Defense Advanced Research Projects Agency

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Briefing prepared for the 16th Annual Science and Engineering Technology Conference

March 2015

DARPA Technical Offices

BTO — BIOLOGICAL TECHNOLOGY OFFICE

- Restore and Maintain Warfighter Abilities
- Harness Biological Systems
- Apply Biological Complexity at Scale

DSO — DEFENSE SCIENCE OFFICE

- Physical Sciences
- Mathematics
- Transformative Materials
- Supervised Autonomy
- Novel Sensing and Detecting
- Complexity

I2O — INFORMATION INNOVATION OFFICE

- Cyber
- Data analytics at massive scale
- ISR exploitation

MTO — MICROSYSTEMS TECHNOLOGY OFFICE

- Electromagnetic Spectrum
- Decentralization
- Information Microsystems
- Globalization

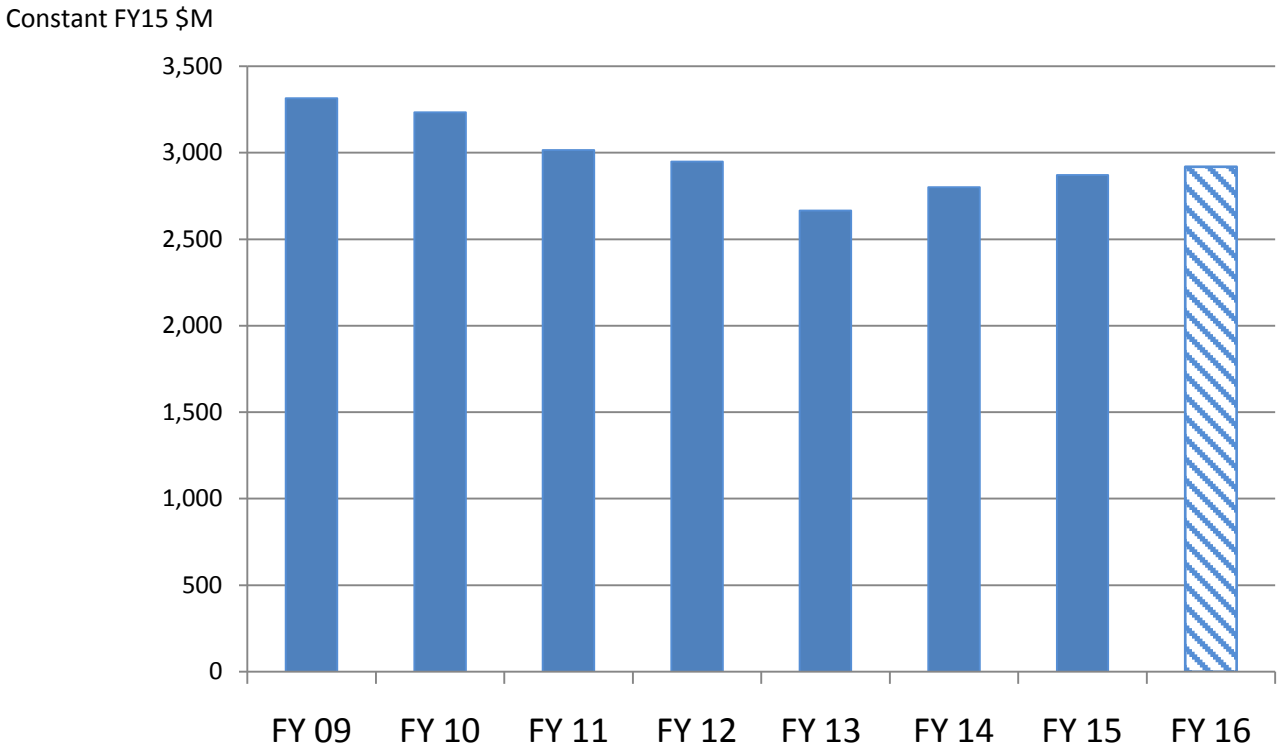
STO — STRATEGIC TECHNOLOGY OFFICE

- Battle Management, Command and Control
- Comms and Networks
- ISR
- Electronic Warfare
- Positioning, Navigation and Timing

TTO — TACTICAL TECHNOLOGY OFFICE

- Ground, Maritime & Undersea, Air, and Space Systems
- Agile Development
- Cooperative Autonomy
- Unmanned Systems
- Power and Propulsion

DARPA Budget (constant FY15 $)

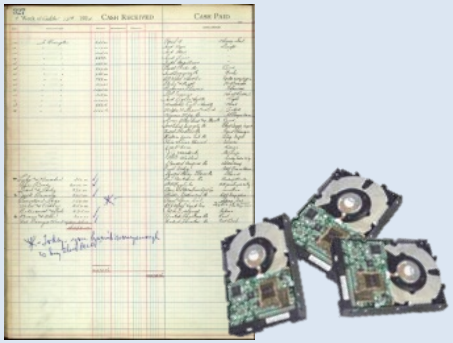


Selected Recent Transition Progress: Networked Terrorism and Ground Warfare

Persistent Close Air Support (PCAS)

Shared real-time situational awareness for rapid, precise CAS

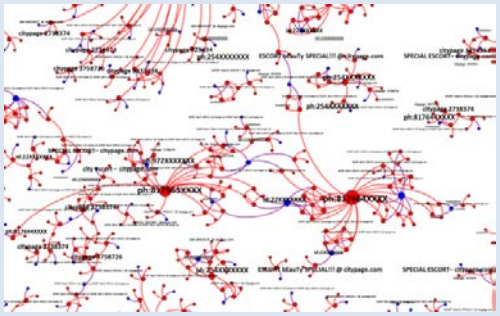
- USMC use of KILSWITCH tablet software on the ground in Afghanistan led to a program of record
- SOCOM using KILSWITCH tablets in operations
- Working with USASOC and USMC to demonstrate direct control of weapons release for faster target engagement



XDATA

Big data analytics for military data

- Cross-agency task force used XDATA to identify $2.5B of terrorist financing
- Core technology transitioned under ODNI POR, IC counter threat finance, US Treasury Financial Crimes Enforcement Network (FinCEN)



Memex

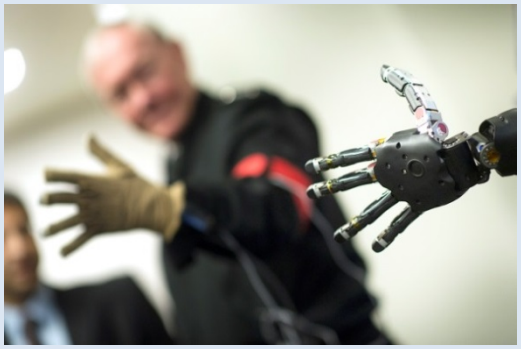
Search technologies to discover, organize, and present domain-specific content

- Rapidly generated leads for investigations of human trafficking, leading to 20 open federal investigations and 8 open indictments in

Insight

Fusion engine for multi-intelligence exploitation

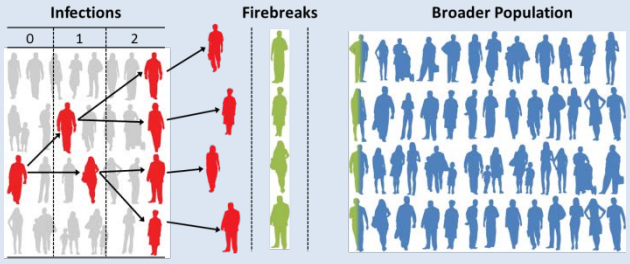
- Backbone for fusion in DCGS-A



Revolutionizing Prosthetics

Upper-limb prosthetics to restore near-natural function

- FDA approval for first major advance in upper-limb prosthetic since the hook: DEKA Arm



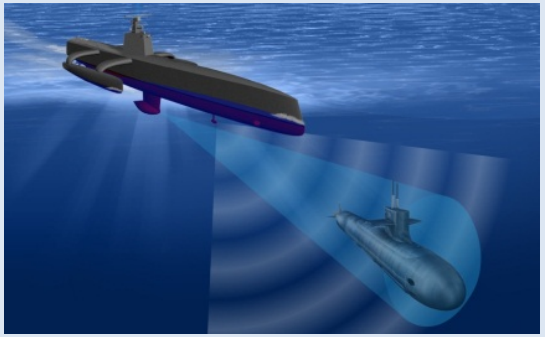
Outpacing Infectious Disease

Rapid, precise diagnostics, prevention, and therapeutics

- Ebola in West Africa "live-fire test" of compact, battery-powered diagnostics
- Rapid development of advanced vaccine underway
- New industrial base for nucleic-acid-based therapies for infectious disease emerging after early DARPA investment

Selected Recent Transition Progress: Highly Contested Environments

Distributed Agile Submarine Hunting (DASH)
Extreme-depth distributed sonar for wide-area surveillance to detect and track quiet submarines
- At-sea prototype testing with USN
- Tactical integration with Navy watch floor



ASW Continuous Trail Unmanned Vessel (ACTUV)
Unmanned surface vessel able to traverse long distances autonomously in accordance with maritime navigational rules
- Joint development and test program with ONR culminating in Navy transition decision

Tactically Exploited Reconnaissance Node (TERN)
Medium altitude, long-endurance unmanned vehicle operable from smaller ships for extended awareness and access
- Joint development program with ONR culminating in a full-scale at-sea demo of fixed wing launch and recovery technologies

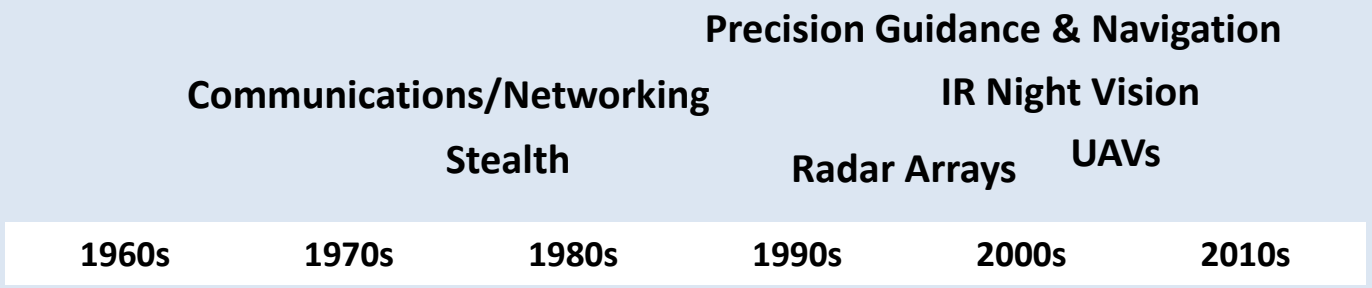
Long-Range Anti-Ship Missile (LRASM)
Stealthy, survivable, precise subsonic cruise missile to outstick surface adversaries
- DARPA-USN LRASM Deployment Office (LDO) executing to rapidly deploy on B-1B & F/A-18
- Aug 2013 (1st Flight Test): Missile tracked and homed via RF signals with IR aimpoint precision
- Nov 2013 (2nd Flight Test): Second autonomous engagement of radar-emitting surface target
- Feb 2015 (3rd Flight Test): Low altitude flight and autonomous obstacle avoidance

Air Dominance Initiative (ADI)
DARPA-USAF-USN study
- Leading warfighter and technology experts: sophisticated, numerous adversary capabilities will demand new platforms, ISR, weapons, EW, cyber, and other advances
- Influenced multiple DARPA and Service programs
- Led to joint DARPA-Service programs:
  - Aerospace Innovation Initiative – X-plane prototypes
  - Low-cost delivery vehicle
  - Modeling and simulation
  - Disposable adaptive decoys
  - EOIR seeker neutralization

Gallium Nitride for RF Arrays
DARPA and Service S&T investment established U.S. technology and manufacturing base
- GaN enables Next Gen Jammer to defeat advanced threat waveforms at long range
- GaN enables Air and Missile Defense Radar (AMDR) to detect and engage advanced missiles at long range
- GaN enables Space Fence to track small space objects and avoid collisions of LEO satellites

DARPA's Mission

Breakthrough Technologies for National Security



New capabilities require a healthy ecosystem across Service S&T, universities, and industry

DARPA's role: pivotal early investments that change what's possible

Major Factors Shaping DARPA Investments Today

Wide range of national security challenges:
evolving nation states, shifting networks

Powerful, globally available technologies
set a fast pace

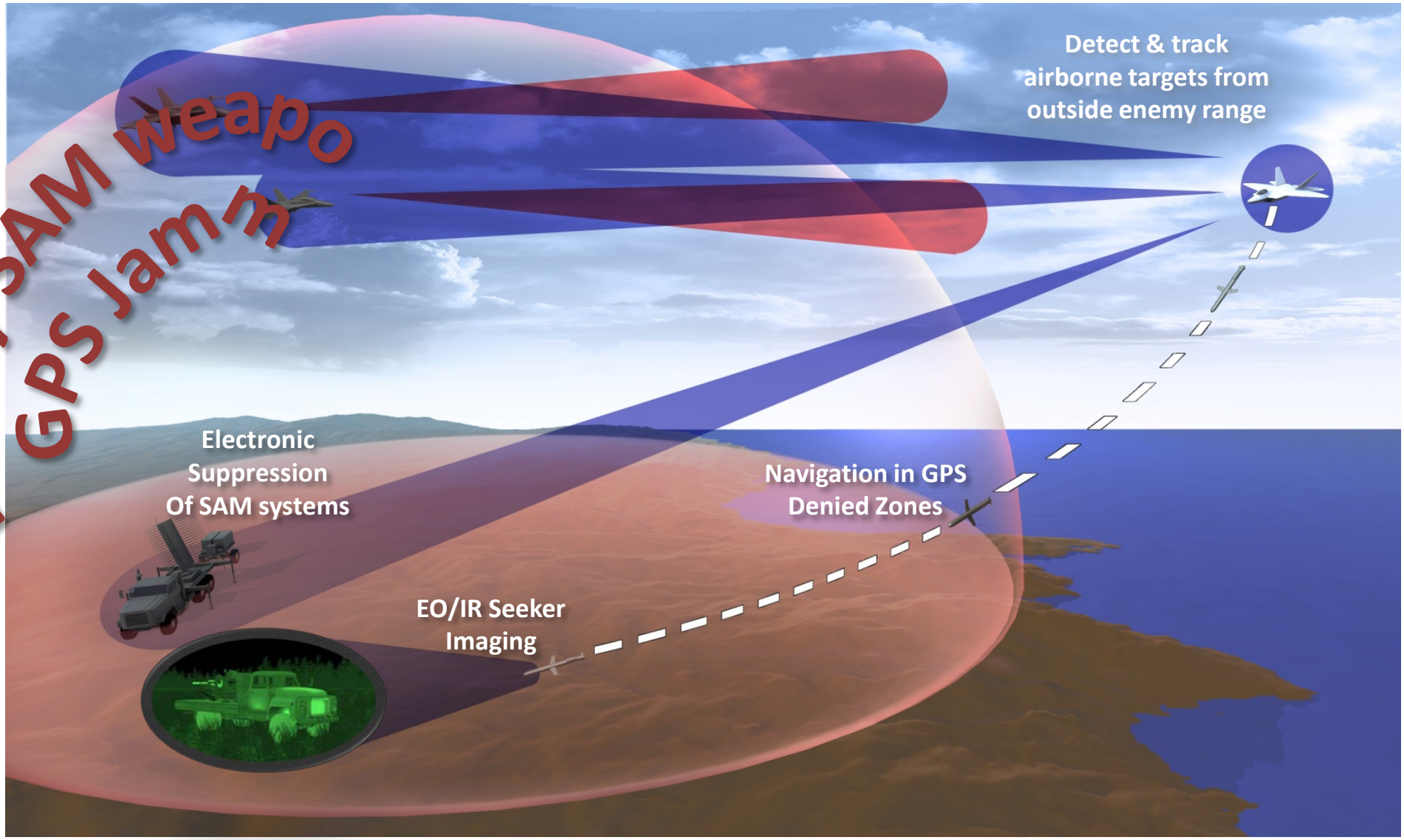
Military systems' cost, pace, and inflexibility
limit our operational capabilities

A New Generation of Breakthrough Technologies for National Security

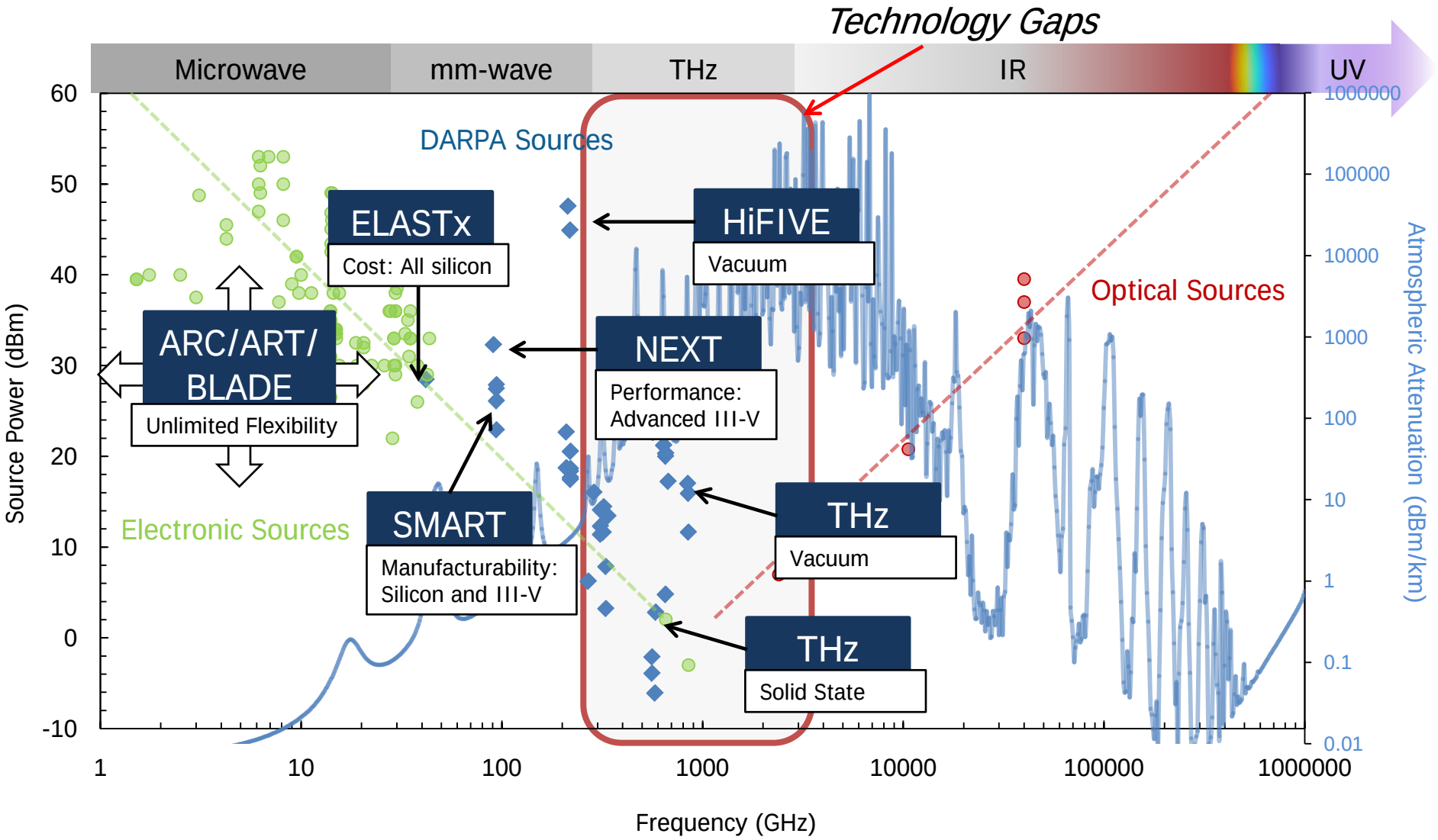
Rethinking Complex Military Systems	
Electromagnetic Spectrum Dominance	Fully & dynamically control the EM spectrum for communications, sensing, imaging
Position, Navigation, and Timing Beyond GPS	Deliver accuracy without dangerous reliance on GPS and enable new coherent effects
Air Superiority in Contested Environments	Architect sustainable, cost-effective air superiority over a peer adversary in 2030+
Hypersonics Capability	Prevent peer adversary sanctuary or strategic surprise
Robust Space	Establish confidence in all aspects of space operations despite new threats
Undersea Capabilities	Provide scalable effects from the undersea sanctuary
Overmatch Squad	Expand reach, situational awareness, and maneuver for strategic overmatch
Defense Against Terrorism	Create new counters for new mass terror threats
Information at Massive Scale	
Cyber Capability	Wield cyber as a military capability with confidence in our own cybersecurity
Big Data	Extract new capabilities from the data explosion and map behavior patterns at scale
Biology as Technology	
Brain Function Research	Drive and harness fundamental advances in understanding brain function
Engineering Biology	Create new classes of materials that are unattainable through today's chemistry
Outpacing Infectious Disease	Design rapid, specific diagnostics and therapeutics
New Foundations for Technological Surprise	

These focus areas are part of a broad and diverse portfolio of DARPA investments
Focus areas change over time as some succeed and graduate, others fail, and DARPA identifies new challenges and opportunities

Controlling the Electromagnetic Spectrum



Control of the EM spectrum is driven by physics

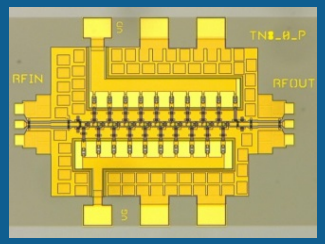


Terahertz Electronics (THz)

EM Spectrum Dominance

Program Overview

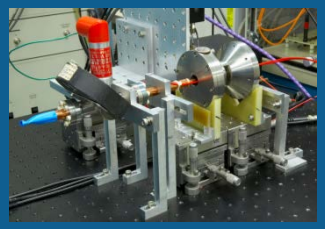
InP HEMT



Differentiators
- High gain
- Low noise
- Highest f_t/f_{max}

First THz MMIC
- 10 dB gain at 1 THz
- 9 dB gain at 1.03 THz

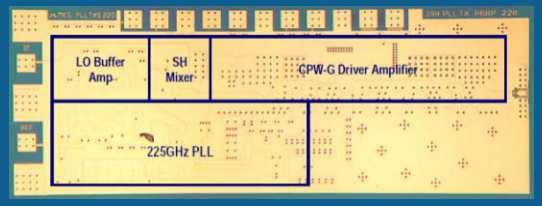
Vacuum Electronics



Differentiators
- Output power
- Efficiency

First 850 GHz TWT
- 39.4 mW at 850 GHz
- 11 GHz BW

InP HBT



Differentiators
- Output power
- Integration density

Highest power per area at 670 GHz – 0.7 W/mm^2

Measured power and gain at THz frequencies

Program Outcomes

Capability Objectives:
- Achieve device and integration technologies to realize electronic circuits operating beyond 1012 Hz (1 THz)
- Close gap between photonics (»1 THz) & electronics (<300 GHz)
- Produce integrated sub-mmW transmitter/receivers
- Goal: Enable use of a new spectral range for military applications

Program Achievements

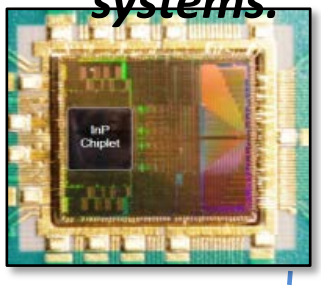
Accomplishments:
- 1.03 THz MMIC recognized with a Guinness World Record
- Solid state and VE components have set world records in every phase of the program at 670 GHz, 850 GHz, and 1.03 THz
- HEMT and HBT technology is used in DAHI, SMART, and ViSAR
- HBT technology transitioned into commercial measurement equipment

EM Spectrum Dominance Technology Transitions: Low-cost, disposable systems

- *F-22, F-15C, F-18, F-16, F-35*
- *THAAD/TPY 2*
- *Zumwalt/SPY 3*
- *NMD-GBR*

- *Next Gen Jammer (NGJ)*
- *Space Fence*
- *Air and Missile Defense Radar (AMDR)*

Single chip, disposable, high performance military systems.

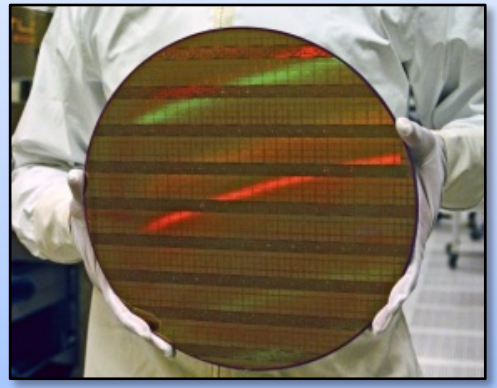


Materials/Devices

GaAs → **GaN** → **DAHI**

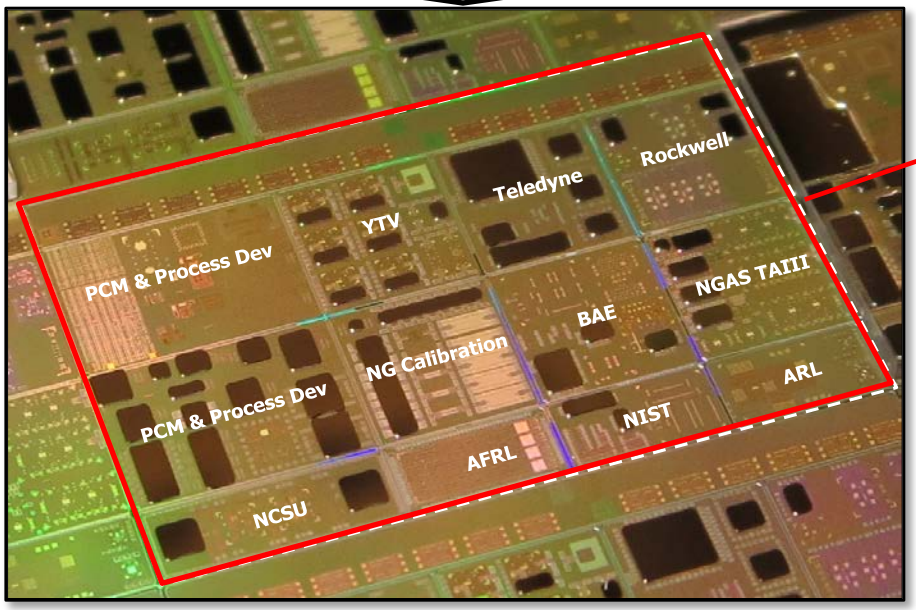
Diverse Accessible Heterogeneous Integration (DAHI) update

Commercial Manufactured Silicon Substrate



Niche high performance materials

3D heterogeneous integration of exotic materials on CMOS



9 Team multi-project wafer run

Results Jan. 2015:
Yielding > 95% on first run

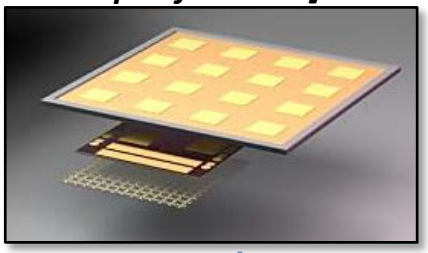
EM Spectrum Dominance Technology Transitions: Adaptive Radar Technology

- *F-22, F-15C, F-18, F-16, F-35*
- *THAAD/TPY 2*
- *Zumwalt/SPY 3*
- *NMD-GBR*

- *Next Gen Jammer (NGJ)*
- *Space Fence*
- *Air and Missile Defense Radar (AMDR)*

Unbanded RF systems:

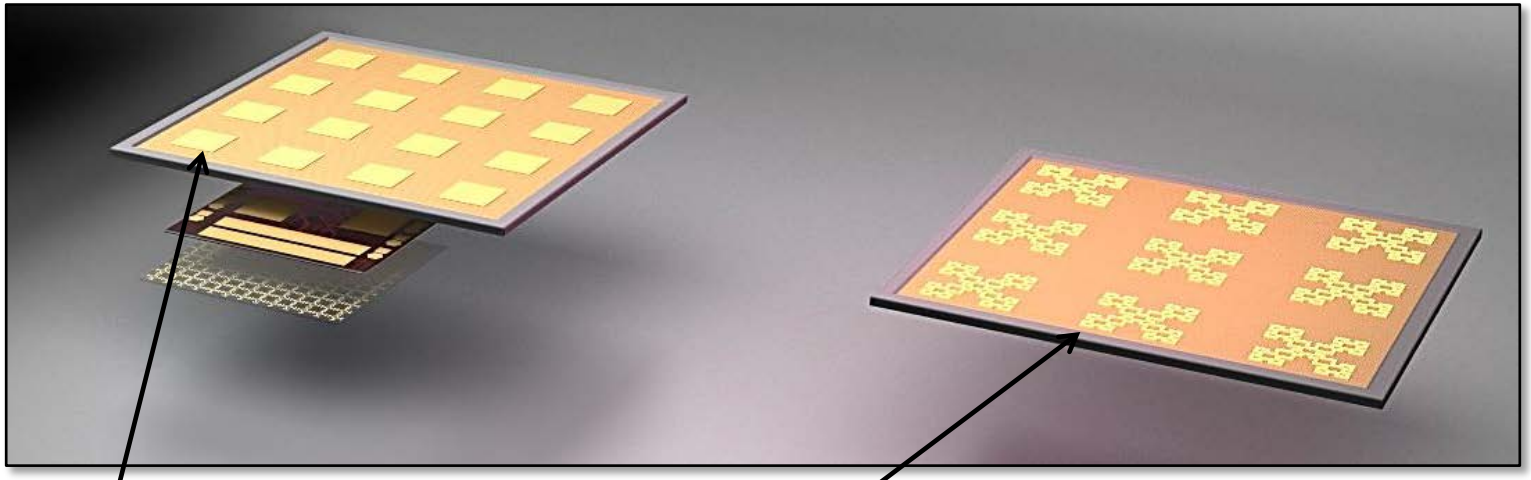
[Not bound to initial design specifications]



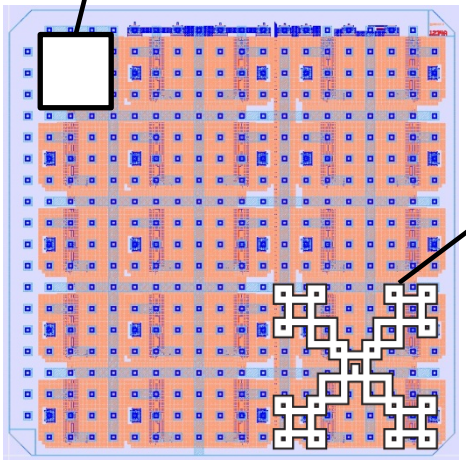
Arrays

GaAs → **GaN** → **ACT**

Example Result of Component Reconfigurability



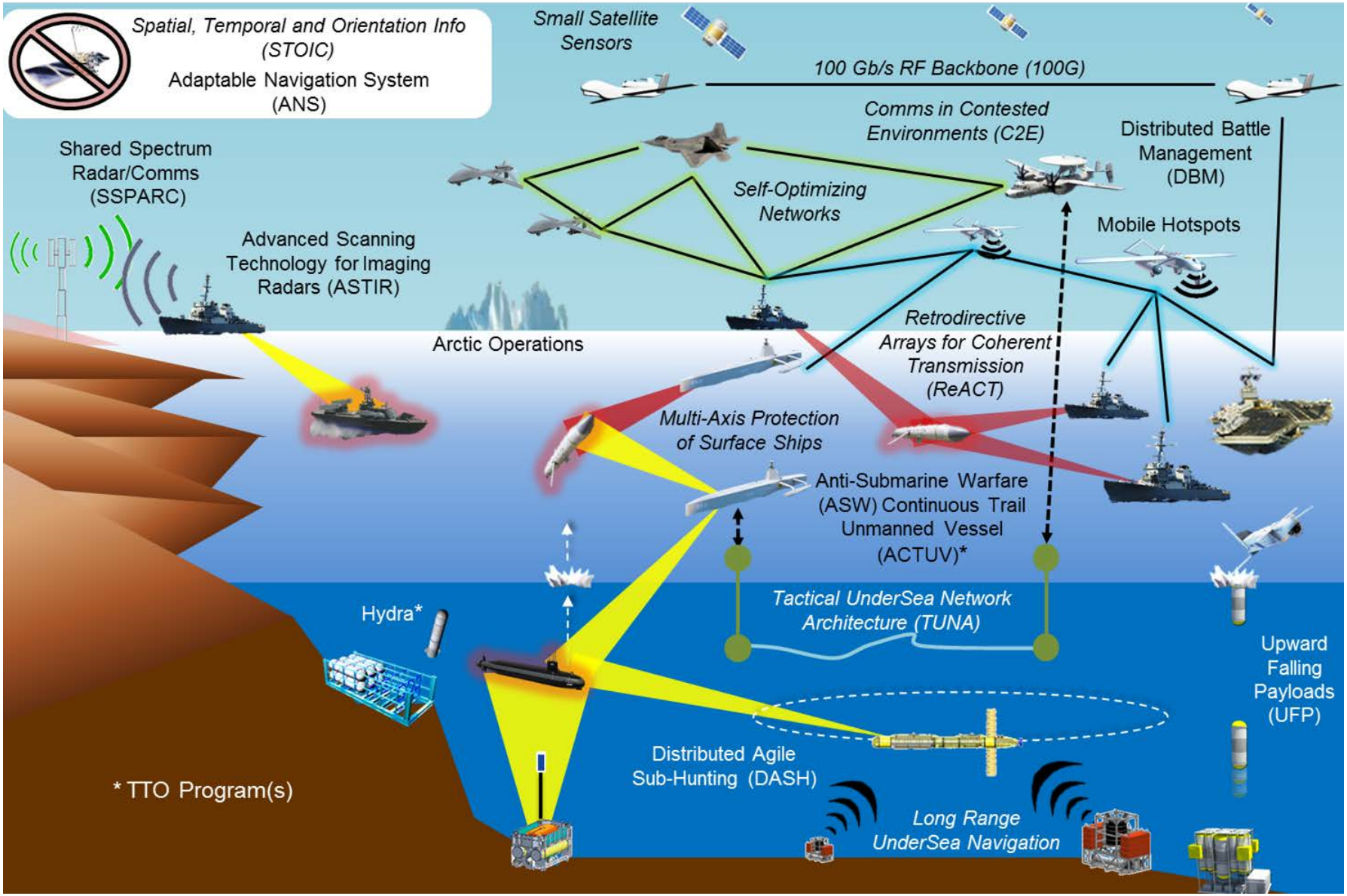
"Unbanded" Systems



Pixelated array face allows for customizable operation that can vary the frequency of the system.

Dynamic control of current flow across the array face allows for on the fly adaptability to combat varying threats and targets. (ACT)

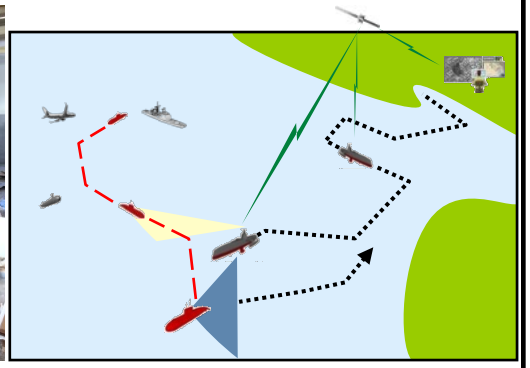
New Maritime Capabilities



Anti-Submarine Warfare (ASW) Continuous Trail Unmanned Vessel (ACTUV)

PROGRAM OVERVIEW

Develop a large unmanned surface vessel with exceptional payload capacity, ocean spanning range, and a high level of autonomy suitable for maritime missions



- Designed for ASW track and trail, flexible for other missions.
- Demonstrated compliance with COLREGS maneuvering rules

PROGRAM OBJECTIVES

- Demonstrate the technical viability of an independently deployed autonomous naval vessel under sparse remote supervisory control
- Design, build, and demonstrate a clean-sheet unmanned vessel with propulsion and maneuverability overmatch against submarine targets
- Deliver additional payloads including mine countermeasures and integrate and test
- Show the utility of large, independently operating unmanned surface vessels for a variety of Naval missions

PROGRAM STATUS

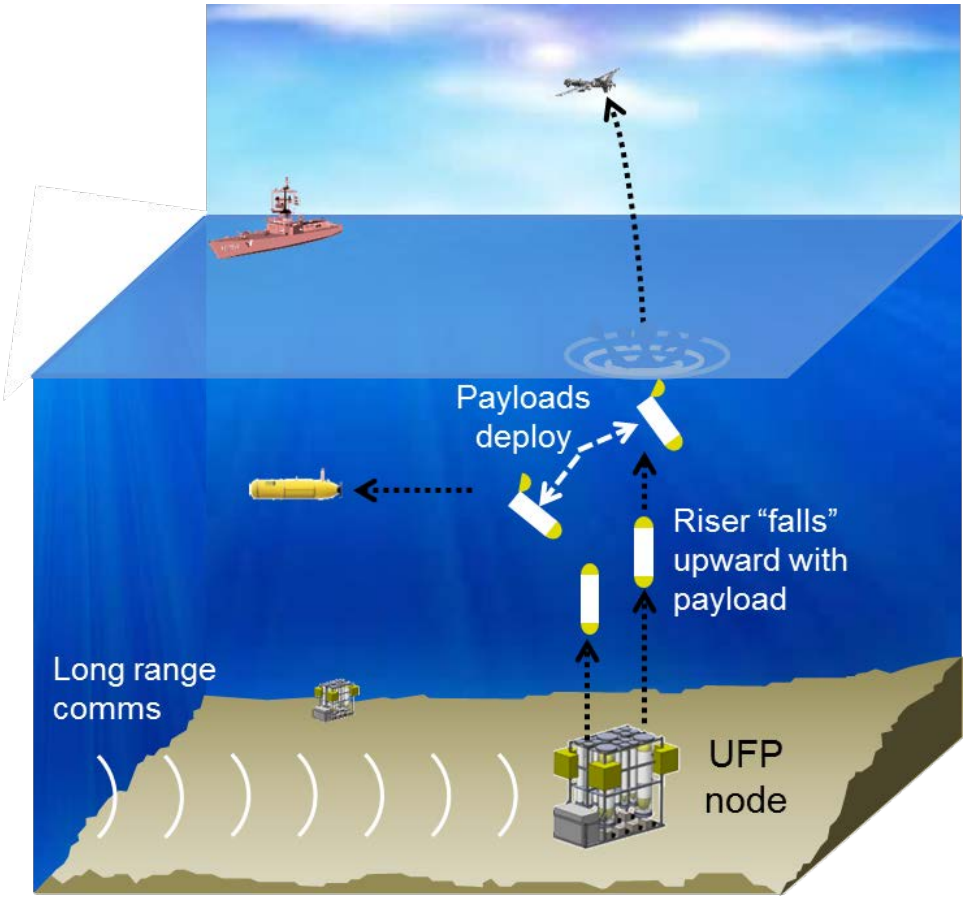
Schedule: FY 2010 – FY 2017

- Complete construction of prototype vessel – 1Q FY 2016
- Initiate testing/trials of full scale prototype – FY 2016
- Begin testing with ONR – FY 2016

- MOA signed with ONR; Discussions with OPNAV and Unmanned Maritime Systems Program Office (PMS 406)

Upward Falling Payloads (UFP)

PROGRAM OVERVIEW



- Pre-deployed deep-sea nodes providing on-demand effects in less than 2 hours
- Exploit ocean concealment and vastness

PROGRAM OBJECTIVES

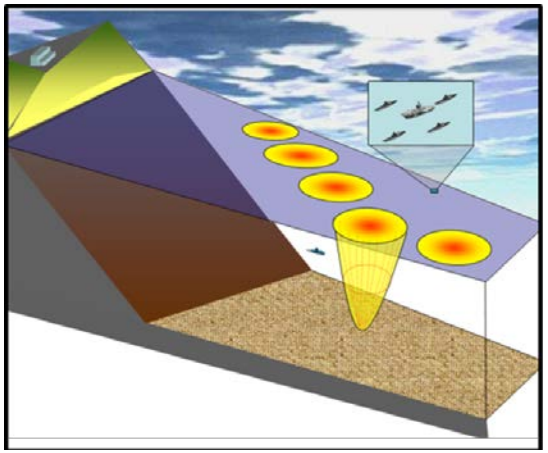
- Deliver unmanned distributed systems over large maritime forward operating areas
  - Pre-deploy deep ocean (>4 km) nodes years in advance
  - Wake up nodes and launch payload to the surface
  - Provide disruptive effects/situation awareness
- Nodes carry platform/payload capable of providing on-demand support to missions such as:
  - Communications reconstitution
  - Intelligence, Surveillance and Reconnaissance
  - Electronic Warfare
- Support operations with low latency (hours) over an enduring system lifetime (5 years)

PROGRAM STATUS

- Schedule: FY 2013-FY 2017
- Phase 2 and 3 kickoff held Q1 FY 2015
- Long range comms system held successful preliminary design review
- Long range comms sea tests scheduled for April and October 2015, February 2016
- Riser and Payload sea tests in October 2015, February and April 2016
- Phase 3 downselect June 2016

Distributed Agile Submarine Hunting (DASH)

PROGRAM OVERVIEW



Counter the diesel-electric submarine threat to U.S. carrier strike groups, ships and submarines

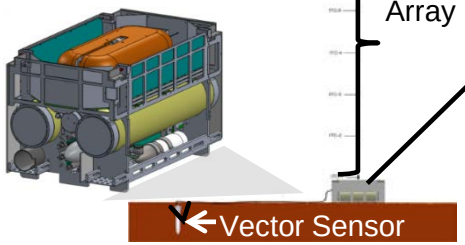
PROGRAM OBJECTIVES

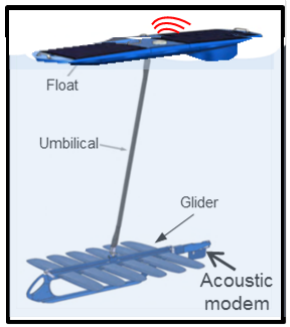
- Develop distributed, unmanned sonar systems to find submarines over large areas
- Provide extended-duration sonar for surveillance and maneuver operations in forward denied areas
- Distribute sonar nodes at extreme depth for affordable and scalable for wide area coverage

PROGRAM STATUS

- Schedule: FY 2010 – FY 2016
- Demonstrated:
  - Long-endurance (> 5 months) operations of TRAPS
  - Fully autonomous operations of SHARK at full depth
  - Tactical communications in operational setting
- Validate upgraded sensor designs (FY 2015)
- Conduct sea trials in FY 2015 and FY 2016

TRAPS
(Transformational RAP System)





WaveGlider Communications Node

SHARK
(Submarine Hold at RisK)

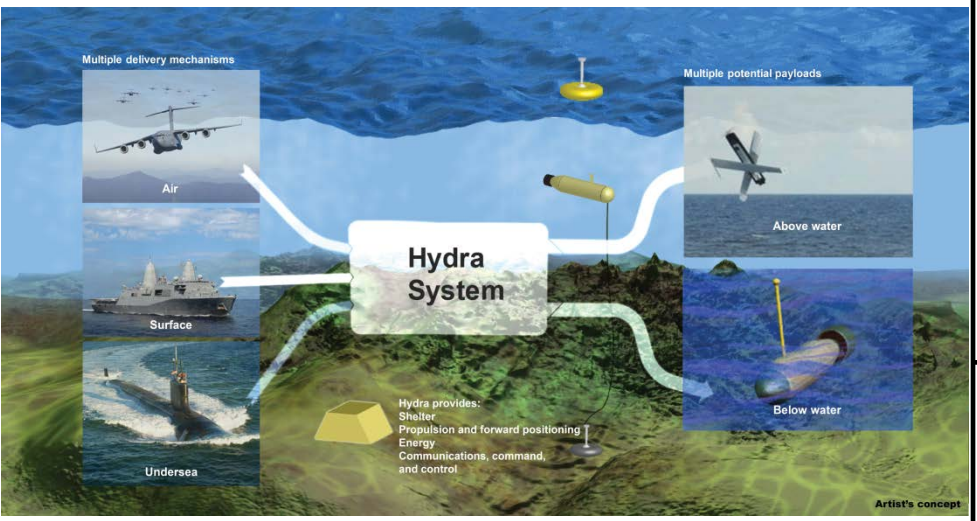
mobile

moored

Hydra

PROGRAM OVERVIEW

Develop and demonstrate an unmanned undersea platform with associated payloads able to be deployed into operational environments and employed in innovative ways.



- Multiple delivery options
- Highly modular
- Multiple potential payloads

Enable a radical conceptual departure from current approach to undersea littoral warfare

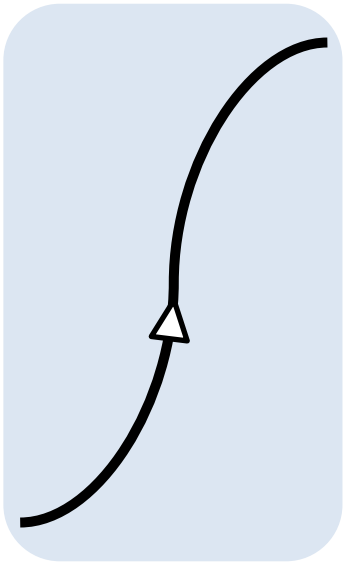
PROGRAM OBJECTIVES

- Develop a deployable system that is able to submerge for long periods and deliver effects on demand
- Integrate undersea vehicle and air vehicle payloads; demonstrate operational utility.
- Develop enabling technologies for undersea power and data transfer. Develop deployment and retrieval options.

PROGRAM STATUS

- Schedule: FY 2014 – FY 2018
- Complete concept designs for the modular enclosure and potential payloads – FY 2015
- Begin development of a prototype modular enclosure – FY 2015
- Initiate development of one or more potential payloads – FY 2015
- Build and test prototype modular enclosure – FY 2016
- Conduct integrated system demonstrations – FY 2017

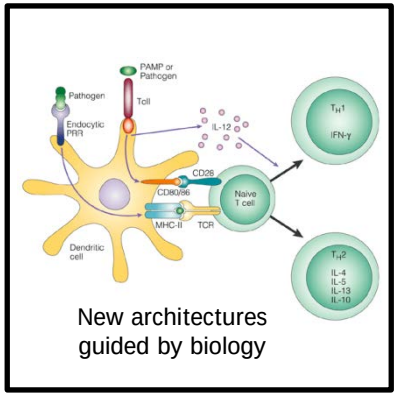
Mastering the Information Explosion



- Information revolution still happening and on an increasing pace. Estimated at 40% growth per yeat.
  - Personal computing, smartphones, tablets, smart TVs, wearables, internet of things.
  - Embedded systems will account for 10% of the digital universe by 2020.
- DoD cyber domain extends from the homeland to the tactical edge. Explosion in codebase size.
  - F-35 has 14x more code than F-22 and 175x more code than F-16
  - 90% of weapon system functions are controlled by software.
  - Tens of billions of open source LoC are added each year.

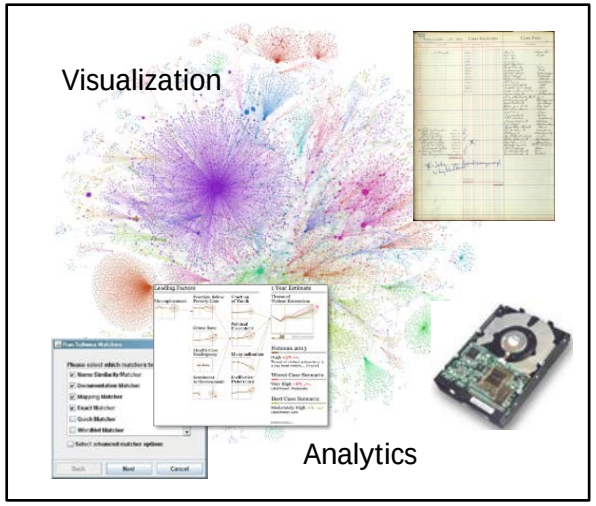
Exploit Cyber and Big Data to gain strategic advantage

CYBER: Trustworthy computing and information

Correct by construction	Clean slate architectures	Automation	Strategic/tactical cyber operations
			
Using formal methods to verify code is proven to do what it is supposed to do	Redesigning and securing the computing base	Automatically adapting and responding to new threats	Understand, plan, and manage the cyber battlespace
HACMS	CRASH	CGC	PlanX

BIG DATA: Empowering the end user to harness the information explosion

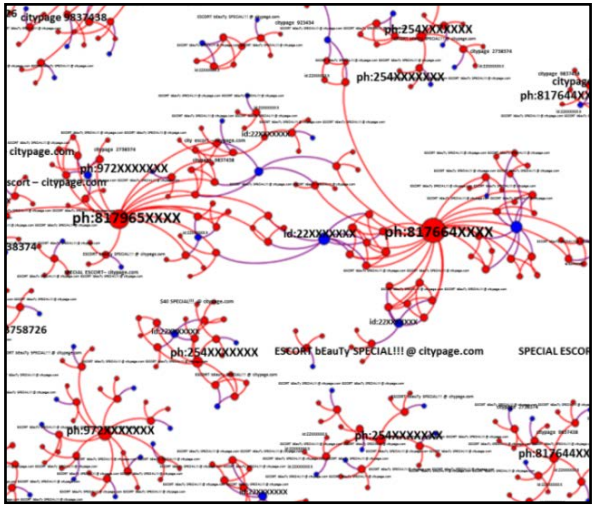
Tools to uncover hidden patterns and networks



Showing how big data can support warfighting decisions in Counter-Insurgency

XDATA

Tools to discover and extract deep/dark web content



Using big data and web search to illuminate illegal activity

Memex

Tools to program without being an expert

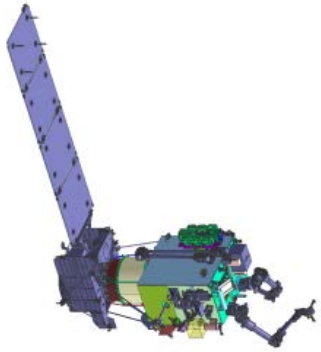
```
ASSUME road_width (uniform_discrete 5 8) //arbitrary units
ASSUME road_height (uniform_discrete 70 150)
ASSUME lane_pos_x (uniform_continuous -1.0 1.0) //uncentered renderer
ASSUME lane_pos_y (uniform_continuous -5.0 0.0) //coordinate system
ASSUME lane_pos_z (uniform_continuous 1.0 3.5)
ASSUME lane_size (uniform_continuous 0.10 0.35)

ASSUME eps (gamma 1 1)
ASSUME theta_left (list 0.13 ... 0.03)
ASSUME theta_right (list 0.03 ... 0.02)
ASSUME theta_road (list 0.05 ... 0.07)
ASSUME theta_lane (list 0.01 ... 0.21)

ASSUME surfaces (render_surfaces lane_pos_x lane_pos_y lane_pos_z
road_width road_height lane_size)

ASSUME data (load_image "frame201.png")
OBSERVE (incorporate_stochastic_likelihood theta_left theta_right
theta_road theta_lane data surfaces eps) True

INFER (mh default one 10000)
```

Using deep program analyses, probabilistic programming, and big data analytics to enable automated synthesis of custom software

PPAML

http://www.darpa.mil/OpenCatalog/XDATA.html

Robust Space

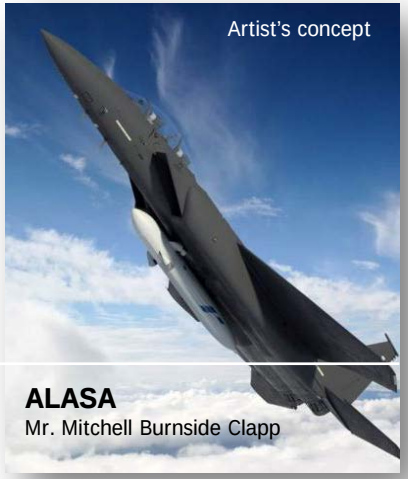


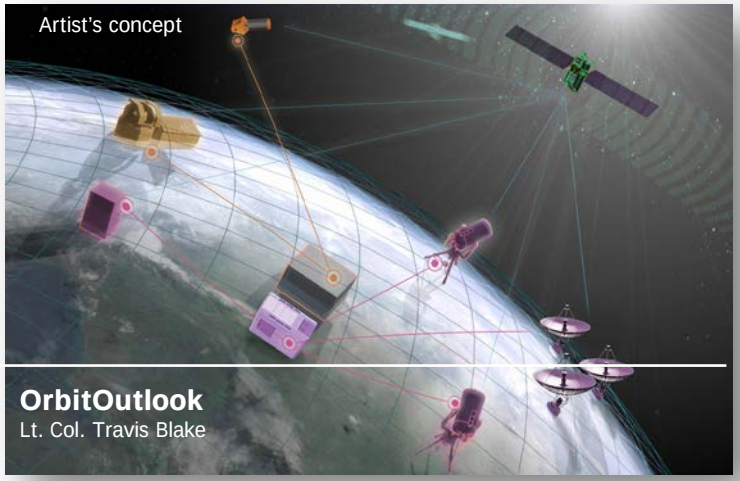
Robotic Servicing of Geostationary Satellites (RSGS)

Normalize and simplify space

Technical goals

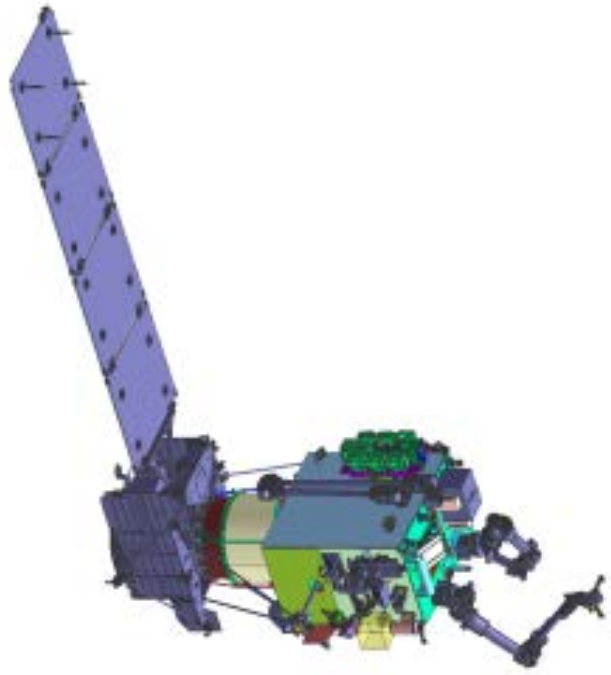
- Affordable routine access
- Reduce escalating systems cost
- New capability
- Survivability / resilience / reconstitution / autonomy
- Disaggregation/simplification
- Space situational awareness





Robotic Servicing of Geostationary Satellites (RSGS)

PROGRAM OVERVIEW



RSGS will develop technologies to demonstrate robotic servicing in geostationary orbit

PROGRAM OBJECTIVES

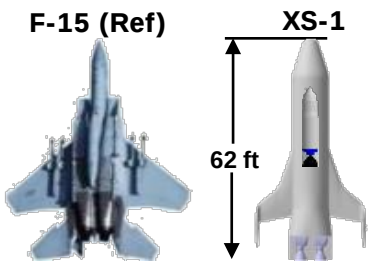
- Demonstrate ability to perform cooperative inspection, anomaly repair, and orbit modification in geostationary earth orbit (GEO)
- Develop reliable, safe, efficient operations
- Transform GEO spacecraft design and operations
- Enable radical space concepts including large aperture assembly, large structures for hosting GEO payloads, modular spacecraft, LEO (low earth orbit)-to-GEO tugs

PROGRAM STATUS

- Schedule: FY 2015 to FY 2020
- Complete critical design of robotic servicing system including robotic arms and tool docking system – FY 2015
- Begin fabrication of primary and secondary robotic hardware and software – FY 2015
- Develop interfaces between servicer satellite and government-provided robotic payload – FY 2016
- Develop comprehensive test plan for robotics – FY 2016

Responsive Launch Programs

Experimental Spaceplane (XS-1)



PROGRAM OBJECTIVES

- Reusable 1st stage, expendable upper stage
- Fly XS-1 10 times in 10 days (no payload)
- Design for recurring cost 10X < Minotaur IV
  - > 3,000 lb payload
  - < $5M/flight
- Launch subscale orbital demo payload once

Enable routine space access and testing of hypersonic aircraft technologies

Airborne Launch Assist Space Access (ALASA)

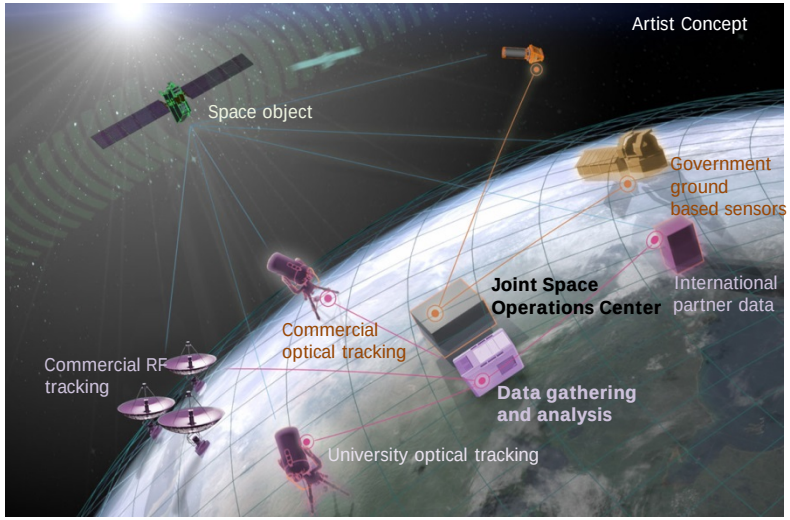
Enable small satellites to be deployed to orbit from an airborne platform, allowing performance improvement, reducing range costs, and flying more frequently, which drives cost per launch down

PROGRAM OBJECTIVES

- Mature and demonstrate technologies for cost effective, routine, reliable access to low earth orbit (LEO) from airfields
- Reduce cost to $1M/flight in the 100 lb mass payload class
- Improve responsiveness to a 24-hour call-up to fit in the air tasking order cycle
- Deliver capability to launch into any Low Earth Orbit
- Demonstrate ability to disperse from a threatened launch airfield and execute mission from elsewhere

Space Situational Awareness

Orbit Outlook

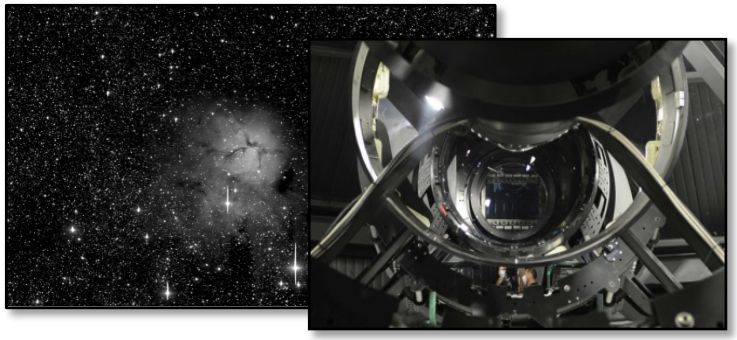


PROGRAM OBJECTIVES

- Collect and integrate space surveillance data from non-traditional DoD sources
- Develop algorithms that allow reliable estimation of the position, velocity, and nature of objects in space from "unreliable," "unformatted," and varied data sources
- Establish processes to verify information and quality assurance

Demonstrate an orthogonal data acquisition methodology by emphasizing the validation of the data not the sensor

Space Surveillance Telescope (SST)



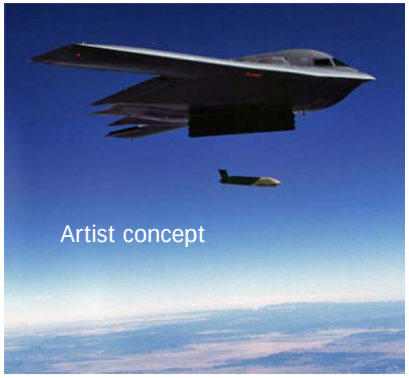
PROGRAM OBJECTIVES

- Program is developing enhanced dim-object detection algorithms, a new, advanced wide-field camera, and CONOPS for faster search capability fo the DoD space surveillance community
- Searches an area in space the size of the United States in seconds, and can survey ¼ GEO region of the sky multiple times in a single night
- In 2014, SST discovered over 500 new asteroids and took over 1,500,000 asteroid observations, which were accepted by the Minor Planets Center
- SST is currently being relocated New Mexico to Western Australia

SST offers ground-based capability for rapid, un-cued search, detection, and tracking of objects in deep space

Tactical Hypersonic Weapons

Tactical Boost Glide (TBG)

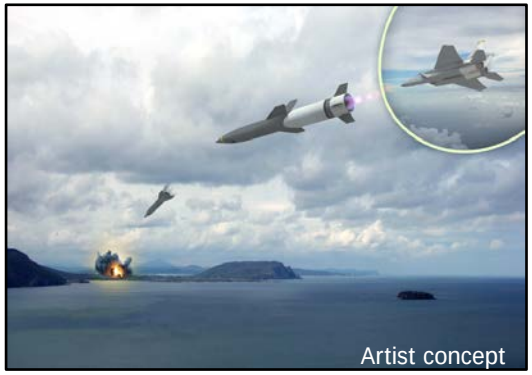


PROGRAM OBJECTIVES

- 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

The 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

Hypersonic Air-breathing Weapon Concept (HAWC)



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

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

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

Tern: fixed-wing performance from smaller ships

PROGRAM OVERVIEW

Tern is a medium altitude, long-endurance unmanned vehicle (MALE UAV), operable from smaller ships

- Joint DARPA/ONR program as of Spring 2014
- Signed Memorandum of Agreement
- Program objective now a full-scale at-sea demonstration of air vehicle launch/recovery, performance parameters

PROGRAM OBJECTIVES

- Provide organic, persistent aviation capability from smaller ships and expeditionary settings:
  - Launch/ recover from DDG-51 destroyer class ship deck
  - Track to moving recovery location up to sea state 5
  - Safe recovery to achieve turnaround for orbit to 95% probability
  - Provide near 24/7 orbit with 500+ lbs payload to 600+ nm
- Enable globally available, responsive and flexible mission sets without the requirement for fixed forward basing:
  - Deep overland ISR and strike
  - Persistent maritime surveillance and interdiction
  - Assured fleet connectivity
- Dramatically reduce the cost of persistent operations

PROGRAM STATUS

- Schedule: FY 2013 – FY 2019
- Conduct demonstration system technology maturation and complete preliminary design – FY 2015
- Initiate subscale testing of propulsion system – FY 2015
- Begin fabrication of demonstrator system hardware – FY 2016
- Commence testing of demonstration system hardware – FY 2016

NEUROTECHNOLOGIES

Source: Lightspring

ElectR$_x$
HAPTIX
NeuroFAST
RE-NET
Restoring Active Memory
Revolutionizing Prosthetics
SUBNETS

DISRUPTIVE MEDICINE

ADEPT
Battlefield Medicine
Dialysis-Like Therapeutics
In Vivo Nanoplatforms
Microphysiological Systems
Pathogen Predators
Prophecy
Rapid Threat Assessment
Warrior Web

Source: Berkeley Lab

ENGINEERING BIOLOGY

Biochronicity
BRICS
Living Foundries

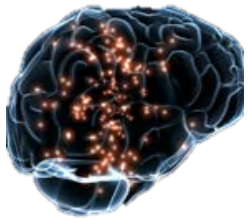
Neurotechnology

Hand Proprioception and Touch Interfaces (HAPTIX)

Revolutionizing Prosthetics

Reliable Neural Interface Technology (RE-NET)

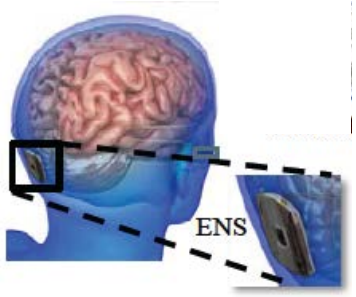
Systems-Based Neurotechnology for Emerging Therapy (SUBNETS)



Movement and Control

Behavior

Memory Recovery



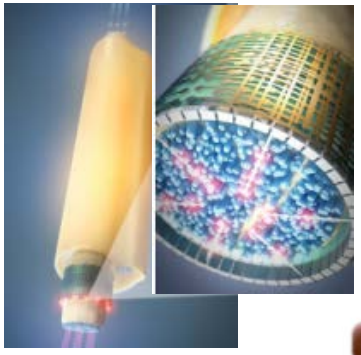
Restoring Active Memory (RAM)

Opportunities:

- Physical performance: ElectRx
- Cognitive capabilities
- Sensory improvement
- Noninvasive brain-machine integration

Prosthetic Hand Proprioception and Touch Interfaces (HAPTIX)

PROGRAM OVERVIEW



HAPTIX will develop the first fully-implantable neural interface system to provide amputees with natural motor and sensory functions for advanced prosthetic limbs.

PROGRAM OBJECTIVES

The HAPTIX program will create the first permanent, fully implantable, bi-directional (motor and sensory) peripheral nerve implant system for controlling and sensing advanced prosthetic limbs.

1. Develop first fully-implantable, bi-directional neural interface system for amputees
   - Independent, rapid, and intuitive motor control of 6+ limb joints
   - Stable, naturalistic touch sensation in 8+ hand locations
   - Stable, naturalistic joint sensation in 8+ limb joints
   - Lightweight system with high-density channel count
2. Obtain FDA IDE approval and initiate pilot clinical trials
3. Demonstrate long-term stability and utility
   - 1+ years of regular at-home use
   - Novel metric development and testing to quantify functional benefits

PROGRAM STATUS

- Schedule: FY 2014 to FY 2019
- Contract Awards pending

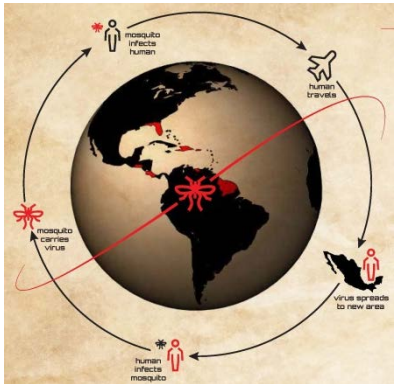
DARPA Prized-Based Challenges

CYBER GRAND_CHALLENGE

August 4, 2016

DEF CON, Las Vegas, NV

http://cybergrandchallenge.com/



The CHIKV Challenge

CHIKUNGUNYA

September 2014 – March 2015

DARPA ROBOTICS CHALLENGE

June 5-6, 2015

Fairplex in Pomona, CA

http://www.theroboticschallenge.org/

DARPA Robots4Us

DARPA Student Video Contest on Societal Implications of Robotics

Contest Opens Feb 11, 2015
Contest Closes April 1, 2015

http://www.theroboticschallenge.org/Robots4Us

Last year we started 46 new programs

Current open BAAs

- DARPA-BAA-14-38: Biological Technologies, Response Date 4/30/2015
- DARPA-BAA-15-05: Biological Technologies EZ BAA, Response Date 11/6/2015
- DARPA-BAA-14-46: DSO Office-Wide, Response Date 6/16/2015
- DARPA-BAA-15-19: Materials for Transduction (MATRIX), Response Date 4/2/2015 (DSO)
- DARPA-BAA-14-39: Information Innovation Office (I2O) Office Wide, Response Date 07/15/2015
- DARPA-BAA-15-18: Communicating with Computers (CwC), Response Date 4/9/2015 (I2O)
- DARPA-BAA-15-29: Brandeis, Response Date 4/29/2015 (i2O)
- DARPA-BAA-14-42: Microsystems Technology Office (MTO) Office-Wide Broad Agency Announcement (BAA), Response Date 9/9/2016
- DARPA-BAA-15-14: Near Zero Power RF and Sensor Operations, Response Date 4/23/2015 (MTO)
- DARPA-BAA-14-48: Strategic Technologies, Response Date 9/17/2015
- DARPA-BAA-15-28: Future Arctic Sensing Technologies, Response Date 4/14/2015 (STO)
- DARPA-BAA-15-24: Shared Spectrum Access for Radars and Communications Phase 2, Response Date 4/27/2015 (STO)
- DARPA-BAA-14-25: Innovative Systems for Military Missions - Tactical Technology Office (TTO), Response Date 4/24/2015
- DARPA-BAA-15-26: Squad X Core Technologies (SXCT), Response Date 4/10/2015 (TTO)

http://www.darpa.mil/Opportunities/Solicitations/DARPA_Solicitations.aspx

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