



McMurdo Ground
Station (MGS)
RAID Demonstration

Tom Sardella/583

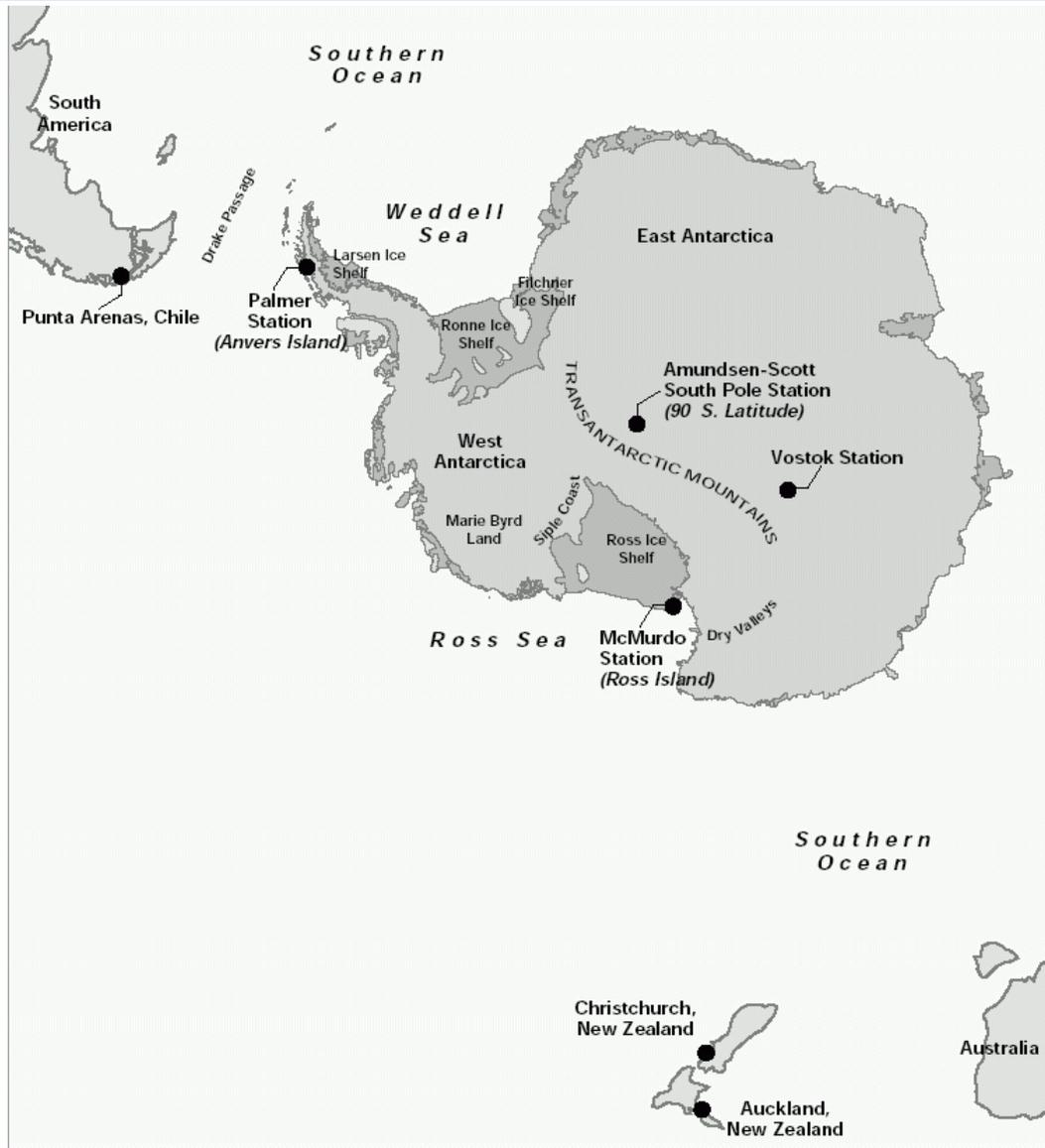


Agenda

- Antarctic Facilities
- Objectives
- Participants
- System Overview
- Status
- Summary
- Future Activities
- Slide Show



Antarctic Facilities





Antarctic Facilities

- International Antarctic Center, Christchurch, NZ
 - Staging facility for New Zealand and U.S. Antarctic Programs
 - Training, orientation, clothing distribution, travel, etc. for USAP participants deploying to the Ross Sea area (McMurdo Station, Scott Base) or South Pole
- McMurdo Station
 - Operated by Raytheon Polar Services Corp. for NSF
 - Primary U.S. base is logistics hub for researchers working in surrounding field camps and at South Pole
 - Largest Antarctic base (~1000 residents in summer)
 - Accessible by air October - February
- Amundsen-Scott South Pole Station



Antarctic Facilities (Cont'd)

- McMurdo Ground Station (MGS)
 - Installed in 1995 to collect Synthetic Aperture Radar (SAR) data (Radarsat, ERS)
 - High latitude ($77^{\circ} 50'$) allows for pass on every orbit
 - S-Band support (FAST, TRACE)
- McMurdo TDRS Relay System (MTRS)
 - High inclination of TDRS-5 And TDRS-8 Allows 12 Hours/day of visibility from McMurdo Station
 - MTRS-1 installed in 1996 to support return of SAR data to CONUS. 7 Meter antenna installed 25 Miles away at Black Island telecomm facility.
 - MTRS-2 installed as backup to MTRS-1. 4.6 meter antenna installed at McMurdo.



Objectives

- Demonstrate use of cartridge tapes as replacement for Ampex reels
 - Reduced storage and shipping costs
- Demonstrate ability to send large volumes of spacecraft data recorded by MGS back to CONUS via TDRS
 - Data return is currently by tape shipment, with delays of up to 6 months
 - Primary concern is transfer of Radarsat data to Alaska Satellite Facility (ASF)



Objectives (Cont'd)

- Collect EOS (Terra, Aqua) Direct Broadcast (DB)
 - Improved local weather forecasting
 - Make available to researchers at McMurdo and off-station
- Provide workstation and software to process DB data into other products
- Develop capability to transfer locally generated science data to CONUS via TDRS
- One year demonstration period ending September 30, 2004
 - If successful, system turned over to operations

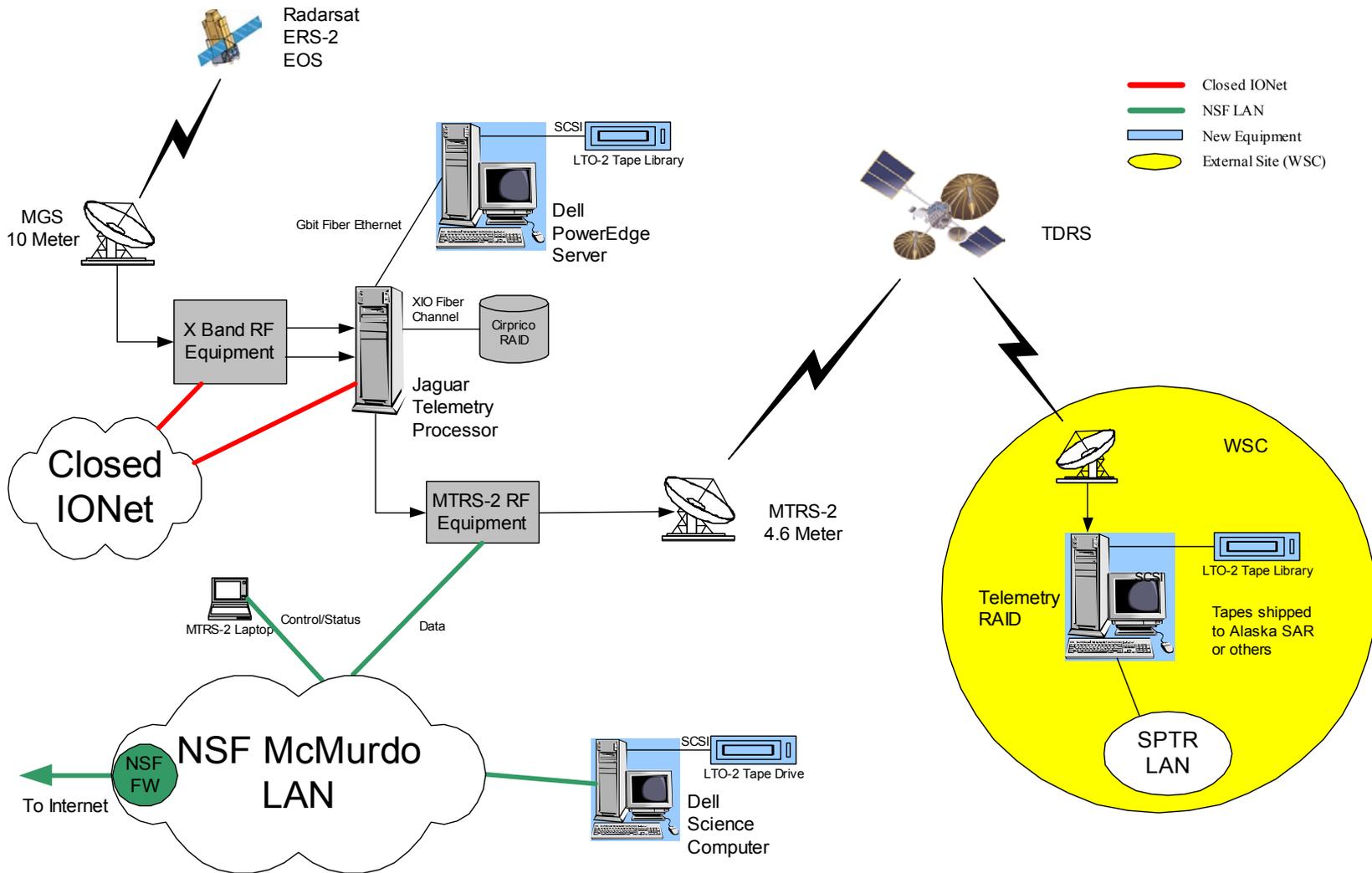


Participants

- Mike Comberiate (NASAMike)/420
 - Team Leader
- Andre Fortin/565
 - Technical lead
 - Supported MTRS testing from GSFC
- Tom Sardella/583
 - Develop file transfer conversion software
 - RAID/MTRS testing
- Dave Beverley/SGT
 - Equipment installation and checkout (Dell Science Computer, Tape Library)



System Overview





System Description

- TSI-Telsys Jaguar Telemetry Processor
 - Record and playback telemetry data up to 155 Mbps
 - SGI/IRIX platform
 - High speed fiber interface to 285 GByte Ciprico RAID
- Cybernetics LTO Tape Library (new equipment)
 - 10 tape capacity
- Dell PowerEdge Server (new equipment)
 - Provides interface to Cybernetics LTO tape library



System Description (Cont'd)

- Dell Science Computer (new equipment)
 - Installed on McMurdo LAN
 - Single LTO tape drive, used to exchange data with Jaguar on Closed IONet
 - Level 0 processing software
- WSC Telemetry Processor (new equipment)
 - Newer TSI-Telsys product installed at White Sands Complex
 - Receive and store telemetry received from MGS RAID
 - Generate tapes to send to ASF (Radarsat, ERS-2) or researchers in CONUS (processed science data).



Status

- Significant problems encountered with Tape Library installation on Jaguar
 - Unable to exchange tapes with Science Computer
 - Difficult to resolve with vendor due to remote location, limited time available, timezone (18 hour difference), and lack of remote access by vendor to MGS resources
 - Resolved problems by re-engineering with Dell PowerEdge running same Operating System (Redhat Linux 9) as Science Computer. Side benefits included a simplification of the Jaguar system operation, with control from Linux GNOME GUI as opposed to Unix command-line on existing Sun workstation. Also able to now run File Transfer software on Linux rather than SGI/IRIX.



Status (Cont'd)

- Interface problems between Jaguar and MTRS
 - ECL interface not properly engineered on previous installation
 - Rate limited to 125 Mbps as opposed to 150 Mbps target
- Successful BER tests run between MGS RAID and WSC RAID through MTRS
- Radarsat data (323 byte frame) successfully transmitted to WSC RAID



Status (Cont'd)

- Converted science data transfer unsuccessful
 - Larger frame (1100 bytes) experiences 12% data loss
 - Identified as a problem with the WSC RAID, which has been shipped back to the factory for repair and upgrade
- Terra DB data successfully recorded and transferred to Science Computer
 - However, numerous data errors with Aqua DB



Summary

- Most of objectives for hardware and COTS software installation at MGS were achieved
 - Data rate problem (125 Mbps vs 150 Mbps) will be worked on a future trip
- Objectives for upgrading MGS RAID exceeded
 - Problems with tape compatibility provided opportunity to re-engineer system, providing for much simplified operation and maintenance
- File Transfer software was not completed
 - Time constraints caused by unexpected hardware problems and upcoming McMurdo Station closure for the winter
- File Transfer testing was not completed
 - Problems with vendor-supplied equipment at WSC



Future Activities

- Reinstall repaired/upgraded WSC RAID, test data transfers from MGS RAID using 1100 byte frame
- Complete development of file transfer software and perform end-to-end testing
- Install and configure open source file manager on WSC RAID to act as file server for science community
- Install DVD burner on WSC RAID as alternative to LTO tapes for distributing large data sets to science community



Acronyms

ASF	Alaska Satellite Facility
BER	Bit Error Rate
CONUS	Continental United States
DB	Direct Broadcast
ECL	Emitter Coupled Logic
MGS	McMurdo Ground Station
MTRS	McMurdo TDRS Relay System
NSF	National Science Foundation
RAID	Redundant Array of Independent Disks
RPSC	Raytheon Polar Services Corporation
SAR	Synthetic Aperture Radar
SPTR	South Pole TDRS Relay
USAP	United States Antarctic Program
WSC	White Sands Complex