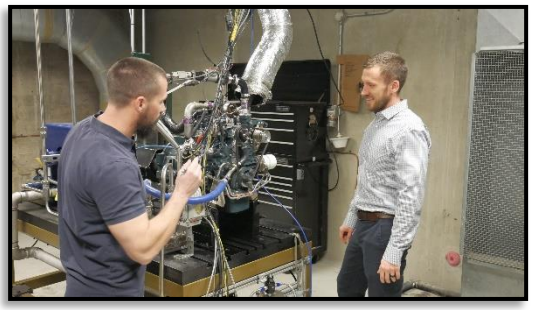
Facility Factsheet

Small-Engine Research Laboratory (SERL)

Description:



The Small-Engine Research Laboratory (SERL) is a facility designed to conduct experimental small-scale propulsion and power generation systems research. The SERL has a collection of unique capabilities to support and execute related research efforts. These research capabilities include: multiple internal combustion (IC) engine test stands ranging from 0.1 kW to 150 kW, a small Unmanned Aerial System (UAS) propeller thrust/torque stand, a 6-axis thrust stand for small-turbine and alternative cycle research, altitude simulation capabilities for both piston and turbine engines, and a small turboshaft engine test stand (350 hp regenerative motored AC dyno w/10:1 gearbox). Altitudes up to 22,000 ft, matching both pressure and temperature, can be simulated on the piston engine test stands. The turbine engine altitude test facility can simulate altitudes up to 32,000 ft and Mach numbers up to 1.2. A wide variety of instrumentation is available to measure pressures, temperatures, fuel flow, air flow, IC engine power and torque, exhaust gas species, fuel injection spray characteristics, and real-time in-cylinder pressure measurements. Laser-based diagnostics and multiple 1+ MHz framing rate digital cameras are also part of the available instrumentation to enable non-intrusive measurement of these combustion parameters. All experiments are operated remotely using in-house-developed data acquisition solutions, engine controls, and a multi-camera high-resolution digital video monitoring system. In-house developed engine controls and electronics offer accurate, real-time control of combustion parameters (initiation timing, fuel injection timing, fuel flow, air flow, fuel blending, and knock evaluation/feedback). In addition to LabVIEW-based data acquisition and control systems for all experiments, the facility is equipped with high-frequency data acquisition at up to 5 MHz and AVL combustion analyzers for real-time in-cylinder combustion characterization.

Purpose:

The overall SERL objective is to develop an understanding of the combustion physics, chemical kinetics, and scientific principles required to increase the efficiency and power density of small-scale propulsion and power generation systems. Specific objectives of the program are: 1) Establish combustion initiation strategies to optimize heat release in highly convective, pressure-coupled small-scale internal combustion (IC) engine environments 2) Develop the understanding of governing thermodynamic and fluidic principles unique to small-scale propulsion along with the control methodologies to enable fuel control in small-scale propulsion and power generation systems 3) Investigate the use of alternative hybrid (combination of IC, battery, and/or fuel cell) and alternative-cycle propulsion and power generation systems, requiring development of power density improvements, operation of fuel cells on heavy fuels, and hybrid system energy management.

Products:

- Small Heavy/Multi-Fuel Engine Enabling Technologies
- Alternative and Bio-derivative Fuels Combustion and Emissions Characterization
- Small-scale Thermo-chemical Hybrid Propulsion System Technology
- Efficient UAS Propulsion and Power Systems Technology

Availability:

Primarily in-house and related DoD contractor research. Other U.S. Government agency, DoD contractor and commercial customer programs upon request. Contact: 937-255-4100.