ADVERTISEMENT FEATURE

A BIRD'S-EYE VIEW TO THE FUTURE OF DESIGN

A micro-satellite research team tests its new design.

NPU researchers developed China's first continuously pressurized high-speed wind tunnel.

Technologies flying high

China's drone industry is growing fast, and predicted to soon become the world leader in this technology. Northwestern Polytechnical University (NPU), the home of China's first unmanned aerial vehicle, is behind the drone industry's rapid rise.

NPU set up China's first production line for drones for export, and is the country's largest industrial base for research and design of small- and medium-sized drones. The drone technology is just one strength of NPU, the major aerospace engineering centre based in Xi'an. The aeronautics and astronautics programmes at NPU delve into basic and applied sciences, as well as multidisciplinary design concepts for flight vehicles. Researchers also tackle aircraft structural topology optimization, bird-strike-resistance, and cleaner low-emission combustion technologies, as well as numerical simulations of flow and combustion in engines. As a result of all this, the university is the pillar of China's aerospace technology development.

The fields of aeronautical and astronautical engineering are increasingly integrating artificial intelligence, information and manufacturing technologies, as well as materials science and advanced structural design to develop aircraft able to fly both within and beyond the Earth's atmosphere. NPU has already made unprecedented progress in autonomous smart aircraft and new-concept flight vehicle design, as well as in the fields of aero-engine structural dynamics, the design of aero-engine compressed components, rocket-based combined cycle propulsion systems and orbital spaceflight control. The results have been used in many of China's major aerospace engineering projects, including those dealing with manned spacecraft, lunar probes and high-resolution Earth observations. In the field of aeronautical engineering, NPU's research is being applied to cutting-edge designs for new-concept flight vehicles, including a blended-wing wide-body aircraft and the combined propulsion system to power it.

Modern aircraft researchers are also increasingly harnessing digital technology. As a result, NPU aeronautical researchers have developed a partially digital platform to help design aircraft airfoil profiles, and it was used in the creation of China's first locally-manufactured large passenger jet, the C919. They have also developed Asia's largest low-speed airfoil wind tunnel and China's first continuously pressurized high-speed wind tunnel to facilitate aerodynamics research on full-size aircrafts and to help develop more advanced airfoil design. In the area of structural dynamics, NPU researchers have creatively applied the new concept of kinetic energy diversion to aircraft bird-strike resistance design, which has led to a weight reduction in the structure design of China's passenger jet ARJ21-700.

An active player in China's manned space programme, NPU is one of the two universities that made the most significant contributions to the nation's first human spaceflight mission, Shenzhou 5. It boasts three national experimental platforms that look at space flight dynamics, combustion, flow and thermal structure, as well as an engineering project on micro-satellites (a state-local joint engineering project).

NPU is the main Asian project coordinator in the European Union's QB50 project, an international network of 50 cube-satellites investigating the lower thermosphere, and it has built one of the three mission control centres for the project.

NPU also specialises in fault detection for aero-engines. The fault diagnosis system and rotating machinery detector developed by its engineers are used in the testing of several key gas turbine engines and rotating machinery prototypes, serving as a powerful tool supporting successful prototype development and industrial application of high-speed rotating machinery. The rotor dynamics design of aero-engines offers insights into designing next-generation industrial gas turbines.

NPU has also advanced the blisk manufacturing technology, which was showcased at international air shows in both Paris and Moscow. The single crystal hollow turbine blade designed at NPU was listed as one of China's top 100 Scientific & Technological Achievements in the 21st century. ■

NPU has established China's largest industrial base for research and design of small- and medium-sized drones.

Plumbing the depths

The naval architecture and marine engineering programme at NPU is developing network-based, intelligent, digitalized, and autonomous precision marine equipment to help China become a maritime power. It focuses on basic theoretical research encompassing marine equipment design, underwater navigation and control, deep-sea environment characteristics, ocean acoustics, underwater acoustic signals and information processing, smart information sensing, and noise and vibration control. NPU has already made many breakthroughs in key technologies including in underwater sonar, unmanned underwater vehicle and underwater networking.

Marine engineering increasingly requires unmanned marine technology and NPU is leading a project to design a 50-kilogram portable autonomous observation system. Researchers have overcome the technical hurdles involved in maintaining motion control in conditions where there is strong multi-modal interference, and created a number of products over which they have full intellectual property rights. All this marks an important step forward for the industrialization of small underwater vehicles.

NPU also has a strong acoustic engineering programme that enjoys the support of national-level key laboratories dealing with underwater information and control, as well as ocean acoustics and sensing. It has taken on many scientific projects on ocean acoustics, underwater acoustical signal processing and system design, and maritime trans-horizon propagation. It is also leading a national major programme investigating China's marine environment, having completed six acoustic investigations in ocean. Other achievements include developing China's first on-board underwater acoustic detection system, a deep sea synchronized underwater acoustic subsurface buoy array, a novel hydrophone for underwater acoustic measurement at depths of 10,000 metres and a trans-horizon propagation system near the sea surface. NPU has won three state science and technology awards for its contributions to China's marine technology power. ■

Advertiser retains sole responsibility for content