Safety FDR

Introduction

The safety subsystem has four main objectives. The first objective is to ensure the integrity of the satellite before and during launch, and that Spartnik will not damage the launch vehicle, the primary payload, or any personnel present at the launch site. Identification, testing, and designing against all possible hazards, including structural, chemical, and electronic will accomplish this. The second objective is to produce a safety document. This document will be presented to prospective launch vehicle companies as assurance of the integrity of the satellite. The safety document is a report, which includes all analysis and testing done on Spartnik's systems as they relate to safety. The third objective is to design and build a cleanroom in which to integrate and test Spartnik's components. The cleanroom is discussed an another area of the Structures FDR. The fourth objective is to ensure the safety of the Spartnik team members during the integration and testing of the satellite. This is accomplished by writing handling procedures for hazardous chemicals, and integration and testing procedures for Spartnik. Possible Hazards

The following is a list of possible Spartnik hazards, broken down by subsystem.

Structures

G&H Mechanism: The mechanism could fail to release the satellite from the launch vehicle. The mechanism has been tested by the structures team, and the tests have produced satisfactory results. Once a launch vehicle has been secured, the launch vehicle adapter plate will be fabricated, and the G&H mechanism will be tested once more. It will then be returned to the G&H Company for verification.

Launch Vehicle Adapter Bolt: Analysis done by the structures team shows that the launch vehicle adapter bolt will be in pure tension during launch. The bolt is made of titanium and is strong enough to withstand the forces during liftoff.

Space worthiness of shell: The shell is made of space-rated honeycomb aluminum, which will withstand the launch. The shape of the shell is an octagonal cylinder, which will withstand the forces applied to it during launch.

Launch Vehicle Compatibility: The launch vehicle compatibility of Spartnik is unknown. Acoustical tests need to be performed to determine the frequency range that Spartnik can withstand. The orientations in which Spartnik can be launched also need to be tested.

• Several components of the Spartnik structure still need to be analyzed and tested. These components include the spacers, through bolts, grapple system, the antenna system, and micro-switches.

Payload

Digital Camera: The plastic parts of the camera could out-gas, creating a hazard to optics on the primary payload. The camera will be coated in Paralene-C to prevent out-gassing.

Power

Batteries: The batteries could become pressure vessels in the vacuum environment of space. This may cause the batteries to leak, or in the worst case, explode. The batteries need to be analyzed and tested to determine the likelihood of this occurring.

Thermal

The main hazard of the thermal subsystem, from a safety stand point, are the chemicals used to aid in heat dissipation. A procedure should be written for the handling of all chemicals and should be included in the safety document along with the materials data sheets for all chemicals used.

Attitude Determination and Control (ADAC)

Nutation Damper: The oil from the circular nutation damper could leak when exposed to a

vacuum environment. The joint where the circle is joined together is the most likely place for a leak to occur. The joint needs to be tested in a vacuum environment to determine if and at what pressure the oil will leak.

Launch Vehicle and Orbit

This subsystem does not have any physical components, and therefore does not need to be addressed from a safety stand point.

Telemetry, Tracking and Control

This subsystem still needs to be investigated for possible safety issues.

Safety Document

The safety document will be presented to prospective launch vehicle companies to assure them that Spartnik will not damage the launch vehicle or any other payloads on the vehicle. The document will contain all data and information pertaining to the safety of the satellite. The document will also include handling and integration procedures for Spartnik, including procedures for handling chemicals. The ground station requirements at the launch site will also be included in the safety document.