**First of its kind flying space laboratory already in-orbit**

**What is the purpose of the OPS-SAT mission?**

**Although only 30 cm high, its innovative computer is ten times more powerful than on any current spacecraft owned by European Space Agency. OPS-SAT is the ESA’s technological satellite designed to test and validate new space technologies that have never before been tried out in-orbit. To date, over 100 companies and institutions from 17 European countries have registered experimental proposals to fly on the world’s only spacecraft open for public use.**

There is a popular saying in the space sector: *has never flown, will never fly,* which accurately describes the reluctance of companies to participate in missions which use new and untested technologies. This is currently one of the biggest barriers standing in the way of development in many areas of the space industry, including mission control and on-board satellite systems. To overcome this hesitant attitude, European Space Agency successfully launched their technological nanosatellite which will serve as a platform for fast and cost-effective testing of new solutions live in-orbit. The full on-board software for this spacecraft has been designed and implemented in Poland.

As described on ESA’s website, OPS-SAT offers ‘a range of resources, including processors, field-programmable gate arrays (FPGAs), cameras, and an attitude determination and control system’, all with the sole purpose of enabling a demonstration of new mission and operations concepts. So far, over 100 projects from leading European space companies and start-ups have been submitted to be trialed on the satellite. Among the experiments registered are using OPS-SAT as a transmitter to establish a communication between Earth and a rover deployed in space, attempting to transmit data optically by laser light and testing full automation of a space mission using AI.

Naturally, while testing new technologies a lot of things can go wrong. To ensure the safety of the flying in-orbit laboratory, the satellite is equipped with two computers: one experimental and powerful enough to launch all the software tests on board – the other, a much older and trustworthy computer due to having been repeatedly used in several successful missions. The only job of the latter is to monitor experiments, shut them down in case of malfunction, regain control over the spacecraft and stabilize its position in-orbit.

Flight software for the OPS-SAT mission is a work of Polish engineers at GMV Poland, a part of the European technology business group GMV. The tasks of the Warsaw company within the OPS-SAT project included the development of the full on-board software for the mission as well as the design and implementation of a number of systems for the satellite. The latter include, among others, ADCS (Attitude Determination and Control System), one of the most important software elements of each satellite, responsible for the proper communication with the device and for the control of the trajectory of its movement in orbit, as well as FDIR (Failure Detection Identification and Recovery), which makes it possible to monitor the parameters of the satellite’s subsystems, and – in case of detecting irregularities – to put it into safe mode.

GMV’s specialists were also responsible for the integration of the new data compression algorithm, POCKET+, as well as for the preparation and implementation of the MOS (Mission Operation Services) information exchange protocol standard.

*The task given to GMV Poland was extremely challenging given that ESA specified that the space to ground interface for the on-board software should use a never before flown standard called Mission Operations Services. This is part of OPS-SAT's mission goals but it was never going to be easy* – explains David Evans, OPS-SAT mission manager at ESA. One of the key objectives of the project is to demonstrate MOS in operational conditions, while controlling the satellite and its payload. If Polish engineers’ solution works, it has a chance to become a standard used in all satellites of the European Space Agency and one day, all the largest space agencies in the world, including NASA. *The OPS-SAT mission is very important for GMV in Poland and the whole Polish space sector. This is the first time when Polish engineers delivered flight on-board software for ESA satellite. Moreover, implementation of Mission Operation Services standard enables GMV to familiarise itself with this breakthrough technology –* says Paweł Wojtkiewicz, GMV’s director for space in Poland.

Poland joined European Space Agency in 2012. Since then, Polish companies have proven themselves to be a trustworthy and competent supplier for ESA, consistently moving up the industry ladder. OPS-SAT is the next landmark of development for Polish companies. *The ultimate success of the project is due to lots of hard work and close cooperation between GMV, the prime (TU Graz) and ESA. Without the flexibility, dedication and skill of the GMV team OPS-SAT would not have been ready to fly* – concludes David Evans.