equipped with custom wafer probes (see figure) designed for the noted frequency band, which is that of WR-3 waveguides [waveguides having a standard rectangular cross section of 0.0340 by 0.0170 in. (0.8636 by 0.4318 mm)]. Among other things, the measurements showed a peak gain of 10 dB at a frequency of 235 GHz.

This work was done by Douglas Dawson, King Man Fung, Karen Lee, Lorene Samoska, Mary Wells, Todd Gaier, and Pekka Kangaslahti of Caltech; and Ronald Grundbacher, Richard Lai, Rohit Raja, and Po-Hsin Liu of NGST for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

NPO-42202

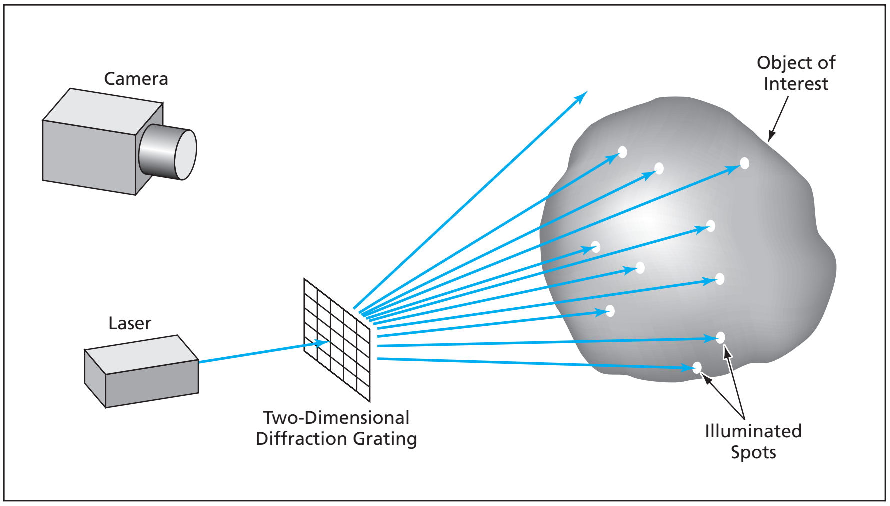
Mapping Nearby Terrain in 3D by Use of a Grid of Laser Spots

A relatively simple system would utilize triangulation.

NASA's Jet Propulsion Laboratory, Pasadena, California

A proposed optoelectronic system, to be mounted aboard an exploratory robotic vehicle, would be used to generate a three-dimensional (3D) map of nearby terrain and obstacles for purposes of navigating the vehicle across the terrain and avoiding the obstacles. Like some other systems that have been, variously, developed and proposed to perform similar functions, this system would include (1) a light source that would project a known pattern of bright spots onto the terrain, (2) an electronic camera that would be laterally offset from the light source by a known baseline distance, (3) circuitry to digitize the output of the camera during imaging of the light spots, and (4) a computer that would calculate the 3D coordinates of the illuminated spots from their positions in the images by triangulation.

The difference between this system and the other systems would lie in the details of implementation. In this system, the illumination would be provided by a laser. The beam from the laser would pass through a two-dimensional diffraction grating, which would divide the beam into multiple beams propagating in different, fixed, known directions (see figure). These beams would form a grid of bright spots on the nearby terrain and obstacles. The centroid of each bright spot in the image would be computed. For each such spot, the combination of (1) the centroid, (2) the known direction of the light beam that produced the spot, and (3) the known baseline would constitute sufficient information for calculating the 3D position of the spot.



A **Diffraction Grating Would Split a Laser Beam** into multiple beams to project a grid of bright spots onto an object of interest. A camera offset from the laser and diffraction grating would capture an image of the illuminated spots. The 3D positions of the spots would be computed from their positions in the image by triangulation.

Concentrating the illumination into spots, instead of into lines as in some other systems, would afford signal-to-noise ratios greater than those of such other systems and would thereby also enable this system to image terrain and obstacles out to greater distances. The laser could be pulsed to obtain momentary illumination much brighter than ambient illumination, and the camera could be synchronized with the laser to discriminate against ambient light between laser pulses.

This work was done by Curtis Padgett, Carl Liebe, Johnny Chang, and Kenneth Brown of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

NPO-40611

Digital Beam Deflectors Based Partly on Liquid Crystals

Laser beams are switched to different directions, without using solid moving parts.

John H. Glenn Research Center, Cleveland, Ohio

A digital beam deflector based partly on liquid crystals has been demonstrated as a prototype of a class of optical beam-steering devices that contain no mechanical actuators or solid moving parts. Such beam-steering devices could be useful in a variety of applications, including free-space optical communications, switching in fiber-optic communications, general optical switching, and optical scanning. Liquid crystals are of special interest as active materials in nonmechanical beam steerers and deflectors because of their structural flexibility, low operating voltages, and the relatively low costs of fabrication of devices that contain them. Recent advances in synthesis of liquid-crystal ma-