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High-Profile Aerospace Lab Planned Near Warsaw

Krzysztof Krystowski, vice-president for Eastern Europe at Italy's Avio Group and CEO of its Polish subsidiary Avio Polska, talks to Piotr Bartosz.

One of the world's most advanced laboratories for testing low-pressure aircraft turbine technologies will be built in Zielonka near Warsaw over the next few years. Could you explain what these turbines are exactly?

A low-pressure turbine is a component of an aircraft turbine engine. Very briefly, engines are composed of several main modules forming a conjugated system. First is the compressor, then the combustion chamber, and finally the high- and low-pressure turbine. Contrary to the piston engine, the kind used in cars, there is no explosion here but continual combustion and increasing pressure of the gas mixture. The exhaust gas travels under pressure to the high-pressure turbine. This first turbine powers the compressor, which in turn increases the pressure before the combustion chamber. The higher the pressure, the more efficient the system is.

Turbofan engines, which are bypass engines, also have a low-pressure turbine, and this is the thing we are talking about. This is the turbine that takes over the remaining pressure that previously traveled through the high-pressure turbine. The low-pressure turbine is coupled with a fan concealed in the casing of the aircraft engine. Every passenger approaching an airplane can see this fan: the GEnX-2B engine is about 2 meters in diameter. The fan acts like a propeller, creating thrust thanks to which the aircraft moves.

The low-pressure turbine is responsible for driving the fan. At first there were only jet engines, where all the power came from the gases being ejected backward. In modern engines, the system comprising a low-pressure turbine and a fan is responsible for over two-thirds of the engine's power. The other third is generated by the ejection of exhaust gases.

Does this mean that the better the turbine, the greater the aircraft's power?

Yes, but that's not all. The turbine has a substantial impact on the engine's efficiency, on fuel consumption, greenhouse gas emissions and noise. There are a great many elements related to the economy of flying, meaning costs, but also to the environmental impact, the comfort of passengers and people living close to airports, which is linked to reducing noise levels.

Is the focus on gradual improvement in this field, or do designers also hope to make some breakthrough discoveries?

Today engine manufacturers and designers are expected to come up with groundbreaking technological ideas. This is the effect of the very high standards set by the Advisory Council for Aeronautics Research in Europe (ACARE). Its Strategic Research Agenda No. 2 states that by the end of 2020 many parameters, including fuel consumption, noise, greenhouse gas emissions, nitrogen compounds and recycling, have to improve significantly.

Engineers decided that a simple extrapolation of technological improvements in the design of engines as we know them today will not enable us to achieve the desired parameters in 2020, hence the ongoing search for completely new engine architecture.

Will manufacturers be able to afford such revolutionary changes?

They will have no other option. There is also great market demand for new solutions, especially those that can seriously reduce fuel consumption. Given the high prices of fuel, these costs can account for up to 50 percent of some carriers' cost structure. Meanwhile, in the case of General Electric's latest GEnX-2B engine, for which we in Bielsko-Biała have designed and manufacture the fixed part of the low-pressure turbine, fuel consumption will be 15 percent lower than for comparable engines available on the market. If we assume this is half a carrier's cost, we are left with 7.5-percent improvement of the carrier's financial result, which is largely thanks to the turbine, among other things. In the best years, carriers report average profitability of 6 to 8 percent. This would mean that a carrier's profit could double

ıst as a result of switching to a different ngine.

Why did the Italian corporation lecide to open its research and devel- pment center outside Italy?

Avio's main research and development ivision is in Turin, Italy. However, there as also been a research and develop- nent facility at Avio Polska for several ears, which today employs almost 80 ngineers. Our staff's achievements re highly appreciated by the corpora- ion's management, and Polish research enters conducting research related to eronautics also enjoy a good reputation. Both these reasons led to the decision to ontinue the development of research nd development work in Poland. The aboratory is the latest project, and it vill be set up in Zielonka near Warsaw. This will not be an R&D division of the orporation but a separate company, plus the Polonia Aero consortium formed together with Polish industrial and research partners.

The facility in Bielsko-Biała has long specialized in designing and manufacturing blades for low-pressure turbines. It was rather natural for Avio to develop this particular branch of knowledge in Poland, where a research and development specialization has been developing for several years. The Avio Group is a manufacturer of modules for turbine engines, mainly for aircraft but not only, as there are marine, power engineering and even space applications. This specialization segment was allotted to Poland seven years ago, and by now we have achieved such a level of development that in fact the idea did emerge in the group to transfer the whole of the specialization to Poland. The support of the Polish Ministry of Science and Higher Education was also important for this idea.

Poland has huge European funds at its disposal for the 2007-2013 period, on a scale incomparable with the funds being committed in any other EU country. It was in Poland that various programs emerged, including ones aimed at fostering innovation, such as the Innovative Economy Operational Program. This program for distributing EU funds includes measures supervised by the ministry. We have gathered a research and development consortium around our idea. It includes two universities, the Warsaw University of Technology's Department of Power and Aeronautical Engineering and the Military University of Technology's Department of Mechatronics. There is also a Polish industrial partner, Wojskowe Zakłady Lotnicze Nr 4 SA. We applied jointly to the Ministry of Science and Higher Education to support our initiative with EU funding.

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Avio Polska is part of the Avio Group, which is 85 percent owned by the Cinven fund and 15 percent by the Finmeccanica group from Italy. The Avio Group is a global leader in the design and manufacture of aircraft transmissions, drives and modules for turbojet aircraft engines and marine engines. Avio Polska has a work force of 360 and its annual sales exceed zl.200 million, making it one of the largest aeronautical companies in Poland.

Avio Polska has won the Polish Product of the Future award and the E-co2 Innowacja award for its innovative and eco-friendly jet blade unit for Ge-nX 2B engines.

The company plans to launch operations in Poland in the maintenance, repair and overhaul of aircraft engines. It has signed a long-term cooperation agreement with a Polish partner, Wojskowe Zakłady Lotnicze Nr 4 SA. The agreement provides for many specialist training courses related to new projects at the Polish plant.

Krzysztof Krystowski is vice-president of the Avio Group for Eastern Europe and president of Avio Polska. He is also president of Polonia Aero and chairman of the Bielsko Federation of Aeronautical Companies, an organization that is a member of the Main Council of the Lewiatan Polish Confederation of Private Employers and leads the way among entities making up the Silesian Aviation Cluster.

In 2005-2008, Krystowski was director-general for business development and then vice-president of Avio Polska. At the time he also represented Poland's aeronautical industry in an informal group affiliated with the European Commission and dealing with the Clean Sky Joint Technology Initiative for the European aeronautical industry. In 2004-2006, Krystowski chaired the council of the FIRE Innovation Center Foundation supporting small and medium-sized innovative enterprises operating on the basis of the most advanced technology. In 2003-2006, he was an undersecretary of state at the Ministry of the Economy, Labor and Social Policy, and then at the Ministry of the Economy and Labor. He was responsible for the economy's competitiveness and innovation, supervised research and development centers and the Patent Office, and also dealt with restructuring in the defense and aeronautical industries and offset contracts. He represented Poland on the EU Council for Competition many times.

Krystowski graduated from the Department of Management and Computer Science at the Wrocław Academy of Economics, now renamed the Wrocław University of Economics. He obtained an MBA degree from Wyższa Szkoła Zarządzania Polish Open University and Oxford Brooks University, and followed up with Ph.D. studies at the Warsaw School of Economics.

Do Polish researchers know how to work with industry effectively?

Avio Polska has excellent relations with the Polish scientific community specializing in aeronautical research. Even the best laboratory and the most advanced infrastructure are nothing without people. As we found out, and as we managed to persuade our bosses at the head office in Italy, Polish scientists in this field are very good; they provide added value for the project.

Is 50 million euros really a lot of money for something that aims to become one of the best aerospace laboratories in the world?

We want our lab to be the best among the dozen or so aerospace laboratories around the world that test low-pressure turbines and conduct research on what is called cold flow technology. Since these fields do not have any great range of application, the lab cannot be compared to NASA laboratories which research space rocket drives, as that is something we won't be working on at all.

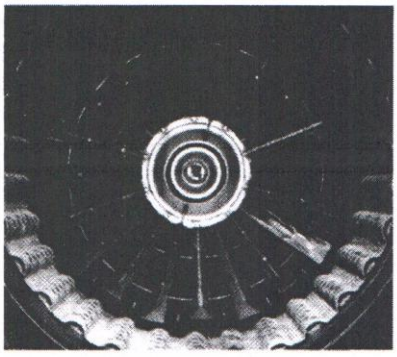
Our project is worth 50 million euros, or about zl.200 million. Considering other projects that the ministry supports with EU funds, this is probably the second or third largest project in Poland. Spending will not end with the end of capital outlays. Running the lab will also cost quite a lot of money.

Will the laboratory employ Polish scientists?

The staff will be small, as this will not be a manufacturing facility. The cost of the whole project stems mainly from the use of expensive research equipment. Providing jobs is not the laboratory's main objective. The main aim is to test advanced technologies, the world's latest technological solutions in the design of low-pressure turbines. The facility is expected to employ around 30 people. Cooperation with research centers, not just those from the Warsaw University of Technology and the Military University of Technology, is obvious, certain and necessary. Depending on the type of research, we want to choose teams of collaborating scientists in such a way as to enlist competent people representing different research centers in Poland.

Who, apart from Avio, will be able to use the laboratory?

We are counting on the interest of all of the world's best engine manufacturers. We assume that they will be attracted by the interesting parameters we are able to achieve. We hope they will do their research right here. Undoubtedly one important client will be the Avio Group itself, but I want to emphasize that the laboratory will not be part of the corporation. Avio became involved in the initiative because we really needed this kind of laboratory, and if someone else had built it we would have been happy to use it. But because we are one of the global leaders in cold flow technology, we were one of the first to feel the lack of this kind of research potential. That's why we devised, designed—together with U.S. company ASE—and plan to build this kind of lab. We want to develop a private industrial and scientific but nonetheless independent research center that will be



open to collaboration with other partners, both industrial and scientific. At the same time, it will conduct its own research, including work for the needs of the EU's Framework Programs.

What is the role of the Warsaw University of Technology and the Military University of Technology in the project?

At the very start of the project both these universities had a substantial influence on what we did. Besides, our consortium obtained funding for another program related to the main laboratory. This involved the construction of two smaller labs, one at the Warsaw University of Technology, the other at the Military University of Technology, creating a network and dealing predominately with fundamental research. I don't want to say they will work exclusively on fundamental research, but they will certainly be closer to theory than our extremely industrial lab. This will be a bridge for collaboration between the industrial laboratory and university facilities. As a result, the role of the two universities will increase in a natural way.

The role of the other research centers, with which we are already working, is also hard to overestimate. We work with the Silesian University of Technology, the Częstochowa University of Technology, the Polish Academy of Sciences' Institute of Fluid-Flow Machinery in Gdańsk, the Rzeszów University of Technology, the Institute of Aviation in Warsaw, and the Air Force Institute of Technology in Warsaw. We accept as something natural that this group will continue to work with us when the new infrastructure is ready. Furthermore, we are convinced that we will also attract scientists from other countries; that these will not be Polish researchers alone.

Will the infrastructure we are talking about be created specially for the needs of this laboratory and will Polish experts contribute to it, or will it be purchased abroad?

A large part of the equipment will be bought abroad because Poland does not have any manufacturers of this type of machinery and products; no one offers them. Of course, we will hold a bidding process for the construction of the building and premises. We want to have one general contractor; a lot will depend on that company. We will do our best to buy as many materials and services as possible in Poland; all the construction work will certainly be carried out by local companies.

How would you describe the future laboratory?

It will be a building with an area of about 5,000 square meters, with an office part. That's quite a lot of space compared with what the average person imagines a laboratory to be. Labs are most often associated with a room or several connect-

ed rooms, with people standing around in white coats, holding measuring cylinders. In this context our lab will be huge, more like an industrial facility, with a great hall and a test chamber several meters in diameter. The height of the room will be about 10 meters, or three stories, and there will be a compressor room as well.

What about the test chamber itself?

The amount of air flowing through a turbine undergoing tests will be up to 80 cubic meters per second. The equipment will be able to produce pressure in the chamber that will be eight times greater than atmospheric pressure.

What about power supply? The laboratory will use as much electricity as a small town. Are you prepared for providing so much power?

We want someone to supply this electricity and it seems this will be possible. That is also why the project is located close to Warsaw, a large conurbation that has significant capacity for delivering power. If we had decided to build the lab near a small town, we would have risked taking away all of its electricity. The peak demand for power at the laboratory is 35 megawatts.

At what stage is the project now? Construction is scheduled to end in 2012. Does that mean research work will start then?

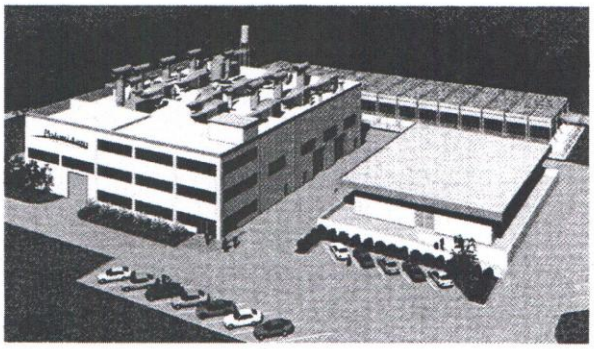
The building will continue to be outfitted in 2013. I hope the first research project will begin in 2014 at the latest. Right now the preparatory and design work is in progress, leading up to a construction permit. We want to obtain this in the middle of next year and begin construction then. This year we plan to choose the general contractor for the project. This is work you cannot see on site but, frankly speaking, it is the most important part of the project. It is easy to build when everything is properly designed, well planned and when you have serious partners well prepared for doing their job. This is what we are focusing on today, so that the construction project itself and setting up the laboratory proceeds smoothly.

Students will be able to work at the laboratory. Does this mean they will be able to work on their Ph.D.s there?

We are open to working with young people and we would really like the lab to give students the opportunity to learn things, make observations and perform tests. I think this is what industry's responsibility toward society is all about. These young people, university graduates, may become our employees in the future. The better prepared they are for their job upon leaving the university, the better not only for them but also for us. It is in our best interest to establish contacts with these people as soon as possible and help them obtain the best possible education and then continue their career, also in research.

What if a scientist working with you wants to publish the results of their work?

What part of the knowledge gained by the research centers can be publicized and what part cannot, is set down in an agreement. It needs pointing out that the lab will not research ready-made products but technologies and engineering designs—something that is still relatively far from the market. It is not suitable for immediate use for commercial purposes; there still has to be an intellectual process, an engineering process within the company before technology demos are turned into a market product.



"Even the best laboratory and the most advanced infrastructure are nothing without people. As we found out, and as we managed to persuade our bosses at the head office in Italy, Polish scientists in this field are very good; they provide added value for the project."

Who will handle the commercial application of the research results?

The owner of the results obtained at this particular laboratory will be our facility. Someone will be appointed as the intellectual property manager. Everything will be a question of how the collaboration with our future research partner is regulated. I can imagine a situation in which part of the results will be the property of the lab and the rest of the collaborating company. These are complicated matters.

Will the scientists working at your laboratory be able to earn extra income to supplement their university salaries?

Yes. The laboratory has to take advantage of the knowledge of experts, and they have to receive extra pay for their work. It's not all that hard to find experts; in this case they are verified by industry, by the market. That is the strength of research centers managed by industry. Industry is close to business; it is close to the market, and ultimately the market decides which technologies are good and which are not. They simply have to be useful, because we have to sell them. This is not art for art's sake or science for science's sake, but—as the main motto of the Innovative Economy Operational Program says—"science for the economy."