

## Advanced Powertrain Research and Testing

When designing new vehicle engines and component systems, one of the biggest challenges is integrating elements from different sources for optimum performance. Systems that work well independently may perform differently when integrated into a full powertrain system. There is a need for test systems that can benchmark individual components as well as integrated systems. This unique facility is the only one of its kind in North America outside the U.S. auto industry.

Argonne National Laboratory's Advanced Powertrain Research Facility's (APRF's) state-of-the-art equipment is available to all component and vehicle test cells to support model development, hardware-in-the loop testing, and technology validation. It includes:

- Light- and heavy-duty engine dynamometers
- 2WD and 4WD chassis dynamometers
- Battery/fuel cell emulator (150kW)
- SULEV emissions measurement capability
- Low-emissions raw emissions bench
- Ultra-fast (<5 ms) HC, NOx measurement
- Fast (10Hz) direct fuel measurement
- Fast (10Hz) particulate measurement; unique Laser-Induced Incandescence (LII) measurement
- Mini-dilution PM measurement
- Scanning Mobility Particle Sizer (SMPS)

### Four-Wheel Drive Chassis Dynamometer Testing

Argonne's state-of-the-art four-wheel-drive (4WD) chassis dynamometer offers controlled testing capabilities for highly accurate measurement of exhaust emissions and fuel performance. This facility can benchmark the most advanced powertrains for 4WD cars and trucks, including super ultra low emission vehicles (SULEVs), hydrogen- and natural gas-fueled vehicles, diesel-engined vehicles, and those using alcohol fuels. It also incorporates a dilution tunnel for measuring diesel particulate matter.



The APRF's 4WD chassis dynamometer can benchmark powertrains for 4WD cars, trucks, and SULEVs.

### Evaluating Hydrogen-fueled Hybrid Powertrains with MATT

As we transition to a hydrogen economy, we need to consider the technical issues associated with using hydrogen as a transportation fuel. Argonne's APRF offers an ideal combination of expertise and facilities for such research. The new Mobile Advanced Technology Testbed (MATT) is a wheeled test bed outfitted with scalable motor components, custom instrumentation, and flexible transmission technology to allow testing of hydrogen-fueled vehicle systems with a wide range of hybridization.



researcher uses the Argonne-designed computer system to evaluate system performance in the Advanced Powertrain Research Facility (APRF).

The Honda Insight HEV during testing at Argonne's APRF.



MATT allows researchers to work toward developing a vehicle control strategy based on performance, fuel economy, and emissions optimization. Argonne researchers are investigating the potential of an integrated control system to compensate for the low power density of hydrogen internal combustion engines. Using MATT, researchers can evaluate hybridization impact on Air-Fuel Ratio, Throttle, EGR, and aftertreatment systems. Argonne's hydrogen testing capabilities will facilitate comparison testing between hydrogen-fueled internal combustion engine hybrid vehicles and fuel cell vehicles. The U.S. Department of Energy will be using data generated by MATT to determine the ultimate potential of hydrogen internal combustion hybrid systems.

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