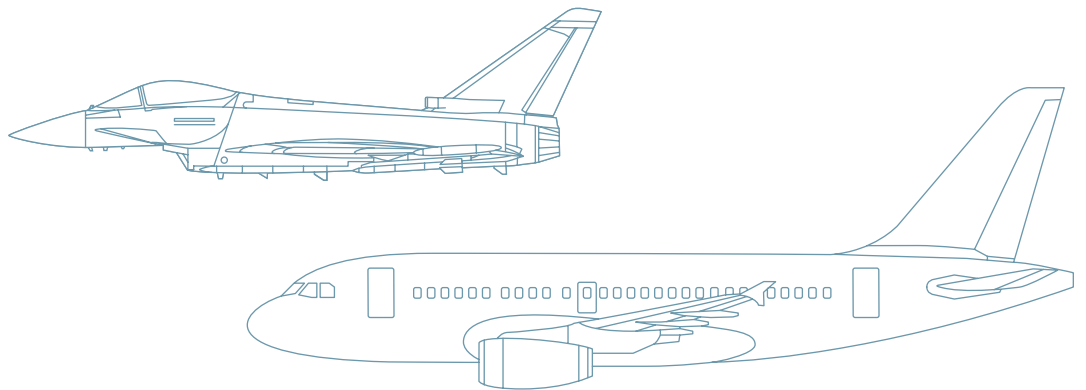


Engine testing



Our competences



MTU Aero Engines is Germany's leading manufacturer of aircraft engine modules and components. MTU also assembles entire aircraft engines. Having been involved in major engine programs for decades, MTU designs, develops and supports commercial and military engines as well as industrial gas turbines. Through alliances with the world's largest engine makers, MTU is present in all essential engine markets.

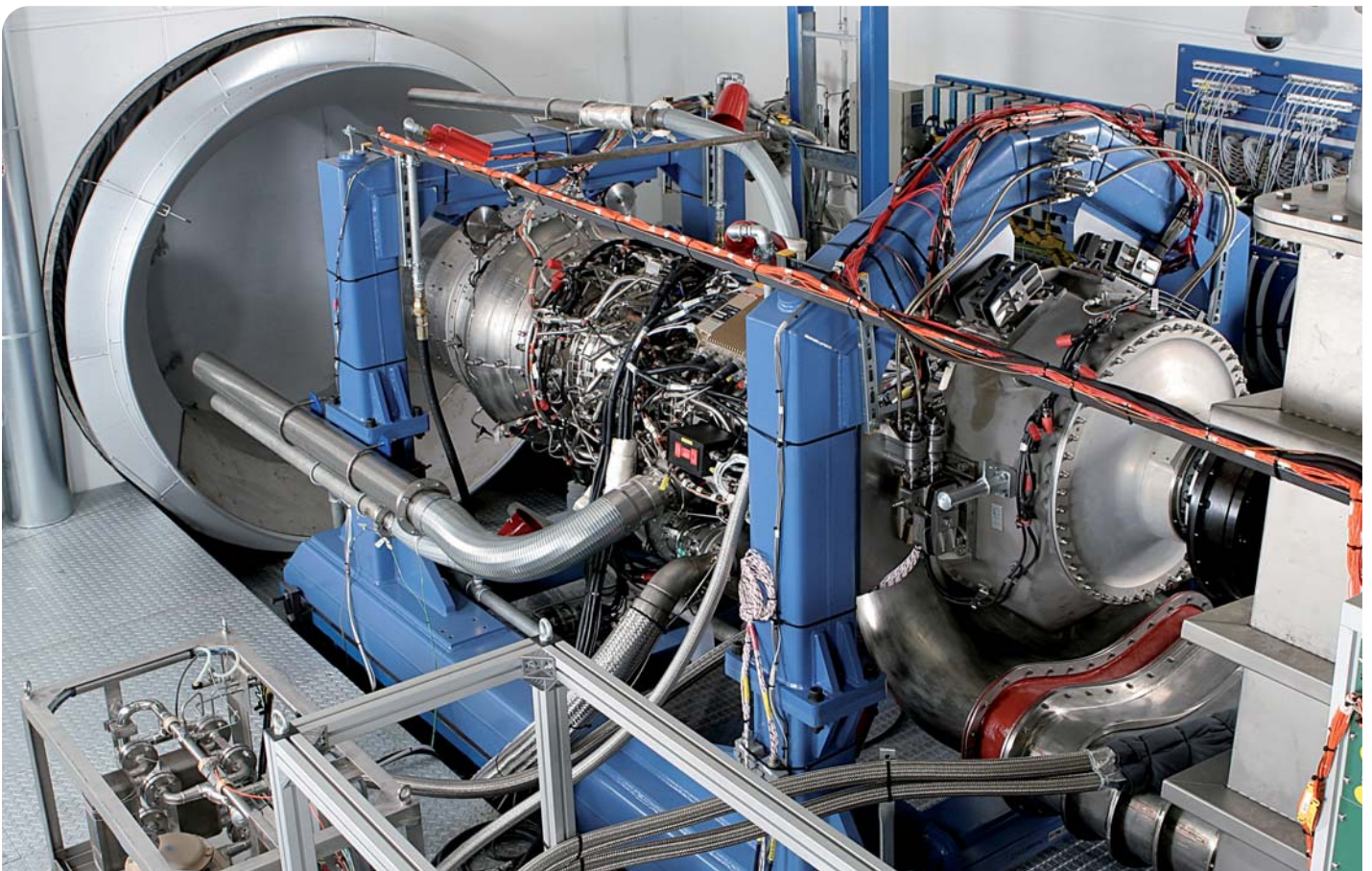
MTU has a wide range of experience in development testing of engines along with the planning, assembly and validation for final airworthiness certification.

Highly professional staff and the wide range of experience gathered over many years ensure dedicated customer solutions and customer satisfaction.

The entire process can be offered as a comprehensive package or alternatively, specific areas of concern to the customer can be addressed, including:

- Validation management
- Hardware planning and provision
- Assembly
- Bench test sea level
- Bench test altitude test facility
- Flight test support
- Evaluation and validation

MTU Aero Engines—demanding requirements need highest technology and maximum flexibility for optimum solutions—anytime and anywhere.



TP400-D6 on test bed in Ludwigsfelde

Engine bench test



The four different Munich engine test facilities for development tests enable 24 hour operation of all types and sizes of turbo engines –three test cells for jet and fan engines up to 400 kN thrust, with and without afterburner, plus one test cell for turboshaft engines up to 3 MW shaft power. Additionally MTU intensively uses the Stuttgart located altitude test facility for engines up to 140 kN with possible reheat operation and the Ludwigsfelde located test facility for the high power prop engines up to 15 MW shaft power. MTU runs heavy instrumented development test engines as well as light instrumented endurance test engines.

Proven skills and capabilities cover the complete spectrum of engine validation and certification testing, including operability, control system, and telemetry tests plus testing of vibration signatures, dynamic behavior and emissions.

Hot day conditions with high ambient temperatures can optionally be achieved via test cell integrated heating. The well experienced staff at MTU is able to perform bird strike, sand, hail, ice and water ingestion tests as well as corrosion tests.

Extensive know-how has been built up over many years on a large number of different engine types. A recent example of innovative and successful work performed by the center is the missile firing simulation capability for on

ground simulated rocket plume ingestion which obviates the need for multiple expensive in-flight firings during development.

All test facilities are fitted with the most recent data acquisition systems guaranteeing best data quality, together with the capability to record up to 2,000 different parameters. MTU's most recent data acquisition system has been designed to meet the growing requirements of development test cells. It can record, display and process data for all engine parameters at a real time sampling rate of 200 Hz and enable selected parameters to be acquired at a sampling rate of up to 5,000 Hz.

A variety of measurement techniques including tip timing, tip clearance, infrared and high speed video allows special surveys by using the latest in digital measurement system technology.

The non-linear performance model developed by MTU enables the test crew to continuously monitor engine condition and the health and safety parameters during engine operation.



Program-planning, verification and validation

Following on from the conceptual engine design stage comes the validation process. Material and hardware planning, purchasing, specific test hardware and module allocation planning required for verification of the test program are other key activities performed. The validation program covers rig/component tests and full engine tests (bench and flight) with analytical and mechanical evaluation of the test results. The validation and certification tests demonstrate compliance with the specification and flight safety regulations. They are ultimately the basis for customer approval.

At the end of the successful validation program an input for the release of the system or component with type-certificate will be given for either commercial or military engine application from the appropriate authority.

All activity at MTU is ISO 9000-certified.



Flight test

The flight test team takes responsibility for engine integration and flight test. The personnel prepare, monitor and evaluate engine flight tests to achieve validation and certification.

The complete carefree package comprises all engine related tasks together with the appropriate servicing and maintenance aspects and includes the required quality management provisions for flight engines. Usually the flight test team performs as a fully integrated support team at the customer's flight test center. Experience on military as well as on commercial engines is available.

Quality

MTU's product quality is based on the professional work of its highly skilled staff rather than relying on frequent checks and retrospective corrective actions.





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