Consolidating the Revolution: Optimizing the Potential of Remotely Piloted Aircraft

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Agenda

- Background
- Demand and Challenges
- RPA/UAV/Drone Future
- Recommendations
- Discussion

Why The Study Now?

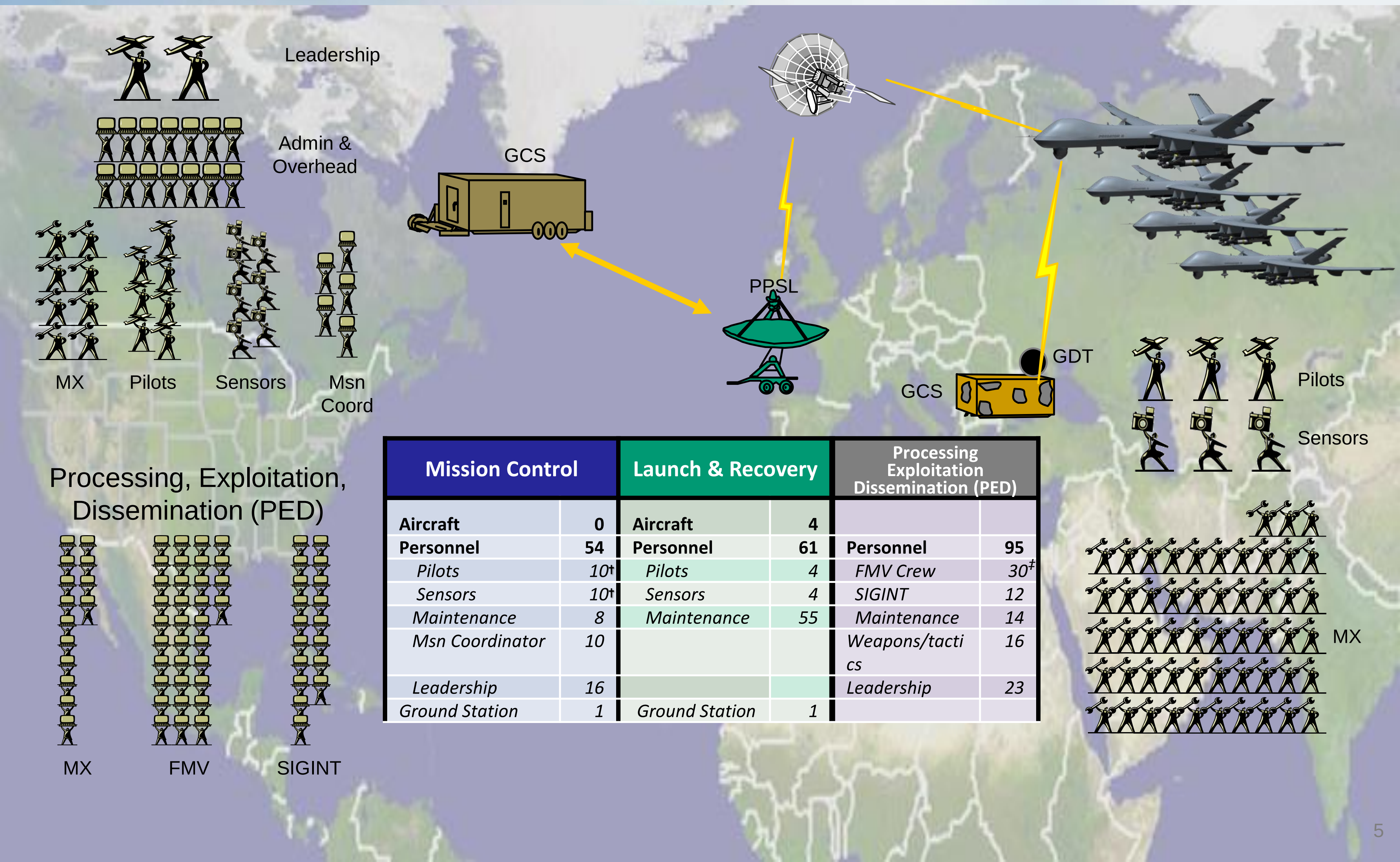
- **16 years of surge in RPA to meet combat demands resulted in strained developments: time for an optimized enterprise approach to fully exploit RPA**
- **Continued growth in mission need paired with budget pressures will demand smarter investments and concepts to meet our security challenges—requires a reset to optimize capability and capacity**
- **Technology advances yet to be implemented are readily available to enhance RPA operations**
- **Organizational reform can yield significant RPA leverage**
- **Optimal investment requires thoughtful ends, ways, and means**

Attributes of Remotely Piloted Aircraft (RPA)

- Persistence - allows time to observe, evaluate, and act very quickly, or to take all the time necessary to be sure of a particular action; communications gateways/key nodes in combat cloud...
- Projects power without projecting vulnerability - Can operate remotely; fewer personnel in combat zones
- Undetected penetration / operation
- Facilitates operations in dangerous environments
- Integrates "find, fix, finish" sensor and shooter capabilities on one platform—yields unparalleled flexibility to adapt to changing priorities and targets of opportunity



Remotely Piloted Aircraft:
MQ-1/MQ-9 Orbit ~200 Total Personnel

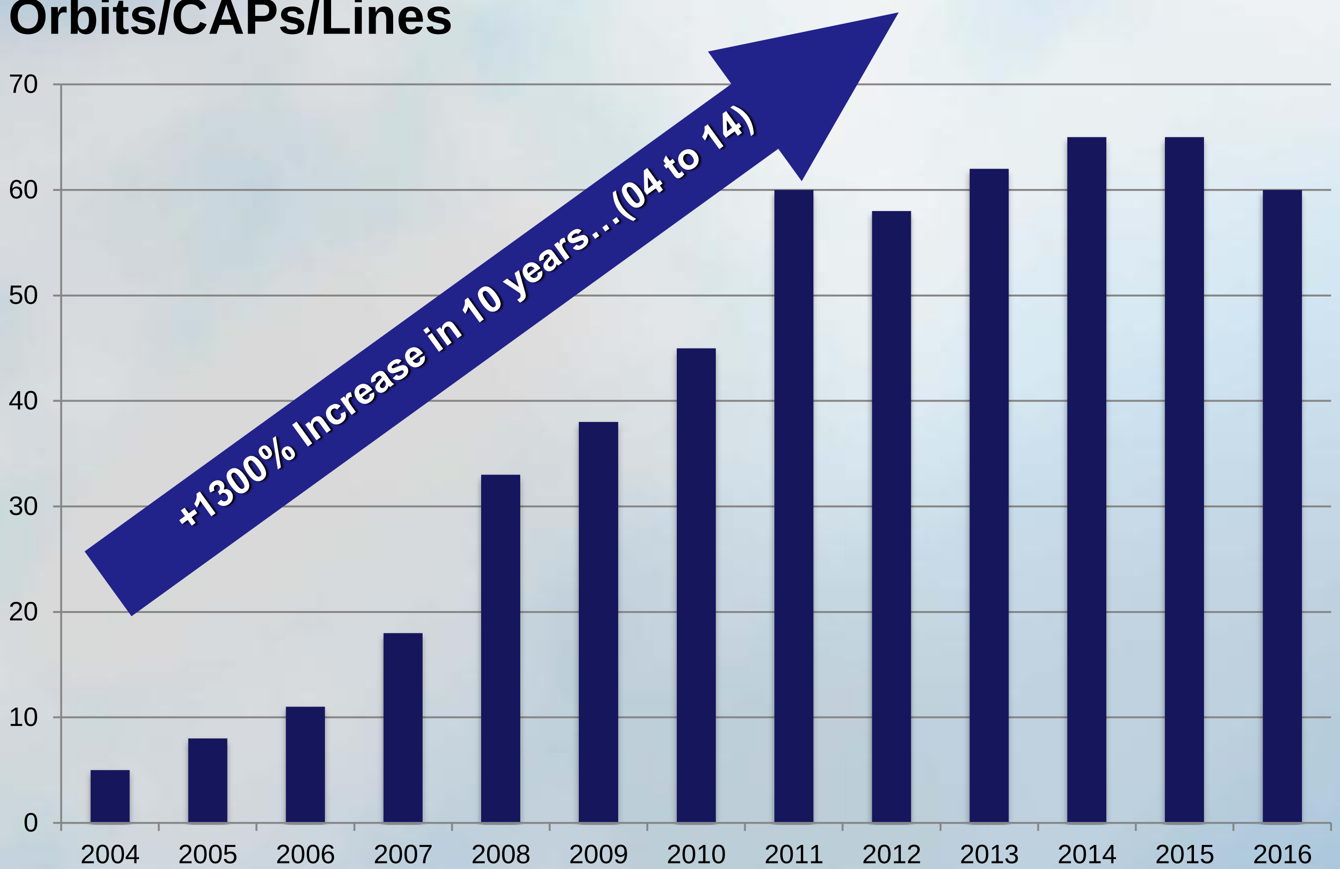


Mission Control		Launch & Recovery		Processing Exploitation Dissemination (PED)	
Aircraft	**0**	**Aircraft**	**4**		
Personnel	**54**	**Personnel**	**61**	**Personnel**	**95**
Pilots	*10†*	*Pilots*	*4*	*FMV Crew*	*30‡*
Sensors	*10†*	*Sensors*	*4*	*SIGINT*	*12*
Maintenance	*8*	*Maintenance*	*55*	*Maintenance*	*14*
Msn Coordinator	*10*			*Weapons/tactics*	*16*
Leadership	*16*			*Leadership*	*23*
Ground Station	*1*	*Ground Station*	*1*		

Growth in Remotely Piloted Aircraft (RPA) Use

Growth in RPA Orbits/CAPs/Lines

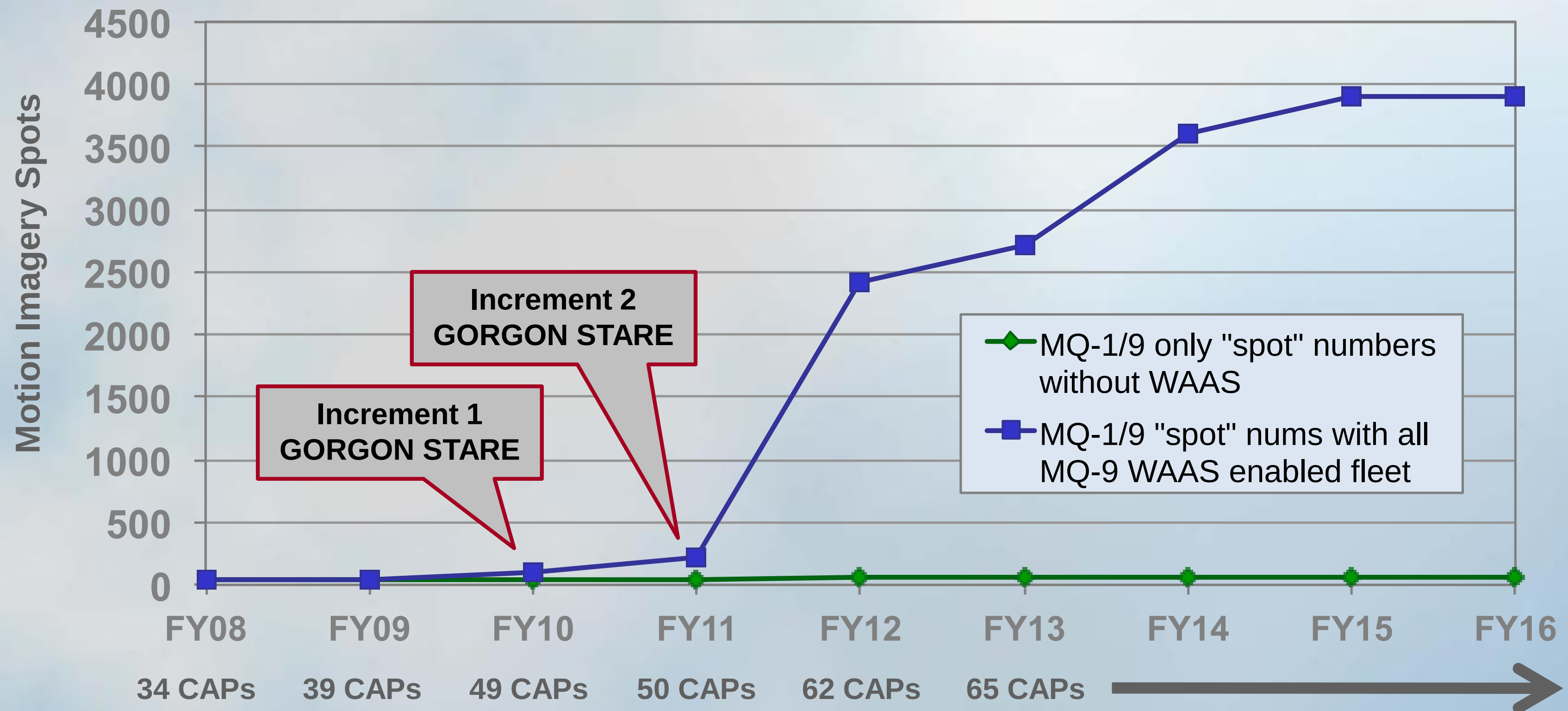
- **2004 = 5**
- **2005 = 8**
- **2006 = 11**
- **2007 = 18**
- **2008 = 33**
- **2009 = 39**
- **2011 = 60**
- **2012 = 57**
- **2013 = 62**
- **2014 = 65**
- **2015 = 65**
- **2016 = 60***



*** 5 GOCO Orbits added in 2016; 10 in 2017; Army to provide 20 additional for total of 90…**

Insatiable demand with no defined end state

Why "CAPs/Orbits/Lines" Should be Evolved as a Measure of Merit/Sufficiency



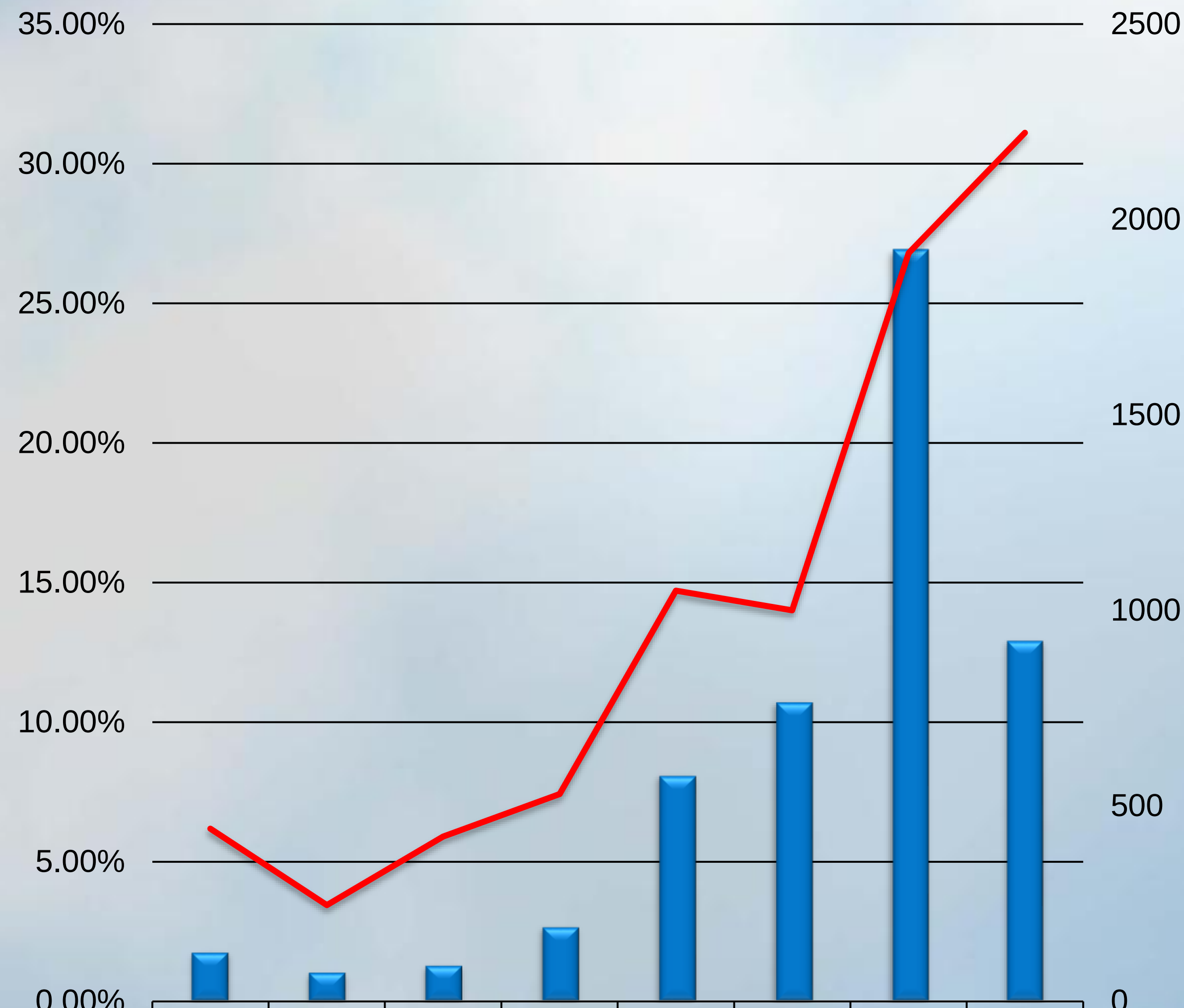
Output is What the Warriors Value—Not Numbers of CAPs/Orbits/Lines

Tenets of RPA Evolution

- RPA compelling where the human is a limitation to mission success
- Seamless manned and unmanned systems integration
- Automation
- “Integrated Systems” approach
- Modularity = Flexibility
- Robust, agile, redundant C2 enables supervisory control (“man on the loop”)
- Linked and synchronized connectivity
- Survivable in contested airspace

MQ-9 Sorties with 1 or More Strikes

CAO: 9 June 2017



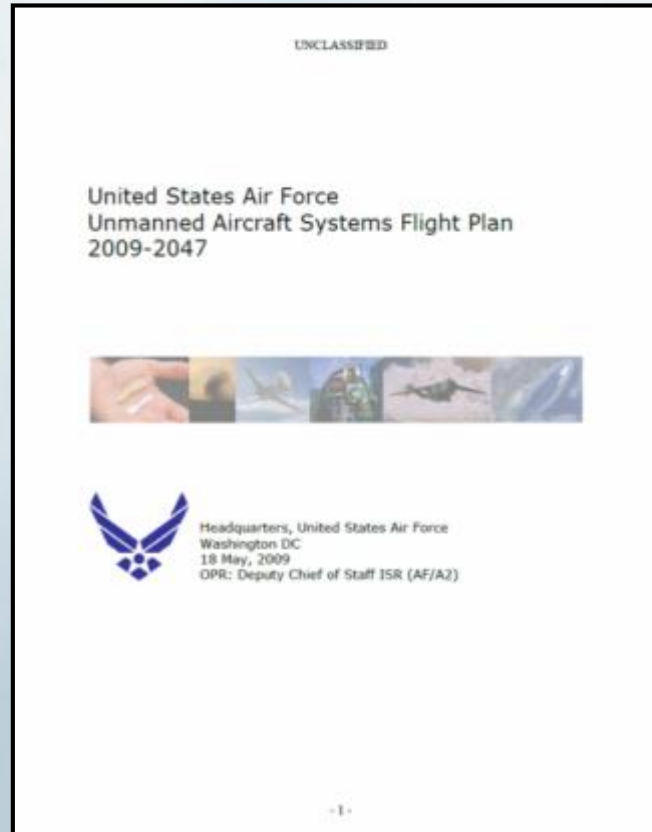
Prior to 2010 less than 2 % of total MQ-1 and MQ-9 sorties employed weapons

	2010	2011	2012	2013	2014	2015	2016	2017
# of Sorties w/ >1 Wpn Employed	126	74	92	192	582	769	1925	926
Strike Sortie as % of Tot Sorties	6.19%	3.45%	5.91%	7.42%	14.71%	14.00%	26.80%	31.12%

AF RPA Flight Plan:
Vision for an unmanned future

An Air Force with…

- Remotely piloted aircraft fully integrated across the full range of operations
- Automated control and modular "plug-and-play" payloads
- Joint RPA solutions and teaming
- An informed industry and academia – knowing where we are going and what technologies to invest in….


UNCLASSIFIED

United States Air Force
Unmanned Aircraft Systems Flight Plan
2009-2047

Headquarters, United States Air Force
Washington DC
18 May, 2009
OPR: Deputy Chief of Staff ISR (AF/A2)

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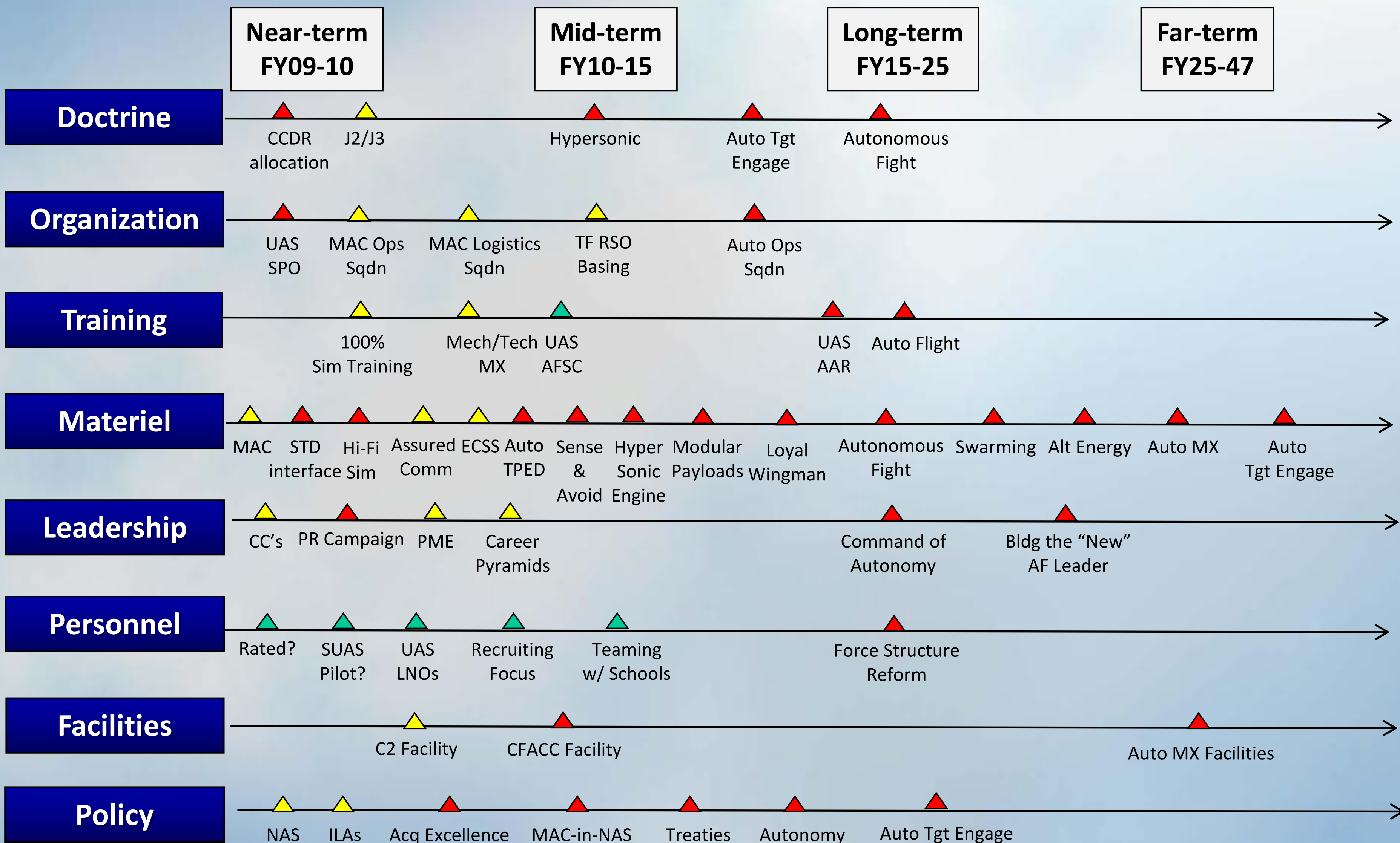
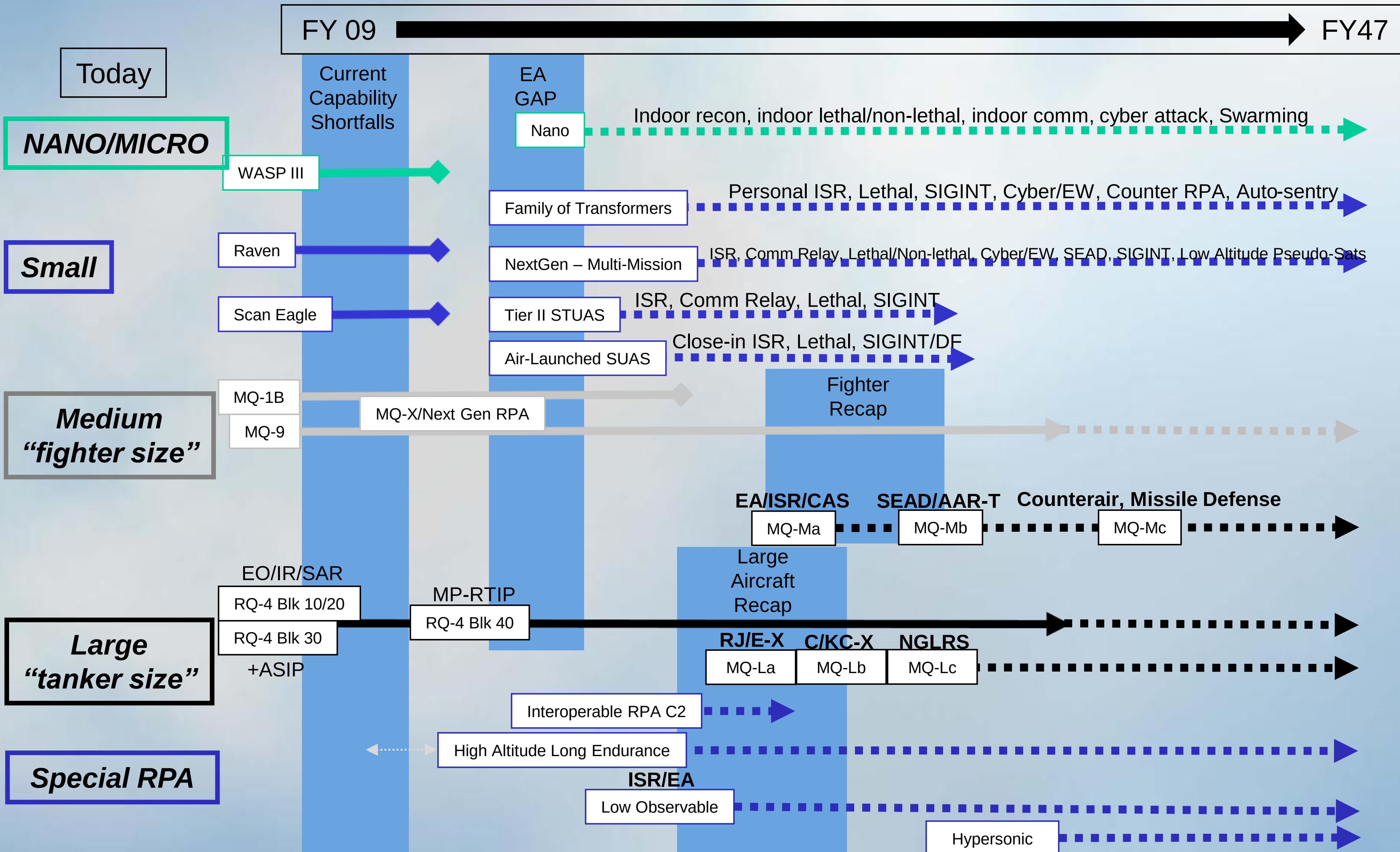
Capabilities-based Air Force RPA vision thru 2047: Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities

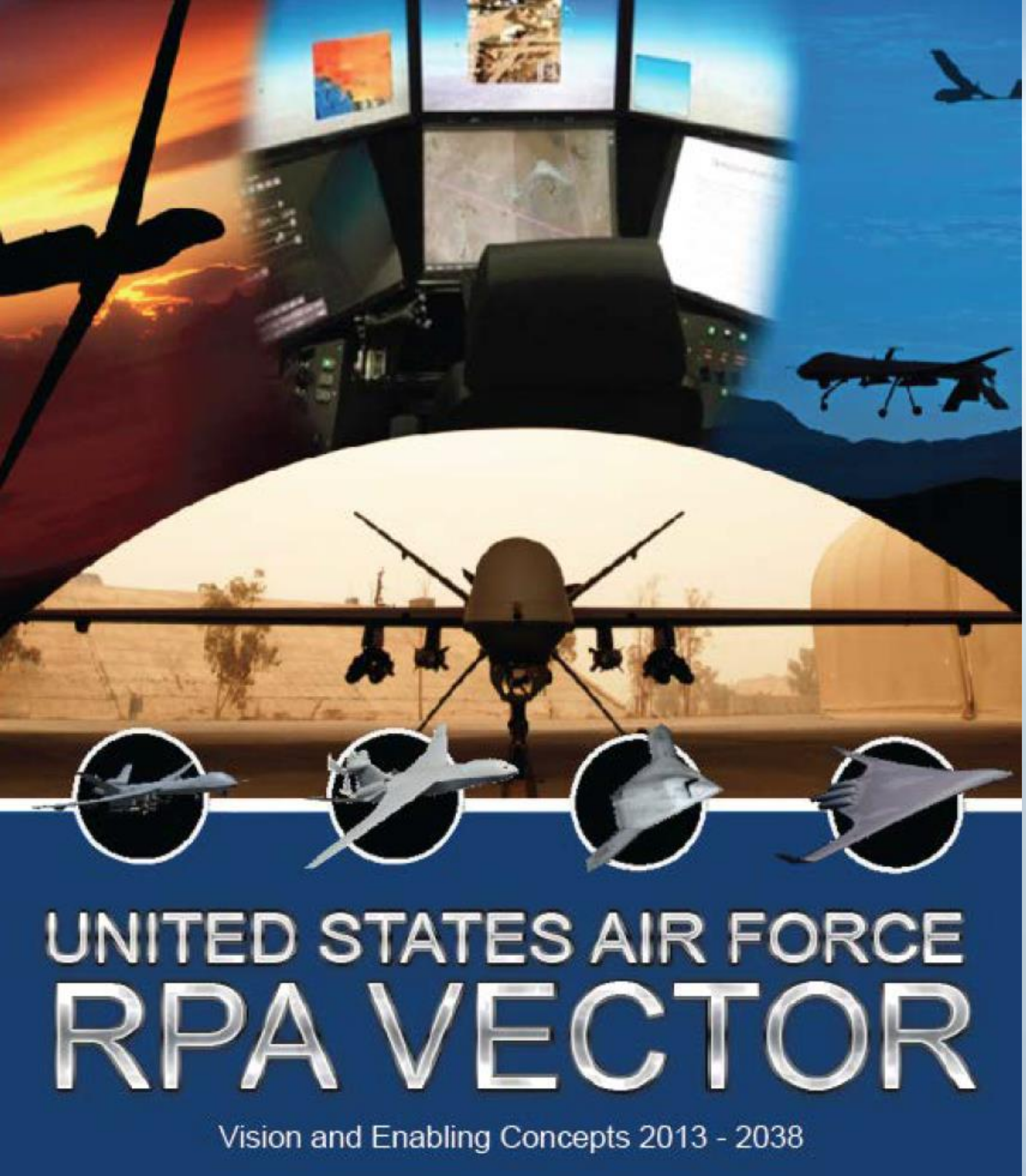
AF RPA Flight Plan DOTMLPF-P



AF 2009 RPA Flight Plan:

Potential Mission sets for RPA





Air Force Vision for RPA in 2014 USAF RPA Vector

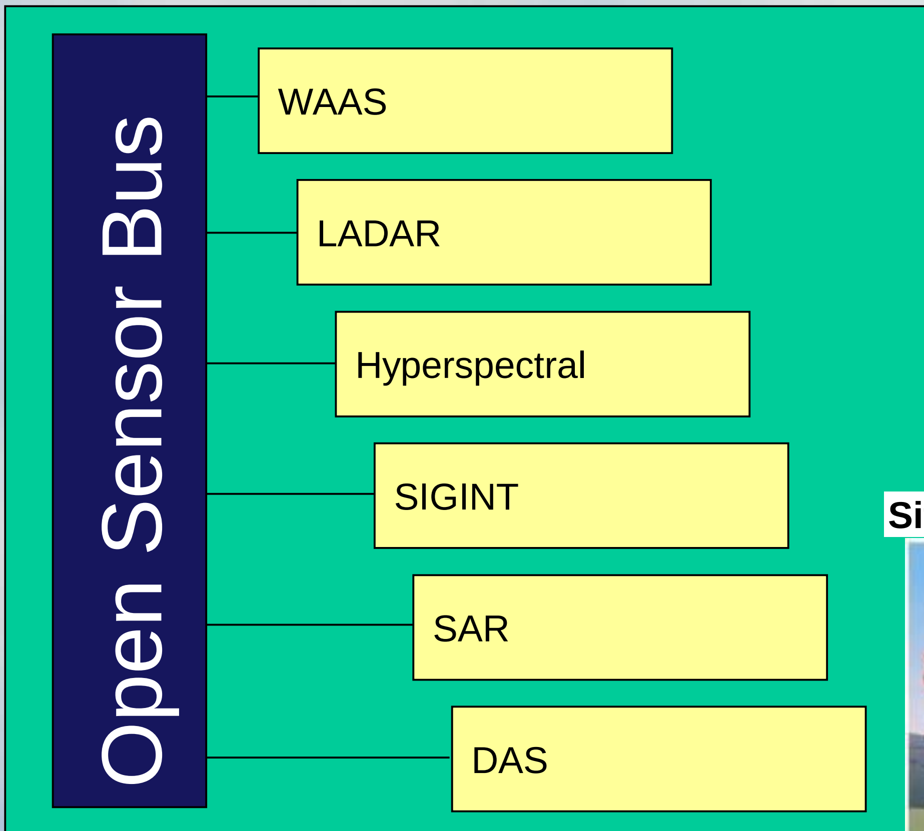
- **Seamless integration of RPA into operations across all domains and levels of warfare.**
- **Widespread use of autonomous systems and processes to provide time efficiencies and operational advantages.**
- **Increasingly interoperable systems through application of open architecture, standards, and modularity.**
- **Teaming across departments and agencies, coalition partners, academia, and industry.**

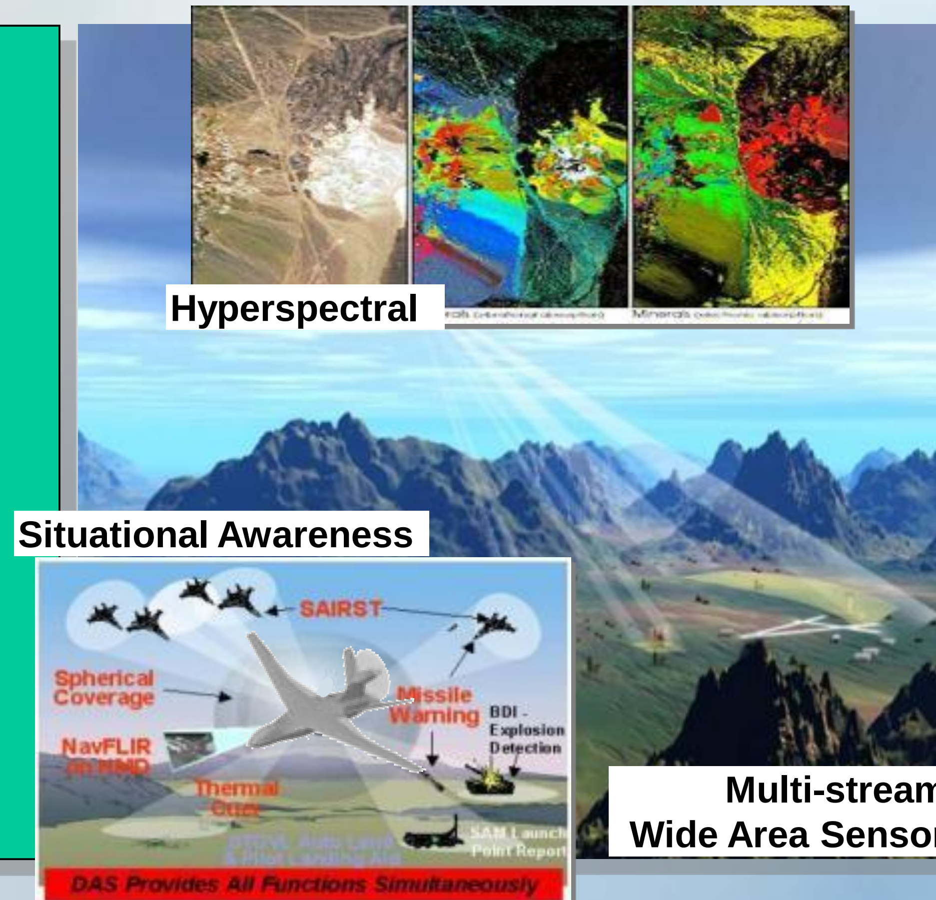
Small Unmanned Aircraft Systems (SUAS) Flight Plan: 2016-2036

Bridging the Gap Between Tactical and Strategic

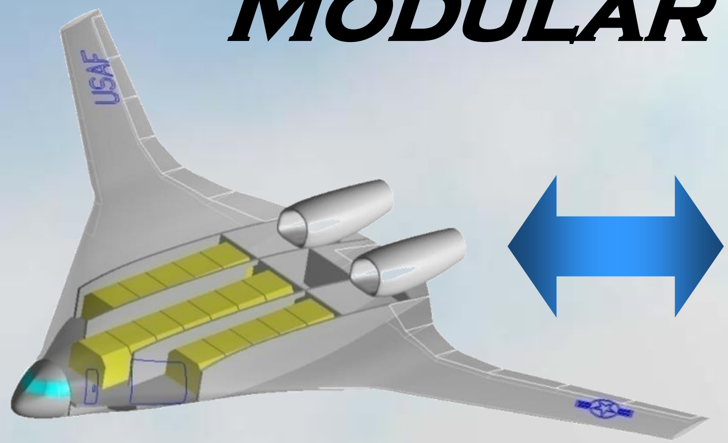
Advanced ISR Capabilities

Open architecture allowing modular sensors to be integrated quickly and inexpensively

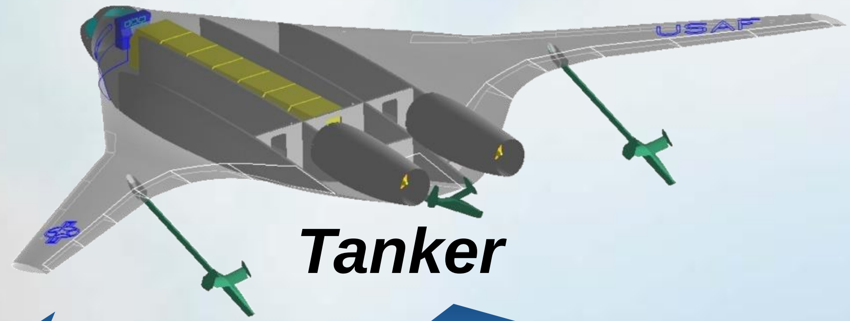




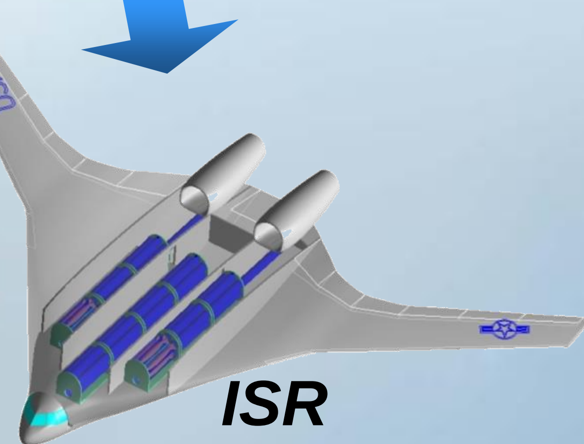
Common Airframe with Modular Mission Bays



Tactical Transport



Tanker



ISR
Weapons platform

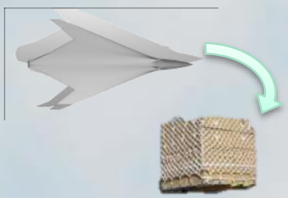
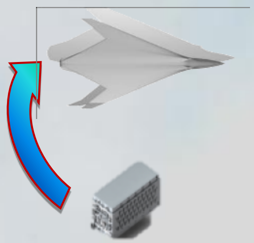
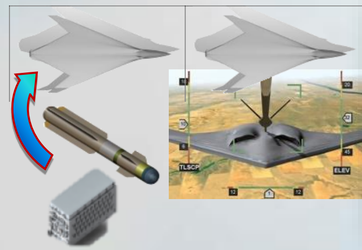
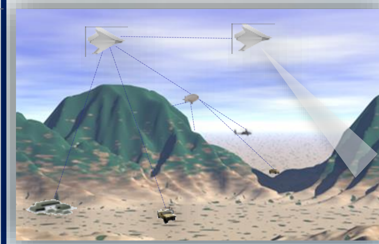
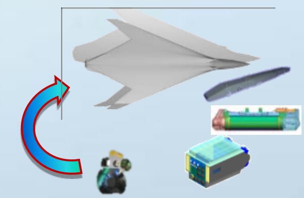
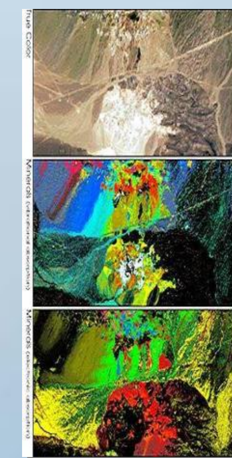
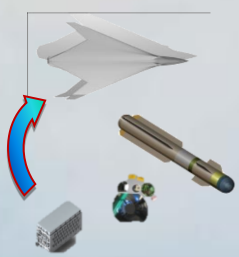
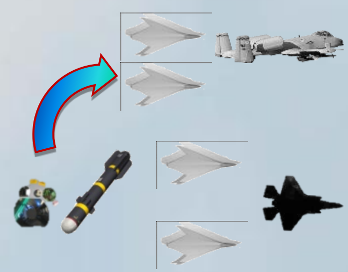
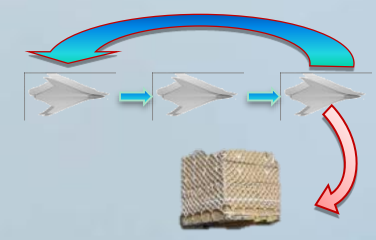
Cost effective, multi-mission solution

- *Transformable to optimize force mix per phase of conflict*
- *Simpler common/modular design*
- *One aircraft design effort*
- *Lower average production cost*
- *Lower life cycle costs*

Potentially streamlines acquisition & sustainment

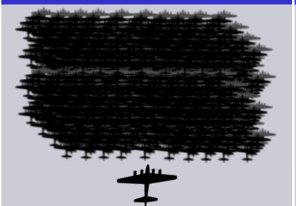
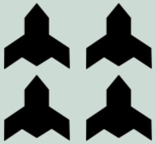
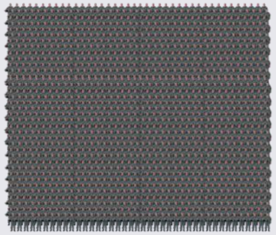
Potential Savings - 25% in total aircraft inventory

RPA MODULARITY = AGILITY

Day 1, Phase 0	Day 5, Phase II	Day 7, Phase III	Day 12, Phase IV	Day 30, Phase V
Deploys with cargo	Electronic Attack	Refueling and Electronic Attack	Armed ISR CAPS Theater comm relay	ISR support of Irregular Warfare
				
Reconfigures with SIGINT / IMINT	Suppression of Enemy Air Defense and ISR	"Loyal Wingman" ▪ CAS ▪ Interdiction	Palletized Cargo Movements	
				

Modularity enables optimized RPA mission reconfiguration in the field

AUTONOMY

WWII	Vietnam	Gulf War	Today	2012 (MAC)	2022 (MAC + 50% auto)	Distant Future
 1,000 planes (B-17)	 30 planes (F-4)	 1 plane (F-117)	 1 plane (B-2)	 4 planes	 Loyal Wingman (Semi-autonomous)	 Swarm (Autonomous RPA)
 10,000 crew	 60 crew	 1 crew	 2 crew	 1 crew	 Mission Commander	 Mission Director
1 Target	1 Target	2 Targets	80 Targets	32 Targets	More Targets	??? Targets
Mass Aircraft	Tactical	Laser	GPS	MAC	Linked	Collaboration
In-the-Loop	In-the-Loop	In-the-Loop	In-the-Loop	On-the-Loop	Collaborative	Directing

Modularity, automation, and interoperability will multiply the effectiveness and efficiency of acquisition, operations, and maintenance

Autonomy – Multi-Aircraft Control
Manpower Savings in an era of Limited Resources

2011

- **50 CAPs**
  - **50 MQ-9 CAPs**
  - **+ 7 a/c in constant transit**
- **10 pilots per CAP**
  - **500 pilots required**
  - **+ 70 pilots to transit a/c**

570 Total Pilots

TBD
(MAC)

- **50 CAPs**
  - **50 MQ-9 CAPs**
  - **2 CAPs per MAC GCS**
  - **1 transit per MAC GCS**
- **5 pilots per CAP**
  - **250 Pilots required**
  - **+ 0 to transit aircraft**

250 Total Pilots

56% Manpower Savings

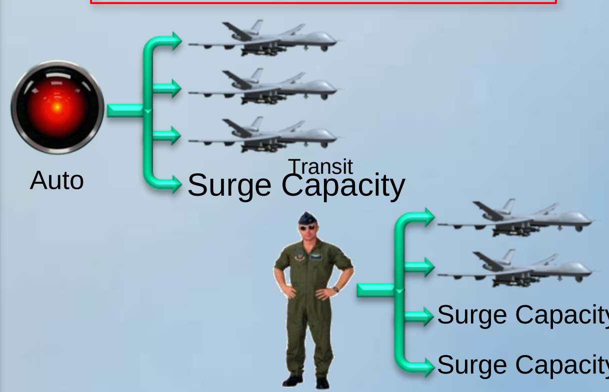
MAC = 1 pilot can fly up to 4 a/c

TBD
(MAC + 50% auto)

- **50 CAPs**
  - **50 MQ-9 CAPs on orbit**
- **25 CAPs automated**
- **25 CAPs in MAC (5 pilots/CAP)**
  - **125 pilots required**
  - **+ 25 auto-msn monitor pilots**
  - **+ 0 to transit aircraft**

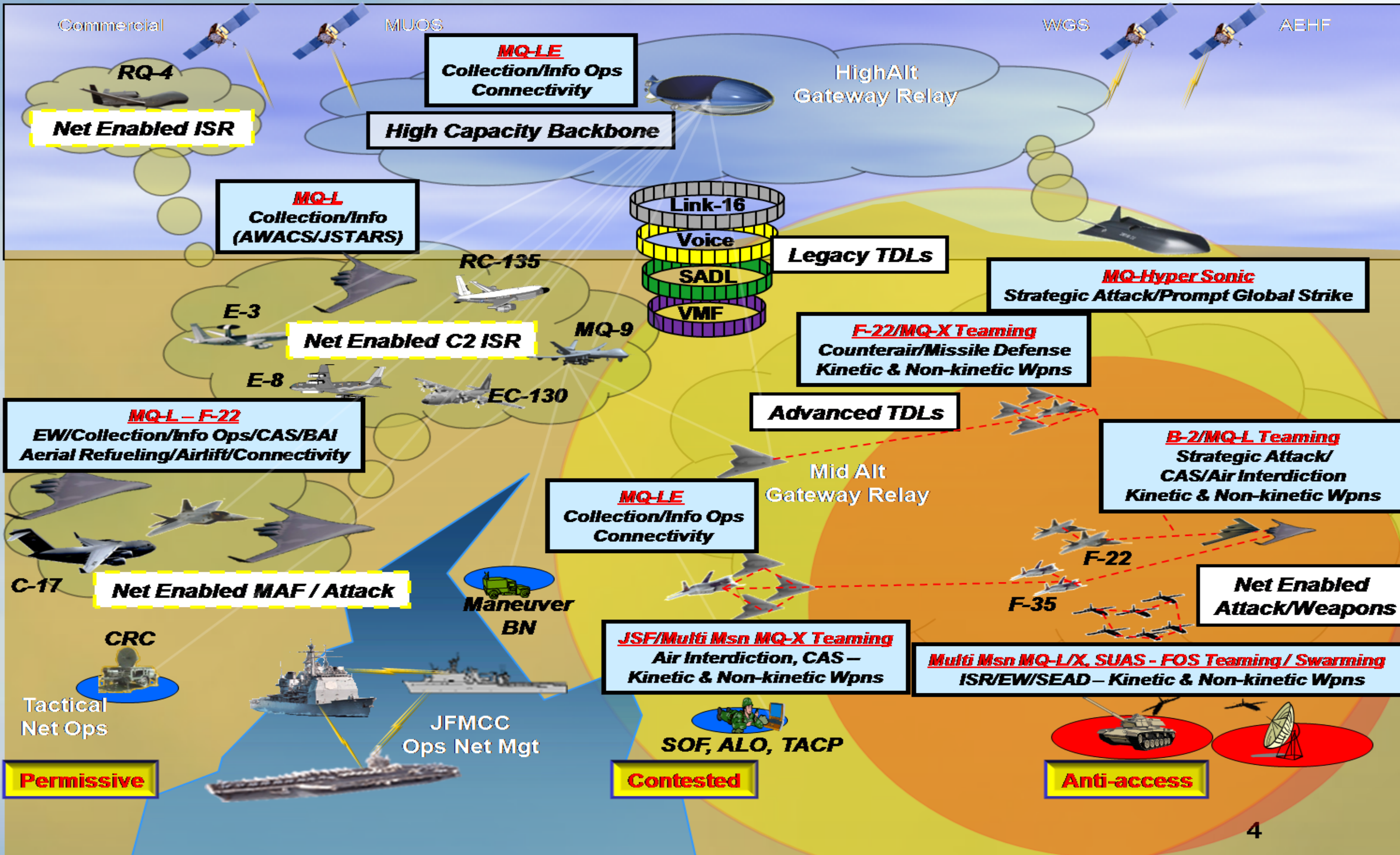
150 Total Pilots

64% Manpower Savings

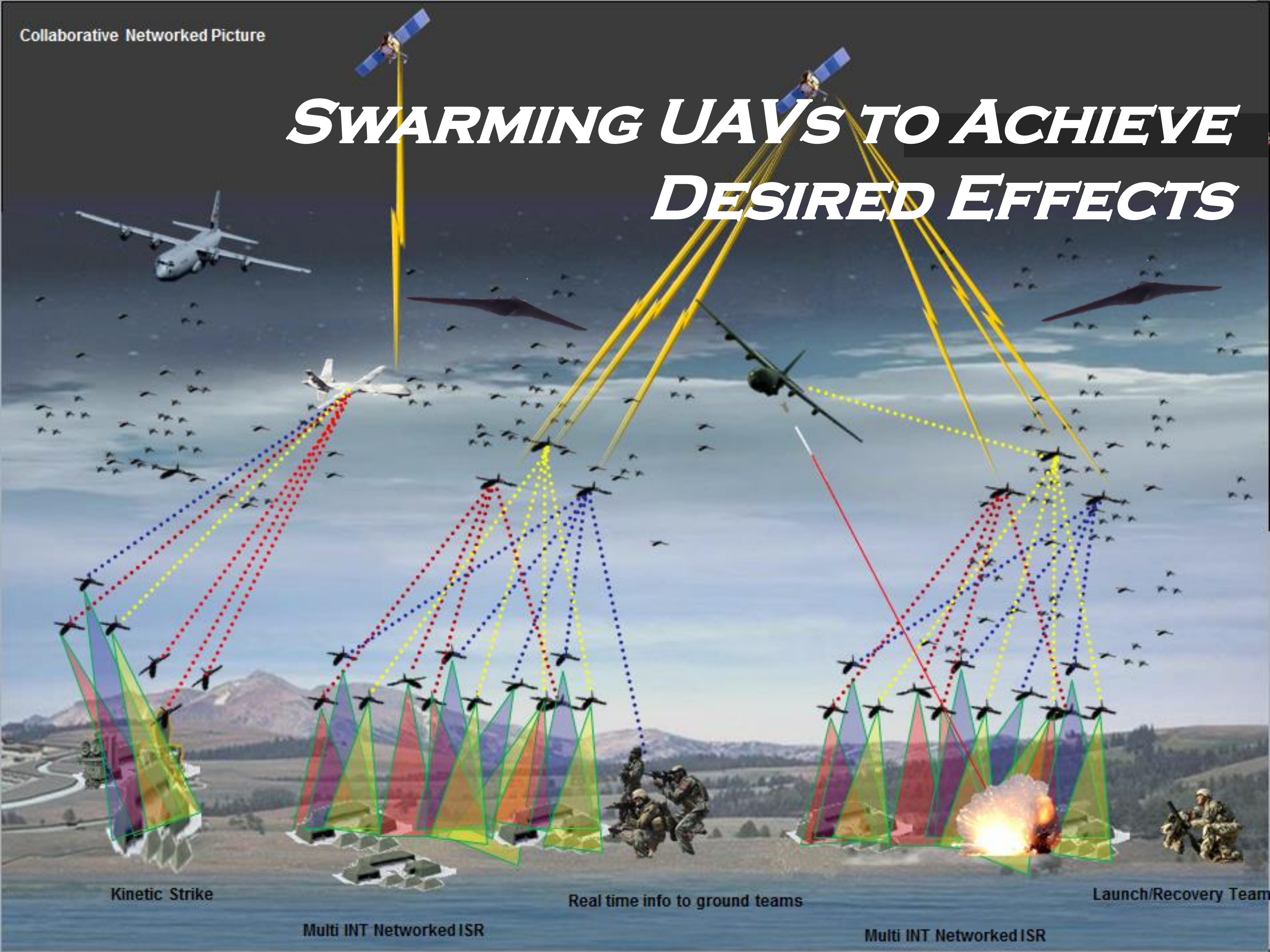


RPAs: Automated Partners/Loyal Wingman

RPA Enabling the "Combat Cloud"

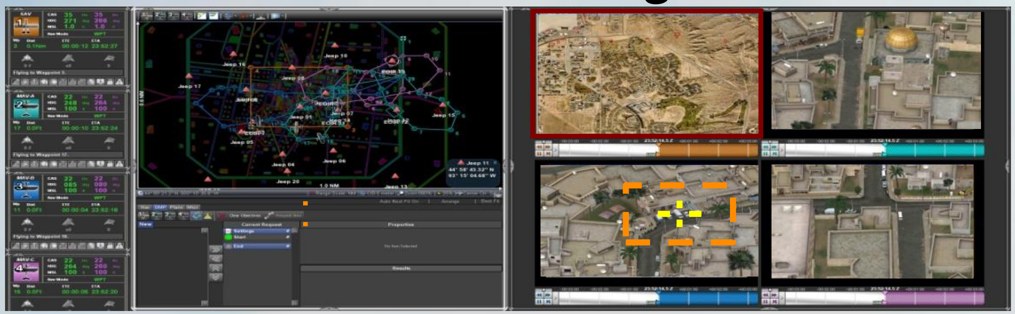


Virtually perpetual RPA fully integrated with systems in every domain integral to enabling a "combat cloud" across the full range of military operations


Collaborative Networked Picture
Swarming UAVs to Achieve Desired Effects
Kinetic Strike
Multi INT Networked ISR
Real time info to ground teams
Multi INT Networked ISR
Launch/Recovery Team

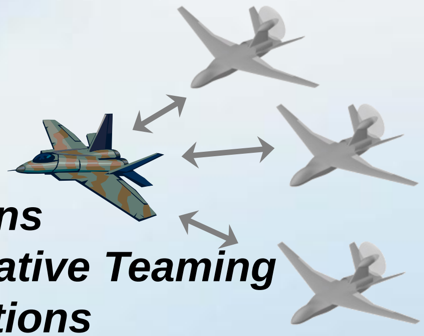
Technology Challenge Areas

Advanced Control Segment and Mission Management



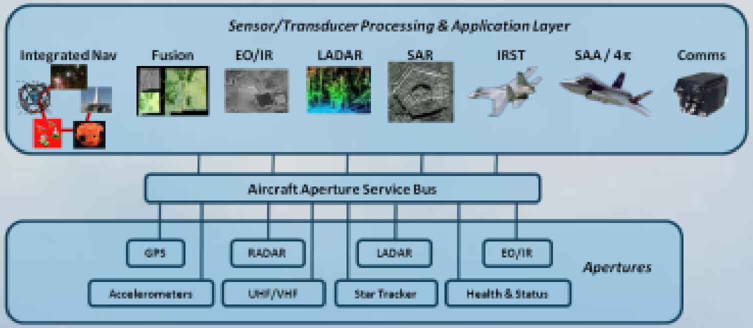
Operations

- Sense and Avoid
- Air Refueling
- Terminal Operations
- Multi-ship Cooperative Teaming
- Distributed Operations
- Manned-unmanned Teaming

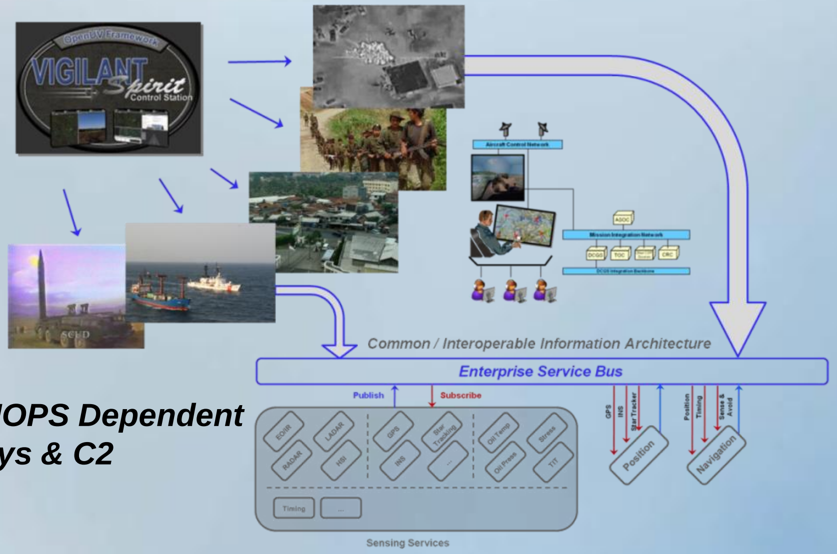


Flexible, Interoperable, Growth-Capable C2 & Information Architectures

Standard & Open Payload Interfaces

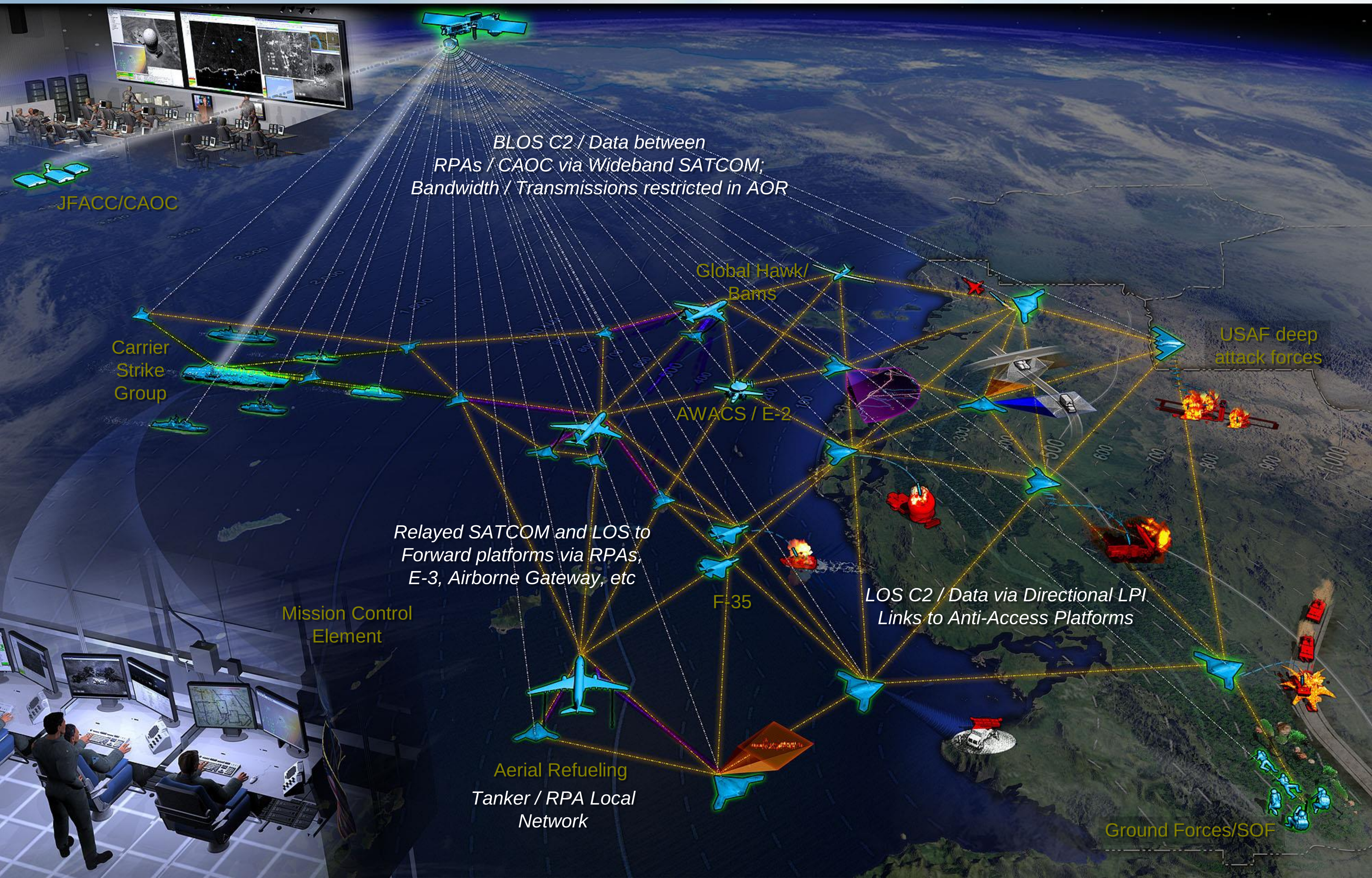


Payloads as Services
Multifunctional Apertures

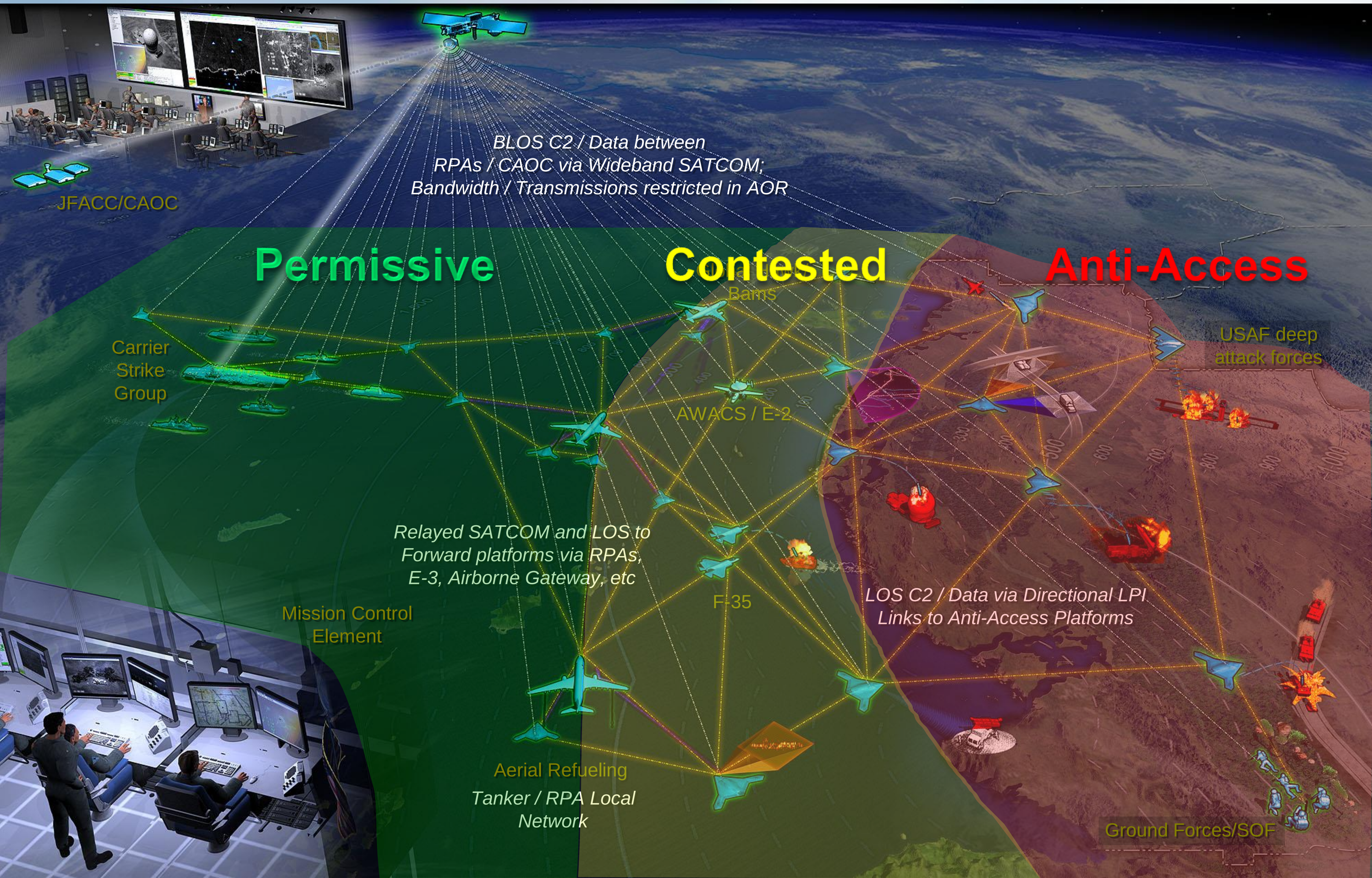


Mission & CONOPS Dependent
Displays & C2

Communicating Across Threat Environments

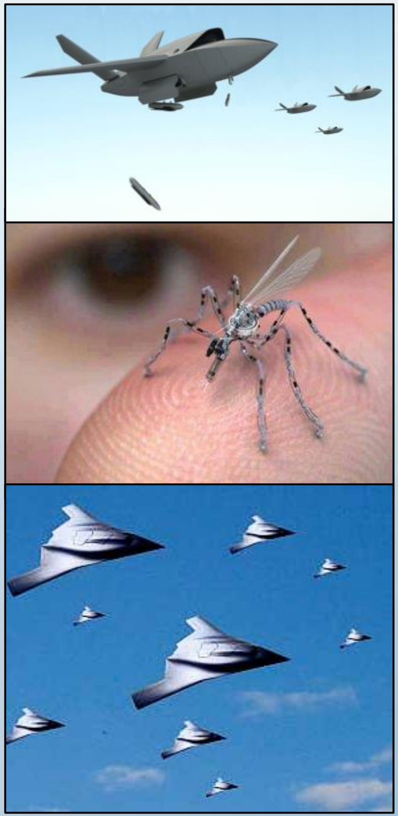


Communicating Across Threat Environments



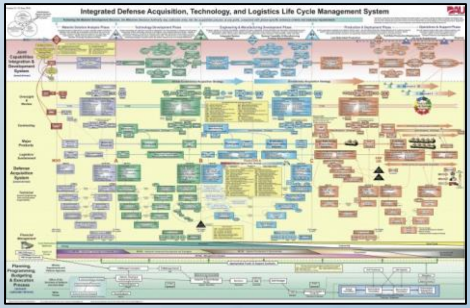
Recommendations: Technology

- **Prioritize technologies that are able to reduce manpower requirements, boost mission efficiency, and rapidly seize new opportunities:**
  - **Build to open mission standards to facilitate modular plug-and-play integration between aircraft, sensors, other payloads**
  - **Pursue integrated, collaborative partnering between RPA and other weapons systems (e.g. loyal wingman; manned/unmanded teaming)**
  - **Automate key functions including landing; multiple aircraft control; sense-and-avoid; and ISR data analysis**



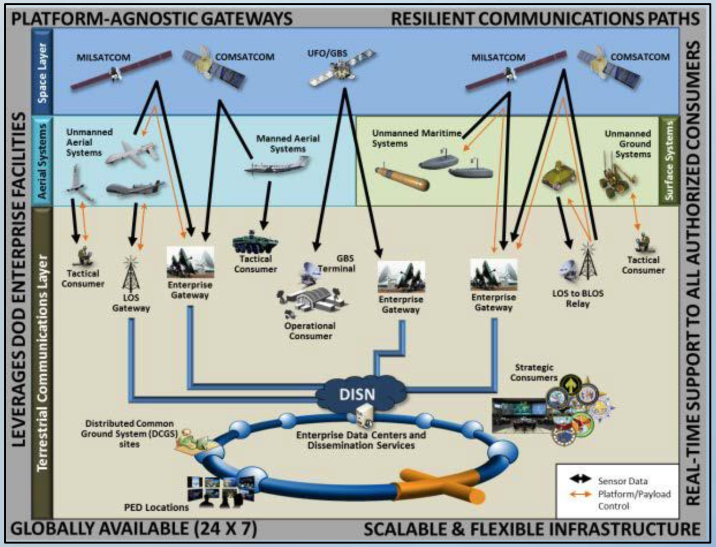
Recommendations: Acquisition

- Streamline the acquisition process to facilitate buying modern RPA technology in an agile, responsive fashion:
  - Develop common operating standards
  - Acquire aircraft, sensors, and weapons in a decoupled, modular fashion through an open mission systems approach
  - RPA as an early adopter of better buying power initiatives
  - Establish a fast-track technology acquisition pilot program for RPA
  - Streamline foreign military sales so that US allies, partners and friends can access American technologies so the US can benefit from amortizing development costs



Recommendations: Organization

- **Optimize DOD RPA efforts to net greater capability by aligning the RPA enterprise in a more efficient and effective fashion:**
  - **Establish a DOD executive agent to coordinate M/HALE RPA**
  - **Ensure all M/HALE RPA are under the direction of an appropriate joint force air component commander (JFACC) that can optimize employment across geographic COCOMs**
  - **Integrate RPA into US airspace for training and domestic support missions**
  - **Rethink traditional mission identification nomenclature for RPAs that better reflect output capability and capacity**



Optimizing the DOD RPA Vision: Why An Executive Agency?

Coordination of separate service-specific M/HALE RPA will:

- **Reduce or eliminate acquisition duplication of effort**
- **Reduce RDT&E funds and timelines by leveraging existing investments**
- **Reduce logistics and sustainment funding requirements by eliminating redundancies**
- **Increase interdependency and interoperability**
- **Build joint solutions—not service-specific solutions**
- **Provide more capability sooner**

Get the <u>most</u> out of RPA to <u>increase</u> joint warfighting capability, while promoting service interdependency and the wisest use of tax dollars

THE FUTURE OF UNMANNED AIR POWER: IMPLICATIONS FOR POLICY & STRATEGY

- Ethical implications of RPA use
  - Allow for *more* “ethical” oversight than any other use of force
  - In future will become a significant issue with greater autonomy
- Cultural implications
  - Common perceptions out of sync with reality…
  - RPA technology enthusiastically embraced inside the Air Force…
- Accuracy/collateral damage
  - Are the most precise means of employing force at a distance in a way that reduces collateral damage, and minimizes casualties
  - Taliban/ISIS number one cause of civilian casualties in Mid-East
- Are RPA subject to excessive exuberance?
  - While introducing enormous capability and concept advantages, RPA are not a panacea for air warfare nor replacement for manned aviation
  - Vulnerability of RPA in contested/denied airspace is significant