

# Engine Durability and Reliability Testing



Southwest Research Institute®  
San Antonio, Texas

Southwest Research Institute™ (SwRI™) plays an integral role in developing and modifying production engines and components for the automotive industry. As an independent and multidisciplinary research, development, and testing organization, the Institute is uniquely qualified to aid automotive and engine manufacturers in producing world-class engines. SwRI provides a wide range of engine-design services, including conceptual design, cycle simulations, definitive design, modeling, systems analyses, prototyping, and preproduction builds.

After design and fabrication are completed, the engine or component is tested for reliability and endurance. Using sophisticated instrumentation and dedicated, state-of-the-art test cells, Institute engineers provide rapid and cost-effective endurance testing. SwRI's Engine and Vehicle Research Division has achieved certification to ISO 9001, ensuring compliance with stringent quality control procedures in design, development, and testing.

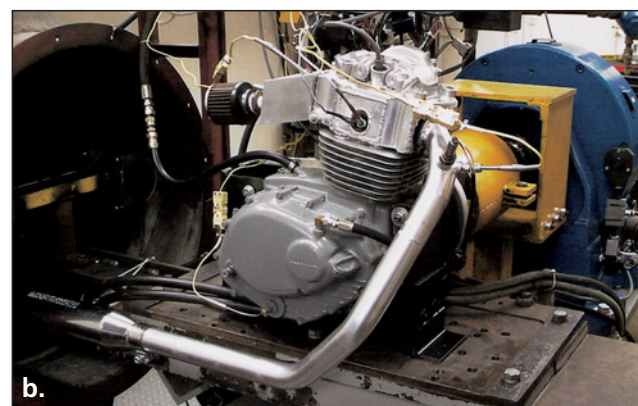
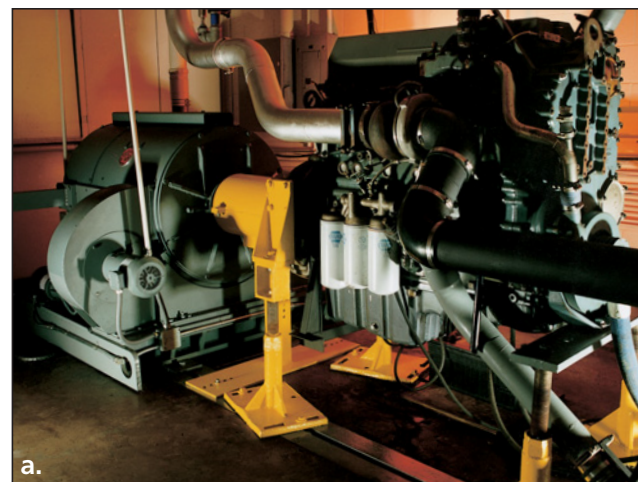
#### Southwest Research Institute

Founded in 1947 as an independent, nonprofit research and development organization, Southwest Research Institute provides a significant research, engineering, and testing resource for industry, business, and government. The Institute uses a multidisciplinary, integrated approach to solving complex problems in science and applied technology.

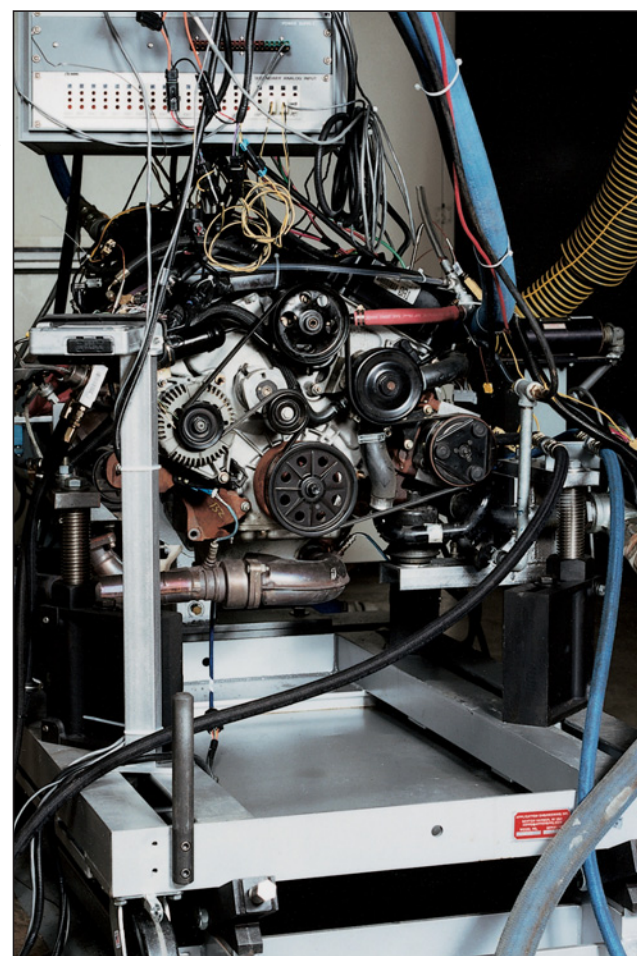
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## Continuous Operation

Institute engineers routinely conduct long-term engine operation on a continuous basis to verify engine and component durability and reliability. SwRI operates an engine durability laboratory with 16 flexible and well-equipped test cells that evaluate a wide spectrum of engines, ranging from hand-held lawn equipment to heavy-duty diesel engines. Experienced technicians perform data-acquisition and closed-loop engine control using a variety of computer hardware platforms and software. As part of SwRI's comprehensive engine data-acquisition system, flight-data recorder systems provide useful pre-event data after an unexpected engine shutdown or failure.



Using quick-change carts to exchange engines in test cells, SwRI technicians reduce the time for engine setup and minimize cost to the client.



SwRI evaluates a wide range of engines, including (a) heavy-duty diesel engines, (b) motorcycle engines, and (c) lawn and garden engines.

## Special Tests

Specially equipped test cells provide a comprehensive range of test capabilities including altitude simulation, low-temperature environment ( $-35^{\circ}\text{C}$ ), thermal cycling, and engine motoring. Using a state-of-the-art coolant chiller system designed specifically for SwRI, the Institute offers *Deep-Thermal Shock* testing (coolant supply at  $-30^{\circ}\text{C}$ ). SwRI staff test components such as starters, alternators, water pumps, diesel injection systems, and port fuel injectors in bench test stands, which enable test components to undergo extreme temperature and vibration testing.

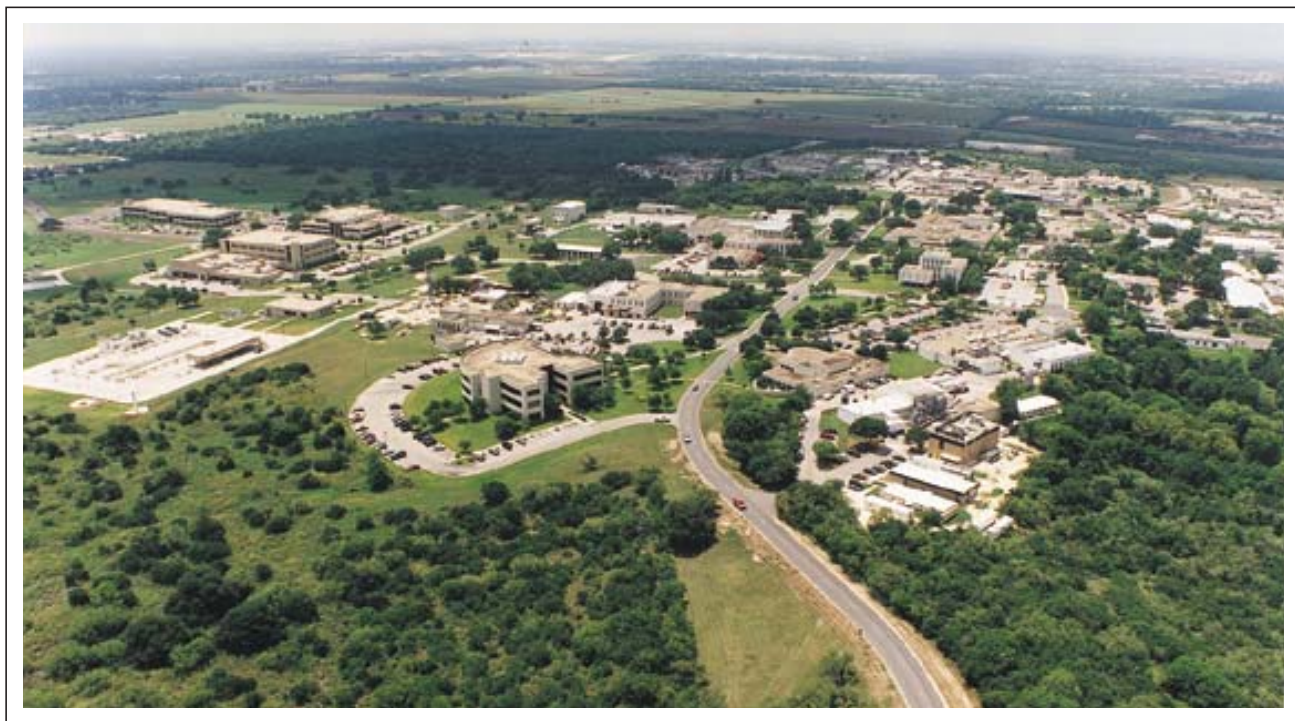
## Flexibility

For more than 30 years, SwRI has performed engine durability and reliability testing on engines that vary in fuel types, sizes, and uses. These engines include:

- Gasoline
  - Automotive
  - Lawn and garden
  - Marine
  - Military
  - Motorcycle
  - Industrial
- Diesel
  - On-highway, including light-, medium-, and heavy-duty
  - Off-highway, including farm, construction, power generation, and military
    - Industrial and stationary
    - Marine
    - Rotary
    - Turbines
    - Locomotive
- Natural gas, liquefied natural gas (LNG), liquefied petroleum gas (LPG), and hydrogen
  - On- and off-highway
  - Industrial and stationary
  - Rotary

Experienced engineers and technicians perform industry standard and customized test procedures and practices. Engine health monitoring and inspections are integral to all engine tests. In addition to monitoring routine engine operation, SwRI staff provide the following services:

- Air filter efficiency evaluation
- Airflow measurement
- Altitude simulation
- Blowby monitoring
- Cold- and hot-engine testing
- Combustion heat release analysis
- Coolant-, oil-, exhaust-, and radiated-heat rejection determination
- Cranking compression evaluation
- Continuous and real-time oil consumption measurement
- Engine assembly
- Engine cycling
- Engine performance mapping
- Engine teardown inspection
- Exhaust emission evaluation
- Failure analysis
- Fuel analysis
- Fuel flow measurement
- Fuel injection pressure determination
- In-cylinder combustion pressure measurement
- Cylinder leakdown comparison
- Needle lift measurement
- Nitrogen high-pressure leakdown determination
- Real-time component wear measurement
- Thermal imaging
- Thermal and deep thermal shock testing
- Turbocharger speed measurement
- Torsional vibration testing
- Used oil analysis
- Visual parts ratings



*Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres and provides nearly two million square feet of laboratories, test facilities, workshops, and offices for more than 2,700 employees who perform contract work for industry and government clients.*

*We welcome your inquiries.  
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**ISO 9001 Certified – Engine and Vehicle Research Division**

The Engine and Vehicle Research Division of Southwest Research Institute has achieved certification to ISO 9001, an internationally recognized quality standard.