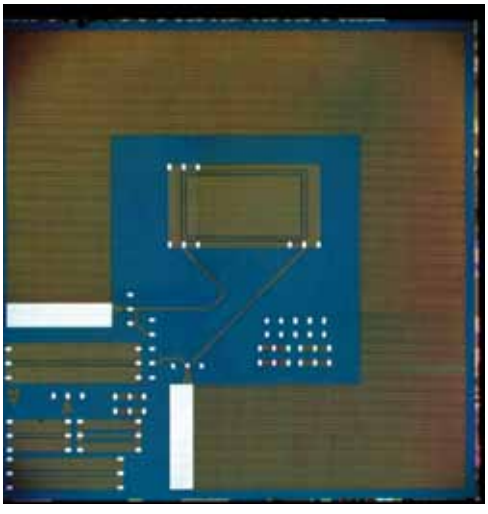
News



Shown is a potential on-chip rhombic antenna topology solution. (Photo courtesy of NYU WIRELESS)

Teams Investigate ANTENNA MODELING/ CONTROL And PROTOCOLS For 60-GHz RANGE

As wireless data traffic increases, more and more solutions are being sought to relieve the stress put on wireless networks. One much-discussed option is the unlicensed bandwidth in the 60-GHz range. As part of the National Science Foundation's (NSF) Networking Technology and Systems (NeTS) program, a grant has been awarded to explore the 60-GHz band in order to better understand its characteristics and develop effective protocols for future networks.

The $500,000 NSF award was given to two individuals: NYU-Poly Electrical and Computer Engineering Chair, Ted Rappaport, and Professor Shiwen Mao of Auburn University. They will lead research teams, comprised of professors and students from the NYU WIRELESS research center, in developing modeling and control techniques for new antennas *(see photo)*. Those antennas will be used in millimeter-wave bands including the 60-GHz spectrum. Mao and Rappaport also aim to create new network protocols and multimedia communications techniques for 60-GHz networks.

One of the team's proposed solutions is an on-chip antenna. In the IEEE paper, "State of the Art in 60-GHz Integrated Circuits and Systems for Wireless Communications," Rappaport and two students discussed integrating and combining antennas directly on chips for future subterahertz communications devices. The report states, "While radiation losses are extremely large due to substrate absorption and conductive currents, the removal of all connections between RF circuits and the antenna offers substantial cost reduction and flexibility in circuit design for low-cost consumer electronics."

The paper notes that although typical on-chip antennas have only 10% efficiency and negative gain, high-gain antenna structures can be designed and fabricated on chip in sub-millimeter sizes. This is possible by using frequency-selective surfaces or highly directional antennas (such as Yagi or rhombic). Such antennas could then be used in large antenna arrays.

This project is part of a global effort to make use of the huge, license-free pieces of spectrum for cellular and backhaul networks. The research could accelerate the deployment of more powerful, bandwidth-intensive, and cheaper wireless applications and services. These, in turn, could support more versatile, robust, and multimedia-rich wireless networks.

This is the second NeTS grant that has supported NYU-Poly's research in the millimeter-wave spectrum. The previous grant, for $1.2 million over four years, supported research to advance broadband connections through millimeter-wave networks. The Federal Communications Commission (FCC) also has delved into millimeter-wave technology, recently modifying the rules for outdoor 60-GHz devices. Changes included altering the rules that could potentially connect broadband networks and WiFi without the need of fiber lines.

Information for this article was also gathered from the NYU WIRELESS presentation, "The Renaissance of Wireless Communications in the Massively Broadband Era."■

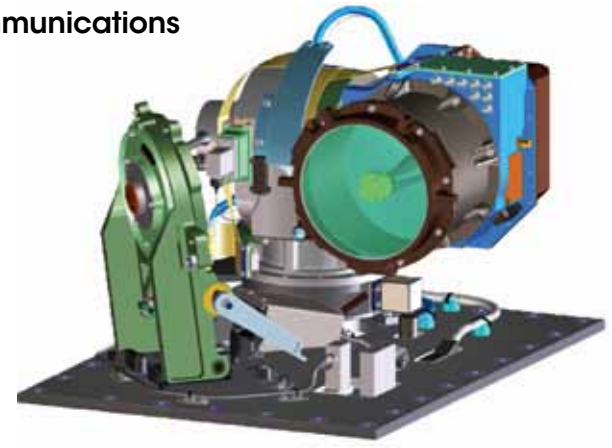
LASER BEAMS REPLACE RF For Lunar Communications

NASA HAS RELIED on RF communication since its first mission into space. As data-capacity demands increase, however, RF is reaching its limits. To extend capabilities, a new system uses lasers as opposed to radio waves for two-way communication. Such communications include increased image resolution and 3D video transmission from deep space. Dubbed Lunar Laser Communication Demonstration (LLCD), NASA's new system recently proved its ability to transmit data between the moon and Earth *(see figure)*.

In the demonstration, LLCD used a pulsed laser beam to transmit data over 239,000 miles from the primary ground station in New Mexico to the spacecraft. That spacecraft is currently orbiting the moon at a download rate of 622 Mb/s—the fastest to date. LLCD technology is capable of reducing the download time of an average-length movie from 639 hrs. to less than 8 min.

By encoding data onto a beam of laser light, LLCD enables "optical communications" or the use of light as the medium for data transmission. Common uses of optical communications use the visible or near-visible portions of the electromagnetic (EM) spectrum. LLCD, however, operates in the near-infrared section in the form of a laser beam. Laser communications enables NASA to work within an unregulated, less-crowded section of spectrum.

Laser wavelengths also are 10,000 times shorter than RF wavelengths, allowing for data to be transmitted across narrower, tighter beams. These smaller wavelengths are more secure and can deliver the same amount of signal power to much smaller collecting antennas. The subsequent reduction in antenna size reduces satellite size and mass, creating a system of terminals that can support higher data rates while lowering cost as well as volume and power requirements.



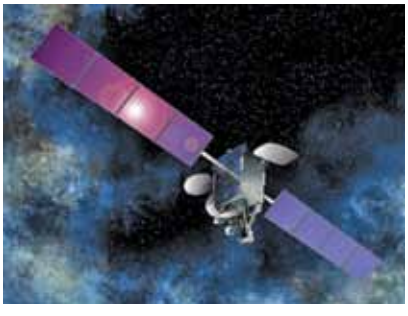
An artistic rendering of the optical module of LLCD. (Photo courtesy of NASA.)

LLCD is hosted aboard NASA's Lunar Atmosphere and Dust Environment Explorer (LADEE), which launched in September 2013. The 100-day robotic mission hopes to provide data that will help to determine whether dust is the cause for a mysterious glow previously observed on the lunar horizon.■

THOR SATELLITE CONSTELLATION Gains Ka-band Payload

PROVIDING BROADBAND SERVICES over parts of Central and Eastern Europe, the THOR (no relation to the Norse god) constellation is adding another satellite to the mix: THOR 7. Based on Space Systems/Loral's (SS/L) LS-1300, the satellite has a total continuous power range from 5 to 12 kW with on-board transmitter power exceeding 5000 W *(see figure)*. The high-throughput satellite (HTS) will help to meet the growing demand for maritime broadband services while providing strong signals over Europe's main shipping routes and oil and gas exploration areas. Equipped with 25 spot beams, THOR 7 also marks Telenor Satellite Broadcasting's (TSBc's) first Ka-band payload.

iDirect's Velocity product line will be used as the ground infrastructure solution. Across the 25 spot beams, the HTS payload will deliver up to 9 Gb/s of throughput. THOR 7 is also equipped with 11 Ku-band transponders, facilitating internetworking roaming with other Ku- and Ka-band satellite operators. THOR 7 also marks the continued evolution from mobile satellite systems (MSSs) to very-small-aperture-terminal (VSAT) systems. The iDirect platform promises to enable automatic, seamless spot-beam handover across all beams, ensuring continuous mobile connectivity. It also will establish an integrated capacity pool, using a time-division-multiple-access (TDMA) hub. That hub can then be efficiently distributed, enabling the development of service plans across the entire coverage area. The platform also utilizes automatic beam switching, whereby a router can automatically repoint an antenna and transfer connectivity to a new beam when a satellite approaches a beam's edge.



An artistic rendering of the THOR 7 satellite. (Photo courtesy of Space Systems/Loral.)

Powered by two deployable solar arrays, the system has a projected lifetime of 15 years. A remote-management appliance is located on-board the satellite, serially connecting its communications and networking devices at a centralized point at TSBc's network-operations center. THOR 7 is expected to launch in the second half of 2014.■

A RUNDOWN OF THE GOES-R WEATHER SATELLITE: The Latest from NASA

A NEW WEATHER satellite, which improves forecasting quality and timeliness, recently reached a significant milestone when its system module was powered on for the first time. Developed by the National Oceanic and Atmospheric Administration (NOAA), the Geostationary Operational Environmental Satellite-R series (GOES-R) will benefit the US and Western Hemisphere in the areas of public safety, severe weather monitoring, space weather prediction, ecosystems management, and transportation *(see photo)*. The data from the satellite provides accurate, real-time forecasts to NOAA's National Weather Service and other organizations.

The GOES-R includes three types of instruments: Earth sensing, solar imaging, and space environment measuring. The Earth-sensing instruments include an Advanced Baseline Imager (ABI) that maps the Earth's weather, climate, and environment. It views the Earth with 16 different spectral bands, thereby providing three times more spectral information and four times the spatial resolution at a rate five times faster than the current GOES system. The Geostationary Lightning Mapper (GLM) takes continuous measurements of frequent intra-cloud lightning, which usually correlates with impending tornadoes and severe storms.

Pointing toward the sun are the Solar Ultraviolet Imager (SUVI) and Extreme Ultra Violet Sensor (EUVS) and X-Ray Irradiance Sensor (EXIS). The SUVI telescope observes the Sun in the extreme ultraviolet-wavelength range, looking specifically at complex, active regions, and solar flares. Those flares have the potential to affect the Earth's environment and can potentially disrupt communications and navigation systems. The EUVS and EXIS sensors detect solar soft-X-ray irradiance and solar extreme-ultraviolet spectral irradiance in the 5-to-127-nm range.

Using a Space Environment In-Situ Suite (SEISS) and Magnetometer (MAG), the GOES-R also can monitor its own space environment. SEISS uses an array of sensors to monitor the proton, electron, and heavy-ion fluxes of the geosynchronous orbit, gathering information that can help mitigate damage to radio communications during high-flux events. The MAG on the satellite measures the magnetic field surrounding it, which helps to validate the large-scale space environment models used in operations.

The latest GOES-R satellite will eventually replace the current GOES system, providing near real-time forecasts.

Data provided by the instrument suite is relayed through a Unique Payload Services (UPS) suite consisting of the GOES-R Rebroadcast (GRB), Data Collection System (DCS), Emergency Managers Weather Information Network (EMWIN), and Search and Rescue Satellite Aided Tracking (SARSAT). For its part, GRB provides full-resolution, calibrated, navigated, near-real-time direct broadcast data.

The DCS relay system collects information from Earth-based platforms that gather sensor data according to a predefined set of frequencies and schedules. EMWIN is a direct service that provides users with information directly from the National Weather Service in near-real time, including forecasts, warnings, and graphics. Lastly, the SARSAT System is used to locate mariners, aviators, and the like in emergency situations via a network of satellites and distress signals sent from emergency beacons.

The system module of the A2100-based satellite will be tested to demonstrate the functionality and integration of three major electrical subsystems: command and data handling, communication, and electrical power. Once testing is completed, the system module will be integrated with the propulsion module.■

PEOPLE

TMD TECHNOLOGIES LTD.—Has announced several top management changes. Peter Butcher, who led the previous management team, has moved to the new role of Executive Chairman. Other new appointments include Dave Brown (Managing Director), James Allibone (Sales and Business Development Director), Howard Smith (Engineering Director), Martin Woolley (Finance Director), and Nigel Hann (Head of Sales). TMD also has announced the retirement of Sales Director Graham Brown and Finance Director John Hill after 16 and 43 years of service, respectively.

BUTCHER

BROWN

NORTHROP GRUMMAN—Douglas Raaberg has been appointed Chief Executive United Arab Emirates (UAE). A US Air Force veteran, Raaberg previously served as Director, Battle Management Command and Control (BMC2) Campaign Lead within the firm's Aerospace Systems sector.

RAABERG

VITESSE—Uday Mudoi has been named Vice President, Product Marketing. A 13-year Vitesse veteran, Mudoi previously held roles at Siemens and Oralogic.

QUALCOMM—Has elected Clark Randt to the firm's board of directors. As the current President of Randt & Co. LLC, Randt served as US Ambassador to China from 2001 to 2009.