2017 Scientific Ballooning Technologies Workshop

Telemetry Options for LDB Payloads

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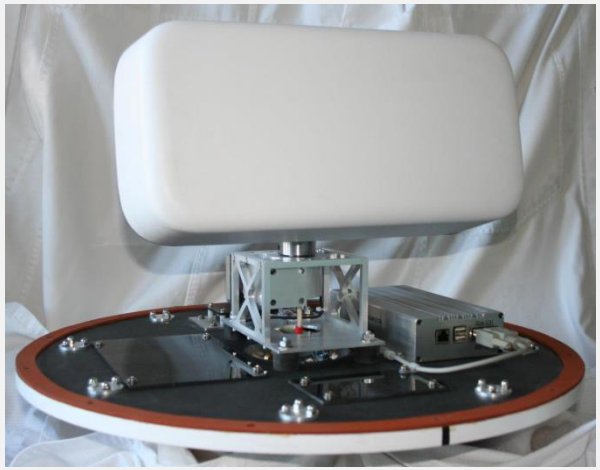
Current LOS Telemetry Options

- 1 Mhz bandwidth digital transmitter
  - 330 Kbit biphase encoded data
  - 740 Kbit randomized NRZ-L encoded data
  - ≈ 0.5 A @ 28V
- 3 Mhz bandwidth digital transmitter
  - 1 Mbit biphase encoded data
  - 2.24 Mbit randomized NRZ-L encoded data
  - ≈ 1.1 A @ 28V
- 6 Mhz bandwidth digital transmitter
  - 2 Mbit biphase encoded data
  - 4 Mbit randomized NRZ-L encoded data
  - ≈ 1.1 A @ 28V
- Analog video transmitter
  - NTSC
  - ≈ 2A @28V

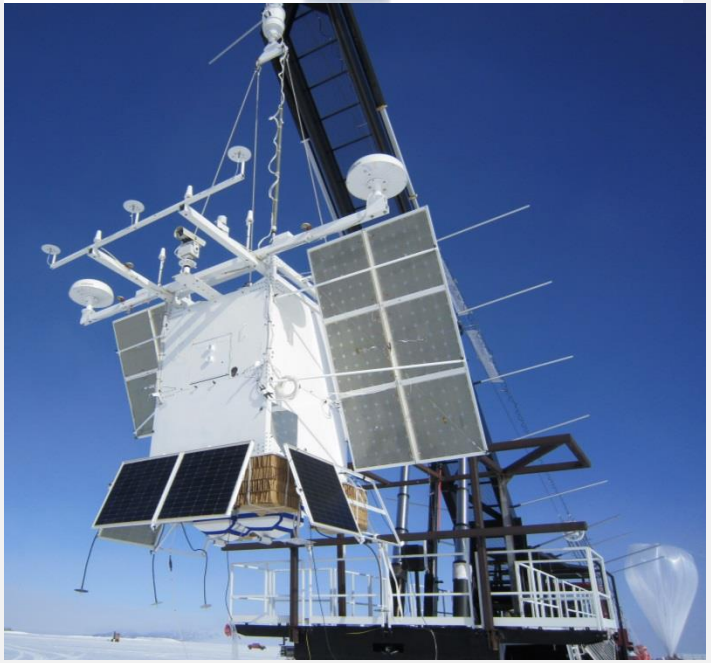
Current TDRSS Telemetry Options

- Powered by CSBF
- Omni Antenna
  - 6-10 Kbps data
  - CSBF downlinks data in 2041 byte packets
- High Gain Antenna
  - 93 Kbps data
  - No packetizing



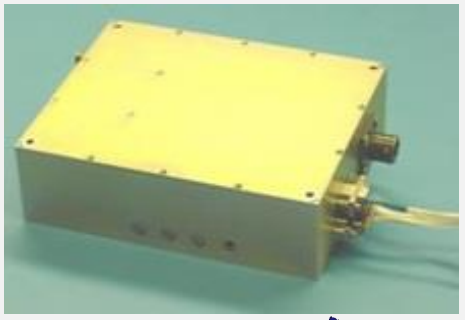
Current Iridium Telemetry Options

- Iridium SBD
  - Email based
  - Continuously available
  - Uplink commands
    - Commands are checked 1/minute
  - Downlink 255 byte science packet
    - One packet every 1 to 15 minutes (selectable)
- Iridium Dialup
  - Usage must be requested
  - Uplink commands
    - Commands received instantly
  - Downlink 255 byte science packet
  - Downlink data through “high rate” port
    - The connection is only 2400 baud
- Iridium Pilot
  - IP based system
  - Up to 134 Kbps throughput
  - Typical throughput is ≈ 60 to 75Kbps (service is bursty)
  - Connect to system from anywhere in the world

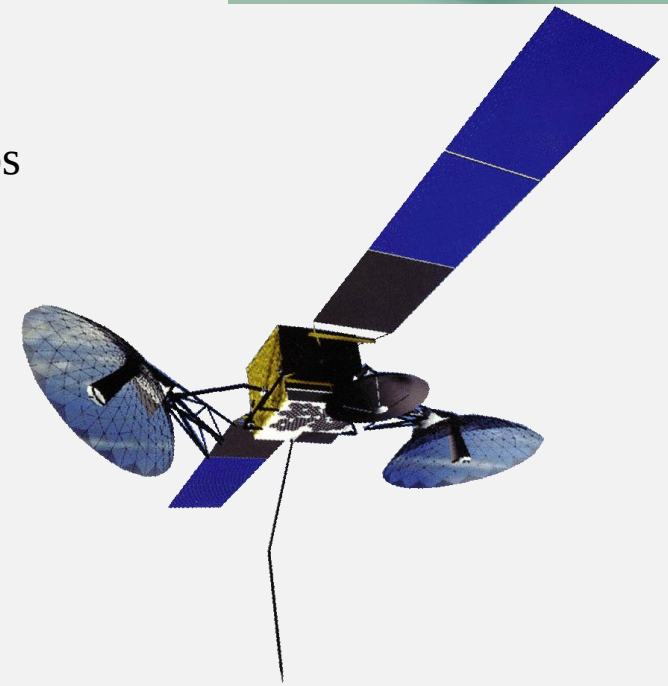


Future Telemetry Options

Low Cost TDRSS Transceiver (LCT2)

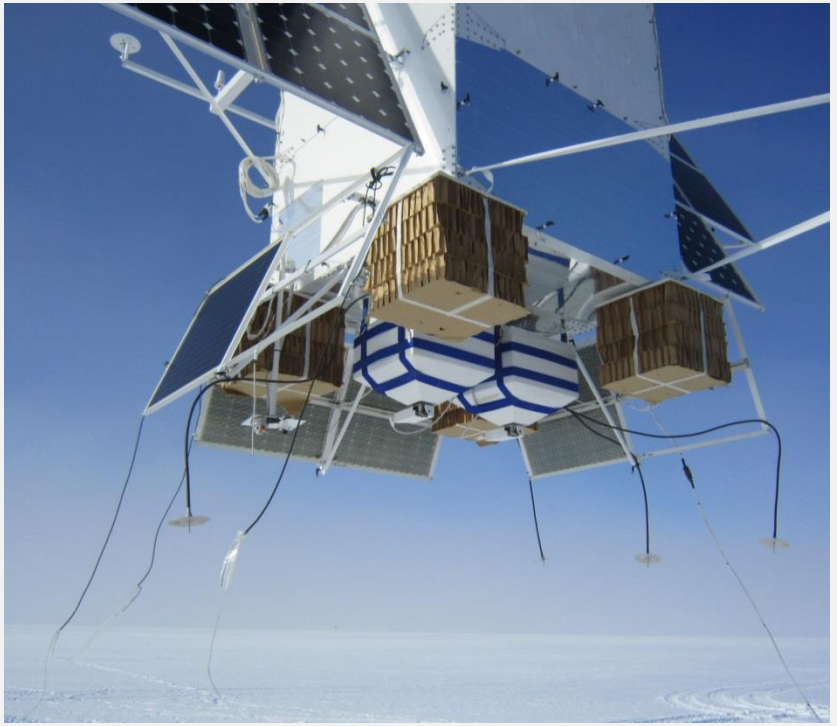


- Designed and built at WFF
- Up to 300 Kbps through current HGA (24” diameter)
- Up to 1 Mbps through new larger HGA (approx 36” diameter)
- Flown at 150 Kbps
  - Flt 667NT – FY15 Ft. Sumner
- Test flight planned for FY17 Ft. Sumner at 300 Kbps
- Science availability possibly in 2018
  - Science interface TBD



Lower Antenna Requirements

- LOS antenna hang below the gondola (minimum 1ft)
- Standard SIP configuration
  - 2 - UHF antennas
    - 1” wide X 27” long
    - Typically 24” separation
  - 2 - L-Band antennas
    - 5” diameter X 3” long
    - Typically 24” separation and away from UHF antennas
- Standard Science configuration
  - 1 - L-Band antenna for 1Mbit TM
  - 1 – L-Band antenna for Sci Video
- FAA transponder antenna
  - 5” diameter X 3” long
  - NOT USED IN ANTARCTICA



Upper Antenna Requirements

- Upper antennas need an unobstructed view of the sky; they should be the highest objects on the gondola
- Standard SIP configuration
  - 3 GPS antennas
    - 4” diameter X 1” tall
  - 3 Iridium antennas
    - 3” diameter X 7” tall
    - 2 feet separation between radiating antennas
  - TDRSS Omni
    - 7” diameter X 12” tall (mid-latitude)
    - 7” diameter X 27” tall (Antarctic)
    - 2 feet separation between radiating antennas
- TDRSS HGA
  - 24” diameter X 16” tall
  - 25 lbs
  - Requires two additional GPS antennas with as large of separation as possible (minimum 36” from any Iridium antenna)
- Iridium Pilot
  - 23” diameter X 8” tall
  - 28 lbs

Science to SIP interface

- Two Low Rate Science ports (one per SIP flight computer):
  - RS232: Baud Rate = 1200
  - Downlink telemetry 255 Byte packet, uplink commanding
  - Extended commanding available (up to 255 bytes per transmission)
  - Commanding through both SIP flight computers is required.
  - GPS position, time, and pressure altitude can be requested.
- Two High Rate Science ports (one per SIP flight computer):
  - RS232: Baud Rate = up to 115,200 (configurable)
  - Must allow for different "effective" bit rates.
  - TDRSS – 6 kbps to 75 kbps (depending on link margin and antenna)
  - Iridium – up to 2 kbps max
- TDRSS Direct
  - RS232: Baud Rate = 115,200
  - Data Rate = 92 kbps
- IRIDIUM Pilot
  - Cat-5 Ethernet connected
  - port configurable
- Science Stack (control and TM) providing:
  - Analog and Digital input channels
  - Command outputs
  - Optically isolated and powered by Science

Science to CSBF ROCC/OCC Interface

- Two Science ports each to the LDB OCC and ROCC computers are required.
  - data port at 115,200 baud (configurable)
  - commanding port at 2400 baud
- Third port required for TDRSS HGA (TDRSS Direct Data) at OCC
  - Data port at 115,200 baud