Electronics/Computers

Infrared Instrument for Detecting Hydrogen Fires

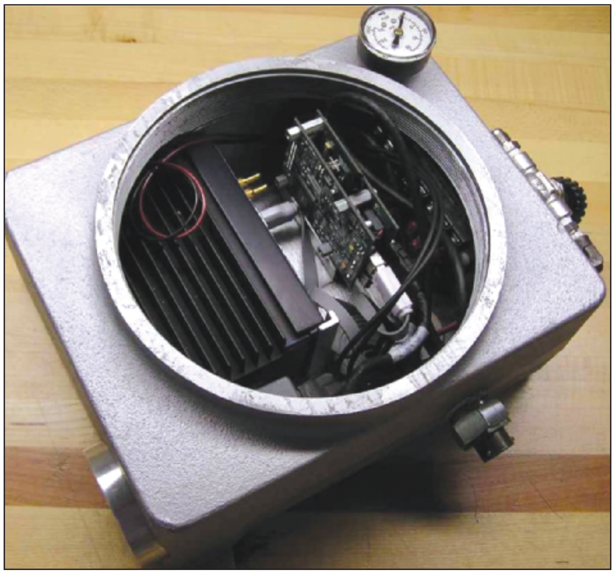
Spatial information is utilized to discriminate against reflected light from other sources.

John F. Kennedy Space Center, Florida

The figure shows an instrument incorporating an infrared camera for detecting small hydrogen fires. The instrument has been developed as an improved replacement for prior infrared and ultraviolet instruments used to detect hydrogen fires. The need for this or any such instrument arises because hydrogen fires (e.g., those associated with leaks from tanks, valves, and ducts) pose a great danger, yet they emit so little visible light that they are mostly undetectable by the unaided human eye. The main performance advantage offered by the present instrument over prior hydrogen-fire-detecting instruments lies in its greater ability to avoid false alarms by discriminating against reflected infrared light, including that originating in (1) the Sun, (2) welding torches, and (3) deliberately ignited hydrogen flames (e.g., ullage-burn-off flames) that are nearby but outside the field of view intended to be monitored by the instrument.

Like prior such instruments, this instrument is based mostly on the principle of detecting infrared emission above a threshold level. However, in addition, this instrument utilizes information on the spatial distribution of infrared light from a source that it detects. Because the combination of spatial and threshold information about a flame tends to constitute a unique signature that differs from that of reflected infrared light originating in a source not in the field of view, the incidence of false alarms is reduced substantially below that of related prior threshold-based instruments.

The camera in the present instrument is a palm-sized commercial one wherein the image sensor is an array of microbolometers that are sensitive in the wavelength range from 7.5 to 13.5 µm. The camera includes circuitry that preprocesses the microbolometer readings to generate digital output. The camera output is coupled to an embedded image-processing computer via a high-speed serial data interface, conforming to standard 1394 of the Institute of Electrical and Electronics Engineers (FireWire). The instrument includes a custom circuit board designed to act as interface between (1) the rest of the instrument and (2) external power supplies and external electronic instrumentation and alarm circuits, such that from the perspective of the external instrumentation and alarm circuits, this instrument exactly mimics an older ultraviolet-based hydrogen-fire-detecting instrument to be replaced.



A **Commercial Explosion-Proof Housing** contains the electronic circuitry of the instrument. The housing is fitted with a 2-in. (5.08-cm) germanium window for the infrared camera, and with a pressure port and pressure gauge so that the interior of the housing can be pressurized with inert gas for additional safety in a hazardous environment.

This work was done by Robert Youngquist and Curtis Ihlefeld of **Kennedy Space Center** *and Christopher Immer, Rebecca Oostdyk, Robert Cox, and John Taylor of ASRC Aerospace Corp. Further information is contained in a TSP (see page 1).*
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Modified Coaxial Probe Feeds for Layered Antennas

Coaxial shields are connected to radiator and ground planes at standing-wave nodes.

Lyndon B. Johnson Space Center, Houston, Texas

In a modified configuration of a coaxial probe feed for a layered printed-circuit antenna (e.g., a microstrip antenna), the outer conductor of the coaxial cable extends through the thickness of at least one dielectric layer and is connected to both the ground-plane conductor and a radiator-plane conductor. This modified configuration simplifies the incorporation of such radio-frequency integrated circuits as power dividers, filters, and low-noise amplifiers. It also simplifies the design and fabrication of stacked antennas with aperture feeds.

It is often desirable to incorporate the aforementioned integrated circuits into antenna structures in order to obtain better performance or more compact packaging than would be achievable by packaging these circuits as electrically connected but structurally separate units. In a typical conventional coaxial probe feed configuration, the integrated circuitry is located beneath the ground plane. Incorporation of the integrated circuitry into the antenna entails difficulty in (1) making solder connections