with multiple processing paths. These multiple processing paths provide for greater tolerance to various component failures. The DSC was designed so that all housekeeping processing functions are performed by either the Mil-Std-1750 processor or the R3000 processor. The image capture and storage is performed either by the DHU or the R3000 processor.

The DSC interfaces to six sensors using two data and control buses. The image data are compressed using a JPEG compression device. The DHU is configured on a frame-by-frame basis to either store data in an uncompressed form or store data in a compressed form using one of the four compression tables stored in the JPEG device. The captured images are stored in a 1.6-Gbit solid-state recorder that is part of the DSC for playback to the ground. Images can be captured by the DSC either on demand, one frame at a time, or by preloading a sequence of images to be captured by the DHU without processor or ground intervention.

As for the future, the Naval Research Laboratory is currently developing a fault-tolerant spacecraft controller using the RH3000 processor chip set. The processor includes shadow checker, real time hardware rollback, fault-tolerant memory, hardware cache coherence, and more.

S15 N93-28779 160725 p. 1

DESIGN CONCEPT FOR AN IR MAPPING SPECTROMETER FOR THE PLUTO FAST FLYBY MISSION. U. Fink[1], F. Low, B. Hubbard, M. Rieke, G. Rieke, M. Mumma, S. Nozette, G. Neukum, H. Hamel, M. DiSanti, M. Buie, and A. Hoffman, [1]Lunar and Planetary Laboratory, University of Arizona, Tucson AZ 85721, USA.

The design of an IR mapping spectrometer that exceeds all the criteria of the Pluto Fast Flyby Mission will be presented. The instrument has a mass of ~1700 g and uses less than 4 W of power. The design concept is based on an *f*/3 spectrograph using an aberration-corrected concave holographic grating. Up to four spectral regions can be covered simultaneously by dividing the grating into two to four sections, each imaging the entrance slit on a different area of the array. The spectrography will be fed by a lightweight 5" *f*/3 telescope based on SDIO precepts. In order to provide spectroscopic access to the fundamental molecule frequencies, an extended-range NICMOS array to ~3.5 μm and an InSb array going to 5.8 μm will be considered.

S16 N93-28780 160726 p. 1

MULTIBEAM LASER ALTIMETER FOR PLANETARY TOPOGRAPHIC MAPPING. J. B. Garvin, J. L. Bufton, and D. J. Harding, Laboratory for Terrestrial Physics, Code 920, Goddard Space Flight Center, Greenbelt MD 20771, USA.

Laser altimetry provides an active, high-resolution, high-accuracy method for measurement of planetary and asteroid surface topography. The basis of the measurement is the timing of the round-trip propagation of short-duration pulses of laser radiation between a spacecraft and the surface. Vertical, or elevation, resolution of the altimetry measurement is determined primarily by laser pulsewidth, surface-induced spreading in time of the reflected pulse, and the timing precision of the altimeter electronics. With conventional gain-switched pulses from solid-state lasers and nanosecond resolution timing electronics, submeter vertical range resolution is possible anywhere from orbital altitudes of ~1 km to altitudes of several hundred kilometers. Horizontal resolution is a function of laser beam footprint size at the surface and the spacing between successive laser pulses. Laser divergence angle and altimeter platform height above the surface determine the laser footprint size at the surface, while laser pulse repetition rate, laser transmitter beam configuration, and altimeter platform velocity determine the spacing between successive laser pulses.

Multiple laser transmitters in a single laser altimeter instrument that is orbiting above a planetary or asteroid surface could provide across-track as well as along-track coverage that can be used to construct a range image (i.e., topographic map) of the surface. We are developing a pushbroom laser altimeter instrument concept that utilizes a linear array of laser transmitters to provide contiguous across-track and along-track data. The laser technology is based on the emerging monolithic combination of individual, 1-cm^2 diode-pumped Nd:YAG laser pulse emitters. The laser pulse output at 1 μm that results from each element is approximately 1 ns in duration and is powerful enough to measure distance to the surface from short range (1–10 km). Laser pulse reception is accomplished in this concept by a single telescope that is staring at nadir and is equipped with a single detector element in its focal plane. This arrangement permits a fixed alignment of each transmitter output into a separate, dedicated sensor footprint, yet minimizes instrument complexity. For example, a linear array of 20 laser transmitters oriented perpendicular to the orbit motion could map an asteroid surface at a spatial resolution of 50 m in a 1-km swath. The two-dimensional topographic image might be most appropriate for missions in which multispectral imaging data are also acquired. The instrument is also capable of laser pulse energy measurement for each sensor footprint, yielding a measure of surface reflectance at the monochromatic 1-μm laser wavelength.

It should also be possible to produce a device that is capable of simultaneous operation on all elements for long-range operation at the millijoule-per-pulse performance level or time-division-multiplexed operation of single laser emitter elements to produce the desired pushbroom laser altimeter sensor pattern on the planetary or asteroid surface. Thus the same device could support operational ranging to an asteroid from long range and scientific observations at high resolution simply by simultaneously or sequentially addressing the multiple laser transmitter elements. Details of the multi-emitter laser transmitter technology, the instrument configuration, and performance calculations for a realistic Discovery-class mission will be presented.

N93-28781 160727 p. 2

ACOUSTO-OPTIC INFRARED SPECTRAL IMAGER FOR PLUTO FAST FLYBY. D. A. Glenar[1] and J. J. Hillman[2], [1]Photonics Branch, Code 715, NASA Goddard Space Flight Center, Greenbelt MD 20771, USA, [2]Laboratory for Extraterrestrial Physics, Code 690, NASA Goddard Space Flight Center, Greenbelt MD 20771, USA.

Acousto-optic tunable filters (AOTFs) enable compact, two-dimensional imaging spectrometers with high spectral and spatial resolution and with no moving parts. Tellurium dioxide AOTFs operate from about 400 nm to nearly 5 μm, and a single device will