**HASP Student Payload Application for 2024**

|  |
| --- |
| Payload Title: |
| Institution: |
| Payload Class (Enter SMALL, or LARGE): | Submit Date: |
| Project Abstract: |
| Team Name: | Team or Project Website: |
| Student Leader Contact Information: | Faculty Advisor Contact Information: |
| Name: |  |  |
| Department: |  |  |
| Mailing Address: |  |  |
| City, State, Zip code: |  |  |
| e-mail: |  |  |
| Office Telephone: |  |  |
| Mobile Telephone: |  |  |

# Flight Hazard Certification Checklist

NASA has identified several classes of material as hazardous to personnel and/or flight systems. This checklist identifies these documented risks. Applying flight groups are required to acknowledge if the payload will include any of the hazards included on the list below. Simply place an (x) in the appropriate field for each hazard classification. **Note:** Certain classifications are explicitly banned from HASP (grey filled items on table below) and the remaining hazards will require additional paperwork and certifications. If you intend to include one of the hazards, you must include detailed documentation in section 3.8 of the application as required by the HASP Call for Payloads.

This certification must be signed by both the team faculty advisor and the student team lead and included in your application immediately following the cover sheet form.

|  |
| --- |
| **Hazardous Materials List** |
| **Classification** | **Included on Payload** | **Not Included on Payload** |
| RF transmitters |  |  |
| High Voltage |  |  |
| Lasers (Class 1, 2, and 3R only) Fully Enclosed |  |  |
| Pressure Vessels |  |  |
| Non-Rechargeable Batteries |  |  |
| Magnets less than 1 Gauss |  |  |
| Intentionally Dropped Components |  | **X** |
| Liquid Chemicals |  | **X** |
| Cryogenic Materials |  | **X** |
| Radioactive Material |  | **X** |
| Pyrotechnics |  | **X** |
| UV Light |  | **X** |
| Biological Samples |  | **X** |
| Rechargeable Batteries |  | **X** |
| High intensity light source |  | **X** |

Student Team Leader Signature: \_

Faculty Advisor Signature: \_

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# Payload Description

This section and its subsections should provide the reader with a reasonable understanding of the “why, what, and how” of your payload.

## 1.1 Payload Scientific / Technical Background

This section and subsections should contain a one to two-page summary of your payload mission, the scientific / technical background justifying your payload design, and the objectives you plan to achieve by the end of your project.

## 1.1.1 Mission Statement

Your statement should clear and concisely describe what you are going to do, where you are going to do it and why you are doing it.

## 1.1.2 Mission Background and Justification

This section will need to include information, derived from web & library sources, which provide a rationale for your mission as well as a context for your proposed measurements.

## 1.1.3 Mission Objectives

Your mission objectives should be specific items that you will have accomplished at the end of your mission. When thinking about and writing up your objectives make sure they are realistic, time-specific and include a measurable.

## 1.2 Payload Systems and Principle of Operation

This is a high-level description of your experiment including a statement of the principle of operation of your experiment plus showing and explaining the major components, processes and interfaces that make up your payload. A preliminary system level diagram should be included here. This diagram is then explained in detail in sections 1.3, 1.4, 1.5 and 1.6.

## 1.3 Major System Components

This section should describe the major component groups in the payload. The function of these groups should be described as well as the elements within the group that together generate the function.

## 1.4 Mechanical and Structural Design

This section describes your mechanical design and layout of your payload. Included here are the types of materials that will be used, methods of attaching the payload to the payload plate, and a description of the expected mechanical stresses and methods of stress mitigation.

## 1.5 Electrical Design

This section should describe your preliminary electrical design including sensors, sensor interface, controllers, data acquisition, storage, telemetry, and power supply system. Preliminary electrical schematics are required here.

## 1.6 Thermal Control Plan

This section should detail the thermal design plan for the payload. This section should discuss the payload operational temperature range and the steps that will be taken to ensure that they payload will maintain this range. What is the thermal environment you expect to encounter? What are the thermal operating ranges for components in your payload? How will you keep your payload in proper operating range?

# 2. Team Structure and Management

## 2.1 Team Organization and Roles

This section should include an Organization Chart and describes the roles, area of responsibility, and academic year of each team members. Subsystem and subtask leaders and their authority level are identified. Contact information such as phone numbers and e-mail can be included here.

## 2.2 Timeline and Milestones

This section includes a list of key milestones (and associated dates) for the project and a Gantt chart timeline. The timeline should be a weekly schedule organized by major WBS elements.

## 2.3 Anticipated Participation in Integration and Launch operations

This section should include a preliminary plan for participation in both payload integration and testing and launch operations. Final plans will be detailed in later documentation.

# 3. Payload Interface Specifications

## 3.1 Weight Budget

This section should document the weight of each payload component and the overall payload. This section should also demonstrate that the payload will successfully meet the guidelines detailed in the Call for Payloads document. In addition, a weight table must be included listing major payload components, weight of component, how the weight was determined and the uncertainty.

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Mass | Uncertainty | Comments |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| TOTAL |  |  |  |

## 3.2 Power Budget

This section should include a power budget discussion and justification identifying the power consumption of each component and showing how your system will utilize the power provided from HASP throughout the flight. In addition, a power table must be included listing current draw of components, how the current draw was determined and the uncertainty, and the total expected transient and steady state current draw for the payload.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Voltage | Current | Power (W) | Comments |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| TOTAL |  |  |  |  |

## 3.3 Downlink Serial Data

This section should identify if the payload intends to downlink serial data from HASP. If yes, then a preliminary discussion of what data will be telemetered down is required. Included in this discussion must be the total size of data package, the period of downlink, and the estimated downlink date rate. If known, and data table and sample data packet should be included.

## 3.4 Uplink Serial Commanding

This section should identify if the payload intends to use the uplink commanding capabilities provided by HASP. If yes, then a preliminary discussion on what commands will be utilized.

## 3.5 Analog Downlink

This section should identify if the payload intends to utilize the analog downlink capabilities provided via the EDAC cable on HASP.

## 3.6 Discrete Commanding

This section should identify if the payload is requesting the ability to utilize the extra discrete commanding (not power on/power off discrete) capabilities provided by HASP. If yes, include a scientific justification on how you intend to use discrete commanding. Remember not all seats have access to additional discrete commanding.

## 3.7 Payload Location and Orientation Request

In the section, identify if you have a payload seat preference. Please identify your top 2 choices. Please provide a short scientific justification for your seat preference.

## 3.8 Special Requests

In this section, please identify any special requests. Height and weight waivers must be detailed, including scientific justification and impact if request is not approved. If you intend to use an item on the Hazardous Material List, please include detailed information if you have it.

# 4. Preliminary Drawings and Diagrams

Please include all preliminary drawings for the payload. Drawings must include dimensions and units. Of special interest is how the payload will be mounted to the payload plate.

# 5. References

# Appendix A

Items that must be included in the Appendix section:

 Detailed electrical drawings not required in previous sections

 Detailed mechanical drawings not required in previous sections

Detailed timeline and milestone WBS document

Items that may be included in the Appendix section:

 Additional images of existing components

 Preliminary PCB layouts

# Appendix B: NASA Hazard Tables

## Appendix B.1 Radio Frequency Transmitter Hazard Documentation

RF transmitters are listed as a safety hazard by NASA. As such, the use of RF transmitters on HASP must be documented and approved in the Ground and RF flight safety plans. Any team that will use a transmitter must provide the following information in both their application and in the PSIP document supplied later in the flight season. **In addition, the frequency range 425 – 435 MHz is used for critical flight operations and therefore BANNED** for any payload use. This table needs to be completed for each RF transmitting device type that will be flown on HASP.

|  |
| --- |
| HASP 2024 RF System Documentation |
| Manufacture Model |  |
| Part Number |  |
| Ground or Flight Transmitter |  |
| Type of Emission |  |
| Transmit Frequency (MHz) |  |
| Receive Frequency (MHz) |  |
| Antenna Type |  |
| Gain (dBi) |  |
| Peak Radiated Power (Watts) |  |
| Average Radiated Power (Watts) |  |

## Appendix B.2 High Voltage Hazard Documentation

High Voltage systems are listed as a safety hazard on NASA payloads. Therefore, the use of High Voltage on HASP must be documented and approved in the Ground and Flight safety plans. A source is considered High Voltage if the output voltage is greater than 50V. Any team that will use a high voltage source must provide the following information in both their application and in the PSIP document supplied later in the flight season for each source type. In addition, a detailed schematic, safety plan and procedure for operation must be included in this application. A final version of these requirements must be included in the PSIP submitted later in the flight cycle.

|  |
| --- |
| HASP 2024 High Voltage System Documentation |
| Manufacture Model |  |
| Part Number |  |
| Location of Voltage Source |  |
| Fully Enclosed (Yes/No) |  |
| Is High Voltage source Potted? |  |
| Output Voltage |  |
| Power (W) |  |
| Peak Current (A) |  |
| Run Current (A) |  |

## Appendix B.3 Laser Hazard Documentation

Lasers are listed as a safety hazard on NASA payloads. Therefore, the use of lasers on HASP must be documented and approved in the Ground and Flight safety plans. Only Class 1, 2, and 3R lasers will be considered for flight. All other laser classes are **banned**. Any team that will use an on-board laser must provide the following information in both their application and in the PSIP document supplied later in the flight season for each source type. The laser approval process is a very time-consuming operation and complete data must be submitted with the application to ensure that payload team is notified of approval status early in the HASP timeline. In addition, a detailed schematic, safety plan and procedure for operation must be documented in the PSIP.

|  |
| --- |
|  HASP 2024 Laser System Documentation |
| Manufacture Model |  |
| Part Number |  |
| Serial Number |  |
| GDFC ECN Number |  |
| Laser Medium |  |
| Type of Laser |  |
| Laser Class |  |
| NOHD (Nominal Ocular Hazard Distance) |  |
| Laser Wavelength |  |
| Wave Type  | *(Continuous Wave, Single Pulsed, Multiple Pulsed)* |
| Interlocks | *(None, Fallible, Fail-Safe)* |
| Beam Shape  | *(Circular, Elliptical, Rectangular)* |
| Beam Diameter (mm) |  | **Beam Divergence (mrad)** |  |
| Diameter at Waist (mm) |  | **Aperture to Waist Divergence (cm)** |  |
| Major Axis Dimension (mm) |  | **Major Divergence (mrad)** |  |
| Minor Axis Dimension (mm) |  | **Minor Divergence (mrad)** |  |
| Pulse Width (sec) |  | **PRF (Hz)** |  |
| Energy (Joules) |  | **Average Power (W)** |  |
| Gaussian Coupled (e-1, e-2) | *(e-1, e-2)* |
| Single Mode Fiber Diameter |  |
| Multi-Mode Fiber Numerical Aperture (NA) |  |
| Flight Use or Ground Testing Use? |  |
| Beams Enclosed? |  |
| Transmitting External to payload? |  |

## Appendix B.4 Battery Hazard Documentation

Batteries are listed as a safety hazard on NASA payloads. Therefore, the use of any batteries on HASP must be documented and approved in the Ground and Flight safety plans. Unmodified general use alkaline and lithium-ion batteries will be approved but must be documented in the form below. Any modifications to pre-packaged batteries are **banned** and will not be allowed on HASP**.** In addition, all rechargeable batteries are banned from use on HASP. All Li-ion batteries must have a UL certification. When not installed in the instrument, Li-Ion batteries must be stored in a fire-rated bag or cabinet. Examples of previous battery types that have been approved on HASP are listed below:

* Any domestic battery manufacturer: Duracell, Energizer, Rayovac, etc
* Ultralife U9VL-J-P

|  |
| --- |
| HASP 2024 Battery Hazard Documentation |
| Battery Manufacturer |  |
| Battery Type |  |
| Chemical Makeup |  |
| Battery modifications | *(Must be NO)* |
| UL Certification for Li-Ion |  |
| SDS from manufacturer |  |
| Product information sheet from manufacturer |  |

## Appendix B.5 Pressurized System Hazard Documentation

Pressurized systems are listed as a safety hazard on NASA payloads. Therefore, the use of any pressurized systems on HASP must be documented and approved in the Ground and Flight safety plans. Any component that has a pressure differential with the external atmosphere surrounding it is considered a pressurized system. Teams that have questions about Pressurized System hazards can request, through HASP Management, a meeting with the NASA Pressure Systems Manager.

Additional documents required for review and certification of the pressurized or vacuumed systems include:

* The following requirements apply to all components within the pressure boundary (the pressure source to the exhaust/relief valve)

- Detailed Pressure Systems Configuration Drawings/Schematics

- Detailed Bill of Materials with Maximum Allowable Working Pressure (MAWP) pressure ratings

- Data Sheets of Applicable Pressurized Components (Valves, Regulators, Relief Valves, Gauges, flexible hoses)

* Proof Pressure Test Records &/or Leak Test Records

Pressure Vessels containing custom made or non-coded components will need to be tested. Pressure/Leak Test results must be included documenting a stable chamber for a per applicable safety and engineering practices. NASA Safety guidelines require a 10-minute pressure/leak test. Mission Assurance testing should be 12 hours.

* Functional Test Record for Relief Valves (sticker or tag on equipment)

- All relief valves must be ASME rated. New valve needs the requires stamp information. Reused valves require a pop test.

* Applicable calibration record for pressure gauges (stickers or tags on equipment)

- Safety critical pressure gauges must be calibrated every 3 years. Reference only pressure gauges must be calibrated every 5 years. Calibration documentation must be included.

* Applicable engineering analyses (possibly analysis may include pipe/tube stress analysis per ASME B31.3, tube pressure rating table or relief device sizing analysis)
* Provide pressurization hazardous procedure, if applicable, and SDS(s)
* Note: Personnel training in pressure system or compressed gas safety is also required to operate pressure systems at NASA WFF or its associated facility.

- Pressure systems safety training and on the job training for mission operations required. A letter from university management certifying that students or system operators have completed this training must be included.

|  |
| --- |
| HASP 2024 Pressurized System Hazard Documentation |
| System Description |  |
| Maximum Expected Operating Pressure (PSIG) or Vacuum |  |
| Fluids (e.g. GN2, GHe, Air)\* |  |
| Notes |  |
| SDS from manufacturer |  |

\***Note:** Only gaseous fluids are allowed here. Any liquids are still banned on HASP.