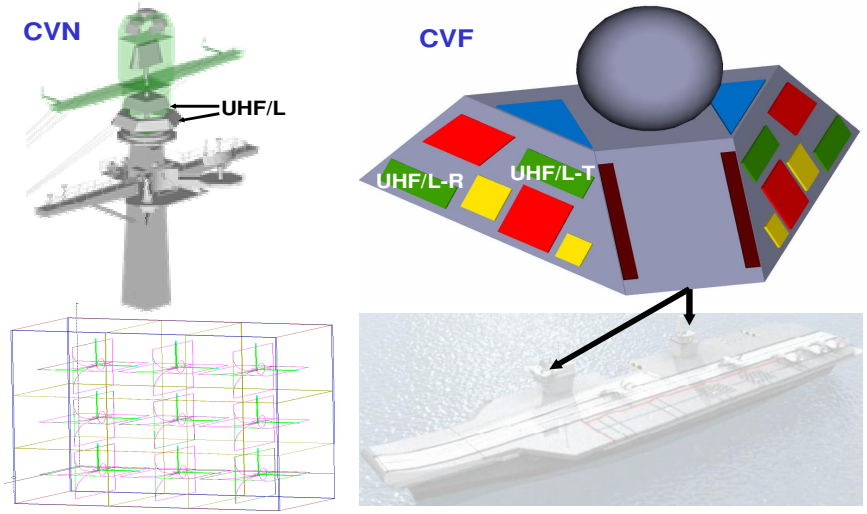
UHF/L-Band Phased Array for CVN

Product Description:

- An Advanced Multi-function SATCOM/Line of Sight Transmit/Receive Array. UHF and L-Band.
- Fully digital beam-forming
- Capable of producing multiple nulls which mitigates both hostile and unintentional self-jamming.

•**FORCEnet:** Reliable, BLOS communications and network infrastructure

TRL at Start: 3 TRL at Transition: 6

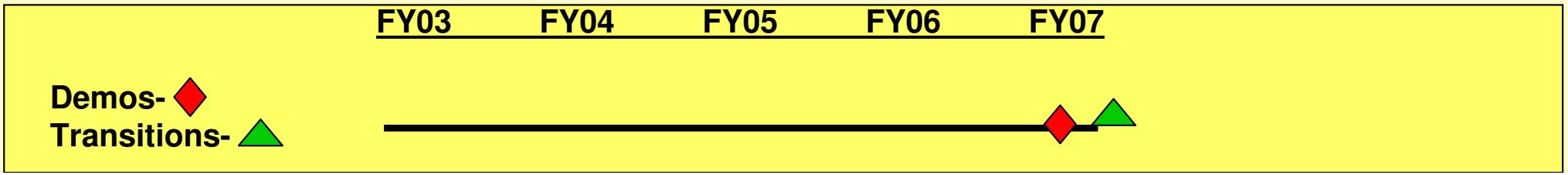


Planned Demos/Deliverables/Transitions

- CVN 21 and PMW 179

Warfighting Payoff:

•Replace 50 federated antennas with a multi- function array.
•Saving up to $3.5M per CVN in non- recurring cost over current system.
•Reduces logistics and life cycle costs.

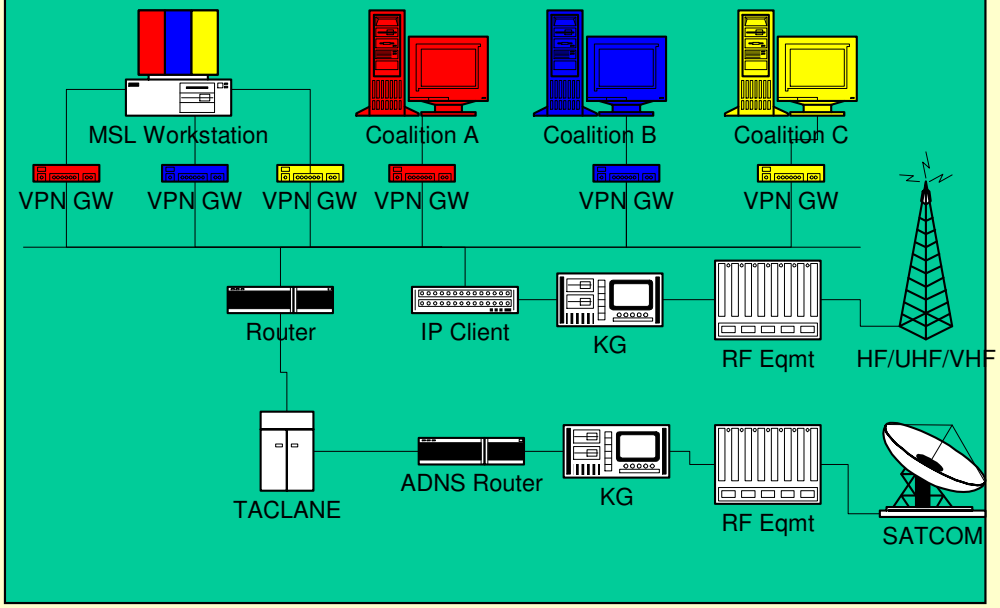


Multinational Virtual Operations Capability (MVOC)

Product Description:
Improve the timeliness in the exchange of tactical and operational information between U.S. and Allied/Coalition forces through use of virtual private networks and secure web servers.

Sea Strike/ Sea Shield/FORCEnet – Enhances interoperability within a coalition Naval forces

TRL at Start: 6 TRL at Transition: 7



Planned Transitions :
- Dynamic VPNs & MSL Workstation – FY05/06

Warfighting Payoff:
- Enhances network centric interoperability among allies and coalition partners by providing at sea reliable, secure, and timely exchange of releasable tactical information.
- Affordable inclusion of multiple security domains by providing technology to substitute for non scalable hardware approach.

	FY03	FY04	FY05	FY06	FY07
Demos- Transitions-	◆ ▲	◆ ▲	◆ ▲	◆ ▲	

Silver Fox Small Tactical UAV

- 22 lbs gross weight – hand or vehicle launched
- Endurance: 4 hours
- IR, Hi-Res black & white and color cameras – 25 nm LOS
- Multiple UAV control from kneeboard-sized laptop
- Complete FalconView user interface / mission planning
- Convoy escort and multi-UAV SWARM modes

Operation Iraqi Freedom

- Initially fielded with Navy SPECOPS
- Delivered initial 8 systems in 60 days with ONR military operators
- 18 Silver Foxes deployed within CENTCOM to-date
- Successful operation in 45 mph winds
- Developing design to support surface search and control for major assets such as A/C
- Developing design to support MC tactical brigade needs

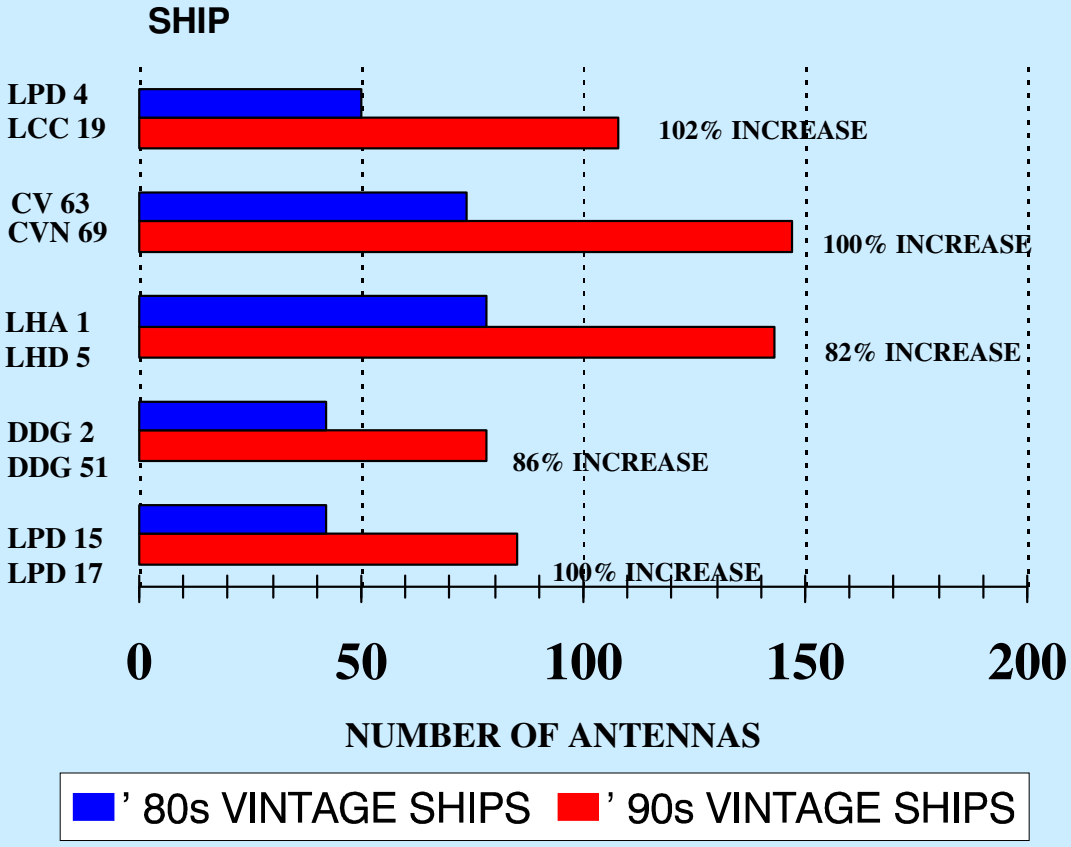
Transformational Development Program

- Spiral development with quick operational roll-outs
- Rapid prototyping and insertion of technical innovations
- Approaches small UAVs as commodities
- Per unit cost currently $26K – EO/Avionics 70% of total cost
- Objective is drive unit costs significantly lower
- Unit expendability as an option is end focus
- Joint collaboration by Universities, DoD Labs, large/small businesses and Combatant Commands
- Funded by ONR STTR Program and Conrgressional interest
- Off-the-shelf technology in an open architecture
- No pilot skills required – operators trained in two weeks or less

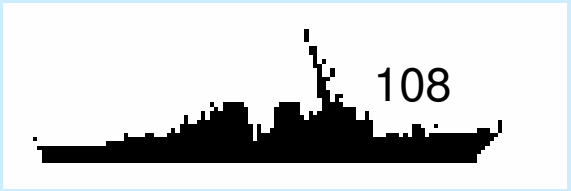
Future Efforts

- FY-04
  - High bandwidth datalink with digital video compression or high throughput communication system
  - Automated threat cueing of operator
  - Automated landing and take-off
  - Improved gasoline and heavy fuels (JP5/8) engine reliability
  - Extended endurance to 20+ hours
  - Extended inertial flight control (GPS denied capability)
  - NAVAIR flight certification
  - T&E shipboard ops/recovery system
- FY-04/05
  - Advanced EO/IR systems (improved performance/lower cost)
  - Integrate advanced chemical agent sensors
- FY-05
  - Assess feasibility of FOPEN 3D SAR imaging capability

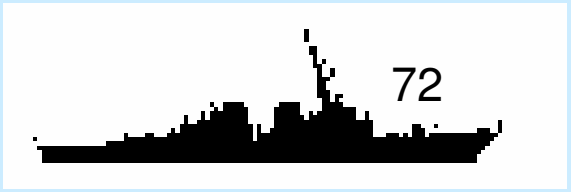
Issues - Topside Antenna Growth



Antenna Growth within Ship Acquisition Program



DDG51 (Flight IIA-MYP)



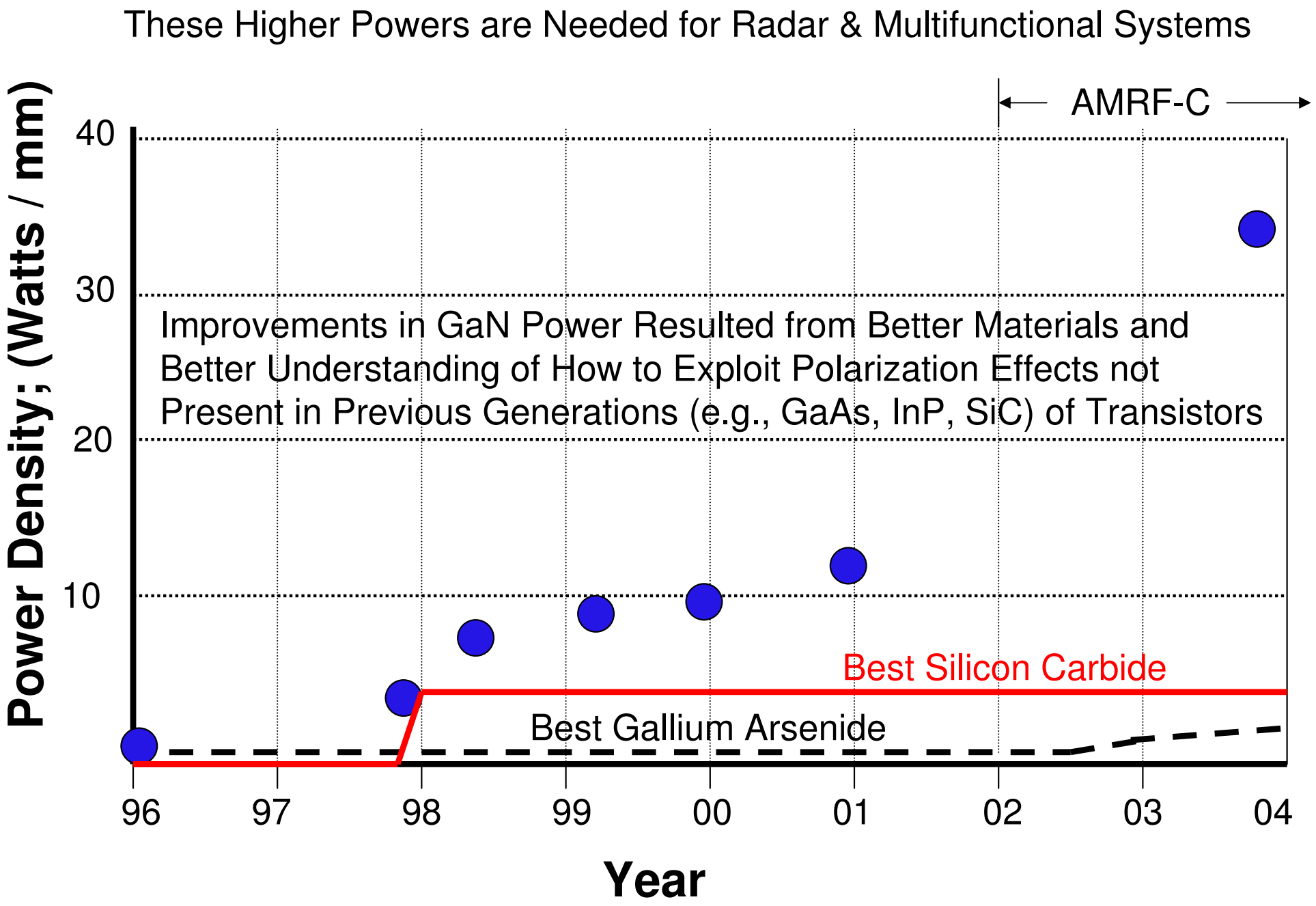
DDG 51 (Flight I)

NUMBER OF ANTENNAS

PHYSICAL CONSTRAINTS --- INCREASED REQUIREMENTS

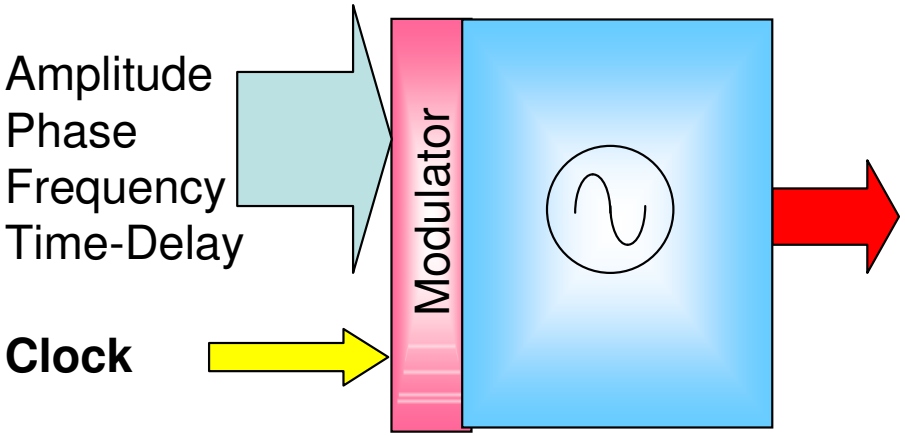
AMRFC Site Today

GaN Power Density for X-band Transistor



ONR World Record: Direct Digital Synthesis

Digital Inputs: **RF Output:**



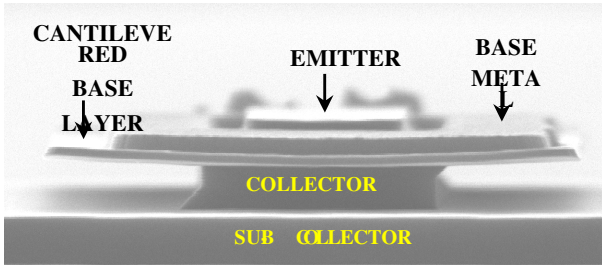
POC: Dr. Dan Purdy, ONR

Objectives:

- RF outputs to 20 GHz
- -160 dBc phase stability derived from clock
- Multi-GHz bandwidths
- Complex waveform generation
- True time delay for beamsteering
- Element level digitization (for ESA)

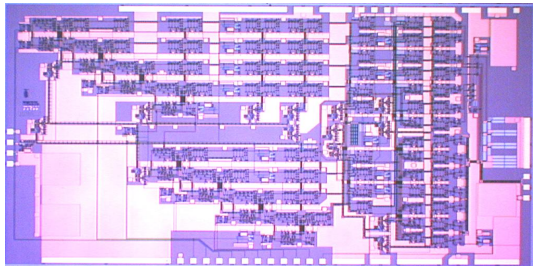
Approach:

- Monolithic mixed signal
- Sub-micron scaling of InP HBT's
- Multi-bit Sine-ROM lookup table
- 1-bit delta-sigma

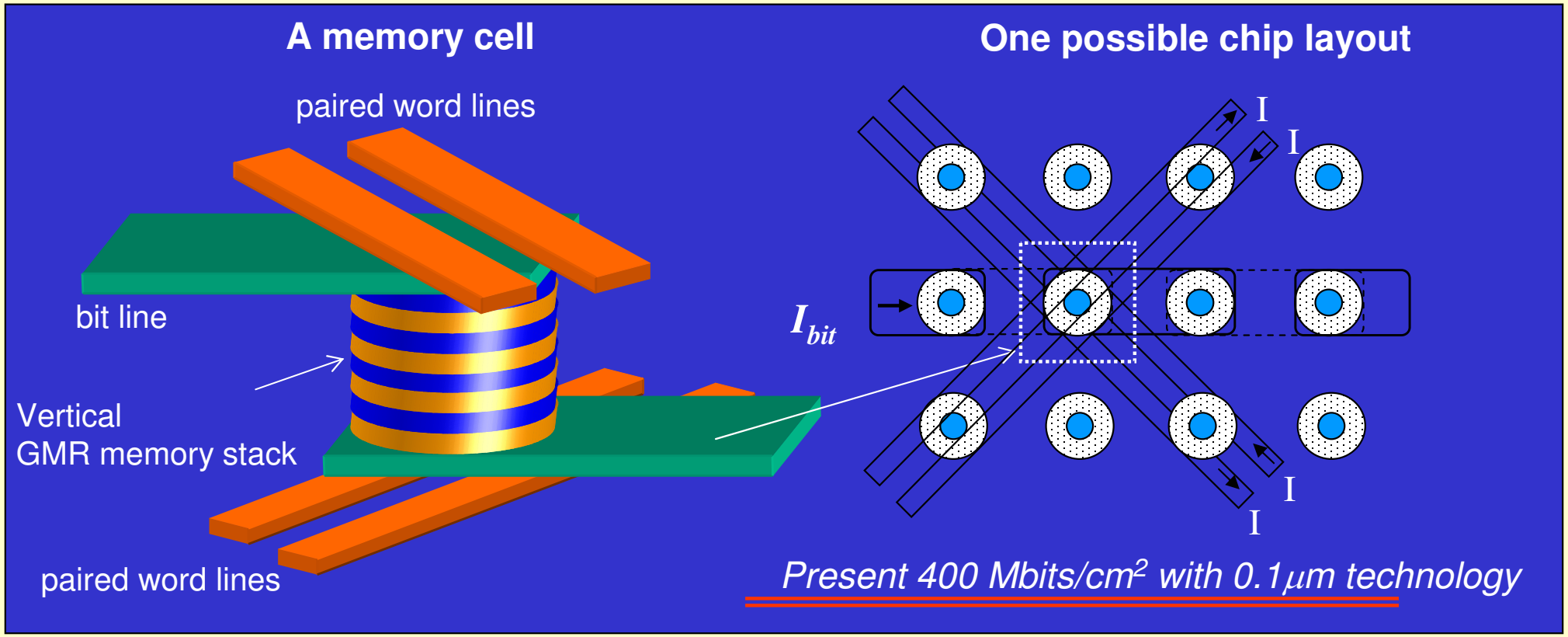


Recent Accomplishments:

- Record 5500 InP Transistors on chip
- Record 4.56 GHz RF output
- Clock frequencies to 9.2 GHz
- Novel architectures

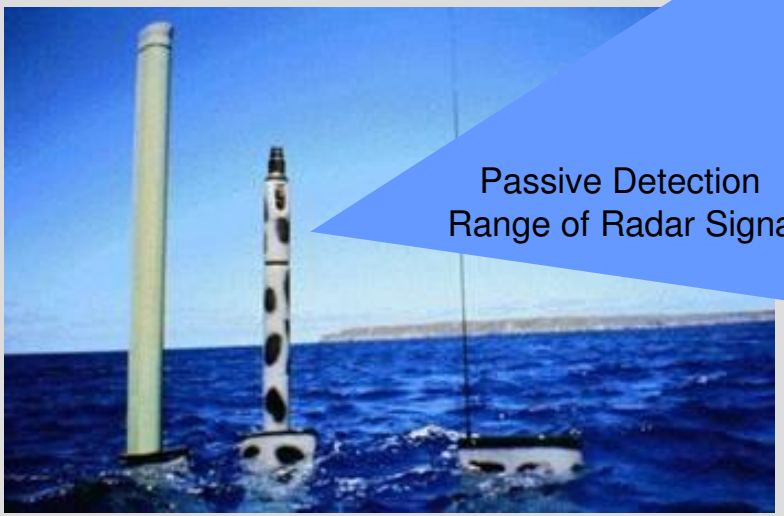


Ultra-High Density MRAM for Multi-fuction Electronics Design:
Modified Vertical GMR Memory

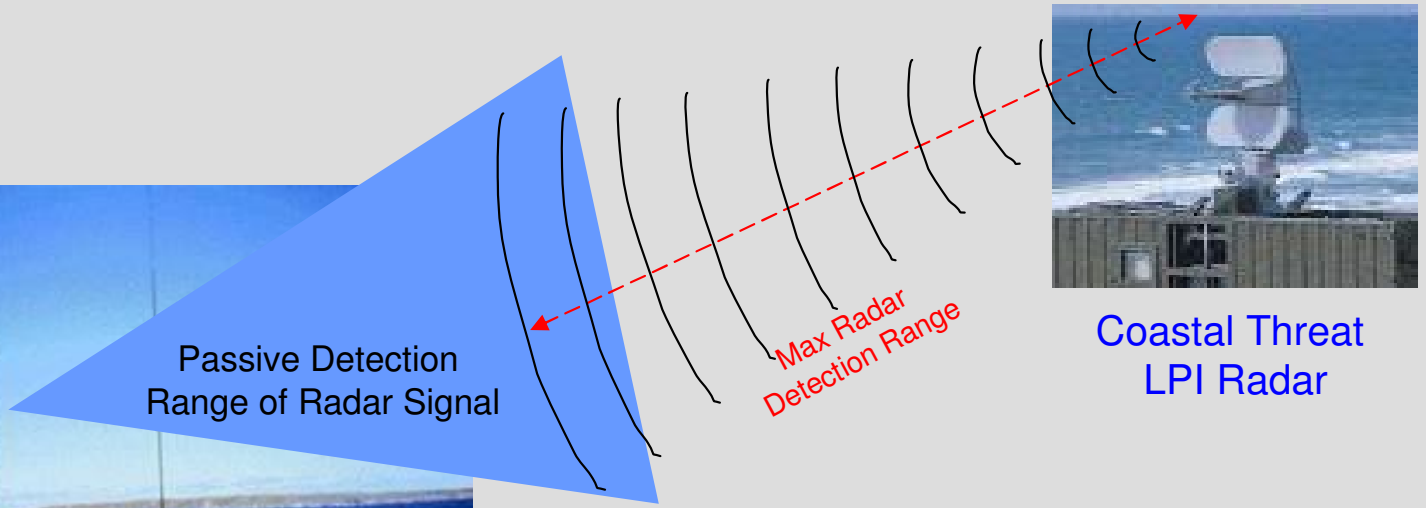


- **The Giant MagnetoResistance Memory (GMR) stack with the paired wordlines provides extremely robust and fast read/write operations. The ultimate storage area density for this design can be at least 40 Gbits/cm^2, far superior to all of the existing memory designs. At the present 400 Mbits/ cm^2 , it is equal to mechanical hard drive densities.**

ES Detection of LPI Periscope Detection Radar



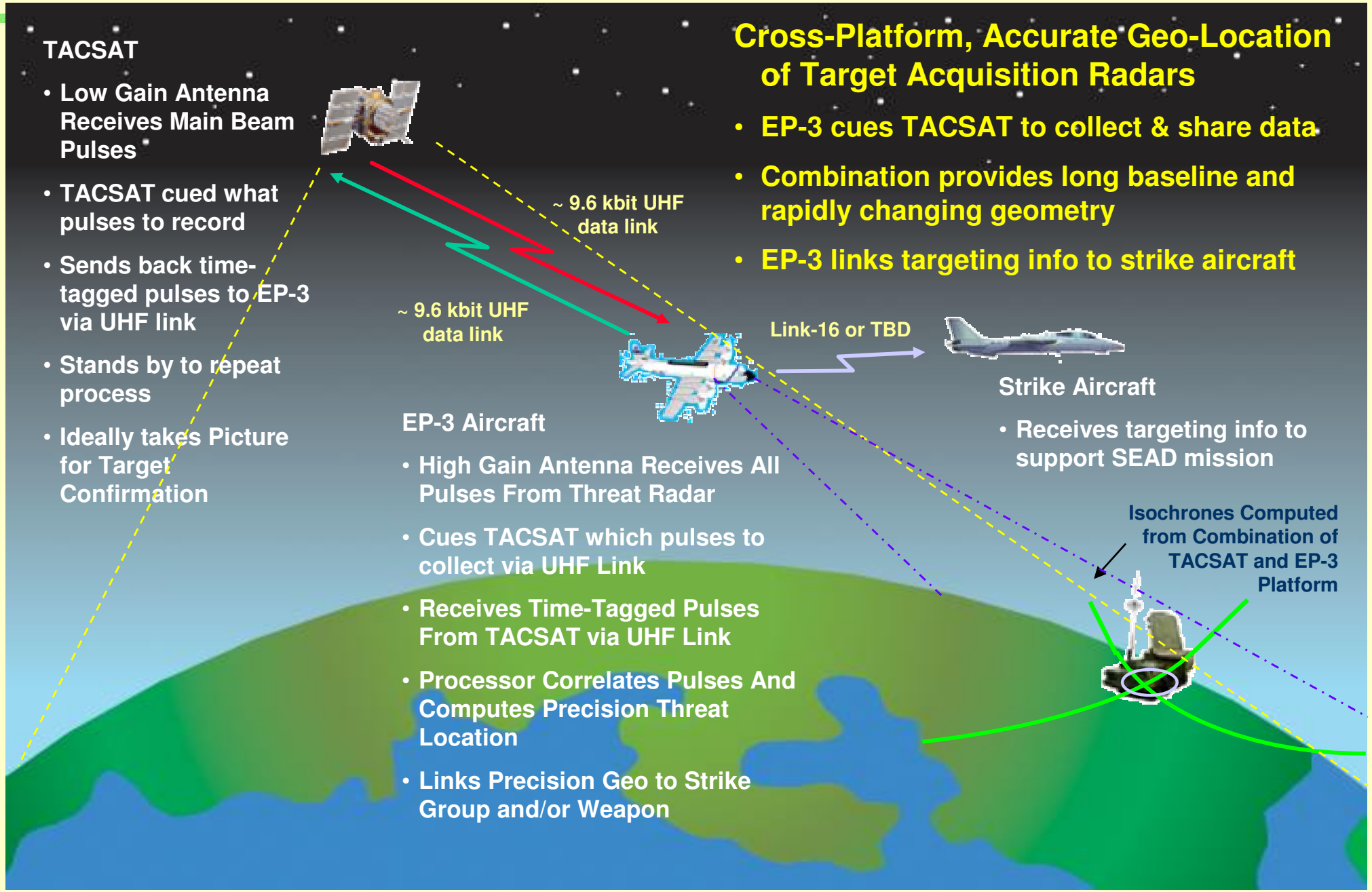
Submerged Submarine
Operating in Littoral Waters



Effective Against:

- FMCW, Chirp, and Noise-like modulation types
- Successful At-Sea-Test August 2003

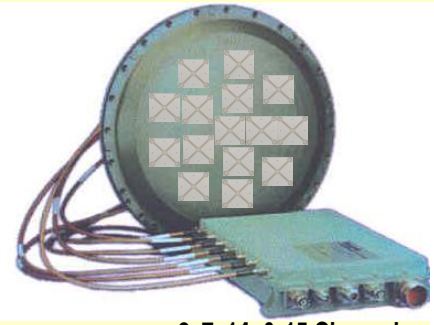
Project ANGUILA S&T Products on TACSAT-1 Mission



GPS AJ Antennas – Aircraft & Submarines

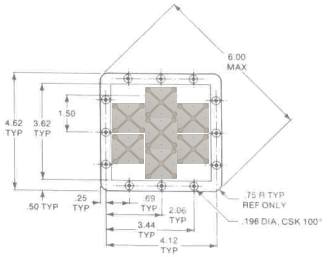
FOR GPS ON PLATFORMS FROM AIRCRAFT TO MISSILES TO BOMBS TO PROJECTILES

15 Element CRPA



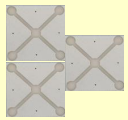
6, 7, 14, & 15 Channel

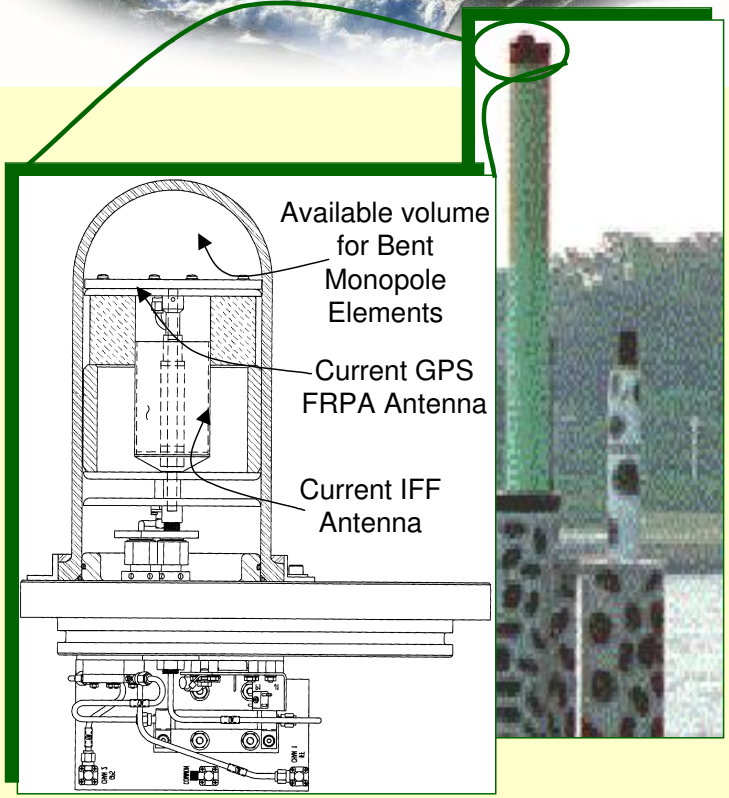
7 Dual Polarized Element, 14 Port FRPA-3



FRPA-3

3 Dual Polarized Element, 6 Port Array





OE-538 IFF/GPS Radome / Antenna Subsystem

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BACK-UPS

XTCF Backup Info

- The standard-based framework allows Core Services, Community of Interest (COI)services, and Community of Interest applications to be integrated more quickly and with lower cost than current development based on Common Operating Environment (COE). The framework is open to applications that use any operating system, programming language, and data model. The framework requires only that the application or service publish the data and metadata in standards compliant formats such as Web Services Description Language.
- Producer data, such as those indicated in green, allow processed data to be published for use by any COI user. It is not necessary to have the “GALE Lite” application, for example, to use the data produced by the application. The application publishes the schema for data, which can then be applied by any user.
- Correlation and fusion systems, such as Analyst Support Architecture and Cryptologic Management and Analysis Support System shown on the slide, can subscribe to Producer Data and act on it. The results of this process are published along with metadata that describes the meaning of fused data.
- Technical reference databases such as those shown in blue at the lower right of the slide are accessible to all framework users. It is not necessary to implement the data base query language, or to have the data base application.
- Visualization can be custom tailored to user needs. The Advanced Battlespace Awareness (ABA) ACTD visualization capability is currently used by XTCF: but the Combatant Commander, Joint Task Force user, or tactical user can employ any visualization that gives the fidelity, resolution, and information representation that supports the warfighting mission.
- To re-emphasize: producers and consumers do not have to implement a complex Application Program Interface (API) to use the services and applications available in the framework. They implement World-Wide Web Consortium (W3C) approved standard interfaces, and use their own COI or CES processes to act on data that is **posted**, **process** the data according to warfighter requirements, and make data and information available for warfighters to **use**.
- The figure shows the capabilities that emerge from XTCF product development that has been co-managed by ONR, DISA, and PEO C4I and Space.

Integrated Information Framework Backup

- This functional view of the information flow required to enable warfighter support was developed as part of an ongoing ONR effort to define the elements of an Integrated Information Environment.
- It focuses on dual processes of decomposition and composition. Decomposition deals with the derivation of information needs from warfighter requirements, and the resource management necessary to identify and collect the data needed to satisfy the information request. This is a process of decomposing information requirements into actionable plans which call for collection of specific data from real time sensors and archival sources to achieve desired results, and includes the possibility of weapons direction for desired effects.
- Composition refers to the process, generally called data fusion, of aggregating data from one or more sensors/sources to estimate the presence of objects and events and to recognize the situations and threats they represent. The product of the fusion process in the best of cases is information corresponding to the warfighter's initial request.
- The process is recognized as being iterative to account for the possibility that information products will not adequately satisfy the information needs, and also to account for dynamic changes in the battlespace environment which drive new information needs.