Transitioning
Science & Technology
Programs

Technology Readiness Assessments
and the Revised DoD Acquisition Series

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Office of the Director, Defense Research and Engineering
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Director, Defense Research & Engineering Priorities

- Focus & Integrate DoD S&T on “Transformation”
- Enhance Technology Transition
- Address National Security S&E Workforce
- Expand Outreach to Combatant Commands and Intelligence Community
- Accelerate Support to the War on Terrorism
DDR&E Priorities
Expanded

• Enhance Technology Transition Efforts
  ● Enhanced Primary Transition Efforts under DUSD (Advanced Systems and Concepts); Mrs. Sue Payton
  ● Increase Investment in Technology Transition Efforts (Quick Reaction Special Projects and Advanced Concept Technology Demonstrations)
  ● Expanded Use of Technology Readiness Assessments as Part of Defense Acquisition Board Major Program Reviews
Under Secretary AT&L Goals*

• Theme: Accelerate Acquisition & Tech Transition Efforts
  ● Revitalize Defense Acquisition Board at Senior Level
  ● Mandate Evolutionary, Spiral Development
  ● Implement Technology Readiness Assessments
  ● Mandate the Goal of S&T at 3%
  ● Exploite the Enormous Potential of ACTDs
  ● Accelerate the Flow of Technology to the Warfighter

* From Nov 2002 Speech at PEO/SYSCOM Conference
Speeding Technology Transition  
“The Challenge”

“Perceptions” of the S&T Community
- S&T’s job is complete at the tech development stage
- Implementation of the technology is the customer’s responsibility
- The role of S&T is “tech push”—If it’s good technology — they will come!
- Development cycle for S&T is too long for most Acquisition and Warfighter customers
- Focus on the technology and not on the business rationale for implementation

Key Impediments
- Budget: Lack of Transition Funds
- Transition Process Lacks Definition & Visibility
- Culture: Different Goals & Timelines between S&T and Acquisition Managers
- Lack of Incentives
Some Tech Transition Dimensions

- Rate of Technology Change Increasing
- Capabilities-based Planning Changes Requirements/Needs Process
- Acquisition Excellence/Spiral Insertion
- Availability of Commercial Technology
- Demos (Try Before Buy)

Multiple Dimensions Mean Multiple Solutions Needed
The Challenge: Pace of Technology

“Moore’s Law” → Computing doubles every 18 months

“Fiber Law” → Communication capacity doubles every 9 months

“Disk Law” → Storage doubles every 12 months

Defense Acquisition Pace

F-22  Milestone I: Oct 86  IOC: Dec 05*
Commanche  Milestone I: Jun 89  IOC: Sep 09

* Computers at IOC are 512 X faster, hold 65,000 X bits of information than they did at MS I

Technology growth is non-linear… Acquisition path has been linear
Technology and Defense Acquisition

DoD 5000-Series:
S&T Role in Evolutionary Acquisition
As of April 2002

- DoDD 5000.1, The Defense Acquisition System
  - Rapid & Effective Transition From S&T to Products
  - Emphasis on Cost & Affordability in Program Development

- DoDD 5000.2, Operation of the Defense Acq. System
  - Identify S&T Solutions in Pre-Systems Acquisition
  - Reduce Technology Risks Before the Acquisition Process
  - Use Mechanisms with User & Acq. Customer to Ensure Transition
    - ATDs, ACTDs, Service & Joint Experiments

- DoD 5000.2-R, Procedures for Acquisition Programs
  - Establish Technology Readiness Levels (TRLs) for Critical Technologies

Documents Available at http://www.acq.osd.mil/ara/
Changes to Defense Acquisition Regulation

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Why? “To create an acquisition policy environment that fosters efficiency, flexibility, creativity, and innovation”

Cancelled By DepSecDef Oct 2002
Additional DepSecDef Guidance
30 Oct 2002

• DepSecDef Issued Interim Guidance (~40 Pages):
  • Reaffirmed the Importance of Technology Transition
  • Reaffirmed Evolutionary Acquisition
  • Reaffirmed Technology Development as a Continual Process
  • Directed Continuation of Technology Readiness Assessments and Independent Technology Assessments (Milestones B/C)

DEPSECDH Intent: Streamline Acquisition, with increased flexibility for technology insertion
- Process entry at Milestones A, B, or C (or within phases)
- “Entrance criteria” met before entering phase

Relationship to Requirements Process

All validated by Requirements Authority
Changes to Requirements Process

• Warfighter “owns” the Requirements Process
• Moving to Top-Down “Joint Capabilities Integration”
• Key Documents:
  • Joint Integrating Architecture (JIA) (Pre MS-A)
  • Initial Capabilities Document (ICD) (Pre MS-A)
  • Capability Development Document (CDD) (MS-B)
  • Capability Production Document (CPD) (MS-C)
  • Capstone Requirement Document (CRD)
Possible Future Requirements / Acquisition Process

Process from Interim Guidance

Requirements

Oversight

Integrated Decision Making

Acquisition
Initial Requirements Process

Enterprise Architecture

Integrated Architectures

Approved

Multi-Mission Area Analysis

Sets Baseline for Technology Development Strategy

Analysis of Capability Solution Sets

Develop Range of Solutions

- JWCAs
- Services, Agencies, OSD
- Combatant Commanders
- Laboratories
- Industry
- Considers DOTMLPF

Initial Capabilities Document

- Captures the capability shortfall in terms of the integrated architecture(s)
- Critical capabilities to satisfy the requirement
- “Best” Joint solution
- Service Sponsor
- DOTMLPF
Evolutionary Acquisition and Spiral Development

Every Spiral Should Enhance Capability

A

Concept Development

System Design Concept

MNS

Concept Development

Operational Assessments

Capability-Based T&E

"Use and Learn" Feedback

Technology Insertion Points

Spiral Development

Every Spiral Should Enhance Capability
Best Practices

All Services are evolving their acquisition processes

FROM

S&T

Acq

TO

S&T

Acq

Operational Requirements (Warfighter)

Enhanced Contact; Fewer Surprises
Navy Science & Technology (S&T)  
Problem / Solution

This

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means this...

Critical Mass

But we need this...

Programs below critical mass were never ready for transition

Circa 1999
Navy FNC IPT Approach

● Industry Board of Directors Model

● Principal Members:
  ● Chair -- Requirements community -- Office of Chief of Naval Operations (OPNAV)/Marine Corp Combat Development Center (MCCDC)/Fleet/Force rep.
  ● Transition Lead -- Acquisition community -- Systems Command (SYSCOM)/Program Executive Officer (PEO) rep.
  ● Execution Manager/Technical Working Group Leader -- S&T community rep.
  ● Executive Secretary -- S&T Resource Sponsor Rep.
Air Force Applied Technology Council (ATC)

- Tech transition process should be a 3-legged stool
  - Air Force Research Lab, Product Centers, and Users
- **Recurring participation at senior levels**
  - MAJCOM/CVs, Product Center/CCs, and AFRL/CC
- Funding commitments for both S&T and transition
- For Advanced Technology Demonstration (ATD) Programs
Army ATD Management Plans
Accelerating Transition

- Coordinated and Documented partnership between Warfighting Customer, Technology Developer and Acquisition Buyer
- Proposed by Technologists and Tacticians
- Approved by GO/SES
  - HQ TRADOC Combat Developer
  - HQDA Chief Scientist
  - HQDA, G8 Force Development
  - PEO/PM

Commitments to Transition needed Technology as Fast as Possible
Measuring Technology Maturity

Technology Readiness Levels

- **TRL 9**: Actual system “flight proven” through successful mission operations
- **TRL 8**: Actual system completed and “flight qualified” through test and demonstration
- **TRL 7**: System prototype demonstration in a operational environment
- **TRL 6**: System/subsystem model or prototype demonstration in a relevant environment
- **TRL 5**: Component and/or breadboard validation in relevant environment
- **TRL 4**: Component and/or breadboard validation in laboratory environment
- **TRL 3**: Analytical and experimental critical function and/or characteristic proof-of-concept
- **TRL 2**: Technology concept and/or application formulated
- **TRL 1**: Basic principles observed and reported

As Defined in 5000.2-R
FCS Multi-Role Armament & Ammunition ATD

(III.WP.1999.01)

FY01 FY02 FY03 FY04 FY05 FY06

**TRL=4**
Recoil Mitigation Demo
**METRICS:**
- 40% reduced recoil force w/ Fire-out-of-battery modified M35 cannon w/ ETC ignition

**TRL=4+**
Recoil Mitigation Variable FIB Modeling
**METRICS:**
- Manage 6659 Lb-Sec Impulse
- Trunnion Force < 100k Lbs

**TRL=5**
ETC Propellant Demo
**METRICS:**
Sub-scale firings of Adv Propellant (Gen II) Model to validate launch velocity.
Full Scale Firing With JA2.

**TRL=5**
Multi-Mode WHD
**METRIC:**
- Shaped Charge L/D=1 (vs 1.7)
- EFP 25% increase in armor penetration

**TRL=5**
Recoil Mitigation Demo
**METRICS:**
- < 90K lbs force hardstand firing of KE slugs
- 3500lb cannon

**TRL=5**
Turret on Hardstand Demo
**METRICS:**
- < 85K lbs force on surrogate vehicle
- < 3000lb cannon

**TRL=6**
BLOS Programed Maneuver (G&C)
**METRIC:**
- Maneuver capability

**TRL=6**
BLOS Seeker/G&C
**METRICS:**
- P\textsubscript{acq/Enc} via Integ Projectile Guide to Hit gun launch to 10km

**TRL=6**
Integrated Armament Demo on Vehicle
**METRICS:**
- In Flight Update NLOS
**METRIC:**
- P\textsubscript{acq/Enc} via Integ Projectile Guide to Hit gun launch to Max Range

**TRL=6**
ETC Integrated Demo Over Temp Range
**METRICS:**
- 20m CEP

**TRL=6**
Seeker/G&C High-g Demo
**METRIC:**
- MP-ERM: 18k g’s air gun test
- Cargo: 20k g’s air gun test

**TRL=5**
Multi-Mode WHD
**METRIC:**
- Warhead demo of 3 lethality modes

**TRL=6**
ETC Integrated Demo Over Temp Range
**METRICS:**
- Fire Full Scale Case Telescoped Ammo

**TRL=6**
Programmed Maneuver NLOS
**METRIC:**
- Smart Cargo-10 to Max Range
  - Ambient Temp functionality
SPEED OF TECHNOLOGY CHANGE

In FY03 President’s Budget Request New Program
Quick Reaction Special Projects – 3 Projects

• Defense Acquisition Challenge Program
  Provides opportunities for inserting innovative and cost-saving technology into
  acquisition programs
  Funds used only for review and evaluation of proposals, not implementation

• Quick Reaction Fund
  Provides flexibility to respond to emergent DoD needs within budget cycle
  Takes advantage of technology breakthroughs in rapidly evolving technologies
  Completion of projects within a 6-12 month period

• Technology Transition Initiative
  Establishes a Technology Transition Council
  Jump starts selected components/subsystems into systems
Summary

• Tech Transition is critical to maintaining capability edge
• Need Reaffirmed at Highest Levels
• DoD Implementing New Projects and Processes to Effect Transition
• Effective Tech Transition remains a Contact Sport
Continuum of Tech Transition

Complementary Approaches to Meet Warfighter Needs

• Thermobaric weapon
• Thermobaric Hellfire
• Anthrax Kill Curve

• Predator
• Blue Force Tracking

• JSF
• FCS

Quick Reaction Projects

ATDs and ACTDs

Formal Acquisition Programs

Technology Transition Initiative

Challenge Program

Complexity of Effort

Technology Transition Opportunities

6 mos 1 yr 3 yrs 5 yrs