Volume 1, No. 2 November 2004

Expanding The Horizons Of Communications

Space Communicator

GSFC Space Communications Program - Code 450

Inside This Issue:

Space Communications Program Expands!

The Space Communications Program is pleased to welcome two new projects to the fold! SCP welcomes the Mars Laser Communications Demonstration (MLCD) Code 455, managed by Rick Fitzgerald and the Space Network Expansion Project (SNE), proposed to be Code 456, managed by Tom Gitlin.

Mission to Mars

In the near future NASA anticipates significant increase in the demand for long haul communication services from deep space to Earth. The near term demand is driven by the Science Mission Directorate, which wishes to deploy more capable instruments onboard the spacecraft and increase the number of missions. One possible solution to NASA's future long-term communications needs is free-space laser communication. Laser communication should enable bandwidth intense instruments to be used in deep space. To this end the OSS directed a laser communication mission be established from Mars, the MLCD Project.

The high-level objectives of the MLCD are to:

- Demonstrate that optical communication, at Mars distances and at data rates roughly an order of magnitude greater than existing microwave links, is operationally feasible for delivering scientific data to the end user;
- Characterize the optical communications channel and the operational characteristics so that future NASA space missions can have confidence in the utilization of this communications technology; and
- Develop an industrial capability to provide optical communications equipment for future operational use and a capability within GSFC and JPL to enable utilization of optical communications in their respective future missions.

Space Network Expansion

As we all know, the Space Communications Program (SCP) provides data relay services to customers by operating as a bent pipe relay system between customer platforms and customer ground facilities. The elements of the SN that perform these services are known as the TDRSS, which consists of a constellation of Tracking and Data Relay Satellites (TDRS) and the White Sands Complex (WSC). The WSC consists of three ground terminals: the White Sands Ground Terminal (WSGT), the Second TDRSS Ground Terminal (STGT), and the Guam Remote Ground Terminal (GRGT).

Since the construction of the STGT, the upgrade of the WSGT, and the construction of the GRGT in the 1990s, the TDRS fleet has expanded with the addition of three second generation spacecraft, and the first generation TDRS spacecraft continue to operate beyond their original design life. Additional ground terminal assets are required to maximize the use of the TDRS fleet and to meet an increasing SN customer demand for services. Development of a fully capable SN ground terminal equivalent to or approaching the present WSC service capability, however, is expensive and time-consuming, since a significant amount of custom equipment developed for STGT, WSGT, and GRGT is no longer available. The SNE Project intends to use commercial off-the-shelf (COTS) components to provide custom (but limited) capabilities for a specific customer base. This approach will allow the ground terminals to be delivered relatively quickly and meet the expanding SN customer service demands.

A Message from the Associate Director / Program Manager for Space Communications

Shakespeare said, "One touch of nature makes the whole world kin." That is certainly true for the Space Communications Program (SCP) during the past few months. We are thankful that our SCP family came through Mother Nature's ferocity without harm. Whether it was Florida being battered by hurricanes or Alaska ravaged by wildfires, our Ground Network team certainly had their hands full. But we met these natural disasters with courage, skill, and professionalism. Florida was hit by hurricanes Charley, Frances, Ivan, and Jeanne which threatened our Merritt Island (MILA) and Ponce de Leon (PDL) tracking stations. Wildfires in Alaska endangered and ultimately burned over the Poker Flat Research Range including our tracking and communications facilities. The efforts of our Ground Network staff to protect our people and resources were phenomenal, resulting in no injuries and almost all facilities surviving without damage. Our creative schedulers made effective use of all of their options (including our partnership with NOAA for backup support) to support our customers with minimal impact to their science missions. Congratulations to everyone involved in getting us safely through this!

Congratulations to our team for their excellent support of the Aura mission (which launched in July), the Equis II (Kwajalein Island) sounding rocket campaign and the National Federation for the Blind Students rocket launch from WFF. We look forward to the upcoming launches of Dart and Swift while we are continuing to do our part towards NASA's safe return to flight. Although the hurricanes have pushed back the target launch date to May 2005 we continue to work towards an earlier Networks readiness date. Our personnel have also been engaged in numerous Shuttle Return to Flight upgrades including: External Tank Television enhancements at MILA, PDL, and Wallops; a new Shuttle UHF Air to Ground capability at the White Sands Space Harbor in New Mexico; and the installation of encoders/decoders at Guam and WSC to provide additional television downlink capability for wing tile inspection. All of these activities are clearly aligned with NASA's mission success!

I would like to acknowledge the contributions and years of service of Jim Gavura and Tony Ippolito who have announced their retirements at the end of the year. Jim is the Station Director (STADIR) of the White Sands Complex (WSC) and Tony is the STADIR of the MILA and PDL stations. Both have contributed greatly to NASA's missions through their many years of effective leadership. We wish both of them well in their retirement! Please welcome Harold Brockelsby who has already joined us at WSC and Gary Morse at MILA and PDL. They will assume the duties of Station Directors at these important facilities.

It has also been a period of continuing organizational change for 450. In addition to the new Code 455, the Mars Laser Communication Demonstration (MLCD), we welcome the new Space Network Expansion (SNE) Project (proposed to be Code 456). It certainly is an exciting time and full of challenges that will allow us to rise to the occasion. The MLCD recently finished their Systems Status Review, and their new suite (E234) was completed on November 5. Stop by and welcome them to their new home on the second floor. The SNE project is off to a rocket start and is approaching an SRR in December. Never a dull moment!

Changes have also been occurring at NASA Headquarters with the Transformation Structure initiative. In June, the President's Commission on Implementation of U.S. Space Exploration Policy found that NASA needed to transform itself into a leaner, more focused agency. This transformation fundamentally restructures NASA's Strategic Enterprises into Mission Offices. We will continue to support NASA's efforts in this area.

Change is never easy. But with your commitment we can meet the resulting challenges and turn them into success. I am proud of our team and the work we do. Each and every member brings the best he or she has and contributes to the success of the Space Communications Program and NASA. As we say farewell to old friends and welcome new friends, we will continue to strive for the continuing excellence the SCP is known for.

Phil Liebrecht

Inside the Space Communicator

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Space Communications Program

The Space Communications Program Logo!

Winning logo submitted by the SCP Honeywell team

When the SCP slogan/logo contest was announced, our Honeywell team reviewed the current strengths and future directions of not only Code 450, but also NASA Goddard. We identified numerous SN and GN capability successes and decided that the slogan should reflect both the science community's needs and the high technology base from which those successes have arisen. Given this, we felt that the SCP role in "expanding the frontiers of science" was a strong, and justifiable, statement. Further, since a majority of the recent successes resulted from the continued implementation of advanced technologies, the phrase "world class solutions for tomorrow's needs" was very appropriate.

The team thought the logo should represent a customer satellite's view of the SCP domain and thus the oval shape with a red rim was chosen to represent an on-board "view port". Due to recent initiatives to expand man's knowledge of the Moon and Mars, we decided that the SCP ground-to-space resources should be centrally located within a near-Earth mock-up of the Solar System. Further, the logo

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Logo (from page 4)

should encompass all facets of current and future SN/GN orbital, GN range/sub-orbital, and emerging laser technology telecommunications. Representative satellites of the SCP science community were included to depict those activities. The various images were easily obtained from public domain web sites, both NASA and other US Government agencies. Did you notice Hurricane Linda in the Gulf of Mexico (of the USGS Earth image)? Learning to use Adobe Photoshop Elements to put it all together did, however, take a whole week of evenings.

Honeywell Team

David Joesting, HTSI	Gus Larsson, HTSI
Eric Mathis, HTSI	Craig Nickel, HTSI
Cathy Barclay, HTSI	James Stevenson, HTSI
Jim Braun, HTSI	Louis Wajda, HTSI

By David Joesting

Lunar Happenings

The Vision for Space Exploration calls for a human return to the Moon no later than 2020. To accomplish this vision, NASA has begun a challenging set of new human and robotic exploration efforts. The Robotic Lunar Exploration Program (RLEP) will characterize and study the lunar environment, obtain information about potential landing and exploration sites, and provide a proving ground for technology to enable a safe, sustained human presence on the Moon. Project Constellation aims to develop the vehicles and technologies necessary to carry humans beyond low Earth orbit, including the Crew Exploration Vehicle (CEV).

Support for both initial RLEP missions as well as developmental Constellation and CEV flights require significant communication capabilities. RLEP requires continuous telemetry, tracking and control (TT&C) functions at up to 100 Kbps whenever the spacecraft is visible from Earth. Symmetric uplink and downlink rates are needed to enable proximity operations and mission cross-support. Support for multiple simultaneous missions, including simultaneous commanding, telemetry and tracking of multiple spacecraft will be required. Continuous tracking (when visible) to ensure precision orbit determination is especially important for early robotic missions as the gravity field of the Moon is not yet well understood. High rate mission data downlinks on the order of 125 Mbps are envisioned to provide high resolution, data rich measurements of the lunar environment. Human crewed missions (CEV) require even higher data rates, availability and reliability to ensure operations as safe as reasonably achievable (ASARA) to sustain human exploration through 2030.

The Lunar ground network to support these programs must be designed to support the RLEP missions as well as the CEV missions and be flexible and evolvable for future anticipated higher data rates as well as being able to support multi-missions simultaneously. A single point solution to meet the immediate needs of the initial RLEP missions would not be consistent with NASA long-range objectives.

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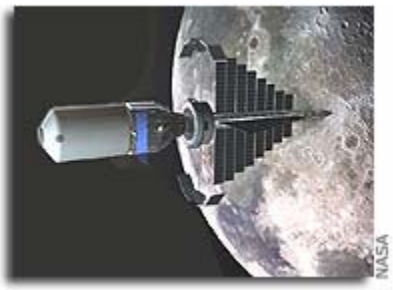
Lunar Happenings (from page 5)

To address this problem, a NASA-wide team was assembled to form the Space Communications Architecture Working Group (SCAWG). For the past 8 months this team has been meeting weekly and performing a variety of studies and analyses to work toward an architecture that will not only meet the RLEP and CEV requirements but consider other missions such as the James Webb Space Telescope (JWST). The scope of these studies includes the end-to-end communications including NISN, data protocols ,signal designs, Lunar relays and ground station designs including the TDRSS. For the ground station portion (including the TDRSS), a number of options have been studied and at this point in time the SCAWG has arrived at a recommended option that is currently working its way up through the necessary NASA management levels for review.



The ground station architecture studies started with considering existing NASA and commercial assets. The 125-Mbps RLEP science rate becomes an immediate driver in the design. Higher rates for CEV suggest that growth potential be incorporated into the design. Use of 26-GHz Ka-band (spectrum allocation for Category A missions) becomes evident. The 100-Kbps TT& C requirements suggest use of the S-Band. X-Band was considered but rejected for geometrical reasons (i.e. narrow beamwidths at Lunar distances and not being compatible with TDRSS for the launch and early orbit phases [LEOP]). Simultaneous multi-mission support for spacecraft orbiting the moon presents both a geometric and a spectrum utilization challenge (i.e. spectrum crowding at S-Band and the difficulty in obtaining allocation for multiple spacecraft). Stringent tracking accuracy requirements for both the RLEP and CEV missions are drivers to include a ranging signal design that not only produces the accuracy required but also allows for simultaneous commanding and telemetry. Because of the limited space and power available on the spacecraft, use of bandwidth-efficient coding becomes obvious. Use of concatenated codes (i.e. Reed Soloman and Convolutional) are being recommended initially because the hardware is available at the 125-Mbps rates (and higher). NASA has a technology program that is expected to produce more efficient codes (low density parity code [LDPC]) with supporting space qualified hardware that will be introduced later in the Exploration sequence of missions.

For some time, NASA has been working toward a long-range plan that would allow eventual replacement of the large antennas in the Deep Space Network (DSN). The basic building block for these arrays has been derived to a 12m antenna considering cost and the number of antennas required. This array concept provides not only lower operations costs but inherently provides expandability (i.e. higher antenna gain if needed) and also robustness (i.e. graceful degradation in case of failure of a single 12m antenna). Fortuitously a 12m antenna also provides an appropriate beamwidth (0.8 degrees and the moon subtends 0.5 degrees) and antenna gain for the S-Band 100-Kbps links. Use of this array concept for the RLEP/CEV also provides NASA an entre into the phased array era albeit in a limited fashion. The array concept has already been used to support Galileo so it is not a technology risk. The 12m antennas will be mass produced so the unit cost will be significantly less than one of a kind single purchased antennas, and replacement and maintenance costs will be lower.

Considering all of the factors above, the SCAWG has baselined a design recommendation that utilizes three 12m antennas arrayed for Ka 125-Mbps support with a fourth antenna in case of failure. The modulation scheme will be QPSK with concatenated RS/Rate ½ convolutional encoding. Transition to LDPC is expected in the near future. For the S-Band link, a single 12m is recommended, with a second for backup and support to other low earth orbiting (LEO) missions. The signal design is code division multiple access (CDMA) identical to the current TDRSS signal structure. Ranging will be achieved with the 3-Mcps spreading code, and studies indicate that the accuracy will exceed the RLEP/CEV requirements. With the 12m beamwidth of 0.8 degrees, all lunar missions with orbits up to 1000 Km will be covered with the single antenna boresighted on the center of the moon (i.e. no movement required). Uplink commands will be sent with the same pseudorandom noise (PN) code with specific addresses for each spacecraft using a single RF frequency. Using coherent transponders, each spacecraft will generate a downlink signal with a unique PN spreading code all on the same single frequency, and the ground receiver will be capable of demodulating using parallel receivers.

This signal design requires only a single set of frequencies, provides ranging and simultaneous support to multiple spacecraft, provides interference protection from other adjacent channels, minimizes the amount and cost of ground hardware, is easily expandable to handle additional spacecraft if needed, and is compatible with the TDRSS, which should be the network of choice for the LEOP, particularly if assembly is to be done in LEO where continuous coverage support would be highly desirable and produces a reasonable link margin for normal operations (i.e. spacecraft high-gain antenna [HGA] is available). In case of an emergency (i.e. loss of spacecraft control), it is expected that a larger ground asset such as a 34m will be available. For JWST Ka Band support, 6 additional 12m antennas have to be added to the Ka array and can be time shared with the RLEP/CEV missions. This will preclude having to spend $15M to upgrade the 34m which is the current plan. A net savings will be achieved because the additional 18 12m antennas will cost less. In addition, the use of the second 12m S-Band antenna can be used to handle missions that are currently on the 26m antenna (scheduled for decommission on 2008) and obviate the need to buy commercial support for these missions.

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Lunar Happenings (from page 6)

So far we have discussed the "what" of the ground station design; the "where" is another question. A set of some 14 combinations of ground locations were analyzed considering existing infrastructure, geometric coverage, NISN and weather conditions to handle the Ka-Band downlink. A set of evaluation criteria were used to rate and rank each of the combinations. A few combinations scored close and highest in the evaluation including the current DSN locations at Goldstone/Madrid/Canberra. Considering the use of the phased array design which is baselined for JWST support, excellent infrastructure, the opportunity to support the current 26m mission set, and the ability to quickly bring up larger assets if needed, the current DSN locations appear to the best overall choice although there are other combinations such as Hawaii, Ascension and Diego Garcia that also provide excellent coverage. The final decision as to where the sites will be located is yet to made.

By Frank Stocklin

Code 450 Sponsored Emeritus Outreach Activities / Year End Summary – 2004

It was a busy year for Education and Outreach activities for Code 450 Emeritus personnel. We started the year off, as in past years, with a running start at Science Fairs and judging. Local elementary, middle and high schools are always in great need of Science Fair Advisors and Judges. In January, February and early March we covered University Park Elementary, St. Joseph's School (Beltsville), Beltsville Academic Center, Deerfield Run Elementary, Thomas Stone High School (Charles County, MD) and Eleanor Roosevelt High School. One of us (Bob) also judged the Fairfield High School Science Fair in Fairfield, PA. At the end of March, one of us (Hugh) served as both Special Awards and Grand Awards Judge at the Prince George's Area Science Fair held at Prince George's Community College. Student entries from middle and high schools in Calvert, St. Mary's, Charles and Prince George's Counties compete for awards and prizes and for the chance to go on to the State, Regional and National Science Fairs.

One of us (Hugh) submitted a successful proposal for a DDF (Director's Discretionary Fund) grant for the application of WI-FI (Wide-band Hi-fidelity) technology to S-Band (2.4 GHz) point-to-point microwave links in support of the History of Winter Project and the lake ice and underwater experiments involving NASA's Explorer Schools in the New York State/ New England Region. In a novel approach, Hugh proposed to use COTS devices, operating under Part 15 of the FCC Rules and approved under IEEE Std. 802.11(b) and 802.11(g), in the Amateur Radio Band at 2.4 GHz. This would change the operation to Part 97 of the FCC Rules, permitting higher power for the links and would use local Amateur Radio clubs to provide technical support, operating under their local Club Station Amateur Radio Licenses. Four of the eleven available WI-FI channels are inside the 2.4 GHz Amateur Radio Band. By using one of these four channels, much higher power can be employed in the links for transmission of video, voice and data back and forth between a local high school in Lake Placid, NY and the NASA Science Team on Crater Lake or Mirror Lake's icy surface. In addition, the Part 97 user is a Primary User on these frequencies and Part 15 (secondary) users must not interfere with these data links. Using a mini-computer, broadband hub and router at the local Northwood High School, the real-time two-way digital data, video and voice signals can be routed to the remote NASA Explorer School locations nationally, via the Internet. This will permit classroom teachers and their students in these Explorer Schools to participate as co-investigators in the lake surface experiments, thus enabling the participation of NASA's "Teacher as Scientist" Program in the History of Winter Project.

We are looking forward to the implementation of the DDF Proposal this coming winter (2004/2005) in New York's Lake Placid area. (Brrrrrrr.....)

On September 29th and 30th we participated in a high altitude student research project called SIM-SAT. Paticipants inluded Patrick Kilroy (Code 568) from Greenbelt; a group from Wallops including Chuck Jacob (Code 452.N); students from Westminster High School in Westminster, MD; and a group from Damascus High School in Damascus, MD. The Goddard Amateur Radio club supported the launch of two payloads carried aloft by the balloons. The payloads used Amateur Radio frequencies for the two downlinks used for the student experiments. These were temperature profiling experiments, using a "Cricket-Sat" circuit board modified for these flights. In addition to the student experiments, a National Weather Service (NWS) radio-sonde package, with GPS receiver and a radar corner reflector, was attached to the trailing umbilical to permit Wallops Range Radar to track the balloons during ascent. The flights were launched on successive days. Both balloons reached altitudes of more than 112,500 feet before bursting and descending by parachute to the ocean surface. The balloons were also tracked by Radio Amateurs (Hams) along the East Coast from Ontario, Canada to North Carolina and Georgia in the U.S. Reports on telemetry received were relayed on a ham radio network set up in the 7-MHz Amateur Band. The Goddard Amateur Radio Club Station, callsign WA3NAN, was the Net Control station. Reports were relayed to the Wallops Club station,

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Emeritus Outreach (from page 7)

callsign KD3DN, for coordination by the Launch Director, Pat Kilroy at Wallops. The Wallops Radar tracked the Radiosonde and the corner reflector during ascent and was actually able to track the second payload down to the ocean surface about 40 miles east of Ocean City, MD. The second payload (SIM-SAT 1-B) was later recovered on the beach in the Outer Banks of North Carolina, near the town of Duck, NC by a young fisherman and his family. It was returned to Code 568 at Goddard when they returned home to Philadelphia, PA. The first payload has not yet been recovered. Both payloads are in flotation/water-tight containers, so there is hope that ocean currents will return the SIM-SAT 1-A payload one day soon.

The SIM-SAT Project Manager is Jack Vieira, Code 840, at Wallops. The Integration and Test (I&T) Manager, Coordinator and Launch Director is Pat Kilroy, Code 568, at Greenbelt. Pat was assisted by two Student Interns from Worcester Polytechnic Institute (WPI) in Massachusetts, who helped with the I&T efforts and performed last-minute troubleshooting and modifications. The high school students are all part of group of Boy Scouts calling themselves Venture Crew 173. Their Scout Master is John Hoge of QSS at Goddard. John and the students set up a ham radio station at Westminster High School under John's callsign, N3JHH.

They tracked the payloads from Westminster, MD and reported in on the Launch Coordination Network, along with the stations in the U.S. and Canada who were also active in tracking and reporting azimuth and elevation angles, signal reports and telemetry data. They have plans for a third SIM-SAT launch later this year with a small TV camera as part of the payload. So, in addition to telemetry, we should be able to look back at the Earth from near-space altitudes on the next flight. We'll keep you posted.

We'll have more on Education and Outreach activities from the Emeritus viewpoint in the next edition. Until then, as they say in Amateur Radio: "73" (Best Regards)...

By Hugh O'Donnell
&
By Robert Stanley

60 MILES ~ 3 DAYS ~ 1 CAUSE

On October 22-24, 2004, I completed my first Susan G. Komen Breast Cancer 3-day event. What is this? It was three days where over 1,900 people united to walk 60 miles to honor lives lost, celebrate survivors, and promote breast cancer research. Those same people who chose to endure 60 miles of walking raised over $5.3M for one cause: to find a cure by funding breast cancer research, education, screening, and treatment.

This started for me when I received a phone call in March of this year that my step-sister had found a lump in her breast. After her well-being, my first thought was "How can I make a difference?" Participating in the Breast Cancer 3-day event was how I decided to do it. So as my sister started her journey I started mine. She was making surgery arrangements; I was signing up to walk and raise a minimum of $2,000. She was having mammograms, sonograms, and surgery; I was asking family, friends, and co-workers to support my journey by making a contribution. She was receiving test results that she had CANCER (specifically ductal carcinoma in situ [DCIS]) and would have to undergo radiation treatments but not chemotherapy; I was finding out I had reached the $2,000 minimum in just 10 days! She started radiation treatments; I started training. She completed radiation; I kept training - in fact, she started supporting me! When I was tired and my feet hurt, I would think how this was just temporary and nothing compared to

Event picture, Caren in the center

what someone who is dealing with cancer is going through - amazingly I would feel better. After almost 900 training miles and over $8,000 raised, I arrived in Arizona to put my training into action!

It was NOT Club Med: We slept in tents on the ground! We used porta-potties! We were out in the sun for 6-9 hours each day - walking! We used showers on a truck! We were

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60 Miles (from page 8)

fed well! We had great support crews, and an unbelievable number of people came to cheering stations to encourage and thank us! It was an unbelievable experience! So many stories/memories: the mother, sitting at a corner, hugging each walker because her daughter had died from breast cancer; the lady at the cheering station crying and thanking us for walking for her - she has stage 4 breast cancer; the fathers with their young daughters thanking us, seeing people walking/limping with injuries and blisters but determined to walk, seeing the survivors who walked enter the closing ceremony...there are too many affected by this disease.

I proudly completed all 60 miles without a limp or blister, just some major tan lines. It was an experience I truly treasure - I know I made a difference! But I could not have done it without the support of my family, friends and co-workers - they are the ones who made it possible for me to participate - they are the ones that raised over $8,000! And for that I thank them from bottom of my heart and the soles of my feet!

If you would like to know more about the Breast Cancer 3-day event please visit http://the3day.org/.

By Caren Gioannini

Partnering with Government Service Providers

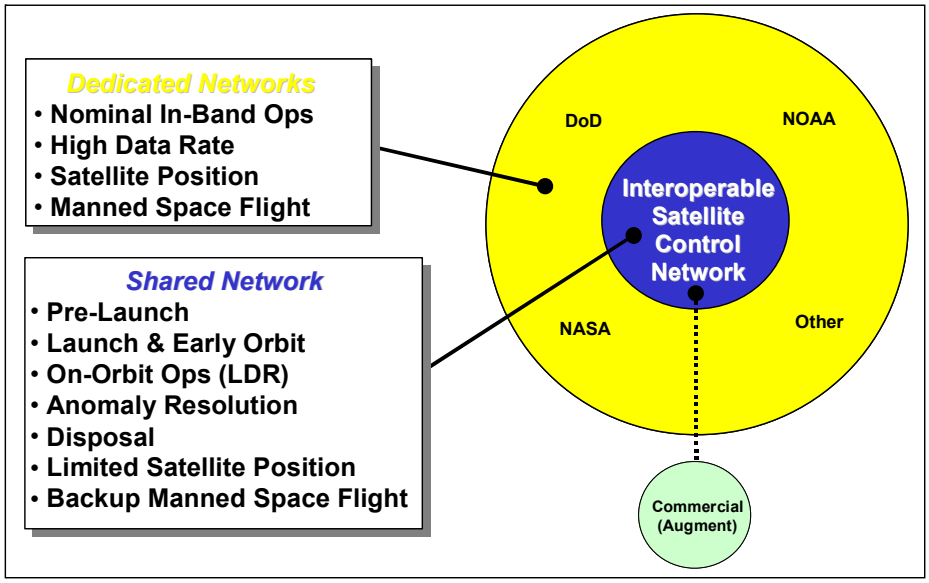
The Space Communications Program continues to look for innovative, cost effective ways to increase available customer data services, especially through partnering with external organizations. SCP and NENS personnel are actively participating in the recently formed Satellite Operations Architecture and Analysis Group (SNAAG), a forum of network service providers from across the military, intelligence, and civil space communities. The SNAAG is currently involved in understanding the roles, missions, architecture characteristics, and constraints associated with the individual networks providers of the NASA, NOAA, Air Force, Navy, and intelligence communities. Six meetings are planned by the end of the calendar year, focused predominantly on fully understanding the networks, at which time the emphasis will migrate towards a focus on standardization and interoperability.

The vision laid forth by the leadership of each organization is enhanced cooperation across all federal providers of Telemetry, Tracking and Command services, as well as low data rate mission delivery. The goal is a federal-level Interoperable Satellite Control Network (ISCN), whereby individual agencies maintain their separate assets and control mechanisms (as depicted in the following figure), but migrate towards the integration of common standards to permit enhanced interoperability.

The SCP hosted October's SNAAG meeting at the White Sands Complex, giving the group insights into TDRSS scheduling and operations functions. One of the primary hurdles early on will be to identify means for enhanced network connectivity, and cross scheduling support.

Interoperability demonstrations are a key short-term goal, and potential joint SN and AFSCN support is a primary focus for the group.

By David Taylor



Human Space Flight Activities and Return to Flight

The Space Shuttle Program announced a new target launch window which opens beginning May 14, 2005. The slip in the target window was a direct result of hurricane damage to KSC and lost work time due to related center closures. A new target launch date is expected to be determined in late October.

The Network Support Group (NSG) for the Integrated Network for Human Space Flight convened its semi-annual meeting on September 23, 2004. Three days of splinter meetings preceded the main forum. The main topic of this NSG and the splinter meetings was to focus on Return to Flight. Over 90 people from multiple NASA centers and tracking stations were in attendance throughout the week. The agenda, presentations, minutes and action items can be viewed at the Network Director's web site: http://scp.gsfc.nasa.gov/hsfnsg.

The NENS contractor supporting Human Space Flight initiated a 6 Sigma team to look at Return to Flight. This effort was supported by NASA and contractor personnel from Goddard, MILA, Wallops, White Sands, the Eastern Range, Dryden, and the Air Force Satellite Control Network (AFSCN). This process was initiated with 3 days of intense discussion and scrutiny of all systems, subsystems (hardware and software), personnel certification, testing and training, and other areas identified as Return to Flight critical items. Additional interviews with key individuals throughout the Network were continued at the NSG the week of September 20th. This team will continue to meet regularly via telecon and interactive web meetings to continue its work in identifying and mitigating Return to Flight issues.

A Soyuz VHF-2 communications checkout was accomplished last month when the ISS crew climbed into the Soyuz capsule and activated the VHF-2 system for a one-time checkout with the ground stations at Dryden, White Sands Complex, and Wallops. This milestone marked the only time this particular frequency has been tested on orbit over the United States. There is a restriction on using this frequency only for emergency use over CONUS because it is the same frequency used by ARINC and America West Airlines. Several months of coordination and planning between Goddard, JSC, and Moscow culminated in a flawless test.

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Human Space Flight (from page 10)

The HSF team continues to work on several Network 'enhancements' for Shuttle including External Tank Television (ETTV), White Sands Space Harbor (WSSH) UHF air-to-ground voice installation, and Guam TV. ETTV continues on schedule with equipment procurements continuing. Some QuVis Digital recorders have been received and are being installed in their associated racks before shipment to Ground Stations at WPS, MILA, PDL, and JDMTA. WSSH UHF work continues with procurements on schedule and work on PRD requirements and T-1 communications link issues moving forward. The Guam TV capability will provide the Shuttle the ability to downlink critical on orbit under wing tile inspection video. The SN project is allocating additional bandwidth to Shuttle on their DS-3 link between Guam and WSC to make this capability a reality.

By James Bangerter

The Customer Commitment Process

Overview

The Customer Commitment Office (CCO) provides the variety of capabilities and services that customers need to ensure mission success. Foremost, we are dedicated to providing our customers with responsive, cost-efficient services and solutions throughout the complete mission life cycle. We are confident that our approach to the complex task of mission integration results in substantive benefits to our customers.

Mission services entail the planning, procurement, provision, and management of functions critical to mission success. The CCO coordinates an extensive set of mission services that span the entire duration of a mission, from the earliest stages of project formulation to the end of mission life. Experienced civil servant and contractor staff use proven processes and systems to provide customers with mission planning, flight dynamics, science data processing, telemetry, commanding, tracking, range, and various additional services, such as anomaly resolution and training.

Throughout the mission life cycle, the CCO team coordinates a comprehensive array of mission tools. Our service offerings are flexible - customers can take advantage of individual or multiple services at any stage in program/project development. For example, in the initial phases of a mission, CCO personnel can provide assistance in determining requirements, producing trade or cost studies, and exploring available options to meet mission goals. Throughout the development stage, we offer project management assistance, and will ensure system readiness through testing and simulations.

SCP customers are as varied as the mission and data services we provide. Customers include domestic and international entities, as well as government and commercial institutions. We support manned and unmanned spacecraft, and single- and multi-vehicle missions. Some customers require support only through launch and the early-orbit phase, while others utilize GSFC mission and data services from project conception to end of mission life. Most of our customers are earth-orbiting spacecraft, launch vehicles, and sub-orbital vehicles, but several ground- and sea-based science missions also employ our mission and data services.

Mission services are needed across the complete life cycle of a spaceflight program or project, beginning with the formulation phase, extending through the implementation phase, and concluding with disposal and post-mission evaluation. Although mission services can be obtained at any point in the mission life cycle, we recommend that communication and coordination between mission representatives and service providers begin as early as possible to ensure maximum return.

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Customer Commitment (from page 11)

During the planning and development of space missions, decisions made in the design of instruments and spacecraft can place constraints on the implementation of tracking, command, and data systems. These constraints can significantly impact mission capabilities and operational cost over mission life. Thus, involvement of mission and data service providers early in the mission formulation phase is critical to mission success.

Customers initiate the process for obtaining GSFC mission services by contacting the SCP's Deputy Program Manager for Customer Commitment (DPM/CC). The DPM/CC and CCO team will work closely with customer representatives to determine the appropriate services to meet individual mission needs. The selection of services depends on many factors, including mission requirements, mission characteristics, cost considerations, and resource availability. The CCO serves as a single-point of contact, coordinating all the space communications and data systems resources needed to provide an integrated solution for each customer. After the optimal set of services is determined, we assist the customer in developing an official service request and appropriate requirements documentation.

Our Partners

The CCO's goal is to assist customers in determining the best mission services offerings to meet individual mission needs. If it's in the customer's best interest, we will coordinate support from another service provider, external to GSFC. For example, other NASA centers, government agencies, and commercial entities can provide mission services. NASA's Jet Propulsion Laboratory (JPL) provides services to deep space missions via the Deep Space Missions System (DSMS); the Western Aeronautical Test Range (WATR) at NASA's Dryden Flight Research Center (DFRC) provides tracking and range services on the West Coast; and NASA's Marshall Space Flight Center (MSFC) provides Wide Area Network (WAN) services. Multiple commercial, government, and international entities provide various telemetry, command, and tracking capabilities that can be coordinated through the CCO.

Customer Commitment

In order to facilitate effective communications and best serve the customer, the CCO provides the customer with expert single-points of contact throughout the service acquisition process and throughout the project lifetime. When a customer contacts the DPM/CC, the customer is assigned a Mission Commitment Manager (MCM), a civil servant project manager that will be the single-point of contact to assist the customer throughout the service acquisition process. The MCM, an expert in GSFC's service capabilities, assists customers in defining requirements, and provides service options and planning assistance to effectively meet customer needs.

The CCO team ensures mission success by applying:

- International Quality and Space Engineering Standards
- Service Planning Tools
- Communications Planning Studies
- Resource and Operations Planning
- System Performance Testing and Readiness Assessment
- Spectrum/Frequency Management
- Consulting Services
- Training and Instruction Services

We look forward to helping our next new customer (and all of our current customers) meet their mission goals.

By Jon Walker

New Customer Mission Support

Code 451 has been active in providing communications capabilities for several cooperative Earth science missions. Primary attention has been given to Earth Resources Satellite-2 (ERS-2)/Global Ozone Measurement Experiment (ERS-2/GOME) for the European Space Agency (ESA); SciSat for the Canadian Space Agency (CSA) and NASA Langley Research Center (LaRC); and EnviSat, an ESA spacecraft, for the National/Naval Ice Center and ESA. Goddard will be providing additional ground station capabilities in support of all of these missions. As a result of these activities, additional scientific data are being collected by these missions for a better understanding of Planet Earth.

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New Support (from page 12)

ERS-2 Satellite

The ERS-2/GOME mission lost its on-board recording capability and requested real-time receiving and forwarding of ozone data from the McMurdo Ground Station (MGS) in Antarctica to ESA facilities. In support of this, Code 451 has been working with representatives of ESA and the Wallops Flight Facility (WFF) to integrate and check out the ESA equipment and the additional equipment provided by Code 452, prior to shipping the equipment to MGS in time for the austral summer opportunity to measure ozone over Antarctica.

SciSat-1 Satellite

The SciSat-1/Atmospheric Chemistry Experiment (ACE) experimenters requested Code 451 to provide ground station support to augment existing CSA stations. Working with the Alaskan Satellite Facility (ASF) and NASA LaRC, Code 451 will be able to significantly increase the volume of science data received. The data are used to measure and understand the chemical processes that control the distribution of ozone in the Earth's atmosphere. Support for this mission will extend at least through FY05. The additional equipment required at ASF for this mission is being provided by Code 452.

EnviSat Satellite

The EnviSat mission support will be to provide data for the tracking of icebergs calved during the austral summer and fall that pose a danger to shipping in the Ross Sea. At present, there are no means for providing current data on the distribution and paths of the icebergs. The National/Naval Ice Center (N/NIC), with the cooperation of NASA and ESA, plans to demonstrate the applicability of space technology for providing near real-time collection and distribution of iceberg path and locations for dissemination to ships sailing in the Ross Sea. Selected images of the Ross Sea will be downlinked at MGS in real time and forwarded to the White Sands Complex (WSC) through the McMurdo-TDRS link. For the three- to four-month feasibility demonstration, N/NIC will make arrangements for the data to be transported from WSC to ASF for processing and interpretation. Support for this mission will require additional station capability to receive selected data from the ESA satellite at the MGS station, and Code 452 is providing the equipment for this capability.

By Paul McCeney

Space Communications Customer Forum

The SCP's Space Communications Customer Forum (SCCF) convened the ninth session in this on-going series of meetings. The 9th SCCF, formerly known as the Mission Services Customer Forum (MSCF), was held on August 12, 2004, in GSFC's Building 3 Goett Auditorium. The SCCF is coordinated and hosted by Mr. Allen J. Levine, Service Planning Manager in the Customer Commitment Office (Code 451).

OPENING REMARKS were presented by Mr. Jon Z. Walker, Deputy Program Manager for Customer Commitment (Code 451). Mr. Walker's remarks included definitions of the SCP's mission and vision, the SCP's role in the transformed NASA, and an overview of SCP's resources and partners.

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SC Customer Forum (from page 13)

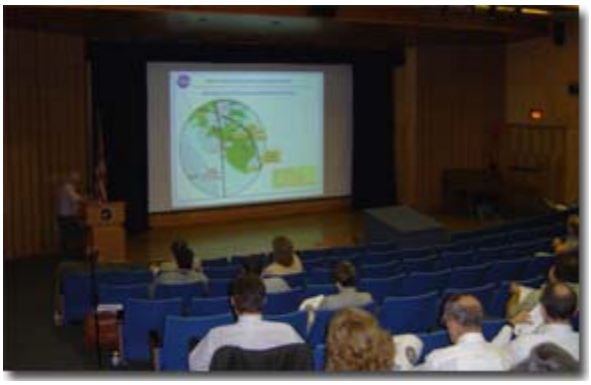
FEATURED TOPICS included Space Network (SN) Future Services, focusing on the *SN Internet Protocol Services (SNIS)* and *Multiple Access Fast Forward Services*. Mr. David J. Israel of the Microwave Systems Branch (Code 567) presented this topic.

RESOURCE/SYSTEM STATUS UPDATES, which provided an overview and/or summary of significant activity in SCP offices and SCP partner organizations, were provided for:

- Ground Network (GN), presented by Mr. Roger Clason (GN Project Manager [Code 453])
- Space Network (SN), presented by Mr. Keiji Tasaki (SN Project Manager [Code 452])
- NASA Integrated Services Network (NISN), which included presentations on *NASCOM IP Operational Network* and *NISN Interfaces with Projects for Requirements and Funding*, presented by Mr. Jerry Zgonc (NASA Communications Branch [Code 291]) and Mr. Norman Reese (USGSA/Code 291), respectively
- JPL's Deep Space Missions System (DSMS) Status, presented by Mr. Gene Burke/JPL.

UPDATES (including organizational overviews; current/future missions; issues and selected items of interest; and areas for more work) were also provided for NASA HQ's Science Mission Directorate by:

- Mr. Ed Macie/Code 428, representing Earth Science missions.
- Mr. Ron Mahmot/Code 444, representing Space Science missions.



HUMAN SPACEFLIGHT status update was provided by Mr. Jim Bangerter/Code 451.

The next forum is scheduled for November 18th, 2004, at 1:00pm in GSFC's Building 3 Goett Auditorium.

For additional information about the SCCF, visit the SCCF website at http://scp.gsfc.nasa.gov/sccf/.

By Al Levine

International Cooperation Activities

Interagency Operations Advisory Group

The next Interagency Operations Advisory Group (IOAG) meeting is scheduled for December 7, 2004. It was planned to coincide with the Consultative Committee for Space Data Systems (CCSDS) Management Council (CMC) Meeting, scheduled for December 8 at Centre National D'Etudes Spatiales' (CNES) Toulouse Space Center, Toulouse, France.

The IOAG has been proactive in encouraging the CCSDS to adopt standards relative to interagency cross-support, including Space Link Extension (SLE) services, CCSDS File Delivery Protocol (CFDP), Bandwidth (BW) Efficient Modulation, and Coding.

The IOAG/CMC Joint Meeting will address such matters as 1) Review of IOAG Strategic Plan, 2) Description of

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International (from page 14)

Support Networks, and 3) IOAG-CCSDS relationships. Major objectives of the joint session will include obtaining resolution/closure on the IOAG liaison statements to CCSDS/CMC, and receiving a briefing from CMC regarding their problems and issues.

The IOAG relies primarily on technical work already completed by other organizations developing standards for space systems such as the Inter-Agency Consultative Group (IACG), CCSDS, and Space Frequency Coordination Group (SFCG). Items involving only two agencies are better covered in existing bilateral venues, such as Interagency Tracking, Communications, and Operations Panels (ITCOPs).

The NASA Head of Delegation is represented by Mr. James A. Costrell of NASA Headquarters' Space Operations Mission Directorate (Space Communications). Other NASA representatives to the IOAG include Mr. Philip Liebrecht, Associate Director/Program Manager for Space Communications/Code 451; Ms. Madeline Butler, Deputy Chief Engineer for Applied Engineering and Technology Directorate (AETD)/Code 500; Mr. Jon Z. Walker, the SCP's Deputy Program Manager for Customer Commitment (DPM/CC)/Code 451; Messrs. Richard Miller and Warren Martin of NASA/Jet Propulsion Laboratory's Deep Space Missions System (DSMS) Plans and Commitments Program Office; and Dr. Wallace Tai of JPL's Systems Engineering and Standards Office (all in the Interplanetary Networks Directorate [Office 900]); and selected contractor personnel.

The Japan Aerospace Exploration Agency (JAXA) hosted the Sixth IOAG Meeting (IOAG-6) on June 9 & 10, 2004, at Tsukuba Space Center (TKSC), located in Tsukuba Science City, Japan.

For more information on the IOAG, visit the IOAG web site at http://www.ioag.org/.

By Jon Walker

Interagency Tracking, Communications, and Operations Panels

A ***NASA/European Space Agency (ESA) ITCOP*** will be convened on December 9 for discussion of future NASA/ESA missions requiring interagency support. A working session with ESA Headquarters' representatives will be convened on December 10, with a primary focus on interagency support of ESA's Automated Transfer Vehicle (ATV) and Ariane-V launch vehicle.

A ***NASA/JAXA ITCOP*** was held on June 8 at JAXA's Institute of Space and Astronautical Science (ISAS) in Sagamihara. Significant items of discussion revolved around interagency cross-support of future JAXA missions, including SELenological and ENgineering Explorer (SELENE) Project, Lunar-A, Astro-E2, and Mu Space Engineering Spacecraft (MUSES)-C.

Accelerated Leadership Program Class, 2003 – 2005

Ms. Evette Conwell, Mission Commitment Manager (MCM) in the Customer Commitment Office (Code 451), was selected as a member of GSFC's **Accelerated Leadership Program (ALP) Class, 2003 – 2005**.

The ALP's first class of 2003 was given assignments in January 2004 to work on Center issues. The ALP class was divided into four teams of five people. The goals of the assignments were to work on real issues facing the Center and provide a venue for the ALP cohorts to use leadership skills gained during the first year of training in the ALP program.

The ALP team was inspired to transform GSFC into a community partner by achieving a sustainable workplace. The ALP team went about the work to provide cost effective solutions to transform GSFC into an exemplary, environmentally sustainable complex. The goal is to have sustainability become a natural filter, used by every GSFC Directorate during the strategic planning process.

The ALP team focused on the topic '***Strategies for a Sustainable NASA/Goddard Space Flight Center***.' The basis for Goddard implementing a more sustainable environment was heavily based upon the NASA mission "*To understand and protect our home planet … To inspire the next generation of explorers,*" and the NASA vision "*…To improve life here…To extend life to there…To find life beyond.*" The group researched the topic and built alliances within the Management Operations Directorate (Code 200) and NASA Headquarters. During the ALP team's presentation to the GSFC Management Council on October 12, the following **four recommendations** were presented and accepted:

- **Storm Water Mitigation**: Minimizing impacts of storm water is easily implemented and often less costly than conventional development. Bio-retention swales, planted with a variety of vegetation, can be less costly than mowed lawns and traditional storm water management practices. Additionally, the variety of vegetation provides an increased habitat for a diversity of wildlife and is visually more pleasing.

- **Employee Electricity Savings Incentives (EESI)**: The EESI program is no-cost, and has the potential to save money and increase employee morale. The following plan of action was proposed:

  1) Monitor the electricity use on a "per-building" basis. The electricity meters for this are already in place, so there is no additional cost.
  2) Communicate the EESI program and electricity usage "per-building" to employees.
  3) If a building saves electricity, the savings will be used as follows:
     - 50% of the savings will go to a facilities capitol investment fund. This fund will allow GSFC to save for future facilities' improvements.
     - 50% of the saving will be allocated to the building Facility Operations Manager (FOM) for building amenities.
  4) Publicize the results and amenities "won" to foster a sense of accomplishment and competition among buildings.

- **Green Roof Pilot Program**: Green Roofs (GR) may provide us an opportunity to witness our buildings being converted from costly, wasteful entities to those that are efficient and environmentally friendly. The implementation of a GR scheme at Goddard can contribute to financial savings and to the preservation of our environment.

- **Sustainable Strategic Planning Process**: The sustainability planning process is intended to provide an organization with the opportunity to engage the entire community of stakeholders.

The **ALP team** is championed by **Ms. Diane Williams** (Director/Code 200); **Mr. Mark Branch** (Environmental Test Engineering and Integration Branch/Code 549); **Mr. Gary T. Davis** (Propulsion Branch/Code 597); **Ms. Felicia Donnell** (Mechanical Systems Center/Code 540); and **Mr. Peter Laurin** (Safety and Environmental Division/Code 250), in addition to **Ms. Conwell**.

By Evette Conwell

White Sands Station Director Transition

After nearly 40 years in the space communications business, the last 20 with NASA as the White Sands Complex (WSC) Deputy Station Director and the Station Director, Jim Gavura's NASA career is coming to a close with his retirement on December 31, 2004.

Jim Gavura

Jim's space communications career began with Bendix Field Engineering Corporation in 1966. He traveled the world with his family, with stops in exotic places like Madagascar, the Seychelles, and Fort Churchill, Manitoba, providing a wide variety of satellite communications support. In 1980 Jim and his family moved from Fairbanks, Alaska to Las Cruces, New Mexico where he was the Engineering Manager at the NASA Ground Terminal (NGT). In 1984 he became the Deputy Station Director under Virg True. When Virg retired in 1990 Jim was promoted into the Station Director position. During Jim's tenure as Station Director he has led the White Sands Complex through the launching of six Tracking and Data Relay Satellites (TDRSs) and the construction of the Second TDRS System (TDRSS) Ground Terminal (STGT), the Technical Support Building (TSB), and Guam Remote Ground Terminal (GRGT) and the refurbishment of the White Sands Ground Terminal (WSGT).

In addition, Space Network operations have grown and prospered under Jim's guidance. In the year 1990 the SN supported approximately 1,700 hours of services monthly with an average proficiency of 99.7%. In the month of September 2004 alone, the SN supported over 11,000 hours of services with a proficiency of 99.95%.

After retiring, Jim and his wife, Carol, will be moving their home to Scottsdale, Arizona where Jim is planning to work on his golf handicap and enjoy the company of his granddaughter, Olivia.

Jim's successor as the Space Network Station Director is Harold Brockelsby. Harold arrived at the SN on October 4th and is quickly coming up to speed. Before joining NASA, Harold was the Chief Information Officer (CIO) for the Air Force Research Laboratory (AFRL) at Kirtland Air Force

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White Sands Director (from page 17)

Base in Albuquerque, New Mexico. Prior to joining the AFRL, Harold was a Vice President and Senior Program Manager for SAIC, managing computer and telecommunications projects at several locations nation-wide. Harold and his wife, Janice, are excited about joining the NASA community and look forward to establishing permanent residence in Las Cruces.

The Space Network wishes Jim and Harold the best in their new endeavors!

By Bryan Gioannini

Harold Brockelsby

The Space Network TDRSS K-Band Single Access Return (KSAR) Upgrade Project (TKUP)

The TDRSS ground stations at White Sands were designed and implemented in the early 1990s, and some of the systems, including the K-Band Single Access Return (KSAR) high-rate equipment and the Data Interface System (DIS) high-rate switches, are reaching obsolescence. The Space Network (SN) is expected to remain in operations for at least another ten years.

NASA Mission Offices (Exploration Systems, Space Operations, Science and Aeronautics Research) and other potential SN customers are expected to evolve to higher data rate communications exceeding the 300-Mbps maximum currently available via the SN 225-MHz return channels. In response to these expected needs, the SN Project recently established the TDRSS KSAR Upgrade Project (TKUP) to upgrade the TDRSS KSAR service. The goals of the TKUP are to:

- provide enhanced KSAR services by adding the capabilities to process bandwidth-efficient signal designs at Ku-Band and Ka-Band (increasing the maximum data rate from 300 Mbps to 625 Mbps).
- replace the KSAR high-rate equipment and DIS high-rate switch equipment.
- provide Single Access Antenna (SAA) autotrack capability for the new signal designs.

These new signal designs will enable SN customers to realize significant reductions in required EIRP compared to existing uncoded KSAR services operating between 150 Mbps and 300 Mbps. The TKUP has potential to improve the legacy autotrack services and to provide one-way and/or two-way Doppler tracking for the new signal designs. The KSAR service enhancement will also include the capability to process the ISS ESA/Col-T and JAXA/JEM QPSK signals without stacking of convolutional encoder/decoders.

Operations concepts, architectures, and systems requirements for the TKUP are currently under development. During the summer of 2004, a modulation and coding study was performed to identify signal structures which maximize the data rate through the TDRSS Ku/KaSAR 225-MHz channel while minimizing customer hardware complexity and power requirements. Table 1 contains the TKUP signal design and key parameters. While the study indicated that the TDRSS Ku/KaSAR 225-MHz channel can support up to 800 Mbps using strong forward error correction coding such as Turbo Product Code (TPC) or Low Density Parity Check (LDPC) code and a 16-ary modulation technique, consideration of reasonable customer hardware power, antenna size, cost and complexity for a LEO spacecraft drove TKUP to select TPC- or LDPC-coded OQPSK and TPC- or LDPC-coded 8 PSK as the baseline signal structure. Legacy modulation and coding methods will be maintained to ensure compatibility with current flight projects.

The TKUP will install new receive equipment at WSC and Guam and perform the necessary software modifications to the WSC ADPE. The existing KSAR high-rate equipment (downconverters, receivers, bit-syncs, decoders, baseband equalizers, controllers, test modulators and associated test equipment, cables and signal routing) and high-rate switches nearing obsolescence will be replaced. The TKUP will integrate the new hardware items into the existing systems for scheduling, control, and status.

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TKUP (from page 18)

Table 1. TKUP Signal Design and Key Parameters

Parameter	BPSK	QPSK	SQPSK	8-PSK
Data rate				
a. Uncoded	6 Mbps-150 Mb	12 Mbps-300 M	12 Mbps-300 M	N/A
b. R1/2 Convolutional coding (stacking)	3 Mbps-75 Mbp	6 Mbps-150 Mb	6 Mbps-150 Mb	N/A
b. R1/2 Convolutional coding (non-stacking)	N/A	6 Mbps-150 Mb	6 Mbps-150 Mb	N/A
c. LDPC code (8160,7136)	N/A		150 Mbps -410	410 Mbps -625
d. TPC coded (1) (128, 120)x(128,120) (2) (256,239)x(256,239)	N/A		150 Mbps -410	410 Mbps -625

Note: The BER support range is 10^{-5} to 10^{-9} (with 10^{-9} being the lowest BER required to be supported by the TKUP service).

The TKUP reference architecture is illustrated in Figure 1. The shaded boxes in the figure indicate new or modified functions within the KaSAR and KuSAR services.

The TKUP will incorporate a demonstration, prior to procurement of the receiver systems, in order to mitigate risk. The results of the demonstration will be used to finalize the signal designs and system requirements. The primary objective of the TKUP demonstration is to reduce project risk by determining the performance of the KSAR 225-MHz wide channel at data rates above 300 Mbps using actual vendor hardware that supports the candidate modulation and coding schemes. Thus far only simulation methods have been used to validate the performance of the proposed TKU signal structure through the TDRSS KSAR 225-MHz channel. Additionally, simulation methods cannot be used to assess BER performance at levels below about 10^{-7}. Also, the demonstration will prove technology readiness and determine the maximum data rate supportable through the Ku/KaSAR 225-MHz channel.

A critical design review will be conducted after the demonstration to finalize signal designs and system requirements and to present a design that meets all requirements. Modifications to existing SN systems will be directed via Near Earth Networks Services (NENS) Indefinite Delivery Indefinite Quantity (IDIQ) task. Once testing and verification of requirements are complete, an Operations Readiness Review (ORR) will be conducted followed by transition into operations, maintenance, and sustaining engineering. After successful transition to operations, the project will be complete.

Table 2. TKUP Schedule

Deliverable	*FY05*	*FY06*	*FY08*
System Requirements Review	02/05		
Preliminary System Design Review	06/05		
Demonstration Complete		06/06	
Critical System Design Review		08/06	
Implementation Complete			05/08
Integration and Testing Complete			05/08
Documentation and Training Complete			05/08
Operations Readiness Review			05/08
Transition to O&M/Sustaining			05/08

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TKUP (from page 19)

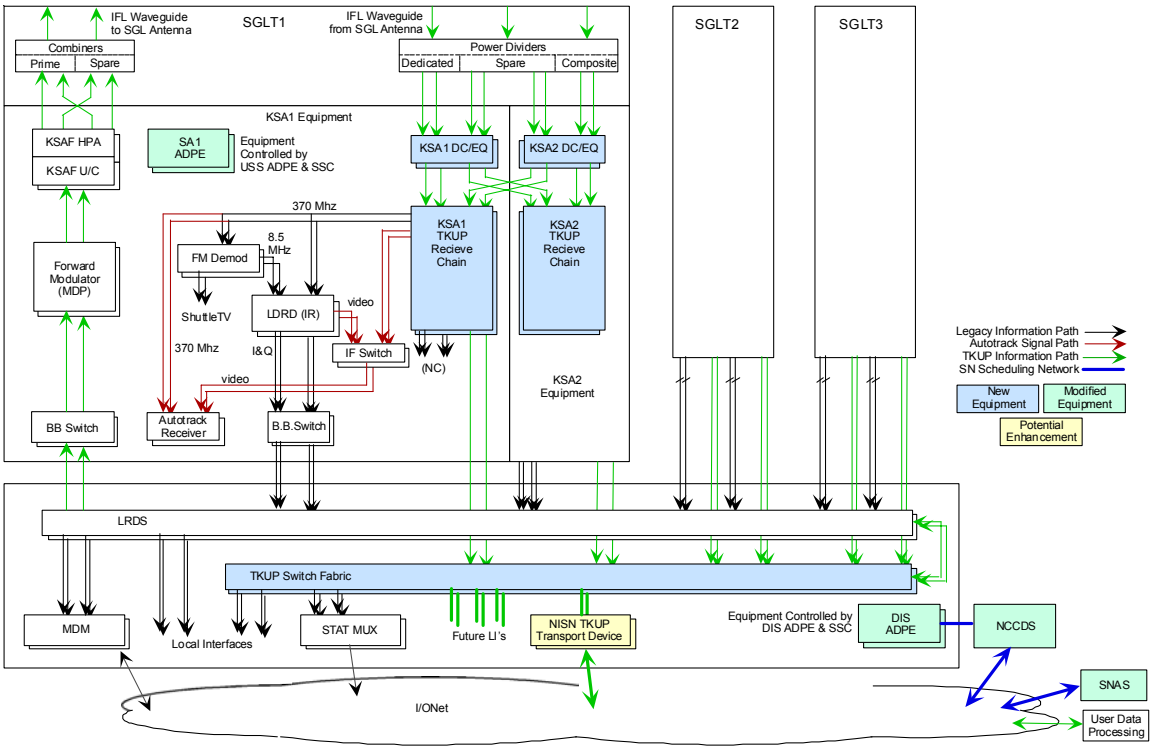

Figure 1. TKUP Reference Architecture

As the TKU Project progresses, technical interchange meetings will be held with interested members of the customer community regarding development of flight hardware, appropriate compatibility testing approaches and data communications interfaces and transport.

Visit the TKUP website at http://scp.gsfc.nasa.gov/tkup/ to learn more about the TDRSS KSAR upgrade activities.

By Yen Wong

Space Network On-line Information Center

The SN Online Information Center continues to develop information modules beyond just the Tracking and Data Relay Satellite System. You'll still find authoritative information about TDRSS, but we've now included information and links to other Mission Services Program and Space Network activities. We've included up-to-date information and links to other SCP websites such as SWSI and DAS. We've also updated the links to the SN customer's websites. The telecommunication information module update is almost complete and ensures that the information in the website is consistent with the *Space Network Users Guide, Revision 8*. The users' guide is also available for download at http://scp.gsfc.nasa.gov/tdrss/guide.html. We have updated the TDRS constellation information to now include TDRS H, I, and J deployments. For specific questions, email us using our feedback form and we'll direct your question to the appropriate expert and return an answer directly to you via email. As always the calendar of upcoming events is updated monthly; the calendar lists upcoming launches and other activities of interest. The site is updated twice monthly to ensure information is current and accurate.

The website can be found at scp.gsfc.nasa.gov/tdrss/

Detailed information is currently available on:

- The Tracking and Data Relay Satellites (including TDRS H, I, J)
- Demand Access
- The White Sands Complex (including WDISC)
- Guam Remote Ground Terminal
- McMurdo TDRSS Relay Terminal System
- TDRSS Telecommunication Services
- Customer Communication Systems and Products (including Transponders)
- TDRSS Applications
- Plus much more…

By Jeff Glass

TDRS Constellation Moves/Plans

The Space Network's constellation of TDRS spacecraft has undergone many changes since TDRS-1 was launched in April 1983. As component failures occurred and new TDRS spacecraft began operations, roles and locations of the existing spacecraft were often changed. Once the final TRW-built spacecraft (TDRS-7) was launched in 1995, the locations and duties of the spacecraft began a seven-year period of relative stability. That configuration is represented in the table below.

TDRS-4	41 west longitude
TDRS-6	47 west longitude
TDRS-1	49 west longitude
TDRS-7	171 west longitude
TDRS-5	174 west longitude
TDRS-3	275 west longitude

Once the Boeing-built TDRS spacecraft were ready for operation, things began to change. TDRS-8 was co-located with TDRS-7 at 171 degrees west longitude in January 2002, and began operations in April. TDRS-7's payload was configured for storage, and the spacecraft was moved to 150 degrees west longitude, beginning in December 2003. TDRS-9 was moved to be co-located with TDRS-8 in early 2004, and began supporting users on 29 March 2004.

Also in the spring of this year, TDRS-5 gave indications that its KSA-1 forward service was failing. TDRS-8 was quickly pressed into service, and replaced TDRS-5 at 174 degrees west longitude on 23 April. Over the next few months, TDRS-5 tests were performed, but nothing could be done to salvage its failed KSA-1 forward service. Despite its degraded state, TDRS-5 was moved to take over the user service load at 171 degrees west longitude upon completion of TDRS-9's operations verification period on 20 September. TDRS-9 was configured for storage and its drift to 79 degrees west longitude was begun soon afterward.

Due to a series of component failures and its increasing orbital inclination, concerns about TDRS-4's continued ability to support users at 41 degrees west longitude have been raised. TDRS-10 has been identified as the best candidate to assume this role, and relocation of the satellite from its test location of 150 degrees west longitude began this summer. TDRS-10 is planned to begin supporting users from its new location early next year. Once this transition is complete, TDRS-4 will be moved to 46 degrees west longitude while continuing to support users. This will leave TDRS-6 available for other tasks, and its relocation to 174 degrees west longitude is planned to start early next year.

This should leave the TDRS satellites in the configuration shown in the table below.

TDRS-10	41 west longitude
TDRS-4	46 west longitude
TDRS-1	49 west longitude
TDRS-9	79 west longitude
TDRS-7	150 west longitude
TDRS-5	171 west longitude
TDRS-8	174 west longitude
TDRS-6	174 west longitude
TDRS-3	275 west longitude

These relocations have required a significant amount of around-the-clock effort on the part of the Spacecraft Engineering Group at the White Sands Complex in New Mexico. SEG personnel plan and execute the relocation maneuvers and reconfigure the spacecraft for their changing roles, in addition to normal operations and troubleshooting problems as they arise. Along with the satellite controllers at WSC, these people deserve credit for helping our aging TDRS satellites to have many years of productive service.

Front row (L to R): C. Maddox, D. Perry, J. Mendiola, P. Holzemer, D. Ward **Back row (L to R):** C. Fichera, L. Burns, L. Vaught, J. Cook, S. Pollock, G. Nesbit, M. Antholzner

By Bert Ransom

Ground Network Project

453

The Summer of 2005 on the Ice

Where is the highest, coldest, windiest, driest and emptiest place on Earth? If you guessed Antarctica, you are correct. NASA has a tracking station on McMurdo station, Ross Island, Antarctica. One has to wonder why it is so dry when over 70% of the world's fresh water is contained in the ice. The harsh environment presents a survival challenge for humans and equipment alike.

The summer is very short there and because the station is located South of the equator it is summer there when it is winter here in Maryland. The United States Antarctic Program (USAP) summer starts in October and ends in February. All airplane flights in and out of McMurdo and work to be done has to be performed during the USAP summer, unless you plan to winter over. Wintering over means that you would spend nine months of dark, dry, windy, cold and isolated work on the "Ice". Being on the Ice is what the veterans who have worked there call it. Any work being planned at McMurdo needs to be done during the short austral summer.

This summer NASA plans to do a lot of work at McMurdo. We are moving from the crowded and old Crary Lab into a newly constructed building called the Joint Spacecraft Operations Center (JSOC). The move starts right after the New Year in January 2005 and is expected to be completed by early February 2005. Some residual work and testing will continue well into March/April until all users are re-certified for operations after the move. This move will also include equipment upgrades to the station. We will modify the 10-meter antenna for uplink command capability at the X-band frequencies so we can support the SpaceTechnology-5 (ST-5) mission. The station will be out of full operation for about three weeks during the move and equipment upgrade. An exciting summer is about to start in McMurdo.

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Summer of 2005 on Ice (from page 22)

Upgrades will continue during and after the move, for support of the following missions:

1. Demonstration for the Defense Meteorological Satellite Program (DMSP), which is being supported as a request from the Department of Defense (DOD). They are demonstrating the capability of MGS to receive, process and transfer the data to the Air Force Weather Agency (AFWA).

2. Demonstration of Autonomous Rendezvous Technology (DART). This mission should have been launched by the time this article is published. The objective was to test the capability of a spacecraft to rendezvous and dock with an on-orbiting spacecraft automatically without human pilots on board. This capability is being proven for future application in the exploration program.

McMurdo Ground Station

3. ESA Remote Sensing Satellite-2 (ERS-2)/Global Ozone Monitoring Experiment (GOME). GOME was requested by The European Space Agency (ESA) because ERS-2 lost the on-board data recording capability and needs MGS for dumping the data before it gets overwritten.

4. ENVISAT, The National Oceanic and Atmosphere Administration (NOAA), and the U.S. Air Force have requested support for ENVISAT because the mapping of the Iceburg motion in the Ross Sea has been a concern for shipping safety. Other methods of collecting this data are cumbersome and slow, and it is desirable to improve the freshness of the data which will in turn provide earlier and more accurate warnings about Iceburg motion for the safe navigation of ships.

5. ST-5. This project has put their Earth Enterprise money into the MGS support. Three satellites will be deployed in tight formation and because of the orbit, MGS provides the best view and support can be available for longer periods of time. Commanding in the X-band will be done and the MGS will be scheduled to support all three spacecraft one at a time during each scheduled pass.

6. Other work includes the addition of a new communications intercom system that is compatible with future plans to upgrade the NASA voice communications.

Most of the planned work will be accomplished by a combined team of Engineers, and Managers contracted by the Ground Network Project, Code 453. Honeywell Technology Solutions Incorporated (HTSI) leads a team from HTSI, VIASAT, ENTERTEC, Dewitt and Associates and support personnel from the National Science Foundation contractor, the Raytheon Polar Services Company(RPSC). These personnel and past employees are to be commended for their willingness to provide these services for the benefit of Science and Technology advancement.

McMurdo, Antartica

The work is harsh and the weather in McMurdo is dangerous. The equipment needs constant care and protection from the environment. The Ground Network is a provider of services to the Science Community and endeavors each day to meet or exceed our customer's requirements and to achieve excellence in all our efforts. To this end, we welcome the opportunity to serve in McMurdo, Antarctica.The temperature in the summer may reach as high as 50 degrees F. This should be great weather for working outside on the antenna.

By Paul Garza

PFRR Pathfinder Radar Damaged by Fire

The wildfires in Alaska this summer heavily damaged the pathfinder airspace surveillance radar. The surveillance radar is required to conduct launch operations at the Poker Flat Research Range. The upcoming January 2005 sounding rocket campaign cannot proceed without resolution of this problem.

NASA and NENS have worked diligently in researching and identifying available options and approximate costs for replacement of the surveillance radar at PFRR.

Lost Surveillance RADAR

After careful consideration, a decision was made to procure remanufactured Pathfinder electronics integrated into arctic capable shelter by a remanufacturer via the NENS contract.

Once this decision was finalized, a detailed WBS and associated schedule for the replacement project was developed. Forecast installation and test completion has been scheduled for November 2004. To date, the purchase order has been delivered to the manufacturer. The manufacturer has completed refurbishing the container and is making progress on installing instrumentation.

The Lost Surveillance RADAR Location

Through hard work and dedication of all people involved, the deadline should be met for replacement of the surveillance radar at PFRR in support of the January 2005 sounding rocket campaign.

Surveillance RADAR Interior

By Steve Currier

2004 Hurricane Season and its Impact on the MILA and PDL Ground Stations

Charley, Frances, Ivan and Jeanne all visited Florida within six weeks. The guys landed on Florida's west coast, the gals the east coast. These major hurricanes each left a trail of destruction that affected the entire state. After their visits, every county in the state, except those in the extreme south, had experienced hurricane force winds (73 mph or greater).

The Merritt Island Launch Annex (MILA) Tracking Station, part of GSFC's Spaceflight Tracking and Data Network, occupies 61 acres on Kennedy Space Center (KSC) in Merritt Island, just one river inland from Cape Canaveral on central Florida's east coast. GSFC's Ponce De Leon (PDL) Tracking Station, a wing site to MILA, occupies 2 acres of land on New Smyrna Beach, about 45 miles north of MILA. These stations are used mainly to provide communications between the Space Shuttle Orbiter and control centers on KSC and Johnson Space Center.

MILA Tracking Station located within KSC

Each year before summer, hurricane plans are reviewed, provisions stockpiled and emergency communications practiced within KSC and between KSC and the county and the state. KSC establishes a Hurricane Center in its Emergency Operations Center (EOC) in the Launch Control Center, and each organization has a NASA and a contractor Hurricane Coordinator to coordinate activities and communicate with the EOC and a Disaster And Recovery Team (DART) to access the damage to their facility after the hurricane passes and begin repairs needed to make their facility safe for personnel to return.

Because hurricane tracking is not an exact science, miles of coastal cities are evacuated as the storm approaches to avoid casualties from flooding caused by the storm surge. The Space Center's challenge is to start preparations early enough so that workers can complete their tasks and still have time to secure their own homes and evacuate on the crowded highways, but not lose productivity unnecessarily if the storm does not pass nearby.

When 50-mph wind from a storm is 72 hours away, the Space Center declares Hurricane Condition (Hurricon) IV, and the EOC is occupied to send out information on the storm and to coordinate and collect data on preparations. Loose outdoor items are moved indoors or tied down, and scrap is scheduled for pickup. At MILA, considerations are made to remove the antenna atop the 140-foot tower if winds exceeding 100 mph are anticipated because the antenna on top decreases the wind load the tower can withstand. MILA's challenge is to accurately anticipate if 100-mph winds will be experienced before the winds pick up too much and prevent the antenna from being removed.

When storm winds are 48 hours away, Hurricon III is declared, normal operations are halted, windows boarded, and doorway thresholds (all but one in each building) covered with plastic and sandbagged. Major antennas (7 at MILA, 1 at PDL) are stowed and stow pins inserted to prevent movement from the winds. Smaller antennas are removed from the roof tops and stored indoors.

When storm winds are 24 hours away, Hurricon II is declared, equipment is powered down and covered with plastic to prevent damage from ceiling leaks, important papers and backup media put in plastic bags and stored in top drawers of cabinets, and the evacuation order awaited from the Center Director.

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2004 Hurricane Season (from page 25)

Upon the Center Director's order to evacuate, which can be given during any Hurricon stage, preps are completed, all personnel leave, the final door in each building is sandbagged and the gates closed and locked. Personnel call a recorded message to determine when it is safe to return.

KSC has a rideout crew consisting of Security and Fire personnel who check the center after the storm passes to determine when it is safe for each organization's DART to return.

On Wednesday, August 11, KSC declared Hurricon III for Hurricane Charlie which was heading for Cuba and the Gulf of Mexico. Preparations began, but lightning storms at MILA prevented the Antenna from being removed from the 140-foot tower until Friday. The Center closed at noon on Friday and Hurricane Charlie landed on Florida's west coast at Charlotte Harbor (100 miles south and 100 miles west of MILA) with 145-mph winds and traversed diagonally across Florida exiting at Ormond Beach (20 miles north of PDL) with winds of 100 mph. MILA did not experience any damage from the 75-mph winds recorded at KSC, but PDL did have minor damage from the 95-mph winds recorded at the neighboring Coast Guard Station. Coax cables snapped, the metal rod that locks the security gate bent and the gate swung open, a metal fence post broke, barbed wire came loose, a light fixture broke off from its pole, and a muffler for one of the motor/generators was gone.

PDL Ground Station

Although damage from Charley was minor, the power remaining in a storm that entered Florida 150 miles away and traversed 150 miles over land caught the attention of this Station Director and the Near Earth Network Support (NENS) contractors operating MILA and PDL. New Smyrna was impassable with debris and downed signs, electrical wires cluttering the roadways, and traffic lights were inoperable for days. Until this storm, any that had landed on the west coast had little effect on the space coast by the time they crossed Florida.

Less than 3 weeks later an even larger storm, Hurricane Frances, was making its way through the Bahamas and up the Atlantic Ocean toward KSC. The NENS contractor decided that additional precautions would be employed since this storm was predicted to make landfall near KSC, and purchased plywood to cover all the windows in the main buildings (KSC requires covering large windows of which MILA has two). KSC went through the Hurricon stages, MILA buttoned up and the Center closed on Wednesday, September 1, just after noon. Hurricane Frances was so huge and slowed down and fortunately the winds died down to 105 mph as it landed at Sewall's Point on the east coast about 100 miles south of MILA Sunday morning, September 5. It traveled very slowly (5 to 8 mph) across Florida and departed at Tampa. The storm covered so much area that while it was over Tampa all of Florida was covered by its clouds, and Jacksonville in the north and the Keys in the south were all experiencing 50-mph winds. Lumbering Frances took its toll on KSC, inflicting millions of dollars worth of damage. The Vertical Assembly Building lost 820 exterior 16ft by 24ft panels, and numerous buildings had roof damage and water entry. KSC didn't open for operations for eight days after the storm passed. MILA again sustained only minor damage: a roll-up exterior door was knocked off its tracks, a metal awning over the entrance gate and a mirror to view around the corner blew away, and small amounts of water entered the buildings. The extra precautions appeared to have paid off. PDL lost another solar lamp arm.

Although reopened for personnel, KSC remained buttoned up as an even larger and more powerful storm, Hurricane Ivan, trekked up the Gulf of Mexico toward Tampa. The storm veered west and entered Gulf Shores, Alabama, damaging much of Florida's western panhandle but not the Space Center or PDL. A few days later a piece of Ivan broke off, traveled south over the Atlantic, and visited Florida's east coast, bringing two days of rain. It then traveled west into the Gulf of Mexico, strengthened to a Tropical Storm, and entered Texas.

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Hurricane (from page 26)

After 3 days of operating the following week, KSC quickly declared Hurricon III for Hurricane Jeanne, which had already traveled up the Atlantic, made a loop south and then west and was headed right for central Florida. MILA and PDL were again buttoned up. The next day the Space Center closed, and the next day Hurricane Jeanne landed on Florida's east coast with 120-mph winds only 3 miles from where Frances landed. Jeanne traveled west into Florida then turned north and exited near Tallahassee and into Georgia. KSC received additional damage totaling over 126 million dollars from the hurricanes. MILA's total damage was about 10 thousand dollars. The Shuttle return to flight schedule slipped as a result of the KSC damage and NASA centers closures from the Hurricanes.

Like the Space Center, the local area also experienced damaged roofs and water entry into homes. Power and telephone service were lost. The author's home lost about 50 shingles, 5 trees, part of a fence, and was without power for a total of 15 days after Frances and Jeanne. Being without power did have some advantages, leading to a simpler and more basic lifestyle with much more interaction with neighbors. And oh, the blessings of being TV-less.

Floridians 100 miles south of the space center where Frances and Jeanne made landfall had severe damage from the strong winds and water surge. Seventy percent of the homes there were damaged and some areas are still without electricity.

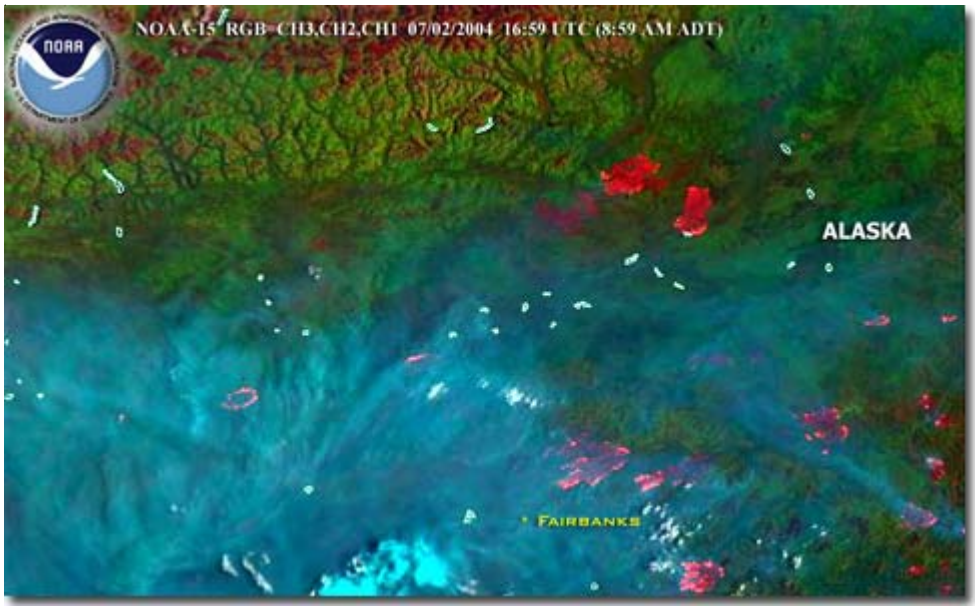
The weather bureau revealed that since 1995, hurricane activity has increased in occurrence and intensity, but Florida had not experienced an increase in incidence - until this year. The hurricane season is from June through November, so it isn't over yet. Some of the boards remain over MILA windows and on residences in the area and will likely remain until November 30.

Figure 1 shows the antenna being removed from the 140-foot tower at MILA in preparation for Hurricane Frances. One crane holds the antenna, the other the people to disconnect it. The tower is not safe to climb because severed bolts were recently found during inspection. Refurbishment of the tower is planned for next month. The antenna is part of the MILA Relay System which relays Radio Frequency signals between a spacecraft being prepared for launch and the Tracking and Data Relay Satellite (TDRS). The antenna was put back on the tower after Frances passed to perform an End-To-End Test between the SWIFT satellite being prepared for launch at Cape Canaveral and its Control Center at Penn State University via TDRS and White Sands. The antenna was again removed after the test in preparation for Hurricane Ivan.

Figure 1.

By Tony Ippolito

The Alaska Boundary Fire and its Impact on the Poker Flat Research Range



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Above is a satellite image, courtesy of NOAA, taken on July 2, 2004, at 16:59 UTC (8:59 Alaska Standard Time, ADT) showing widespread smoke and wildfires within Alaska. On June 13, 2004, almost 3 weeks before this image was taken, lightening ignited a wildfire in a heavily forested area northeast of Fairbanks. Over the next few weeks, winds and dry weather fueled this blaze causing its rapid spread to within several miles of the Poker Flat Research Range (PFRR) and within 20 miles of Fairbanks. It was named the Boundary Fire. During the last 4 days in June, the number of acres burnt increased more than 5-fold from 40,000 to 220,000 acres making it Alaska's highest priority fire[1].

By June 28th, thick smoke had engulfed the Fairbanks vicinity including the PFRR. On the 1st of July 2004, Boundary swept through the PFRR, but was stopped short of Fairbanks, Alaska's 2nd largest city of about 31 thousand inhabitants.

Poker Flat Research Range (PFRR)

The PFRR is the world's largest land-based rocket range and is located about 15 miles north of Fairbanks (30 miles by car), on 5,132 acres[2], just off the Steese highway at mile marker 30. The University of Alaska's Geophysical Institute has owned and operated the range since 1968. The name *Poker Flat* was derived from Bret Harte's 1890's short story, *The Outcasts of Poker Flat*.

Originally, the PFRR was primarily dedicated to the launch of sounding rockets used in atmospheric studies. Since its inception, the range has continued to evolve and diversify to support more advanced experiments. Today, the range encompasses rocket assembly and launch capabilities; tracking, telemetry and command stations; and real-time ground-based atmospheric monitoring devices of the Northern Lights, magnetic storms, and ionospheric disturbances.

Activities at the PFRR have been funded through cooperative agreements with the National Aeronautics and Space Administration (NASA); the U.S. Air Force Geophysics Laboratory; the National Science Foundation; the National Oceanic and Atmospheric Administration (NOAA); and Honeywell Technology Solutions Inc. (HTSI) DataLynx™.

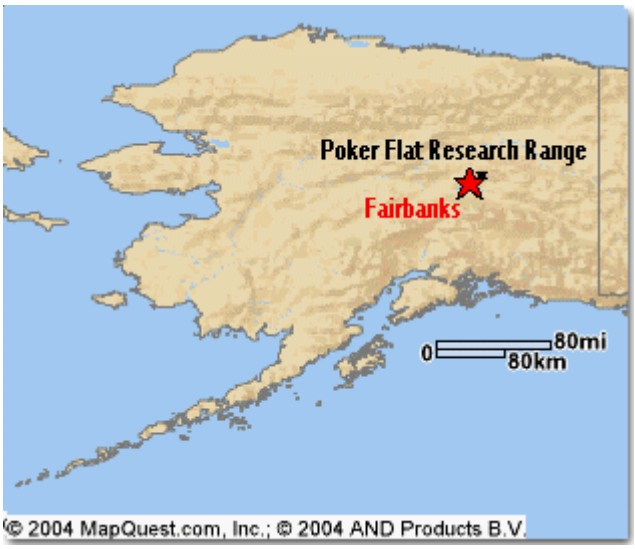
DataLynx is a robust commercial satellite management service including tracking, data acquisition and commanding and mission operations. DataLynx prime automated ground station is located at the PFRR and is remotely monitored from its operations center located in Columbia, Maryland. DataLynx supports both government and commercial clients including NASA.

The following sequence of events during the last 3 days in June and the first several days of July 2004 are based on email messages from Gregory W. Walker, the PFRR manager; Jim Styers, United States Air Force; Gaspar

continued on page 29

Alaska Boundary Fire (from page 28)

Torres, DataLynx Facility Manager; and Richard Franchek, DataLynx Operations Manager. These events detail the progression of the Boundary fire and its impact on NASA mission support activities at the Poker Flat Facility.

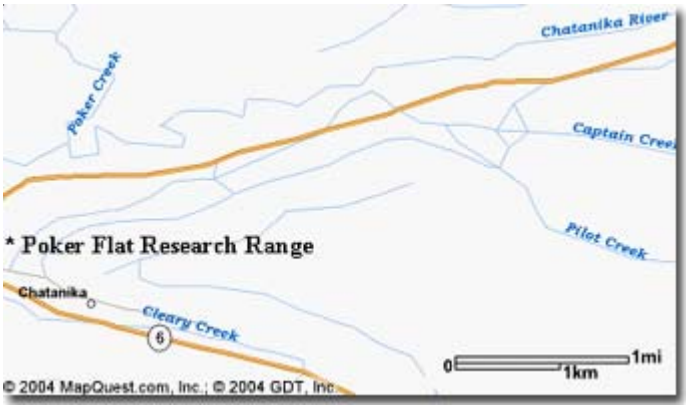


Sequence of Events

June 28
Early in the day, Boundary jumped across the Chatanika River at the 61 mile marker on the Steese Highway and was headed south west, toward the site. However, the Forestry Service projected the fire would by-pass the site based on weather forecasts.

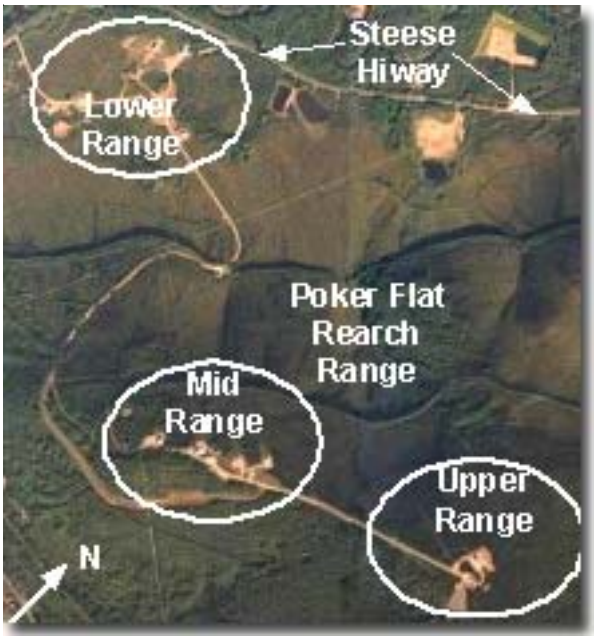
Site air quality was very poor due to thick smoke. On-site personnel were experiencing eye irritation and some breathing problems.

The Weather Service advised people to stay indoors. Visibility was reduced to 1200'. The Steese Highway remained open, but there were delays at mile 45 where a pilot car was used to bus travelers through the burn area. The advance of the fire would continue to be monitored closely.



June 29
The smoke condition improved slightly as the winds shifted from the south. The range remained open, but NASA mission support offload contingency planning was initiated for the Alaska Ground Station (AGS) 11 meter (m) antenna system; the Transportable Orbital Tracking System (TOTS); the Low Earth Orbit Terminal (LEOT); and the DataLynx Poker Flat-1 7.3m antenna system (PF1). The TOTS, LEOT, and the AGS 11m are located in the mid-range and the PF1 is located in the upper-range.

June 30
The wind shifted back to coming out of the northeast up to 30mph. The AGS 11m system and the TOTS were shut down and their satellite supports were migrated to alternate sites in preparation for 0900z PFRR personnel evacuation. The PF1 and LEOT mission supports continued to be taken remotely at the DataLynx Operations Center (DOC) in Columbia, Maryland and Wallops Island, Virginia, respectively.



The range was evacuated as planned at 0900Z (01:00 ADT), while Boundary was reported to be at Steese Highway Mile 39 and progressing toward the range. The Forestry Service placed a fire line at Steese Highway mile marker 32 in an attempt to divert the fire from the PFRR facility. Trees and brush near PFRR buildings were removed and structures were sprayed with fire retardant chemicals as a preventative measure. At 2100Z, the PF1 and LEOT were shut down and their supports offloaded.

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Alaska Boundary Fire (from page 29)

At 8:00 PM ADT, the Boundary began to burn through the upper range with flames reaching as high as 200 to 300 feet. The picture above is from a camera within the Davis Science Observing Room looking North courtesy of Yasuhiro Murayama of the Japanese National Institute of Information and Communications Technology.

July 1
Boundary continued burning through the PFRR facility mostly in the upper- and mid-range. Mission supports were moved off the Poker Flat assets through Friday, July 9th. Antennas and communication lines appear to be intact. In the upper-range, the fire destroyed the Surveillance Radar facility (see photo on page 24, Lost Surveillance RADAR, courtesy of Greg Walker, PFRR manager) and two storage connex's.

July 2
There was a shift in the wind direction causing the fire to blow back on itself thus giving fire fighters the opportunity to take the offensive. The PFRR fire danger has been greatly minimized due to a large reduction in the fire front. Crews began to mop up hot spots in the upper- and mid-ranges, which will continue for at least the next several days.

July 3
An increase in humidity and overnight dew further reduced the fire risk at the range. The fire danger at Poker Flat Research Range was reduced. Fire crews continued to extinguish hot spots.

PFRR staff was allowed to return to work. Post fire recovery procedures were developed to safely restore mission support services. In-depth inspections of the tracking antennas indicated minimal damage. The TOTS, LEOT, and AGS systems took test passes. The PF1 antenna cables needed replacement. Communication ground lines are working, but there is still a concern of power spikes due to fire-damaged trees falling on power lines.

July 4
The winds picked up while the humidity dropped, kicking up several small fires in the lower- and mid-ranges.

Some specially trained fire fighters were recruited to eliminate hot spots, which threatened structures and to totally eliminate the smoldering fire line. One of Alaska state senators, Lisa Murkowski, is expected to visit the range on Monday, July 5th.

July 7
TOTS returned to operational service while LEOT and AGS returned to their pre-fire status of "yellow" due to a software application issue and a bad LHCP X-band low noise amplifier, respectively.

July 9
PF1 was returned to service. Twenty PF1 passes were missed due to the fire, but 60% of these were recoverable.

Summary
The fire at PFRR caused major forestry damage, but only one building was lost. Staged evacuation and contingency support plans maximized PFRR personnel safety and customer support, respectively. Lessons learned from this event were documented and distributed to minimize the impact of any future potential wildfires.

More than 800 fire fighters battled the Boundary Fire and by the end of August 2004, it was 75% contained. In 2.5 months, the Boundary Fire had burned more than half a million acres (>820 square miles).

References
1 The Geophysical Institute at the University of Alaska Home Page at http://www.gi.alaska.edu/whatsnew.html

2 The PFRR Web Site at http://www.pfrr.alaska.edu/pfrr/main.htm

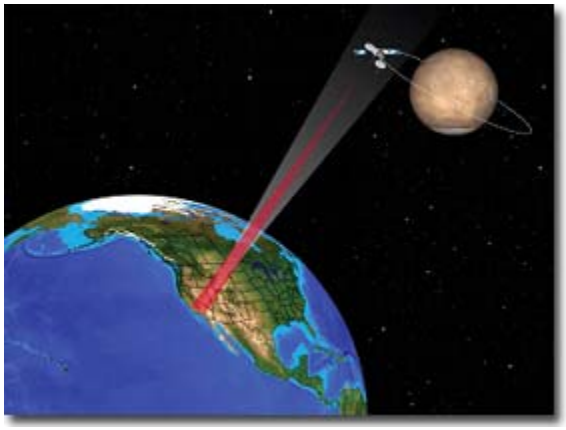
More information on the Boundary Fire can be found at:

The Alaska Fire Service Home Page at http://fire.ak.blm.gov/
The Alaska Division of Forestry Home Page at http://www.dnr.state.ak.us/forestry/

By Van S. Husson

New Mission to Mars

In the near future the National Aeronautics and Space Administration (NASA) anticipates a significant increase in demand for long-haul communications services from deep space to Earth. Distances will range from 0.1 to 40 Astronomical Units (AU), with data rate requirements in the 1's to 1000's of Mbits/second. The near-term demand is driven by NASA's Office of Space Science (OSS), which wishes to deploy more capable instruments onboard spacecraft and increase the number of deep space missions. The long-term demand is filled with extreme communications challenges such as very high data rates from the outer planets, supporting sub-surface exploration, or supporting NASA's Human Exploration and Development of Space Enterprise beyond Earth orbit.



One possible solution to NASA's future long-term communication needs is free-space laser communications. In this context, a laser sends information using a beam of light and optical elements, such as telescopes and optical amplifiers, rather than Radio Frequency (RF) signals, amplifiers, and antennas. Laser communication should enable bandwidth-intense instruments, such as hyper-spectral imagers, synthetic aperture radar (SAR) and instruments with high definition in spectral, spatial or temporal modes to be used in deep space exploration. To this end, OSS directed a laser communication mission be established from Mars. In May of 2003, a Phase II feasibility study of laser communication from Mars was completed. At that time a budget was approved to create the Mars Laser Communication Demonstration (MLCD) project. MLCD consists of a flight laser communication terminal called the Mars Lasercom Terminal (MLT), on-board the Mars Telecommunications Orbiter (MTO), a terrestrial-based optical receive system and a mission operation system. The MTO mission is scheduled to launch in the fall of 2009. The MLCD demonstration will provide a continuous data link of between 1 and 30 Mbits/second from Mars to Earth, depending on the instantaneous distance and atmospheric conditions. This is a significant performance improvement over today's RF systems. MLCD is planning to use ground terminals capable of receiving the encoded laser beam and transmitting an uplink beacon laser to the flight terminal, for active tracking and pointing control of the narrow laser beam. Critical technologies for receiving the deep space signal include low-cost large collection apertures and low-noise photon-counting detectors. MLCD will provide much needed engineering insight by the end of this decade.

The Mars Laser Communication Demonstration project consists of three partnering organizations: NASA's Goddard Space Flight Center (GSFC), NASA's Jet Propulsion Laboratory (JPL) and the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL). The MLCD Project is newly formed as Code 455 within the Space Communications Program Office (Code 450) of the Flight Programs and Projects Directorate at GSFC. MLCD is led by Project Formulation Manager Rick Fitzgerald, along with Financial Manager Laurey Adkison. Other key GSFC personnel include Flight Terminal Manager Bernie Edwards, Instrument Systems Engineer Mark Flanegan, Systems Engineering Manager Chi Wu, and Co-Investigator Dr. Mike Krainak, all from AETD. Newly appointed Resources Analyst Donna Montgomery (Code 455) is also critical to success of the project. The MLCD Deputy

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New Mission to Mars (from page 31)

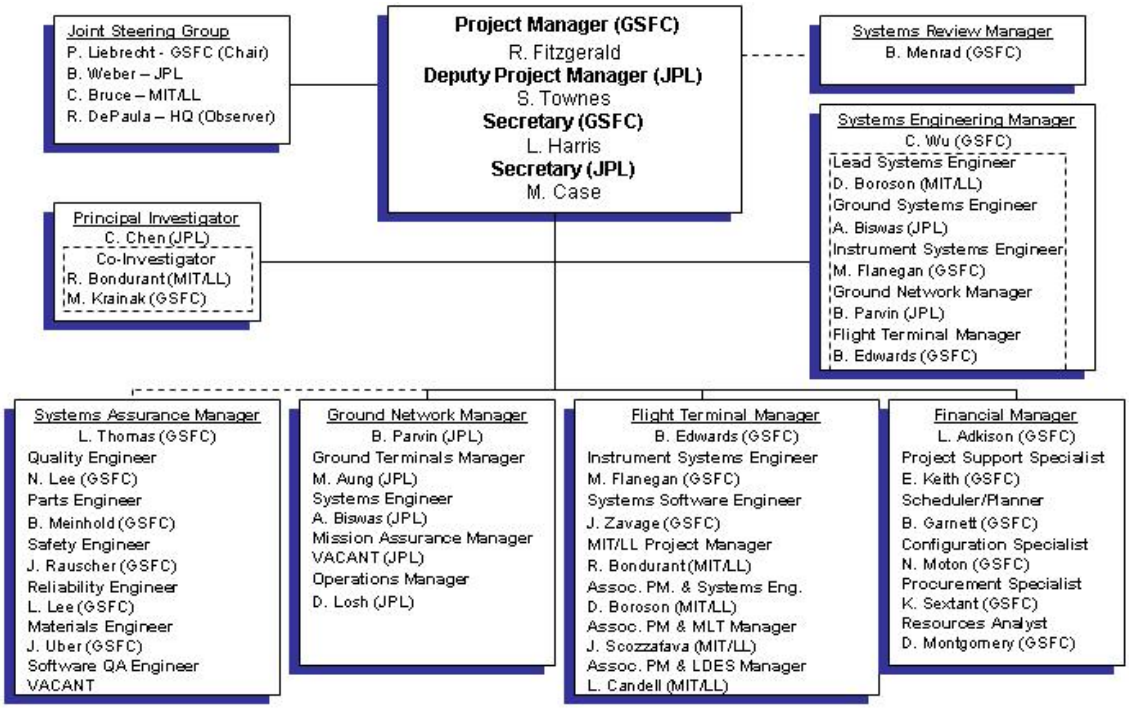
GSFC MLCD Team

Project Manager is Dr. Steve Townes from JPL. Since its inception last year, the MLCD Project successfully completed a Concept Review in January 2004 and is headed toward a Systems Requirements Review in October of this year. In between, the project was forced to descope portions of the ground system, in order to maintain a healthy management reserve. After a short Phase B, the project will hold its Preliminary Design Review on January 2005. Delivery of the laser instrument to MTO is scheduled for February 2008.

With an aggressive schedule and a cutting-edge technology development in front of it, the MLCD project is faced with a difficult challenge. The project, however, is staffed with many of the world's leading experts in free-space laser communication. The MLCD team has already made steady progress and is willing to take on this new mission to Mars!

By Richard Fitzgerald

MLCD Organization Chart



SCP People & Announcements

The following are recipients of the 2004 NASA Honor Awards Group Achievement Award:
The GSFC SMCDS Procurement Team "In recognition for your exceptional dedication and commitment in support of the Space Mission Communications and Data Services Acquisition."

The 451/Special Projects and Missions Team "For outstanding resourcefulness, initiative and achievement in support of Homeland Security following the September 11, 2001 terrorist attack in the United States of America."

TDRS-I Orbit Raising Recovery Team "For the personal sacrifice, dedication and engineering excellence exhibited by the NASA/Boeing team which led to the successful recovery of the TDRS-I spacecraft."

The following are additional recipients of 2004 NASA Honor Awards:
John Hankinson/450 received the 2004 NASA Honor Awards Public Service Medal "For your exceptional leadership and technical contribution in meeting the challenges associated with network support for the launches of the TDRS H, I, J spacecraft."

Edward Lowe/454 received the 2004 NASA Honor Awards Exceptional Service Medal "In recognition for your outstanding leadership and dedication during the successful development and implementation of the TDRS H,I,J Replenishment Program."

Robert Jenkens/454 received the 2004 NASA Honor Awards Outstanding Leadership Medal "In recognition for your outstanding leadership and dedication enabling the successful development and implementation of the TDRS H,I,J Replenishment Program."

The Code 400 Peer Awards

Congratulations to *Jon Walker/451* on being nominated and receiving the FPPD Peer Award for Honoring Diversity.

Other members of the 450 family who received nominations for the Code 400 Peer Awards were *Evette Conwell/451, Dick Schonbachler/451, Tammy Wang/451, Bryan Gioannini/452, Diane Rawlings/452, Paula Tidwell/452*, and *Karen Snyder/PAAC-II*.

Phil Liebrecht/450 received the Core/Red/Blue Group NASA Achievement Award for 2004 as a member of the NASA Space Exploration Blue Team.

GN's AGS operators were commended by R. Pickering and Carolyn Dent, in response to the 7/20/04 Poker Flat Research Range Power Outage, acknowledged the AGS team: "due to the aggressive work of the AGS operators, we were able to complete a successful contact at 1:45 (1745GMT)."

The Space Network DSMC team for Launch Support of Aura (on-site SN schedulers) were personally thanked by Paul Ondrus, Aura Project, for their support of Aura through many replans. He also wanted WSC schedulers to be acknowledged: *Deborah Moran, Alexis Aguirre, Annette Garcia, Mike Ostic, and Rich Romansky*.

The *Ground Network Project* received thanks from the Genesis Project, Genesis Telecommunications & Systems Manager, Steve Waldherr, JPL for: "..gratitude for providing Santiago services for tracking the Genesis Spacecraft on 9/8/04. We truly appreciate the preparation and hard work that lead up to a flawless support by the Santiago tracking site...We appreciated your professionalism during all the interfaces with the JPL Deep Space Network and the Genesis Project."

The *Customer Commitment Office* and *Ground Network* successfully completed on schedule the ISS Soyuz VHF2 Comm Tests. Mark Severance (NASA/JSC Gemini Systems), for the ISS Operations Teams in Houston and Moscow, expressed appreciation to the Spectrum Mgmt community for allowing conduct of the critical emergency comm system. "Your efforts and support have made a significant contribution to enhancing the safety of ISS operations for the duration of the program."

Ted Sobchak/451 received a Group Achievement Award for his participation in the GSFC Exploration Task Group.

The *SMCDS Team* received a Group Achievement Award.

Todd Probert/NENS received the Quality and Process Improvement Award on behalf of the White Sands Complex Chiller Plant Team. The award was presented at the 2004 Annual Awards of Excellence Ceremony on October 6, 2004.

Ken Griffin/WFF received the Customer Service Excellence Award on behalf of the Alaska Wildfire Response & Recovery Team. The award was presented at the 2004 Annual Awards of Excellence Ceremony on October 6, 2004.

Marilyn Seppi/210, the former NENS Contracting Officer, accepted a position (with a promotion!) with the NASA Headquarters Contract Management Division as a Procurement Analyst. We bid Marilyn farewell and congratulations on her new job.

Klaus Sexton/210 has been appointed as the new NENS Contracting Officer. Congratulations to Klaus on his new position here with SCP.

The Ground Network Project welcomes Denese Logan. She is employed by Service Source and provides administrative support to the GN. Denese has been at Goddard for eight years. Her previous experience was with the QSS/MEDS contract.

The Ground Network Project welcomes Doris Handy. She is employed by Service Source and provides administrative assistance to the Research Range Services office at Wallops. Doris has been at Wallops for 17 years and has worked at the telephone office, the Wallops Orbital Tracking Station scheduling office, and with the Balloon Program.

Code 450 welcomes Debbie Williams. Debbie is a newcomer to Goddard. She works in the financial area as a Resource Analyst.

It is with the deepest regret that we learned of the passing of one of our friends and colleagues, Mr. John Joseph Catena, Jr. John had been at Goddard for 18 years. Our sympathy goes out to his family.

Lisa Wilderson joins the PAAC-II contract as Data Manager for both the Space and Ground Networks. Lisa has been at Goddard for four years and was previously employed by Code 504, Technology Transfer Office.

Linda Kearney is the PAAC-II representative to the new Code 456, Space Network Expansion Project. Linda has been at Goddard for six years and comes from the Astro-E2 Project, Code 410.5.

Karen Jackson is the PAAC-II Project Support Specialist for the Mars Laser Communication Demonstration, Code 455. Karen has been at Goddard for four years and worked previously with Code 923, Biospheric Sciences, as a Project Support Analyst and Code 155, Reimbursables. Karen will be located in the new MLCD suite of offices at the end of the East corridor in Building 12.

Linda Vaughn is one of the PAAC-II Configuration Managers for the Space Network. Linda has a wealth of experience dating back to 1976 when she worked for CSTA in operations here at Goddard. Her most recent experience has involved software testing for Raytheon.

Congratulations to John Daniels on his retirement from Code 450. John retired on July 30 after serving 36 years with the Federal Government; 10 years with the military and 26 years at NASA. His service to NASA spanned the Apollo, Space Shuttle, and International Space Station eras of the U.S. Space program. We will miss John and thank him for his hard work and dedication.

The ***Space Communicator*** is located on the SCP website at
http://scp.gsfc.nasa.gov/communicator

Previous issues of this publication, formerly named *The Integrator*, are also available online in the newsletter archive.

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