IRIDIUM SATELLITE SYSTEM & NAL PRODUCT OVERVIEW

2018 SAFE EUROPE
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NAL Research Corporation is an Iridium satellite solutions provider that specializes in solving difficult communications and data transmission challenges with standard or customized solutions.

- Established in 1997 & located in Manassas, Virginia
- Acquired by Drew Marine in 2016 and operating under Special Security Committee
- Design and manufacture Iridium TTL/BFT/FFT products since 2000
- Design and manufacture Iridium receivers and transceivers
- Primary markets: remote sensing, tracking, and search and rescue
- Support ~1,200 organizations – US and foreign militaries, US law-enforcement agencies, other US federal agencies, national labs, universities, US state and local agencies, and commercial entities
- Top Iridium Government Partner for the last 15 years
- One of Iridium’s original partners
About Iridium

• The world’s largest commercial satellite constellation

• Uniquely sophisticated architecture of 66 cross-linked Low-Earth Orbit (LEO) satellites
  – Delivers high-quality mobile voice and data coverage over the globe
  – Includes oceans, airways and polar regions

• Each Iridium NEXT satellite is linked up to four others – two in the same orbital plane and one in each adjacent plane
  – Creates a dynamic mesh network that routes traffic among satellites to ensure a continuous connection, everywhere

• In-space redundancies across the network are combined with a secure, dedicated ground infrastructure
  – Both a commercial and military gateway with remote back-ups
  – This unique configuration will allow services to continue to remain unaffected by natural disasters – including hurricanes, tsunamis, earthquakes, and fires that can cripple terrestrial infrastructure
Iridium Satellite Details

• 66 Low-Earth Orbit (LEO) Satellites:
  – The large number of fast-moving satellites with multiple overlapping spot beams minimizes missed connections and dropped calls.
  – The LEO orbit also provides a shorter transmission path with less signal attenuation.

• 15 spares (9 in-orbit, 6 on-ground):
  – In-orbit spares can be quickly repositioned and activated, as needed.

• Unique LEO constellation:
  – With a 476 miles (780 km) orbit, the proximity of Iridium’s LEO network means pole-to-pole coverage, shorter transmission path, stronger signals, lower latency and shorter registration time than with GEO satellites.
  – The network is considered a meshed constellation of interconnected, cross-linked satellites so that each satellite “talks” with the other nearby satellites in front, behind and in adjacent orbits.

• Global, pole-to-pole coverage:
  – Each Iridium satellite is linked to up to four others creating a dynamic network that routes traffic among satellites to ensure global coverage, even when traditional local systems are unavailable.

• L-band availability:
  – Reduced interference from weather and a more reliable network.
NAL Research Applications

- **Standard**
  - Personnel and Equipment Tracking
  - Asset Tracking
  - 2-way comms in remote locations
  - Distress alerting with GNSS location

- **Specialized (Law Enforcement)**
  - Embedded boards & chips
  - Clandestine personnel or asset tracking
  - Concealed appliances
  - Sensor alerts
  - Input/Output triggers & alerts
## Iridium vs Cospas-Sarsat

<table>
<thead>
<tr>
<th>CAPABILITY</th>
<th>IRIDIUM BEACON</th>
<th>COSPAS-SARSAT BEACON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POSITION ACCURACY</strong></td>
<td>Standard position accuracy using embedded GPS is 3 meters or better.</td>
<td>Standard position accuracy using embedded GPS is 100 meters at mid-latitudes (40° North to 40° South) due to system designed truncated GPS bit message; further declining accuracies as beacon is moved more to the northern or southern latitudes.</td>
</tr>
<tr>
<td><strong>ALERT LATENCY</strong></td>
<td>From Alert activation to delivery of Alert to assigned recipient is 2 minutes or better on average.</td>
<td>From Alert activation to delivery of alert to assigned recipient is 8-10 minutes on average.</td>
</tr>
<tr>
<td><strong>OPERATIONAL SECURITY</strong></td>
<td>Devices equipped with 256 AES encryption of alert message, 2-way communications and tracking information.</td>
<td>No encryption provided or allowed on standard beacons; additionally, alerts are broadcast to multiple receiving ground stations around the globe maintained by variety of nations.</td>
</tr>
<tr>
<td><strong>2-WAY COMMUNICATIONS</strong></td>
<td>Global 2-way voice and short burst data (SBD) are standard add-ons allowing for push-to-talk as well as communications in any form.</td>
<td>Currently the system does not support or allow 2-way standard add-ons allowing for push-to-talk as well as communications in any form.</td>
</tr>
<tr>
<td><strong>TRACKING</strong></td>
<td>Upon activation, beacon can be set to ‘Track Mode’ simultaneous with emergency alerting, or without the alerting function active; allowing the beacon (and the associated personnel) to be tracked at command set intervals.</td>
<td>Currently the system does not support or allow tracking in any form.</td>
</tr>
<tr>
<td><strong>PRIORITIZED DISTRESS ALERTING</strong></td>
<td>While Iridium provides a multiple of communication services, distress alerting is prioritized above all other communications.</td>
<td>Cospas-Sarsat primary function is distress alerting.</td>
</tr>
</tbody>
</table>
NAL Handheld Devices

SHOUT nano

SHOUT 3G
(2G/3G/4G/LTE)

SHOUT ts/tw

SARLink
NAL Black-Box Trackers

- **9602-LP**
- **9603-3G**
  - (3G/4G/LTE)
- **PTT Modem**
  - (DTCS/Netted Iridium)
- **9603RTL**
  - STL/GNSS/SBD/GDB/GSM 3G-4G-LTE
  - IMU/3-D Accelerometer/Motion Sensor/IO/A-D
- **AVeTS**
  - Optimized for Vehicle Tracking, anti-tamper

NAL Research Corporation Proprietary Information
NAL Custom-Designed Handheld Devices

*STL – Satelles Timing and Location (optional)

- Originally designed by Boeing called BTL
- Satelles Incorporated obtained the IP from Boeing and Iridium and renamed BTL to STL
- STL signal is delivered to a ground receiver using an Iridium paging channel (1626.104MHz)
- Designed to augment or replace onboard GPS receiver
- It surpasses GPS in two important ways:
  - Provides indoor location without local infrastructure
  - Delivers trusted location virtually impossible to spoof and/or jam
NAL New Handheld Devices – 2018 Launch

SHOUT tw

SHOUT ns

SHOUT sp
Iridium Phone Android
(SHOUT ts/Voice/PTT)
NAL SHOUT tw

✓ Pocket-size, self-contained low-cost, satellite tracker
✓ Programmed for either DoD or commercial Iridium gateway
✓ High resolution color touchscreen
✓ Menu options are displayed as icons for quick access
✓ Ultra-low power consumption
✓ Automatic location reports (>1500 reports per charge)
✓ Data logging (waypoints and tracking reports)
✓ Free-text, canned messages or combination of both
✓ Encryption on both transmit/receive
✓ Two-way SDB communications (10-byte or 30-byte formats)
✓ Guarded distress alert switch
✓ Real-time reporting
✓ Complete global coverage

Dimensions (LxWxD): 4.1” x 2.3” x 0.9” (104 x 58 x 23 mm)
Weight: 7.2 oz (204 g)
Enclosure: Hard-anodized aluminum
Power Input: External DC power or internal battery
Transmission Power: 1.0 W
Encryption: AES 256-bit on transmit & receive
GPS Receiver Type: 1575.42 MHz (L1), 50-channel, C/A code, -160 dBm
GPS Accuracy: 2.5 m CEP
Start-up Times: < 1 sec hot start, 29 sec cold start
Operating Temp: 40°F to +185°F (40°C to +85°C)
Waterproof: IP67 (1 meter depth – salt or fresh water)
NAL SHOUT ns

✓ Low-cost, body-worn tracker and messaging device
✓ Programmed for either DoD or commercial Iridium gateway
✓ Ultra-low power consumption
✓ Automatic location reports (>600 reports per charge)
✓ Sequenced distress alert switch
✓ Bluetooth connectivity to smart phone – Android and iOS
✓ Free-text, canned messages, or combined via smart phone
✓ Data logging (waypoints and tracking reports)
✓ Encryption for transmit and receive
✓ Real-time, pole-to-pole coverage
✓ Internal rechargeable battery using AC adapter, USB port, or solar charger
✓ Integrated motion sensor

Dimensions (LxWxD): 3.0” x 1.8” x 0.7” (76 x 46 x 18 mm)
Weight: 3 oz (85 g)
Enclosure: High performance engineered polymer
Power Input: External DC power or internal battery
Battery: Lithium Ion (Iridium) / Lithium 5-yr battery (C-S)
Transmission Power: 1.0 W (Iridium) / 5.0 W (Cospas-Sarsat)
Encryption: AES 256-bit on transmit & receive
GPS Receiver Type: 1575.42 MHz (L1), 50-channel, C/A code, -160 dBm
GPS Accuracy: 2.5 m CEP (Iridium)
Operating Temp: -4°F to +140°F (-20°C to +60°C)
Waterproof: IP67 (1 meter depth – salt or fresh water)
NAL SHOUT sp

- Hand-carried satellite smartphone tracker and messaging device
- Android Operating System 6.0
- Iridium Satellite and Cellular Connectivity
- Programmed for either DoD or Commercial Iridium Gateway
- Automatic location reports (>1500 reports)
- Wi-Fi Connectivity a/b/g/n
- Bluetooth 4.0 low-energy connectivity
- Guarded emergency alert switch
- High-resolution touchscreen
- Camera with LED flash
- Micro USB interface
- 3.5mm headset jack
- Ruggedized & waterproof
- Free-text, canned messages, or combined free-text and canned messages
- Data logging (waypoints and tracking reports)
- Geo-fencing
- Internal rechargeable battery
- Compatible Airtime Service(s): SBD, SMS, Voice

Dimensions: 4.9” L x 2.7” W x 0.9” D
Weight: ~12 oz
I/O Interface: Micro USB, Micro SIM reader, 3.5mm headset jack
Cooling: Convection
Enclosure: Hard-Anodized Aluminum (EMI Shielded)
Cellular Transceiver Type: u-blox LISA-u230, 3.75G
Supported Cellular Bands: UPTS/HSPA: 2100, 1900, 1700, 900, 850, 800 MHz
GSM/GPRS/EDGE: quad band – 850/900/1800/1900 MHz
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