



**KISTLER**

measure. analyze. innovate.

**Safe, smooth  
and efficient  
flights**

## **Solutions for aviation testing**

Proven measuring equipment for all application needs on  
the ground and in the air



## **Absolute Attention for tomorrow's world**

Kistler develops solutions for challenges in measurement technology with a portfolio that comprises sensors, electronics, systems and services. We push the frontiers of physics in fields such as emission reduction, quality control, mobility and vehicle safety: our products deliver top performance to meet the standards of tomorrow's world, providing the ideal basis for Industry 4.0. This is how we pave the way for innovation and growth – for our customers, and with our customers.



Kistler: the byword for advances in engine monitoring, vehicle safety and vehicle dynamics. Our products deliver data that plays a key part in developing efficient vehicles for tomorrow's world.



Measurement technology from Kistler ensures top performance in sport diagnostics, traffic data acquisition, cutting force analysis and many other applications where absolutely reliable measurements are required despite extreme conditions.



By supporting all the stages in networked, digitalized production, Kistler's systems maximize process efficiency and cost-effectiveness in the smart factories of the next generation.

# Kistler technology for the aviation industry



Manuel Blattner  
Head of SBF Test & Measurement

Aviation is a high-tech industry that drives innovation and plays a key part in the economy. An aircraft is a highly complex vehicle, fully equipped with electronics that require many years of research and development by hundreds of qualified engineers; aircraft include millions of structural components, and their costs run into billions. To remain profitable and competitive, they must be designed to operate safely for 25 years.

Aviation connects people and continents. Aircraft are the most important means of transporting global merchandise; as the most commonly used vehicles for international travel, they are also closely associated with individual mobility. Nowadays, the focus is on passenger experience as well as operational excellence.

Aviation is currently facing multiple challenges: the quest for climate and noise

protection demands cutting-edge technologies, and air transport security is an equally urgent requirement. Although air traffic continues to grow, aviation accidents have decreased thanks to the minutely detailed procedures prescribed for regular maintenance and security testing. Standards for aircraft design and maintenance are strict. Checklists specify tests based on the age and flight hours of each aircraft, with follow-up for each and every structural component.

As an industry insider, Kistler is dedicated to developing sensor technology with exactly the level of sensitivity you need for testing and approval, no matter what your test plan requires. We also offer you our professional advice and worldwide services.

As your partner, we play our part in the successful performance of your aviation enterprise – and that success depends on the utmost reliability of your equipment.

## Contents

Sensors for aviation testing from Kistler – in a class of their own	4
PiezoStar and high-temperature stability	5
Ultra-high temperature sensor solutions	6
TEDS-capable acceleration solutions	7
Customer-specific force dynamometer solutions	8
Innovative modular DAQ solutions with transparent measuring chain reliability	10
Ground vibration testing (GVT), modal and structural analysis	12
Landing gear and brake testing	14
Wind tunnel testing	16
Jet engine testing	18
Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS)	20
Flight vibration, buffeting and flutter testing	22
Hydraulic system performance testing	24
Kistler services: increasing success you can measure	26





Kistler is the aviation testing partner of choice for safe, smooth and efficient flights.

## Sensors for aviation testing from Kistler – in a class of their own

A passion for sensors demands absolute conviction that the little things can make a big difference to the world of work for engineers, researchers, measurement technicians, students and manufacturers. Kistler, the pioneer of piezoelectric measurement technology, is proud to serve many committed and satisfied customers throughout the international aviation industry. For over 60 years, we have built up trust and expertise by constantly seeking perfection and always endeavoring to meet each customer's needs.

Prior to its maiden flight, every aircraft undergoes a program of fundamental ground tests to ensure safe operation. These include vibration investigations, simulation of the high-level forces and shocks exerted on the landing gear, aeroelastic behavior tests in a wind tunnel and engine testing, etc. These are followed by flight tests, such as vibrational tests focusing on avionics and the aeroelastic stability of the aircraft's control surfaces.

We work in partnership with renowned European, American and Asian aviation industry players. Aviation testing standards associated with aircraft ground and flight applications call for sensor technologies that offer specifications for the most demanding

**Our solutions provide the most accurate measuring results, thanks to:**

- Wide temperature range and high-temperature capabilities
- Variegated modal sensor featuring TEDS capability, low- noise and repeatable low-frequency response
- Professional customized dynamometer design and manufacturing
- Innovative DAQ solutions
- Outstanding service with global network

requirements. Based on piezoelectric (PE), integrated electronic piezoelectric (IEPE) and piezoresistive technologies from Kistler, the force, torque, pressure and acceleration measuring chains that we offer in this brochure meet the requirements for every scenario – from small-scale laboratories to the most demanding operational environments.

# PiezoStar and high-temperature stability




Market trends toward miniaturization and stability at changing or higher operating temperatures have resulted in a need for new types of crystals. The proprietary PiezoStar family of crystals developed by Kistler provide the material we use to produce sensors that exhibit very low changes in device sensitivity when exposed to temperature variations. This proven attribute makes them ideal for measuring pressure, force and acceleration even under extreme conditions.

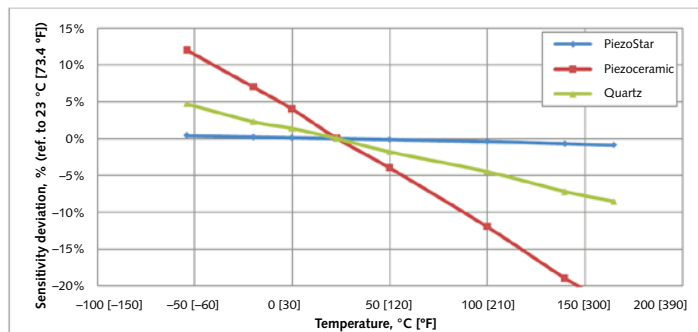
Our new crystal compounds are the result of over ten years of cooperation and research with universities throughout the world; their unique performance optimizes data quality for physical measurements. Thanks to the high rigidity of the PiezoStar elements, sensors based on them have high natural frequencies. This material is the key factor that gives our pressure, force and acceleration sensors higher accuracy and better sensitivity, even at very high working temperatures.

PiezoStar elements ensure unique temperature stability up to 165 °C (330 °F) for the dedicated IEPE (voltage output) accelerometer families. PiezoStar has also extended the operational temperature range to 700 °C (1 300 °F) for piezoelectric (charge output) pressure sensors and accelerometers.



PiezoStar crystals are just one of many innovations from Kistler.

Product highlights	
	Single-axis, teardrop IEPE PiezoStar acceleration sensor family Type 8715B
	Triaxial mini cube IEPE PiezoStar acceleration sensor family Type 8766A
	Triaxial center-hole IEPE PiezoStar accelerometer family Type 8765A



Typical sensitivity deviation with temperature of a PiezoStar voltage mode accelerometer compared to a sensor based on a ceramic or quartz sensing element.







Temperatures of 700 °C (1 300 °F) for sustained pressure and acceleration measurements; short-term measurements at even higher temperatures are possible with our high-temperature sensor solutions.

# Ultra-high temperature sensor solutions

Kistler's proprietary single-crystal PiezoStar sensing elements are the basis for the superior performance of our ultra-high temperature pressure and acceleration sensors. They have been thoroughly tested at well over 700 °C (1 300 °F). Unlike ceramic-based sensor elements, they are not pyroelectric and show no popcorn effect.

Due to their outstanding high-temperature capability, PiezoStar sensor elements can be placed directly in very hot locations. This simplifies the system and delivers more accurate measurements. Ground-isolated differential designs, robustness against electromagnetic interference, long lifetimes and approvals for operation in hazardous areas are among the features of this measuring system.

Kistler grows its PiezoStar crystals entirely in-house, whereas the availability of comparable sensor elements containing natural crystal Tourmaline is highly dependent on the world's sources.

Product highlights	
High-temperature pressure and acceleration sensors, differential charge amplifiers and matching cables are the main elements needed to configure the measuring chain. Our components are available in a vast variety of versions and are designed to guarantee seamless interoperability. Ex-certified components complete the portfolio.	
	700 °C (1 300 °F) high-temperature pressure sensor with hardline cable Types 6021A, 6023A and 6025A
	700 °C (1 300 °F) high-temperature accelerometer with hardline cable Type 8211A
	Low-noise softline cable Type 1652A
	Differential charge amplifier Type 5181A

# TEDS-capable acceleration solutions

When high sensor channel count is at stake – in modal analysis, for instance – it can be very time-consuming to assign a sensor to the correct channel of the data acquisition system. This also involves a major risk of errors. It was for this specific reason that the acceleration sensor community invented the Transducer Electronic Data Sheet (TEDS).

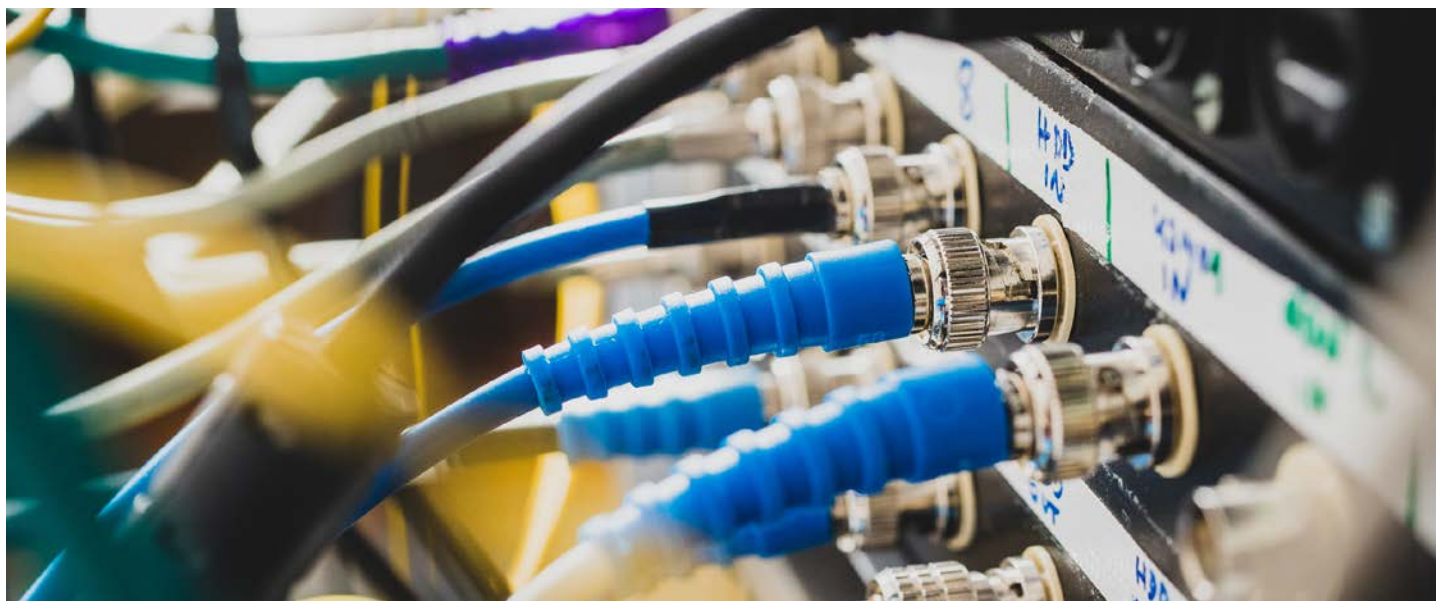
A TEDS sensor is an IEPE sensor with a built-in memory containing information about the sensor and its application. The internal memory includes information about the manufacturer, specifications and calibration, following IEEE standard 1451.4 (Institute of Electrical and Electronics Engineers). The information allows a data acquisition or measuring system to connect directly to the sensor, recognize it and automatically take account of its sensitivity, among other parameters. While only TEDS-capable IEPE signal conditioners and data acquisition systems will support digital mode, any TEDS sensor is capable of connecting to both analog and digital modes of these devices.

Kistler offers a broad range of acceleration sensors featuring a variety of TEDS templates that also allow compatibility with various types of data acquisition and analysis software.

Product highlights	
	Single-axis modal sensor family with TEDS capability Type 8640A...T
	Triaxial modal sensor family with TEDS capability Type 8688A...T
	Mini cube triaxial ceramic-based accelerometer family with TEDS capability Type 8763B050BT
	Orientable single-axis modal sensor with TEDS capability Type 8000M0x

## TEDS-capable sensors – your plug and play benefits:

- Automatic setup between TEDS sensors and TEDS-capable data acquisition system
- Reduce time and costs for installation
- Reduce potential for human errors
- Easily check configuration



Your high channel count vibration measurement setup made easy thanks to TEDS-capable accelerometers.





Our engineering team will work closely with you to carefully analyze your specific setup and offer a sensing solution.

## Customer-specific force dynamometer solutions

Kistler offers an extensive portfolio of standard single and multi-component force sensors. These can be used alone, as combined sets or within standard off-the-shelf dynamometers that meet a vast range of size and accuracy requirements for test objects. But unfortunately, there are some cases where no standard sensor or dynamometer is suitable. It is our passion to provide you with exactly the measuring tool that will best meet your requirements. To achieve this, our engineering team will work closely with you to carefully analyze your specific setup and develop a sensing solution.

We know the right questions to ask, based on the expertise we have gained in designing and manufacturing custom dynamometers for aerospace applications over many years. Our aim: to take the correct action at every stage of the process, right from the start.

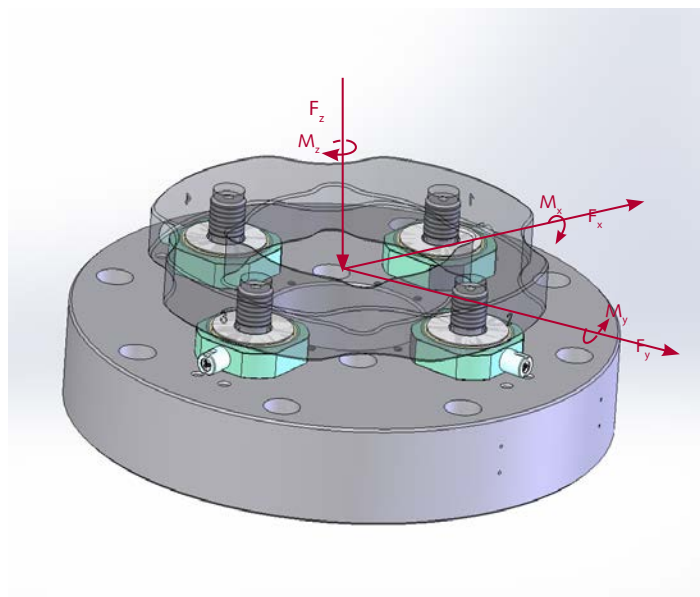
### Professional design and manufacturing services by Kistler – your benefits:

- Careful analysis of your requirements
- Control drawing, including dynamometer design and most important specifications
- Approval by customer
- Detailed design, manufacturing of all parts and assembly of the dynamometer
- In-house calibration on our unique 3-component reference force press
- Delivery of the final dynamometer, including the calibration certificate and Bode diagram of natural frequency





In-house calibration on Kistler's unique 3-component reference force press.

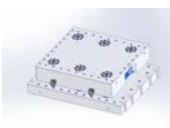



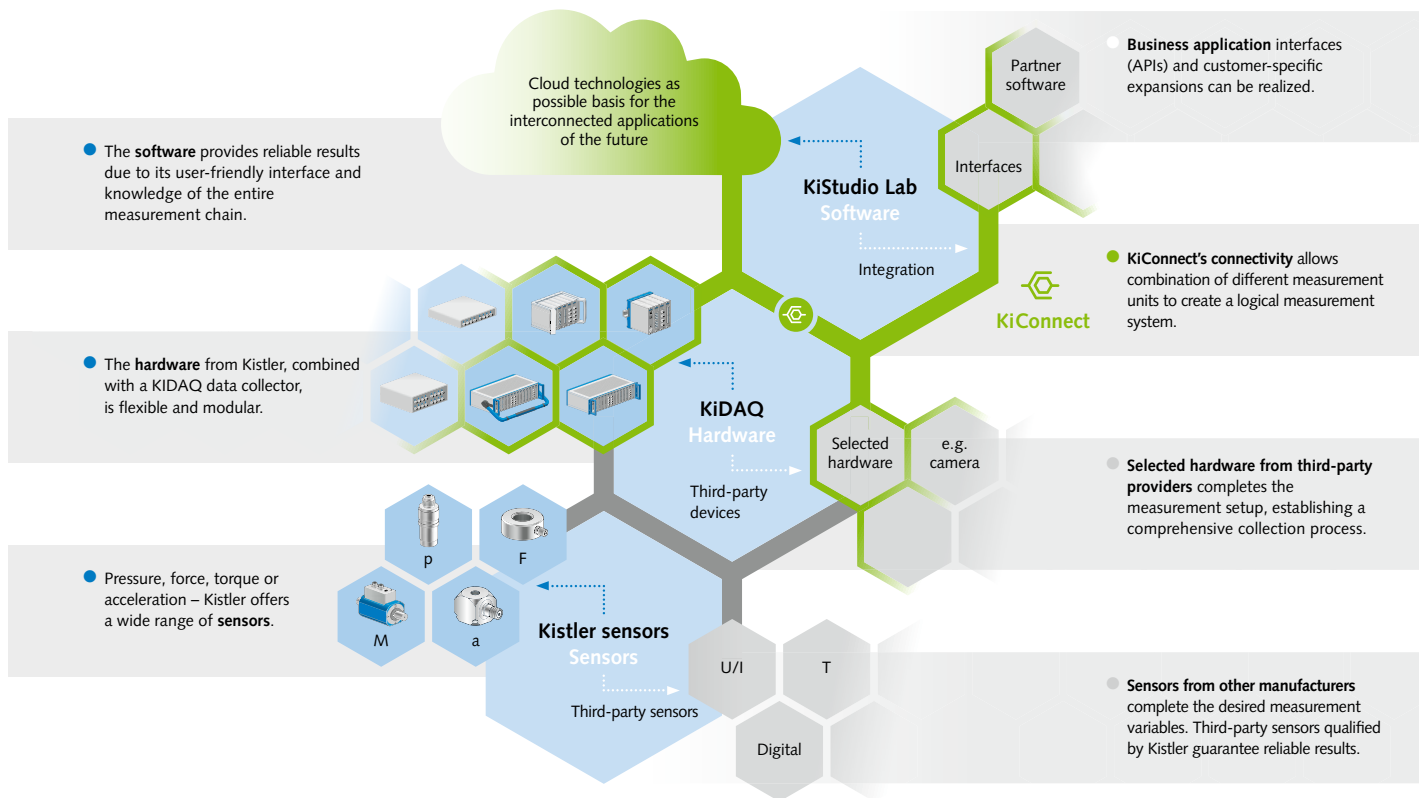
6-component dynamometer. This dynamometer is built of four Type 9047C force sensors. The top and base plate were specifically designed for the customer's requirement. Special calibration with a specific adapter reproduces the same situation as in the real application.

## Customized force dynamometer solutions

Thanks to our absolute commitment to quality, we can assure you that each dynamometer will meet your specifications and work right from the beginning, throughout the test plan.

- **Multi-component**  
Our 3-component force sensors are at the core of all customer-specific dynamometers.
- **Single-source**  
Kistler grows its own crystals for sensors used under extreme operating conditions. Precision measuring equipment from Kistler is subject to 100% quality control; all manufacturing steps take place in-house.
- **Highly specialized**  
Our customized high-performance dynamometers will meet your specifications, unlike self-built dynamometers.
- **Professional**  
Many years of experience and expertise in designing and manufacturing dynamometers for the aerospace industry make us your ideal partner. We speak your language and know exactly what it is all about.

Product highlights	
	Customized landing gear dynamometer
	Customized bird strike dynamometer



KiDAQ measurement architecture at a glance.

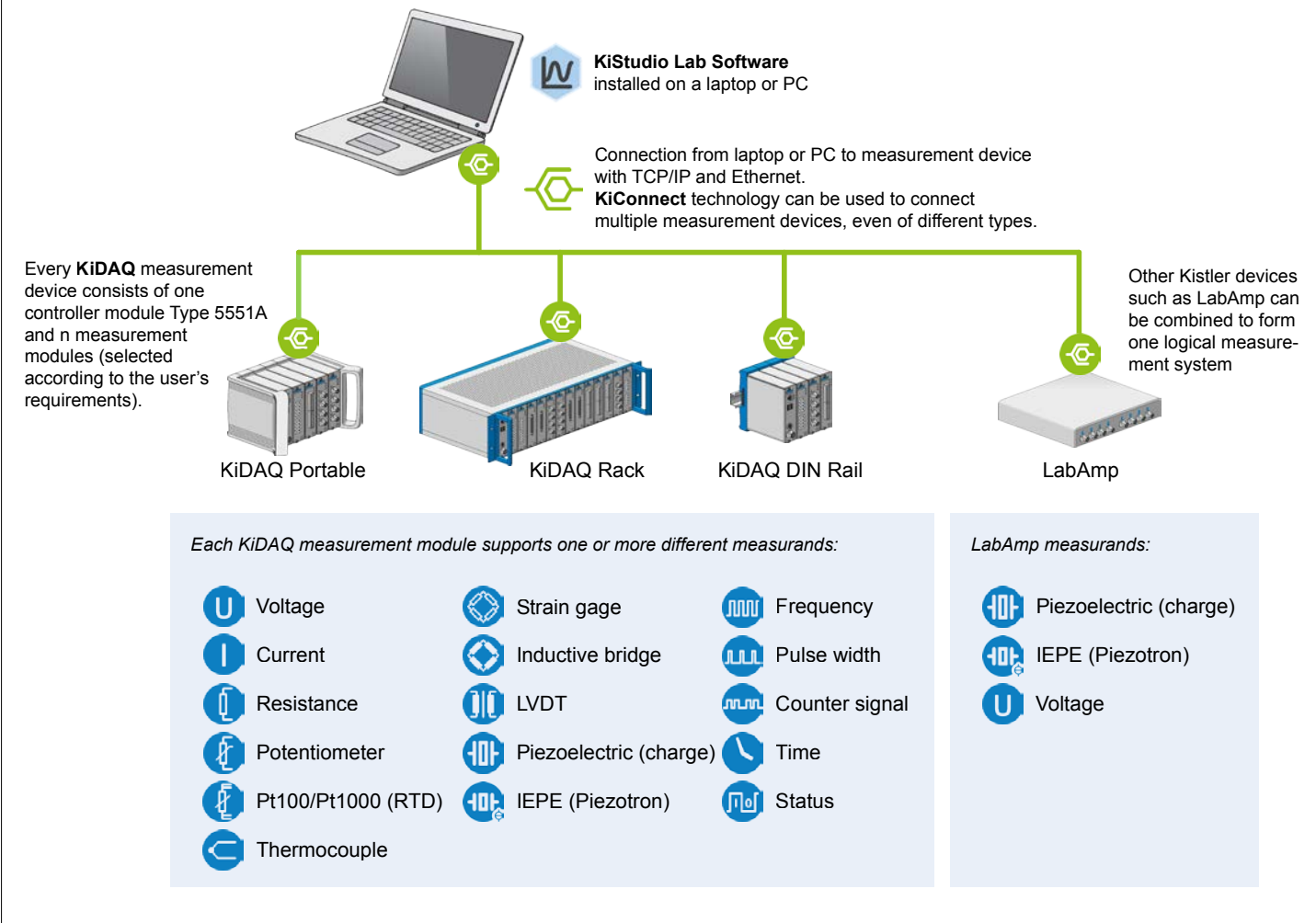
## Innovative modular DAQ solutions with transparent measuring chain reliability

In aviation research and development, most measurement tasks start with a complex and lengthy test setup. This is because measurement technicians or engineers have to connect measurement elements from different sources before they can assemble the system. With KiDAQ, the measurement technology experts from Kistler present an innovative and integrated data acquisition system that offers all the components you need for your measurement task – all from one single source.

Intelligent KiConnect technology is the connecting element inside the KiDAQ data acquisition system. Thanks to KiConnect, users can easily connect Kistler products and selected devices from other suppliers to assemble a logical measurement setup, enabling time-synchronized measurements with the Precision Time Protocol (PTP).

As the leading manufacturer of piezoelectric measurement technology, Kistler offers extensive measurement technology and application know-how backed by decades of experience. Measurement technology specialists can draw on this expertise to provide reliable information about the measurement uncertainty of the entire measuring chain. We share this know-how with our users by offering automatic calculation of the measurement uncertainty with the help of Kistler's KiXact technology. Once users know the measurement uncertainty percentages and magnitudes of each individual component, they can reduce the percentages by changing the operating conditions or optimizing device selection, so they benefit from maximum transparency and know-how. Kistler has filed a patent for its KiXact technology.

## Product highlights



KiConnect technology offers the benefits of a highly modular interconnected hardware portfolio.





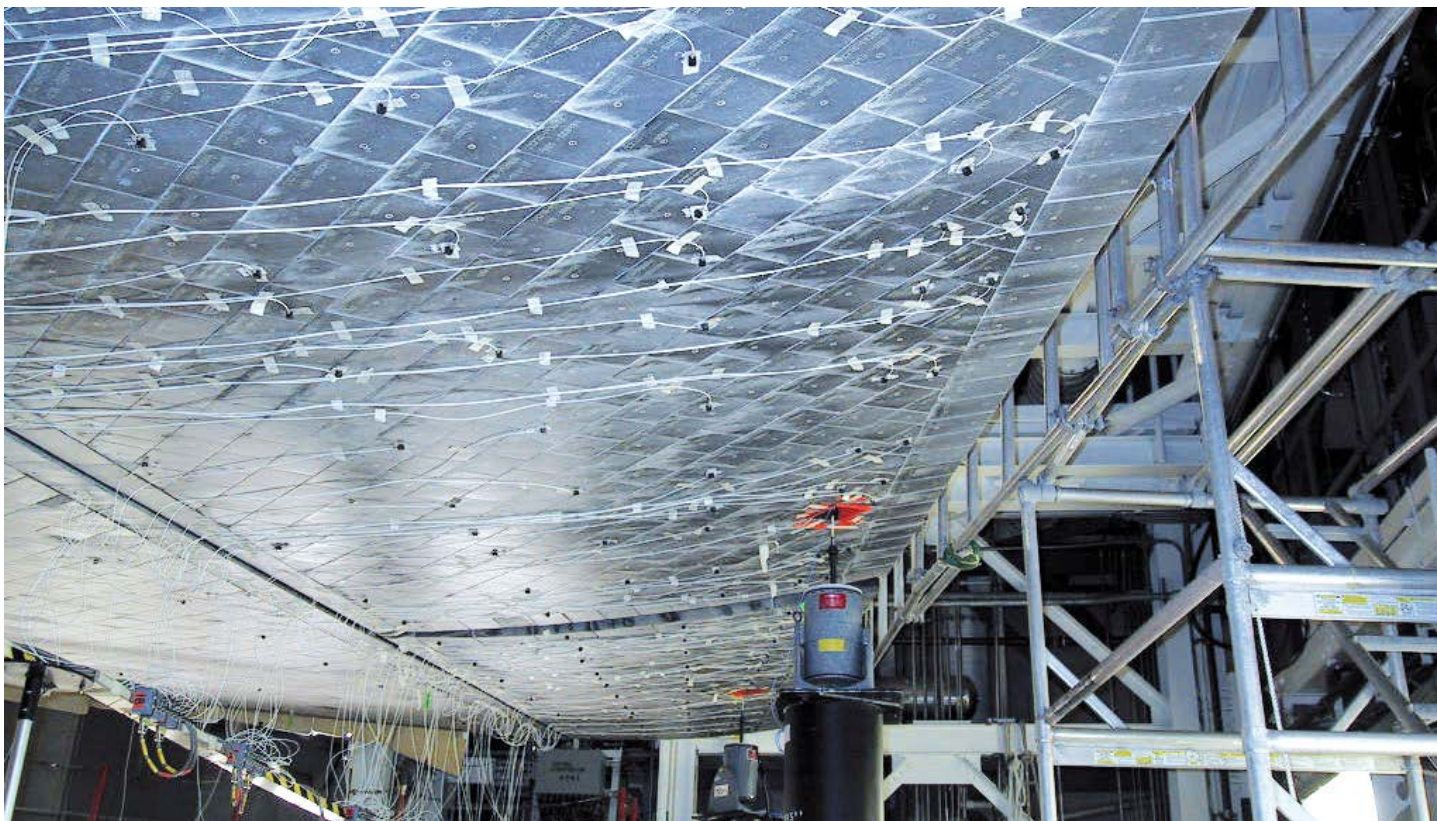
Prototype Airbus Beluga XL undergoes ground vibration testing (source: AIRBUS).

## Ground vibration testing (GVT), modal and structural analysis

**Modal analysis is performed regularly on aircraft and their subcomponents to detect structural changes and potential damage. It includes experimental and analytical vibration investigations of acoustic, fatigue and functional aspects during the development phase of equipment and products.**

One of the primary goals for design engineers is to determine the modal characteristics of the mechanical structure by testing and identifying the natural vibration modes. Such investigations typically call for a large number of high-performance accelerometers at reasonable cost. Modal accelerometers from Kistler are available for three measurement ranges, including 5 g, 10 g and 50 g, offering an accurate frequency and phase response within the specified frequency range.





High channel count systems of this type must offer the required technical properties, but easy handling during installation is also of the utmost importance. Short installation times, low error rates and reliability over a 10-year timeframe are the key criteria. There are two key parameters to reduce error rates and time needed for installation: TEDS capability (Transducer Electronic Datasheet) and the sensitive axis alignment in relation to the overall coordinate system.



Ground vibration testing of a space shuttle.

## Key technologies for the application

- Low noise**  
 The low-noise performance of ceramic-based acceleration sensor families allows measurement of very small signals with no need for heavier seismic masses that could modify the behavior of the unit under test (UUT).
- Flat frequency response**  
 Modal sensors from Kistler are characterized by a flat and repeatable frequency response, especially towards low frequencies. We also provide specific low-frequency calibration certificates and phase response characterizations on demand.
- TEDS capability**  
 The IEEE 1451.4 TEDS automatically transfers sensor parameters to TEDS-capable signal conditioning, to minimize transcription errors and record-keeping tasks.
- Easy handling**  
 For fast and easy installation, special clips or housings enable flexible orientation of the sensitive axis.

Product highlights	
	Single-axis modal sensor family with modular mounting and TEDS capability Type 8640A...T
	Triaxial modal sensor family with modular mounting and TEDS capability Type 8688A...T
	Orientable single-axis modal sensor with TEDS capability Type 8000M0x
	Modal impulse hammer family Type 972x





Functional test on landing gear (source: IABG).

## Landing gear and brake testing

Landing exposes the landing gear strut and the entire aircraft structure to high-level forces and shocks. Maintenance of landing gear and brakes is critical to safety. Aircraft brake dynamometer testing simulates actual operating conditions, including taxiing, take-off and landing.

Aviation engineers perform a series of quality and fatigue tests on the landing gear. Touchdown on the runway is by far the largest load case for the landing gear. The wheels accelerate to landing speed in almost no time. The inertial mass of the wheels creates a large force.

For realistic testing, the wheels of the landing gear are accelerated up to landing speed. Then the landing gear is dropped, creating a load similar to a real touchdown. By measuring these forces, the landing gear design can be verified and the forces and moments occurring in the aircraft structure can be determined.

Kistler offers customers complete engineering solutions with the benefits of high accuracy and very short delivery times.

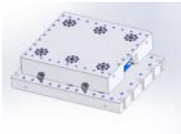



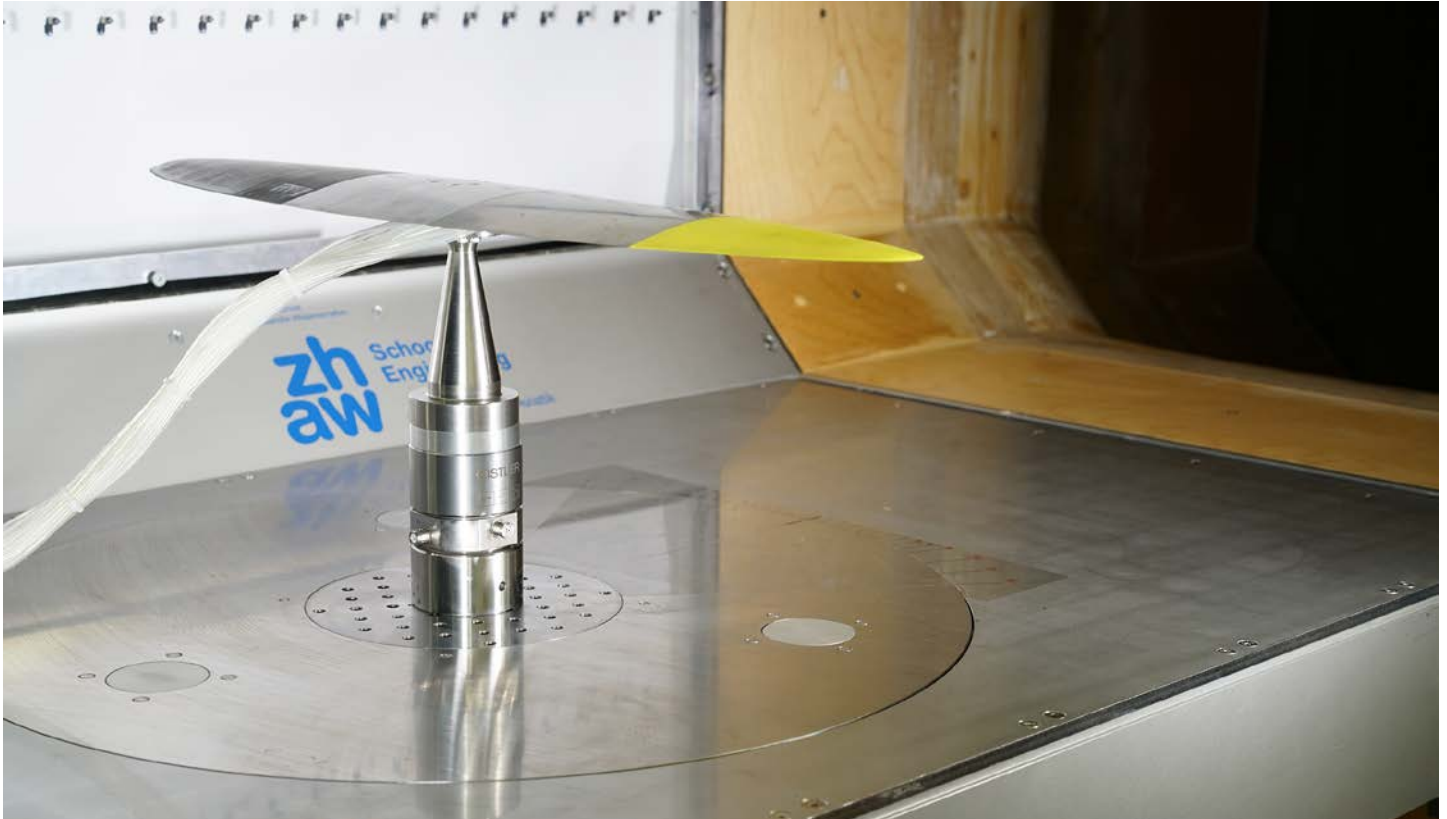


Calibration of a customized force dynamometer for the landing gear drop test on Kistler's special tri-dimensional calibration rig.

## Key technologies for the application

- Guaranteed accuracy and proven load range**  
 We provide a ready-to-use force plate, fully designed and calibrated according to customer needs.
- High natural frequency and high accuracy**  
 Thanks to its high rigidity, low crosstalk and good linearity, piezoelectric technology can achieve high natural frequencies and excellent accuracy.
- Outstanding flexibility**  
 Every sensor based on Kistler's piezoelectric technology has an extremely wide measuring range, so just one sensor can cover an enormous variety of tests and load cases.

Product highlights	
	Customized force dynamometers for landing gear drop tests
	Quasi-static 8-channel charge amplifier and data acquisition unit Type 5167A



6-component force sensor Type 9306A in a wind tunnel application at Zurich University of Applied Sciences (ZHAW).

## Wind tunnel testing

**A wind tunnel is a tool used in aerodynamics research to study the effects of air moving past solid objects. The test object, often called a “wind tunnel model”, is instrumented with suitable sensors to measure aerodynamic forces, pressure distribution, or other aerodynamic characteristics.**

The wind tunnel consists of a tubular passage with the object under test mounted in the middle. Air is made to move past the object by a powerful fan system or other means.




Piezoelectric multicomponent force sensors are often integrated in models that feature sting configurations. In other cases, the dynamometer can be mounted at the wing root in order to measure the aeroelastic behavior of the wing in critical flow conditions. This would in fact be similar to flutter testing at transonic speeds.



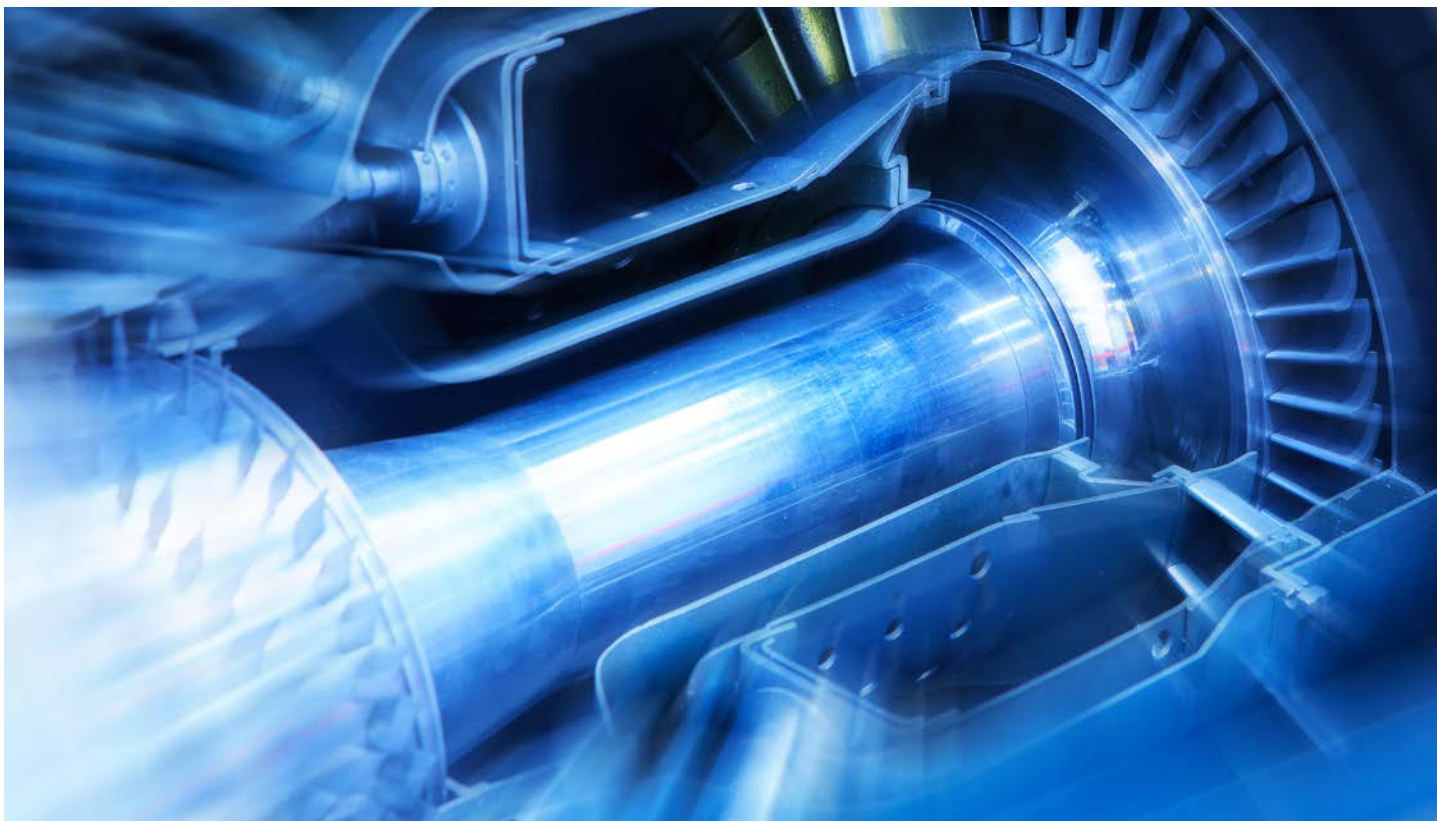
A wind tunnel is a tool used in aerodynamics research to study the effects of air moving past solid objects.

## Key technologies for the application

- Extended frequency response**  
 The high rigidity of piezoelectric technology ensures a very high natural frequency. This is the ideal condition for measuring aeroelasticity and measurements in transonic wind tunnels, as no deflection of the model is observed.
- Outstanding flexibility**  
 Piezoelectric technology from Kistler offers many benefits: one single sensor covers all measuring ranges, measurement setup is easy, and installation costs can be cut. One sensor or dynamometer can be used to measure different angles of attack and a wide variety of airfoils.
- Extremely rugged**  
 Piezoelectric sensors are extremely rugged and resilient against overload. It is virtually impossible to destroy or even mishandle them.

Product highlights	
	6-component piezoelectric force sensor Type 9306A
	3-component force link family Type 9317C–9377C
	Quasi-static 8-channel charge amplifier and data acquisition unit Type 5167A





Reliable and stable operation of jet engines is crucial for safety.

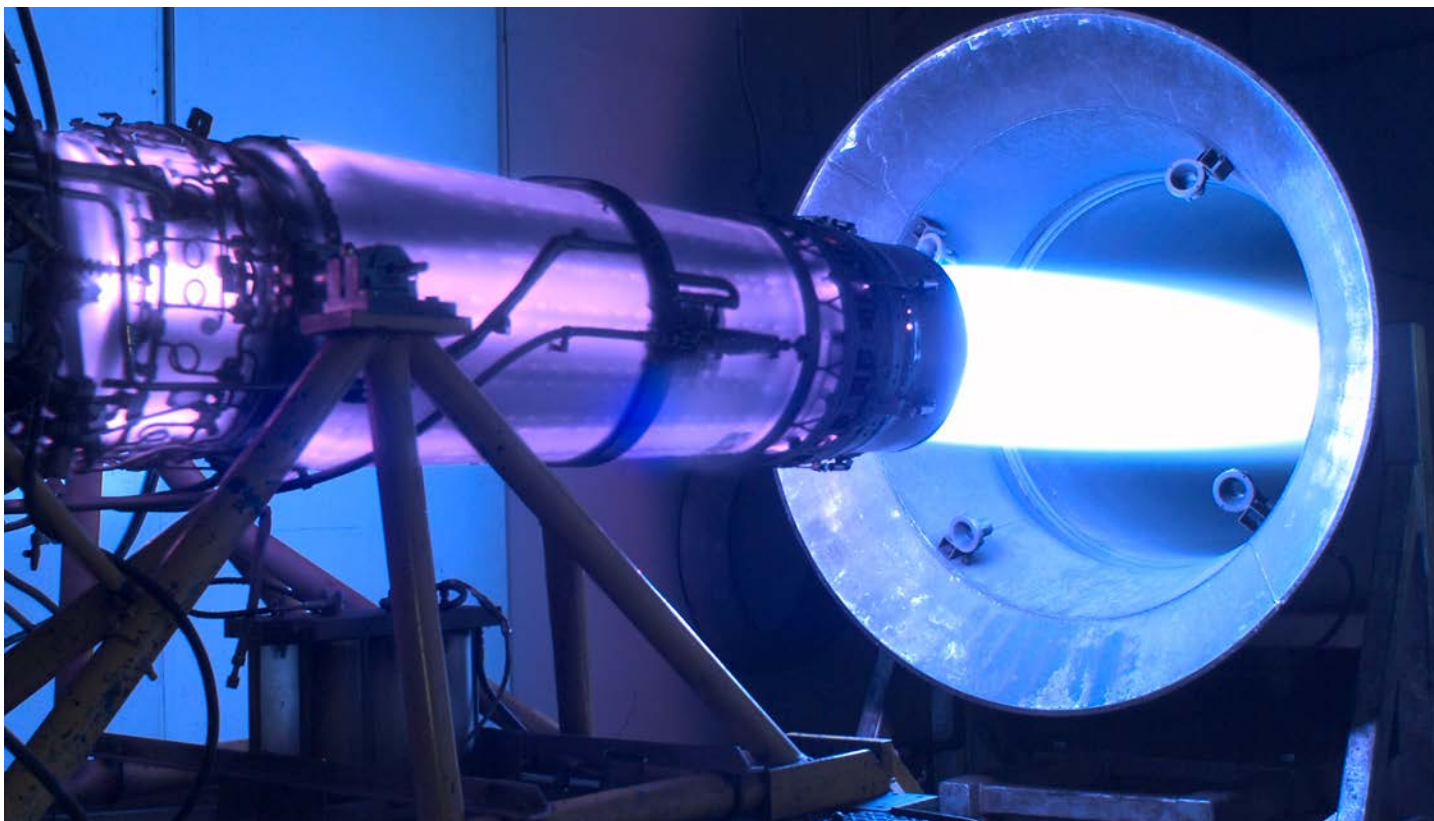
## Jet engine testing

**Reliable and stable operation of jet engines is crucial for safety. A jet engine undergoes several measuring campaigns throughout its lifecycle to prove that it meets all the requirements.**

During the R&D phase, vibration and pressure pulsation measurements in hot environments up to 700 °C (1 300 °F) supply important information about the operating condition of

the engine. This provides the engineering team with the basis for further developments.

This particular type of testing is performed after manufacture and also after any major overhaul work. Later in the jet engine's lifetime, for example, the same high-temperature sensors are used in an end-of-line performance test to verify proper functioning of the engine.



During the R&D phase, vibration and pressure pulsation measurements provide important information about the operating condition of the engine.

## Key technologies for the application

- **High-temperature capability**




Kistler's proprietary single-crystal PiezoStar sensing elements are the basis for the superior performance of our ultra-high temperature pressure and acceleration sensors. They have been thoroughly tested at well over 700 °C (1 300 °F). Unlike ceramic-based sensor elements, they are not pyroelectric and show no popcorn effect. This guarantees reliable and stable results over temperature and time.

- **Isolated ground, differential design**

The internal isolated ground effectively interrupts any ground loop. At the same time, the differential design ensures maximum resilience against electromagnetic interferences. High-quality signals with low noise levels are the direct result.

- **Robust design**

The measuring chain is specifically designed for longtime applications in harsh environments – as proven by Highly Accelerated Life Testing (HALT) and application-based experience.

Product highlights	
	700 °C (1 300 °F) pressure sensor series Types 6021A, 6023A and 6025A
	700 °C (1 300 °F) acceleration sensor Type 8211A
	Differential charge amplifier Type 5181A





Testing usually includes combinations of extreme thermal and vibration stress tests.

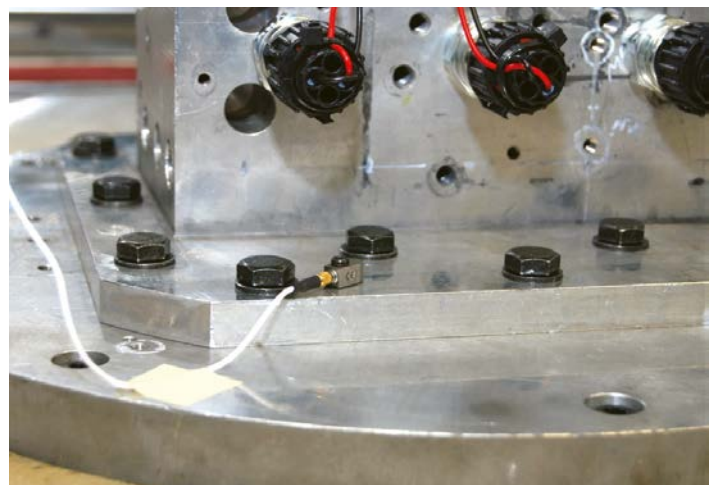
## Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS)

Environmental testing is used to validate design criteria during product development in the aerospace sector and other industries. The aim: to ensure that reliability goals are met. Environmental Stress Screening (ESS) is a mode of environmental testing that ensures a product's lifecycle and its compliance with quality, safety and other standards. Typically, this test is performed on electronic components so that latent weaknesses and defects are forced to manifest themselves through failure during the screening procedure.

Testing usually includes combinations of extreme thermal and vibration stress tests, subdivided into Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS).

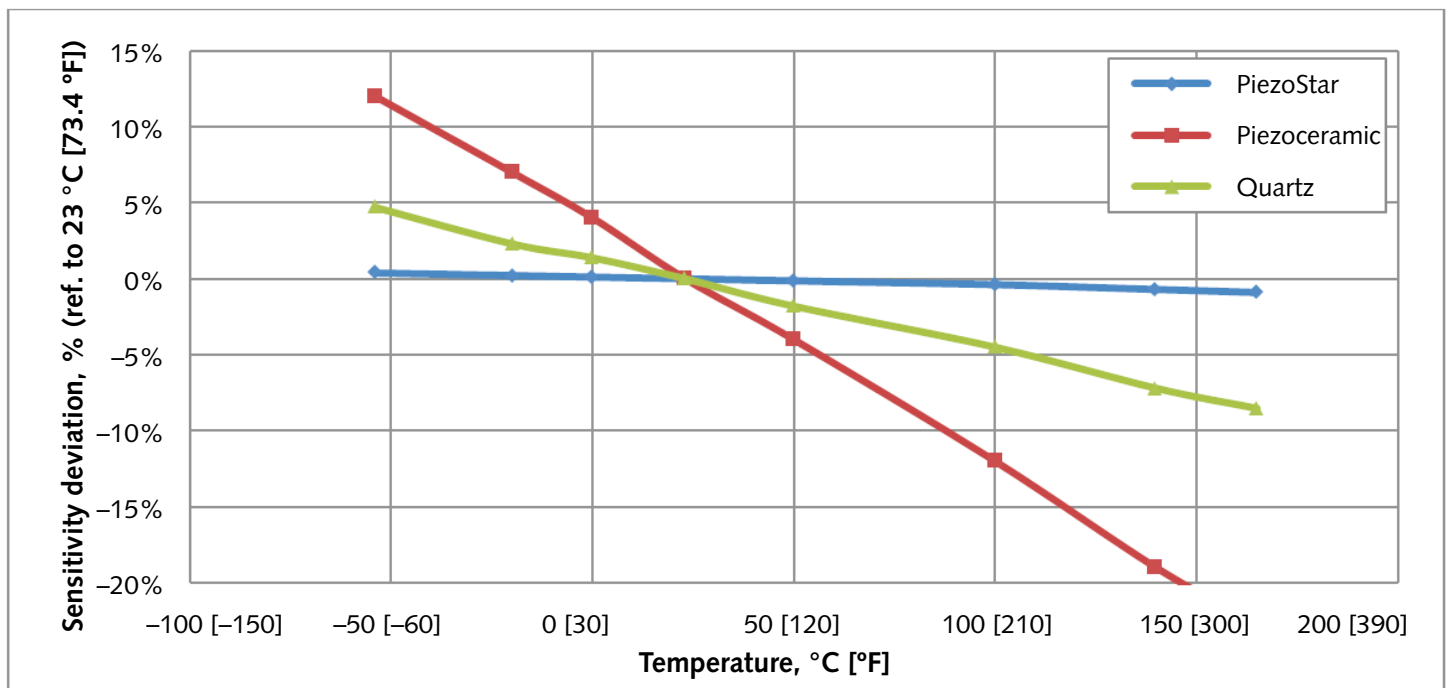
Highly Accelerated Life Testing (HALT) is a design verification process performed before a product is manufactured in order to detect design and assembly flaws. Design or assembly techniques can then be improved to ensure optimum product quality.

Highly Accelerated Stress Screening (HASS) is an evaluation process applied to all final products on an assembly line. It helps to identify weak components and manufacturing defects that cause a higher probability of early failure. HASS involves exposure to environmental influences including vibration, temperature, humidity, and pressure.



Type 8715B250 teardrop PiezoStar accelerometer mounted on an electrodynamic shaker in a thermal chamber for Highly Accelerated Life Testing (HALT).





Typical sensitivity deviation with temperature of a PiezoStar voltage mode accelerometer compared to a sensor based on a ceramic or quartz sensing element.

## Key technologies for the application

- **High-temperature stability**


PiezoStar-based IEPE (voltage mode) accelerometers from Kistler are the ideal sensors for precision vibration testing because they exhibit very low sensitivity deviation in response to temperature variations. Distorted input and output signals do not require numerical compensation for temperature after testing. This has been a problem with commonly used materials, notably piezoceramics such as PZT (lead zirconate titanate).

- **Lightweight**

Our PiezoStar-based sensors are small and lightweight in order to avoid any mass loading effects that would lead to a change in behavior of the unit under test. They are two to four times smaller than any other crystal-based sensors typically used under changing temperature conditions.

- **Easy mounting**

Sensor solutions from Kistler can use a center-hole design that allows for screw mounting when usage of standard removable adhesive is no longer possible. They also offer easy cable and measurement axis orientation. These sensors are generally ground-isolated to avoid any ground loop issues.

Product highlights	
	Single-axis teardrop center-hole PiezoStar accelerometer family Type 8715B
	Triaxial center-hole PiezoStar accelerometer family Type 8765A
	Triaxial mini cube accelerometer family Type 8766A500



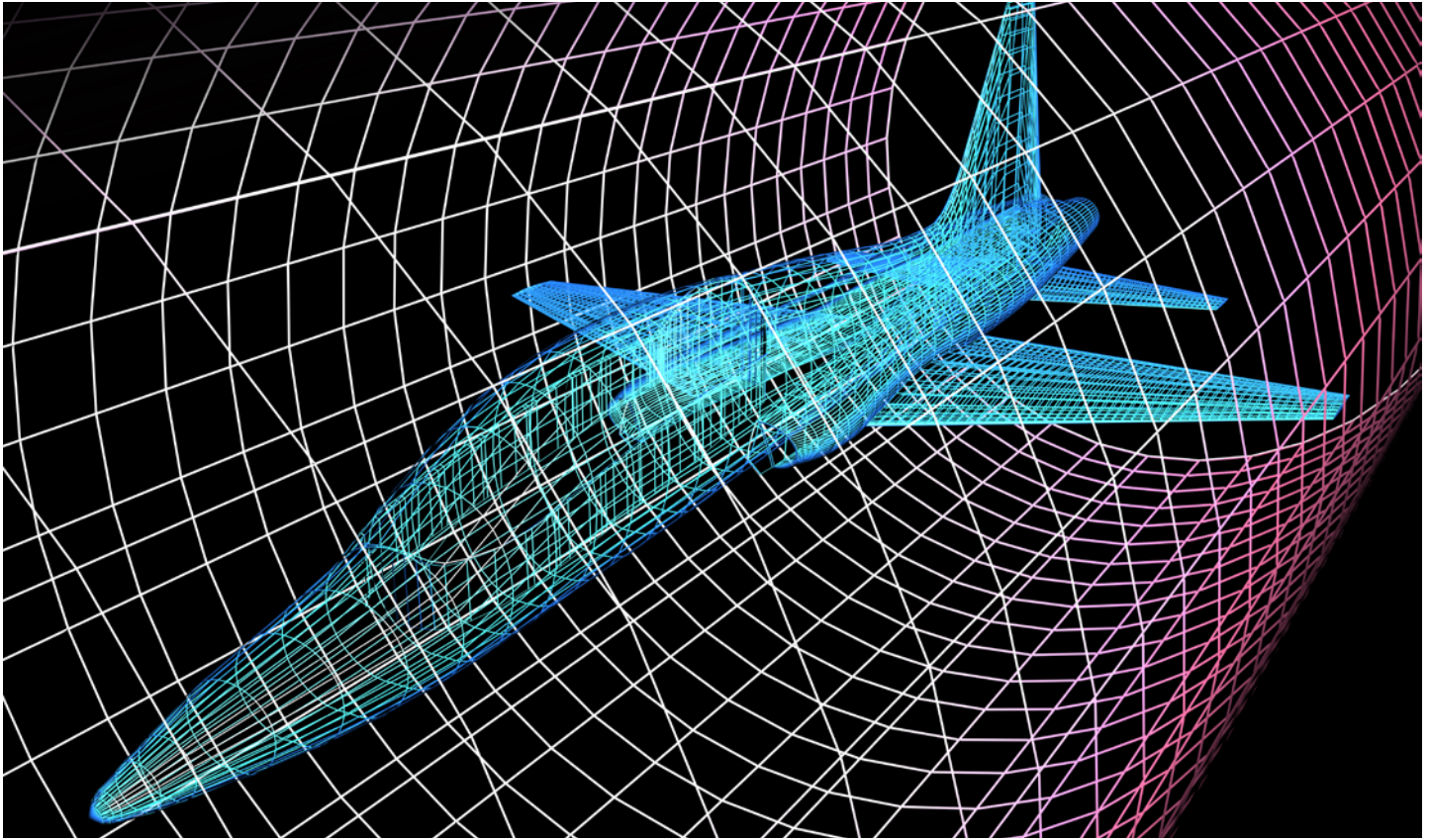
Flutter and buffeting tests are essential stages in the procedure for a new design qualification.

## Flight vibration, buffeting and flutter testing

**During flight testing, engineers validate the aircraft design by performing operational structural vibration testing. Many flight test scenarios are then applied to the aircraft in order to validate the shock and vibration performance of all aspects of the aircraft, including the control surfaces.**

Flutter and buffeting tests are essential stages in the procedure for a new design qualification. In buffeting tests, flight load data is acquired so that real condition inputs can be defined for future structural testing requirements. These tests involve higher frequencies, so they need IEPE accelerometers to measure the vibration-induced load inputs into the structure and components.





As opposed to buffeting tests, flutter measurements are typically performed with DC-response accelerometers; in this case, the aim is to study the aircraft's aeroelastic stability so that safe flying conditions are ensured.



During flight testing, engineers validate the aircraft design by performing operational structural vibration testing.

## Key technologies for the application

- Excellent temperature stability**  
 Our PiezoStar IEPE technology allows the sensor to have the same sensitivity whether the temperature is 25 °C (77 °F) or -55 °C (-67 °F ).
- Low profile**  
 Both the MEMS capacitive and PiezoStar quartz-based sensors are available with an optimal design for ultra-low profile. This allows for applications in confined spaces.
- Ground isolation**  
 Our anodized aluminum sensor base ensures solid ground isolation. This avoids ground loop issues that would generate major electrical noise perturbations within the measuring signal.
- Easy mounting**  
 Some sensor solutions from Kistler use a hole design for convenient screw mounting. Sensors can also be rotated to achieve the desired cable location or measurement axis orientation.

Product highlights	
	PiezoStar miniature triaxial center-hole IEPE accelerometer Type 8765A
	Ultra-slimline triaxial quartz IEPE accelerometer Type 8794A
	PiezoStar teardrop center-hole IEPE accelerometer Type 8715B
	MEMS capacitive slimline single-axis accelerometer Type 8316A...AC





Aircraft flight commands are converted into real-time actions performed by hydraulic systems that directly impact flight safety. For example, landing gear absorbs landing loads to ensure stable operation.

## Hydraulic system performance

**Aircraft make extensive use of hydraulic systems for mission-critical functions. The performance of hydraulic systems determines an aircraft's usability, flightworthiness and reliability.**

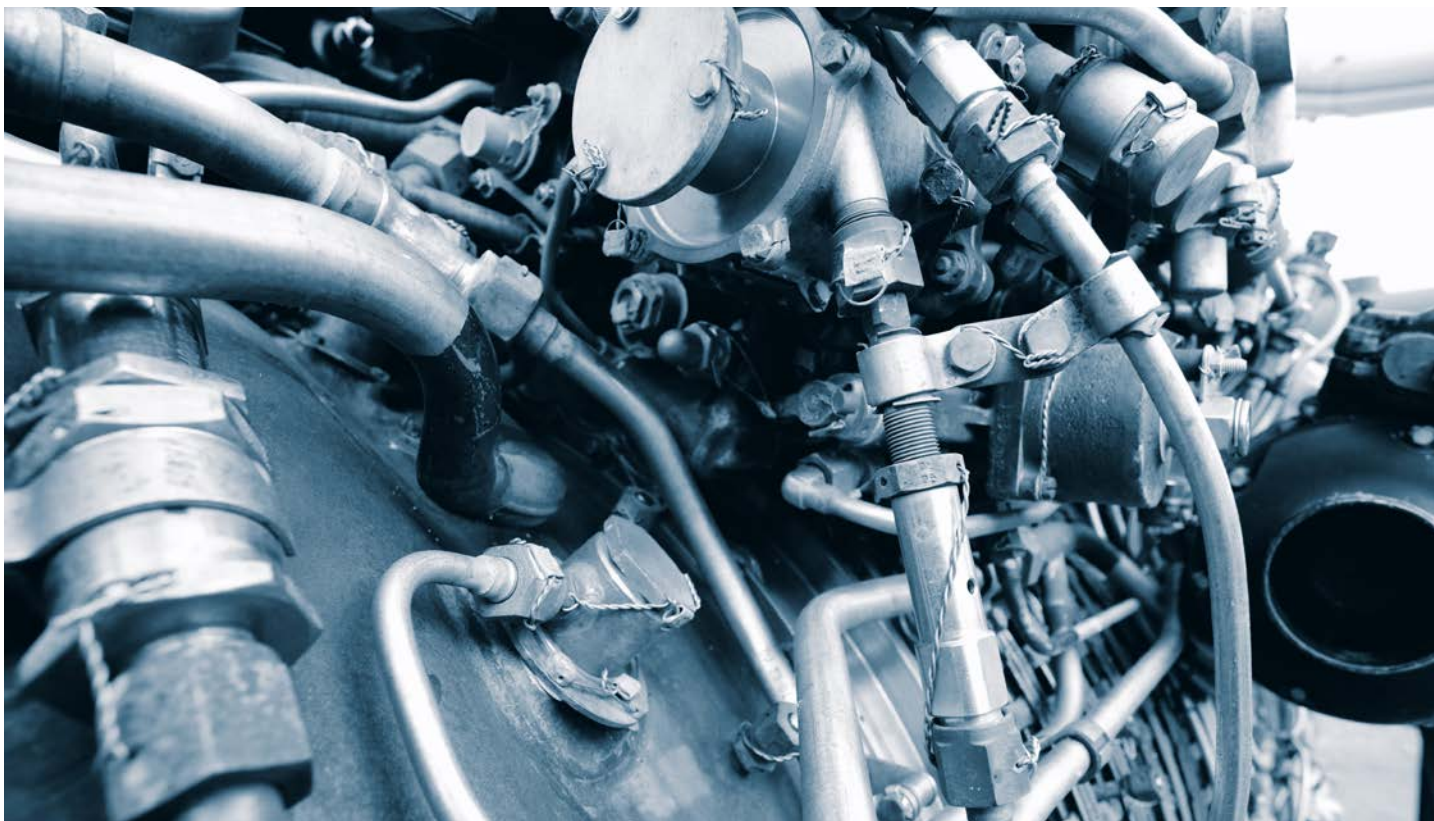
Typical applications include assessing the hydraulic systems that operate the primary and secondary flight controls, landing gear and braking systems. Many aircraft functions depend on hydraulic devices including pumps, actuators, control surfaces and valves, so intensive ground and flight testing focuses on this equipment.

Of particular interest is the measurement of static and dynamic pressure and fluctuations associated with various mission scenarios, flight profiles and related loads. For instance, aircraft flight commands are converted into real-time actions performed by hydraulic systems that directly impact flight safety. Examples

include landing gear, which absorbs landing loads to ensure stable operation, braking systems coupled with spoilers to increase wing drag, and thrust reversers on engines.

Kistler's piezoresistive pressure sensors are particularly suitable for static and dynamic pressure evaluation in hydraulic systems. The micro-machined silicon sensing element is fully isolated from the pressure media by a welded stainless steel diaphragm and a high-integrity seal assembly. By design, the silicon sensing element exhibits high stability and repeatability: two extremely important parameters for test engineers. These versatile high-performance pressure sensors operate in harsh test environments where temperature extremes, high vibration and shock levels are present – consistent with aviation applications.






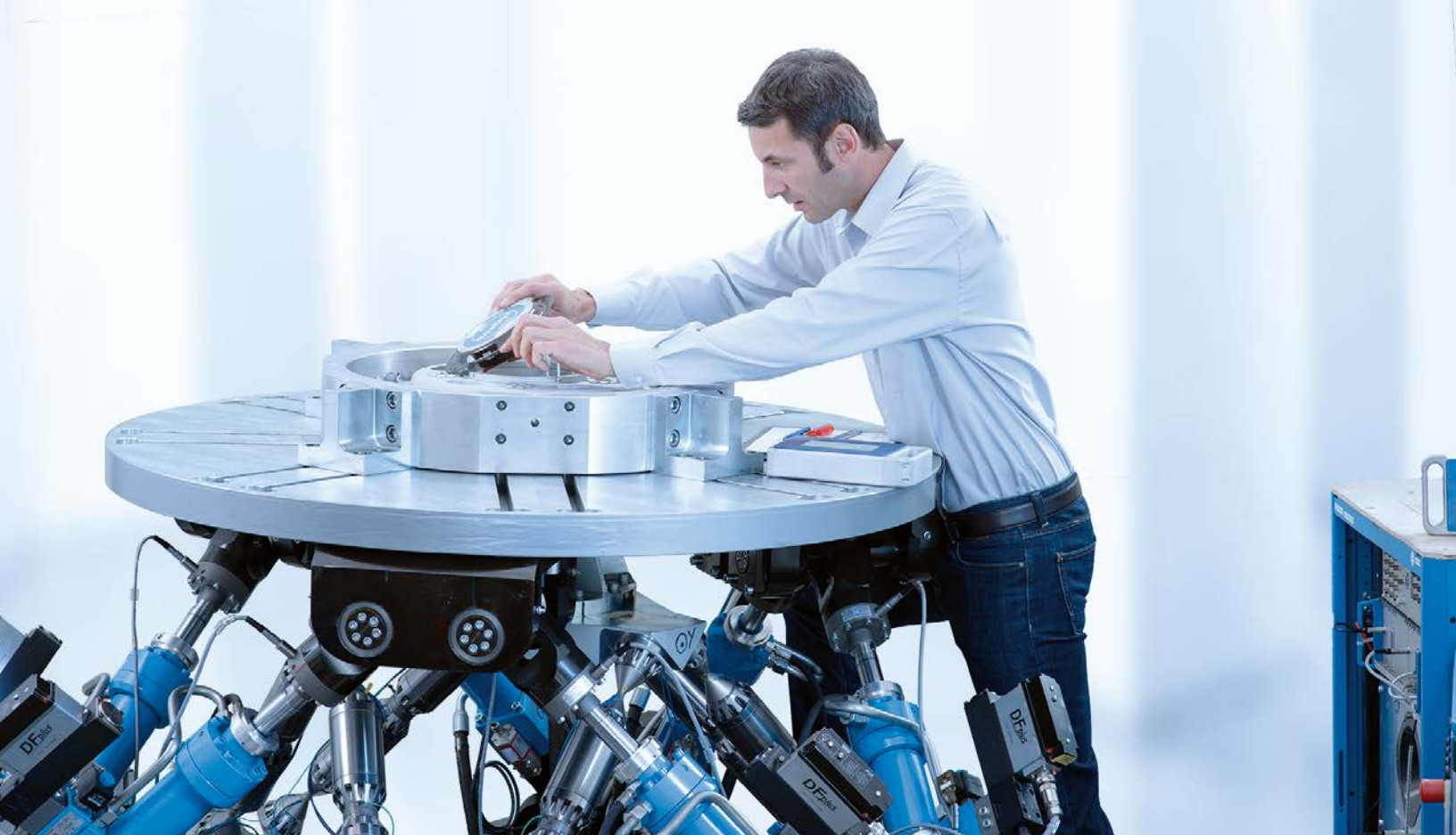


Component parts of an aircraft hydraulic system.

## Key technologies for the application

- Pressure ranges**  
 Hydraulic system performance requires the capability to measure both static pressure and dynamic pressures of up to 2 kHz. This calls for maximum pressure range capabilities of up to 350 bar (5 000 psi) or up to 10 bar differential (150 psi), and barometric pressure ranges must also be available. These environments may also require high proof/burst pressures of up to 3 or 4 times full-scale pressure.
- Robust operational performance**  
 The harsh environment for aircraft flight testing often demands robust operational performance. This requires qualification of sensors at specific levels, e.g.: shock as per MIL-STD- 202G, Method 213B-1, Conditions E, C; and vibration at 50 g peak, 10 Hz to 2 kHz. Kistler's piezoresistive transducers are designed for survivability of up to 50 million full-scale cycles at 2 Hz.
- Stability/accuracy**  
 Sensors used for critically important flight qualification testing must meet very high stability and accuracy requirements. Piezoresistive transmitters from Kistler are temperature-compensated over a range of -40 to 120 °C (-40 ... 250 °F). They can achieve accuracy of 0.1 % (full scale) with stability per year of 0.1 % (full scale).

Product highlights	
	Absolute piezoresistive pressure transmitter Type 4260A
	Relative piezoresistive pressure transmitter Type 4262A
	Differential piezoresistive pressure transmitters Type 4264A



## Kistler services: increasing success you can measure

**Good service is the cornerstone of daily interactions with customers. But at Kistler, we believe that "good" is simply not good enough. And to prove the point, we make sure that our extensive service program is precisely tailored to your specific needs.**

Kistler services do not end when you purchase our sensors or electronic measuring equipment. We are happy to advise you on your measuring problem and help you select the right components. Our experienced service technicians offer on-site support to ensure that your new Kistler system is optimally integrated, connected and configured into your system. The benefit: after just a brief introduction, you can start work on your measurement task immediately.

### **Calibration with continuous documentation**

Thanks to our calibration service, you can rest assured that your Kistler sensors and systems will remain fully functional throughout their service lifetime – the basis for precise and reliable measurement results. Each calibration is documented, without exception. On request, our measurement technology experts can also perform the calibration directly at your location. Our calibration laboratories in China, the U.S., Japan and Germany can also perform fast and efficient on-site recalibrations.

### **Custom solutions**

As a system provider, Kistler supplies you with complete solutions that optimally meet your measurement needs. Our specialists are happy to design a new, tailor-made solution together with you – for even better performance in your field of application.

### **Kistler services**

- Guidance on how to define your measurement task and select the components
- Startup
- Device calibration
- Repair
- Training
- Customized solutions



## At our customers' service across the globe

Thanks to Kistler's global sales and service network, we are always close to our customers. Some 2 000 employees at 61 locations are dedicated to the development of new measurement solutions, and they offer customized on-site support for individual applications.



**KISTLER**  
measure. analyze. innovate.

Take the lead – right from the start

**Biomechanics**  
Force measurement solutions for motion analysis, sports performance diagnostics, rehabilitation and ergonomics

Safe braking thanks to efficient maintenance

**Brake force measurement in the rail transport sector**  
Sensors and accessories for precise brake force testing

Flexible to create and easy to integrate

**Weigh In Motion**  
Measuring equipment for a wide variety of traffic data collection, enforcement and toll collection applications

Measuring equipment for demanding T&M applications

**Test & Measurement**  
Sensors and signal conditioning hardware

Develop and operate gas turbines more efficiently

**Gas turbine monitoring**  
Measuring combustion dynamics to optimize turbocharging performance

Analyzing and commanding sophisticated machining processes

**Cutting force measurement**  
Precision measuring systems for machining

Find out more about our applications:  
[www.kistler.com/applications](http://www.kistler.com/applications)

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