Micro Aerospace Solutions' Attitude Detection Systems

Micro Aerospace Solutions (MAS) has developed MEMS-based inertial sensor technology into inertial measurement units (IMUs) for small satellite attitude detection systems. These sensors can be combined with sun sensors, horizon sensors, GPS and other external references as well as MAS' thruster systems to provide complete small satellite attitude detection and control system (ADCS).


MAS offers three levels of attitude detection inertial measurement units. Our systems have flown in space on nanosatellite as well as military suborbital applications. We use small, low cost sensors gained together to improve accuracy and drift rate. Our sensor systems also offer inertial or timer triggered events such as pyro firings or data collection.
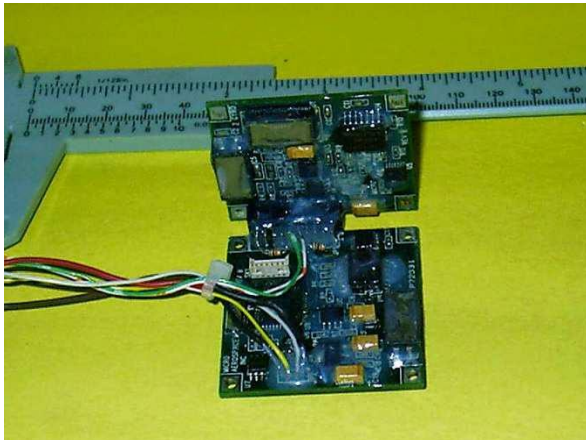
Each system board provides gyro sensors as well as MEMS-based accelerometers (not required for some applications) and an I2C A/D converter which allows each individual sensor board to be addressable. The accelerometers are configurable for outputs from 0-2 to 0-50 G's. A microcontroller board provides complete IMU output by high-speed serial data. Output rate is configurable with rates up to 100 Hz. Form factors include stand-alone, enclosure optional and PC104.

The boards can also be customized per customer requirements. This system allows a working device as simple as a single axis gyro and accelerometer or as complex as a three axis gyro and accelerometer IMU with multiple sensors in each axis for redundancy and to matrix together the system output for higher accuracy measurements.

MAS Inertial Sensors Summary			
Specification	**MASIMU02**	**MASIMU03**	**MASIMU04***
Power	0.6 Watts	0.5 Watts	0.25 Watts
Mass (without enclosure)	20 grams	100 grams	30 grams
Mass (with enclosure)	60 grams	150 grams	-
Voltage	5 to 12 volts	5 to 12 volts	5 to 12 volts
Dimensions (with enclosure)	2 x 2 x 1.5"	2 x 2 x 1.5"	3.75 x 3.5 x 0.5"
Interface	Serial	Serial	Serial/PC104
Drift (deg/min)	0.2	0.02	<0.01
			*Can be integrated w/ space-rated GPS
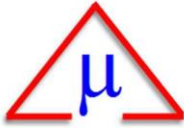
Micro Aerospace Solutions' Attitude Detection Systems

- **Flight heritage**
- **Low power**
- **Flexible and configurable**
- **Inertial sensors (gyros and accelerometers)**
- **Capable of controlling triggered events (time, acceleration, etc.)**
- **Space-rated GPS integrated package available**
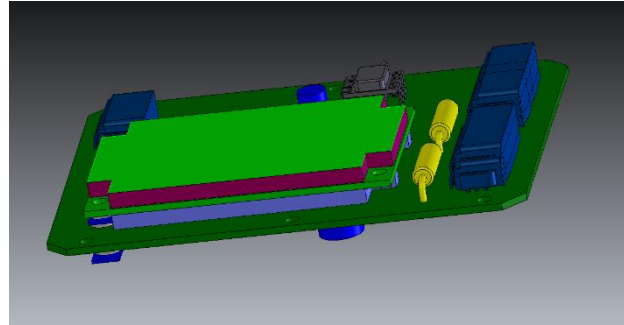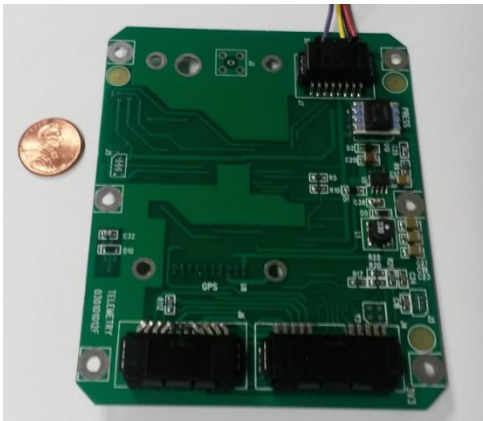- **Serial output to computer or transmitter**

Figure 1. MASIMU04 with integrated GPS

Through the use of proper filtering, multiple sensors can vastly improve the performance of COTS inertial sensors. Below is an example of filtering three ultra-miniature sensors improves bias and noise performance.
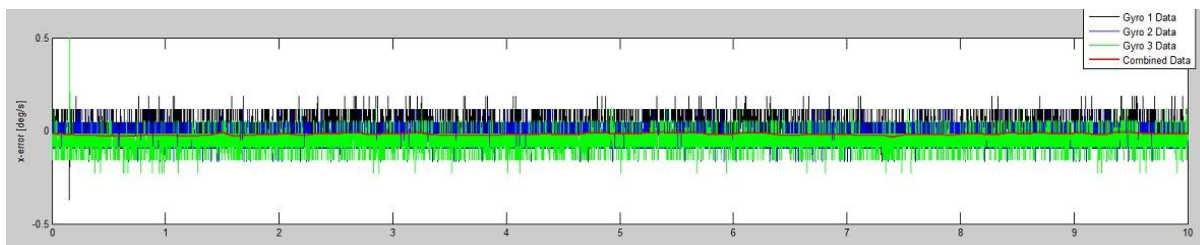
Figure 2. MASIMU04 Inertial Sensor System

Figure 3. Improvement with use of multiple gyros