Using Near Space Vehicles in the Pursuit of Persistent C3ISR

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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

<table>
<thead>
<tr>
<th></th>
<th>Find</th>
<th>Fix</th>
<th>Track</th>
<th>Target</th>
<th>Engage</th>
<th>Assess</th>
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<td><strong>C3</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>I</strong></td>
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<tr>
<td><strong>R</strong></td>
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</table>

*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 Begins
65,000 ft or ~20 km

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

FAA controls <60,000 ft
Near Space Vehicles
The View from Up There

Texas 203k nm²
Colorado 78.6k nm²
Alabama 39.6k nm²
Rhode Island 1.2k nm²

Max LOS 168nm (89k nm²)
90° 4.1nm (53 nm²)
30° 2.4nm (18 nm²)

Max LOS 368nm (425k nm²)
90° 19.7nm (1219 nm²)
30° 11.4nm (408 nm²)

Max LOS 271nm (231k nm²)
90° 10.7nm (360 nm²)
30° 6.2nm (121 nm²)

Texas 203k nm²
Colorado 78.6k nm²
Alabama 39.6k nm²
Rhode Island 1.2k nm²
Threats
What Can Reach Up There?

65k ft

120k ft

130k ft

Ceiling 68k-78k ft

65k ft

162 nm

MiG-31

SA-5
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

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<th></th>
<th>C3</th>
<th>I</th>
<th>S</th>
<th>R</th>
<th>Personnel</th>
<th>Tech Readiness</th>
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<td>4</td>
<td>1</td>
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<td>Long Endurance Aircraft</td>
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<td>2</td>
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<td>4</td>
<td>3</td>
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</tbody>
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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
Artist’s concept of High Altitude Airship courtesy Lockheed Martin brochure www.lockheedmartin.com
Slide 5 Photo E-3A AWACS courtesy Global Security webpage www.globalsecurity.org/military/systems/aircraft/e-3-picts.htm
Repeat of artist illustration of an Intelsat
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.jpaerospace.com/ascender175.html
Slide 12 Photo of TCOM 71M Aerostat courtesy TCOM website 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
Repeat of artist’s concept of HAA
Slide 14 Photo of U-2S in flight courtesy Global Security website www.globalsecurity.org/intell/systems/u-2-pics.htm
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