

# Payload Project Resources

## 1. Notes

- a. A sensor or transducer responds to some aspect of its environment and produces an electrical signal from which that aspect of the environment can be inferred. A temperature sensor produces an electrical signal that can be interpreted to determine its temperature. All transducers and sensors produce approximations of the thing you want to measure (the “measurand”); there is always some error.
- b. A typical measurement system consists of one or more sensors, some means to amplify the electrical signals from the sensors (usually called signal conditioners) and some means to record the signal. Nowadays recording is usually digital, which means the signal is converted to a sequence of 1s and 0s and stored in computer-like memory.
- c. Many times electronic parts manufacturers will sell an “evaluation board” for a particular component. This is a circuit board with the component mounted along with the support components necessary to use the target component. For example, Digikey (see below) carries the Freescale development board for the Freescale MMA8450Q acceleration sensor.
- d. Manufacturers and distributors often will send 1 or 2 free samples of an electronic part upon request. (Suggestion: Instead of stating the fact you would like some free parts to use in your payload, state the other fact that you are evaluating parts for use in a student-built payload for a NASA educational program. Some companies make it easy to order samples from their web sites.
- e. Most commercial off-the-shelf (COTS) parts are designed for use and survival in a normal everyday environment on or near the surface of the earth. They may not survive extended exposure to the very low pressure (near vacuum), very low temperature (or very high temperature if facing the sun), and radiation environments of space. The SOI flight however is only a few minutes in duration, so many parts that might fail during a lengthy mission might work fine on this short flight. NONE of the parts mentioned below have been evaluated by this writer for a space application. You may have to contact manufacturers for their advice and/or consider including thermal insulation in your payload. Remember that the flow of electrical current always causes heat, so in trying to keep things from getting too

cold, you don't want to make them too hot!

- f. If using data recording, consider an acceleration switch to trigger the recording so that all the memory is not used up before the launch.
- g. Measuring outside air temperature might not be practical for this fast flight where the temperature will probably be changing rapidly. This is because for a temperature sensor to work, the sensor itself has to heat or cool to the temperature to be measured, and that takes some time, called delay time. If you wanted to measure the temperature of your payload inside the container, that would probably be reasonable because the closed container would be somewhat buffered from rapid changes in outside temperature. See Omega below for temperature measurement hardware. Thermocouples would probably be the easiest to use.
- h. As an alternative to a measurement system consisting of sensor(s), signal conditioner(s), and digital recorder, you might consider a payload where the only data recording is photographic, either still pictures or video (rice grains floating in microgravity...? A bubble suspended in oil...? Etc?)

2. Electronic parts and hardware suppliers - A VERY brief description of each company follows.

- a. Newark Electronics [www.newark.com](http://www.newark.com) – Electrical and electronic parts distributor for many manufacturers.
- b. Digikey [www.digikey.com](http://www.digikey.com) – Electrical and electronic parts distributor for many manufacturers; including some Freescale brand sensors
- c. Radio Shack [www.radioshack.com](http://www.radioshack.com) Electronic parts
- d. Mouser Electronics [www.mouser.com](http://www.mouser.com) Electrical and electronic parts distributor for many manufacturers. Type 'acceleration' in the search window and find many accelerometers and development boards.
- e. Allied Electronics [www.alliedelec.com](http://www.alliedelec.com) - Electrical and electronic parts distributor for many manufacturers.
- f. Freescale Semiconductors [www.freescale.com](http://www.freescale.com) – Manufacturer of sensors. Based on a quick look, it appears many of their products are obsolete with replacements promised in 2011. It may be easier to see what distributors have in stock; many of the above distributors carry Freescale products. Probably worth a closer look.
- g. Analog Devices [www.analog.com](http://www.analog.com) – Manufacturer of sensors and signal conditioning (amplifiers). See their iSensor line, which includes magnetometers.

- h. ST Microelectronics [www.st.com](http://www.st.com) – Sensors including accelerometers, electronic gyroscopes, inclination sensors, yaw/roll indicators, free-fall detection (as would occur in microgravity).
- i. Microstrain [www.microstrain.com](http://www.microstrain.com) – Inclinometers and other expensive sensors.
- j. Vernier [www.vernier.com](http://www.vernier.com) – Lots of inexpensive sensors and data acquisition hardware designed specifically for educational purposes. This equipment is designed to survive in a classroom environment, not an outer space environment, BUT the duration of the flight is short, so some of these items might work as payload components before being damaged by low temperature and/or low pressure.
- k. Onset Computer Corp. [www.onsetcomp.com](http://www.onsetcomp.com) – Maker of “HOBO” data loggers, and others. These would be used to record signals produced by sensors. Some of their product kits include sensors.
- l. Cameras/Video?
- m. “PC-104” microcontrollers – small embeddable computers. Require programming. [www.pc104.com](http://www.pc104.com)
- n. Omega Engineering [www.omega.com](http://www.omega.com) Their extensive product line includes the NOMAD series of low cost data loggers; see especially the OM-42 and OM-44. These take 1 and 2 inputs, respectively and also measure temperature and humidity (although temp and hum may not be useful for a payload; see note e. above).
- o. Some sources of very small cameras/recorders
  - i. <http://www.pimall.com/nais/e.menu-bb.html>
  - ii. <http://www.pimall.com/nais/pvrc300.html>
  - iii. [http://www.spycameras.com/cameras,all-in-one-camera,hide-it-yourself-\(1\).html](http://www.spycameras.com/cameras,all-in-one-camera,hide-it-yourself-(1).html)
  - iv. <http://www.datavideo.us/products/players-recorders/dn-60-dv-hdv-solid-state-cf-card-recorder.html>