ISPIDA ASTG

Team Name	Aerospace Team Graz
Rocket Name	ISPIDA
Category	H9 (9 km hybrid SRAD)
University	Graz University of Technology
Country	Austria
Team ID	02

Introduction and Project Goals

Following four previous launch vehicles, the Aerospace Team Graz now presents its most advanced system to date: ISPIDA, the fifth rocket of the team and the third powered by a hybrid engine. Building on the experience from earlier EuRoC campaigns, this project sets goals that reflect both technical progress and competitive aspirations:
- reach an apogee of 9 km with a nominal launch and recovery,
- land the guided nosecone on a designated landing site,
- create high-quality and comprehensive technical documentation,
- and reach the top 5 at EuRoC 2025.

Additionally, this mission and the EuRoC 2025 provide valuable opportunities for the team to gain practical experience, broaden their technical expertise, and build lasting connections with fellow students from across Europe.

Hard Facts

- diameter 152.4 mm
- length 4357 mm
- wet mass 47.0 kg
- dry mass 29.6 kg
- burn time 9.5 s
- total impulse 32.1 kNs
- max. velocity 1940 km/h
- total flight time 4 min
- telemetry range 30 km
- max. thrust 4.0 kN
- max. acceleration 7.2 g

Aerostructure Subsystem

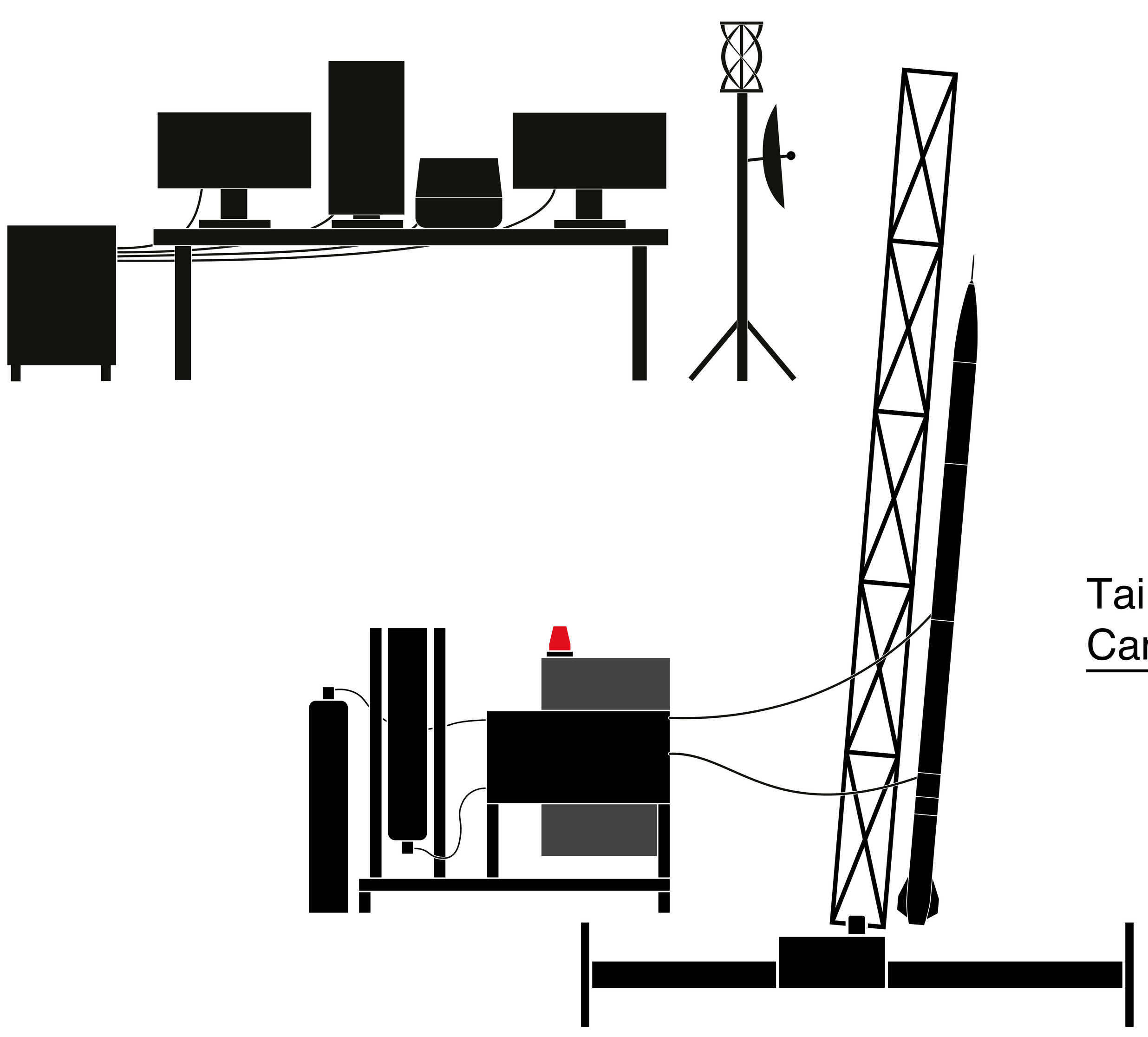
The main hull is divided into five carbon fiber reinforced polymer sections, supplemented by glass fiber elements to guarantee RF transparency where required. The oxidizer tank is structurally integrated into the airframe, designed to accommodate sensors, fluid lines, and couplings.

To achieve precise apogee targeting, an actively controlled air brake provides additional aerodynamic control during ascent.
Four lightweight CFRP fins, filled with a microsphere resin solution, ensure aerodynamic stability throughout flight.

Ground Support Equipment

The fully remote-controlled filling station enables safe fueling of both oxidizer and pressurizer, while multiple sensors continuously monitor pressures, temperatures, wind speed, and other critical parameters.

The mission control complements this system by providing real-time data visualization from all sensors and full remote operation of every subsystem and actuator.



Guided Nosecone

The guided nosecone separates from the rocket at apogee. It deploys a parafoil at 450 m and is steered autonomously. Dedicated avionics and telemetry enable controlled flight to a defined landing site.

Recovery Subsystem

The recovery system is a dual-deployment, two-parachute system with electrical and mechanical cross-redundancy.

1st deployment: Argon-actuated nosecone separation system initiates drogue parachute ejection at apogee. Shallow pressure chamber located beneath drogue chamber for minimal gas usage. Cross-shaped aramid drogue ensures stable descent.

2nd deployment: Pyrotechnically activated pin-release system deploys main parachute. Elliptical polyamide canopy provides slow and controlled landing.

Flight Computer Subsystem

The avionics system combines in-house hardware, a custom operating system, and advanced estimation algorithms to provide reliable flight control:

- Hardware: 85 self-designed and assembled PCBs, supported by 76 distributed sensors (excl. payload).
- Software: a SRAD real-time operating system with a modular and flexible architecture.
- Communication: decentralized sensor and control nodes connected via CAN bus.
- Interfaces: USB-C umbilical for on-pad power supply and reset capabilities.
- Navigation: altitude estimation through multiple sensors fused with an extended Kalman filter.

Telemetry Subsystem

A bidirectional LoRa wireless link with transmitting power up to 1.5 W ensures robust communication.

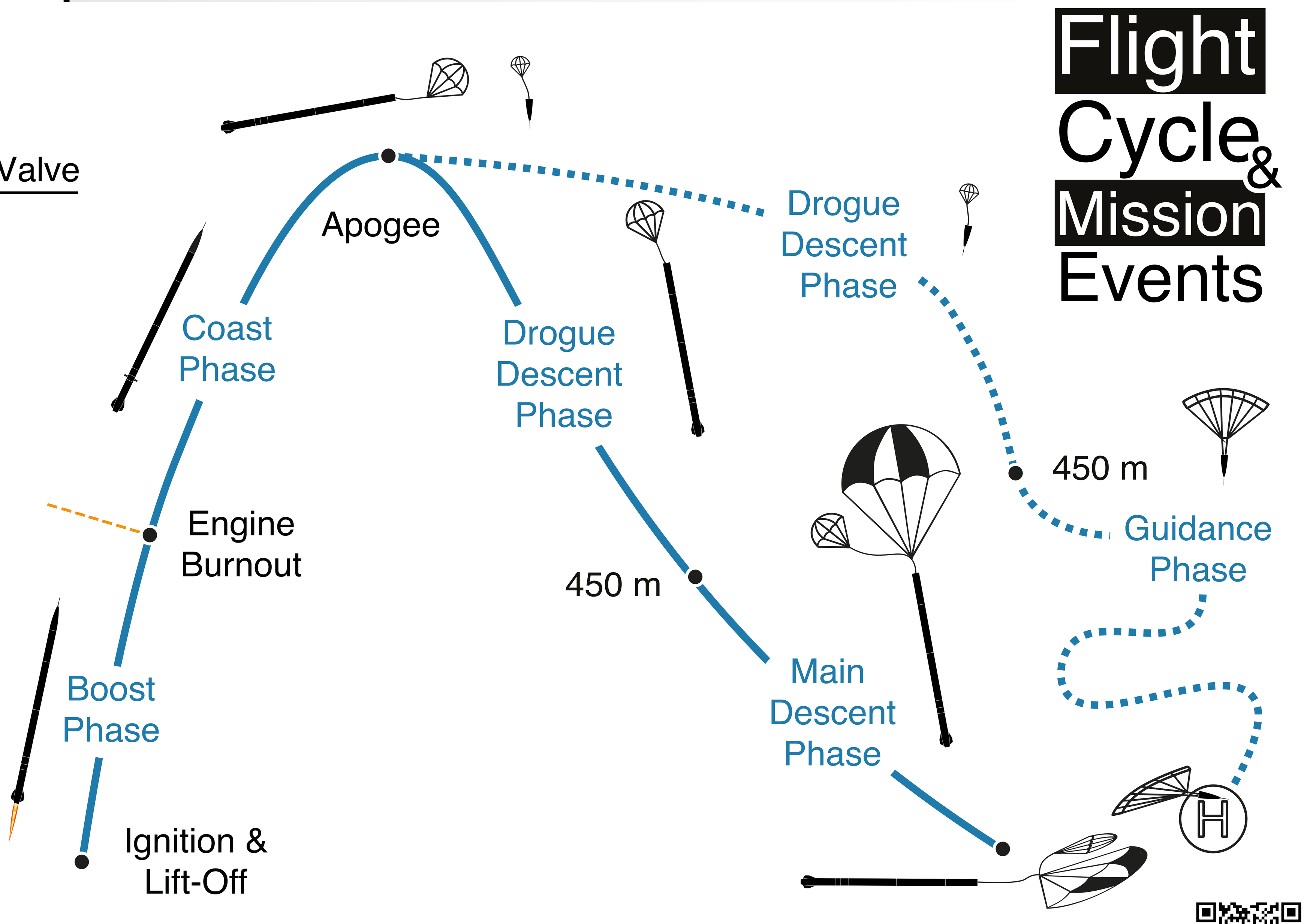
Self-developed antenna system, consisting of two patch antenna rings on the outside of the rocket:
- GNSS antennas for location tracking,
- 2.4 GHz antennas for data and command transmission.

Propulsion Subsystem

The externally pressurized hybrid rocket engine combines HTPB fuel with nitrous oxide oxidizer, pressurized by nitrogen at 300 bar.

Some features include:
- active pressurization via a servo controlled ball valve,
- cavitating venturi for passive mass flow regulation,
- metal 3D-printed single element swirl injector,
- twisted finocyl fuel grain geometry,
- and a full graphite nozzle.

Flight Cycle & Mission Events



aerospaceteamgrazofficial aerospaceteamgraz Aerospace Team Graz