



**Engine Test Cell Upgrades
Worldwide
Poland WZL # 4 Case Study**

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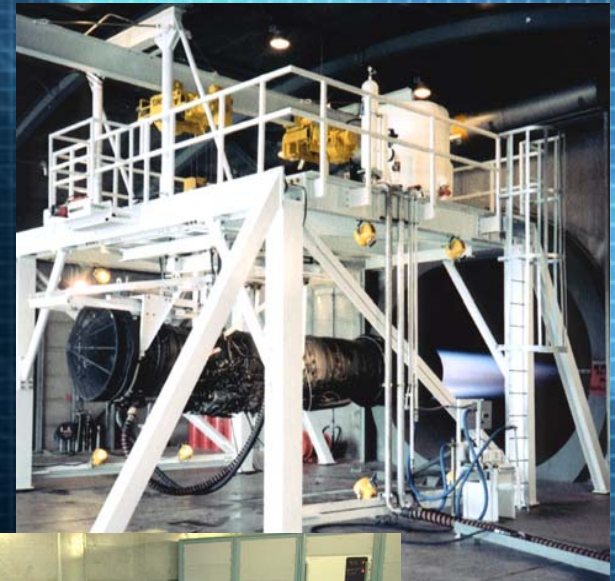
Corporate Overview

- **Turbine Engine Support Business Since 1956**
 - **Headquartered in Stafford, TX. (Houston)**
 - **Serve Aerospace Market**
 - **Design**
 - **Manufacturing**
 - **Worldwide Integration Services**
 - **Financial Strength**
 - **AS9100 & ISO 9001 Certified Business Systems**
 - **Spaceflight Quality Certified Production Facility**



Corporate Overview

- **Aero-Engine Test Equipment & Facilities for Over 35 Years**
 - Whatever it takes to run jet engines off the wing!
 - Turboprop, Turboshaft, Turbofan, Turbojet
 - Turn-key Facilities to Cell Modifications/Upgrades
 - Engine Adapters, Thrust Stands, Bellmouths, Screens, Probes
 - Cables/Harnesses
 - Data Acquisition/PLC Systems
 - Fuel/Air/Oil Systems
 - Inlet/Exhaust Systems





Corporate Overview

- **Military Engine Test System Support**
 - **Pratt & Whitney**
 - F100-100,200,220,220E,229
 - F119, F135, J52, TF30, J58
 - **General Electric**
 - J85, J79, F101, F110, F404, F414, F118, TF-34, T700, T64
 - **Rolls Royce/Allison**
 - T56 Air Force/Navy Versions
 - 501D, 501C
 - **Honeywell/ Allied Signal/ Textron Lycoming**
 - T53, T55, F124





Corporate Overview

- **Commercial Engine Test System Support**
 - **Pratt & Whitney**
 - JT8-15, 17, 200; JT9, PW2000, PW4000's
 - **General Electric**
 - CFM56-3, 7; CF6, CF34
 - **Rolls Royce/Allison**
 - A250, 501KB, 501KC
 - **Honeywell/ Allied Signal/ Textron Lycoming**
 - TPE331, TFE731





Engine Test Cell Upgrades Overview

- **Test Cell Modifications & Upgrades**
 - **Mission**
 - **Incorporate New or Up-Rated Engine Series into Existing 3rd Party Test Facility**
 - **Challenges**
 - **Solutions**
 - **Success**





Poland WZL # 4 Test Cell Case Study

- **Test Cell Modifications & Upgrades**

- **Mission**

- **In support of Pratt & Whitney, the PAADF and WZL**
 - » **Incorporate F100-229 engine test capability into an existing CFM56 test facility in Poland**
 - » **Maintain separate systems for DAQ/Fuel/Adapter**
 - » **Win competitive proposal against incumbent**
 - » **Execute to support F100 engine build and test schedule**



Poland WZL # 4 Test Cell Case Study

- **Test Cell Modifications & Upgrades**
 - **Challenges**
 - **Competitive Proposal**
 - **3rd Party Facility**
 - **Limited Technical Data from OEM**
 - **Overseas Location**
 - **Completely Different Engine Types**
 - » **Military vs. Commercial**
 - **No Impact to Existing Operations**
 - **Local Contracting Required**



Poland WZL # 4 Test Cell Case Study

- **Challenges**
 - **Engine Adaptation**
 - System set-up for CFM56 test operations
 - Thrust delta
 - Centerline offset
 - Engine/Cell exit plane delta
 - **DAQ/PLC Control**
 - Integrate completely separate DAQ with no impact to CFM56 operations
 - Limited space/limited pass-throughs
 - No coupling plate changes
 - Manual/Automated seamless throttle control





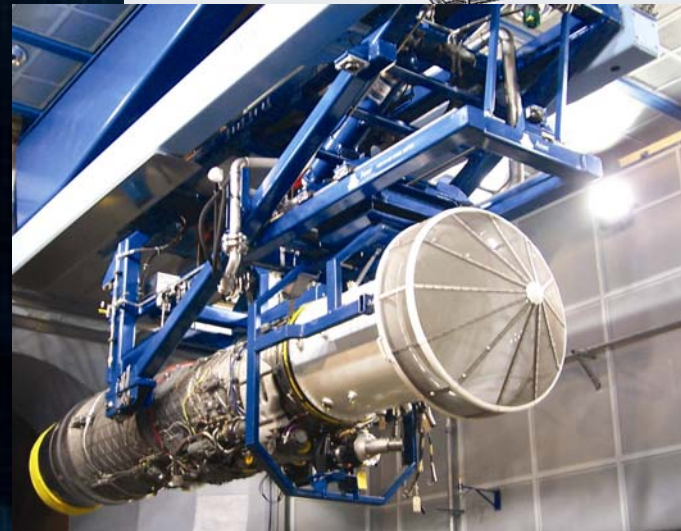
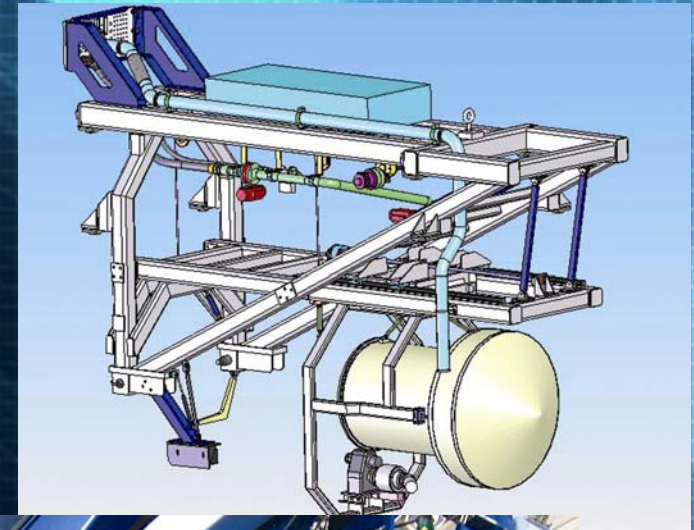
Poland WZL # 4 Test Cell Case Study

- **Challenges**
 - **Fuel Delivery System**
 - Heated fuel delivery system
 - Afterburner Fuel flow support
 - Limited integration space in existing fuel room
 - Power-failure fuel backup system
 - Critical fuel flow/pressures per engine ATP requirements
 - **Facility Integration**
 - Significant electrical/piping impact
 - Moving internal equipment to new locations
 - Storage and transportation issues
 - Contracting with WZL for facility modifications



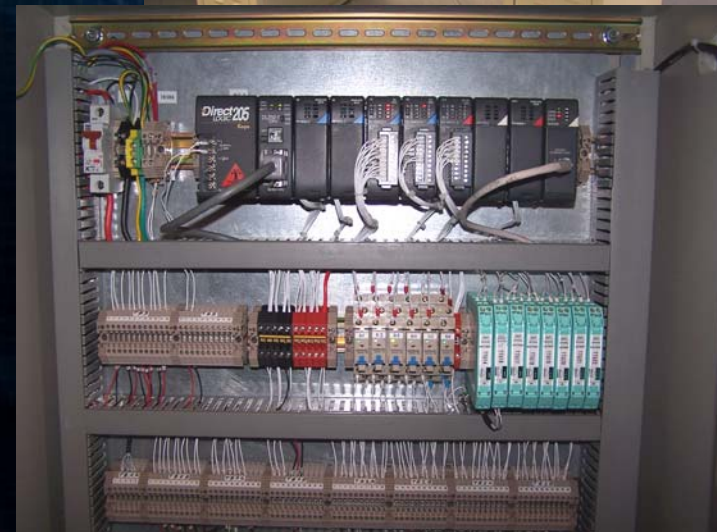
Poland WZL # 4 Test Cell Case Study

- **Solutions**
 - **Engine Adaptation**
 - 3D design
 - FEA analysis
 - 3X/5X F.O.S.
 - Double-drop adapter design for centerline
 - Rear thrust pin backset for exit plane
 - Coupling plate matched to maintain CFM56 connection
 - Air-operated hoist system for ease of engine installation



Poland WZL # 4 Test Cell Case Study

- **Solutions**
 - **DAQ/PLC System**
 - Stand-alone console
 - Achieved minimal footprint
 - Adapter-mounted DAQ modules/PLC modules
 - Full digital signal transmission to control room
 - » Minimized coupling plate impact
 - Manual/Automated mode throttle system
 - Critical facility controls piggybacked via PLC





Poland WZL # 4 Test Cell Case Study

- **Solutions**

- **Fuel Delivery System**

- Relocated Oil Preservation System to Mechanical Room
 - Custom Designed Flow Control and Hot Fuel Delivery Package
 - Coriolis Flow Meter for Total Fuel Flow/Specific Gravity
 - Accumulator on Skid for Emergency Fuel Backup
 - Heated Fuel System Capable of “on-the-fly” Fuel Heating/Delivery
 - Increased Bypass Return Line Size to Handle Fuel Flow Transients/Snaps
 - On-Adapter Accumulator to Handle Max-Snaps





Poland WZL # 4 Test Cell Case Study

- **Solutions**

- **Facility Integration**

- Utilized WZL facility capability for most concrete/pipe welding and removal/replacement
 - Atec Project Engineer and Field Support team on-site for overview of facility installation activities
 - Piping designed at Atec
 - DAQ fully assembled/tested at Atec prior to shipment
 - Engine Adapter DAQ enclosure pre-assembled to adapter prior to shipment
 - Full integration of equipment in three weeks





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Poland WZL # 4 Test Cell Case Study

- **Success**
 - **Production**
 - **Factory ATP Performance**
 - » **Engine Adapter Load Test**
 - » **DAQ/PLC Full ATP at Atec Facility with Customer Supplied DEEC Unit**

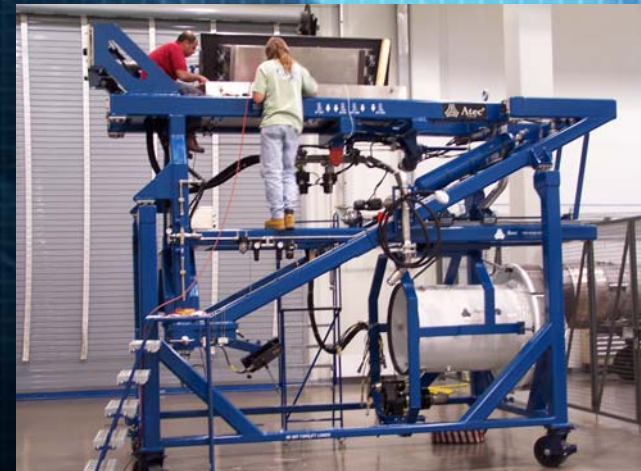




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Poland WZL # 4 Test Cell Case Study

- **Success**
 - **Integration**
 - **In-Country Contracting**
 - **Field Engineering/Installation Team**





Poland WZL # 4 Test Cell Case Study

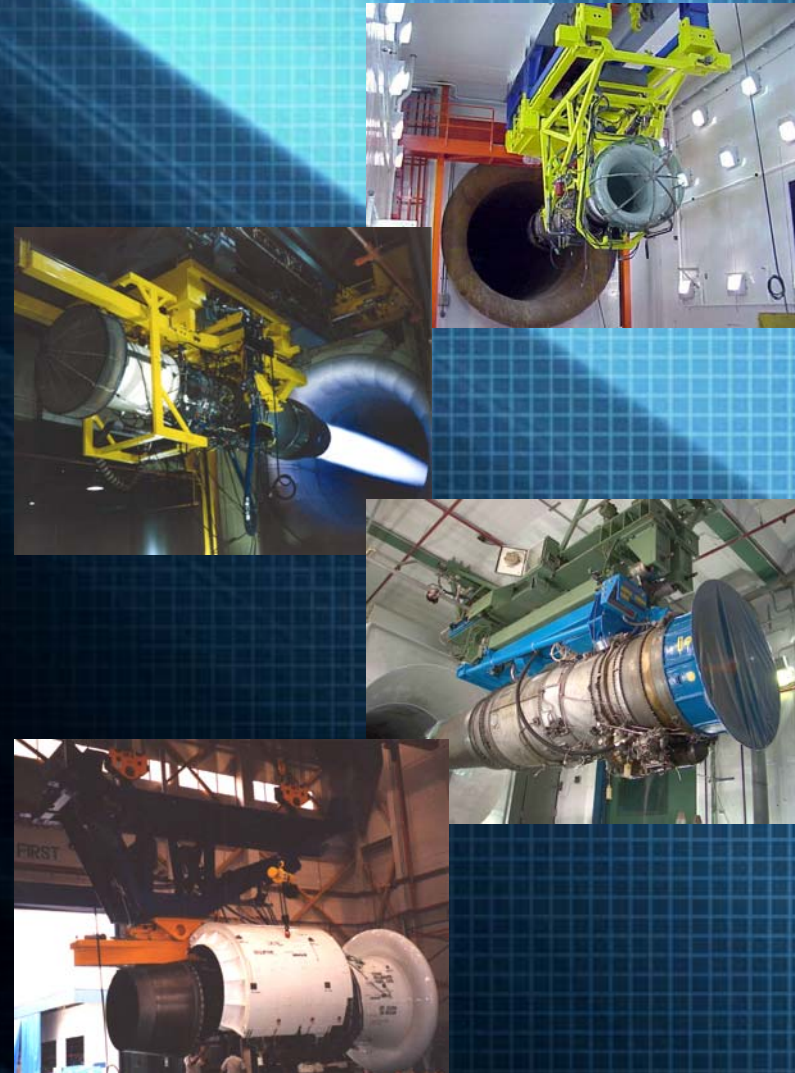
- **Success**
 - **Acceptance at WZL Facility**
 - **Formal Hand-Over to Customer**
 - **Service after Sale**
 - **Customer Testimonial**





Test Cell Integration Experience

- **Worldwide Capability**
 - USA
 - Europe
 - Middle East
 - South America
 - S.E. Asia





Atec

Test Cell Integration Experience





Presentation Summary

- *Atec = Your Test Cell Modification Specialist*
- *Atec = Over 35 Years of Test Cell Support*
- *Atec = Mechanical & Electronic Systems*
- *Atec = Worldwide Integration Support*
- *Atec = Whatever it takes to run your engine off-wing !!*





Questions

**Thank You for your time this morning.
Come see us in Booth #306!**

