

AERODYN **ENGINEERING**

VOLUME 1 **TESTING AND** **SERVICES**

www.aerodyneng.com



Welcome to
AERODYN ENGINEERING INC.

Aerodyn Engineering Inc. (AEI) provides unparalleled customer services and support to Aerospace, Power Generation, Automotive, and Industrial customers with high-quality instrumentation, test services, and analysis that is ISO-9001:2008 Registered. We are dedicated to exceeding our customer's expectations for response and quality.

We base our business on long-term relationships of trust and value.

ISO-9001:2008 REGISTERED

WORLDWIDE FIELD TEST AND DATA ACQUISITION

Aerodyn provides a complete field test service, offering on-site support at demanding, and often remote test sites. We instrument test articles, route lead wires, configure data acquisition systems, record data, reduce data, and write test reports. AEI conducts tests on aircraft, in test cells, at power stations, aboard ship, and at manufacturing facilities.

Tests are conducted at locations both domestic and international. Test durations range from hours to many months of support. AEI is always ready to go at a moment's notice when a requirement develops.

ENGINEERING CAPABILITIES

- Instrumentation and sensor
- Aeronautical
- Mechanical
- Finite element analysis
- Data acquisition
- Electrical
- CAD design and drafting
- Modal analysis

TESTS CONDUCTED ON EQUIPMENT OF ALL TYPES

- Gas turbines
- Steam turbines
- Aircraft
- Wind turbines
- Air movement systems
- Piston engines
- Automotive components
- Wind tunnels
- Blast chambers
- General rotating machinery

SIGNAL CONDITIONING AND RECORDING

AEI can provide all of the test equipment required for a project from our comprehensive inventory. Alternatively, we can utilize the customer's equipment as needed. AEI's experience, equipment inventory, and flexibility optimize our response time and ease our customer's logistics.

DATA ACQUISITION EQUIPMENT

- Sensor excitation
- Signal conditioning
- Digital data logging
- Analog tape recording
- Custom virtual instruments
- High-speed video
- Real-time data reductions
- Infrared imaging
- Remote data acquisition
(Internet or direct dial modem)

ALLIANCE MEMBER

AEI creates LabVIEW™ applications (virtual instruments) customized to the customer's application needs. Data can be acquired and analyzed real-time, allowing for decisions regarding the test program to be made immediately. Data can be digitized and presented to the customer in electronic format during testing and/or transmitted electronically to off-site engineers for review.

REMOTE MONITORING AND DATA RETRIEVAL

AEI has creative solutions that eliminate the need for on-site personnel to manually transfer data, further reducing costs and allowing the customer to reallocate valuable assets. Data can be retrieved from remote systems via landline, cellular phone, or the Internet. We can create a data logger that automatically e-mails data to off-site personnel. Additionally, we can publish a secure Web site allowing the customer to view real-time data from anywhere in the world.



DYNAMIC TESTING

AEI offers a wide range of dynamic test and analysis capabilities. Testing can be conducted either in-house or on-site using a variety of sensors to identify and characterize natural or forced frequency responses of systems or components.

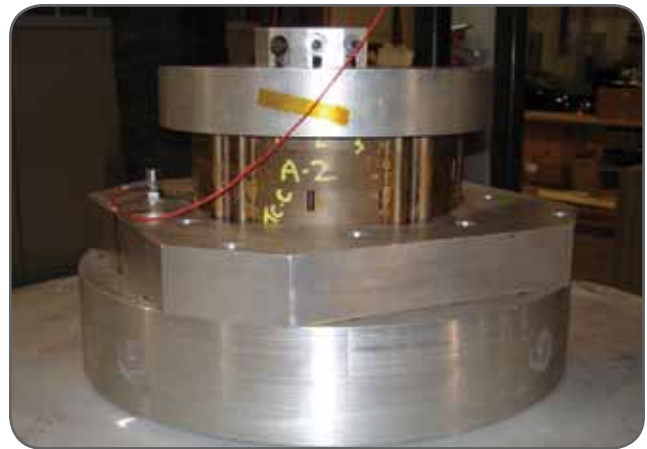
DATA ANALYSIS

AEI understands that data is only useful after it is presented as information. We offer a wide range of dynamic test and analysis capabilities. Data can be processed into industry standard formats or customized to specific requirements. Results are delivered to the customer in levels of effort that range from reduced data files to full formal test reports with data interpretation.

MODAL ANALYSIS

AEI performs Modal Analysis using ME'scope™ software to determine a component's structural resonances. Forces are applied to test articles with a variety of excitation methods, including impact hammers and portable shakers. Measurements of operating deflection shapes (ODS) can be animated, an extremely valuable tool in understanding a component's vibratory responses to input forces.

- Data acquired from hardware of all sizes and complexity.
- Animated and graphical representation of frequency mode shapes.
- Verification of a component's structural response to design modifications such as bracket re-design.
- Correlation of analytical models to experimental results.
- Portable systems for on-site testing.



VIBRATION SHAKER TESTING

Aerodyn Engineering can provide a single source solution for your vibration testing needs. Our field testing expertise enables us to instrument your part, measure your component's vibration environment, and perform the data reduction. We can design and fabricate the fixtures required for your vibration shaker test through our in-house CAD, analysis, and fabrication services. Based on the measured application data, we can develop the appropriate vibration input profile and test your part. Vibration testing can also be conducted according to customer supplied specifications. Vibration shaker testing is performed on our 6,000 force pound electrodynamic shaker equipped with a 36" x 36" slip table.

The shaker can be positioned vertically or rotated to the horizontal position and attached to the slip table to facilitate any test configuration. The shaker is controlled through an eight-channel Data Physics vibration controller. Although one channel must be used for control, the remaining seven channels can be used as control, limit, or measurement channels.

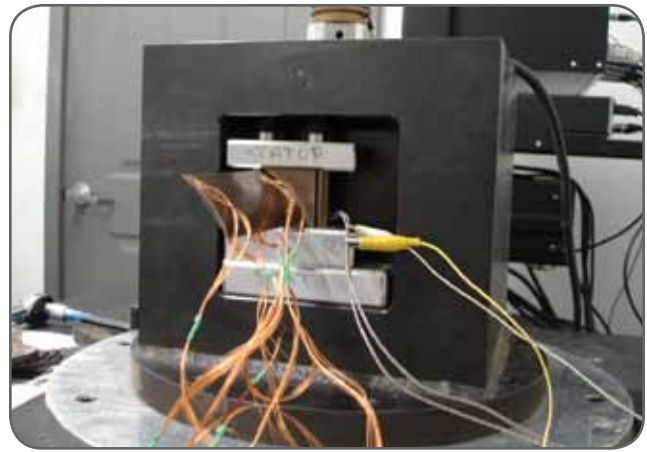
Test capabilities include:

- Fixed sine
- Swept sine
- Random
- Sine-on-random
- Classical shock
- Resonance search and dwell

The resonance search and dwell test profile is well suited for high-cycle fatigue testing of gas turbine engine blades. In addition to fatigue testing, Aerodyn Engineering can provide frequency screening for defining the frequency characteristics of a part population and identifying specific modes of vibration.

AIRFOIL CHARACTERIZATION

AEI conducts airfoil analysis by means of Stress Ratio testing. Accurate determination of stress levels and locations are made by analyzing signals from an array of strain gages placed at critical locations. Vibratory modes are excited using electro-dynamic, piezoelectric, acoustical, and air siren equipment.



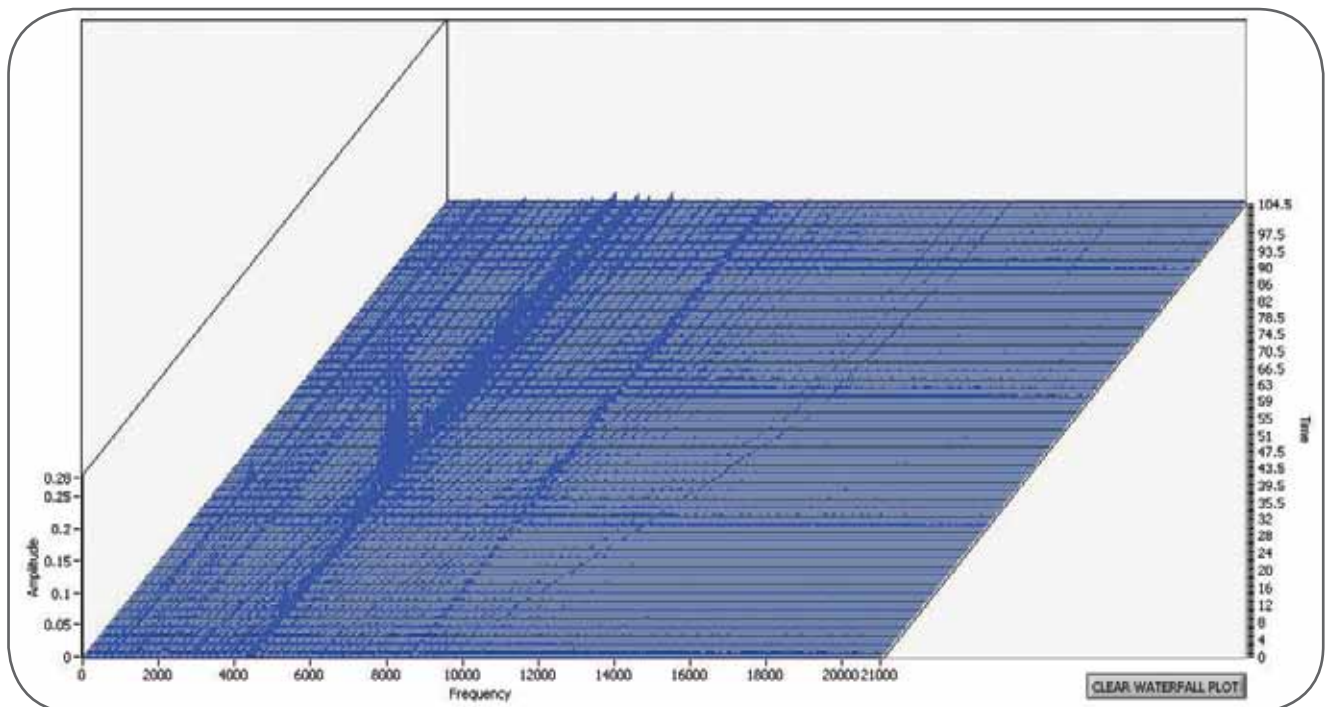
- Dynamic strain measurements at numerous locations over a frequency range of 10 Hz to 25 kHz.
- Correlation of predicted stress locations for individual modes.
- Strain amplitude ratios relative to reference gages provided for all frequency modes of interest.
- Correlation of tip deflection to maximum strain for response modes.
- High Cycle Fatigue Testing (HCF) providing strain levels and tip deflections of airfoils to failure.

ADVANCED SIGNAL PROCESSING

AEI acquires data from measurement hardware with National Instruments™ LabVIEW™ data acquisition software. LabVIEW™ provides tools for data visualization, user interface design, Web publishing, report generation, data management, and software connectivity. As a National Instruments™ Alliance member, we have created an extensive library of advanced signal processing and custom data reduction algorithms.

Signal Processing Routines:

- Frequency spectrums
- Cross power spectrums
- Waterfall plots
- Color spectrograms
- Transfer functions
- Harmonic analysis
- Acoustic analysis
- Statistical averaging
- Bode plots
- Campbell diagrams
- Balancing
- PID control
- Octave analysis
- Frequency response function



PRESSURE TEST BOX

The Aerodyn pressure test box is used for pressure and flow testing of small to medium sized pressure tubes.

- Input: shop air
- Output: pressure sensor or any small pressure vessel to be tested
- Features: flow meter, air regulator, pressure gauge, shutoff valve



RAKES AND PROBES

AEI offers industry leading aerothermal rake and probe design and manufacturing. Aerodyn's unique combination of extensive in-house capabilities and close-knit structure allows challenging and time pressured rake and probe jobs to be handled. AEI welcomes anything from simple make-to-print jobs to elaborate design/fabricate/proof test projects.



Common rake and probe elements include the following:

- Thermocouple temperature measurement
- Total pressure measurement
- Static pressure measurement
- Flow angle detection
- Emissions sampling

In a single rake assembly, any combination of the above can be positioned precisely where desired.



AEI also offers flow calibration of rakes and probes via our in-house flow tunnel. Yaw and pitch can be varied to sub-degree increments while temperature and pressure measurements are taken, stored, and reduced to data files and plots. This information is often vital and necessary to correctly use the rake or probe. The maximum yaw and pitch capability depends on the rake geometry. Varying nozzle diameters can produce air speeds up to .95 Mn.



Common rake and probe calibration services provide customers the following:

- Temperature recovery
- Pressure recovery
- Flow angle calibration (two or more pressure sensors per element)

JORGE'S STORY

We are proud to announce that Jorge is an official part of Aerodyn Engineering Inc. Jorge came into our lives last year when he ran into some of our lab techs working out in the desert. Jorge crash-landed on Earth and scrambled across the desert until he saw his first human face. It was his lucky day! Jorge, being from another planet, was curious about what our techs were doing on this project, so he decided to stay and watch. Lucky for our engineers, Jorge's superb instrumentation skills have turned out to be an asset to Aerodyn. Jorge's laser welding vision has proven to be a quick and helpful hand out in the field. He was quickly trained in instrumentation skills and even confined space training!

Jorge is our most traveled employee and is willing to journey far and wide to lend a supporting hand with instrumentation. His skill in speaking 142 languages has proven to be yet another asset for his career. Please welcome Jorge as we are sure he'll become much more involved with Aerodyn's work in the future.





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