Elevating DARPA's Status as a Disruptor: Driving Government – Commercial Synergies

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Space: The Tipping Point

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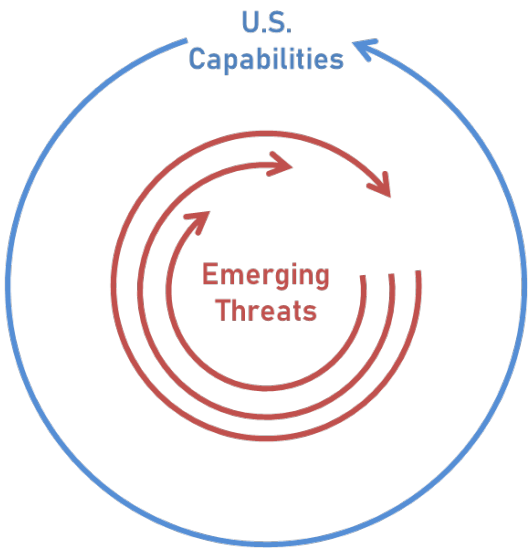
The Problem

- The U.S. military industrial complex has fine-tuned its ability to build very capable, exquisite space systems
- Our risk-averse processes incentivize performance over cost and schedule, further exacerbating the pursuit of monolithic, everything-to-everyone solutions
- The result is Orders of Battle (OOB) that are predictable in timelines, stove-piped in operations, few in numbers, and have interminable lifecycles
- This leaves us in an unresponsive posture—our ability to put capability on orbit lags the emerging threat landscape, often significantly



The Opportunity

- Strong command signal from senior leaders for change (e.g., Space Force)
- Commercial opportunities abound – lots of private sector capital pouring in
- DARPA has several ongoing efforts to pivot to this new architecture and leverage commercial space investments to do so

Access to Space: XSP and Launch Challenge

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The Problem
Our launch enterprise is driven by long satellite development timelines constrained to launch from a number of federal ranges.

DARPA's Approach
Experimental Space Plane (XSP) – two-stage-to-orbit spaceplane with reusable first stage with rapid turnaround capability

DARPA Launch Challenge – prize-based challenge to demonstrate launch capabilities that are both flexible (launch from anywhere) and responsive (launch at any time)

Commercial Opportunity
Public/private partnership to build commercial service offering to U.S. Government (XSP) and incentivize emerging small launch vendor base early to help meet commercial and DoD needs (Launch Challenge)

Space Architecture: Blackjack

The Problem

National Security Space has expensive, monolithic, vulnerable systems (many of which are in GEO) that are not responsive to new missions

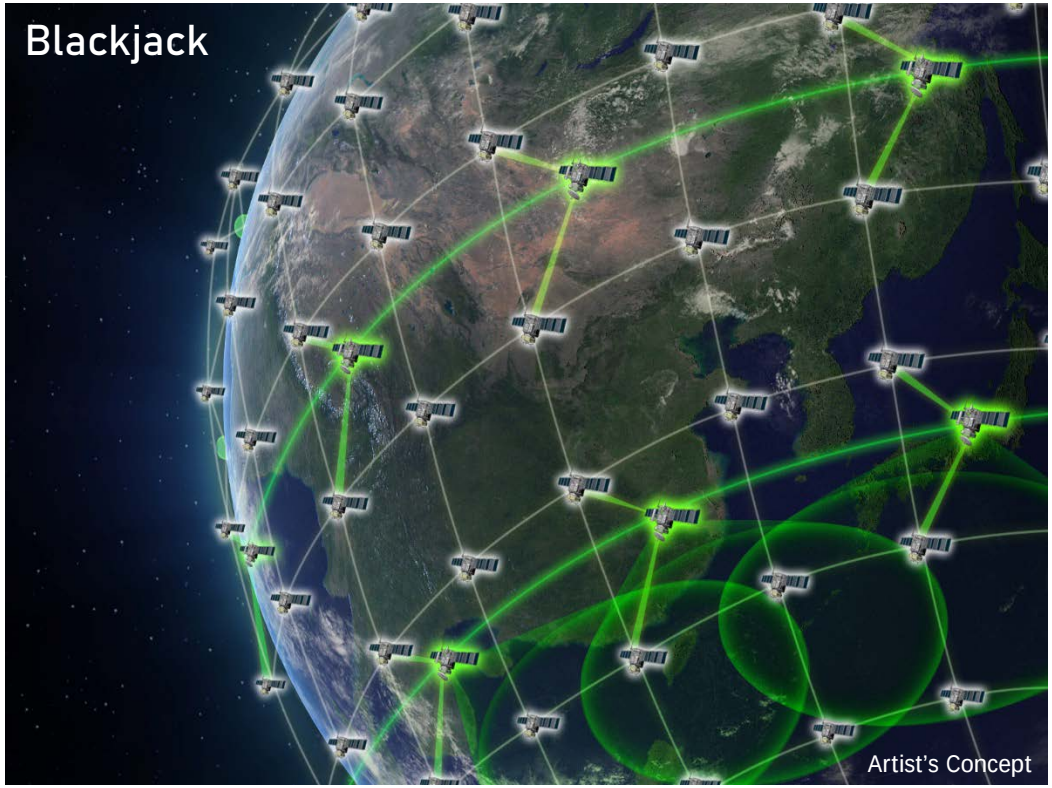
DARPA's Approach

Demonstrate a proliferated small satellite constellation in LEO

- Resilience
- Low Latency
- Global Persistence
- Rapid Tech Refresh
- Responsive to Emerging Threats

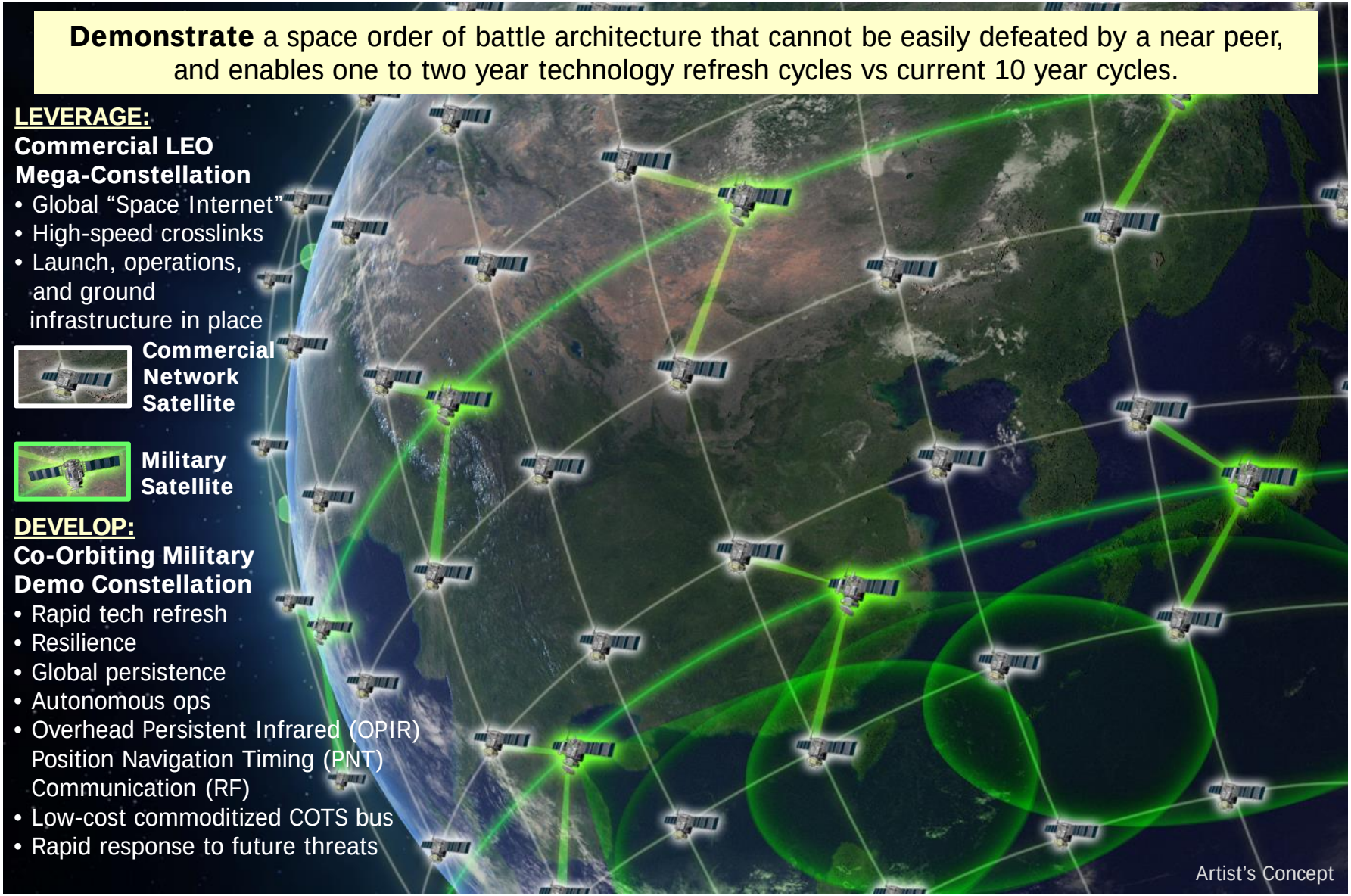
Commercial Opportunity

Employ commercial business case to provide "building blocks" derived from production lines, leveraging commercial economies of scale.



Military Space - Pivot to Low Earth Orbit (LEO)

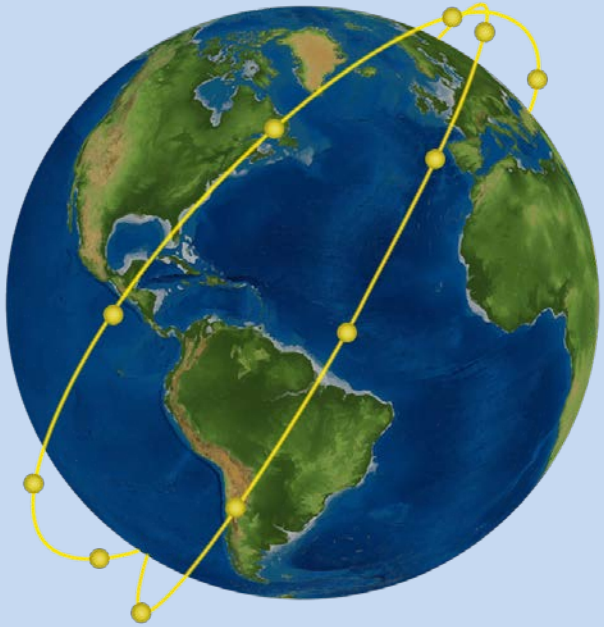
Demonstrate a space order of battle architecture that cannot be easily defeated by a near peer, and enables one to two year technology refresh cycles vs current 10 year cycles.



20 LEO Autonomous Spacecraft Demonstration

20-Spacecraft Demonstration

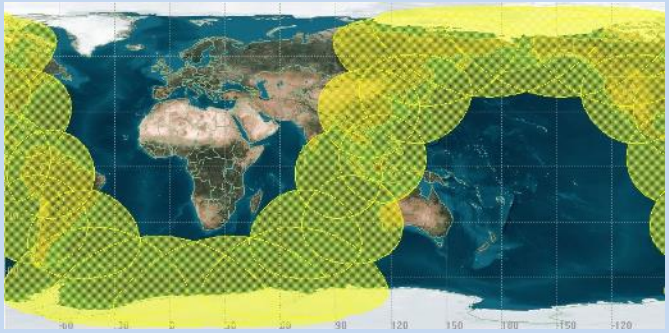
Two planes x 10 sats/plane at 1000 km
(Two spacecraft initially plus 18 more for full demo)



Demonstrate:

- Persistence – spacecraft handoff
- Autonomy
- Network / crosslinks
- On-board processing
- Stereo sensing
- Global Command, Control, Communications (C3)
- Commercial Production Line Approach

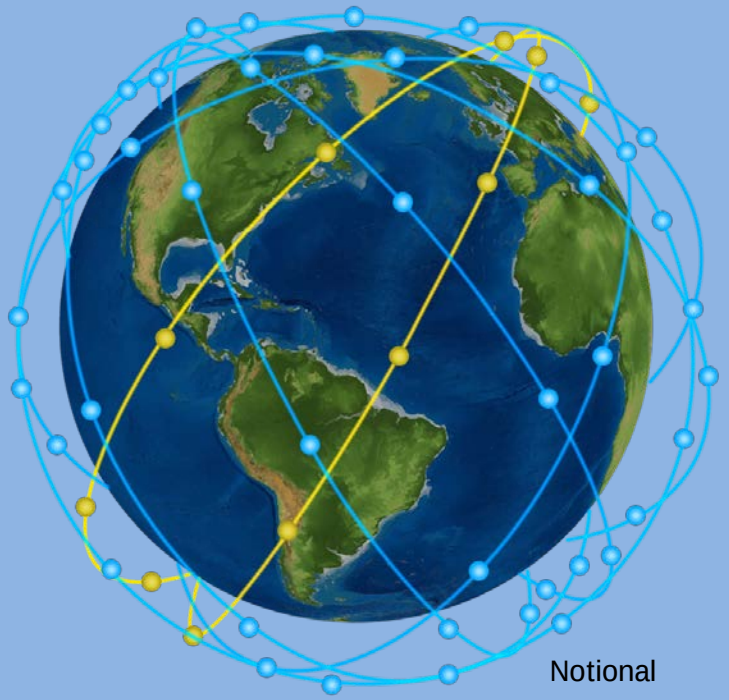
Notional orbits/inclination



Coverage footprint would enable simultaneous theater-level demos

90-Spacecraft Objective System

9 planes x 10 sats/plane
(not part of Blackjack program)

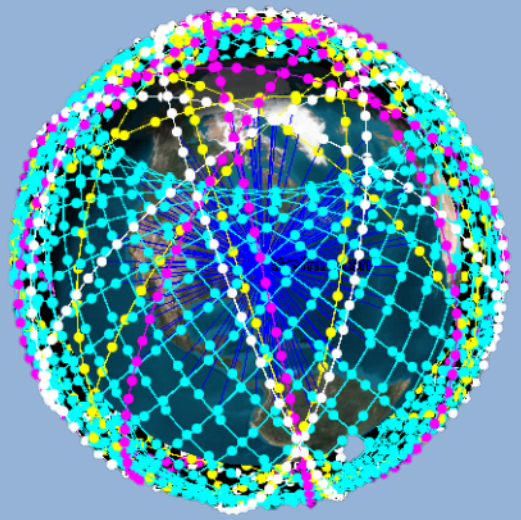


Notional

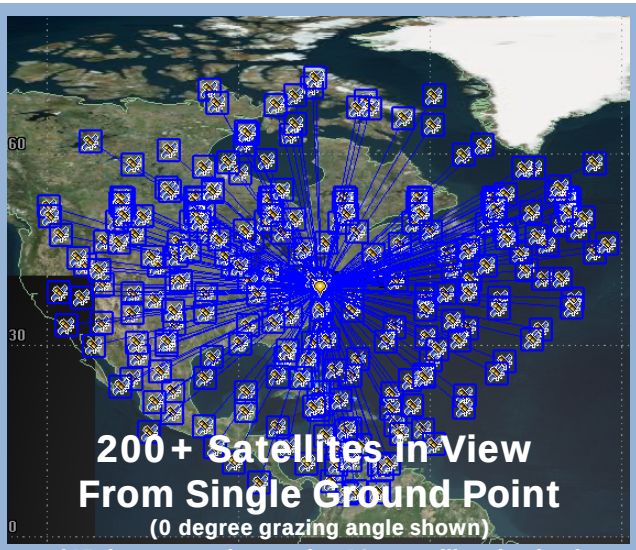
- Global coverage
- Commercial launch capability to launch two military spacecraft per week
- Full system could launch in 2022

Commercial Mega-Constellation in LEO for Global "Space Internet"

Concepts with hundreds to thousands of LEO comm satellites

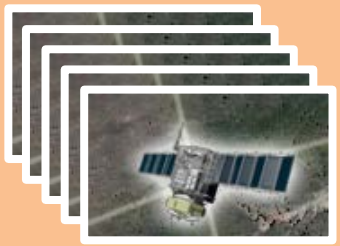


Commercial LEO Mega-Constellations

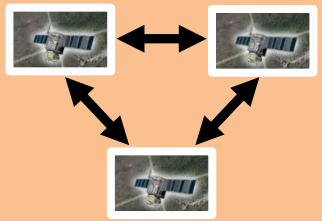


Leverage Commercial Investment

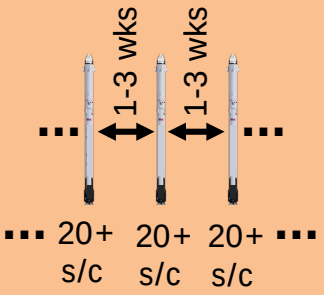
1. Commoditized Bus



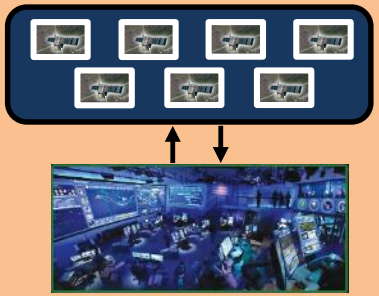
2. Inter-satellite Links



3. Frequent launches



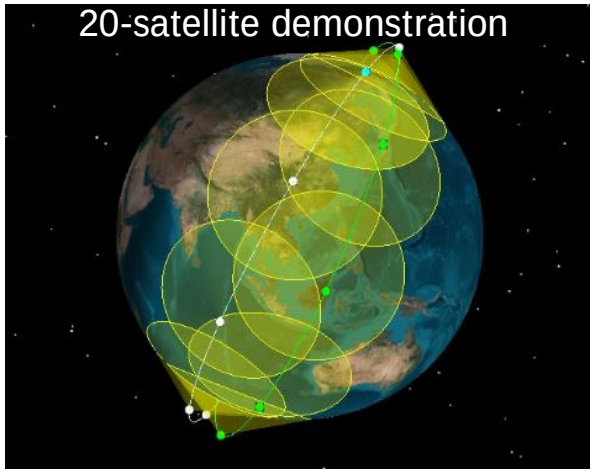
4. Constellation management



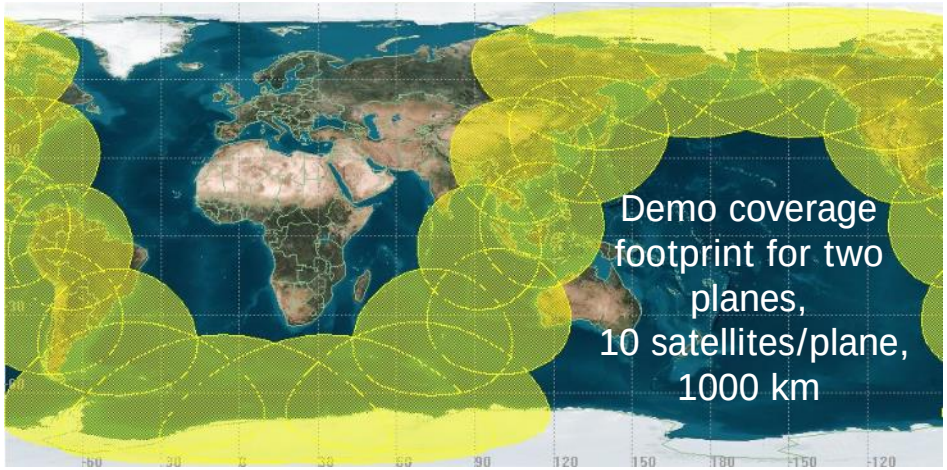
- Unprecedented low cost: Bus: **$1M-5M;** Payload: **$1M-5M**; Launch: **$2M-5M**
- 2021 demo (planned): 20 autonomous spacecraft in two orbital planes for theater-level ops

Blackjack Schedule

FY2018	FY2019	FY2020	FY2021	FY2022
Phase 1 – Architecture & Design				
	Phase 2 – Detailed Design & Integration			
			Phase 3 – Launch & Demonstrations	



Notional orbits/inclination



Summary

- Our current space architecture is a hold-over from the previous era of operating in a space sanctuary
- We've talked about a new space order of battle architecture and some of its critical components, and why we're working on them
- This new architecture will require a cultural shift in how we do business today and will require investment
- We have identified opportunities to leverage commercial approaches and solutions to help
- We invite your ideas and welcome your feedback on how we implement this vision

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