

UNAVCO (G-295) McMurdo RTK GPS Base Station

November 2004

Troubleshooting and Repair Guide

The following guide is designed to allow the McMurdo science technician to perform troubleshooting and repair of the RTK system in event of failure when a UNAVCO representative is not present at McMurdo. Periodic maintenance is not necessary, but a periodic inspection should be included when the science technician is in the NASA McMurdo Ground Station (MGS) building.

Contact UNAVCO for specific questions or concerns, and to report any trouble calls so we can purchase new spares or improve robustness.

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Operational Requirements

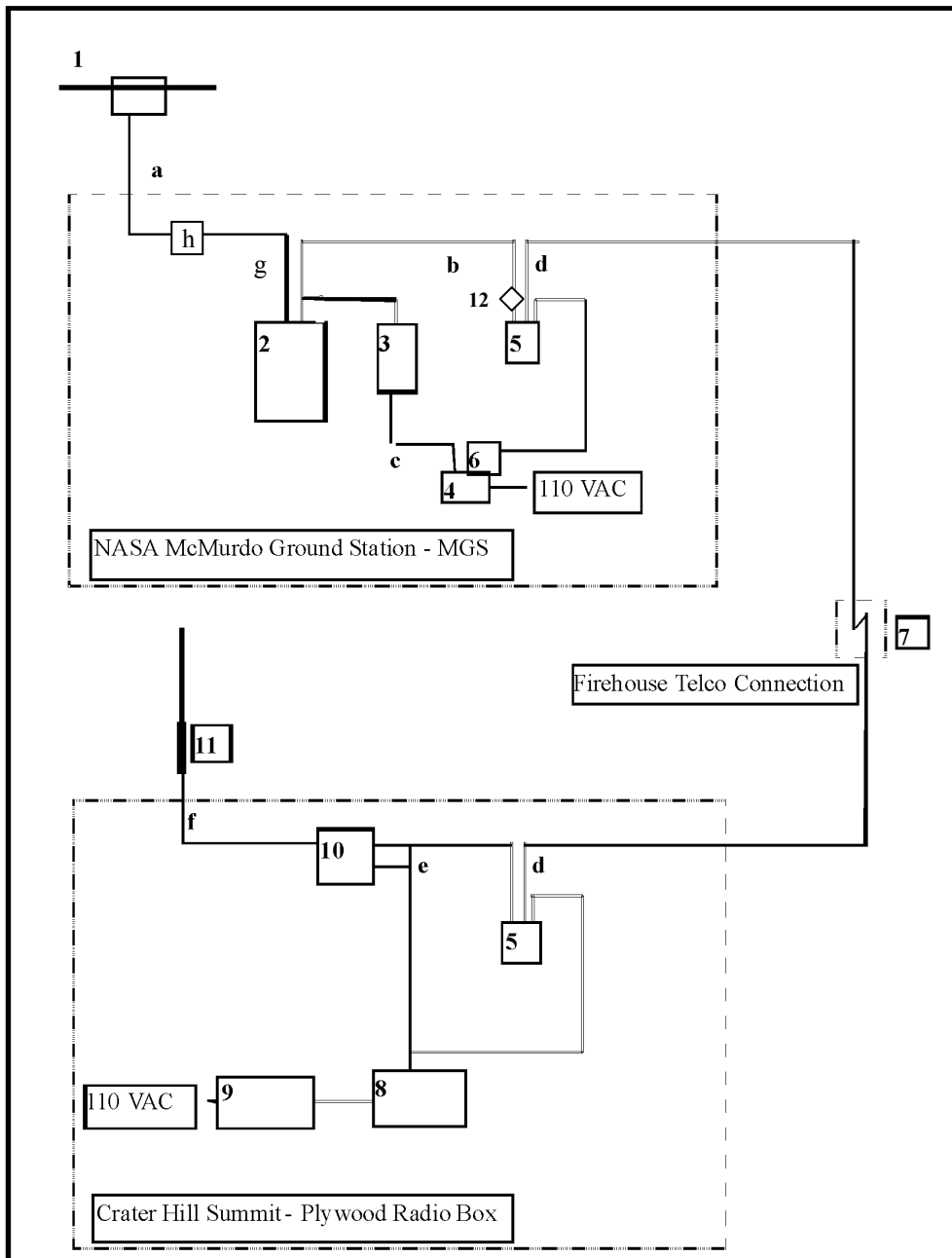
Continuous operation throughout WINFLY and Mainbody. Winter operation TBD based on demand.

The system needs to be operational continuously at all times that there are RTK field users. Primary users are RPSC surveyors and UNAVCO.

Periodic Inspection

When the science technician is in the NASA McMurdo Ground Station (Building 71), a quick check of the system should be made. Verify that the TD (transmit data) light on the Black Box Short Haul Modem is green and flashing red approximately once per second. If this is not the case, immediately proceed to troubleshoot and fix the problem.

System Diagram



Components:

1. Trimble GPS Antenna
2. Trimble 4700 DGPS receiver
3. Receiver power supply (18V)
4. Surge suppressor AC power strip
5. Black Box ME800A short haul async modem
6. Black Box modem 17VAC power supply
7. Twisted pair connection (MGS-Crater Hill)
8. Astron RS20A 20A power supply
9. APC 1400 Smart UPS
10. Pacific Crest RFM96 418MHz 2W radio transmitter
11. 418 MHz omni-directional radio antenna
12. DB9 TO DB25 adaptor with gender bender attached

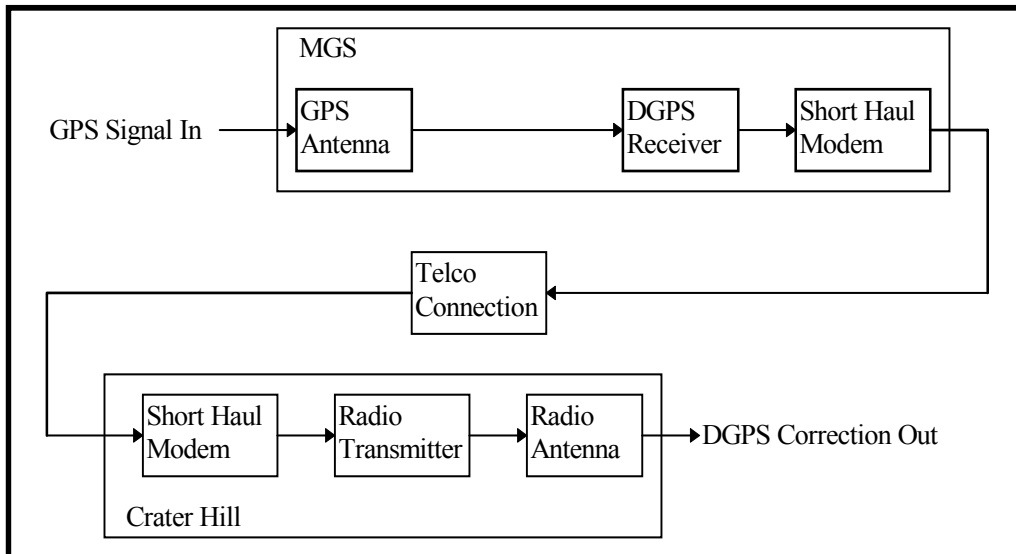
Cables:

- a. N-N antenna cable, male both ends (~30m)
- b. 7 pin 0-shell Lemo to male DB9 power/download
- c. Standard 110V power cord
- d. Twisted pair telephone line with RJ11 connectors
- e. Pac Crest power/data cable
- f. Male BNC - male N antenna cable (~30ft)
- g. N-Lemo GPS antenna cable (~10 m)
- h. N-N barrel adapter, female on both ends

Troubleshooting

The DGPS consists of several components connected in series, as shown in the block diagram. If normal operation is detected at a particular component, it is likely that all upstream components are functioning normally. The following troubleshooting procedure is designed to quickly and methodically isolate a faulty component or connection, and provide repair instructions. Refer to the System Diagram for specific **Components** and **Cables** references.

DGPS Block Diagram



1. **DGPS Receiver** The Trimble GPS receiver functions exclusively to generate time dependent differential GPS corrections. Its operation is completely independent of the NASA/JPL MCM4 GPS receivers. A steady green LED and slowly blinking red LED suggests a functional receiver.

Things to check if receiver may not be operating normally (use Trimble software- GPS Configurator):

Power - A blank display indicates a lack of power. Press the green power button to power up receiver. If nothing happens, verify the power supply is connected properly to AC power and plugged in to receiver port 2 or 3. If a power component is bad (power supply, surge suppressor), replace it. There is a spare power supply in the DGPS spares box. If the receiver is faulty, contact UNAVCO immediately as this will leave the DGPS system out of operation.

Satellites - If the receiver is not tracking satellites, verify that the antenna is detected. If the red satellite LED is not slowly flashing (furthest left LED), check the antenna, connectors, and antenna cables. If these appear normal and a faulty receiver is suspected, contact UNAVCO immediately as this will leave the DGPS system out of operation.

Receiver Settings - If the receiver has power and is tracking satellites, but not functioning properly, verify (and correct if necessary) the following receiver settings using the Trimble GPS Configurator software.

Note: Control settings will not change unless someone changes them.

Base/Rover Setup Tab:

RTCM OUTPUT OFF
CMR OUTPUT ON – port 2 CMR plus 0 offset

CHECK THE STATION INFO BY HIGHLIGHTING MCMD AND THEN CLICKING EDIT

STATION INFO:
LAT > 77° 50' 20.6057" S
LON > 166° 40' 06.746" E
HGT > +99.46 m
ANTENNA HEIGHT (m) > 0.00
Compact L1/L2
BOTTOM OF ANTENNA MOUNT

Serial Outputs Tab:

BAUD RATE/FORMAT
SERIAL PORT 2 SETTINGS
BAUD RATE > 9600
FORMAT > 8-NONE-1
FLOW CONTROL > NONE

General Tab:

MASKS/SYNC TIME
ELEVATION MASK > +10°
PDOP MASK > 07.0
SV SYNC TIME > 001.0 SEC

2. **Short Haul Modem - MGS** The short haul modem is used to send the digital DGPS signal to Crater Hill via the McMurdo telephone lines. The “loopback” feature is for troubleshooting - make sure the modem is not in loopback mode (both lights will flash in loopback). During normal operation, the TD light will be green and flash red about once per second. If for some reason the RD light is flashing like the TD light should be, open up the modem and flip the unlabeled little black switch to the other position. The TD light may now be on (note the appropriate name of the modem “Black box”)

A steady green TD light indicates power to the modem, but no data flow. Check cable (b) from the DGPS receiver and check the receiver control settings. If the modem TD light still does not flash red, replace the modem with a spare from the DGPS spares box.

If the modem is not receiving power, check the power supply and surge suppressor, and repair if possible. Swap the modem with a spare from the DGPS spares box if the power supply is working and the problem is with the modem.

3. **Short Haul Modem - Crater Hill** The short haul modem is used to receive the digital DGPS signal from MGS via the McMurdo telephone lines. The “loopback” feature is for troubleshooting - make sure the modem is not in loopback mode. During normal operation, the RD light will be green and flash red about once per second.

A steady green RD light indicates power to the modem, but no data flow. Verify that the MGS short haul modem is functioning normally, and check cable (d), the McMurdo telephone line. If a break in the line is suspected, notify Telco and have them troubleshoot the phone lines. The line from MGS is

connected to the line from Crater Hill in the Telco office on the second floor of the firehouse. If the modem RD light still does not flash red, replace the modem with a spare from the DGPS spares box.

If the modem is not receiving power, check the power supply, inverter, battery, charger, and surge suppressor, and repair if possible. Swap the modem with a spare from the DGPS spares box if the power supply is working and the problem is with the modem.

Crater Hill Data Line Wiring Order (inside SHM):

Red	RX+
Green	RX-
Yellow	TX+
Black	TX-

4. **Radio Transmitter** The blue Pacific Crest radio transmitter is run at 2W only to prevent overheating and failure. A steady red power light and a flashing (once per second) TX light indicates proper operation. A flashing RX light at once per second indicates that the Taylor Valley repeater is operating. This solar powered repeater is only in use during the summer.

If the transmitter power light is on, but the TX light is not flashing, verify that the short haul modem is receiving data from MGS. Check the cable to the radio transmitter. Swap the radio transmitter with the spare from the DGPS spares box if the problem is with the radio transmitter

If none of the status lights are on, check if the radio transmitter is receiving power. Check the battery charger, battery, and fuse. Replace these items as necessary. If power is available, but the radio doesn't work, swap it with the spare from the DGPS spares box.

5. **Radio Antenna** The omni-directional antenna is tuned for 418.000 MHz, the system operating frequency. If the radio transmitter TX light is blinking once per second, but DGPS corrections are not being received by system users, check the transmitter antenna cable connections. **Do not disconnect the transmitter antenna during transmission**, or transmitter damage may occur. Check the antenna for physical damage. If the antenna is damaged, replace it with a spare from the DGPS spare box.

Spares Box Contents

The spares box contains spare components to be swapped in the event of system failures. Contents include:

Trimble power supply
Black Box short haul modem
418 MHz omni-directional radio antenna
10A power supply
Manuals

Radio Modem Settings

The following radio modem settings are included as reference only - radio modem maintenance by the science technician is limited to swapping the unit with a spare. Items in [brackets] do not apply to RX ONLY modems.

Transmit and Receive Modems: Channel – [TX: 418.000 MHz] RX: 418.000 MHz
Baud Rate: 9600
Parity: None
RS-485 Delay: 0
Break to Command: Off
Mode: Transp w/EOT Timeout
EOT: [5]
Digipeater Delay: [0.00]
Local Node: [Non-Repeating]
Link Rate: 9600
Retries: [3]
CSMA Monitor: On
FEC: On
Scrambling: On
Digisquelch: High
TX ACK Timeout: [0.1]
Local Address: 0
Dest. Address: [255]

Repeater: Channel - TX: 418.000 MHz RX: 418.000 MHz
Baud Rate: 9600
Parity: None
RS-485 Delay: 0
Break to Command: Off
Mode: Digipeater
EOT: 5
Digipeater Delay: 0.00
Local Node: Repeating
Link Rate: 9600
Retries: 3
CSMA Monitor: On
FEC: On
Scrambling: On
Digisquelch: High
TX ACK Timeout: 0.2
Local Address: 0
Dest. Address: 255