



# Using Near Space Vehicles in the Pursuit of Persistent C3ISR

**Major Andrew Knoedler**

**Air Command and Staff College**

**Center for Strategy and Technology**

**225 Chennault Circle**

**Maxwell AFB AL 36112**

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## **ACKNOWLEDGEMENTS**

# OVERVIEW

- **Battlespace Awareness**
  - Kill Chain and C3ISR
  - Current Approach
  - Persistence
- **Near Space**
  - Environment
  - Threats
- **Near Space Vehicles**
  - Balloons
  - Airships
  - Aircraft
- **Summary**

**NEAR SPACE VEHICLES COMPLETE  
PERSISTENT BATTLESPACE AWARENESS**

# Battlespace Awareness (C3ISR)

- **Command, Control, Communications**
- **Intelligence**
- **Surveillance**
- **Reconnaissance**
- **How we do it**
  - **Aircraft**
  - **Satellites**
  - **24/7 with effort**
  - **Secure with some effort**



# Kill Chain

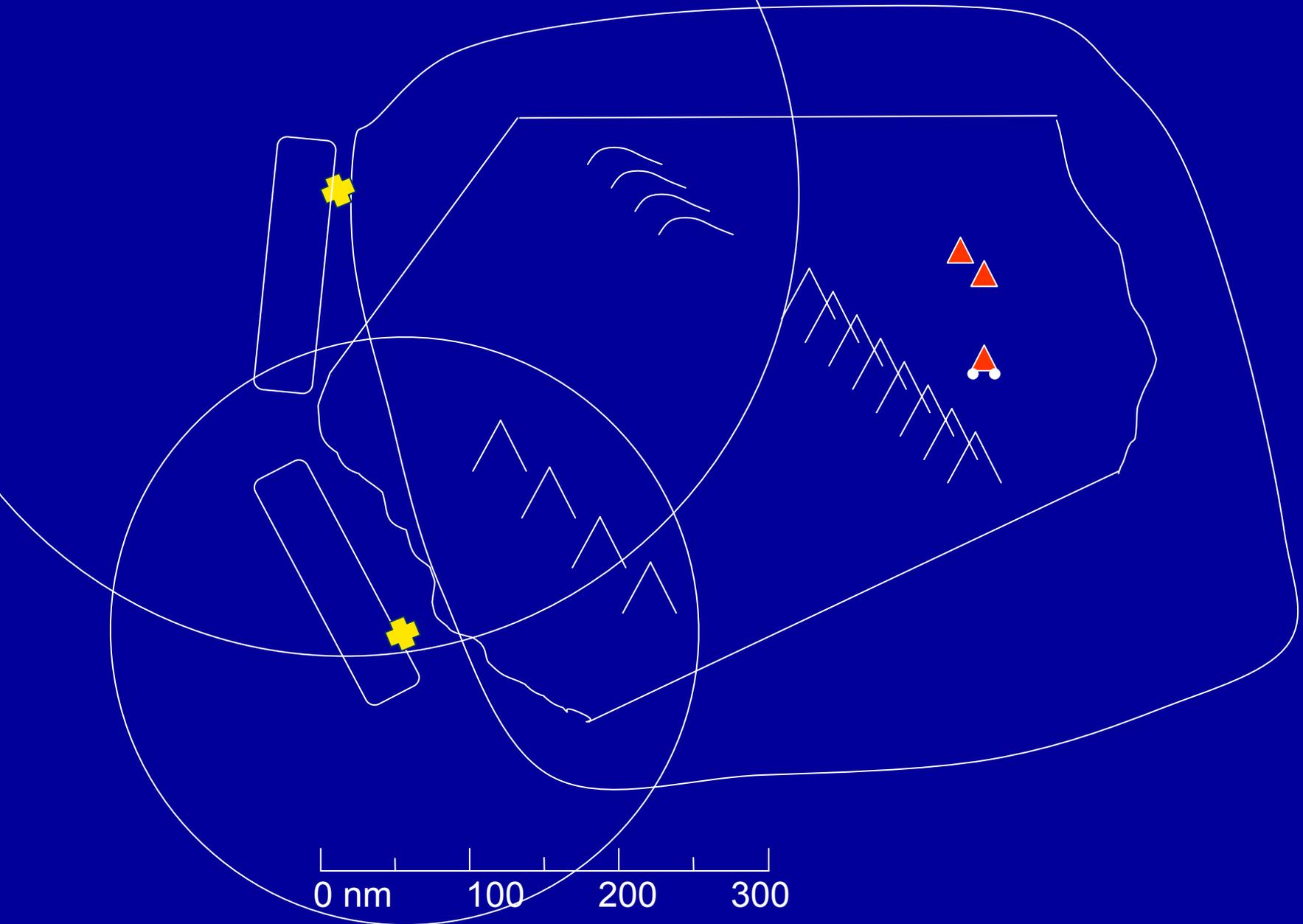
	Find	Fix	Track	Target	Engage	Assess
C3	■				■	■
I	■	■	■	■		
S	■		■		■	■
R			■	■	■	■

■ Critical to that link

# Persistence

- **Satellites**
  - **Geosynchronous**
    - 24/7 fixed coverage and lower resolution
  - **Low Earth Orbit**
    - Better resolution
    - Limited area coverage per pass
    - Constellations required, (e.g. Iridium)
- **Aircraft**
  - **Manned**
    - 8-12 hours
  - **Unmanned**
    - 6-24 hours
  - **Constellation for full coverage**

# Persistence at a Price



# Near Space

**Near Space Stops @ Low Earth Orbit**  
490,000 ft or ~150 km

## Fun Facts

Temp: -140 to 2000° C

Wind: 0-40 kts (with excursions)

Density: 7% to ~0%

Ozone: max at 30km

Single Event Upsets/Ionosphere >50km

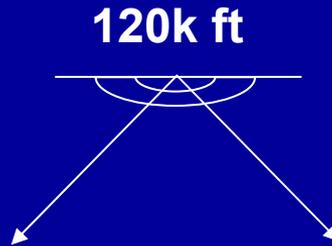
**Near Space Begins**  
65,000 ft or ~20 km

FAA controls <60,000 ft

# Near Space Vehicles

## The View from Up There

Texas 203k nm<sup>2</sup>  
Colorado 78.6k nm<sup>2</sup>  
Alabama 39.6k nm<sup>2</sup>  
Rhode Island 1.2k nm<sup>2</sup>



Max LOS 368nm (425k nm<sup>2</sup>)  
90° 19.7nm (1219 nm<sup>2</sup>)  
30° 11.4nm (408 nm<sup>2</sup>)

Max LOS 168nm (89k nm<sup>2</sup>)  
90° 4.1nm (53 nm<sup>2</sup>)  
30° 2.4nm (18 nm<sup>2</sup>)



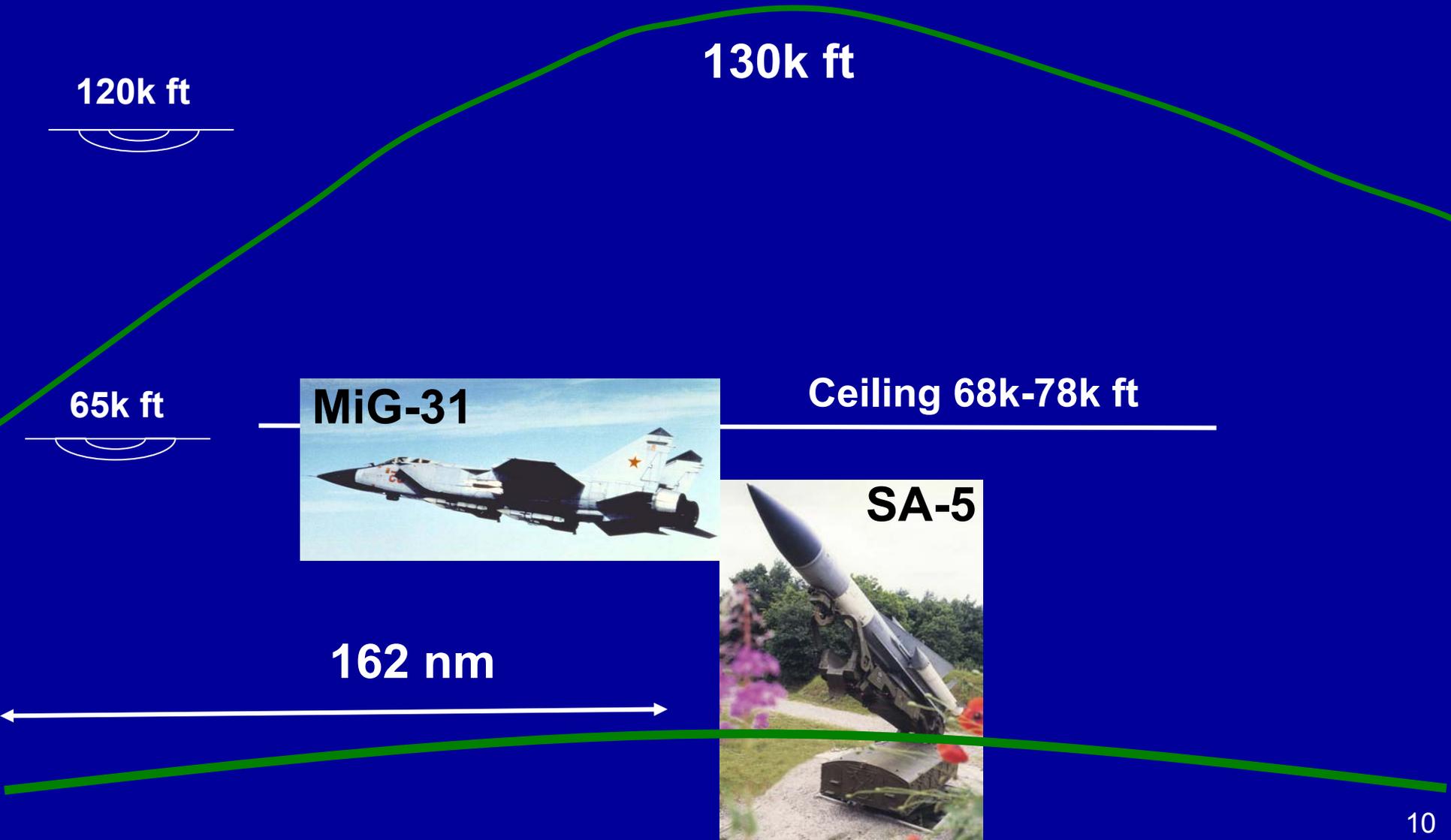
Max LOS 271nm (231k nm<sup>2</sup>)  
90° 10.7nm (360 nm<sup>2</sup>)  
30° 6.2nm (121 nm<sup>2</sup>)

25k ft



# Threats

## What Can Reach Up There?



# Near Space Vehicles

- **Balloons**
- **Airships**
- **Aircraft**



# Balloons

- **Zero Pressure**
  - Space Data Corp – Skysite®
  - USAF Demo – Combat Skysat
  - NASA – Long Duration Balloon
    - Antarctica 2004/05
  - Tethered Aerostats
- **Superpressure**
  - NASA – Ultra Long Duration Balloon
    - Feb 05



# Airships

- **Blimps**
- **Semi-rigid**
  - Ascender 175
- **Dirigibles (rigid)**
  - Stratellite™
  - High Altitude Airship



**Ascender 175**



**Sanswire One**



**High Altitude Airship**



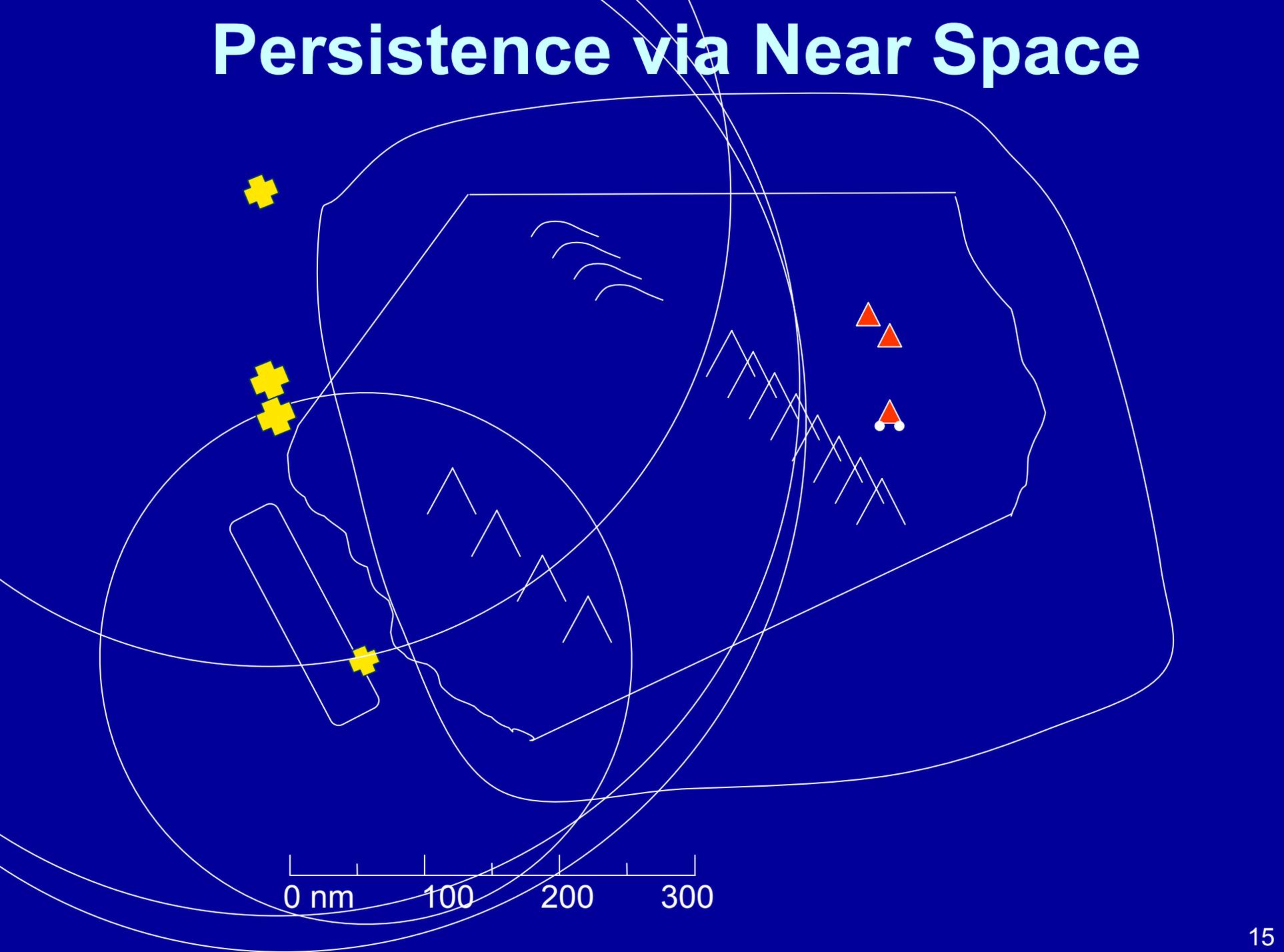
**Aerosphere Prototype**

# Near Space Aircraft

- **Traditional**
  - **Manned**
    - U-2S
  - **Unmanned**
    - RQ-4 Global Hawk
    - Theseus
    - Proteus
- **Alternate Fueled**
  - **Solar/Fuel Cell**
    - Helios Global Observer
    - QinetiQ Zephyr



# Persistence via Near Space



# Near Space Vehicles

## Weighting Matrix

	<b>C3</b>	<b>I</b>	<b>S</b>	<b>R</b>	<b>Personnel</b>	<b>Tech Readiness</b>	<b>Sum</b>
<b>Balloon</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>16</b>
<b>RQ-4A/B</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>22</b>
<b>Long Endurance Airship</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>19</b>
<b>Long Endurance Aircraft</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>21</b>

On a scale of 1 to 5: higher numbers are better

# Summary and Recommendations

- **Battlespace Awareness**
  - Short of 24/7 persistence
  - Near Space Vehicles complete the picture
- **The Way Ahead**
  - DoD heading toward a funding downturn
    - Best return on investment
    - Same effect for less cost
  - Assess risk of investing in emerging technologies
- **Commercial sector**
  - Bear the brunt of development
  - Drive for cheap and ubiquitous wireless coverage
  - DoD could choose to wait and piggyback

**QUESTIONS?**

# Picture Credits

Slide 1 Artist illustration of an Intelsat courtesy [www.intelsat.com/resources/satellites.aspx](http://www.intelsat.com/resources/satellites.aspx)

Artist's concept of High Altitude Airship courtesy Lockheed Martin brochure [www.lockheedmartin.com](http://www.lockheedmartin.com)

Slide 5 Photo E-3A AWACS courtesy Global Security webpage [www.globalsecurity.org/military/systems/aircraft/e-3-picts.htm](http://www.globalsecurity.org/military/systems/aircraft/e-3-picts.htm)

Repeat of artist illustration of an Intelsat

Slide 10 Photo of MiG-31 in flight courtesy Federation of American Scientists [www.fas.org/nuke/guide/russia/airdef/mig-31.htm](http://www.fas.org/nuke/guide/russia/airdef/mig-31.htm)

Photo of SA-5 Gammon missile on its launcher courtesy Russian Arms Catalog, 2000

Slide 11 Photo of a weather balloon climbing courtesy

Photo of Ascender 175 airship in its hangar courtesy JP Aerospace website [www.jpaaerospace.com/ascender175.html](http://www.jpaaerospace.com/ascender175.html)

Photo of Global Hawk courtesy Global Security website [www.globalsecurity.org/intell/systems/global-hawk-picts.htm](http://www.globalsecurity.org/intell/systems/global-hawk-picts.htm)

Slide 12 Photo of TCOM 71M Aerostat courtesy TCOM website [www.tcomlp.com/aerostats\\_What\\_aero.html](http://www.tcomlp.com/aerostats_What_aero.html)

Artists illustration of fully inflated UDLB

Slide 13 Repeat of Ascender 175 photo

Photo of Sanswire One airship in its hangar courtesy Sanswire website [www.sanswire.com/stratellites.htm](http://www.sanswire.com/stratellites.htm)

Repeat of artist's concept of HAA

Photo of Aerosphere prototype courtesy of Techsphere website, [www.techspheresystems.com/DesktopDefault.aspx?TabId=17](http://www.techspheresystems.com/DesktopDefault.aspx?TabId=17)

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Photo of Proteus in flight courtesy of Scaled Composites website, [www.scaled.com/projects/proteus.html](http://www.scaled.com/projects/proteus.html)

Artist's concept of Helios Global Observer courtesy of Mr Wierzbanowski at AeroVironment