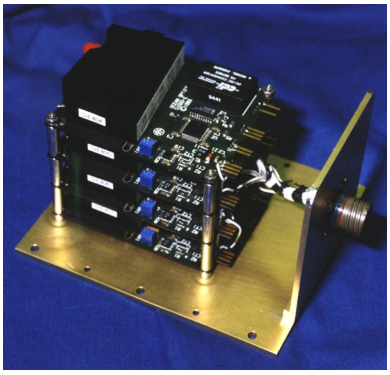
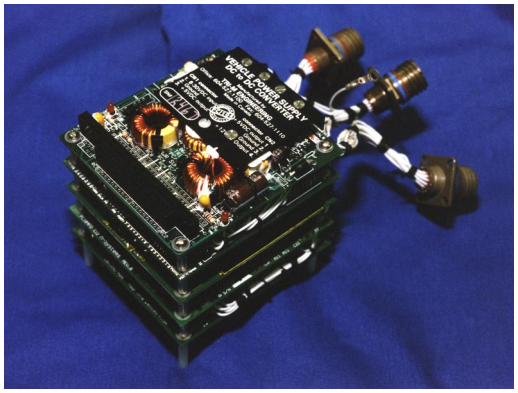
# Technology Opportunity

## Measuring Instrumentation Development and Evaluation at Marshall Space Flight Center



The Instrumentation Branch of the Instrumentation and Control Division at NASA's Marshall Space Flight Center (MSFC) in Huntsville, Alabama, has the expertise and facilities to conduct research, development, evaluation, and selection of measuring instrumentation for a variety of applications. Scientists and engineers have developed instrumentation for propulsion system components for NASA's launch vehicles and for many of the flight experiments developed under the management of MSFC.

Marshall's Instrumentation Branch is available for developmental testing to evaluate sensors for pressure, temperature, vacuum, humidity, acceleration, vibration, heat flux, high-temperature strain, infrared to ultraviolet radiation, displacement, and gas analysis.



### Potential Commercial Uses

In addition to the NASA programs supported by MSFC's astrionics laboratory, sensor development and testing has many commercial applications for industries that provide environmental monitoring devices, airline and automotive industries, the food industries, semiconductor industries, and fuel and chemical manufacturers.

### Benefits

Commercial industries can benefit from the expertise and available testing facilities at MSFC. By taking advantage of the available resources within Marshall's Instrumentation Branch, manufacturers can better develop state-of-the-art sensors to measure the performance and health of a particular device or system, saving time and money on initial research and development.

### The Technology

Scientists and engineers at MSFC use the facilities of the Instrumentation Branch to perform research, development, and evaluation of measuring sensors in support of Marshall's space flight programs.

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George C. Marshall Space Flight Center

## Optical Plume Anomaly Detection Engine Diagnostic Filtering System

Specialized research and development equipment at Marshall's Instrumentation Branch includes the Optical Plume Anomaly Detection system, which is used as a diagnostic tool and health monitor of liquid-fueled engines. Because of state-of-the-art technology in anomaly detection spectroscopy, Marshall scientists are able to discern trace amounts (parts per billion) of metals involved in the Space Shuttle's main engine plume. Once trace amounts are detected, the Optical Plume Anomaly Detection - Engine Diagnostic Filtering System extracts valid and useful information such as species quantification using preprocessing algorithms, neural networks, and spectroscopic/atomic models.

The goal of the Optical Plume Anomaly Detector is to provide early warning signals that imply imminent engine failure. The system, consisting of a spectrometer and a multichannel radiometer, obtains time-line data in the form of various metal atomic and molecular lines. Detection of certain traces indicates engine hardware deterioration.

## In-Flight Leak Detection: A Hydrogen/Oxygen Leak-Imaging Sensor

MSFC scientists are working to develop and test an optical system to detect hydrogen or oxygen leaks during space flight. Due to size, weight, and availability of sensors, hydrogen and oxygen propellant leaks are difficult to detect in a space environment. Tracer gas techniques identify leaks during the initial checkout phase, but these techniques cannot identify leaks caused by cryogenic cool-down of joints. These techniques also cannot function when the spacecraft is fueled, on the launch pad, or in flight.

A confocal telescope has been constructed, allowing limited three-dimensional imaging. This imaging detector dramatically lowers the background fluorescence, which distorts conventional detection methods. A key part of this confocal telescope concept is that lower probe laser intensities (far below the threshold for igniting gases) can be used.

This technology is general in nature. It can be commercialized for applications such as hydrogen facility leak detection, forensic analysis, and automated surface inspection.

## Contacts

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Additional information about Avionics Systems Simulations, NASA's Technology Transfer Program, and a Technology Transfer Agreement are available on the World-Wide Web:

(http://techtran.msfc.nasa.gov) and (http://astrionics.msfc.nasa.gov)

## Key Words

Astrionics/Measuring Instrumentation
Spectroscopy
Technology Transfer