Tactical Technology Office

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Mission

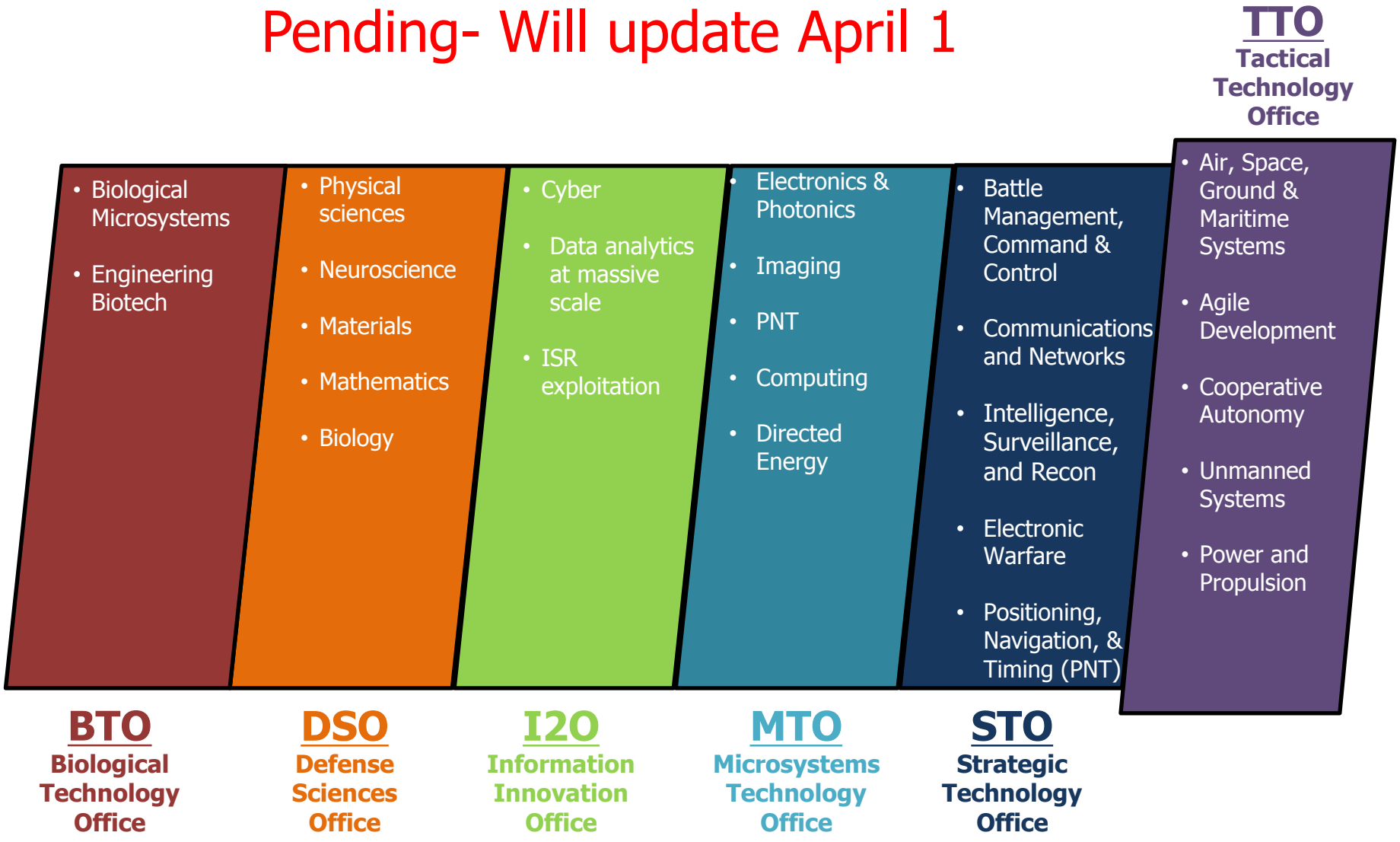
The Defense Advanced Research Projects Agency (DARPA) was established in 1958 to **prevent strategic surprise** from negatively affecting U.S. national security and **create strategic surprise** for U.S. adversaries by maintaining the technological superiority of the U.S. military.

To fulfill its mission, the Agency relies on **diverse performers** to apply multi-disciplinary approaches to both advance knowledge through basic research and **create innovative technologies** that address current practical problems through applied research.

As the DoD's **primary innovation engine**, DARPA undertakes projects that are finite in duration but that create **lasting revolutionary change**.

DARPA technical offices

Pending- Will update April 1



Tactical Technology Office (TTO)

Objective

To provide or prevent strategic and tactical surprise with very **high-payoff, high-risk development and demonstration** of revolutionary **new platforms**

Cross-cutting Themes

Agile development approach, cooperative autonomy, unmanned systems, power and propulsion

System Focus Areas

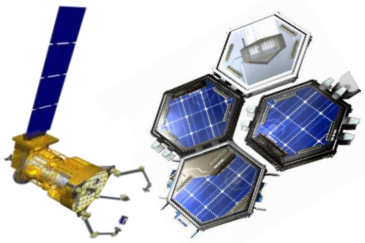
Air Systems

Control the air anytime / anywhere

Artist's concept

Space Systems

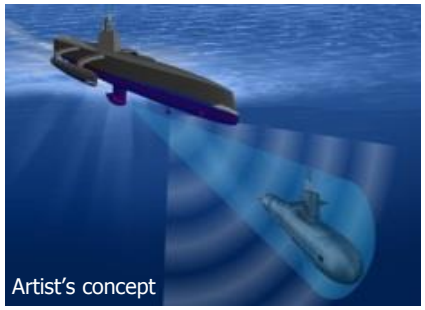
Normalize and simplify space



Artist's concept

Maritime Systems

Control the sea, influence events on land



Artist's concept

Ground Systems

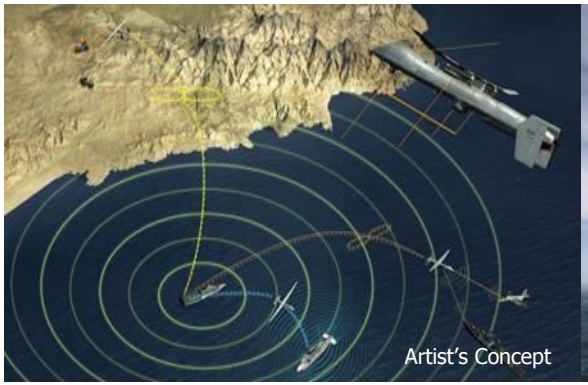
Amplify unit / soldier effectiveness

Artist's concept

Air Systems

Tactically Exploited Reconnaissance Node (TERN)

Medium-Altitude, Long-Endurance Unmanned Vehicle (MALE UAV) performance operable from smaller ships

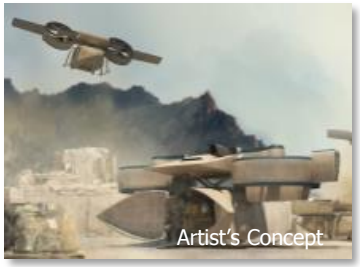


TERN Program Goals

- Provide organic, long-range aviation capability from smaller ships with 70 feet (DDG) deck length
- Enable globally available, responsive and flexible mission sets without the requirement for fixed forward basing, deep overland ISR, persistent maritime surveillance and interdiction, and assured fleet connectivity
- Dramatically reduce the cost of persistent operations

Aerial Reconfigurable Embedded System (ARES)

Unmanned air logistics, vertical takeoff and landing (VTOL) air vehicle with modular, multi-mission capability



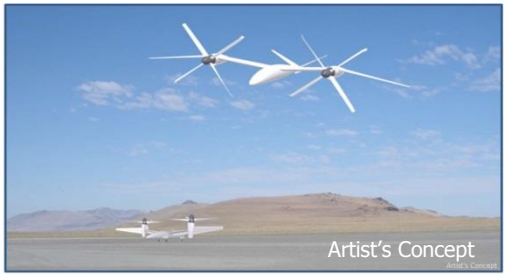
Artist's Concept

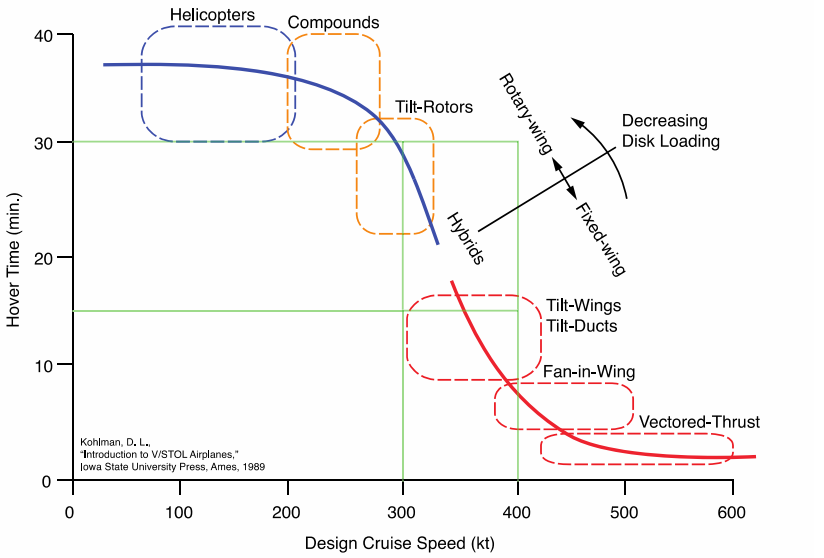
ARES Program Goals

- Enable flight demonstration of a full-scale, modular, VTOL, multi mission unmanned air system (UAS)
- Enable 3,000 lb useful load (7,000 lb gross take-off weight)
- Enable flight speed and handling similar to a light general aviation aircraft
- Enable VTOL operations from prepared or unprepared landing sites with and without mission pod

Vertical Takeoff and Landing Experimental Plane (VTOL X-Plane)

Vertical flight capabilities applicable to light-medium class aircraft





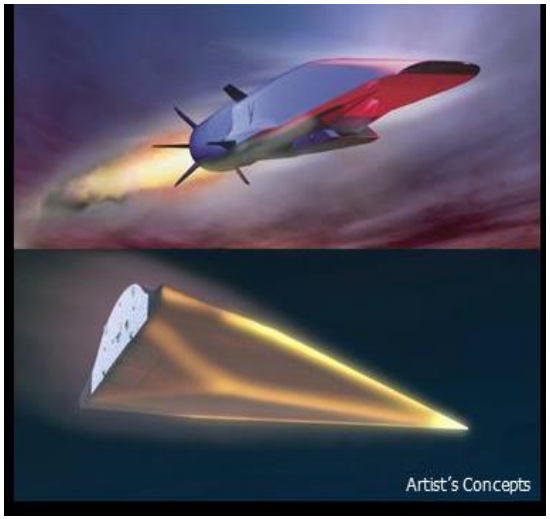
VTOL X-Plane Program Goals

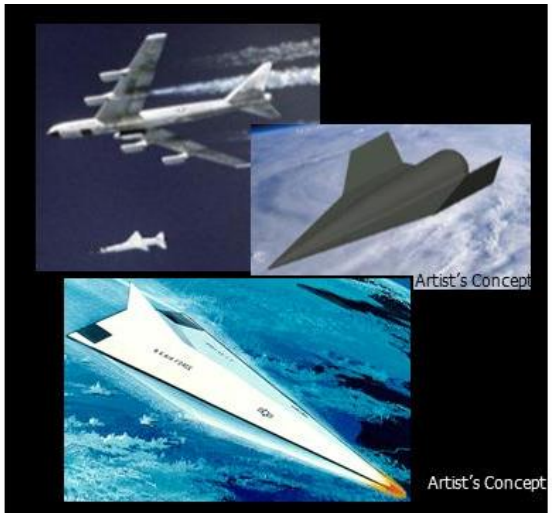
Artist's Concepts

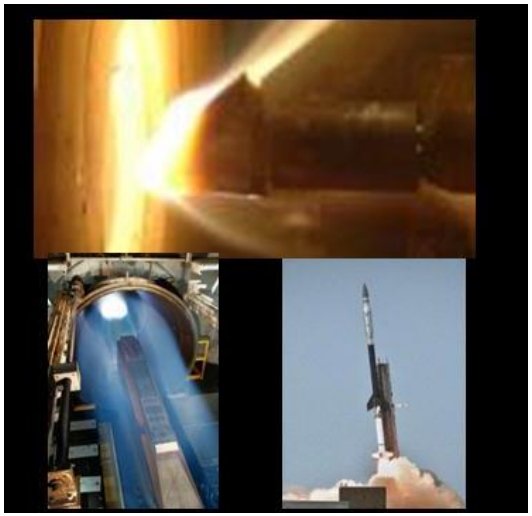
- Flight test a VTOL air vehicle to demonstrate a flight speed equal to or greater than 300 kt, hover efficiency equal to or greater than 75%, and cruise efficiency equal to or greater than ten
- Maintain the ability to perform useful work at a useful load of greater than or equal to 40% of the aircraft gross weight
- Demonstrate at a relevant weight class of 10,000 lbs – 12,000 lbs gross weight
- Ensure applicability to larger and smaller weight classes
- Ensure applicability to manned and unmanned aircraft

Hypersonics

Long-range, high-performance maneuvering hypersonic flight; and exploration of vehicle concepts for tactical-range hypersonic cruise missiles and hypersonic boost glide vehicles







Hypersonic Program Goals

- Enable demonstration of highly survivable hypersonic air vehicle platform designs operating at tactical and strategic ranges
- Evaluate vehicle performance to support terminal trajectory flight profiles and aero-efficient vehicle body designs for geometric and weight constrained environments
- Address affordability and manufacturing techniques to reduce complexity in the design of hypersonic vehicles

Space Systems

Airborne Launch Assist Space Access (ALASA)

Provide more affordable, routine, and reliable access to space

Todays capabilities: Vertical launch

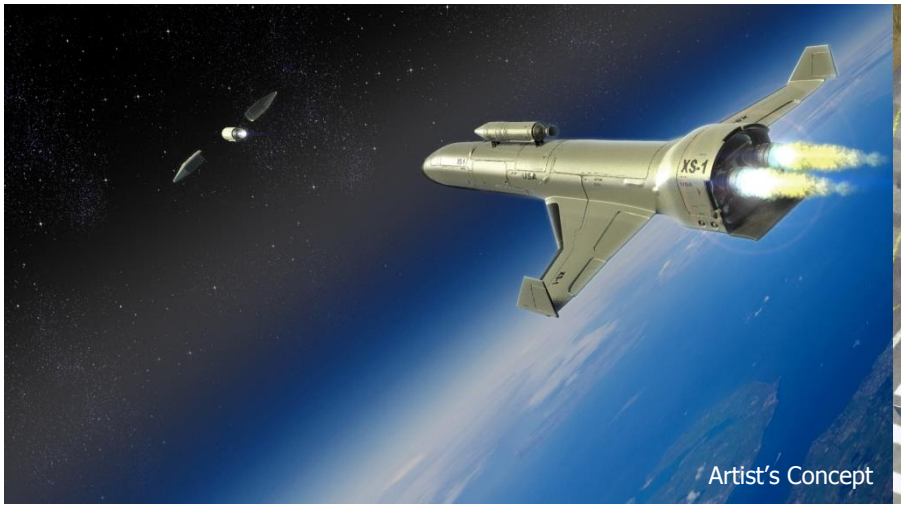
ALASA capabilities: Horizontal launch

ALASA Program Goals

- Leverage performance, flexibility and re-usability of air launch
- Take advantage of streamlined design and manufacturing
- Reduce infrastructure costs by using runways vs. fixed sites, automating operations; avoiding unnecessary services
- Exercise the concept frequently enough to show learning curve effects
- 100 lbs to LEO for $1M, including integration and range costs

Experimental Spaceplane (XS-1)

Routine-access space/hypersonic vehicles developed by integrating, testing, and maturing technologies and lean operations



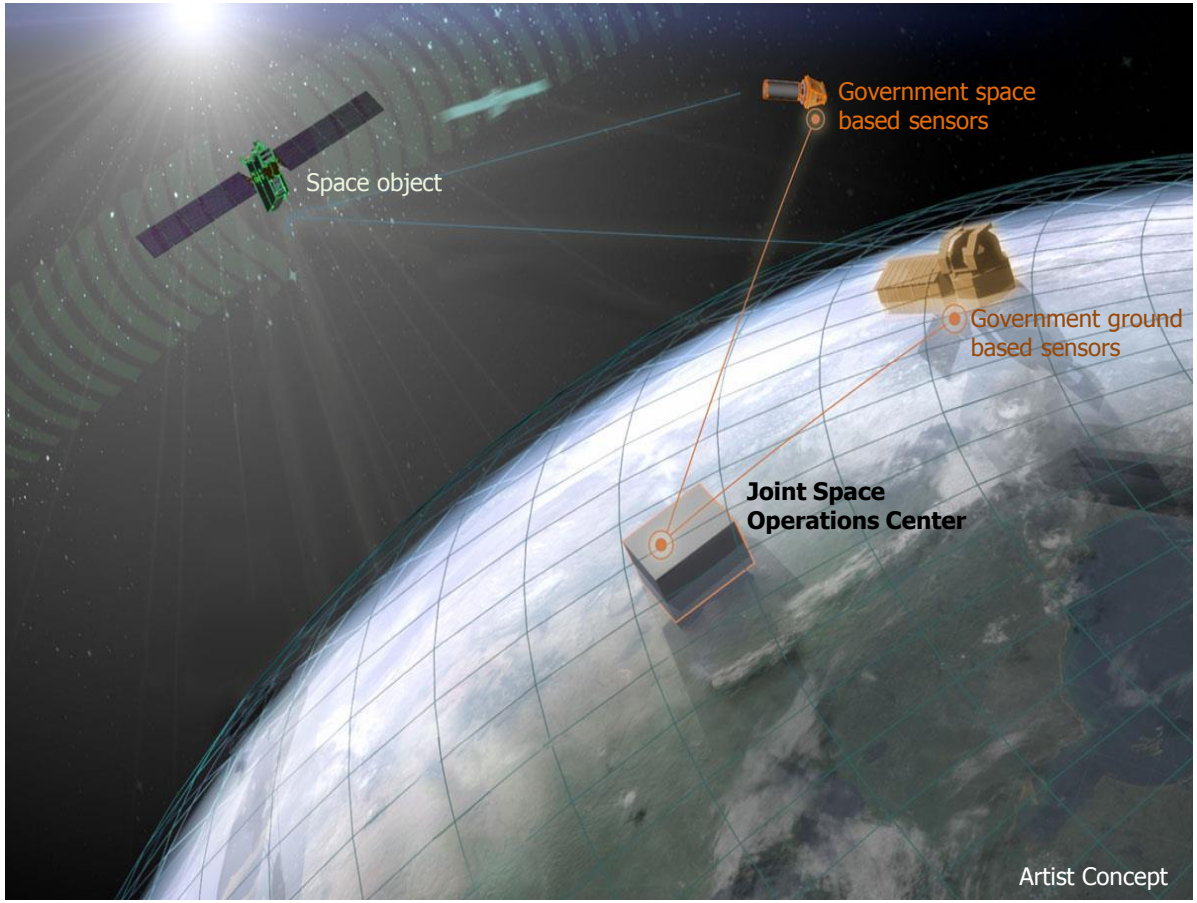
XS-1 Program Goals

- Fabricate and fly a subscale X-plane that meets the following requirements:
  - Reusable first stage
  - Fly 10 times in 10 days
  - Fly to Mach 10+
  - Launch at less than $5M each for cargoes of approximately 3,000 to 5,000 lbs
- Validate critical technologies for a wide range of next generation high speed aircraft to enable new military capabilities

OrbitOutlook

Leverage hundreds of available, low cost assets to increase coverage and persistence of tracking space objects

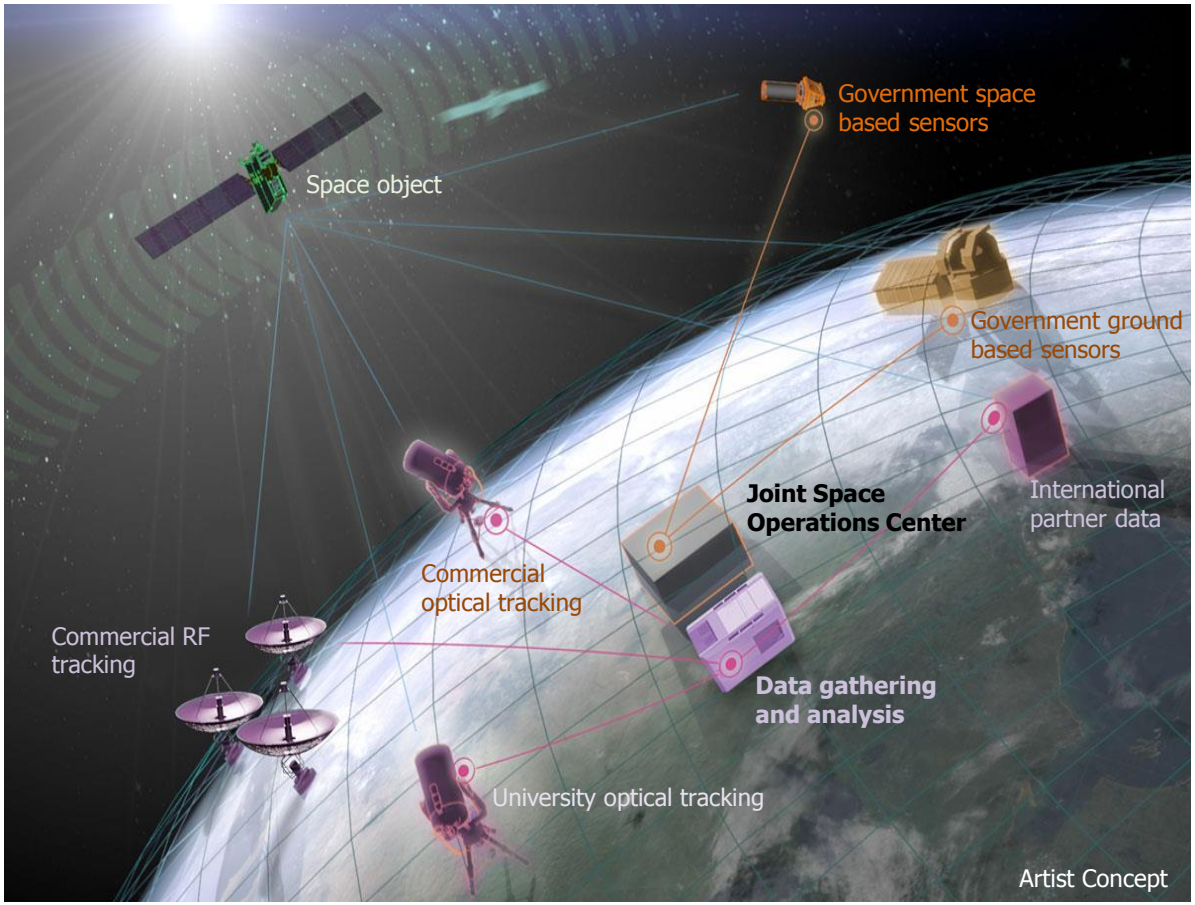
- Space Situational Awareness (SSA) currently uses sophisticated and exquisite certified government sensors
- With this model, greater coverage can only come at a significant cost



OrbitOutlook

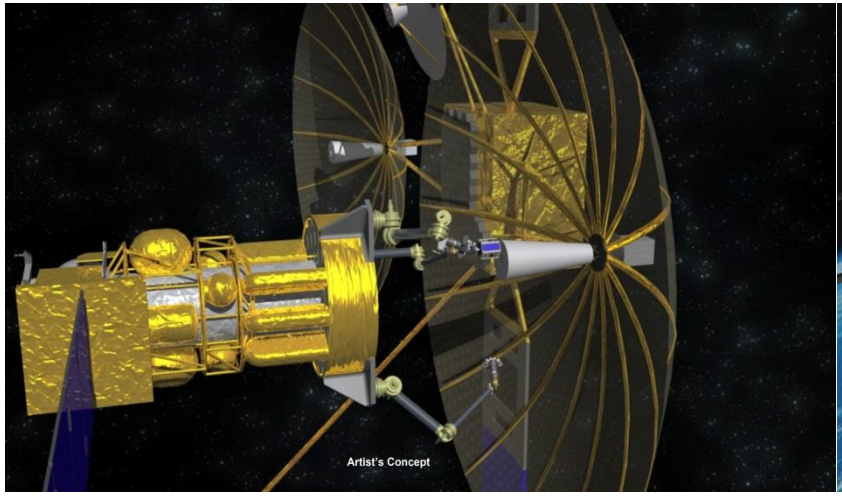
Leverage hundreds of available, low cost assets to increase coverage and persistence of tracking space objects

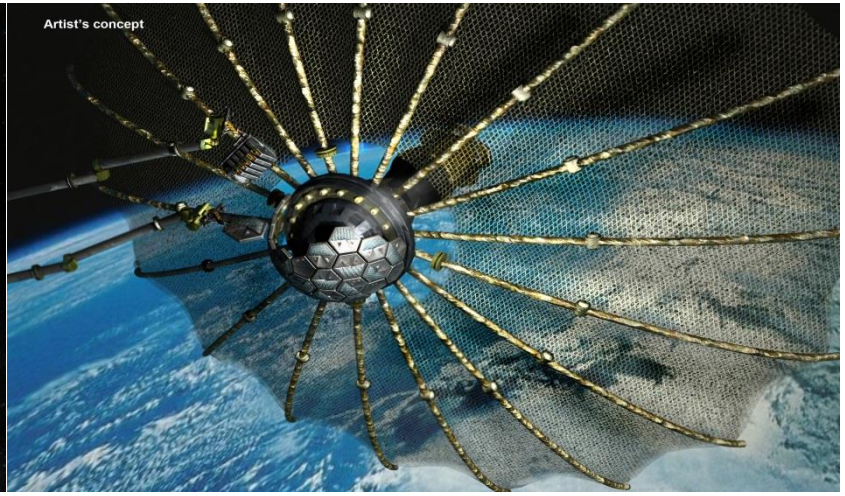
- Integrate space surveillance data from non-traditional DoD sources
  - Commercial
  - Academia
  - International partners
- Establish processes to verify information assurance and data quality
- Develop characterization and Indications and Warning (I&W) techniques



Phoenix

Technologies for robotic satellite servicing and spacecraft reconfiguration for geosynchronous orbit (GEO) and the ability to create new space systems at greatly reduced cost





Phoenix Program Goals

- Demonstrate a new concept in satellite morphology for on-orbit assembly through a new construct ("satlet")
- Demonstrate the ability to launch and dispense on-orbit small mass systems at monthly tempo using existing commercial services with a new construct ("POD")
- Demonstrate use of an on-orbit robotically enabled space vehicle capable of manipulation and maneuvering to perform a multitude of servicing actions (i.e. assembling, reconfiguring, repairing spacecraft on-orbit)

Phoenix technologies intended to foster growth in GEO space operations and capabilities

- Demonstrate and enable effective GEO robotic methods to enable on-orbit operations

Enable a host of robotic operations on-orbit in GEO that support lower cost and higher performance

- Develop satlets; a new, flexible, modular, scalable, low-cost satellite architecture

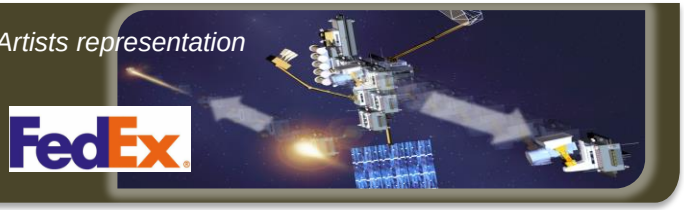
Create new satellite morphology to allow "on orbit build" at 10x cost savings

Artists representation

- Leverage existing global commercial markets to drive an increased tempo of smaller mass to geosynchronous orbit

Create a "FedEx to Space" market, take advantage of every kg available, worldwide*

Artists representation



** FedEx is a trademarked name.*

Phoenix path forward

- Phoenix is the leading DOD and USG space robotics effort
- Phoenix plans to focus on GEO robotics demonstration/validation
  - Evaluate best mission type
- Investigate public/private partnership
  - Workshop(s) and studies to evaluate
- Satlets to be matured for space qualification (LEO is the best first step)
- Mature and demonstrate POD concept
- Pursue parallel, separate GEO robotic demonstration and satlet development
- Do not preclude the potential to converge again in the future for a repurposing demo if study shows it as a desirable capability

Tele-ops control of on-orbit Robotic Servicer/Tender at GEO.

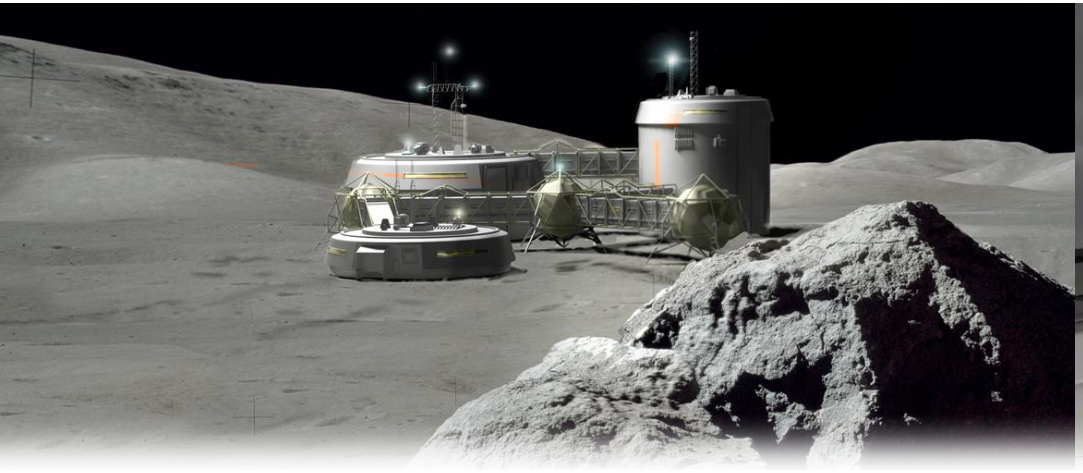
Artist's Concept

Modules (satlets) that can be aggregated for scalability and re-configurability, and can be easily replaced

Artist's Concept

What we are thinking about…

- Leveraging public-private partnerships
- Real-time space traffic coordination
- Beyond GEO
- Strategic heavy lift



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