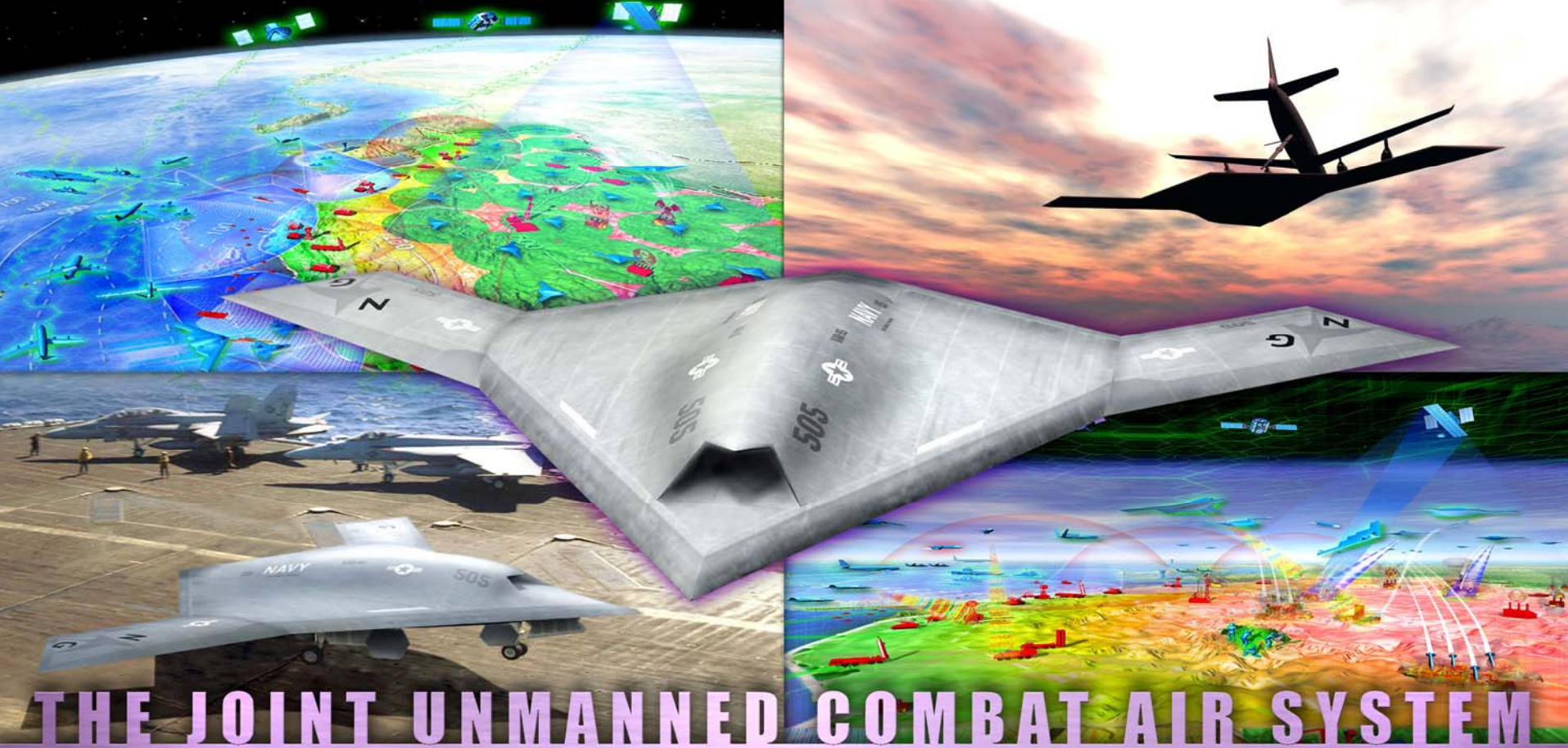
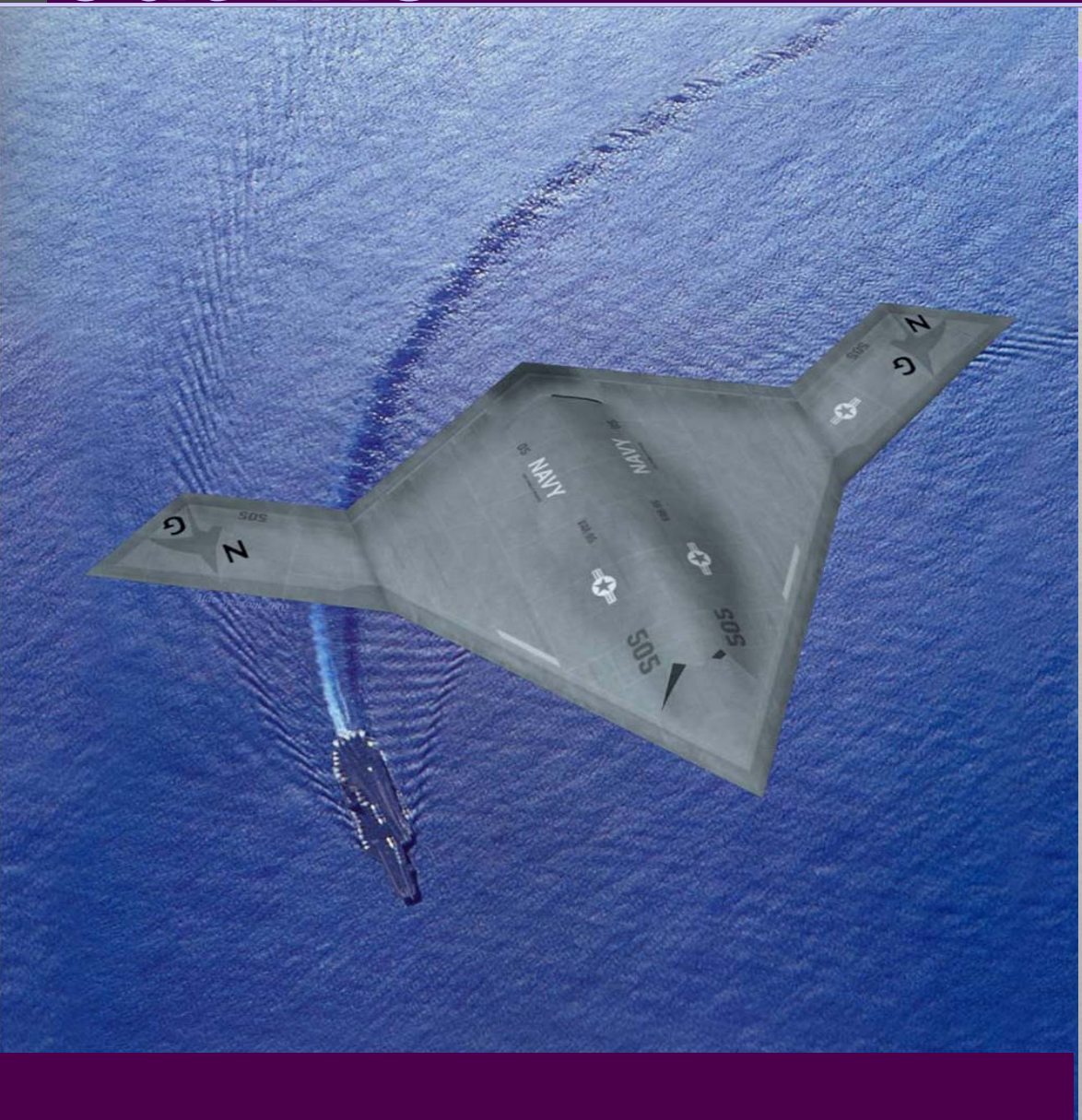


THE JOINT UNMANNED COMBAT AIR SYSTEM
And US Military Transformation

CLOSING THE PERSISTENT SURVEILLANCE-ATTACK GAP

Outline



The Transformation Imperative

UCAS Persistence Capability in Perspective

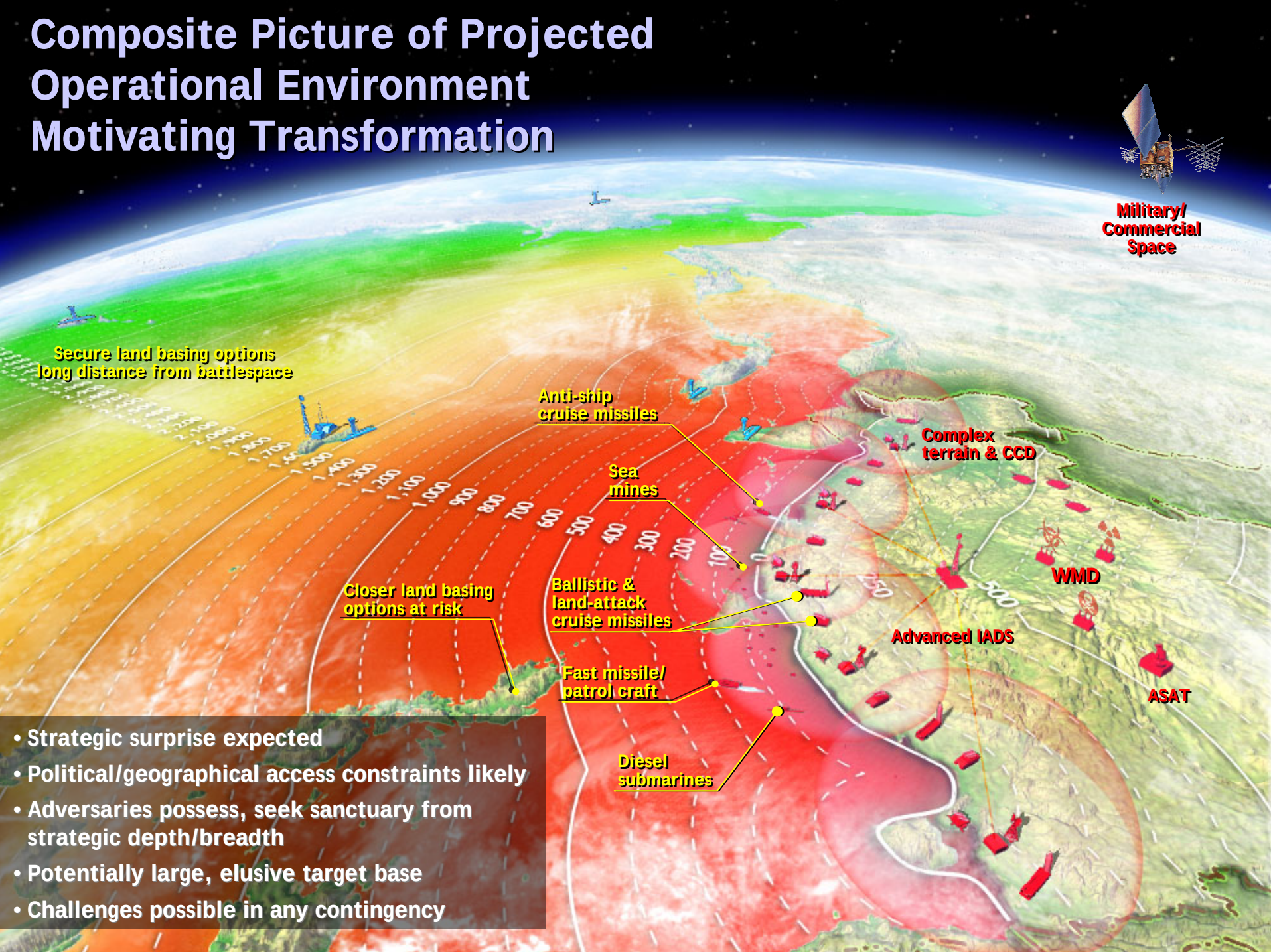
DARPA Joint UCAS Program

Conclusions

The Bottom Line, Up Front

- **Transformation is focused on providing capabilities the Joint Force needs to support new warfighting concepts in projected operational environments**
- **Current/planned forces face an emerging need for deep/broad-area persistence capability, especially in access-constrained environments**
- **The unmanned combat air system (UCAS) concept is a uniquely attractive solution for providing this critical capability**
  - Dramatic increase in "efficient persistence" over manned alternatives
  - Operational utility of UCAS-based persistence virtually unlimited—could address multiple capability needs and support multiple transformational goals
  - Negates aircrew casualty risk—saving lives, enhancing deterrence and providing commanders with increased flexibility
- **The DARPA Joint UCAS program will prove the technical feasibility of the UCAS concept and create near-term acquisition options for the USAF/USN**

Composite Picture of Projected Operational Environment Motivating Transformation



DOD VISION FOR TRANSFORMING U.S. MILITARY CAPABILITIES THROUGH Force Transformation

OPERATIONAL GOALS

1. Protecting critical bases of operation
2. Projecting/sustaining US forces in distant anti-access/area-denial environments
3. Denying enemies sanctuary through persistent surveillance, tracking and rapid engagement
4. Assuring information systems and conducting effective/discriminate offensive IO
5. Enhancing the capability and survivability of space systems and supporting infrastructure
6. Developing an interoperable, joint C4ISR architecture and tailorable joint operational picture

TRANSFORMATION PILLARS

1 Strengthening Joint Operations

- Joint Operating Concepts
- Deployable Joint Command & Control
- Standing Joint Force HQs
- Joint Presence

2 Exploiting US Intelligence Advantages

- Enhanced HUMINT
- Advanced technology for collection, analysis, security
- Horizontally integrated & automated TPED
- Advanced sensors

3 Experimenting for Transformational Change

- Wargaming
- Modeling and simulation
- Exercises
- Operational lessons learned
- Red-teaming

4 Developing Transformational Capabilities

- ID & close gaps in capability to support new joint concepts
- Transformational RDT&E
- Transformational joint training & education

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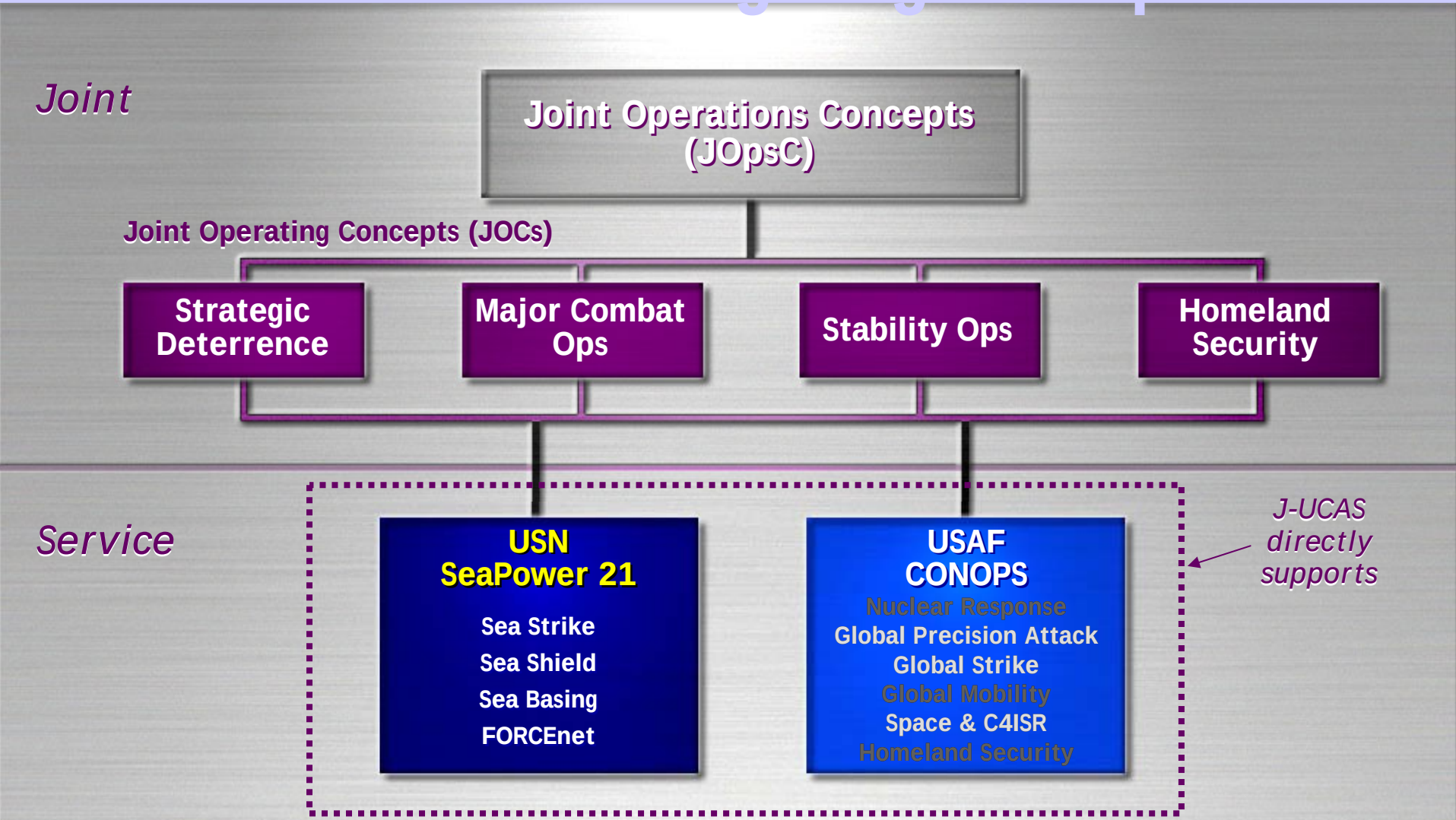
J-UCAS Addressable Joint/Service Transformational Warfighting Concepts



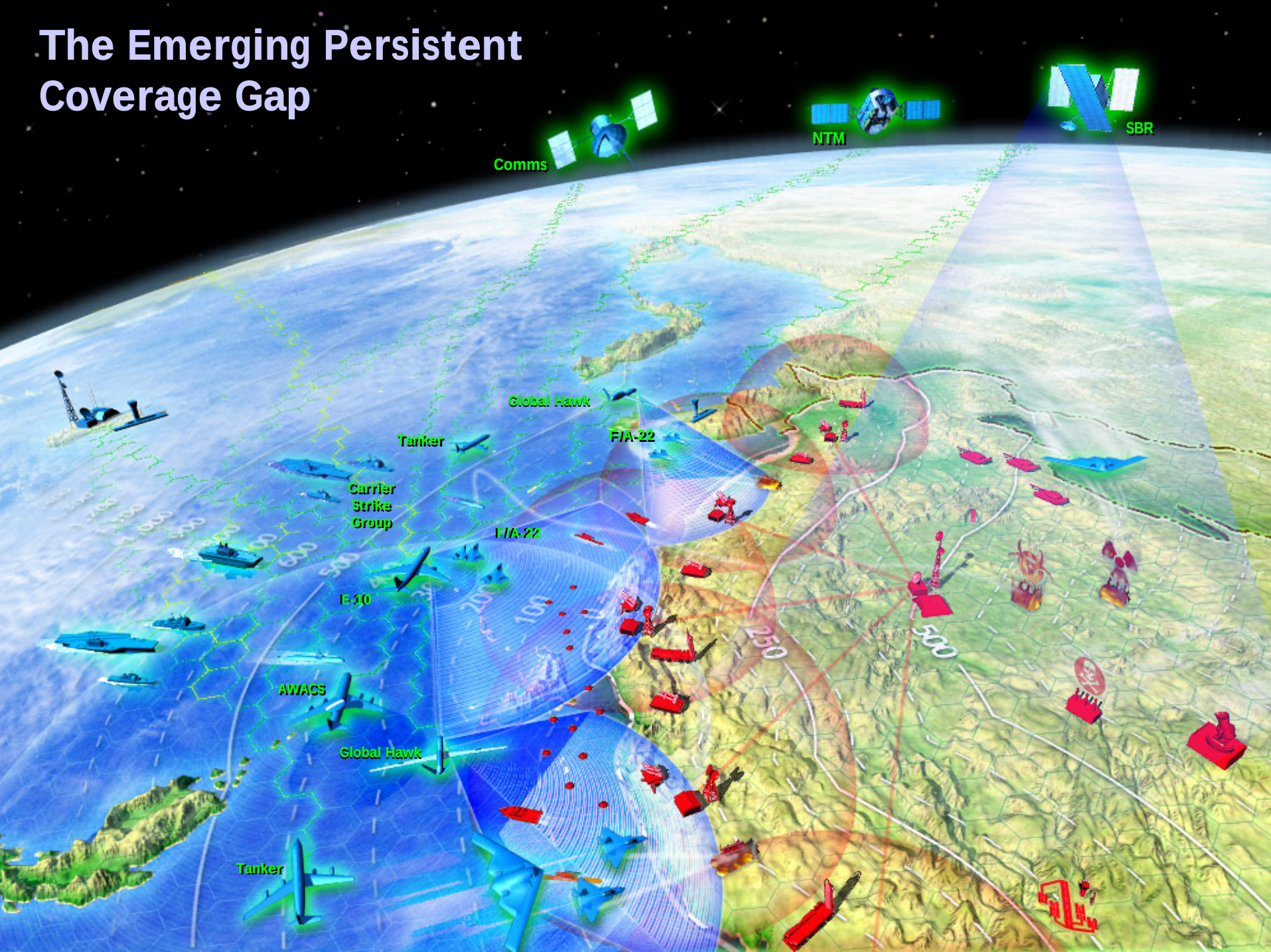
USAF/USN Transformational CONOPS in Projected Operational Environment

EMERGING JOINT PERSISTENT SURVEILLANCE–ATTACK

Capability "Supergap"

- **Planned force strong against fixed targets**
  - Robust airborne/sea-based standoff capabilities
  - B-2 force provides good penetrating capability
- **But weak against emergent/time-sensitive targets,** *especially at depth and in access-constrained conditions*
  - Time-sensitive targets—mobile, relocatable, otherwise emergent—are increasingly important
  - Persistence—*being there* when target presents itself—is the key attribute, but…
    - Fighters lack persistence from long distances and/or at depth
    - Current airborne surveillance systems must standoff
    - 80% of manned bomber force must standoff
    - Stealthy B-2 constrained by small force size and human combat endurance limitations

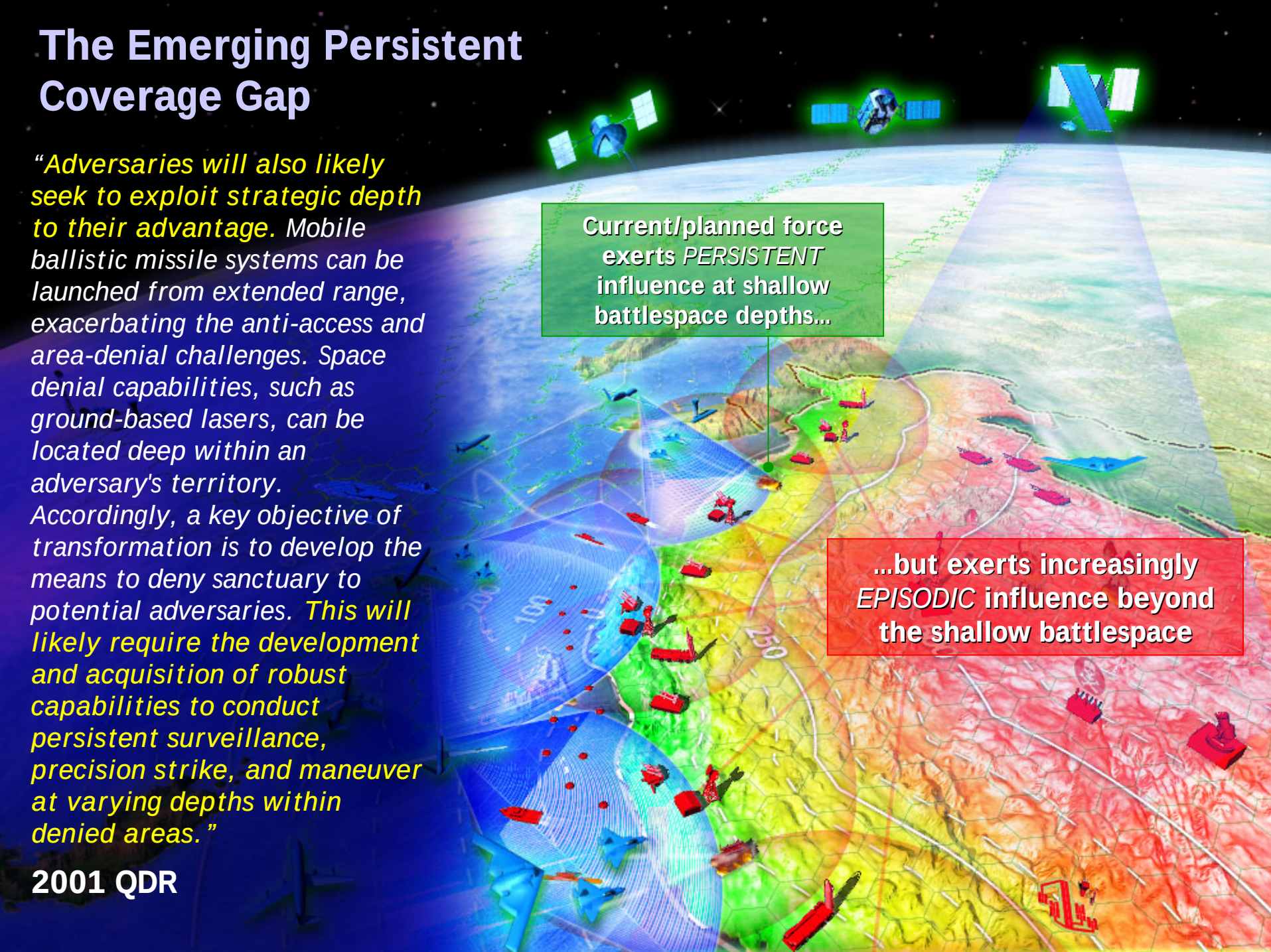
The Emerging Persistent Coverage Gap



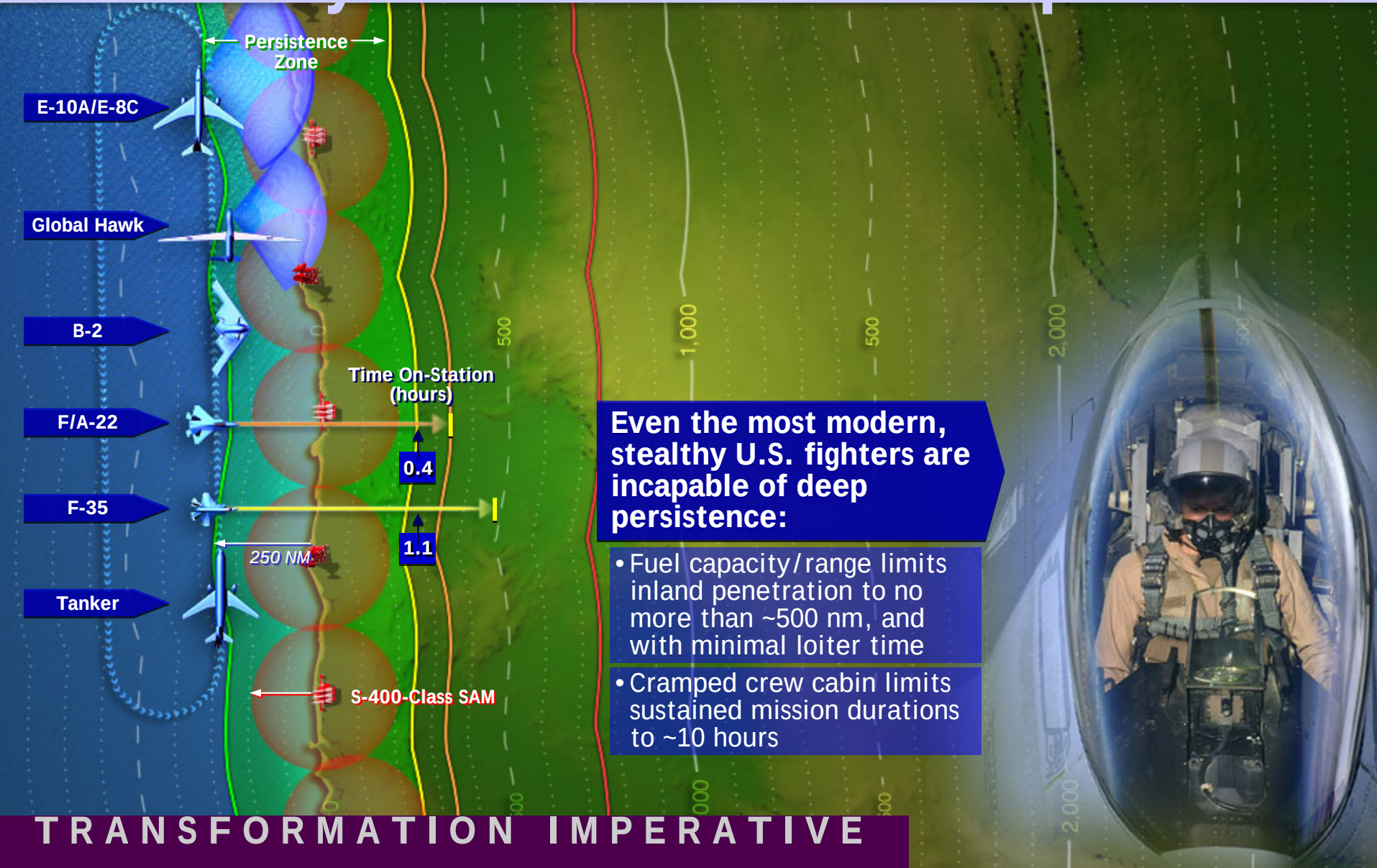
The Emerging Persistent Coverage Gap

"Adversaries will also likely seek to exploit strategic depth to their advantage. Mobile ballistic missile systems can be launched from extended range, exacerbating the anti-access and area-denial challenges. Space denial capabilities, such as ground-based lasers, can be located deep within an adversary's territory. Accordingly, a key objective of transformation is to develop the means to deny sanctuary to potential adversaries. This will likely require the development and acquisition of robust capabilities to conduct persistent surveillance, precision strike, and maneuver at varying depths within denied areas."

2001 QDR



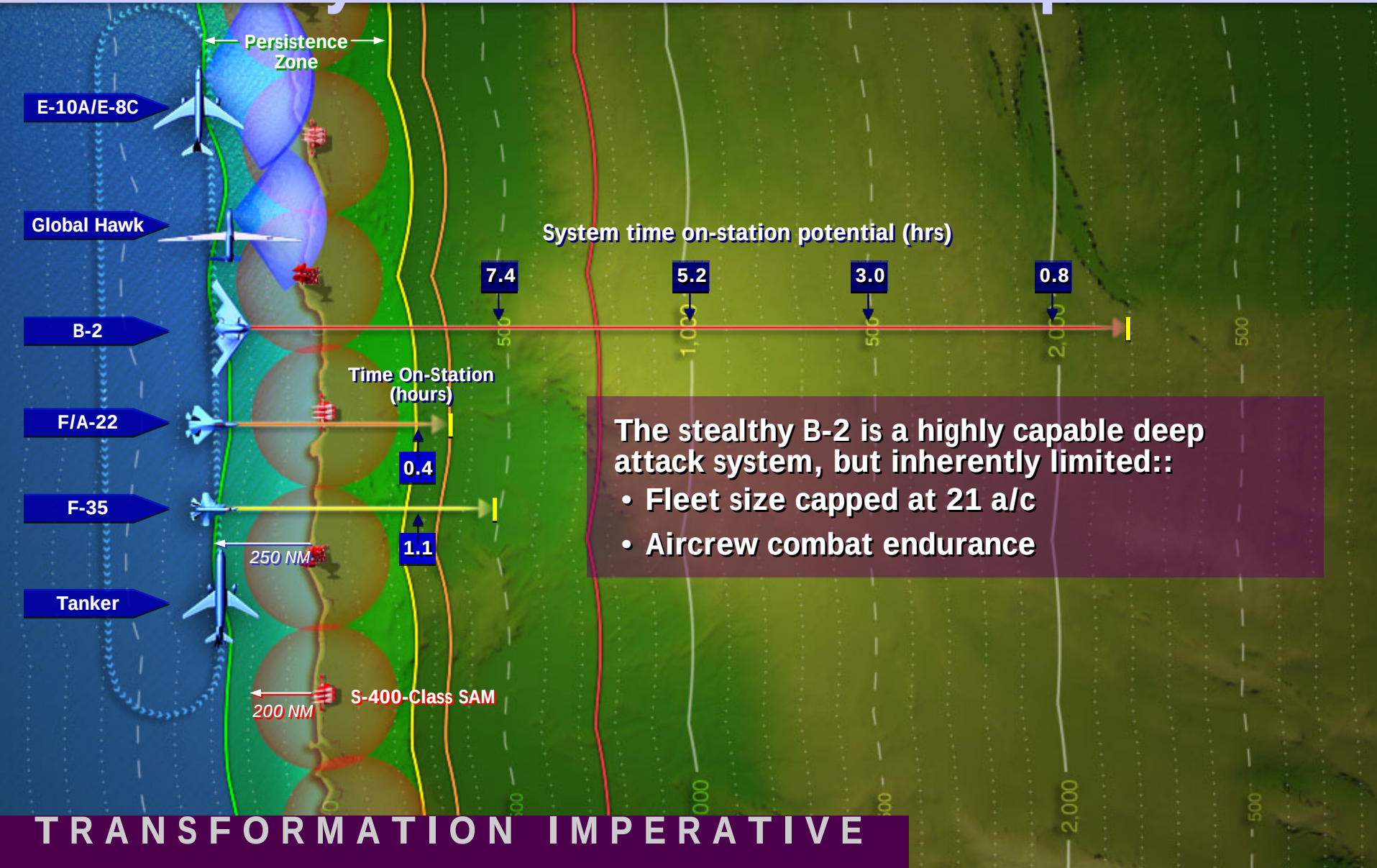
Vast Majority of Planned Force Can't Persist Beyond the Shallow Battlespace



Even the most modern, stealthy U.S. fighters are incapable of deep persistence:

- Fuel capacity/range limits inland penetration to no more than ~500 nm, and with minimal loiter time
- Cramped crew cabin limits sustained mission durations to ~10 hours

Vast Majority of Planned Force Can't Persist Beyond the Shallow Battlespace



The stealthy B-2 is a highly capable deep attack system, but inherently limited::

- **Fleet size capped at 21 a/c**
- **Aircrew combat endurance**

Persistence "Super-Gap" Creates Shortfalls in Multiple Joint Mission Capability Areas

JOINT FUNCTIONAL CONCEPTS / CAPABILITY AREAS

Battlespace Awareness	Protection	Force Application	Command & Control	Focused Logistics
▪ All source Intel collection	▪ Personnel and infrastructure protection	▪ Land, sea, air and space ops	▪ CROP	▪ Deployment distribution
▪ Environmental data collection	▪ CND	▪ Joint targeting	▪ JFC2	▪ Sustainment
▪ Own force info collection	▪ Counter-proliferation	▪ Conventional attack	▪ Comms and computer environment	▪ Medical
▪ Predictive analysis	▪ Non-proliferation	▪ Nuclear attack		▪ Mobility
▪ Knowledge management	▪ Consequence management	▪ CNA		▪ Logistics C2
	▪ Missile defense	▪ Electronic attack		
		▪ PSYOPS		
		▪ Special ops		
		▪ Joint fires		
		▪ SEAD		
		▪ Military deception		

RED denotes mission capability depending on persistence

*Source for Joint Functional Concepts: Joint Staff (J-8), *CJCSI 3170.01C: The Joint Capabilities Integration and Development System (JCIDS)*, 2003

Why Unmanned Combat Aircraft?

- **"Going unmanned" doesn't remove humans from the system—it decouples human from air vehicle component of the system to improve overall system capability while reducing cost and risk**
  - Relief from human endurance constraints enables **dramatic increase in efficient, multimission battlespace persistence** over manned systems
    - Virtually unlimited application—could address multiple mission shortfalls
  - Relief from human mortality constraints **negates aircrew casualty/capture risk**
    - Enhances strategic/operational flexibility in projected threat environment by increasing leadership risk tolerance, reducing/negating CSAR requirement
    - Higher perceived usability enhances deterrent effect of U.S. forces
  - Potentially strong **cost-effectiveness** advantages
    - Superior endurance enables persistent broad-area coverage with greatly reduced force sizes—even at extreme distance and/or battlespace depth
    - Lower O&S costs by reduction in peacetime flying hours

UCAS concept offers potential for affordable, Joint, theater-wide persistent surveillance-attack with zero aircrew casualty risk

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Assessing Relative Persistence Capability

Alternative Near- to Medium-Term Surveillance-Strike System Types

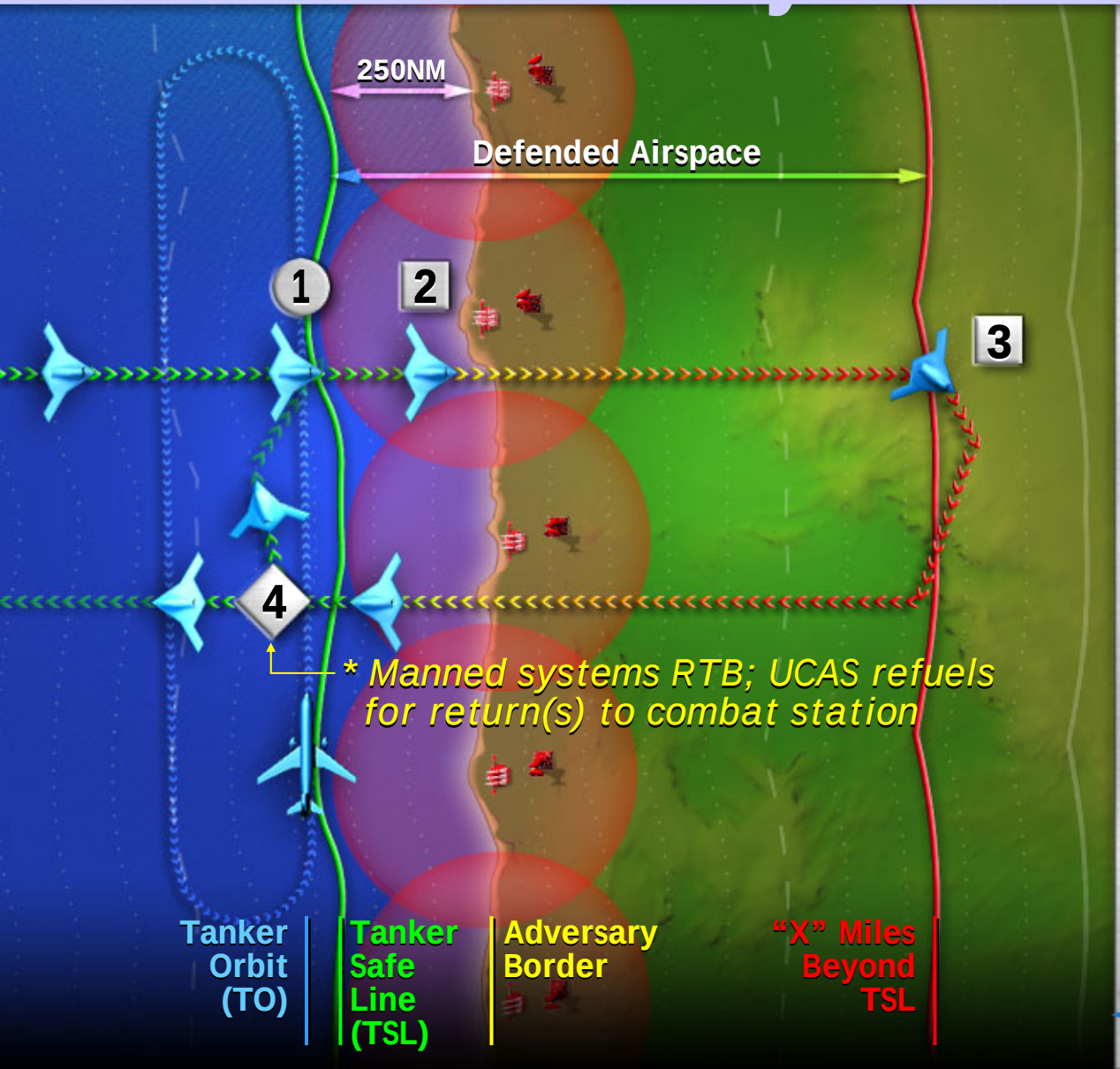
System Performance Characteristics	Notional Manned Systems				Unmanned Combat Air System**
	Strike Fighter	Fighter Bomber	Sustained Supersonic Ftr-Bomber	Bomber	
Cruise Speed (kts)	460	460	860	460	460
Unrefueled Range (NM)	1,500	3,300	3,300	5,500	3,700
Vehicle Endurance Limit	N/A*	N/A*	N/A*	N/A*	50
Sustainable Aircrew Total Mission Endurance (hrs)	10	10	10	30	N/A
Aircrew Combat Endurance (hrs)	10	10	10	10	N/A

**Aircrew endurance constraints preclude manned aircraft surpassing system endurance limits*

***Approximates projected performance of X-47B demonstration system — a robust precursor for USN operational system*

MULTIMISSION PERSISTENCE

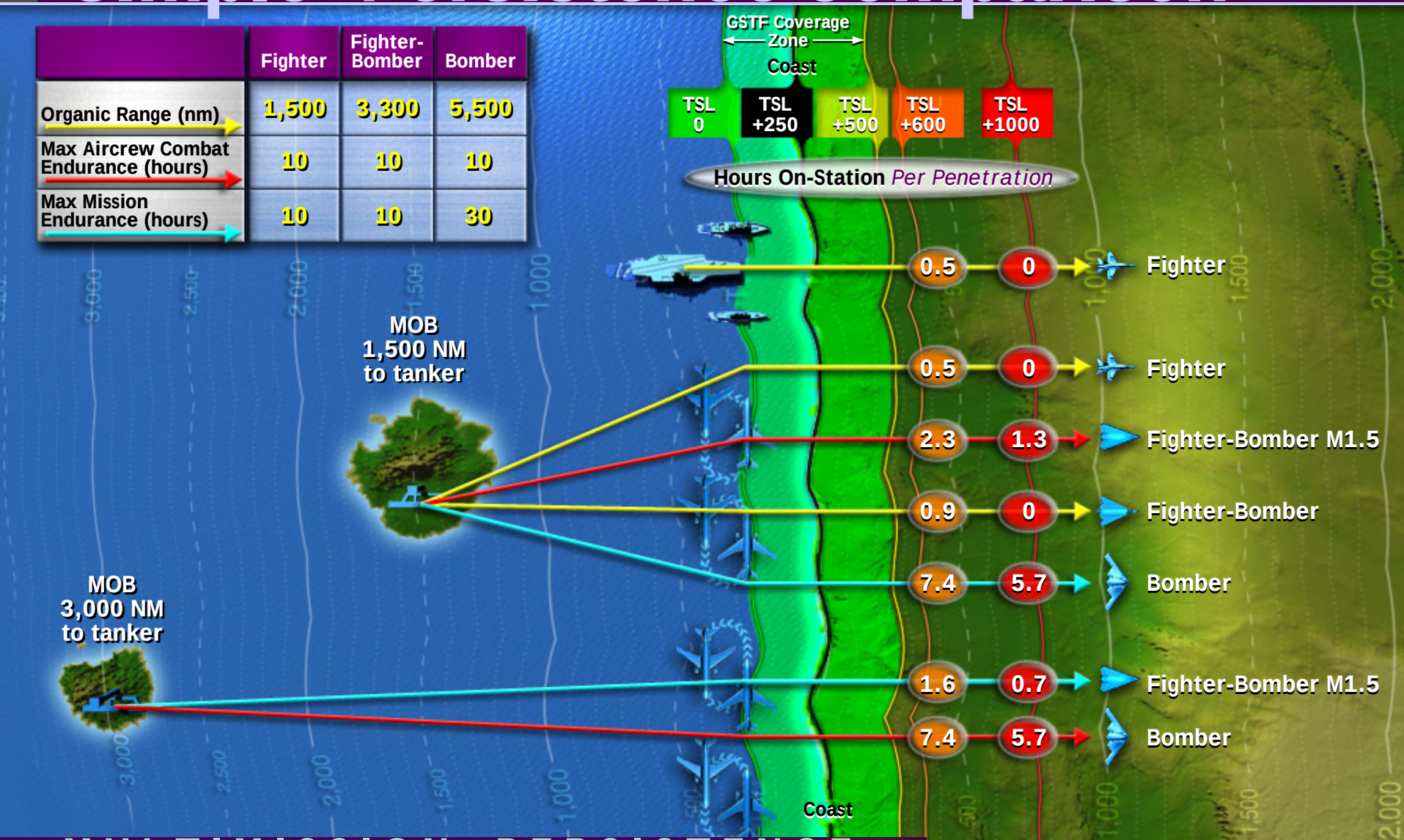
Persistence Analysis Model



1. Take-off or arrive at Tanker Orbit (TO), top off fuel, and decrement residual mission Maximum Flight Time (MFT) endurance (relevant if launched elsewhere).
2. Cross Tanker Safe Line (TSL) and begin decrementing residual mission time, Organic Fuel Reserve (OFR), and Crew Combat Endurance (CCE) in defended air space.
3. Calculate round trip mission cost from TO to specified depth ("X") and decrement from residual MFT, OFR and CCE. Time on station is minimum value among residual MFT, OFR and CCE, stated in hours.
4. If the most constraining of MFT, OFR and CCE allows another cycle, return to step 1 and repeat, else return to base for turnaround.

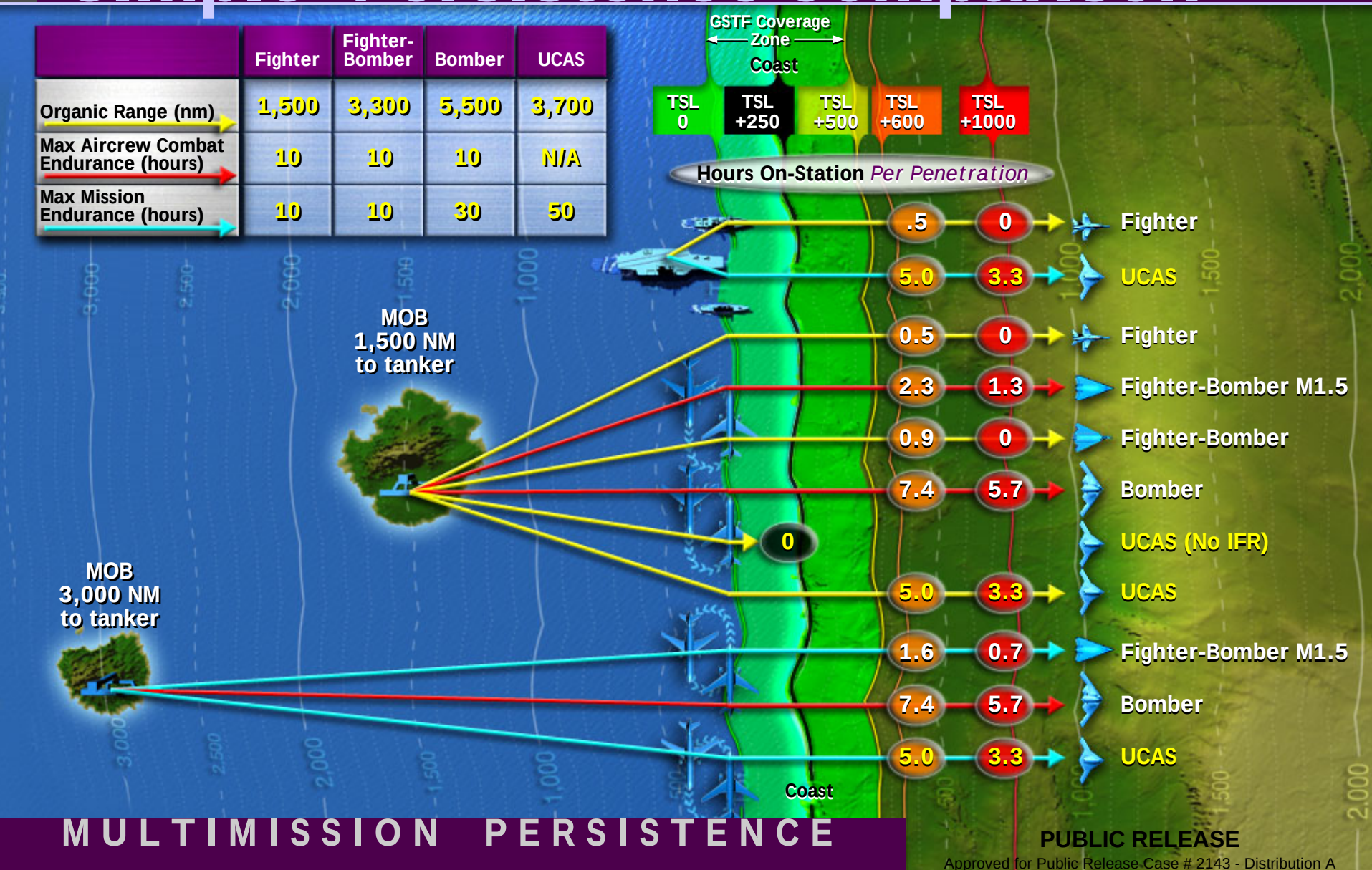
"Simple" Persistence Comparison

	Fighter	Fighter-Bomber	Bomber
Organic Range (nm)	1,500	3,300	5,500
Max Aircrew Combat Endurance (hours)	10	10	10
Max Mission Endurance (hours)	10	10	30



"Simple" Persistence Comparison

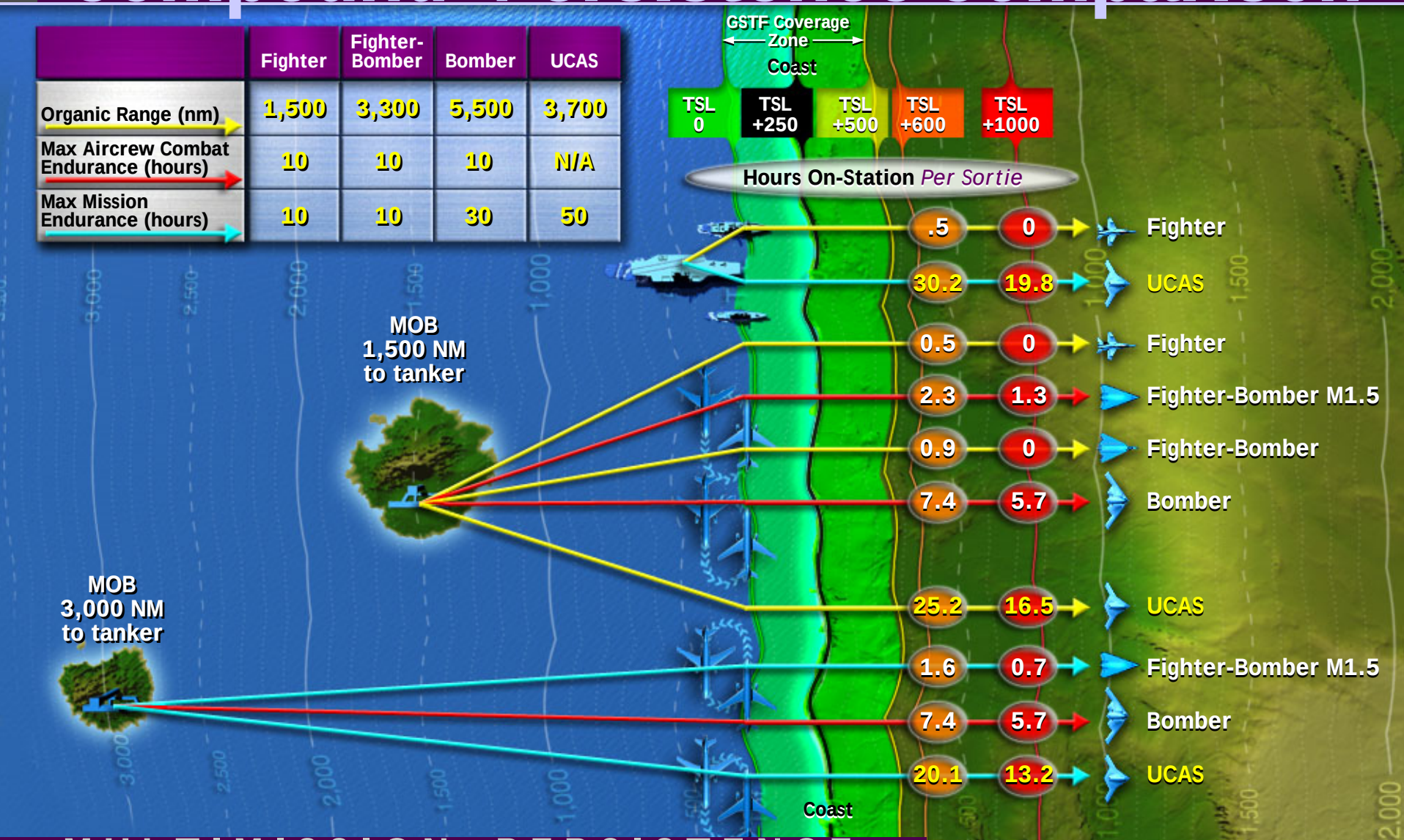
	Fighter	Fighter-Bomber	Bomber	UCAS
Organic Range (nm)	1,500	3,300	5,500	3,700
Max Aircrew Combat Endurance (hours)	10	10	10	N/A
Max Mission Endurance (hours)	10	10	30	50



MULTIMISSION PERSISTENCE

"Compound" Persistence Comparison

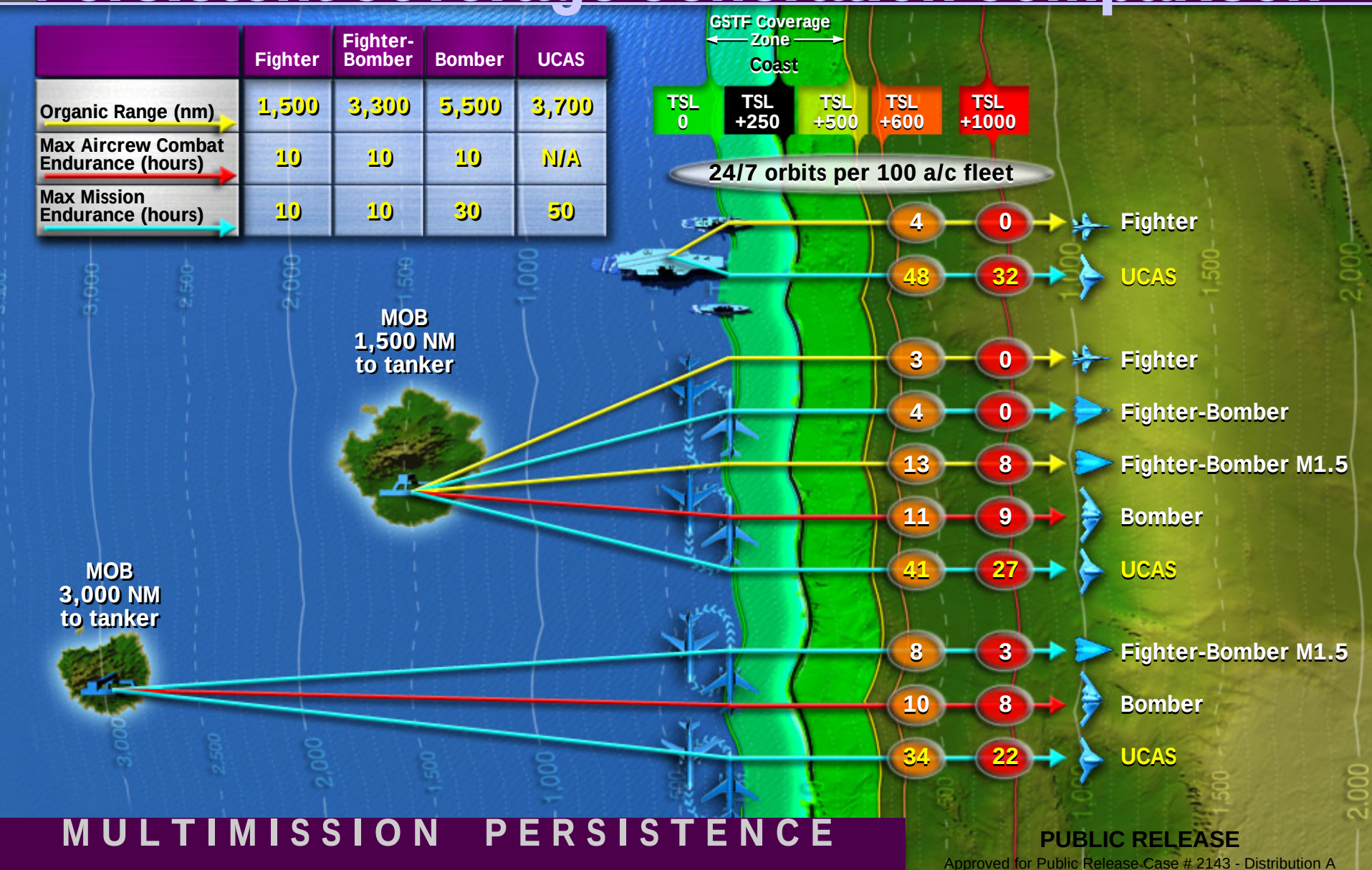
	Fighter	Fighter-Bomber	Bomber	UCAS
Organic Range (nm)	1,500	3,300	5,500	3,700
Max Aircrew Combat Endurance (hours)	10	10	10	N/A
Max Mission Endurance (hours)	10	10	30	50



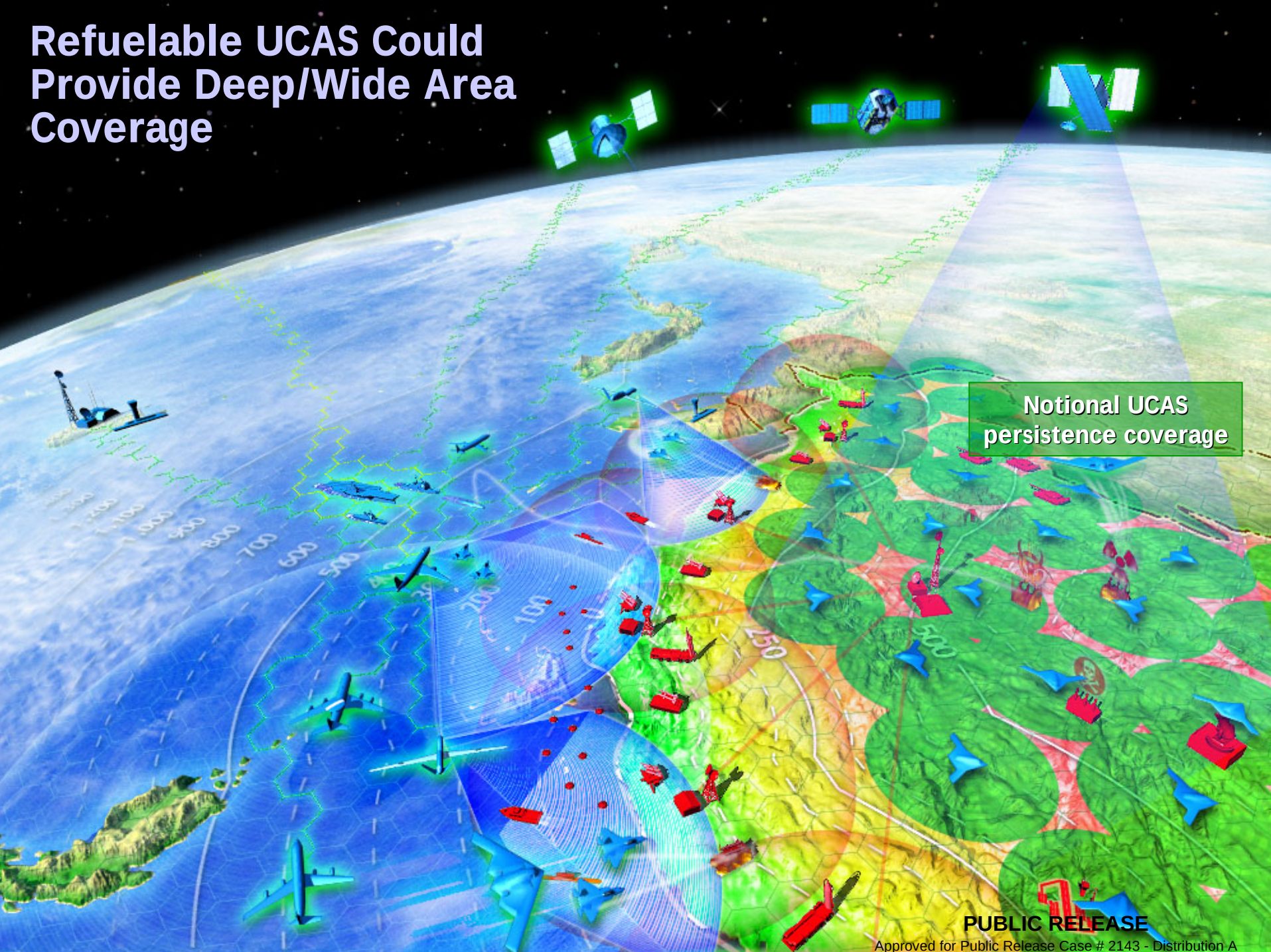
MULTIMISSION PERSISTENCE

Persistent Coverage Generation Comparison

	Fighter	Fighter-Bomber	Bomber	UCAS
Organic Range (nm)	1,500	3,300	5,500	3,700
Max Aircrew Combat Endurance (hours)	10	10	10	N/A
Max Mission Endurance (hours)	10	10	30	50

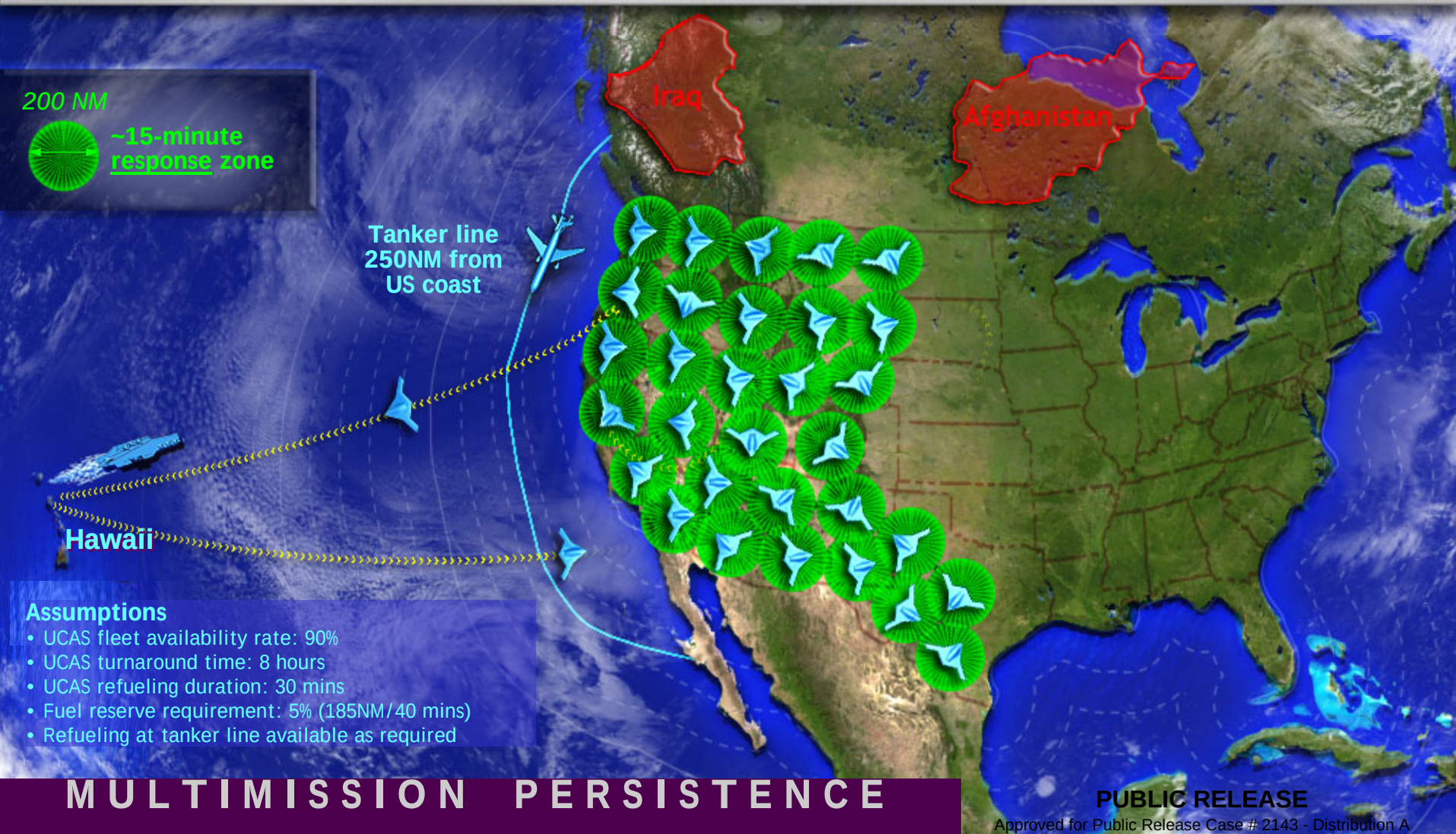


Refuelable UCAS Could Provide Deep/Wide Area Coverage



UCAS Multi-mission Persistent Coverage in Perspective

Illustrative 24/7 Surveillance-Attack Coverage of 100 a/c Fleet of X-47B-Class UCAS



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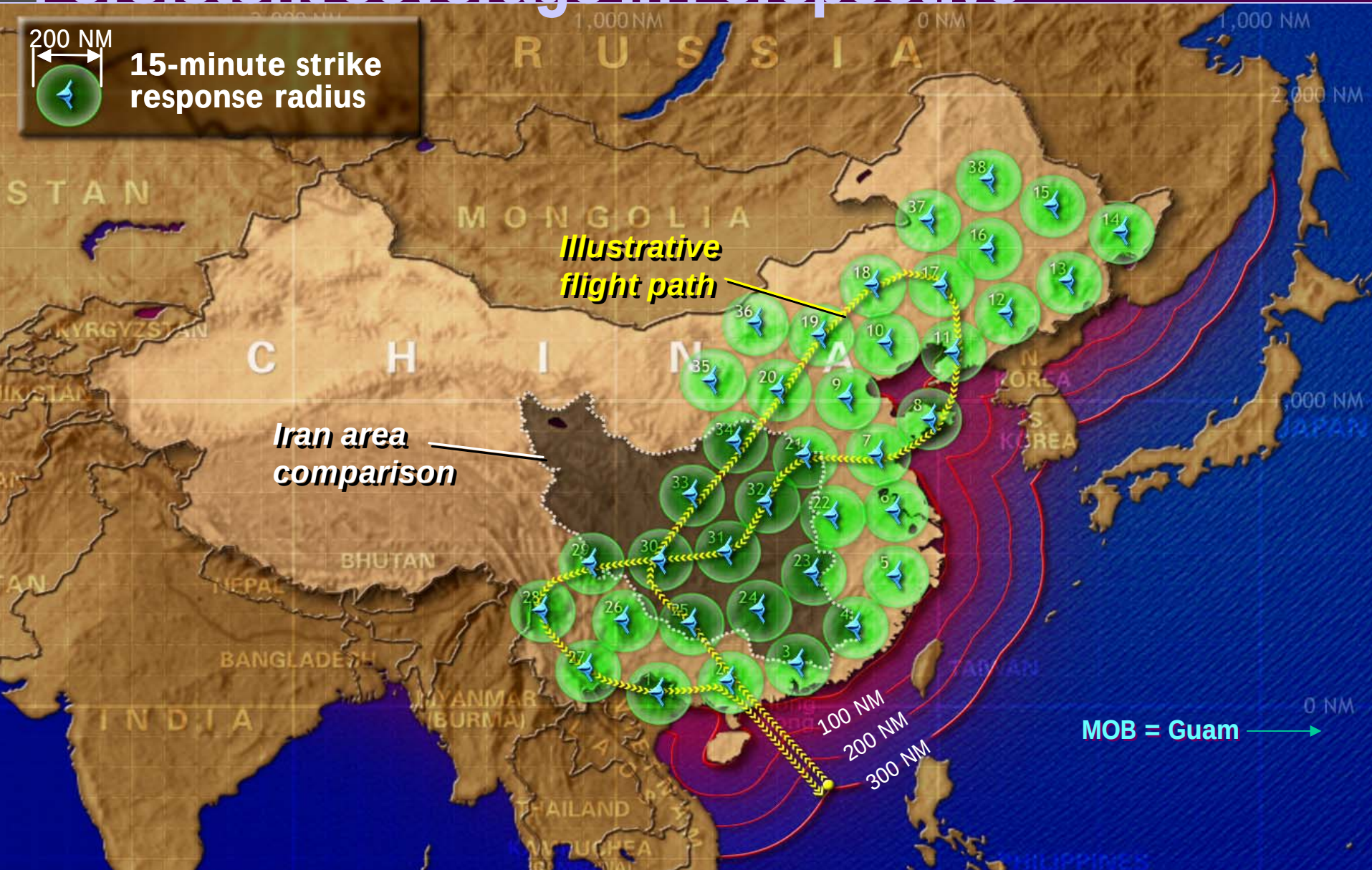

J-UCAS Operational Assessment Program Is Focused on a Limited Mission Set, But...

Initial Joint Mission Emphases (by Joint Capability Area)	Example Mission
BATTLESPACE AWARENESS	
Surface surveillance	Littoral counter-TEL surveillance
Target acquisition	TEL track/ID
FORCE APPLICATION	
Electronic attack	Jam IADS radar
Lethal SEAD/DEAD	Attack IADS radar with JDAM
PROTECTION	

...UCAS Multimission Persistence Could Provide Broad Mission Utility, Support Multiple Joint Capability Areas

Select Potential UCAS-Provided Mission Capabilities (By Joint Capability Area)	Example Mission
BATTLESPACE AWARENESS	
Surface surveillance	Littoral counter-TEL surveillance
Target acquisition	TEL track/ID
SIGINT/ELINT	Detect/fix enemy radar
FORCE APPLICATION	
Electronic attack	Jam IADS radar
Lethal SEAD/DEAD	Attack IADS radar with JDAM
Fixed target attack	Airbase attack
Emergent/time-critical target attack	Attack emergent TEL; SOF support; CAS
PROTECTION	
Cruise missile defense	CM detect/track/warning/engage & atk ops
Ballistic missile defense	Boost-phase BM detect/engage & atk ops
Anti-submarine warfare	Sonobuoy delivery/monitoring

Outline

The Transformation Imperative

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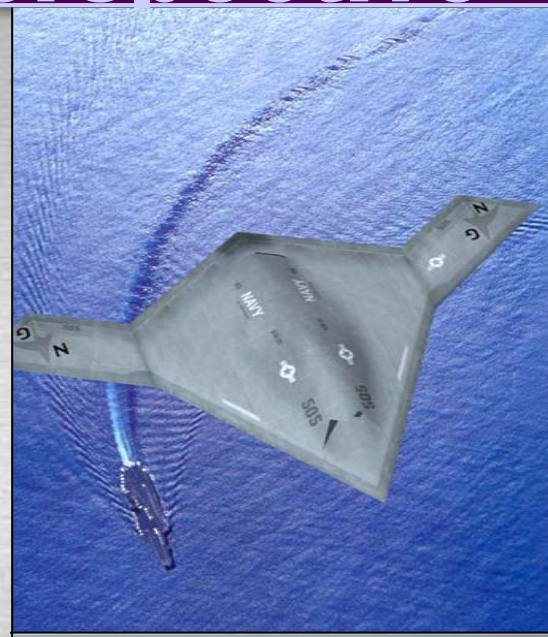
DARPA J-UCAS Program in Perspective

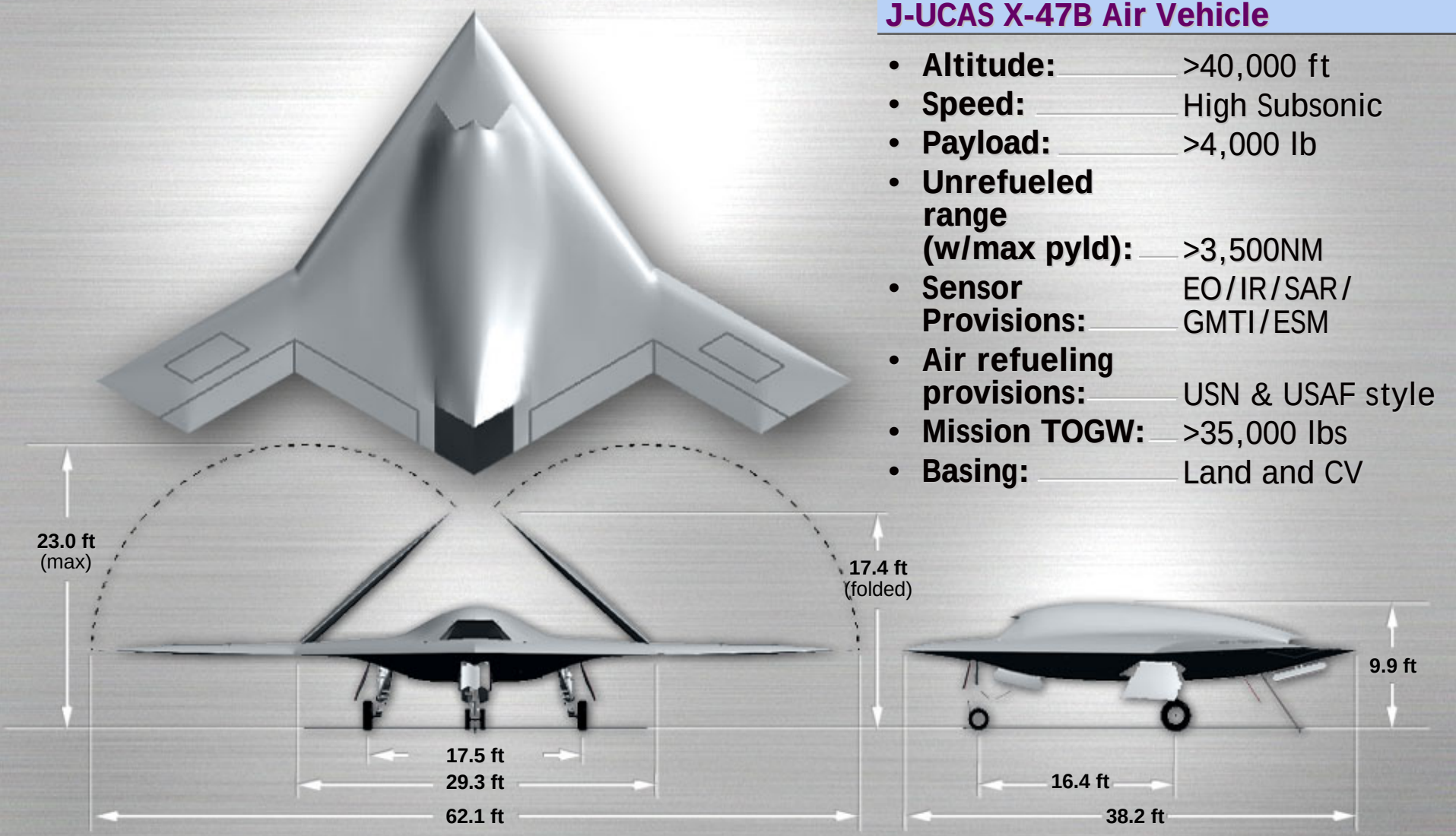
- **Recognizing the UCAS concept's extraordinary potential, DoD established the J-UCAS demonstration program to make UCAS acquisition a near-term option for USN/USAF**
- **Three core J-UCAS program objectives:**
  - *Demonstrate technical feasibility*
    - Family of network-centric, land/CV-capable demo systems
    - Mission capabilities managed through a Common Operating System (COS)
  - *Assess J-UCAS joint operational utility*
    - Modeling/simulation and live mission demonstrations
    - Core missions: SEAD, Strike, ISR, Electronic Attack
  - *Create compelling Service acquisition system options*
    - Demonstration system "maturation"
    - New/alternative vehicle concepts addressing broader Service and Joint needs, broader mission set
- **Not an acquisition program…yet**



X-47B J-UCAS Demonstration System

J-UCAS X-47B Air Vehicle

- **Altitude:** >40,000 ft
- **Speed:** High Subsonic
- **Payload:** >4,000 lb
- **Unrefueled range (w/max pyld):** >3,500NM
- **Sensor Provisions:** EO/IR/SAR/GMTI/ESM
- **Air refueling provisions:** USN & USAF style
- **Mission TOGW:** >35,000 lbs
- **Basing:** Land and CV



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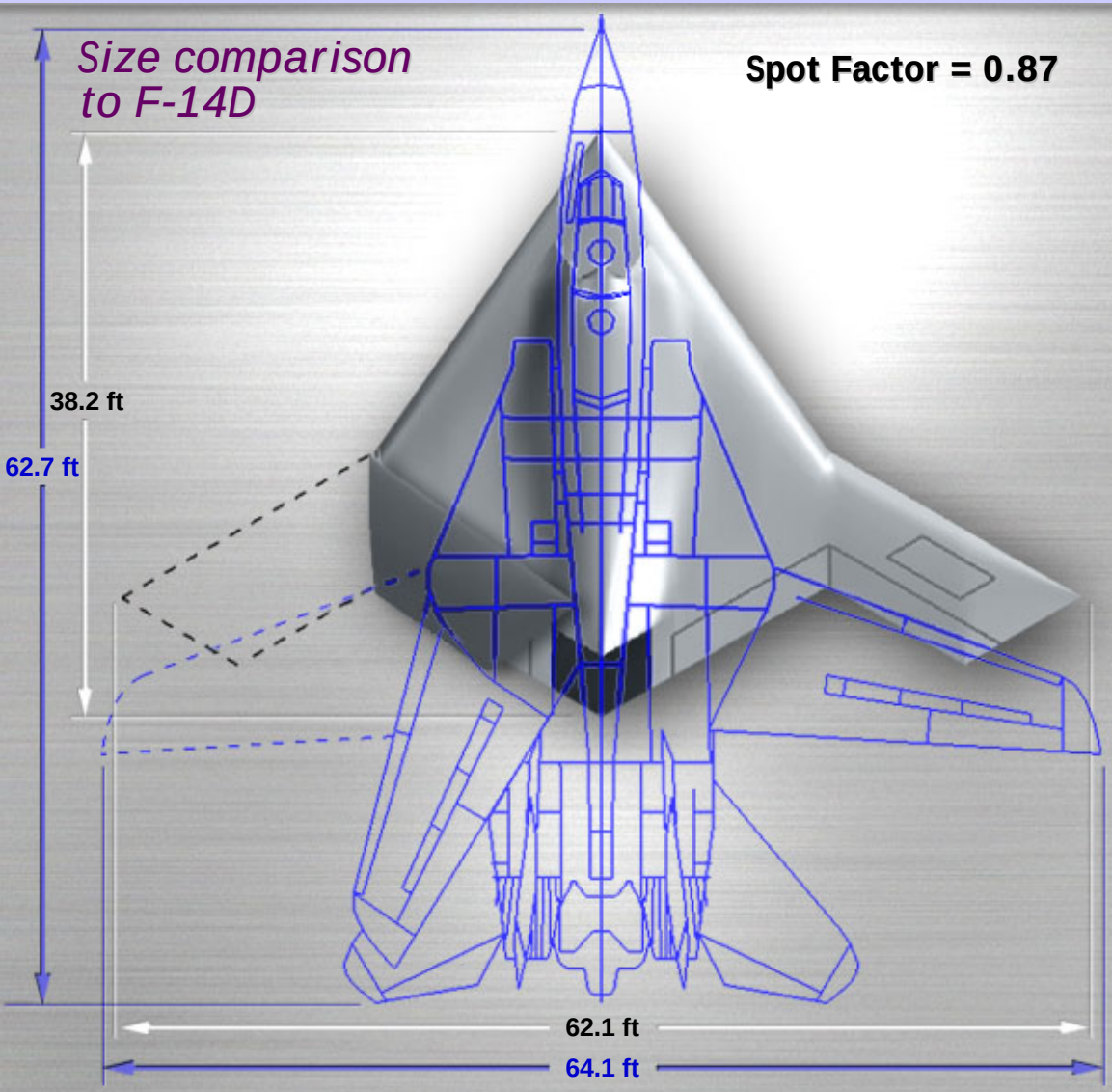

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DARPA J-UCAS PROGRAM

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- **Closing the mulitmission persistence "supergap" is fundamental to US military transformation**
- **UCAS concept is a very attractive solution for meeting this critical need**
  - Step-function increase in "efficient persistence" over potential manned alternatives
  - Negates aircrew casualty risk
  - Operational/mission utility of UCAS-based persistence virtually unlimited
- **J-UCAS program will mitigate technical risk and permit near-term Service acquisition**
- **Revolutionary program likely to face resistance—broadening support base is critical**

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