00 FLIGHT DECK

CORMAC HERBERT

AEROSPACE ENGINEERING

University of Southern California · Expected graduation May 2028

USC aerospace junior — MATLAB analysis, NX and SolidWorks geometry, shop and flight-test follow-through

Looking for a Summer 2027 internship anywhere in the U.S. Aero performance and testing interest me most; I am also open to analysis and other aerospace roles.

Contact

Email

LinkedIn

Resume

BOREALIS CAD

TWIN-ENGINE STUDY

01 —— IDENTITY

ABOUT

I am an aerospace engineering junior at USC. Most of my work is taking a vehicle from a sketch to a number I can defend: MATLAB and Python for the analysis, SolidWorks and Siemens NX for the geometry, then the shop and the flight line to see what actually happened.

The hardware I can point to is Phoenix, a 1.21 m glider. I did most of the wing structure; teammates built the fuselage. I reduced the flight-test data and rebuilt the polar when the first launches did not match the model. Borealis is a class Arctic STOL study — I owned fuselage geometry, cabin layout, and the parasite drag buildup.

FILE

NAME
Cormac Herbert

PROGRAM
Junior · B.S. Aerospace Engineering
University of Southern California

GRADUATION
May 2028

SEEKING
Summer 2027 intern · U.S. relocation open
Most interested in aero performance and testing
Also open to analysis and related roles

CONTACT
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02 — ACTIVE FILE

PROJECTS

Phoenix is the glider I structured the wing for and then flight-tested. Borealis is a class Part 23 study. Older shop builds are in the archive tab.

FEATURED ARCHIVE

As-built Phoenix — 1.21 m NACA 6415

AS-BUILT PHOENIX | SEVEN GLIDE PATHS | THEORETICAL R(U)

P-01 GLIDER DESIGN AND FLIGHT-TEST CAMPAIGN

PHOENIX

Fall 2024 · delivered 5 December 2024

ROLE Wing structure, flight-test reduction, and MATLAB drag buildup · 6-person team SNACKS — I did most of the wing structure; teammates built the fuselage

Design, build, and fly a 1.21 m glider, then prove the polar with instrumented launches. I took the wing; the fuselage was a team effort. The question was not whether it would fly — it did — but why the first four shots veered right and fell short of the MATLAB range curve.

SPAN	AR	RMAX	(L/D)MAX
1.21 m	5.63	29.5 m	16.9

TECHNICAL EXECUTION

Wing structure. I did most of the wing structure (NACA 6415, $b = 1.21$ m, $\bar{c} = 0.215$ m, AR = 5.63, $S = 0.269\ m^2$) while teammates built the 0.89 m fuselage. I used that as-built geometry in the drag buildup, not the sketch mass.

MATLAB drag buildup. I assembled $D = D_0 + D_i$ with laminar/turbulent Cf, Oswald e from AR, and $C_L \approx W/qS$. Pre-flight polar assumed 0.60 kg and 2.00 m launch; I rebuilt it on the pad at 0.85 kg, 1.75 m, $\rho = 1.24\ kg/m^3$.

Seven-flight campaign. I reduced speed, duration, X-range, and mass for each shot. Video clocks gave time; tape and clay on the left wing and stabilizer were the only in-field mass properties I changed.

Close the polar with flight data. Theory peaked near 7.6 m/s and 22–24 m. Flight 7 ran 9.2 m/s and 29.5 m. I backed experimental $(L/D)_{max} = R/h = 29.5 / 1.75 = 16.9$ and compared it to the 4.79 and 21.14 book values from two $C_{D,0}$ estimates.

OUTCOME

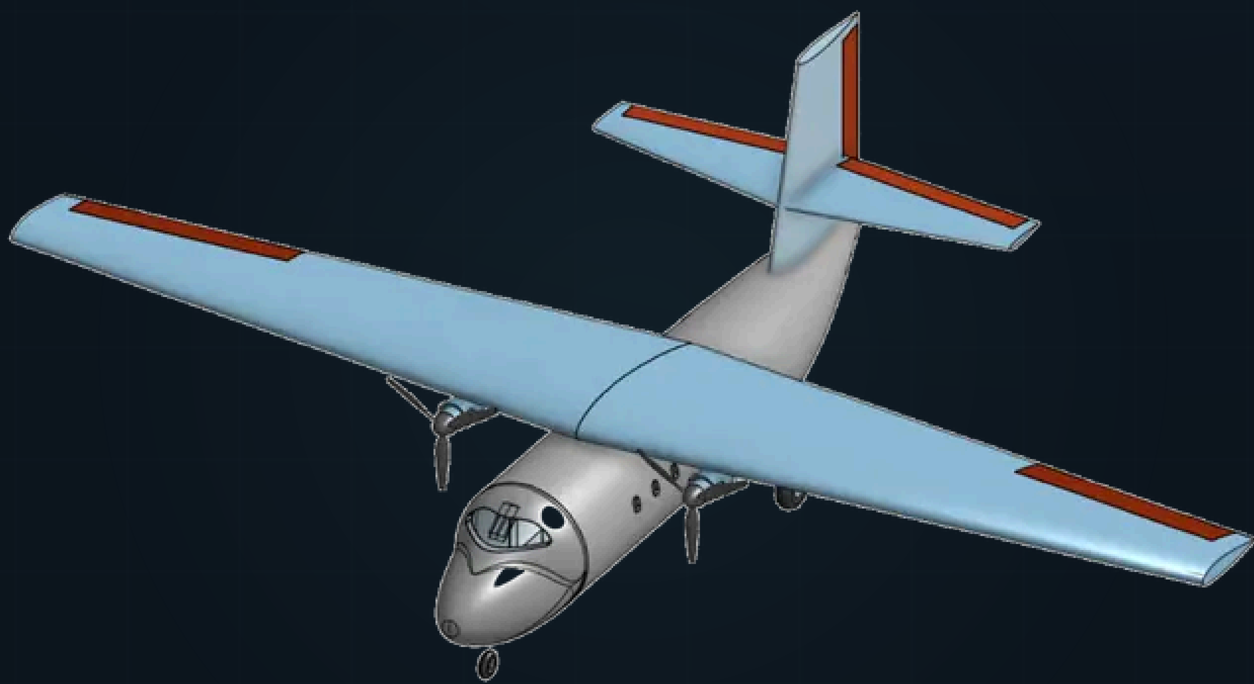
- The vehicle **flew** — seven instrumented launches, **Rmax = 29.5 m** on flight 7 at **9.2 m/s**.
- Experimental **(L/D)max = 16.9**. Mean experimental range **16.7 m** vs mean theory **22.6 m**.
- As-built mass **0.85 kg** vs 0.60 kg predicted (**+42%**). Launch height **1.75 m** vs 2.00 m.
- After I stopped the left-wing launch assist, the path straightened and the last shots finally beat the mid-speed hole in the polar.

WHAT BROKE

Flights 1–4 veered right. A launcher was holding up the left wing — I treated that as a failed test point, not a polar. We cut the assist, I added clay/tape for lateral trim, and flight 5 tracked straight. Experimental range $\sigma = 7.98$ m versus 1.49 m in theory (5×). The MATLAB model was not wrong so much as fed the wrong mass, height, and a contaminated launch. Rebuilding the polar on flight-day numbers is what made Rmax = 29.5 m readable instead of lucky.

MATLAB | NACA 6415 | Flight test | Drag buildup

Full report



NX isometric — control surfaces in terracotta

NX ISOMETRIC | CONFIGURATION CALLOUTS | THEORETICAL PERFORMANCE | MATLAB V-N AT 9 KM

P-02 ARCTIC STOL TWIN-TURBOPROP

BOREALIS

Spring 2026 · AME 261 · delivered 7 May 2026

ROLE Fuselage geometry, cabin layout, and full-aircraft drag buildup · 5-person Team 9 — I owned fuselage, layout, and drag buildup; teammates covered the rest of the airframe

Size a 14 CFR Part 23 Arctic STOL that clears a 50 ft obstacle in under 500 ft, carries 9 passengers or equivalent cargo or a medevac litter set, and still makes 450 nmi with FIKI and −30 °F ops. The cabin volume I needed fought the parasite drag I had to kill. The numbers below are a class parasite buildup in XFOIL, AVL, and MATLAB — no CFD and no wind-tunnel closeout.

CD0	(L/D)MAX	V-N	FUSELAGE
0.00636	31.57	+3.8 / −1.5 g	16.66 m × Ø2.91 m

TECHNICAL EXECUTION

Fuselage CAD in Siemens NX. I locked a 16.663 m × 2.911 m ellipsoid cabin so 9-PAX, cargo, and medevac all fit, then pulled a 129.06 m² wetted area from the solid for the drag model.

Reynolds-based parasite buildup in MATLAB. At cruise I ran $Re_{fus} = 1.31 \times 10^8$, $C_f = 0.00176$, and converted fuselage CD0 to wing reference S = 100.1 m². Stacked with wing, empennage, gear, and nacelles to $C_{D0,total} = 0.00636$.

Polar and cruise trim. I closed $C_D = 0.006368 + 0.03939\,C_L^2$, giving $C_{L,Emax} = 0.402$ and $(L/D)_{max} = 31.57$. Constant-V cruise at 9 km (the FAR-relevant mode) sat on that polar at ~155 KTAS.

Section data into 3D. The wing used NACA 2217 from XFOIL, then AVL for the 3D lift distribution. I fed those coefficients into the MATLAB mission loop rather than treating the fuselage as a free parameter.

V-n envelope. I built the 9 km V-n diagram with stall curves, $n_{max} \approx +3.8 / -1.5$, and a thrust-limited high-speed cap so the structural envelope matched the drag and PT6A-60A power model.

OUTCOME

- **CD0 = 0.00636** on S = 100.1 m² after the fuselage term was referred to wing area.
- **(L/D)max = 31.57** at CL = 0.402 — enough to clear **450 nmi** with a 45-minute loiter reserve.
- Field length **< 500 ft** over 50 ft; ROC **3,543 ft/min** at MTOW vs the 800 ft/min floor; VNE target **> 180 KTAS** (cruise 275.6 KTAS in the mission deck).
- Fuselage Re **~1.31×10^8** at cruise; empty-weight fraction **0.76**; twin **PT6A-60A** at 772 kW each.

WHAT BROKE

A tighter fuselage would have cut my parasite count, but it would not have taken a litter, a cargo pallet, and nine seats. I stopped shrinking diameter at 2.911 m and recovered efficiency on the polar instead. Composites would have saved empty weight; I kept **aluminum** because Arctic field repair beats a lighter coupon. Constant-CL cruise theoretically stretched toward ~2,700 km — I discarded it for constant-V, the mode the FARs actually allow, and accepted the small range penalty.

MATLAB | XFOIL | AVL | Siemens NX

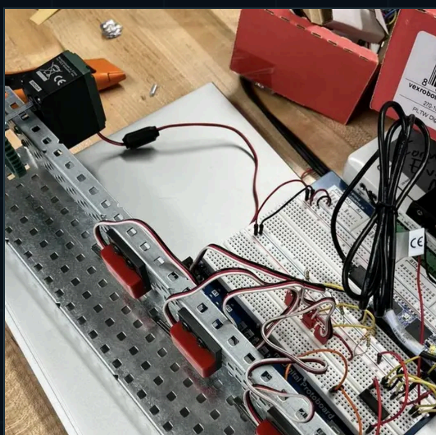
Full report

02 —— OLD PROJECTS

ARCHIVE

Earlier shop builds and class machines. They are here to show I have been wiring, machining, and iterating hardware for a while — not as featured work.

FEATURED   ARCHIVE

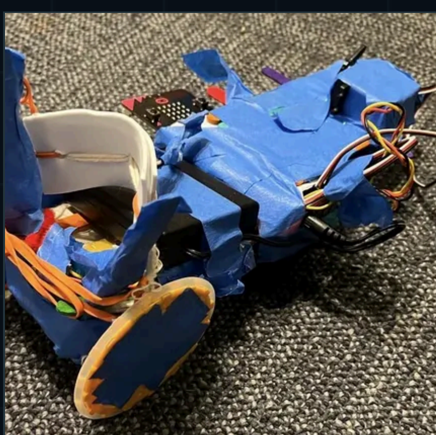


A-01 ARDUINO LOCK

PASSWORD MACHINE

A physical combo lock on a VEX frame. The password was a sequence of limit switches; get them in the right order and it made a sound. Most of the work was breadboard wiring so the stages actually stayed in sequence.

ARDUINO · VEX

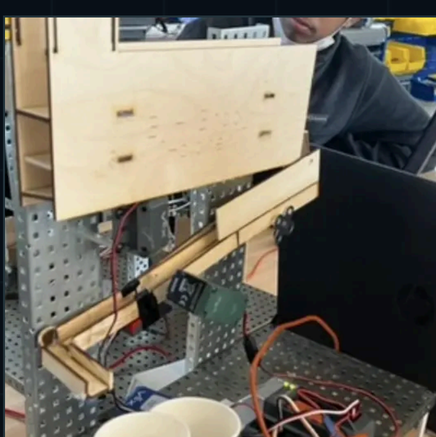


A-02 AUTONOMOUS CHASSIS

ALL-TERRAIN PROJECTILE ROBOT

A taped-together chassis that had to drive a course on its own and fire at a target. I wired sensors and motor controllers to a micro:bit and spent most of the build getting the firing logic to wait until it was actually in front of the target.

MICRO:BIT · SENSORS

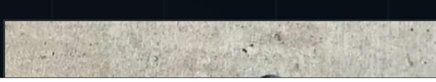


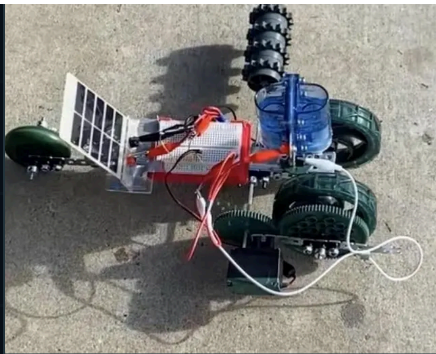
A-03 ROBOTC SORTER

MARBLE SORTER

A wooden hopper feeding marbles into a VEX sorter I programmed in RobotC. A few sensors and actuators dumped them into cups by color and size. Alignment and jams took more time than the code.

ROBOTC · VEX





A-04 SOLAR / HYDRO

CLEAN ENERGY RACECAR

A small Arduino racecar running on solar and hydro. The useful problem was torque versus mass on a light chassis. It took first at that meet — still a shop-class car, not a research vehicle.

ARDUINO · SOLAR

SKILLS & COURSEWORK

SKILLS

SOFTWARE & CAD

Python · MATLAB · Robot C · Siemens NX v20 · SolidWorks · Autodesk · Microsoft Excel

ANALYSIS

Structural Analysis · Aerodynamic Analysis · Analytical thinking

SHOP & TESTING

Carbon Composite Casting · Precision Machining · CNC Milling · CNC Turning · Drilling · Grinding · Soldering · 3D printing · Wind Tunnel Testing · Power Tools

AI

AI Prompt Engineering · AI Automation

COURSEWORK COMPLETED

13

AME 105	Introduction to Aerospace Engineering
ENGR 102	Engineering Freshman Academy
MASC 110	Materials Science
MATH 229	Calculus III for Engineers and Scientists
ITP 168	Introduction to MATLAB
MATH 245	Mathematics of Physics and Engineering I
PHYS 151	Fundamentals of Physics I: Mechanics and Thermodynamics

AME 201	Statics
PHYS 152	Fundamentals of Physics II: Electricity and Magnetism
AME 204	Mechanics of Materials and Structures
AME 208	Computational Methods in Engineering
AME 261	Basic Flight Mechanics
PHYS 153	Fundamentals of Physics III: Optics and Modern Physics

IN PROGRESS

4

AME 310	Engineering Thermodynamics I
AME 309	Dynamics of Fluids
AME 302A	Modeling and Analysis of Dynamic Systems
AME 341	Mechoptronics Laboratory

Cormac J. Herbert

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Education

University of Southern California — Viterbi School of Engineering Los Angeles, CA
B.S. in Aerospace Engineering • GPA: 3.06 *Expected May 2028*

- **Class standing:** Rising senior for Summer 2027; returning to USC for senior year afterward.
- **Relevant coursework:** Statics; Mechanics of Materials & Structures; Materials Science; Computational Methods in Engineering; Flight Mechanics; Physics I–III (Mechanics, Thermodynamics, E&M).

Technical Experience

USC Rocket Propulsion Lab • Team Member Jan 2025 – Present
Student-built rocketry team *Los Angeles, CA*

- Design and detail rocket flight-hardware components in **Siemens NX**, producing fabrication-ready engineering drawings for the build team.
- Fabricate and modify parts using manual machining and shop power tools, iterating on fit and tolerance through build and integration.
- Size components against expected structural loads with first-principles hand calculations in MATLAB and Excel.

USC Aero Design Team • CAD Designer & Team Member Sep 2024 – Dec 2024
Student competition aircraft *Los Angeles, CA*

- Modeled aircraft structural components in **Onshape** and **Autodesk** for a student competition airframe.
- Fabricated carbon-composite structures (layup and finishing) and machined parts using shop tools.
- Supported aerodynamic analysis in MATLAB and validated design assumptions through wind-tunnel testing.

Engineering Projects

"Borealis" — Arctic STOL Twin-Turboprop • Conceptual Aircraft Design Spring 2026
5-person team, AME 261, USC Viterbi

- Designed a 14 CFR Part 23–compliant twin-turboprop STOL aircraft with a 5-person team, meeting every RFP constraint including a $\leq$500 ft takeoff/landing over a 50 ft obstacle and 450 nmi range.
- Led fuselage geometry and the full-aircraft drag buildup from first principles (Reynolds-based skin friction, $Re \approx 1.3 \times 10^8$), yielding a parasite-drag coefficient of 0.0064 and a maximum L/D of 31.5.
- Built a MATLAB longitudinal stability model (neutral point, static margin, elevator trim) validated against a DC-8 baseline, and constructed the V–n diagram bounding the $+3.8/-1.5$ g structural envelope.

"Phoenix" — Glider Design & Flight-Test Campaign Fall 2024
6-person team, USC Viterbi

- Designed and fabricated a 1.21 m-wingspan glider (NACA 6415, AR 5.63) to maximize range from a fixed-height launch.
- Executed a 7-flight instrumented test campaign, achieving a 29.5 m maximum range and an experimental $(L/D)_{\max}$ of 16.9.
- Traced a $2\times$ parasite-drag over-prediction by reconciling flight data against a MATLAB drag-buildup model, then iterated ballast and trim between launches to correct flight-path deviation.

Leadership & Initiative

Pleasanton Quality Windows • Co-Founder May 2026 – Present
Self-started residential services business *East Bay, CA*

- Co-founded a door-to-door exterior-services business with two partners; sourced equipment, produced marketing materials, and delivered hands-on manual services (power washing, gutter and window cleaning) to local clients.

Technical Skills

CAD & Drafting: SolidWorks (CSWA certified), Siemens NX, Onshape, Autodesk, engineering drawings & drafting standards
Analysis & Test: MATLAB, statics / structural analysis, aerodynamic analysis, hardware test planning, wind-tunnel testing
Fabrication: precision machining, power tools, carbon-composite layup, 3D printing, soldering, electronics & sensor integration (motors, controllers, sensors)
Programming: Python, MATLAB, Robot C, Microsoft Excel

Certifications

SOLIDWORKS Certified Associate (CSWA) • **Google AI Essentials Specialization**