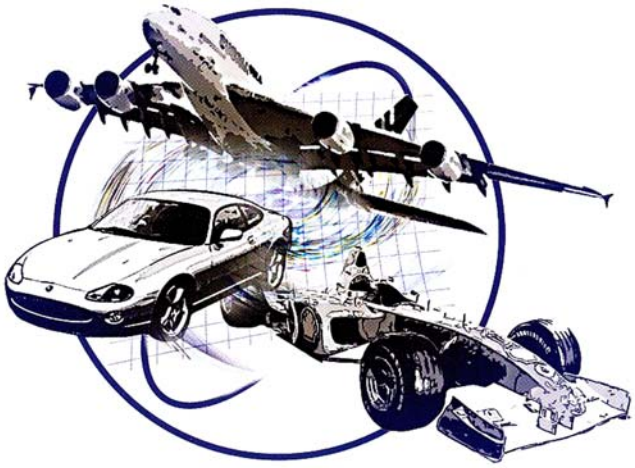
Ate AEROTECH



Since 1985, Ate AEROTECH has provided aerodynamic test equipment for wind tunnels as well as supplying state of the art test and robotic equipment for a myriad of other complex engineering applications. Our worldwide clients work in the educational, research, industrial, automotive, motorsport, aerospace and defence sectors.

Ate AEROTECH enables its customers to develop efficient and competitive products for their markets. We do this by consistently producing highly accurate equipment to exacting specification and on time. We are currently providing a full scale overhead flow survey system (traverser) to a major motor manufacturer in Germany.

Over the past 25 years we have:

- Worked with many of the Formula 1 racing teams, including Toyota where we provided overhead balance and positioning systems
- Provided floor and overhead mounted precision flow survey systems for the likes of NASA and Chrysler Motors
- Supplied virtual centre balances and model support systems for the US Air Force and US Naval academy.
- Commissioned various systems for automotive, aerospace and sports equipment research at The University of Loughborough
- Provided a virtual centre balance and sting support for the (NIAR) National Institute for automotive research.
- Constructed special purpose wind tunnels for the International Tennis Federation and Super Radiator Coils.
- Provided full wind tunnel control and data acquisition systems

Contents

1-0 External Multi-Component Wind Tunnel Balances.

2-0 Special Purpose Load Cells.

3-0 Multi-Component Strain Gauge Balances.

4-0 Wind Tunnel Model Positioning systems.

5-0 Wind Tunnel Flow Survey Systems.

6-0 Laboratory & Educational Wind Tunnels

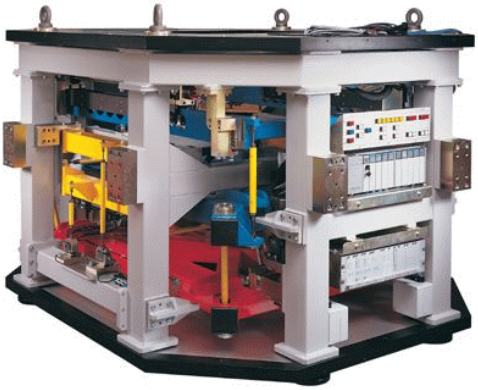
7-0 Research & Development Test Facilities and Equipment

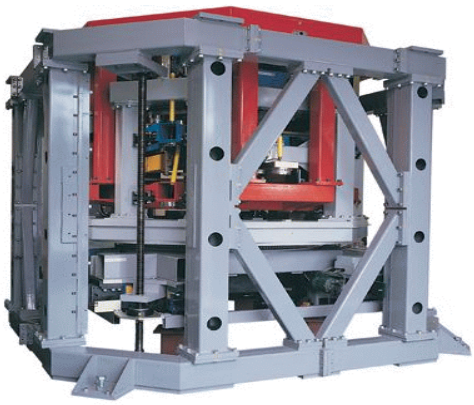
8-0 Custom Designed Control & Instrumentation Software.

9-0 New Product Development.

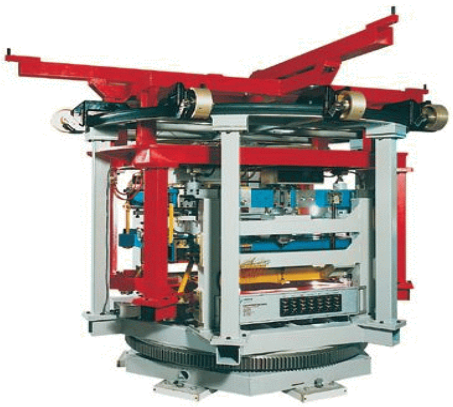
EXTERNAL MULTI-COMPONENT WIND TUNNEL BALANCES

AEROTECH is a world leader in the supply of external wind tunnel balances with an enviable reputation for accuracy, repeatability and reliability. They are used in automotive, aeronautical and teaching facilities worldwide. Each balance is designed, manufactured, installed and calibrated to customer specific requirements.





- Overhead or Under Tunnel configuration
- Weigh-beam or Loadcell measurement systems
- Fully computerised Data Acquisition and Model Attitude Control
- Balance Elevation for different resolution centres
- Full integration with Tunnel Controls
- Designed for new facilities or to fit existing tunnels



- Can be designed as multi-purpose: Full Model aircraft on tunnel centre-line with automotive on ground plane
- Balances can be fully enclosed and air conditioned for harsh environments (eg. Icing Tunnels)
- Comprehensive Calibration Equipment
- Routine Calibration Verification (quick check) devices built in
- High accuracy, repeatability and stability
- Model “Tare Systems” can be incorporated to offset model and support equipment loads prior to load measurements, thereby maximising resolution and accuracy

SPECIAL PURPOSE LOADCELLS

Aerotech has developed its unique expertise in custom designing and manufacturing special purpose, single axis and multi-component, strain gauged loadcells and internal balances from many years experience in supplying to the stringent requirements of the Aerospace and Motor-sport Industries. Devices have been used for the testing of high speed aircraft and missiles, Formula 1 racing cars and for many other diverse industrial applications.

- Single Axis - Tension, Compression or Torque
- Multi-Axis - Up To 3 Forces and 3 Moments in One Loadcell
- High Accuracy and Rigidity
- Low Thermal Effects
- Environmental Protection as Required
- Incorporation Within Motion Systems
- Comprehensive Calibration
- One Offs or Batch Quantity
- Custom Designed for any Application, examples being:

- Wing, Body and Wheel loads on race-car models
- Suspension and Wing loads on full scale racing cars
- Continuous Process Weighing and Monitoring
- Harsh Environment Industrial Weighing
- Sports Equipment Design and Regulation Conformity
- Mechanical Linkage System Loads and Activation Sensing
- Multi-Axis Weighing Platforms
- Helicopter and Turbine Propeller Rotor Loads
- Body Components on Production Cars (eg Wing Mirrors)
- High Speed Train and Rolling Stock Aerodynamics
- Loads in Tensile Testing Machines
- Heavy Goods Transport Aerodynamics

REFURBISHMENT OF EXISTING EXTERNAL BALANCES

In addition to the design and build of custom pieces of aerodynamic measuring equipment, Aerotech also has a reputation for the refurbishment, updating and modification of existing balances to a high standard.

Our services include:

- Design evaluation and report on modifications
- Replacement of flexures and links as necessary
- Weighbeam refurbishment or Loadcell replacement
- New motion systems - Yaw, Incidence, etc
- Complete strip down and refurbish as necessary
- Re-assembly and re-commissioning
- Re-calibration to high levels of accuracy
- Updated Control and Data Acquisition Systems
- On-site installation and re-calibration

MULTI-COMPONENT STRAIN GAUGED BALANCES

Aerotech multi-component internal strain gauged balances are specifically designed to measure the aerodynamic loads exerted on a scale model or its component parts during wind tunnel testing. The design principles have evolved from many years experience in the design and manufacture of highly accurate and rugged multi-component internal strain gauged balances for use in wind tunnels for the aerospace industry and automotive racing industry.

- All Aerotech internal balances are custom designed to suit each user's individual requirements and are, usually, of one-piece construction, with each strain gauge bridge dedicated to the measurement of one aerodynamic component alone.

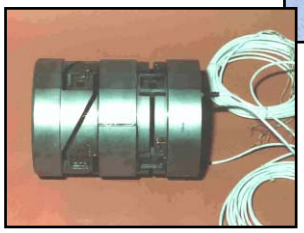
- They have the capability of simultaneously measuring three orthogonal model or wind related forces (drag, side force and lift) together with the moments about their respective axes (rolling, pitching and yawing moments) to a high degree of accuracy and repeatability.

- Strain gauged balances can also be designed for isolated or simultaneous load measurements on tail planes, flaps, ailerons, undercarriages, spoilers and external stores.

- Other uses may include the testing of road vehicles, ships, buildings, bridges, pylons and civil engineering structures under aerodynamic loading conditions.

- Balances can be supplied to meet the user's requirements for space envelope and load range, with outputs matched for maximum resolution.

- Matched Data Acquisition and Signal Conditioning Systems can be supplied in either analogue or digital outputs and fully calibrated to integrate with the client's own system



Typical Applications for Strain Gauged Balances

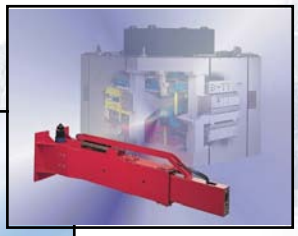
- Multi-axis Sting Balances for full-model aircraft
- Aerodynamic behaviour during stores separation testing (captive trajectory on wing-borne stores)
- Wall Balances for Half Model Testing
- Helicopter and Rotor Blade aerodynamics
- Aileron and flap loads on model wings
- Aerodynamic loads on civil engineering structures
- Flow dynamics on model ships in Towing Tanks
- Full Body forces and moments on race-car models
- Front and Rear Wing loads on race-car models
- Missile testing in high speed tunnels, etc

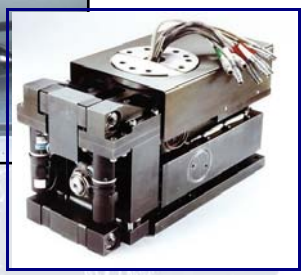
WIND TUNNEL MODEL POSITIONING AND SUPPORT SYSTEMS

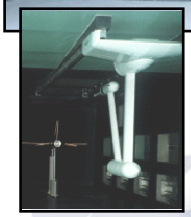
Aerotech designs and manufactures a range of Model Support and positioning equipment for many configurations of model testing of automotive, race-car, half and full model aircraft, civil structures, etc

Automotive Model Mounting Systems

- Extendable columns mounted to the Model Platform of an external balance and fitted with appropriate wheel pads and fixings to support and secure the model.
- Can be supplied with magnetic bases and air bearings for easy manoeuvring, precise positioning and secure fixing.
- Columns can also be motor driven to extend upwards to provide adequate clearance for underbody model changes and ride height adjustment.







Support Systems for Race-car Models

- Overhead Support Struts with precision ride height control.
- External Wheel Support Systems – automatically adjust with model position and attitude.
- Internal Model Motion Systems for precision attitude changes in Pitch, Yaw and Roll
- Model Motion Systems can be supplied with an integrated six component internal balance and complete with fully calibrated on-board digital signal conditioning

Aircraft Model Support and Positioning Systems

- 3-Pylon, 2-Pylon and Single Pylon Strut Systems
- Aerodynamically Profiled Fairings - high stiffness, minimal blockage
- Fairings can be mounted on small turntables within the main turntable and be controlled to move in synchronism with Yaw motion to maintain wind-on direction with constant blockage
- Multi-axis Turntable Systems. Floor, ceiling and sidewall with synchronous control
- Elevating Rear Struts for Model Incidence Angle Change
- Sting Support Systems for use with internal Strain Gauged Balances
- Captive Trajectory Systems for wing mounted “stores” aerodynamics

AEROTECH WIND TUNNEL FLOW SURVEY SYSTEMS

The behaviour of the air flowing around a model in a wind tunnel is monitored by a Flow Survey System onto which can be mounted various probes to measure parameters such as pressure, velocity, temperature or acoustic noise. The probe is traversed around the model in order to survey a user-selected range of locations, thus providing a profile for the measured parameter. Aerotech Flow Survey Systems can be either floor, ceiling, or side-wall mounted and can be designed to operate in either Cartesian or polar coordinates. Calibrated positional accuracy is of a high order and the sophisticated control algorithms allow intricate and accurate profiles to be achieved.

Rotary Flow Survey Systems

- High Positional accuracy and repeatability
- Optional laser correction for greater positional accuracy
- Low aerodynamic interference
- Large survey area from single, discrete rail installation
- Additional rail systems can be installed to increase survey areas
- Compact Design
- High stiffness carbon fibre composite construction
- Fully programmable control and data acquisition capability
- Selection of pass-through facilities for accurate Signal and data transmission
- Low installed weight
- High structural integrity
- High aerodynamic stability

As installed in DaimlerChrysler Full Scale Facility, Auburn Hills, USA

Overhead Cartesian Gantry Systems

- High Positional accuracy and repeatability
- High precision calibration using laser theodolite
- Large survey volume - typically 13m x 12m x 4.3m (x, y, z)
- High stiffness with minimum blockage
- Aerodynamically shaped, high modulus carbon fibre shrouding on motion systems and cable-ways
- Custom designed attachments and pods for various instrumentation - noise, pressure, etc
- Designed with a system natural frequency to avoid building and other structural frequencies
- Full controllability in manual or auto modes

LABORATORY AND EDUCATIONAL WIND TUNNELS

FEATURES:

- High Flow Quality
- 300mm x 350mm Test Section
- For low speed wind tunnel testing.
- Atmospheric in-draft or closed-return
- Flow conditioning with honeycomb and screens
- PC based controls and data acquisition
- Variable speed fan with electronic controls

Ate – AEROTECH laboratory and educational wind tunnels offer a high performance wind tunnel testing facility capability with various options for future upgrades in capability and performance. Our base design includes a test section size (300mm by 350mm) suitable for instructional uses as well as for research in such fields as sports equipment and basic aerodynamics. The wind tunnel circuit is tuned for high flow quality, speeds to 70m/s, and installation within a 12m long room. The PC based control system provides for automated test condition monitoring and control, as well as for model data acquisition.

Our wind tunnel design allows for various options to be available for the balance, pressure measurement system, and for flow visualization. The wind tunnel can be custom equipped with automated control of the various model supports and test equipment if desired. Since the windtunnel is equipped with a test plenum, options exist with regard to the test section wall designs. Fully closed, slotted wall, open-jet, and contoured wall test section can be fitted in the same circuit giving the opportunity to study the wall effects of the various types of test section designs. Other test section sizes, speed ranges, and circuit configurations can be provided on a custom basis.

Technical Summary: (*Typical example*)

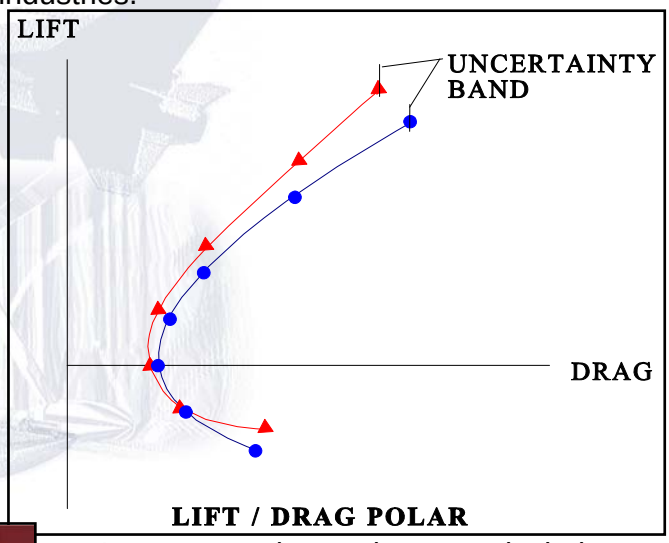
Wind Speed	:	to 70m/s	
Circuit Type	:	Atmospheric open return convertible to closed return	
Test Section	:	300mm high by 350mm wide by 600mm long	
Flow Quality	:	Uniformity	<+/- 1%
		Turbulence Intensity	<+/-0.7% rms
		Flow Angularity	<+/-1 deg
		Steadiness	<+/-0.5 m/s
Model Support	:	Vertical strut with wind fairing	
Balance	:	3~Component with manual pitch adjustment	

RESEARCH AND DEVELOPMENT TEST FACILITIES AND EQUIPMENT

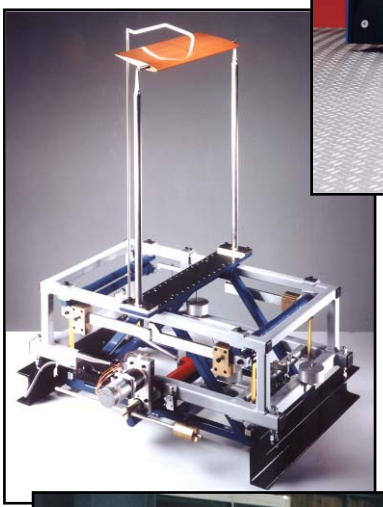
Continuous Research and Development has been a feature of Aerotech's products. We can assist with new laboratory equipment and development when there is a need for a feature or performance which does not currently exist, or we can assist with refurbishment programmes of existing equipment where budgets are restricted.

Aerotech have the technology and expertise to assist you with facility improvements or the planning of a new facility. Our staff can be relied upon to develop concepts which are based on our broad experience with automotive, aerospace, racing, and the sports equipment industries.

We are capable of providing design and consultancy services only or the complete project on a turn-key basis. Our approach to R & D test facility projects can be tailored to your needs. We can bring the benefit of our technical experience and high quality products to your laboratory improvement plans efficiently and economically.



As an example, our low speed wind tunnels can be equipped with interchangeable test sections, various balance and model support options, PC based controls and data acquisition, and features for high flow quality. A variety of performance and speed specifications can be met depending on the test requirements.



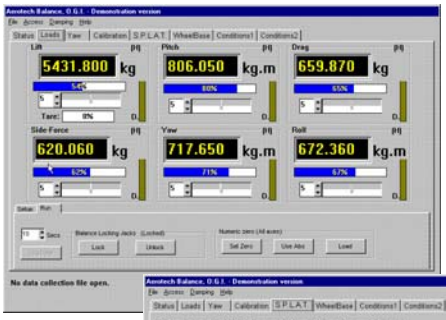
Accessory equipment is available including smoke generators for flow visualization, internal and external balances, moving belt ground planes and flow conditioning equipment. Dedicated Control and Instrumentation software can be written for special testing arrangements particular to your laboratory.

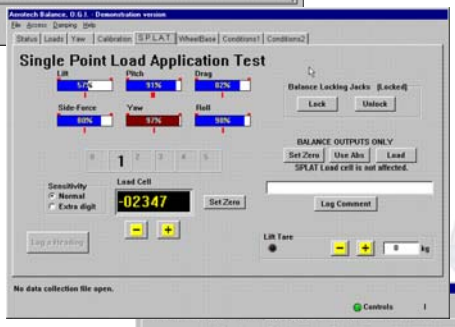
Other types of test facilities can be designed and supplied from materials test equipment to durability and performance test rigs. Our team is prepared to assist you in the development of your facility.

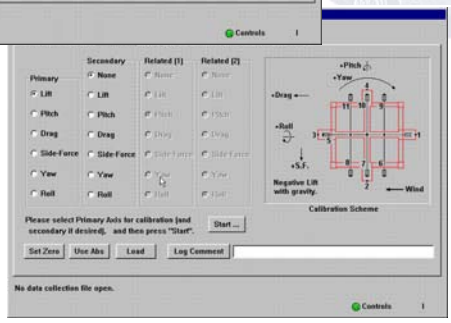
We are happy to offer an initial survey of your laboratory facilities and make recommendations for additions or improvements.

CUSTOM DESIGNED CONTROL AND INSTRUMENTATION SOFTWARE

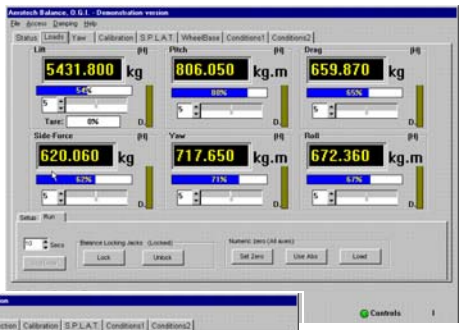
From nearly two decades of experience in wind tunnel test equipment, AEROTECH has developed a control and data acquisition system to complement all of its product range. The systems are configured in a modular format, enabling us to interface with existing equipment or to provide a complete turnkey project.

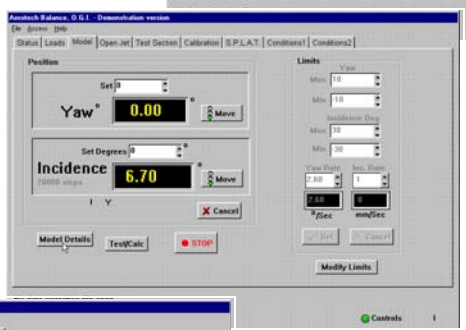


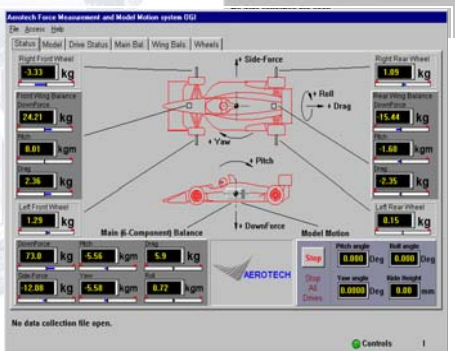




- Custom Designed and Manufactured Data Acquisition and Motion Control Systems
- Stand Alone or Integrated into user=s existing equipment
- PC based or multi-user systems
- Graphical presentation of acquired data in near real time
- Multi-axis Calibration Systems
- Multi-axis model motion control systems
- Multi-axis aerodynamic force data





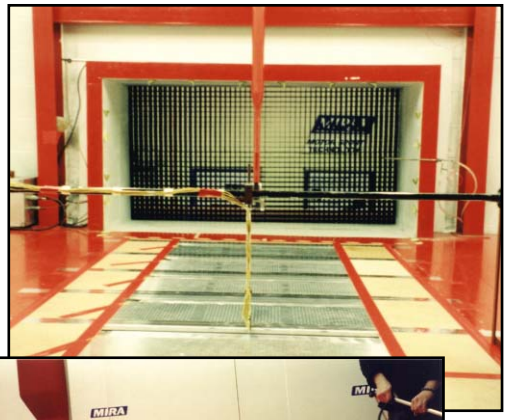


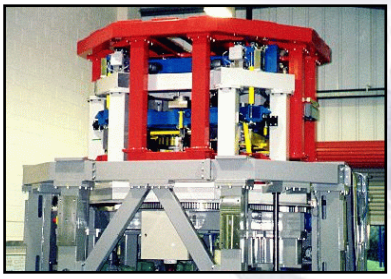
- Modular Software Packages to suit user=s requirements
- Complete Wind-Tunnel Management and Control Systems
- Update and Refurbishment of Existing Facilities
- Computer Management of Multi Port Pressure Scanning Devices
- Communications and networking
- Automation and sequencing
- Flexible and modular approach

NEW PRODUCT DEVELOPMENT

Test equipment for the aerodynamics research industry varies widely in terms of performance requirements, design, and construction. Since each test facility is unique, Aerotech=s test equipment is usually custom designed, highly engineered, innovative and employing state-of-the-art components

Test facilities are continually relied upon for more precise data and greater data productivity. The competition for research and development funds, as well as the need to maintain up-to-date instructional facilities, demand that test facilities be continually improved.

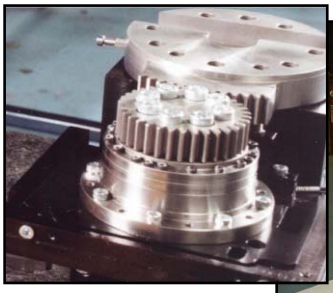


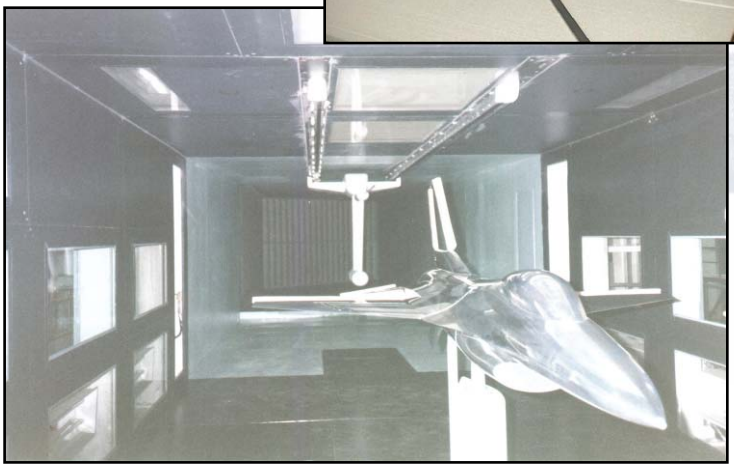


Design innovation has always been one of Aerotech's main strengths. We are constantly striving to provide innovative solutions to the Test Engineer that are economic whilst performing to a tight specification.

Examples of this have been in the design and development of our "Fluid Belt Moving Ground Simulator" (right) which can be used as an economic replacement for a moving belt system when testing automotive models with standard ground clearances. We have also designed and installed External Balances on Elevation Systems (above, left) to be able to change the resolution centre of the balance to be more versatile with a variety of test configurations and model setups.

As instrumentation, data acquisition, and controls have been continuously improved, there is a need to retrofit test facilities with higher performance systems. As a result, the facilities themselves have been shown to need improvements in terms of the quality of the test conditions and the accuracy and speed of the various mechanical systems such as model supports, balances, and low survey systems.





Aerotech ATE, Ltd. offer a wide variety of test facility equipment and services for the improvements needed to keep your research laboratory competitive.

Whatever your requirement in the field of fluid or aerodynamic research, talk to us at Aerotech. We may have the answer you have been looking for.

For a more comprehensive appraisal of our products and services,

visit our web-page: www.ate-aerotech.co.uk or

e-mail us at: info@ate-aerotech.co.uk.

www.ate-aerotech.co.uk

Aerodynamic Test Equipment Ltd
Head Office
Crown Technical Centre, Burwash Road,
Heathfield, East Sussex, TN21 8QZ, UK
Tel +44 1435 865245 Fax +44 1435 865588
Email: info@ate-aerotech.co.uk