



P a r a m o u r d u c i e l





Techspace Aero has been awarded both the Walloon Grand Prix for Export and the Grand Prix of the Belgian Export Trade Office.

# Excellence for the benefit of customers

We, the men and women of Techspace Aero, commit ourselves to excellence :

“Strong in our belief that each individual contributes to the progress of our company, we emphasize Communication, Sharing of Information, Team Work and the Right to Take Initiatives.”

“Our priority is the satisfaction of our customers through : competitive and quality products; meeting commitments; faithful relations based upon our loyal behavior.”

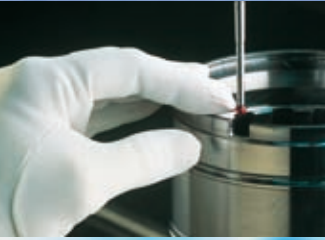
“We adapt ourselves to the evolution of technology through continuous training, investments, research and development.”

“The continuity of our activities is guaranteed by our willingness to progress.”

“Together.”

① Techspace Aero associates the abilities of its highly skilled personnel with modern equipment and cutting-edge technologies.

② The company personnel is proud to demonstrate their commitment to Techspace Aero customers.





Techspace Aero was the first Belgian Aerospace company to obtain the ISO9001 certification for its complete range of activities.

# World recognition for its expertise

Techspace Aero is the only Belgian aircraft engine manufacturer and one of nine in Europe. With total annual sales in excess of MEur 260, the company employs a highly skilled workforce of 1,250 employees in its modern facilities located at Herstal (Liège), at the crossroads of Europe.

As a partner in major aerospace programs, responsible for complete systems or subsystems, Techspace Aero shares the risks with the world leading engine manufacturers.

The company is backed by the power of its three shareholders, Snecma, the Walloon Region of Belgium and Pratt & Whitney.

Techspace Aero markets, designs, develops, qualifies, produces and maintains its own products.

Techspace Aero has developed three major strategic lines of products : in aircraft propulsion, low pressure compressors, bearing compartments and various major components for jet engines ; equipment for aircraft lubrication systems and spacecraft propulsion systems or related subsystems ; aircraft engine maintenance, repair and testing services. Techspace Aero also develops and provides turbojet engine test facility engineering (turn-key tailored made projects) to Airline and Air Force customers.

Production processes are approved by original manufacturers and Techspace Aero is certified to the highest quality standards delivered by international and military authorities : ISO 9001, JAR-145, FAR-145, AQAP-1110 (US equivalent MIL-Q-9858A) and AS9000 for the whole range of its activities.

❶ Techspace Aero's plant in Herstal, North of Liège, Belgium.

Covered area :

63.000 m<sup>2</sup>.

Workshops : 45.000 m<sup>2</sup>.

Workforce : 1250 employees.

❷ Transport aircraft engine installed in a Techspace Aero test cell.





Techspace Aero has contributed to the Ariane 5 Vulcain engine design in the development of a functional model of the complete propulsion system. A new model has been developed for the latest Vulcain 2.

# Engineering, RT&D capabilities

Techspace Aero's Engineering Group includes some 160 highly skilled technicians, with 50% being graduate Engineers and Doctors of Science. It co-operates with a network of regional, national and international Universities, Laboratories and Research Centers. Techspace Aero is involved in the major European Research and Development programs in Aircraft and Space propulsion.

The engineering department operates under a modern concurrent engineering organization ; for example, the project and product engineers, located inside the production shops, are part of integrated teams. Project engineering is strictly conducted under a company specific project management system and cooperation at shop level extends to Kaizen teams, Manufacturing Process Action groups, etc.

The engineering organization includes a Knowledge Management team, a Design Quality Assurance service, a norms and documentation management office, a highly experienced functional modeling department, a specific office for materials and a trained risk management cell.

Technical services also include design, development of testing and production technologies providing a unique expertise in machining, inspection, assembly and a variety of manufacturing processes such as welding, milling, broaching, grinding, non destructive testing and other special processes.

Techspace Aero's expertise covers tribology, cryogenics, mechanical CAD/CAM design, finite element modeling, computing cell data acquisition systems, functional modeling for turbojet engines or space propulsion applications, and product support.

The Techspace Aero engineering organization, quality and expertise have widely contributed to ISO9001 and AS9000 qualifications.

Throughout its experience stored in a data base, Techspace Aero has significantly reduced the lead time between a Request For Proposal and the proposal delivery.

1 Lubrication units were the first pieces of equipment fully designed and developed by Techspace Aero for aircraft engines.

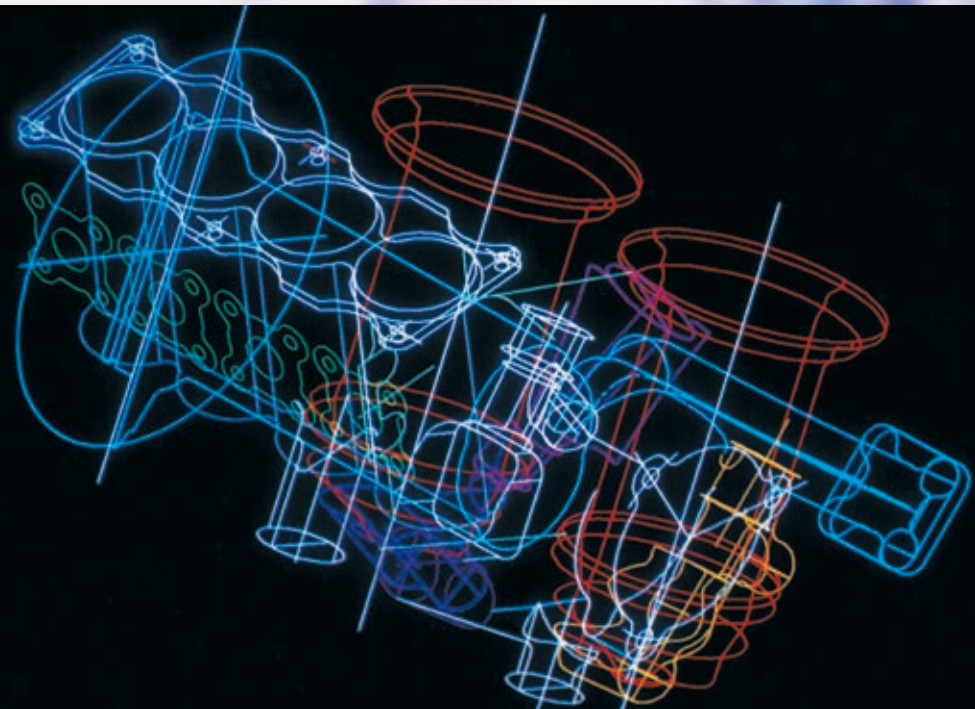
2 Stress analysis pattern of a jet engine Bearing Housing.

3 Turbo-engine Low Pressure Compressor design.

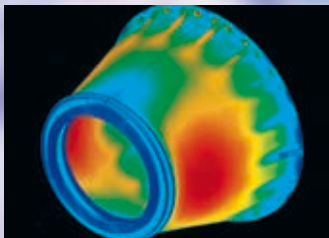
4 Techspace Aero designed and installed a specific development test bench for bearing compartments of turbojet engines.



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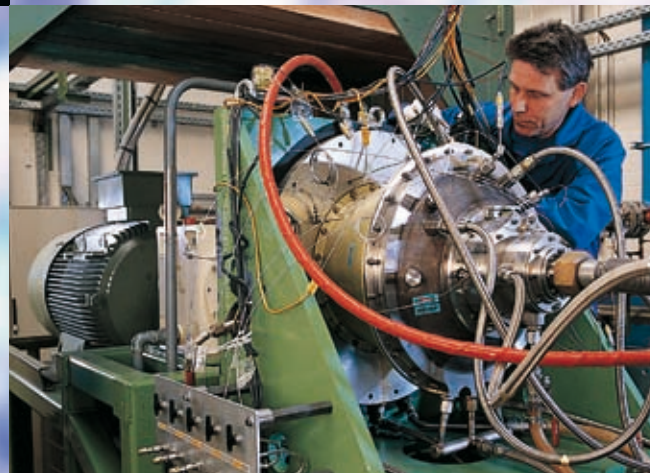
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Assembly of the bearing compartment module for the CFM56 engine.

## Aircraft Propulsion : major systems

Through international ventures, Techspace Aero has positioned itself as a partner to aircraft engine OEMs (Original Equipment Manufacturers) in undertaking the development of complete systems such as Low Pressure compressors and bearing compartments.

Accustomed to the different operation methods of our partners, we focus our efforts in optimizing the mechanical design of key elements such as disks, stators, cases, shafts, carbon seals, deaerators, turbine vanes & blades, abradable materials, ...

We are an integral part of the team from the early design process beginning with a close interaction with our customer in order to optimize its specifications.

Then, we undertake the total design study, including technology, calculation, material, reliability, drawings, CAD models, as well as manufacturing activities and customer support.

As a result of assuming those tasks, we allow our partners to concentrate on key features, such as overall engine performance. This combined effort satisfies the need for the highest quality product as well as the necessary sharing of the tasks for modern engine development.

This specialization requires high investment in Research, Development and human resources.

Our commitment resulted in several innovations improving bearing lubrication, vibration dampening, Low Pressure Compressor vane fixing and bearing housings scaling.

Techspace Aero Low Pressure systems, compressors and major components, equip 50% of the commercial transport aircraft engines delivered in the last ten years.

1 Bearing Compartments and their lubrication in aircraft jet engines are one of the main specialties of Techspace Aero.

2 CFM56-5 Fan Disk.

3 Techspace Aero designs and produces Low Pressure engine components & systems and assembles complete modules (example CFM56). This view depicts Fan disk & LPC spool assembly, stator vanes, front bearing compartment, ...

4 Abradable material by coating Plasma Spray on a stator vane assembly.

5 Stress analysis pattern of a compressor blade.

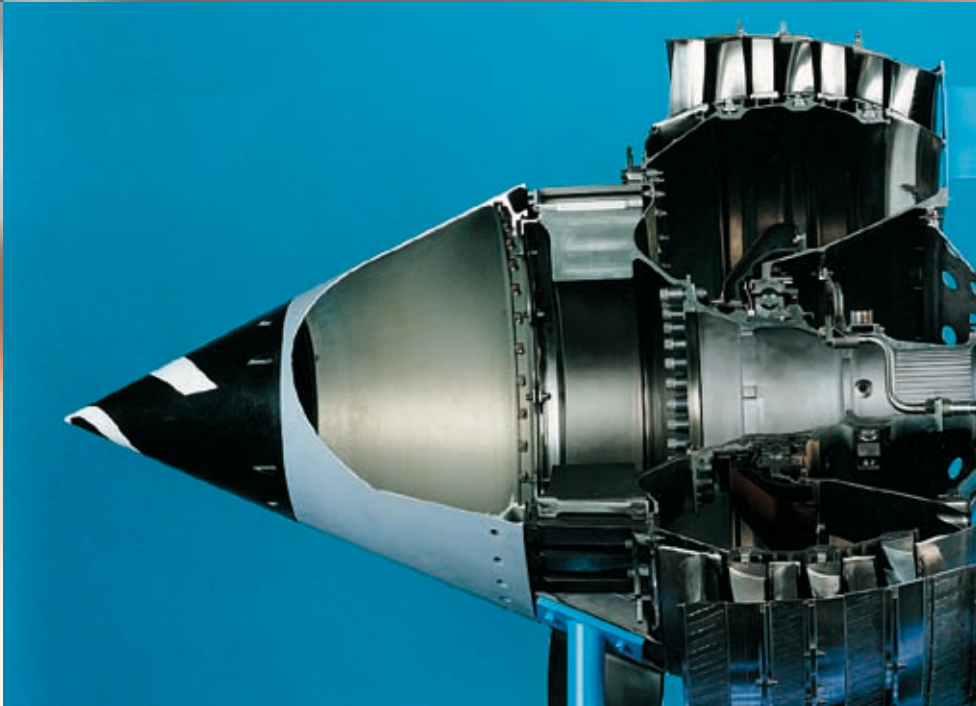
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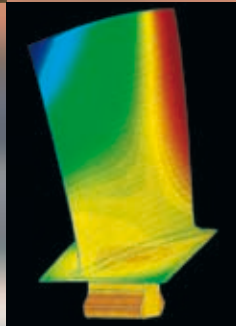
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Techspace Aero designs major components and develops computer models for those parts such as this jet engine thrust reverser system.

## Aircraft propulsion : high added value components

In 1949, Techspace Aero entered the aircraft engine business in the area of component manufacturing. Since then, the company participated in a large number of successful programs such as the Derwent, Avon, J79, Tyne, Atar, Larzac, F100, F110, JT8D, JT9D, CFM56 and PW4000 engine series.

The company has developed an advanced expertise in manufacturing high added value engine components. This includes capabilities in a wide range of machining, non destructive inspection, welding processes, heat and surface treatment lines. These processes call for modern manufacturing methods : just in time production system, Kaizen events, Process Certification and TPM.

This expertise is recognized throughout the world by the OEMs and Techspace Aero has been qualified by General Electric, Pratt & Whitney, Rolls Royce, Snecma and many Air Forces for which we manufacture production and spare parts.

Including more than 300 CNC machine-tools, workshops are divided into product lines combining machining and special processes.

The major part of its current activity includes the production of compressor and turbine casings, stator vane assemblies, compressor and turbine disks, bearing supports, turbine blades, gas duct segments and high pressure vane sectors.

① Large casings production line.

② F100-PW HP turbine air-seal & separator.

③ 360' broaching machine for Fan and Turbine disks.

④ PW4000 HP compressor case under dimensional inspection.

⑤ F110-GE HP turbine disk.





The Gerotor design of the pump components is a main feature of the Techspace Aero's integrated lubrication units.

## Equipment : world leader in lubrication

Techspace Aero is the leader worldwide for turbojet engine lubrication systems. Its share in the aircraft market of 100 seats or more, in terms of deliveries, remained as high as 55 % over the last decade.

As an original manufacturer, Techspace Aero designs, develops, manufactures, assembles, tests and maintains these pieces of equipment.

Techspace Aero primary success was to generate trust and confidence among those engine leaders who, 30 years ago, foresaw the need for highly reliable engines in the commercial transport aircraft market.

In return, our partners are provided with the most reliable products the market can offer. Figures speak for themselves : the current MTBF's (Mean Time Between Failure) exceeds 3 million flight hours and products have been running 35 to 40 million hours without a major event.

Joint advanced modeling techniques and Techspace Aero engineering expertise allow for simulating, from the early design stage, the behavior of our systems in normal and extreme conditions as well as the impact of improvement brought about by the use of augmented lift seals, thus enhancing safety while reducing development planning and costs.

Through intensive Research and Development, Techspace Aero develops state-of-the-art lubrication units based on the end-user equipment requirements.

An integrated unit contributes to overall engine weight optimization and provides for easy maintenance.

1 Oil tank design of the CFM56-7 (B737-600/700/800).

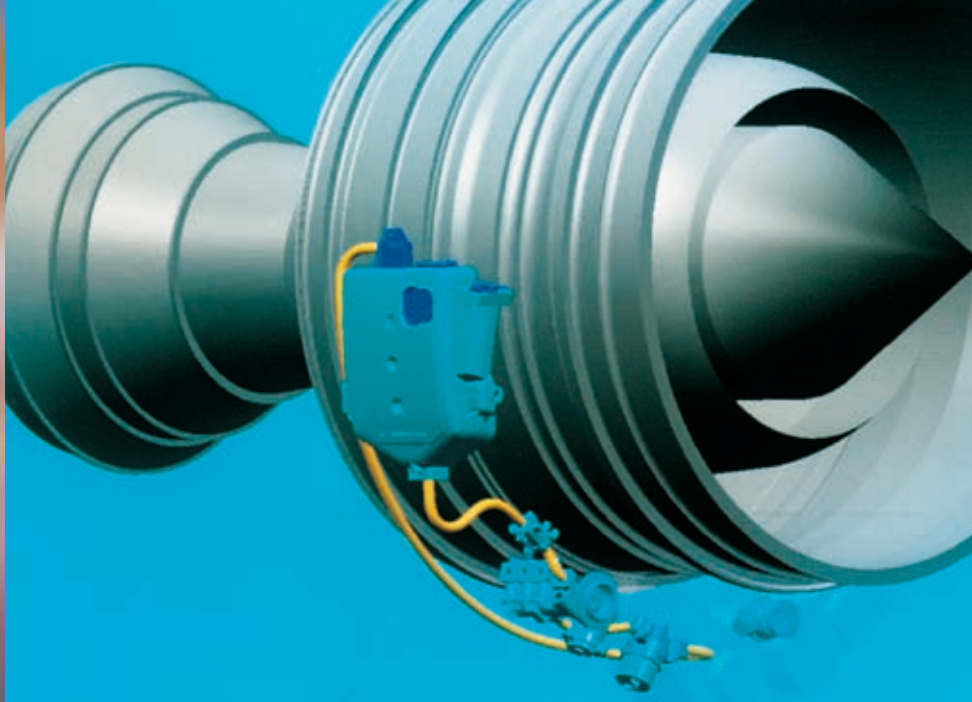
2 Typical lay-out of a jet engine lubrication system.

3 Techspace Aero's lubrication units equip more than 50 % of the commercial transport aircraft engines delivered over the last ten years. Every 3 seconds, somewhere in the world, an aircraft takes off with Techspace Aero's equipment. This single light unit integrates all functions of supply, scavenge, filtration, pollution detection and clogging indication.

4 CAD development of the hydraulic tank for fluid actuators of the Airbus A330/A340 aircraft.

5 GE90 engine anti-leak valve.

6 V2500 engine lubrication scavenge valve.





Testing leakage in the Vulcain engine Chamber Valve under cryogenic temperatures.

## Equipment : European leader in space valves

Techspace Aero participated in the European space ventures from their inception. Since 1974, Techspace Aero has been taking part in the Ariane programs, specifically in engineering, development and production of equipment for Auxiliary Liquid Boosters (PAL), and in the production of three main Valves and Control Units for the Viking 4 and 5 engines. Techspace Aero delivers its equipment to Aerospatiale, DaimlerChrysler Aerospace and Snecma space propulsion division.

On the Ariane 5, Techspace Aero is the engineering authority responsible for the design, development, qualification and production of most Cryogenic and Hot Gases Valves for the VULCAIN and VINCI engines.

On the main Cryogenic Stage of Ariane 5, Techspace Aero develops, qualifies and produces the Liquid Helium Tanking Valve and a Safety Poppet Valve for Air Liquide.

Many technologies developed at Techspace Aero for space activities are used today in aeronautical engineering : physical system modeling, reliability-availability-maintainability-safety concept (R.A.M.S), tribology, new materials, ...

Techspace Aero is the European leader in large liquid valves for space propulsion or related sub-systems, e.g. for rocket engine supply valves and control units.

Its engineering capabilities cover all space fluids and other industrial applications using cryogenic fluids.

Associated with the European propulsion engine prime contractors in the European Space Agency programs, Techspace Aero participates in programs to prepare the future, such as FESTIP, RECORD, GSTP, ...

① Liquid Helium Tanking Valve.

② Chamber Valve of the Vulcain engine.

③ Thermal chart of the new Vulcain 2 Hot Gases Valve.

④ Vulcain engine powering Ariane 5 launcher main stage.

⑤ FESTIP future space program.





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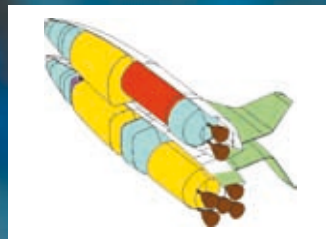
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Using the best hi-tech processes for manufacturing CFM56 “Booster Vanes”, Techspace Aero has developed specific repair capabilities for the stator vane assemblies.

## MRO Services : reactivity & reliability

Over the years, Techspace Aero has built a significant expertise in the maintenance and repair of complete engines, main modules as well as major components. Maintenance services to end user Customers worldwide, for both military and commercial engines, represent approximately 25% of the company's total activity.

To meet Customers' requirements, Techspace Aero offers world-class services that cover all aspects of engine maintenance :

- Overhaul, Repair and Test,
- On Condition Maintenance (OCM)
- Configuration and spare parts management,
- Product logistics,
- Technical surveys and logistic management advice.

To date, more than 7,000 engines or main modules have been processed by Techspace Aero maintenance shops, that integrate full in-house capability for the most advanced techniques : Eddy Current, Holography & Shearography, Water Jet, Electron Beam Welding, Plasma Spray, .

Techspace Aero integrates on one site all the life time stages of components, especially for commercial aircraft engines : design, development, manufacturing, repair engineering, repair work, control and testing.

Therefore, Techspace Aero offers the most appropriate and cost effective repairs, using the latest technologies for the repaired component highest reliability.

These services are proposed to air forces, airlines and repair centers worldwide at competitive prices and lead times.

Techspace Aero is qualified AQAP-110, ISO 9001, FAR-145 & JAR-145.

① Jet engine annular combustion chamber.  
Techspace Aero has developed improved thermal barriers for various high temperature resistant components.

② CFM56 engine inspection prior to an after-maintenance test.

③ F100-PW HP Core Modules being processed at Techspace Aero's maintenance shops.

④ Techspace Aero is certified by the US Air Force for the maintenance of F100-PW complete engines and all modules.





Turn-key test facility designed and installed by Techspace Aero at the Florennes Air Base. The Belgian Air Force operates F16 aircraft powered by F100-PW engines.

# Tailor made testing and test facilities

## A partner of choice

Techspace Aero has become a recognized partner for the most important engine manufacturers, in the field of engine test programs. Owned facilities has been developed over 50 years of experience.

The expertise acquired in the design of test cells has led Techspace Aero to create an unique unit dedicated to this field : the **Business Unit Test Cell Engineering**.

## From test cell design to in-service

Commercial and military turnkey installations provided to customers have proven our capacity to manage and perform full programs, as well as answering specific customer requests.

Environmental issues (acoustics, exhaust...) are one of our main concerns. Facilities are designed with safety, quality, comfort and functionality criterion for the end-users.

The Measurement, Control and Command system "MCC" is based on a distributed and modular network. Thus, this polyvalent and user-friendly architecture performs automation possibilities for production / maintenance test cells, as well as dealing with many measurements at high rates for development test cells.

Furthermore, standard hardware and software guarantees that the "MCC" remains at the cutting edge of technology and maintains a modern and user-friendly interface with the users.

## Upgrade of existing installations

The Business Unit Test Cell Engineering is also dynamic in the upgrades of existing test cell facilities.

Interventions are of all types, being backed-up by technical audits, acoustic studies, training...

## A team committed to its customers

A full innovative maintenance service is proposed to customers. To meet your needs in due time, the Business Unit has a complete team of specialized technicians and engineers.

These services can be completed on site or else at distance with our remote troubleshooting and maintenance system.

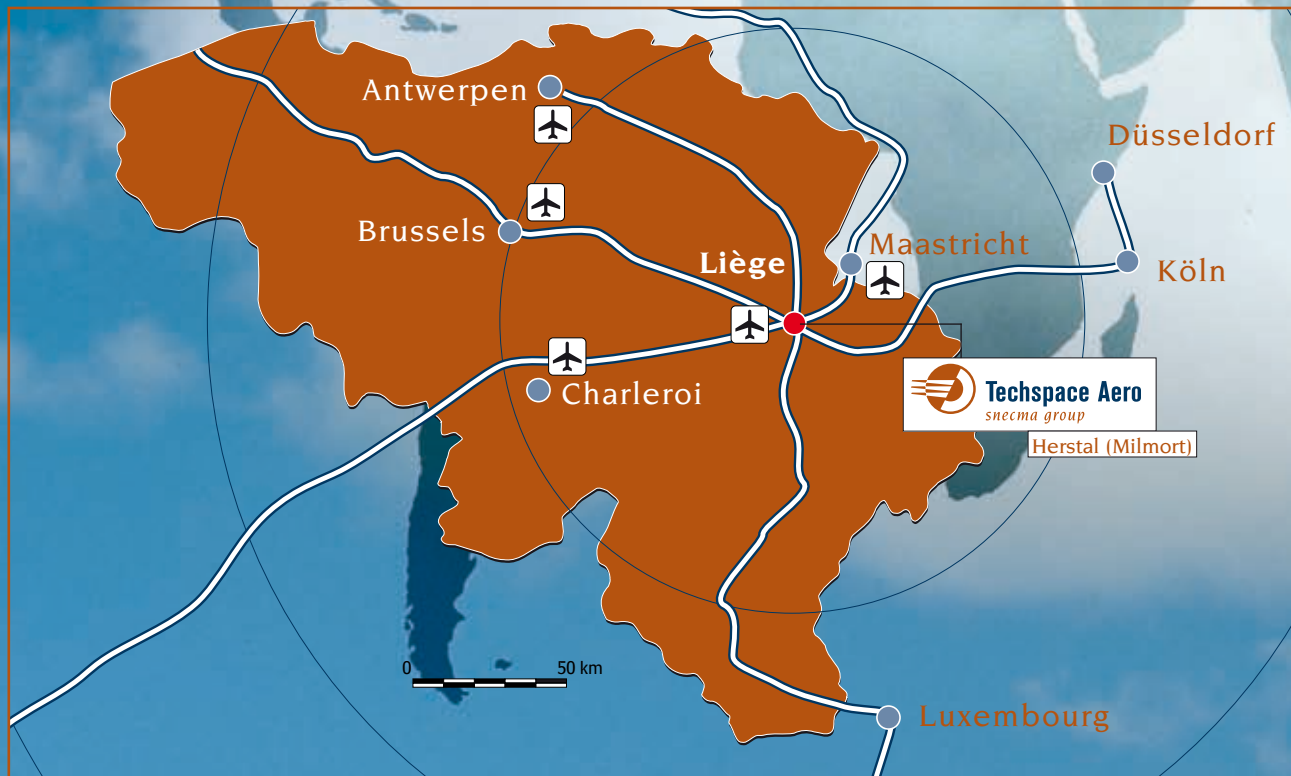
1 Techspace Aero easy-to-operate test control panel fully assisted by computer installed in a Snecma Services test facility, at Villaroche (France).

2 Grouped connections clamps allow very quick installation of the engine in the test cell.

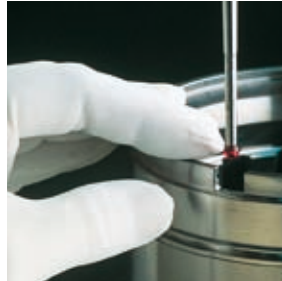
3 A CFM56-5B commercial engine ready for a test in Techspace Aero's facility.

4 The Hush House facility design allows testing without dismantling the engine from the aircraft cell.









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