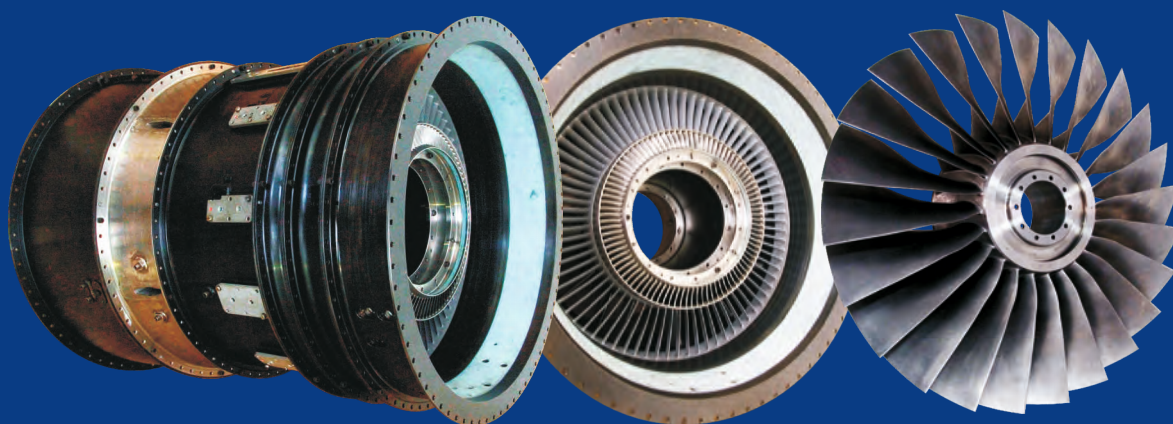




**COMOTI**  
ROMANIAN RESEARCH &  
DEVELOPMENT INSTITUTE FOR  
GAS TURBINES



**A E R O S P A C E**

**ENERGY &  
SAVING ENERGY**

**ENVIRONMENT**



The only specialized company that integrates  
such activities as

scientific research,  
design,  
manufacturing,  
testing,  
experimental activities,  
technologic transfer and  
innovation

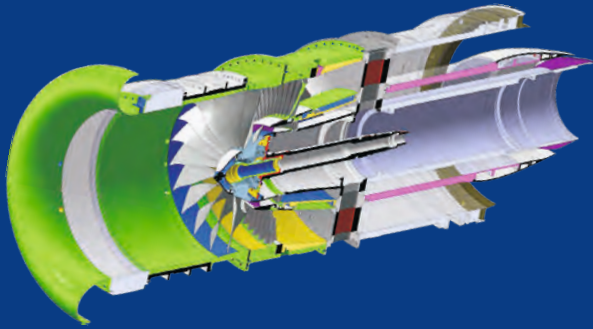
in the field of aircraft, space and industrial gas  
turbines and  
high speed bladed machinery.

# IMPORTANT MILESTONES

- 2016 Re-launch activity for the defense industry.
- 2015 MAN Diesel & Turbo Starting collaboration.
- 2014 1<sup>st</sup> Project Coordinated EC FP7 Aviation R&D Program - TIDE.  
GHH RAND – new 4 years License Agreement.
- 2013 EC FP7 1<sup>st</sup> Aviation R&D Program - OPENAIR.  
Manufacturing of FIRST COMPOSITE GUIDES VANE BLADE.
- 2012 ESA – 1<sup>st</sup> Space Project. HP Compressor – up to 45 bara.  
ARIANE V. EXPANDER GROUP Electric Generator.
- 2011 CLEAN SKY – 1<sup>st</sup> Project ELTESTSYS.  
Test Bench Drive System.
- 2009 New Test Bench for Gas Turbines.
- 2008 Screw Compressor Packages - 100 units delivered.
- 2003 EC FP6 1<sup>st</sup> Aviation R&D Program - VITAL.
- 2001 AVIATION RESTART.  
EC FP5 1<sup>st</sup> Aviation R&D Program - SILENCE(R).
- 2000 C0-Generation Plant in RO, Suplacu de Barcău – collaboration with PRATT & WHITNEY.
- 2000 1<sup>st</sup> C0-Generation Plant in RO, Botoșani - AI 20 aviation engine.
- 1998 1<sup>st</sup> Screw Compressor Equipment delivered.
- 1997 GHH RAND – starting collaboration, license agreement.
- 1996 COMOTI – National R&D Institute for Gas Turbines.
- 1995 1<sup>st</sup> Centrifugal Air Blower.  
1<sup>st</sup> Waste Water Treatment Plant at SLATINA.
- 1992 1<sup>st</sup> Centrifugal Air Compressor Equipment delivered.  
Strategic decision: activity diversification (exploring Energy & Environment Market).
- 1990 COMOTI SA
- 1985 INCREST – Scientific center for Aircraft Engines.



# A E R O S P A C E

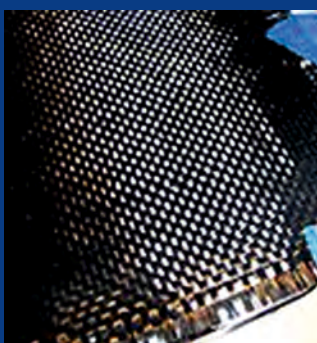
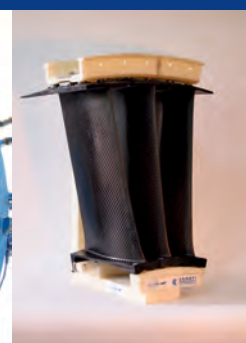
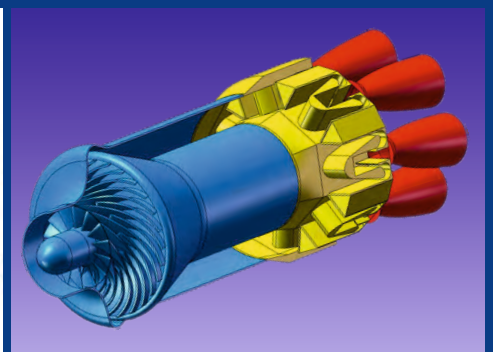
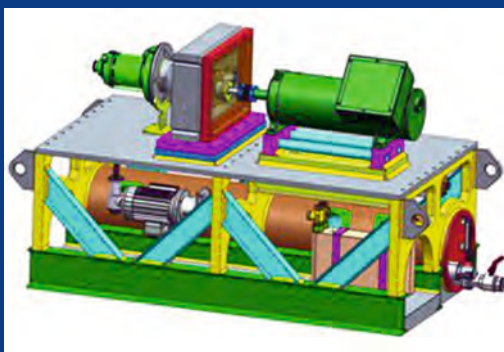
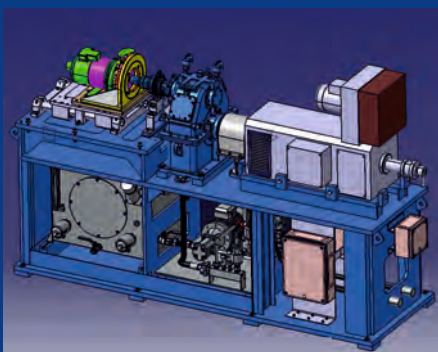
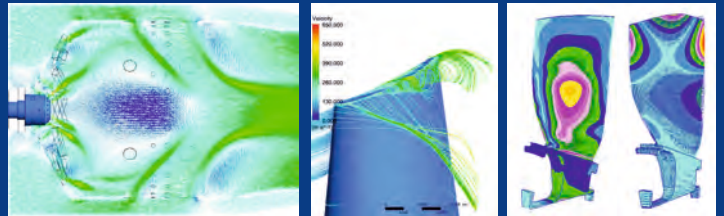
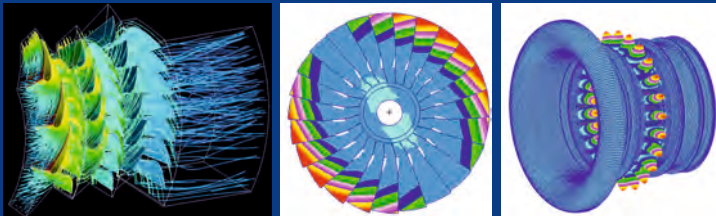
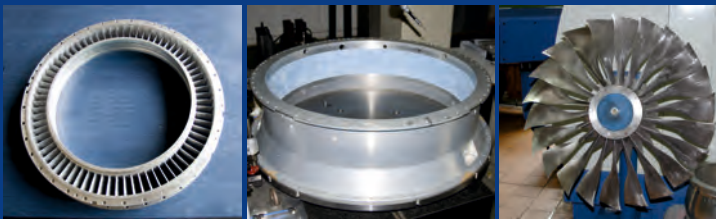


## AVIATION R&D Related Activities

Participation in EC funded programs, FP 5, FP6, FP7, CLEAN SKY, HORIZON 2020 in cooperation with leading companies such as SAFRAN AE (former SNECMA), SAFRAN HE (former Turbomeca), Labinal PS, ONERA, DLR.

### CAPABILITIES:

- CFD / Numerical simulation;
- Design, 3D modelling;
- Stress and Vibration analysis;
- Composite materials – bladed parts design;
- Prototypes and small serial production of blade parts;
- 3D inspection, validation and mechanical testing;
- Functional test for GT and other assemblies.

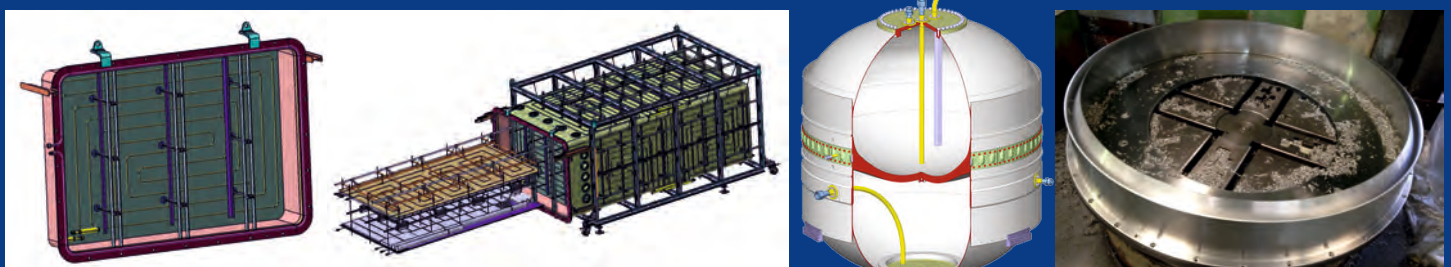
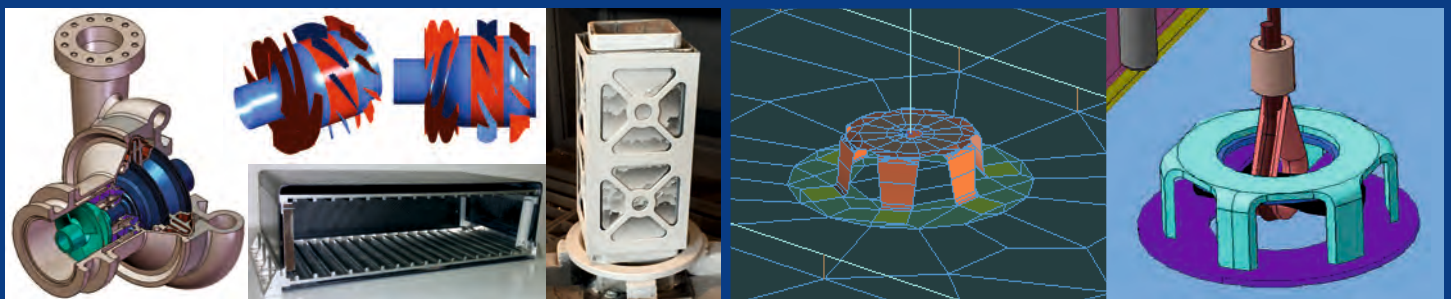
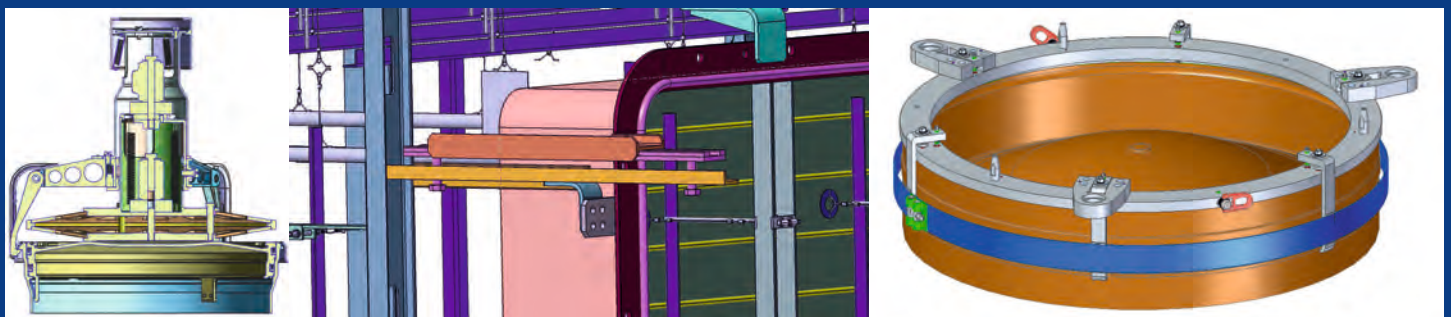
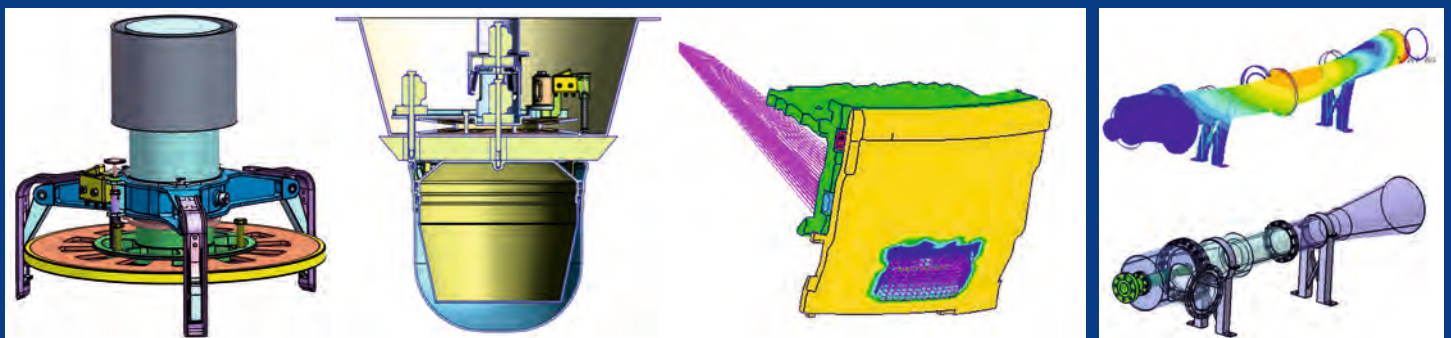




# A E R O S P A C E

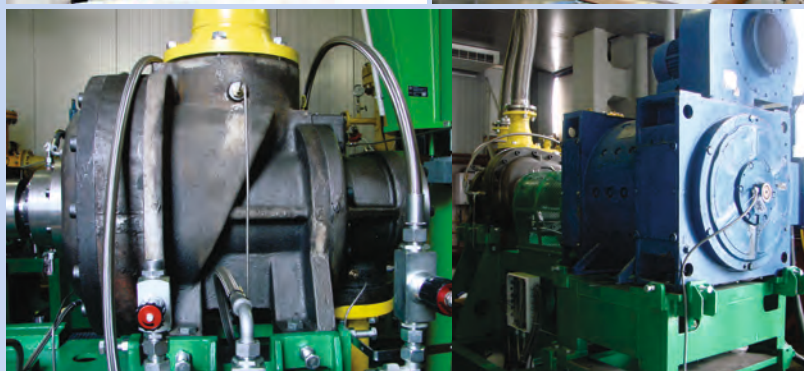
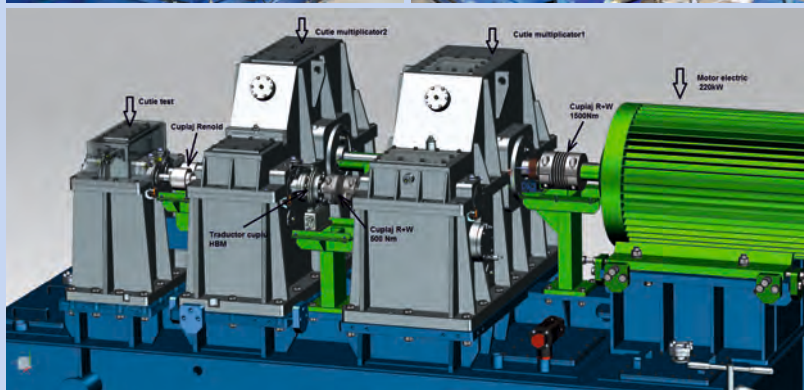
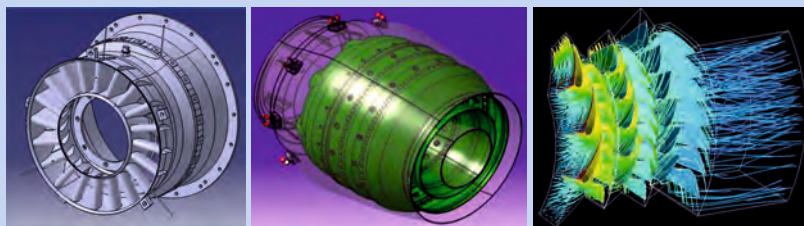
## SPACE R&D Related Activities

- 2013 - Starting the cooperation with ESA involving in ARIANE 5ME/6 launchers programs in partnership with MT Aerospace Germany.
- 2013 - Starting the cooperation with ROSA - 6 National Space R&D Programs.





# ENERGY & SAVING ENERGY



## CAPABILITIES

- Design, 3D modelling, CFD/Numerical simulation, Stress, Vibrations and Thermal Analysis;
- Automation of energetic groups, general revisions, service, maintenance;
- Dynamic balancing, inspection and oil analysis, Machining prototypes and small series;
- Test benches for GT and Compressors, Metrology.

## PRODUCT

High efficient compressing equipment for air and natural gas:

**Screw Compressors CU series under GHH RAND License for natural gas market** (extract, transport), gas tank vapor recovery offshore, gas compression for GT power (booster), petrochemical industry, refrigeration applications.

- gas flow max 3,750 Nm<sup>3</sup>/h;
- discharge pressure: max. 26 bar;
- compression ratio: max. 15.

**High Pressure Screw Compressors** with oil injection, type: - CU220, CU200, CU128 (longer shaft) used for gas collection from low pressure (old) wells, gas lift, gas delivery into national pipelines network, off shore stations.

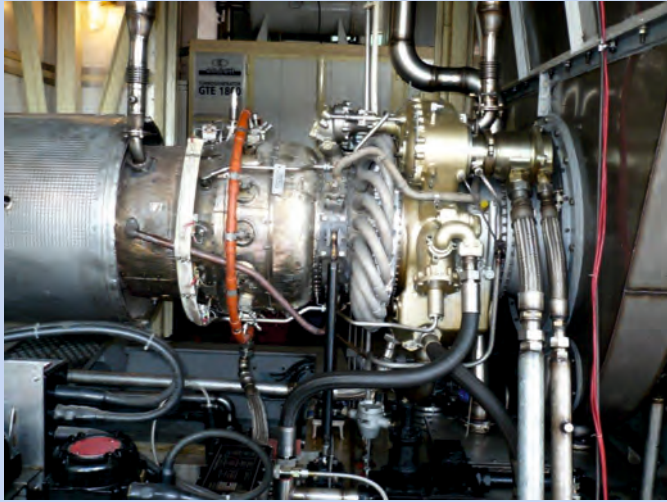
- suction pressure from 4,5 bar;
- discharge pressure up to 45 bar;
- flow 2,000 - 5,000 Nm<sup>3</sup>/hour (1,500 – 3,000 rpm).

**Centrifugal Air Compressor free oil CCAE** family used to increase the amount of oil extracted by underground combustion with an average utilization factor of about 90%.

- discharge pressure up to 21 bara;
- flow up to 15,000 Nm<sup>3</sup>/h;
- number of compression stage with intercoolers: 3-5.



# ENERGY & SAVING ENERGY



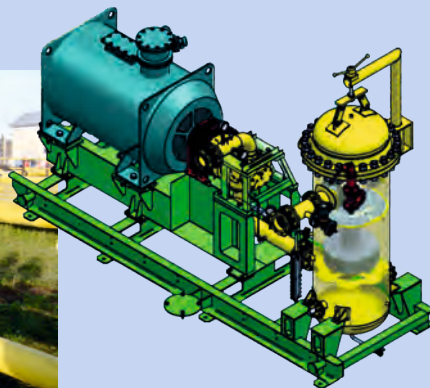
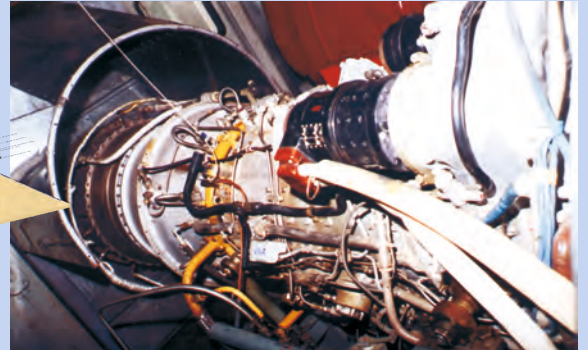
## COGENERATION

Cogeneration power plant (electric and thermal with gas turbines) in cooperation with PRATT & WHITNEY CANADA.

PARAMETERS:

- co-generative lines of 2x1.75 MW installed electric power;
- 6 kV an effective thermal potential of 7t/hx2 technological steam;
- 300° C / 20 bar) a consumption of 920 Nm<sup>3</sup>/h natural gas for each line (including the high thermal installation).

Since 2000 COMOTI is Official Packager for P&W GT Engines.



## EXPANDER

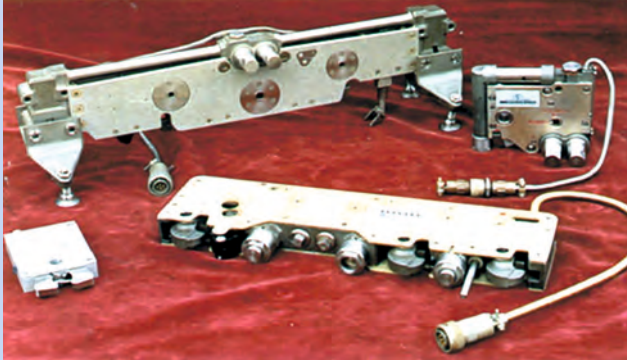
Producing green energy by recovering the energy detention in the lamination process of the natural gas (mechanical energy can be recovered and converted into electrical energy) using a turbo-generator:

- suction pressure 20 bar
- discharge pressure 3.5 bar
- flow 6,000 Nm<sup>3</sup>/hour (1,500 rpm)
- electrical power 180 kW



# DEFENSE

# INDUSTRY

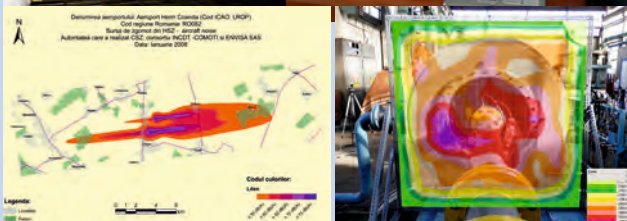
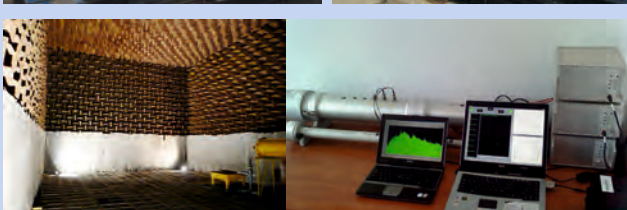
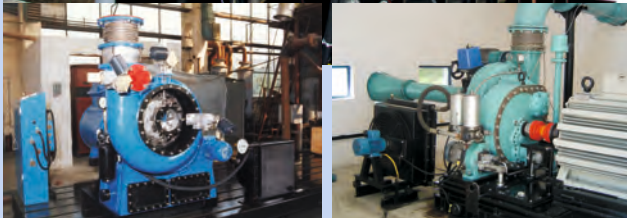


- Turbine of the T22 frigates aggregate repairs;
- Technical inspection of the propulsion system of the T22 frigate;
- Revision and expertise of propulsion systems of Romanian Military Navy ships to extend service life;
- Research by bench testing of marine propulsion engines.

## RELEASE UNITS

- They are meant to equip fighters, utilitarian, school and training aircraft, with various outer pylon attachments that can be released in flight at pilot's control (IAR 330 Puma SOCAT, IAR 99 Hawk).

# ENVIRONMENT



## CENTRIFUGAL AIR BLOWERS

and control system for biological stage waste water treatment plants.

Developed a family of CAB, type TS and ESC with flow between 3,000 m<sup>3</sup>/h (ESC 3) and up to 10,000 m<sup>3</sup>/h (ESC10).

- Oil free and with airflow variation between 50% ÷ 100%.
- Blower type: centrifugal rotor with backwards curved blades (3D rotors).
- Drive type: asynchronous electric motors with 400V supply.

## ACOUSTIC and VIBRATION MEASUREMENT

## NOISE MAPPING

## PHYSICS AND CHEMICAL TESTING LABORATORY

for source emission measuring GT Noise Suppression.

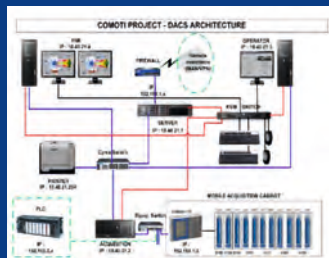


# GAS TURBINES TESTING FACILITY



The testing facility integrates 3 testing cells dedicated a wide variety of turbine engines for aircraft and industrial applications, as follows:

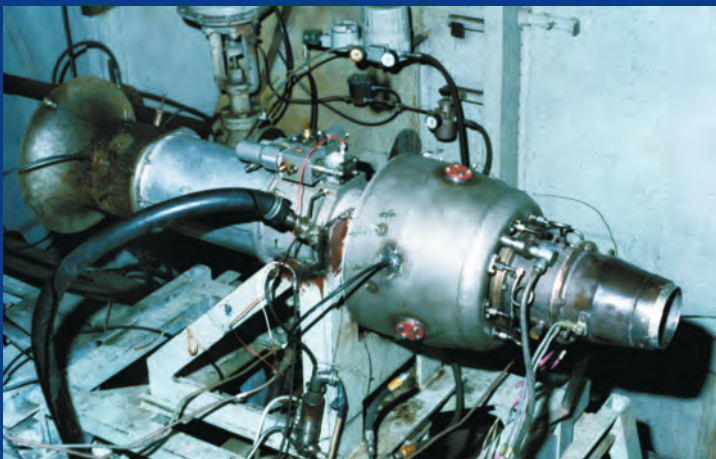
- **Test Cell No. 1** is for testing turboshaft engines with powers up to 5.4 MW and speeds up to 25,000 rpm and the gas turbine modules;
- **Test Cell No. 2** is for testing micro turbo engines with thrust up to 250 daN;
- **Test Cell No. 3** is for testing turbojets and turbofans with a maximum thrust of 7,000 daN and air flow of 50 kg/s.



## EQUIPEMENT:

- hydraulic brake, HOFFMAN FROUDE;
- Central control unit Techspace Aero-CENCO Europe, Belgium;
- Cyres software.

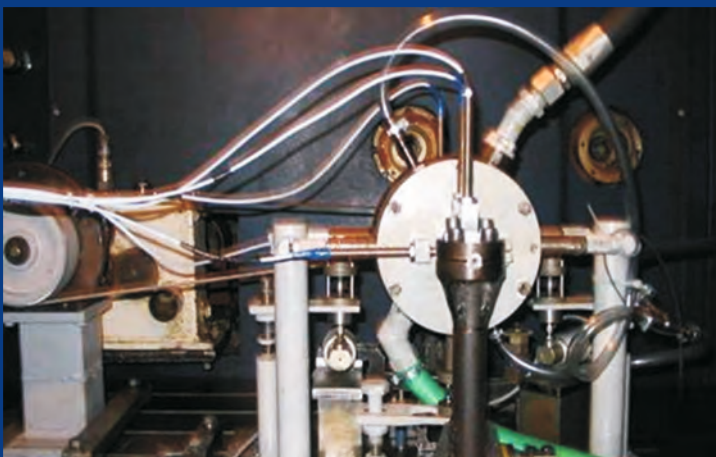
# AGREGATES TEST FACILITIES



Testing Jet Engines: 80 to 7,000 daN.



Testing Turbo Shaft Engines: 20 to 2,500 kW.



Bearings hydraulic test rig.



3D measuring machine.



# MATERIALS TEST FACILITIES

## COMPOSITE MATERIALS LABORATORY FOR AERONAUTIC FIELD

### Prepreg technology

Fibres: carbon, Kevlar, glass....

Resins: various groups of thermoplastic and thermosets polymers (epoxy, phenolics, polyamides, polyesters, vinilesters, polyimides etc.).

Use of different core materials: foams, paste, Al "honeycomb" structures etc.

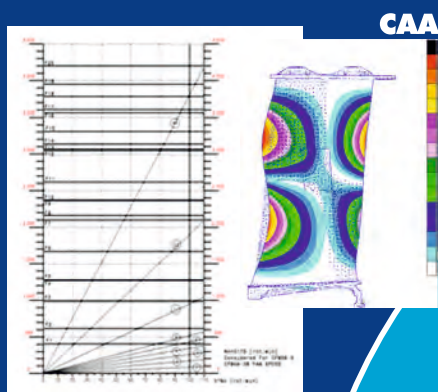
All the prepreg preparation process is done according to standards (ISO 9, class 4, class 100,000) in a clean room.

### Design & Manufacturing MOULD

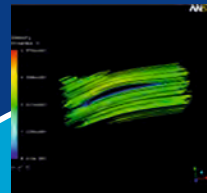
Possibility of using OPEN and CLOSED mould using different materials: aluminum, steel, composite, Necuron...

### Structure design and Stress Analysis

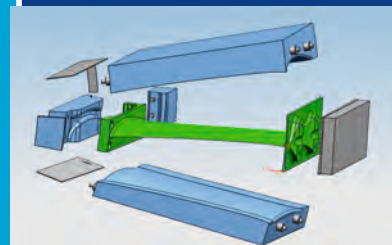
CFD SIMULATIONS - CATIA V5 and ANSYS CFX



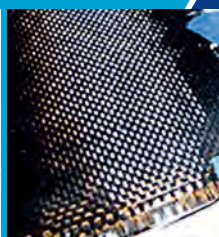
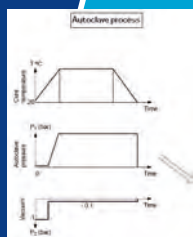
### CFD ANALYSIS



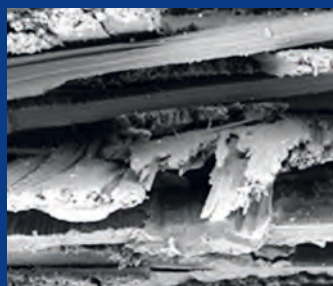
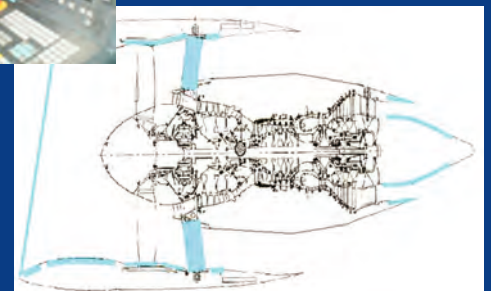
### 3D CAD MODELING



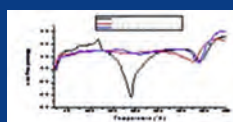
### CAM



### COMOTI'S AUTOCLAVE TECHNOLOGY



### US technique



### STRUCTURAL/MECHANICAL CHARACTERIZATION



### CARBON FIBRE STATOR BLADE

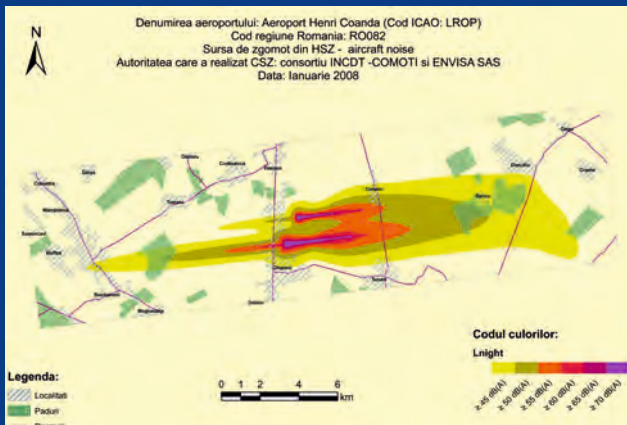




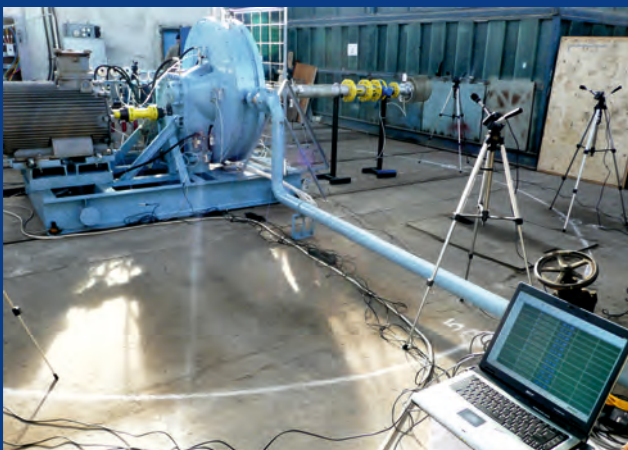
# ACOUSTIC AND VIBRATION TEST FACILITIES



Acoustic tests - Anechoic chamber (1,200 m<sup>3</sup>).



COMOTI in collaboration with ENVISA realized the strategic noise map for International Airport "Henri Coanda" - Otopeni, Bucharest, Romania.



Measurement and studies for noise directivity of the industrial sources.

The Research and Experiments Center in The Field of Noise and Vibrations - COMOTI is certified by The Accreditation Organization from Romania - RENAR according with SR EN ISO/CEI 17025/2005.

The laboratory can perform studies in the following specialized chambers:

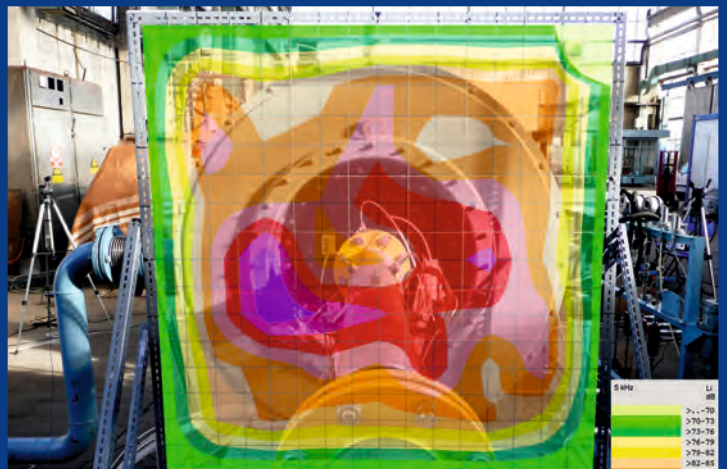
- **The Anechoic Chamber** realized according with ISO 3745;
- **The Reverberation Chamber** realized according with ISO 3741- Annex D ISO 354;
- **The Transmissibility Chambers** according with ISO 140/1, /7, /8, STAS 6161/4, STAS 6691.



Reverberant chamber.



Chamber with traps.



Measurement and studies for sound intensity mapping of the noise sources.



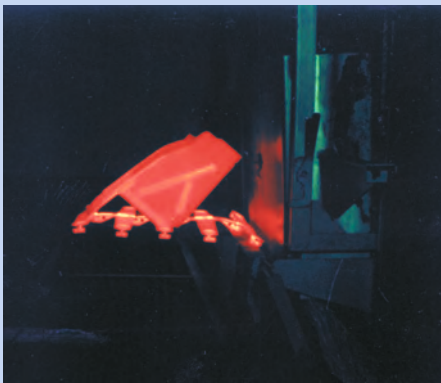
Measurement and studies for noise source identification trough correlation of vibration with noise.



# COMBUSTION CHAMBER TEST FACILITIES



Combustion chamber experimental and research.



Gas turbine combustor & afterburning parts.

Laser measurements laboratory.

# NATURAL GAS SCREW COMPRESSORS TESTING FACILITY

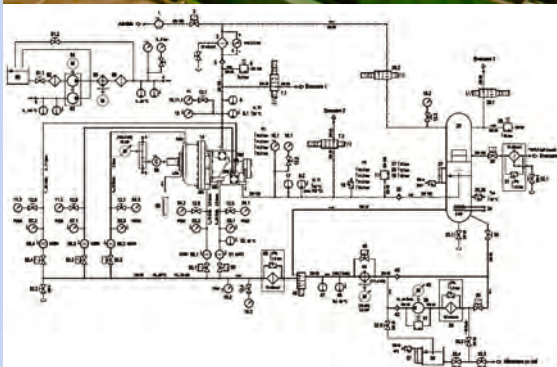


The testing facility is entirely designed by COMOTI and is dedicated to test CU licensed family, CU stainless steel case family, High Pressure Screw Compressors.

- Rotational speed range DC motor: 512 - 1,200 RPM;
- Power: max. 75 kW, DC electric motor;
- Test pressure: max. 50 bar;
- Rotational speed for:
  - first output 1,152 - 2,700 RPM;
  - second output 2,573 - 6,075 RPM.

## Process parameters:

- Rotational speed for the DC motor: tahogenerator CROUZET;
- DC motor torque: T10F, non-contact torque measuring system, Hottinger Baldwin MessTechnik, BRD accuracy class 0.1, max. rotational speed 10,000 RPM, nominal torque: 3 kNm;
- Pressure sensors: Tensometric system Rittmeyer, Switzerland, accuracy class: 0.01.



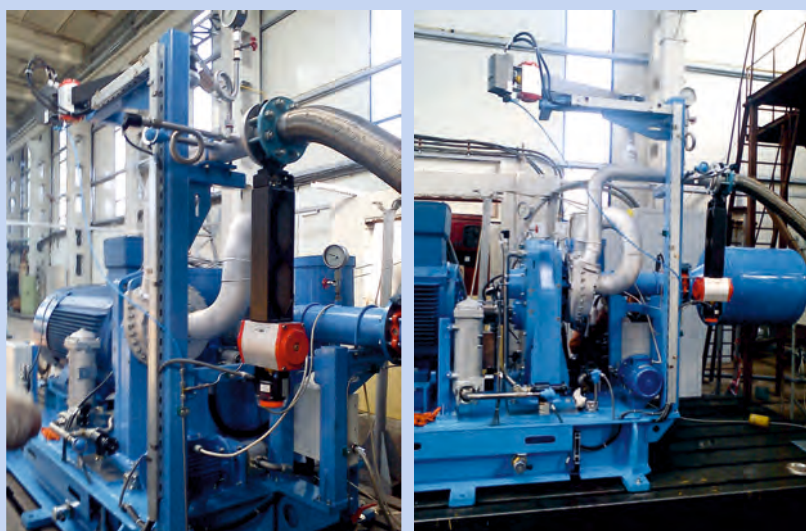
◀ Technological diagram of test rig.



# CENTRIFUGAL COMPRESSORS TESTING RIGS



1.3 MW test rig with two stage, non intercooled MTI 1,500 compressor.



The arrangement of two other centrifugal compressors, with and without intercooling on the other test rig.

Compressor CCAE 6-43 on the test rig (no intercooling).



Compressor CCAE 9-125 (intercooled) on the test rig.

COMOTI has different capabilities to test and to qualify centrifugal compressors, one stage and multistage, with or without intercooling. These facilities are designed to assure all required parameters, as follows:

- Oil pressure, oil injection temperature, oil flow;
- Buffer instrumental air pressure, flow and temperature;

General cooling water parameters, flow, pressure, temperature.

All test rigs are fully governed by electronic systems, specially high speed, multi channel PLC, mainly produced by FE FANUC and SIEMENS.

Data acquisition process is assured by the use of state of the art sensors, laboratory precision class.

Torque is measured using Hottinger Baldwin Messtechnik contactless sensors, various capable loads. Temperatures are controlled via Pt100 and Pt150 sensors. Oil and water flows are controlled using dedicated sensors, many of them being combined p, T, flow high precision sensors.

Data acquisition process is integrally automatic, without human intervention.

All test rigs are fitted with noise suppressors, to assure the compliance the with european standards.

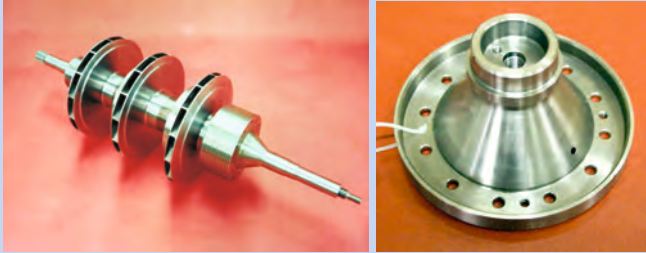
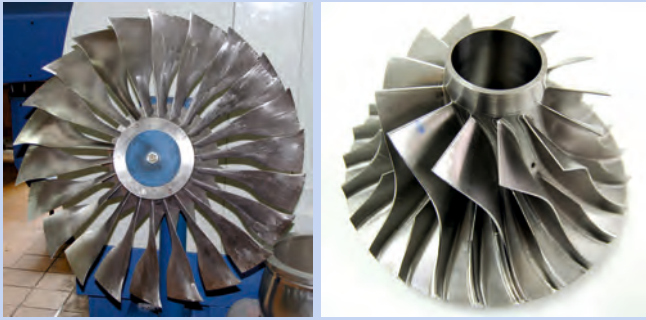
There are two main facilities:

- Test rig able to assure testing of intercooled, multistage centrifugal compressors, equipped with alternative current motor with 0.7 MW / 3,000 RPM;
- Test rig able to test individual centrifugal stages, equipped with DC motor with 1.3 MW / 1,200 RPM capability. The link to the compressor is assured by a RENK geared transmission able to reach 25,000 RPM. Test rig is equipped with torque measurement on compressor shaft.

All installations are equipped with automatic control loops, able to protect the test rig and tested equipment in case of failure.



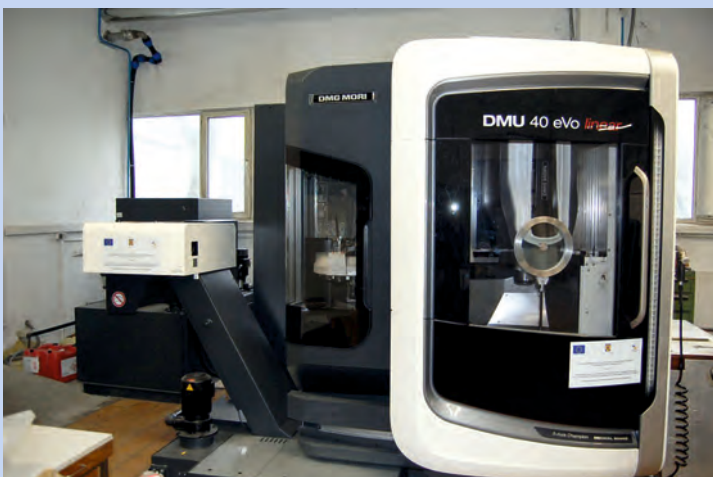
# MANUFACTURING



- Experimental Parts, Prototypes and Small Series Production for Aviation and Industrial Gas Turbines and other Rotating Machinery (titanium alloys, Ni-Co alloys, stainless steel, aluminium alloys).

- Machining Types:

- DMU 40 Evo, 5 simultaneously axes milling machine;
- HAAS CA3330, 5 simultaneously axes grinding machine;
- CNC DAHLI high speed 5 axes milling machine;
- CNC FOREST LINE 5 axes milling machine;
- CNDMU 70 e VO linear Deckel Maho;
- STARRAG copy milling machine;
- CNDMU 70 Deckel Maho;
- GILDEMAISTER CTX 620 linear.





# PATENTS

Awards and medals for our patents in various international exhibitions:



Geneve 2017 - Silver medal



Geneve 2016 - Gold medal



Geneve 2016 - Silver medal



Eureka 2016 - Gold medal



Geneve 2014 - Gold medal



Geneve 2014 - Silver medal

# QUALITY



- AEROQ Quality System Certifying according to SR EN ISO 9001:2015, SR EN ISO 14001:2015, OHSAS 18001:2007 and SR ISO/CEI 27001:2013.
- Authorized Supplier for Minister of Defense according to Romanian MoD NG OMCAS - 02.01 and SR EN ISO 9001, by OMCAS.
- Certificated as PETROM SA - member of OMV Group - Products and Services Supplier.



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[www.comoti.ro](http://www.comoti.ro)