



**45th Annual Targets, UAVs & Range Operations Symposium & Exhibition**  
***“Tools and Technologies for The Warfighter”***  
**San Diego, CA**

**29 – 31 October 2007**

Agenda

**Tuesday, October 30, 2007**

**Keynote Speaker:**

**Brigadier General David J. Eichhorn**, USAF, Director of Air, Space and Information Operations, Headquarters, Air Force Material Command, Wright-Patterson Air Force Base, Ohio

- **Joint Close Air Support Enabled by Future Airborne Networking** wmv format

**Session I: Ranges and Range Operations**

- Common Range Integrated Instrumentation System (CRIIS), **Mr. Magdy “Mike” Sorial**, CRIIS Program Director, 29ARSG/EN, Eglin AFB
- Real Time Trajectory Planning for Targets via Heuristics Search, **Mr. Luis E. Alvarado, Sr.**, Systems Control Engineer
- Target Operational and Engineering Support **Mr. Thomas Dowd, Director**, Threat/Target Systems Department, Pt. Mugu, CA
- DOT&E Targets Overview, **Mr. Joshua Messner**, DOT&E Target Resources, OSD
- JSF Range and Airspace Requirements, **Major “Digger” Davis**, HQ ACC/A8F
  1. **Targets** QuickTime format

**Session II: New Technology**

- Low Cost Alternative Target, **Mr. Larry Berger**, Chief Engineer, MDSI
  1. **GT-400 Flight Test** wmv format
- Joint Ground Robotics Program, **Mr. Duane Gotvald**, Deputy Project Manager, PEO GCS Robotic Systems Joint Program
  1. **QuickTime Video Clip**

**Hugh Harris Scholarship Update**

**Wednesday, October 31, 2007**

**Session III: Current Trends**

- GPS-Based Target Control Software Innovations, **Mr. Dennis Brooks**, Project Director, Target Control Systems, US Army TMO, Huntsville, Alabama
- DTRMC, OSD Strategic Plan, **Mr. Jerry Christensen**, DOT&E

**Session IV: Military Programs and Requirements**

- Navy, **Captain Pat Buckley**, USN, PMA-208
  1. **Sales Aren't Up** wmv format
- Air Force, **Michele Brazel**, Squadron Director, 691st Armament Systems Squadron, Eglin AFB, Florida
  1. **691ARSS** wmv format
- Overview Of U.S. Army, PEO STRI, PM ITTS TMO Activities, **Mr. Al Brown**, TMO Deputy Director, PMITTS, PEO STRI
  1. **Targets Management Office** wmv format





# National Defense Industrial Association



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# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

**David Miller**

Meggitt Defense Systems

NDIA Target, UAV & Range Ops Division

**David Laird**

Micros Systems, Inc

Symposium Chair

**Session Chairs**

Joshua Messner

Craig Tangedal

John Vanbrabant

Charles Farrior

Bob Palmer

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**Major Joseph P. Hylan, USMC (Ret)**





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

**Symposium Chair:**  
**Mr. David Laird**  
**Micro Systems, Inc.**

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# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

**8:00 AM**

*Welcome Remarks*

**David Laird, Micro Systems, Inc.**

**Symposium Chair**

**8:15 AM**

*Keynote Presentation*

**Brigadier General David J. Eichhorn, USAF**

**Dir, Air, Space and Information Operations**

**HQ, AFMC**

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# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

**Session I - Ranges & Range Operations**

**Chair: Dennis Mischel**

**DOT&E Targets**

**9:00 AM Session Introduction**

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# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

9:15 AM

*Common Range Integrated Instrumentation System*  
Magdy "Mike" Sorial, CRIIS Program Director

9:40 AM

*Real Time Trajectory Planning for Targets via  
Heuristics Approach*  
Manuel Soto, White Sands Missile Range

10:00AM

*Break – Exhibits Open for Viewing*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

10:45AM

*Target Operational & Engineering Support*

Thomas Dowd, Dir, Threat Target Systems, Pt Mugu

11:05AM

*JSF: Targets & Ranges Test & Training Requirements*

Col Russell Handy, Commander, 33d Fighter Wing

11:50AM

*Improvements & Upgrades at the Sea Range*

Karen Draper, Sea Range Test Mgmt Br, Pt Mugu

12:10AM

*Willis Howard Award Presentation*

David Miller, Meggitt Defense Systems

NDIA Division Chair

*The Voice of the Industrial Base*





Strength through Industry & Technology



# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

12:25 – 1:45 *Lunch – Exhibit Hall*

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

Session II – New Technology

Chair: Craig Tangedal

1:45 PM *Session Introduction*

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

2:05PM

*Improvised Explosive Devices*

Captain Jeffrey Timbore, USN, JIEDDO

2:25PM

*Hammerhead, NATO Qualified Sea Surface Target  
System*

Spencer Fraser, MDS Canada

2:45PM

*Break – Exhibit Hall*

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Tuesday, October 30, 2007

3:20PM

*GT-400 Low Cost Alternative Target*

Larry Berger, Chief Engineer, MDSI

3:40PM

*Joint Ground Robotics Program*

Duane Gotvald, Dep Proj Mgr, PEO GCS Robotic  
Systems Joint Program Office

4:00PM

*Hugh Harris Scholarship Update*

Mr. Cort Proctor, Micro Systems, Inc

4:30PM-6:00PM *Reception in Exhibit Hall*

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

8:00AM

*Welcome and Keynote Introduction*

David Laird, Micro Systems, Inc, Symposium Chair

8:15AM

*Keynote*

Mr. John Salafia, Director, Target Programs,  
Unmanned Systems, Northrop Grumman Integrated  
Systems

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

Session III – Current Trends

Chair: John VanBrabant

Northrop Grumman Corporation

9:00AM Session Introduction

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

9:15AM

*GPS-Based Target Control Software Innovations*

Dennis Brooks, Proj Dir, Tgt Control Sys, US Army  
TMO

9:35AM

*Break in Exhibit Hall*

10:00AM

*General Session Resumes*



*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

10:00AM

*Super Sonic Sea Skimming Target – A Lower Cost  
Alternative*, LCDR E. Ferguson, RCN, NDHQ

10:20AM

*DTRMC, OSD Strategic Plan*  
Jerry Christensen, DOT&E

10:40

*Target Management Initiative*  
Ken McCormick, DOT&E

11:10AM

*Surface Target Laser Aim Scoring System*  
Rob Couture, Program Dir, Meggitt Defense Systems

11:30AM

*DAU: Contingency Contracting*  
Joel Brown, DAU, San Diego

11:50

*Lunch – Exhibit Hall*

*The Voice of the Industrial Base*





# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

**Session IV – Military Programs & Requirements**

**Chair: Charles Farrior**

**Army TMO**

**1:30pm Session Introduction**

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# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

**1:45PM**

*Army*

**Mr. Steve Milburn, TMO, Huntsville**

**2:15PM**

*Navy*

**Captain Pat Buckley, USN, PMA-208**

**2:45PM**

*Air Force*

**Michele Brazel, Sqdn Director, 691<sup>st</sup> Armt Sys Sqdn**



*The Voice of the Industrial Base*





Strength through Industry & Technology



# 45<sup>th</sup> Annual Targets, UAV & Range Division Symposium

Wednesday, October 31, 2007

3:15PM

*Concluding Remarks*

David Laird, Symposium Chair

*The Voice of the Industrial Base*





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# Targets Management Office



## *Purpose:*

**Provide NDIA Symposium An  
Overview Of  
U.S. Army, PEO STRI, PM ITTS  
TMO Activities**

**“Tools and Technologies for  
the Warfighter”**

**Briefed by: Mr. Al Brown  
TMO Deputy Director, PM ITTS, PEO STRI  
256-842-6421 DSN: 788-6421  
e-mail: [alvin.brown@us.army.mil](mailto:alvin.brown@us.army.mil)**







# Targets Management Office



## *False Impression Caveat*

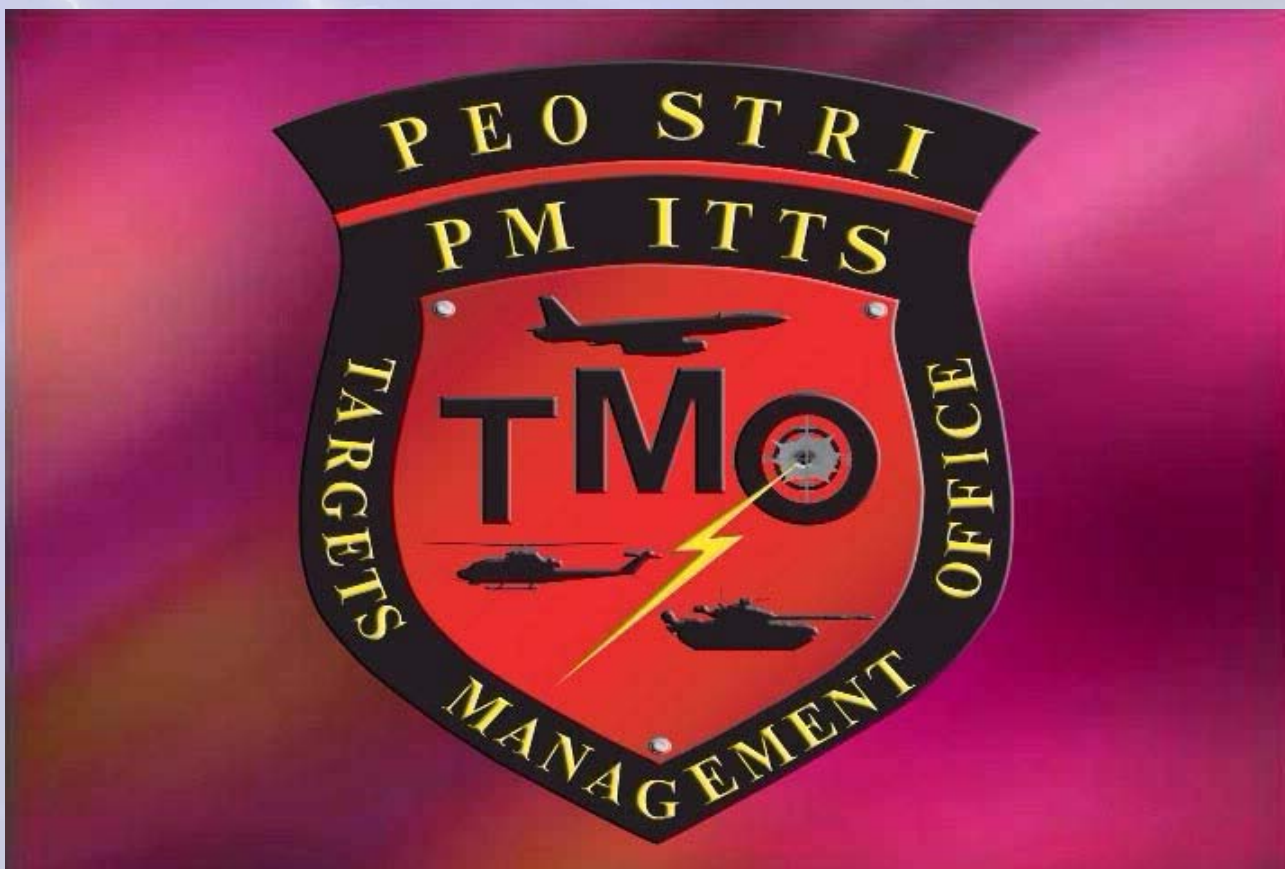
It should be explicitly noted that the U.S. Government makes no official commitment nor obligation to provide any additional detailed information or agreement of sale on any of the systems/capabilities portrayed during this presentation that have not been authorized for release.





# Targets Management Office

## Video







# Targets Management Office



## OUTLINE

- **Mission**
- **Activities**
- **Customer Base**
- **Organization (Tie-in with Testing & Training)**
- **Recently Developed Products**
- **Future Efforts**
- **Summary**





# Targets Management Office



## **TMO MISSION**

MANAGE THE **LIFE CYCLE**

**ACQUISITION** OF TECHNICALLY OPTIMIZED,  
INTEROPERABLE AND ADAPTABLE TARGETS, TARGET  
CONTROL SYSTEMS AND GROUND RANGE SYSTEMS USED  
IN THE LIVE AND VIRTUAL TESTING, TRAINING AND MISSION  
REHEARSAL ENVIRONMENTS, PROVIDING **BEST VALUE**  
**PROCUREMENT**, AND SUPERIOR **LIFE CYCLE SUSTAINMENT**  
AND OPERATION WHEN REQUIRED, FOR THE U.S. ARMY  
TRANSFORMATION, FUTURE FORCES, JOINT  
SERVICES, ALLIED CLIENTS AND  
GOVERNMENTAL AGENCIES

**We respond to customer needs  
and institutional requirements**



## PRIMARY ACTIVITIES

### Based on customer target requirements

- Aerial – Fixed and Rotary Wing
- Mobile Ground / Foreign Materiel
  - “Real Deal Steel”
  - Surrogates
- Virtual – Models and Simulations
- Precision Targetry Systems
- Auxiliary / Ancillary Equipment







# Targets Management Office



## WHAT WE DO



Develop products

Buy products



- AND we
- Fly 'em
  - Drive 'em
  - Fix 'em











# Targets Management Office



## *What we have developed recently*

### Low Cost Movers



### Threat Vehicle Surrogate Targets



### Virtual Targets



UAS-Ts



JCHAAT



*Things we plan to develop/purchase in the next five years*

## Precision Targets



Fully Mission  
Capable Threat  
Targets

Looking at  
technology areas to  
enhance current  
capabilities

## RPVTs



Rotary Wing  
Targets





# Targets Management Office



*An Individual Product we plan to develop/purchase during the next five years*

## Precision Targets



*Develop state-of-art signature technologies and applications for use on existing targetry or new targetry development efforts to support Army requirements.*

### **Develop concepts that:**

- Minimize cost
- Maximize signature fidelity – visual and thermal
- Minimize logistic requirements – reduce handling cost, easily transportable, easy to assemble, recyclable
- Maximize utility – adaptable to CCD&O technologies





# Targets Management Office



*An Individual Product we plan to develop/purchase during the  
next five years*

## Fully Mission Capable Threat Ground Targets



*Acquire and field fully mission capable latest version, Foreign Threat Mobile  
Ground Targets (MTB, IFV, and APC) to meet emerging requirements for  
threat representative missions.*

### **Capabilities will include:**

- Operational Turrets
- Communications
- Shoot-back capability
- Operational Sights
- Smoke (VEESS, launchers)
- Ancilliary Equip





# Targets Management Office



***An Individual Product we plan to develop/purchase during the next five years***

## Remotely Piloted Vehicle Targets



***Provide targets with ancillary devices and contractor support services for STRAC mandated live-fire crew gunnery weapon qualifications and missile engagement events.***

**Government Owned/Contractor Operated Aircraft.**





# Targets Management Office



*An Individual Product we plan to develop/purchase during the next five years*

## Rotary Wing Targets

**Most Likely  
Not This**



*present realistic, threat representative, helicopter targets for use by Test and Evaluation and by Training groups worldwide.*





# Targets Management Office



## SUMMARY

### ***TMO:***

- ALWAYS LOOKING FOR BETTER, FASTER, CHEAPER PRODUCTS FOR OUR CUSTOMERS
- RECOGNIZED LEADER OF AERIAL AND GROUND TARGETS
- READY TO RESPONSIBLY SUPPORT T&E AND SPECIAL TRAINING REQUIREMENTS

**NEED INDUSTRY TO CONTINUE PROVIDING STATE OF THE ART TECHNOLOGIES FOR ADAPTATION AND INCORPORATION INTO TARGETRY**





# U.S. Navy Aerial Target Systems

Presented to 45<sup>th</sup> Annual NDIA Symposium

**Captain Pat Buckley**

**Program Manager**

**PMA-208, Aerial Target & Decoy Systems**

**31 October 2007**





# Outline



- Organization
- Product Line
- Operating Sites
- Supersonic Targets
- Subsonic Targets
- Full Scale Targets
- Target Control Systems
- Summary



# NAV AIR

## REPORTING RELATIONSHIPS

**ASN (RD&A)**  
ASSISTANT SECRETARY OF THE NAVY  
(RESEARCH, DEVELOPMENT AND ACQUISITION)

**CNO**  
CHIEF OF NAVAL OPERATIONS

OPERATING  
AGREEMENT

**NAVAL AIR SYSTEMS COMMAND HEADQUARTERS**  
PATUXENT RIVER

**COMMANDER**  
AIR-00

**VICE COMMANDER**  
AIR-09

**DEPUTY COMMANDER**  
AIR-00A

**AIR-09R**  
NAVAL RESERVE

**STAFF \***  
COMPTROLLER AIR-10.0  
COUNSEL AIR-11.0  
CIO AIR-7.0  
ESPO AIR-00ES  
IG AIR-00G  
JAG AIR-00J  
CNO CM AIR-00W

(ADDU FOR C4I)

**COMSPAWAR**  
SPACE & NAVAL WARFARE  
SYSTEMS COMMAND

(ADDU FOR LOG SPT)

**COMNAVSUP**  
NAVAL SUPPLY SYSTEMS  
COMMAND

**NAVICP**  
NAVAL INVENTORY  
CONTROL POINT

\* REPORTS DIRECTLY TO AIR-00 FOR THEIR RESPECTIVE  
AREAS OF RESPONSIBILITY

**PEO (T)**  
TACTICAL  
AIRCRAFT  
PROGRAMS

**PEO (A)**  
AIR ASW, ASSAULT  
& SPECIAL MISSION  
PROGRAMS

**PEO (W)**  
STRIKE WEAPONS &  
UNMANNED  
AVIATION

**PEO (JSF)**  
JOINT  
STRIKE  
FIGHTER

**PROGRAM  
EXECUTIVE  
OFFICES**

**AIR-1.0**  
PROGRAM  
MANAGEMENT  
ACQUISITION EXEC

**AIR-2.0**  
CONTRACTS  
ASST. COMMANDER

**AIR-3.0**  
LOGISTICS  
ASST. COMMANDER

**AIR-4.0**  
RESEARCH &  
ENGINEERING  
ASST.  
COMMANDER

**AIR-5.0**  
TEST &  
EVALUATION  
ASST. COMMANDER

**AIR-6.0**  
INDUSTRIAL  
OPERATIONS  
ASST. COMMANDER

**AIR-7.0**  
CORPORATE  
OPERATIONS  
ASST. COMMANDER

**NAVAL AIR TECHNICAL  
DATA AND ENGINEERING  
SERVICE COMMAND  
(NATEC)**  
NORTH ISLAND  
COMMANDING OFFICER

**AIRCRAFT DIVISION**

PATUXENT RIVER,  
LAKEHURST  
COMMANDER

**WEAPONS  
DIVISION**

CHINA LAKE, POINT MUGU  
COMMANDER

**NAVAL TEST WING  
ATLANTIC**  
PATUXENT RIVER  
COMMANDER

**TRAINING  
SYSTEMS**  
ORLANDO  
COMMANDING OFFICER

**NAVAL TEST WING  
PACIFIC**  
POINT MUGU  
COMMANDER

**NAVAL AIR  
DEPOT  
(NAVAIRDEPOT)**  
NORTH ISLAND  
COMMANDING OFFICER

**NAVAL AIR PACIFIC  
REPAIR ACTIVITY  
(NAVAIRPRA)**  
ATSUGI, JAPAN  
COMMANDING OFFICER

**NAVAL AIR  
DEPOT  
(NAVAIRDEPOT)**  
JACKSONVILLE  
COMMANDING OFFICER

**NAVAL AIR  
MEDITERRANEAN  
REPAIR ACTIVITY  
(NAVAIRMRA)**  
NAPLES, ITALY  
COMMANDING OFFICER

**NAVAL AIR  
DEPOT  
(NAVAIRDEPOT)**  
CHERRY POINT  
COMMANDING OFFICER

**NAVAL  
AIR DEPOTS**

• PEO(W) renamed to PEO(U&W) –  
(Unmanned Aviation and Strike Weapons)

• PMA-208 – Aerial Target and Decoy  
Systems

**LOGISTICS  
SUPPORT  
ACTIVITY**

**PRODUCT CENTERS  
(NAVAL AIR WARFARE CENTERS)**

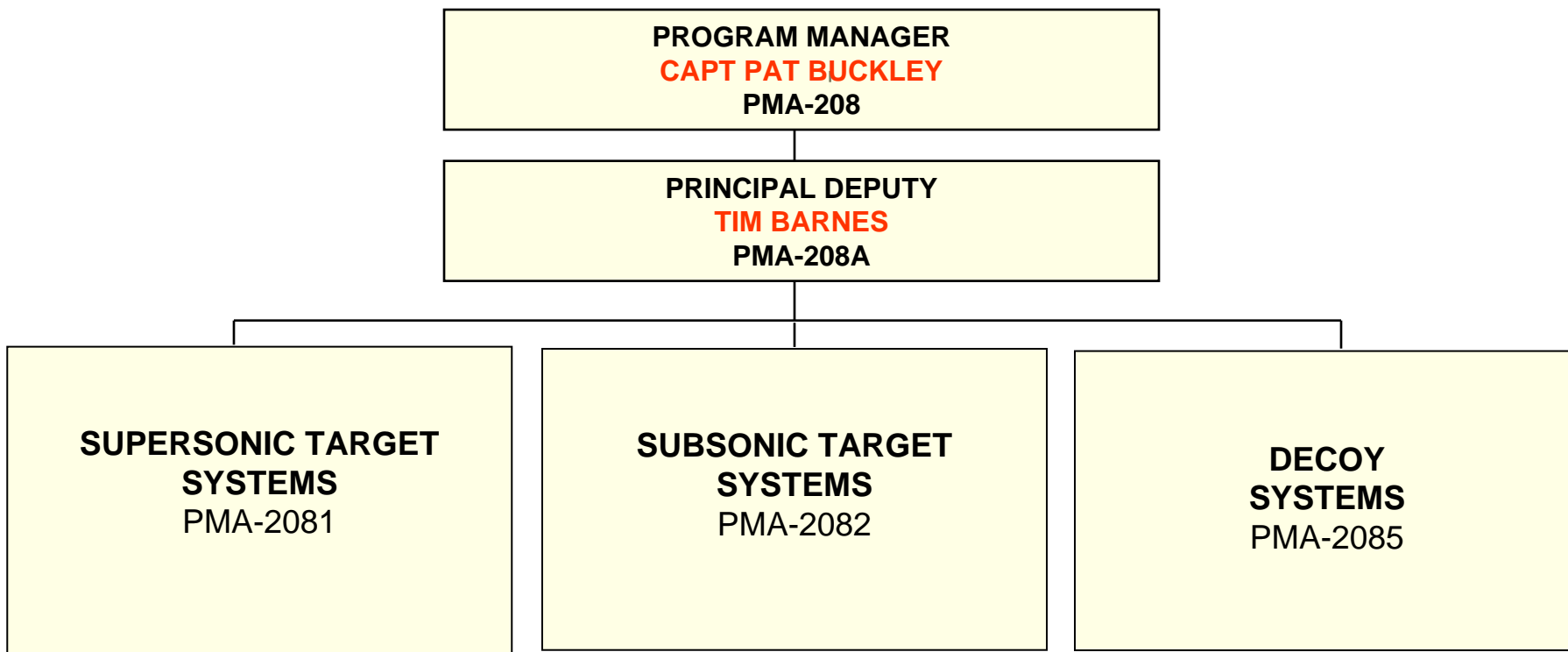




# PMA-208

## AERIAL TARGET & DECOY SYSTEMS

### PROGRAM OFFICE 2006



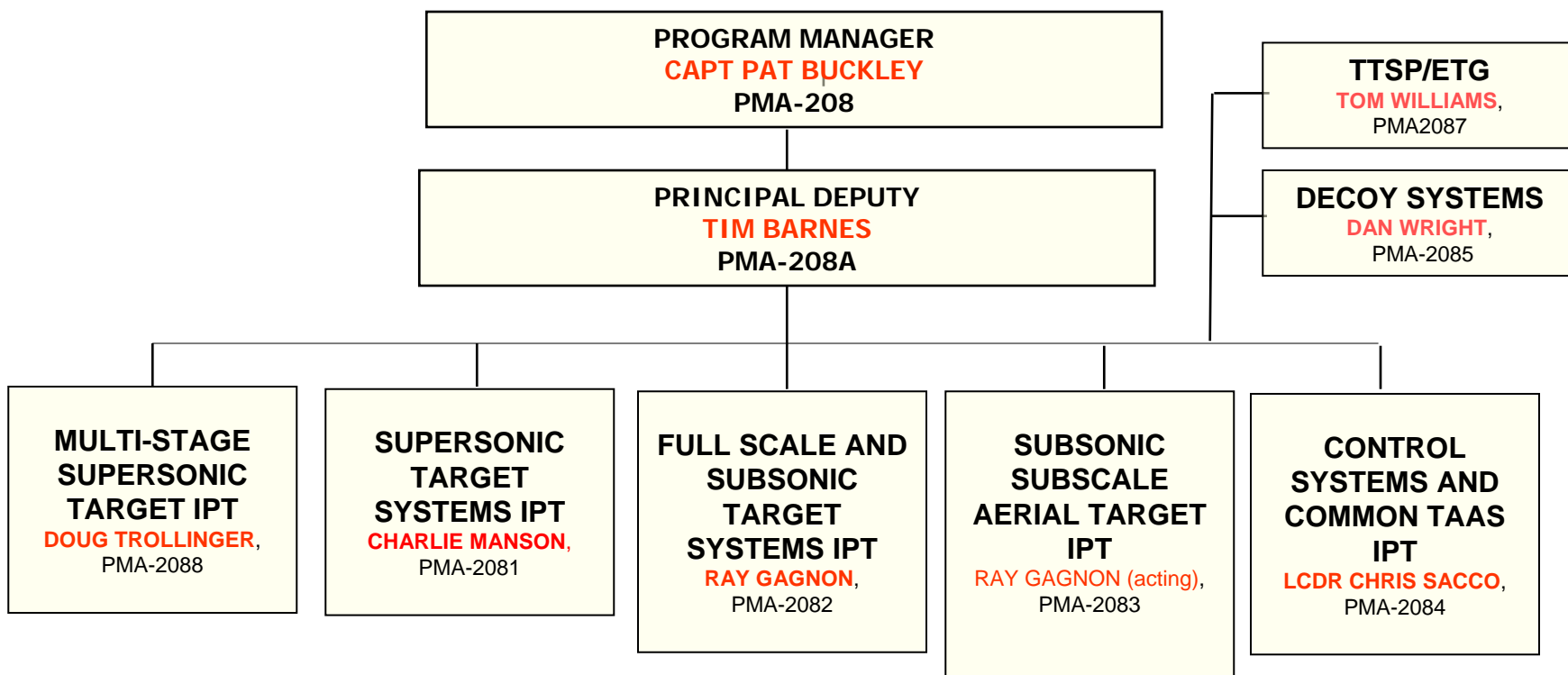




# PMA-208

## AERIAL TARGET & DECOY SYSTEMS

### PROGRAM OFFICE 2007







# PMA-208 Product Line Fielded



## Supersonic



GQM-163A



MA-31



AQM-37C

## Full Scale & Subsonic



BQM-34S



BQM-74E

QF-4



## Decoys

TALD



ITALD



## Miscellaneous



QLT-1C



COMMON  
TA/AS



THREAT  
SIMULATION



TDU-32

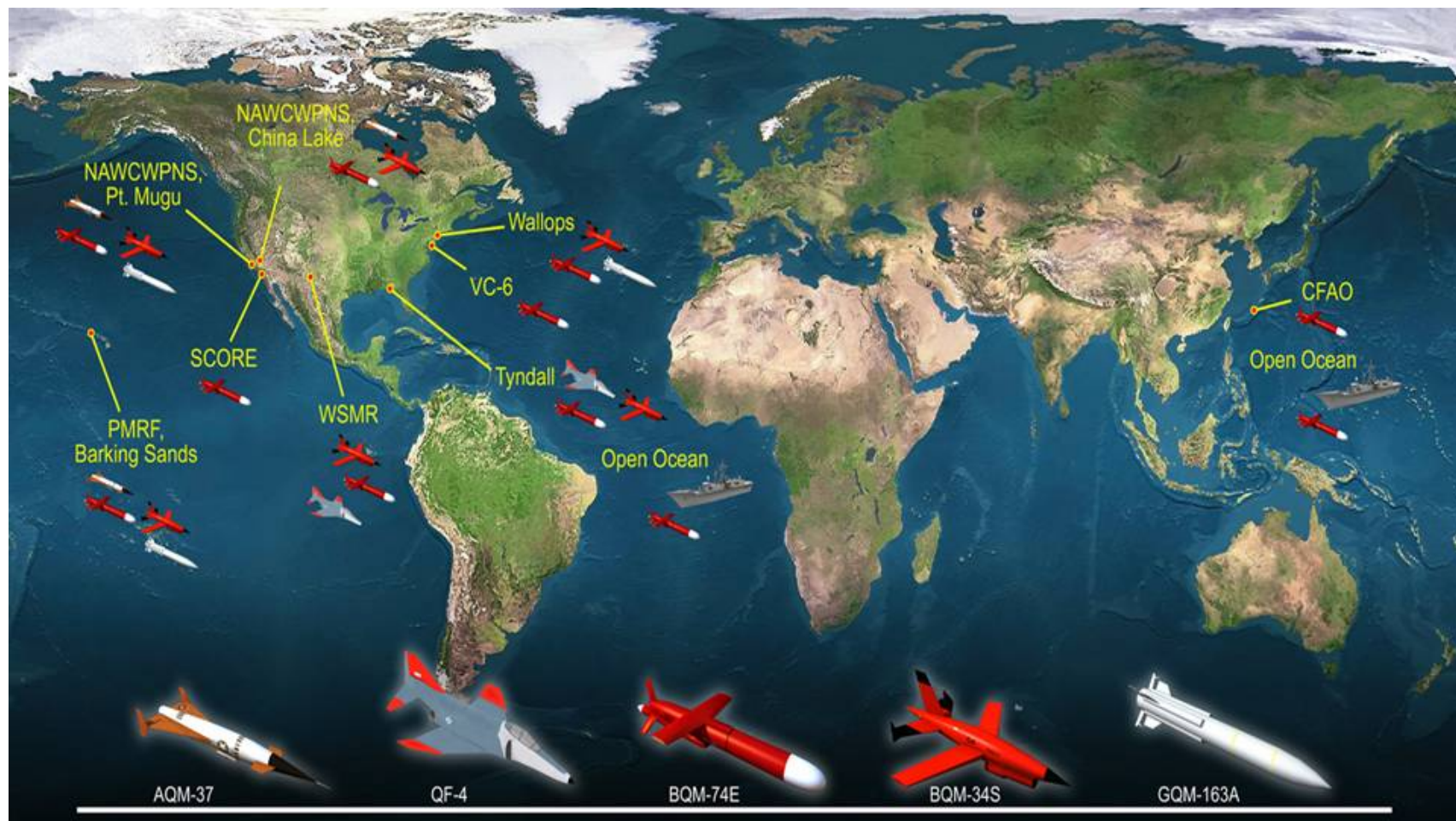


SNTC





# Operating Sites



- VC-6 decommissioning in summer of 2008
- NAVAIR to conduct East Coast ops





# Supersonic Targets





# GQM-163A Supersonic Sea Skimming Target







# GQM-163 Program Status



- Operations to date:
  - 6 October 2005; 12 June 2007; 13 June 2007
- FRP-2 contract awarded September 2007
- First Stream Raid OP planned for December 2007
- Plan to award FRP-III Second Quarter FY-08
- Prime Contractor: Orbital Sciences Corporation

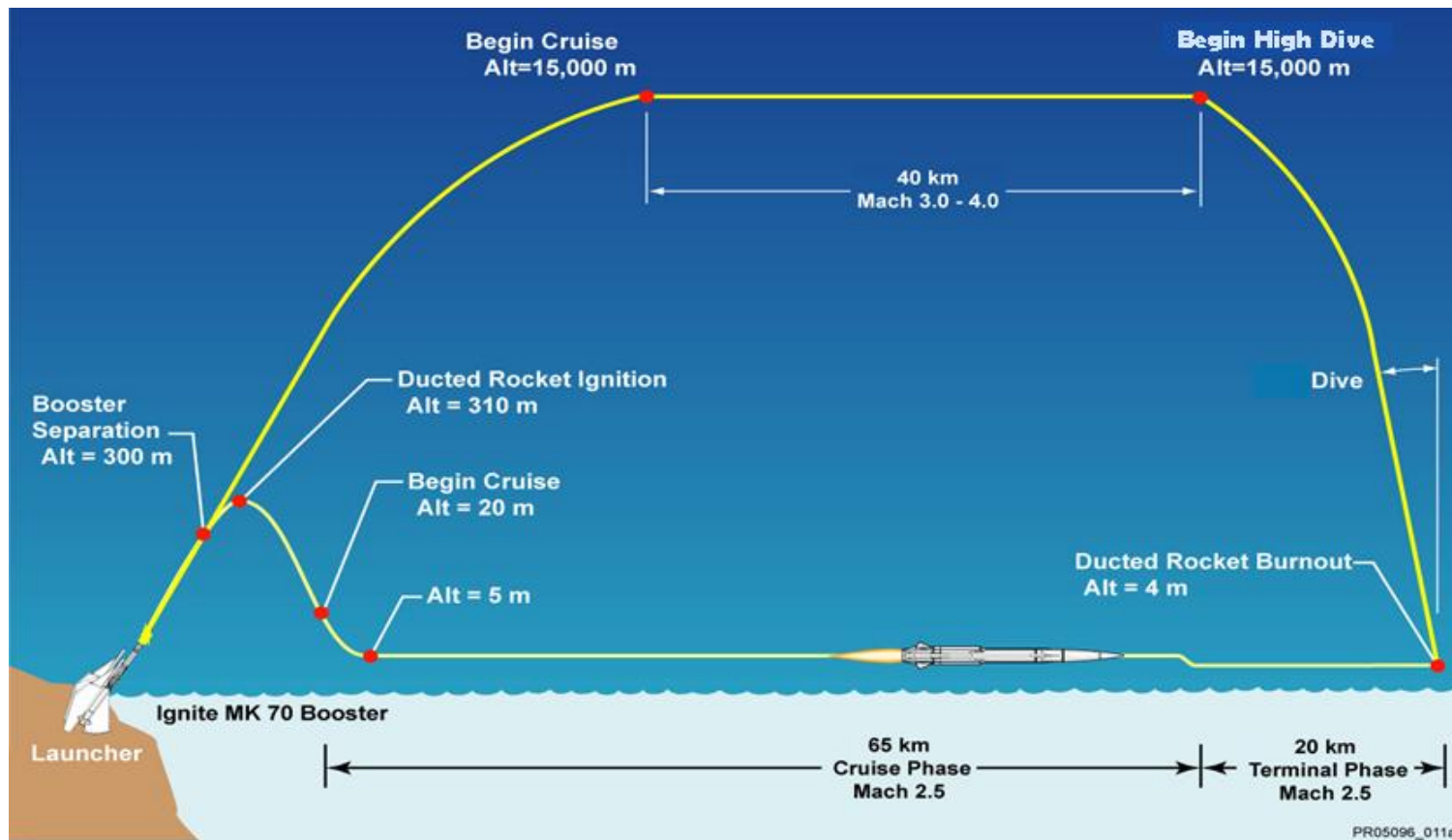
**GQM-163 Supports Threat A, B & C Requirements**





# GQM-163A

## High Diver Initiative



- High Diver development initiated in March 2006
- Demo expected in mid-2008





# MA-31







# MA-31 Update



- Program initiated via Foreign Comparative Testing (FCT) & Expanded Demonstration Test (EDT) from 1995-2000
- USN contracted with Boeing for the delivery of MA-31 targets in FY2000
  - Executing plan to close out MA-31 procurement contract due to numerous setbacks beyond Navy/Boeing control
- Conducting Joint Navy (LPD-18) & Army (Patriot) operation in December 2007 at Pt. Mugu range with last remaining assets
  - Expecting final contract closeout after the operation





# AQM-37



- **Medium to high altitude supersonic cruise with dive capability**
  - Mach 2.0 – 4.0
  - Range 100 mi
  - Altitude 1000 ft – 100 Kft
  - Demonstrated TBM profiles (300 Kft, 120 nmi downrange)
  - F-16 launch platform
- **Out of production system**
  - Last Delivery Dec 2001
- **Conduct approximately 10-15 operations per year (~ half FMS)**
- **Potential high-diver surrogate**
  - Low fidelity







# Threat D and Multi-Stage Supersonic Target (MSST)



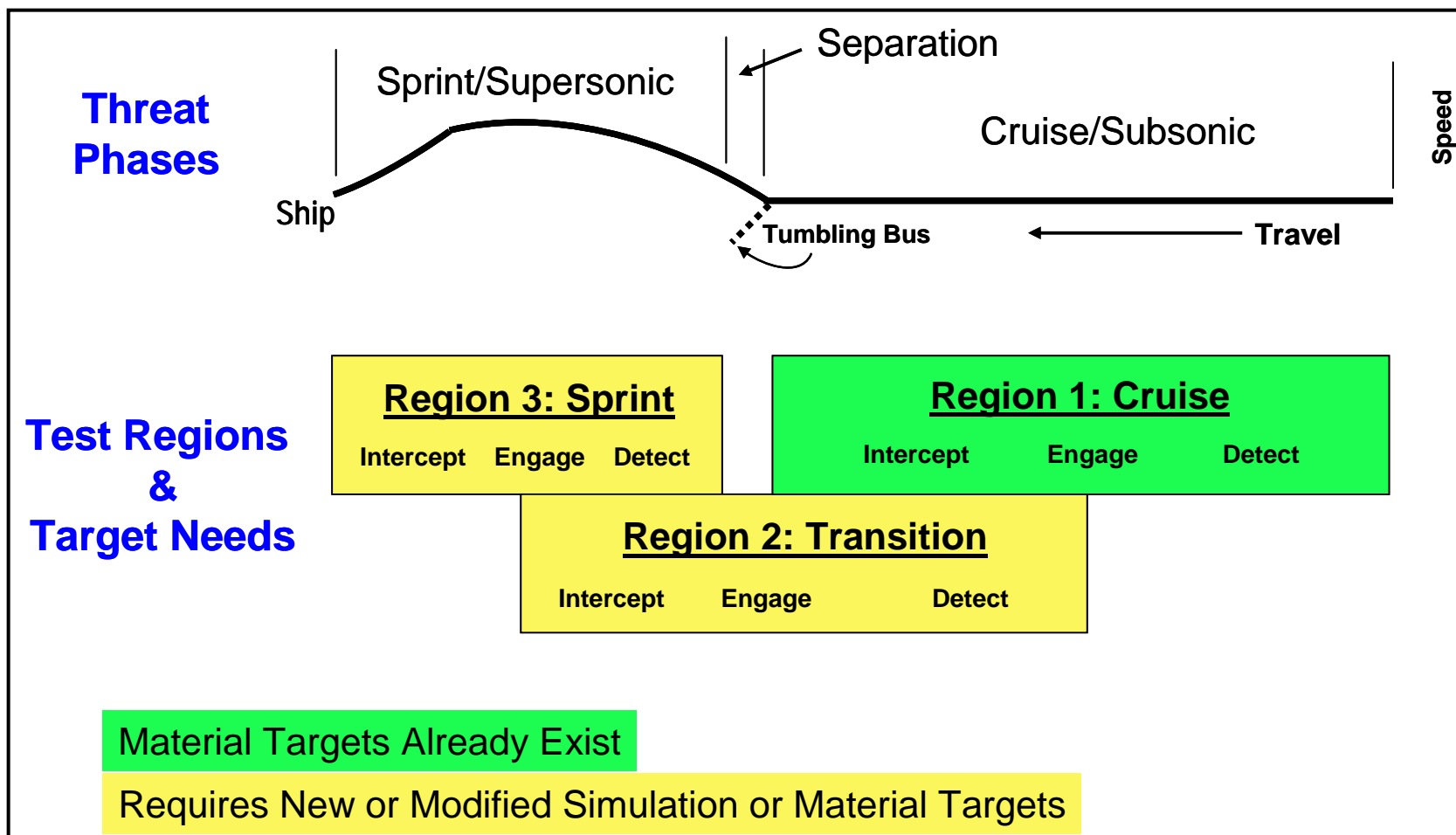
The case for a Threat D target has been kicked around for years . . .





# Threat D

- Threat D poses challenging T&E requirements







# Multi-Stage Supersonic Target



- Requirement & Resourcing
  - Navy did not fund target development in POM-08 budget submission
  - DEPSECDEF directed Threat D study. Study completed April 2007
  - Study recommended target development. Navy endorsed.
  - OSD 3-Star Programmer review supported the development of a Threat D Target
    - Agreed with study conclusions and Navy's recommendation
  - October 2007 - CDD in Final Navy review, approval anticipated mid-November 2007
- Acquisition
  - PMA-208 MSST team stood up in May 2007
  - Draft RFP posted 25 July 2007
  - Industry Day held 31 July 2007
  - Planning to release Request For Proposal (RFP) in November 2007
  - Anticipating 4.5 year System Development & Demonstration effort, with follow-on contract for Low Rate Initial Production and Full Rate Production
    - Planning to award SDD contract in FY08





# Supersonic Summary



- GQM-163 Coyote in production
  - Meets Threat A, B, & C SSST requirements
  - Superb performance. Coyote will be long term workhorse for SSST mission
  - GQM-163 high dive capability being developed
- MA-31
  - Last assets will be expended in December 2007
  - Program to be completed
- AQM-37
  - Potential near-term high diver surrogate
- Multi-Stage Supersonic Target
  - Navy Team stood up May 2007
  - CDD in final approval process
  - RFP release planned for November 2007
  - Anticipated contract award 3rd quarter FY08





# Subsonic Targets





# BQM-34S



- **Sustainment**
  - Maintain required inventory
- **Missions**
  - Low fidelity A/C simulator
  - T&E workhorse – special configurations
    - Harpoon Seeker integration
- **Product Improvements**
  - UIAU integration:
    - Replace existing autopilots with UIAU from BQM-74
    - Common avionics, radar altimeter, Support Equipment with current production BQM-74E
    - Reduced logistics
    - Avoid obsolescence
    - Allows for performance growth if required
      - LACE
      - PAWN
- **Prime contractor – Northrop Grumman**

Current Inventory ~ 200

FY06 Ops/Expenditures – 19/2

FY07 Ops/Expenditures – 14/3







# BQM-74E



- **Production**

- Procurement rate 60/yr
- Training and T&E workhorse

- **Missions:**

- High fidelity Anti-Ship Cruise Missile (ASCM) Surrogate
- Low-fidelity A/C simulator
  - Altitude: 7 ft – 40 Kft
  - Endurance: 68 min
  - Ground Launch; Shipboard Launch;
  - Air Launch: C-130, Gulfstream, F-16

- **Product improvements**

- Programmable semi-autonomous waypoint navigation
  - Selectable Lost Carrier Sensitivity from waypoint to waypoint
  - Return to Recovery Area
  - FY08 limited fielding planned

- **Prime contractor – Northrop Grumman**

**Current Inventory ~ 265**

**FY06 Ops/Expenditures – 235/62**

**FY07 Ops/Expenditures – 158/52**







# Subscale Subsonic Aerial Target (SSAT)



- Need for a high fidelity subsonic target vehicle that meets Navy requirements
- Performance requirements being validated
- Considering full and open competition for a fly-off
  - Opportunity for Navy to evaluate SSAT candidates
  - Potential for RFP release in late FY08/early FY09
  - Potential multiple award in FY09 for fly-off
    - Down select to single source for production





# Alternative Subsonic Flight Demonstration



- Navy strategy to “open aperture” to explore wider range of subsonic targets that may fulfill Navy needs
  - Goal is to ensure long-term best value – performance & affordability
  - Demonstration initiative underway
- Contract competitively awarded to Composite Engineering, Inc. (CEi) of Sacramento, CA in September 06
  - Design based on Air Force BQM-167A
  - Five flight demonstrations planned
    - First flight 26 September
    - Second flight planned for 31 October





# Subsonic Targets Summary



- ASCM Threat capabilities drive Navy subsonic target requirements
- BQM-34 still a viable system
  - Existing inventory will last indefinitely at current usage rate
- BQM-74E remains Navy workhorse
  - Relatively low cost
  - Shipboard & air launch capable
- Follow-on subsonic target needed to meet current requirements

**Navy pursuing strategy to identify tomorrow's subsonic target**





# Full Scale Targets





# QF-4/QF-16



- QF-4
  - Operating at Tyndall & White Sands Test Ranges
  - Air Force existing contract runs thru Lot 15 (FY09)
  - Plan to award new contract for two Lots in FY-10 & FY11
  - Last deliveries in FY13 from procurements in FY-11
- AST QF-16
  - Replacement for the QF-4
  - Air Force lead program
    - Navy providing requirements inputs and funding
  - IOC 3QFY15
  - ~15 years of production at 25 A/C per year





# Mobile Land Targets

- **Requirement**
  - Fast, highly maneuverable, threat representative vehicles for aircrew training
  - Enable JTACS & aircrew to identify & engage moving targets not normally associated with traditional enemy forces
- **FY08 Planning**
  - Low Rate Initial Production award
  - 'Kit' concept
    - Vehicle
      - New or used
      - Control System
      - Autonomous or remote controlled



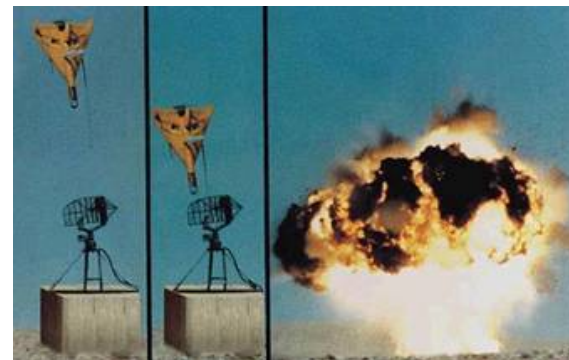




# UAV Target



- Requirement
  - Provide the Navy/Marine Corps a test capability to represent an attack UAV that can:
    - Loiter above the battlefield
    - Search and home in on specified targets/ signals
    - Dives ~90° on the target
    - Detonate high explosives
- No existing targets are threat representative
- Working with requirements office to formalize requirement







# Target Control System





# System for Naval Target Control

## UHF 360 – 380 MHz



### Current: SNTC System



- UHF 435–450 MHz
- Single Frequency at a time
- BQM-74/BQM-34 capable/HSMST/QST-35 Sea-borne Targets
- Low transponder cost
- 200 nmi line of sight
- 330 nmi via Relay
- Training/T&E

### Future: SNTC System UHF 360-380 MHz Upgrade

- Recommended primary user status by Navy Marine Corp. Spectrum Center (NMSC)
  - 250-300 KHz bandwidth available to accommodate full scale capability and future system growth

- UHF 360-380 MHz
- Changes Freq to avoid interference
- BQM-74/BQM-34 capable
- HSMST/QST-35 Sea-borne targets capable
- Low transponder cost
- 200 nmi line of sight
- 330 nmi via Relay
- Training/T&E





# Target System Challenges

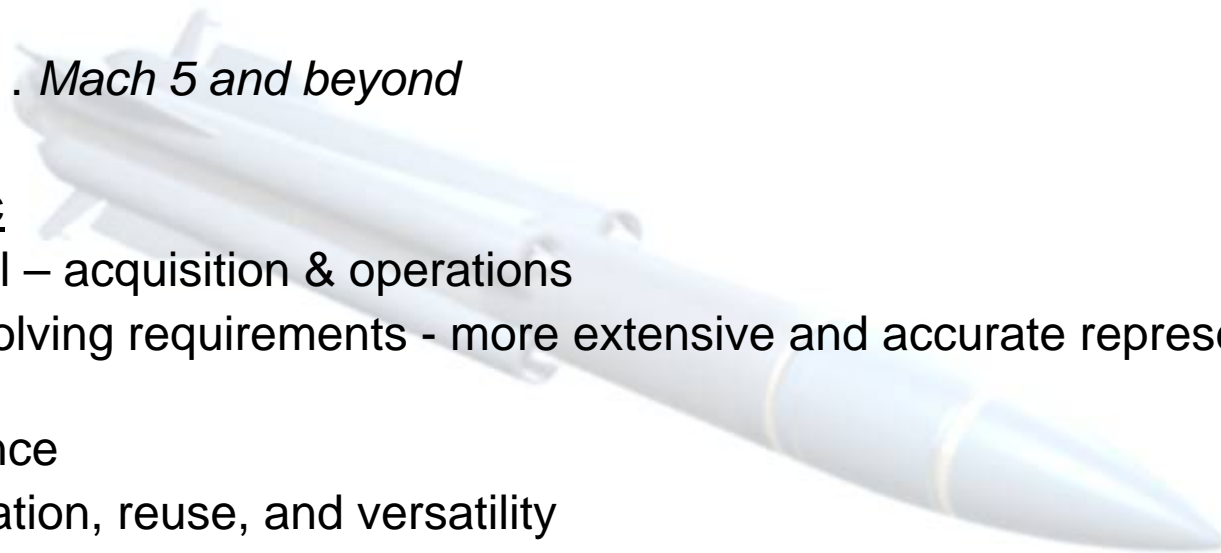


## Evolution of the threats

- Supersonic dive
- Asymmetric threats
- Enhanced threat capability
- Stealth
- Scramjet . . . *Mach 5 and beyond*

## Programmatic

- Cost control – acquisition & operations
- Meeting evolving requirements - more extensive and accurate representation of threat
- Obsolescence
- Reconfiguration, reuse, and versatility
- Inventory management







# The Way Ahead

*The threats will continue to evolve. The Navy Target Team will continue to work with all stakeholders to provide required threat representations to meet the needs of developmental testing, operational evaluation and Fleet training.*



**Teaming with our Industry partners and Service counterparts is key to our continued success**





# Back-Ups

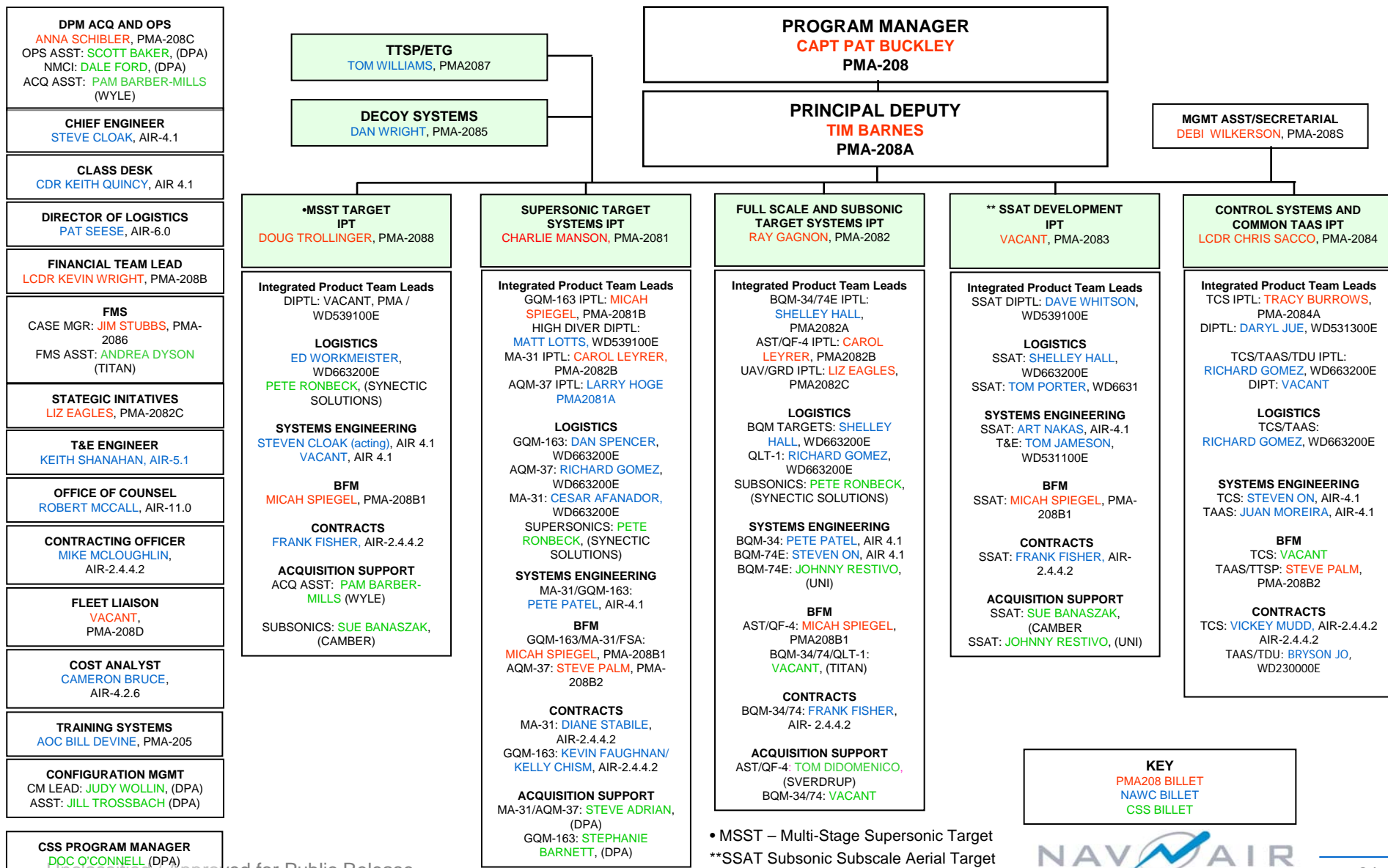




# PMA-208

## Aerial Target & Decoy Systems Program Office

### September 2007





# U. S. ARMY TARGETS MANAGEMENT OFFICE



## GPS-Based Target Control Software Innovations

### ***BRIEFER:***

**J. Dennis Brooks**  
**Project Director, Army Target Control Systems**  
**256-842-0376**  
**E-MAIL: [dennis.brooks2@us.army.mil](mailto:dennis.brooks2@us.army.mil)**





# Army Targets Management Office

## *Background*



The Army Targets Management Office, a division of PM for Instrumentation Targets and Threat Simulators, provides target presentations worldwide & provides lifecycle support of aerial and ground targets.



### • **Targets**

- ♦ MQM-107D, E, IAP
- ♦ QUH-1 Helicopter.
- ♦ BQM-34
- ♦ MQM-171 (Broadsword)
- ♦ QH-50 Helicopter
- ♦ QAH-1 Helicopter
- ♦ MQM-170 (Outlaw)
- ♦ Mobile Ground Targets





# *Army Targets Management Office*

## *TTCS Introduction*

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PM-ITTS





# Target Tracking Control System

## *Background*



**Original TTCS – Vega Corp.  
1976-2004**



**Next Generation TTCSR –  
Micro Systems, Inc.  
1989-Present**



**Current Generation TTCSU –  
Micro Systems, Inc.  
1998-Present**



***TTCS***

***Army's Primary  
Target Control  
System for Rotary  
Wing and Subscale  
Targets!***





# Target Tracking Control System

## Variations



**QTY**

**1-**

**FIXED SITE**



**8-**

**TRANSPORTABLE  
SHELTERS**



**2-**

**PORTABLE UNITS**







# Target Tracking Control System *Configuration*



- **System Control Console**
- **Target Control Console**
  - Position Display Subsystem (PDS)
  - Telemetry Display Subsystem (TDS)
  - Trainer/Simulator (Stealth)
- **Radio Frequency Unit**
  - 2 transceiver sections (RFM)



- Based on “Montage” control system developed by MSI.
- Montage is also the basis for the Navy AFWTF control system (decommissioned) and the SNTC.
- Each TTCS Shelter Contains:
  - Two TCCs
  - Two T/S
  - One SCC
  - One RFU
- Each shelter capable of controlling 2 targets.
- Each RFU capable of controlling 4 targets
- Cost effective life cycle.
  - Procurement
  - Maintenance
  - Sustainment
- Faraday shelter (EMI Insulated) protects ground equipment in high EM field environments.







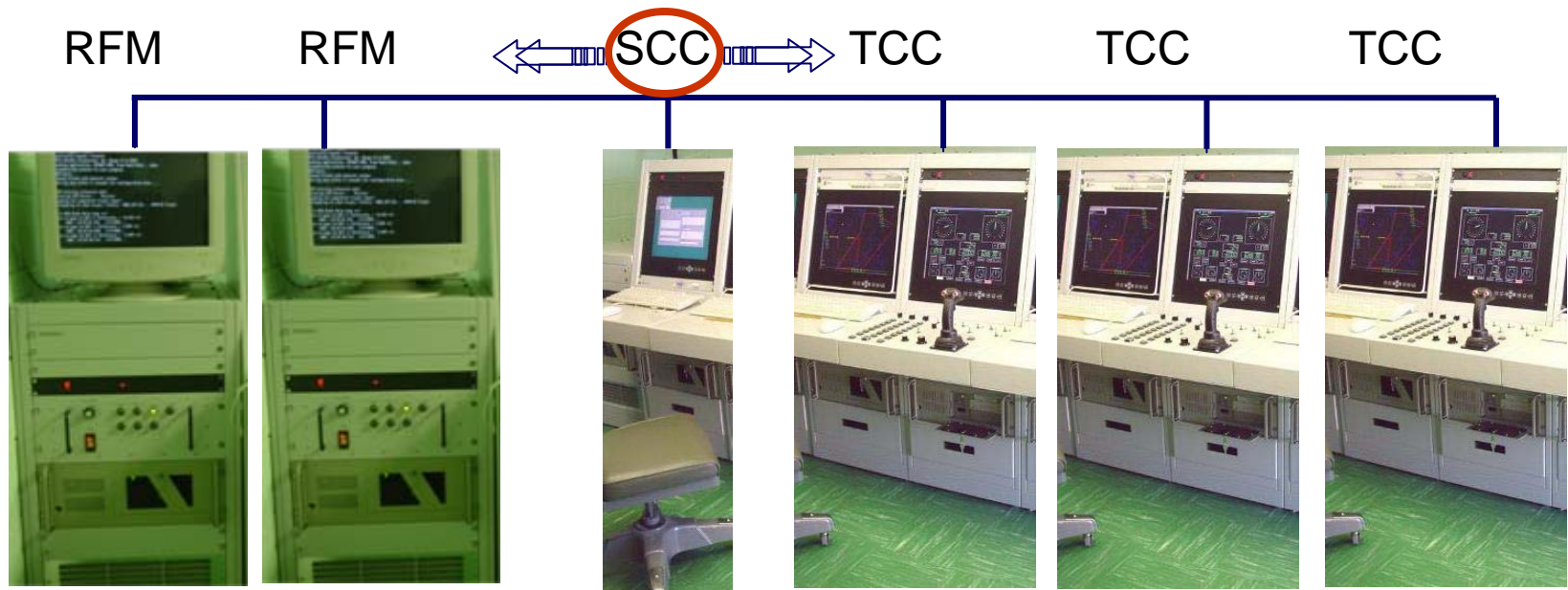
# Target Tracking Control System

## Capabilities

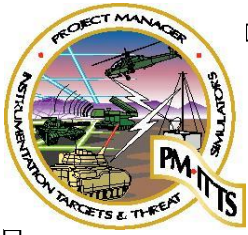


- **System Control Console**
- **Target Control Console**
- **Radio Frequency Unit**

- System Control Console (SCC) is the “Master Coordinator” of the TCS.
- Up to 8 Target Control Consoles (TCC) can be added to a SCC
- Up to 4 Radio Frequency Modules (RFM) can be added to the SCC
- SCC coordinates RF frequency and TCC assignments.







# *Army Targets Management Office*

## *New Target Control Software Tools*



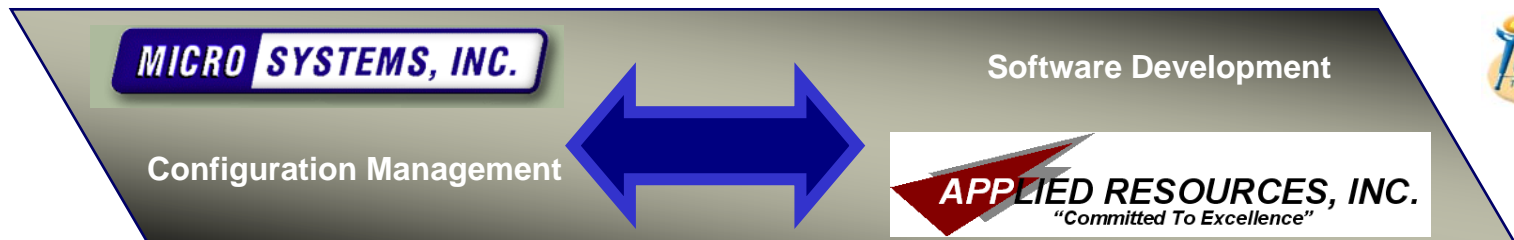


## Target Tracking Control System

# Software



- TTCS target control is through joystick, discrete and proportional commands.
  - Very precise value input
  - Ability to follow straight flight track very closely.
  - Flight track in turns is extremely difficult.
- Major capability update to automated control.
  - *Rabbit Follower (RF).*
  - *Improved Low Altitude Threat Simulation (ILATS).*
  - *Autonomous MQM-107IAP.*







# *Software*



- *Rabbit Follower*

- Based on DFCS & GRDCS software algorithms and source code.
- Mission planning upgraded to “point and click” drawing tools.
- Improvements in tracking errors and throttle handling algorithms.
  - Max cross track error nominally  $< 100\text{ft}$ .
- Includes formation offset capability.





# Software



- *Improved Low Altitude Threat Simulation (ILATS)*

- Perform low altitude terrain following with or without radar altimeter augmentation.
- Terrain look-ahead distance settable.
- Allows use of any of several digital terrain databases.
- Database information augmented by Ellipsoid and High Point processing.
- Best performance (simulation) with SRTM data over DTED I / II.
  - DTED Level 1 data are too widely spaced, leaving room for peaks well above the posts.
  - DTED Level 2 data is available but bulky. (*24 Geocells take over 600 MB in RAM.*)
  - SRTM ECHP data is suitably detailed for subscale aircraft missions.
    - Combines Level 2 Information with Level 1 Storage Size
- Multiple test flights down to 100 feet AGL





## Target Tracking Control System

# Software



- *Ellipsoid*

- SRTM & DTED Data are provided as EGM96 referenced data
  - EGM96 is a Standard Geoid
- The MQM-107 GPS provides position relative to the WGS84 Standard Ellipsoid
  - A table provides EGM96 to WGS84 differences
- Pre-flight converted files eliminate need for real-time conversion, many times per second





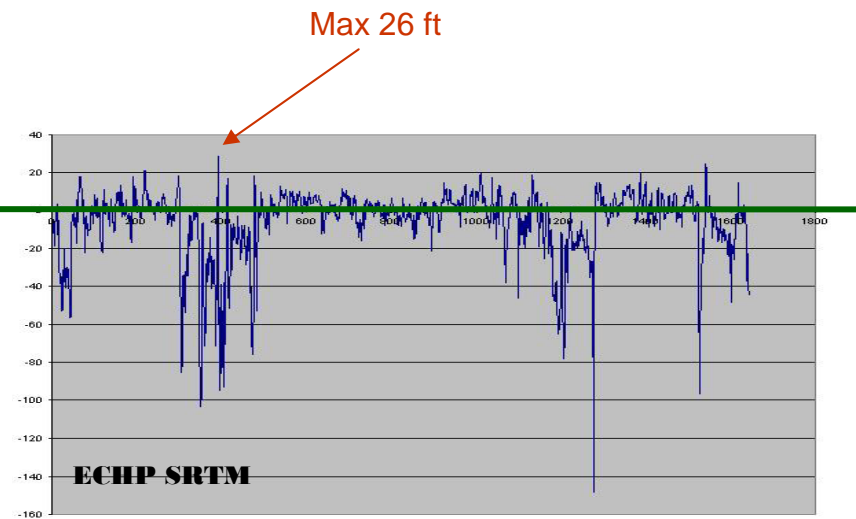
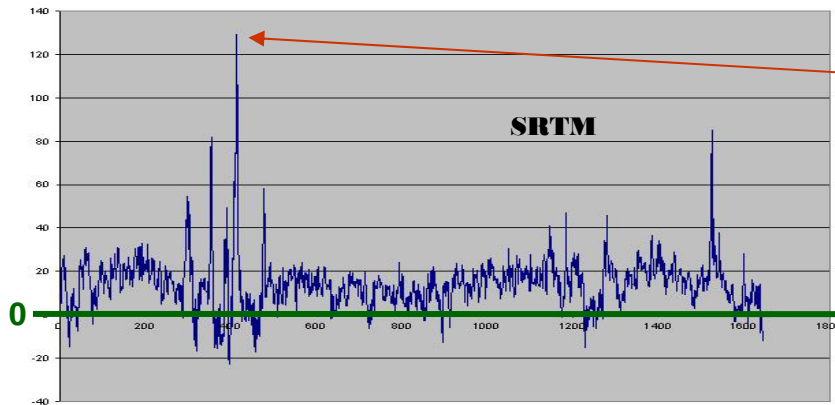
# Target Tracking Control System

## Software



### • High Point Processing

- Un-processed DTED1, DTED2, SRTM1 or SRTM2 would drive altitudes up to stay safe.
  - Graphical data shows the differences between terrain clearances computed from GPS altitude and the databases and mission data based on an on-board radar altimeter.
  - Data = Computed – Measured
  - **Positive Values are dangerous** (computed values expected greater clearance than reality provided).
  - **Negative values show we would fly higher than desired.**



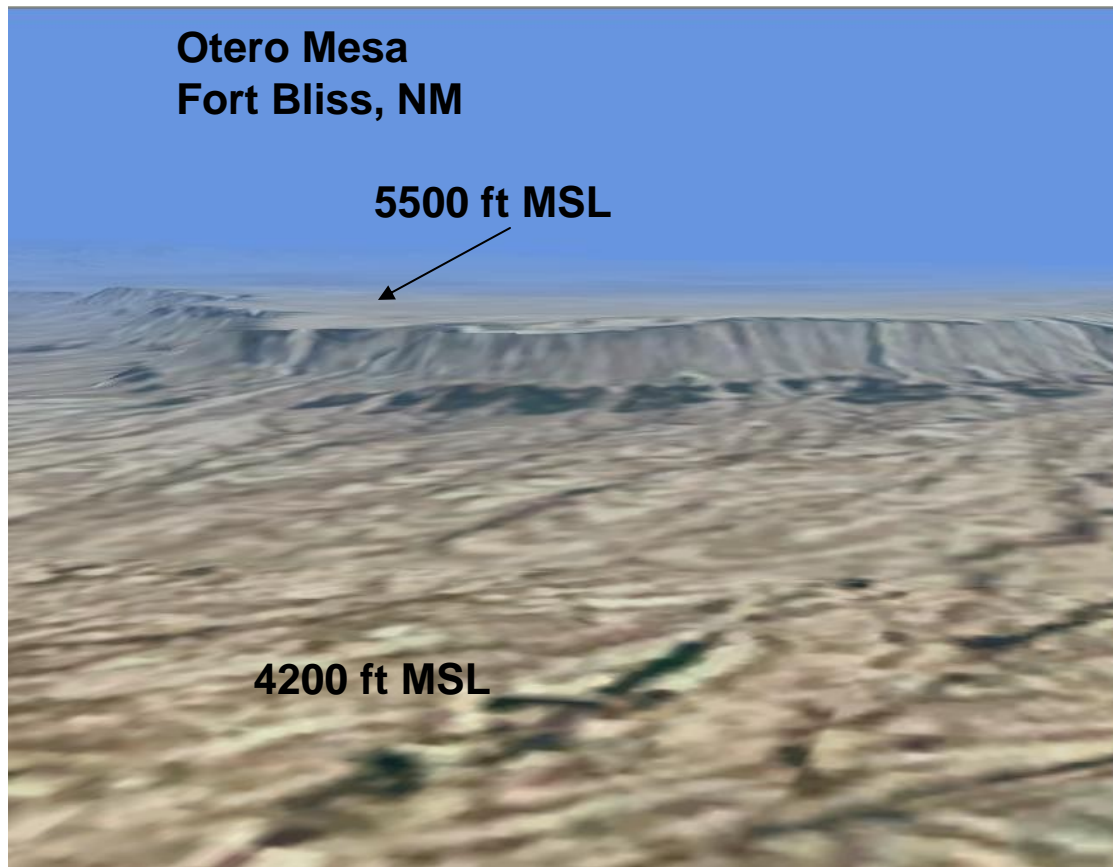




# Target Tracking Control System *Software*



- Improved Low Altitude Threat Simulation*



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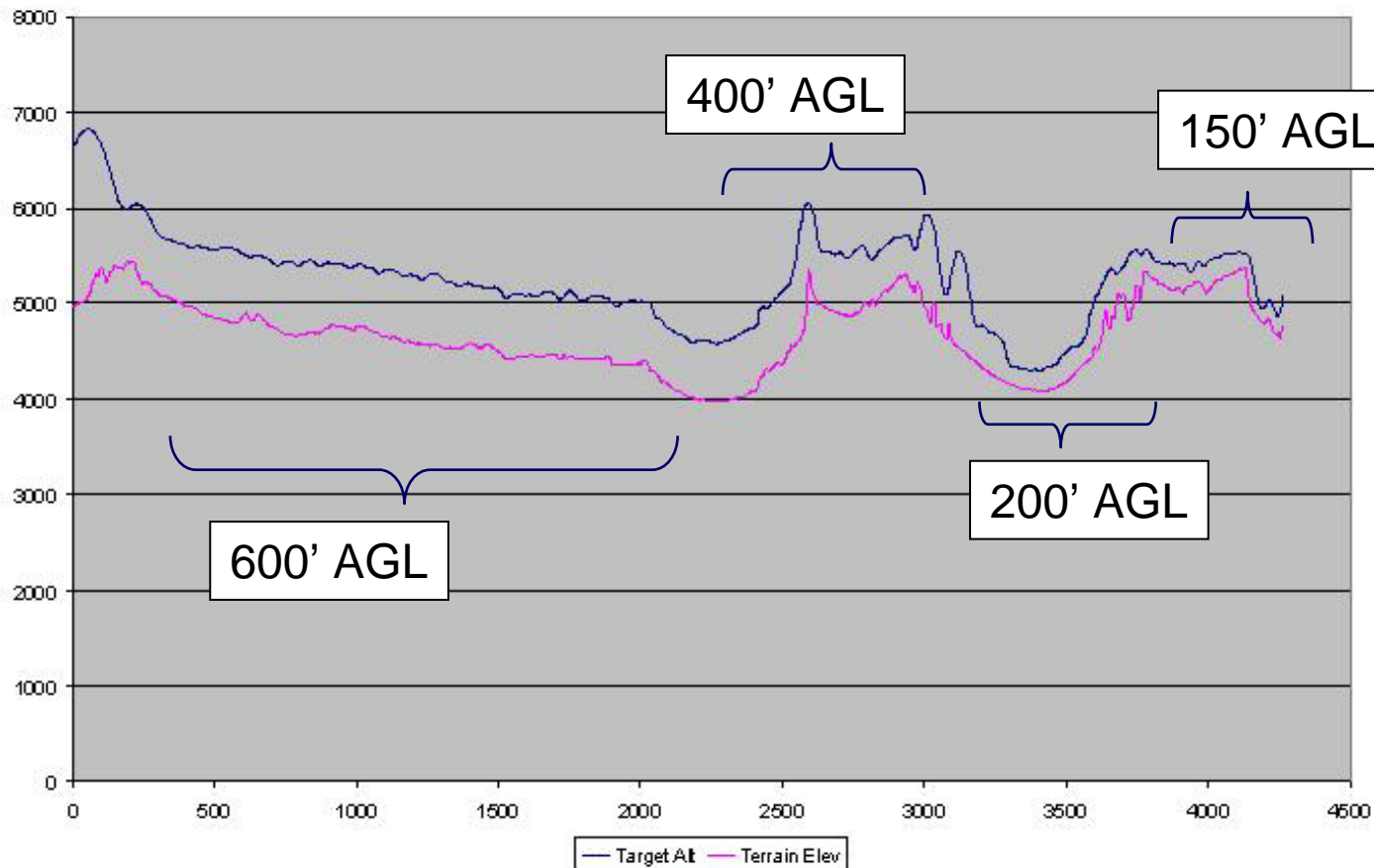
## Target Tracking Control System

# Software



- Improved Low Altitude Threat Simulation*

Flight #1 at 350 Kts, Data at 4.5 Hz, 17.5 Minutes Flight Time







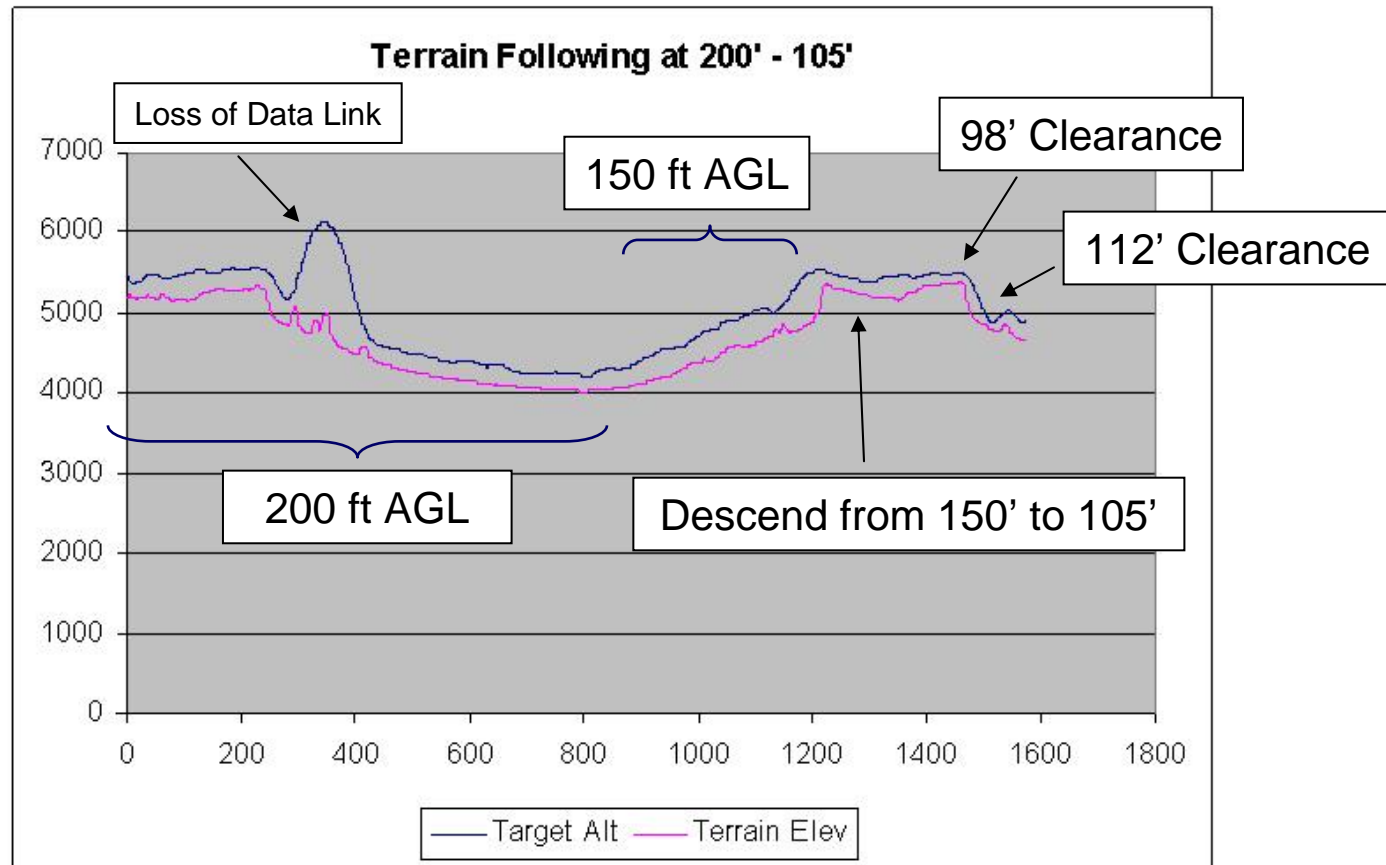
## Target Tracking Control System

# Software



### • Improved Low Altitude Threat Simulation

Flight #2 at 350 Kts, Data at 4.5 Hz, 5.8 Minutes Flight Time





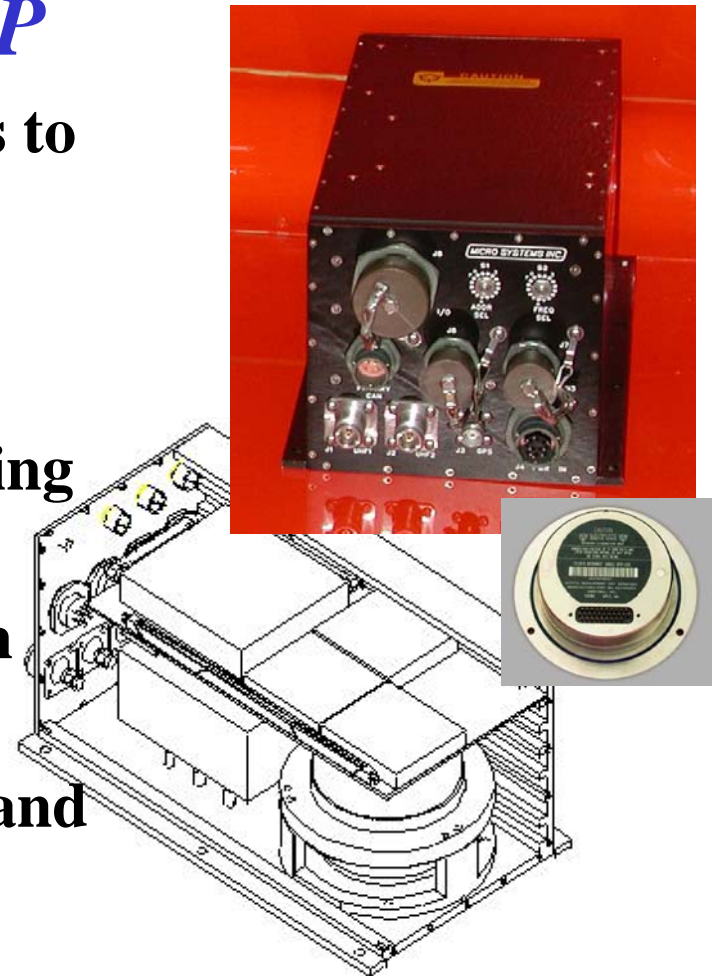


## Target Tracking Control System

# Software



- ***Autonomous MQM-107IAP***
  - Use PDS mission planning tools to create flight profile
  - Upload to Common Avionics Package with laptop.
  - Maintained UHF data link during test mission.
  - Track error slightly larger than RF.
  - Discrete commands for smoke and auto recovery did not work.
    - *Fix known, not implemented.*







## *Target Tracking Control System*

# *Summary*



RF, ILATS, and Autonomous capability provides significant capability improvements to targets and mobile target control assets.





# *Shaping Technology into Tomorrow's T&E Capabilities*

**Gerry Christeson**

**Test Resource Management Center  
Office of the Under Secretary of Defense  
(Acquisition, Technology and Logistics)**

**October 31, 2007**





# Outline

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- **Overview of TRMC**
- **The Investment Mission**
  - Test & Evaluation/Science & Technology (T&E/S&T) Program
- **The Strategic Planning Mission**
  - CY2007 Strategic Plan Highlights
  - CY2005 Targets Gaps Resolution Case Study





**FY2003**

# **National Defense Authorization Act**



**Established  
TRMC**

- DoD Field Activity
  - Direct Report to USD(AT&L)
- ☆☆☆ SES Director

**Oversee  
T&E Budgets**

MRTFB  
Other T&E Facilities  
Within & Outside DoD

**Biennial 10-Year  
Strategic Planning**

**Administer  
T&E Investment  
Programs  
CTEIP  
T&E/S&T**

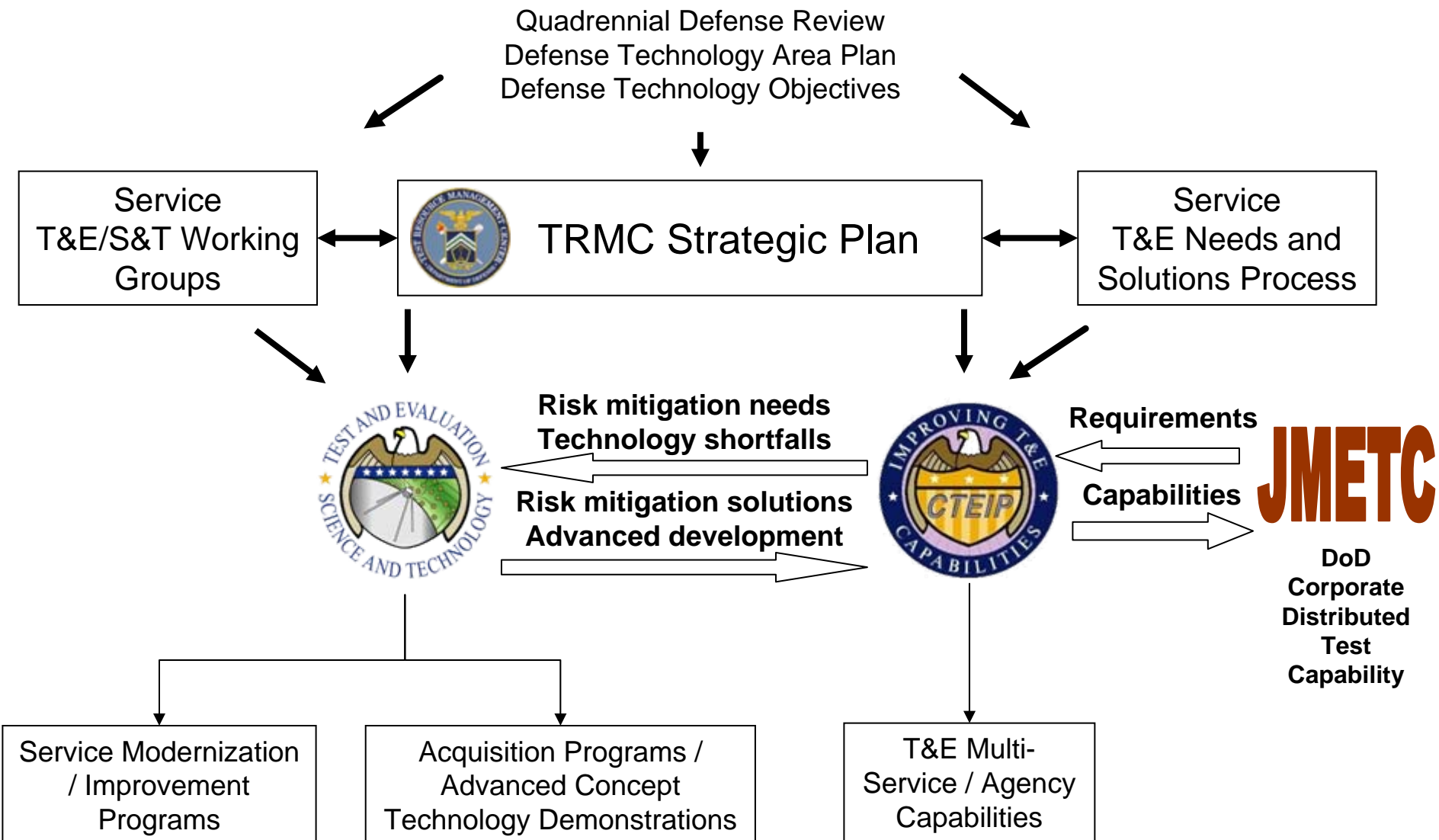
**Annual T&E Budget  
Certification  
Military Departments  
& Defense Agencies**





# TRMC Investment Programs

Synergy through Aligned Investment







# **T&E/S&T Program Overview**

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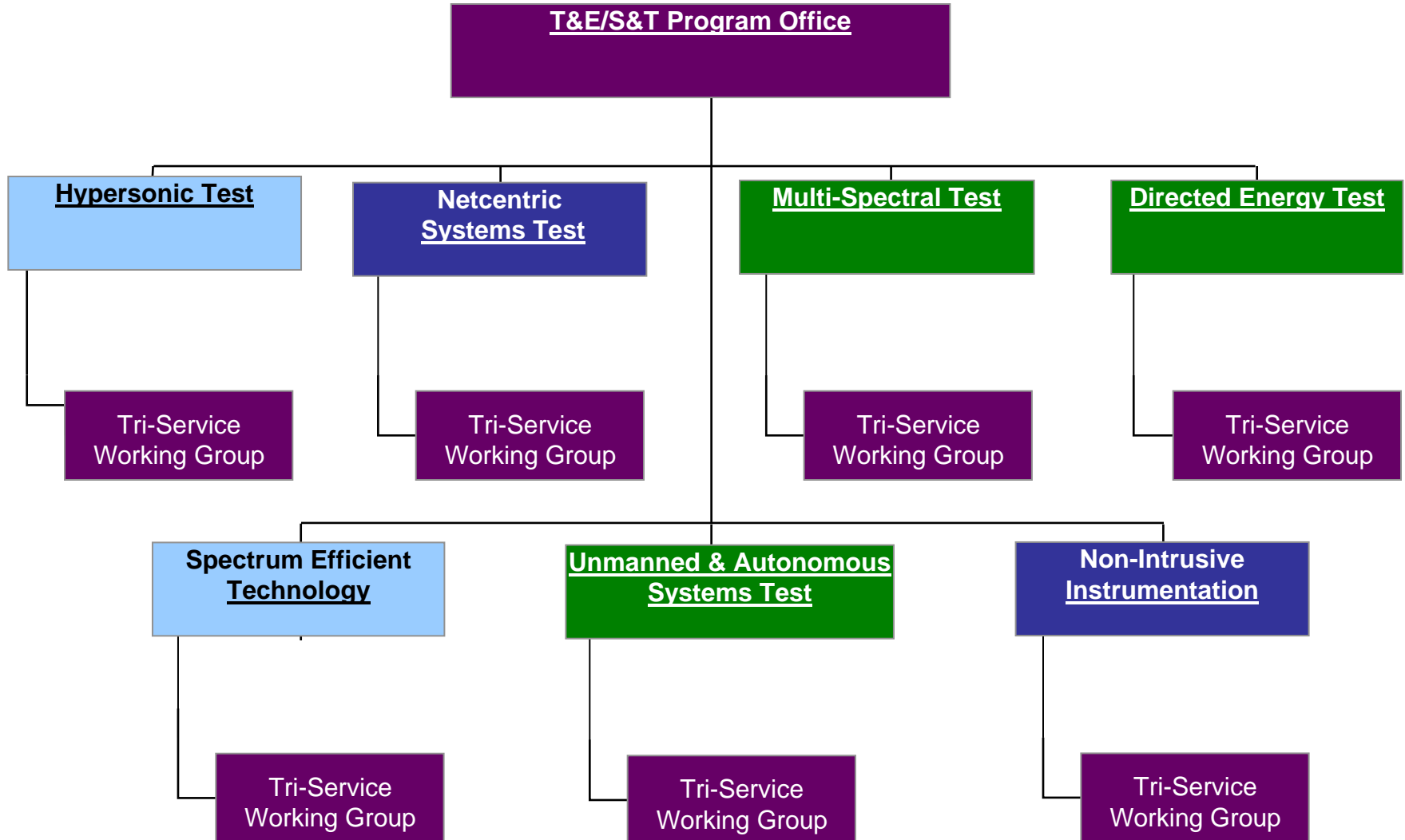


- **Program started in FY 2002**
  - Joint DDR&E / DOT&E initiative
  - Transitioned to TRMC in Feb 2005
- **Mission**
  - **Investigate and develop new technologies required to test and evaluate our transforming military capabilities**
    - Mature technologies from TRL 3 to 6
    - Includes any system that makes our warfighters more survivable and effective in combat
      - Lethal and non-lethal weapons
      - Intelligence surveillance and reconnaissance
- **Goal**
  - **Transition emerging technologies into test capabilities in time to verify warfighting performance**





# T&E/S&T Program Structure







# T&E/S&T Program Project Selection Process



## Drivers

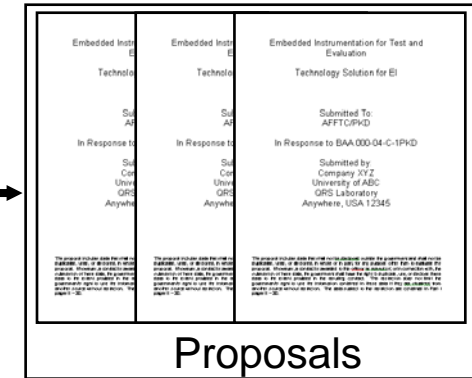
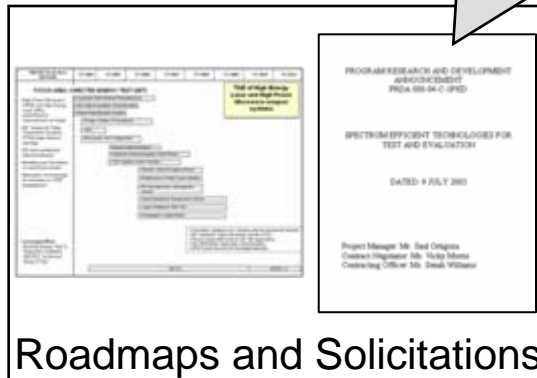


## Tri-Service Focus Area Working Group

- Executing Agent
- T&E Community Reps
- S&T Community Reps
- Subject Matter Experts

T&E Needs/Requirements

Solicitations are issued through  
<http://www.fedbizopps.gov>



## Source Selection Evaluation Team

- Working Group
- Subject Matter Experts
- Contracting Reps

## Executing Agent



Final  
Selections

Recommendations

Focus Area  
Execution

Funding Decision





# T&E/S&T Program

## Active Focus Areas



### Test Technologies for

- Emerging Warfighting Capabilities
  - Hypersonic Vehicles
    - 14 active projects
  - Directed Energy Weapons
    - 20 active projects
  - Multi-Spectral / Hyper-Spectral Sensors
    - 9 active projects
  - Netcentric Warfare Systems
    - 13 active projects
  - Unmanned and Autonomous Systems
    - 5 active projects
- Enhanced Test Capabilities
  - Spectrum Efficient Technology
    - 15 active projects
  - Non-Intrusive Instrumentation
    - 13 active projects
- 89 Active Projects





# Example: Directed Energy Test



## T&E GAPS

- Target sub-systems HEL protection
- Target sub-systems HPM surety
- Target surface temperature measurement
- Target Surrogate Materials
- Surface target incident irradiance/fluence measurement
- Airborne target irradiance and imagery resolution
- Ability to measure HPM fields non-intrusively

## S&T Challenges

- Develop laser protected antenna
- Develop Quantum Well Infrared Photodetector (QWIP) focal plane array
- Develop holographic diffusive target board using photo-thermo-refractive (PTR) glass
- Develop scene-based cross correlation adaptive optics
- Develop reflectance and dynamic fusion models
- Develop non-intrusive HPM sensors

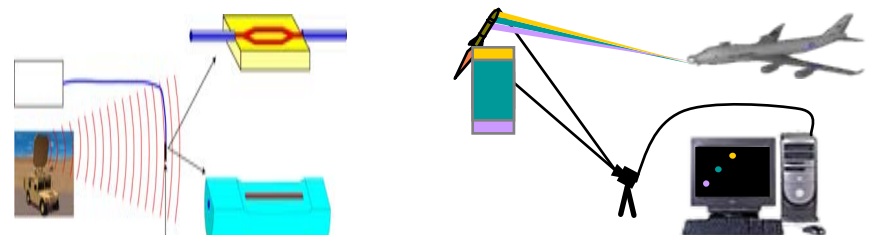
## Transitions/Successes

- Microwave Test Diagnostics Recorder integrated within Directed Energy Test and Evaluation Capability (DETEC) HPM Sensor Suite.
- T&E Adaptive Optics System integration with WSMR HEL Advanced Pointer Tracker (APT)



## Budget (\$M)

	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13
Directed Energy Test	8.83	14.58	23.01	23.07	22.95	23.29	23.42







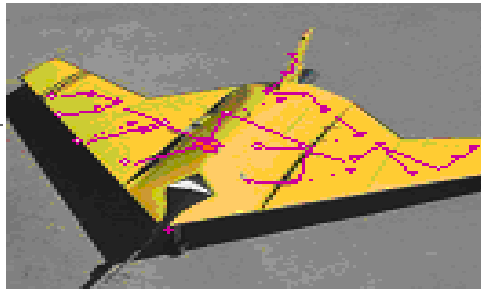
# UAST Example

## Remote Embedded System Test



### T&E GAPS

- Long duration, light weight hybrid power/energy system for reliable UAS operation of onboard sensors and data transmission devices.



### Description

- Research and develop methodologies to harvest energy from such sources as thermal, piezoelectric, vibration
- Self healing on-board sensor network

### UAST Technology Topic Addressed

Topic 5: Power/Energy Management to Support UAST

### S&T Challenges

- Developing “fail safe” methods to power UAS sensors even when operational control systems have been compromised.

### Transition Partners

- CTEIP- Framework for Advanced Modeling Environment, Unmanned and Autonomous System Test, Next Generation TSPI Instrumentation

### Budget (\$M)

FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	Total
.246	.994	.577	0	0	0	1.817

### Deliverables

FY08 Demo w/ wired vibration nodes  
 FY09 Demo graceful node degradation  
 FY10 Demo robustness and scalability





# Budget



\$Millions											
FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13
7.9	8.6	12.8	14.7	22.6	38.8	62.9	94.9	97.3	98.9	100.4	101.9

- **\$24M Budget Growth in FY08**
- **Additional \$32M Budget Growth in FY09**





# *Shaping Technology into Tomorrow's T&E Capabilities*



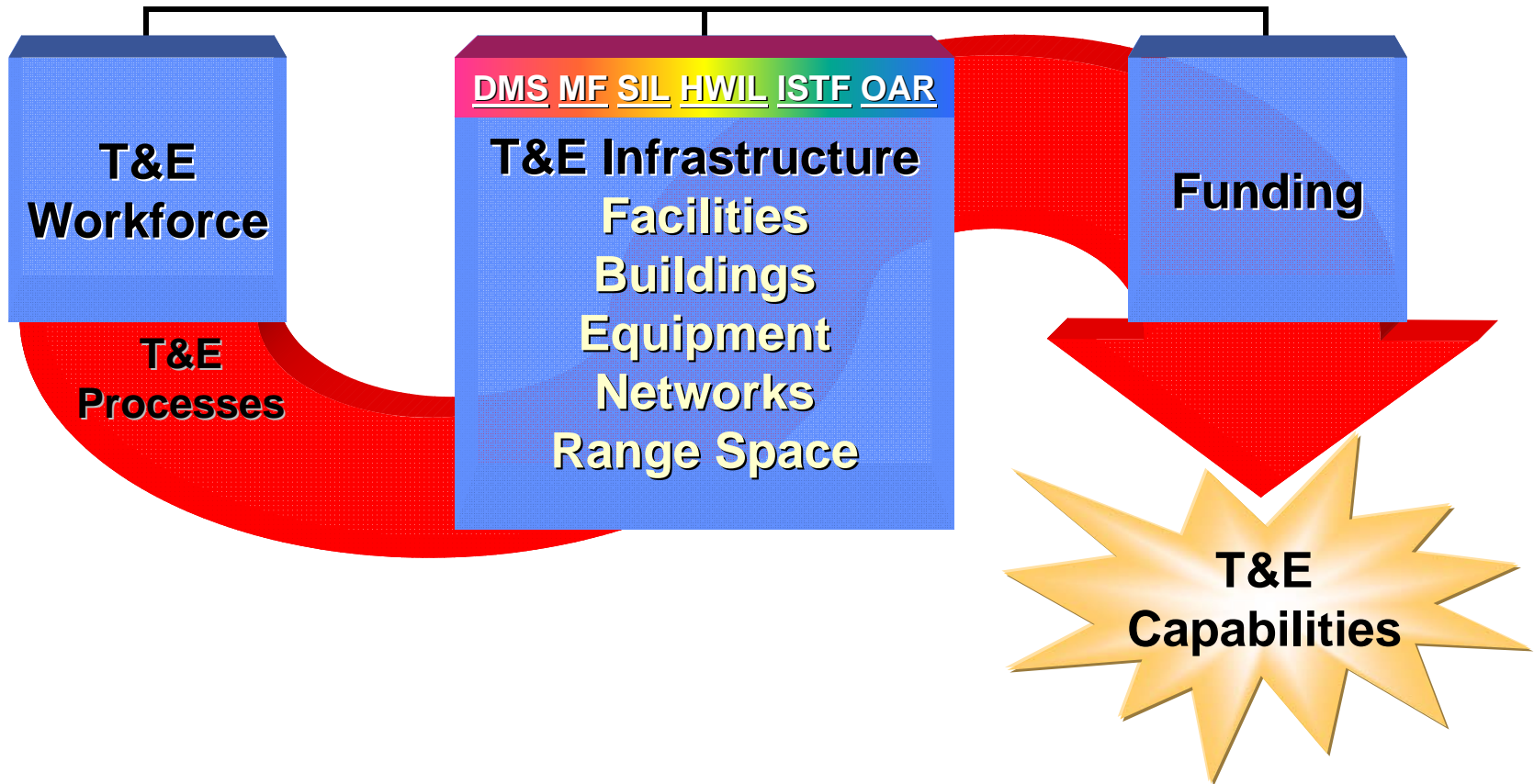
- **T&E/S&T program is maturing technology to meet critical T&E needs**
  - Transition emerging technologies in time to verify warfighting performance
  - Maturing technologies that will facilitate the integration of Test and Training
- **Sustained growth and demonstrated value**
  - 89 projects ongoing across 7 focus areas
  - FY09/10 Budget Ramp expands opportunities
- **Successful Partnership with Services, Laboratories, Industry, and Academia**

**T&E/S&T Industry Days 19-21 February 2008**  
**(San Diego Marriott La Jolla)**





# Strategic Planning for DoD's T&E Resources



**T&E Resources**: A collective term that encompasses the requisite **Workforce**, **Infrastructure** and **Funding** resulting in a **T&E Capability**, by means of the **T&E Processes**





# **The Strategic Plan Tactical View: Test Capability Areas**

---



- *Air Combat*
- *Land Combat*
- *Sea Combat*
- *Space Combat*
- *Electronic Combat*
- *C4ISR*
- *Armaments and Munitions*
- *Targets and Threats*
- *Common Range Instrumentation*
- *Test Environments*

***Follows Tri-Service T&E Executive Agent's Reliance Taxonomy***





# Test Capability Area Risk Assessment



TRCs TCAs	Digital Modeling & Simulation (DMS)	Measurement Facilities (MF)	Integration Laboratories (IL)	Hardware in-the-Loop Facilities (HITL)	Installed System Test Facilities (ISTF)	Open Air Ranges (OAR)
Air Combat	GREEN	GREEN	GREEN	GREEN	YELLOW	YELLOW
Land Combat	YELLOW	YELLOW	GREEN	GREEN	YELLOW	YELLOW
Sea Combat	YELLOW	YELLOW	GREEN	GREEN	GREEN	YELLOW
Space Combat	YELLOW	YELLOW	GREEN	GREEN	GREEN	YELLOW
Electronic Combat	YELLOW	YELLOW	GREEN	GREEN	GREEN	YELLOW
C <sup>4</sup> ISR	YELLOW	GREEN	GREEN	GREEN	GREEN	YELLOW
Armaments/ Munitions	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
Targets and Threats	YELLOW	GREEN	GREEN	YELLOW	GREEN	YELLOW
Common Range Instrumentation	YELLOW	GREEN	GREEN	GREEN	GREEN	YELLOW
Test Environments	YELLOW	YELLOW	GREEN	YELLOW	GREEN	GREEN

## T&E Requirements 2008-2011

**GREEN** assessment indicates that sufficient capabilities exist within a Test Resource Category for a corresponding TCA to meet current T&E requirements.

**YELLOW** assessment indicates that sufficient capabilities do not exist within a Test Resource Category for a corresponding TCA, however, T&E can be conducted in a less-than-efficient manner with resulting higher risks being absorbed by development and acquisition programs.

**RED** assessment indicates that severe capability limitations exist within a Test Resource Category for a corresponding TCA and high risks are being absorbed by major acquisition programs as a result of these deficiencies.





# T&E Gaps Examples



Gap Title	Rationale/Description	Action	Date
Low-speed Aerial Icing	Improved test capability is needed to certify rotary wing, low-speed fixed wing aircraft, and unmanned aerial vehicles to fly in icing conditions. <b>Legacy capability</b> does not support full icing qualification IAW FAR 25C and is <b>incompatible with unmanned aerial systems station keeping requirements.</b>	Army	FOC 2012
Multiple Small Craft Attack Scoring Capability	Programs such as LCS, DDG 1000, CVN-21, CG(X), will require demonstration of survivability in a swarm attack environment. <b>While progress is being made in the target control arena, the ability to score a gunnery test in the small craft swarm environment remains an issue.</b> Ongoing proof of concept initiative has been unable to deliver a capability that can be employed in full scale test scenarios.	Navy	FOC 2012
TSPI in a GPS-denied Environment	Accurate Time Space Positioning Information (TSPI) data (<1m) is critical for resolving RTCA issues and evaluating performance and effectiveness of Land Combat systems, including FCS and Ground Soldier Systems in an UE. Current (Global Positioning System) <b>GPS-based TSPI capabilities will not reliably track forces located inside buildings and underground tunnels.</b> Additionally, <b>open-air players frequently experience satellite signal “dropout” due to building obstructions, threat jamming, and other co-channel interference effects</b> unique to an operating area’s electromagnetic environment.	TRMC	IOC 2014





# **“Strategic” View: Focus Areas**

---



- **Strategic Issues in the DoD derived from high-level Departmental Guidance**
  - *Directed Energy*
  - *Nuclear Weapons Effects*
  - *Hypersonics*
  - *Distributed Test*
  - *Urban Test Environments*
  - *Unmanned and Autonomous Systems*
  - *IED Defeat*





# Examples - Focus Area Issues/Actions



## Directed Energy:

Develop a Directed Energy Test and Evaluation Capability Tri-Service Study [Phase 2 capability roadmap](#) to establish a time phased OAR infrastructure modernization plan to meet future DEW test requirements. **(Lead: Army - CTEIP)**

## Hypersonics:

Conduct a study of [OAR T&E capabilities](#) (e.g. range space, instrumentation, test control) needed to test hypersonic air vehicles through launch, cruise, and recovery flight regimes. **(Lead: Air Force)**

## Urban Test Environment:

Conduct a Joint DoD Agency/Service study to [define requirements for a realistic, reconfigurable, instrumented urban test environment](#) that best makes use of existing DoD infrastructure and distributed LVC capabilities. **(Lead: Army)**

## Unmanned and Autonomous Systems:

Complete a requirements analysis of instrumentation, measurement, monitoring, and control capabilities needed for UAS testing and [develop UAS T&E capabilities roadmap](#). **(Lead: Army – T&E/S&T)**





# The Gaps Resolution Challenge

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**“Everything is very simple in War, but the simplest thing is difficult.”**

***CARL VON CLAUSEWITZ***  
***1832***



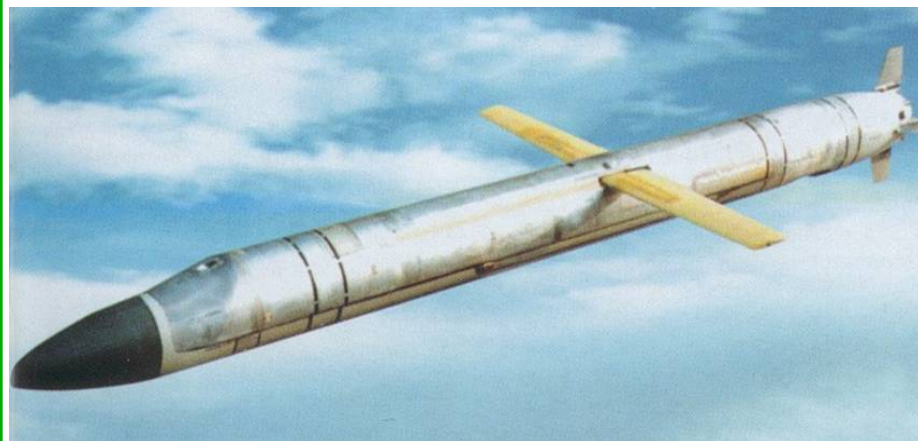


# Threat D

## Supersonic Anti-Ship Cruise Missile (ASCM) Target

### *Required T&E Capabilities*

- Advanced supersonic sea skimming target that represents the full range of intelligence validated air vehicle signature and “transition profile” maneuver performance
  - Sprint vehicle separation
  - Acceleration profile
  - Terminal velocity
- Current Capability: None



Supersonic Target

### *T&E Program Drivers*

- Multiple ship self-defense weapons systems to include:
  - Standard Missile (SM-6 TEMP need date FY10/11)
  - Self Defense Test Ship Testing (SDTS TEMP need date FY11/12)
  - LPD-17 & CVN-21
  - DD(X)

### *Gap Resolution (As of Sep 2005)*

#### Threat “D” RDT&E Funding Profile (\$M)

FY	07	08	09	10
Funded	22.9	10.6	0	0
Required	22.9	52.5	42.3	12.7
Delta		(41.9)	(42.3)	(12.7)

**SM-6 & SDTS test dates at High Risk unless Navy provides full RDT&E funding in POM-08**





# GAP Resolution Chronology

---



- Sep 2005 CY 2005 Strategic Plan Released
- Dec 2005 TRMC "Critical Gaps" Memorandum to Services
- Mar 2006 OSD Stakeholders Approve Threat D Target Acquisition Strategy
- Aug 2006 SP Addendum Reaffirms Gap/Requirement
- Aug 2006 Navy POM-08 "Zeros" Threat D Funding
- Sep 2006 DOT&E/TRMC Submit Targets POM Issue Paper
- Oct 2006 PA&E Targets Issue Team Reaffirms Requirement - "End-user Pays" Offsets
- Oct 2006 3-Star Programmers ..."Deal or No Deal"
- Nov 2006 PDM-II Directs Additional Threat D Study
- Jan 2007 Navy (JH-APL) Begin "Alternatives" Study





# Resolution Chronology Cont.



- Mar 2007 Study Team Recommends Multi-stage Target
- Apr 2007 Congressional Staff Weighs In - RFI
- Apr 2007 3-Star Programmers Accept Recommendations
- Jul 2007 SASC Language – More ASCM Target Studies
- Aug 2007 Navy Cuts Test I&M Budget to Pay Share of MSST Development Bill
- Sep 2007 TRMC Submits PBD to Restore I&M Budget
- Oct 2007 TRMC-Navy “FY09 T&E Budget Certification” Drill

## Current Status:

- MSST Development Program On-Track, PMA-208 Adequately Funded
- Restoration of the Navy’s Major Test Range I&M Funds TBD (OSD Comptroller Action Pending)
- Congressional Requirement for Additional ASCM Target Studies TBD (Authorization Bill Conference Report Language Pending)





# TRMC's Overarching Goal

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*“Robust and Flexible T&E Capabilities  
to Support the Warfighter”*



# T&E Threat Resource Activity TETRA



**Ken McCormick**

**DOT&E/TETRA**

**256-313-7700**

**UNCLASSIFIED**





# Outline

## T&E Threat Resource Activity



- **Organizational Relationships**
- **Responsibilities**
- **Intelligence Support to DOT&E**
- **Resource Analysis Support to DOT&E**
- **Threat Resource Investments**





# **TETRA = T&E **Threat** Resource Activity**

**Threat Resources include:**

- **Actual Threat Hardware (Foreign Materiel)**
- **Threat Simulators including Surrogates**
- **Models of Threats**
- **Threat Simulations**
- **Hybrid Systems**

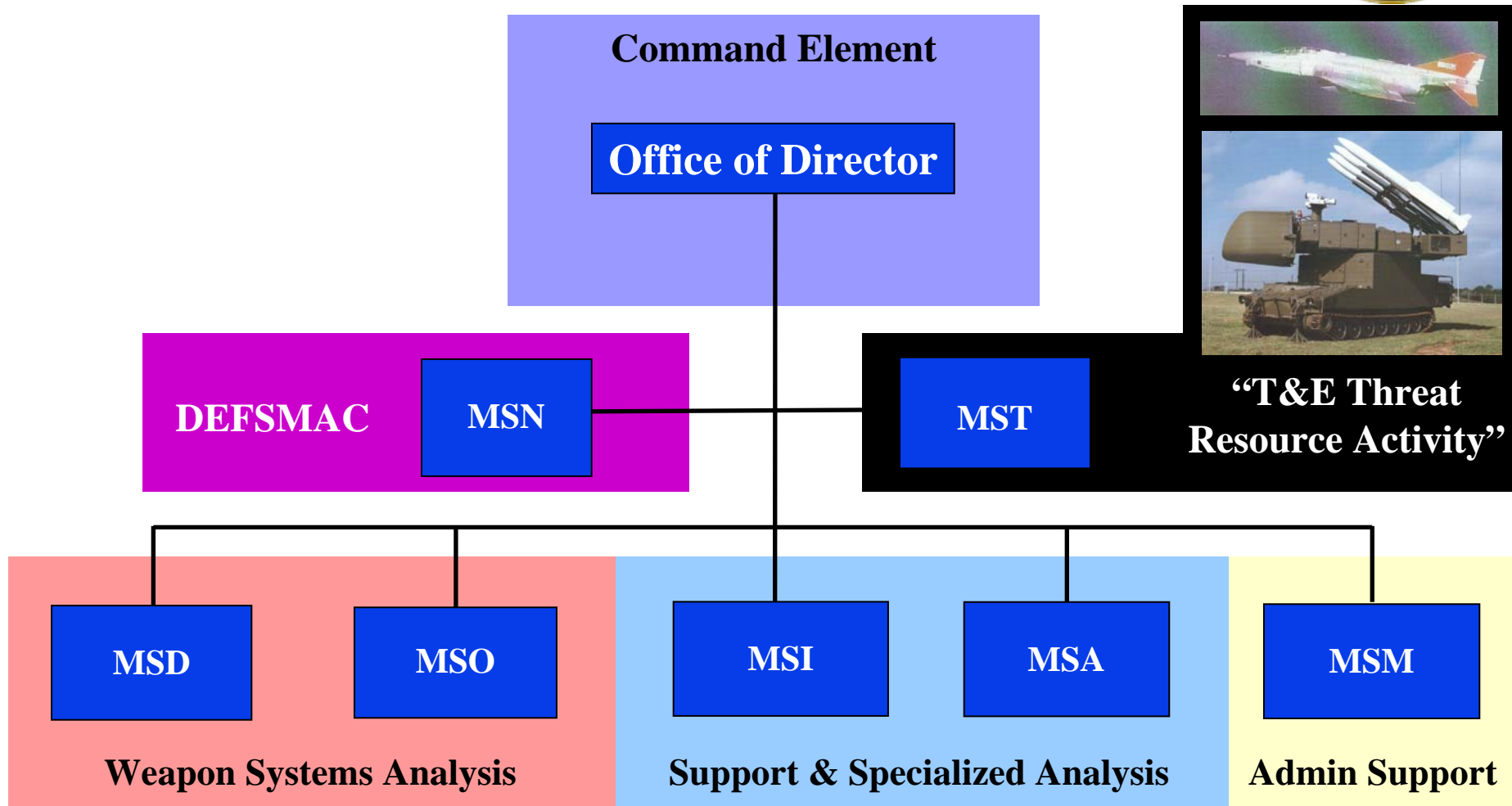




# TETRA in DIA/MSIC



T&E Threat Resource Activity







# Relationship with DOT&E



## T&E Threat Resource Activity

**DIA**

**MOA**

**Hon. Charles C. McQueary**  
*OSD / Director, Operational Test  
& Evaluation*

**Mr. Dave Duma**  
*Principal Deputy Director*

**Mr. Steve Daly**  
*Deputy Director  
Land &  
Expeditionary  
Warfare*

**Mr. Mike Crisp**  
*Deputy Director  
Air Warfare*

**Mr. Bill  
McCarthy**  
*Deputy Director  
Net-Centric  
Systems*

**Mr. Tom Blann**  
*Deputy  
Director  
Naval Warfare*

**Mr. Richard  
Sayre**  
*Deputy Director  
Live Fire T&E*

• **MSIC T&E Threat Resource Activity, Huntsville, AL**

• **MSIC T&E Threat Resource Activity, Arlington, VA**

**DOT&E Oversees Operational  
Testing of Major Defense  
Acquisition Programs**

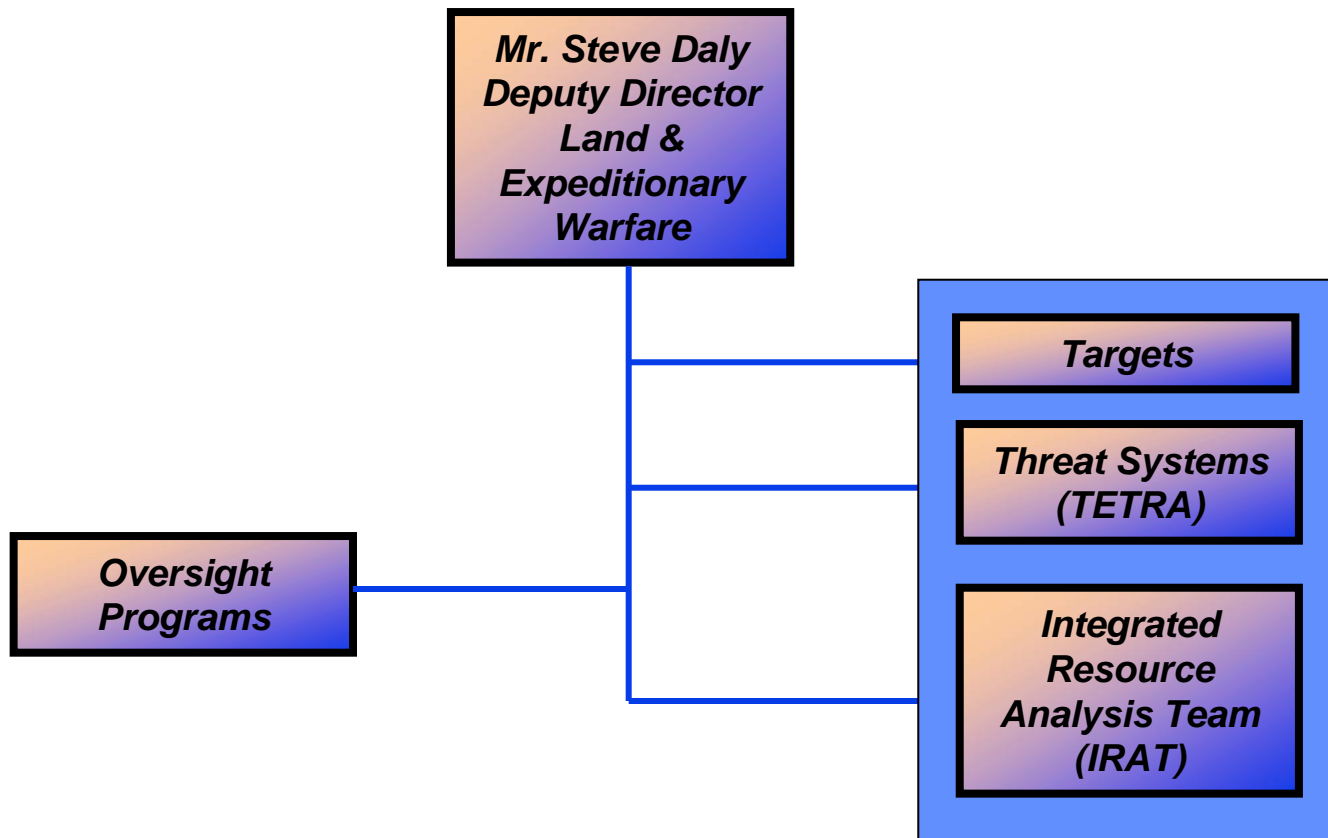




# Land & Expeditionary Warfare Responsibilities



T&E Threat Resource Activity



Title X Acquisition  
Program Oversight

Test Resources





# Test Resource Relationships



## T&E Threat Resource Activity

### *Targets*

Responsible for oversight of Service Target Developments & Procurements

Manages Target Management Initiative (TMI) consisting of studies, prototypes and demonstrations to:

- Improve Threat Realism
- Reduce Cost of Operations
- Foster Interoperability

### *Threat Systems (TETRA)*

Responsible for oversight of Threat Simulators, Models, Surrogates and Foreign Materiel Used in T&E

Manages the Threat Systems Program Investments to Help Satisfy Threat Test Resource Shortfalls

Provides DOT&E Action Officers with Intelligence Support

### *Integrated Resource Analysis Team (IRAT)*

Responsible for providing independent resource analyses on a wide range of test needs in support of DOT&E including Infrastructure, personnel and policies

Coordinates Operational Test-related investments in the Resource Enhancement Project (CTEIP), TMI and Threat Systems





# TETRA Organization



## T&E Threat Resource Activity

**Intelligence Support Team**  
**Stef Minne**

**Threat Resource Support Team**  
**James “Jeb” Buck**

### **Weapon System Specific Intelligence Support**

- Focal Point for Intelligence RFIs
- Formal Intel Production Support

### **General Intelligence Support**

- Bi-Weekly Briefings to DOT&E Action Officers
- SCI Briefs to Deputies and Action Officers
- Capstone Threat Capability
- Intel Trends for IRAT/Resource Analysis

### **Validation Report Analysis**

- Ensure data on threat assets can support accreditation decisions

### **Resource Analysis**

- Oversee Service Threat Assets
- Chair the T&E Sub-Committee to the FMPSC
- Automated Joint Threat Systems HDBK
- Financial Database

### **Investments**

- Sponsor new/improved threat asset
- development
- Lead special study efforts





# Intelligence Support



## T&E Threat Resource Activity

- Provide DOT&E Action Officers with Intelligence Impacting Acquisition Program T&E
- Provide Bi-Weekly Intelligence Highlights Briefing at DOT&E Staff Meetings
- Coordinate DIA J2/J3 (Executive Support Division) SCI Briefing Topics of Interest to the Director
- Provide SCI Update Briefings to DOT&E Deputies and Selected Action Officers

*Provide Quick Reaction On-Site  
Intelligence Support to the DOT&E Staff*





# Validation Analysis



## T&E Threat Resource Activity

- **Oversee and Conduct Technical Analysis on Service-Prepared Threat Representation Validation Reports - Including Targets**
- **Chair the Threat Representation Validation Report Review Committee and the Validation Working Group**
- **Participate in Army and Navy Threat Validation Integrated Product Teams/Working Groups**
- **Coordinate Validation Reports within DOT&E**

***Validation Ensures Information on Threat Assets  
is Available for Informed Accreditation***





# Resource Analysis



## T&E Threat Resource Activity

- **Provide DOT&E Action Officers with Analytical Support for Threat Adequacy Issues**
  - Identify Test Threat Capability Shortfalls
- **Oversee Army, Navy, Air Force and Marine Corps Threat Related Infrastructure**
- **Co-Chair the Test & Evaluation Subcommittee for the USD(I) Foreign Materiel Program**
- **Maintain the Joint Threat Systems Handbook**
  - Over 5,000 Threat Simulators, Targets, Models, Foreign Materiel
  - Accurate up-to-date information on Availability, Quantities, Locations, Specifications, and Validation

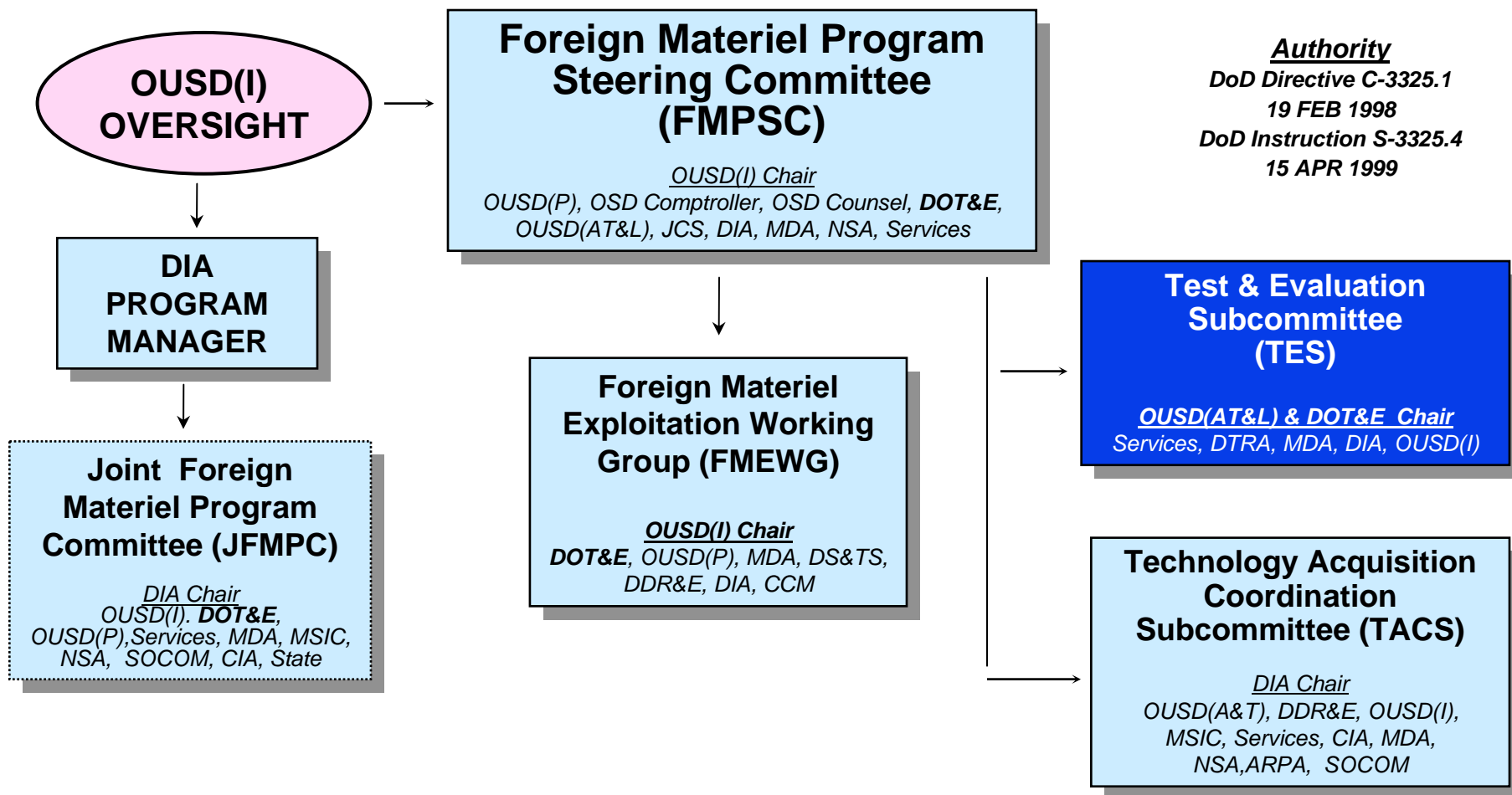




# Foreign Materiel Program



T&E Threat Resource Activity







# Automated Joint Threat Systems Handbook (AJTSH)



T&E Threat Resource Activity

- **A Comprehensive Reference of the Current DoD Threat Resource Inventory**
  - Threat Simulators
  - Targets
  - Foreign Materiel
  - Digital Threat Models
- **Supports Test Planners With Accurate and Up to Date Information**
  - Availability
  - Quantities
  - Locations
  - Performance Parameters / Specifications







# Focused Investments



## T&E Threat Resource Activity

- **Fund Studies/Developments for Threat Realistic T&E Environment**
  - Threat Design Studies
  - Threat Intelligence Data Analysis and Test Methodology Studies Leading to Hardware / Software Development
  - Threat Simulators
    - Digital Threat Models
    - Threat Surrogates
    - Foreign Materiel Hardware
- **DOT&E-funded Threat Simulator Investments**
  - \$4 - \$4.5M/Year
- **TRMC-funded Threat Simulator Investments**
  - \$2.5 - 3.5M/Year



# Threat Systems Investment Process



**T&E Threat Resource Activity**



**Develop  
Focus Areas**

**AOs  
IRAT  
IDA  
Strategic Plan  
Working Groups  
Services**

**Solicit Proposals  
& Screen**

**Threat Systems  
Staff  
IRAT  
TRMC  
Services**

**Evaluate  
& Select**

**AOs  
IRAT  
Threat Systems  
Staff  
Services  
  
DOT&E Selects**

**Fund**

**DOT&E  
TRMC**





# FY08 Investment Focus Areas



## T&E Threat Resource Activity

- **Testing Against Advanced SAM Threats**
- **Development/Fielding of Chinese Threat Test Assets**
- **Develop, Integrate and Validate Standard Missile Fly Out Models (FOMs) for T&E**
- **SA-2/3/6 Upgrades**
- **How to Conduct Low Band Testing**
- **IR Signature Collection – Post Burn-Out (PBO)**
- **Other Threat M&S**
- **Distributed Testing with Threat Assets**
- **New T-SPIL Developments**
- **TENA Compliant Instrumentation Packages for Threat Systems**



# Testing Against Advanced SAM Threats



T&E Threat Resource Activity



- **Newer SAM Threats are Being Developed**
- **Very Capable, Sophisticated Integrated Systems**
- **Foreign Materiel Purchases Not Probable in the Short Term (<10 Years)**
- **Major “Limitation of Test” for New Weapon Systems**
- **TETRA initiative – Conduct Pre-ITEAMS for Advanced Russian and Chinese Air Defense Systems**
  - S-400 Concludes in Dec 2007 & has an Additional \$4M FY08 Congressional Earmark to Complete the Design
  - HQ-9 begun This Past Summer
  - High Fidelity System Model and Hardware Design to Support M&S, HITL, ISTF or OAR Testing

**ITEAMS = Integrated Technical Evaluation and Analysis of Multiple Sources**

**HITL = Hardware-in-the-Loop**

**ISTF = Installed System Test Facility**

**OAR = Open Air Range**





# Chinese Threat Test Assets



## T&E Threat Resource Activity

- Department has Very Limited Inventory of Chinese Threat Assets
- Chinese Threat Assets Pose Continuous “Limitation of Test” Situations
- China Represents a Potential Adversary and has a Robust Foreign Military Sales Program
  - Pakistan and Iran are Major Customers
- **TETRA sponsored a Threat Modernization Effort to See How We Could Use or Modify Existing Equipment, or Buy Chinese Threat Representations**





# FOM Problem in T&E



## T&E Threat Resource Activity

- **Electronic Warfare Testing Methodology Requires Correlation Across T&E Facilities Including**
  - Software-in-the-Loop Facilities
  - Hardware-in-the-Loop Facilities
  - Installed Systems Test Facilities
  - Open Air Ranges
- **Most Legacy Models Not Authoritative, Not Validated**
  - Results Can Not Be Correlated
  - Same Threat, Different Model Gives Different Answers and is Expensive to Maintain

***TETRA Initiative:  
Develop a Roadmap to Migrate DIA-Validated FOMs to  
All T&E Facilities***



# Roadmap for T&E FOM Integration



T&E Threat Resource Activity



- **Sponsored Pilot Projects to Determine Feasibility**
  - Demonstrated IR MANPADS
  - Demonstrated RF SAMS
- **TETRA Established a Collaborative DOT&E/Service Relationship**
- **Beginning FY08 – 4 Year Effort**

TETRA will Fund Integration of [All](#) IR FOMs

TETRA Sponsored TRMC-Funding of [All](#) RF FOMs
- **TETRA is also Working Service Sustainment**

*TETRA Bridged the Intelligence Community Threat Models  
with Test & Evaluation Facilities*





# SA-2/3/6 Upgrades



T&E Threat Resource Activity

- **SA-2/3/6 Appear All Around the World**
- **Russia has On-Going Programs to Modify or Upgrade these Weapon Systems**
- **Some Upgrades Pose Credible Threats to Our Aircraft**
- **TETRA's Current Initiative to Work with the Services to Determine**
  - **Specific Test Requirements for these Modified Systems**
  - **Availability of Upgrades from Original Manufactures**
  - **Alternatives If the Upgrades are Not Available**





# Mission

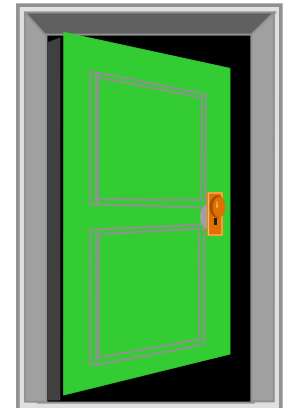
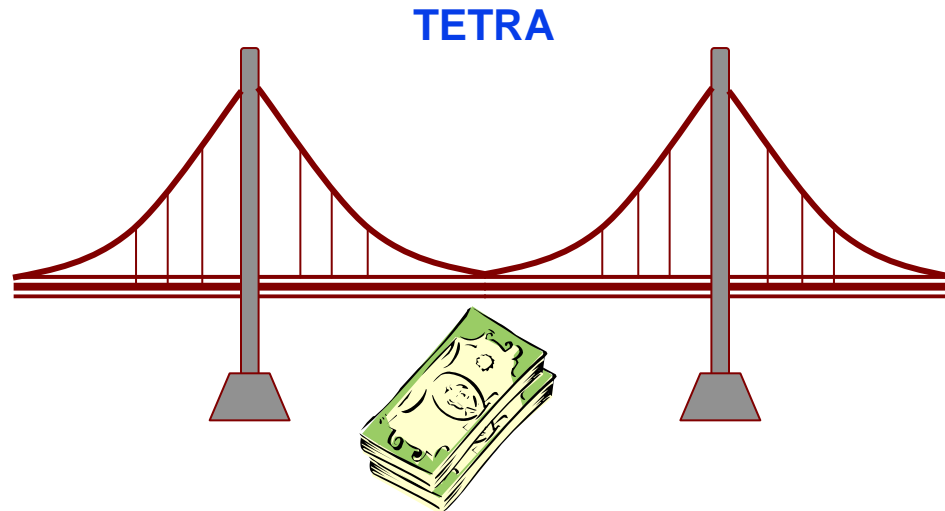


T&E Threat Resource Activity

T&E  
Community

“Threat Resource”  
Bridge Between the  
T&E and Intelligence Communities

Intelligence  
Community







# United States Air Force



## ***Air Force Aerial Targets***

***October 2007***

***NDIA Brief***

***San Diego, CA***



***Ms. Michele Brazel***

***Director, 691st Armament Systems Squadron***

***Eglin AFB, FL***





# Overview



697 ARSS

- **Purpose**
- **System Description**
- **Organizational Structure**
- **Product Groups**
  - Full-scale Aerial Targets
  - Subscale Aerial Targets
- **Summary**





# ***Purpose***



- **Provide “Presentations” of Realistic Threat Representative Systems (Aircraft and Cruise Missiles) in Support of the Following:**
  - **Lethality Testing Required for New or Improved Weapon Systems Prior to Production (10 USC 2366)**
  - **USAF Air-to-Air Weapon System Evaluation Program**
- **Validate Performance Of DoD Ground-to-Air and Air-to-Air Missiles and Aircraft Systems**
  - **Emulates Performance, Signatures and Countermeasures (Infrared and Electronic Attack)**





# Overview



697 ARSS

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# ***System Description***



697 ARSS

- **Aerial Target “Presentations” include:**
  - **The Target Itself**
  - **Target Control System**
    - **Gulf Range Drone Control System (GRDCS)**
  - **Launch, Recovery, Maintenance & Repair of Target**





# Overview



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# 691st Armament Systems Squadron



691 ARSS

## DIRECTOR



*Ms. Michele Brazel*

## DEPUTY DIRECTOR



*Ms. Audrea Feist*

## CONTRACTING



*Ms. Leanne Green*

## FINANCE



*Ms. Jo-An Williams*

## CHIEF ENGINEER



*Mr. Charlie Reuter*

## AFSAT



*Mr. Jim Cornwell*

## QF-4



*Ms. Lee Neugin*

## QF-16



*Mr. Ken Hislop*

***Develop, Procure and Sustain Aerial Targets  
and Related Systems***

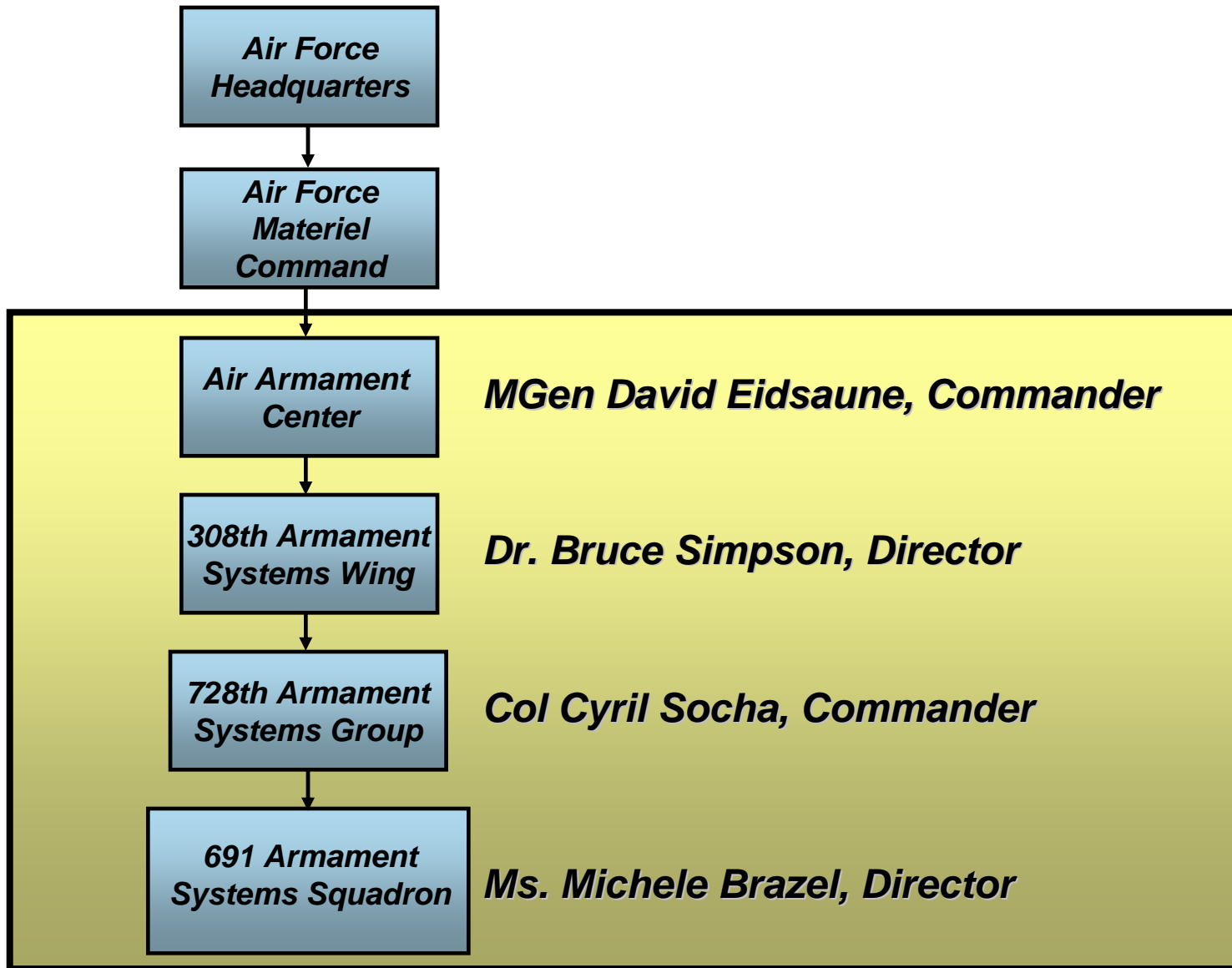




# Where We Fit In



691 ARSS



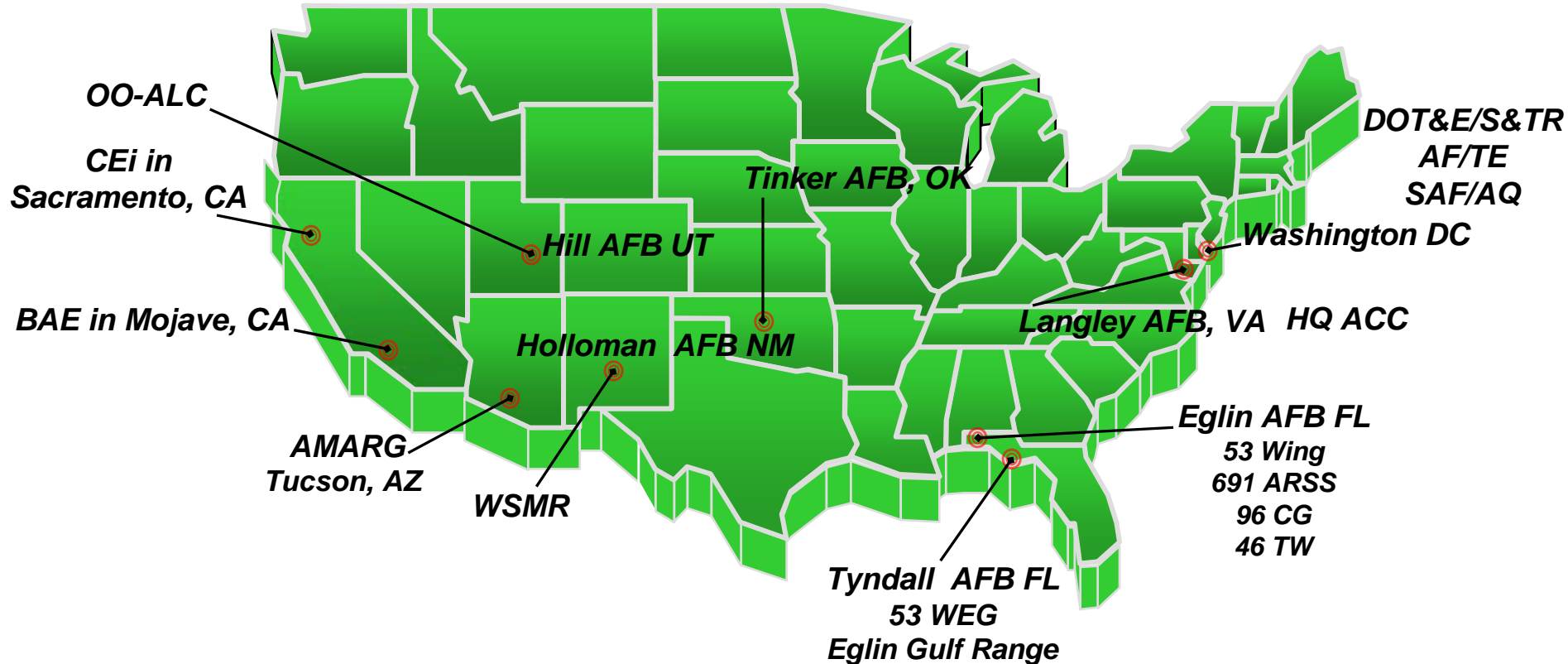




# USAF Aerial Targets Stakeholders



691 ARSS





***Click Middle of Screen to Start Movie***





# Overview



697 ARSS

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  - **Subscale Aerial Targets**
- **Summary**





# ***QF-4 Full Scale Aerial Target***

**Program Manager: Ms. Lee A. Neugin**

## ***Description***

- Full Scale Aerial Target for Threat-Representative Weapon System Evaluation
- Meets USAF, Army, Navy, Allied Test Requirements
- Droned Refurbished F-4 Aircraft Out of AMARG
- Program in Full Rate Production
- Prime Contractor is BAE Systems, Mojave, CA

## ***Key Features***

- Satisfies Title 10 "Live Fire/Lethality"
- Operates via Ground-Based Target Control System
- Supersonic, High-G, Heavy Payload Capability
- Provides 3rd Generation Threat Representation









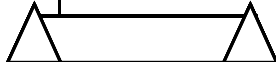

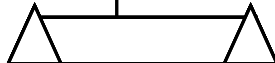

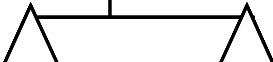




# QF-4 Master Schedule



691 ARSS

	FY05				FY06				FY07				FY08				FY09				FY10				FY11							
	O	J	A	J	O	J	A	J	O	J	A	J	O	J	A	J	O	J	A	J	O	J	A	J	O	J	A	J				
Lot 11	 Dec 04												Deliveries: Aug 06– Aug 07																			
Lot 12					 Feb 06												Deliveries: Aug 07– Jul 08															
Lot 13									 Mar 07												Deliveries: Aug 08- Jul 09											
Schedules shown above are based on actual contract schedules																																
Schedules below are planned schedules																																
Lot 14													 Jan 08												Deliveries: May 09- May 10							
Lot 15																	 Jan 09												Deliveries: May 10-May 11			





# ***QF-4 2007 Accomplishments***



- **Completed Lot 11 and Began Lot 12 Deliveries**
  - Total of 226 QF-4s Delivered to Date
- **Conducting Government Ground Test of QRF-4C Model**
  - Provides Three Additional Years Of Fullscale Capability
  - Projecting 17 Production Lots vice Current 15 Lots
- **Supported 42 NULLO Test Missions in FY07**
  - 61 Missiles Fired
  - 8 Kills





# ***The Future of QF-4***



691 ARSS

- **Lots 14 – 17 Will Consist of RF-4C Models Only**
- **Last QF-4 Delivery Planned For FY13**
- **Sufficient Inventory through FY15**
  - **Assumes 16 – 20 QF-4 Kills Per Year**
  - **Bridges Ops Capability Until QF-16 Deliveries**





# ***QF-16 Air Superiority Target***

**Program Manager: Mr. Ken Hislop**

## ***Description***

- **Fullscale Target for Threat-Representative Weapon System Evaluation**
- **Meets USAF, Army, Navy, Allied Test Requirements**
- **Program in Pre-System Development and Demonstration Phase**
- **Droned Refurbished F-16 Aircraft**
- **Risk Reduction in Progress: Airframes, Engines & Target Control System**

## ***Key Features***

- **Follow on for QF-4 Program: Supersonic, High-G, Heavy Payload Capability**
- **Satisfies Title 10 "Live Fire/Lethality"**
- **Provides 4th Generation Threat Representation**

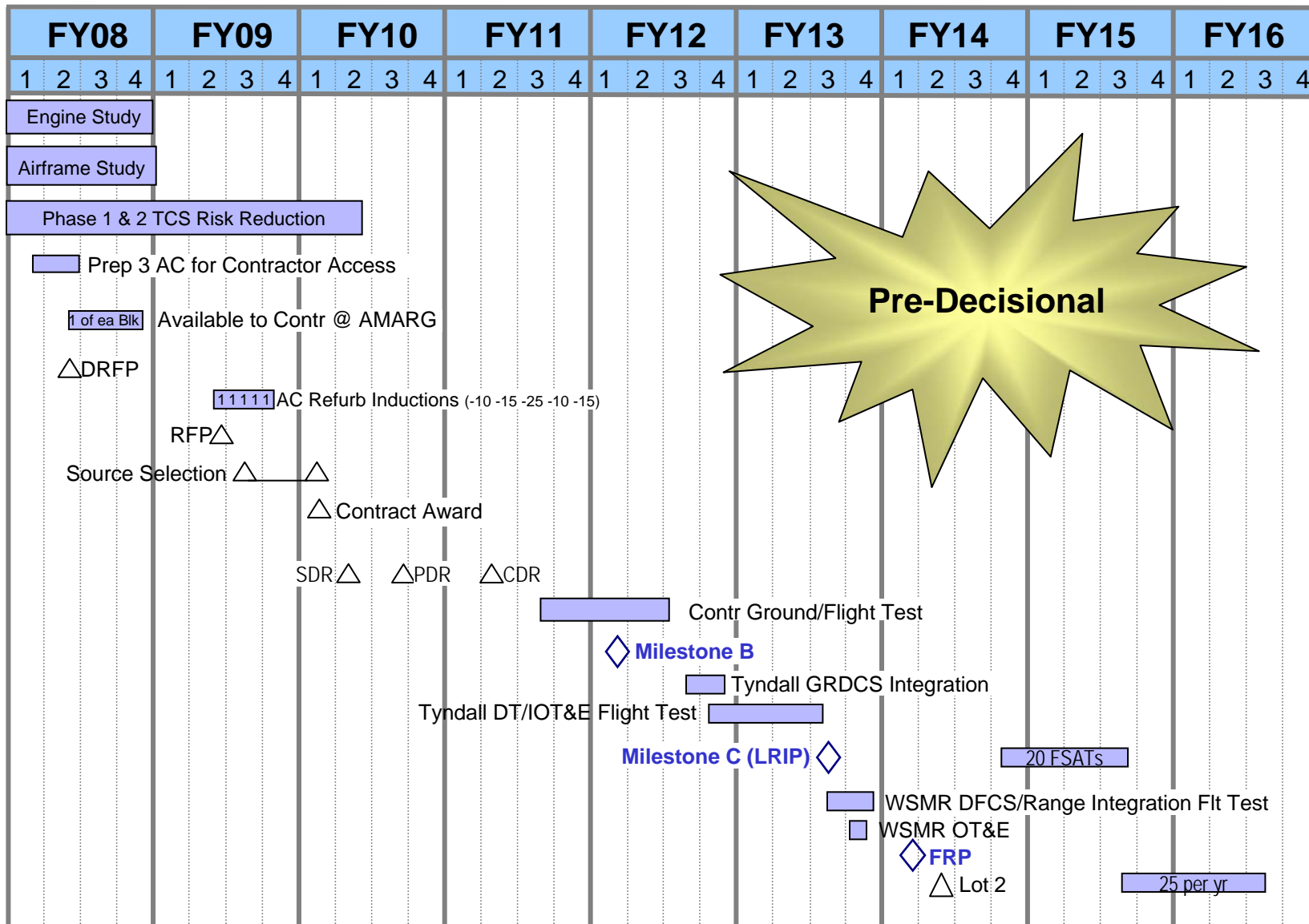




# Proposed QF-16 Schedule FY08-FY16



697 ARSS







# ***QF-16 Risk Reduction***



691 ARSS

- **Risk Reduction Activities: FY07 - 09**
  - **Focus on Government Furnished Equipment**
- **F-16 Airframe Study**
  - **Assess Condition and Availability of Block 10, 15, and 25s**
  - **Cost of Refurbishment**
- **Engine Study**
  - **OSS&E Impacts to Manned and Unmanned Capability**
  - **Assesses Multiple F100 Engine Configurations**
- **Target Control System (TCS)**
  - **Data Link Tester Development**
    - **Integrate Ground S/W with Contractor-Developed Airborne S/W**
  - **Portable TCS For Contractor Development Support**





# ***F-16 Aircraft Survey***



691 ARSS

- **Provide Potential Primes Access to Airframes**
  - **Three F-16s Available at AMARG in Late FY08**
    - **Blocks 10, 15 and 25**
  - **Government Crew Chief Supervises Visits**
  - **Program Office Set Ups Visitation Schedule**
  - **Aircraft Will Be On Ground Power For Analysis**
  - **Gun and Ammo Canister Will Be Removed**
- **Multiple Visits May Be Permitted**



***Better Understanding of Aircraft***  ***High Confidence Proposals***





# ***QF-16 AST Status***



691 ARSS

- **FY09 PBR Funding Approved**
  - Air Force and Navy Funded
- **1<sup>st</sup> Industry Day Complete**
  - 63 Industry Attendees Representing 23 Companies
- **Draft RFP Due Out in Mar 08**
  - Key Focus For Industry Day II
- **2<sup>nd</sup> Industry Day Planned 3QFY08**
  - Increase Use of One-on-One Sessions
- **RFP Release in 2QFY09**
- **Contract Award in 1QFY10**

***Acquisition Strategy not yet Approved – Information Regarding Future Events / Strategy is Tentative***





# Overview



697 ARSS

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# ***AFSAT Sub Scale Aerial Target***

**Program Manager: Mr. Jim Cornwell**



## ***Description***

- **An Affordable, All-Composite Airframe**
- **Flies Faster/Slower, Higher/Lower, and Provides 3x+ More Presentations Than Legacy USAF Subscale Targets**
- **Program in Initial Production Phase**
- **Prime Contractor is CEi, Sacramento, CA**

## ***Key Features***

- **Satisfies Title 10 "Live Fire/Lethality"**
- **Operates via Ground Based Target Control System**
- **Subsonic, Relatively Heavy Payload Capability**

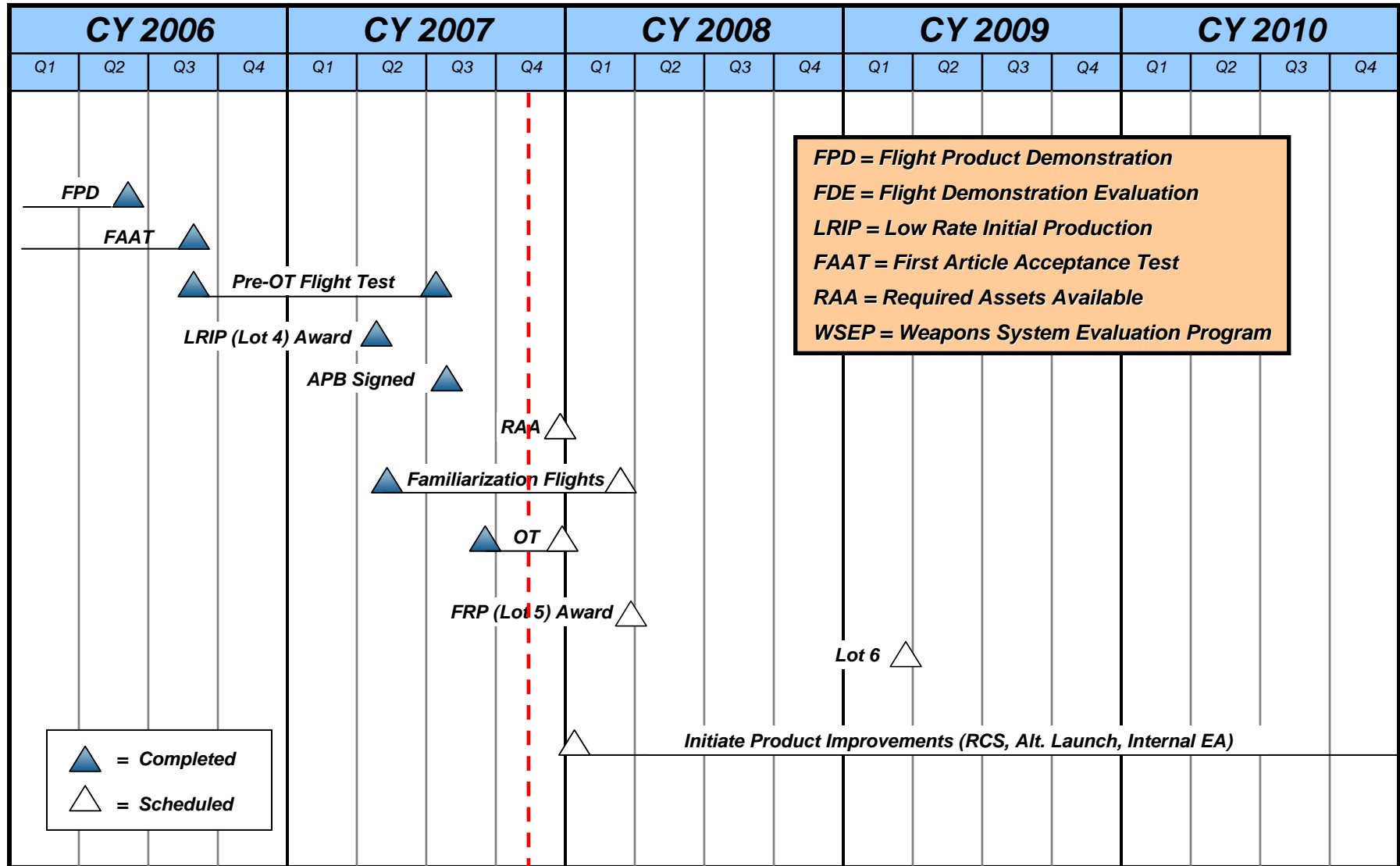




# AFSAT Master Schedule



691 ARSS







# ***AFSAT 2007 Accomplishments***



691 ARSS

- **Completed Pre-Operational Testing**
- **Supported 21 Familiarization/Weapon System Evaluation Program Missions**
  - **114 Presentations Achieved with 103 Missiles Fired**
  - **5 Kills**
- **Currently in Operational Testing**
  - **Estimate Completion by Nov 07**
- **Full Rate Production Decision Planned NLT Mar 08**





# Overview



697 ARSS

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# Summary



691 ARSS

- **QF-4 Production Planned Through FY13 Using RF-4C Model**
  - **Inventory Depletion Expected in FY15**
- **QF-16 Strategy Underway**
  - **Draft Request for Proposal (RFP) Planned 2QFY08**
  - **Production Deliveries Planned to Begin in FY15**
- **AFSAT OT Testing Complete / Awaiting OT Final Report**
  - **Next Step to Execute Lot 5 Award 2QFY08**



# Unmanned Aircraft Systems Supporting Battlefield Troops Past, Present, and in the Future

**NDIA Targets, UAVs and Range Operations  
Symposium 2007**

October 31, 2007

**John Salafia**

Director, Aerial Target Programs, Unmanned Systems  
Northrop Grumman Corporation



# POWAY, CALIF.

Firefighter Jason Peterski attempts to keep a wall of flames from separating houses on Sand Hill Road Oct. 22

# FIRE STORM

Fanned by fierce winds, the worst California wildfire in memory lay waste to vast swaths of land and displace nearly a million people

Kristina Ford (right) and neighbors watch as Ford's home is threatened by flames in Poway.





# Last Century Saw Many Revolutions...



*Commercial Jet Travel*

*Supersonic Flight*

*Heavier Than Air Flight*

*Satellites*

*We are on the brink  
of another revolution...*

*Information Technology*

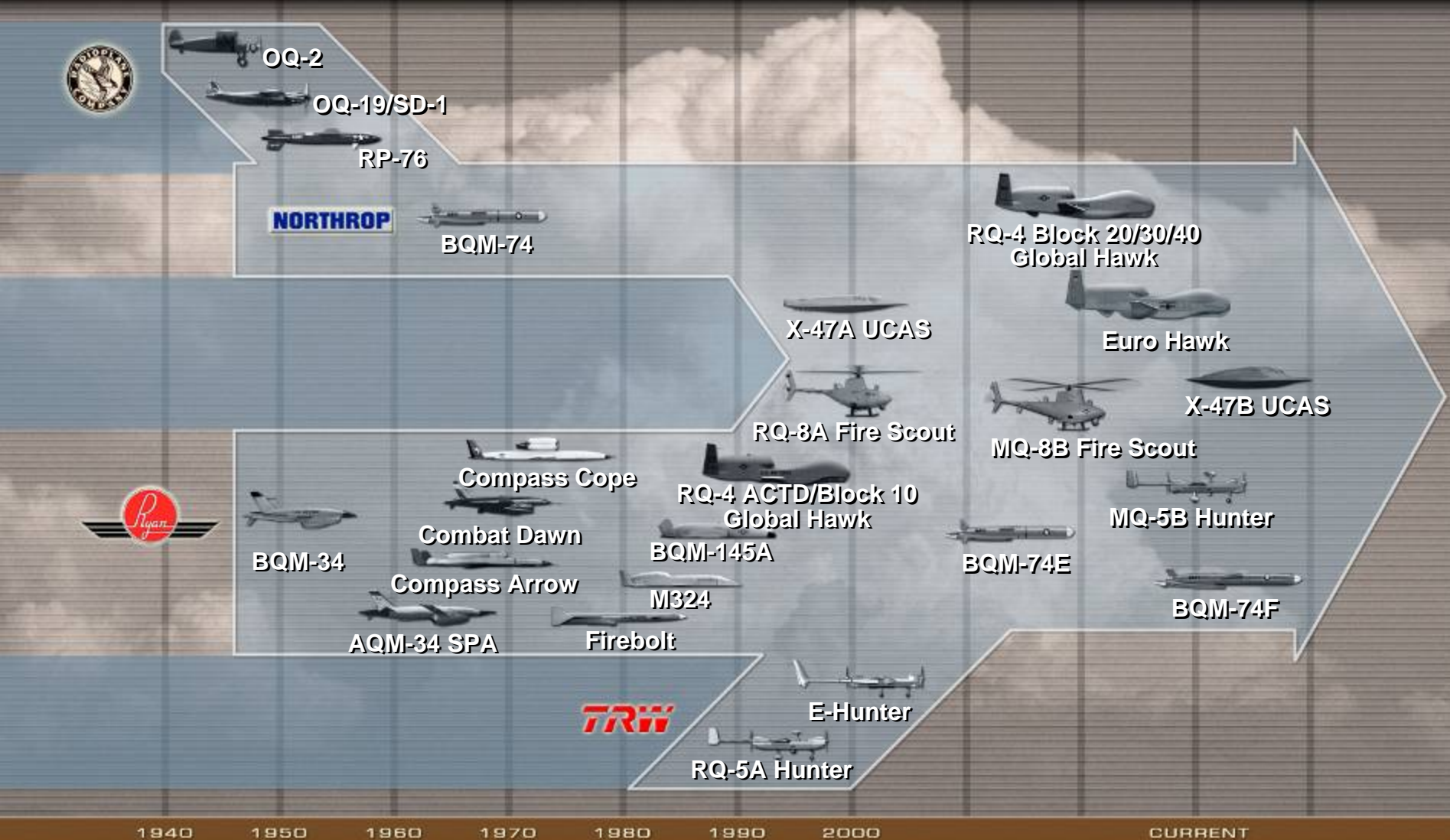
**...the Unmanned  
Revolution.**

*Communications*

*Space Exploration*



# Capability Developments for the Future are Built Upon a Legacy of Unmanned Aerial Systems

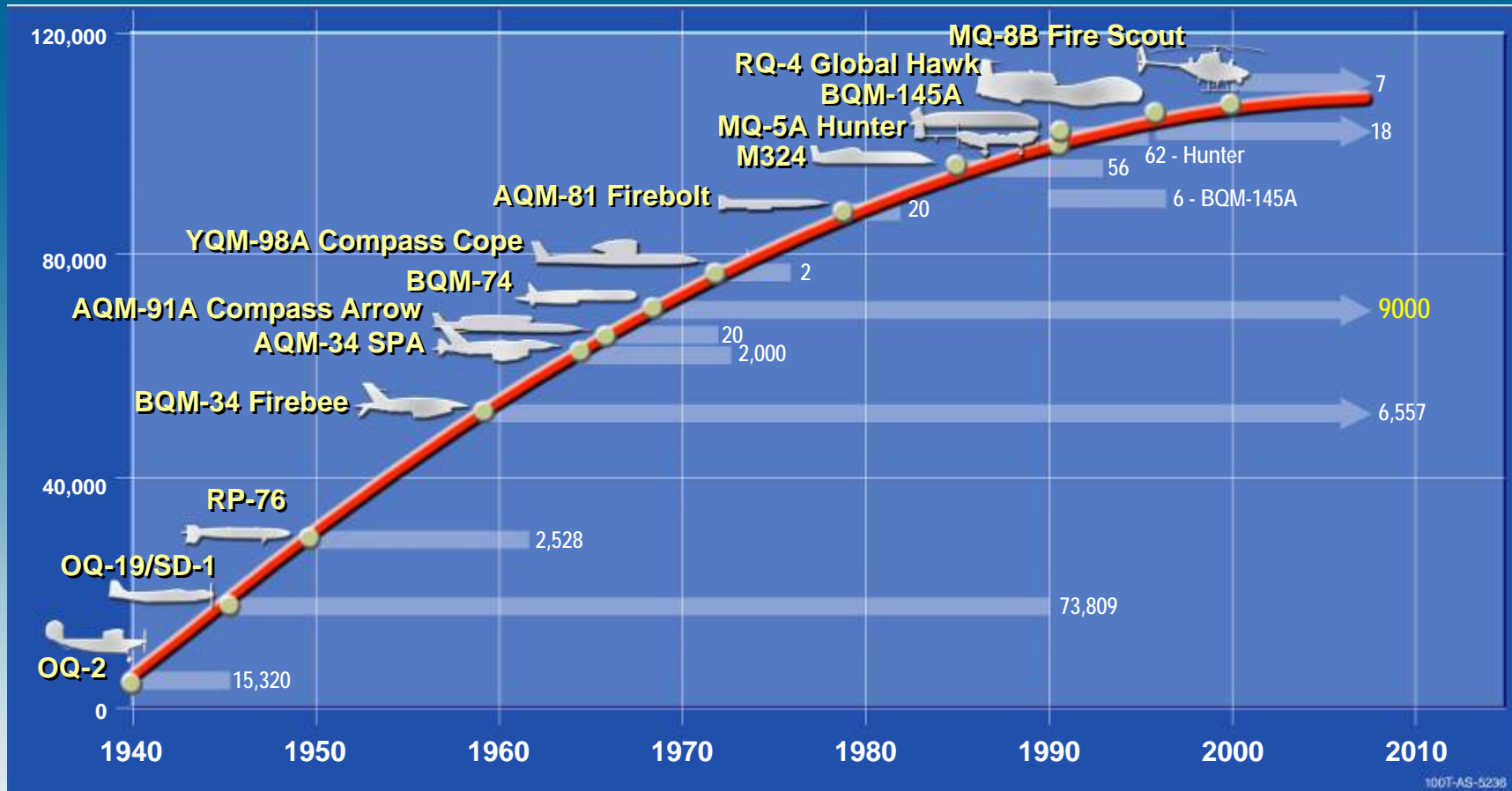


Unmanned. Unmatched.

**NORTHROP GRUMMAN**  
DEFINING THE FUTURE™



# Unmanned Systems Across All Mission Areas



**>100,000 Unmanned Vehicles Delivered**

**NORTHROP GRUMMAN**



# A Solid Future for Unmanned Missions

- Very long endurance without physiological issues
- Very high altitude without pressurization and oxygen
- Sustained ultra high-G combat operations
- Penetration of hostile territory without crew risk

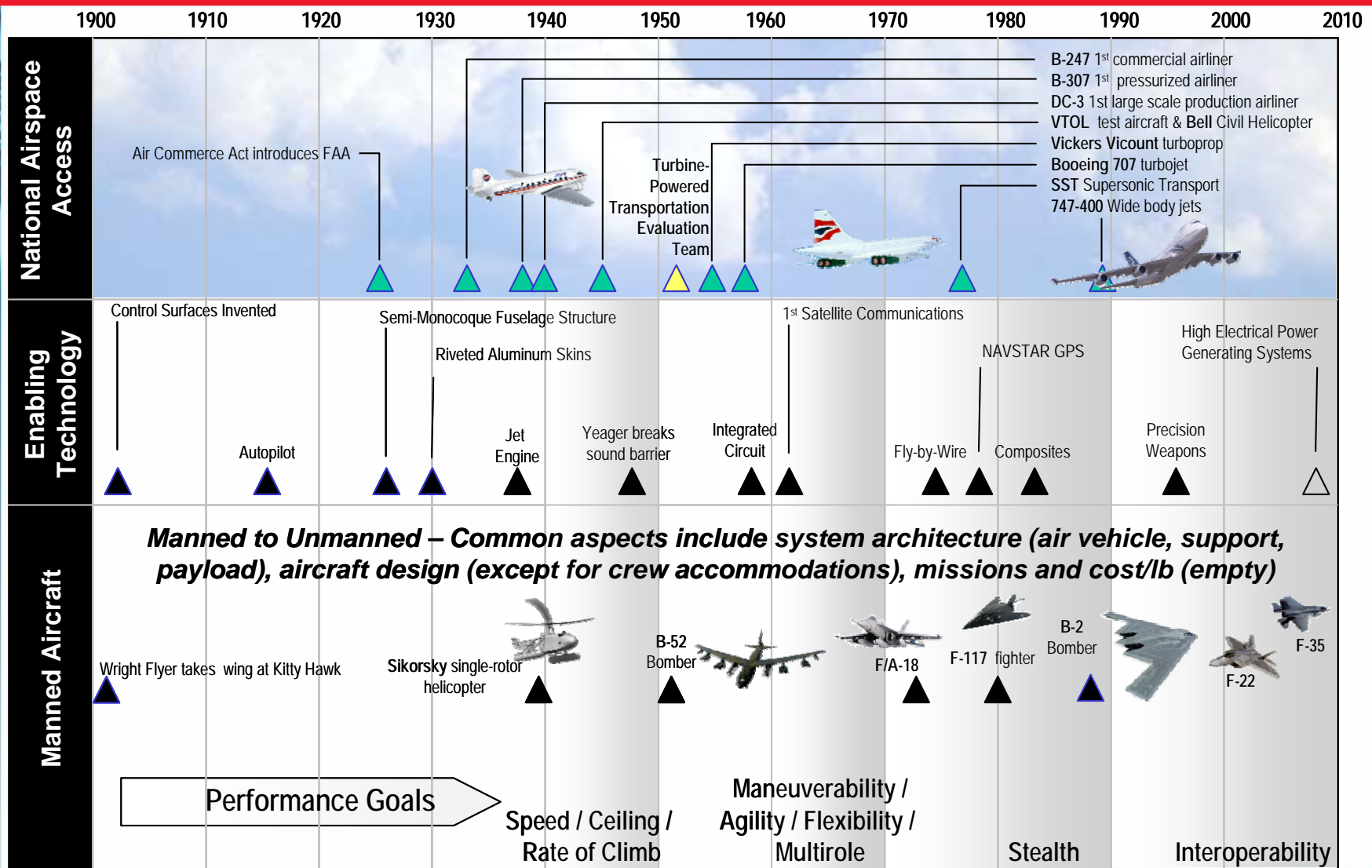
MISSION	CURRENT AIRCRAFT	INTRODUCTION OF UA INTO OPERATIONS					
Payload with Persistence		2005	2010	2015	2020	2025	2030
Communication Relay	ABCCC, TACAMO, ARIA Commando Solo		(e.g., AJCN)				
SIGINT Collection	Rivet Joint, ARIES II Senior Scout, Guardrail		(e.g., Global Hawk)				
Maritime Patrol	P-3		(e.g., BAMS)				
Aerial Refueling	KC-135, KC-10, KC-130						
Surveillance/ Battle Management	AWACS, JSTARS						
Airlift	C-5, C-17, C-130						
Weapon Delivery							
SEAD	EA-6B		(e.g., UCAS)				
Penetrating Strike	F-117		(e.g., UCAS)				
Integrated Strike/SEAD	EA-6B, F-16, F-117			(e.g., UCAS)			
Counter Air	F-14, F-15, F-16						
Integrated Strike/SEAD/ Counter Air	F/A-18, F/A-22						

Source: OSD UAS Roadmap 2005-2030 (04August2005)

**NORTHROP GRUMMAN**



# Building Upon Where We Have Been



**NORTHROP GRUMMAN**



# Series 147 "SPAs" in Southeast Asia

1965-1972



Model	Weight (lb)	Length (ft)	Wing Span (ft)	Height (ft)	Max Speed (mph)	Max Altitude (ft)	Max Range (mi)	Max Endurance (hr)	Max Payload (lb)	Notes
A	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	First F-5A - first reconnaissance model
B	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Lightning Bug - first flying high altitude day photo
C	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Training and low altitude day photo
D	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	From C for electronic equipment
E	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	From D for variable electronic equipment
F	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	From E - electronics
G	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Longer & with larger engine
H	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Short photo, more range
I	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	First low alt. day photo (M-100)
J	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Expendable day photo
K	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Short and medium alt. day photo
L	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Medium alt. day photo
M	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	First night photo from M-100
N	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low alt. day photo
O	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	By F-5C for short and long range
P	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Longer range (M-100)
Q	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Medium alt. day photo and low altitude
R	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo
S	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Improved day low altitude day photo
T	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Night photo version of S
U	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	The low altitude version of S
V	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo
W	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo
X	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo
Y	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo
Z	27,135	36	17.0	10.0	400	40,000	1,000	1.0	10,000	Low altitude day photo

3,435 Combat Sorties

NORTHROP GRUMMAN

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# More Recent Warfighter Support...



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# New Age of the UAV... 1972 - 2007





# Supporting Battlefield Troops Today



Reservists in Nevada analyze sensor data



Mission control integrated with DCGS at Beale AFB

Tight coupling with strike aircraft for TCT

Global Hawk operates from air base with manned aircraft

Other UAVs In Theater



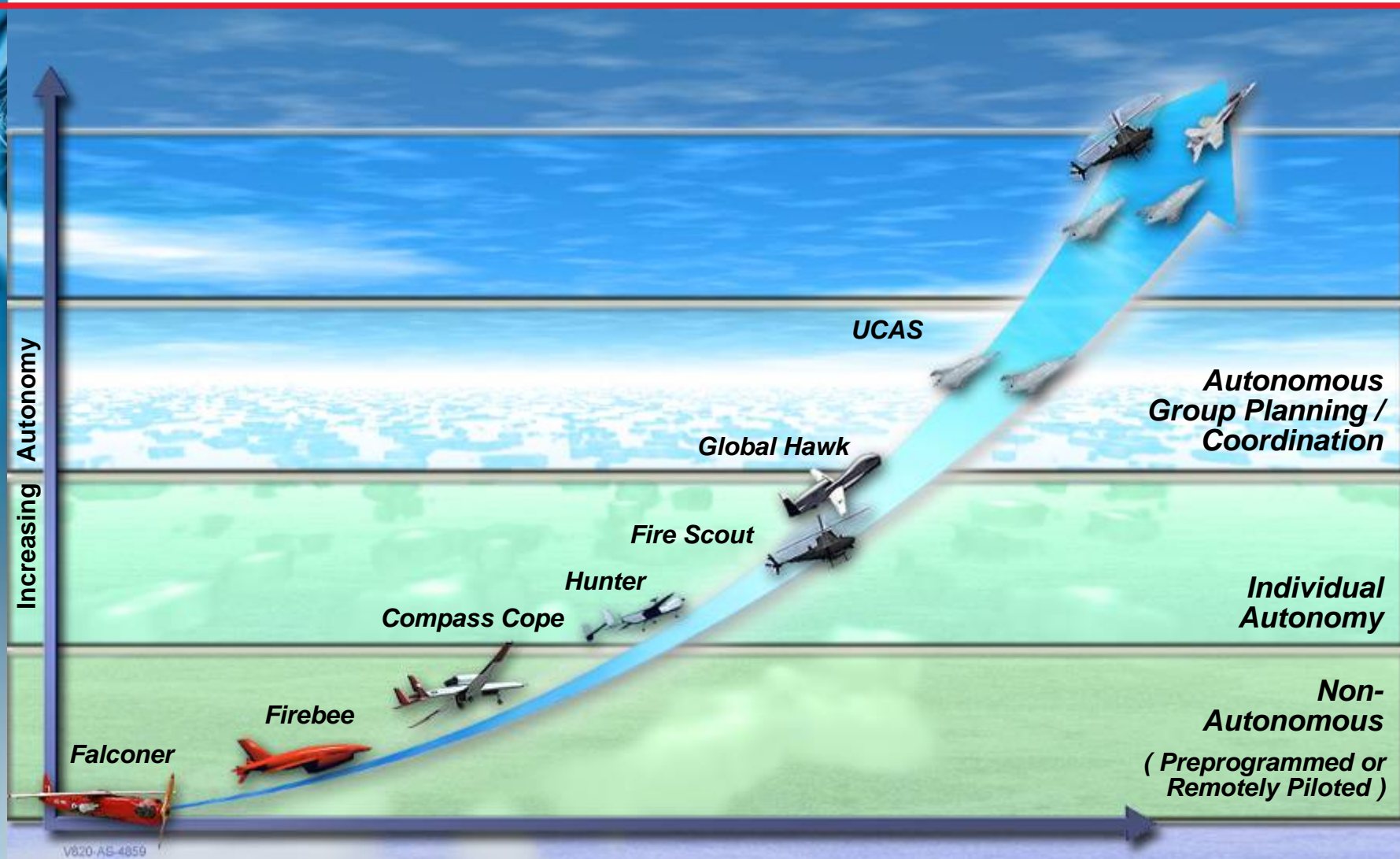
Commanders in the Middle East coordinate via internet chat with mission controllers and imagery analysts



Existing comm links provide two-way data to many types of users



# Autonomy



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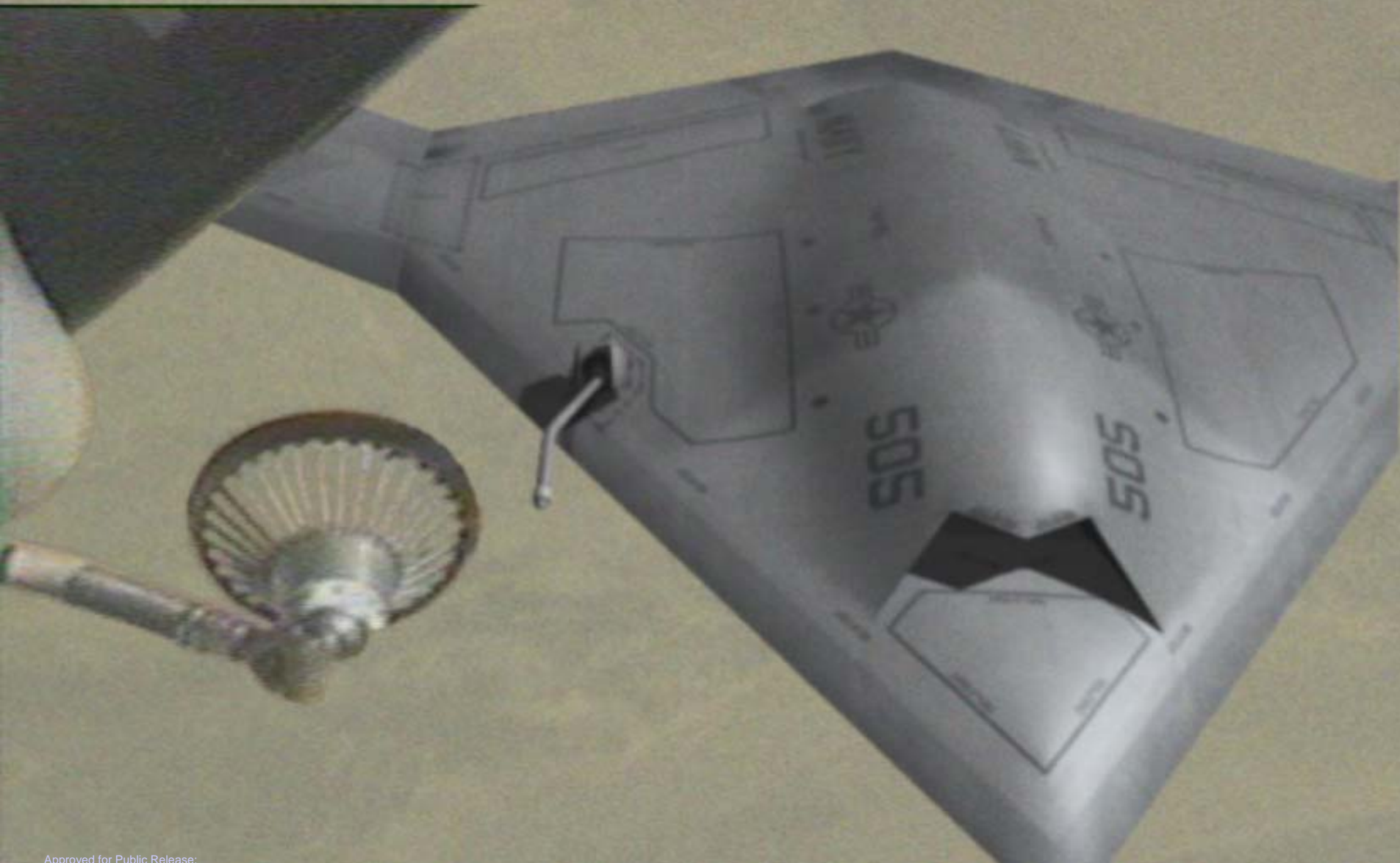
# Carrier Compatibility



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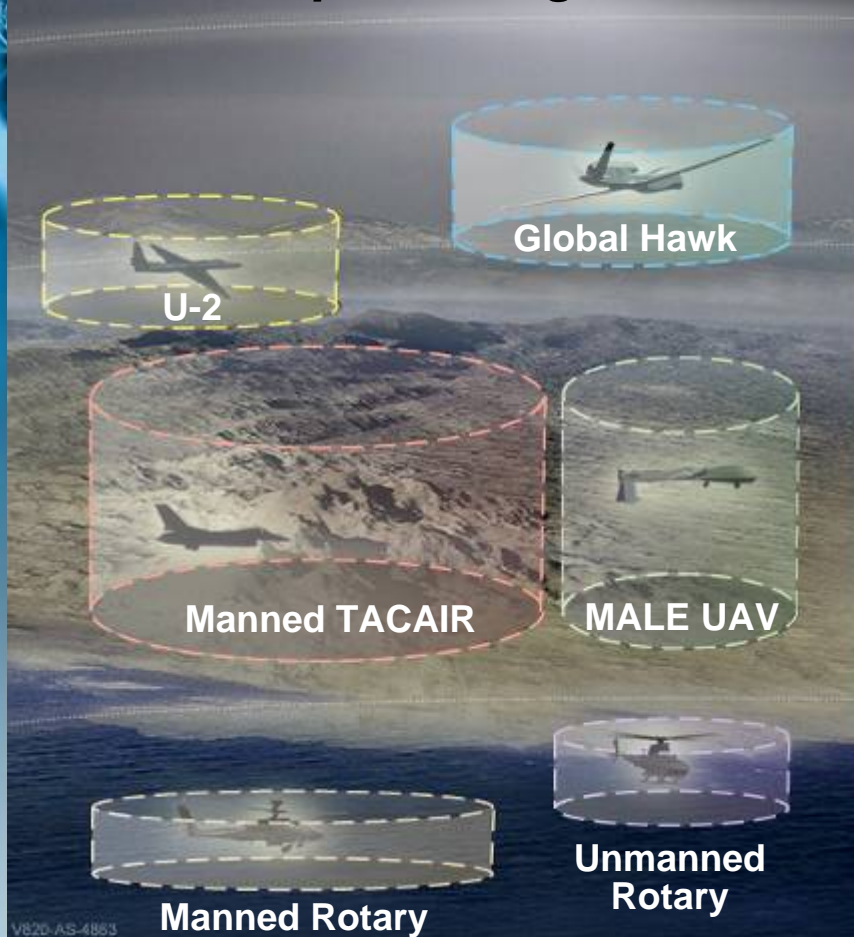
# Aerial Refueling of Unmanned Aircraft: The Ultimate in Endurance





# Airspace Integration – A Key Enabler of the Unmanned Revolution

## *Manned-Unmanned **Battlefield** Airspace Integration*



## *Manned-Unmanned **National** Airspace Integration*



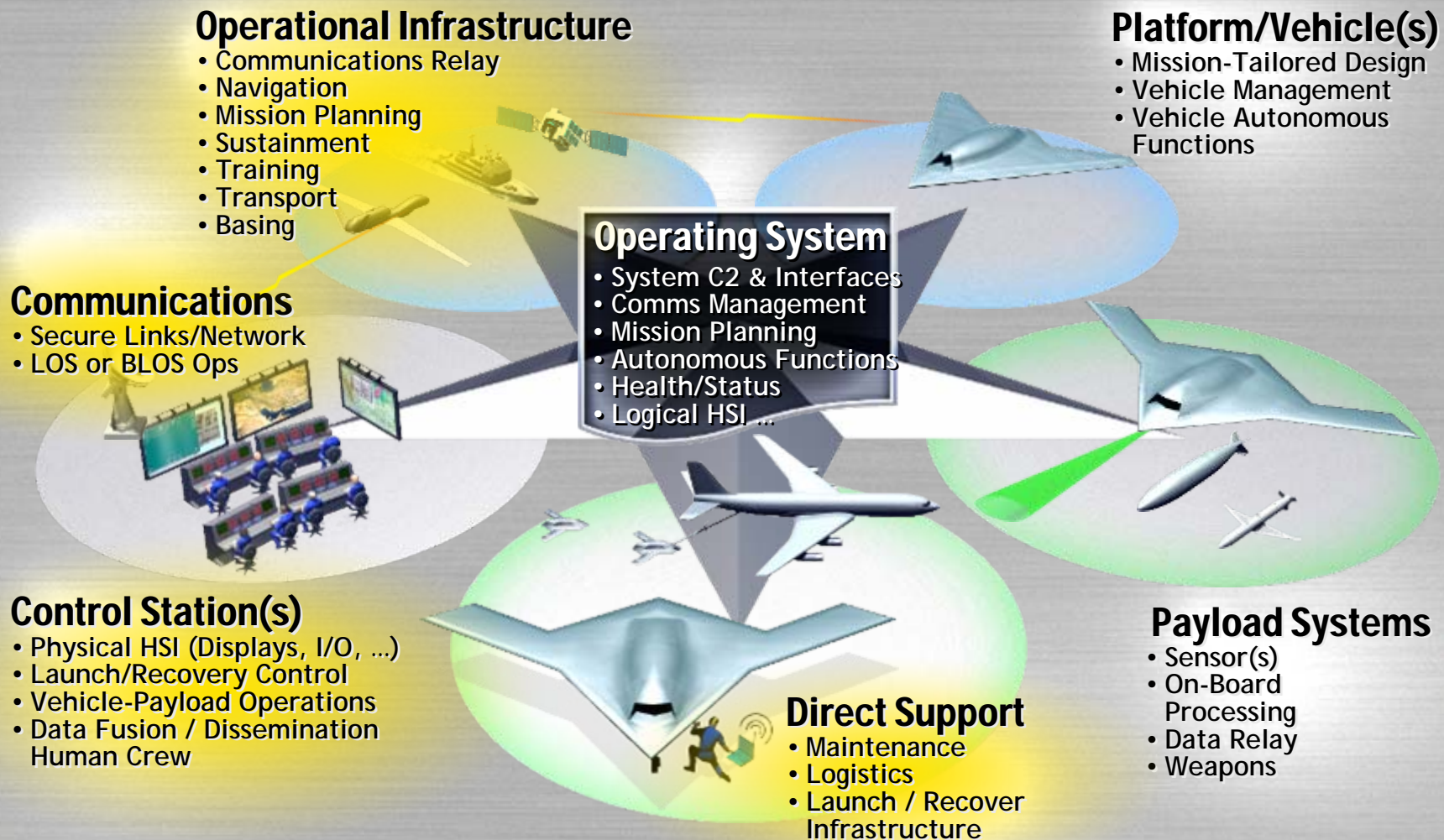
Battlefield

Homeland

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# Benefits of Interoperability



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# Emerging Power Projection Challenges Demand An Unprecedented Combination of Attributes

## Composite Picture of Future Operational Environment

- Short-warning aggression, political/geographical access constraints, and long-range area denial threats require **GLOBAL RANGE**
- Advanced integrated air defenses require broad-band/all-aspect **LOW-OBSERVABILITY**
- Large numbers of distributed time-sensitive targets require **BROAD-AREA PERSISTENCE**

Space-Based  
Surface Surveillance

Space-Based  
Communications

OTH Radar

Mobile Cruise Missiles

Mobile Ballistic Missiles

Advanced IADS

Fielded Forces

Mobile SAMs

Long-Range Ballistic Missiles

Land-Attack Cruise Missiles

Anti-Ship Cruise Missiles

Fast Missile / Patrol Craft

Diesel Submarines

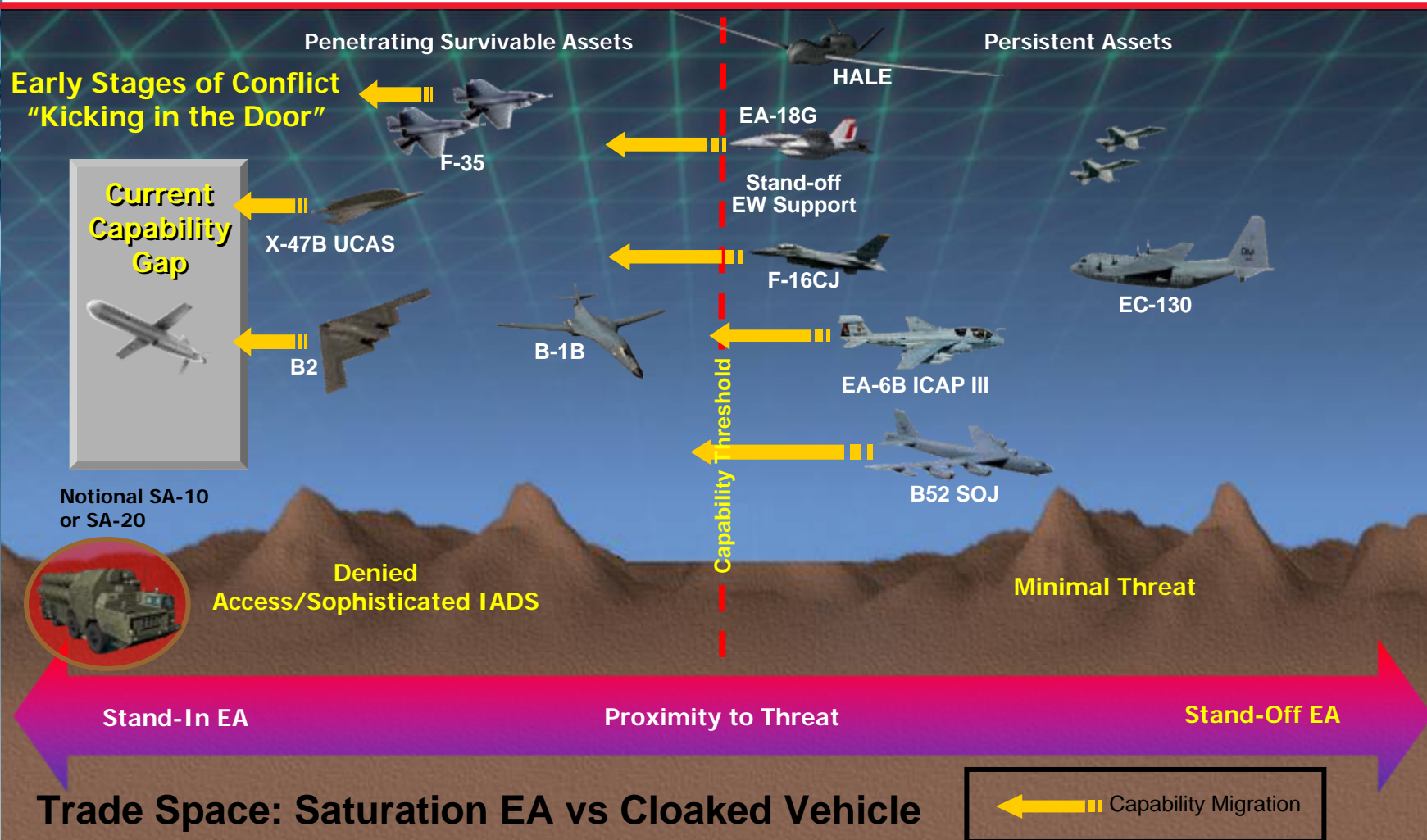
Sea Mines

Expeditionary  
Flotilla

Advanced Interceptor Aircraft



# Notional EW Capability in High Threat Environments



- Defined by Current Inventory of Aircraft
- Must Combine both Saturation and low RCS and utilize vehicles capable of stand-in EA
- Passive & Direct Techniques to dull /deceive/confuse

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# Heterogeneous Unmanned Reconnaissance Team II (HURT II)

## HURT is All About ...

- Information architectures
- Adaptive systems-of-systems
- Ubiquitous, distributed, persistent sensing

## A Joint DARPA/ARMY Program

WS2 (Operating)  
87 @ 1447  
285 ft AGL

PX (Operating)  
HL @ 1448  
57 AGL

WS1 (Operating)  
HL @ 1448  
413 ft AGL

P1 (Operating)  
Designated  
878 ft AGL



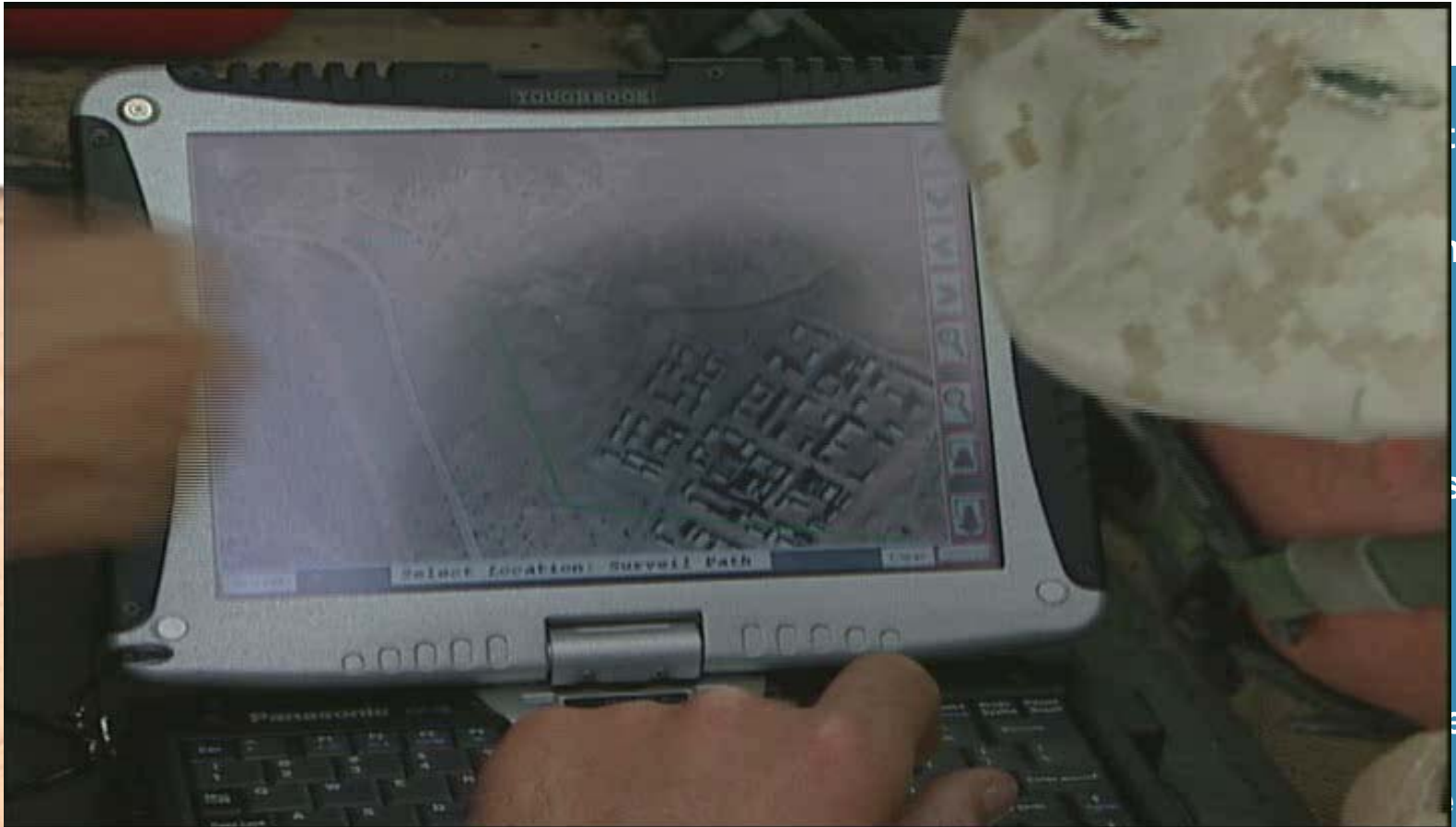
HURT coordinates multiple platforms to provide tactical RSTA for warfighters







# Integrated: Heterogeneous Unmanned Reconnaissance Team



computers





Unmanned. Unmatched.

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