Coarse Sun Sensor

Requirements Specification

1.0 Performance & Configuration Requirements

1.1 Detection: The coarse sun sensor will be used to measure the angle between the sun vector and the normal to the coarse sun sensor detector.

1.2 Output: analog (2 wire) output current measurement.

1.3 Maximum Output Level: 1.3 milli-amps for the Sun along detector normal vector

1.4 Mass: less than 0.025 kg/detector

1.5 Detector FOV: minimum FOV of 70° half angle cone

1.6 Accuracy: < +/- 5° sun angle measurement from a single detector

2.0 Environmental Test & Analysis Requirements

2.1 Flight Thermal Environment: The expected flight temperature extremes will be in the range of 0°C to 40°C.

2.1.1 Thermal Design Test Temperature Limits: The coarse sun sensor will be tested to the following limits depending on the qualification status of the sensor.

2.1.1.1 Acceptance Testing Limits: +/- 5°C beyond flight environment. The acceptance testing limits shall be used for acceptance testing for a coarse sun sensors designs that have been qualified to the limits in paragraph 2.1.1.3.

2.1.1.2 Protoflight Testing Limits: +/- 10°C beyond flight environment. The protoflight testing limits shall be used for coarse sun sensor designs that have not been qualified and will not be qualified to the limits in paragraph 2.1.1.3. In this case all coarse sun sensors shall be tested to protoflight limits.

2.1.1.3 Qualification Testing Limits: +/- 15°C beyond flight environment. If the coarse sun sensor design has not been qualification tested to this limit, then either a qualification unit will be tested with subsequent units going through acceptance limits, or all units will be protoflight limit tested.

2.1.2 Number of Thermal Test Cycles

2.1.2.1 Acceptance Testing: 7 Cycles; 2 hour dwell at each extreme

2.1.2.2 Protoflight & Qualification Testing: 13 Cycles; 2 hour dwell at each extreme

2.2 Pressure Decay Environment: The ambient pressure range shall be less than 1×10^{-5} torr (space vacuum) after launch and during launch it will follow the pressure decay environment in Figure 1

2.3 Mass Acceleration Environment: The coarse sun sensor shall be capable of surviving a maximum quasistatic acceleration, as shown in Figure 2, applied in three orthogonal axes, one axis at a time. These accelerations are to be used for evaluating load carrying capability.

2.4 Random Vibration Environment: The maximum flight vibration spectrum shall be as shown in Figure 3. If the coarse sun sensor has been tested to the qualification level then all units will be acceptance tested only. If the coarse sun sensor has not been qualified then either a qualification test will be performed along with acceptance testing for subsequent units or protoflight testing will be performed on all units.

2.5 Pyroshock Environment: The maximum shock spectrum shall be as shown in Figure 4.

3.0 Documentation Requirements

3.1 Interface Control Document: Describes the electrical and mechanical interfaces, mass, and material properties for the coarse sun sensor.

3.2 Acceptance Test Report

3.2.1 Functional & Performance Testing: Provides results of functional and performance testing of the coarse sun sensor.

3.2.2 Environmental Testing: Show by test the unit satisfies thermal cycling and random vibration environmental requirements. If the unit has not been qualified to the expected environment then either perform qualification testing on one unit and acceptance testing on remaining units or perform protoflight testing on all units.

3.2.2.1 Thermal Cycling Testing

3.2.2.2 Random Vibration Testing: See Figure 3

3.2.3 Environmental Analysis: Show by analysis the unit satisfies the pressure decay and mass acceleration environmental requirements.

3.2.3.1 Pressure Decay: See Figure 1

3.2.3.2 Mass Acceleration: See Figure 2. The analysis should use a factor of safety on yield of 1.6 and a factor of safety on ultimate of 2.0.

3.2.4 System Level Testing

3.2.4.1 Pyroshock: See Figure 4. Pyroshock testing will be performed at the system level testing after final delivery but the unit must be capable of surviving the specified environment.

3.3 Calibration Parameters Delivery: Any parameters or equations necessary to meet performance requirements shall be delivered with the units.

Figure 1 **Pressure Decay Curve**

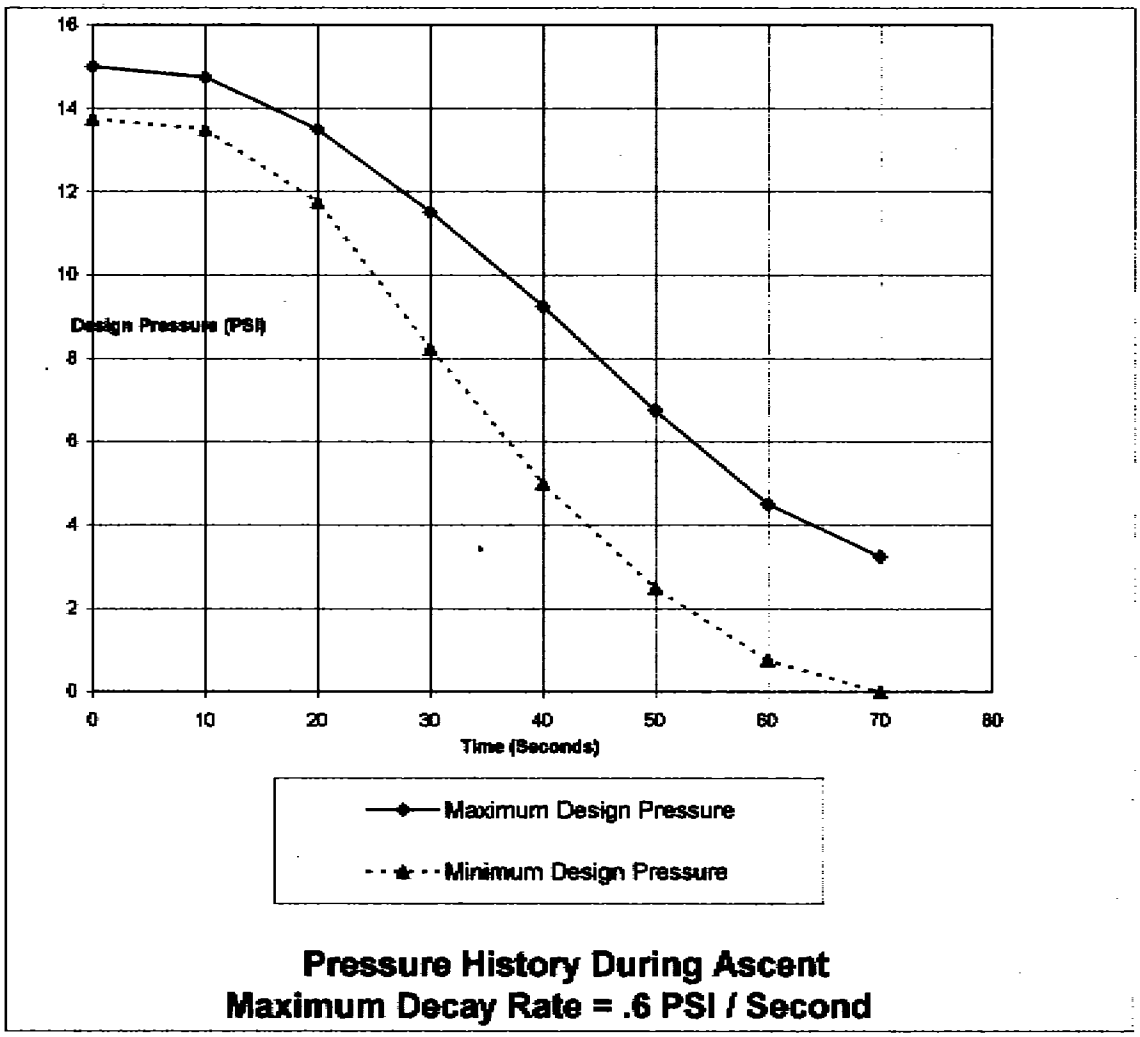
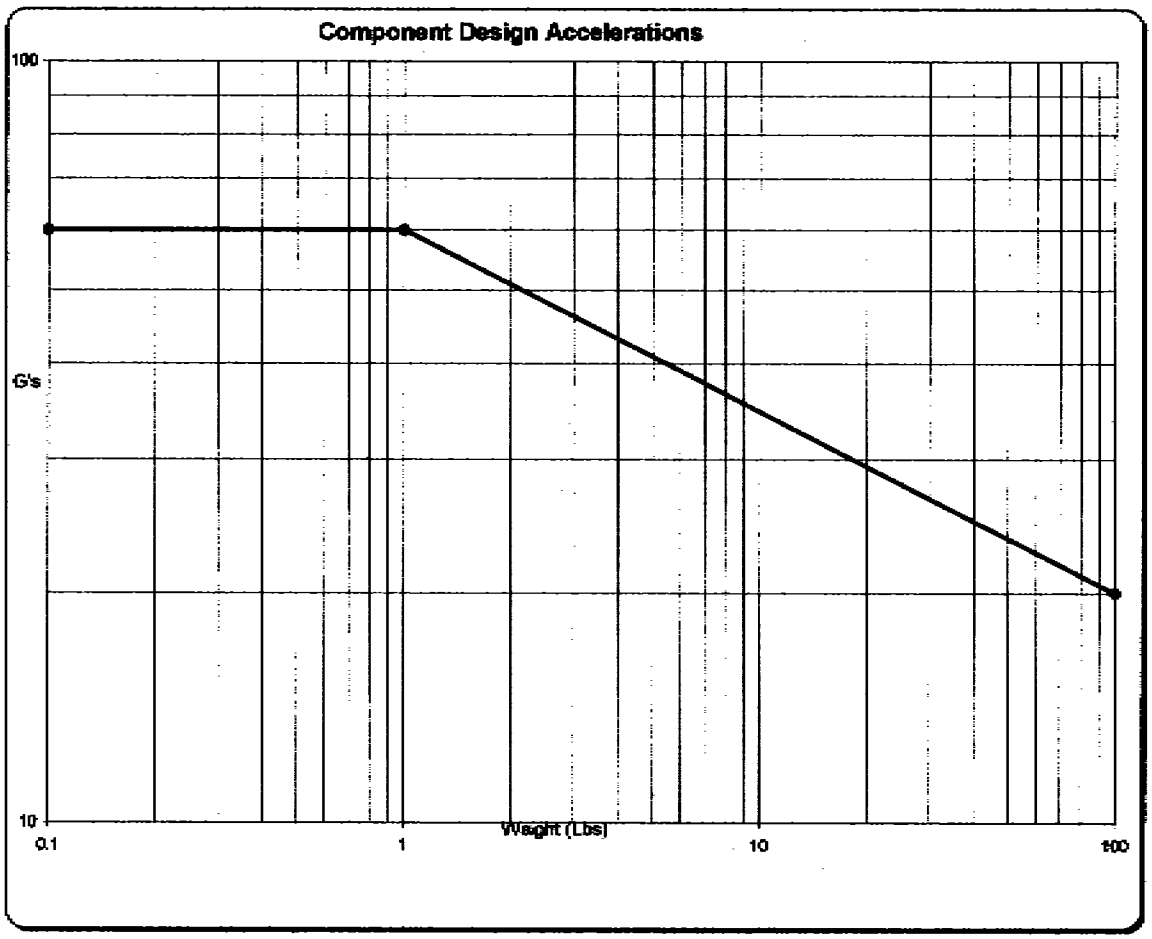


Figure 2 **Mass Acceleration Curve**



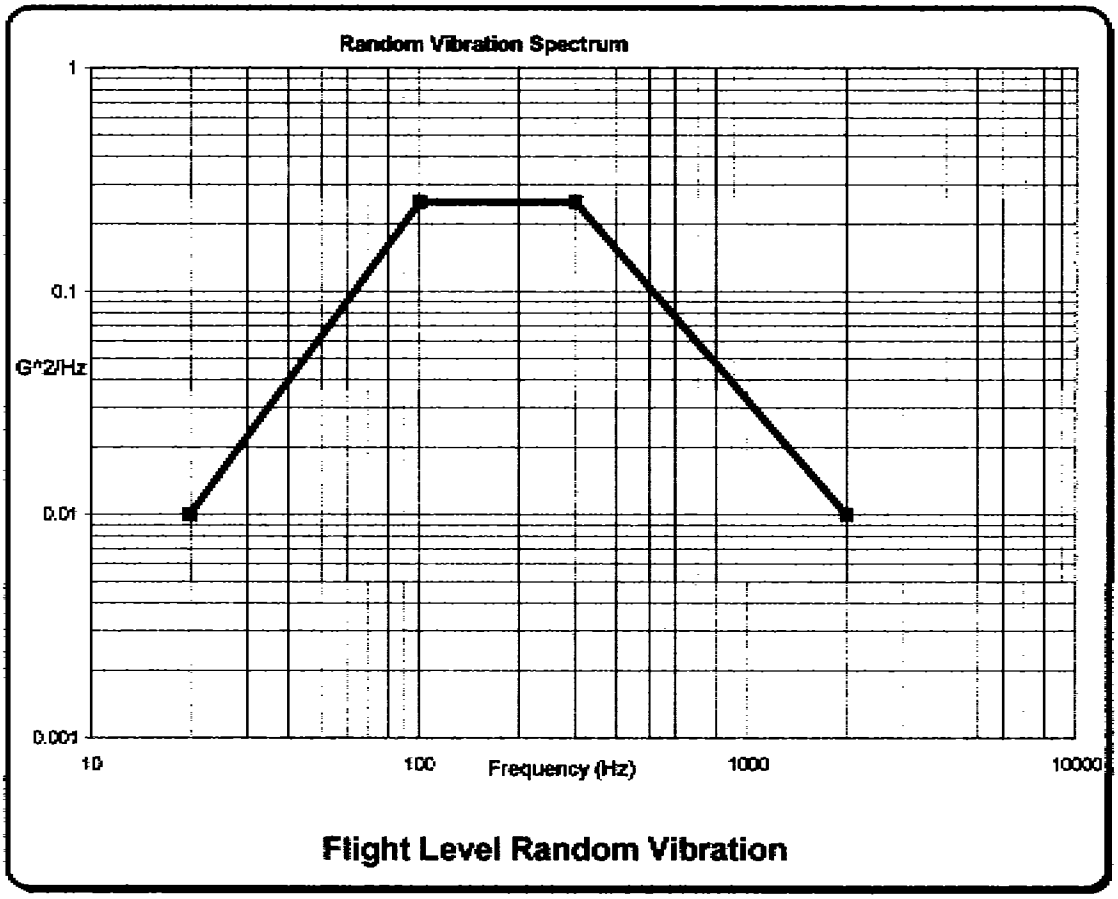
Design Accelerations	
Component Wt. (Lbs)	G's
0.1	60
1	60
100	20

To be applied in 3 orthogonal Axes, one axis at a time

Design Acceleration Philosophy

- These accelerations are to be used for evaluating the load carrying capability of components and secondary structure
- For Designated Components, the acceleration level from this curve may be used for random vibration test spectrum notching

Figure 3 **Random Vibration Environment**



Flight Environment

11.7 Grms

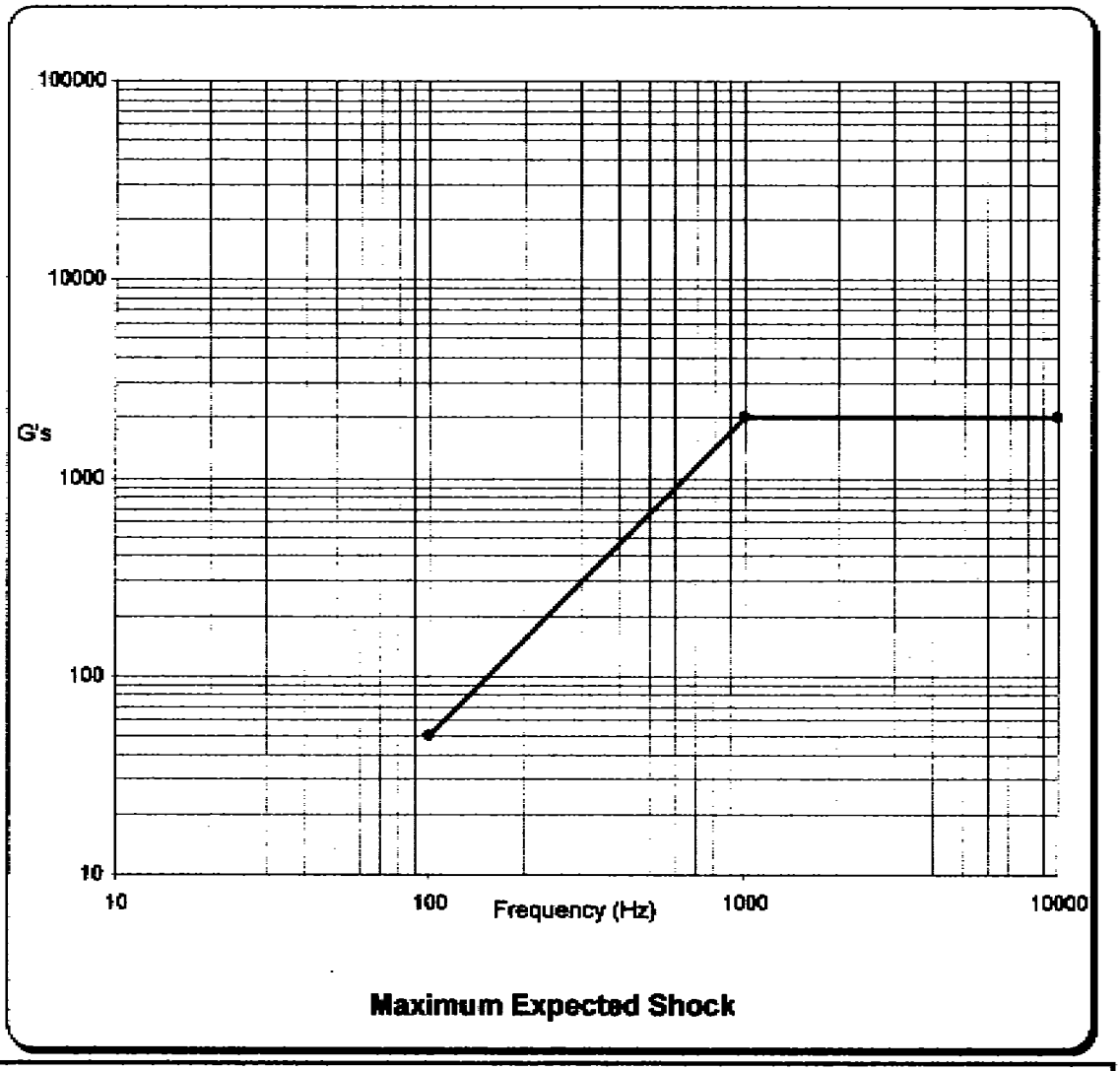
Frequency (Hz)	G^2/Hz
20	0.010
100	0.250
300	0.250
2000	0.010

Apply in 3 Orthogonal Axes

Test Levels

	Margin Above Flight Level (dB)	Duration (Minutes)
Non-Flight Prototypes (Design & Qualification Level)	6	2
Flight Units (Flight Acceptance Level)	0	1
Prototype Flight Unit (Protoflight Acceptance Level)	3	2

Figure 4 **Pyroshock Environment**



Maximum Expected Shock

Shock Response Spectrum Levels (Q = 10)

Frequency (Hz)	G's
100	50
1000	2000
10000	2000