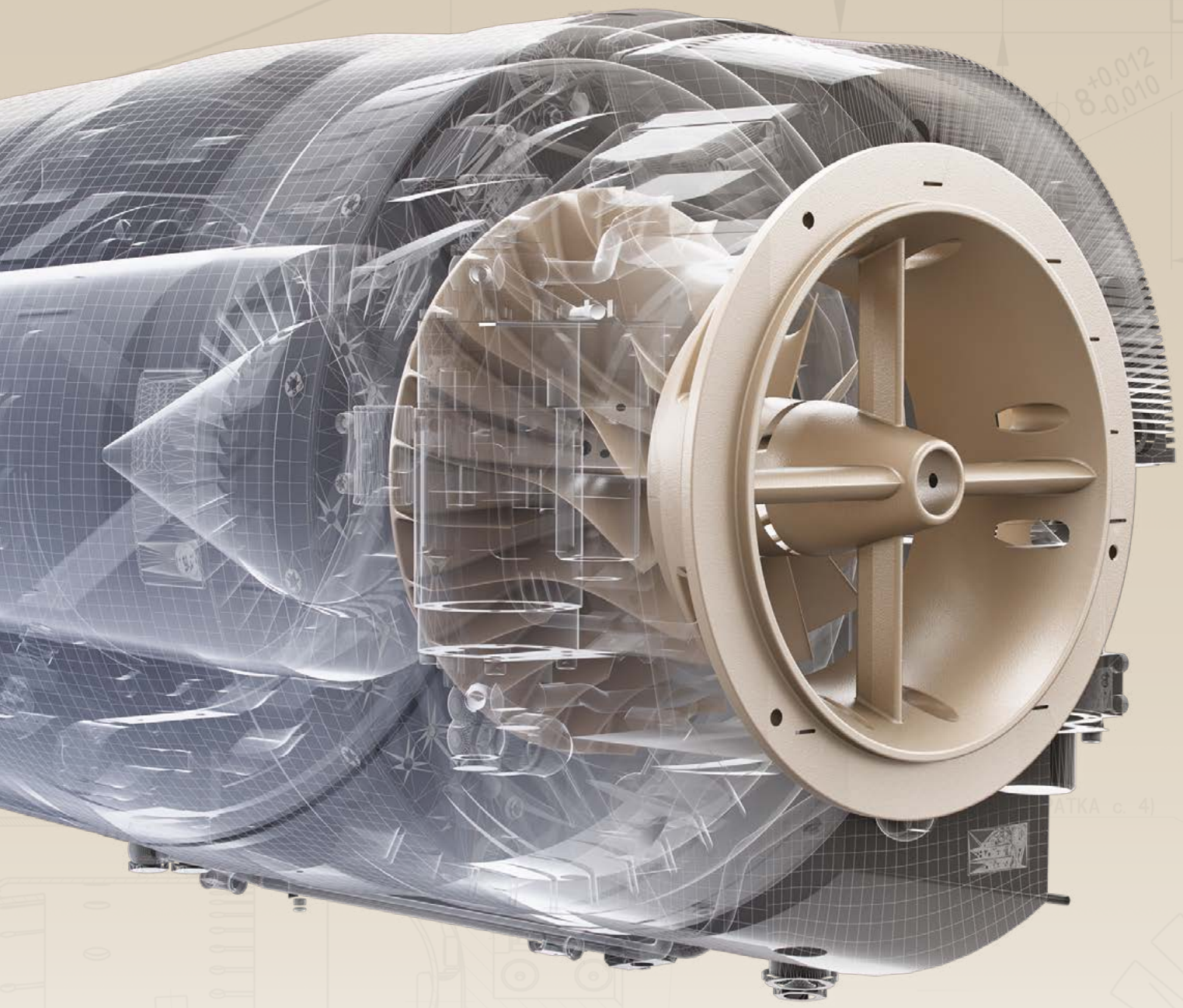
PBS AEROSPACE MAGAZINE



PBS AEROSPACE

CONTENTS

Tomas Koutsky
Director of PBS Aerospace

Dear business friends and partners,

Since writing our last PBS Aerospace Magazine editorial over a year ago, a lot has changed, especially in the business opportunities and programs we work on. Even though I am not at liberty to name any details, I can say we are establishing new prospective collaborations.

Simultaneously, new opportu-nities are also being generated due to positive references of our current customers and partners, which of courses pleases us and testifies to the establishment of the PBS brand on the US Market. Our products' superlative quality, coupled with our adaptability and receptivity to customer modification requests, has fostered this success. Active facilitation of product integration into diverse aerial platforms' final designs stands as a paramount priority. We aspire to provide localized support for integration services, maintenance, repairs, and overhauls of PBS products within the United States.

We firmly believe that we will uphold our position as a global leader in designing and manufacturing small turbine engines, contributing to bolstering the defense capabilities of the USA and its NATO Allies.

I would also like to thank the PBS Aerospace team for their dedicated efforts, and of course, our customers and business partners for their trust.

PBS AEROSPACE

Turbojet engine PBS TJ100

PBS Velka Bites production site

Turbojet engine assembly

Electroplating

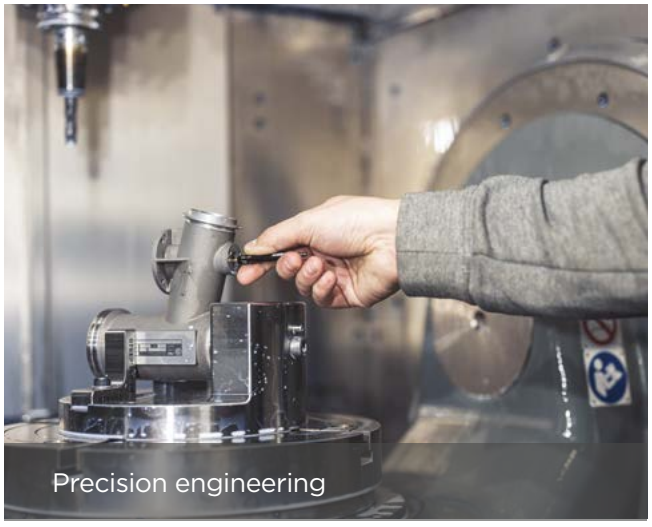
200+
YEARS IN THE BUSINESS

75 %
EXPORT

50+
YEARS IN AVIATION

800
EMPLOYEES

Precision casting



Precision engineering

About us

PBS AEROSPACE 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, a.s.
PBS AEROSPACE Inc.
PBS INDIA PRIVATE LIMITED
PBS ENERGO, a.s.
Prvni brnenska strojirna, a. s.

2022

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

2021

Commencement of the development of the PBS TJ200 turbojet engine

2020

Commencement of the serial production of cryogenic turboexpander HEXT/CTE 200

2018

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

2015

Flight tests of TS 100 turboshaft engine on T-250 helicopter

2014

Incorporation of Prvni brnenska strojirna Brno into the PBS Group

2013

First flight of VUT061 Turbo with TP100 turboprop engine

2012

PBS Velka Bites was awarded the title „Company of the Year“

2006

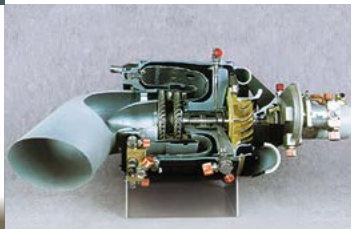
Establishment of PBS ENERGO, a. s.

2003

Commencement of the serial production of jet engine TJ100

1985

Commencement of the production of decanter centrifuges



1973

Commencement of the development of generators and auxiliary power units

1969

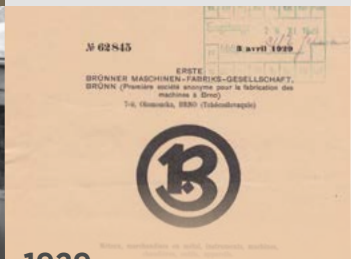
Establishment of a precision casting foundry in PBS Velka Bites

1950

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

1945

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



1929

Creation of the PBS brand

1903

First steam turbine manufactured under the Parsons license

1837

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

1824

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

1814

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

HIGHLIGHTS OF THE YEAR 2023

PBS TJ200

The latest addition to the PBS turbojet engine portfolio is the new PBS TJ200. This brand new, clean sheet design turbojet engine is in the final stages of development and the engine mock-up was presented for the first time at the Paris Air Show 2023. This state-of-the-art engine has a thrust rating of 2,280 N.

PBS TJ200 will represent the most powerful propulsion unit from the PBS turbojet engine family.

AI-PBS-350

Prvni brnenska strojirna Velka Bites, a.s. (PBS) and Ivchenko-Progress SE, a renowned Ukrainian state enterprise specializing in designing and developing aircraft engines, signed a Memorandum of Understanding (MoU) on strategic cooperation at the Paris Air Show 2023. The agreement aims to establish a commercial, development, and production cooperation framework on the new AI-PBS-350 3,400 N turbojet, which will be a joint product of PBS and Ivchenko-Progress SE.

PBS APU SPARK40

At the Paris Air Show 2023, on Tuesday 20th June, PBS officially unveiled the new PBS APU SPARK40 auxiliary power unit. With the PBS APU SPARK40, we have effectively doubled the AC power available for onboard systems while increasing the amount of pressurized air. We have also reduced weight, increased the operating envelope, optimized the fuel-oil system, improved reliability, and extended the life of the combustion chamber.

PRECISION ENGINEERING AT ITS BEST

PBS Aerospace's core business is aerospace engineering: in-house development, production, testing, and certification of small turbine engines, auxiliary power units, and environmental control systems.

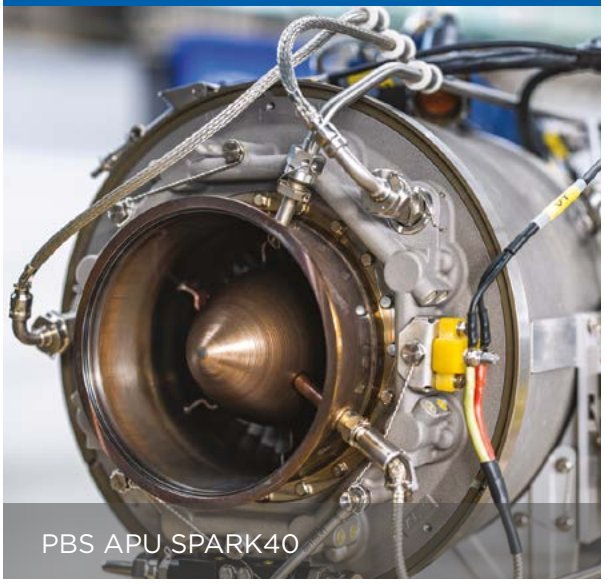
Aircraft Engines

PBS-designed and manufactured turbojet, turboprop, and turboshaft engines provide exceptional performance for small manned and unmanned aircraft systems. Other variants of these propulsion units are designed for defence applications, in particular for missiles. Our reliability is proven by more than 1,500 successful installations in UAVs, airborne targets, microjets, and light helicopters.

Turbojet engine PBS TJ150

Auxiliary Power Units (APU)

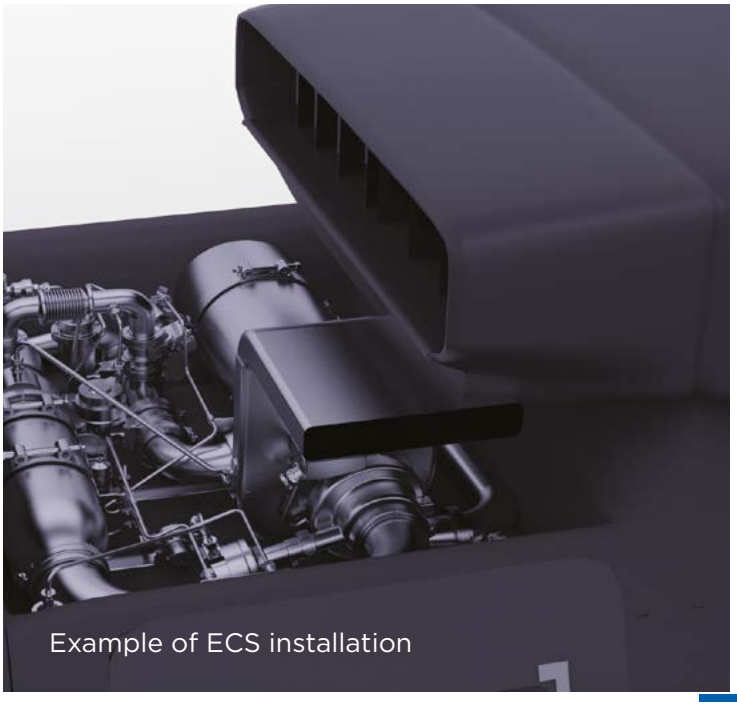
We are an APU EASA-certified manufacturer. Our APUs can be tailored to customer requirements. To date, we have installed more than 7,000 PBS APUs. They are mainly used in medium helicopters and training aircraft. At this year's Paris Air Show, we launched our latest APU, the PBS APU SPARK40 for medium helicopters, aircraft, and UAVs.



PBS APU SPARK40

Environmental Control Systems (ECS)

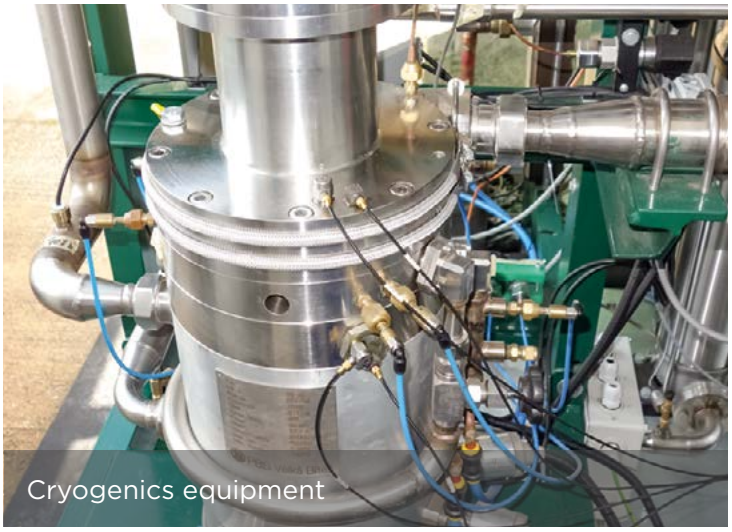
Our ECSs are designed to be successfully tailored to specific customer requirements. To date, we have produced and installed more than 7,200 PBS ECS. They are mainly used in medium helicopters and training aircraft, but can be quickly adapted for use in light transport aircraft and business jets.



Example of ECS installation

Cryogenics

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


Cryogenics equipment


Aircraft gearbox

Precision casting and electroplating

Over 90 % of our products are manufactured in our own facilities. Our manufacturing technologies range from precision casting to conventional engineering processes, electroplating, metal finishing to actual product assembly and testing.

Thanks to our experience, modern machinery and production quality, we are a supplier of castings to the world's leading manufacturers of turbochargers, combustion turbines, aircraft components and glass wool insulation materials.

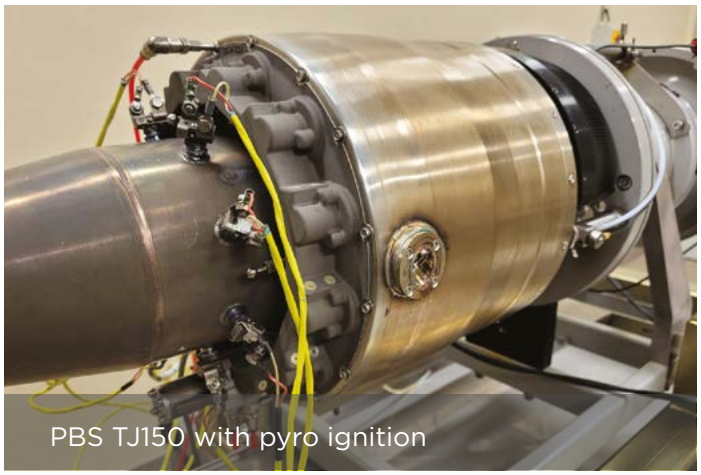

Surface treatment


Precision casting

PBS test facility

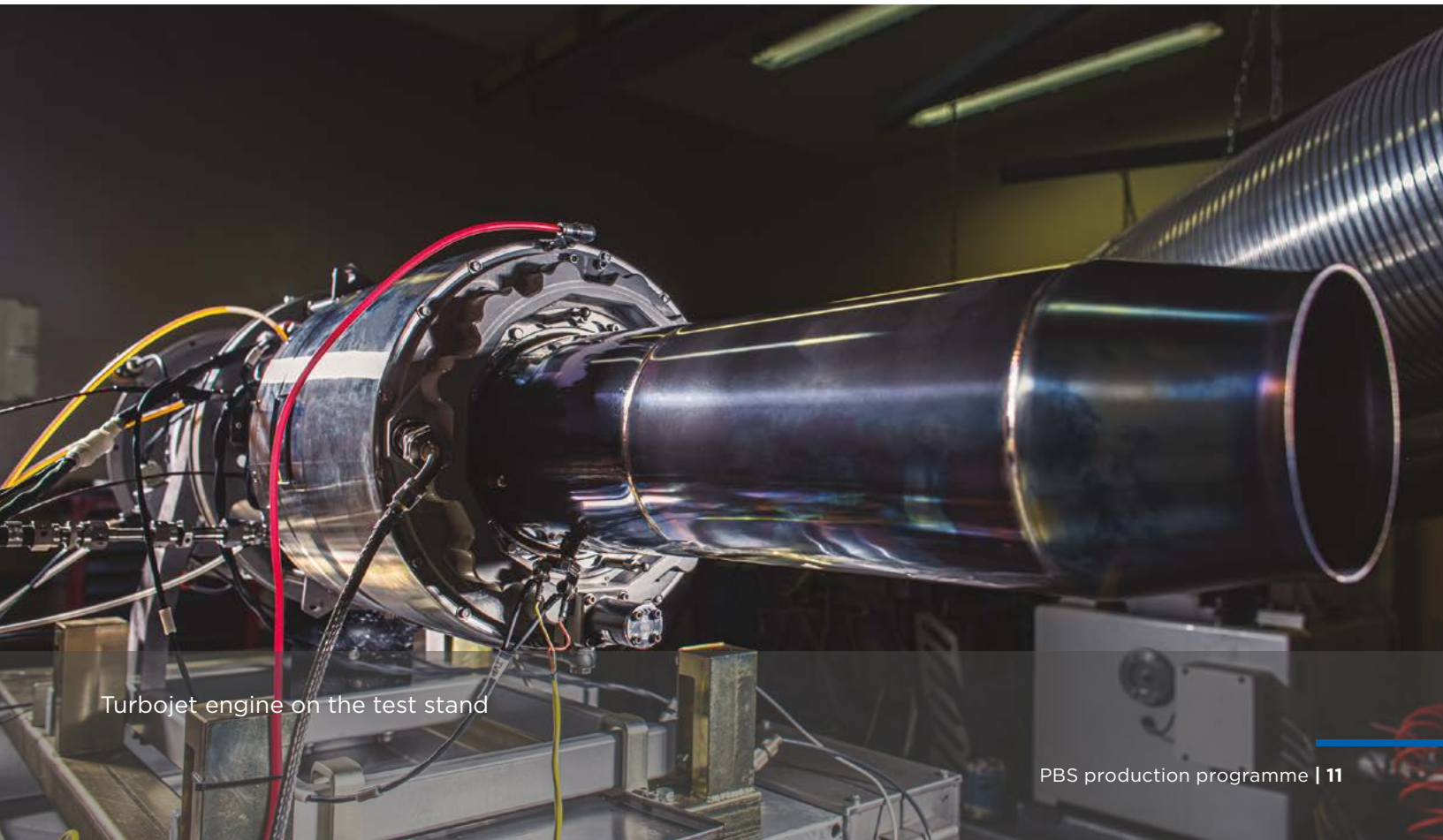
The development and production of aircraft turbine engines at PBS Velka Bites are also made possible by its own test facility. 16 specialized test boxes are designed for testing turbine engines, auxiliary power units, and air conditioning systems. Specialized equipment is also available for testing, for example, the starting of jet engines at high speeds up to Mach 0.9.

Separate test boxes are also available for testing products for the cryogenic industry.



PBS TJ150 with pyro ignition

PBS TP100

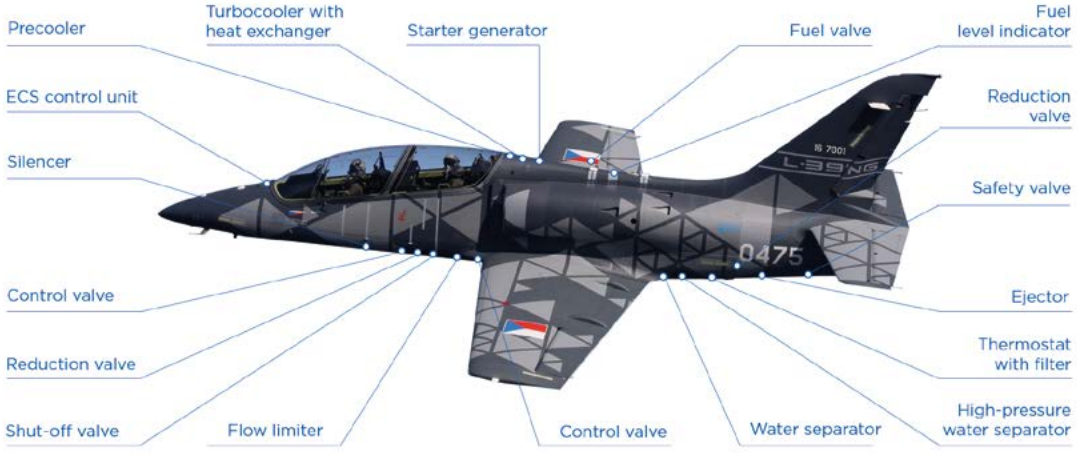


Turbojet engine on the test stand

AERO L-39NG

AERO L-39NG PROGRAMME

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



50+ YEARS OF SUCCESSFUL COOPERATION

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

As early as 1969, the turbostarters for the AI-25W jet engines of the L-39 Albatros trainer aircraft were the first PBS products for the aerospace production programme. In the following years, they were replaced by the production of the Safir 5 air generator, the predecessor of today's Safir 5K/G APU, which is still one of the key products of the Aircraft Division. In 1972, we also delivered the first 11 of the 4,500 sets of environmental control systems for the L-39.

The L-39 Albatros gained worldwide popularity mainly due to its flight characteristics, ease of control, and high reliability. Almost 2,900 of these aircraft were built between 1971 and 1997.

There are many types of PBS equipment and devices in use on the AERO jets

We believe that the very successful cooperation between PBS and Aero Vodochody, which has lasted for over 50 years, will continue and that new or upgraded aircraft with PBS equipment and components will continue to win accolades and demonstrate the high level of the Czech aviation industry all over the world.

ECS takes care of crew comfort in flight

OUR PRODUCTS WORLDWIDE

Excellent technical parameters, production quality and attention to the end customer have opened the way for PBS products to be used in many interesting projects in the aerospace industry in many countries around the world. Whether it is turbine engines, auxiliary power units or environmental control systems, the traditional high quality of Czech engineering is highly praised.

Curti Aerospace Zefhir over Northern Italy

CURTI AEROSPACE ZEFHIR

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


Launch of the Mirach 100/5 aerial target

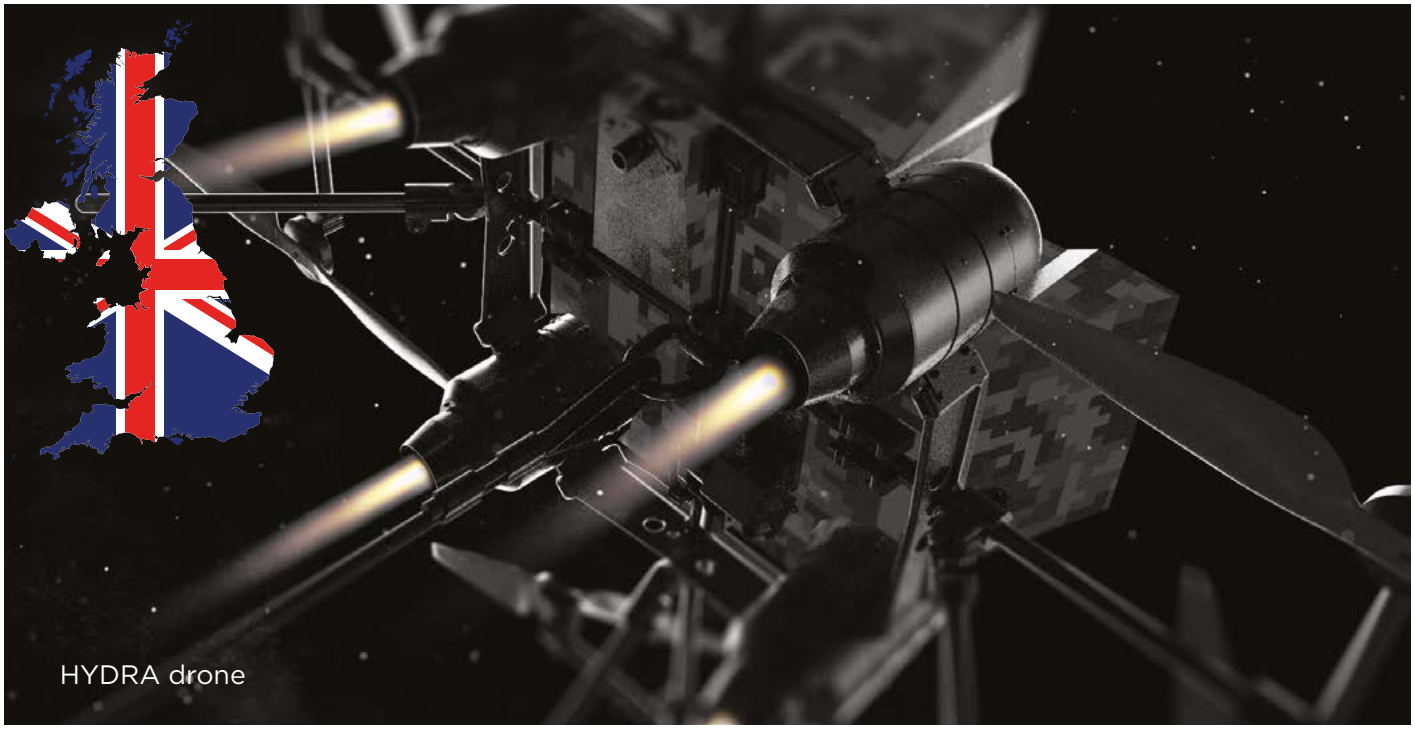
LEONARDO MIRACH 100/5

We are a proud partner of Leonardo in the modernisation of the Mirach 100/5 training target. The Mirach 100/5 target has been an outstanding success for Leonardo over the past decades, becoming one of the most widely used training drones by international navies and air forces.

Sixteen armed forces, including those of Belgium, Denmark, France, Germany, Greece, Italy, Spain and the United Kingdom, have trained with the Mirach 100/5.

The upgraded Mirach 100/5 V2 is an evolution of the successful Mirach 100/5, incorporating a number of mid-life upgrades including the PBS TJ150S engine, advanced new avionics, and improved reliability.

The Mirach 100/5 accurately simulates enemy aircraft and incoming missiles during training exercises, enabling armed forces to train with radars and weapons systems in realistic scenarios.



HYDRA drone

HYDRADRONES HYDRA

Combining the high specific thrust of PBS jet engines, with the quick response times of BLDC motors, the British company created an immensely powerful and maneuverable UAV. Being a VTOL, it does not require a runway to operate and can take off and land on virtually any flat surface. Due to the Extremely high energy density of jet fuel (12 kWh/kg) compared to batteries (<200 Wh/kg), Hydra is able to pack huge amounts of power into a small, lightweight form factor.

The advanced AI-powered sensor suite enables Hydra to operate GPS-denied environments. Using a long line and cargo net made of Kevlar, Hydra can carry up to 140 kg in a standard NATO half pallet.

INTA aerial target

INSTITUTO NACIONAL DE TÉCNICA AEROESPACIAL: THE FIRST CUSTOMER

The first customer for the PBS TJ100 engine was INTA, the Spanish manufacturer of aerial target drones. Thanks to the continuous innovation process and more than 20 ongoing customer modifications, our jet engines have gradually gained customers in more than twenty countries. The degree of customization is a major advantage of PBS engines.

Flight of Subsonex JSX-2 aircraft

SONEX AIRCRAFT SUBSONEX

The PBS TJ100 engine's excellent power-to--weight ratio with up to 292 lbf (1,250 N) thrust with low fuel consumption, high reliability, and outstanding technical level convinced Sonex Aircraft, the American manufacturer of sports aircraft, to choose this engine for its SubSonex Personal Jet.

The SubSonex Personal Jet concept was first unveiled at AirVenture 2009. Following successful mating with the PBS TJ100 engine, the SubSonex JSX-1 prototype made its first flight in August 2011 and completed a successful flight test programme in 2012. Today, there are dozens of these machines flying around the United States.


NASC TRACER™ UAV


NASC TRACER™ UAV

NAVMAR TRACER UAV

Navmar Applied Sciences Corporation (NASC) continues with the project of a multirole UAV.

The NASC TRACER™ unmanned aircraft is a low-cost, high-performance UAV designed for speed, versatility, and survivability.

With a wingspan of 18’ and a gross take-off weight of 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.

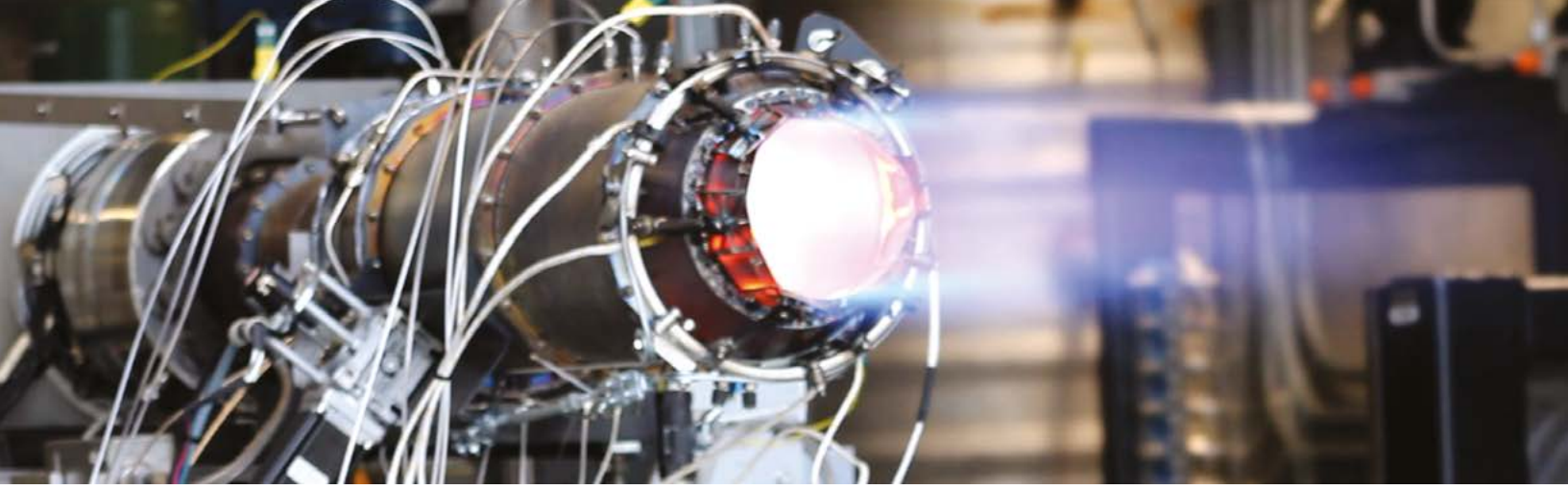
Visualization of Thunder Wasp TS drone

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

Independently and without outside capital, ACC-Group and ACC-Innovation have financed, developed, and manu-factured a range of the world's largest quadcopter drones with a payload capacity of well over 1000 kg.

This has been made possible by the company's patents, the powerful and reliable PBS TS100 turboshaft engines, and the diverse skills available within the three companies. The PBS TS100 turboshaft engines deliver excellent performance whether it's for lifting or surveillance with longer flights.

Visualization of Thunder Wasp TS drone



PBS AEROSPACE'S TURBOJET ENGINE POWERS VELONTRA'S BREAKTHROUGH IN ADVANCED HYPERSONIC PROPULSION

PBS Aerospace takes pride in celebrating Velontra's remarkable achievement in harnessing the power of our turbojet engine for advanced hypersonic propulsion. Velontra's success in developing cutting-edge solutions for attritable super and hypersonic applications is a testament to PBS's commitment to innovation and excellence.

The Bronco propulsion system, ingeniously built around PBS's turbojet engine, stands as a testament to the unmatched performance and cost-effectiveness that our technology offers. This achievement reinforces PBS Aerospace's position as an industry pioneer, continuously pushing the boundaries of aerospace technology.

Velontra's utilization of our turbojet engine underscores the critical role that PBS plays in shaping the future of aviation and propulsion systems. As we celebrate Velontra's achievement, we reaffirm our commitment to driving innovation and revolutionizing the landscape of compact, high-performance, and affordable hypersonic solutions.

"Velontra is excited to have developed advanced propulsion with PBS Aerospace for attritable super and hypersonic applications."

RESEARCH & DEVELOPMENT

PBS's aim is to satisfy the needs of our customers to the best of our ability and to stay one step ahead of the competition. To achieve this vision, we have made research and development an integral part of our production process. We regularly invest in cutting-edge technologies that enable us to continually extend the life and improve the parameters of our products and services.

TURBOJET ENGINES

With the very strong support of our R&D team, PBS has successfully launched six different engine programmes over the past 20 years. Our current turbine engine development activities are focused on two areas.

The first is the development of new versions of existing turbine engines in response to customer requirements, and the second is the development of new engines in higher thrust categories.

The first area includes, for example, newly developed versions that allow engines to be re-used after landing in salt water. The pyrotechnic ignition engines, on the other hand, are used in in--flight launch applications due to their extended launch envelope.

The new PBS TJ200 engine, currently in the final stages of development, is the first step towards PBS entering the higher thrust categories.

It is a compact engine of simple design, fuel lubricated, equipped with a BLDC starter-generator, electric metering fuel pump and a FADEC electronic control system. The PBS TJ200 will be the most powerful engine in the PBS-designed family of jet engines.

HEXT/CTE300 cryogenic turboexpander

CRYOGENICS

Highly sophisticated cryogenic product development has been part of PBS R&D since the mid-1980s. Internal R&D activities are now focused on mastering the art of tailor-made turboexpanders for gas liquefaction and air separation. As of 2023, PBS R&D is well advanced with the development of a more powerful and efficient turboexpander called HEXT/CTE 300.

All PBS expander product lines utilise a very unique PBS aerodynamic bearing know-how, which benefits customers in terms of reduced maintenance costs. The PBS R&D team is also responding to the current global environmental challenges by offering Green Expander-Generator solutions. The expander-generator solutions are now available and will participate in the emerging hydrogen value chain.

Turboexpander assembly




AUXILIARY POWER UNITS

Following the completion of the development of the new APU and its launch this year, further development work is focused on the development of a next-generation APU that will be able to address current and anticipated future requirements for auxiliary power units in modern aircraft, helicopters, and unmanned aerial vehicles. Thorough market research is underway as well as sub-development work on subsystems of the future new APU.

PBS APU installation in a modern helicopter

ENVIRONMENTAL CONTROL SYSTEMS

Innovation is the driving force behind every technological breakthrough. With this in mind, PBS has been working on a new generation of environmental control system, since the limits of a simple air cycle machine have been reached.

Recent R&D activities include upgrading the turbocooling unit to a 3-wheel bootstrap technology with airfoil bearings, including a high-pressure water separation system, or significantly changing the heat exchanger concept. As the overall performance of the PBS solution is improved, so are the temperatures, which are controlled by electric solenoid valves.

Simply put, one of PBS's strongest capabilities is its innovative, pioneering spirit, which constantly explores new possibilities and sets it apart from the competition.

PBS ECS unit installation in a modern helicopter

FOSTERING FUTURE TALENT

POWERING INNOVATION: PBS PARTNERS WITH EMBRY-RIDDLE TO ENHANCE UNIVERSITY´S TESTING CAPABILITIES

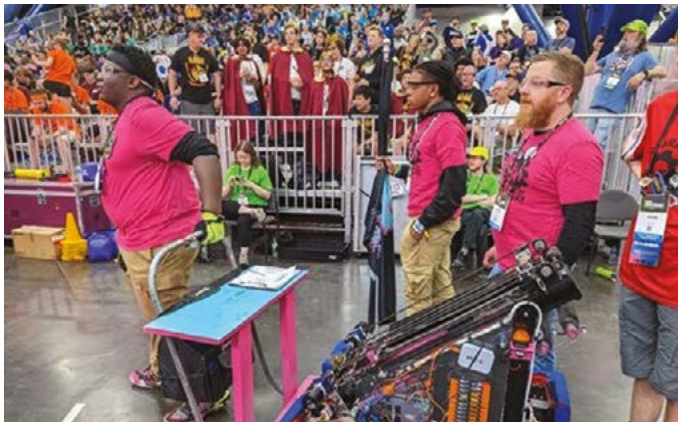
PBS Aerospace has been assisting Embry-Riddle Aeronautical University with the development of a specialized test cell to support numerous testing capabilities for PBS' turbojet engine line.

Embry-Riddle's Viper Propulsion team at the Prescott Campus designed a self-contained testing facility to support engine tests on the PBS TJ40-G2 turbojet — an engine used in small manned and unmanned aircraft systems.

The senior capstone team has been collaborating with the PBS Engineering team since September 2022 and is now ready to release the final design & construction of the completed test cell. Part of the collaboration involved PBS providing Embry-Riddle with a CAN-USB converter which is used to analyze engine performance.

FIRST® INTERNATIONAL ROBOTIC CHALLENGE IN HOUSTON

FIRST® International Robotic Challenge is an international event for youth robotics competition season and an annual celebration of science, technology, engineering, and math (STEM) for the community as young people are preparing for the future. It inspires young people to be science and technology leaders and innovators by engaging them in exciting mentor-based programs that build science, engineering, and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership.

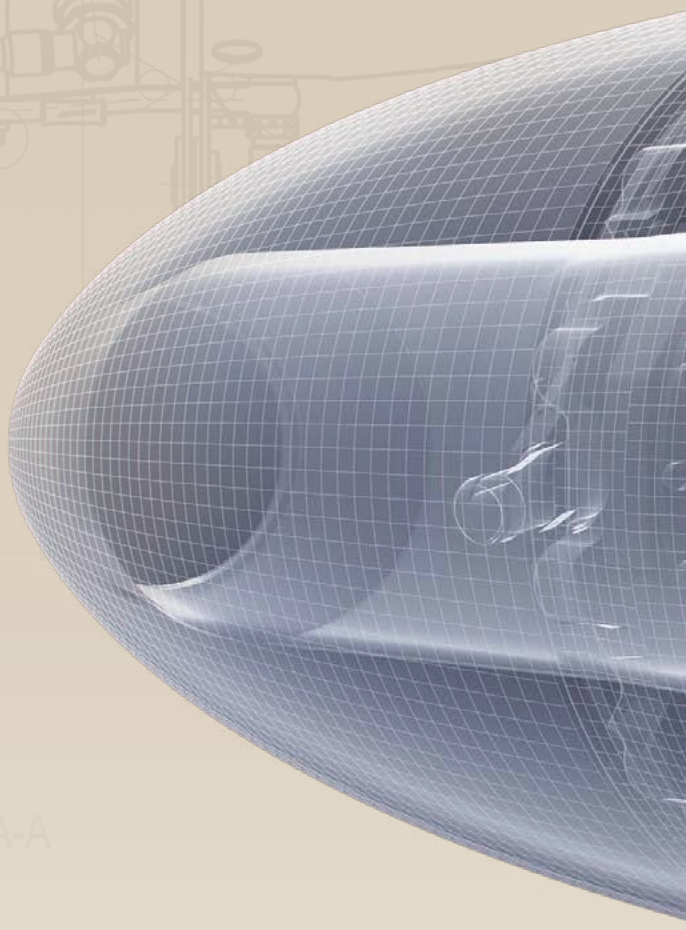


This was first such an even and it was held from 19th until 22nd April at Robert Brown Convention Center in Houston, Texas. The team Tindley Trailblazers competed in the Hopper Division 2023 and they were ranked 57 with a record of 3-7-0.

PBS Aerospace is extremely honored to sponsor such an incredible group of talent. Even though Tindley Trailblazers did not prevail they achieved a lot this season.
The team was previously awarded:

- District Engineering Inspiration Award
- District Event Winner
- Judges Award
- Regional Engineering Inspiration Award

These are just a few of their overall accomplishments. Tindley Trailblazers competed in 16 competitions this year and won 1 competition. They will continue to strive for excellence and create great successes in the engineering industry.



PBS AEROSPACE

PBS AEROSPACE Inc.
3400 Peachtree Rd. NE, Suite #939
Atlanta, GA 30326
USA
www.pbsaerospace.com

JOUR03B-EN-2306