The GMS is intended to be a quick response system. A SCAmpR 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 SCAmpR 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.

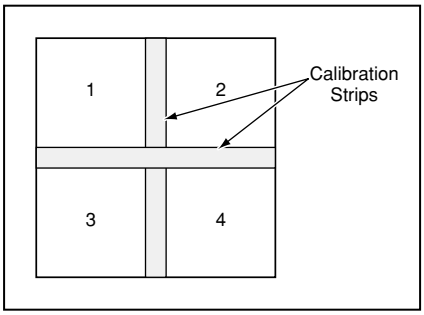
Integrated Optoelectronics for Parallel Microbioanalysis

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

NASA's Jet Propulsion Laboratory, Pasadena, California

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 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 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.

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 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].*
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Relating Downlink Data Products to Uplink Commands

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

NASA's Jet Propulsion Laboratory, Pasadena, California

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 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