tune continuously over one octave by changing the RF acoustic frequency applied to the device.

An infrared (1.2–2.5 µm) Acousto-Optic Imaging Spectrometer (AImS) has been designed that closely conforms to the surface composition mapping objectives of the Pluto Fast Flyby. It features a 75-cm focal length telescope, infrared AOTF, and 256 × 256 NICMOS-3 focal plane array for acquiring narrowband images with a spectral resolving power ($\lambda/\Delta\lambda$) exceeding 250.

We summarize the instrument design features and its expected performance at the Pluto-Charon encounter.

N93-28782 160728 P-1

THERMAL ANALYZER FOR PLANETARY SOILS (TAPS): AN *IN SITU* INSTRUMENT FOR MINERAL AND VOLATILE-ELEMENT MEASUREMENTS.

J. L. Gooding[1], D. W. Ming[1], J. E. Gruener[2], F. L. Gibbons[2], and J. H. Allton[2]. [1]Code SN, NASA Johnson Space Center, Houston TX 77058, USA, Code C23, Lockheed Engineering and Sciences Co., Houston TX 77058, USA.

TAPS offers a specific implementation for the generic thermal analyzer/evolved-gas analyzer (TA/EGA) function included in the Mars Environmental Survey (MESUR) strawman payload; applications to asteroids and comets are also possible [1]. The baseline TAPS is a single-sample differential scanning calorimeter (DSC), backed by a capacitive-polymer humidity sensor, with an integrated sampling mechanism [2]. After placement on a planetary surface, TAPS acquires 10–50 mg of soil or sediment and heats the sample from ambient temperature to 1000–1300 K (Fig. 1). During heating, DSC data are taken for the solid and evolved gases are swept past the water sensor. Through groundbased data analysis, multicomponent DSC data are deconvolved [3] and correlated with the water-release profile to quantitatively determine the types and relative proportions of volatile-bearing minerals such as clays and other hydrates, carbonates, and nitrates (Fig. 2). The rapid-response humidity sensors also achieve quantitative analysis of total water [4]. After conclusion of soil-analysis operations, the humidity sensors become available for meteorology.

The baseline design fits within a circular-cylindrical volume <1000 cm^3, occupies 1.2 kg mass, and consumes about 2 Whr of power per analysis. Enhanced designs would acquire and analyze multiple samples and employ additional microchemical sensors for analysis of CO_2, SO_2, NO_x, and other gaseous species. Atmospheric pumps are also being considered as alternatives to pressurized purge gas.

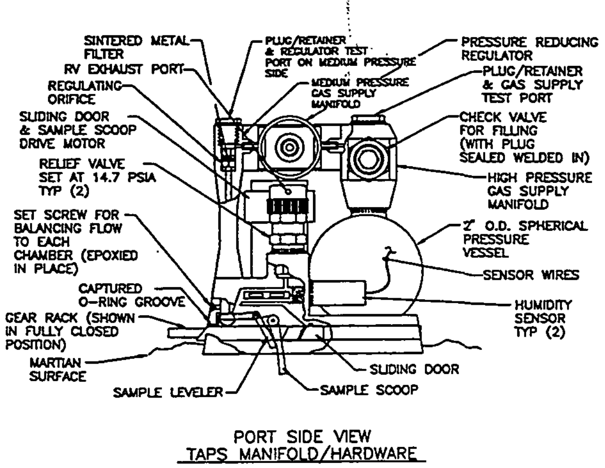

Fig. 1. TAPS Mark-1B packaging concept.

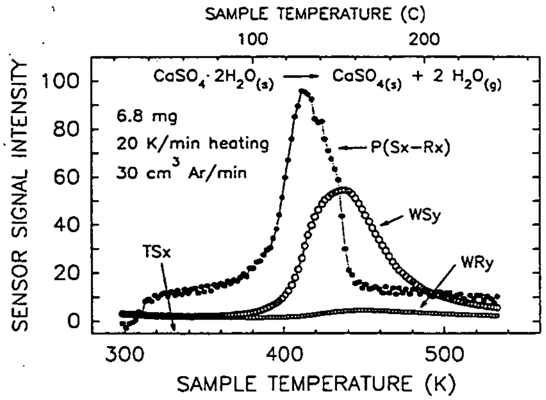

Fig. 2. Simultaneous DSC [(P(Sx-Rx) spline] and evolved-water [WSy spline] data from analysis of gypsum by the TAPS Mark-1 sensor testbed.

References: [1] Gooding J. L. (1989) in *Proc. 18th North Amer. Thermal Anal. Soc. Conf., Vol. 1* (I. R. Harrison, ed.), 222–228. [2] Gooding J. L. (1991) *LPSC XXII*, 457–458. [3] Gooding J. L. (1991) in *Proc. 20th North Amer. Thermal Anal. Soc. Conf.* (M. Y. Keating, ed.), 329–334. [4] Gooding J. L. et al. (1992) in *Proc. 21st North Amer. Thermal Anal. Soc. Conf.* (W. Sichina, ed.), 477–481.

N93-28783 160729 P-2

IMAGING SPECTROMETERS USING CONCAVE HOLOGRAPHIC GRATINGS.

J. Gradie[1] and S. Wang[2], [1]Terra Systems, Inc., 169 Kuukama Street, Kailua HI, 96734, USA, [2]SETS Technology, Inc., 300 Kahelu Avenue, Mililani HI 96789, USA.

Imaging spectroscopy combines the spatial attributes of imaging with the compositionally diagnostic attributes of spectroscopy. Imaging spectroscopy is useful wherever the spatial variation of spectral properties is important, such as mapping spectrally distinct compositional units on surfaces (planetary, terrestrial, medical, industrial), spectral emission and absorption of gases and surfaces (planetary, etc.), or regional spectral changes over time.

Imaging spectrometers produce a series of spatial images at many wavelengths in a number of ways: (1) a single-spot field of view that is step-wise scanned over the spatial field while the wavelengths (or wavenumbers) are scanned sequentially (single-detector element), (2) a single-spot field of view that continuously scans the field of view while sampling all wavelengths simultaneously (a linear-array detector), (3) a slit that continuously scans the field of view while sampling all wavelengths simultaneously (a two-dimensional array detector), or (4) frames of the full field of view taken at sequential wavelengths.

For spacebased remote sensing applications, mass, size, power, data rate, and application constrain the scanning approach. For the first three approaches, substantial savings in mass and size of the spectrometer can be achieved in some cases with a concave holographic grating and careful placement of an order-sorting filter. A hologram etched on the single concave surface contains the equivalent of the collimating, dispersing, and camera optics of a conventional grating spectrometer and provides substantial wavelength-dependent corrections for spherical aberrations and a flat focal field. These gratings can be blazed to improve efficiency when used over a small wavelength range or left unblazed for broadband uniform efficiency when used over a wavelength range of up to 2 orders. More than 1 order can be imaged along the dispersion axis by placing an appropriately designed step order-sorting filter in front of the one- or two-dimensional detector. This filter can be shaped for additional aberration corrections. The VIRIS™ imaging spectrometer based on the broadband design provides simultaneous imaging of the entrance slit from $\lambda = 0.9$ to 2.6 µm (1.5 orders) onto a 128 × 128 HgCdTe detector (at 77 K). The VIRIS™ spectrometer has been used for lunar mapping with the UH 24-in telescope at Mauna Kea Observatory. The design is adaptable for small, low-mass, spacebased imaging spectrometers.

52 N93-28784 160730 p. 1

THE ULTRAVIOLET PLUME INSTRUMENT (UVPI).

D. M. Horan, Naval Center for Space Technology, Naval Research Laboratory, Washington DC 20375-5354, USA.

The Ultraviolet Plume Instrument (UVPI) was launched aboard the Low-power Atmospheric Compensation Experiment (LACE) satellite on February 14, 1990. Both the spacecraft and the UVPI were sponsored by the Directed Energy Office of the Strategic Defense Initiative Organization. The mission of the UVPI was to obtain radiometrically calibrated images of rocket plumes at high altitude and background image data of the Earth, Earth's limb, and celestial objects in the near- and middle-UV wavebands. The UVPI was designed for nighttime observations, i.e., to acquire and track relatively bright objects against a dark background.

Two coaligned, intensified charge-coupled device cameras were used to locate the object of interest, control UVPI, and obtain images and radiometric data. The tracker camera and the plume camera shared a fixed 10-cm-diameter Cassegrain telescope that used a gimbaled plane steering mirror to view a field of regard that was a 50° half-angle cone about the spacecraft's nadir. Additionally, a plane mirror on the instrument's door could be used with the steering mirror to extend the field of regard to view the Earth's limb and stars near the limb in a southerly direction.

The tracker camera had a relatively wide field of view, 2.0° by 2.6°, and a single bandpass of 255–450 nm. The tracker camera had three functions. First, its wide field of view and bright image were used to find the object of interest. Second, images from the tracker camera could be processed within UVPI and the results used to control the gimbaled mirror for autonomous tracking of the target. Third, the tracker camera was calibrated and could obtain radiometric data within its bandpass.

The plume camera had a much narrower field of view, 0.18° by 0.14°, and had a correspondingly higher resolution than the tracker camera. The plume camera had a four-position filter wheel to provide four bandpasses: 195–295 nm, 220–320 nm, 235–350 nm, and 300–320 nm. Only one bandpass could be selected at a time. The purpose of the plume camera was to obtain high-resolution images and radiometric data within its bandpasses.

The UVPI collected high-quality, calibrated UV emission images from four rocket launches in four attempts. These successful observations have provided more than 150 s of calibrated plume images from space. The plume camera data obtained for these high-altitude plumes in the 195–295 nm and 220–320 nm bandpasses is not obtainable from the ground because it is blocked by the Earth's ozone layer. All UVPI plume observation data have been processed by the NRL LACE Program and archived in the SDIO Plumes Data Center at Arnold AFB, Tennessee, and the SDIO Backgrounds Data Center at NRL.

Background observations include southern auroral events, measurements of the Earth's limb under different lighting conditions, nadir scans, measurements near an erupting volcano, and measurements of emission from city and highway lighting. Data from all UVPI observations has been processed and deposited in the SDIO Backgrounds Data Center at NRL.

Radiometric calibration of the UVPI was done before launch and confirmed after launch by star observations. Stars of known emission spectrum based on measurements by other spaceborne sensors were used. The calibration values obtained using the stars are close to the calibration values obtained before launch.

omit

THE ATMOSPHERIC ULTRAVIOLET RADIANCE INTEGRATED CODE (AURIC): VALIDATION OF VERSION 1.0.

R. E. Huffman[1], J. Zdyb[1], R. Link[2], and D. J. Strickland[2], [1]Phillips Laboratory/Geophysics Directorate, Hanscom AFB MA 01731, USA, [2]Computational Physics, Inc., Fairfax VA 22031, USA.

This abstract was withdrawn by the author.

N93-28785 160731 p. 2

MICROTEXTURED METALS FOR STRAY-LIGHT SUPPRESSION IN THE CLEMENTINE STAR-TRACKER.

E. A. Johnson, Spire Corporation, One Patriots Park, Bedford MA 01730, USA.

Anodized blacks for suppressing stray light in optical systems can now be replaced by microscopically textured metal surfaces.