



# PikeOS protecting Earth

**By the end of 2020, a revolution took place in space: The very first prototype of a new type of nano satellites was sending data, working fully operational and flying in a near-to-earth orbit.**

**This satellite is called Argos Neo on a Generic Economical and Light Satellite (ANGELS) and belongs to the Kinéis satellite network. This network is already operational with 8 in orbit satellites and will be completed by 25 nano satellites with Argos instruments on board that will be launched in 2023.**

**But what is Argos, how does it work and why is it revolutionary? To understand these questions, we need to take a step back in history.**

In 1978, the French space agency (CNES) and its US-pendant NASA partnered up with the US oceanic and atmospheric organization NOAA to build a system of satellites with the purpose to observe animal migration such as the journey of sea turtles and passage of birds. Until then animal migration couldn't be properly observed and scientists had to stick to and deal with data that was gathered on-site. Luckily, satellite technology was fast evolving and ready to deliver

useful data. This was the invention of Space IoT, long before GNSS systems such as GPS or Galiléo were created.

The consortium brought up a satellite system that was called Argos. It quickly became a huge success as scientific institutes realized how efficient and capable the system was. Gradually, more and more institutes and space agencies took interest in Argos and participated in the project. It comprised more and more (environmental) applications and opened its gates for commercial purposes through CLS (Collecte Localisation Satellites). Today more than 22.000 transmitters are active and more than 100 countries participate in Argos.

However, satellites and rocket launches remained expensive while microelectronics constantly shrank in size. Under these circumstances, it became obvious and possible to build smaller types of satellites in order to save weight and therefore money. In 1999, the California Polytechnic State University and the Stanford University developed a satellite platform called CubeSat. These nano satellites measured only 10 cm per side and 11,35 cm in height, standardized as a size of 1 U.

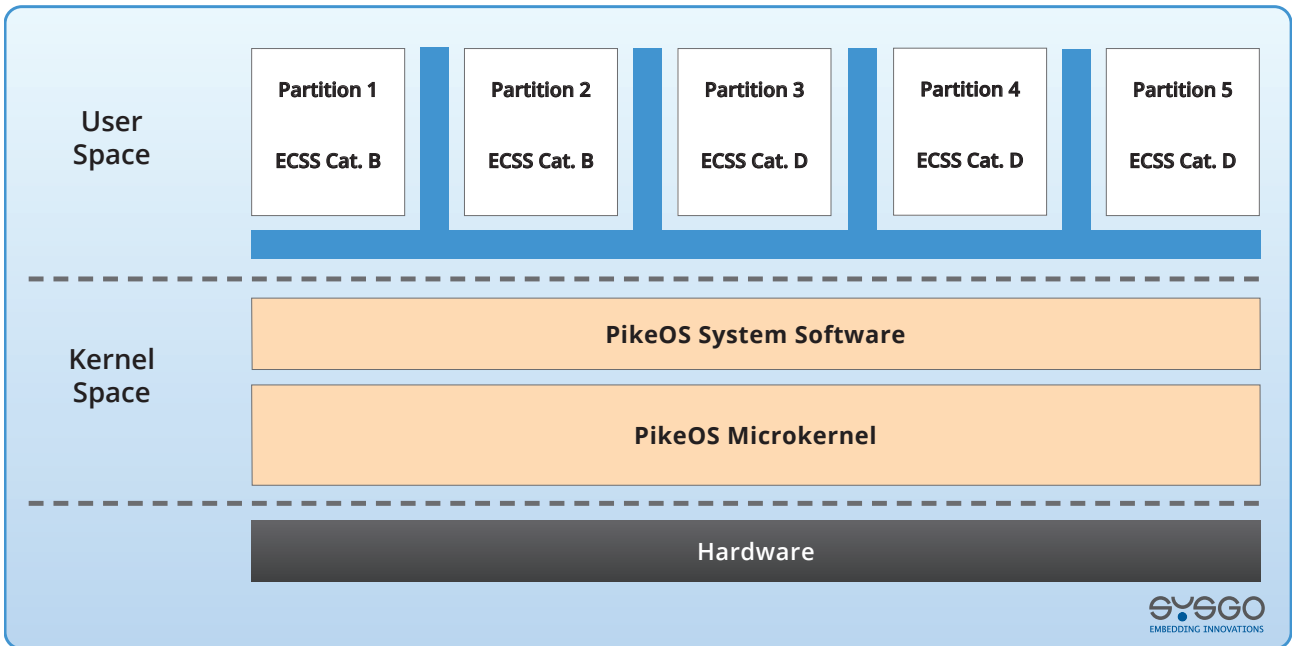
This platform became more and more popular in the 2000s and 2010s and finally found its way to CNES and French firm HEMERIA.

While Argos satellites were big in size and consumed a huge amount of power, Thales Alenia Space, HEMERIA and CNES (among other companies) began to develop a satellite that would only be consuming a third of the power of a regular Argos satellite while being ten times smaller, utilizing the full potential of newly evolved embedded space operating software.

Pursuing a staunch and radical new space approach, comprising miniaturized commercial-off-the-shelf (COTS)

components and an efficient way of designing, developing and testing, the collaboration succeeded and built a prototype that is now part of Argos.

HEMERIA was responsible for the platform part of the satellite while Thales Alenia Space was in charge of Argos NEO instrument. Thales Alenia Space chose SYSGO's space-grade real-time operating system (RTOS) hypervisor PikeOS as operating system for the payload onboard software, because of its overall robustness, flexibility and good performance. PikeOS as operating system is the foundation for in time and space separated applications, called partitions.



These partitions, among other tasks, fulfil system supervision, command and control operations as well as decoding Argos beacons. They allow to use different levels of software criticality based on the space ECSS standard.

Thanks to its microkernel architecture, partitions can also be updated without impacting others in operation. By that, ArgosNeo is allowed to add or optimize functions, and to improve its security robustness.

25 satellites are now deployed to build the Kinéis constellation, improving the current system. These satellites will receive data from around the globe, increasing

data transmission and two-way communication in very short time (10-15 minutes) between satellite passes, thus revolutionizing satellite telemetry.

Today, Argos is the only satellite-based system for location and data collection specifically designed to study and protect the earth's environment.

By choosing PikeOS on Kinéis payload onboard computers, Thales Alenia Space continues its mutualization strategy by using a COTS RTOS for their current and future onboard platform and payload projects.

### About SYSGO

SYSGO is the leading European manufacturer of embedded software solutions such as the real-time operating system and hypervisor PikeOS and the embedded industrial-grade Linux ELinOS. Since 1991, SYSGO has been supporting customers in the aerospace, automotive, railway and IIoT industries in the development of safety-critical applications. SYSGO was the first company worldwide to achieve the safety requirement level SIL 4 for its multi-core capable real-time operating system and hypervisor PikeOS.

PikeOS version 4.2.3 Build S5577 meets the Common Criteria at EAL 3+ for ARMv7, ARMv8 and x86\_64 and is also certified according to the strictest safety standards such as IEC 61508, EN 50128, EN 50657 and ISO 26262, thus enabling application development according to the "Safe & Secure by Design" principle. For industrial embedded systems, SYSGO also offers ELinOS, a Linux distribution with real-time extensions for embedded systems. Furthermore, solutions such as the railway development platform (SAFe-VX) and the Secure Automotive Connectivity Platform (SACoP) for secure data transfer in, with and between automobiles are available.

SYSGO works closely with its customers such as Samsung, Airbus, Thales, Continental, etc., throughout the entire product life cycle and supports them in the formal certification of software according to international standards for functional and IT security. SYSGO is headquartered in Klein-Winternheim near Frankfurt, has subsidiaries in France and the Czech Republic and maintains a worldwide sales network. The company is ISO 9001:2015 and ISO 27001:2017 certified and part of the European Thales Group.

More information: [www.sysgo.com](http://www.sysgo.com)

### About Thales Alenia Space

Drawing on over 40 years of experience and a unique combination of skills, expertise and cultures, Thales Alenia Space delivers cost-effective solutions for telecommunications, navigation, Earth observation, environmental management, exploration, science and orbital infrastructures. Governments and private industry alike count on Thales Alenia Space to design satellite-based systems that provide anytime, anywhere connections and positioning, monitor our planet, enhance management of its resources, and explore our Solar System and beyond.

Thales Alenia Space sees space as a new horizon, helping to build a better, more sustainable life on Earth. A joint venture between Thales (67%) and Leonardo (33%), Thales Alenia Space also teams up with Telespazio to form the parent companies' Space Alliance, which offers a complete range of services.

Thales Alenia Space posted consolidated revenues of approximately 2.15 billion euros in 2019 and has around 7,700 employees in nine countries.

More information: [www.thalesgroup.com/en/space](http://www.thalesgroup.com/en/space)

Founded in 1991, SYSGO became a trusted advisor for Embedded Operating Systems and is the European leader in hypervisor-based OS technology offering worldwide product life cycle support. We are well positioned to meet customer needs in all industries and offer tailor-made solutions with highest expectations in Safety & Security. More information at [www.sysgo.com/space](http://www.sysgo.com/space)