MiniLab™

Gas Turbine Power System

Product Summary

- Gas Turbine Engine Designed and Manufactured to Aerospace Standards
- Engine Operations Instrumented for Temperature and Pressure Measurement
- Gas Turbine Auto Start and Auto Shutdown System
- National Instruments™ Data Acquisition System Configured With LabVIEW™
- Includes Laboratory Procedures and Available Classroom and Lab Curriculum
- Shipped Ready to Operate

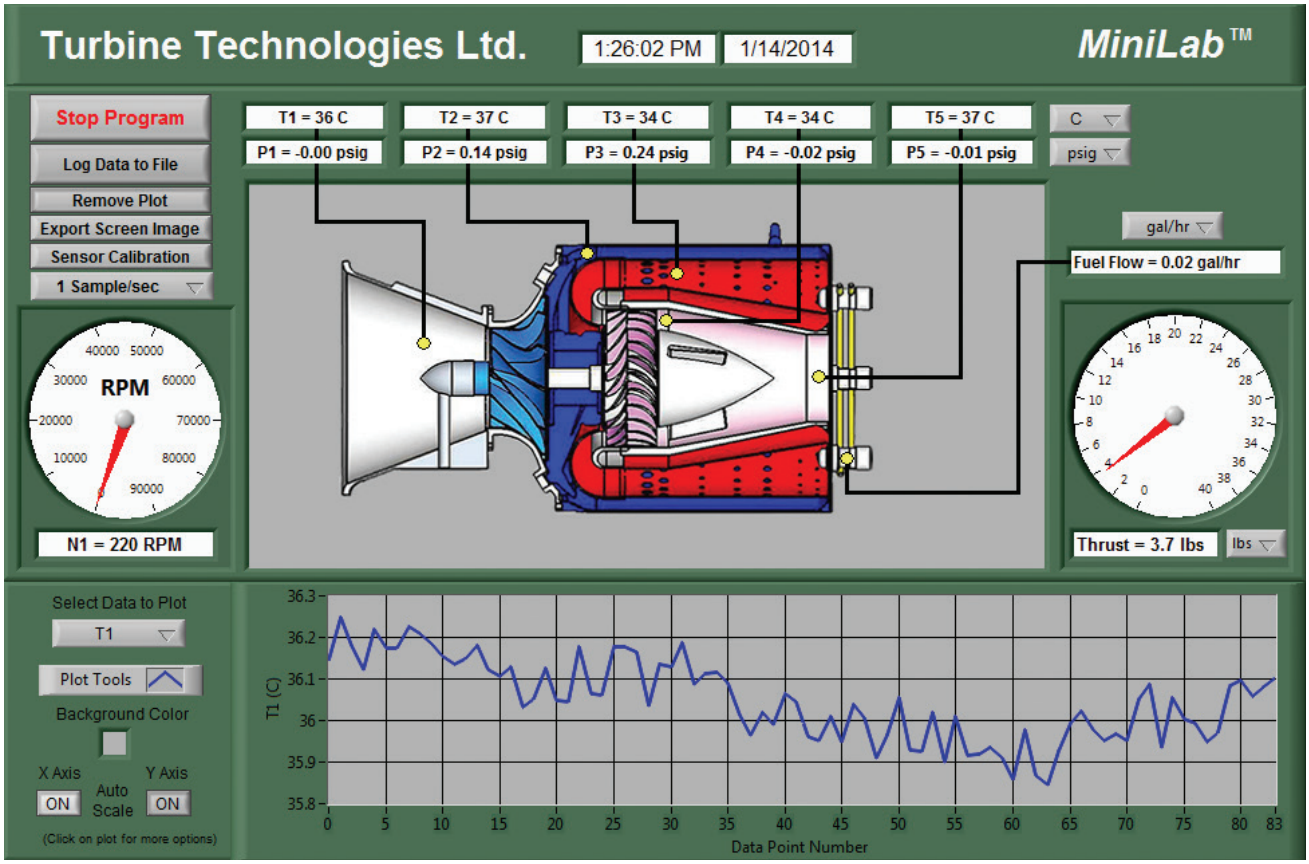
MiniLab™ Gas Turbine Power System

Students will learn: Fundamentals of jet engine propulsion and become familiar with the associated thermodynamic principles and efficiencies of the Brayton Cycle.

Description

A complete gas turbine power plant designed for engineering, technical and military education as well as advanced research and study. The core gas-generator is representative of all major gas turbine types and the Brayton and Gas Turbine cycles.

The SR-30™ Turbo-Jet engine is designed and manufactured by Turbine Technologies, LTD specifically for the MiniLab™ Gas Turbine Power System. The compact engine features a centrifugal flow compressor, reverse flow annular combustor and an axial flow turbine stage. Ambient air enters the engine through the bell shaped inlet. The air is then compressed, diffused and directed into the combustor can. Kerosene based fuel, introduced via six high-pressure atomization nozzles, is mixed with the compressed air and ignited. Heated combustion gas expands and accelerates through the vane guide ring causing the turbine to rotate. Useful work is extracted from this rotation as the turbine powers the compressor. The combustion gases are further accelerated through the thrust nozzle where the remaining heat energy is converted to kinetic energy in the form of jet thrust. The ejected gas returns to ambient atmospheric conditions thereby completing the thermodynamic cycle. For safety and performance reasons, no off-the-shelf, former military or surplus components are used in any portion of the engine. All components are manufactured in-house to exact specifications. Electronic controlled vacuum investment casting ensures void and impurity free components. Individual component materials are selected based upon desired mechanical properties, durability and longevity.



Data Acquisition System Included

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Turbine Technologies, LTD.

SR30™ Inlet

Combustor components and the vane guide ring utilize Inconel® 718 alloy. The integral bladed disk turbine wheel is manufactured from CMR 247 Super Alloy. All material is verified to possess the desired properties specific to the application. The completed engine undergoes rigorous final operational testing and inspection.

The MiniLab™ cabinet is composed of a rigid steel chassis mounted on rolling castors for portability and ease of storage, requiring no permanent facility modifications or additions. The SR-30™ engine is securely mounted within the cabinet behind protective transparent polycarbonate shields allowing view of the engine during operation. All engine accessories including fuel and oil pumps are located in the lower portion of the cabinet. Safe and reliable air starting provides for consistent and easy engine operation without the need for additional electric starters, complicated couplings, heavy cabling, high amperage current or auxiliary batteries. All fuel atomization is accomplished within the fuel control unit and adjacent nozzles. No gaseous fuels of any type are required for starting. A wide range of kerosene based or diesel blended fuels may be used without the need for any fuel preheating or conditioning. All fuel, oil and starting air lines are aviation grade braided stainless steel.

Industrial grade sensors measure all key engine station parameters as well as overall system variables for real time display on the provided computer. Direct engine thrust is accurately measured through a pivoting bearing arrangement utilizing a calibrated load cell, eliminating problems inherent to linear bearings with critical alignment requirements. A National Instruments™ USB connected digital data acquisition system is fully integrated and pre-calibrated. Data can be recorded for playback or analysis. The full range of sensors allows calculations of fuel flow, thrust and pressure ratio to be compared directly to measured values. A custom LabView™ generated Virtual Instrument panel displays all operating parameters in real time digital displays as well as graphically. Convenient on-screen settings buttons allow easy data display configurability.

As the original engine manufacturer, complete spares availability is guaranteed. On site operator training is available at additional cost. A comprehensive Operator's Manual details all aspects of system operation. Safety instructions address all operating conditions.

Auto Start system enables a single green push button for engine start. System parameters are monitored during engine operation and out-of-limit conditions results in the safe shutdown of the engine. A LCD panel alerts the operator to any system faults. Total run time and cycle counts are digitally recorded. A single red push button safely shuts the system down.

Single Push Button Start

MiniLab™ Gas Turbine Power System

Details

Dimensions

MiniLab™: 40 W x 42 D x 62 H inches (102 x 107 x 158 cm)
As Shipped: 48 W x 54 D x 70 H inches (122 x 137 x 178 cm)

Weight

MiniLab™: 460 lbs (208 kg)
As Shipped: 535 lbs (242 kg)

Operating Requirements

Master Switch, Keyed - Secured control of equipment usage
Green Start Button, Push - Initiates Engine Start, Multiple Functions
Red Stop Button, Push - Initiates Engine Shut-down, Multiple Functions
T-Handled Power Lever - Controls Engine RPM
Integral LCD Display - Real Time System Status

Operating Requirements

Typical Laboratory Setting Power
Power: 120V single-phase 60Hz (220V upon request)

Operating Requirements

Design Maximum Thrust: 40 lbf (178 N)
Approved Fuels: Jet A, A-1, B; JP-4, 5, 8; Kerosene, Diesel, Fuel Oil #1 or #2
Exhaust Gas Temperature: 1328˚F (720˚C)
Mass Flow: 1.1 lbs/s (0.5 kg/s)
Ignition System: Air gap, high voltage capacitor discharge type hermetically sealed ignition coil and igniter plug
Compressor Type: Single Stage Centrifugal (Radial Outflow)
Turbine Type: Single Stage Axial Flow
Design Maximum RPM: 87,000
Engine Mount: Pivot bearing support allowing direct thrust to be obtained by a load cell
Engine Compression Ratio: 3.4
Engine Pressure Ratio: 30.0
Specific Fuel Consumption: 1.2
Approved Oils: MIL-PRF-23699F-STD
Engine Diameter: 6.8 inches (17 cm)
Engine Length: 10.8 inches (27 cm)

Instrumentation

Digital: High Speed Data Acquisition System
Data Acquisition Software with Configurable Data Output
Windows® Computer for On-Screen Data Display
Single Cable National Instruments™ USB to PC Connection
Sensors (Preinstalled and Calibrated)

- Compressor Inlet Temperature and Pressure (T1/P1)
- Compressor Exit Temperature and Pressure (T02/P02)
- Turbine Stage Inlet Temperature and Pressure (T03/P3)
- Turbine Stage Exit Temperature and Pressure (T04/P04)
- Thrust Nozzle Exit Temperature and Pressure (T05/P05)
- Fuel Flow
- Thrust
- Engine Rotational Speed (RPM)

Digital and Analog: As provided on the Operator Panel

- Digital Turbine Inlet Temperature (TIT)
- Digital Exhaust Gas Temperature (EGT)
- Digital Engine Rotational Speed (RPM)
- Analog Oil Pressure
- Analog Engine Pressure
- Analog Air Start Pressure

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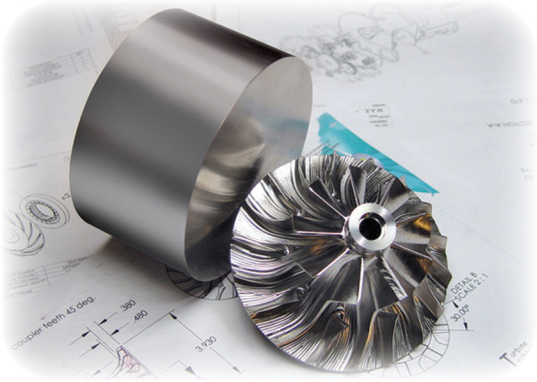
Experimental Opportunities

Experimental and research opportunities include scientific, engineering, thermodynamic and environmental investigations. With a wide array of sensors, experiments relating to secondary education physics and chemistry through graduate level fuels and combustion research are readily performed. Standard courses in engineering thermodynamics and fluid mechanics benefit from textbook direct examples conducted and measured in real time. The limitations of theoretical models and the variability of experimental technique can be experienced first-hand. In addition to academics, the MiniLab™ is ideally suited for general gas turbine familiarization and jet engine operational training for aviation and military professionals; as well as alternative fuels, emissions and scaled-engine testing and research.

All Engine Components Designed and Manufactured In-House



Purchase Specifications

- A complete gas-turbine power system to consist of an engine designed and manufactured for engineering education.
- Engine must utilize a centrifugal flow com- pressor, reverse flow annular combustor and an axial flow turbine stage.
- Engine to be of current manufacture and consisting of all new components.
- All engine components either vacuum investment cast or precision CNC machined.
- All high-heat components manufactured from 17-4 ph stainless steel, Inconel® 718 or CMR 247 Super Alloy.
- Traceable and verifiable material to be used throughout engine.
- All elements comprising the system to be contained in a rigid steel chassis mounted on rolling castors.
- All system metal surfaces to be stainless steel, anodized or powder coated to promote durability and wear resistance.
- Complete system not to require any permanent facility modifications or additions.
- Engine situated behind transparent protective shields allowing clear view during operation. • Operator capable of manual control throughout entire range of operation.
- Operator panel to consist of digital TIT, EGT, and RPM indicators, analog oil pressure, en- gine pressure ratio, fuel pressure and air pressure gauges, keyed master, green start, red stop and T-handled power control lever.
- System to be equipped with calibrated transducers and thermocouples capable of measuring compressor inlet, compressor exit, turbine stage inlet, turbine stage exit and thrust nozzle exit temperature and pressures, fuel flow, thrust and engine compressor / turbine rotational speed.
- Engine thrust to be measured by a load cell permitting direct indication of thrust value.
- To be supplied with a USB based digital data acquisition system complete with computer and user configurable data acquisition software capable of measuring and recording analog, digital and frequency signals.
- Fully automatic engine start and operational health monitoring system provided with LCD status readout and cumulative run- time and cycle count.
- Representative engine components and technical data optionally available for teaching use and training aids.
- Manufacturer to guarantee spares availability and provide technical support services for core engine and power system.
- Provided with a comprehensive Operator's Manual.
- Provided with summary operating checklist for all operating conditions.
- Provided with safety instruction to address all operating conditions.

MiniLab™ has a free two year warranty on the entire system

All MiniLab™ specifications are subject to change

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