FROM EARTH TO OUTER SPACE
ARIANESPACE 2022 CSR

Arianespace is committed to putting Space at the service of a better life on Earth by providing access to transportation services, and solutions for institutional and commercial satellites across orbits. A subsidiary of ArianeGroup, Arianespace holds 74% of its capital. The following document briefly sets forth **the social, environmental and societal issues related to our business**.

1 | SPACE FOR OUR EMPLOYEES

1.1 | A SAFE AND HIGH-QUALITY WORK ENVIRONMENT

Employee health and safety are our utmost responsibility. We strive to ensure safety at work and to prevent professional risks:

- a **safety analysis** is carried out prior to all operations;
- annual audits are conducted to assess employee workload and working conditions in order to improve employee **quality of life**;
- **prevention of social risks** is one of the major focus areas of our annual manager training program.

To promote employee work/life balance, our principles and operations have been formalized in the Company Agreement, which focuses on the quality of life at work, and the rights of employees to disconnect, which has been in effect since 2019. In 2021, our internal barometer score for workload and working conditions, which had slightly increased in 2020, was 3.70/5.

Arianespace values open social dialogue based on trust as a key factor in the quality of life at work. We offer our employees the right to express themselves. In addition, we value the careers of employee representatives and ensure they have the necessary leeway to do their jobs.

Finally, Arianespace **promotes access to professional training and career guidance**. Each year, we provide an average of 2,000 hours of training.

1.2 | INCLUSIVE, AGILE AND INSIGHTFUL CULTURE

Workplace parity, and **the promotion of diversity** and **non-discrimination**, are at the heart of Arianespace's values and apparent in the company's internal policies. We promote multiple skill sets, creativity, innovation and diversity of opinion on a daily basis. In accordance with regulations in place since March 1, 2020, Arianespace publishes its gender parity index. In 2021, the company obtained a score of 83/100.

Arianespace is committed to **generational diversity and inclusion**. We have set targets for hiring young people on permanent contracts, and a formal integration policy has been set up to include an onboarding program for new hires. We also welcome a younger audience on work-study programs in order to help them gain access to the field of space. A commitment has been made to senior employees, including measures to improve their employability and working conditions, and to prevent tedious tasks by adapting working hours and workstations.

2 | SPACE FOR THE ENVIRONMENT

2.1 | SUPPORT AND IMPLEMENT SUSTAINABLE SPACE ACTIVITIES

Arianespace operates under the framework of French space law, the most restrictive in the world with regards to space debris regulations[1]**.** In accordance with the LOS (Law on Space Operations), which requires upper-stage deorbiting in launcher development, our industrial partners are continually improving our launchers **to minimize the generation of new debris** that would compromise the safety of space activities.

Arianespace is implementing a proactive policy to minimize the impact of **Ariane 5** space debris. Stage passivation at the end of all launch phases allows to reduce the risk of structures exploding in Space. Final maneuvering of the upper stage keep the forward and backward trajectories of geostationary transfer orbit (GTO) missions as low as possible and thus accelerate stage deorbiting.

We are also working with our partners on a generation of improved launchers to ensure successful deorbit.

Ariane 6 will be the first European launcher to incorporate this deorbit capability. Regulations also require that:

- the level of risk to people associated with possible fragment fallout is reduced to a minimum (1 in 10,000 launches);
- the number of debris that can be left in Space in case of shared launch is limited to two, provided that it does not represent a threat to space operations. Their natural deorbiting must be done within a maximum of 25 years.

These commitments are the strictest in the world, and we are advocating to make them a global standard.

This is also the case with **Vega** currently, but will also be applicable to **Vega C**, which will offer better consideration of the following:

- the re-ignition capability of the AVUM upper stage engine will allow better control of atmospheric re-entries from low orbit missions;
- stage passivation, to avoid explosions in the event of an on-orbit collision;
- for multiple missions requiring to reach several orbits in a single flight, Vega C will have the capacity to serve intermediate trajectories allowing to ensure the re-entry of the different payload structures (VESPA or others).

Moving forward, our industrial partners will take **eco-design** into consideration for next-generation European launchers.

Preliminary work on eco-design has been carried out by ArianeGroup in partnership with ESA (European Space Agency) and CNES (French space agency) as part of the discussions on Ariane Next. Two directions are currently being explored: **launcher reuse** and **the use of propellants that have less impact on the environment**.

Vega E, the next evolution of the Vega launcher family, will include significant improvements in terms of durability. The launcher's architecture will be simplified and will incorporate a new propellant to avoid the use of hydrazine derivatives in keeping with REACH regulations[2]. Improvements in launcher design should also lead to a reduction in raw material usage and optimization of processes.

At the fourth Paris Peace Forum, **Arianespace became one of the first companies to sign the Net Zero Space charter**[3]**,** which aims to reduce space debris by 2030 and promote a more sustainable use of space for Humanity.

Eliminating existing debris is one of the major issues facing the space sector. ArianeGroup is leading a study, as part of ESA's Future Launcher Preparatory Program (FLPP), geared to optimizing Ariane 6 vehicle launches and to eliminate space debris.

[1] Space Operations Law published in 2008 and gradually implemented between 2010 and 2020.
[2] Which aim to ensure safe manufacturing and usage of chemical substances in European industries.
[3] This agreement is the result of an international effort by many space industry players, including Eutelsat, Planet, Astroscale and the French space agency, CNES.

2.2 | MINIMIZE ENVIRONMENTAL IMPACT ON EARTH

The Life Cycle Analysis of Ariane 6 (version 64) operations carried out by ArianeGroup shows the theoretical figure of **20,000 metric tons of CO_2 emitted over the life cycle of a future Ariane 64 launcher**.

- most of the estimated emissions (46%) are linked to the production and refueling of propellants at the Guiana space center;
- other activities on the ground prior to and during the flight account for 30%;
- the manufacture and assembly of structures in Europe account for 21%;
- the remaining 2% is associated with testing and transportation.

Greenhouse gas (GHG) emissions due to the combustion of solid propellants at liftoff account for **around 1% of the total GHG emissions** associated with launcher life cycles.

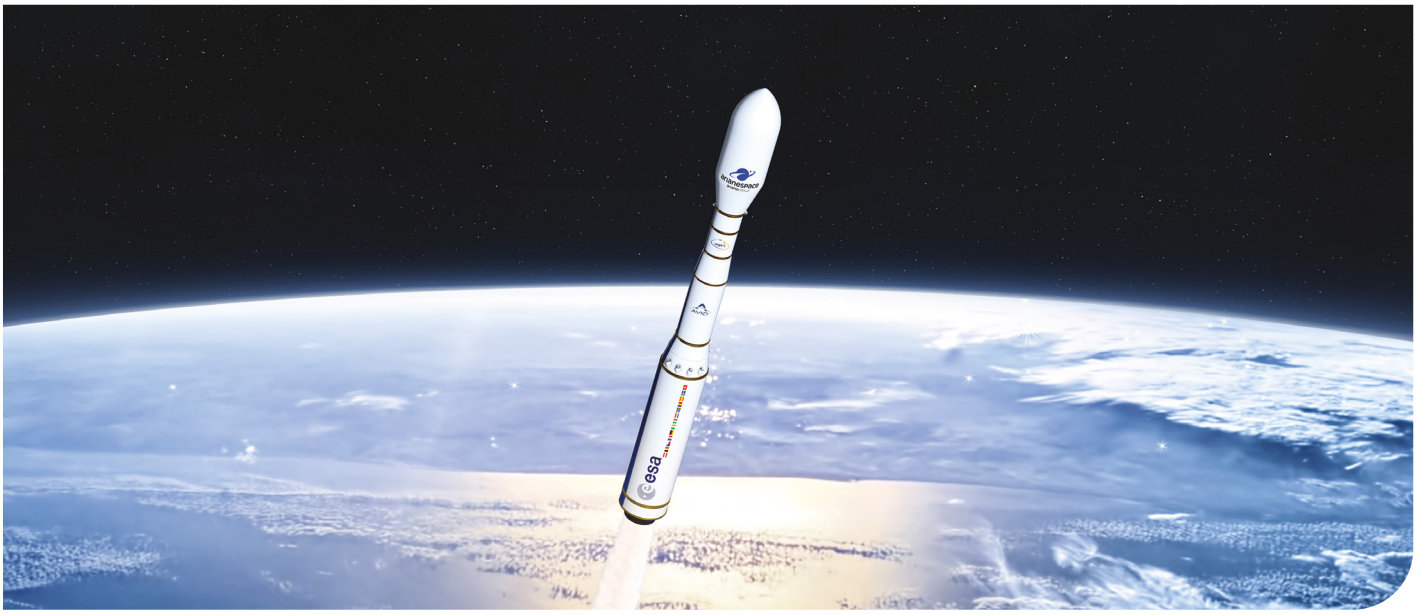
Another significant impact of space activities is the combustion of ammonium perchlorate – one of the components of the solid propellant used by ArianeGroup launchers – generates hydrogen chloride (HCl) gas, which is known to damage the ozone layer. **Each Ariane 5 launch produces 91 tons of this gas.**

The impact of our activities on oceans is caused by **Ariane and Vega launcher debris that falls back to Earth**. This debris is mainly metal, as propellants are completely burned during the combustion phase. The stages are passivated to ensure that they sink and do not incur a risk for vessels at sea. **Further more, trajectories are planned to avoid centers of inhabited areas.** The total amount of metal that falls into the Atlantic Ocean for each Ariane 5 flight is about **90 metric tons**. With an average of six flights per year, this represents **540 tons every year**.

In addition to legal requirements in accordance with the SEVESO classification system and thresholds for hazardous substances in launch installations, Arianespace in French Guiana is committed to a continuous improvement process pertaining to environment's protection and efficiency, and to the reduction of energy consumption, in keeping with its **ISO 14001 and ISO 50001 certifications** (since 2014). In 2019, despite two new buildings with high energy requirements, Arianespace has reduced its energy consumption by 5.4% since its certification. That year, consumption accounted for 42,810 MWh. The improvement process is ongoing and new energy reduction goals have been set.

For each flight, CNES has also set up **an Environmental Measurement Plan (EMP)** to measure and assess the impact of solid rocket booster (SRB) combustion residues. This plan aims to continuously monitor and periodically measure air purity, chemical residues from SRBs, the quality of natural waters (rivers, underground springs), vibration and acoustic levels during launches, and the impact on vegetation, aquatic fauna and birds.

Finally, **the impact of a space launch must be analyzed in terms of our continent and all the activities that take place there**. If we assume that around 500 million Europeans benefit from access to Space thanks to Ariane, this means that each launch costs **40 g of CO_2 equivalent per European.** Ten annual launches are therefore equivalent to what new European cars emit on average in just 3.5km of use and only 0.02% of the annual carbon budget (2t/year) that each European would have if he/she adopted a carbon neutral lifestyle.



3 | SPACE FOR A BETTER LIFE ON EARTH

3.1 | PROMOTE A RESPONSIBLE VISION OF SPACE

Launch operators must be exemplary in the way they conduct space missions: we advocate for the regulation of space activities, especially those in low Earth orbit (LEO), in keeping with the French LOS. **Our Net Zero Space groups** continue to conduct work in this direction.

Arianespace operates with integrity in accordance with the ArianeGroup Ethics Charter, which formalizes our commitment to the observance of laws and regulations, and ethical standards. (*See ArianeGroup Ethics Charter*)

Fighting corruption is also a priority for Arianespace. In this field, we operate in accordance with the ArianeGroup Code of Conduct, which formalizes specific processes and validation steps concerning, among other things, conflicts of interest, corporate gifts, selection and monitoring of business partners, sponsorship and donations. (*See ArianeGroup Code of conduct*)

Finally, Arianespace conducts its activities in compliance with duty of care requirements. In order to establish a duty of care plan, we report on our initiatives to identify risks and prevent serious violations of human rights and fundamental freedoms, or risks to health, safety and the environment resulting from the company's activities, including its relations with subcontractors and suppliers. (*See 2020 Due Diligence Report*)

3.2 | SPACE ACTIVITIES AS LEVERAGE FOR PROGRESS ON EARTH

The satellites delivered by Arianespace contribute directly to progress on Earth and to the preservation of our planet. Depending on their function, they enable the development and execution of numerous activities with high societal value.

In the telecommunications sector, they ensure access to telephone, radio and television services, and to the internet. Satellites also **help advance research**; the data they collect is useful for science, particularly to observe Earth and to monitor climate change. Military satellites also contribute to **defense and security operations**. Satellites also provide **navigation services** via Galileo – the European global navigation satellite system – optimize all types of transport (road, sea, air), and enable precision agriculture. Finally, they play a role in **education**, as universities launch small satellites.