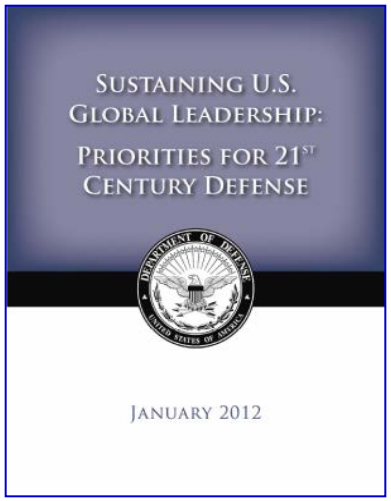
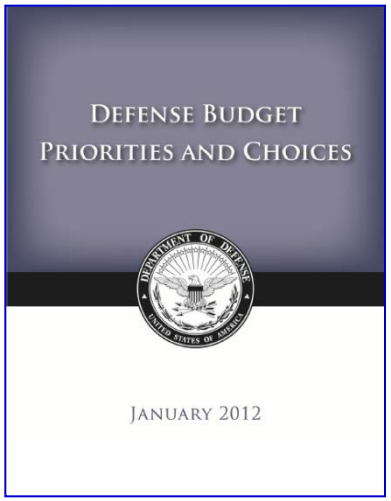
Precision Strike Annual Review

Al Shaffer
Principal Deputy Assistant Secretary of Defense
for Research and Engineering
March 17, 2015

Key Elements of Defense Strategic Guidance





- The military will be ***smaller and leaner***, but it will be agile, flexible, ready and technologically advanced.
- ***Rebalance our global posture*** and presence to emphasize the Asia-Pacific region.
- Build partnerships and ***strengthen key alliances and partnerships*** elsewhere in the world.
- Ensure that we can quickly confront and defeat aggression from any adversary – ***anytime, anywhere***.
- ***Protect and prioritize key investments*** in technology and new capabilities, as well as our capacity to grow, adapt and mobilize as needed.

DoD at Strategic Crossroads

Secretary Hagel
Budget Roll-Out Brief
24 Feb 2014

"The development and proliferation of more advanced military technologies by other nations means that we are ***entering an era where American dominance on the seas, in the skies, and in space can no longer be taken for granted"***

The strategic question is – will the force of tomorrow be:

- Larger with diminished capability or,
- Smaller with more technologically advanced capabilities

Enhanced Mutual Reliance Offsets Some of These Risks

Building the Force of the Future

Secretary Carter
Submitted Statement
Senate Armed Services Committee
FY2016 Budget Request
3 March 2015

"As DoD counters the very real dangers we face in the world, we will also grab hold of the bright opportunities before us – opportunities to be more competitive and re-forge our nation's military and defense establishment into a future force that harnesses and develops the latest, cutting-edge technology, and that remains superior to any potential adversary…"

"These are the three main pillars on which DoD will build the force of the future – competiveness through:

- ***Technical and Operational Superiority***
- *Accountability and Efficiency*
- *Attracting Future Talent"*

Defense R&E Strategy

1. **Mitigate current and anticipated threat capabilities**
   - Cyber
   - Electronic Warfare
   - Counter Space
   - Counter-WMD
   - Missile Defense

2. **Affordably enable new or extended capabilities in existing military systems**
   - Systems Engineering
   - Modeling and Simulation
   - Capability Prototyping
   - Developmental Test & Evaluation
   - Interoperability
   - Power & Energy

3. **Create technology surprise through science and engineering**
   - Autonomy
   - Data Analytics
   - Human Systems
   - Hypersonics
   - Quantum Systems
   - Basic Sciences

Technology to offset Manpower

Technology Needs

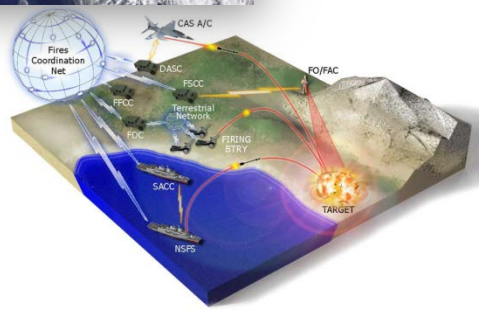
- Cyber / Electronic Warfare
- Engineering / M & S
- Capability Prototyping
- Protection & Sustainment
- Advanced Machine Intelligence
- Anti-Access/Area Denial (A2/AD)

Challenges

- Modern Electronic Warfare
- Ballistic and Cruise Missile Defense
- Precision Navigation and Timing (PNT) / Communications / Intelligence Surveillance and Reconnaissance (ISR)
- Modern Integrated Air Defense
- Weapons of Mass Destruction (WMD)





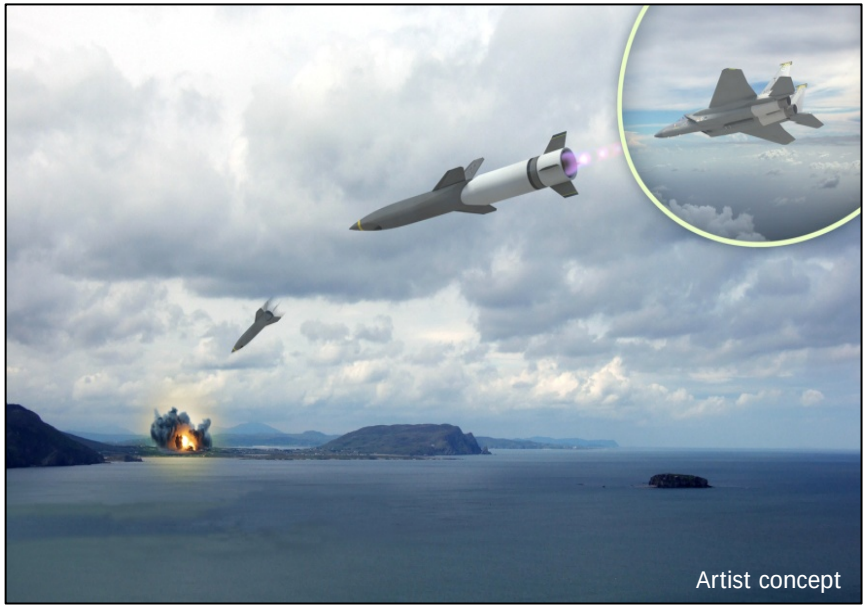


Future Precision Strike

- Hypersonics Weapons (AF Family)
- Supersonic Combustion Ramjet Engines (Scramjet)
- Tactical Boost Glide
- Long Range Anti-Ship Missile (LRASM)
- Rail Gun
- Directed Energy
- Adaptive Engine Transition Program (AETP)

Hypersonic Air-breathing Weapon Concept (HAWC)

PROGRAM OVERVIEW



HAWC seeks to demonstrate the critical technologies and attributes of an effective and affordable hypersonic cruise missile

Three Pillars to focus program objectives:

Air Vehicle Feasibility

Effectiveness

Affordability

PROGRAM OBJECTIVES

Transformational changes in responsive, long-range strike capabilities against time-critical or heavily defended targets. Joint DARPA/Air Force (AFRL) program

- Advanced air vehicle configurations capable of efficient hypersonic flight
- Hydrocarbon scramjet-powered propulsion to enable sustained hypersonic cruise
- Thermal management approaches designed for high-temperature cruise
- Affordable system designs and manufacturing approaches

PROGRAM STATUS

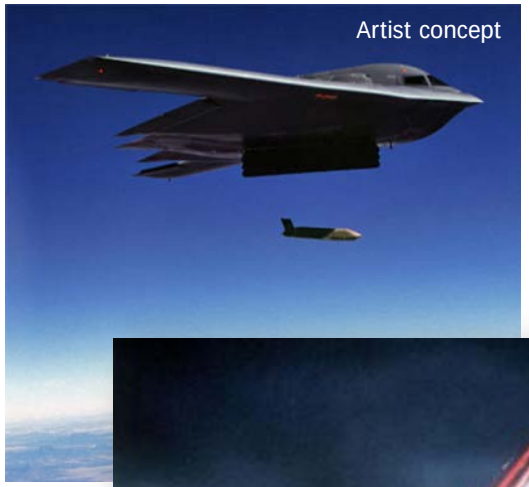
Schedule: FY 2014 – FY 2019

- MOA and Program Annex signed by DARPA and USAF – December 2013
- Conducting objective system trades studies and conceptual design definition
- Deriving hypersonic air-breathing missile demonstration system design from the objective system
- Developing flight testing plans for the hypersonic air-breathing missile demonstrator
- Initiating risk reduction testing of enabling subsystem technologies

Tactical Boost Glide (TBG)

PROGRAM OVERVIEW

The Tactical Boost Glide (TBG) program is a joint DARPA/Air Force effort that aims to develop and demonstrate technologies that enable air-launched, tactical-range hypersonic boost glide systems



PROGRAM OBJECTIVES

- The TBG program is employing a disciplined systems engineering approach for defining demonstration system objectives and identifying enabling technologies needed for future boost glide systems
- The TBG program plans to focus on three primary objectives:
  - Vehicle Feasibility
  - Effectiveness
  - Affordability

PROGRAM STATUS

Schedule: FY 2014 – FY 2020

- MOA and Program Annex signed by DARPA and USAF – December 2013
- Conducting objective system trades studies and conceptual design definition
- Deriving hypersonic boost glide demonstration system design from the objective system
- Developing demonstration system flight test objectives and plans
- Initiating work to reduce risk and mature enabling technologies

Long Range Anti-Ship Missile (LRASM)

Program Overview

The Long-Range Anti-Ship Missile (LRASM) was developed and demonstrated by DARPA and the Office of Naval Research (ONR) to advance Offensive Anti-Surface Warfare (OASuW) technologies. In 2014, DARPA/Navy/USAF created the LRASM Deployment Office (LDO), transitioning the DARPA demonstration to a Navy program of record. This air-launched missile will provide an Early Operational Capability (FY2018) to the fleet in a compressed acquisition and system development timeframe, utilizing the Model 4 Accelerated Acquisition framework within DoD 5000.02.

System Capabilities / Goals

Semi-autonomous air-launched anti-ship missile that reduces dependence on external platforms and network links to **penetrate sophisticated enemy air defense systems**

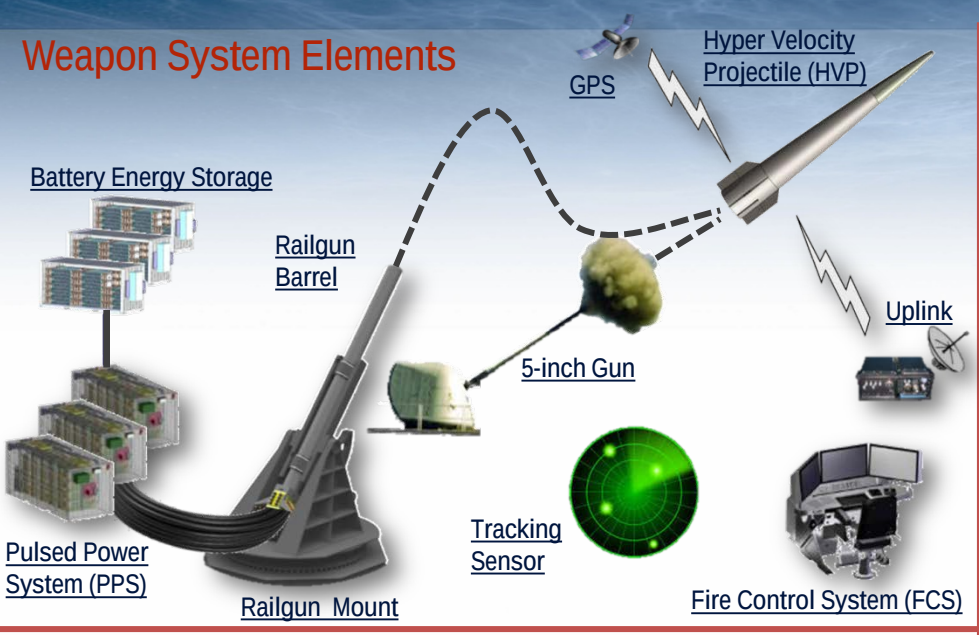
- Maximize effectiveness with fewer missiles
- Provide extended-range capabilities
- Multiple launch platforms creates employment flexibility
- Independent target discrimination
- EOC dates: FY2018 (B-1B), FY2019 (F/A-18)

Program Status

- **Transition**: DARPA/ONR demonstration to Navy program of record – February 2014
- **Requirements**: CDD approved – February 2015
- **Recent Events / Milestones**:
  - Completed Preliminary Design Review of missile and all subsystems – October 2014
  - Second In-Flight Demonstration successfully completed – February 2015
- **Upcoming Events / Milestones:**
  - Flying Test Bed test series – FY2016
  - System Critical Design Review of missile and all subsystems – FY2016

Electromagnetic Railgun (EMRG)

Weapon System Elements



What is it?

- Gun fired with electricity
- No explosive gun propellant or rocket motors
- Long range: 110 NM initial capability
- Minimum collateral damage
- Persistent, volume & precision fires
- Multi-mission: Land Attack, Anti-Air, and Anti-Surface

When?

- S&T Development started in 2005
- Successful GO/NO-GO Decision 2009
- Barrel Life & 1st Gen. Industry Launcher Prototypes 2012
- High Firing Rate Development 2012-2017

Recent Progress Highlights

32MJ Muzzle Energy Milestone Achieved

BAE Advanced Composite Prototype

Actively Cooled Rep-Rate Pulsed Power Module

Pulsed Power - Dahlgren

Pellet Dispense Demo

Accomplishments

- Demonstrated 5x increase in railgun launch energy to 33 MJ
- Increased barrel life from 10s to 100's
- Pulsed power 2x system size reduction and thermal management
- Next generation actively cooled pulsed power modules for repetition rate firing designed, fabricated and evaluated
- Industry advanced prototypes display tactical characteristics
- BAE Systems to develop Rep-Rate Composite Launcher

Transition Potential

- Multi-mission analysis confirm lethality and utility
- Modular approach enables use on variety of sea & land platforms
- Sea and land based demos to enable rapid transition
- Collaboration: ONR (Barrel, Power, Projectile), OSD (Railgun Mount, Sensor, Fire Control), NAVSEA (Platform Integration)

Solid State Laser Quick Response Capability (SSL-QRC)

Mission Capabilities

- Small Boat Swarm Disruption/Defeat

- Counter-UAV and Counter- ISR

Now: Quick Response Capability (SSL-QRC):

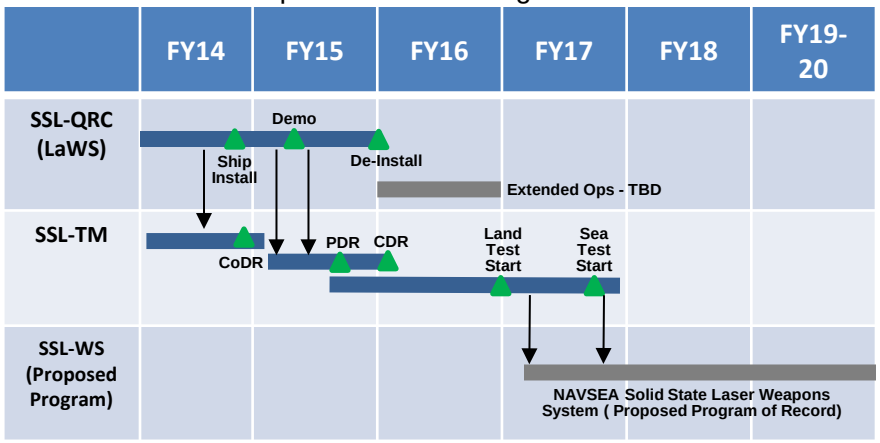
- COTS-Based 30 kW Laser Weapons System (LaWS)
- USS Ponce Deployment In Arabian Gulf (2014/15)
- Provides Fleet Operational Insights

Next: Technology Maturation (SSL-TM):

- 100+ kW Laser Weapon System Demonstrator (LWSD) integrated on Navy Self Defense Test Ship for Extended At-Sea Testing
- Scalable / Open System Design - Suitable for Multiple Surface Platforms And Enables Additional Capabilities (e.g. Counter ISR)

Technical Challenges

- ✓ Long Term Exposure of Laser To Maritime Environment
- ✓ Shipboard Integration
- ✓ Concept Of Operations
- ✓ Crew Operations & Training



Structured To Provide Earliest Possible Capability:

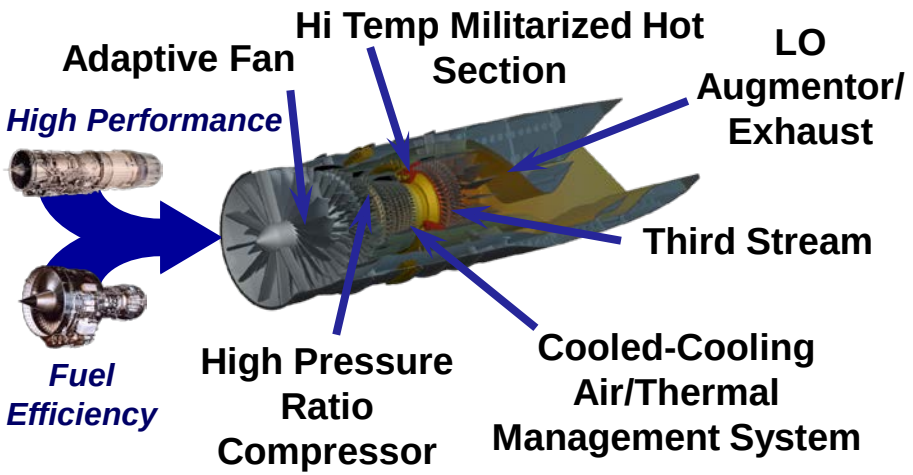
- SSL-QRC – FY14/15 Deployment & Exercises
- SSL-TM Schedule Aligned To Leverage SSL-QRC Lessons Learned And Support Transition Activities

Government / Industry Partners

- NAVSEA PMS 405 – Acquisition Transition Planning
- OPNAV N96 – Surface Weapon Systems
- OPNAV N2/N6 – Counter ISR sponsor
- Government - NSWC Dahlgren, Crane & Port Hueneme, NRL, SPAWAR. NAWC China Lake and NAWC Point Mugu
- Industry: TBD selected from ONR BAA #15-0005

U.S. AIR FORCE

Adaptive Engine Transition Program (AETP)



Description

- AETP is the SECDEF's next generation jet engine technology program. It is the follow-on to the successful ADVENT (S&T) and AETD (tech maturation) programs
- AETP sets the stage for all future combat aircraft capabilities through its new engine architecture offering increased performance and a 25% reduction in specific fuel consumption

Program

- Two contract awards to be made in spring of 2016.
- Detailed design review of flight weight engines
- Sea-level tests, altitude tests

Technology

- Adaptive fan with three stream engine architecture
- Efficient high pressure compressor
- Advanced metallic and ceramic matrix composite hot section materials
- Cooled cooling air engine thermal management
- Three stream compatible augmentor / exhaust

Benefits to Warfighter

- Enables future air dominance aircraft to get to the fight, stay for the fight, and exit the fight
  - Reduced fighter support package
  - Higher speed, greater range, increase loiter
  - Reduced thermal signature
  - Enables LO weapons

DoD-Industry Engagement
The Marketplace: Your DoD S&T/R&D Resource

Defense Innovation Marketplace website is ***the*** **communication resource** between DoD S&T/R&D and Industry/Academia, hosting:

- **DoD R&E Strategic Guidance**
- **Long-Range Research and Development Program Plan**
- **Virtual Technology Interchanges**
  - ***Human Systems COI Virtual Technology Interchange – June 2015***
- **Independent Research & Development (IR&D) Secure Portal**

Are YOU using the Marketplace and the IR&D portal?

ASD(R&E)

DoD Research and Engineering Enterprise:
http://www.acq.osd.mil/chieftechnologist/

Defense Innovation Marketplace
www.DefenseInnovationMarketplace.mil

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