ZUCROW LABS
2024
ANNUAL REPORT

Diane Collard, research scientist at Zucrow Labs, uses a blowtorch to ignite energetic materials and test their burn rate. The Purdue Energetics Research Center at Zucrow Labs is one of the most advanced academic labs in the world for synthesizing and testing explosives, propellants, and pyrotechnics. *Photo by Charles Jischke*

Read the full story...

PURDUE UNIVERSITY®

purdue.edu/zucrow

JOHN GLENN TO NEW GLENN

Almost every American rocket and missile ever launched into the skies owes at least part of its heritage to Maurice Zucrow, founder of Zucrow Labs.

To this day, Zucrow graduates fill the ranks of today's top aerospace companies, creating the world's most powerful rockets. For example, SpaceX's **Raptor** engines (seen here powering Starship's Super Heavy booster) are manufactured by Zucrow Labs alums.

*Maurice Zucrow served on the advisory committee for the **Atlas** rocket, which launched John Glenn as the first American to orbit the earth in 1962. Atlas successors are still in service today.*

*The Space Shuttle's **RS-25** main engines owe their high chamber pressures (3,260 psi) to early experiments conducted at Zucrow Labs. Those engines, which never failed a mission, are still in use today for SLS.*

*Blue Origin's **BE-3** and **BE-4** engines, seen here on the New Glenn rocket, were designed and tested by Zucrow Labs graduates.*

Read more about the 75-year history of Zucrow Labs...

From the Director

Bob Lucht (with wife Martha) receives the AIAA Propellants and Combustion Award from AIAA CEO Clay Mowry.

As aerospace engineers, we all look forward to January. That's when we gather in Orlando at the **AIAA SciTech Forum** — the largest aerospace research event in the world, with more than 6,000 in attendance.

Zucrow Labs is always well-represented at SciTech, with our researchers offering numerous technical presentations and panel discussions every year. This year, I was fortunate to receive the **AIAA Propellants and Combustion Award**, cited for "numerous contributions to combustion, propulsion, and power generation through innovative development of advanced laser diagnostics and applying them to practical energy systems."

Of course, I wasn't the only Purdue award winner! My predecessor as Zucrow Labs director, **Stephen Heister, received the 2024 AIAA–ASEE J. Leland Atwood Award**. This award rightfully recognizes Steve for both his technical expertise, and his commitment to excellence in education. (As if to prove the point, one of Steve's students, Kevin Dille, also won an award for Best Paper in Pressure Gain Combustion!)

It was a bittersweet moment, because Steve had announced that Fall 2024 was going to be his last semester at Purdue. **He has now retired after 34 years**, finishing as the Raisbeck Engineering Distinguished Professor for Engineering and Technology Integration.

"Distinguished" is really an understatement. Steve is a giant in the aerospace world, and his contributions at Zucrow Labs alone will leave an impact for generations to come. He took the reins in 2011, after a string of acting directors and no substantive additions or improvements since the 1970s. He began to transform Zucrow Labs into a cutting-edge facility — indeed, one of Purdue's crown jewels. **Under his leadership, Zucrow became the largest academic propulsion lab in the world.** Since he handed the baton to me, we have grown to more than 24 acres and 200 graduate students, with new facilities and capabilities being added every day.

We had the opportunity to celebrate this in Fall 2024 with two bookend events on the same day: a **Zucrow Labs 75th anniversary celebration**, and a ribbon-cutting for **ZL9, our brand new $73 million propulsion research facility**. You can read more about both events in this annual report.

Celebrating our history, and propelling into the future — two reasons I'm excited to be here at Zucrow!

Stephen Heister (right) stands with his student Kevin Dille at the AIAA awards ceremony.

Robert P. Lucht
Director, Maurice J. Zucrow Laboratories

Maurice J. Zucrow Laboratories · 500 Allison Road · West Lafayette, IN 47907-2014
Phone: (765) 494-1501 · purdue.edu/zucrow

ZL9 is open!

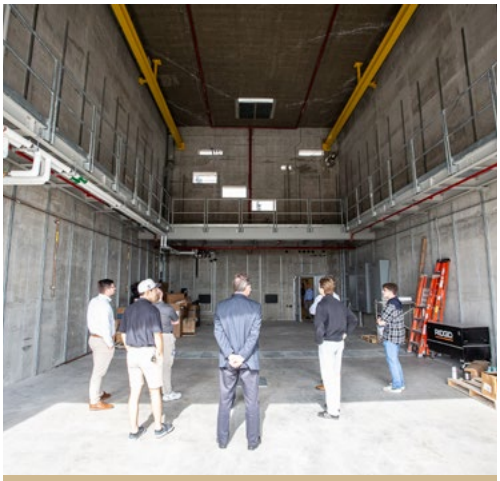
On October 4, 2024, Zucrow Labs opened its doors and welcomed hundreds of guests to tour the brand-new $73 million **High-Speed Propulsion Lab**, otherwise known as ZL9.

Every part of this facility has been designed with the experimenter in mind. In addition to the impressive test cells and individual laser labs, a massive new high-pressure heated air plant can reliably deliver conditions for any propulsion experiment imaginable. A new fabrication workshop enables almost any test rig to be designed, built, and operated all under one roof. We even designed specific spaces in the hallways to assemble lengthy wiring harnesses (we used to do this outside on the sidewalk!)

ZL9 also features all the intangibles that make for a welcoming environment for the 100+ new researchers who will work there. Expansive windows, conference rooms, kitchens, meeting areas, a staffed lobby, and a new parking lot with paved walkway and electric vehicle chargers.

ZL9 incorporates everything that makes Zucrow great, and takes it to the next level.

Hundreds of Zucrow students, faculty, alumni, and industry partners came to watch Eckhard Groll (head of ME), Arvind Raman (Dean of Engineering), and Bill Crossley (head of AAE) cut the ribbon on this spectacular new facility.



ZL9's five main test cells are an astonishing 34 feet tall. The three rectangular inlets above deliver high-pressure heated air. Each test cell also hosts its own individual climate-controlled laser diagnostics facility.

Bob Lucht and Scott Meyer were thrilled to showcase ZL9's new features, including its scenic 2nd floor conference room.

Celebrating 75 years of Zucrow Labs

After the October 4, 2024 ribbon cutting for ZL9, we welcomed guests from Zucrow's past, present, and future at a special event to **Celebrate 75 Years of Zucrow Labs**.

In addition to some keynote speakers, we delved deep into the Chaffee basement to find all sorts of historic treasures, including hand-drawn data plots from old experiments, Maurice Zucrow's original diploma, and the very first master's thesis from the lab in 1948. We also found a plethora of historic photographs, from the construction of the very first Zucrow Labs test cells to a historic visit from Wernher von Braun.

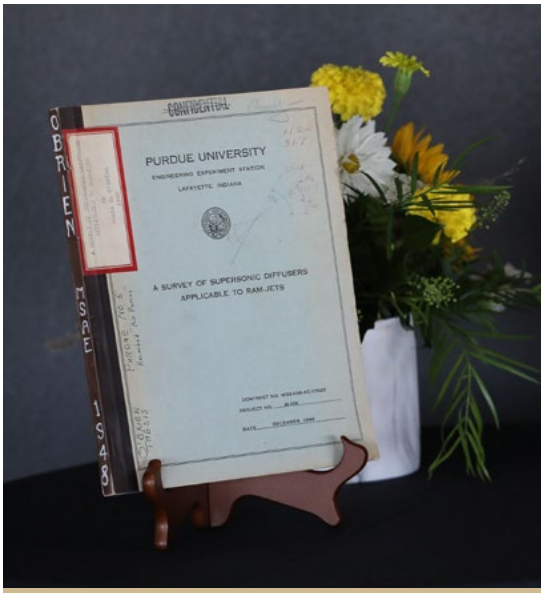
Watch the celebratory video...

Read about the 75 year history of Zucrow...

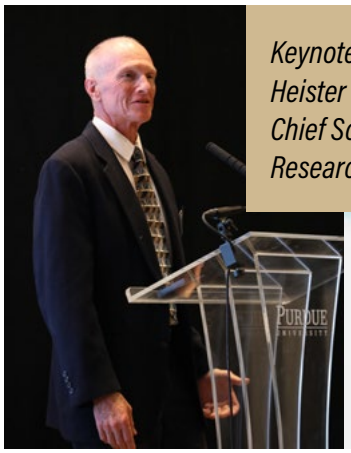
Bob Lucht welcomes guests to the Zucrow Labs 75th Anniversary event.

Ron Paulus (BSME '60) was a project engineer for the Saturn V, and also worked on Skylab and the Space Shuttle solid rocket boosters.

Yen Matsutomi (BSAAE '03, MSAAE '05, PhD '09) is VP of the Engines Design Office for Blue Origin.



Denis H. O'Brien's 1948 master's thesis on ram-jets was one of the first to emerge from Purdue's "Rocket Lab," since re-named after its founder Maurice J. Zucrow.



Keynote speakers were Steve Heister and Venke Sankaran, Chief Scientist at Air Force Research Labs in Dayton, OH.

Hypersonic shock tunnel: first tests

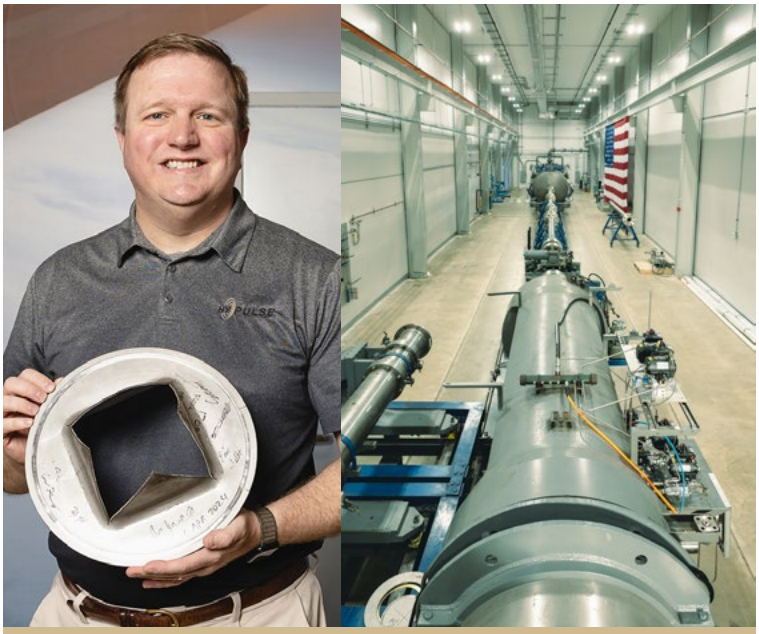
Four years in the making, the **HYPULSE hypersonic shock tunnel has come to life** at Purdue's Hypersonics and Applied Research Facility (HARF).

"HYPULSE is versatile because you can put in any gas you want," said **Joe Jewell,** the John Bogdanoff Associate Professor of Aeronautics and Astronautics. "We can mix up the atmosphere of Titan, or one of the outer planets, or fill it with CO2 to match Mars."

Originally designed by NASA in the 1960s, HYPULSE eventually landed at Northrop Grumman, who donated it to Purdue in 2020. To house the tunnel, Purdue opened the $41 million 65,000 square-foot HARF facility in 2023. Shortly thereafter, Jewell and his team worked to verify the pumps, valves, seals, sensors and data collection systems before conducting their first true hypersonic tests in 2024. By the end of 2025, they expect to be running experiments at Mach 25 and beyond.

"Very few universities have anything like this," Jewell said. "HYPULSE opens up entirely new pathways for hypersonic research."

Read the full story...



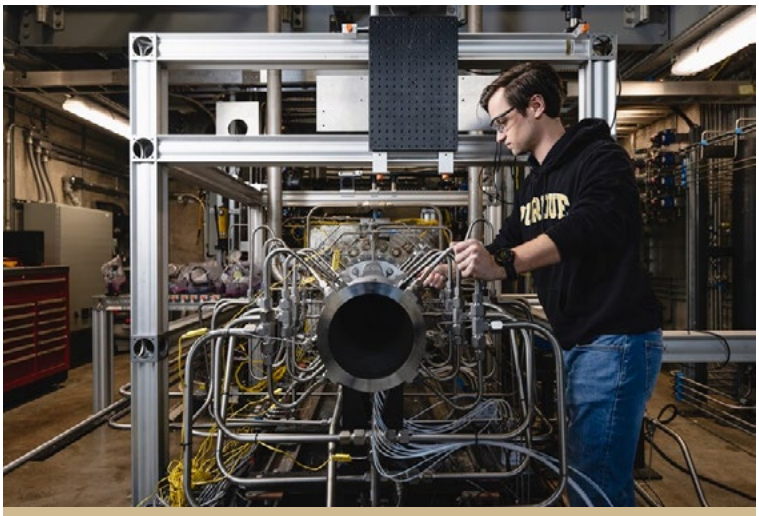
HYPULSE director Joe Jewell, seen here with the burst metal disc that initiates the shock tunnel test. HYPULSE is one of several unique facilities at Purdue Applied Research Institute's Hypersonics and Applied Research Facility (HARF).

Additively manufactured scramjet

A team of Purdue graduate students successfully tested a **full-scale, 3D printed scramjet**, an engine that allows aircraft to travel at speeds of Mach 5 and beyond. The test provided insights to increase the engine's efficiency and reduce hypersonic manufacturing costs. The scramjet was designed by **Carson Slabaugh's** team and printed at Purdue's Hypersonics Advanced Manufacturing Technology Center (HAMTC). Testing was performed in Slabaugh's laboratory at hypersonic flight conditions.

"It's really difficult to simulate the conditions at that speed," said graduate research assistant Will DeVerter. "Zucrow is one of just a few labs in the world with the capability to supply air and fuel at conditions requisite for full-scale scramjet propulsion. We were very happy with the test results; ignition was achieved on the first attempt, and our hardware remained unscathed even after firing the engine several times. Results like that prove the efficacy of the additive manufacturing process."

Read the full story...



Will DeVerter, a graduate research assistant in the Purdue Applied Research Institute's Hypersonics Advanced Manufacturing Technology Center (HAMTC), prepares his team's 3D printed scramjet for testing at Zucrow Labs. (Purdue University photo/ Charles Jischke)

AI for new clean propulsion models

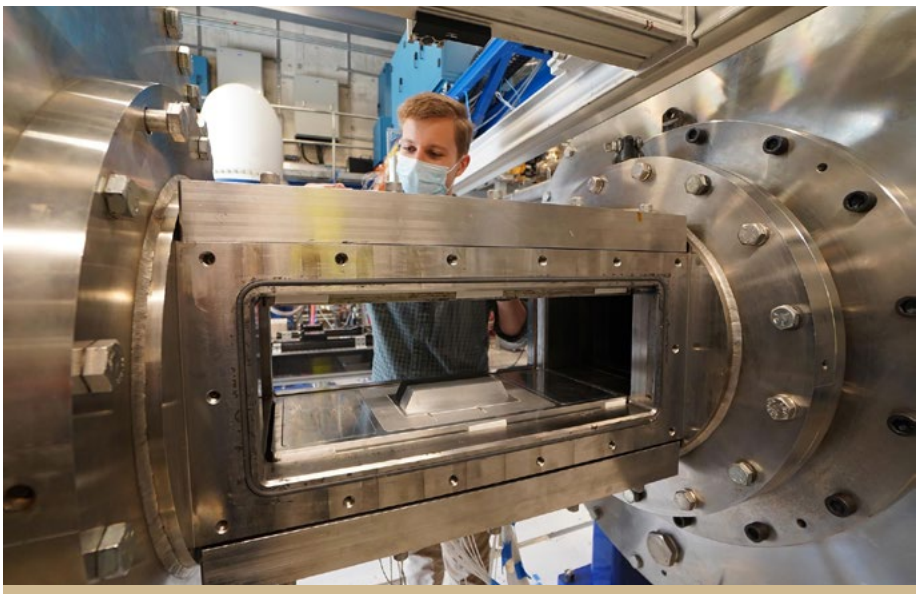
As a leader in propulsion technology, Purdue University is always searching for innovative ways to make aviation more sustainable. Their latest initiative is TRANSDIFFUSE, a €10 million collaborative project which promises to revolutionize the field of turbomachinery through an innovative model based on artificial intelligence.

Guillermo Paniagua promised to dye his hair blue if his team received this €10 million ERC grant. They did, and he did! (Purdue University photo/Jared Pike)

"We always have an eye on a sustainable future for aviation," said **Guillermo Paniagua**, professor of mechanical engineering. "This project proposes an ambitious roadmap to develop AI-based models of new propulsion technologies, allowing us to transition towards cleaner and more efficient aviation and energy generation."

Paniagua has joined forces with Eusebio de Valero from Universidad Politecnica de Madrid (UPM) and Oriol Lehmkuhl from the Barcelona Supercomputing Center (BSC-CNS). Their new project, called TRANSDIFFUSE, has been awarded almost 10 million euros with a Synergy Grant (SyG) from the European Research Council (ERC) in the 2024 call. The ERC SyG scheme is one of the most prestigious and competitive funding schemes in the European Union.

One of the main innovations of TRANSDIFFUSE will be the creation of FluidGPT, an AI-based model that is expected to generate significant breakthroughs in sustainable energy, such as the development of pressurized hydrogen combustion (PGC) engines. These innovative compact and lightweight turbines promise to be highly efficient, thus allowing to redesign propulsion standards in aeronautics and power generation systems.

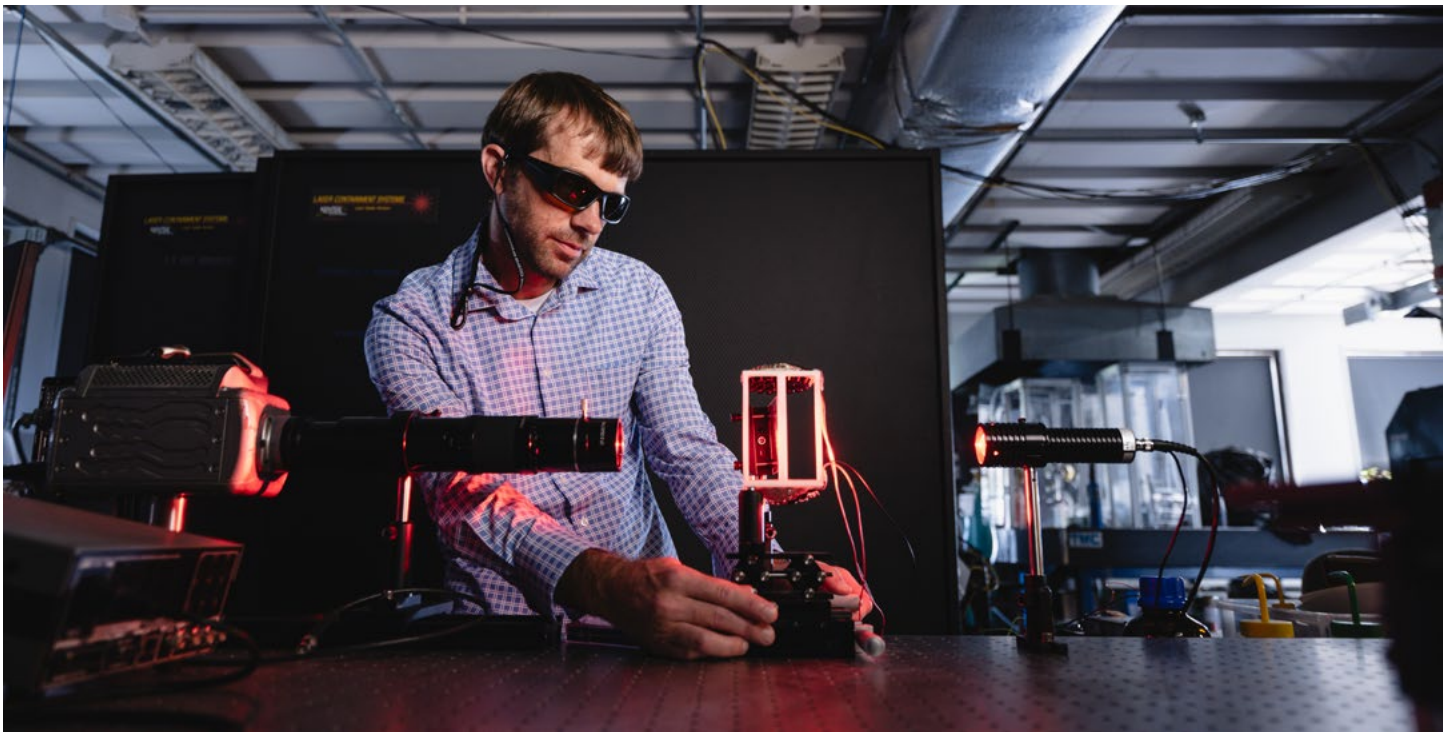


Guillermo Paniagua's PETAL Lab researches the latest advances in turbomachinery. Their team will soon be collaborating on a new project to bring AI-based fluids modeling to these turbines. (Purdue University photo/Jared Pike)

The challenge addressed by the project is the control of the transonic flows generated from the rotating detonation combustor, a general challenge that has hindered the performance of compact turbomachinery. With the development of FluidGPT, the consortium aims to characterize, predict and manipulate these complex and unstable flows, thus unlocking the development of transonic diffusive passages, a critical component in new engines demanding efficiency and compactness.

Read the full story here...

Faculty profile: Daniel Guildenbecher



Daniel Guildenbecher, associate professor of mechanical engineering, studies the behavior and evolution of energetic particles as they move and collide with each other. Understanding how these particles form, transport and react helps scientists to improve jet engine and rocket fuels as well as tailor energy release for explosives used in mining, manufacturing and military applications.

"Guildenbecher's reputation as an authority on multiphase optical diagnostics is sterling," said Stephen Beaudoin, professor of chemical engineering and director of the Purdue Energetics Research Center (PERC). "We are delighted to welcome him to the PERC team and are excited by where his unique capabilities will lead us."

Guildenbecher's team is based in the new ZL9 building.

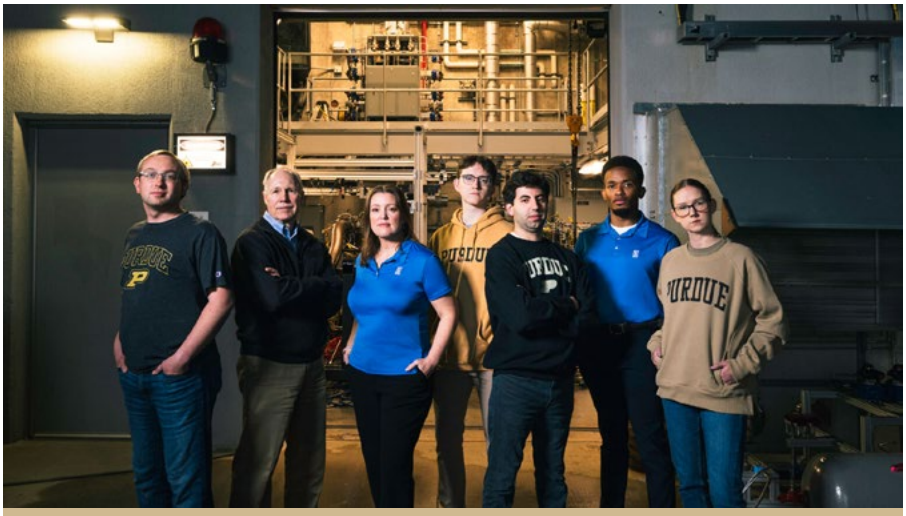
Using techniques such as digital holography and imaging pyrometry, Guildenbecher captures three-dimensional images of highly reactive particles and measures their characteristics such as size, velocity and temperature distribution as they are in motion. "Guildenbecher is an expert in several advanced diagnostics that are devoted to characterizing multiphase flows," said Christopher Goldenstein, associate professor of mechanical engineering and longtime collaborator with Guildenbecher. "Using these tools, he is able to extract amazing information about how particles evolve in reacting and high-velocity flows that are extremely difficult to study experimentally."

The three-dimensional measurement techniques Guildenbecher employs are highly relevant for energetic environments where optical access is extremely difficult and limited. "When you're trying to take measurements in these extreme environments, you are typically limited to one viewpoint, so you try to maximize the amount of useful data that you can get from that one view," Guildenbecher said. "What differentiates my research is the ability to characterize an entire particle field in a three-dimensional space using a single high-speed camera."

Read the full story here...

Purdue and Rolls-Royce: safeguarding our future

From state-of-the-art facilities in West Lafayette, **Purdue and Rolls-Royce are leading the world in what's next for aerospace research**.



Purdue was the first Rolls-Royce University Technology Center (UTC) partner in the country. (Purdue University photo/Rebecca Robiños)

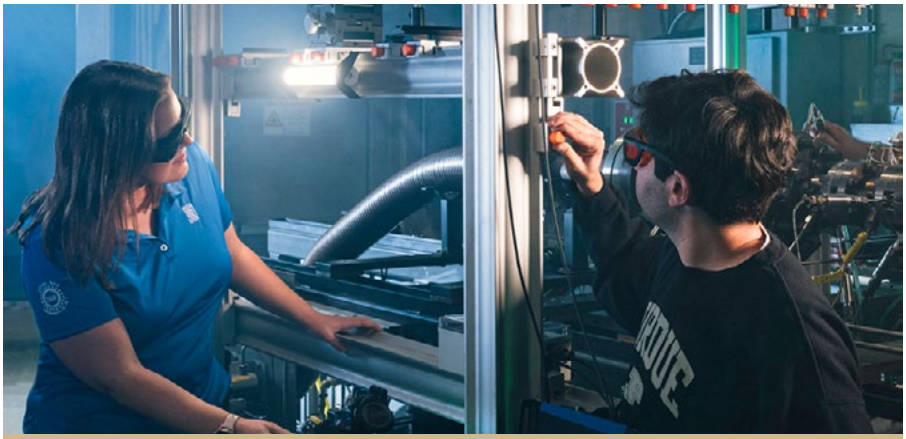
"Purdue is a world-class research institution and a top university in the U.S. for engineering aeronautics and astronautics," says Warren White, head of assembly and testing at Rolls-Royce. "Our partnership is strengthened by an aligned interest in transformative technologies in civil and defense aerospace."

For over 70 years, this partnership has safeguarded national security and provided innovative solutions. Today, it continues to lead progress in critical fields, including advanced manufacturing, compressor and turbine technologies, and hybrid-electric and hypersonic propulsion.

In 2003, Purdue was designated as the first Rolls-Royce University Technology Center (UTC) partner in the U.S. "Giant leaps in aerospace happen here," White says. "We are proud to be working with Purdue to advance these efforts."

Those giant leaps include forging a more sustainable future in aviation by employing hybrid-electrical technology instead of relying on fossil fuels; overcoming challenging operating environments with improved high-altitude testing; and helping aircraft reach high speeds with hypersonic systems.

In 2022, Purdue and Rolls-Royce signed the largest industry-academia deal in the university's history: a 10-year, $75 million strategic alliance. Since then, major investments have benefited Purdue's Zucrow Laboratories — the largest academic propulsion laboratory in the world — as well as the Hypersonics and Applied Research Facility (HARF), home to the only Mach 8 quiet wind tunnel in the world and the hypersonic pulse (HYPULSE) reflected shock/expansion tunnel.



"I work right alongside other Boilermakers," says Tonya Munevar, a testing outsource manager at Rolls-Royce who earned a master's degree in technology and research from Purdue in 2011. (Purdue University photo/Rebecca Robiños)

"I work right alongside other Boilermakers," says Tonya Munevar, a testing outsource manager at Rolls-Royce who earned a master's degree in technology and research from Purdue in 2011. "A personal highlight for me is supporting the students as they transition from theoretical thinking to industry practice while helping them understand and adapt to the new expectations."

Read the full story...

Solid fuel for RDEs

Zucrow Labs researchers are developing a safer, more energy dense fuel for rotating detonation engines (RDE), a new type of jet engine used in military and space applications that is designed to be more powerful and efficient than traditional versions.

(Left) Terrence Meyer, professor of mechanical engineering, uses laser diagnostics to measure solid fuels' gas compositions after burning. (Right) Steven Son, the Alfred J. McAllister Professor of Mechanical Engineering, prepares a mixture for the synthesis of a solid fuel used in a rotating detonation engine (RDE).

Steven Son, the Alfred J. McAllister Professor of Mechanical Engineering, and **Terrence Meyer**, professor of mechanical engineering, are collaborating with the Air Force Research Laboratory (AFRL) and Spectral Energies to build formulations for solid fuels that will power an RDE.

"The idea to use solid propellants for rotating detonation is a fairly new one, so some of the innovative work happening at Purdue is really cutting-edge technology," said Eric Paulson, AFRL senior aerospace engineer and a lead collaborator on this project. "There's a lot of work that's been done with liquids, but solid fuel in an RDE is a pretty new game. It's a very high interest technology across the Department of Defense."

Solid fuels were chosen because of their stability and efficiency. They are less temperamental than liquid or gas fuels, have a longer shelf life and provide greater energy density, meaning less fuel is required to power the vehicle. "Safety is one of the biggest reasons why we're working with solid fuels," Son said. "If you get a hole in a liquid fuel tank, then you're going to have a leak that could cause a fire hazard. Solid fuels don't have that problem."

RDEs and solid fuels have the potential to advance rocket propulsion and hypersonic flight. Unlike traditional propulsion engines that use subsonic combustion to power up, RDEs operate through supersonic detonation, which burns fuel more efficiently and requires lighter and simpler components. Adding a solid fuel into the equation further enhances the vehicle's fuel economy. "The detonation wave in an RDE propagates at over 3,000 mph, which is about 100 times faster than a typical engine," Meyer said. "This increase in power means that the combustor can be made more compact and lightweight and achieve more thrust with less fuel.

Because this research delves into relatively uncharted territory, there are several challenges that the group is working through. RDEs are typically designed for liquid and gas fuels, so solid fuels must be tailored to fit with the engine's structure. "The challenges come from trying to integrate several different systems together. We have to develop and characterize our solid fuel and tailor it to a very specific application," said Eric Holst, a Purdue graduate research assistant on the project who is pursuing his PhD in aeronautics and astronautics. "Not that many people who are familiar with RDEs also have expertise in solid fuels and vice versa. So, it's kind of unique bringing these two different research areas into one complete package."

So far, the team has identified several candidate fuels it hopes to begin testing in an RDE currently housed in Maurice J. Zucrow Laboratories. The team has used a variety of imaging tools to measure the concentration of gases produced by the solid fuel exhaust and determine how fast those products are able to detonate. "We've demonstrated burning propellants and producing something that can then burn again in an RDE," Paulson said. "That proof of concept is key to being able to generate additional funds that mature this technology for an actual defense application."

Read the full story...

Watch the video...

Visiting an aircraft carrier

Even Purdue's globally renowned propulsion experts aren't immune from geeking out over fighter jets, catapult takeoffs, and blazing afterburners. A group of Zucrow Labs faculty and staff were invited by the U.S. Navy to a jaw-dropping and informative day aboard the **USS Abraham Lincoln** aircraft carrier.

"Standing 5 feet from a taxiing F-18, and about 50 feet from a catapult launch on afterburners, is amazing," said AAE professor Tim Pourpoint. "I never expected I would have that opportunity in my life"

More photos and video...

Zucrow Labs managing director Scott Meyer walks toward the E-2C Hawkeye plane taking visitors to the USS Abraham Lincoln.

Professors Timothee Pourpoint and Steve Son are ready to fly!

An F-18 operated by the U.S. Navy fires up its afterburners in preparation for a heavy catapult launch on the flight deck of the USS Abraham Lincoln.

She's back!

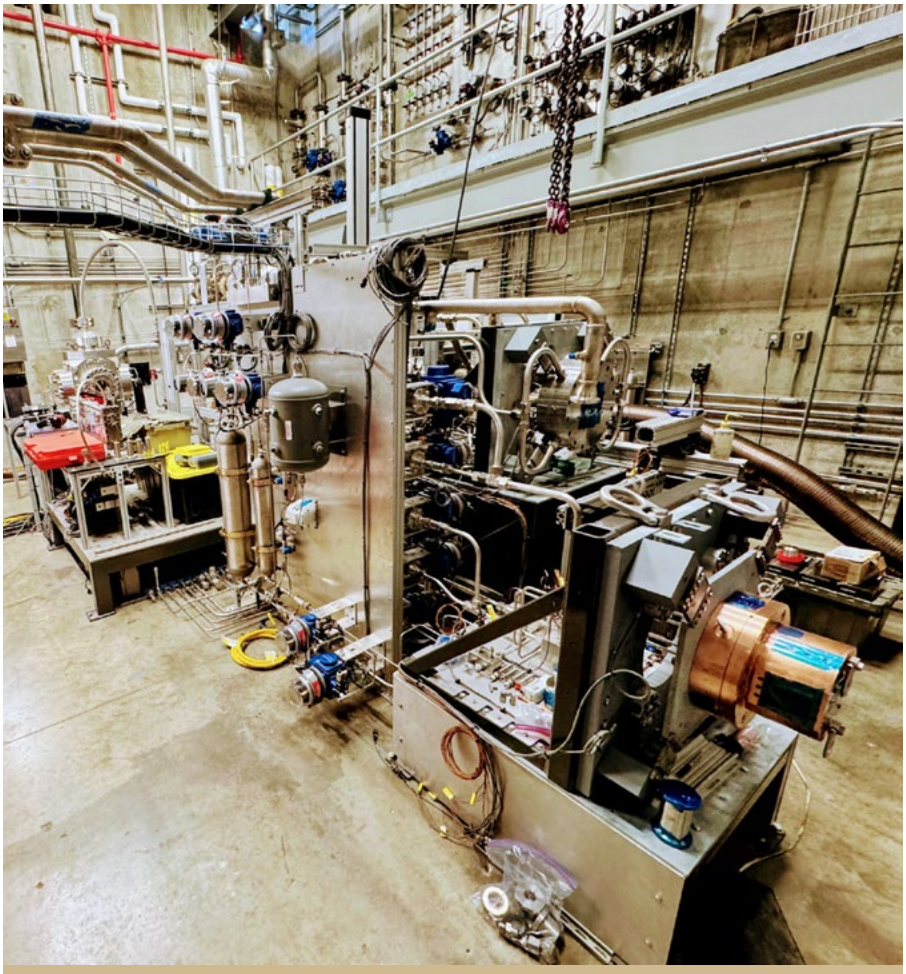
NASA astronaut and Zucrow Labs alum **Loral O'Hara** (MSAAE '09) returned to earth in March 2024, after six months aboard the International Space Station. During her time on the orbiting laboratory, O'Hara contributed to dozens of scientific investigations and technology demonstrations to prepare for future space exploration missions and generate innovations and benefits for humanity on Earth. She also took time to talk to Purdue students during a live downlink event.

Watch the video of Loral's Q&A from space...

Read more about Loral's accomplishments in space...

New thrust stands installed

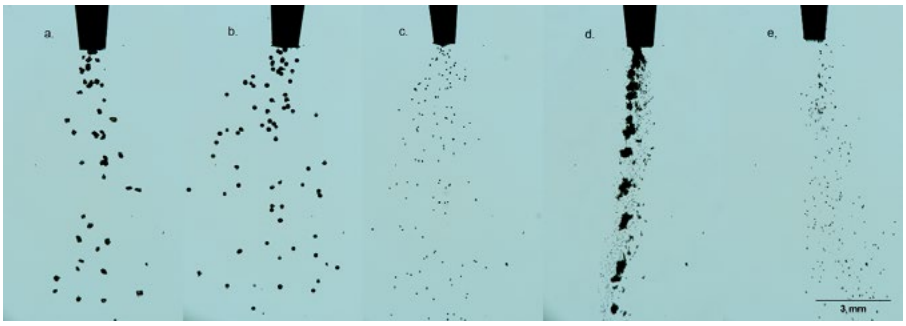
A Zucrow team led by **Terrence Meyer, Mikhail Slipchenko, and Venkat Athmanathan** has designed and built two advanced test stands—HAMR and RAMR—designed to address numerous challenges with the evaluation, understanding, and advancement of rotating detonation engines (RDEs) and other high-speed propulsion systems. These test platforms are capable of evaluating air-breathing and rocket combustors with thrust levels up to 5,000 lbf. They support gaseous oxygen (GOx) flow rates exceeding 12 lbm/s and heated air flow rates over 20 lbm/s, for various liquid and gaseous fuels. A key feature of these facilities is their integration of MHz-rate planar diagnostics, providing optical access to chamber pressures potentially up to 1000 psi. This capability allows for direct, high-fidelity assessment of combustion physics under extreme conditions, building on Zucrow Laboratories' leadership in diagnostics for high-speed propulsion research. Current work is being performed in close collaboration with Purdue alumni Christopher Fugger and Austin Webb, including several multi-year research projects supported by Spectral Energies, LLC and various federal agencies.



Two new stands, each capable of 5,000 lbf thrust for high-speed propulsion research, have come online at Zucrow.

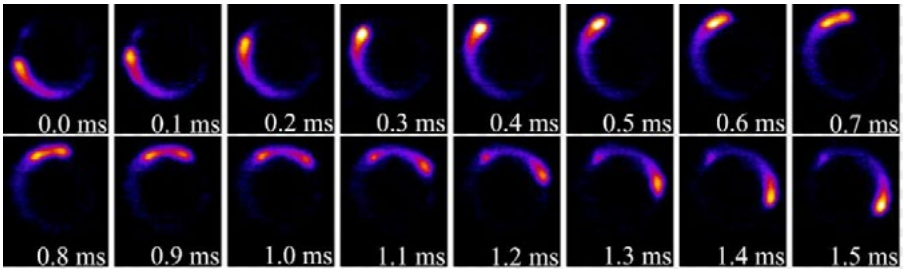
Research briefs

SURROGATES FOR 3D-PRINTED ENERGETICS



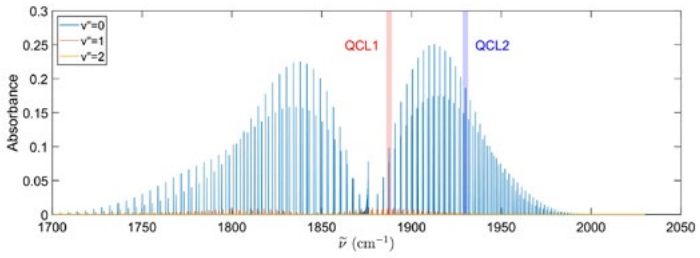
In July 2024, Monique McClain's team presented research on energetic processing methods at the International Pyrotechnic Society Seminar. They observed the flow of surrogate powders via high-speed camera as a function of motor voltage and nozzle size. Understanding the role these factors play on the dynamics of powder flow is critical to ensure high-precision deposition. They also developed and characterized a new method for making a molding powder, with 90% sugar by weight using hydroxyl-terminated polybutadiene. This new processing approach could be a much faster method to tune the properties of plastic-bonded explosives.

NOVEL DIAGNOSTICS IN RDEs



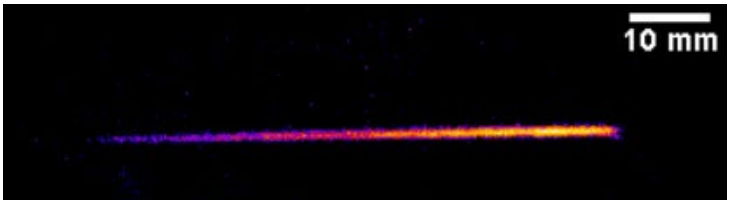
In March 2024, Terrence Meyer's team demonstrated megahertz-rate heat-flux measurements in a hydrogen-air RDE via an atomic layer thermopile probe. The project was spearheaded by Dr. Venkat Athmanathan in collaboration with Spectral Energies, LLC. They compared the experimental results with the numerical simulations from Zucrow alum James Braun at North Carolina State University. In February, in partnership with NASA's Glenn Research Center, the same team investigated liquid injection in RDEs and captured the first million-frames-per-second volumetric fluorescence images of detonation-spray interactions. In May, they achieved another key milestone by demonstrating phase Doppler interferometry to measure drop size and velocity distributions for the first time in an RDE during hot fire testing.

SHOCK TUNNEL FLOW CHARACTERIZATION



Chris Goldenstein's team worked with Sandia National Labs to measure nitric oxide temperature via laser absorption spectroscopy. The measurements captured the temporal evolution of the flow and revealed pronounced thermal nonequilibrium, with each molecular species having a higher vibrational temperature than rotational temperature. This was the most extensive characterization of shock tunnel flow ever performed, and researchers are referencing the measurements in their creation of models in hypersonic computational fluid dynamics codes.

100,000 FPS LASER FLUORESCENCE OF CO



Joe Jewell's team, in collaboration with Terrence Meyer and Mikhail Slipchenko, demonstrated two-photon laser-induced fluorescence measurements of carbon monoxide at rates faster than 1 kHz. They pushed the state-of-the-art by two orders of magnitude to 100 kHz with a custom burst-mode laser and optical parametric oscillator, suitable for use in hypersonic tunnels. This allows for advances in coupled measurements of ablation products and gas mixing in boundary layers and wakes.

Awards and honors

Two Zucrow Ph.D. students have been named Women in Defense Scholars.

Stephanie Andress, Ph.D. student in Mechanical Engineering, researches additively manufactured energetic materials.

Angelique Klimek, Ph.D. student in Chemical Engineering, focuses on the development and characterization of advanced energetic materials.

More info...

Venkat Athmanathan, Senior Research Scientist, was selected to serve as the Technical Co-chair and organize the AIAA Pressure Gain Combustion Technical Conference, planned for the summer of 2026.

More info...

Kevin Boes, Ph.D. student in Mechanical Engineering, received the National Defense Science and Engineering Graduate (NDSEG) Fellowship, one of the most prestigious fellowships for graduate students working in national defense. *More info...*

Antonio Castillo, postdoc in Aeronautics and Astronautics, received the Outstanding Research Award, recognized by the College of Engineering for demonstrated excellence and leadership in research through publications, organizations, and mentoring. *More info...*

Two Zucrow personnel received Staff Awards of Excellence from Purdue's College of Engineering:

Dean Dilley, Operations Engineer, won the Management & Professional Customer Service Excellence Award.

Rohan Gejji, Senior Research Engineer, received the Outstanding Research Staff Excellence Award.

More info...

Mohammed Abir Mahdi, Ph.D. student in Mechanical Engineering, received AIAA's Abe M. Zarem Graduate Award, recognizing graduate students who have demonstrated outstanding scholarship in the field of astronautics.

More info...

Guillermo Paniagua, Professor of Mechanical Engineering, received the Impact on Industry award from the College of Engineering's Faculty Excellence Awards, recognizing his outstanding collaborations with industry.

More info...

Li Qiao, Professor of Aeronautics and Astronautics, was named a Fulbright Scholar, collaborating with researchers at Tohoku University in Japan on "Exploring Ammonia as a Hydrogen Carrier for Aerospace Applications."

More info...

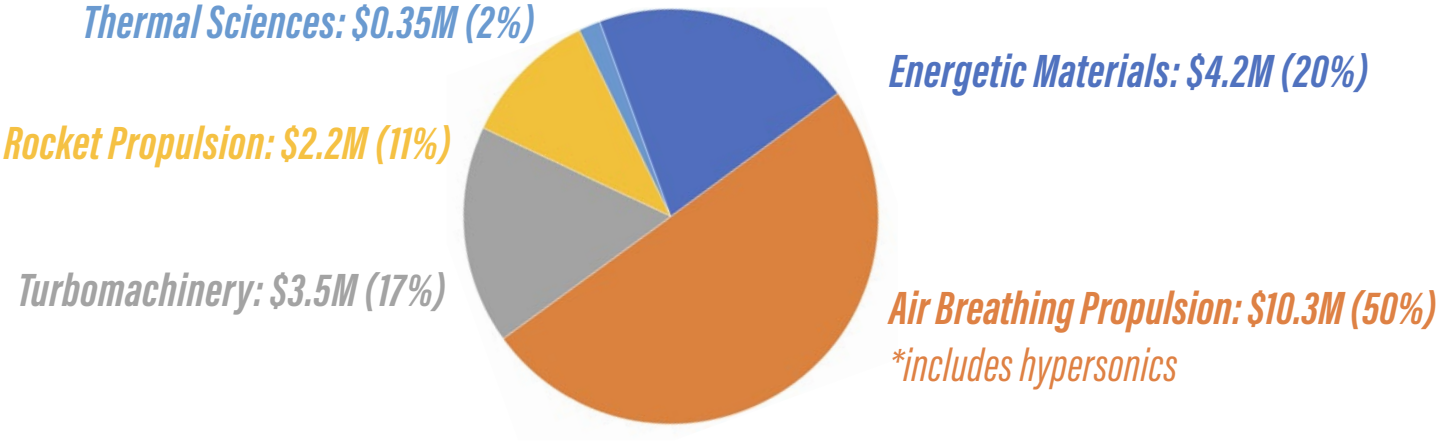
Energetics talent showcase

The Purdue Energetics Research Center (PERC) hosted a first-of-its-kind energetic materials talent showcase in May 2024. Because few universities have programs dedicated to energetics, defense employers often struggle to recruit candidates with the proper training to handle these sensitive materials. PERC addressed this challenge by facilitating connections between recruiters and students with enough experience to dive into a research project on day one.

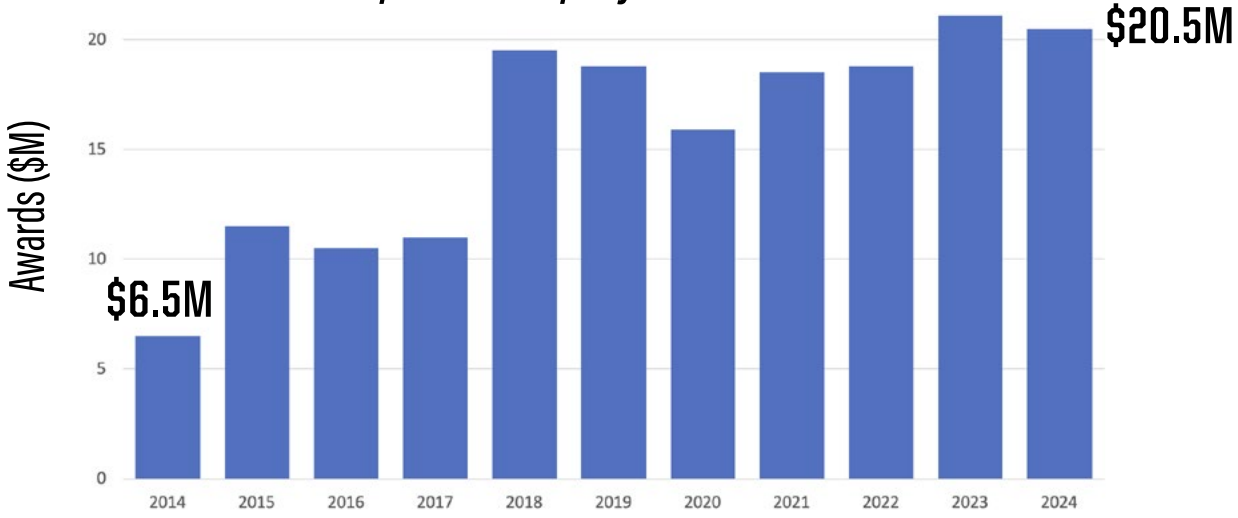
Read the full story...

Zucrow by the numbers

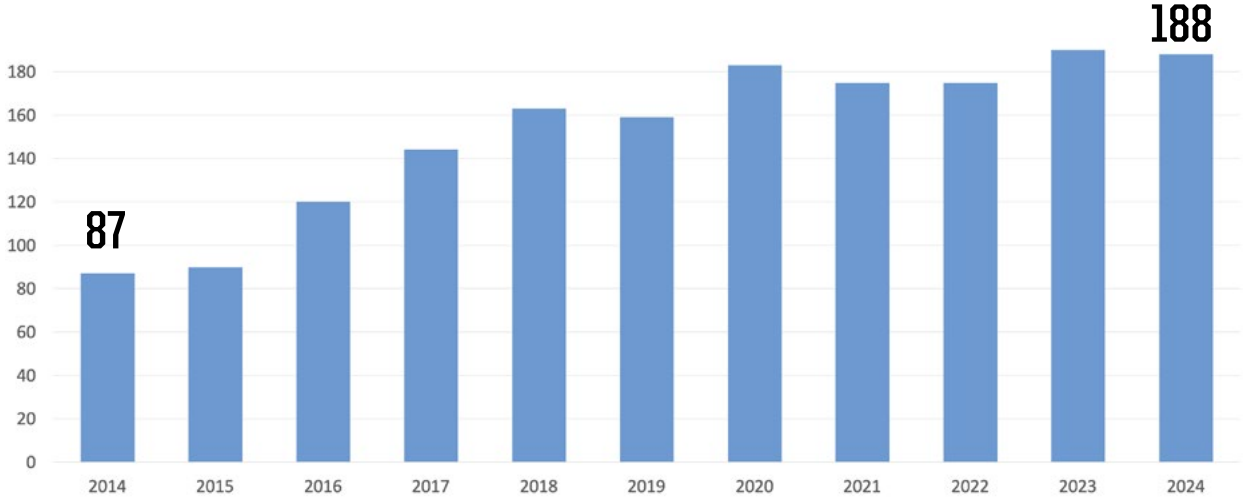
Total expenditures at Zucrow for calendar year 2024: **$20.5 million**



Growth in sponsored projects at Zucrow Labs



Growth in number of graduate students working at Zucrow Labs



BOOOOOOM!

How do rocket scientists celebrate Halloween? *In Terry Meyer's research group, they duct-taped a carved pumpkin onto their rotating detonation engine test rig, ignited it, and filmed the results with a high-speed camera. The* ***ghastly*** *results showed the true* ***supernatural*** *power of RDEs!*

Watch the video here!

PURDUE UNIVERSITY®

purdue.edu/zucrow

Students enjoy the "fruits" of their labors!