

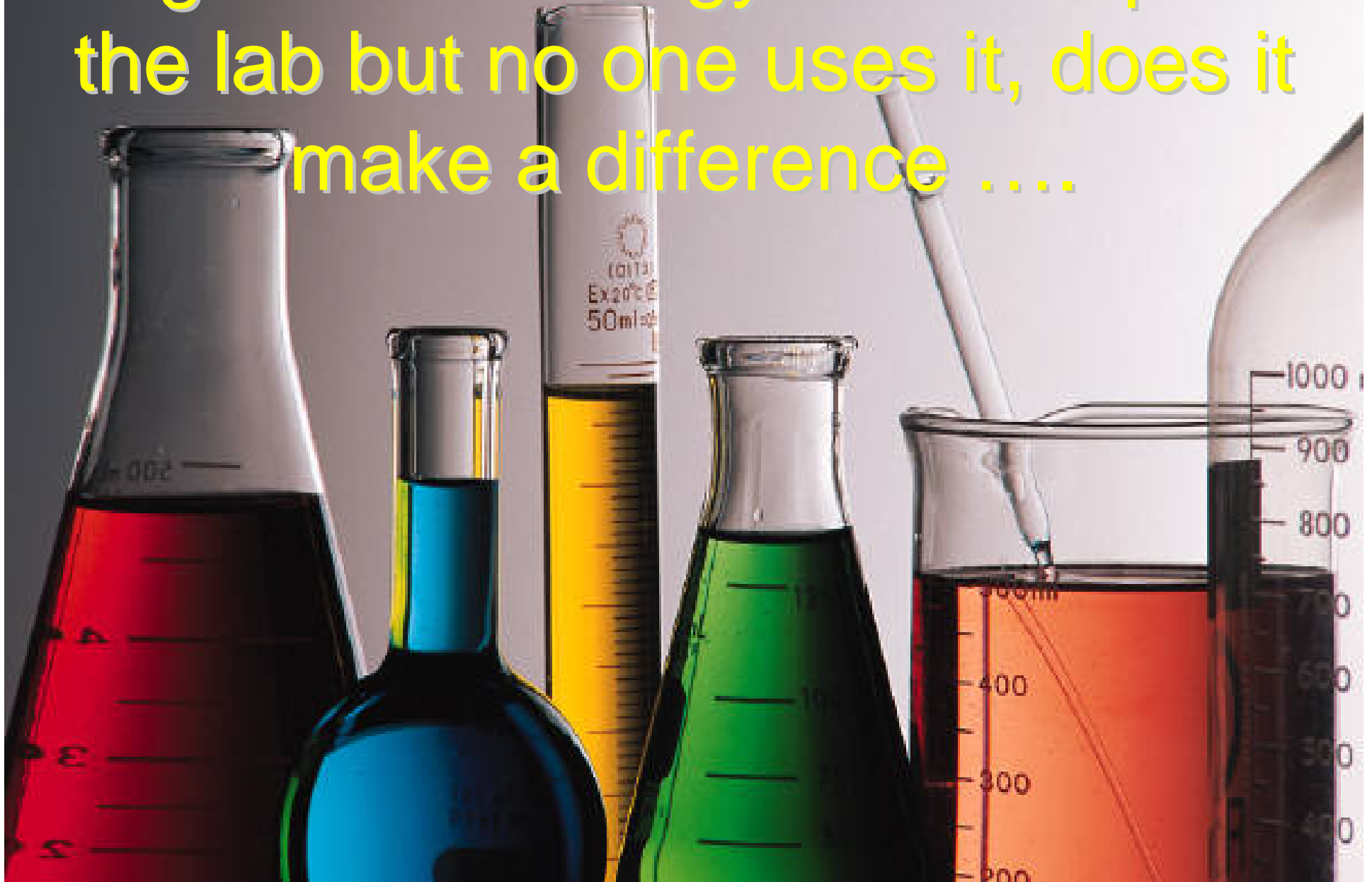


# *Transitioning S&T Programs*

**Defense Systems Acquisition Management Course  
November 20, 2003**

**Mr. Al Shaffer  
Director, Plans and Programs  
Office of Director, Defense Research and Engineering**

If a great technology is developed in the lab but no one uses it, does it make a difference ....



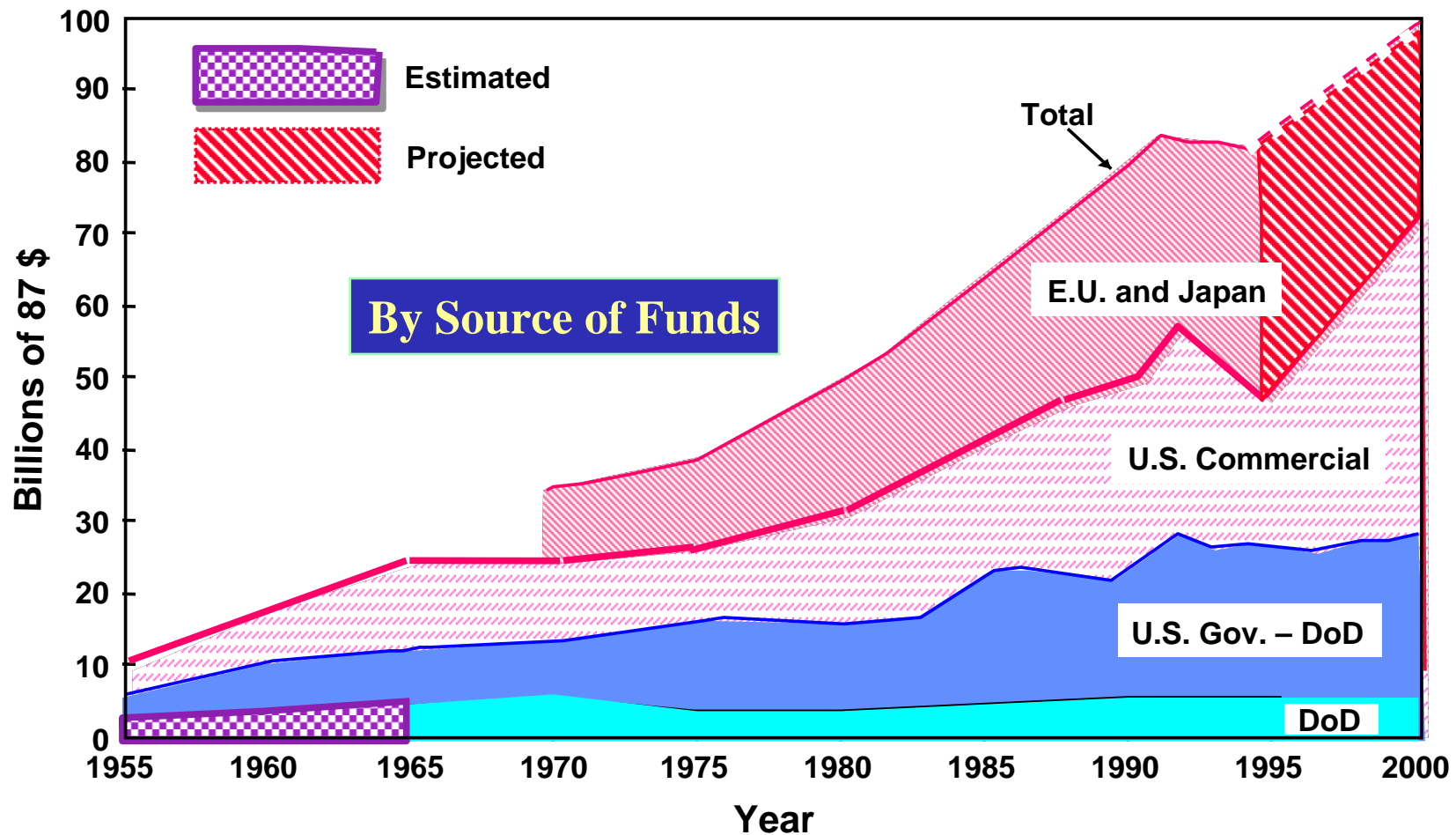
# Overview

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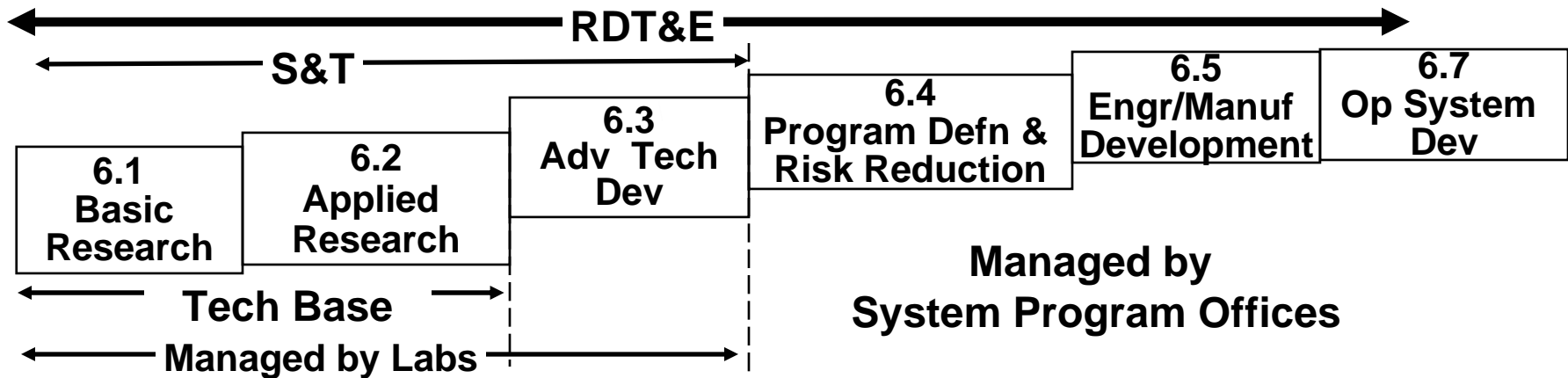
- **Why Focus on Transition Issues?**
- **Capabilities Based Acquisition**
- **DoD Best Practices**
  - Army
  - Navy
  - AF
- **Technology Transition Thrusts and Opportunities**
- **Industry Role**
- **Summary**

# U.S. and Worldwide Research Base Since WWII

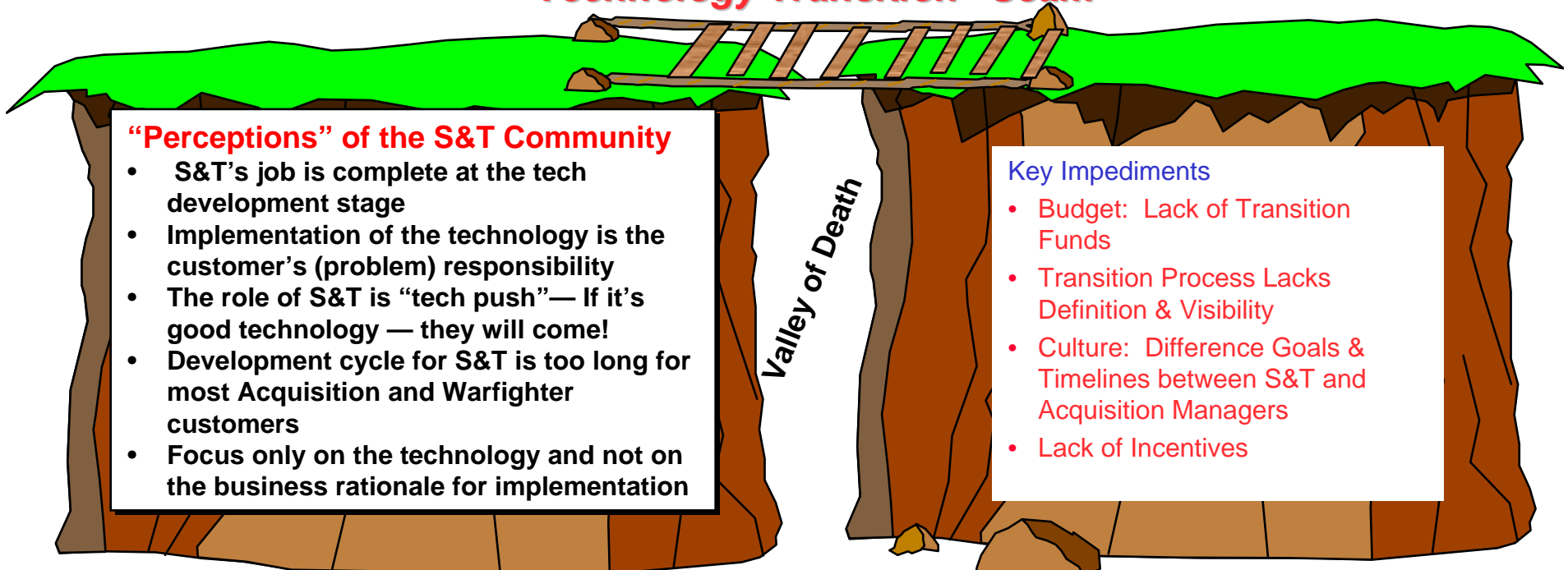


Source: Report of the Defense Science Board Task Force on the Technology Capabilities of Non-DoD Providers; June 2000; Data provided by the Organization for Economic Cooperation and Development & National Science Foundation

# Speeding Technology Transition “The Challenge”



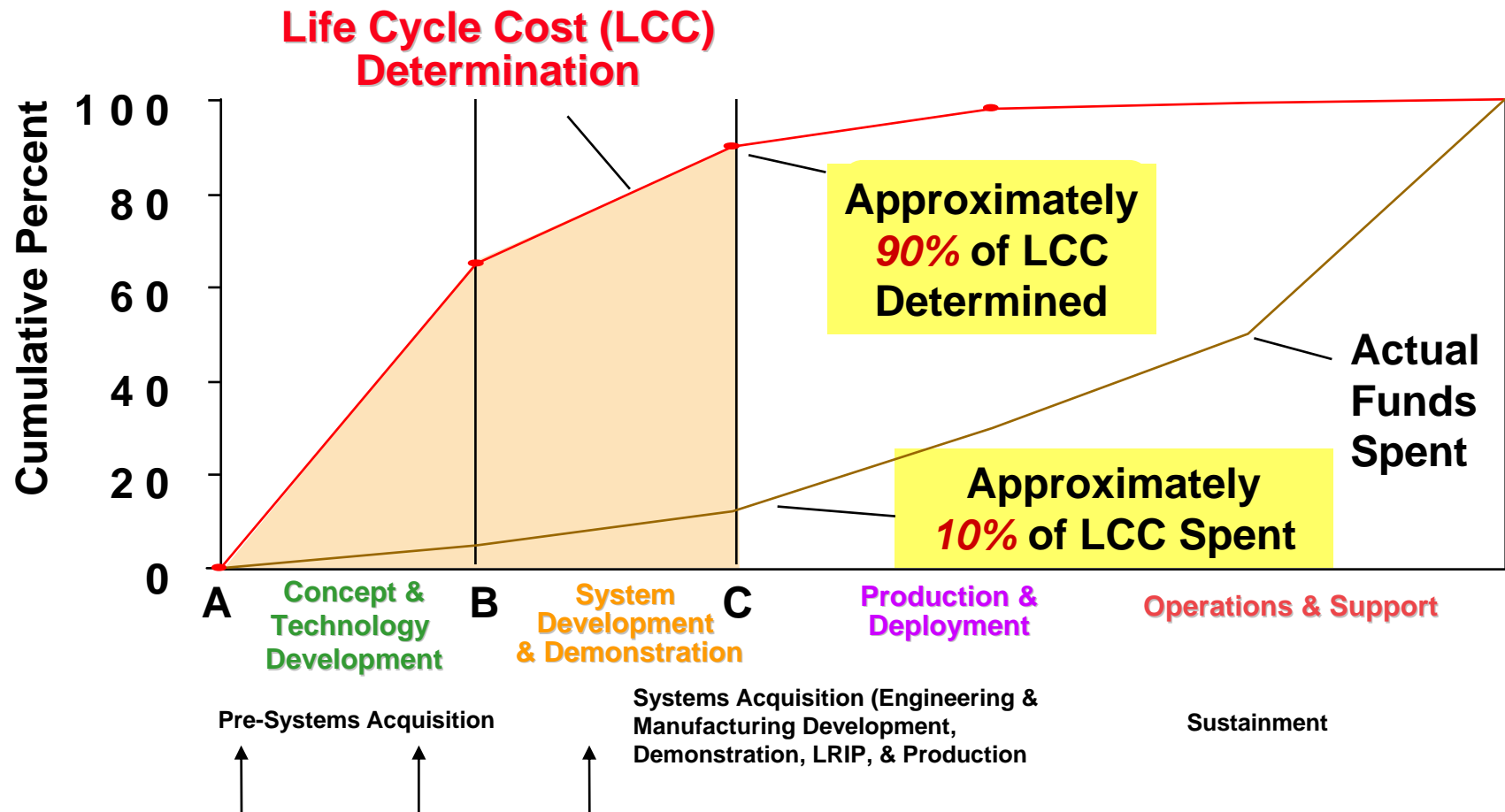
## Technology Transition “Seam”



# Why Transition in S&T?



Acquisition Community is Focused on Cost Reduction Throughout Life Cycle



**S&T: Technology Opportunities & User Needs**

# Dimensions to Technology Transition

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- Rate of Technology Change is Increasing
- Capabilities-based Planning Acquisition
- Excellence and Spiral Insertion Provides New Transition Model
- Availability of Commercial Technology Increasing; Need to use to Maximum Extent
- Industry's Role Changing
- Try Before Buy
- Fail Small, Fast, Early

***Multiple Dimensions Mean Multiple Solutions Needed***

# The Challenge: Technology Pace



“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 98	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**



# "Say Hello to the Freshmen"

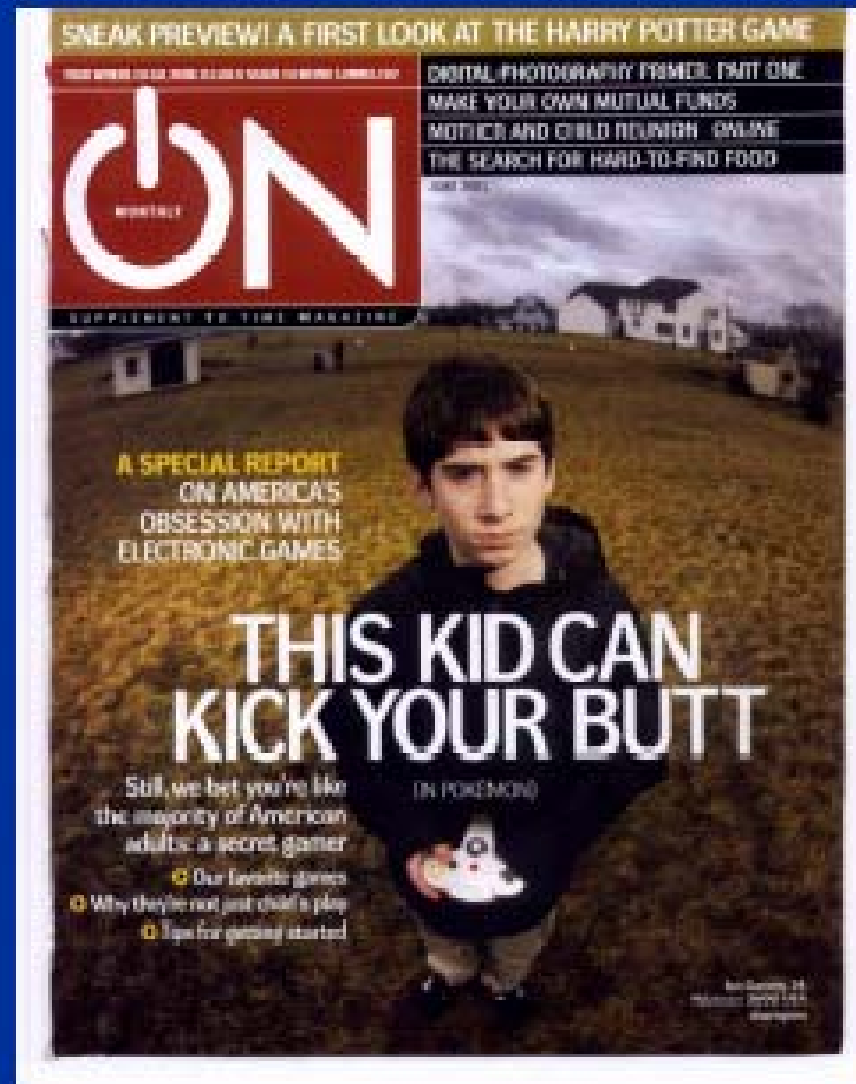
Class of 2004, most ***born in 1982***

- The Kennedy tragedy was a plane crash, not an assassination.
- We have always been able to reproduce DNA in the laboratory.
- There have always been automated teller machines.
- "Spam" and "cookies" are not necessarily foods.
- Joysticks are operated with the left thumb.



The average 18-year old has 1500 hrs in simulated environment

Over 2% of the Korean population subscribes to the MMP game *Lineage*.



*Continuous competitive pressure spurs innovation*

Source: Military-Related R&D an Academic's View by Peter Lee, Carnegie Mellon University, NDIA S&E Technology Conference, February 2002

# 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



- **DoDD 5000.1, The Defense Acquisition System**

- Rapid & Effective Transition From S&T to Products
- Emphasis on

- **DoDD 5000.2**

- Identify S&T
- Reduce Tech
- 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

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**

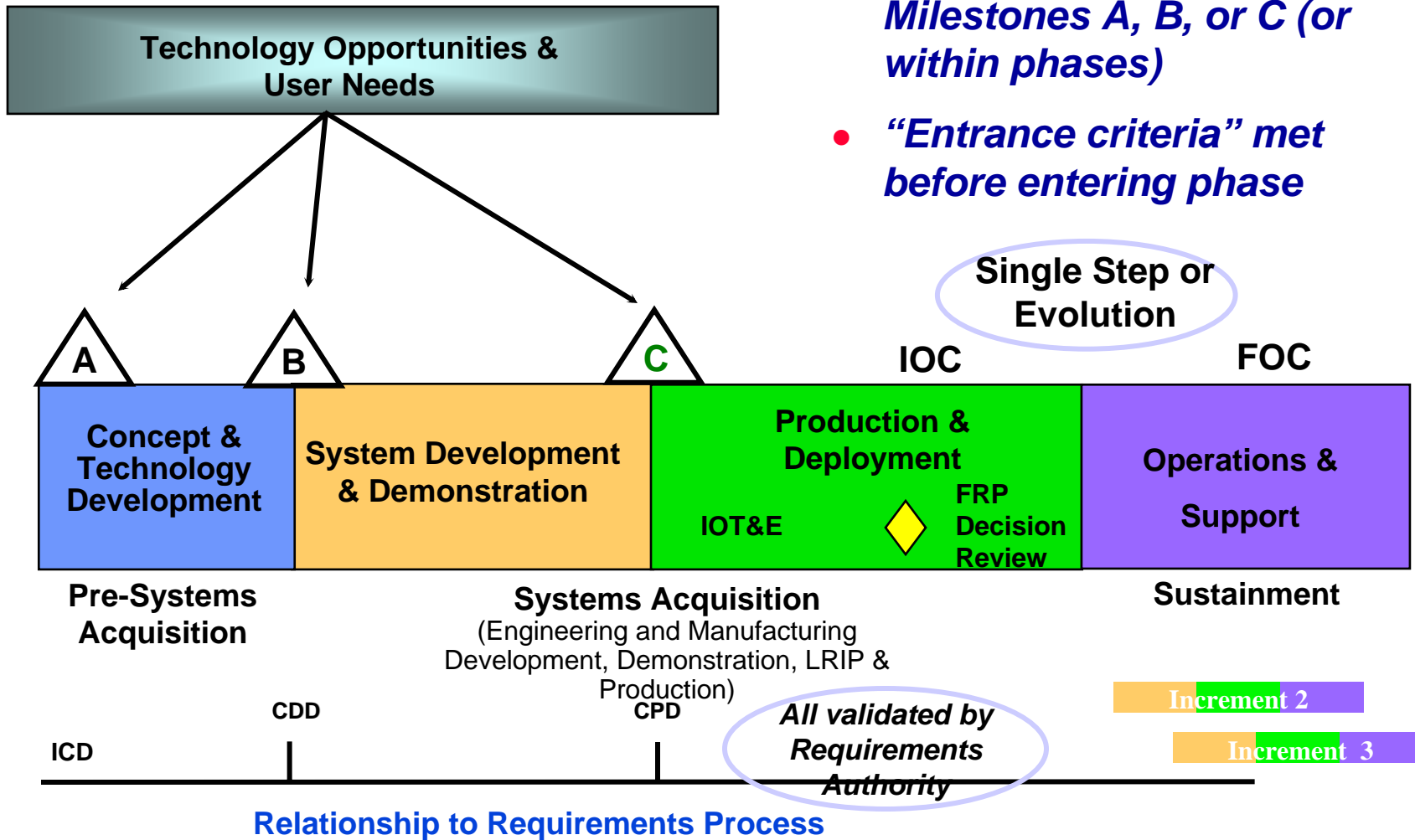
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- **DepSecDef Issued Interim Guidance (~40 Pages):**
  - **Reaffirmed the Importance of Technology Transition**
  - **Reaffirmed Evolutionary Acquisition**
  - **Reaffirmed Technology Development as a Continual Process**
  - **Directed Continuation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

**DEPSECDF Intent: Streamline Acquisition, with increased flexibility for technology insertion**

# The Acquisition Model



- *Process entry at Milestones A, B, or C (or within phases)*
- *“Entrance criteria” met before entering phase*

# Changes to Requirements Process

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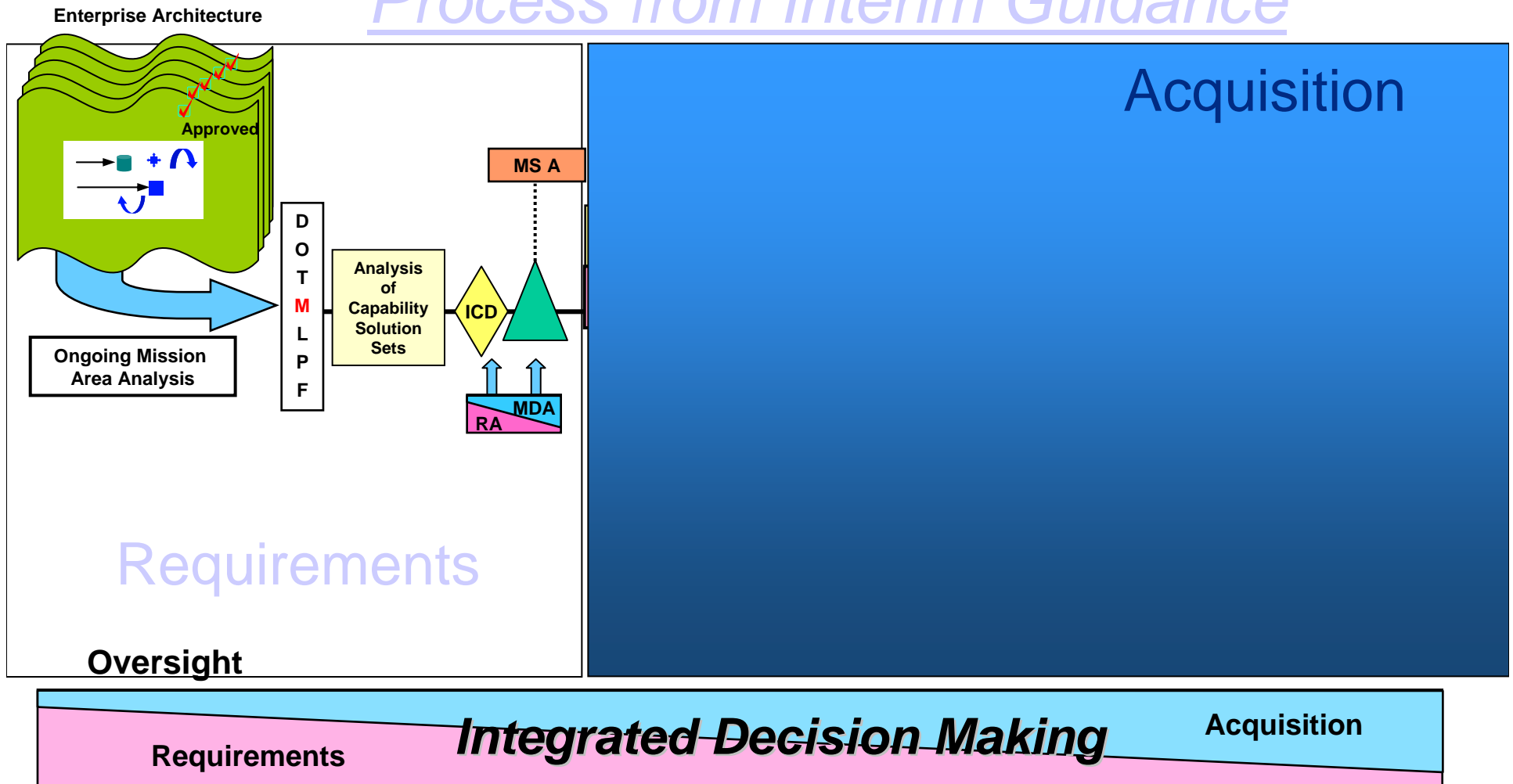


- Warfighter “owns” the Requirements Process
- Moving to Top-Down “Joint Capabilities Integration”
- Key Documents:
  - Joint Integrating Architecture (JIA) (Pre MS-A)
  - Initial Capabilities Document (ICD) (Pre MS-A)
  - Capability Development Document (CDD) (MS-B)
  - Capability Production Document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

# Capabilities-Based Requirements / Acquisition Process

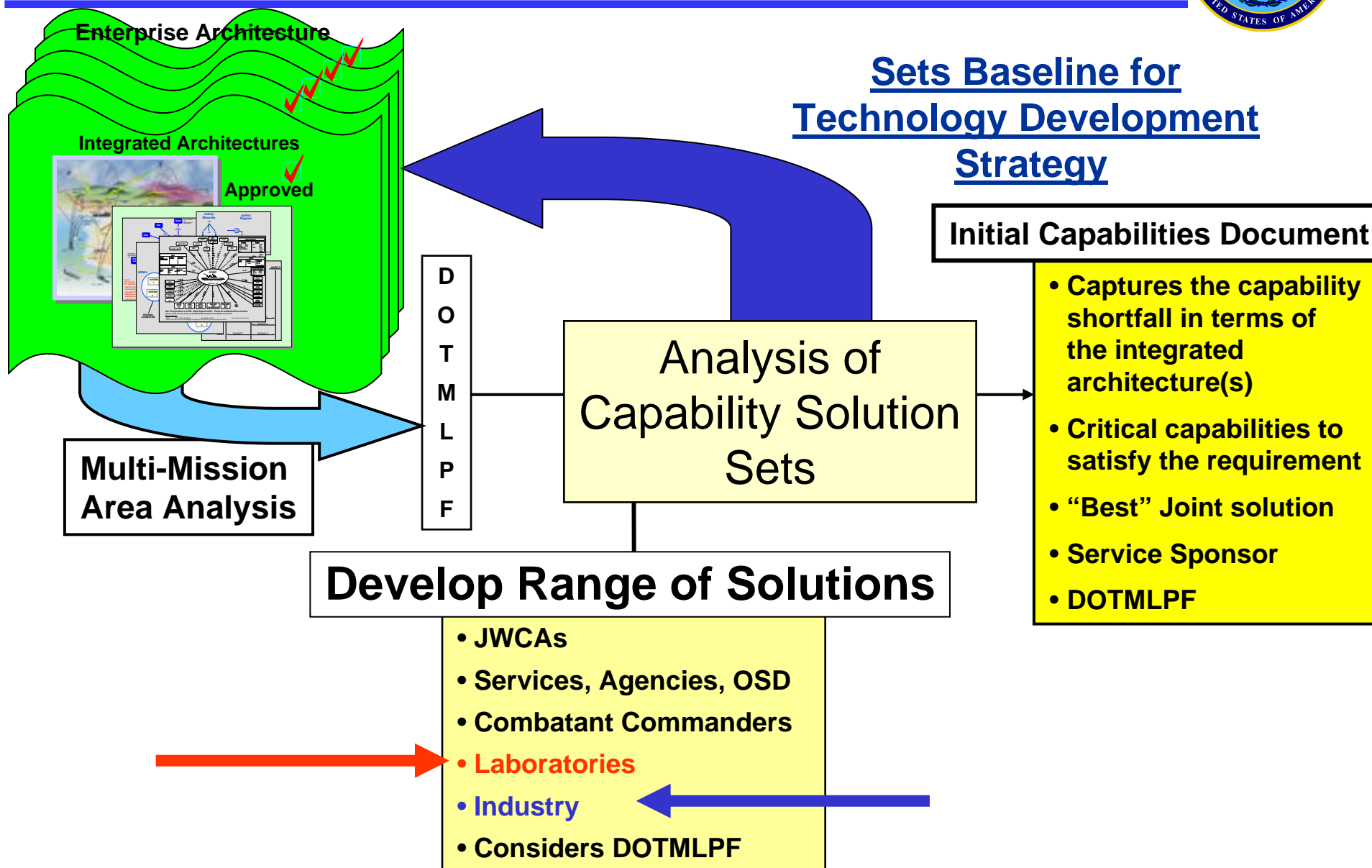


## Process from Interim Guidance

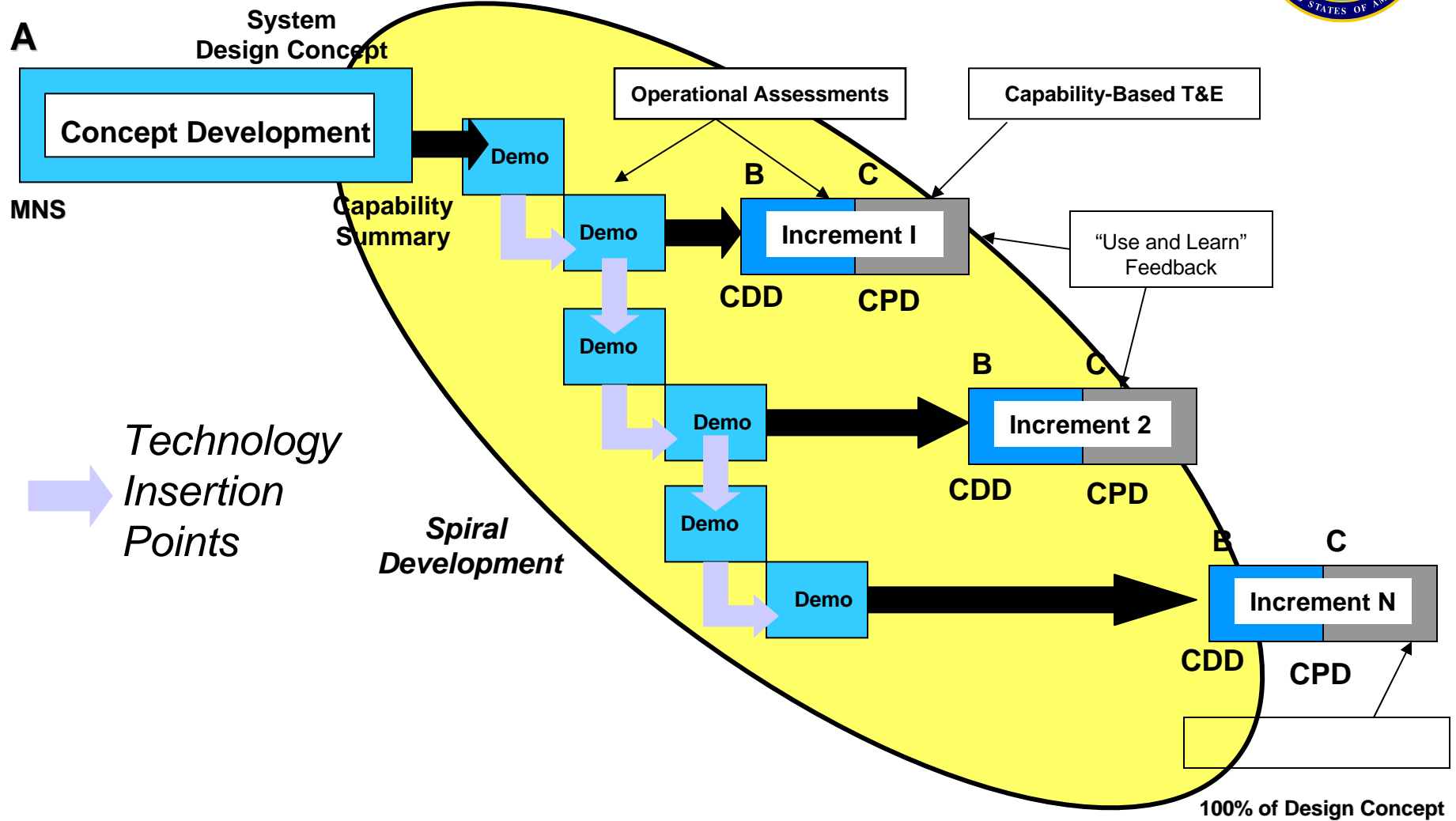




# Initial Requirements Process



# Evolutionary Acquisition and Spiral Development



**Every Spiral Should Enhance Capability**

# Best Practices

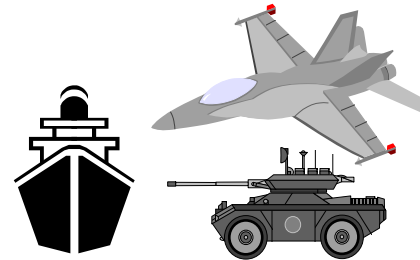


All Services are moving their acquisition processes

FROM

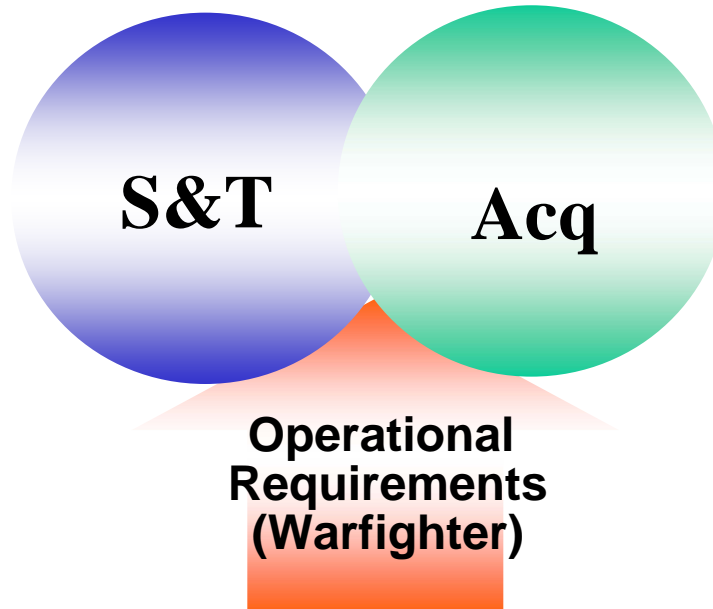


S&T



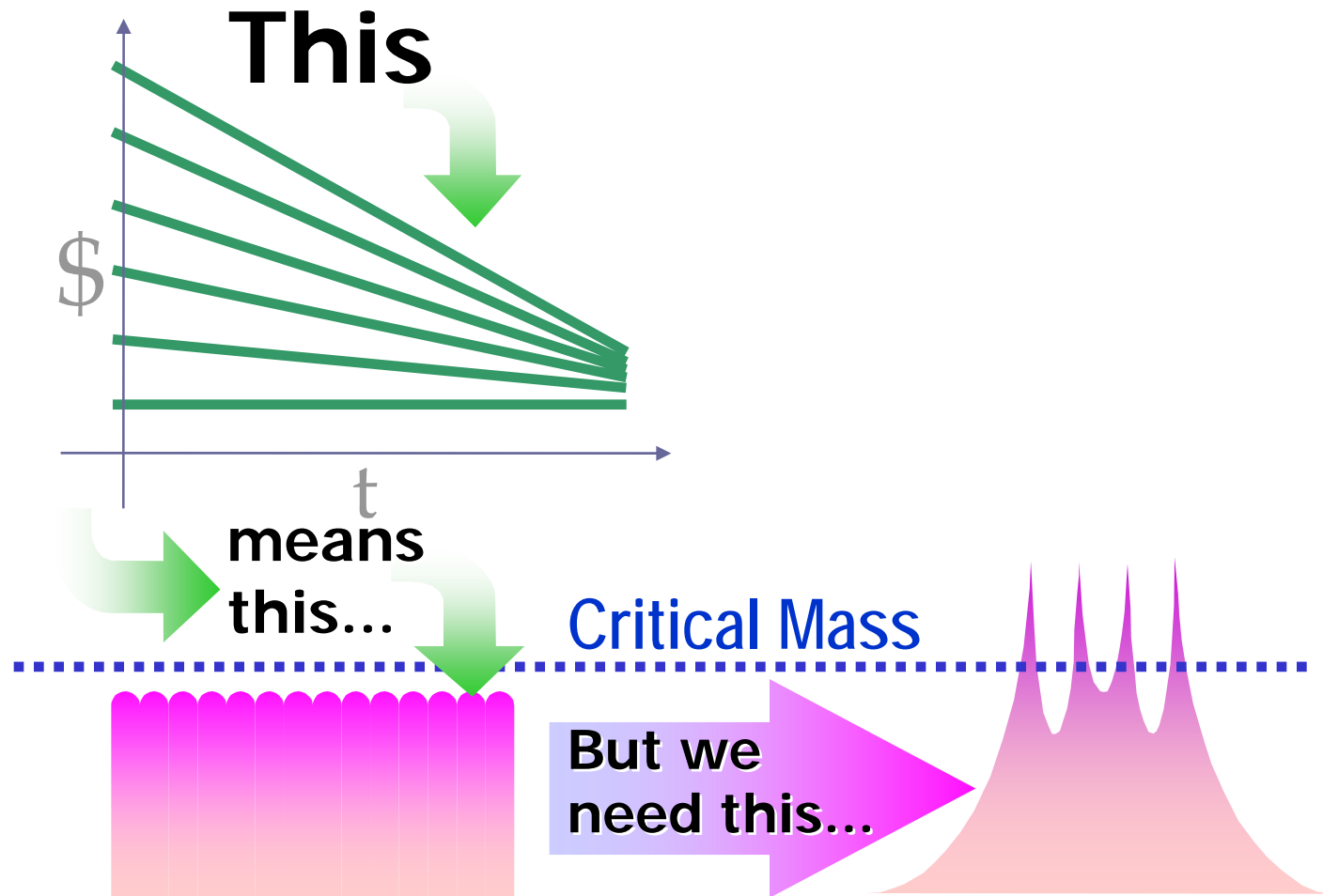
Acq

TO



*Good start:  
Need Logistics &  
Industry,*

# Navy Science & Technology (S&T) Problem / Solution



**Programs below critical mass were never ready for transition**

# 12 Future Naval Capabilities (FNCs)

---



- **Time Critical Strike**
- **Organic Mine Countermeasures (MCM)**
- **Autonomous Operations**
- **Littoral Anti-Submarine Warfare (ASW)**
- **Electric Warship and Combat Vehicle**
- **Littoral Combat/Power Projection**
- **Total Ownership Cost**
- **Missile Defense**
- **Capable Manpower**
- **Warfighter Protection**
- **Fleet Force Protection**
- **Knowledge Superiority and Assurance**

# Navy FNC IPT Approach

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- **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.

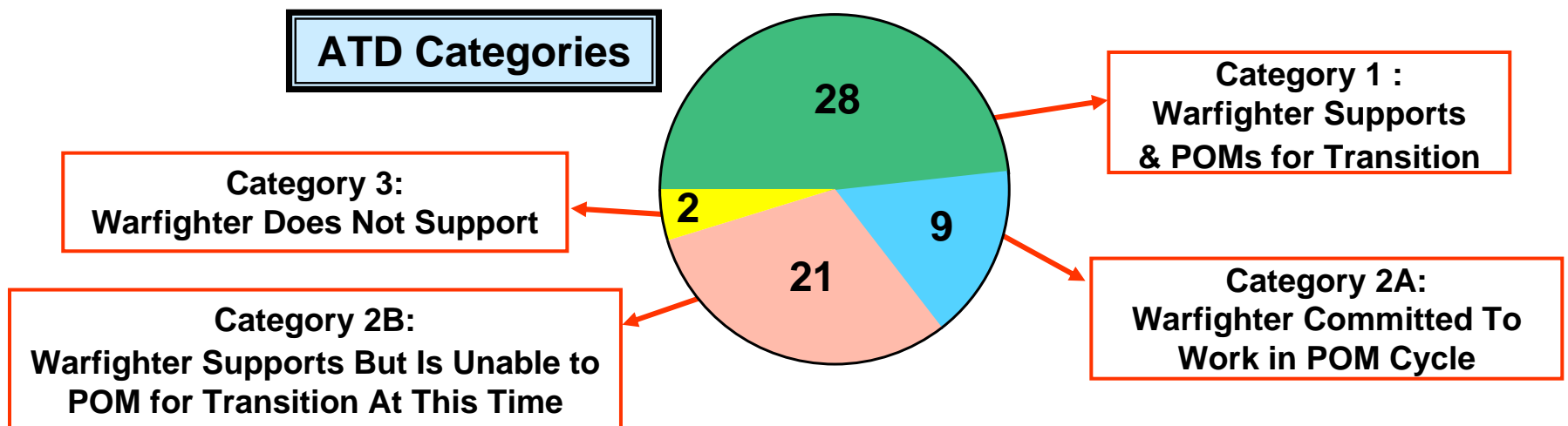
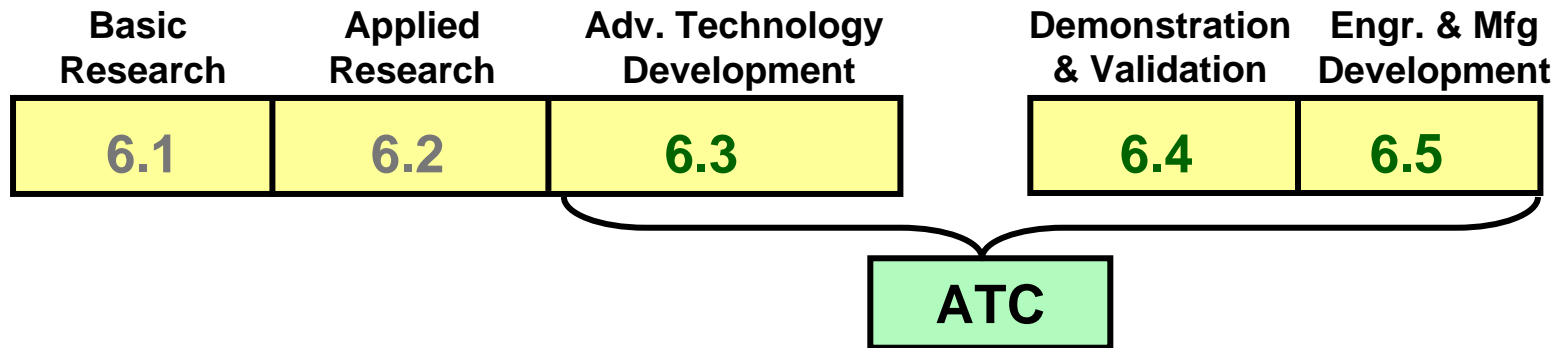
# Air Force Applied Technology Council (ATC)

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- Tech transition process should be a 3-legged stool
  - AFRL, Product Centers, and Users
- Recurring participation at senior levels is mandatory
  - MAJCOM/CVs, Product Center/CCs, and AFRL/CC
- Funding commitments for both S&T and transition program development are the key to technology transition
- Process Focuses on Advanced Technology Demonstration (ATD) Programs
- Developing an Air Force Instruction to standardize procedure

# Air Force ATC





# Technology Readiness Levels (TRLs) Background

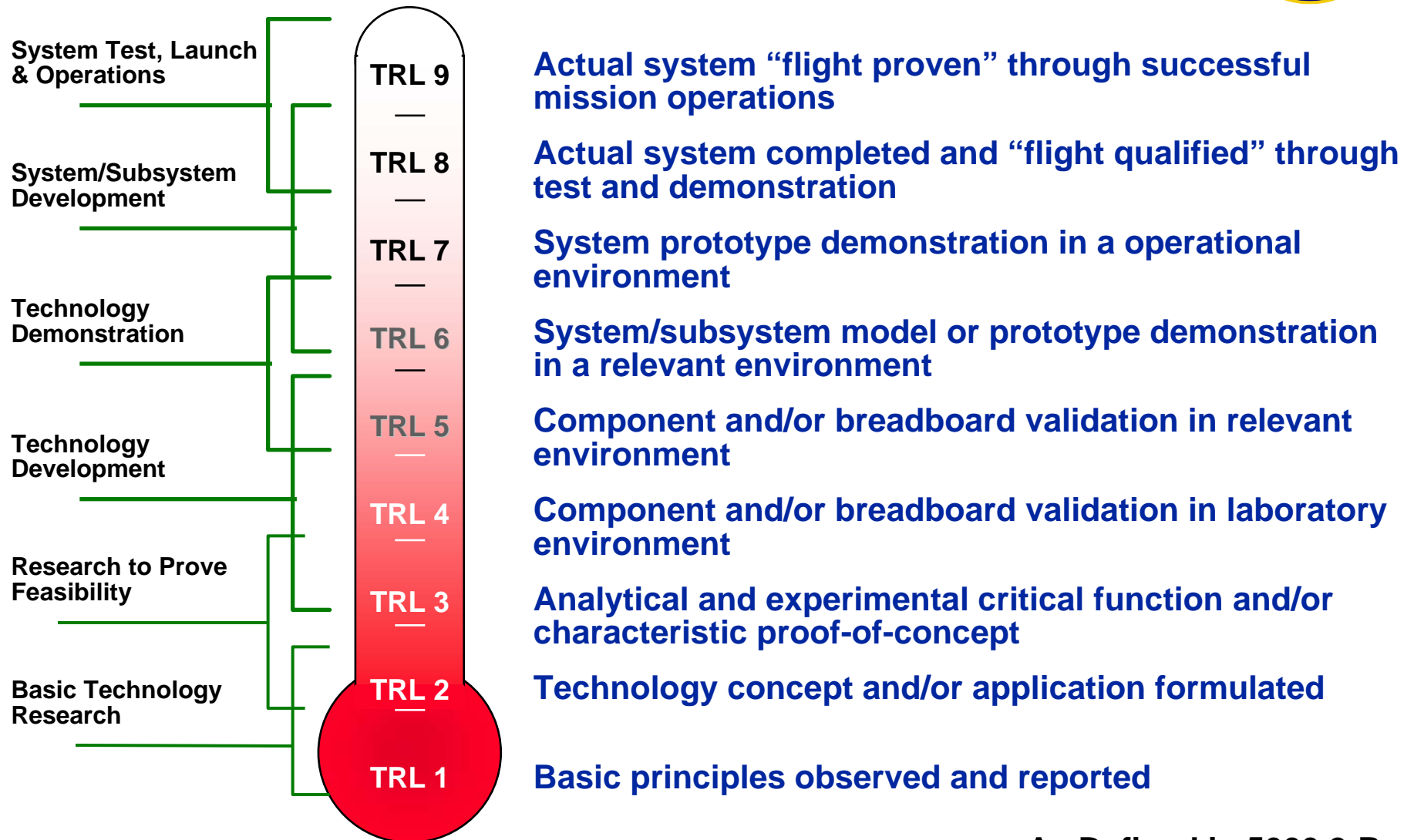
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- **GAO report, “ Best Practices- Better Management of Technology Development Can Improve Weapons System Outcomes”**
- **Inclusion in DoD 5000-Series Acquisition Documents**
- **Defense S&T Advisory Group Recommended Establishment of a TRL IPT**
  - **Develop a framework and guidelines for consistent implementation**

***Consensus: Proper Use of TRLs Provides Effective Acquisition Assessment Tool***

# Measuring Technology Maturity Technology Readiness Levels



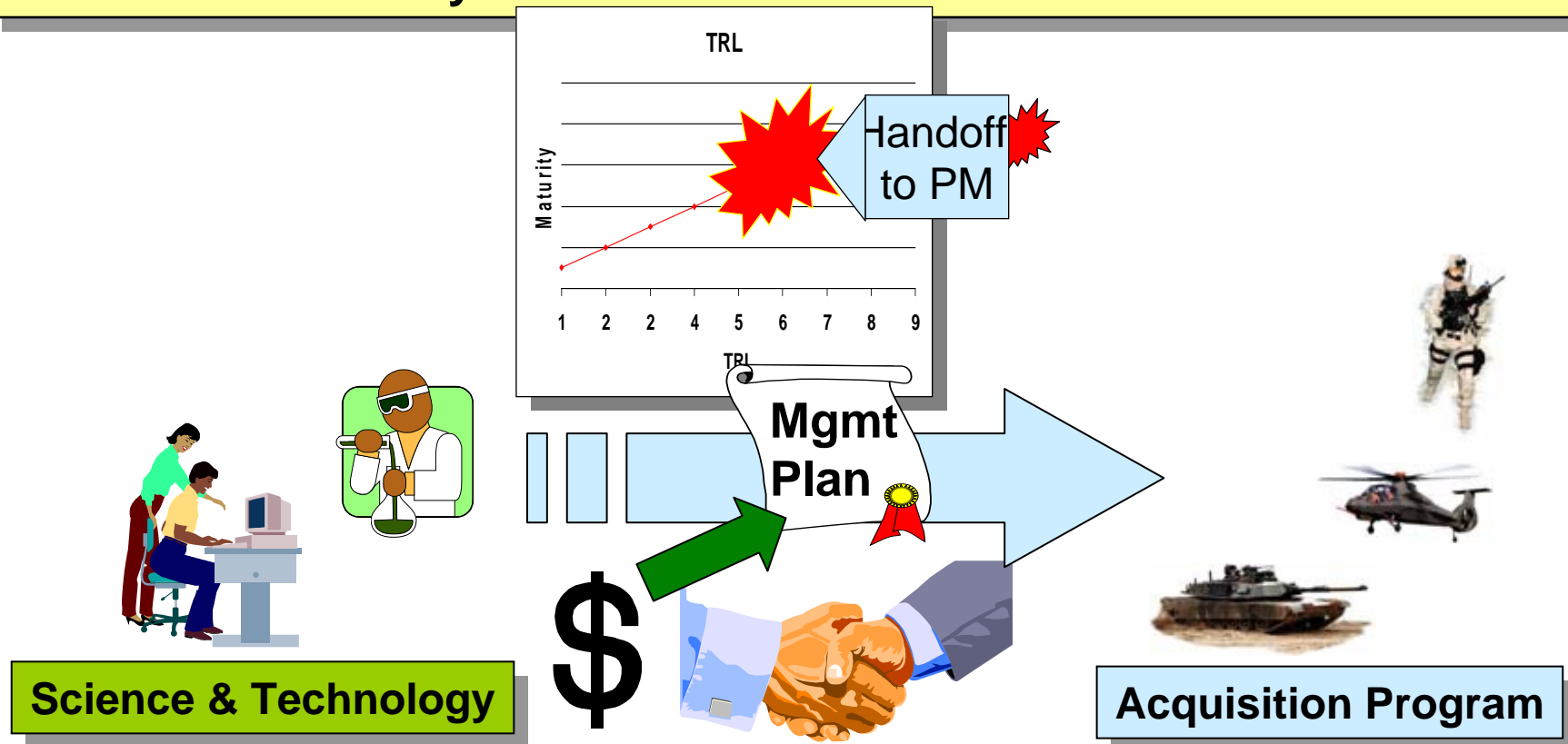
As Defined in 5000.2-R

# Army Transition Plans



## Develop directive from senior stakeholders requiring:

- Transition plans synchronized/supported in S&T & PM budgets
- Achievement of key **Technology Readiness Levels** as an exit criteria
- Use of affordability as an exit criteria

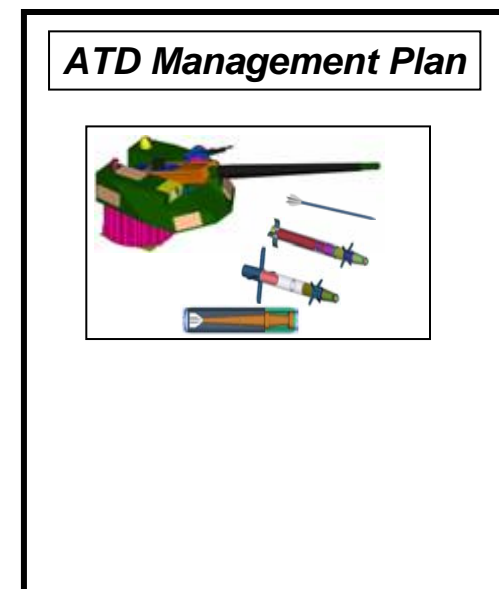


# ***Army ATD Management Plans***

## ***Accelerating Transition***

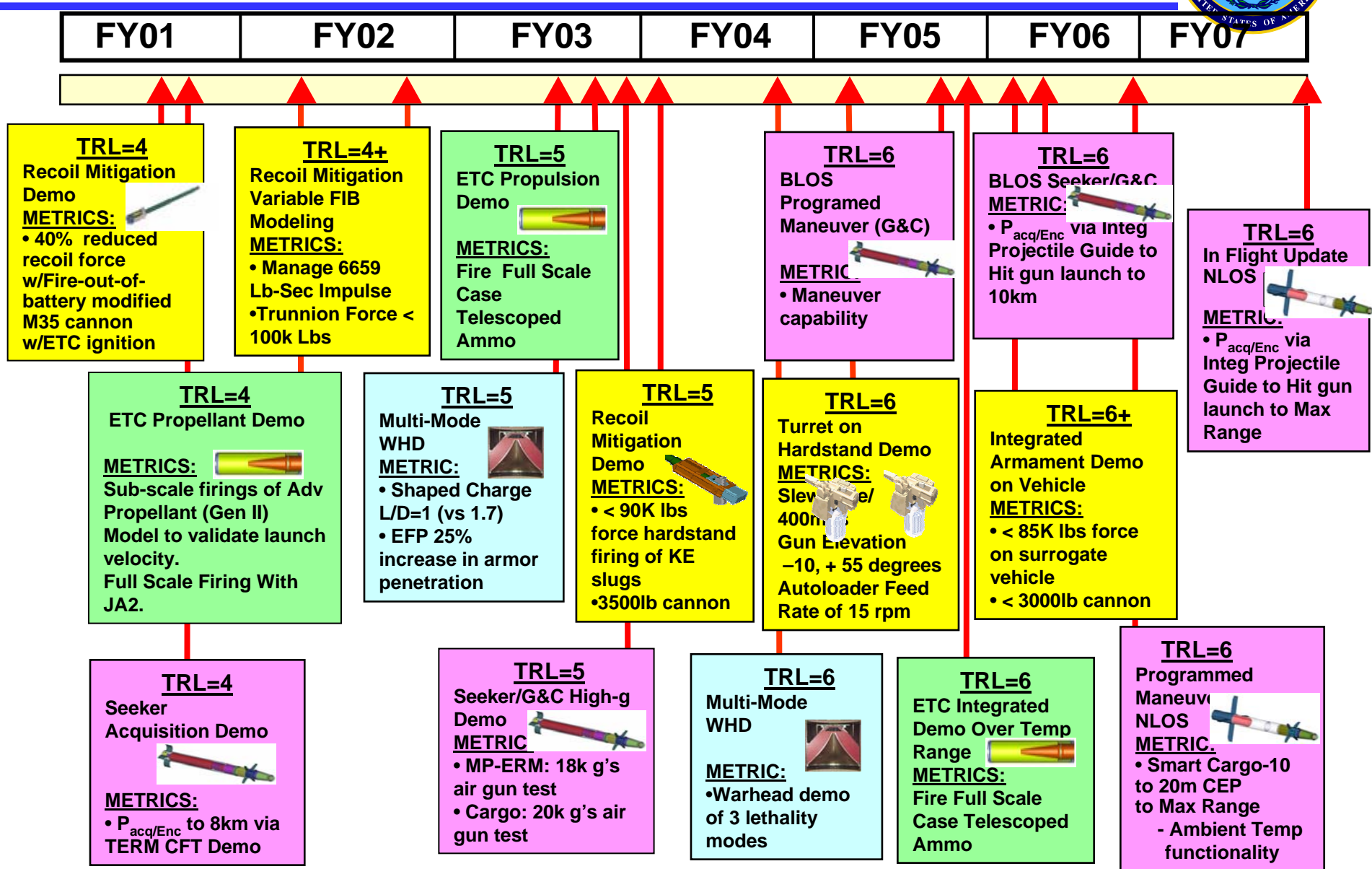


- ***Coordinated and Documented partnership between Warfighting Customer, Technology Developer and Acquisition Buyer***
- ***Proposed by Technologists and Tacticians***
- ***Approved by GO/SES***
  - ***HQ TRADOC Combat Developer***
  - ***HQDA Chief Scientist***
  - ***HQDA, G8 Force Development***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



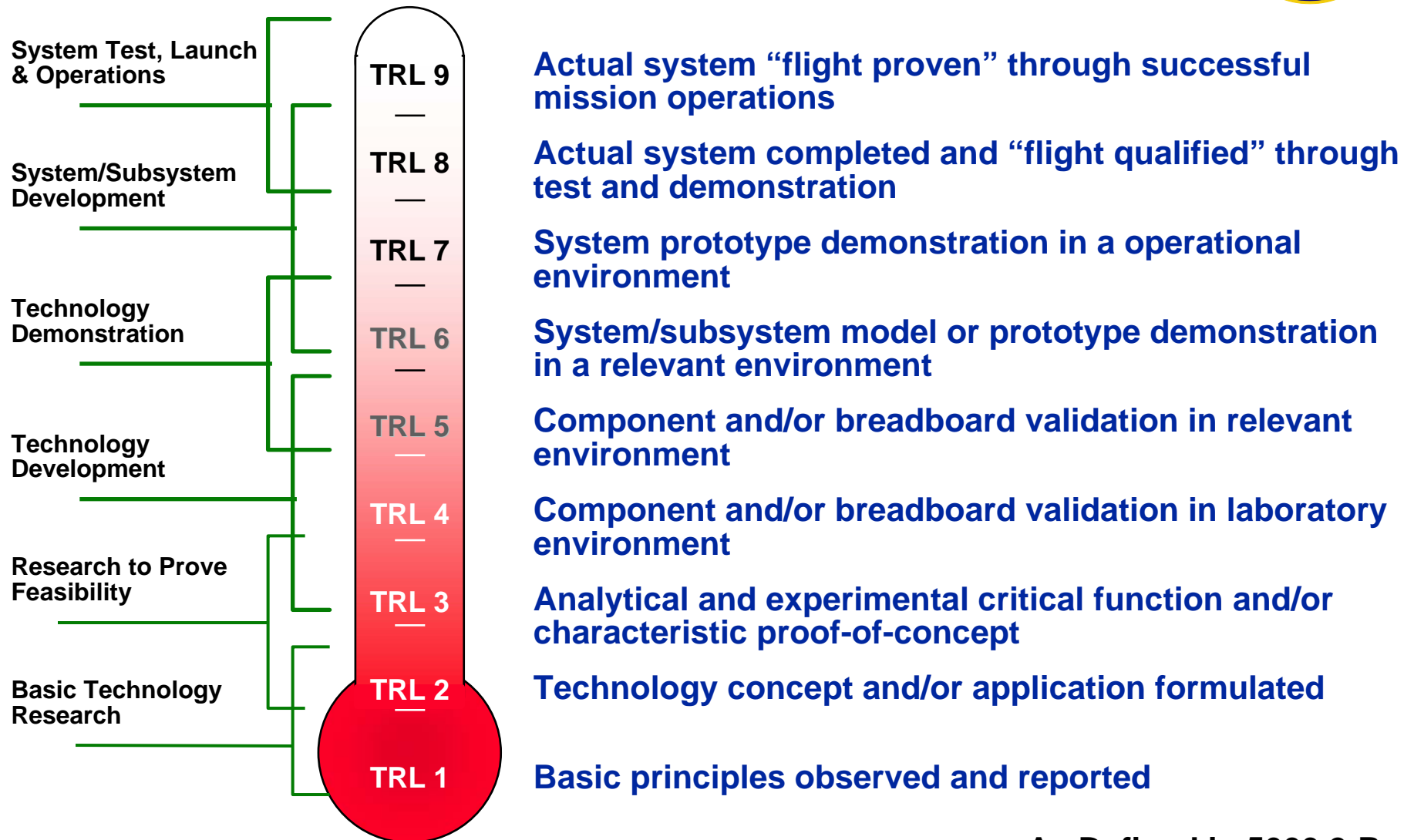
***Commitments to Transition needed Technology as Fast as Possible***

# FCS Multi-Role Armament & Ammunition ATD (III.WP.1999.01)



# Measuring Technology Maturity

## Technology Readiness Levels



As Defined in 5000.2-R

# Transition Thrusts

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## SYSTEM / COMPONENT DEVELOPMENT

- Quick Reaction Projects (less than 12 months)
- Advanced Concept Technology Demonstration (1-5 years)

## SYSTEM ACQUISITION

- Warfighter Rapid Acquisition Fund
- Spiral Acquisition

## CONCEPT EXPLORATION

- Joint Experimentation
- Modeling & Simulation

## COMMERCIAL OPPORTUNITIES

- Defense Acquisition Challenge
- Venture Capital Fund

# SPEED OF TECHNOLOGY CHANGE

---



QRSP was established in FY 03 at \$25.4M;

FY04 Budget Request: \$75M

FY 2003 Congressional language directed 3 elements to accelerate technology transition

- **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



# Objective

## Speed Rapid Technology Development



***Technology Maturity***

**Quick Reaction Fund**

**Technology Transition Initiative**

**Defense Acquisition Challenge**

*Idea/  
Technology  
Opportunity*

*Transition  
To Planned/Fielded  
System*

*Improve  
Subsystem →  
Program of Record*

***Three Complementary Projects to Develop  
Technology at Different Maturity Levels***

# QUICK REACTION FUND PROGRAM DESCRIPTION

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- **Initiate high priority or high leverage technology efforts during the execution year**
- **Provide opportunity to execute within technology cycle in rapidly maturing technology**
- **Provide flexibility to respond to emergent DoD issues and address surprises and needs in real time**
  - **Technology matures in less than a year in some areas**
  - **Responds to technology opportunities in major acquisition programs**
- **Address cycle time discontinuity between DoD-programming and execution for rapidly evolving civil sectors**

# Examples of Quick Reaction Efforts



## *Thermobaric Hellfire Enhanced Capability*

Chemistry to the Field in one year - Increased Blast Lethality in Multi-Room Structures

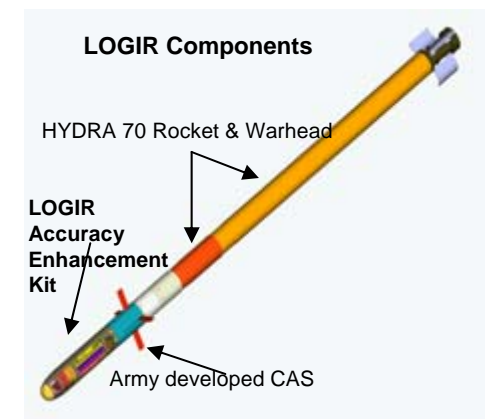
- Rapid Reaction to War Fighter Need; start Jan 02
- Form/Fit/Function Drop-In Warhead Section
- Unique Enhanced Explosive Formulation (metal augmented charge)
- Retains Effectiveness in Remaining Hellfire Blast-Frag Target Set
- Available for possible global war on terrorism



## *Low-Cost Imaging Rocket (LOGIR)*

Making 2.75" Rocket Smart – Fire and Forget

- Rapid reaction to integrate precision guidance with developing weapon; start May 02
- Improve ability to kill moving and fixed targets
- Reduce warfighter exposure while increasing success
- Increase lethality while reducing collateral damage
- First flight Jan 03; Complete System ~4QFY03



# Examples of Quick Reaction Efforts - Thermobaric Weapons



## Rapid Technology Transition



- A “Quick Reaction” type development, enabled by base S&T program and ACTD Framework
- Chronology: Program Approved 21 Sept
  - **Small Quantity Lab Testing – Oct 01**
  - **Full Up Static Test – Nov 17**
  - **Flight Tested - Dec 14**
- Funding: Approximately \$6M

*Theory* → *Weapon*  
**3 months**

# Defense Acquisition Challenge Program Program Description

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- **Authorized by Title 10, USC, Sec 2395b, the Defense Acquisition Challenge Program (DACP) provides increased opportunities for the introduction of innovative and cost-saving technologies into DoD acquisition programs.**

# Defense Acquisition Challenge Program Schedule

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- FY 2003/2004 Program Process/Schedule
  - Release of Broad Area Announcement – 15 March
  - Receipt of draft vendor proposals – 1 April
  - Receipt of final vendor proposals – 2 June
  - OSD level Review Panel – 3-5 June
  - Funding of selected FY 2003 DACP projects – 1 August
- FY 2005/2007 Program Process/Schedule
  - Biannual solicitation, appraisal, selection and execution process continued

# DoD Technology Transition Programs



***Dual Use Science & Technology  
DUS&T***

***Small Business Innovative Research - SBIR***

***Manufacturing Technology - ManTech***

***Title III / Defense Production Act***

***Independent Research & Development \****



# Dual Use Science & Technology (DUS&T)

***Objective - Partner with Industry to Jointly Fund the Development of Dual Use Technologies Needed to Maintain DoD's Technological Superiority on the Battlefield & by Industry to Remain Competitive in the Marketplace***

## Basic Tenets:

- Cost sharing between the Military Services & Industry (Traditional and Non-Traditional)
- Use of “Other Transactions” in lieu of standard contracting to attract commercial firms
- Formation of partnerships with industry to develop dual use technologies

***Example: Active Brake System for the HMMWV & Commercial Trucks***





# Manufacturing Technology (ManTech)



**Objective:** Improve Affordability of DoD Systems by Investing in New & Improved Manufacturing Processes & Equipment Across The Weapon System Life Cycle

## **Program Attributes**

- Improve Cycle Time & Process Capabilities
- Demonstrate Key Information Technologies
- Adopt Best Commercial Practices for Military Applications

## **Example: Optics Manufacturing**



1990



- Optics Processing Was Labor Intensive
  - Artisan Based
- Industry Was Moving “Off Shore”



2000

- Processing uses CNC Machines
- U.S. has become a world leader
- 5x grinding + 4x better surface = 4x faster polishing

# Defense Production Act / Title III



***Purpose: Create, expand, modernize, and maintain domestic production capacity for essential items and industrial resources needed for national defense***

## ***Incentives to Industry:***

- DoD shares cost of capital investments
- Process improvements
- Material qualification
- Purchase commitments

## ***Example: Gallium Arsenide Wafers***

- Wafer prices reduced by 40%
- U.S. producers global market share increased from 25% to 60%
- Systems using GaAs - Cheaper, more reliable, and more capable



# Small Business Innovation Research (SBIR)



- Stimulates Technological Innovation
- Increases Small Business Participation in Federally Funded R&D
- Encourages Commercialization of Technology

## *FY00 Funding*

- Federal Agencies: \$1.1B
- DoD: \$564M
- DUSD(S&T): \$26M
  - Cognitive Readiness
  - Advanced Distributed Learning
  - Smart Sensor Web
  - Biomedical Programs

## *Program Phases*

- **Phase I:** Six months/\$100,000 (feasibility study)
- **Phase II:** Two years/\$750,000 (prototype development)
- **Phase III:** Commercialize for military & private sector markets

- **Example: Acoustic Mouthpiece Using Terfenol-D**
  - Low Voltage Transducer Embedded Inside a SCUBA Diver's Mouthpiece
  - Allows Diver to Hear Through Dental Sound Conduction
  - Capability Will Be Available for Special Forces Divers Without Full Face Masks



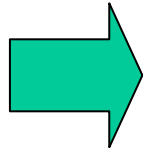
# Independent Research & Development (IR&D)



## *DoD/Industry Interaction*

### DoD

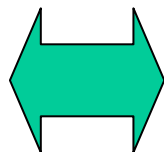
Provide information on DoD's R&D activities & plans, mission needs, & operational requirements



### Industry

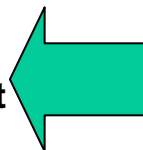
Plan, fund, and conduct IR&D

Review IR&D activities and provide feedback to contractors



Provide technical information about IR&D

Review IR&D database to identify IR&D of interest



Provide IR&D project descriptions

## *Example: Army After Next*



- Program efforts in areas of battery technology, hybrid electric vehicle programs, and energy storage technologies
- Estimate savings: \$50M

# Bottom Line: Warfighter Confidence

---



*Right Materiel, Right Place,  
Right Time, at the Right Cost -*

***All The Time***



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**BACK UP**

# Technology Transition Initiative Program Description

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- **Addresses the gap between the time a technology is demonstrated and the time it gets fielded**
- **Established by section 242 of the FY 2003 Defense Authorization Act**
- **Establishes a Technology Transition Manager**
- **Establishes a Technology Transition Council to provide advice and assistance to the Technology Transition Manager.**
  - **Science and Technology Executives from each military department and each Defense Agency**
  - **Acquisition Executives from each military department**
  - **Members of the Joint Requirements Oversight Council**

# Complementary Technology Transition Thrusts



	Time	Deliverable	Cost	Complexity
QRSP - <i>Anthrax Kill Curves</i> - <i>Thermobaric</i>	Less than 12 months	Components to single or mini systems	\$5-10M	Minimal
ACTD - <i>Predator UAV</i>	1-5 years	Prototype and Conops	\$10-50M	Medium
Acquisition Program - <i>JSF</i>	4-20 years	Major Systems	\$1B +	Large

## Ancillary Programs

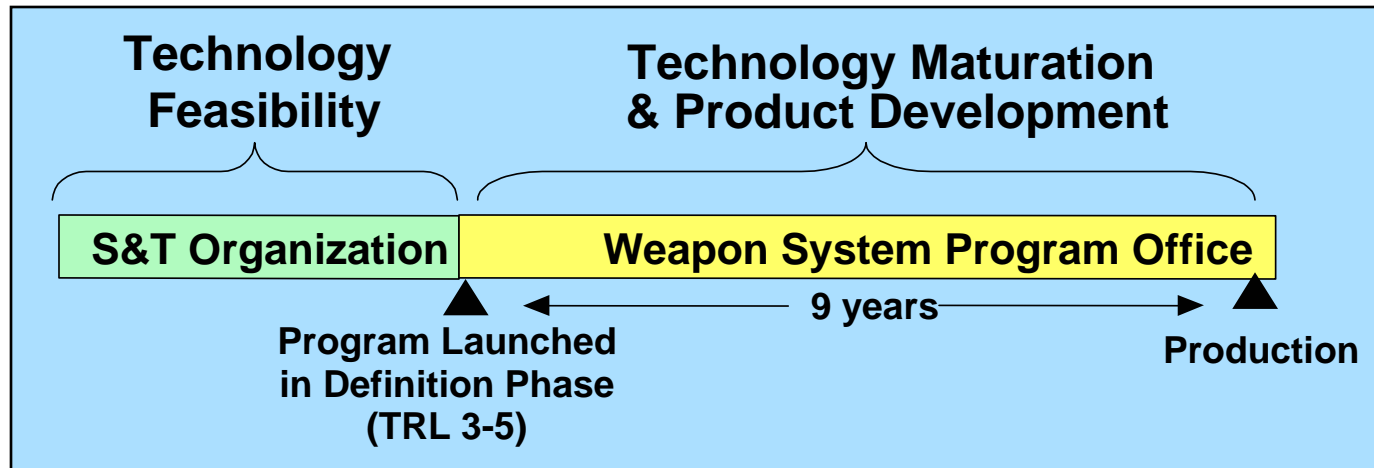
WRAP	Up to 2 Years	Spiral Insertion Component/ System, into formal ACQ	Undef	Requires MAJCOM follow on \$
Joint Experimentation	2 years between	CONOPS	N/A	N/A
Venture Capital Fund	Indet.	Commercial Technology	N/A	N/A
Industrial <i>ManTech, DUS&amp;T, SBIR, Title III</i>	6 mon to 3 yrs	Enabling capabilities	\$1-20M	Medium



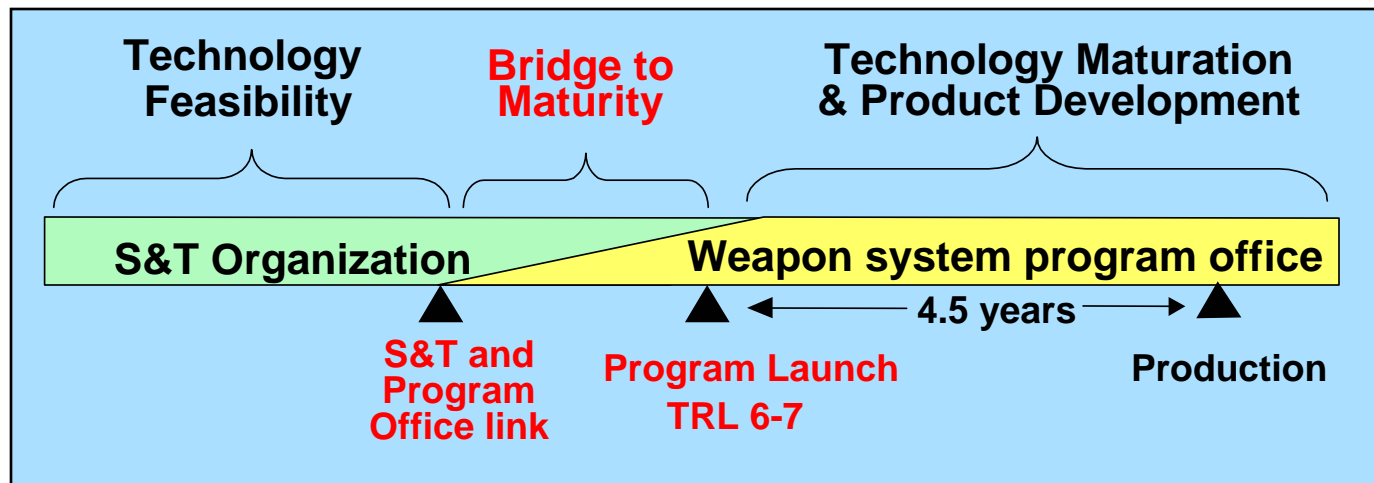
# IPPD in S&T



**Traditional Approach**

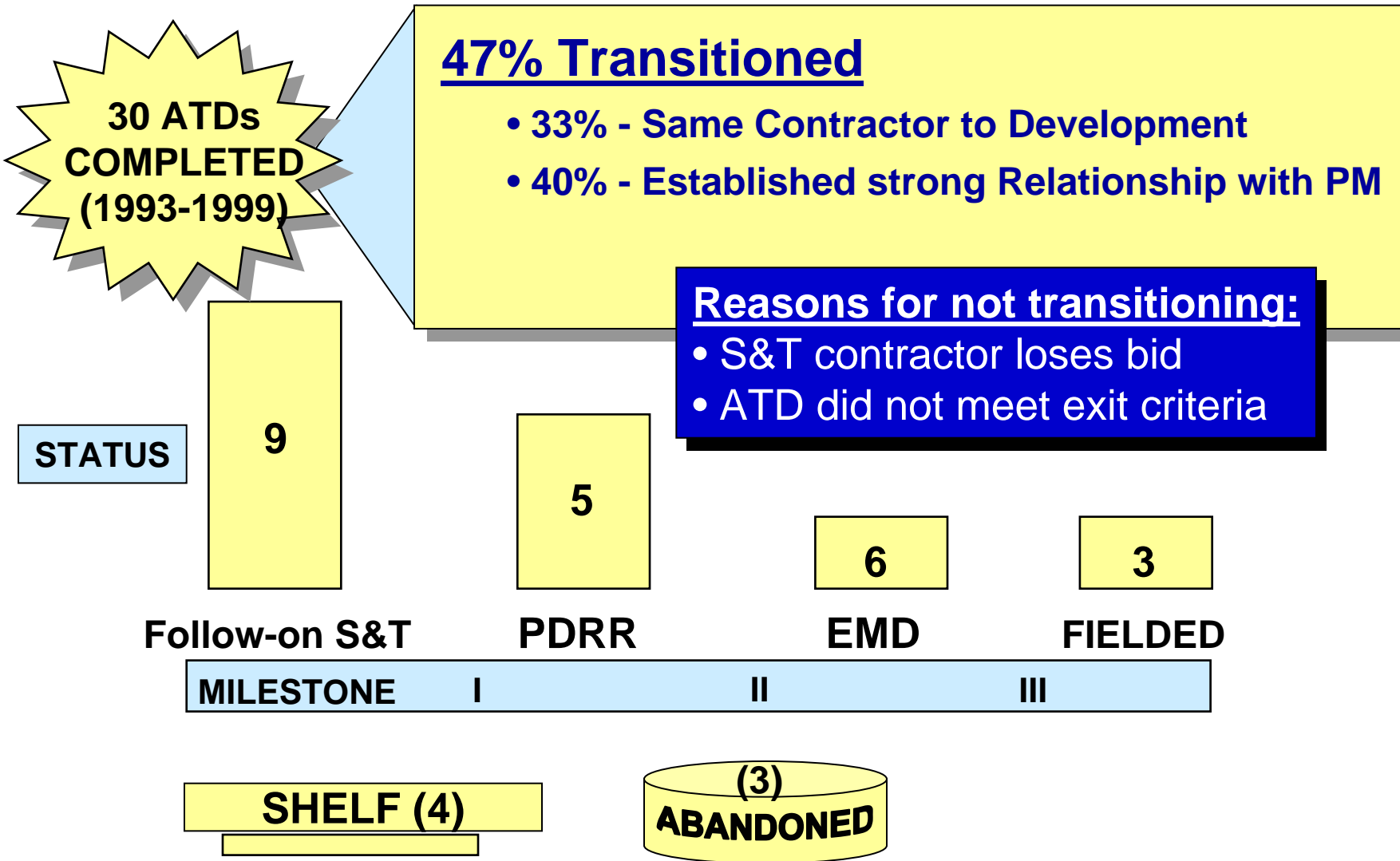


**Best Practices: DoD**



Source: BEST PRACTICES: Better Management of Technology Development Can Improve Weapon System Outcomes (GAO/NSIAD-99-162) July 1999

# Army Technology Transition



# Technology Transition Initiative Highlights

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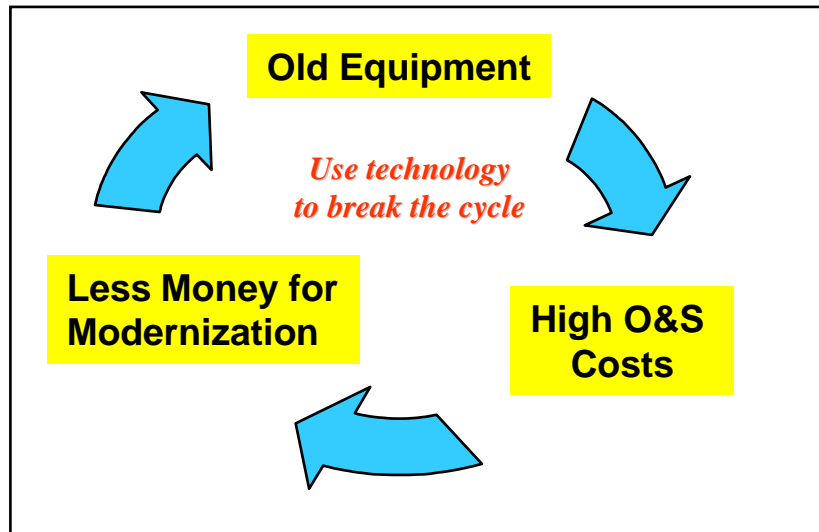


- **First year provides a “proof of concept” model, allowing DoD to establish appropriate guidelines for implementation.**
  - **Process must provide an incentive to program managers to accept projects into program’s of record.**
- **Technology transition council will act as a blue ribbon panel. Review process ensures high visibility for joint projects of greatest potential for successful transition to joint capabilities.**
- **Joint Staff & JFCOM reflect voice of Unified Combatant Commanders for the transition of Joint Capabilities.**

# Commercial Operations & Support Savings Initiative (COSSI)



## The Problem



### **Purpose:**

- Provide funding for the nonrecurring engineering, testing, & qualification needed to insert a commercial technology into a legacy system
- Reduce operations and support costs

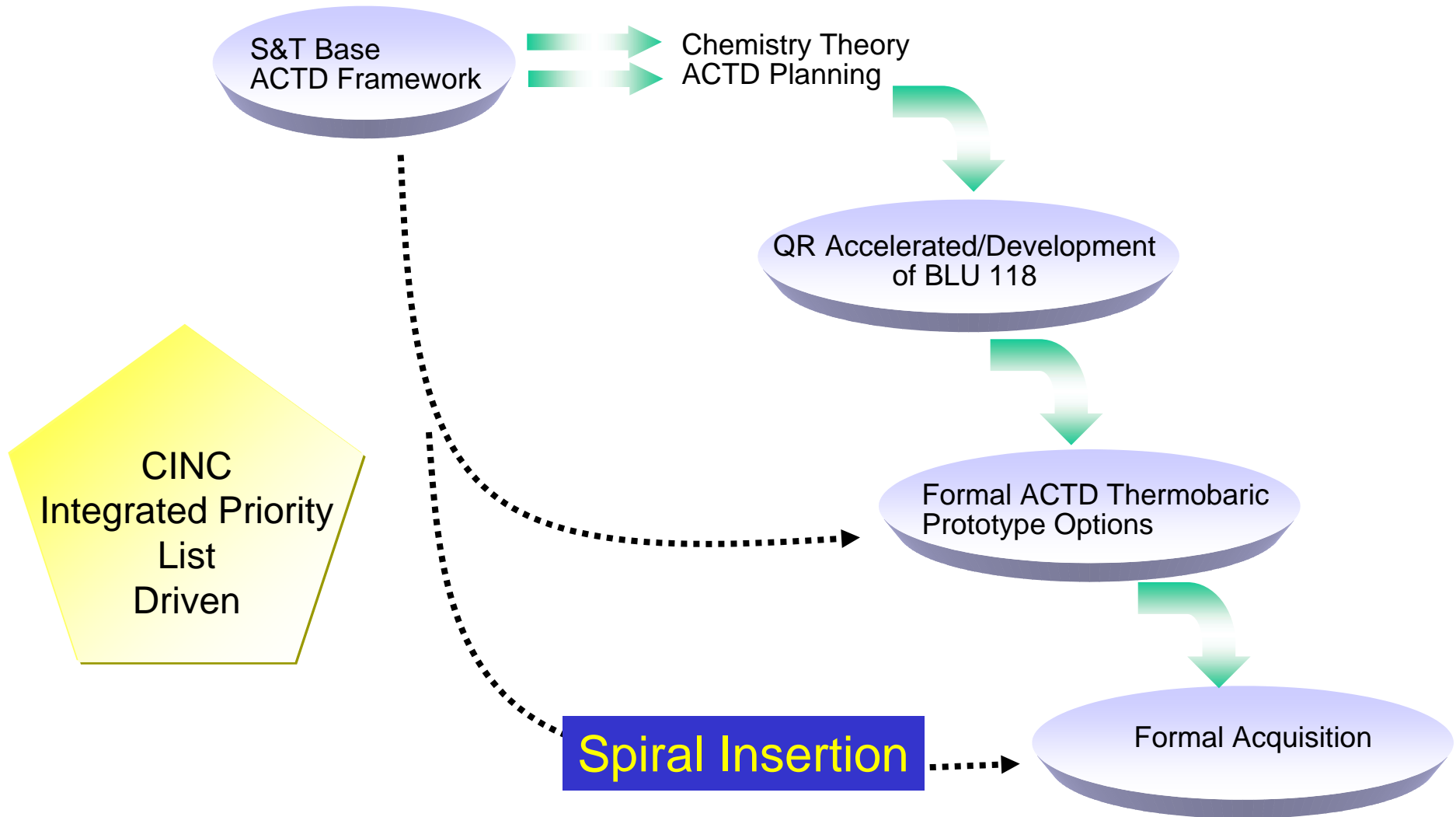
### **Example: Diagnostic System for Helicopter Monitoring & Maintenance**



- **Issue:** Current Diagnostics are Done Manually - Labor Intensive, Inexact, Leading to Unnecessary Removals
- **Solution:** Adapt Commercial System that Automatically Collects & Analyzes In-Flight Data

# Case Study

## “Thermobaric Weapons” Acceleration Complementary Transition Effort



# Affordable Transition



## Objectives

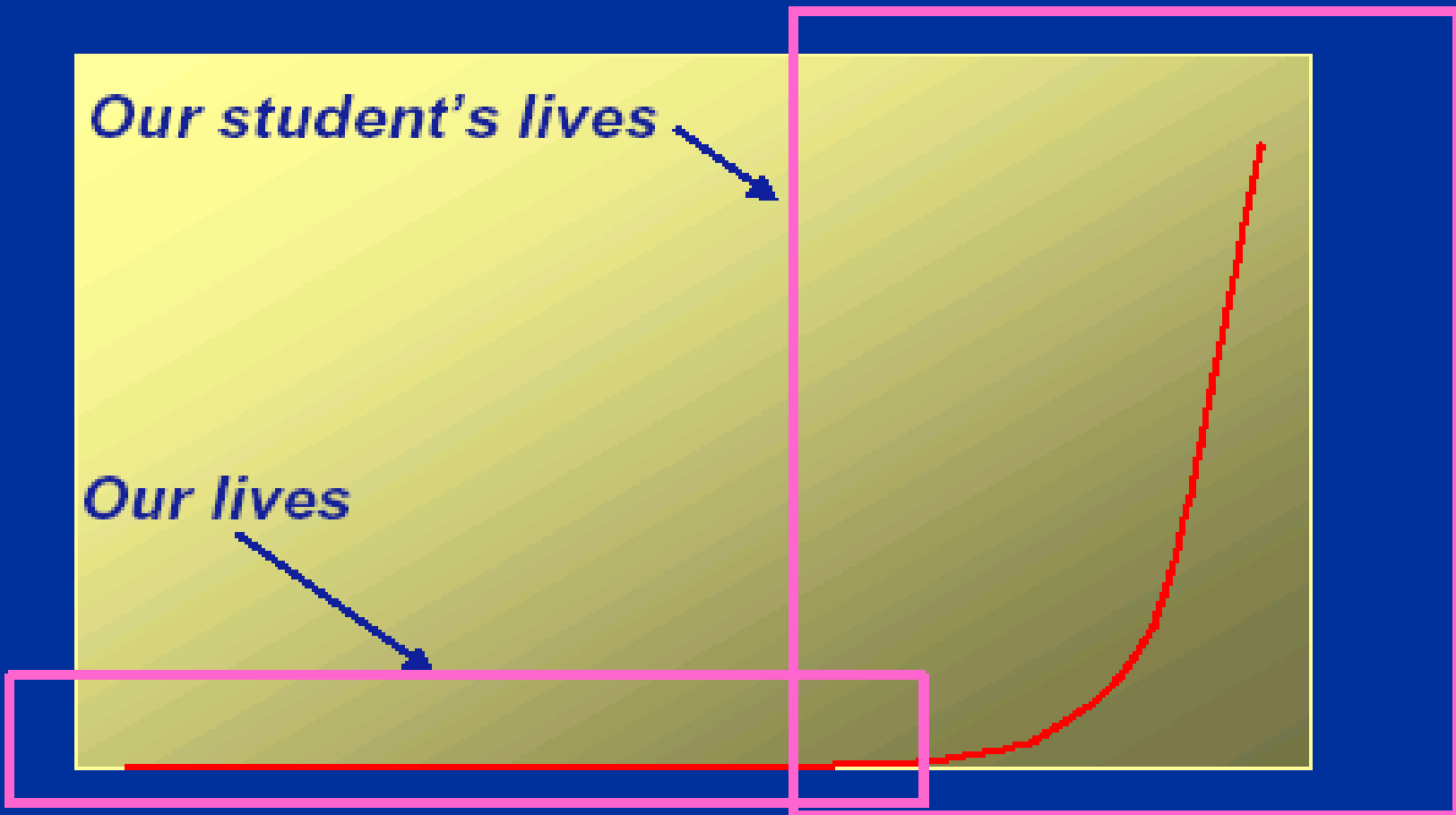
- *Improve Dialogue Between S&T, Acquisition, Logistics & Industry*
- *Improve Technology Transition from S&T to the Next Stage of Acquisition*



## Key Elements to Achieve Technology Transition

- **Identify the Customer**
- **Team with the Customer**
- **Consider Impact of Affordability & Technology Decisions**
- **Plan for Transition**

# Moore's Law and our students



Processor speeds from 1981 to 2015 (projected).

Source: Military-Related R&D an Academic's View by Peter Lee, Carnegie Mellon University, NDIA S&E Technology Conference, February 2002

# Why Transition in S&T?



## DoD 5000-Series: S&T Role in Evolutionary Acquisition

- **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**
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    - > 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/>



# Air Force Affordability Policy



- Use Integrated Product & Process Development (IPPD) on all Integrated Technology Transition Programs (ITTPs) and ATDs
  - Exceptions Approved by AFRL Affordability Director
- Invest in tools to implement affordability metrics, assess best value, and balance performance with cost
  - Goal is a common cost modeling tool set across AFRL
- Develop a Return on Investment approach for every 6.3 project
  - Refine as project matures

***Signed by Commander, AFRL (February 2000)***

# **OUSD (AT&L) Goals**

- 1. Achieve credibility and effectiveness in the acquisition and logistics support process**
- 2. Revitalize the quality and morale of the DoD Acquisition, Technology, and Logistics workforce**
- 3. Improve the health of the defense industrial base**
- 4. Rationalize the weapon systems and infrastructure with defense strategy**
- 5. Initiate high leverage technologies to create the warfighting capabilities, systems, and strategies of the future**



# Defense Research and Engineering

- Robust S&T Investment Enables Transformation
  - S&T Investment aligned with critical DoD goals/capabilities (QDR)
  - New transformation initiatives focus on intersection of transformation, joint, and combating terrorism
  - Maintain balanced S&T investment (between Service / Agencies and near through far term research)
- Accelerate Technology Transition to the Warfighter
  - On-going, stable S&T investment allows technologies to be ready for transition
  - Complementary programs necessary (i.e. Quick Reaction Funds, Advanced Concept Technology Demonstration, Formal spiral acquisition)
  - Technology transition a focus for AT&L leadership under Acquisition Excellence
- Enhance National Security Workforce and Laboratories
  - Increase DoD investment in University-based research (knowledge and workforce in critical technology areas)
  - Expanded use of workforce pilot programs will strengthen labs
  - Laboratories supporting national security need to modernize infrastructure

# Quick Reaction Special Projects

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- Initiate **high priority** or **high leverage** technology efforts during the execution year
- Provide flexibility to respond to emergent DoD issues and address technical surprises and needs in real time
  - Technology matures in less than a year in some areas
  - Need some funds to apply to rapidly needed technology
  - Respond to technology opportunities in major acquisition programs
- Projects would be initiated at the direction of USD(AT&L) and DDR&E
- Projects would be conducted by a military department and/or defense agency
- Typically smaller scale / limited scope prototypes

# ACTD Program Description

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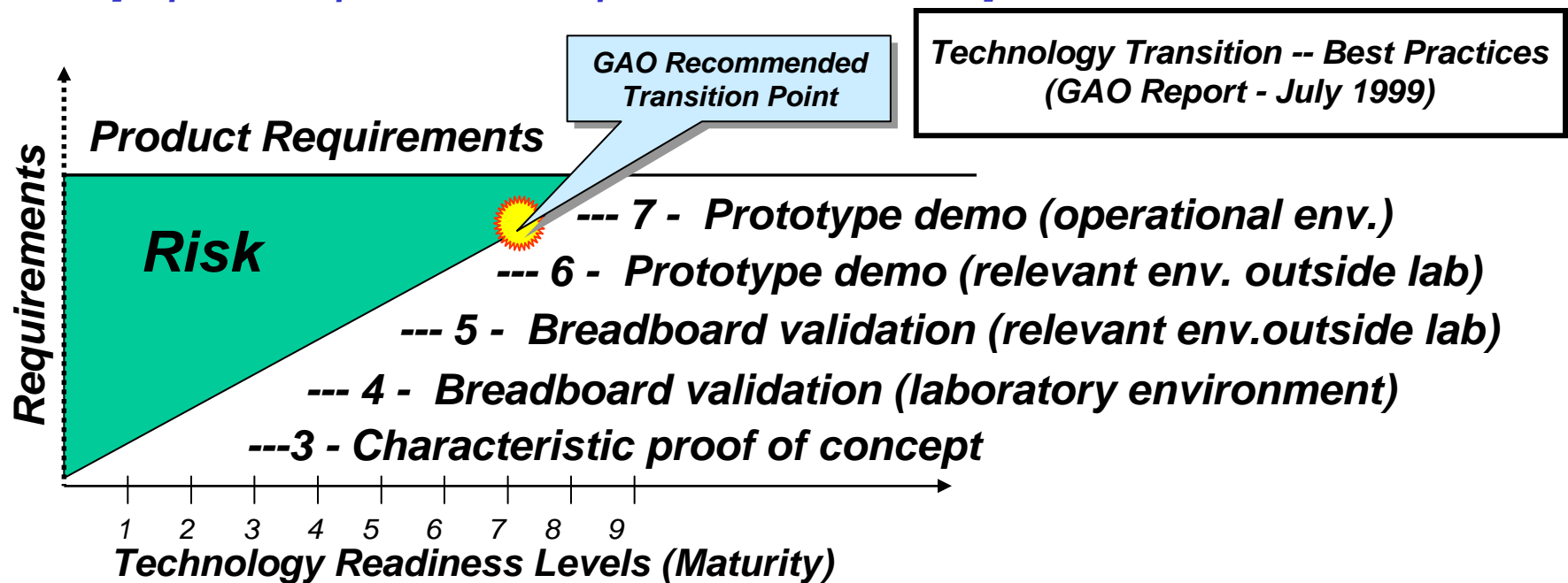
- Initiate **high priority** or **high leverage** prototypes in response to CINC requirements
- Develop and operationally exercise prototype system; then
  - Transition to Acquisition Program
  - Return to S&T Development
  - Discard after Military Value Assessment
- Projects initiated after formal selection process through the JROC
- Projects sponsored by Service or Agency
- Demonstration projects with Conops Development

*Try Before You Buy*

# Army - Providing Rigor In Technology Transition Management



GAO [<http://searchpdf.adobe.com/proxies/2/16/11/77.html>]



- **Technology Readiness synchronized with FCS Schedule**
  - > **TRL 5 Components/ Subsystems by PDR (FY03)**
  - > **TRL 6 Components/ Subsystems by CDR (FY04)**
  - > **TRL 6 System of System Demonstration by end FY05**

**Army S&T IS using TRLs**

# Technology Transition Initiative Summary

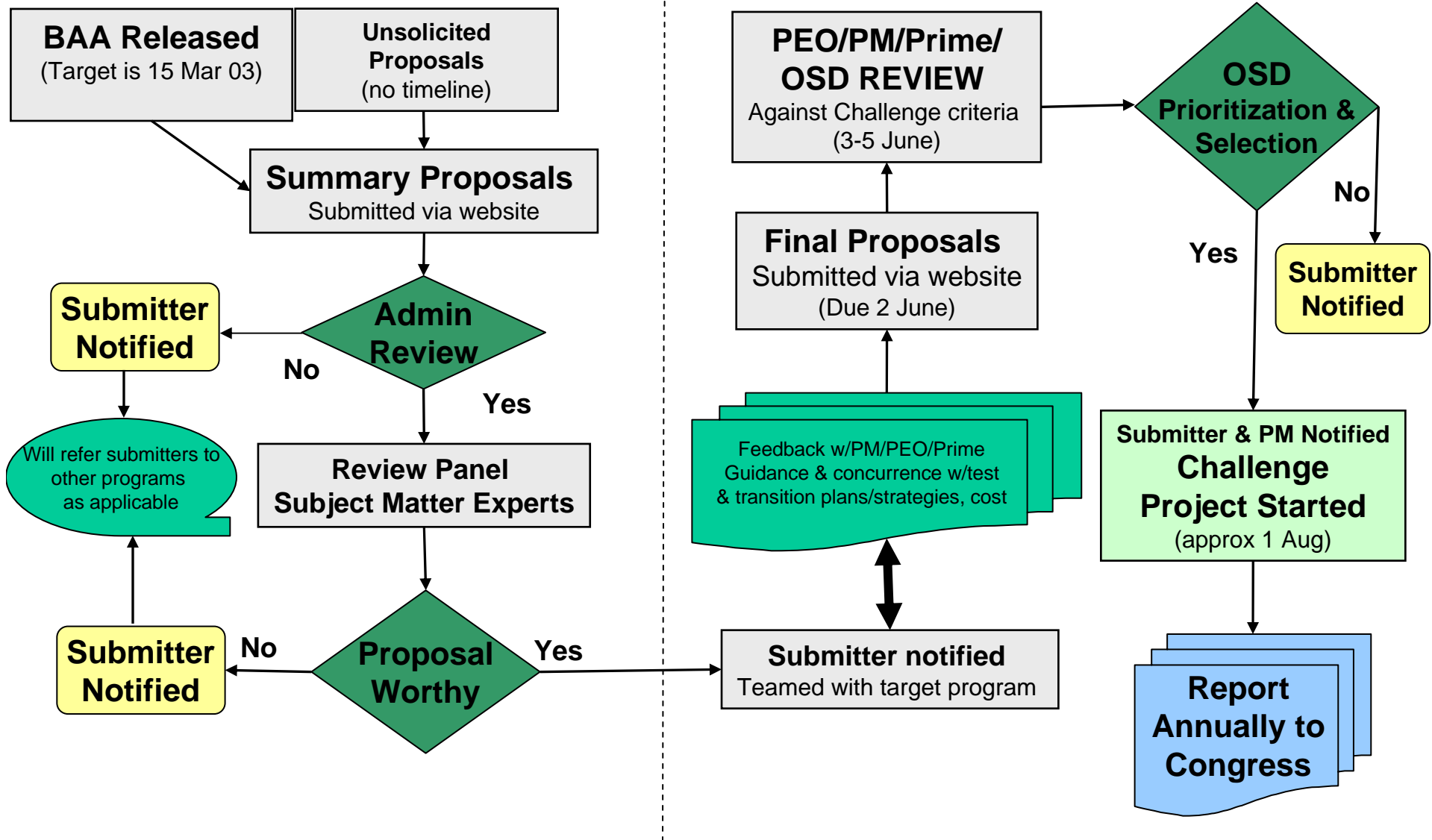
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- Promising technological improvements can languish for years waiting for acquisition and operational funding. Technology Transition Initiative (TTI) is the first step toward addressing these challenges.
- TTI provides “seed” funding to accelerate transition of new technology into operational capability.
- Projects will be implemented by a Military Department or Defense Agency.
- OSD to contribute at least 50% of cost from the Technology Transition Initiative Fund

# Defense Acquisition Challenge

## - Pilot Process





# Defense Acquisition Challenge Program Summary

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- **This program will provide companies, not already part of the recognized defense industrial base, an opportunity to introduce their innovative technologies into the defense acquisition program.**