HALCYON | 01

ASTG

Team Name	Aerospace Team Graz
Rocket Name	HALCYON
Category	H3 (3 km hybrid SRAD)
University	Graz University of Technology
Country	Austria
Team ID	01

Introduction and Project Goals

Since its founding in late 2019, the Aerospace Team Graz grew to an interdisciplinary team of over 80 students from 15 different fields of study. After two solid propelled rockets, AVES and AVES II, launched at previous EuRoC editions, the team introduces its first hybrid rocket, **HALCYON.**

The main **project goals** are to
- perform a test flight of the complete rocket,
- accomplish a successful launch and recovery,
- create high quality and extensive technical documentation,
- and reach the top 5 at EuRoC.

Additionally, this mission and the European Rocketry Challenge itself will help the team members to gain experience, to expand their knowledge and to make new friends and colleagues from all over Europe.

Hard Facts

- diameter 152.4 mm
- wall thickness 1.3 mm
- mass 32 kg
- max. velocity 950 km/h
- max. acc. 6 g
- payload 4 kg
- telemetry range 16 km
- length 3568 mm
- total impulse 11000 Ns
- burn time 5 s
- max. thrust 2.5 kN
- total flight time 218 s

Aerostructure Subsystem

Four lightweight CFRP fins with foam core (under 80g each) provide aerodynamic stability

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

Hull consisting of five separate sections made of carbon fiber and glass fiber reinforced composites
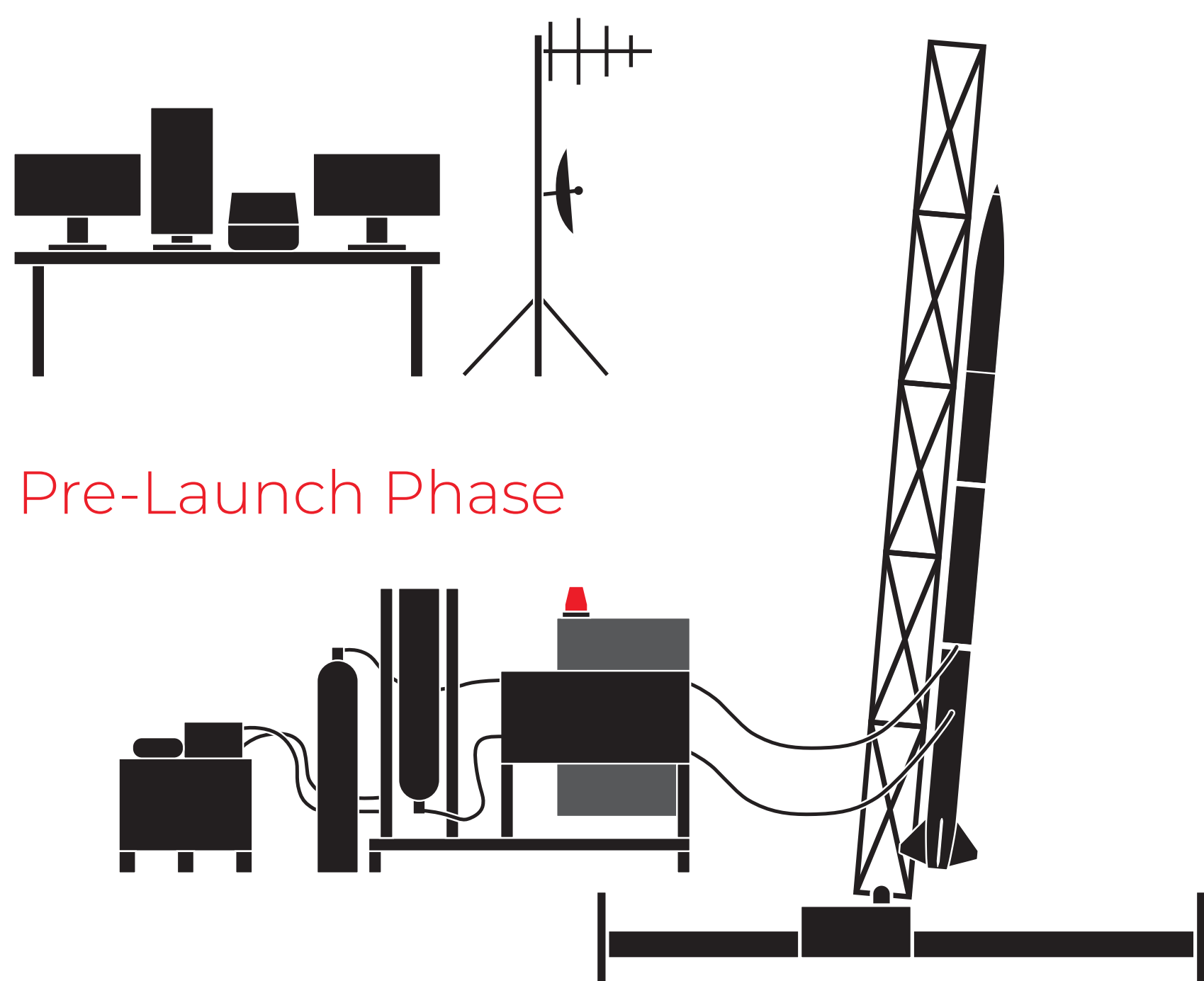
Ground Support Equipment
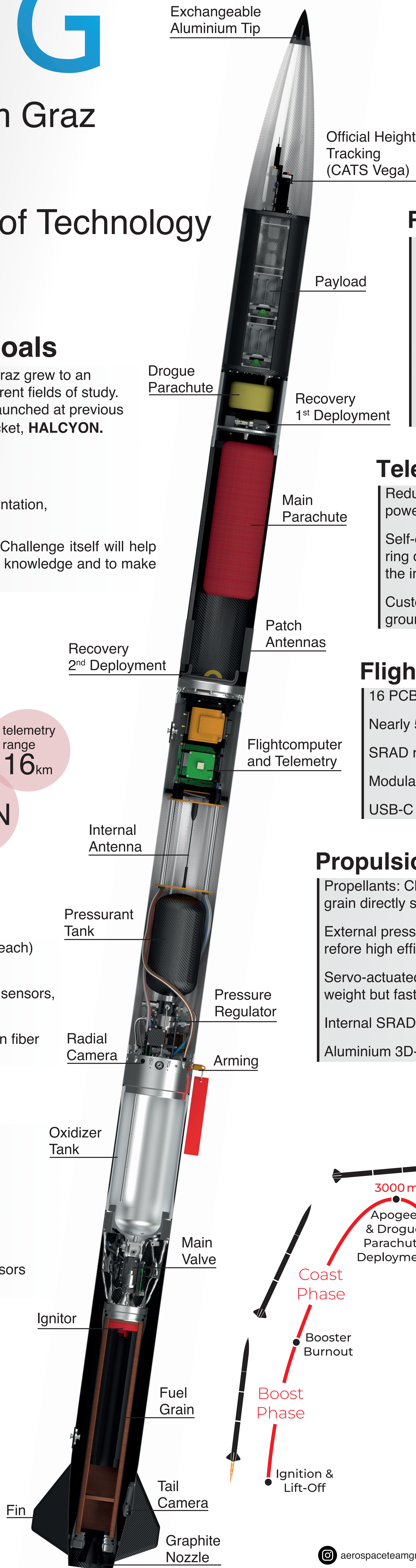
Propellant Filling Station:
- Cooling system with dry-ice heat-exchanger to chill nitrous oxide to -10°C for increased density
- Heating system to induce mass flow during fueling

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

Pre-Launch Phase

Payload

Compartment for three 1U CubeSats designed for up to 4 kg payload mass total:

- easily exchangeable via payload rail system
- RF transparent nose cone for payload telemetry
- camera window provides outside view during descent

Recovery Subsystem

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

1st deployment: CO_2 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

Telemetry Subsystem

Redundant bidirectional wireless links with high transmitting power (1 W & 6.5 W)

Self-developed antenna system, consisting of a patch antenna ring on the outside of the rocket, and a monopole antenna on the inside

Custom packet protocol with visualization and storage on the ground

Flightcomputer Subsystem

16 PCBs all designed and soldered in-house

Nearly 50 sensors spread troughout 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

Propulsion Subsystem

Propellants: Chilled nitrous oxide as oxidizer and a paraffin based fuel-grain directly spincasted into phenolic cotton insulation

External pressurization ensures a constant point of operation and therefore high efficiency

Servo-actuated ball-valve directly integrated with tank interface for low weight but fast and precise actuation

Internal SRAD ignitor provides reliable ignition of the engine

Aluminium 3D-printed swirl injector for fine oxidizer atomization

Rocket labels
- Exchangeable Aluminium Tip
- Official Height Tracking (CATS Vega)
- Payload
- Drogue Parachute
- Recovery 1st Deployment
- Main Parachute
- Patch Antennas
- Recovery 2nd Deployment
- Flightcomputer and Telemetry
- Internal Antenna
- Pressurant Tank
- Pressure Regulator
- Radial Camera
- Arming
- Oxidizer Tank
- Main Valve
- Ignitor
- Fuel Grain
- Tail Camera
- Fin
- Graphite Nozzle

Flight Cycle & Mission Events

- 3000 m — Apogee & Drogue Parachute Deployment
- Coast Phase
- Booster Burnout
- Boost Phase
- Ignition & Lift-Off
- Drogue Descent Phase
- 450 m — Main Parachute Deployment
- Main Descent Phase
- Landing