

3. INSTITUTIONAL DEVELOPMENT PLAN FOR THE NEXT 4 YEARS

3.1. SCIENTIFIC SWOT ANALYSIS

STRENGTHS

- a) Is the only Romanian research and development Institute for aviation and industrial gas turbine, for their applications and their subassemblies, such as aircraft engines components, groups for gas compression, co-generative groups, gas centrifugal compressors, air blowers;
- b) Is nationally and internationally recognized for its scientific achievements and professionalism: industrial applications such as aircraft engines, co-generative electricity and heat production, natural gas screw compressor, natural gas or air centrifugal compressors, aircraft engines components, aviation defense products;
- c) Products designed and manufactured for various customers, have brought significant savings, being sought on Romanian market;
- d) It is recognized at European level on research field for gas turbine aircraft engines and for centrifugal compressors, having technical-economical and scientific collaboration reports and with prestigious international companies, such as: SNECMA France, DLR Germany (Aviation and Space German Institute), GE Novo Pignone Italy, Pratt&Whitney USA, Central Institute of Aviation Motors (CIAM) Russian Federation, etc.;
- e) It has highly qualified specialists and experienced in Institute's field of expertise.
- f) It has a micro production capacity for manufacturing high-tech complex spare parts, (small series and unique) which allows the implementation of experimental spare parts, which need to be tested in various research projects and research of new technologies to achieve these landmarks.
- g) It was accepted as a partner in several research contracts founded by the European Union FP5 (SILENCE(R), METHOD, JEAN, ABRANEW), FP6 (VITAL, CoJeN, X3-NOISE) and FP7 (TEENI, OPENAIR, Clean Sky, ESPOSA, etc.) some of them being true tests for the qualitative and quantitative growth of future cooperation, so far has attracted over 2.3 million euros from EU for these projects. Situation well known at EC Directorate level-Energy and Transport Research.
- h) It has an equipment at European level, regarding the design and the manufacturing in aviation field (CATIA, NASTRAN and UNIGRAPHICS CAD/CAM specialized software and graphics work stations), last generation CNC 5axe milling and CNC lathe, automatic 3D geometry measuring of the manufactured parts.
- i) Accredited laboratories for Acoustics and Vibrations, Chemistry testing, and Metrology laboratory under accreditation;
- j) Modern laboratories for experimenting research: gas turbine combustion chambers, centrifugal and screw compressors, acoustics and vibrations laboratory, composite materials laboratory, material testing laboratory, physics and chemical testing laboratory;
- k) The Institute has 36 CPUs Dual Core Intel Itanium which runs on HP Integrity RX2660 Technology through a GB network, with the most powerful operating systems based on UNIX.

WEAKNESSES

- a) The retirement of important researchers from our Institute in the following years;
- b) There is a limited number of specialists who can lead large projects;

- c) Some equipment from laboratories and benches are outdated;
- d) Gas Turbines benches are only partially in operation;
- e) Some machine tools from micro production are from 1980's generation;
- f) Gas Turbines benches will not be used in testing large gas turbine engines, because houses were built on land area;
- g) Age average of institute employees is quite high - 47 years;
- h) The number of young researchers stills small compared with the desired requirements, which must cover the departures in the coming years, the retirement of current researchers;
- i) Some laboratories from the Institute are not yet accredited;
- j) We cannot provide a large enough salary in order to attract a significant number of top researchers in the Institute field.

OPPORTUNITIES

- a) The existence of lasting cooperation with large international companies in the field of aviation engines, such as: SNECMA and TURBOMECA from France and Pratt&Whitney from USA;
- b) The existence of a very good cooperation with GHH-RAND from Germany (Part of Ingersoll-Rand USA), in the screw compressor field;
- c) Increasing importance of natural gas using;
- d) The need to implement very efficient solutions for producing co-generation heat and electric energy;
- e) The imposition of increased use of energy with renewable resources (wind, biomass, biofuels, etc.);
- f) The constant requirement to improve the equipment energy efficiency;
- g) Increasing demands for environmental protection, both for wastewater waste treatment and diminution of noise and vibrations;
- h) Capitalization of the positive EC Directorate perception about INCDT COMOTI;
- i) High invetion capacity of COMOTI researchers.

THREATS

- a) The financial crisis from Europe;
- b) The possible departure of some highly qualified scientists to institutions from Western countries;
- c) Continuous depreciation of the economic situation and the possible extinction of large units of the Romanian aviation industry;
- d) The tough competition of foreign firms on the Romanian market;
- e) The repeating situation of Romanian research between 2009 and 2010, when were held competitions for the winning new projects within PNCD12

3.2. STRATEGIC SCIENTIFIC OBJECTIVES AND DIRECTIONS

Strategic scientific objectives of COMOTI are classified on three direction where the institute is active: aviation propulsion systems, energy and environmental protection.

Aviation propulsion systems

The main activity will be in the field of aviation gas turbines propulsion systems with accent on small and medium size turboprops, helicopter gas turbines, auxiliary (Auxiliary Power Units APU) gas turbines and micro gas turbines (mainly turbojets).

Activities in the field of reciprocating (piston) aviation engines will be started and especially diesel engine for aviation as a new and high efficient solution.

In the field of aviation gas turbines there will be studied:

- optimization methods for the main components (compressor, turbine, combustion chamber etc.) in order to increase their efficiency and the overall propulsion system efficiency;
- new gas turbines configurations capable to reduce fuel consumption;
- usage of innovative ultralight materials to reduce the overall weight of the gas turbines;
- new and innovative solutions to reduce the noise produced by different components;
- lowering NO_x emissions by improving the performances of the combustion chambers;
- realization of state-of-the-art cooled blades capable to withstand temperature of 1500 K;
- utilization of bio fuels in aviation and their influence on propulsion system components.

Energy

This domain contains the following components: energy production and increasing energetic efficiency and especially the efficiency of natural gas and air compressors.

Energy production

There will be continued and finalized the activities related to MTI 1500 industrial gas turbine realization. Countries like Czech Republic and Turkey will be attracted in the project to improve the technological capabilities for its realization and to assure a large market for the final product.

There will be tried the promotion of a FP7 European project to realize a family of industrial gas turbines in the range of 500kW÷5MW.

In the field of cogeneration there will be tried the realization of small cogeneration groups of maximum 250kW adapted to East European countries need, in collaboration with a foreign company with notable related results.

There will be studied and realized new solutions of gas turbines groups producing electric energy using mixed thermodynamic cycle and different gas fuels like natural gas and biogas.

The research regarding expansion energy recovery in SRMs (Station of Reduction and Metering for natural gas) by the use of helical (screw) expanders will be continued as well as the studies and experimental models realization, when appropriate, for new concepts of vertical axis wind turbines and usage of heat pumps combined with cogenerative systems.

Increasing compressor efficiency

There will be studied new and innovative solutions of centrifugal compressor stages using state-of-the-art CFD (Computational Fluid Dynamics) theories to increase their efficiency and overall compressor efficiency.

There will be developed screw compressors with oil injection (oil flooded) for pressure range 70÷80 bars and high flow rates adapted to the needs in the oil and gas industry in partnership with GHH-RAND from Germany and City University London from Great Britain.

Environmental protection

This domain contains the following sub domains and activities:

- noise reduction especially for aviation propulsion systems and centrifugal compressors using new and innovative solutions;

- NOx emission reduction through studying and realizing new combustion chambers and injection systems for gas turbines;
- realization of new and innovative equipment for biological stage aeration from the waste water treatment plants ensuring low energy consumption and high reliability.

3.3. THE HUMAN RESOURCES STRATEGY

Considering the fact that, in the next 8 years, approximately 40% of COMOTI personnel will retire, including here some of the top researchers in the Institute, measures will be taken in order to maintain and, increase if possible, the research capacity through:

- attracting personnel highly qualified in the field of work of the Institute, with abilities for research work;
- attracting young graduates of technical universities in the aviation, mechanics, energy, electronics and automation fields. There will be sought young people with good results during college and with aptitude for research. In order to achieve this, close contact will be maintained with the universities in the field for early information concerning the talented young people who, in order to be attracted, will be hired as designers starting with their 3rd or 4th year of study.

After graduation, the hired young people will be encouraged to obtain the MS and the PhD diplomas in the fields of interest for the Institute.

Therefore each year 4 – 8 good young graduates will be hired.

If the opportunity arises, young PhD's from and outside the country will be attracted by offering jobs in top teams involved in European projects and motivating salaries.

In order to maintain the high level of competency established by the researchers reaching the retiring age solutions will be sought for keeping them as Institute employees for long periods of time and they will be stimulated to share their working experience with the young researchers.

The researchers in the Institute will be encouraged to continually perfect their knowledge through top courses in their competences field.

3.4 MECHANISMS FOR STIMULATING THE APPEARANCE OF NEW RESEARCH DIRECTIONS

As a result of the market's requirements and tendencies, new research directions may arise, as in past years: the carbon fibre composite materials, on the one side, and the utilization of gas fuels from biomass gasification or of landfill gas from waste deposits in industrial gas turbines in order to obtain electrical and thermal energy, on the other side.

Prior to invest material and human resources in the new research directions, strong argumentation of the fact that a market exists for these must be undertaken.

If the market exists, the material resources will be invested mainly through attracting budgetary funds from national and European programmes. The new ideas must be protected through national and international patents.

Part of the Institute's investment resources will be directed to these researches by creating the specific experimental facilities.

For a new research direction proved promising, a new research team, focused on this direction, will be created. The team will include at least 2 – 3 researchers willing to work in the new research field.

Following the first promising results of these researches and the patent request submissions, the researchers will be encouraged to make known their results in international conferences in the field and in specialized journals with high impact factor.

The results obtained at the finalization of the researches will be applied by industrial beneficiaries.

3.5. FINANCIAL SWOT ANALYSIS

STRENGTHS

- As the main activities are research and development, there are research multiannual contracts such as: PN II , Nucleu și Capacități Program, financed from the State budget and wined by participating at competitions;
- It is the only research and development institute for gas turbine, turbo machinery and aircraft engines from our country, for consequent develops international specific contracts;
- Contracts concluded with EU founs, such as FP 6 , FP 7 , POS-DRU , POS- AXA II environment, structural founs Romania-Bulgaria, dues to a sustained activity of our qualified staff;
- Economical contracts concluded with several internal and foreign companies, such as OMV PETROM , TRANSGAZ MEDIAȘ, OTOPENI AIRPORT , BORETZ-RUSSIAN FEDERATION, LINDE GAZ – HUNGARY, VPT - GERMANY, HERCO-GERMANY , and other contracts with cu NETHERLANDS, POLAND , CANADA;
- Quality products obtained from micro production, research and development activities are marketed because of the low production costs compared to other companies in the same field;
- Products obtained by the institution are sought and sold on internal and external market, the evidence are the incomes from these contracts;
- It provides, in addition to those shown above, maintenance, service, assembling, and metrology in our institution specific fields. The quality of these services is provided by COMOTI's ISO certification. Also we are working on the implementation of OMFP 946/2005 regarding internal control code management which includes the management of internal control standards;
- The activity is performed in the institute headquarters, which ensure the elimination of additional costs and rents, and the opportunity to obtain additional income from renting spaces and land ownership;
- All these have provided a financial balance in terms of institute's cash flow;
- There is a constant concern of the management to finance retrofitting and modernization of production lines of existing research and development laboratories;
- Another strength point are the human resources in which there are constant investments for specialization and for attracting new specialists;
- Institution management is provided by a highly skilled management and professional team in the field of expertise.
- A specific strength is that the salary was negotiated under the CLB, partly fixed and partly flexible, which varies depending on the employee's performance and contribution, enabling the institution to limit the wage bill at a time. This line provides the industry competitiveness and motivate employees to bring new contracts;

- The positive image and perception on market is due to a good promotion of products and services, offered by our institution, characterized by quality, low cost, reliability, in all our actions and activities, and maintenance of good working relationships with industry partners;
- Institute asset, available capital, buildings, land, experimental research and development laboratories, equipment for high performance, patents, articles published in national and international magazines, published books by institution's staff;

WEAKNESSES

- Specific legislative framework of state institutions, which leads to the addiction of financing most of our activities in research and development contracts, due to the lack of new competition organized by the competent bodies;
- The number of beneficiaries in the country using our products and services is reduced compared to foreign markets on which we cannot access so easily because of existing legal framework.
- Growing old staff with secondary education and the lack of specialists trained in technical vocational schools, even the disappearance of some jobs, such as mechanics on machines for processing numerical control, adjustors, Quality Control Technology specialists, etc.;
- The current economic environment, GDP, inflation, unemployment, income and expenditure structure of the national income and expenditure budget, the still small budget allocated annually for research.
- The actual underfunding leads to an inability to complete the research topics or the lack of research products for sale, due to permanent corrections of research budgets on minus;
- The lack of correlation between the internal and the EU legislation, lead to prevention of winning new contracts. For example, under EU legislation COMOTI is categorized as SME (Small Medium Enterprises) and according to Romanian legislation, as public research and developmental institution, with rules which restrict international presence initiative and respectively contracting.

OPPORTUNITIES

- Stabilizing internal economic situation in the future and creating the premise of developing more realistic BVC - s and a medium and long term forecasts, would lead to the creation of new markets for development and research products;
- Emergence of new competition would provide additional cash flows, organized not only by tutelary forum, but also other internal bodies;
- EU regional development policy with access to structural funds, infrastructure program to support innovation and technology transfer;
- Recovery of Romanian industry activity - Gas Turbines, turbine and aircraft engines would provide new opportunities to COMOTI, increasing its revenues;
- Existence of good relations of cooperation with leading international companies such as SNECMA, TUBOMECA from France, in the field of aviation engines, and with GHH-RAND, INGERSOL – RAND from Germany, in the screw compressor field, will provide, in the future, financing development of our institution by concluding competitive contracts.

THREATS

- Reiteration of the competition situation from February of 2008 from the National Plan II, when contracts were won and the founding were reduced, led to the recording of unrecovered expenditures made in advance;
- Insufficient funds allocated by the Ministry of Finance for research, but also imposed strict eligibility criteria, to participate in competitions, make the Institute to participate at a smaller number of projects, in comparison to previous years, leading to a higher rate of small projects and thus to a reduction in earned incomes;
 - The abolition of educational institutions, technical vocational schools, will lead to a lack of specialists in this field and to the impossibility of producing and selling COMOTI specific business products and services, reducing the revenue obtained from their sale.

3.6. INFRASTRUCTURE: INVESTMENT PLAN AND STRATEGY

Through the investment plan it is aimed:

- realization of high performance state-of-the-art experimental basis allowing the research in the fields specified in the strategy of the institute;
- increasing the computing power through the acquisition of new multiprocessor computers (over 64) capable to better satisfy the needs for CFD (Computational Fluid Dynamics), FEM (Finite Element Method) stress and vibration analysis;
- continuing the improvement of work conditions through finalizing work spaces modernization (both offices and laboratories) as well as constructing a new assembly for laboratories and offices for the team of combustion chambers and unconventional energy; facilities development will be conducted at the headquarter and at the other working point from Măgurele, Iași and Sf.Gheoghe (Danube's Delta).

High performance state-of-the-art experimental basis development contains:

- finalization of the new research and development benchmark for turboshafts and turbojets gas turbines;
- continuation of composite material laboratory endowment with all the necessary equipment;
- finalization of research and development benchmark for centrifugal compressors with power up to 4 MW and research and development benchmark for screw compressor for high pressure and flow rate with power up to 650 kW;
- development of combustion chamber experimental basis;
- realization of a new laboratory for research and development of axial and radial turbines for tests in similitude conditions and in real conditions;
- starting the modernization of experimental basis for wind turbines in Sf.Gheorghe in the Danube's Delta;
- realization of a experimental cell for reciprocating (piston) engine at Iași.

These investments will be realized through the participation at new competitions for research capacities as well as by using financial resources from the institutes investment money (form budgetary sources and from the realized benefit).

3.7. TECHNOLOGY TRANSFER AND THE ATTRACTION OF NON-PUBLIC FUNDS

COMOTI is using for promotion of technologies and products conceived in research projects, the Technological Information Centers from Romania like:

- Technological Information Centre CIT-IMACT, SC Impact Impex SRL Targu Mures and ENVICONS-CIT ;

COMOTI has a series of industrial partners from ROMANIA interested to take over the production of products realized during research and development projects. These companies finance integral these projects. Here we can mention:

- OMV-Petrom – Cogenerative Plant 2xST18 from Surpalcu de Barcau- they want to improve and multiply this project due to excellent results of the first research project, financed integral by the beneficiary;
- TRANSGAZ Medias – interested in screw expander and noise reduction solutions;
- ARMAX GAZ Medias it took over the manufacture of separation tanks that equip the screw compressors and are interested in future development of these separation tanks;
- GENERAL TURBO Bucuresti expressed their intention in financing the R&D of a industrial Gas Turbine in the range of 5 MW;
- We will search with the help of our partner, GHH-RAND, solutions for the transfer of screw compressor packages for natural gas towards producers form Russian Federation and Republic of China; Comoti delivers presently only few very important parts, like the screw compressor.
- Identification of a suitable Romanian producer with good technical and financial capacity, able to receive the production of air centrifugal blower family;
- Creation of a new international consortium made by firms from Romania, Czech Republic, Turkey, etc. for the manufacture and commercialization of the industrial turbo engine MTI 1500 under development at COMOTI.

Another source of finance is the benefit of COMOTI from each year.

By producing single or small series products of high quality we will try to obtain a higher benefit through valorification of these products.

A major part of this benefit will be used for the finance and co-finance of research and development products which will lead to realization of market requested products in the field of activity of the institute.

And not least will continue to increase the improvement of research services done for our international partners (ex. Manchester University - GB)

3.8. STRATEGIC PARTNERSHIPS AND VISIBILITYEVENTS, COMMUNICATIONS, COLLABORATIONS

Promotion and visibility

Promotion and visibility increase of the institute is done through the following actions:

1. Participation to dedicated conferences at national and international level (like ASME conferences and CEAS conferences), where the research results of the institute researchers are presented;
2. Publication of research papers in international renown journals like ASME Journals, CEAS Journals or journals with impact factor, ISI;

3. Participation to national and international exhibitions and fairs from our activity field;
4. Organization of workshops where are presented the results obtain in different research projects to potential beneficiaries and mass media;
5. Participation to ANCS Romanian research promotion actions;
6. Realization of a partnership with a media company to promote the best results obtain by our institute during research projects;
7. Printing flyers and advertising documents to present our products and services that our institute provide;
8. The continuous update of our internet site, www.comoti.ro, in Romanian and English languages; Creation of a novelty section where are presented the latest research results and products and the participation to different events; Also creation of a special section where are presented our laboratories;
9. Institute anniversary event – TURBO biannual International Conference;
10. Attempt to organize of a International Conference of the European Aerospace Societies in collaboration with CEAS (Council of European Aerospace Societies), AAAR (Romanian Aeronautic and Astronautic Association)
11. Active participation to workshops organized by X-Noise network in collaboration with CEAS each year.

Collaborations

The collaboration partnerships in the field of research & development of aircraft Gas Turbines with renowned companies in the field (SNECMA and TURBOMECA from France) and with research organizations in the field (ONERA-France, DLR-Germany and CIAM-Russian Federation) will continue.

It will be initiated new partnerships with PBS-Czech Republic and TEI-Turkey companies and with aviation institutes form Prague and Warsaw.

In the field of Industrial Gas turbine applications it will be continued the cooperation with Pratt & Whitney (SUA) and Ingersoll-Rand (SUA).

In the screw and centrifugal compressors field will continue and develop the R&D collaboration and also creation of new products with GHH-RAND from Germany.

At national level will continue and develop collaborations in the field of aviation with the following companies: Aerostar Bacau; IAR Brasov, si Turbomecanica-Bucuresti; also in the field of energy with: OMV Petrom, Neptun Campina, ARMAX Gaz Medias, ICPE-CA, Confind Campina, General Turbo Bucuresti; also in the field of waste water treatment with: RAJA Constanta si RAJA Targoviste.