

## RECENT DEVELOPMENTS IN HIGH-DATA-RATE OPTICAL COMMUNICATIONS AT JPL

Keith E. Wilson  
Jet Propulsion Laboratory  
California Institute of Technology  
4800 Oak Grove Dr. MS 161-135  
Pasadena CA 91109-8099  
(818) 354-9387

Optical communications is a telecommunications technology that meets the demand for high-data-rate, long-range free-space links using small, low-mass, low-power-consumption subsystems. To better understand the performance of this technology, a series of turn-of-the-century demonstrations that follow up on the successes of the early and mid-1990s have been planned both in the U.S. and abroad. This paper will report on planned key developments in the NASA/JPL optical communications program in the first decade of the next millenium that will pave the way for future high-data-rate, free-space optical communications.

We shall describe progress in the construction of NASA/JPL's first optical communications ground terminal, the Optical Communications Telescope Laboratory (OCTL). Construction of this 200 square meter laboratory at TMF (Table Mountain Facility, Wrightwood, CA) is scheduled to be completed in October 1999. The contract for the telescope, its pier, and the dome was awarded to Contraves-Brashear, Pittsburgh, PA in September 1999. First light at the telescope is scheduled for the first quarter of 2001. An R&D station, OCTL will serve as NASA/JPL's primary ground station for its optical communications demonstrations. In addition, it will be used as an experimental laboratory for evaluating the performance of optical receivers for the future deep space and near-Earth optical ground station networks. It will also be used to develop laser-beam-propagation strategies for beacon and data uplinks to satellites and spacecraft.

Developments at the TMF and AMOS (Air Force Maui Optical Station, HI) ground stations for the (Space Technology Research Vehicle) STRV-2 demonstration will be reported. This LEO (Low-Earth-orbit)-to-ground demonstration is scheduled for early 2000, and it will support unidirectional and bi-directional links from the STRV-2 satellite. Downlink data rates are up to 1 Gbps, at ranges out to 3300 km.

The high-data-rate optical communications demonstration from the International Space Station (ISS) to the OCTL will be discussed. This demonstration is scheduled for 2003 and will use the optical communications demonstrator (OCD) terminal currently under development at JPL. A key objective of the demonstration is to assess the performance of a 2.5 Gbps space-to-ground link. In addition, the OCD will provide a high rate capability to the ISS transmitting data to the OCTL at up to OC-3 (155 Mbps) data rates.

LEO-to-GEO (geostationary orbiter) optical crosslinks can facilitate the recovery of the large volumes of data from spacecraft instruments such as hyperspectral imagers and Fourier transform spectrometers. We shall describe the design of a second-generation OCD terminal to support a crosslink for recovering such data from a typical polar orbiting satellite.

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