

- Computational Fluid Dynamics
- Deep Ocean Simulations
- Fracture Mechanics
- Flow Measurement
- Multiphase Flow
- Probabilistic Failure Analysis
- Environmental Testing
- Surface Engineering & Coatings
- Telecommunications Evaluations
- Structural Mechanics
- Failure Analysis
- Eddy Current Modeling
- Diagnostic Software
- Thermal & Corrosion Analysis
- Nondestructive Evaluation
- Pipeline Compression
- Acoustics
- Biomechanics & Biomaterials
- Magnetostrictive Sensors
- Materials Integrity & Life Prediction
- Terminal Ballistics
- Guided Wave Inspection
- Aerodynamics
- Propellant Dynamics

Mechanical Engineering

Southwest Research Institute's mechanical engineering program serves the defense, aerospace, and energy sectors, applying expertise in materials, structures, nondestructive evaluation, sensor technology, energetic systems, and fluids and machinery dynamics.

Our defense program extends to all branches of the military and involves ballistics, explosives, survivability, and light- and heavy-armor analyses. For the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), we developed and delivered the Dynamic Deformation Instrumentation System for measuring the effects of landmines and improvised explosive devices on ground vehicles. The system comprises hardened miniature high-speed cameras combined with digital image correlation software to measure the transient motion and deformation of a vehicle's floor and hull during underbody blast. The system performed successfully during field testing, resulting in additional blast survivability research for TARDEC.

Our aerospace program encompasses aircraft structural life extension, jet engine performance and reliability, and launch vehicle structural dynamics and propulsion systems. DARWIN®, an SwRI-developed fatigue crack growth software program that determines the probability of fracture of jet aircraft engine rotors, completed its 20th year of continuous funding. The Federal Aviation Administration is extending this important research program through 2019. DARWIN is also being used for advanced military applications. For the U.S. Air Force Research Laboratory, we are linking DARWIN to third-party software to address complex crack and component geometries, and to simulate X-ray inspection methods and advanced manufacturing processes for aircraft engine rotors.

Our work in support of aircraft structural integrity for extending the service life of the U.S. Air Force fleet continues. This year, we completed full-scale wing tests that achieved a new benchmark for the expected structural life of T-38 wings. Our A-10 team was selected as

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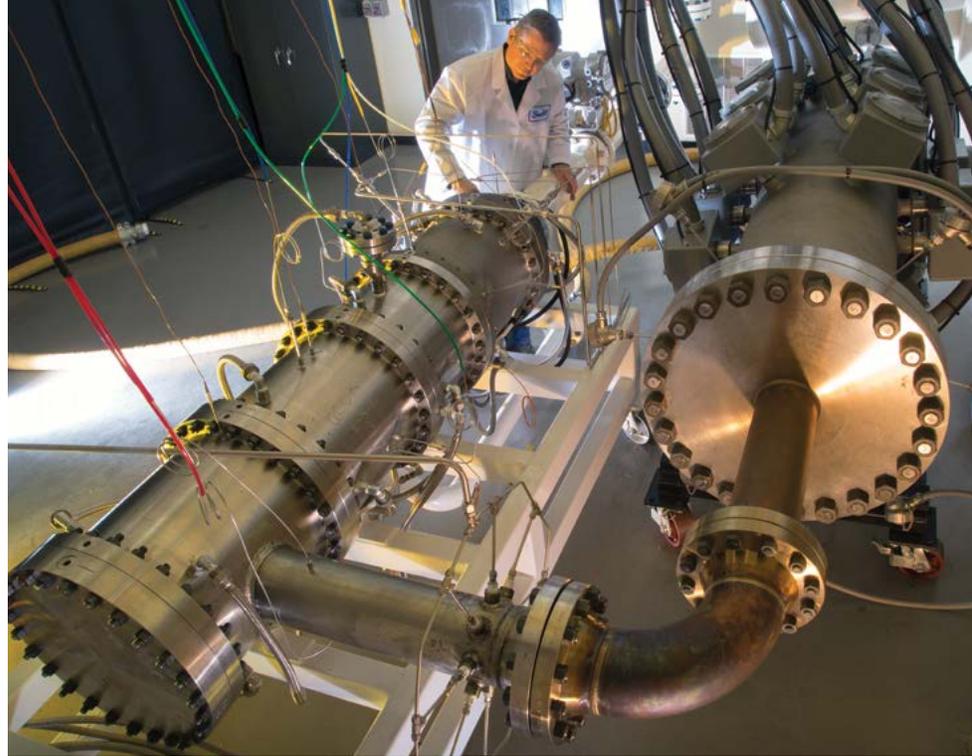
This past year, SwRI built a new facility for testing small-caliber guns, ammunition, and light armor materials. The 1,200-square-foot facility includes state-of-the-art instrumentation and high-speed video for measuring and recording ballistic impact events.



We designed and built this combustor rig to evaluate a novel SwRI-developed concept to maximize the efficiency of solar power plants.

the USAF Team of the Year under the Department of Defense Value Engineering Award program for developing innovative approaches to efficiently manage airframe structural inspection requirements for the A-10 fleet.

Evaluating roadside safety structures remains a core program. Our program is ISO-accredited and approved by the Federal Highway Administration to provide crash testing services to evaluate guardrails, end terminals, security barriers, and other structures. For one project, SwRI conducted full-scale crash testing of a pickup truck traveling at 62 mph to evaluate the performance of a high-tension cable barrier used in the median of a divided highway. We also are assisting the industry's transition to the American Association of State Highway and Transportation Officials crash test standard.



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Our energy program includes oil and gas production and transportation, renewable energy, clean coal, and nuclear power. To help ensure the safety of offshore oil production, we develop sensor systems to independently validate the industry's pipe weld inspection systems.

We are developing clean energy technology for the U.S. Department of Energy to address factors associated with climate change. This year, we completed a major, six-year carbon dioxide compression project that led to the design of advanced inter-cooling compression technology. This technology will significantly increase compressor efficiencies and lower the cost of electricity in carbon separation and sequestration power plant applications.

We initiated the Separation Technology Research (STAR) program to advance research for better oil and gas separation equipment and test protocols. Now in its second year, the multimillion-dollar joint industry program has grown to 20 member companies. The first project for the STAR program, testing oilfield production scrubber devices offered by seven manufacturers under field conditions, is underway at our recently upgraded onsite Multiphase Flow Facility. ●

Visit mechanicalengineering.swri.org for more information or contact Vice President Danny Deffenbaugh at (210) 522-2384 or danny.deffenbaugh@swri.org.

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SwRI researchers are performing F-16 wing component durability evaluations. Test results will be used to help extend the service life of the aircraft.

We conducted full-scale testing of a pickup truck impacting a highway median cable barrier to evaluate the barrier's performance.

