Project Name: NREL (National Renewable Energy Laboratory) Wind Turbine Dyno Test Facility
Location: Golden, CO
Completion Date: 2013
Description: New 5MW (6,700hp) dynamometer system for testing wind turbine drivetrains
Relevancy: ACS designed and manufactured the dyno risers for a customer-supplied dynamometer.
- Critical alignment of very large components
- Dynamometer-8,000 Hp ABB Motor:
  - comprised of 137,000 lb.; 15’ tall Non-Torque Loading (NTL) system
  - connected by a low speed shaft to a 103,000 lb, 10’ tall gearbox
  - coupled by a high speed shaft to a 70,000 lb 16’ tall drive motor
- Dynamometer components were set at a 5° slope to match the input to the test turbines.
- Tolerance of +/- 0.005” achieved utilizing a laser tracking device and 3D system model to precisely measure and adjust actual locations of equipment to digital model’s theoretical perfect location in real time
- Performed baseline vibration measurements

Project Name: Cummins High-Horsepower Technical Center-Seymour Engine Plant
Location: Seymour, IN
Completion Date: 2015
Description: Twelve (12) diesel engine dynamometer test cells.
Relevancy: ACS experience with large scale projects including large AC Dynamometers.
- Test and develop engines up to 7000HP, 40,000lb.
- (9) Water brake dynamometers
  - (1) G-drive
  - (2) AC dynamometers
    - 5260 kW, 3050 VAC
      - regenerative drives, liquid cooled drive
    - 2200 RPM capable
    - Dyno motor bearings lubricated and cooled by its own oil pumping system
    - Dyno motor cooled by air to water heat exchanger system
    - Integrated with rigid steel fabricated riser (structurally verified design optimized to eliminate vibration interactions)
      - Integrated with driveline lift – hydraulically actuated
      - Designed to support torque meter calibration in place
      - Integrated driveline guarding with automated safety shutdown
- Engineered driveline with integrated torsional coupling and misalignment flex disc system
  - Included lightweight design optimized for stiffness
  - Tuned for vibrations and modes outside of engine operating range
  - Includes spline connection between engine and driveline for quick change out of engine.
### Project Name: MTU America Development Test Cells and Facility  
**Location:** Aiken, SC  
**Completion Date:** 2014  
**Description:** Four (4) research and development test cells.  
**Relevancy:** ACS experience with AC dynamometers and drivelines.  
- Engines output range 550kW up to 4500kW  
- (3) Waterbrake dynamometers; (1) 4200kW and (2) 4500kW  
- (1) Tandem dynamometer; 4000kW (AC 800kW; Waterbrake 3200kW)  
- Engineered driveline with on engine coupling and misalignment flex disc system  
  - Driveline including high speed shafting  
  - Bearing blocks, including a removable housing for ease of service  
  - Straight and u-joint drivshafts utilizing HBM torque meters  
- Linear Vibration Analysis (LVA) and baseline vibration measurements  
- Assisted with Torsional Vibration Analysis (TVA)  
- Guarding allowing clear access to the driveline for laser alignment

### Project Name: John Deere PEC (Product Engineering Center) 2A7/8 Tier 4 Test Cells  
**Emissions Upgrade**  
**Location:** Waterloo, IA  
**Completion Date:** 2006  
**Description:** Upgrade two existing diesel engine development test cells for Tier 4 transient emissions testing  
**Relevancy:** Two AC dynamometers, one 250 hp and one 850 hp, that include engine driveline components, riser, calibration arm and in-line torque meter.  
- (2) AC Dynamometers, one 250HP and one 850HP  
- Dynamometer riser & driveline guarding  
- Driveline components from dyno to engine  
- Calibration system that allows the torque meter to be calibrated without removing from the system  
- Dynamometer hub design and installation on tapered shaft

### Project Name: Jaguar Land Rover – Test Cells 1-3 Transmission Testing Upgrades  
**Location:** Gaydon, UK  
**Completion Date:** Anticipated 2015  
**Description:** Two wheel and four wheel drive test cells for transmission research and development testing.  
**Relevancy:** (3) transmission and driveline test cell dynamometer systems and mounting  
- Permanent magnet input dynamometers support testing up to:  
  - 209 kW, 1.6 kN-m, 8000 rpm  
- Allow continuous vertical positioning 250mm  
- AC resistance output dynamometers to support testing up to:  
  - 254 kW, 2.7 kN-m, 3000 rpm  
- Allow axial positioning up to 200mm fore and aft  
- Vibration sensing on dynamometer bearing blocks  
- HBM speed and torque measurement integrated into each assembly  
- Design and fabrication of transmission adaptors to utilize five different assemblies on the same test rig  
- Including transverse style transmissions as well as longitudinal style
High Horsepower Relevant Test Experience

**Project Name:** Caterpillar Test Cell 503 ATAAC System  
**Location:** Lafayette, IN  
**Completion Date:** 2007  
**Description:** New production diesel test cell for large engines up to 7,242 Hp.  
**Relevancy:** Experience with large (7,242 HP) diesel engine test facilities  
- Articulating exhaust system improves test cycle time  
- ATAAC Crane mounted system integrates into test cell to improve test cycle time and reliability  
- A large spring isolated inertia mass isolates testing vibration from the main building structure  
- Increases cooling water capacities to engines  
- Dual fuel capability provides both diesel and natural gas fuel availability  
- A large 95,000 cfm air handling unit maintains cool cell temperatures even during extended test cycles.

**Project Name:** Electro-Motive Diesel Advanced Engine Development Test Center (AEDTC)  
**Location:** LaGrange, IL  
**Completion Date:** 2012  
**Description:** Two diesel engine dynamometer test cells for development  
**Relevancy:** ACS experience with large AC dynamometers  
- Development and testing of aftertreatment systems (ATS) to meet Tier 4 and higher emissions requirements  
- Diesel engines up to 8000HP, with capabilities for alternative fuels  
- Synchronous Generator Dynamometer 6000KW  
- Engine support systems including, Lube Oil, Fuel Conditioning, EGR (Exhaust Gas Recirculation), Inter Cooler, After Cooler, Jacket Water, Engine Exhaust  
- Cell ventilation system capable of air flow up to 200,000 cfm  
- Load bank installation  
- Creation of 3-D model of the facility allowed offsite fabrication of mechanical pipe and ductwork in controlled shop conditions while concrete and steel work was in progress onsite.

**Project Name:** GE Transportation Tier 4 Turbocharger Test Cell Modernization  
**Location:** Erie, PA  
**Completion Date:** 2013  
**Description:** Renovation of diesel engine test lab for locomotive engine turbochargers  
**Relevancy:** ACS ability to design, build, install and commission test equipment for diesel engine test lab  
- Designed for steady state testing of both single-stage and dual-stage turbochargers for Tier IV emissions-compliant locomotive engines  
- GE RX3i with Proficy software test cell control and safety PLC system  
- Supply, install and commission data acquisition system  
- Combustor air supply system capable of up to 0.2 lb/sec  
- Compressed air turbocharger starting system  
- Combustor diesel fuel supply system that injects up to 3.75 gpm at 600psi maximum and achieves a turbine speed up to 50,000 rpm  
- Turbocharger water conditioning system to maintain 120F-200F cooling water  
- Inter-stage air-to-water cooling system which cools from 425F to 110F compressor air  
- Lube oil conditioning system to preheat and maintain 140F-215F oil temperature.