ESA, What's Next?

By: Caterina Cappeller, Riccardo Papesso,
Alberto Susa & Fabio Schettino

Bocconi SEDS
Apr. 28, 2021

With this article we wanted to give you an idea of the importance and the uniqueness of the ESA in today's landscape for space exploration and industry, and we briefly introduced you to the agency's strategy and goals for the short and long term. If you want to know more, please visit https://www.esa.int

What is the ESA?

The **European Space Agency** (**ESA**) is an intergovernmental organization composed of 22 European member states dedicated to space exploration. Although 19 of its members are also part of the European Union, the ESA operates almost independently from the EU and therefore has to be distinguished from the EU's GNSS Agency (*Global Navigation Satellite System*). The ESA was established in **1975** as a result of the merger between two previous agencies, the European Launch Development Organization (ELDO) and the European Space Research Organization (ESRO). In addition to the 22 association agreements from member states, the ESA has signed a series of cooperation agreements which aim to include other European and non-European countries in its operations and projects, such as Turkey, Israel, and Canada.

Currently, the ESA is headquartered in Paris and can count on a worldwide staff of about 2,200 people and on an annual budget of about 6.68 billion euros—costing each EU citizen €12 per year. These numbers make the ESA **one of the most influential players in today's public aerospace industry**, placing the agency immediately after giants such as NASA and CNSA (China National Space Administration), and surpassing in terms of resources other important players such as Roscosmos (Russian Space Agency) and JAXA (Japanese Space Agency). The agency's facilities are distributed among several sites located in European countries, each of which has different responsibilities: The European Astronauts Centre (EAC) and The European Space Operations Centre (ESOC) in Germany; The European Space Astronomy Centre (ESAC) in Spain; The ESA centre for Earth Observation (ESRIN) in Italy; The European Space Research and Technology Centre (ESTEC) in the Netherlands; The European Centre for Space Applications and Telecommunications (ECSAT) in the UK.

When breaking down costs, ESA operations cost each EU citizen €12 each year, giving the agency an annual budget of €6.68 Billion

2020 Highlights

2020 has been a challenging year for Earth's inhabitants. The destruction of COVID-19 forced us to pause our lives, but at the same time we were required to keep things working. This was no different for Europe's space industry, having to keep essential missions up and running. ESA also had the opportunity to showcase its capabilities in helping institutions tackle the global crisis, sharing the agency's resources and knowledge. The ESA gave its contribution in a multitude of ways, including sending a B-LiFE – *biological light fieldable laboratory for emergencies*, a mobile laboratory that provides a coronavirus diagnosis within a few hours – to Piedmont, Italy and helping in the production of medical equipment. Two 3D printers, usually employed for printing special items for astronaut training, were put to use to help provide components for protective face shields for medical staff.

Together with NASA, JAXA and the European Commission, the ESA provided satellite data to monitor the impact and recovery from environmental changes caused by the Coronavirus lockdown—including monitoring the level of nitrogen dioxide and carbon dioxide in the air.

Artist rendering of ESA's Solar Orbiter probe.

In addition to helping in the battle against the virus, the ESA kept its operations running. February saw the launch of the **Solar Orbiter**, the first mission to take close-up images of our star's polar regions which could unlock some of the biggest questions in solar physics, such as "what drives the solar wind?", or "how do sudden events, like solar flares and coronal mass ejections, impact the Solar System?". If you looked to the sky in April, you would have seen **BepiColombo** (joint mission of the ESA and JAXA to the planet

Mercury) flying past us, using Earth's gravity to change its direction as it flew deeper into the Solar System on its way to rendezvous with Mercury. Earth Observation-wise, the 1440 kg satellite **Sentinel-6** was launched in November, a vital tool that will chart the height of sea levels and the thickness of sea ice, along with PhiSat, the first attempt to use AI on a satellite in Earth Observation. In trying to bridge the digital divide between Africa and Europe, the **Eutelsat Konnect** was launched, increasing broadband coverage. And if you were having nightmares about an asteroid hitting Earth and dooming the human species to the same fate of the dinosaurs, now you can have sweet dreams: **Hera**, the ESA's first planetary defense mission to deflect asteroids started development in coordination with the German company OHB. Finally, Exoplanet hunter **Cheops** studied in September one of the hottest planets ever recorded—"WASP-189b". Its temperature is estimated to be around 3200 °C (5790 °F): so, air-conditioning wouldn't help if you're planning to spend your holidays there!

Future – The Short Term

Throughout 2021, the ESA will continue to cooperate with other space agencies, with two ESA astronauts launching to the ISS, and further collaboration with NASA for the development of Artemis-1 mission, which will see the first flight of the ESA's European Service Module **Orion**. This year will also see the launch of **Quantum**: a new telecommunications satellite which, for the first time, can be reprogrammed in orbit. 2021 will also see the first flight of the **Vega-C** launcher: a larger and more powerful rocket to launch payloads. Moreover, Europe's global satellite navigation system, **Galileo,** will continue to operate, with two first-generation satellites being launched. The contract for second-generation satellites was signed in January, so these will slowly replace older satellites already in orbit. Many more satellites will progress their journeys, for instance, the aforementioned **BepiColombo**, will fly around Venus for the second time, and then continue its 7-year itinerary to Mercury and the Sun.

Two deep space telescopes will be launched in 2021, bringing the total number in operation to 15

Artist rendering of ESA's Ariane 6 Heavy Lift Rocket

The **James Webb Space Telescope** will be a keynote launch of 2021. The telescope will study the history of our universe from the Big Bang to the formation of solar systems and life on Earth. Another telescope, **Flyeye,** will follow, developed by the Matera Space Centre in Italy. This telescope has been designed to scan for near-Earth object such as potentially dangerous asteroids. The ESA is also planning on continuing its effort toward climate change action by maintaining its activity of 16 Earth observation satellites to monitor our planet, which help distribute huge amounts of data used for scientific and operational purposes. In 2022, the ESA expects to complete the development and launch its new heavy-lift launcher **Ariane 6**, guaranteeing independent access to space for Europe. Lastly, exploration of Mars continues and 2022 should see the launch of the ESA's Mars lander and Rover **ExoMars**, with the aim of obtaining and returning samples from the red planet.

Future – The Long Term

In the long term, the ESA intends to promote a *sustainable* and *international* endeavor to visit new places and discover what waits for us beyond our thin atmosphere. Its main goals not only concern **Space Exploration** (landing of first Martian samples on Earth is expected for 2031, while 2024 will see the first woman on the moon with the Gateway mission) and **Safety**, but the economic aspect too. The space industry has a strong and capable supply chain, and the European agency aims at increasing the competitiveness of its peers on the global market, providing new technologies developed through innovative research. **Global cooperation** will also play a crucial role in the ESA's strategy for the future: the agency will ensure to enhance the cooperative framework as collaboration becomes more and more essential in all aspects of our

life, and the space industry makes no exception. Finally, **inspiring the next generation** is another utmost priority for the ESA. Only by attracting younger generations and sharing the values of global cooperation in space can we hope to expand the boundaries of our knowledge and become a multiplanetary species.

Protecting Our Pale Blue Dot

We believe that a special focus needs to be put on how vulnerable we are as residents of this planet. With the advance of technologies in the last decade, the human species had the opportunity to understand potential perils of its position in the Solar System, and also to prevent the effects of hazards from space. This is one of the key objectives of the ESA for the long-term, that is ensuring **Space Safety & Security** for our Pale Blue Dot: and with the cooperation and support of 22 member states, the ESA is in a unique position to coordinate the data to understand and respond to threats.

By 2030, the ESA will be capable of providing early warnings of dangerous asteroids about 3 weeks in advance, not only because of Hera and Flyeye, but also thanks to a new in-space satellite to deflect asteroids coming from the direction of the sun.

But it’s not just asteroids, humans will have the need to protect themselves against what they have created with their own hands: the plethora of satellites that are in orbit around our planet. These small devices have the potential to prevent us from launching and operating in space in the future, which is a big threat to our expansion into space. Luckily, the ESA will provide a system capable of removing and avoiding debris.