**SmallSat Integration Guidelines**

This document provides guidance for the coordination and integration of SmallSat related safety documentation.

**General Integration Policy**

The Range User/Launch Vehicle Provier is responsible for verifying SmallSat compliance with applicable engineering and safety system standards.

**AFSPCMAN 91-710 System Safety Documentation Requirements**

The purpose of the AFSPCMAN 91-710 system safety process, as tailored to SmallSats, is to:

* Implement a process to identify any SmallSat specific hazards, and
* Ensure those hazards do not pose a risk to personnel, other manifested spacecraft, or the launch vehicle.
1. **Volume 1 (Range Safety User Requirements Manual, Air Force Command and Range Safety Policies and Procedures):**
2. SSPP: A System Safety Program Plan (SSPP) for individual SmallSats is not required. The Range User shall be responsible to ensure that SmallSat missions for a specific launch, either meet the Range User SSPP, or will develop an integrated SSPP covering all SmallSat missions for a specific launch.
3. Tailoring: SmallSat specific tailoring, if required, may be accomplished at the request of the SmallSat Developer. As an alternative to formal tailoring, the Range User can establish Generic SmallSat Tailoring, in conjunction with Range Safety, for use by individual SmallSat Developers. The intent is to ensure the SmallSat Developer has specific guidance to ensure compliance with Range User AFSPCMAN 91-710[T].
4. **Volume 3 (Launch Vehicles, Payloads, and Ground Support Systems Requirements Requirements):**
5. Hazard Assessment: The individual SmallSat developer needs to identify SmallSat specific hazards. Several guidance documents are provided to assist in this effort. The SmallSat developer can use the portal document “Launching CubeSats from Vandenberg SFB” (SEAL-SSD-025) for insight on addressing the hazards determined through the use of Attachments A, B, and C. These attachments provide the means to determine and list ground processing hazards. Notify SLD 30/SEAL if your satellite has hazards that are not addressed in either SEAL-SSD-025 or the attachments. The attachments are intended as examples – it is the responsibility of the user to adapt the worksheet to the specific SmallSat situation.
6. MSPSP: A Missile System Prelaunch Safety Package (MSPSP) for individual SmallSats is not required. Information from the Range User needs to provide sufficient technical insight to substantiate any one of the following assertions for the individual SmallSat, or multiple SmallSats:
	* 1. That a SmallSat(s) poses no hazard;
		2. That hazards present in the SmallSat(s) are controlled to an acceptable level;
		3. That SmallSat hazards do not affect personnel safety.

Additional information for integration is provided in Attachment D, Range User SmallSat Integration Example.

1. Documentation format and content: Documentation format and content shall be determined through collaboration between the Range User/Launch Vehicle Provider, the SmallSat Developer, and Range Safety and will address hazard control verification. Additional SmallSat integration guidance is provided in Attachment D. Range Safety shall provide final approval of the documentation. Verification can be through memorandum or attachment to Range User data deliverables.

1. **Volume 6 (Personnel, Equipment, Systems, and Material Operations Safety Requirements)**
2. Ground Operations Plan (GOP):
3. With Range Safety concurrence, Ground Operations Plans (GOPs) for individual SmallSats will not be required.
4. For SmallSat launches, the Range User/Launch Vehicle Provider will ensure that SmallSats are included within the Range Users’ GOP, or shall provide an integrated GOP that covers all SmallSat and dispenser processing and operations.
5. Procedures and/or Operating Instructions
	1. Procedures and/or operating instructions to be performed at Vandenberg SFB shall be identified and assessed in the GOP.
	2. Procedures and operating instructions developed for SmallSats shall meet the requirements specified in Volume 6, Attachment 3, as tailored by the Range User/Launch Vehicle Provider.

**REFERENCES**

*What are SmallSats and CubeSats?* NASA, 06 August 2017, www.nasa.gov/content/what-are-smallsats-and-cubesats. Accessed 28 October 2021.

**Attachment A – SmallSat Safety Worksheet Example #1**

## SmallSat Name:

|  |  |  |
| --- | --- | --- |
| Hazardous Condition | Y, N/A or N/C | Comments |
| High noise levels  |  |  |
| High or low touch temperatures |  |  |
| Confined spaces, low O2 or asphyxiation |  |  |
| Biological or organic hazards |  |  |
| Hazardous commodities (material, liquid or gas) incl. cryogenics, toxics, flammables, volatiles or asphyxiants |  |  |
| Explosives or propellants |  |  |
| Stored energy sources |  |  |
| Deployments, moving surfaces, pinch points or sharp edges |  |  |
| Potential for corona or arc-flash in hazardous atmospheres or combustible areas |  |  |
| Electrostatic or electrical hazards (powered bus, batteries, voltage sources) |  |  |
| Non-ionizing radiation, RF emissions or EMI sensitive equipment |  |  |
| Radioactive materials(Ionizing) Radiation Sources |  |  |
| Lasers or masers |  |  |
| Structural hazards |  |  |
| Fracture or safety critical piece-parts or hardware |  |  |
| Hazardous, safety critical GSE, moves/lifts or operations |  |  |
| Ladders, work stands or platforms  |  |  |
| Other critical equipment or move/handling requirements |  |  |
| Any other hazardous conditions not identified |  |  |
| Not Applicable (N/A) – Condition does not exist for this SmallSat.Non-Credible (N/C) – Hazardous conditions is fully contained within the payload such that there is no means for personnel injury or damage to other payloads and the launch vehicle. |

## Additional Information

## Pressure Vessels

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Item 1 | Item 2 | Item 3 | Item 4 |
| Manufacturer |  |  |  |  |
| Type / Construction |  |  |  |  |
| Size |  |  |  |  |
| Commodity |  |  |  |  |
| Ground MEOP, psig |  |  |  |  |
| Proof pressure, psig |  |  |  |  |
| Burst pressure, psig |  |  |  |  |
| Burst Factor of Safety |  |  |  |  |
| Design Standard (e.g., DOT, AIAA, MIL-STD) |  |  |  |  |

## Batteries

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Item 1 | Item 2 | Item 3 |
| Manufacturer |  |  |  |
| Model |  |  |  |
| Chemistry (e.g., Li-Ion) |  |  |  |
| Capacity (A-hr) |  |  |  |
| Nominal Voltage |  |  |  |
| Charging Method |  |  |  |

## Transmitters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Item 1 | Item 2 | Item 3 | Item 4 |
| Max Power at Feed, W |  |  |  |  |
| Antenna Gain, dB |  |  |  |  |
| Frequency, Mhz |  |  |  |  |
| Use during ground processing |  |  |  |  |

## Deployments

|  |  |  |  |
| --- | --- | --- | --- |
| Item / Location | Deployment Device | Qty | Worst Case Ground Deployment Event |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Attachment B – SmallSat Data Sheet Worksheet Example #2**

PROGRAM NAME:

|  |  |  |
| --- | --- | --- |
| **MISSION / FLIGHT VEHICLE**  | MISSION: | LAUNCH VEHICLE: |
| **PROGRAM POINT OF CONTACT** | NAME: | CONTACT INFORMATION: |
| **SmallSat** | SIZE: | WEIGHT: |
| **VFSB LAUNCH LOCATION**  | LOCATION(S): | SmallSat QUANTITY: |

**Energetic Potential Hazards**

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Safety Data** | **YES** | **NO** |
| **1** | Pressurized Systems |  |  |
| **2** | Radioactive Materials (Ionizing Radiation) |  |  |
| **3** | Ordnance |  |  |
| **4** | Solid Propellant |  |  |
| **5** | Hazardous commodities (material, liquid or gas) incl. cryogenics, toxics, flammables, volatiles or asphyxiates |  |  |
| **6** | Payload powered/functioning during ground processing or ascent flight |  |  |

**Powered / Command Hazards**

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Safety Data** | **YES** | **NO** |
| **7** | Electrostatic or electrical hazards (powered bus, batteries, voltage sources) |  |  |
| **8** | Potential for corona or arc-flash in hazardous atmospheres or combustible areas |  |  |
| **9** | Non-ionizing radiation (RF emissions or EMI sensitive equipment) |  |  |
| **10** | Lasers or Masers |  |  |
| **11** | High noise levels |  |  |
| **12** | Deployables- Actuating Mechanism(s) |  |  |

**Operational Hazards**

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Safety Data** | **YES** | **NO** |
| **13** | Hazardous, safety critical GSE, moves/lifts or operations |  |  |
| **14** | High or low touch temperatures |  |  |
| **15** | Biological or organic hazards |  |  |
| **16** | Fracture or safety critical piece-parts or hardware |  |  |
| **17** | Other critical equipment or move/handling requirements |  |  |
| **18** | Will potential hazards be contained within spacecraft structure |  |  |
| **19** | Other hazardous conditions |  |  |

Provide additional information for all Hazards.

Information should contain a summary of hazard potential/quantity, and payload design to contain/control the hazard.

**Supplemental Information**

|  |  |
| --- | --- |
| **No.** | **Hazard Description and Controls** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

The purpose of this worksheet is to provide a streamline review of secondary payload safety.

The worksheet will provide information with respect to SmallSat safety compliance with AFSPCMAN 91-710, as tailored for the program.

The worksheet is to be used to identify any potential hazards that may have impact on launch processing, launch, and other launch contractors.

This worksheet will be reviewed and approved by the Range User to verify safety compliance based on information provided by the SmallSat developer.

Worksheet Instructions:

1. Provide basic SmallSat information and responsible point of contract. The Launch Vehicle provider shall provide launch location of the SmallSat.
2. Identify Potential SmallSat Hazards, answer Yes/No to the (19) stated items.
3. Items with a “Yes” response shall require explanatory data to be provided in the Supplemental Information.
4. Hazard Items determined to be relevant to safety compliance per AFSPCMAN 91-710, shall require addition documentation to show safety compliance.

**Attachment C –** **SmallSat Safety Data Sheet Worksheet Example #3**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **General Information** |   |   |  |
| Mission |   |   |   |
| Launch Site  |   | Environmental Limits |   |
| Size |   |   |   |
| Weight |   |   |   |
| **Potential Hazards** | **Y/N** | **Details** | **Safety Limit**1 |
| Propellant(s) |   | If Yes, Provide System Detail | Inert gas or hypergolic |
| Pressurized vessels/systems |   | If Yes, Provide System Detail | 150 psi or DOT/ASME Qual |
| Radioactive (ionizing) materials |   | RADSAFCOM (Radiological Safety Committee)  | Any amount (applies to ground processing and payload specific usage) |
| Ordnance |   | If Yes, Provide System Detail | Identify |
| Solid Propellant |   | If Yes, Provide System Detail (Identify Hazardous Classification and Amount) |  |
| Hazardous commodities (material, liquid or gas) incl. cryogenics, toxics, flammables, volatiles or asphyxiants |   | If Yes, Provide System Detail - Safety Data Sheets | Identify  |
| Any potential hazards contained within spacecraft structure |   | Provide Analysis |   |
| **Powered/Command Hazards** |   |   |   |
| Is the payload powered/functioning during ground processing or ascent flight |   | If yes, provide power / command inhibit structure | Timeline and Functions |
| Electrostatic or electrical hazards (powered bus, batteries, voltage sources) |   | If yes, provide hazard control limit | Identify |
| Potential for corona or arc-flash in hazardous atmospheres or combustible areas |   | If yes, provide hazard control limit | No ignition sources, dual fault |
| Non-ionizing radiation, RF emissions or EMI sensitive equipment |   | If yes, provide hazard control limit | Identify |
| Lasers or masers |   | If yes, provide hazard control limit | Identify |
| High noise levels  |   | If yes, provide hazard control limit | Identify |
| Deployables- Actuating Mechanism |   | If yes, provide hazard control limit | Identified by SmallSat developer |
| **Operational Hazards** |   |   |   |
| Hazardous, safety critical GSE, moves/lifts or operations |   | Verify operational controls |   |
| High or low touch temperatures |   | Verify operational controls | Identify |
| Biological or organic hazards |   | Verify operational controls |   |
| Fracture or safety critical piece-parts or hardware |   | Verify operational controls |   |
| Other critical equipment or move/handling requirements |   | Verify operational controls |   |
| Other hazardous conditions |   | Verify operational controls |   |

**Note:** 1. The “Safety Limit” column identifies specific codes and standards which set limit(s) for the identified hazards. Information existing in the published version of the table are offered as examples only. It is the responsibility of the SmallSat developer, in conjunction with the Range User/Launch Vehicle Provider to identify requisite limits for hazards and provide the corresponding code or standard citation.

**Attachment D – Range User SmallSat Integration Example**

SmallSat **Developer**

Documentation required: SmallSat details, hazard list, hazard analysis

C1

C2

C3

C4

Cn

C1

C2

C3

C4

Cn

C1

C2

C3

C4

Cn

**Integrator**

Documentation required

MSPSP

GOP

Tailoring

SmallSat details

Hazard list

Hazard analysis

Cn

**Integrator:**

Takes all pertinent information from SmallSat Developer and develops an MSPSP. This can be an addendum to the Vehicle MSPSP, which focuses on the payloads. (Refer to item 2.b. in main body of text.)

If GOP is affected by the various payloads, this can also be provided as an addendum GOP to the main GOP submitted. (Refer to item 3.a in main body of text.)

In the case that a possible non-compliance is encountered by the payloads, these can be captured, either by ELS, Tailoring, or waiver, separate from the vehicle documentation.

**SmallSat Developer:**

The SmallSat provided should provide all pertinent information to the integrator to develop the MSPSP, such as a description of the payload, hazards list, hazards reports, and process hazard analysis.

The integrator may want to provide a standard template to facilitate the compilation and insertion of individual payload information into the MSPSP.

Cn - individual SmallSat information

**Note:** See example deliverables outline on the next page.

**SmallSat Cn Example Outline**

1. **Mission Overview**

[*Guidance:* *Details on the individual SmallSat mission. An overview allowing reviewer to understand entire process of the mission*.]

1. **Payload Operations**

[*Guidance:* *Details on the payload dispenser and any other information that is pertinent to safety review. Include CONOPS from arrival at VSFB to deployment, including modes of operation*.]

1. **Safety**

[*Guidance:* *Provide description of hazards and inhibits (i.e. short circuit, battery thermal runaway, crushing, battery chemical toxicity, etc.). Include figures or schematics, if necessary. The hazards and inhibits can be documented as a hazards analysis table*.]

1. **Payload Summary**

[*Guidance:* *A brief review of previous discussions that include a compliance statement meeting the safety requirements of AFSPCMAN 91-710*.]

1. **Reference Documents**

[*Guidance:* *List of reference documentation. The reference documentation should also be submitted to the integrator as part of the SmallSat deliverable*.]