Developing, refining, and testing the next generation propulsion and power technologies



Research on propulsion and power has a long and rich history at the University of Notre Dame. The University established a Department of Mechanical Engineering in 1886, and by the decade's end Notre Dame researchers had constructed a steam engine, an Edison dynamo power generator, and a flying machine for testing and refining propeller designs.

Following World War II, Notre Dame launched a dedicated aerospace engineering laboratory that gained worldwide recognition for advanced aerospace research.

Today, gas turbine engines provide propulsion for most of the world's commercial aircraft and a significant fraction of the world's electrical power generation. Notre Dame researchers strive to develop these and other power and propulsion technologies to build a safer and more connected world. The University is one of the nation's leading destinations for engine research and testing, serving as a trusted advisor and collaborator for both government and industry partners.

Learn More

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Facilities

Notre Dame's propulsion and power research facilities form a corridor for aerospace engineering and research that extends beyond the University's main campus.

- The **Notre Dame Turbomachinery Laboratory** (NDTL) consists of a 25,000 square foot Ignition Park facility situated in downtown South Bend, in addition to its on-campus facilities. NDTL combines the benefits of a vibrant research program with a technology development and validation test facility. NDTL's staff are experts in internal and external aerodynamics, aeromechanics, structural dynamics, instrumentation, combustion, computational fluid dynamics, acoustics, and tribology.
- The **Hessert Laboratory for Aerospace Research** is one of the finest university-based aerospace research facilities in the country. More than 84,000 square feet of research space spans two buildings — Hessert Laboratory and Hessert Laboratory at White Field just north of campus. These facilities feature 19 major high-speed wind tunnels that generate the near-flight conditions for Notre Dame's groundbreaking work in aerospace engineering. Faculty and students work on a range of research related to innovations in flight, including faster aircraft, more fuel-efficient jet engines, and specialized components for commercial use, national defense, and space exploration.
- Hessert also features unique facilities that underpin the research agenda of the **Institute for Flow Physics and Control** (FlowPAC), one of the world's largest research groups focused on fluid mechanics. FlowPAC's laboratories and equipment support investigations in aero-acoustics, aero-optics, fluid-structure interactions, gas-turbine propulsion, general flow control, hypersonics, multi-phase flows, sensor and flow actuator development, and wind energy.

Testing Capabilities

Commissioned in 2016, NDTL's specialized Ignition Park Test Facility offers advanced capabilities for testing gas turbine engines and other propulsion systems. With the support of NDTL, the facility provides customers with access to a wide range of advanced equipment and software tools, as well as experienced engineers and technicians who are dedicated to providing comprehensive testing services to a variety of industries.

NDTL's facility offers flexible capabilities in multiple test cells to execute component testing for customers while protecting their intellectual property. These capabilities include:

- 10 MW in rotating power/load capability;
- 50 lbm/s (23 kg/s) of conditioned air at 12 atmospheres and temperatures up to 1200°F (650°C);
- Vacuum system for altitude simulation;
- 12 MW of cooling capability; and
- A large-scale HPC cluster.

Partnerships

Alongside industry and government collaborators, NDTL develops technologies for conventional and high-Mach air-breathing propulsion, energy generation, advanced thermal management, and energy storage solutions. NDTL's infrastructure and staff expertise in high-energy, high complexity R&D test programs make it a natural partner for addressing challenges associated with these technologies.

NDTL's collaboration with Atlanta-based startup Hermeus recently resulted in a successful demonstration of a turbojet-to-ramjet transition in a turbine-based combined cycle engine. Hermeus will continue to partner with NDTL to refine the engine for use in a Mach 5 commercial aircraft.

NDTL's research partners include major aero-propulsion OEMs (e.g., Carrier Global Corporation), the Department of Defense, the Department of Energy, and early stage companies, including Hermeus and FGC Plasma.

Workforce Development

Notre Dame's doctoral program in Aerospace and Mechanical Engineering is one of the largest and most successful graduate programs at the University. The University's exceptional research facilities provide relevant research experience, preparing students for their future careers in academia, government, and the private sector. NDTL Alumni hold key technology leadership positions in both government and industry.

Further, NDTL operates an internship program focused on experiential learning that creates opportunities for students to work with its industry and government partners and global experts in the fields of aerospace and mechanical engineering. NDTL's internship program exposes undergraduate engineering students to exciting challenges and careers in propulsion and power.

In addition, undergraduate students benefit from a vibrant, innovative environment that includes a Rocketry Team and a Design-Build-Fly Team that compete nationally and internationally.

