Workshop
Iridium and other comms systems

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Questions
How can I get wireless comms at South Pole with 7 km range?

How do I get Long Range WiFi?

This solution may need frequency clearance from the spectrum manager

- High power IEEE 802.11 WLAN
- Freewave Transceivers
- WiMAX, WipLL
Where can I get a low power computer (SBC)?

This may depend on your definition of “low power”.
Technologics TS-7260
Where can I get a Cold Weather Router?

Technologics TS-7260 with Ethernet board

Moxa
AWK-3121 or AWK-4121
How do I maximize traffic with 1 Access Point?

Reliable inverse multiplexer for UAV ops?

ARGOS Checksum?
Iridium
How do I get started with Iridium?
How do I link a Campbell Datalogger to Iridium?

See later discussions
Where can I find an Iridium Handbook?

The basics start here
Can I determine my location with Iridium?

Yes.

8.1 -MSGEO - Request Geolocation

*Exec Command:* -MSGEO

Query the geolocation grid code received from the network in the last Access Decision Notification message. The response is of the form:

-MSGEO: <x>,<y>,<z>,<time_stamp>

<x>, <y>, <z> is a geolocation grid code from an earth centered Cartesian coordinate system, using dimensions, x, y, and z, to specify location. The coordinate system is aligned such that the z-axis is aligned with the north and south poles, leaving the x-axis and y-axis to lie in the plane containing the equator. The axes are aligned such that at 0 degrees latitude and 0 degrees longitude, both y and z are zero and x is positive (x = +6376, representing the nominal earth radius in kilometres). Each dimension of the geolocation grid code is displayed in decimal form using units of kilometres. Each dimension of the geolocation grid code has a minimum value of −6376, a maximum value of +6376, and a resolution of 4.

<time_stamp> is assigned by the ISU when the geolocation grid code received from the network is stored to ISU internal memory. Current Iridium system time, which is a running count of 90 millisecond intervals, is used for the time stamp. Time stamp is a 32-bit integer displayed in hexadecimal form.
Should I use SBD or Dialup?

This depends on a number of factors:
  - Volume of data
  - Size of individual data records
  - Presence of computing power at Iridium location
  - Qualification for DOD SIM

- SBD for records < 340 or 1960 Bytes
  - Commercial SIM limited to 2 KB/day to equal DOD cost

- Dialup for > 1 kByte record size
Iridium Service Cost Comparison

- Assumes one report per day

![Graph showing service cost comparison for different Iridium services.](image-url)
- What’s a cheap way to check an Iridium modem?
  - An RF Diode Detector (properly impedance matched)
  - A USB Power Detector
  - A USB Spectrum Analyzer
Can I minimize or control the latency of short data bursts on Dialup?
Dial-up connection time significantly impacts datarate

“Flattening” at about 35 KB
How do I increase bandwidth above 2400 bps?

- Bonded modems, which isn’t cheap.
- OpenPort, which isn’t cheap ($5K)
Paddy Sullivan’s Datalogger System

DATA ACQUISITION

Kotzebue Datalogging

DATA ACQUISITION

VECO Polar Resources, NPS’s Arctic Logistics Provider, is supporting Dr. Sullivan’s research by providing data transmission and storage during the length of his project. The data comprises hourly soil moisture and temperature readings in addition to local meteorological readings: rainfall, wind speed, air temperature, and solar radiation.

Through a solar powered Campbell Scientific CR10X1 datalogger and Iridium satellite modem, project data is transmitted daily to this site for storage and plotting. Although the study site, in the Notsok National Reserve, is very remote, data analysis is possible throughout the year owing to this capability.
FAQS
Learning From Experience

Iridium – Dial-Up

Everyone Does Dial-Up – Remote Usage Reminder

- Disable “PIN” and “Call Forwarding” For Modem Use
- Power Cycle Modems Once / Week Or Sooner (Cures Many Evils)
- ALWAYS Dial-out Occasionally (Loss of Registration Issue Example)
- Use More Than One Communications Mode – Devices Can Be Concurrently Provisioned For: Dial-up, SBD, RUDICS, SMS, Etc.
- DoD SIMs and Commercial SIMs Do Not Talk To Each Other !!!
- Remember the Iridium Dial Plan – There Are Different Access Codes For NADP, 800#’S, Intl, Etc. (Iridium Is Country Code “8”) 008-816-763-12345
- Be able To Reconfigure Remote Systems On-The-Fly (Epoch Change Example)
- Have Intelligent “Phone-Home” Algorithm – No Blind Dialing...
Operational Suggestions

1) Upgrade to latest firmware
2) Up the voltage to 4.8 VDC
3) Grounding - ref wind generated static
4) Power supply grounding - insure common reference
5) Beware of power supplies with insufficient current - will run modem enough to respond to AT commands but not run the RF board satisfactorily
6) Use two stop bits
Operational Suggestions

- Consider a non-hockey-puck style antenna
- Use multi-channel technology if possible (router or Linux SBC which manages ML-PPP link consisting of several modems)
- Eliminate ground station Iridium modem by using a government phone line of commercial SIM cards (beware of cost with commercial SIMs)
- Insure Iridium to computer baud rate is identical at both sides - not supposed to make a difference but it does in some applications
- Use Data-After-Voice (DAV) [AT+WDAV=1] for Iridium modem to Iridium modem comms (must always be set in the initialization string in both modems - modems will not save WDAV setting to memory)
Understand the Interface

- Pin 1 is a sensitive toggle to power on/off for A3LA-X. It will only turn off power on earlier A3LA models.
- Understand that Power Ground may be isolated from Signal Ground

<table>
<thead>
<tr>
<th>PIN #</th>
<th>SIGNAL</th>
<th>DESCRIPTION</th>
<th>INTERFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EXT_ON_OFF</td>
<td>Power on/off control input</td>
<td>DC Power</td>
</tr>
<tr>
<td>2</td>
<td>+12VDC</td>
<td>Output Voltage to Power the DPL Handset</td>
<td>DC Power</td>
</tr>
<tr>
<td>3</td>
<td>EXT_GND</td>
<td>External GND input</td>
<td>DC Power</td>
</tr>
<tr>
<td>4</td>
<td>EXT_B+</td>
<td>External 4.0VDC - 32.0VDC input</td>
<td>DC Power</td>
</tr>
<tr>
<td>5</td>
<td>SPKR_AUD</td>
<td>Speaker audio output</td>
<td>Analog Audio</td>
</tr>
<tr>
<td>6</td>
<td>DA_TX</td>
<td>PCM digital audio output</td>
<td>Digital Audio</td>
</tr>
<tr>
<td>7</td>
<td>RI</td>
<td>RS232 Ring Indicate</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>8</td>
<td>RTS</td>
<td>RS232 Request To Send</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>9</td>
<td>S_TX</td>
<td>RS232 Transmit Data</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>10</td>
<td>DCD</td>
<td>RS232 Data Carrier Detect</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>11</td>
<td>DA_FS</td>
<td>PCM digital audio frame sync output</td>
<td>Digital Audio</td>
</tr>
<tr>
<td>12</td>
<td>DA_CLK</td>
<td>PCM digital 2.048MHz audio clock output</td>
<td>Digital Audio</td>
</tr>
<tr>
<td>13</td>
<td>S_RX</td>
<td>RS232 Receive Data</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>14</td>
<td>SIGNAL_GND</td>
<td>Signal ground, 0V signal reference and return</td>
<td>GND</td>
</tr>
<tr>
<td>15</td>
<td>MTC_AUD</td>
<td>Microphone audio input</td>
<td>Analog Audio</td>
</tr>
<tr>
<td>16</td>
<td>EXT_B+</td>
<td>External 4.0VDC - 32.0VDC input</td>
<td>DC Power</td>
</tr>
<tr>
<td>17</td>
<td>EXT_GND</td>
<td>External GND input</td>
<td>DC Power</td>
</tr>
<tr>
<td>18</td>
<td>DPL_TX</td>
<td>Digital Peripheral Link (DPL) data output</td>
<td>DPL UART</td>
</tr>
<tr>
<td>19</td>
<td>DTR</td>
<td>RS232 Data Terminal Ready</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>20</td>
<td>DPL_RX</td>
<td>Digital Peripheral Link (DPL) data input</td>
<td>DPL UART</td>
</tr>
<tr>
<td>21</td>
<td>DSR</td>
<td>RS232 Data Set Ready</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>22</td>
<td>CTS</td>
<td>RS232 Clear To Send</td>
<td>RS232 Data</td>
</tr>
<tr>
<td>23</td>
<td>SIGNAL_GND</td>
<td>Signal ground, 0V signal reference and return</td>
<td>GND</td>
</tr>
<tr>
<td>24</td>
<td>DA_RX</td>
<td>PCM digital audio input</td>
<td>Digital Audio</td>
</tr>
<tr>
<td>25</td>
<td>SIGNAL_GND</td>
<td>Signal ground, 0V signal reference and return</td>
<td>GND</td>
</tr>
</tbody>
</table>

Table 1. Pin assignment for the multi-interface connector.
Operational Suggestions

- AT+CBST=71,0,1   Modem selection necessary for RUDICS
- LBT always Auto-bauds independent of interface setting
- DOD SIMs required paired Modems for commercial users (i.e., without .MIL domain connection)
- Always send the Initialization string(s) at each power-up or connection. This allows modem substitution without worrying about stored profiles.
- Use grounded antennas to reduce noise and damage from static buildup.
- NAL’s MPT option can be more problematic than beneficial. It restricts baud rate to 19.2 kbps; imperfect logic corrupts data.
**Operational Suggestions**

- Large quiescent power dissipation is in DC-DC converter, which needs to supply large current surges on short notice.

**Figure 19.** Average current drawn by model A3LA-D during dial-up connection at 9.0VDC input.
**Operational Suggestions**

- Provide the best sky visibility to achieve reliable connectivity. Keep cable losses to a minimum.
- Each “Signal Bar” equals ~4 dB. (AT+CSQ)
- SBD transfers over 350 Bytes (9601) or 1980 Bytes (9522) add considerable message handling complexity.