Detonation Propulsion at Illinois

Students building Resonance, a rotating detonation rocket engine

Sponsorship proposal

November 2026

About us

We are Detonation Propulsion at Illinois, a student group at the University of Illinois Urbana-Champaign. We are developing Resonance, our first liquid-fueled rotating detonation rocket engine.

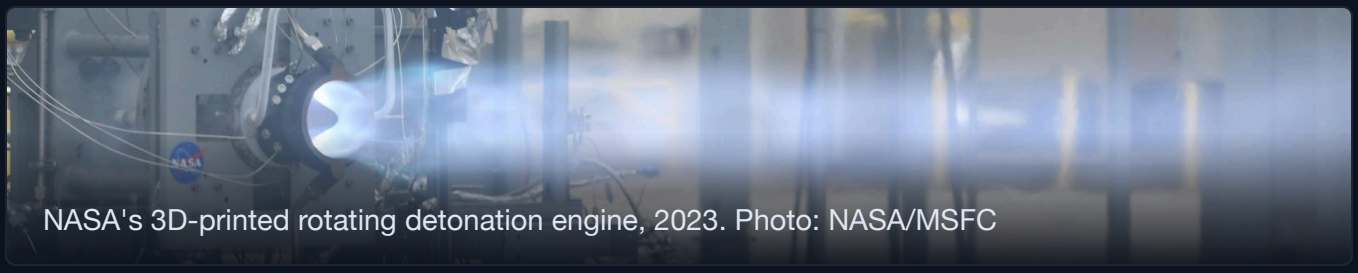
How a rotating detonation engine works



Illustration of a rotating detonation chamber.

A conventional rocket burns its propellant in a steady flame. In a rotating detonation engine, a supersonic shock wave circles a ring-shaped chamber thousands of times a second and burns fresh propellant as it goes. Researchers study these engines for their potential to use propellant more efficiently. Our first goal is to demonstrate sustained detonation on liquid oxygen and methane and to measure how it performs.

- Detonation front
- Burned gas, leaving through the nozzle
- Fresh propellant, refilling the channel



NASA's 3D-printed rotating detonation engine, 2023. Photo: NASA/MSFC

What we want to demonstrate

Our goal is to be the first US student team to hot-fire a liquid-fueled rotating detonation engine. We are bringing together student design work, simulation, manufacturing partners and an instrumented test campaign to work toward that goal.

Resonance

A student research engine, designed around liquid oxygen and liquid methane.



Engine surface detail from our announcement film. Rendering.

Design thrust	Propellants	Cooling
2 kN class	**LOX and LCH_4**	**Water**

Design approach

Liquid propellants

We are studying how liquid injection and mixing affect a rotating detonation engine.

Water cooling

A separate water supply supports the engine walls and allows cooling tests before firing.

Built to be measured

Imaging, pressure, temperature, flow and thrust measurements will document how the engine behaves.

Made with partners

Printing, machining and inspection feedback shape the parts before they reach the test stand.

The engine is in design review. These are development targets, not measured hot-fire results.

Team

Our team brings experience in liquid rocketry, aircraft propulsion and student engineering projects. We meet every week to work on the engine design and the research behind it.

Leads



Syed Aabis Akhtar

Founder and project lead

Founded the group and leads the project. He built LOX/IPA feed-system hardware and helped assemble and test a liquid rocket engine with Liquid Rocketry at Illinois. In high school he co-founded a payments startup that raised over $50,000, and he built developer tools with more than 150,000 downloads.



Dilan Singh

Administration

Supports team administration and coordination. He worked on hydrogen-electric aircraft propulsion in New Zealand, is an AIAA technical lead applying machine learning to micro-turbojet performance, and won a leadership award in a NASA-judged program with more than 200 students.

How we work

Research first

We studied published engines from NASA, Purdue, and ETH Zurich while developing the preliminary design.

Written down

The engine's design targets are published at rdrelab.com.

Open to review

We welcome feedback from engineers who have built similar engines.

From design to testing

The engine model is built out. Design review, supplier discussions and test preparation are moving forward together.

1

Design and review

Refine the design and review the analysis.

In progress

2

Build and inspect

Manufacture parts and check the finished hardware.

Next

3

Cold flow

Test plumbing, cooling and instruments without ignition.

Planned

4

Hot fire

Conduct an instrumented firing campaign.

Planned

Progress so far

Engine CAD

The engine and supporting systems are modeled. Detailed design remains under review.

Research and simulation

Injector spray, cooling and chamber studies are informing the design.

Manufacturing discussions

We are working with printing, machining and inspection companies on build options.

Testing and instrumentation

Facility interfaces and sensor requirements are being coordinated with the test team and suppliers.

What support unlocks

Finished parts, inspected hardware, working instruments and bench tests are the next steps toward firing. We will document each stage and share progress with the partners who make it possible.

The schedule follows design reviews, funding, supplier lead times and facility readiness.

Sponsorship

A $30,000 campaign to move Resonance from design work into manufactured hardware and test preparation.

We welcome funding, donated equipment, loans, materials and services. Support can cover one useful item or a larger part of the build.

Where support goes

Manufacturing and inspection	Printed metal, machining, EDM, finishing and inspection	$10,000
Instrumentation and test equipment	Camera access, sensors, electronics, recording and calibration	$8,000
Fluid-system hardware	Valves, regulators, filters, fittings, tubing and hoses	$5,000
Cooling-water system	Tank, plumbing, collection hardware and bench testing	$4,000
Test supplies and contingency	Gases, seals, fasteners, cleaning, shipping and price changes	$3,000
Total campaign target		$30,000

One target, several ways to contribute

Cash and the agreed fair value of in-kind contributions count toward the same $30,000 target. Sponsored items replace planned purchases. We will not buy an item again if a partner or university award provides it.

Planning allocations. Final purchases follow quotations and confirmed support.

Equipment and services

If your company supplies or makes any of these, there is a direct way to help.

Metal printing and materials

Copper-alloy engine bodies, suitable feedstock or stock material, build preparation, depowdering, heat treatment and post-processing.

Machining and fabrication

Injector and backplate machining, small-hole EDM, finishing, sealing faces, mounts, fixtures and test-bench fabrication.

Inspection and cleaning

CT scanning, dimensional checks, material records, leak testing, oxygen-service cleaning and inspection documentation.

Pressure and temperature

Cooling-water, igniter-head and chamber pressure channels; bench-test sensors; temperature probes; compatible conditioning, cables and calibration.

Imaging and data acquisition

High-speed camera access or loan, lenses and lighting, triggered recording, data acquisition, sensor interfaces and standalone bench logging.

Valves and fluid connections

Suitable valves, regulators, filters, relief devices, tubing, hoses, fittings and adapters for the propellant, igniter and nitrogen systems.

Water supply and bench equipment

A suitable pressure tank and documentation, water plumbing, collection containers, pump and flow instrumentation for bench tests, and water-weighing equipment.

Electrical parts and test supplies

Power supplies, control enclosures, relays, wiring, connectors and ignition electronics; oxygen, methane, hydrogen and nitrogen supplies, cylinder support, seals, fasteners, cleaning supplies and shipping.

Donations, loans, discounted work and introductions are all useful. We can match a specific contribution to your capabilities and share the relevant drawings or requirements directly.

Work with us

Help turn student engineering into hardware, and show the work your support makes possible.

Sponsorship levels

Platinum	$10,000+	Leading recognition on our website and project updates, plus a results briefing after each test campaign.
Gold	$5,000+	Recognition tied to the work you support, a partner feature and a team technical briefing.
Silver	$2,500+	Your logo on our website and project updates, plus opportunities to meet the team.
Bronze	$500+	Your name on our website and sponsor progress updates.

Each level includes the recognition below it. In-kind support counts at its agreed fair value.

What partners receive

We will feature your contribution on our website, LinkedIn and project updates. We will document the work through photos and video, share relevant inspection and test results, and develop a case study with your team.

Start with one useful contribution

Tell us what you can provide. We will identify a matching need and agree the scope with you. Cash gifts are coordinated through the University of Illinois Foundation.

Contact

Syed Aabis Akhtar
aabisa2@illinois.edu
rdrelab.com