ALCEDO 01

Team Name	Aerospace Team Graz
Rocket Name	ALCEDO
Category	H9 (9 km hybrid SRAD)
University	TU Graz
Country	Austria
Team ID	01

Introduction and Project Goals

Aerospace Team Graz was founded in 2019 and grew to an interdisciplinary student organization with approximately 90 members, spanning 18 fields of study. After developing two solid propellant rockets the focus shifted in 2023 to hybrid engines with HALCYON. The team proudly presents HALCYON's successor: ALCEDO.

The main project goals are to:
- Create high-qualitiy and comprehensive technical documentation as a foundation for future projects.
- Optimize and improve the design of our pressurized hybrid engine.
- Participate the first time in the history of ASTG in the 9 km flight category of EuRoC
- Design and build a rocket capable of launching to either 3 km or 9 km, ensuring a successful campaign at EuRoC even if flight conditions prohibit a 9 km launch.
- Reach the top five at EuRoC'24.

Hard Facts

- max. velocity: 1962 km/h
- diameter: 152.4 mm
- telemetry range: 30 km
- mass: 42.3 kg
- length: 3915 mm
- burn time: 9 s
- payload: 2.5 kg
- max. acc.: 9.8 g
- total impulse: 24762 Ns
- max. thrust: 4.4 kN
- total flight time: 4 min

Aerostructure Subsystem

Four lightweight CFRP fins with foam core provide aerodynamic stability

Structural oxidizer tank with integrated connections for sensors, fluid lines, and airframe couplings

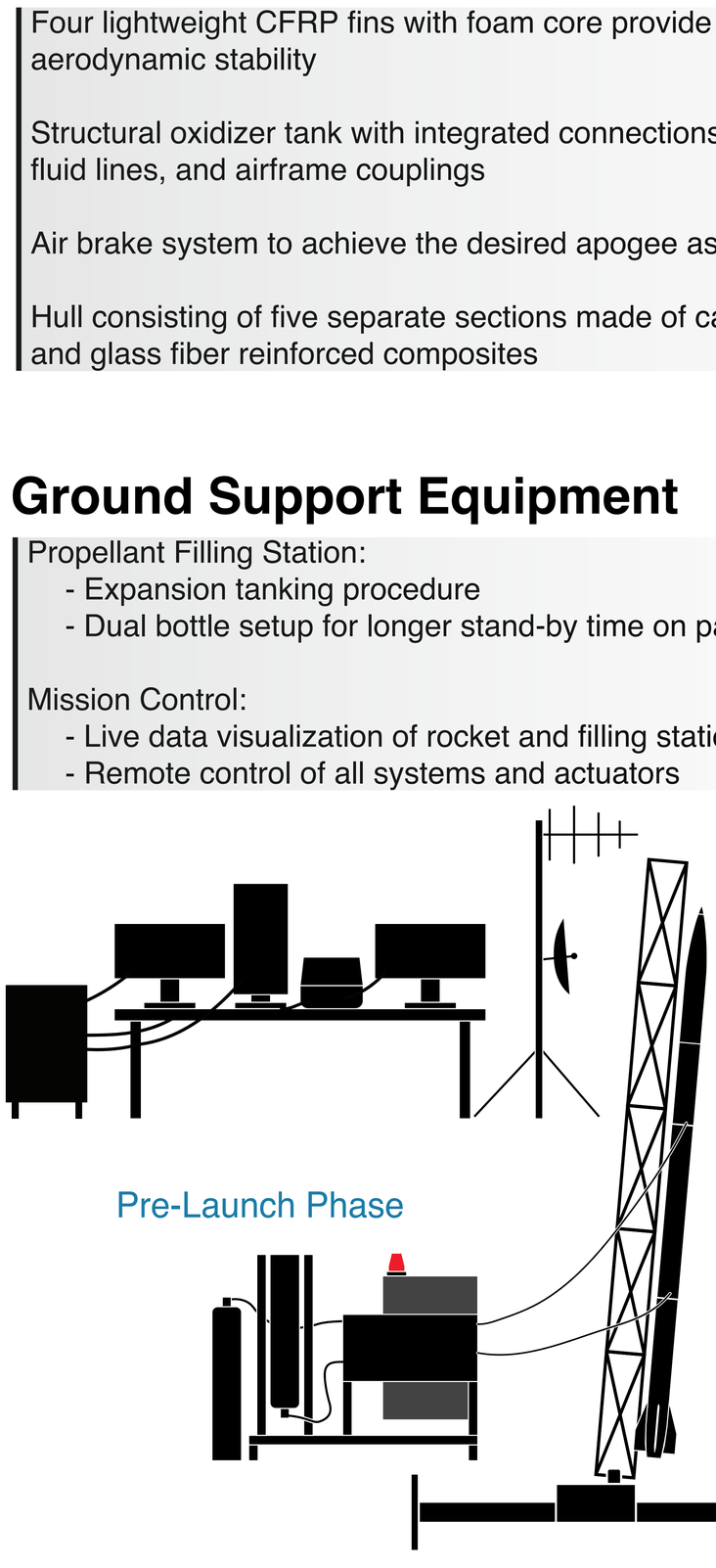
Air brake system to achieve the desired apogee as close as possible

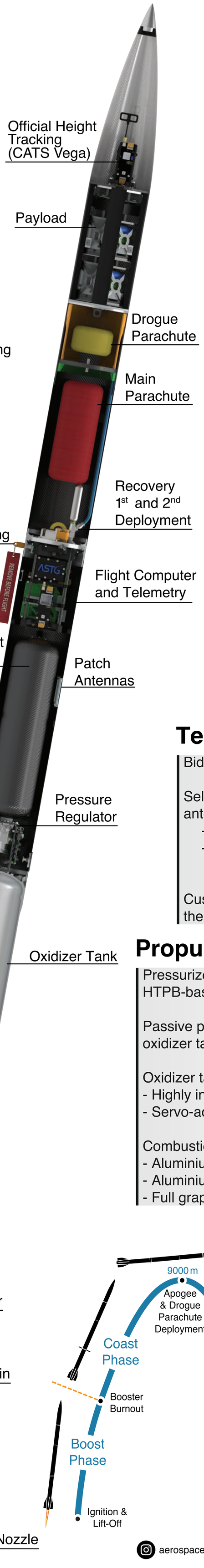
Hull consisting of five separate sections made of carbon fiber and glass fiber reinforced composites

Ground Support Equipment

Propellant Filling Station:
- Expansion tanking procedure
- Dual bottle setup for longer stand-by time on pad

Mission Control:
- Live data visualization of rocket and filling station sensors
- Remote control of all systems and actuators





Payload

Compartment for two 1U CubeSats designed for up to 2.5 kg payload mass total:
- Easily exchangeable via payload rail system
- RF transparent nose cone for payload telemetry
- Camera window provides footage of parachute deployment
- Demonstrator for Attitude Determination System

Recovery Subsystem

Fully redundant dual-deployment recovery system with two-parachute design

1st deployment: argon cartridges used for nose cone separation and Drogue parachute deployment at apogee; compact pressure chamber minimizes gas usage

2nd deployment: redundant tender descender release mechanism used to deploy the Main parachute

High strength aramid Drogue chute and Main chute bag and lightweight ripstop main parachute

Flight Computer Subsystem

28 PCBs all designed and soldered in-house

Nearly 60 sensors spread throughout the rocket (excl. payload)

SRAD real-time-operating-system with flexible software design

Modular sensor and control nodes connected via CAN bus

USB-C umbilical connection for power and data transfer on pad

Telemetry Subsystem

Bidirectional wireless link with high transmitting power (1W)

Self-developed antenna system, consisting of three patch antenna rings on the outside of the rocket:
- One GNSS ring for location tracking
- Two 2.4 GHz antenna rings for data and command transmission

Custom packet protocol with visualization and storage on the ground

Propulsion Subsystem

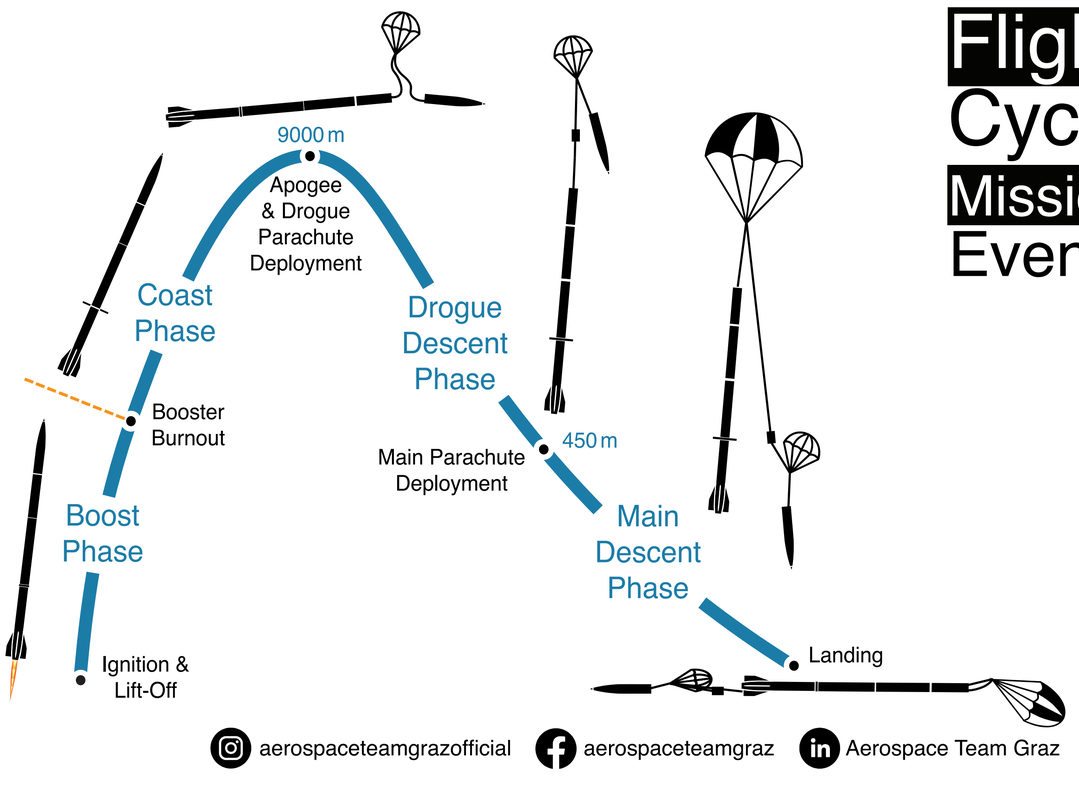
Pressurized hybrid engine using nitrous oxide as oxidizer, HTPB-based fuel, and 300 bar nitrogen as pressurizing gas.

Passive pressurization with a pressure regulator between the oxidizer tank and pressurant tank.

Oxidizer tank:
- Highly integrated to save space and weight
- Servo-actuated ball valve serves as main valve

Combustion chamber:
- Aluminium casing with phenolic cotton insulation
- Aluminium 3D printed single-element swirl injector
- Full graphite nozzle

Flight Cycle & Mission Events



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