Arizona Near Space Research

Payload Design Specification (PDS)
Version 1

Requirements For Payload Builders

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Revision History

Effective Date	Revision	Author	Description of Changes
9/10/2025	V1.0	C. Jacobs	Initial Release

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List of Acronyms and Abbreviations

ANSR – Arizona Near Space Research

ASCEND! – Aerospace STEM Challenges to Educate New Discoverers

PDS – Payload Design Specification

FRR – Flight Readiness Review

RF – Radio Frequency

FCC – Federal Communications Commission

GPS – Global Positioning System

STEM – Science, Technology, Engineering, and Mathematics

1.0 Introduction

Arizona Near Space Research (ANSR) conducts high-altitude balloon missions to support STEM education, research, and outreach. Student teams, educators, and research partners design payloads that fly aboard ANSR missions to collect data, test technologies, and gain hands-on engineering experience.

The Payload Design Specification (PDS) provides a set of guidelines to ensure payloads are safe, reliable, and compatible with ANSR flight operations.

1.2 Purpose

The purpose of the PDS is to:

- Provide a common framework for payload design.
- Ensure payloads are safe for launch, flight, and recovery.
- Standardize integration across different teams and missions.

1.3 Scope

The PDS applies to any and all payloads flown on ANSR high-altitude balloon missions, including educational flights (e.g., ASCEND!), research payloads, and partner experiments.

1.4 Non-Compliance and Exceptions

ANSR reserves the right to deny or ground any payload that does not comply with the PDS, appears unsafe, or poses a risk to mission success. Non-compliant payloads may be refused flight by any ANSR official or officer.

A waiver process exists to document an exception to a requirement for a specific requirement once sufficient detail has been provided to receive written approval following ANSR review. Each noncompliant requirement will need a waiver in order to be approved for flight.

1.5 Definitions and Terms

To improve clarity in interpretation of these requirements, the following terms are defined by ANSR:

- Shall means an item is required for compliance to follow this specification.
- Should means an item is strongly recommended to be followed, as it likely improves mission success, but is not required.
- Will indicates an event that occurs during the flight operations process.
- Note means a recommendation or helpful guidance.

2.0 Payload Specifications

2.1 General Requirements

2.1.1 All parts shall remain attached throughout flight and recovery.
2.1.2 Payloads shall not contain hazardous materials (flammables, explosives, pyrotechnics, compressed gases, or liquids).
2.1.3 Payloads shall be self-contained with their own power source.
2.1.4 Payloads shall use the standard lamp rod attachment mechanism as defined by ANSR. The lamp rod must pass continuously through the payload and shall not be cut or broken.
2.1.5 Payload weight shall not exceed 3 lb (1.36 kg) including all components, unless otherwise approved.
2.1.6 Payloads should be designed with recovery in mind (robust construction, labels with team contact info).

2.2 Mechanical Specifications

2.2.1 Maximum dimensions: 24 in × 24 in × 24 in.
2.2.2 The lamp rod passes through the center of the payload box and extends at least 6 in beyond the top and bottom surfaces to allow for secure attachment to the balloon flight string with shackles.

2.3 Electrical Specifications

2.3.1 Payloads shall use battery power only (no external tethered power).
2.3.2 Batteries should be secured to prevent movement and short circuits.
2.3.3 Any radio transmitters shall comply with FCC/ham radio regulations.
2.3.4 All RF sources shall be reviewed and approved by ANSR before flight. Teams must coordinate frequencies and transmission timing with ANSR.
2.3.5 Wiring should be secured and insulated.

2.4 Operational Requirements

2.4.1 Payloads should operate safely at temperatures down to -60°C and low atmospheric pressures (~1% of sea level).
2.4.2 Payloads shall tolerate ascent, float, and descent without shedding parts.
2.4.3 Payloads shall not deploy objects or separate during flight.
2.4.4 Payloads should be designed for tool-less integration and recovery.
2.4.5 Payloads should include an accessible power switch or 'Remove Before Flight' device.
2.4.6 Payloads shall include an external surface area reserved for ANSR-provided identification or mission sticker.

3.0 Testing Requirements (Recommended but Optional)

3.1 Bench Testing

Prior to delivery, teams should demonstrate:

- Successful power on/off.
- Data recording or transmission functions.
- Safe battery handling and secured wiring.

3.2 Environmental Testing

3.2.1 Hot/Cold Test: Operate payload in a household freezer, outdoors in direct sun, or in a thermal chamber to simulate high-altitude conditions.
3.2.2 Vibration Test: Perform a 'shake test' to ensure nothing comes loose.
3.2.3 Drop Test: Drop payload from >1 m to confirm robustness of enclosure.
3.2.4 Teams should prepare and use a launch checklist to verify readiness.

4.0 Integration and Flight Operations

4.1 Payload Review and Delivery

4.1.1 Payloads shall be delivered to ANSR by the integration deadline at the preflight workshop for in-person inspection and final weight collection.

5.0 Contacts

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