

message instead of displaying the corresponding height measurement and color.

This work was done by Robert C. Youngquist (formerly of Dynacs) and Chris

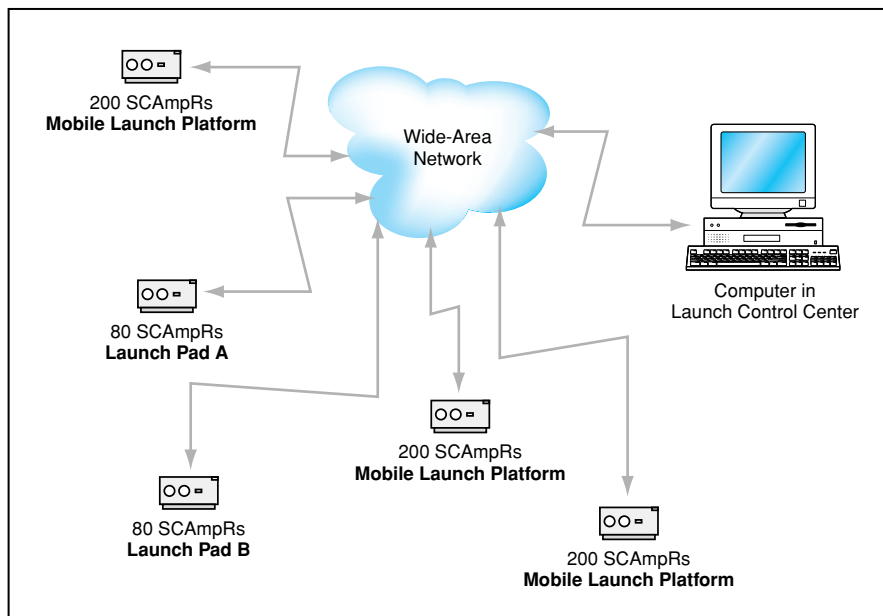
Davis of Kennedy Space Center; Jimmy Polk, Brad Burns, William Haskell, and Tim Opalka of Dynacs Engineering Co., Inc; and Michael McClure of United Space Alliance.

Further information is contained in a TSP [see page 1], KSC-12098

Signal-Conditioning Amplifier Recorders

The cost and complexity of a data-acquisition system would be reduced.

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Data Would Be Recorded Temporarily by the SCampRs and later transmitted to the computer in the launch control center via the wide-area network. This arrangement is less complex than is that of the present system, in which the data are transmitted to redundant recording equipment via a redundant and more complex system of communication links and interfaces.

Signal-conditioning amplifier recorders (SCampRs) have been proposed as a means of simplifying and upgrading the Kennedy Space Center (KSC) Ground Measurement System (GMS), which is a versatile data-acquisition system that gathers and records a variety of measurement data before and during the launch of a space shuttle. In the present version of the GMS system, signal conditioning amplifiers digitize and transmit data to a VME chassis that multiplexes up to 416 channels. The data is transmitted via a high-speed data bus to a second VME chassis where it is available for snapshots. The data is passed from the second VME chassis to a high-speed data recorder. This process is duplicated for installations at two launch pads and the Vehicle Assembly Building (VAB). Since any failure of equipment in the data path results in loss of data, much of the system is redundant. The architecture of the existing GMS limits expansion or any modification to the system to meet changing requirements because of the cost and time required. A SCampR-based system is

much more flexible.

The basis of the simplification, flexibility, and reliability is the shifting of the recording function to the individual amplifier channels. Each SCampR is a self-contained single channel data acquisition system, which in its current implementation, has a data storage capacity of up to 30 minutes when operating at the fastest data sampling rates. The SCampR channels are self-configuring and self-calibrating. Multiple SCampR channels are ganged on printed circuit boards and mounted in a chassis that provides power, a network hub, and Inter-Range Instrument Group (IRIG) time signals. The SCampR channels share nothing except physical mounting on a circuit board. All circuitry is electrically separate for each channel. All that is necessary to complete the data acquisition system is a single master computer tied to the SCampR channels by standard network equipment. The size of the data acquisition system dictates the requirements for the specific network equipment.

The computer polls each channel for health status and data snapshots. The

bandwidth of the network dictates the extent of the data snapshots. It is likely that in most applications the health status/data snapshot frame can be obtained often enough to pass all data in real time to the master computer. Data is time tagged and stored safely in non-volatile memory at the SCampR where it remains for retrieval regardless of the status of the communication network. Once a SCampR is commanded to record, no further communication is necessary to successfully complete a measurement. Even the loss of the IRIG time input will not cause a disruption because each SCampR channel will automatically revert to generating time if the input is interrupted.

A SCampR can record data in any of a variety of ways upon command. For example:

- A SCampR can be configured to record and time-stamp data only when a pre-defined minimum change occurs, for example during a long fueling operation where flows and pressures would normally remain constant.
- A SCampR can be commanded to start recording at a future time, for a given duration, so that in the event of a failure of communication at a critical time, data would still be recorded as originally intended. As long as communication continued, the commanded starting time could be adjusted (as would be needed to accommodate a hold in the launch countdown).
- A SCampR can be commanded to record data samples at a specified rate or to sample at different specified rates at specified times in the future.

Inexpensive commercial-off-the-shelf (COTS) hubs integrate the SCampR chassis into a communications network. Transfer of data and other communications, such as commands and health status, will be performed by a standard method of network communication. The current implementation is a polling form of TCP/IP. Any number of computers can be connected to the network for viewing or rebroadcasting of data snapshots in addition to commanding and monitoring health status of the SCampR channels.

The GMS is intended to be a quick response system. A SCAMP chassis can be installed for special situation measurements with minimal infrastructure requirements. Also, it has become a recurring requirement for the GMS to support measurements during rollout of the mobile launch platform. The SCAMP architecture

will provide the capability for quick implementation of a very reliable and easily reconfigurable data acquisition system.

This work was done by Pedro J. Medelius and John Taylor of Dynacs, Inc., for Kennedy Space Center. Further information is contained in a TSP [see page 1].

This invention is owned by NASA, and a

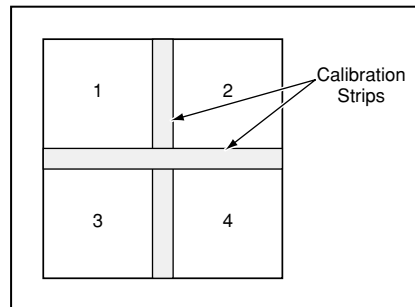
patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Technology Programs and Commercialization Office, Kennedy Space Center, (321) 867-8130. Refer to KSC-12296.

Integrated Optoelectronics for Parallel Microbioanalysis

Tests for microbial species and hazardous chemicals could be performed quickly and inexpensively.

Miniature, relatively inexpensive microbioanalytical systems ("laboratory-on-a-chip" devices) have been proposed for the detection of hazardous microbes and toxic chemicals. Each system of this type would include optoelectronic sensors and sensor-output-processing circuitry that would simultaneously look for the optical change, fluorescence, delayed fluorescence, or phosphorescence signatures from multiple redundant sites that have interacted with the test biomolecules in order to detect which one(s) was present in a given situation. These systems could be used in a variety of settings that could include doctors' offices, hospitals, hazardous-material laboratories, biological-research laboratories, military operations, and chemical-processing plants.

Each system would consist primarily of an integrated circuit or perhaps several integrated circuits packaged together. The system would include (1) a source of optical excitation (e.g., ambient light, superluminescent or laser diode); (2) a photodetector-array circuit of the active-pixel-sensor (APS) type that would be compatible with complementary metal oxide semiconductor (CMOS) circuitry; and (3) on-chip signal-and data-processing circuits for rapid and reliable identification of toxic substances and biomolecules (e.g., antigens) associated with known or general classes of hazardous chemicals, bacteria, and viruses. Each pixel or group of pixels in the APS array would be coated with an antigen-specific optobiochemical reagent or other substance that would change its resultant



In this **Simplified Example of a Biomolecular-Signature Detector** with self-calibration, the APS array would be divided into four pixels or groups of pixels, each coated with a different substance that would act as a receptor for one of four fluorophores associated with one of four molecules that one seeks to detect.

optical characteristics (i.e., absorption, fluorescence, luminescence, etc.) in response to a biomolecule or hazardous chemical that one seeks to identify. In addition, the array could include strips, bonded directly to the APS surface (see figure), that would produce known temporal and spectral APS outputs for on-chip or off-chip calibration.

In the use of a system of this type, unlike in conventional bioanalytical laboratory practice, the detection of biohazards would not be subject to the limits of visual acuity of human observers and of the resolution of conventional microscopes. Moreover, detection would not be slowed by the need to perform repetitive tedious procedures under sterile laboratory conditions. Instead, it would be possible to simultaneously identify any or all of a large number of different microbial species and/or chemical agents

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within an analysis time of a few seconds. For example, the number of species and/or chemical agents that could be identified could be as large as a million in the case of a 1,024-by-1,024-pixel APS array.

In a typical analytical procedure, a sample would be dissolved or otherwise suspended in a transport liquid, whereby liquid would be deposited onto the surface of the APS array. After a specified interaction time, the light source (ambient or pulsed) would be sensed and the APS array would be gated so as not to respond to the source light but to respond to the longer-lived fluorescence that would follow the source pulses. The intensity change and/or delayed fluorescence signal from each pixel would be read out and analyzed; the analysis of the signal from each pixel could include correlation with calibration signals and/or with signals from other pixels. In a case in which the response from a pixel could include optical or fluorescence signatures from multiple bioanalytical or fluorescent probes associated with different target molecules of interest, it would be possible to distinguish among them by their position and/or fluorescence lifetimes. For the purpose of measuring fluorescence lifetimes, the light source could be modulated periodically and the reading from each pixel taken at multiple fixed phase delays relative to the optical excitation.

This work was done by Robert Stirbl, Philip Moynihan, Gregory Bearman, and Arthur Lane of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP [see page 1]. NPO-21047

Relating Downlink Data Products to Uplink Commands

Data returned by exploratory robots are associated with previously issued commands.

An improved data-labeling system provides for automatic association of data products of an exploratory robot (downlink information) with previously transmitted

commands (uplink information) that caused the robot to gather the data. Such association is essential to correct and timely analysis of the data products — including, for

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example, association of the data with the correct targets. The system was developed for use on Mars Rover missions during the next few years. The system could also be