

Florian Havard

Engineering projects, 2019 to 2026

Fourth-year engineering student at ESTACA, Space track (launchers and satellites).
Seeking a 4- to 5-month internship starting in May 2027.

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ESL-2 recovery system, design

2025 to 2026 | Recovery team project manager | Team of 5, EUR 400 budget, 9 months

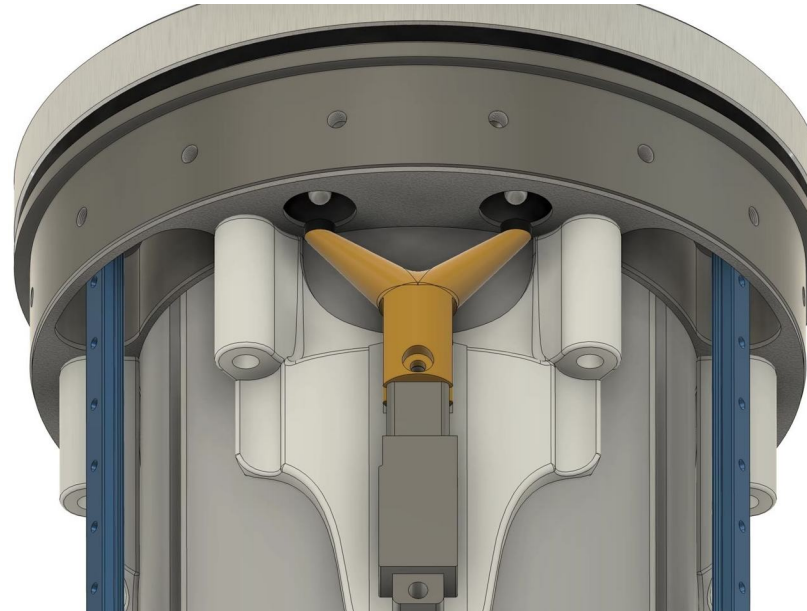
Starting point. ESL-1 flew on July 11, 2025, reaching about 2,800 m apogee. With the team, I analyzed the flight from onboard video and axial accelerometer data in Excel. The main parachute deployed early, which we traced to the nose cone opening shock. Planète Sciences had also flagged excessive nose cone rocking, caused by an insufficient shoulder length and excessive clearances.

Constraint. The lengthened shoulder made a full redesign of the nose cone ejection necessary. The mechanism had to fit into a 25 mm thick annular volume, 200 mm outer diameter and 150 mm inner diameter, and still clear a 10 m² parachute.

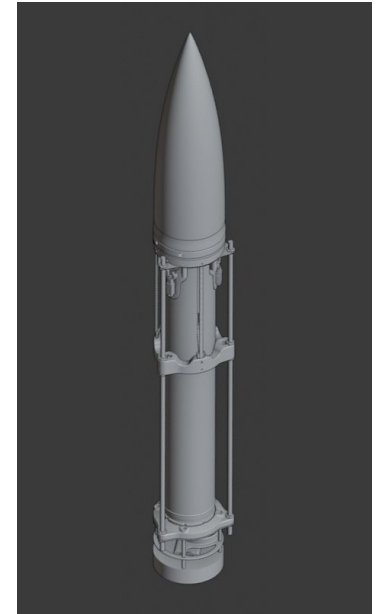
Design. A spring-loaded catapult ring guided on linear rails pushes the nose cone out. Until then, the nose cone is locked by 6 axial pins released by electric linear actuators. The main parachute is packed in a fabric bag closed by petals held by a cord, opened on command by a servo that winds the cord onto a drum. I did all the CAD, in Fusion 360.

Sizing. Spring stiffness sized in MATLAB from a force balance, chosen for a clean ejection without excessive exit velocity. The catapult ring is loaded in compression against the locked nose cone.

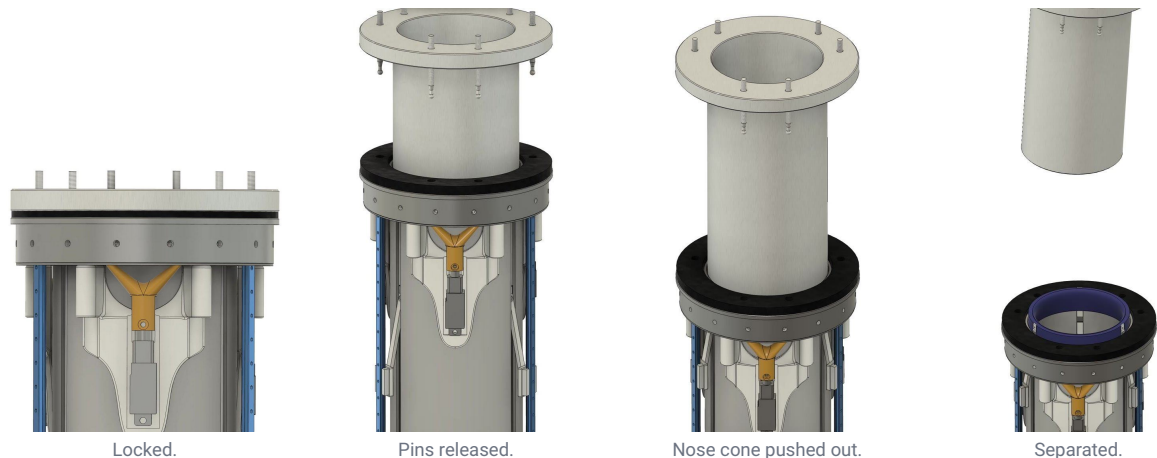
Failure modes first. Before freezing the design, I looked for the configurations that could make it fail. Linear rails guide the ring to limit the risk of binding. The lock stays closed without power. The actuators are powered only for release, which reduces the risk of an unintended opening after a board reset under liftoff vibration.



Ejection bay in Fusion 360, nose cone locked.



Nose section with the recovery bay.



Ejection sequence, frames from my Fusion 360 assembly animation. The prototype built from this design is on the next page.

ESL-2 recovery system, from CAD to prototype

2025 to 2026 | Built, assembled and integrated with the recovery team

Locked



CAD



Prototype

Ejection

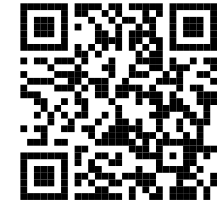


CAD



Prototype

Prototype video



youtube.com/shorts/Lv7lkc7pJxE

Same mechanism, as designed in Fusion 360 and as built. Prototype frames from the ejection test video of May 9, 2026.

Build. Machined steel tube and PETG and nylon printed parts, then assembly and integration. The three large threaded rods belong to the bench frame only. The rings are at the 200 mm nominal diameter, ready to receive the carbon composite skin.

First assembly. Most subassemblies worked the first time.

Issues found and fixed. Some clearances were too tight and were fixed by reprinting or sanding. One actuator mount was under-constrained. Its push finger drifted off axis and bore on the frame, leaving the nose cone locked. The mount was corrected, and the current prototype completed a bench ejection test.

Next. Full ground ejection, structural and integration tests remain planned for 2026-2027.



Linear rail and carriage, springs, electric linear actuators and 3D printed mounts.

ESL program management, 2026 to 2027

In progress | ESL program co-lead and ESL-2 project manager

Role. I co-lead the ESL program and manage the ESL-2 rocket this year, from structures to avionics, the Hermès flight software and recovery, and its integration with the NAGA hybrid engine. I am also the society tutor of the PITA 3A structures project, a supervised year-long project of 6 third-year students. Its forecast spending is shown below.

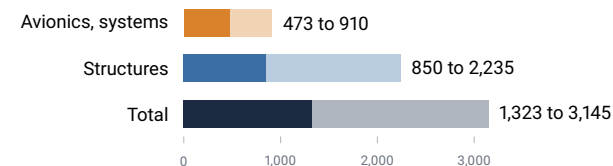
Planning. Initial schedules from August to May in two-week steps, one per project and a combined view. The combined view puts the critical interfaces on the same timeline as the work packages, such as the NAGA dimensions frozen and passed to structures.

Budget. Forecast built line by line, with a low and a high estimate for each item and notes on possible sponsors or reuse of existing parts.

Recruitment. 15 students interviewed for the structures team, scored on a weighted grid. Motivation for this specific project weighs most, then technical reasoning and method, with a short deflection exercise on an interface.

Sponsoring. Sponsor outreach to fund part of the budget.

Forecast spending, ESL-2 (EUR)



Dark part, low estimate. Light part, up to the high estimate.

ESL-2 schedule, combined view

Structures, PITA 3A project

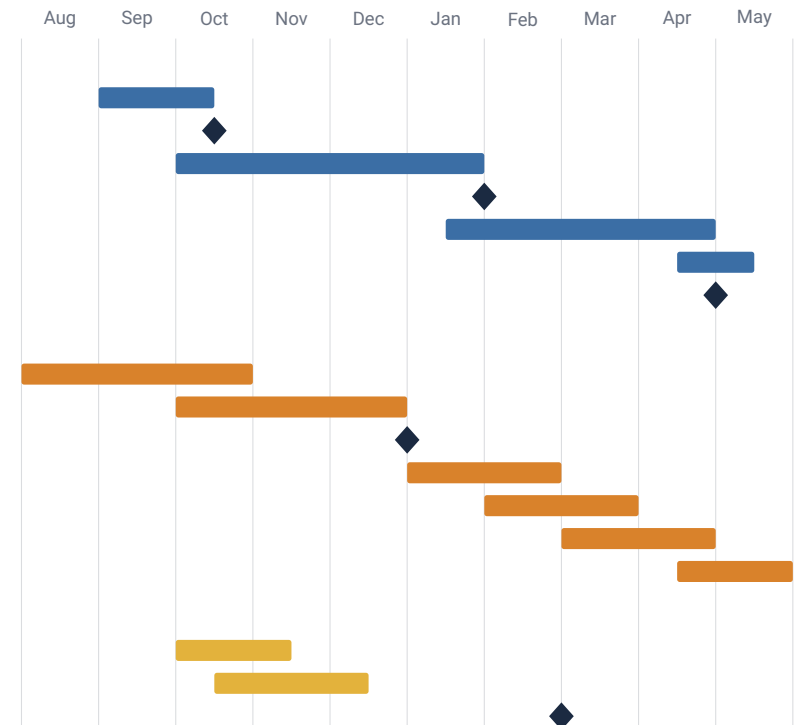
ESL-1 analysis, preliminary sizing
 PRR, mid-October
 Sizing, parametric CAD, theoretical tests
 PDR, end of January
 Test benches, orders, skin manufacturing
 Launcher assembly and integration
 Static fire, early May

Avionics and NAGA controls

ESL-1 software, recovery completion
 Action plan, avionics bay CAD
 Avionics PDR, end of December
 Hermès, NAGA control software, PCBs
 Orders and breadboard tests
 Board integration, integrated tests
 Balloon or minirocket test flight

Critical interfaces

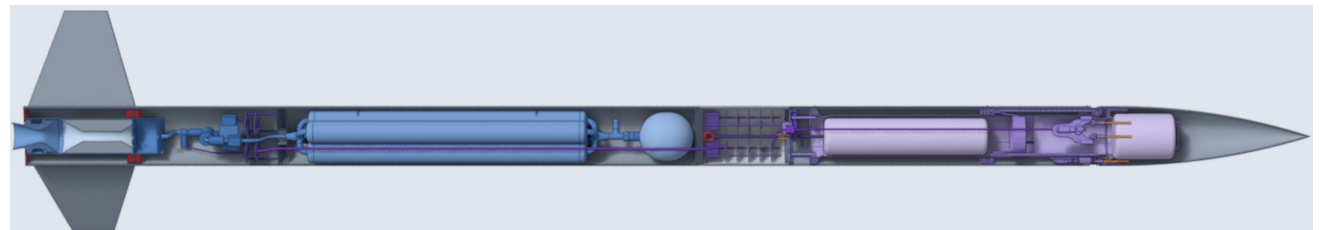
NAGA dimensions frozen for structures
 Structures and avionics, avionics bay
 CDR if major NAGA changes, end of February



Where my work sits in ESL-2

2026-2027 avionics bay, in progress

2025-2026 recovery system



Schematic and provisional section view of ESL-2, engine at the tail, nose cone on the right. The design is still evolving.

RadFA, woven fabric winding machine

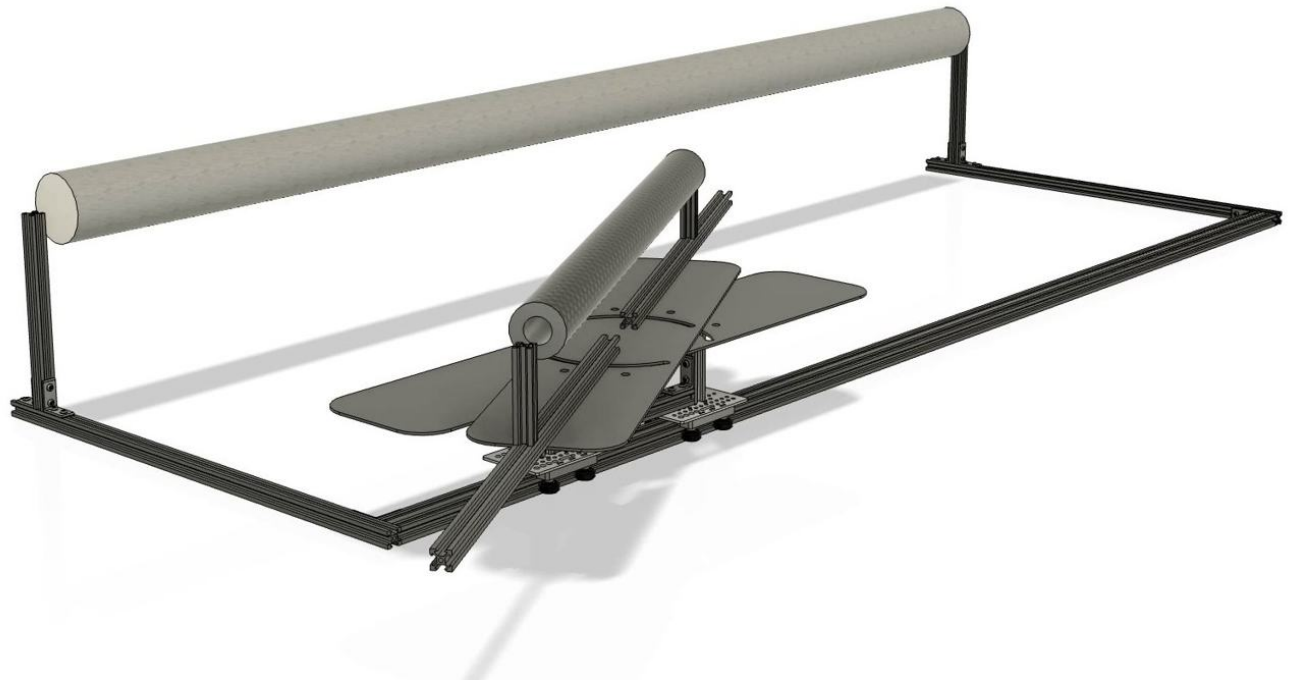
2026, in design, nothing built yet | Designer

Need. The ESL composite skins are 5 m long with a 200 mm diameter, beyond what the existing machine can handle. RadFA is meant to produce them.

Architecture. Three stepper motors drive the mandrel and the roller carriage, controlled by an ESP32-S3. Simplified CAD in Fusion 360.

Control board. I designed the first version of the control board.

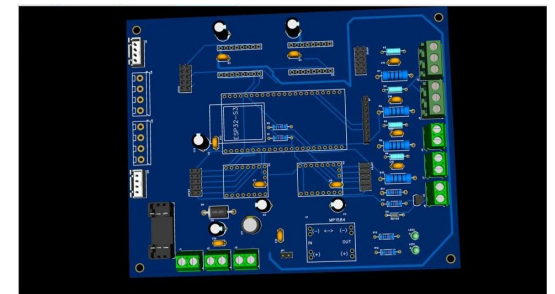
Status. Design in progress. Manufacturing is still to come.



Simplified CAD in Fusion 360, mandrel on the frame and roller carriage.



Roller carriage, close-up.



Control board v1, PCB view in EasyEDA.

MiniRockets, flight timer and MF39 Velocity Raptor

2023 to 2025 | Team member in 2023-2024, MF39 project manager in 2024-2025 | Team of 5

2023-2024. As a team member, I built the rocket's flight timer on a breadboard.

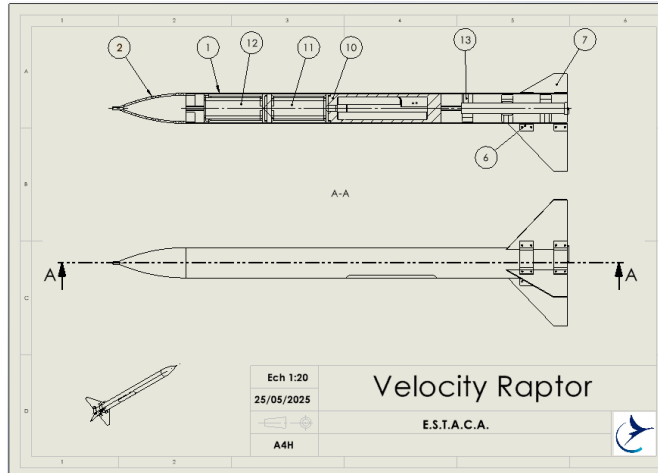
MF39 Velocity Raptor. A small sounding rocket designed to measure its own velocity. 840 mm glass fiber skin made by the team, 1.37 kg, Pandora Pro 24-6G motor. Nominal flight at C'Space 2025, on the next page.

My part. As project manager, I led the team and worked on a bit of everything, CAD, electronics, code and soldering.

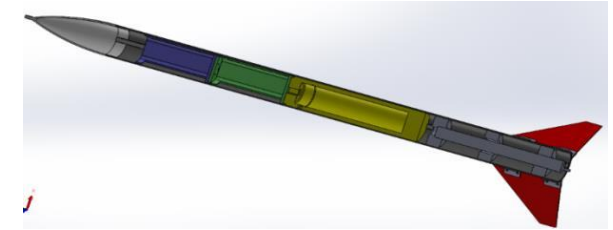
Integration first. Sliding internal structure, so that every subsystem could be pulled out and slid back in, to make integration work easier.

Pitot experiment. Designed an onboard experiment to measure static and dynamic pressure with a rocket-scale Pitot tube, using a C++ program adapted from the ESL avionics software. At C'Space, the board and code were ready but had not been tested, so we chose to focus on the rocket and its recovery system. MF39 flew without the experiment.

Deflection check. The CNES requirements cap the static deflection at 1% and the dynamic one at 2%. Calculated values were 0.75% and 1.15%. With so little margin on the static case, it had to be tested with care.



Drawing of MF39 Velocity Raptor.



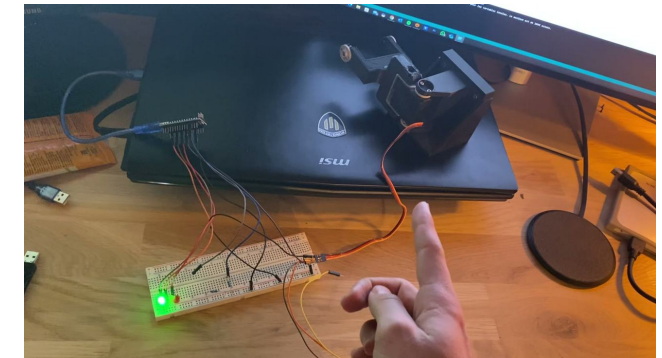
Internal layout in SolidWorks, two electronics compartments, parachute compartment and motor section.



Electronics module slid into the skin.



Parachute hatch and its servo latch, bench test, June 2025.



Flight timer on a breadboard, 2023-2024.

C'Space 2025, launch campaign of MF39

July 2025 | MF39 project manager, on site | Nominal flight on July 8, 2025



1 MF39 on site



2 Qualification checks



3 Fault isolated on the bench



4 Faulty solder joints, redone



5 Liftoff, July 8



6 Under parachute



7 Recovered

On site. I was at C'Space 2025 to launch MF39, while the ESL-1 team prepared their own flight. The aim was to qualify as early as possible.

The fault. After qualification, MF39 failed its verification checks. To isolate the fault, I reworked the onboard board and code and swapped the Arduino, then inspected the wiring closely and found intermittent contacts. I redid the solder joints, the rocket was requalified and flew nominally the next day.

Photos 5 to 7 © 2025 CNES Planète Sciences.

Alouette II rear transfer gearbox, design project

2025 to 2026 | CATIA 3DEXPERIENCE | Team of 2

Brief. Model the gearbox that carries power from the main rotor output to the tail rotor of an Alouette II, after imposed changes to the bearing sizes. Every part diameter had to follow, and the bearing pairs were shifted so as not to disturb the bevel gear contact.

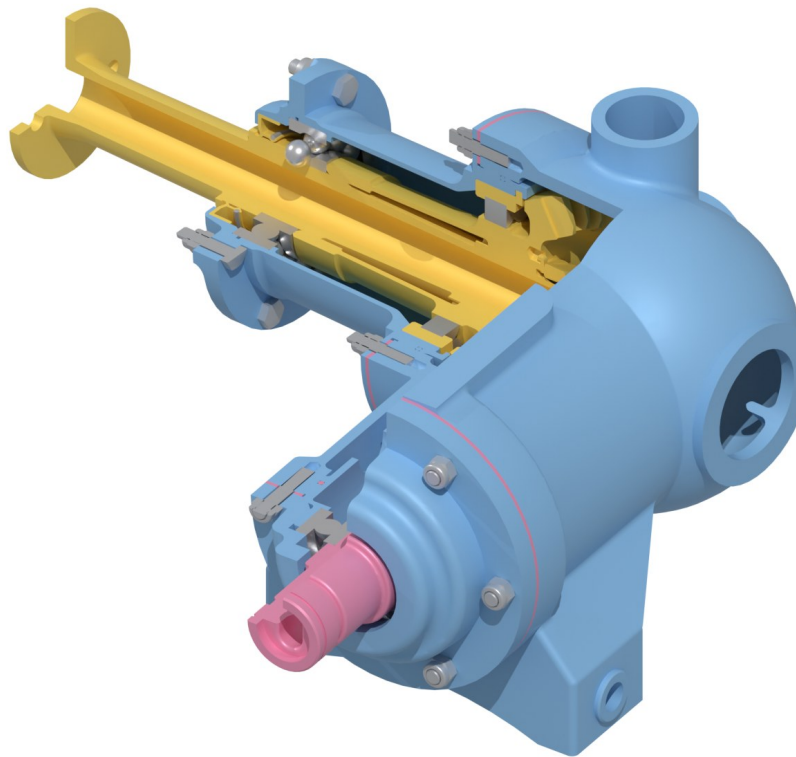
Making it assemble. The first input shaft could not take its bearings. A shoulder was replaced by a circlip and another by a constant diameter spacer. To meet the brief, the output shaft was split in two, with torque carried by splines.

Gear to shaft link. The bevel gears now sit on a flat face with a short centering. Torque is transmitted by friction at the bolted joint, and a tenon carries the shear load instead of the screws.

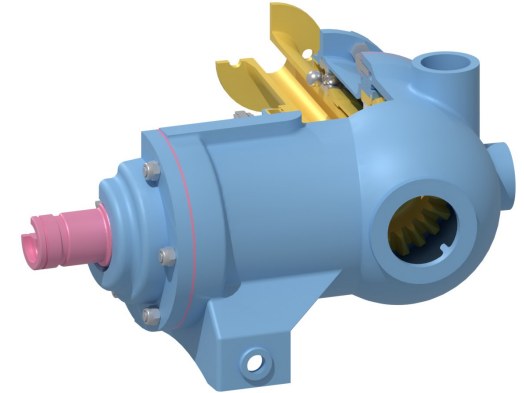
Parameters. The bolt pattern between the output housing and its flange is driven by parameters, each sketch controlled by a single dimension.



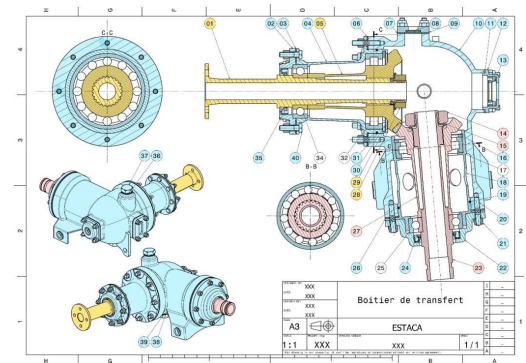
Output shaft in two parts, splined, as the brief required.



Section view of the gearbox 3D model, colored by equivalence class, input in pink, output in yellow, housing in blue.



Same model, seen from the input side.



Equivalence classes on the assembly drawing.

Mission analysis, Artemis II in GMAT and a KSP mission

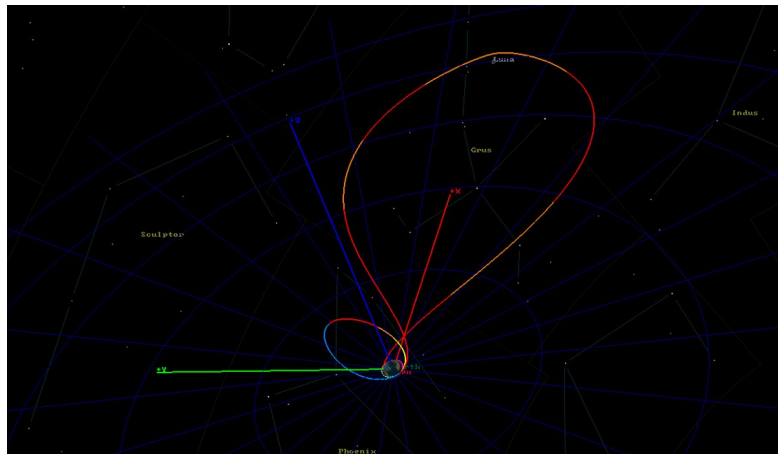
2025 to 2026 | Course projects

Artemis II mission profile modeled in GMAT

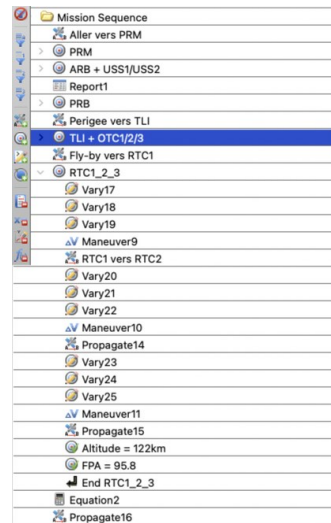
Year 4 course project, NASA General Mission Analysis Tool

Mission. Orion from its initial Earth orbit to the entry interface, starting from NASA real-time telemetry. Perigee and apogee raise burns, upper stage separation, perigee raise, trans-lunar injection, three outbound corrections, a lunar flyby and three return corrections, following the planned profile set in the course brief. In flight, two of the three outbound corrections were canceled.

Targeting. Each phase is solved with the differential corrector. The outbound corrections target the flyby at 6,545 km above the lunar surface, defined on the Earth-Moon crossing line. The return corrections target the entry interface at 122 km altitude with a 95.8° flight path angle.



Simulated trajectory, Earth orbits and lunar flyby.



Mission sequence in GMAT.

Simulated mission to Minmus in KSP

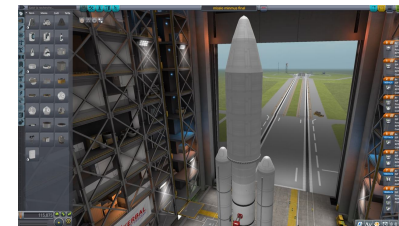
Year 3 course project, Kerbal Space Program, team of 3

Mission. Orbit insertion around Kerbin, transfer to Minmus with a plane change of about 6° , orbital rendezvous down to zero relative velocity, landing on Minmus, then return to Kerbin with no crew lost. Rocket of 92 t with 7,542 m/s of delta-v.

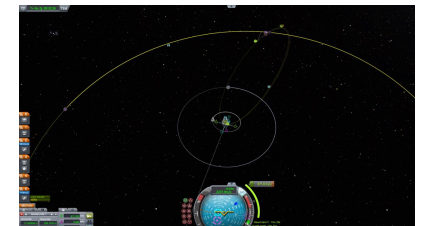
Looking back. Our first mission. The rocket could be better matched to the mission, with a smaller delta-v margin.



Landed on Minmus.

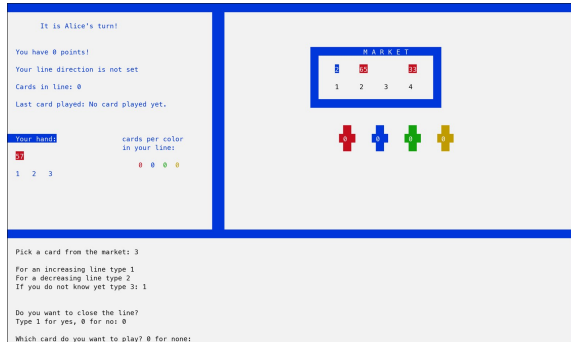


Rocket in the assembly building.



Orbits during the mission.

2023 to 2025 | C, C++ and Python | Screenshots of the programs running, console text translated for this portfolio, program logic unchanged



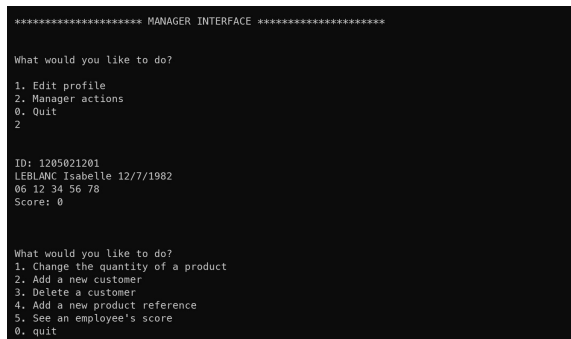
A turn in progress, market, hand and jackpot.

Year 1, C

Linelt card game

Team of 2

Card game for 2 to 5 players. Each builds an increasing or decreasing line from cards taken in a shared market. The 106 cards use a structured type, and the board is drawn in the console with colors and cursor positioning.



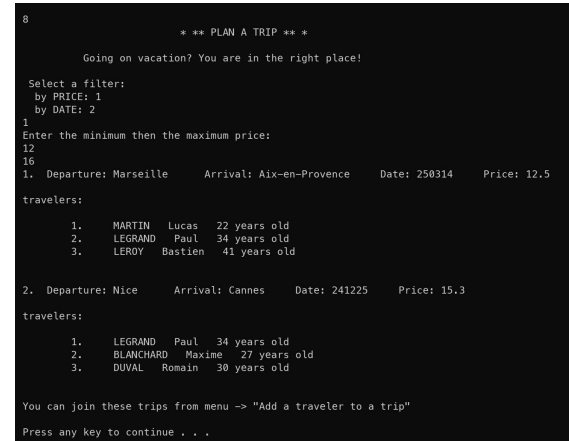
Manager interface, after code authentication.

Year 2, C++

Online shop manager

Individual project

Shop management with a class hierarchy, a person class, then clients and employees, then managers. Each role gets its own menus. Managers edit stock, add products and clients, and check employee scores.



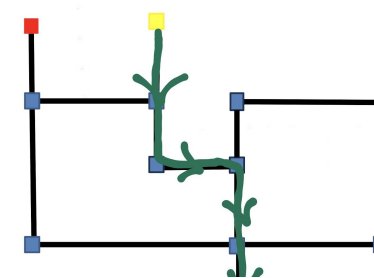
Trips filtered by price.

Year 2, C++

Ride sharing manager

Individual project

Console application in the spirit of BlaBlaCar, built on traveler and trip classes. Register travelers on trips, create, edit or delete trips and users, and filter trips by price or date.



Exploration path in a test maze.

Year 2, Python

Maze solving robot

Team of 3, LEGO Spike

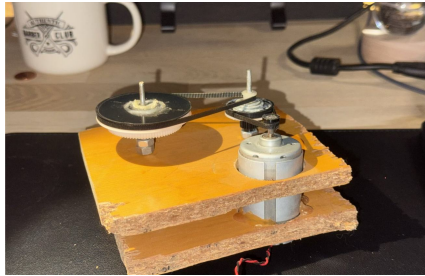
The robot explores depth first, trying right, straight then left at each intersection, and backtracks from dead ends. Intersections become nodes, positioned by wheel odometry. Once the target is found, Dijkstra on the discovered nodes gives the shortest way back.

```
def dijkstra(current):
    checked.append(current)
    for neighbor in current.neighbors:
        d = distance(current, neighbor) + current.distance
        if neighbor.distance > d:
            neighbor.distance = d
            parent[neighbor] = current
```

Shortest path step, excerpt translated to English.

Personal projects, where it started

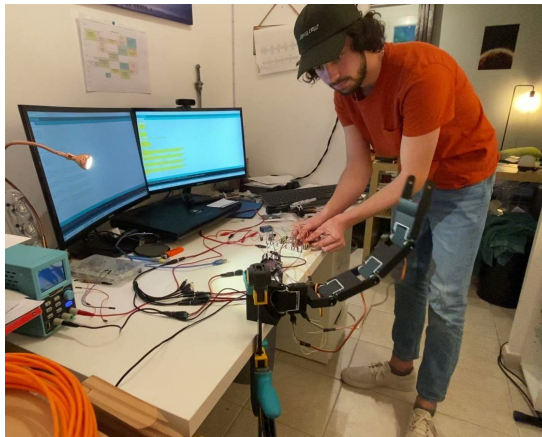
2019 to 2026 | Built at home, from middle school to now



What is left of the mechanism.



A shot taken with it, around a radio-controlled helicopter.

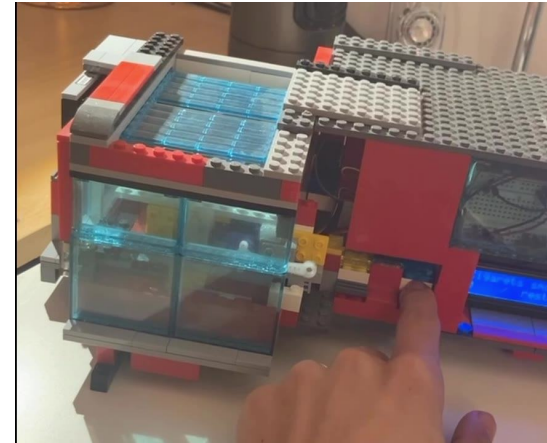


Arm and controller.

2019

Camera dolly arm

Built at 14 from a dismantled printer, reusing the speed reducer that was inside.



LEGO and Arduino.

2020

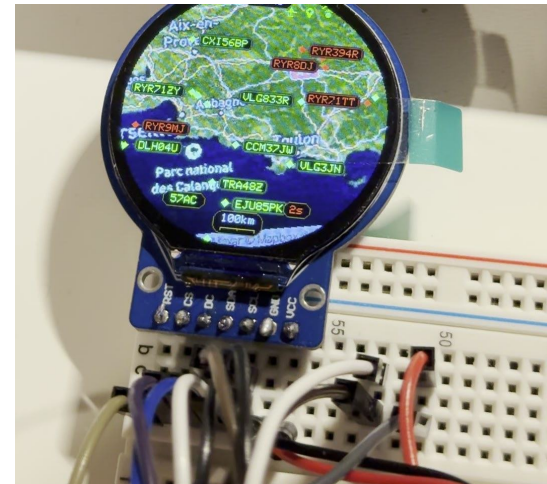
Cigarette dispenser

My first Arduino project, built with LEGO for my father. It sat on the terrace and counted the cigarettes taken each day, to cap the daily number and lower it over time so that he would quit. He never used it... so the clinical trial is still pending.

2021

Robot arm

3D printed robot arm with servos, driven by an Arduino. It reproduces the movements of a controller fitted with potentiometers at the joints.



Breadboard test.

2026

Desktop radar

Air traffic display centered on a given position. I defined the requirements and the architecture (ESP32-S3, round display, rotary encoders) and handled the breadboard wiring. The 3D printed enclosure is in progress.

Astrophotography

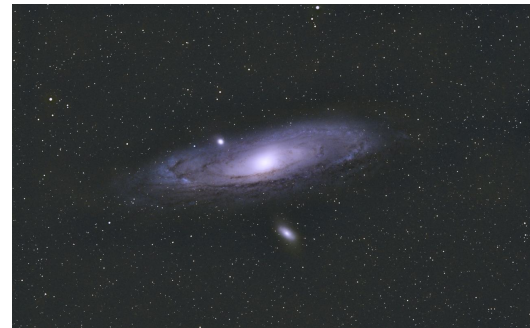
A practice of several years | Deep sky, Moon, Sun and aurora



Milky Way core, July 2026.



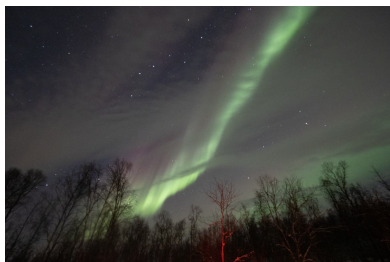
Orion Nebula, December 2022.



Andromeda Galaxy, December 2022.



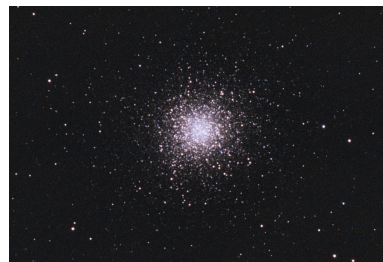
Moon, May 2026.



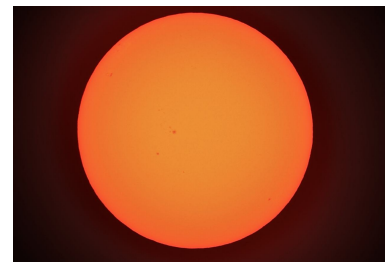
Aurora, Norway, February 2023.



Lagoon and Trifid nebulae, June 2023.



Hercules globular cluster, August 2025.



Sun, June 2024.



Comet C/2023 A3 (Tsuchinshan-ATLAS),
October 2024.

Equipment. 61EDPH II apochromatic refractor, 300 mm focal length, on a Sky-Watcher equatorial mount. Celestron NexStar Evolution, 2 m focal length, on an alt-azimuth mount with a wedge.