McMurdo Communications Architecture for Polar Environmental Satellite Data Retrieval

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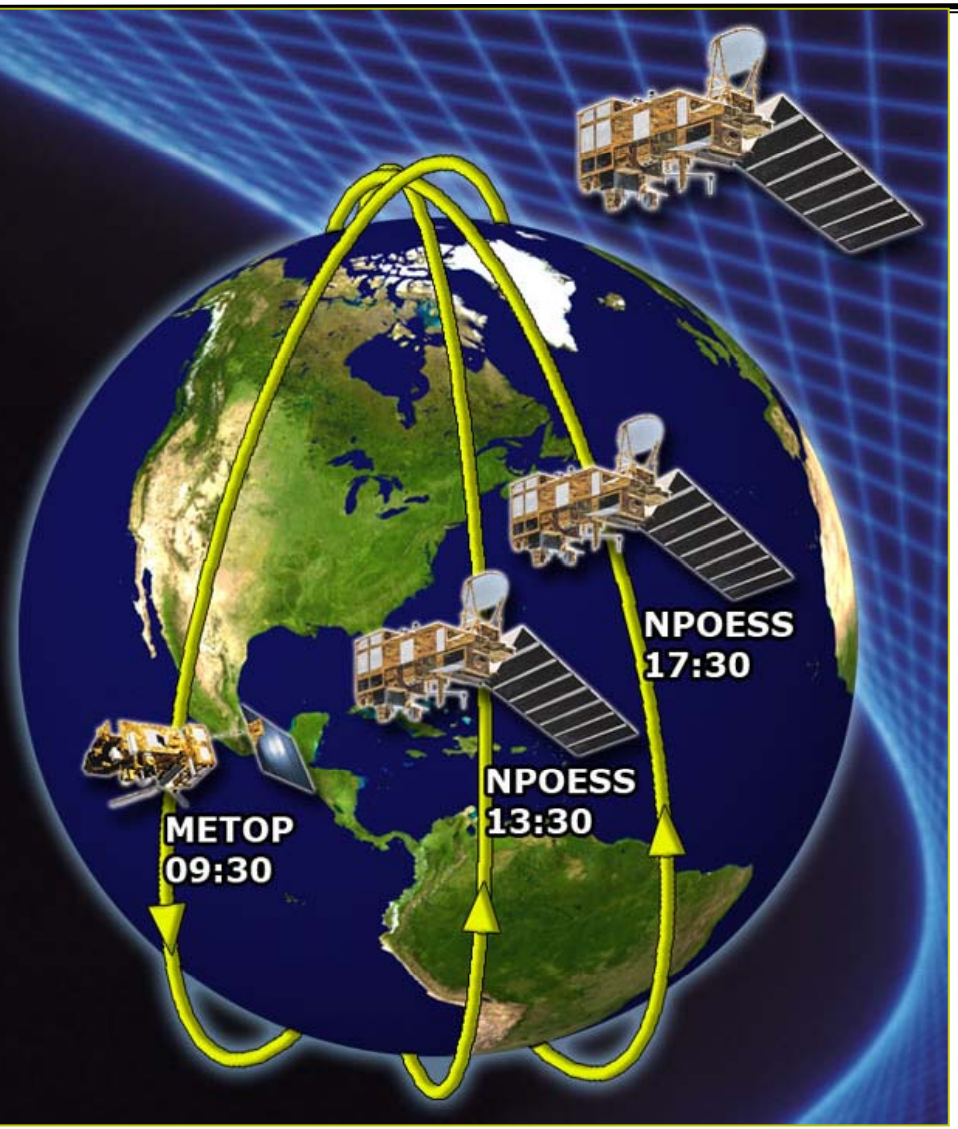
NPOESS Mission

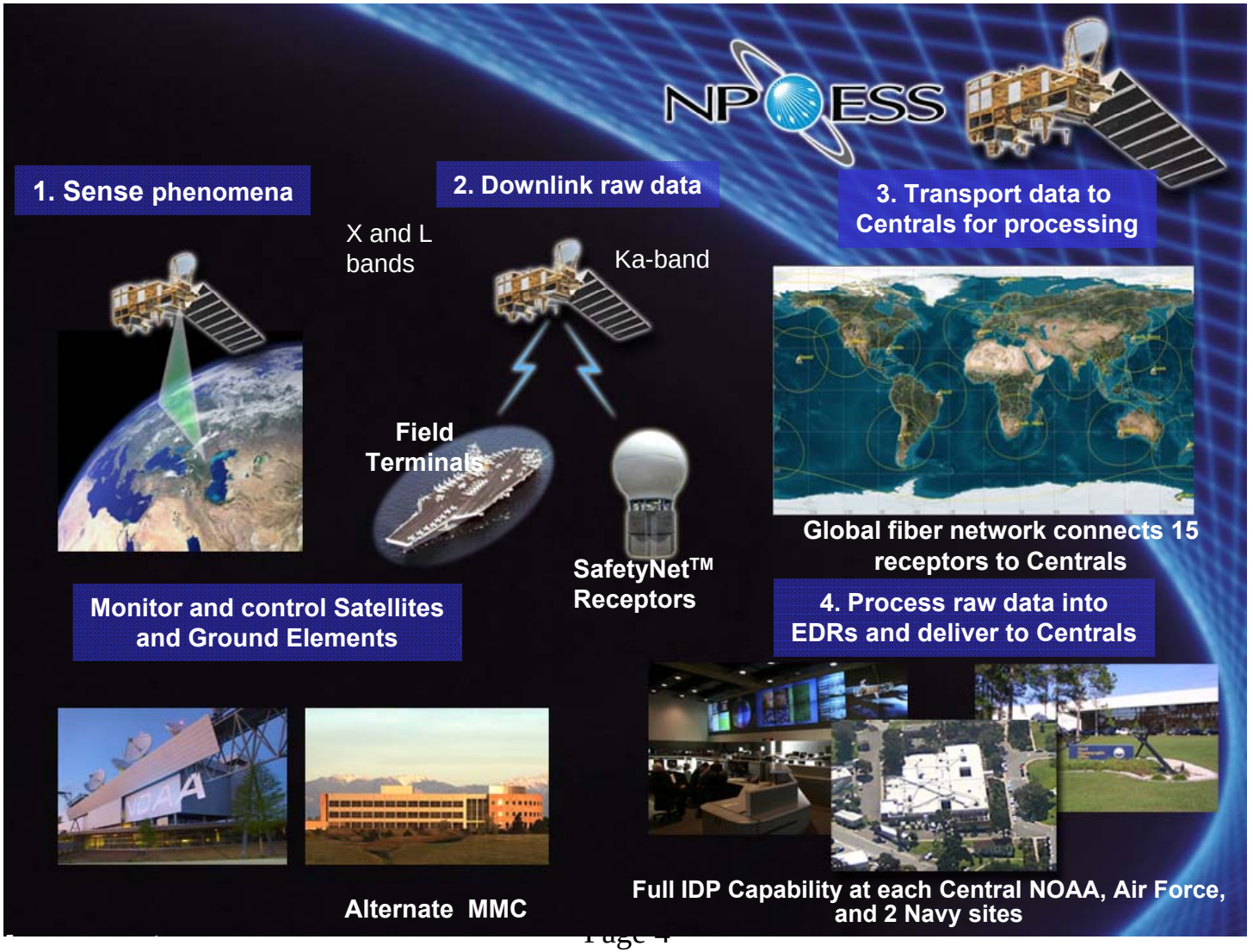
- **NPOESS Constellation includes Two Orbit Planes (1330A, 1730A)**
- **Data from the Eumetsat's MetOp Satellite Augments NPOESS (0930D)**
- **Baseline NPOESS architecture includes a globally distributed network of small, unmanned ground receptors at fifteen locations around the world, connected by a global WAN.**



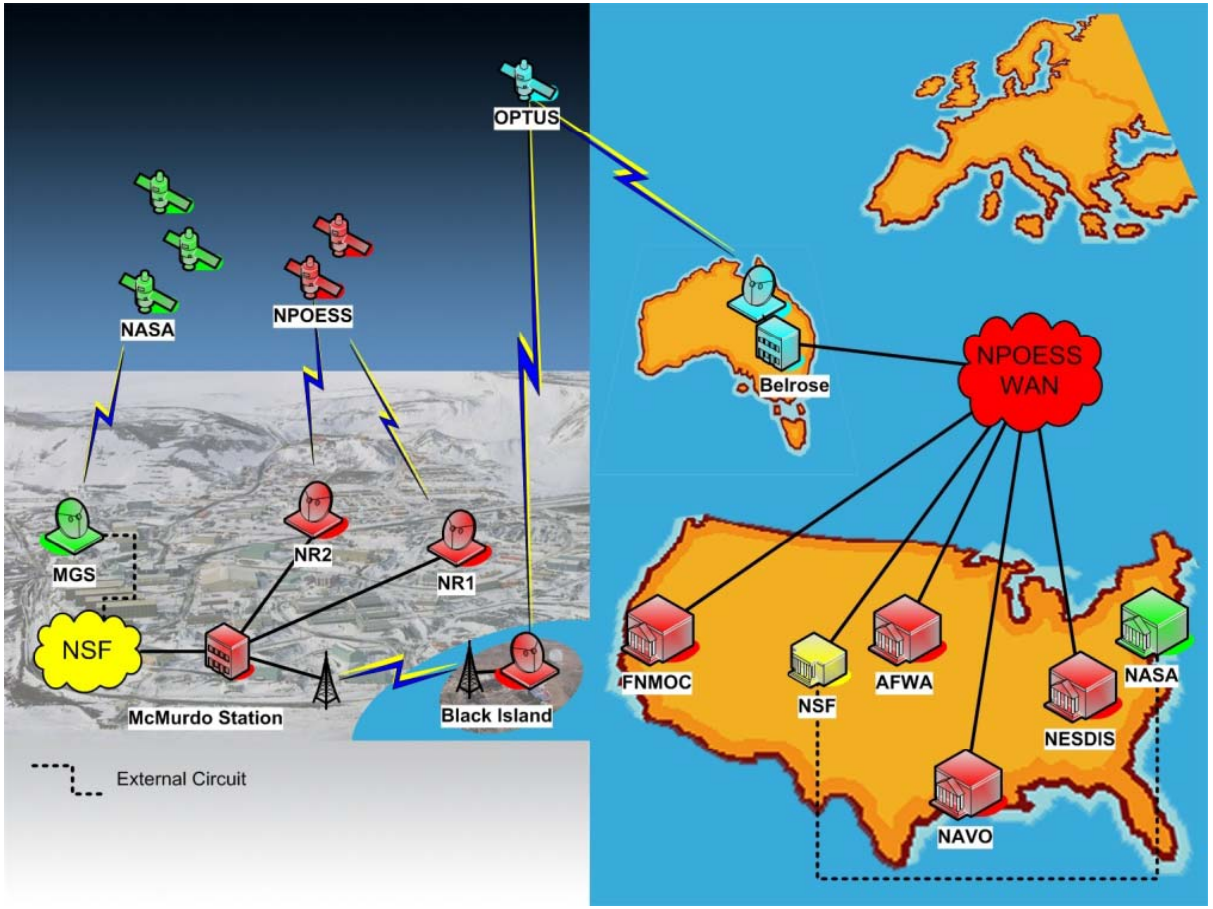
SafetyNet™ Baseline Architecture

- **Baseline SafetyNet™ architecture includes a globally distributed network of small, unmanned ground receptors at fifteen locations around the world, connected by a global WAN.**
- **One of these locations in the National Science Foundation (NSF) base at McMurdo Station, Antarctica.**
- **Operation at McMurdo created the need for providing wide band data capacity for McMurdo to the SafetyNet™ WAN.**
- **Existing NSF antennas have been modified to support Ku band commercial communications satellite owned by Optus of Australia. (Arrangement made with Optus to modify their D1 satellite design to cover McMurdo**

NPOESS Baseline Concept



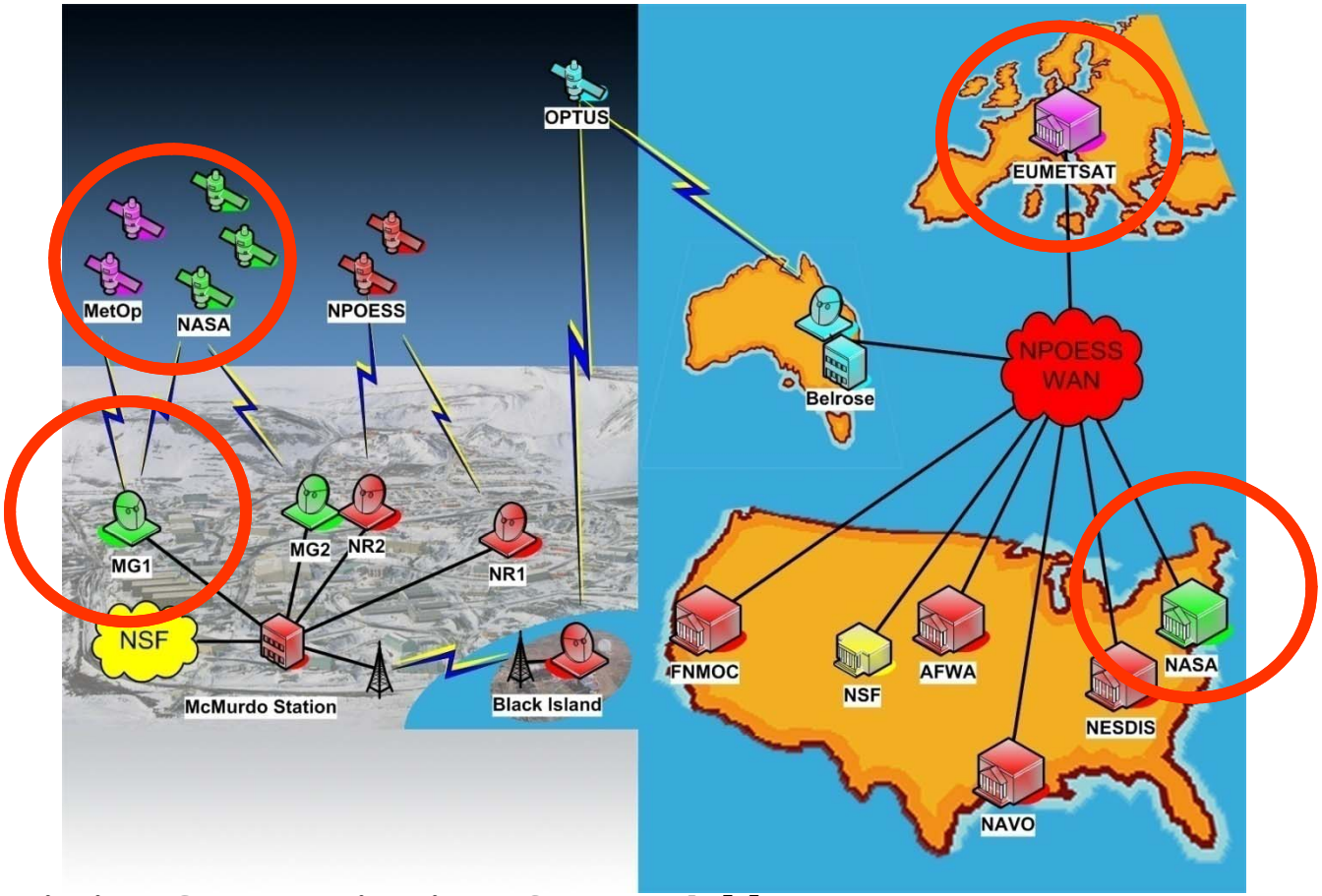
NPOESS Baseline Architecture with Existing NASA Supported Missions



Architecture Description

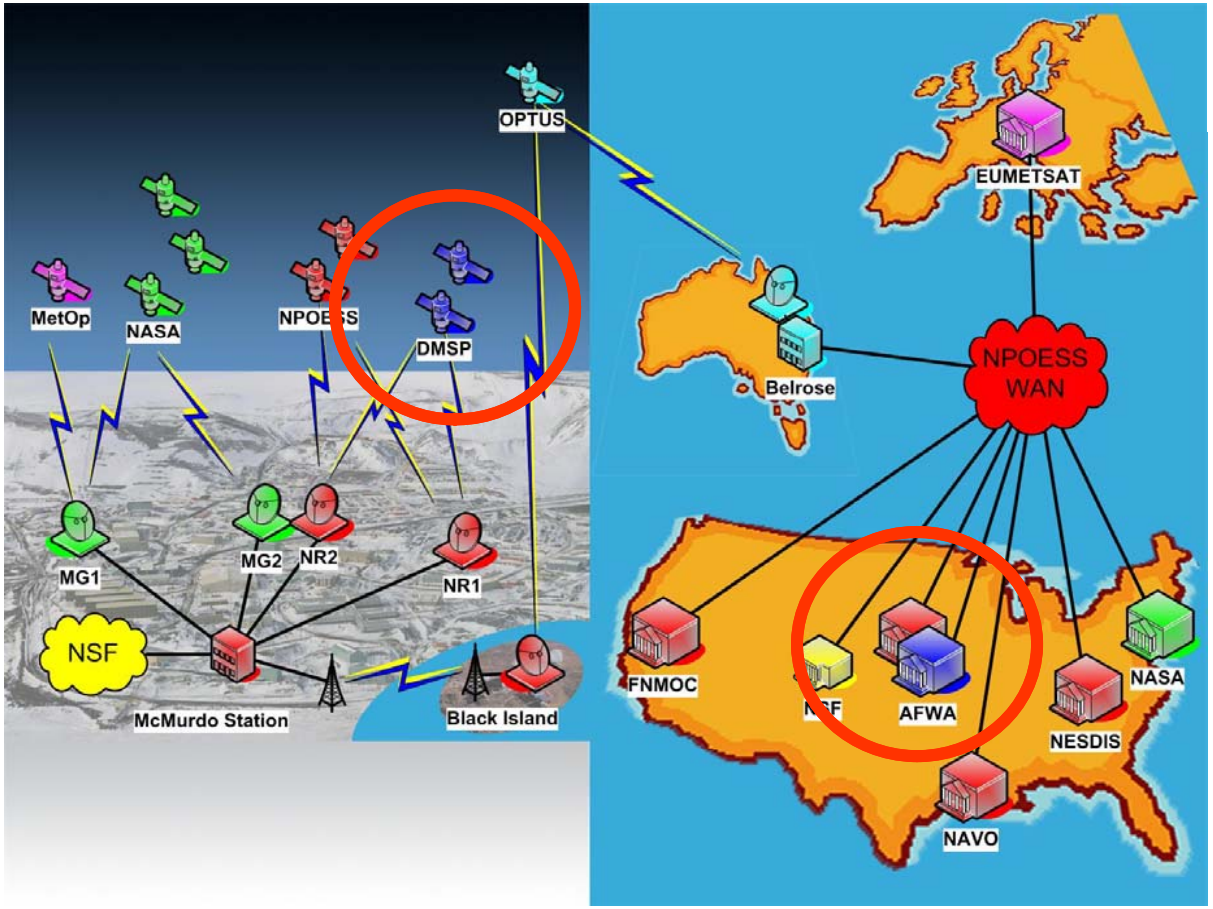
- **The McMurdo multi-mission architecture modifies the baseline NPOESS era networking capabilities to/from McMurdo to allow new end users (missions) to use the ground station capabilities at McMurdo**
  - Add capability to share the satellite link across the missions
  - Provide a network capability to/from each of the mission sites
    - NPOESS Baseline missions sites to/from McMurdo are:
      - NSF at Centennial, CO
      - NPOESS at AFWA, NESDIS, FNMOC, NAVO
    - New Missions sites to/from McMurdo being added are:
      - EUMETSAT at Darmstadt (delivery of data from the MetOp Polar environmental satellite)
      - NASA at Goddard (delivery of data from various NASA missions)
      - DMSP at AFWA (delivery of half orbit data to improve data latency)
- **NASA to Provide a Metop Capable Front End Processor in McMurdo**
  - This capability upgrades existing low data rate on legacy NSF link.
- **NPOESS to Provide S-band receive capability (modified NPOESS receptors) to support DMSP mission**
- **NPOESS to Provide backup downlink site for satcom link**

NPOESS plus MetOp, and Integrated NASA Operations



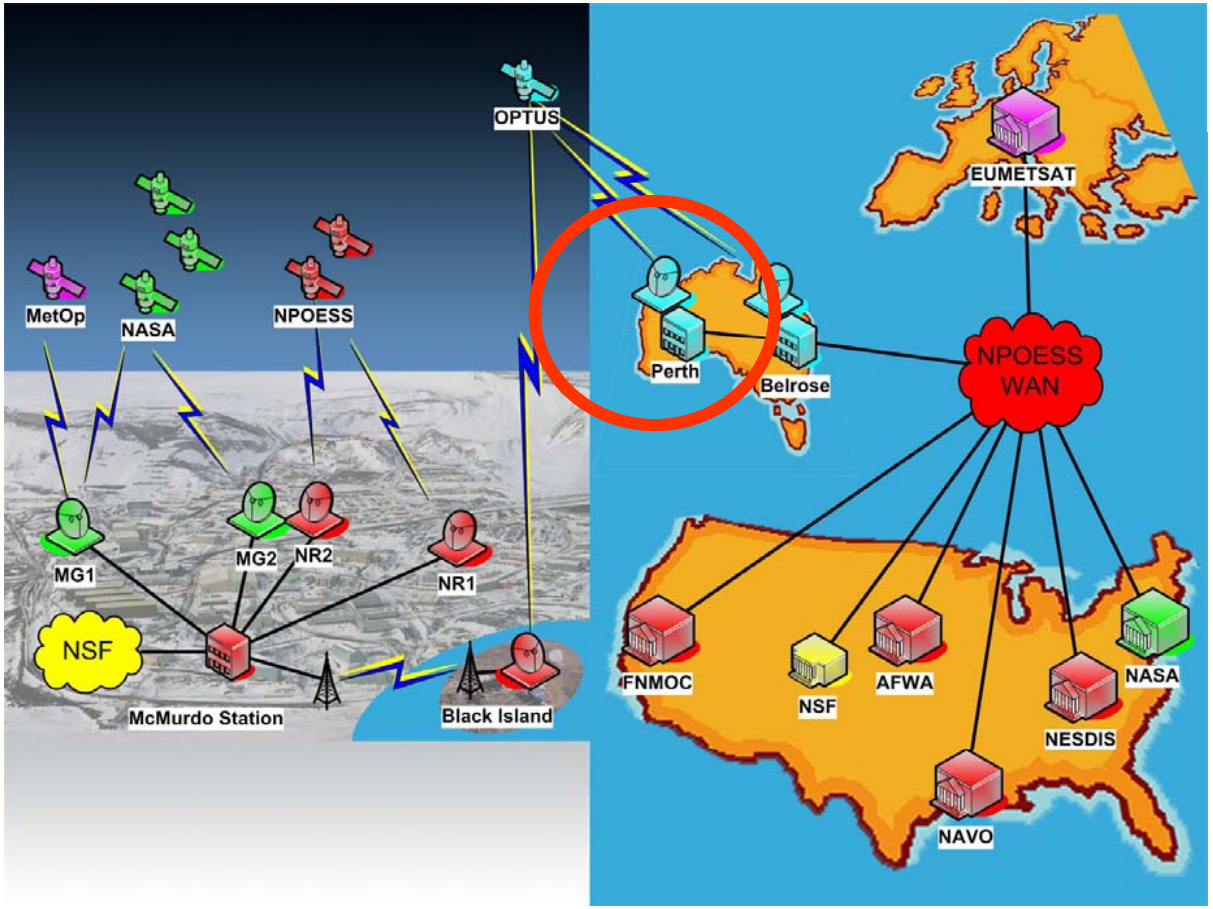
- **Multi-Mission Communications System Adds:**
  - Support for EUMETSAT's Metop mission (Ku Band Satcom, FEP, and SafetyNet™ WAN)
  - Wide band network connectivity for NASA missions (Ku Band Satcom and backhaul)

Additional DMSP Support



- **Multi-Mission Communications System adds:**
  - Support for DMSP mission (modified SafetyNet™ Receptors, Network link via Ku Band Satcom, and terrestrial backhaul to AFWA)

Second Satcom Downlink Site in Perth

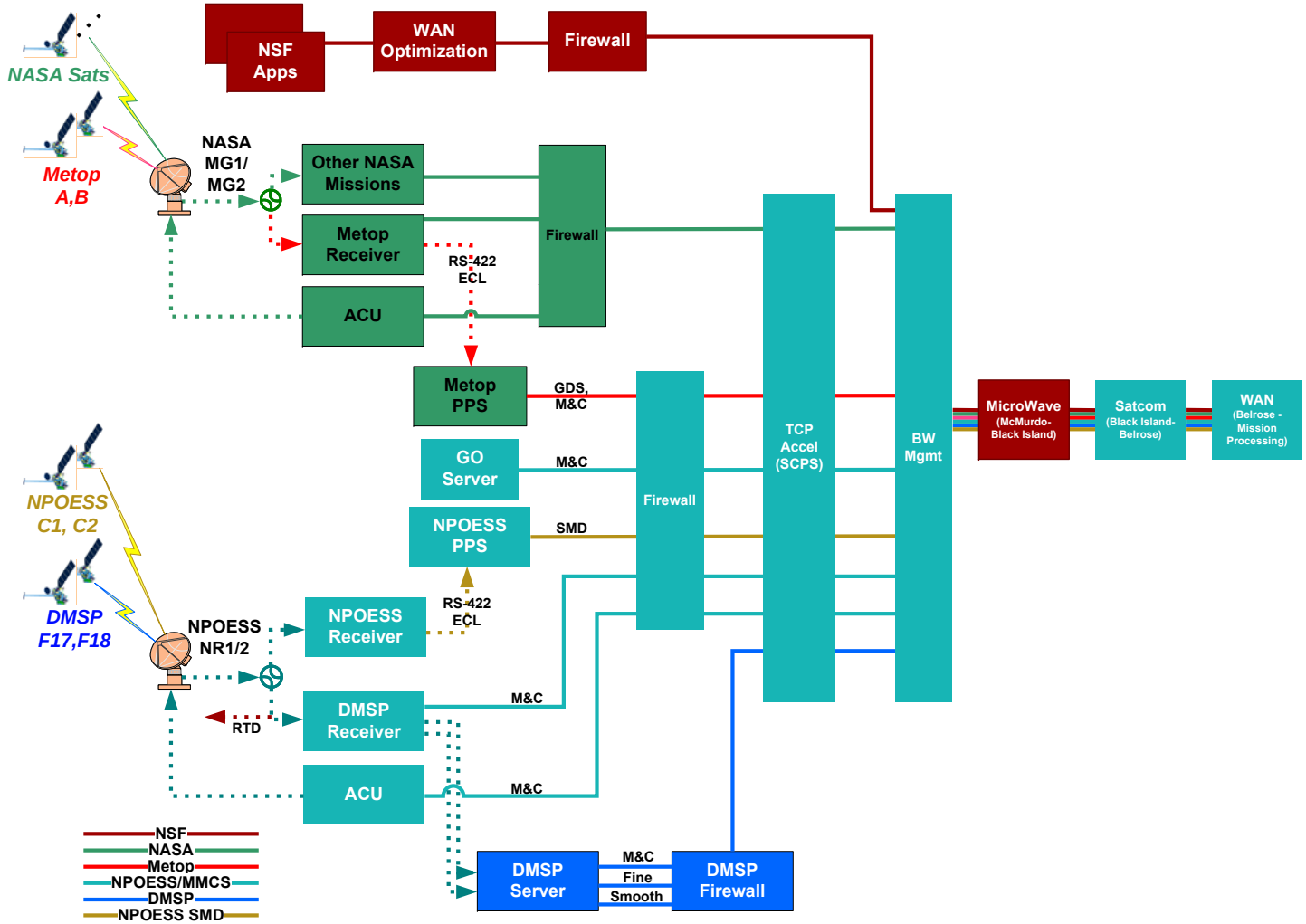


- **Multi-Mission Communications System adds:**

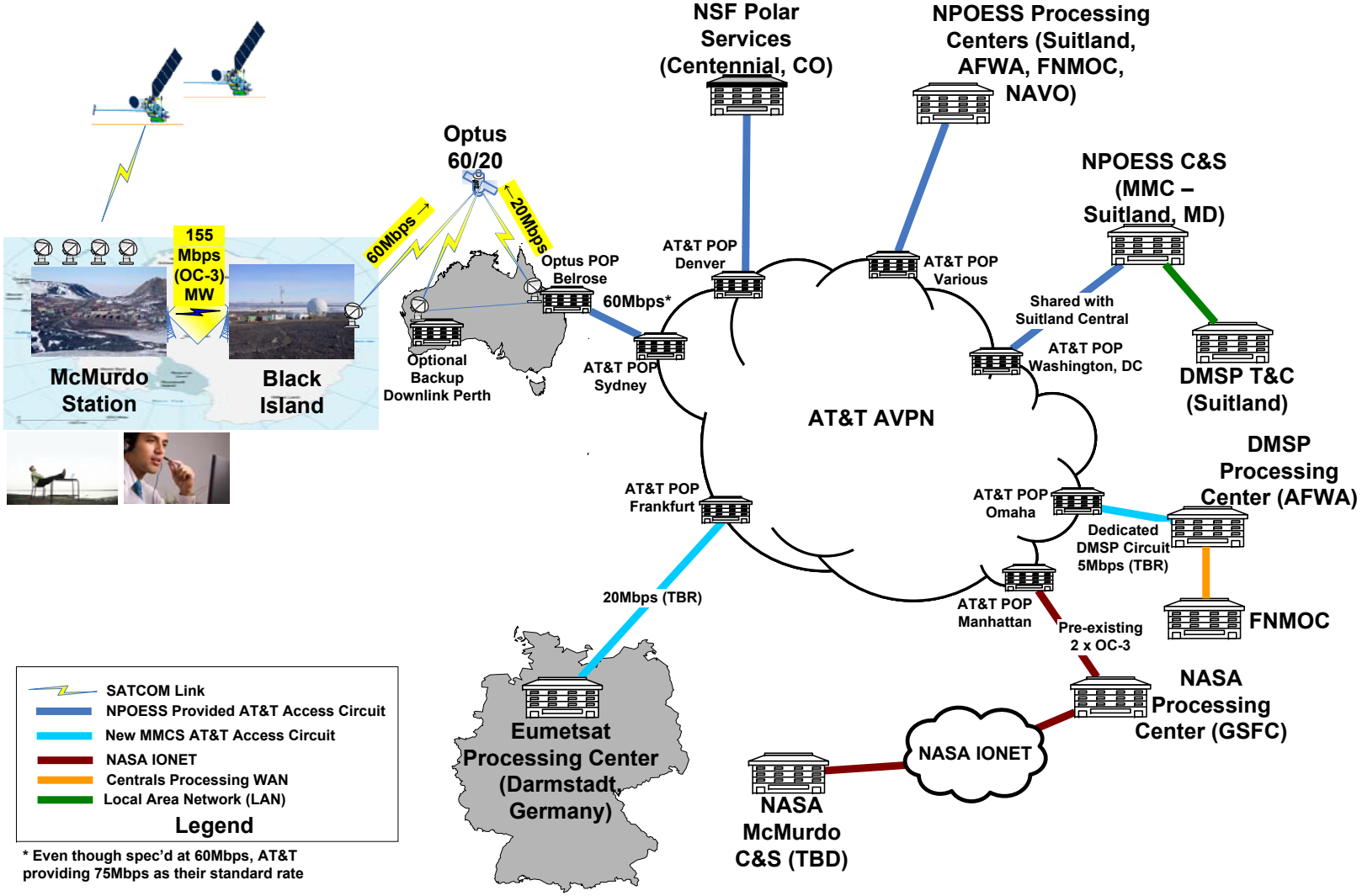
– Satcom link diversity (2nd ground station near Perth)

– Mitigation for rain outages observed at existing Belrose satcom ground station

McMurdo Multi-Mission Architecture and Data Flow



End-to-end McMurdo Multi-Mission Communications



* Even though spec'd at 60Mbps, AT&T providing 75Mbps as their standard rate

Conclusion

- **McMurdo offers significant latency advantages for Environmental Satellite Data Collection.**
  - Integral Element in the SafetyNet™ Architecture
    - 95% of data in 28 minutes or less.
  - Allows Multi-Mission support to MetOp and DMSP Environmental Satellite Systems
    - Reduced data latency to ~ One Half Orbit.
  - Improved Support for NASA Supported Missions with Higher Bandwidth available