DIDS PATENT PENDING

DISTRIBUTED IMPACT DETECTION SYSTEM

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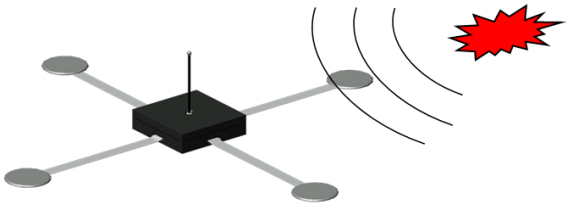
Ultra *Low-Power* Wireless Impact Detection System

Impact detection and characterization on manned spacecraft has been an elusive goal due to the transitory nature of the detectable high-frequency signals. DIDS enables the use of many wireless, self-powered, miniaturized, "stick on" piezoelectric sensor nodes. Each node continuously monitors four transducers for an impact event, such as the foam impact that caused the Columbia tragedy or a micro-meteor impact. The figure to the right depicts the operating concept for DIDS.



When a programmable threshold is exceeded by an impact event, an extremely low-latency signal acquisition circuit captures the event as a digital waveform for post-processing and impact characterization. In addition, autonomous synchronization between nodes of the wireless network will provide for accurate location determination through amplitude and time-of-arrival analysis. The innovative signal conditioning circuit design is capable of operation in the micro-watt range on average while constantly maintaining the capability to acquire high-frequency acoustic signals in the hundreds of kilohertz range. DIDS employs multiple operating modes in order to maintain extremely low average power consumption. These modes include:

- Trigger mode: DIDS' primary mode of operation
- Data Acquisition Mode: DIDS take a snapshot of data
- Processing Mode: DIDS processes or stores the data
- RF Com Mode: DIDS sends an alert that an event occurred. RF is also used for configuring the sensor units and downloading data.

The sensor to the right comprises the DIDS Sensor Unit along with four Acoustic Emission transducers. The transducer array is designed in combination with the extremely low-latency trigger capability to insure that the entire trigger event is captured.

A/E Sensor Unit

In addition to A/E sensor, Invocon has interfaced DIDS with accelerometers and ultrasonic transducers. The accelerometer unit is very similar to the A/E unit. It was delivered to NASA for comparative testing with Invocon's Wing Leading Edge Impact Detection System. The ultrasonic sensor unit is shown at the right. It includes four directional transducers and was delivered to NASA for testing as a leak detection system.

Ultrasonic Sensor Unit

Specifications

DATA ACQUISITION RATE	4 channels factory set (850kHz per channel typical for A/E sensors).
SYNCHRONIZATION	< ±30μs typical between remote units
SENSORS	Acoustic Emission, Accelerometer, Ultrasonic Microphone
GAIN	Software settable 1/15, normal, 15
TEMPERATURE MEASUREMENT	On-board temperature monitoring for health and status
OPERATING TEMPERATURE RANGE	-40°C to +85°C (Reduce battery life by 50% when continuous operation at -35°C.)
POWER	Battery powered: 3.0-4.0V input range. Average current is microAmps
BATTERY LIFE	2 years or 2000 events (approx.) Extended-life external batteries available.
MEMORY	128M-byte non-volatile (higher memory available)
PACKAGING	Approximately 4.3cm x 4.3cm x 2.2cm.
WEIGHT	1.8 ounces (Sensor Unit + Battery)

System specifications subject to change without notice.