

Headquarters U.S. Air Force

Integrity - Service - Excellence

AF Science, Technology, and Engineering Overview



**Col Mark D. Koch
Associate Deputy Assistant Secretary
(Science, Technology, and Engineering)**

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Agenda

- **AF S&T Organization**
- **AF S&T Vision**
- **SAF/AQR**
- **S&T Program Tenets**
- **S&T Program Priorities**
- **Strategy Development**
- **Summary**



AF S&T Organization

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Hon. Michael B. Donley
Secretary of the Air Force

Gen Norton A. Schwartz
Air Force Chief of Staff

Air Force Materiel Command
Gen Donald Hoffman

AF Service Acquisition Executive
Mr. David Van Buren

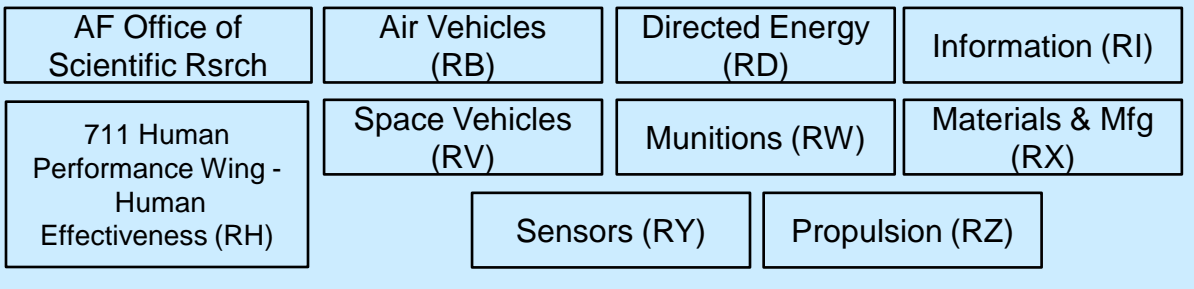
Dr. Mark T. Maybury
AF Chief Scientist

Air Force Research Laboratory
MGen William N. McCasland

Tech Executive Officer
(dual-hatted)

**Deputy Assistant Secretary,
Science, Tech & Engineering**
Dr. Steven H. Walker

"PEO-like" relationship





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AF S&T Vision



Create compelling
air, space, and cyber
capabilities for
precise and reliable
Global Vigilance,
Reach and Power for
our Nation



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SAF/AQR



**Deputy Assistant Secretary for
Science, Technology and Engineering
Dr. Steven Walker**

- Congressional
- Budget

**Associate Deputy Assistant Secretary
Col Mark D. Koch**

**Engineering &
Technical Mgt Division
(AQRE)**

**Strategy
Division
(AQRS)**

**Science & Technology
Division
(AQRT)**



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SAF/AQR Portfolio

Technical Advice to SAE

S&T Program Oversight



**Life Cycle Systems
Engr & Tech Policy**

“Functional Directorate” & “Capability Directorate”



S&T Strategy



S&E Career Field



Technology Transition



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S&T Program Tenets

- Prepare for an Uncertain Future and Investigate Game-Changers to Shape the Art-of-the Possible into Military Capabilities
- Create Technology Options that Address Urgent Warfighter Needs and Provide New AF Service Core Function Capabilities in Support of the Joint Mission
- Maintain In-House Expertise to Support the Acquisition and Operational Communities and Modernize and Improve the Sustainability of Unique Research Facilities and Infrastructure
- Develop Future Air Force Leaders with an Appreciation for the Value of Technology as a Force-Multiplier
- Remain Vigilant Over and Leverage Global S&T Developments and Emerging Capabilities



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S&T Program Priorities

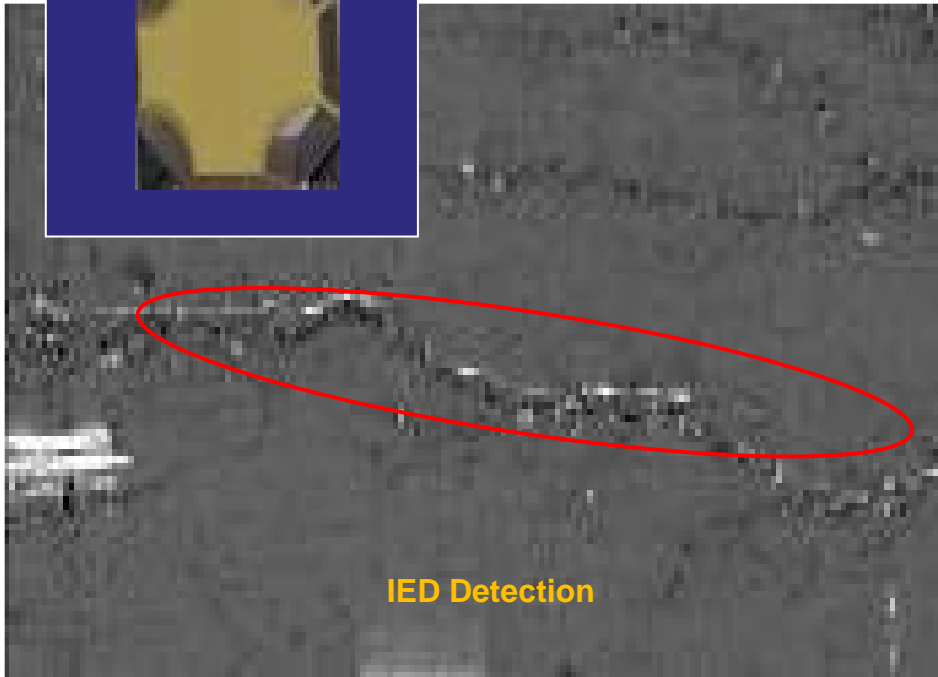
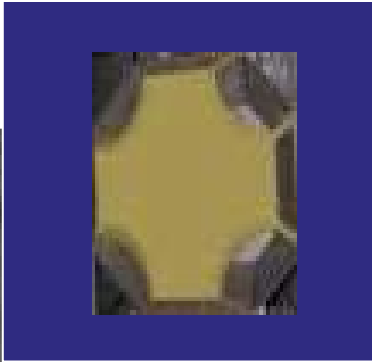
- **Priority 1:** Support the current fight while advancing breakthrough S&T for tomorrow's dominant warfighting capabilities
 - Enable the AF to operate effectively and achieve desired effects in all domains and all operations
 - Improve the agility, mobility, affordability and survivability of AF assets

The Right Balance - 6.1/6.2/6.3, All Domains, Performance vs. Affordability

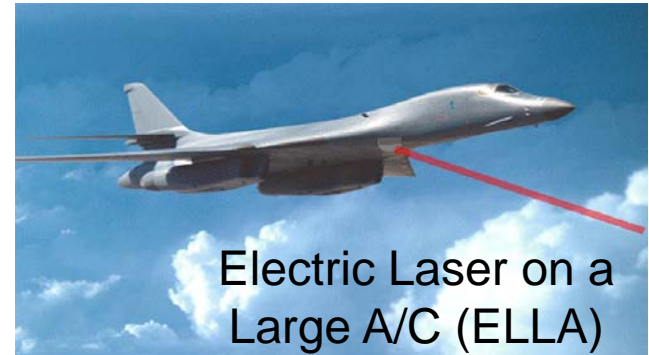


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Support the Current Fight While Advancing Breakthrough Capabilities



IED Detection



Electric Laser on a
Large A/C (ELLA)

Support the Current Fight... Advancing Tomorrow's Capabilities



S&T Program Priorities

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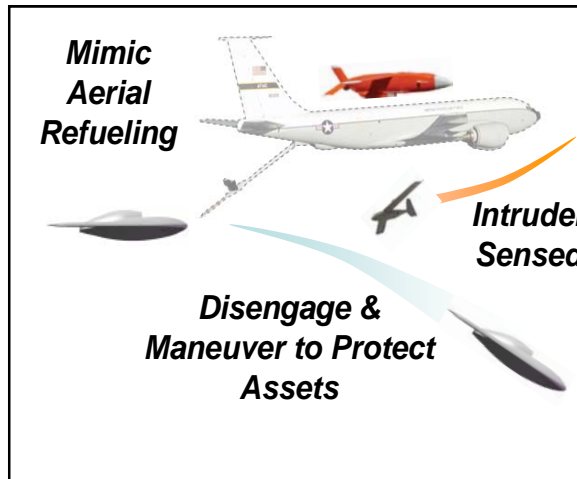
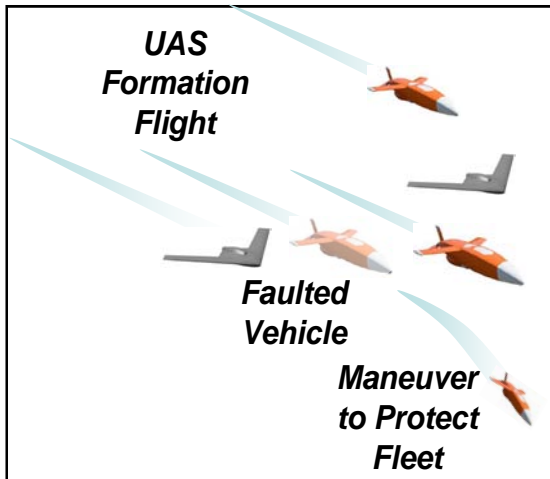
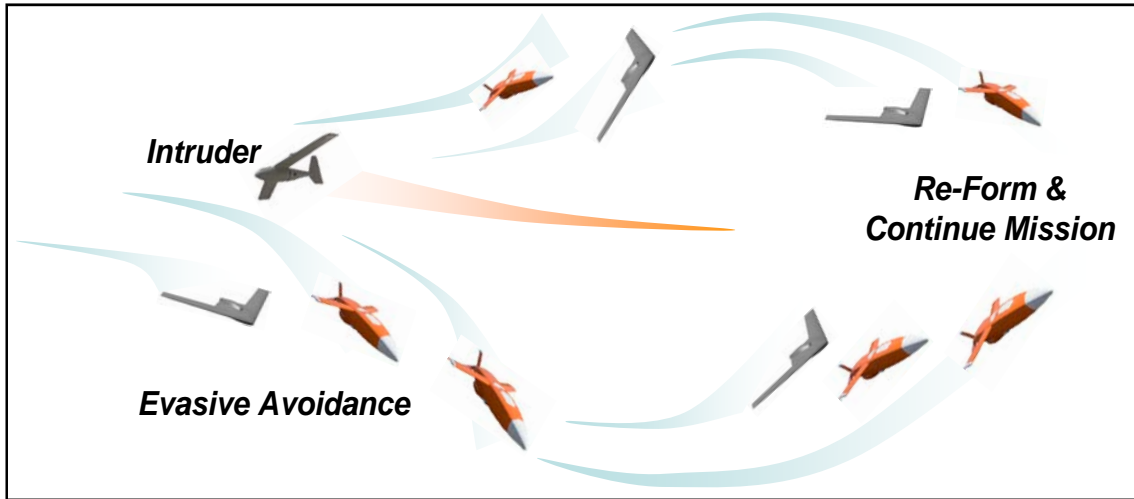
- **Priority 2:** Execute a balanced, integrated S&T Program that is responsive to AF Service Core Functions; Increase emphasis in S&T that will:
 - Improve the sustainment, affordability and availability of legacy systems
 - Reduce cyber vulnerabilities while emphasizing mission assurance
 - Support the needs of the nuclear enterprise
 - Deliver autonomous systems and human performance augmentation technologies envisioned in Technology Horizons
 - Provide robust situation awareness to enhance decision-makers' understanding and knowledge by improving ISR capabilities and data PED
 - Enable long-range precision strike
 - Reduce energy dependency

Where Do We Invest the Next Dollar



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Delivering Human Performance Augmentation and Autonomy





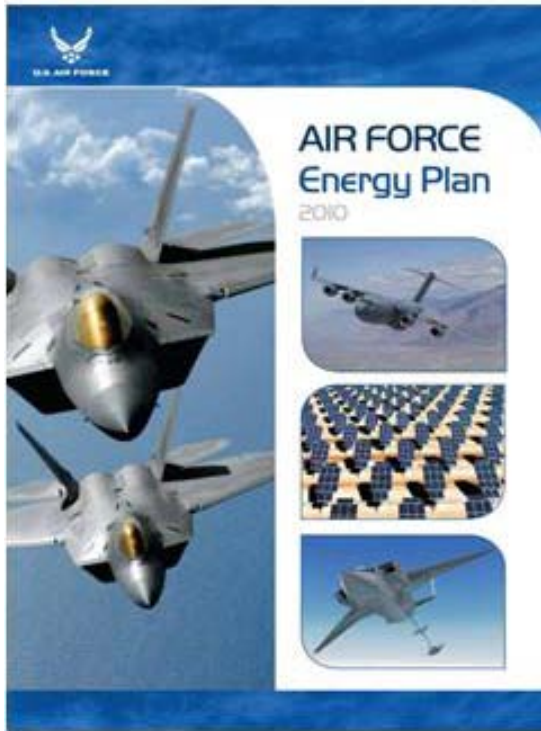
Reduce Energy Dependence

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Seed Crops

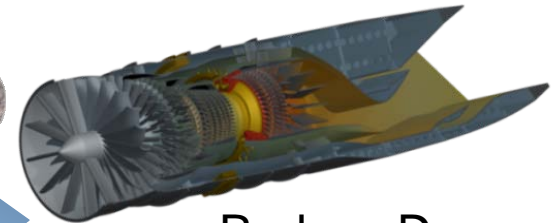
Increase Supply



Change the Culture



Fuel Efficiency...



Reduce Demand

...Combined Into
Single Propulsion
System

Make Energy A Consideration In All We Do



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S&T Program Priorities

- **Priority 3:** Retain and shape the critical competencies needed to address the full range of S&T product and support capabilities
 - Increase level of in-house basic research
 - Enhance critical competencies of the organic cyber workforce
 - Support AF STEM initiatives to develop and optimally manage the future S&E workforce

Shaping the Current and Future Workforce



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Retain and Shape Critical Competencies Internal to AFRL



Provide Organic Basic Research and Advanced Development Opportunities in Critical Areas



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Industrial Base

- Greater consideration given to non-domestic sources
- Greater need for acquisition and sustainment decision makers to be provided with usable, current IB information
- Greater need for the AF to provide clear guidance in terms of shaping the IB
 - Critical domestic capabilities – technologies and skill sets
 - Sufficient competition – supply chain management
 - Risk mitigation tools
- S&T community has an important role to play here



S&T Program Priorities

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- **Priority 4:** Ensure the AF S&T program is integrated into the AF Corporate requirements and programming processes
 - Be a trusted partner of the acquisition/sustainment community – assess tech maturity/enhance and accelerate tech transition
 - Leverage R&D efforts within industry – including small businesses
 - Develop and demonstrate technology solutions that decrease manufacturing risks

Bridge the Valley of Death



Flagship Capability Concept

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- **Definition:** An integrated technology project collaboratively developed by MAJCOM(s), Center(s), and AFRL that:
 - Addresses a documented and prioritized MAJCOM capability need
 - Is commissioned via AF S&T Governance structure
 - Is traced to a CRRRA Gap, linked to a Service Core Function Master Plan

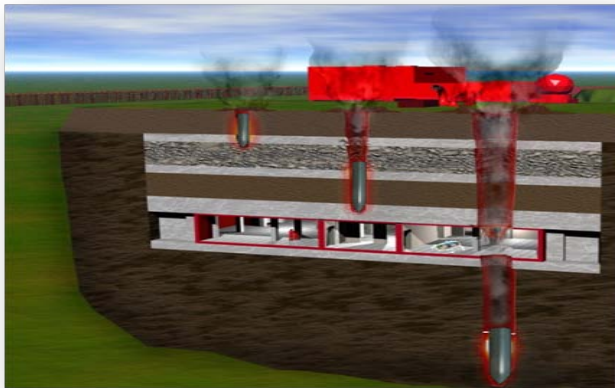
- **Attributes:**
 - Initial systems engineering and development planning (DP) initiated
 - Somewhere between a leading DP concept and a prototype
 - Assigned to lead Center for transition
 - MAJCOM transition manager identified
 - Transition funding (6.4) committed two years prior to S&T completion
 - Defined S&T baseline/exit criteria
 - S&T project ideally completed during current FYDP



Initial Set of Flagships

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- 1. High Velocity Penetrating Weapon (HVPW)**
- 2. Responsive Reusable Boost for Space Access (RBS)**
- 3. Selective Cyber Operations Tech Integration (SCOTI)**



Flagships Helping Bridge the Valley of Death



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Strategy Development Efforts

- **Energy**
- **Cyber**
- **Hypersonics**
- **Space Situational Awareness**
- **Sustainment**



X-51A Program Objective

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Flight test the AF Hypersonic Technology (HyTech) scramjet engine, using endothermic hydrocarbon fuel, by accelerating a vehicle from boost ($\sim M=4.5$) to Mach 6+



Pratt & Whitney
A United Technologies Company

- Acquire ground and flight data on an actively cooled, self-controlled operating scramjet engine (rules and tools development)
- Demonstrate viability of an endothermically fueled scramjet in flight
- Prove viability of a free-flying, scramjet powered, vehicle (Thrust > Drag)



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Survivable, High Speed Weapon

Enabling Capabilities

Hypersonic Air Vehicle and Propulsion Technologies Enable Long Range at High Speed with Effective Payload

Precision Strike

Variable Warhead Effects

Long Range



Aircraft Systems
Internal bombers
External fighters

Net Enabled
In-Flight Targetable

High Speed

Rapid, Responsive Strike in Anti-Access/Access Denied (A2/AD) Environments



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High Speed Aircraft

Capabilities and Attributes

Operation in A2/AD Environments

Penetrate Denied Areas (Survivable)

Large ground coverage area

High utility in space-denied areas

Mach 4+ Cruise



Runway Takeoff and Landing

Turbine Based Combined Cycle

Reusable, Long-Life Airframe

On-Demand Flight in A2/AD Environments



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Summary

- Air Force Depends on the S&T Program to discover, develop, and demonstrate high-payoff technologies across all domains – *Tech Push*
- S&T Program Priorities, Program Tenets, and Processes aligned to turn science and knowledge into militarily relevant capabilities – *Tech Pull*
- Flagships linking S&T, Development Planning, and MAJCOM transition funding into HAF-commissioned AF Capabilities – *The Bridge Over The Valley of Death*
- Industrial Base, Engineering, and Technical Management – *Improving Acquisition Outcomes*



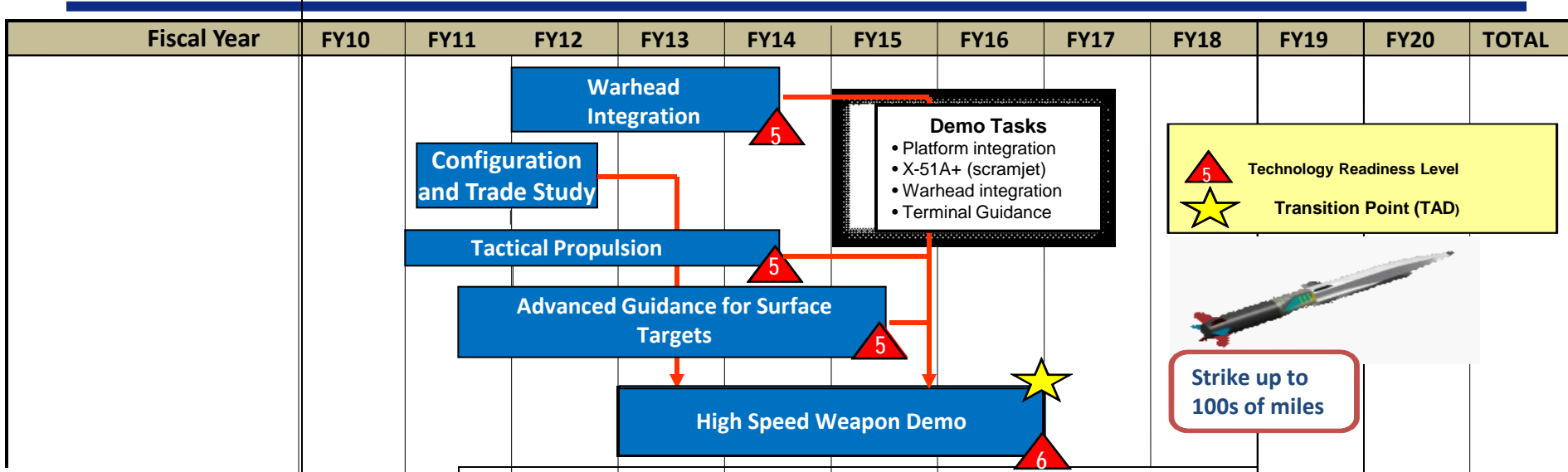
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BACKUPS



High Speed Weapon Roadmap

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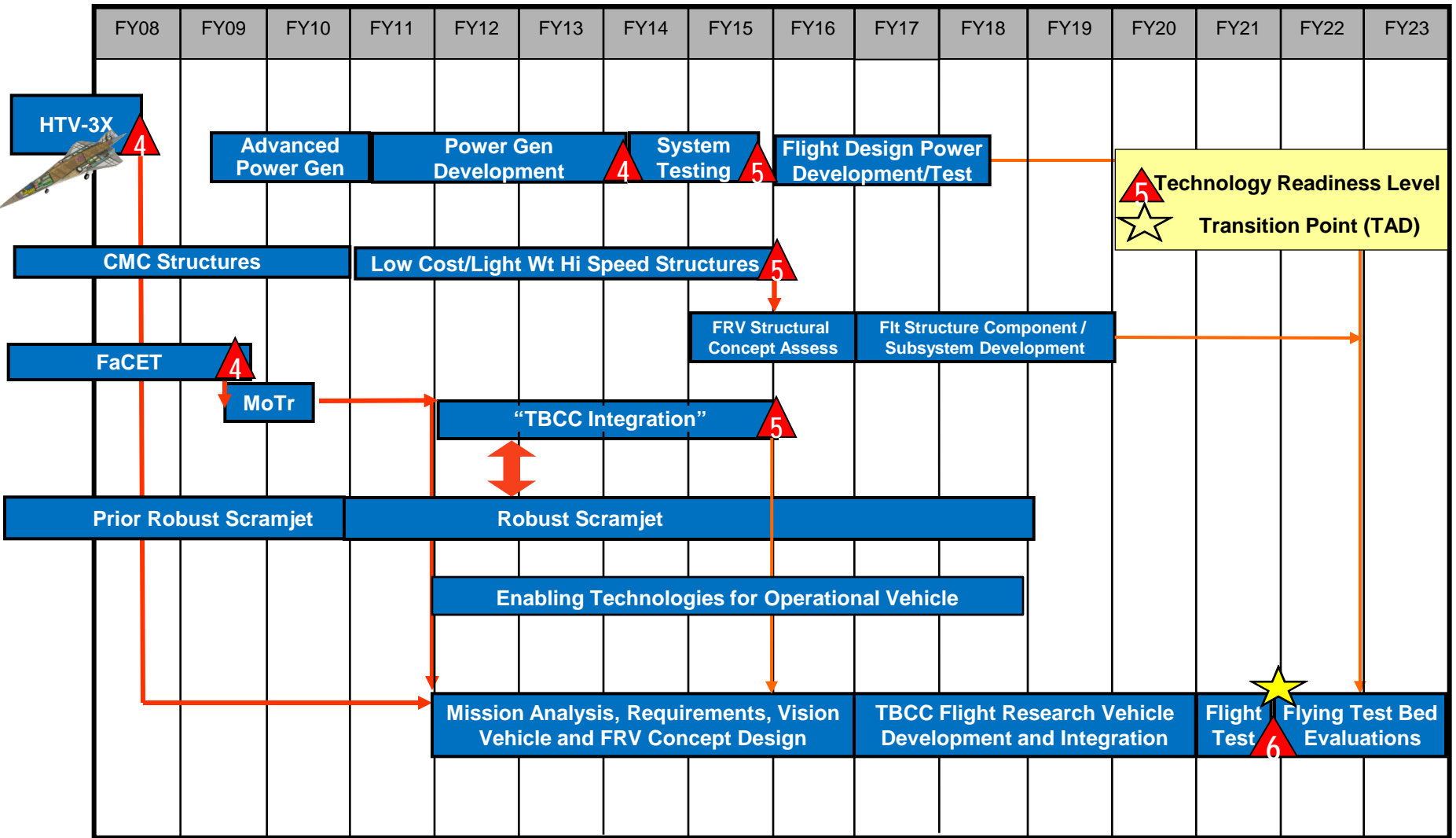
TECHNOLOGY GAPS

- High Speed Multimode Seekers
- Anti Jam GPS
- Alternative high speed guidance (GPS denied environment)
- Compact energetic booster
- Aeroconfiguration, structures and materials, control surfaces, TPS
- Compatibility with current and emerging fighters and bombers
- Compatibility with Navy/VLS



High Speed Aircraft Roadmap

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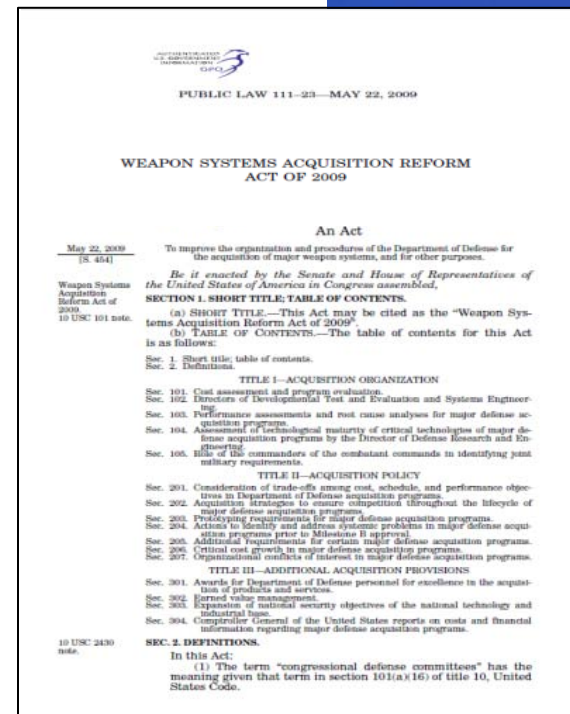
Revitalizing Development Planning (DP)

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Weapon Systems Acquisition Reform Act (WSARA) of 2009 requires:

Director, Systems Engineering to “Review the organizations & capabilities of the military departments with respect to...*development planning* ...and identify needed changes or improvements”

SAE to “develop & implement plans to ensure the military dept has provided appropriate resources for: *Development planning and systems engineering organizations with adequate numbers of trained personnel*”





What is Development Planning?

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- Acquisition contribution to AF-level capability planning
- Early analyses of technical issues, risks, and resources
 - Inform sponsors and decision makers on realm of the possible
 - Greatest leverage prior to Materiel Development Decision
- Systems engineering efforts define the trade space of concepts
- DP activities foundation for new system development
- Results in high-confidence estimates of cost, schedule, and technical performance