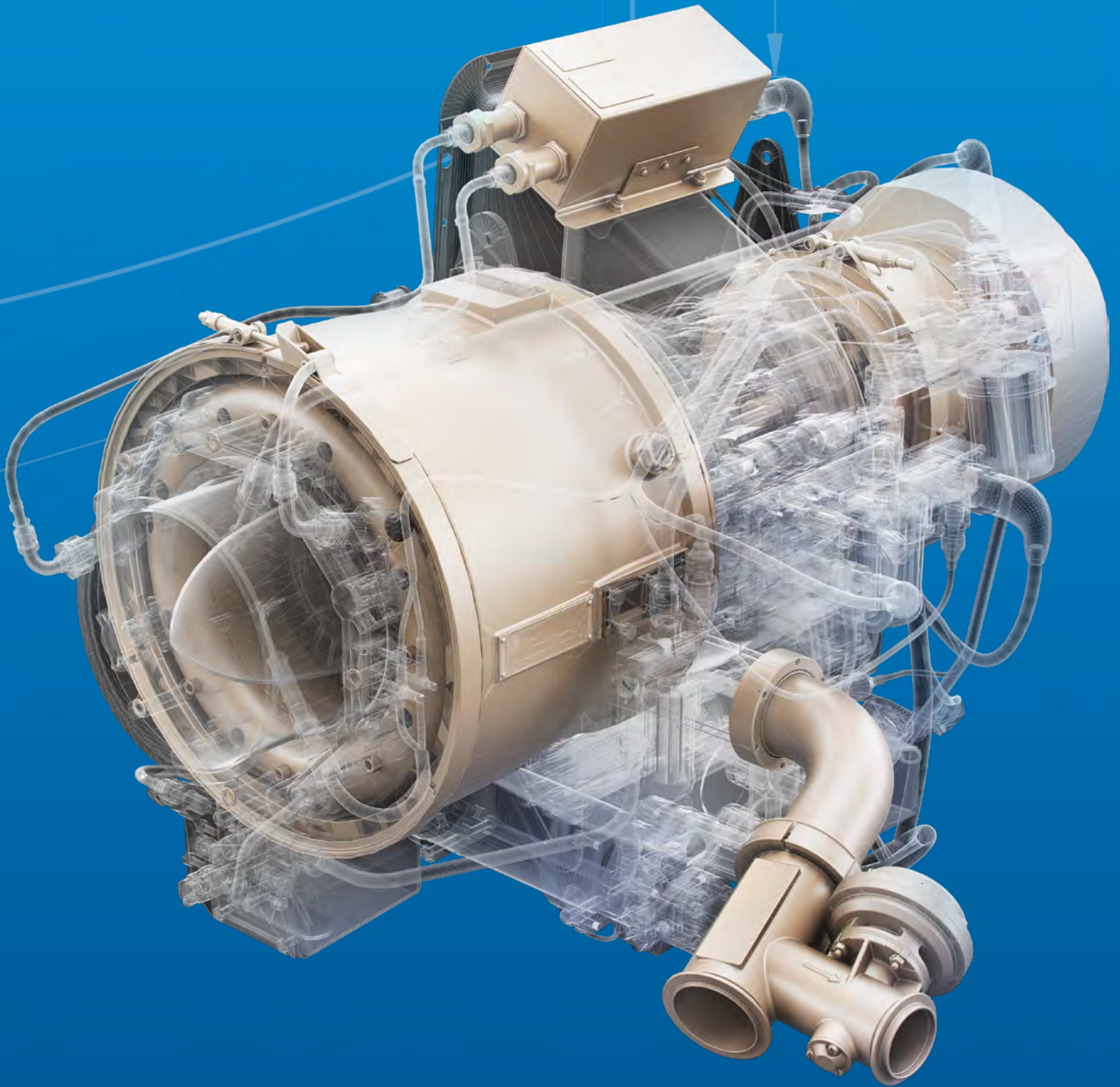


# PBS JOURNAL

BUSINESS • PRODUCTS • SOCIAL NEWS



# CONTENTS

**04**

PBS Velka Bites

**06**

Historical milestones

**07**

2023 Highlights

**08**

Precision engineering at its best

**12**

Our success story

**14**

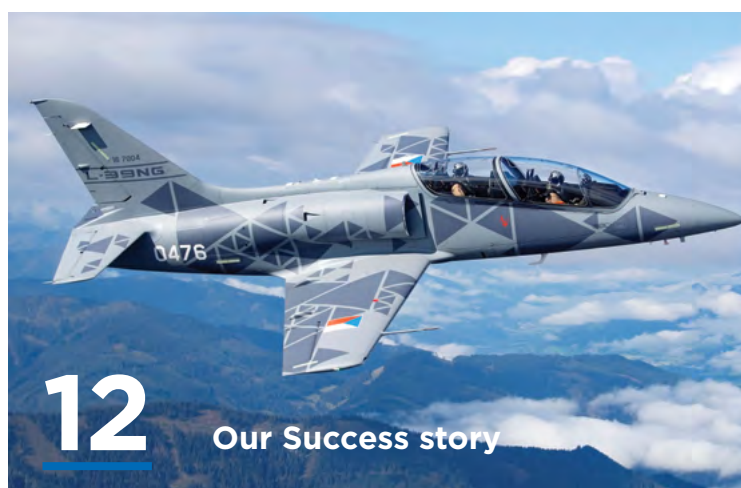
PBS products all over the world

**20**

Research and development

**23**

Environmental, social, governance







Milan Macholan

CEO and member of the board of První brněnská strojirna Velká Bítov

## Dear Business Partners,

**P**rvní brněnská strojirna Velká Bítov (PBS) entered the aerospace industry more than 50 years ago and has become a globally recognized manufacturer of small turbine engines, auxiliary power units, environmental control systems, and other components for the aviation industry. Together with other Czech aerospace manufacturers, we continue the legacy of our predecessors and spread the good name of the Czech industry and engineering. We are proud to be successful worldwide with products designed, engineered, manufactured, and tested in the Czech Republic, specifically at PBS. However, the PBS brand is not just synonymous with aerospace manufacturing. Our experience with high-speed turbines has led us to the technologically advanced manufacture of cryogenic turboexpanders,

pumps, and compressors for liquefying rare gases.

One of our most prestigious references in this field is the long-standing use of our cryogenic products in the European Organisation for Nuclear Research (CERN) facilities.

Our precision casting foundry supplies high-precision castings in cobalt and nickel-based superalloys for our aerospace production and the energy, turbocharger, and healthcare industries. We are also a leading custom supplier of surface treatments for metal components, offering a comprehensive range of services.

I would like to thank all the supporters of PBS and invite all those interested in new technologies to visit our production plant in Velká Bítov in the Vyškov region.



# PBS VELKA BITES



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 engineering



Precision casting

## About us

**P**BS 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 International Trading, a.s.**

**PBS AEROSPACE Inc.**

**PBS INDIA PRIVATE LIMITED**

**PBS ENERGO, 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**

PBS celebrates 200 years of brand success



**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.



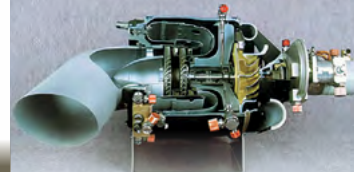
**2003**

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



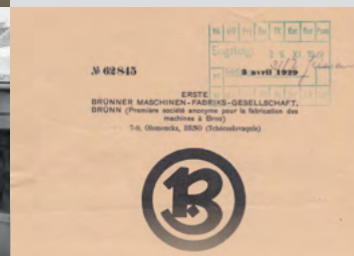
**1950**

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



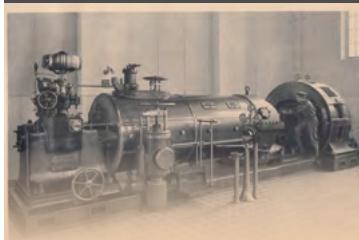
**1945**

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



**1929**

Creation of the PBS brand



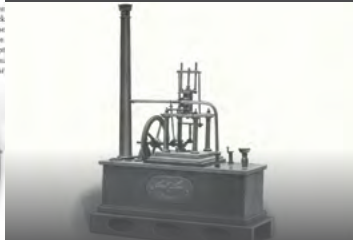
**1903**

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 První brněnská strojírna by Jan Reiff



# HIGHLIGHTS OF THE YEAR 2023



## 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.

## 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

První brněnská strojírna 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.

# PRECISION ENGINEERING AT ITS BEST

PBS Velka Bites core business is aerospace engineering: in-house development, production, testing, and certification of small turbine engines, auxiliary power units, and environmental control systems. In addition to aerospace, PBS also focuses on investment casting and cryogenics.





## Aircraft Engines

**P**BS-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)

**W**e 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)

**O**ur 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

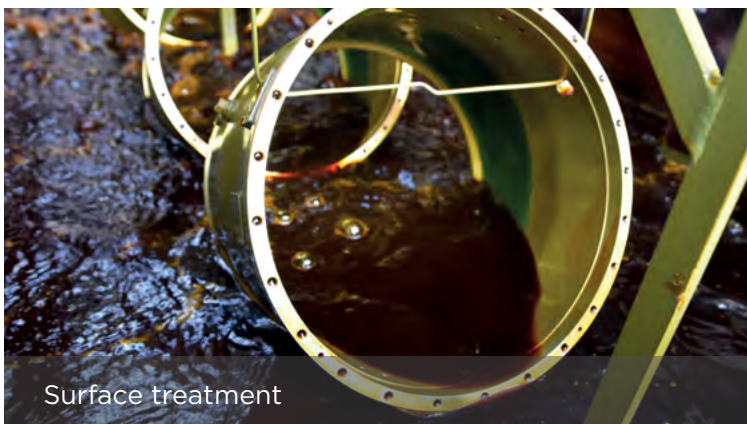


Aircraft gearbox

## 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

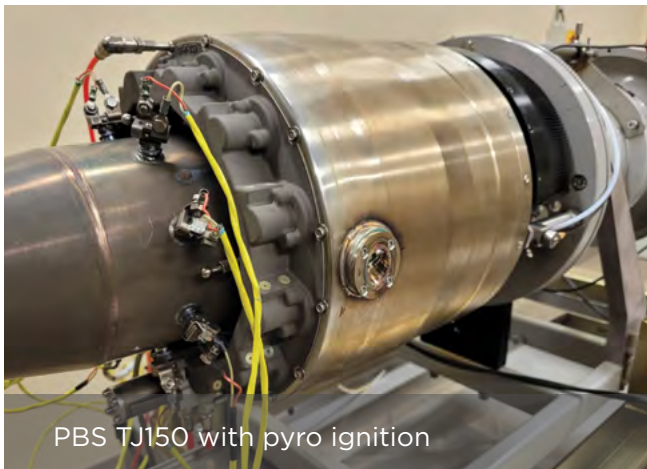


Precision casting



## PBS test facility

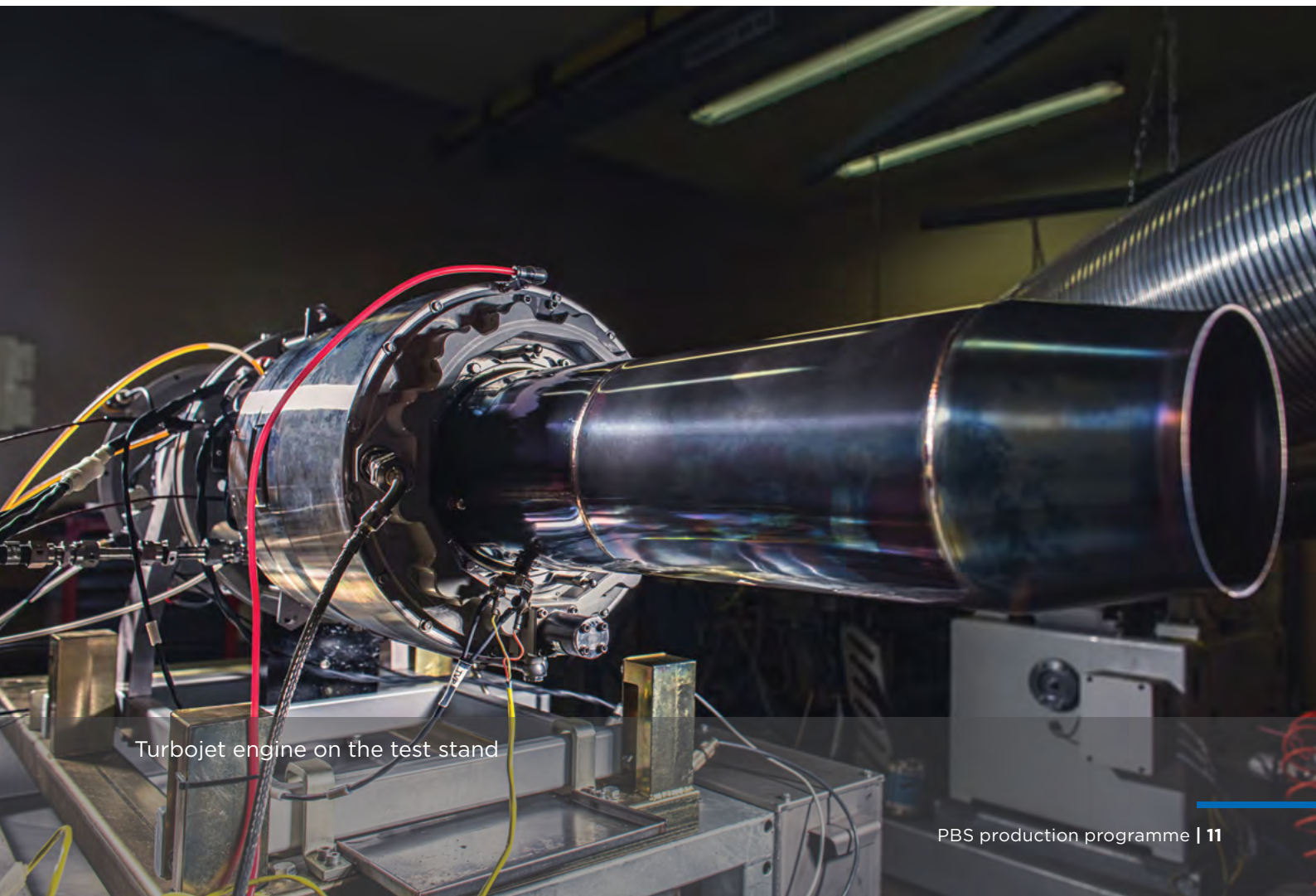
The development and production of aircraft turbine engines at PBS Velka Bites are also made possible by its own test facility. 16 specialized test boxes are designed for testing turbine engines, auxiliary power units, and air conditioning systems. Specialized equipment is also available for testing, 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

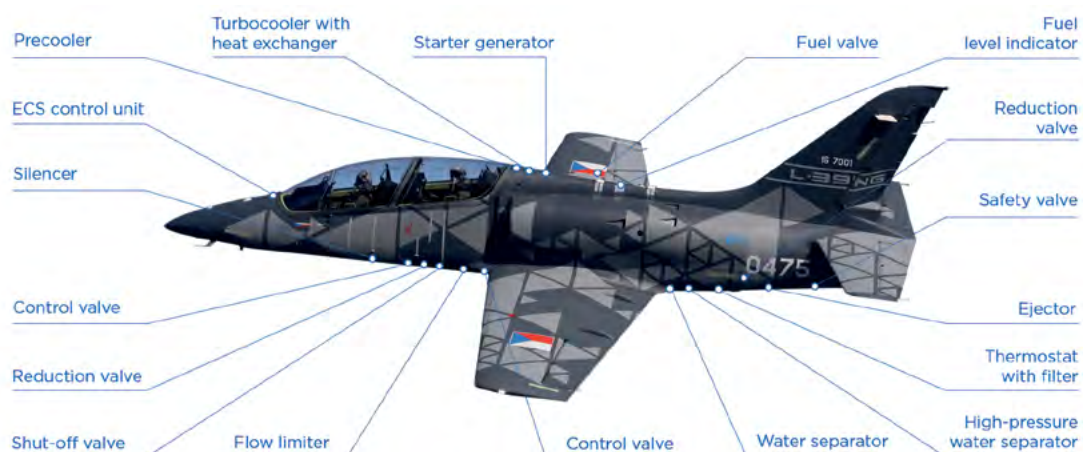




AERO L-39NG

# 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

**A**ERO 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 prede-

cessor 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

**W**e 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

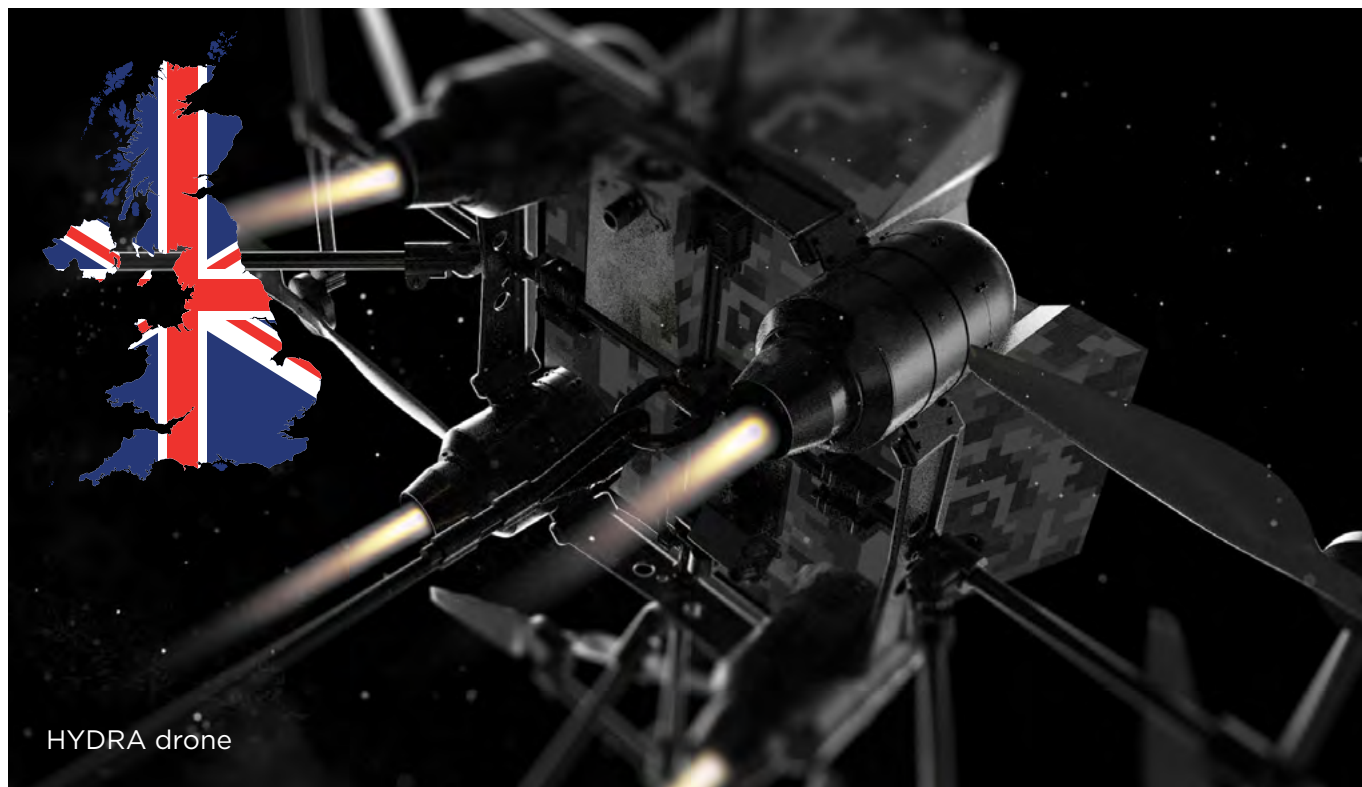
## LEONARDO MIRACH 100/5

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 AEROSPAZIAL: 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 of up to 292 lbf (1,250 N) with low fuel consumption for its thrust category, 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 manufactured 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





Mil Mi-17 V5 equipped with SAFIR 5K/G MI APU

## 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 CUSTOMER REFERENCE

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

Here is an example of our success in working with Indian manufacturers in this area. They have chosen one of our PBS turbojet engines for their applications.



Indian UAV application



# 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



# ESG

## ENVIRONMENTAL, SOCIAL, GOVERNANCE

As ESG becomes increasingly prominent, organizations involved in the aerospace and defence industry must address the challenges and identify growth opportunities. There are many drivers of the ESG agenda for aerospace and defence companies, but those that lead on ESG are most likely to find competitive advantage.



Presents for children from the orphanage



We support an internationally successful pond hockey team



Automatic defibrillators on company premises



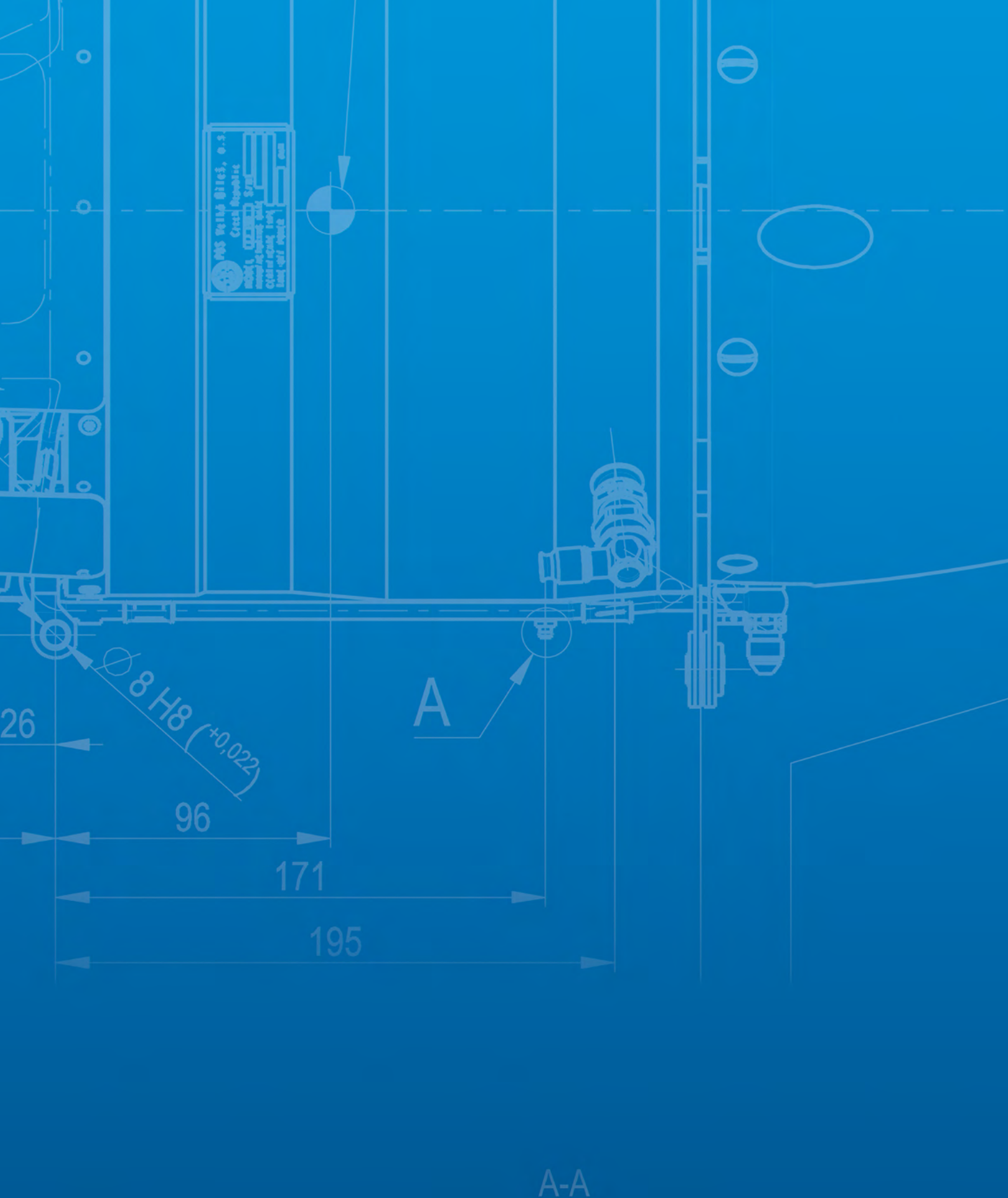
Helping in a home for the mentally handicapped



Some of our employees donate blood



FC PBS Velká Bíteš



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