Galileo satellite system. Credit: ESA / J.Huart

Towards A Common European Space Policy: In Pursuit Of Independence And Scientific Progress – Analysis

By Nayef Al-Rodhan*

Joint space activities at the European level date back to the 1960s, with the creation of two organizations, working with different principles: the European Space Research Organization (ESRO) and the European Launcher Development Organization (ELDO). In both cases, the goal was to pool resources of different European countries to conduct projects that were too ambitious for a single country.

ESRO was an integrated structure, with funding according to the GDP, while in ELDO each participating country developed independently a part of the Europa launchers. ESRO was a success while ELDO failed, and in 1975 a single European Space Agency (ESA) was created on the basis of ESRO and ELDO, working as an integrated structure like ESRO, but with more flexibility in financing – space research being funded according to GDP whereas space systems and launcher programs were financed only by the countries choosing to participate.
Since 1975 ESA has enjoyed a great success in pooling together the means of many countries. It must however be underlined that ESA is not an organization making European space policy. It implements

decisions taken by its member states, at the level of ESA Council meetings at the Ministerial level, and manages the corresponding programs.

Additionally, ESA has been created by its own treaty and is not formally within the perimeter of the European Union. Like other organizations such as CERN, it is an intergovernmental agency, and some of its member states, like Switzerland, do not belong to the EU. Therefore, the question of the definition of a common European space policy, and the related issue of the relationships between ESA and the EU (and its executive body the European Commission) have been raised since the 1980s.

The first document referring to a common European space policy emerged in 1988. That year, the European Commission stated that the EU must create a common space policy between national activities to boost technological innovation and better ensure security. Today, the European Space Agency (ESA) is made up of 22 member states, which all contribute funds and intellectual resources. ESA's budget for 2017 got a 9.5% increase, reaching 5.75 billion euros. There are seven ESA location sites spread across Europe, with different functions, such as the European Astronauts Center in Cologne and the European Space Astronomy Centre in Madrid. ESA also has liaison offices in the USA, Russia and several ground tracking stations in many other parts of the world.

Although it is made up of many members, one political assumption has shaped ESA's behavior. The assumption is that in order to be a powerful space actor, Europe must have autonomous, balanced and comprehensive (covering all sectors) space programs. For Europe, avoiding dependence on other space powers for access to space is seen as a crucial strategic objective. Several ESA projects, which will be outlined below, demonstrate this goal. Member states are also committed to using satellites in a collaborative manner and under common EU standards (both for competition and financial regulations).

The other strategic objective of ESA has been to set a precedent in the use of space for peaceful scientific advancement. This process began with Horizon 2000, which was the first long-term comprehensive program outlining the future direction of ESA in space sciences. It focused on solar system sciences, as well as astrophysics and astronomy. In 1987, the European Union ratified the Single European Act, which in Title VI enlarged the European market community to include research and technological development, as well as market space objectives such as sharing standards, intellectual resources, trade and education. ESA also looks at space from the view of commercial interests, something which is normal in any democracy with strong market players vying for influence. Yet it remains a pioneer of peaceful and altruistic scientific exploration in space, setting a stable behavioral precedent for nations new to space investigation.

Projects For Autonomy In Space

EU crisis management in space consists of the Common Foreign and Security Policy, implemented by the High Representative for Foreign Affairs and Security Policy (currently Federica Mogherini, who is also Vice-President of the Commission) and member states. Currently, ESA, representing the will of its member states, is concentrating its efforts on becoming more independent in space and increase its autonomy in other spheres – for example in security, environmental and economic affairs. This trend can be demonstrated by taking a closer look at a few projects.

The most well-known European project which aims to increase autonomy is the development of an independent global satellite navigation system (GNSS), known as Galileo. Galileo is the only civilian controlled GNSS, and it is the result of cooperation between ESA and the European Commission. In December 2016, the Galileo satellite navigation system began operating initial services, with over 18 satellites providing positioning, timing and navigation information around the globe. The system is fully interoperable with GPS, and its coverage will increase geo-location precision ten-fold, with the aim of enhancing navigation services, infrastructural synchronization, security for public services (via robust encryption) and location accuracy for search and rescue situations – all free of charge. Galileo will also hold great scientific value. It will be able to gather information about environmental events, such as tracking deforestation or rising sea levels, shifting polar ice caps, biomass density and even soil moisture. In fact, Galileo possesses more functions than the US Global Positioning System (GPS). The entire system is scheduled to be fully operational by 2020, breaking the US monopoly on the GNSS market and increasing the EU's economic and military independence.

Indeed, possessing an autonomous GNSS system means European states must no longer rely on GPS for several critical economic functions, which contributed around 6-7% of EU GDP. For example, aviation, communication, precision agriculture, financial transactions all depend on the precise time-keeping functions provided by satellites. The network also allows the EU to partake in the lucrative business of selling bandwidth for telecommunications and boosts the quality of services on the ground. Galileo does not come without risks, however. The system – which was initially planned at a time when cyber-attacks were not a large concern – uses binary encryption and is therefore vulnerable to jamming and spoofing. As Europeans rely more on Galileo's services, the more important goal will be to take measures to defend against cyber-threats.

In addition, Europe has several operational launchers, including Ariane – 5, which has been developed with ESA funding by Europe's space industry, and is the most-used European rocket launcher (averaging six or seven launches per year) and is pivotal to maintaining autonomous access to space for European nations. The same scheme has been at work for the development of a smaller launcher, Vega, with a large role for Italy. Europe cooperates also with Russia in using the Soyuz. In December 2014, the ESA Council decided to develop Ariane – 6 as its next launcher, to maintain Europe's place in the commercial launch service market and to better equip European missions. Ariane-6 first flight is planned for mid-2020.

ESA has also placed significant funds – in partnership with Russia – into its ExoMars mission. The project aims to deploy a rover on the surface of the Red Planet, which will then collect and analyze samples from 2m beneath the planet's surface, in the hope of finding evidence of previous life. Its first attempt to land hardware on Mars – the Schiaparelli lander – failed due to a computer glitch during the landing sequence, causing the device to crash land. Despite this first disappointment, the project has secured funding to carry out its activities until 2020, the proposed date for landing the rover on Mars. Success would make ESA the only space organization aside from NASA to successfully land hardware on Mars.

Furthermore, ESA has several future projects on-going or planned, alone or in cooperation with other organizations. An important case is in the field of space meteorology, for which ESA provides its technical expertise to another European intergovernmental organization, EUMETSAT, which provides nonstop satellite data on weather and climate. The Meteosat Third Generation (MTG) is a project to be completed in 2020 with the launch of six new satellites, which will "monitor the atmosphere, ocean and climate" for the European Union.

In space sciences, the "Cosmic Vision," which outlines ESA objectives until 2025, has clarified the main themes of ESA's future research inquiry. The Cosmic Vision themes are: planets and life, the solar system, fundamental laws, the universe, and the hot and energetic universe.

Examples of ESA's growing space capabilities include the Athena advanced telescope. Athena, to be launched in 2028, will "address fundamental open questions in astrophysics". The telescope will observe materials just before they are consumed by black holes, to measure the environmental conditions around black holes and the energy capacity of the universe. While initially a similar project had been planned with NASA and Japan, ESA decided to continue autonomously due to NASA's changing priorities.

Research Projects

Increased autonomy is one facet of European common space projects. ESA's identity in space is equally and distinctly defined by scientific pursuits, which constitute an impressive list of projects. ESA is thoroughly committed to the use of space for peaceful scientific research and it partners with many other space agencies in the pursuit of cutting-edge projects and discoveries. Research areas include biology, environmental sciences, physics, radiation sciences and technology. Like every other space agency that is considering longer space flights in the future, ESA is interested in the effects of space on the human body and mind. ESA has used the Kubik incubator system to conduct cell biology experiments inside the International Space Station (ISS) over the last ten years.

Additionally, it is also interested in stem cell research to find ways to mediate bone marrow loss that occurs during space flight and collaborates with NASA to research blood rushes to the head and decreased blood pressure experienced by astronauts in space. This experiment is conducted on rats inside the Space Shuttle Myocyte.

ESA also experiments with growing plants in space, as an important step in longer space missions or even future colonization attempts. As plants need light and their roots follow gravity, the question of how dark, zero-gravity environments affect plant growth is a fascinating one. The ESA GRAVI-1 experiment proved that plants react to low gravity levels and the Tropi experiments showed that plants react to red light.

Additionally, ESA focuses on life support with the Micro-Ecological Life Support System Alternative team, which states that: "by finely tuning how microbiological cells, chemicals, catalysts, algae, bacteria and plants interact we could process waste to deliver never-ending fresh supplies of oxygen, water and food".

In the realm of physics, space can serve as a convenient laboratory which allows for controlled environments unlike any on Earth. For example, scientists can conduct experiments on fluids, metals or plasmas in zero gravity. Alloys are an important component in the construction of jet engines or X-ray detectors. ESA scientists are exploring the effects of microgravity on such alloys. ESA is also interested in plasma research for medicinal and microchip purposes.

Outer space is also incredibly useful for studying radiation – its localization outside of Earth's protective layers makes it possible to get a closer look at the sun and cosmic radiation. Radiation is important for future space travel, as astronauts get bombarded with far more radiation than we do on Earth. Understanding these effects is thus crucial to the success of longer space flights. ESA has a solar facility on the Columbus modulewhich has been studying solar radiation since 2008. This ongoing project will allow for a greater understanding of solar flares and sun spots and will also work to improve current climate models.

Finally, ESA is testing new technologies in space. For example, the Meteron project (Multipurpose End-To-End Robotic Operations Network) is being tested inside the ISS to assist its future missions. This project investigates remotely operated robots that connect astronauts on the ISS with machines on Earth. These robots can simplify future missions by scouting good landing areas and improving communication networks over vast distances in space.

ESA technology in space additionally benefits many systems on Earth. The Vessel ID system, for example, monitors marine traffic, and ESA is hoping to develop its own maritime surveillance service, not just for economic reasons, but also to better protect the environment and monitor fishing in protected areas. Such endeavors can benefit us all.

The development of ESA research projects also represents an important diversification in global space investigation. Indeed, whilst NASA focused, until 2017, principally on landing humans on Mars, ESA is considering the use of a moon base, where several states could continue to cooperate and conduct space exploration, in light of the finite lifespan of the ISS. The United States decided in 2017 to follow the same path and to give priority to a return to the Moon in the 2020s, and the “Moon Village” concept of ESA fits very well with this new American strategy.

Whereas some experts have noted that such an endeavor would incur hefty costs, others have applauded ESA’s ambitions to promote peaceful collaboration in outer space. Such plans indicate that space exploration is moving away from a situation of domination by a few select nations and organizations.

Implications For Outer Space Security

Although the European Space Agency is made up of more than 20 member states, it nonetheless possesses what could be considered a strategic culture, in the sense that it has uniform values and outlines some core objectives to maximize its security and its position. ESA has two primary values which act as guidelines. One is the creation of European autonomous space system, in order to create greater security and economic independence from bigger space powers. The other is the use of space for scientific experiments in numerous fields, which can benefit all humanity and sets a precedent for using space for peaceful and progressive scientific means.

From a geopolitical perspective, the possession of a sophisticated space program constitutes a source of national pride, enhanced military capacity and a potential means of increasing a nation's geopolitical standing in international affairs. Although ESA is a tool at the service of its member states, which pursue their own domestic goals for outer space activity within ESA framework, or at national levels, it interestingly serves an example of the collaborative development of a space program which requires the coordination of shared strategic goals. This is a reality which holds interesting implications for outer space security.

Significantly, there is a now a key grouping of countries committed to the peaceful use of outer space technology for research, giving hope to those who advocate the cooperative use of space, instead of its potential weaponization and fragmentation. ESA's commitment to outer space research could hold numerous benefits for mankind's efforts to monitor and mitigate the effects of global warming, improve health care and respond to health crises. Finally, achieving European independence and autonomy from larger space programs would constitute a significant shift in the geopolitical complexion of outer space security. One can also add that ESA, as a very efficient tool to federate means of a large number of countries wanting to define and pursue common goals in space, can become a model for a future World Space Agency.

Yet faced with rapidly evolving global security issues, it will be interesting to see whether the national security priorities of ESA member states allow the agency to remain committed to peaceful and research-oriented goals.

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