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### **NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS) COMMAND, CONTROL AND COMMUNICATIONS SEGEMENT (C3S) MCMURDO MULTIMISSIION COMMUNICATIONS SYSTEM**

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### **ABSTRACT**

The National Oceanic and Atmospheric Administration (NOAA), Department of Defense (DoD), and National Aeronautics and Space Administration (NASA) are jointly acquiring the next-generation weather and environmental satellite system; the National Polar-orbiting Operational Environmental Satellite System (NPOESS). NPOESS replaces the current Polar-orbiting Operational Environmental Satellites (POES) managed by NOAA and the Defense Meteorological Satellite Program (DMSP) managed by the DoD. The NPOESS satellites carry a suite of sensors that collect meteorological, oceanographic, climatological, and solar-geophysical observations of the earth, atmosphere, and space. Northrop Grumman Aerospace Systems (NGAS) is the prime contractor of the NPOESS Program, as well as the provider of the Space Segment. The command and data distribution portion of NPOESS is the Command, Control and Communications Segment (C3S), developed by Raytheon Intelligence and Information Systems. C3S is responsible for managing the overall NPOESS mission from control and status of the space and ground assets to ensuring delivery of timely, high quality data from the Space Segment (SS) to the Interface Data Processing Segment (IDPS) for processing. One of the key features of the data delivery system provided by C3S is SafetyNet™. The NGAS patented SafetyNet™ architecture consists of 15 globally distributed ground receptors developed by Raytheon Company. These receptors or antennae will collect up to five

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times as much environmental data approximately four times faster than current polar-orbiting weather satellites. Once collected, these data will be forwarded nearly instantaneously to U.S. weather centrals via global fiber optic network for processing and production of data records for use in environmental prediction models.

One of the more significant SafetyNet<sup>TM</sup> receptor sites, due to its high latitude location, is located at McMurdo, Antarctica. C3S has been working in conjunction with the National Science Foundation (NSF) to upgrade and expand the existing off-continent satellite communications (SATCOM) link at McMurdo Station. The upgrade will provide 60 Mbps of bandwidth outbound from McMurdo and 20 Mbps of bandwidth inbound to those missions utilizing McMurdo. The first major milestone of the upgrade was completed in 2008, which increased the existing bandwidth of 3 Mbps to and from Antarctica to 10 Mbps of bandwidth for each direction. In addition to the bandwidth increase over the SATCOM, Raytheon's C3S is also in the process of upgrading the network infrastructure at both McMurdo Station and at the SATCOM site located at Belrose Earth Station, Australia. The new infrastructure will provide routing support for several missions, as well as provide expansion capabilities to support future missions that wish to use McMurdo. The upgrade is scheduled for completion in early 2011 in preparation for the use of McMurdo Station to support new "multimission" downlink capabilities, called the McMurdo Multimission Communications System (MMCS).

The significant increase of the available bandwidth to and from McMurdo allows additional Polar-Orbiting environmental and weather satellite systems to utilize McMurdo Station as a second downlink site. Two additional missions, the European Organisation for the Exploitation of Meteorological Satellites' (EUMETSAT) Meteorological Operational (Metop) polar system and the NOAA operated Defense Meteorological Satellite Program (DMSP), are planning to exploit the high latitude location of McMurdo and the communications bandwidth increase to downlink their mission data in McMurdo. The existing NASA McMurdo Ground Stations (MGS) antenna will be used to support the EUMETSAT mission. The future NPOESS Receptor antennas at McMurdo will become a dual-band antenna by altering the antenna feed to

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receive not only a Ka-Band downlink from the NPOESS spacecraft, but an S-Band downlink from the DMSP spacecraft.

Once the data is received at McMurdo Station, the existing communication systems' upgrade provided by C3S will support the routing of data from Antarctica and be distributed to each mission's processing facility by the NPOESS Wide Area Network (WAN). The network infrastructure will provide the ability to share, shape, and accelerate the SATCOM capacity by allocating each mission a minimum and maximum allowed bandwidth. The acceleration across the SATCOM link allows each mission's bandwidth utilization to vary based on the link usage and each mission's requirements. The flexibility provided by the sharing, shaping, and acceleration ultimately allows the SATCOM link to accommodate more missions compared to static bandwidth allocations to each individual mission. Each mission will experience a reduction in latency from collection on the spacecraft to distribution to the user community due to the use of the second downlink site and the sharing configuration on the SATCOM link.

### **Bibliography**

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