PBS INDIA MAGAZINE

PARTNERSHIP • BUSINESS • PRODUCTS • COMPANY

B PBS INDIA

PBS GROUP COMPANY STRUCTURE



CERTIFICATES AND LICENCES



DOA, POA, MOA



AS 9100, ISO 9001, ISO 14001



Non-destructive testing (PT, RT)

PBS INDIA PRIVATE LIMITED continues its expansion in the Indian market



PBS is a stable and innovative engineering company that belongs to the world's oldest engineering brands with more than 200-year history. The PBS brand was registered in India as early as 1955. The key industries for PBS India are the aviation and space industries and research and development within these branches.

The main products for the Indian market are turbojet and turboprop engines, auxiliary power units (APU), environmental control systems (ECS), cryogenics and foundry products. India's long-term goal is to achieve self-sufficiency in defence technologies and become one of the world leaders in the field of defence. And our products can make a significant contribution to this.

We want to build a fair and mutually beneficial business in India. India is not only a significant opportunity for us, but also one of key territories of our business interest, which is why we have established a separate Indian company, PBS INDIA PRIVATE LIMITED. We strive for cooperation

especially with manufacturers of UAVs and target drones, missiles, airplanes and helicopters, while also offering our precision casting foundry products and production cooperation here. We have been successfully cooperating with the Indian Air Force for a long time, which has been satisfied using our APUs in its helicopters for many years. Our customers are also many Indian private companies from the unmanned aerial vehicles category. We also collaborate on projects with major state-owned enterprises of India. Due to the trends of Make in India trends, we also see a great opportunity in production cooperation on specific projects. Our interest is mainly in long-term cooperation and its further all-round development. We are interested in working with young talents from this beautiful country. It was a great honour for us, when in 2021, together with 3 other Czech companies, we were able to secure a donation to Indian hospitals in the form of 70 lung ventilators to help during the Covid 19 pandemic. Our office is located in Bangalore, but we operate throughout India and want to further develop these ties. You will regularly find our exhibition booths at the Aero India and Defexpo events. The activities of PBS INDIA are strongly supported by the foreign representation of the Czech Republic in New Delhi, and the Czech Trade export agency. We also have very good relations and cooperation with the Indian Embassy in Prague. We firmly believe in further mutually beneficial development of cooperation between our countries.

Petr MOTYL Director, PBS INDIA PRIVATE LIMITED

Dear Business Partners and Aviation Fans!



It is with great pride that I would like to introduce you to PBS in the pages of this publication, a company with a proud history of more than 200 years in precision engineering. The experience accumulated by our predecessors has led PBS to the point where it entered the segment of aerospace manufacturing more than fifty years ago, one of the imaginary peaks of engineering production.

PBS is a confident, successful and economically stable company now, as a world-leading manufacturer of hi-tech turbine power units and components for the aerospace, energy and cryogenics industries. The know-how gained from the development, production, assembly and testing of more than 15,000 turbine power units for the aerospace industry is the most valuable products we own and offer you, our business partners.

We enjoy the challenges presented by the new developments in aviation. I see our primary contribution as supporting the expansion of unmanned applications in the civil and defence industry, the use of hydrogen as a

next-generation fuel and innovations related to more significant environmental protection. Let me take this opportunity to thank our partners and all those who support PBS and aviation.



90% DEVELOPED, MANUFACTURED AND TESTED IN-HOUSE

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PBS is a pioneering engineering company, a member of PBS Group a.s. With a history that goes back 200 years, we are one of the oldest brands on the global market. We are a renowned manufacturer of turbine engines primarily designed for UAVs and target drones with a thrust of up to 2500 N, and APU and ECS for aircraft.

We are also one of European leading suppliers of nickel and cobalt based superalloy castings.

PBS Group a.s. consists of five companies: Prvni brnenska strojirna Velka Bites, PBS Aerospace, PBS India, PBS Energo, Prvni brnenska strojirna.

PBS FACTORY

50 YEARS IN AVIATION

75%





2022

The development of HEXT/CTE 300 cryogenic turboexpander for use in the hydrogen industry completed



2015 Flight tests of TS100 turboshaft engine on T-250 helicopter



2021 Commencement of the development of the PBS TJ200 turbojet engine



2014 Incorporation of Prvni brnenska strojirna Brno into the PBS Group



2020 Establishment of PBS INDIA PRIVATE LIMITED in India



2013 First flight of VUT 061 Turbo with TP100 turboprop engine



2018 Commencement of the serial production of jet engine PBS TJ80-90, first model of the new PBS TJ80 engine range



2012 PBS Velka Bites was awarded the title "Company of the Year"



2006 Establishment of PBS ENERGO, a. s.



2003 Commencement of the serial production of jet engine TJ100



1973 Commencement of the development of generators and auxiliary power units



1969 Establishment of a precision casting foundry in PBS Velka Bites

3 avril 1929

M 62845

Creation of the PBS brand



1955 Registration of PBS brand in India



1903 First steam turbine manufactured under the Parsons license

1950 Founding of PBS in Velka Bites, construction of the first production halls





1837

Relocation of the machine works to Brno on Olomouc Street and commencement of production



Bombing and destruction of a large part of the First Brno plant in Brno



1824

The first Luz steam engine in operation, and the granting of privileges for the construction o steam engines and boilers



1814

1929

Establishment of the machine works in Slapanice, the foundation of Prvni brnenska strojirna by Jan Reiff

MORE ABOUT PBS



IMPORTANT CUSTOMERS

The Indian Air Force have been using the SAFIR 5K/G APUs manufactured by our company for their Mil Mi-17 helicopters for many years. We also supply spare parts and provide service for these APU products.



OTHER APPLICATIONS

We used the world-famous Czech-made L 13 Blanik glider as a flying test laboratory for verifying the performance of PBS TJ100 engines. The experimental glider L 13 with our PBS TJ100 engine reached 10,000 m in tests. The PBS TJ100 engines have subsequently proven themselves also in Experimental Category aircraft in the USA, including aerobatic gliders.

The experience with these high-altitude flights is still used today, for example in the Airbus Blue Condor project, which uses, among other things, the Arcus J glider with the PBS TJ100 engine.



WE HIRE YOUNG TALENTS

We are interested in working with young talent and offer opportunities for mutual collaboration. We strongly believe in developing mutual cooperation between our countries.



AERO INDIA, DEFEXPO

PBS is one of the most prominent companies in the Czech Republic. PBS INDIA is often supported by members of the Government of the Czech Republic in our dealings with important officials of India. Here is a photo of the meeting between the Minister of Defence and the Ambassador of the Czech Republic with the representatives of the Indian Air Force.



RESEARCH & DEVELOPMENT

We use our CESSNA 172 T aircraft as a flying test lab for testing our turboprop engines. PBS has its own in-house manufacturing, development and research facilities. We have been on the market for over 200 years, with our know-how being based on the latest innovations and trends in the Aerospace segment.



COOPERATION

We appreciate the opportunity to work with global and Indian companies and understand the needs of our customers. We are interested in understanding your history, culture and traditions as best as possible. We understand the needs of Make in India and Aatma-Nirbhar Bharat.

MANY FACETS OF PRECISION ENGINEERING

The key area for PBS is aerospace engineering: in-house development, production, testing and certification of small turbine engines, auxiliary power units and environmental control systems. Besides aerospace, PBS also focuses on investment casting and cryogenics.



AIRCRAFT ENGINES

Turbojet, turboprop and turboshaft engines designed and produced by PBS ensure exceptional performance for small manned and unmanned aircraft systems and defence expendable systems. Our reliability is proven by more than 1,500 successful installations in UAVs, aerial targets, microjets and light helicopters.



AUXILIARY POWER UNITS (APU)

We are an EASA certified producer. Our APUs are tailored to customer needs to provide bleed air, electric and hydraulic power. To date we have installed over 6,500 PBS APU. They are mainly used in medium helicopters and training aircraft. We have developed a variant that meets the requirements for off-shore operations.



ENVIRONMENTAL CONTROL SYSTEMS (ECS)

Our ECSs are developed in order to be successfully tailored to specific customer needs. To date we have produced and installed over 7,000 PBS ECS. They are mainly used in medium helicopters and training aircraft but can be quickly adapted for use in light transport aircraft and business jets.

CRYOGENICS

Since the late 1980s we have been developing and supplying cryogenic turbines for the liquefaction of helium. Today we are a major supplier of turboexpanders, compressors and pumps for the world's leading manufacturers of cryogenic systems.







MANUFACTURING AND INVESTMENT CASTING

Our production technologies range from investment casting through conventional manufacturing processes to our own assembly and testing. More than 90% of all our products are produced in-house.

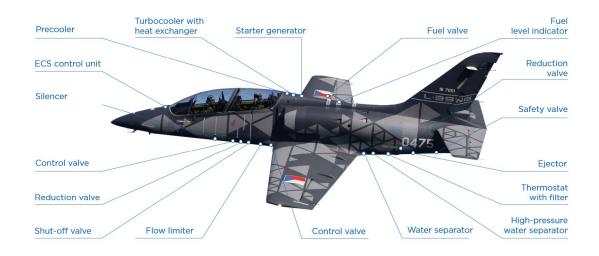
PBS is also a proven supplier of parts and components for leading aerospace manufacturers.



AERO L-39 PROGRAMME

50+ YEARS OF SUCCESSFUL COOPERATION

The L-39NG represents a new generation of modern and cost-effective jet trainer based on the historical heritage of the proven and reliable L-39 Albatros. It continues the success story of the world's most widely used trainer aircraft, the Aero L-39 Albatros. And we are proud to be part of that story.





AERO VODOCHODY AEROSPACE

AERO Vodochody AEROSPACE a.s. is the largest aircraft manufacturer in the Czech Republic and it is one of the oldest manufacturers of aircraft in the world.

Back in 1969 the turbostarters for AI-25 W jet engines in the L-39 Albatros training aircraft were the first ever PBS products for an aviation programme. In the following years, they were replaced by the manufacturing of the Safir 5 air generator, which is the predecessor of today's APU Safir 5K/G, which still belongs among the key products of the aircraft division. Then in 1972, we also supplied the first 11 out of the 4,500 -sets of environmental control systems for the L-39. The L-39 Albatros has gained worldwide popularity thanks mainly to its flight characteristics, easy control, and high reliability. From 1971 – 1997 there were almost 2,900 of these aircraft built.

We believe that more than 50 year long and very successful cooperation between PBS and Aero Vodochody will continue and that the new or innovated aircraft from Vodochody with devices and components from PBS will continue to gain praise and demonstrate the high level of the Czech aviation industry around the world.



In 2020, PBS GROUP established a subsidiary, PBS INDIA PRIVA-TE LIMITED, in the South Indian metropolis of Bangalore. It is a significant and logical step to strengthen an already very good position of the PBS brand in India and increase the satisfaction of local customers.

PBS Group is a stable and innovative engineering company that belongs among the world's oldest engineering brands with more than 200-years of history. The key industries for PBS India are the aviation and space industries and research and development within these branches. The main products for the Indian market are turbojet and turboprop engines, auxiliary power units (APU), environmental control systems (ECS), cryogenics, and foundry products. PBS is constantly investing in research and development, has high-quality technical support with in-house development and testing capacities. The ability to design, construct, produce, and test virtually the entire final product is an important competitive advantage, as well as the possibility to adapt the products to specific customer's requirements while guaranteeing quality. The worldclass level of production is proven by the fact that PBS is a certified company and a holder of design (DOA), production (POA), and maintenance (MOA) organisation approvals issued by the European Aviation Safety Agency (EASA). PBS's quality management system is ISO 9001, AS 9100, ISO 14001, and NADCAP certified.

PBS INDIA PRIVATE LIMITED

"We count on creating an important business base for the PBS brand to support our activities. We want to do long-term business here in India to reach mutual satis-

PBS INDIA: A RELIABLE PARTNER TO THE INDIAN DEFENSE AND AEROSPACE INDUSTRY



faction," said Petr Motyl, Member of the Board PBS India, who doesn't hide the ambitious plans for the subsidiary.

PBS INDIA is going to help the PBS GROUP to develop other business activities in India mainly related to aviation, machining, precise casting, and cryogenic technologies, which could be used, for example, in the Indian space or research programmes. We have world-wide success in selling APUs, which are being also used in the MI-17 helicopters operated by the Indian Air Force. There is a significant number of these helicopters in operation in India and the APUs from PBS are responsible for starting their main engines and supplying electricity for pre-flight preparation. PBS engines can be easily used for manned and unmanned aerial vehicles (UAV) or light sports aircraft. Environmental control systems provide heating, cooling, and ventilation of the cockpit, passenger and cargo space of airplanes and helicopters on the ground or in any flight mode. For the cryogenic industry, which focuses on cooling at very low temperatures, PBS mainly supplies compressors, pumps and turboexpanders for temperatures ranging from -270°C to -123°C. Other advantages of PBS are quality technical solutions and the capability to quickly respond to inquiries.

In 2018, the company introduced two new types of turbojet engines to the market while older types of engines are also constantly improved. PBS even developed a "marine" version of engines specially designed to allow for repetitive landing in salt-water, a kind of engines which would be useful in India. PBS joins collaborations and projects with important Indian entities such as Hindustan Aeronautics Limited, BEL, DRDO, Larsen Toubro, the Indian Air Force, and others. The company is also ready to deal with the challenges of the Indian national program, Make in India. PBS regularly attends the Aero India Expo and cooperates with the Czech administration authorities, i.e., the Czech Embassy in New Delhi and the CzechTrade agency.

"Together with the development of relations between India and the Czech Republic, we feel that our company and its products are more than welcome in India," concluded Petr Motyl.



SAFIR 5K/G MI: APU FOR INDIAN HELICOPTERS

With more than 50 years of experience in aviation and defence and over 6,000 APUs supplied, PBS is a valuable partner for the Indian Air Force fleet of Mil Mi-8/17 helicopters. Many of them are flying with our SAFIR 5K/G MI APUs installed. We are able to offer alternatives to third-party APUs with better tactical/technical specifications suited ideally for harsh climatic conditions. Moreover, PBS is currently focusing its APU R&D activities towards APUs with enhanced performance specially designed for future helicopter programs.



SELECTED INDIAN CUSTOMERS REFERENCES

We are building on our successful activities in India as suppliers of turbine engines for UAVs, UCAVs, aerial targets and missiles.

Here you can see one example of our successes in this area of cooperation with Indian manufacturers. They chose one of our PBS jet engines for their applications.





LEONARDO: ENGINE FOR A NEW GENERATION OF SUCCESSFUL AERIAL TARGET

We have become a proud partner of Leonardo in the modernization of the Mirach 100/5 training target. The Mirach 100/5 target has been a standout success for Leonardo over the last decades, becoming one of the most widely used training drones operated by international navies and air forces. Sixteen armed forces including those of Belgium, Denmark, France, Germany, Greece, Italy, Spain and the UK have trained with the Mirach 100/5.



The updated Mirach 100/5 is an evolution of the successful Mirach 100/5 featuring a range of mid-life upgrades, including PBS TJ150S engine, advanced new avionics and enhanced re-liability.

The Mirach 100/5 accurately simulates hostile aircraft and incoming missiles during training exercises, allowing Armed Forces to train with radars and weapon systems in realistic scenarios.

CURTI AEROSPACE ZEFHIR: HELPING TO MAKE SAFE LIGHT HELICOPTERS A REALITY

The Italian manufacturer Curti Aerospace chose our PBS TS100 turboshaft engine for their light helicopter Zefhir. The Curti Zefhir is a two-seat light single turbine-powered recreational or trainer helicopter. The helicopter complies with EASA CS-27 requirements for larger helicopters and its critical flight elements are tested accordingly. For the use in Curti Zefhir, our engine is derated from 241 to 141 shp (180 to 105 kW) controlled by FADEC.





INSTITUTO NACIONAL DE TÉCNICA AEROESPACIAL: THE FIRST CUSTOMER

The first customer of PBS TJ100 jet engine was the Spanish manufacturer of training targets, INTA. Thanks to the continuous innovation process and more than 20 customer modifications underway, our jet engines have gradually gained customers in more than twenty countries.

The degree of individual customization is a great advantage of PBS jet engines.





ACC GROUP A.B. THUNDERWASP DRONE: FIGHTING FIRES TOGETHER

One of the projects in which we play an important part is the Swedish firefighting drone Thunderwasp from ACC Group A.B. The scalable drone system will also use our PBS TS100 turboshaft engines.





PROUD PARTNER OF EUROPEAN AEROSPACE AND DEFENCE PROJECTS

In addition to these selected projects, PBS is involved in a number of European projects in the aerospace and defence sectors. In particular, our jet engines with their excellent thrust-to-weight ratio are used in a wide range of projects including expendable applications. Our strong asset is our ability to flexibly modify our products according to customer requirements.



SONEX AIRCRAFT SUBSONEX: PERSONAL MICROJET WITH CZECH HEART

Excellent power-to-weight ratio of up to 292 lbf (1,250 N) with low fuel consumption for its output category, high reliability and outstanding technical level of our PBS TJ100 engine convinced the American sports aircraft manufacturer Sonex Aircraft to use this powerplant for its SubSonex personal jet. The SubSonex Personal Jet concept





was first unveiled at AirVenture in 2009. After successful pairing with the PBS TJ-100 engine, the SubSonex JSX-1 prototype achieved first flight in August 2011 and completed a successful flight test program in 2012.

SubSonex JSX-2 prototype achieved its first flight in July of 2014 and the first kits with engines were shipped to customers in February, 2015. The SubSonex Personal Jet has enjoyed a huge amount of great press since its introduction!

NAVMAR TRACER: LOW COST BUT HIGH PERFORMANCE WITH PBS ENGINES



Our power units are also part of another interesting project. This year, Navmar Applied Sciences Corporation (NASC) announced the ongoing development of a new multirole jetengine, Unmanned Ae-rial Vehicle (UAV).

The NASC TRACER[™] unmanned aircraft is a low-cost, high-perfor-mance UAV designed for speed, versatility and survivability. With a wingspan of 18' and a gross take-off weight less than 1,500 lbs., it provides the end users with capabilities in a relatively small footprint that are traditionally found in much larger and more expensive UAS.

RESEARCH & DEVELOPMENT

(B) PBS

TURBOJET ENGINE PBS TJ200

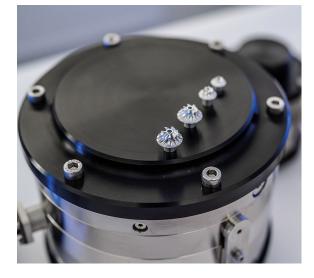
With the very strong support of our R&D team, PBS has successfully launched 6 different engine programs in the past 20 years. As of 2022 PBS R&D department is now adding a seventh engine program to the very successful product portfolio – a brand new, clean sheet design turbojet engine that will be designated PBS TJ200. It is a compact engine of a simple design, fuel lubricated, equipped with a BLDC starter-generator, electric metering fuel pump and electronic control system of FADEC type. TJ200 will represent the most powerful propulsion unit from the PBS turbojet engine family. The new engine program design is well underway, and the engine will proceed to the testing phase later this year.



CRYOGENIC TURBOEXPANDERS HEXT/CTE 300

Extremely-demanding cryogenic product development has been part of the PBS R&D since the mid-1980s. The internal research & development activities have now been focused on mastering the art of tailor made turboexpanders for gas liquefaction and air separation. As of 2022 PBS R&D is well underway with the development of more powerful and more efficient turbine expander designated CTE 300.

All PBS expander product lines exploit a very unique PBS technology and know-how of aerodynamic bearings which benefit the customers in terms of reduced maintenance costs. The PBS R&D team is also responding to the current global environment challenges with the offering of green expander-generator solutions. The expander-generator solutions are now available and will be taking part in the emerging hydrogen value chain.



OUR VISION

The goal of PBS is to satisfy the needs of our customers as much as possible while staying a step ahead of the competition. In order to achieve this vision, we have made research and development an integral part of our production process. We regularly invest in state-of-the-art technologies which allow us to continuously extend the service life and improve the parameters of our products and services.

AUXILIARY POWER UNITS SAFIR 5K/G MI40



Latest R&D activities related to the Auxiliary Power Units were focused on perfecting the 5K/G family. As of now, the latest APU solution represents the apex of a half-a-century long technical development. Every performance parameter was excelled, and so were the dimensions and weight. Major innovations saw the fuel system being without the fuel line and the engine control unit enabling a broader communication with the multifunction display.

ENVIRONMENTAL CONTROL SYSTEM NG



Innovation is the driving force behind every technological breakthrough.

Respecting the mission, PBS has been working on a new generation Environmental Control System, since the limits of a simple cycle Air Cycle Machine have been reached.





By counting all the innovations in, a perfect APU solution has been created and it matches today's performance and safety standards of civil and military aircraft and UAVs. Creating a state-of-the-art dependable APU is a reverberation of the paramount skills, capabilities and an out of the box thinking of PBS engineering.

Recent R&D activities involve upgrading of the turbocooling unit to a 3-wheel bootstrap technology with airfoil bearings, including a system of high-pressure water separation, or significantly changing the concept of heat exchangers. Since the overall performance of PBS solution is being upgraded, so are the temperatures which are controlled via electric solenoid valves. In simple terms, one of the strongest capabilities of PBS is its innovative trailblazing mind set always exploring new opportunities and setting the difference within the competition.

PBS HELPS INDIA DURING COVID SITUATION

In recent years, almost the whole planet has gone through a difficult situation with the Covid 19 pandemic.

In 2021 the Czech Republic donated 500 oxygen cylinders during the worst wave of the pandemic.

Over and above this government activity, four Czech private companies also contributed a selfless donation of 70 oxygen ventilators to the state of Karnataka in May 2021 (PBS Group, Czech Trade, Liko-S, Mico and the Indian company Pushpak). This donation to the



hospitals in the state of Karnataka was received in Bengalore by the Deputy Chief Minister for the state of Karnataka and the Minister for Health. We at PBS INDIA are proud to have been able to help the people of India in this way.

UNMANNED AERIAL SYSTEMS INDIA 2022



PBS INDIA has positioned itself in the Indian Defence Market as a Turbojet Engine manufacturer and solution provider for the Unmanned Applications of Indian Armed Forces. PBS INDIA supports as well as organizes events, seminars, and exhibitions to promote the usage of Turbojet Engines for Unmanned Applications like for UAV, Aerial Targets, Drones, Loitering Munitions and Missiles.

COLOURS OF INDIA IN PBS CZECH REPUBLIC

PBS is a major Czech exporter and supplies its products to almost 50 countries around the world. Our employees in the production plant have the opportunity to learn about Indian culture through small informal events such as "India Day in PBS factory", which was organized in the summer of 2022.





PBS INDIA PRIVATE LIMITED

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