Near Space Communications Systems

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Overview

Space Data produces high-altitude communications platforms that:

- Provide emergency response communications within 30 minutes and coverage over hundreds of miles within 2 hours
- Require minimal or no infrastructure, a capability that’s critical in post-disaster scenarios and remote locations
- Support voice, data and asset tracking
- Have been in commercial operation for more than 3 years and are now being purchased in quantity by the U.S. Air Force
- Are cost-effective, recoverable and immediately available
- Can be tailored to users’ specific needs and support interoperability
What We Do

Fill gaps in terrestrial wireless networks providing ubiquitous coverage to
1) enterprises operating in rural areas,
2) wireless service providers, and
3) government agencies
for services and products including:

- Modems
- SkySite® Platform at 100,000 ft
- Services
  - M2M / Telemetry
  - Short Messaging
  - Wireless E-mail
  - Voice
  - Broadband

Products
- Modems
- GPS Trackers
- PDAs
- Handsets
The Solution Simply Integrates 3 Proven Technologies

- Integrated with proprietary altitude / network control & logistic systems

Weather Balloons

- 20-Mile Altitude
- A Century of Experience
- Simple Logistics
- All Weather Operations
- FAA Acceptance of two 6 lb payloads

Ever Shrinking Wireless Devices

1990: 1365 grams
Single Ch. Analog Radio

- 93% Weight Reduction over 15 yrs. + more functions

2005: 95 grams
3 bands + Bluetooth +
+ MP3 + TV + Organizer
+ GPS + Mpixel Camera

Base Station Radios are also Shrinking (i.e. Picocells and Femtocells)
- Expendable
- Infrastructure keeps pace with Moore’s Law

GPS Network

- Precise Timing
- Location
- Inexpensive
Weather Balloons: over 80 Years of Reliable Launch Experience with Worldwide Coverage

- 880 worldwide sites launch 2X / day at noon / midnight
- Over 800,000 launches / yr with no incidents of Aircraft Damage
- FAA rules permit unmanned use in National Air Space (NAS) if:
  - 1) Total payload mass suspended from balloon < 12 lb
  - 2) Each payload package must be < 6 lbs
  - 3) Payloads must separate with 50 lb force
- FAA Regulations bar winged UAVs from NAS
  - Est. will take more than a decade and more than $400 M to gain approval

Developing a UAS collision-avoidance system will be a more complex task than the development of TCAS. It took the aviation community more than a decade and about $400 million to develop TCAS, notes Andrew Lacher, Mitre Corp. UAS program lead. Aviation Week 2-21-07
Space Data’s Coverage Solution

Our network consists of transceivers on weather balloons at 100,000 feet

- A single SkySite® covers everything under a 420-mile diameter circle
  - Single SkySite = 300 terrestrial towers
- Only 41 M2M or 200 Voice SkySites needed to cover the entire US
- Uses industry standard protocols:
  - Interoperates with existing carriers who utilize towers
  - Interoperates with existing user devices
- In 24 x 7 operations for the past 39 months
  - Over 180,000 flight-hours of cumulative near-space operations
  - Over 13,000 flights to date

Each SkySite rises to 100,000 feet and levels off. In the uniform winds at that altitude, a constellation of interlocking SkySites float in unison to blanket large regions with coverage. New SkySites are launched every 12-24 hours to replace the previous constellation which is taken down, recovered and reused.
Space Data’s Commercial Machine-to-Machine Network

• Full Constellation provides ubiquitous coverage to > 20% of CONUS
• Tower-based urban coverage provided through roaming to SkyTel
• In operation for over 3 years focused on oil and gas markets
• Over 13,000 flights, over 180,000 flight hours, over 85% recovery rate

Commercial Coverage with 13 Launch Sites
Types of Near Space Platforms

Platforms

- **Tethered Aerostats**
  - Limited mission envelope
  - Already militarily exploited

- **Free-Floating Weather Balloon**
  - Limited mission envelope
  - Already exploited

- **Altitude Control, Free-Floating Weather Balloon**
  - Moderate mission envelope
  - Technology commercially mature and military deployment imminent

- **Altitude Control, Free-Floating Hi-Altitude Balloon**
  - Moderate mission envelope
  - Limited military exploitation

- **Station-Keeping Hi-Altitude Airship**
  - Broad mission envelope
  - Technology not mature

Recovery Method

- **Parachute Descent**
- **Controlled Parachute Descent**
- **Parafoil Descent**
- **Glider Descent**

Low Risk Low Payoff

- **Continuum of Near-Space Assets**

High Risk High Payoff

*Courtesy of Air Force Space Battle Lab*
Combat SkySat Demonstration, March 2005

- Demonstrated Forward Air Controller Mission
- Interoperability of Modulations and Bands

- Recovery Vehicles

- Dual Payload SkySat Platform
  - AM – Aeronautical Band
  - FM – Terrestrial Band

- Two Linked PRC-148’s

- Remote Ground Station and mission launch

- RGS acts as gateway

- NOC

- Chandler, AZ

- Land Line
JEFX 06 Mar 06 Spiral II
Comms between Phoenix, Nellis AFB, and Coronado Island
Approx 270 miles
Approx 270 miles
Approx 380 miles

Courtesy of Air Force Space Battle Lab
Near Space Communications System (NSCS)

- Deployment contract with USAF
  - $49 M / 5 year IDIQ Contract
  - Awarded Aug. 2006
  - Free-floating Balloons
    - Comm Relay – secure voice/data
    - “Truck” to carry lower 6-pound payloads to Near Space
  - Three Versions:
    - 225 - 375 MHz (UHF/FM)
    - 30 - 88 MHz (LVHF/FM)
    - UHF / VHF cross-band payload
  - 65,000 - 100,000 ft operation for 6 to 12 hours
- Training materials and Ground Stations delivered 1Q07
- Active Programs
  - Initial deployment quantities on order
  - U.S. Southern Command
    - Joint Urgent Operational Need – JS approved validation
  - U.S. Central Command
    - Quick Reaction Capability
Applications for Homeland Security

- Support FEMA, State/Federal agencies in contingencies (power outage, hurricanes, earthquakes, etc.)
- Enhance border and coast monitoring efforts, filling in coverage gaps and tracking assets
- Extend comms and personnel/asset tracking for wildland fires
- Provide extended communications for transportation security
Emergency Response

- Broad communication coverage for recovery management
- Group talk ability
  - Effective at coordinating large number of first responders
- Initial replacement of telecommunications infrastructure
- Bridge comms between federal, state & local authorities
SkySat Coverage at 77K

22 Jun 2007 00:18:01.000  Real Time Offset: 0.00 sec

Lat (DMS): 19:51:53.4200 N  
Long (DMS): 156:16:33.5190 W  
MGRS: 04UVH3321503597  
Alt MSL (ft): 77766  
Alt AGL (ft): 77766  
Course (deg): 278  
Speed (mph): 0.6  
Climb Rate (ft/sec): -76.1
SkySite® Voice Repeater Kit

- Demonstrated at Assoc. of Public safety Comm. Officers (APCO) Conference – August 2006 in Orlando, Florida
- Responsive communications for disaster recovery operations
Demonstrated Coverage of Single Payload to Standard Motorola Handheld Radios at APCO 2006
Border Protection

- Digital, encrypted voice for Border Patrol agents
- Covers deep canyons & extends battery life
- Supports agent comms. & asset tracking
- Responsively tasked
400-mile Diameter Coverage Footprint
Coastal Protection

- Extend off-shore / international waters comms
- Expanded comms for specific emergency events
- Comms over greater lengths of waterways when needed
- Broader USCG involvement in disaster recovery
Wildland Fires Proof-of-Concept Configuration

Portable Ground Station

Relocatable Ground Station

Launch & Recovery Vehicle

Dual Payload SkySat Platform
Transportation Security

- Asset tracking
- Rapid dissemination of information over broad areas
- Facilitate interoperability
- Coordinate protection activities sector-wide
- Support specific transportation security events
- Support broad secure comms architectures
- Improve security across all modes of transportation
- Support mobile command post
- Coordination across federal, state & local agencies
Typical Near Space Platform Launch
Near Space Platform Applications

- Emergency Response
- Border Patrol Comm. / ISR
- Wildland Fire Comm/Tracking
- Tactical Ground-to-Ground Comms.
  - Convoy Support
  - Special Operations
- Intelligence, Surveillance & Reconnaissance (ISR)
  - “Truck” to carry special payloads to altitude
  - Visual / IR Imagery
- Tactical Air-to-Ground
  - Supports low-flying aircraft
- High Bandwidth Data Relay
- Other satellite-like missions
Interoperability
Bridging Repeater supports communication between security agencies

- Cross-banding
- Coordination
- Broad coverage
- Responsive

Public Safety

Military

![Public Safety Vehicles](image1.png)

![Military Vehicles](image2.png)
Good Coverage in Challenging Topography

- 220 Mile link from bottom of Grand Canyon on Aug 3, 2006
  - Used 900 MHz, 2-way handheld radio
  - Only “5 palms” of sky visible
- LEO Sat phone only worked 2 out of 15 min
- Walls too high for GEO Sat Comms.
## Applications & Devices

<table>
<thead>
<tr>
<th>Data Markets</th>
<th>Applications</th>
<th>Devices</th>
<th>Key Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil and Gas</strong></td>
<td>Production Automation</td>
<td><img src="image1" alt="Device Image" /></td>
<td>• Replaces CDPD being decommissioned this year (75,000 wells losing coverage)</td>
</tr>
<tr>
<td></td>
<td>Asset Tracking</td>
<td><img src="image2" alt="Device Image" /></td>
<td>• Monitor assets for greater efficiency &amp; security</td>
</tr>
<tr>
<td></td>
<td>Field Comm.</td>
<td><img src="image3" alt="Device Image" /></td>
<td>• Low cost service to coordinate field operations</td>
</tr>
<tr>
<td>**Industrial</td>
<td>Irrigation</td>
<td><img src="image4" alt="Device Image" /></td>
<td>• Control and monitor water usage</td>
</tr>
<tr>
<td>Automation</td>
<td>Alarm Systems</td>
<td><img src="image5" alt="Device Image" /></td>
<td>• Secure assets inexpensively in remote areas</td>
</tr>
<tr>
<td></td>
<td>Meter Reading</td>
<td><img src="image6" alt="Device Image" /></td>
<td>• Read rural utility meters for energy usage</td>
</tr>
<tr>
<td><strong>Fleet Tracking</strong></td>
<td>Trailer Tracking</td>
<td><img src="image7" alt="Device Image" /></td>
<td>• Low power/small device easily integrates on trailer</td>
</tr>
<tr>
<td></td>
<td>Cargo Tracking</td>
<td><img src="image8" alt="Device Image" /></td>
<td>• Track individual pallets using GPS tags</td>
</tr>
<tr>
<td>**Personal</td>
<td>In-field work force comm.</td>
<td><img src="image9" alt="Device Image" /></td>
<td>• Over 1.1 million compatible devices deployed</td>
</tr>
<tr>
<td>Messaging</td>
<td></td>
<td><img src="image10" alt="Device Image" /></td>
<td>• New, lower-cost PDAs entering market from Asia</td>
</tr>
<tr>
<td><strong>Gov’t Markets</strong></td>
<td><strong>Applications</strong></td>
<td><img src="image11" alt="Device Image" /></td>
<td>• Call up police / fire personnel in rural areas</td>
</tr>
<tr>
<td><strong>Emergency</strong></td>
<td>Dispatch service</td>
<td><img src="image12" alt="Device Image" /></td>
<td>• Voice on standard Land Mobile Radios</td>
</tr>
<tr>
<td><strong>Response</strong></td>
<td></td>
<td><img src="image13" alt="Device Image" /></td>
<td>• Track material &amp; soldiers in hostile areas</td>
</tr>
<tr>
<td></td>
<td>Tracking / Communication</td>
<td><img src="image14" alt="Device Image" /></td>
<td>• Encrypted voice communications for military</td>
</tr>
<tr>
<td></td>
<td>Intelligence</td>
<td><img src="image15" alt="Device Image" /></td>
<td>• Monitor &amp; triangulate on enemy communications</td>
</tr>
</tbody>
</table>

*Image Credit: Space Data Corporation*
**Near-Space: High Resolution, Low Cost**

<table>
<thead>
<tr>
<th>QuickBird 60 cm natural color</th>
<th>SkySite® natural color demo</th>
</tr>
</thead>
<tbody>
<tr>
<td>$60,000,000 vehicle</td>
<td>$600 for vehicle construction*</td>
</tr>
<tr>
<td>$15,000,000 launch</td>
<td>$50 launch*</td>
</tr>
</tbody>
</table>

* Not strictly an apples-to-apples comparison
Conclusion/Recommendations

• Responsive platform exists now to provide broad wireless coverage safely above affected areas
  – No reliance on infrastructure
  – Store until required… launch as needed
• Homeland Security suited payload version available for demo now
  – System can be tailored to specific user needs
• Incorporate into disaster response plans now
  – Experience shows “real time integration” nearly impossible

The View from 90,000 Feet