MÜLLER-BBM
VibroAkustik Systeme

PAK

POWERFUL SOLUTIONS FOR NOISE AND VIBRATION ENGINEERING IN AEROSPACE, AVIATION AND DEFENSE

MEASURE. ANALYZE. ASSESS. MANAGE.

ABOUT US

Müller-BBM VibroAkustik Systeme is part of the Müller-BBM group, an engineering company based near Munich, Germany, founded more than 50 years ago. The Müller-BBM group is an international company providing consulting services and sophisticated technical products, systems, and software at the highest level.

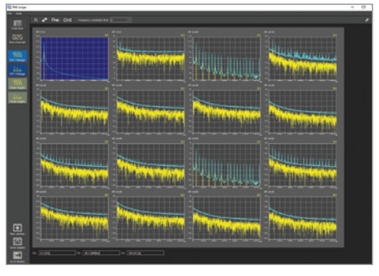
Passionate about innovation and technology leadership, Müller-BBM VibroAkustik Systeme is continuously striving for excellence in acoustics and vibration. Our tight partnership with industrial leaders as well as our recognized expertise in vibroacoustics is fundamental for our technical innovations and establishes us as a strong partner for future-oriented testing solutions and turnkey integration in customers' workflow processes around the world.

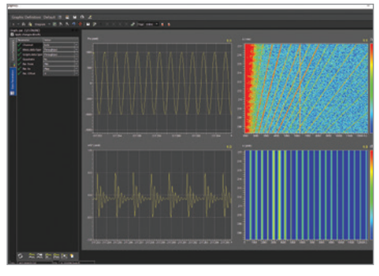
We pride ourselves on offering first-class measurement and analyzing tools in the fields of acoustics, vibration and strength. With PAK, our vibration and acoustics measurement system platform, users combine appropriately configured hardware and software (on a computer or a smart device) for their specific **data acquisition** needs.

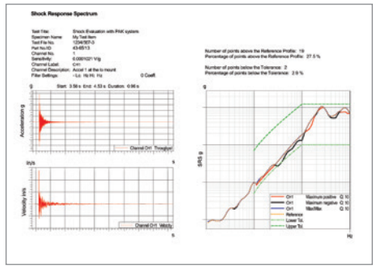
In doing so, users benefit from always being ready to measure as well as direct graphical representation of the measurement data. **Data analysis**, assessment, and modification tasks are completed in a clear and explicit way, during or after the measurement. **Data management** uses the latest cloud technology, allowing worldwide access to a corporate data network.

Selected tools:

Noise and Vibration	Acoustics	Rotational Analysis	Structural Analysis
• Multi-channel Data Acquisition & Analysis • Digital Data Recording • High Speed Shock Capture • Transient Capture • Random, Sine and Shock Data Reduction • Acoustic Control • Monitoring / Limiting	• Reverberation Measurement • Sound Intensity • Sound Power • Octave Analysis • Sound Localization • Exterior Noise	• Order Analysis • Online Monitoring • Kalman Filtering • Torsional Vibration • Angle-based Analysis	• Impact Measurement • Shaker Measurement • MIMO, SIMO • Operational Deflection Shape Analysis • TPA, TPS, CTC, PCA • Matrix Inversion • Modal Analysis







Our System in Action

The most efficient processes today are those that move with speed and agility. Müller-BBM VibroAkustik Systeme and its comprehensive **PAK system** platform is an established and reliable noise and vibration engineering testing partner that accelerates industry processes for:

- Aerospace
- Aviation
- Defense

One Solution

Whether it is a **mobile** system for field use or synchronized larger system in the **lab**, we always have the appropriate solution for your needs. Our modular system, comprising of measurement hardware and analysis tools, offers you the opportunity to grow along with the changing requirements organizations regularly encounter.

System Versatility

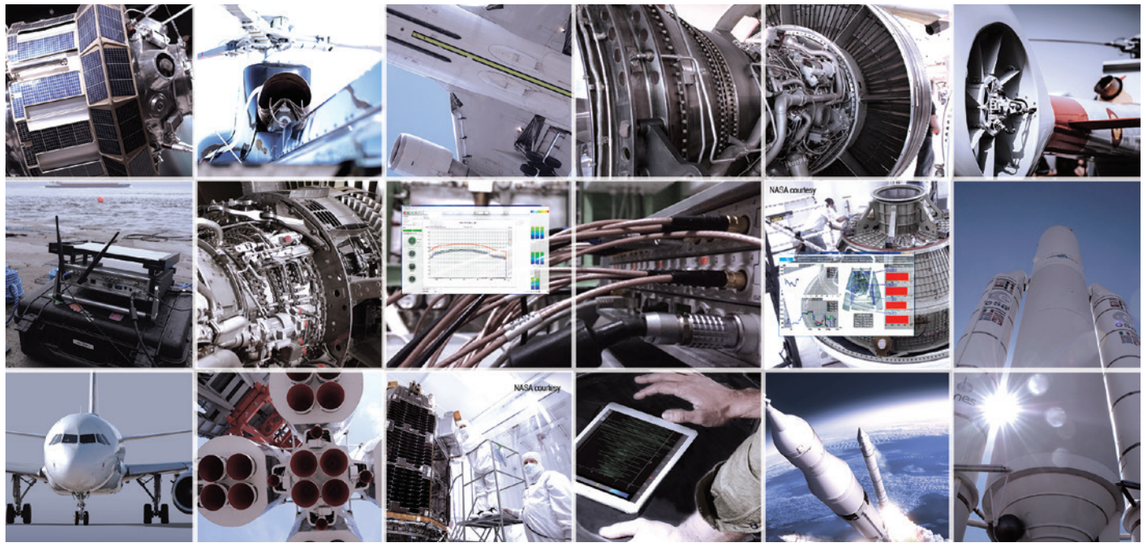
All common sensor types for the measurement of **acceleration, strain, airborne noise, and structure-borne noise** as well as the **precise recording of rotation** are supported. Due to the dynamic nature of these parameters, it is essential that analog, digital bus and timing data (such as **IRIG, GPS, IEEE 1588 v2,** and **fiber optics**) are sampled at exactly the same time to ensure accurate representation of the environmental conditions.

Boasting extremely **powerful graphics**, PAK is a performant tool to help keep track of dynamic quantities in every situation. In order to perform efficient mobile measurements, important data is always clearly displayed online. Our **PAK live** technology assists users with real-time data and even enables them to undertake the measurement without any additional computer software. For extensive measurements in the lab, PAK offers standardized processes that guarantee solid and sustainable achievement of measurement and validation tasks.

Long-Term Data Security

Regardless of the application, our emphasis is on a true open model. PAK measurements stored since 1995 can still be read and analyzed by the latest PAK version. This openness is complemented with the open data standard ASAM ODS. The data generated with PAK can be stored automatically in **ASAM ODS ATF/XML** format.

We are continuously striving for further standardization of data and process management as ASAM organization member and as well as driver member in the **openMDM®** association. Our customers appreciate and benefit from long-term data availability.



AEROSPACE

Design and production of high-tech structures including spacecraft, satellite, subsystems, and launch vehicle require serious testing to meet environmental challenges, weight requirements and flight launch specifications. Vibration and acoustic development, qualification and acceptance tests are not only beneficial for the reliability of flight hardware, but often approving quality assurance requirement for all aerospace systems.

Aerospace engineers need to deliver components that are safe, reliable and economical in operation. This directly effects performance and certification. To identify potential functional benefits and to achieve future optimization in design, structural analysis is a key factor for the development process. Our capabilities include:

- Structural Analysis
- Multi-Channel, High-Speed Dynamic Data Acquisition and Analysis

Müller-BBM VibroAkustik Systeme continuously supports your ongoing scopes of engineering tasks such as:

- Spacecraft and Satellite Dynamics
- Launch Vehicle Dynamics
- Deployment of Solar Arrays and Antennas
- Online Monitoring of Propulsion and Maneuvering Systems

With our comprehensive dynamic data acquisition, analysis and management tools, we accelerate your development, implementation and integration of new technology while reducing time and costs when improving performance characteristics, achieving structural margins, or managing changing structures.

AVIATION I JET ENGINES

Manufacturers of commercial and military aircraft face many challenges such as extreme environmental conditions, punishing structural loads, and discomforting noise emissions. They are concerned with machinery vibration or the noise and vibration created by rotating equipment. Major goals are set in reducing noise and vibration as well as performance and reliability of their product.

One of PAK's defining qualities is its versatility. General aviation testing applications cover:

- Transfer Path Analysis, Structural Dynamics
- Wind Tunnel Testing
- Sound Localization
- Cabin Noise Measurements and Sound Quality Evaluations

Our partners in the jet engine industry strongly rely on PAK's superior capability to deal with complex rotating machinery. Analysis of data can be performed in time, frequency, or angular domain. A number of high-speed multi-channel systems with 1,000's of measurement inputs and data rates of more than 500 Mbyte/s are in operation worldwide.

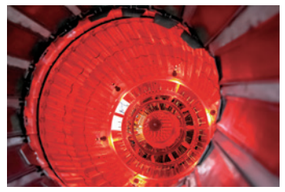
Jet engine development and maintenance benefits from standardized applications such as:

- Dynamic Data Acquisition and Limit Monitoring during Testing
- Performance and Durability Testing during Flight Cycle Simulation
- Gearbox Testing
- Nodal Diameter Evaluation
- Resonance Control and Monitoring
- Ingestion / Impact Testing, Operational Deflection Shape Analysis
- Acoustic Emission and Radiation Pattern Determination
- Visualization of Acoustic Modes

Nowadays, special attention is paid to the architecture of the engine reliability and redundancy as well as to maximized performance at take-off, ultra-lightweight structures, and reduced fuel consumption, with emphasis on flight safety and regulation fulfilment. Müller-BBM VibroAkustik Systeme assists the aviation industry to cope with this growing complexity in aircraft development processes.

PAK is an application that is scalable, robust and secure – allowing for quick configuration, setup and control / monitoring of measured channels, and making the workflow of noise and vibration testing faster and easier than ever before. Its intuitive, application-specific user interface is easy to navigate.

All capabilities to guarantee test object safety, minimize test item fatigue and secure reliable data are inherent to the system. From power-up, PAK is automatically ready to measure and record. Input data is clearly visualized through smart devices or personal computers. In-situ calibration can be performed effortless by one person.



DEFENSE

Experimental testing and analysis is highly important for the defense industry and governing bodies due to the high stakes involved and the need of resistance to extreme stresses and/or conditions. Commercial and governmental contractors need to transport and store sensitive materials, complex electronics needs to function, troops need to communicate, and vehicles need to perform reliably. Such requirements make noise and vibration testing an absolute must.

Government defense contractors, the military as well as test service providers frequently perform vibration and acoustic testing to assess survivability of electronics, systems, munitions, and entire vehicles. Vibration qualification and development tests are not only beneficial for the reliability of products, but often a requirement for government programs worldwide.

Engineers at leading companies partner with Müller-BBM VibroAkustik Systeme to test, analyze, and reproduce dynamic conditions of these sensitive test items. In delivering industry-leading software and system solutions, we help partners to address reliability, longevity, performance, and efficiency best by:

- Efficient Data Acquisition and Processing
- Redundant Data Storage
- Sustainable Data Management

Our solutions seamlessly integrate in lab or field environments with capabilities that include:

- Multi-Channel Dynamic Data Acquisition and Analysis
- Data Reduction (Random, Sine, Shock, and Acoustics)
- High-Speed Shock Acquisition
- Acoustic Simulation
- Portable and Ruggedized Data Recorders

Executing safe and efficient test operation with innovative technologies ensures not only technical and functional excellence for systems or components, but also sets the path to accomplish challenging time to market and cost of production demands. Measurement performance and quality during all testing operations will make that decisive difference.

The inherent capabilities of PAK deliver high customer value. Technically significant to engineers are: High channel density, advanced signal conditioning and mixed sampling addressing a wide range of sensors and quantities, acquisition rates of up to 1 MHz/s and 24-bit resolution, superior synchronization, standalone operation with redundant data storage as well as powerful graphics, automated reporting, broad analysis portfolio, efficient workflows, and solid data management.

NEXT GENERATION

Testing and Engineering

Development and validation processes and engineering tools have undergone a massive transformation in the last decade. Test and validation programs need to respond to the challenges of the present and prepare for the future. Müller-BBM VibroAkustik Systeme's next-generation of testing and engineering solutions elevates the efficiency in testing environments to an unprecedented level.

An Integrated Solution

Our portfolio of components-off-the-shelf (COTS) solutions ranges from a scalable dynamic data acquisition hardware platform to versatile analysis applications and measurement data management components.

Integration is equally possible into existing environments as well as through standalone operation with a subset of components. All components are combinable into either a single solution or distributed over the network for demanding lab environments.

The **PAK family** manages the complete test cycle which can be split into four distinctive subsets of tasks: test preparation and measurement assignment (test definition), execution, analysis and storage / archiving. Through the separation of measurement assignment, data acquisition and data analysis, customers benefit from an open system solution allowing for efficient open-loop-testing.

Valuable Architecture

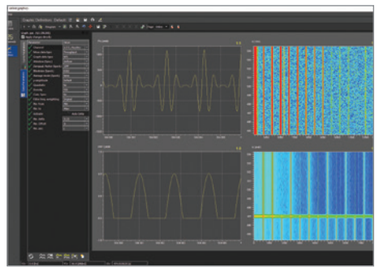
From inception, the streaming of data is one of our core competencies. We have enhanced the technology to an advanced level with embedded standalone components.

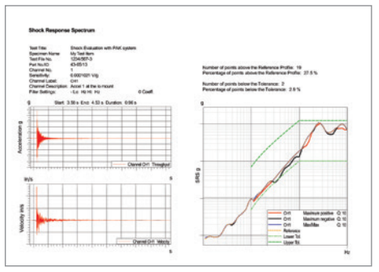
With our **PAK live** technology, measurement devices, such as our **PAK MKII frontend** and **QuantusSeries systems** stream live data continuously and store the data locally and/or via the given IT infrastructure.

All live data is provided to applications via the **PAK device cloud** data server. Real-time applications such as **PAK scope, PAK recording, PAK virtual channels, PAK monitoring** with limiting and **PAK online graphics** access live data streams in parallel, both locally and remotely. The system performance is efficiently increased by multiple instances of any application.

Retrieval of previously recorded data as well as further offline processing can be performed through **PAK cloud**, our on-demand service for data management. All data is exclusively accessible and secured within your IT environment.

From smaller setups, requiring the service to act as a lean search-and-access-the-data local application, to a landscape solution covering the needs for distributed computing over different locations and different sets of data repositories, **PAK cloud** services comfortably scale with customer's environment and adapt to individual requirements. Optional services are available for automated test assignment and configuration, post-test data processing and quantity database turn our solution into a valuable asset for every lab, test bench, mobile and field applications.





BOOST YOUR WORKFLOW WITH A COMPREHENSIVE APPROACH FROM TEST PREPARATION TO DATA MANAGEMENT

CONTACT US NOW.

ASAM MEMBER openMDM

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About Us

Müller-BBM VibroAkustik Systeme provides test solutions for the Aerospace, Aviation and Defense industries in the areas of high speed data acquisition and shock, structural dynamics, fatigue analysis and turbine testing.

We are leading in vibroacoustic measurement technology focused on the interpretation of dynamic and static parameters for the experimental test market. Our tight partnership with the industry and acknowledged expertise in acoustics and vibration results in innovative solutions that seamlessly integrate into laboratory, production and field environments.

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