modern projects. Transmitting images will always consume large amounts of bandwidth, and storing images will always require special devices. Our goal is to describe an image compression transform coder based on artificial neural networks techniques (hereafter Neural Network Compression Transform Coder or NNCTC). Like all generic image compression transform coders, the NNCTC embodies a three-step algorithm: invertible transformation to the image (transform), lossy quantization (quantize), and entropy coding (remove redundancy). Efficient algorithms have already been developed to achieve the two last steps, quantize and remove redundancy [4]. The NNCTC offers an alternative invertible transformation based on neural network analysis [3].

A comparison of the compression results obtained from digital astronomical images by the NNCTC and the method used in the compression of the digitized sky survey from the Space Telescope Science Institute based on the H-transform [3] is performed in order to assess the reliability of the NNCTC.

Artificial neural network techniques are based on the dot-product calculation, which is very simple to perform in hardware [4]. It is in this sense that the NNCTC can be useful when high compression and/or decompression rates are required (e.g., space applications, remote observing, remote database access).

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PROTOTYPE BACKSCATTER MÖSSBAUER SPECTROMETER FOR MESURment OF MARTIAN SURFACE MINERALOGY. T. D. Shelfer[1], R. V. Morris[1], D. G. Agresti[2], T. Nguyen[3], E. L. Wills[2], and M. H. Shen[2], [1]Code SN4, NASA Johnson Space Center, Houston TX 77058, USA, [2]Physics Department, University of Alabama at Birmingham, Birmingham AL 35294, USA, [3]Lockheed Engineering and Sciences Co., Houston TX 77058, USA.

We have designed and successfully tested a prototype of a backscatter Mössbauer spectrometer (BaMS) targeted for use on the martian surface to (1) determine oxidation states of iron and (2) identify and determine relative abundances of iron-bearing mineralogies. No sample preparation is required to perform measurements; it is only necessary to bring sample and instrument into physical contact. The prototype meets our projected specifications for a flight instrument in terms of mass (<500 g), power (<2 W), and volume (<300 cm³).

A Mössbauer spectrometer on the martian surface would provide a wide variety of information about the current state of the martian surface:

1. *Oxidation state:* Iron Mössbauer spectroscopy (FeMS) can determine the distribution of iron among its oxidation states. Is soil oxidized relative to rocks?

2. *Mineralogy:* FeMS can identify iron-bearing mineralogies (e.g., olivine, pyroxene, magnetite, hematite, ilmenite, clay, and amorphous phases) and their relative abundances. FeMS is not blind to opaque phases (e.g., ilmenite and magnetite), as are visible and near-IR spectroscopy.

3. *Magnetic properties:* FeMS can distinguish between magnetite and maghemite, which are putative mineralogies to explain the magnetic nature of martian soil.

4. *Water:* FeMS can distinguish between anhydrous phases such as hematite, olivine, pyroxene, and hydrous phases such as clay, ferrihydrite, goethite, and lepidocrocite. What are the relative proportions of hydrous and anhydrous iron-bearing mineralogies?

In summary, a BaMS instrument on MESUR would provide a very high return of scientific information about the martian surface (with no sample preparation) and would place a very low resource demand (weight, power, mass, data rate) on spacecraft and lander. Our BaMS instrument can be flight-qualified within two years and is also suitable for lander missions to the Moon, comets, and asteroids.

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SPACECRAFT COMPUTER TECHNOLOGY AT SOUTHWEST RESEARCH INSTITUTE. D. J. Shirley, Southwest Research Institute, San Antonio TX 78228-0510, USA.

Southwest Research Institute (SwRI) has developed and delivered spacecraft computers for a number of different near-Earth-orbit spacecraft including shuttle experiments and SDIO free-flyer experiments. Here we describe the evolution of the basic SwRI spacecraft computer design from those weighing in at 20 to 25 lb and using 20 to 30 W to newer models weighing less than 5 lb and using only about 5 W, yet delivering twice the processing throughput. Because of their reduced size, weight, and power, these newer designs are especially applicable to planetary instrument requirements. The basis of our design evolution has been the availability of more powerful processor chip sets and the development of higher-density packaging technology, coupled with more aggressive design strategies in incorporating high-density FPGA technology and use of high-density memory chips. In addition to reductions in size, weight, and power, the newer designs also address the necessity of survival in the harsh radiation environment of space. Spurred by participation in such programs as MSTI, LACE, RME, Delta 181, Delta Star, and RADARSAT, our designs have evolved in response to program demands to be small, low-powered units, radiation tolerant enough to be suitable for both Earth-orbit microsats and for planetary instruments. Present designs already include MIL-STD-1750 and Multi-Chip Module (MCM) technology with near-term plans to include RISC processors and higher-density MCMs. Long-term plans include development of whole-core processors on one or two MCMs.

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THE BACKGROUNDS DATA CENTER. W. A. Snyder[1], H. Gursky[1], H. M. Heckathorn[1], R. L. Lucke[1], S. L. Berg[2], E. G. Dombrowski[3], and R. A. Kessel[2], [1]Code 7604, Naval Research Laboratory, Washington DC 20375-5352, USA, [2]Computational Physics, Inc., Suite 600, 2750 Prosperity Avenue, Fairfax VA 22031, USA, [3]Sachs-Freeman Associates, 1401 McCormick Drive, Landover MD 20785, USA.

The Strategic Defense Initiative Organization (SDIO) has created data centers for midcourse, plumes, and backgrounds phenomenologies. The Backgrounds Data Center (BDC), located at the Naval Research Laboratory (NRL), has been designated by the SDIO as the prime archive for data collected by SDIO programs for which substantial backgrounds measurements are planned. The BDC will be the prime archive for MSX data, which will total about 15 TB over three years. Current BDC holdings include data from the VUE, UVPI, UVLIM, FUVCAM, TCE, and CLOUDS programs. Data from IBSS, CIRRIS 1A, and MSTI, among others, will be available at the BDC in the near future. The BDC will also archive data from the Clementine mission.

The BDC maintains a Summary Catalog that contains "metadata," that is, information about data, such as when the data were obtained, what the spectral range of the data is, and what region of the Earth or sky was observed. Queries to this catalog result in a listing of all datasets (from all experiments in the Summary Catalog) that satisfy the specified criteria. Thus, the user can identify different experiments that made similar observations and order them from the BDC for analysis. On-site users can use the Science Analysis Facility (SAF) for this purpose.

For some programs, the BDC maintains a Program Catalog, which can classify data in as many ways as desired (rather than just by position, time, and spectral range as in the Summary Catalog). For example, datasets could be tagged with such diverse parameters as solar illumination angle, signal level, or the value of a particular spectral ratio, as long as these quantities can be read from the digital record or calculated from it by the ingest program. All unclassified catalogs and unclassified data will be remotely accessible.

The activities and functionality of the BDC will be described. Information is presented about the BDC facilities, user support capabilities, and hardware and software systems.

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THE ENHANCED-MODE LADAR WIND SENSOR AND ITS APPLICATION IN PLANETARY WIND VELOCITY MEASUREMENTS. D. C. Soreide, R. L. McGann, L. L. Erwin, and D. J. Morris, Boeing Defense and Space Group, Seattle WA 98124, USA.

For several years we have been developing an optical air-speed sensor that has a clear application as a meteorological wind-speed sensor for the Mars landers. This sensor has been developed for airplane use to replace the familiar, pressure-based Pitot probe. Our approach utilizes a new concept in the laser-based optical measurement of air velocity (the Enhanced-Mode Ladar), which allows us to make velocity measurements with significantly lower laser power than conventional methods.

The application of the Enhanced-Mode Ladar to measuring wind speeds in the martian atmosphere has a number of advantages over previously fielded systems. The point at which the measurement is made is approximately 1 m from the lander. This eliminates the problem of flow distortion caused by the lander. Because the ladar uses a small, flush-mounted window in the lander instead of being mounted out in the wind, dust damage and erosion will be dramatically reduced. The calibration of the ladar system is dependent only on the laser wavelength, which is inherently fixed. Our approach does require the presence of aerosol particles, but the presence of dust in the martian atmosphere is well established. Preliminary calculations indicate that the Enhanced-Mode Ladar will only consume 0.001 Ws per velocity update, not including the power for signal processing. We have developed a brassboard version of the Enhanced-Mode Ladar for airplane applications that we will flight test in early April. This brassboard has been used to measure wind speeds (in Earth's atmosphere) with a backscatter coefficient similar to that on Mars. Results of a single set of measurements are shown in Fig. 1.

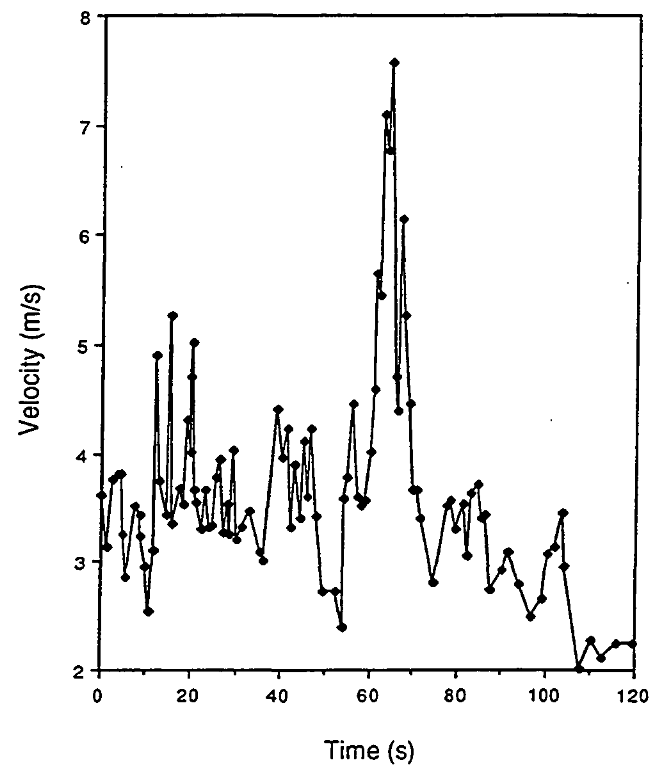

Fig. 1. Wind speed vs. time backscatter coefficient = 4.5E-6.

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THE MESUR MISSION. S. W. Squyres, Center for Radiophysics and Space Research, Cornell University, Ithaca NY 14853, USA.

The MESUR mission is the most ambitious mission to Mars planned by NASA for the coming decade. It will place a network of small, robust landers on the martian surface, making a coordinated set of observations for at least one full martian year. The mission addresses two main classes of scientific objectives. The first requires a large number of simultaneous observations from widely distributed sites. These include establishing networks of seismic and meteorological stations that will yield information on the internal structure of the planet and the global circulation of the atmosphere respectively. The second class of objectives requires sampling as much as possible the full diversity of the planet. These include a variety of geochemical measurements, imaging of surface morphology, and measurement of upper atmospheric properties at a range of latitudes, seasons, and times of day.