25 dB. This result illustrates the usefulness of the integrated radial probe transition, and the wide (over 10-percent) bandwidth that one can expect for amplifier modules with integrated radial probes in the submillimeter-regime (>300 GHz).

This technology was developed for a submillimeter-wave imaging system under the DARPA SWIFT program, in collaboration with Northrop Grumman Corporation. Submillimeter-wave imaging has many applications to homeland security, hidden weapons detection, airport security, detection of bio-weapons, as well as potential applications in commercial test equipment. This technology is partially a semiconductor chip product and partially a waveguide module. The semiconductor is not fixed in its final form, but the module is essentially fixed in its final form.

This work was done by Lorene Samoska, Goutam Chattopadhyay, David Pukala, Todd Gaier, Mary Soria, and King Man Fung of Caltech and William Deal, Gerry Mei, Vesna Radisic, and Richard Lai of Northrop Grumman Corporation for NASA's Jet Propulsion Laboratory. The contributors would like to acknowledge the support of Dr. Mark Rosker and the Army Research Laboratory. This work was supported by the DARPA SWIFT Program and Army Research Laboratory under the DARPA MIPR no. 06-U037 and ARL Contract no. W911QX-06-C-0050. Further information is contained in a TSP (see page 1). *NPO-45088*

Metrology System for a Large, Somewhat Flexible Telescope

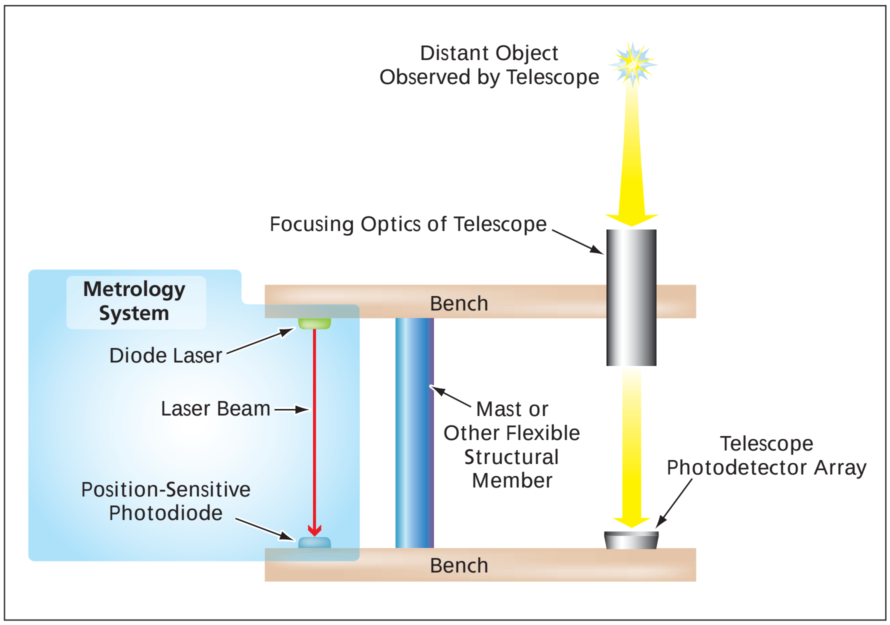
This system would measure focal-plane position errors caused by structural deformations.

NASA's Jet Propulsion Laboratory, Pasadena, California

A proposed metrology system would be incorporated into a proposed telescope that would include focusing optics on a rigid bench connected via a deployable mast to another rigid bench holding a focal-plane array of photon counting photodetectors. Deformations of the deployable mast would give rise to optical misalignments that would alter the directions (and, hence, locations) of incidence of photons on the focal plane. The metrology system would measure the relative displacement of the focusing-optics bench and the focal-plane array bench. The measurement data would be used in post-processing of the digitized photodetector outputs to compensate for the mast-deformation-induced changes in the locations of incidence of photons on the focal plane, thereby making it possible to determine the original directions of incidence of photons with greater accuracy.

The proposed metrology system is designed specifically for the Nuclear Spectroscopic Telescope Array (NuSTAR) a proposed spaceborne x-ray telescope. The basic principles of design and operation are also applicable to other large, somewhat flexible telescopes, both terrestrial and spaceborne. In the NuSTAR, the structural member connecting the optical bench and the photodetector array would be a 10-m-long deployable mast, and there is a requirement to keep errors in measured directions of incidence of photons below 10 arc seconds (3 sigma).

The proposed system would include three diode lasers that would be mounted on the focusing-optics bench. For clarity, only one laser is shown in the figure, which is a greatly simplified schematic diagram of the system. Each laser would be aimed at a position-sensitive photodiode that would be mounted on the detector bench alongside the aforementioned telescope photodetector array. The diode lasers would operate at a wavelength of 830 nm, each at a power of 200 mW. Each laser beam would be focused to a spot of ≈1-mm diameter on the corresponding position-sensitive photodiode. To reduce the effect of sunlight on the measurements, a one-stage light baffle and an 830-nm transmission filter of 10-nm bandwidth would be placed in front of the position-sensitive photodiode. For each metrology reading, the output of the position-sensitive detector would be sampled and digitized twice: once with the lasers turned on, then once with the lasers turned off. The data from these two sets of samples would be subtracted from each other to further reduce the effects of sun glints or other background light sources.



This **Deformation of the Mast** would change the position of incidence of the laser beam on the position-sensitive photodiode.

This work was done by Carl Christian Liebe, Randall Bartman, and Walter Cook of Caltech and William Craig of Lawrence Livermore National Laboratory for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).NPO-44119