APEX @ ASU - Advanced Propulsion EXploration

Sponsor Pitch

Our Mission

> To go places other clubs stop short of, building new challenging contributions to the propulsion community at ASU

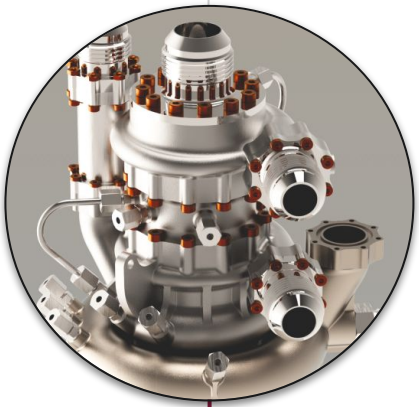
Project Description

APEX is focused on designing, building, and testing innovative rocket engines, starting with the development of a **Turbopump-fed LOX/Kerosene rocket engine**. Our goal is to create an efficient and lightweight propulsion system that can be used in small- to medium-scale rockets for space shot launches.

Priority Timeline

Spring - Fall 2025

Design and fabricate our LOX/Kerosene **Turbopump**



Spring - Fall 2026

Design and fabricate the combustion chamber, utilizing **regenerative cooling**

Spring - Fall 2027

Design and fabricate the rocket hull, and **launch!**

Beyond

Explore and design **Tap-cycles, expander cycles, electric driven pumps**, and more!

What Makes us Unique

Existing clubs

SDR: Focuses on *pressure fed* liquid/Hybrid Rocket engines

SEDS: Focuses on solid rockets

SDSL: Focuses on Satellites and electric Propulsion.

APEX @ ASU

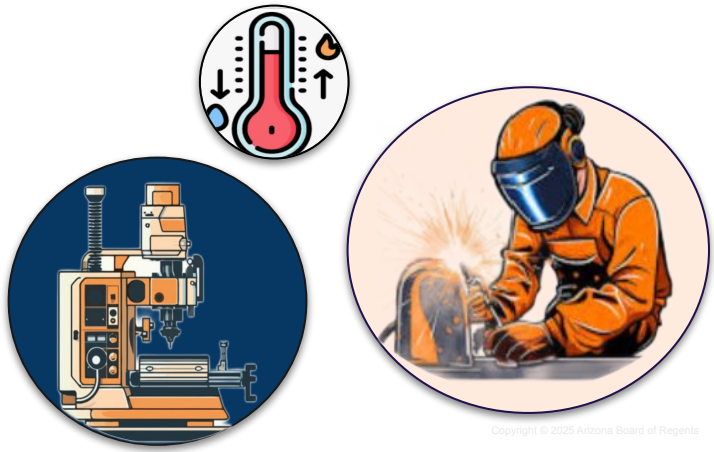
- **pump-fed engines** bring better thrust-to-weight ratio, chamber pressure, and specific impulse compared to current engines in development at ASU.
- SDR and SEDS **do not** specialize in gas power cycles or regenerative cooling techniques due to limited time, resources, and their focus on multiple projects.
- APEX fills a valuable role in the space ecosystem at ASU - **we provide utility!**

Benefit to Students

APEX offers many different areas for students to learn and engage with:

- Advanced design, manufacturing, tolerance analysis, and other high level concepts
- Adhering to safety standards and federal regulations like ITAR, FAA, etc.,
- Propulsion technology and theory involving thermo-fluid dynamics and material science.
- Broad technical skills like Welding, 3D printing, CNC milling, composites, and more!

We're doing it *because* it's difficult -
that's what ASU expects of us!

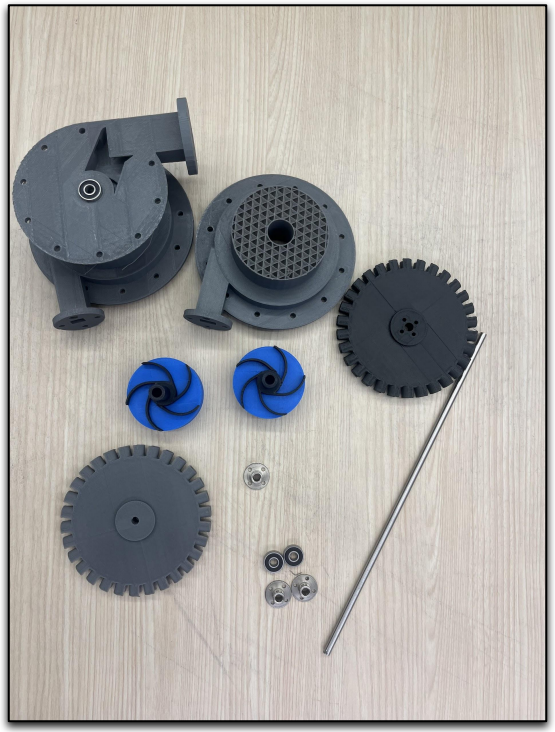


Our Team

APEX is in good hands! Our members have experience with

- Internships at Boeing, Anduril, Collins Aerospace, Honeywell Aerospace, Magna, and more.
- Winning a combined $80,000+ in funding from various hackathons, ventures, and school projects.
- Previous officer positions in student organizations like SDR and ASME @ ASU
- Awards from Change the World, EPICS, Edson E+I, and more!

Progress So Far



- We’ve been approved as an official club!
- First turbopump model has already been completed and is nearing print completion for water testing.
- Test stand is being designed and essentially ready to be built.

What We Need To Move Forward

Funding

- The materials we need aren’t normally stocked by ASU and must be bought.
- New clubs can’t access student org funding for a year due to ASU budget timing.
- Parts must be rated for more extreme environments and aren’t easy to find locally.

Resources

- ASU workspaces have long 3D printing queues and take forever.
- No CNC machines operating on campus (many are broken or not publicly usable).
- Small storage allocations for clubs.

Experience

- Knowledgeable mentors - no one is doing turbomachinery research on campus!
- Our designs will need to be optimized before being committed to metal.

What We Need To Move Forward

Item	Quantity	Unit Cost ($)	Total Cost ($)
Test stand frame (304/316 SS)	1	500	500
Mounting plates (6061-T6 Aluminum)	2	75	150
Vibration dampeners (Neoprene/Silicone)	4	15	60
LOX feed lines (316 SS tubing)	10	30	300
Cryogenic-rated valves (SS)	4	120	480
Pressure relief valve (600 PSI)	1	150	150
Check valve (316 SS)	1	100	100
Fitting adapters & couplers (Swagelok)	10	20	200
Pressure transducers (0-1000 PSI)	2	180	360
Thermocouples (Type T)	3	25	75
Cryogenic flow meter	1	600	600
DAQ system (Arduino + shield)	1	80	80
Relay/solenoid drivers	2	15	30
Cryogenic solenoid valves	2	200	400
PTFE coated wiring harness	1	50	50
LOX-rated insulation (aerogel/foam)	1	100	100
Remote camera system	1	120	120
Class D Fire extinguisher	1	250	250
Emergency shutdown switch	1	30	30
Turbopump (test article)	1	1000	1000
Thrust stand with load cell	1	850	850
12V Lithium-ion battery pack (rechargeable)	1	90	90
Battery charger for Li-ion pack	1	25	25
Power distribution board	1	40	40
Breadboard / terminal blocks	2	10	20
Signal wires (PTFE-coated, 25ft)	1	35	35
Power wires (14 AWG, 25ft)	1	30	30
Cable management (zip ties, clips)	1	15	15
EMI shielding materials (foil/tape)	1	20	20
Enclosure box for electronics (IP65+)	1	60	60
		Total Estimated Cost:	6220

- This is a tentative list of the parts needed to create a professional test stand for water testing (3D printed model) and hot fire testing (machined model)
- Our test stand will require durable framing, plumbing, and sensors making it expensive!
- The test stand is a high cost item that is meant to last throughout the life of the project

Impact

- The development of this test stand is a massive push for student-led propulsion research at ASU. It will enable safe, repeatable testing of high-performance liquid rocket systems, specifically turbopump-fed, LOX/kerosene engines under industry-relevant conditions of extreme cold and high pressure.

- *Any* help regarding funding, resource, or experience needs will push us forward greatly.

- Everyone is ready to work, our only delay is accessing things we need to move forward!