EUROPEAN
COMMISSION

Brussels, 25.7.2023
SWD(2023) 280 final

COMMISSION STAFF WORKING DOCUMENT

For a resilient, sustainable and digital aerospace and defence industrial ecosystem: Scenarios for a transition pathway

COMMISSION STAFF WORKING DOCUMENT

For a resilient, sustainable and digital aerospace and defence industrial ecosystem: Scenarios for a transition pathway

This document is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position.

Table of Contents

1. INTRODUCTION

Following the experience of the COVID-19 pandemic, the update of the EU Industrial Strategy[1] highlights the need to further accelerate the green and digital transitions and increase resilience of EU industrial ecosystems. **The Aerospace and Defence (ASD) ecosystem**, as defined in the EU Industrial Strategy, covers manufacturing companies in aeronautics, space and defence, space operators, data and service providers, and research institutes. This ecosystem supplies the EU with crucial capacities for strengthening overall resilience, technological sovereignty and open strategic autonomy, also with regards to critical infrastructure and security and protection of its citizens and territory.

The update of the EU Industrial Strategy proposed the *'co-creation of transition pathways for each industrial ecosystem to offer a better bottom-up understanding of the scale, cost, long term benefits and conditions of the required action to accompany the twin transition for the ecosystem. Such plan should take into account relevant inputs such as industrial technology roadmaps announced in the Communication on the European Research Area and those developed under the Action Plan on Synergies between civil, defence and space industries'.*

With this Staff Working Document (SWD) **the Commission is launching the preparation of a dedicated Transition Pathway for the ASD ecosystem** to support its transformation taking into account both the challenges and opportunities of the dual transition, but also the increasing geopolitical tensions and the strategic nature of the ecosystem.

The Transition Pathway will contribute to the development of a business case for the transition to resilient, innovative, sustainable and digital ecosystem in a co-creation process with Members States, industry and all stakeholders, including social partners and non-governmental organisations. The co-creation of Transition Pathways is an opportunity for the entire industrial ecosystem to jointly identify the challenges and to find common responses to them. As outcome of this co-creation process, the Transition Pathway should be agreed with Member States, industry and all stakeholders and contain the possible actions to accompany the transition.

This SWD outlines on-going initiatives, sets out key considerations, opportunities and challenges in the field of aerospace and defence and aims to steer the debate to encourage the identification of possible avenues of joint action. It builds upon a first contribution from the Commission expert group on policies & programmes relevant to EU space, defence and aeronautics industry[2], and forms a basis for consultation and co-creation with Member States, industry and other stakeholders of a joint vision to support the green and digital transition and to ensure a sovereign and resilient Europe.

The SWD does not constitute an official position of the Commission, nor does it prejudge any such position. The consultation process initiated by this SWD invites Member States and all concerned stakeholders to contribute to support the twin transition of the defence and aerospace ecosystem and increase its resilience. The questions contained in this SWD will also be subject of an open public consultation, which will be launched in parallel to its publication.

2. THE EU AEROSPACE AND DEFENCE ECOSYSTEM

The **Aerospace and Defence** ecosystem core manufacturing activities, many of them operating in the global markets, generated an annual turnover of EUR 247 billion in 2021 (EUR 125 billion for aeronautics, EUR 12 billion for space and EUR 110 billion for defence)[3]. Its complex supply chains are composed of a wide range of companies, from large system operators and integrators to high-tech

[1] COM(2021) 350 final, 5.5.2021, European industrial strategy | European Commission (europa.eu)
[2] Register of Commission expert groups and other similar entities (europa.eu)
[3] SWD(2021) 351, 5.5.2021 – annex 3, p.75

specialised small and medium-sized enterprises (SMEs) and highly innovative start-ups, often with strong links to other ecosystems. In defence, and partly space, Member States define the needs and act as the primary customers for a wide range of products. European technology institutes and academia play a particularly important role in this ecosystem due to its high-tech, high-innovation nature, and act as knowledge transfer channels.

SMEs and start-ups represent an important part of the ASD ecosystem, since they perform many niche, complex and innovative tasks in the manufacturing supply chain and in the downstream sector. In civil aeronautics, they represent more than 80% of all companies providing, amongst others, high-tech material processing and engineering services. In space, SMEs are particularly strongly represented in the downstream space sector and NewSpace[4] start-up companies are developing innovative applications at a fast pace. In the defence sector, more than 2,500 defence-related SMEs are key enablers of innovation and growth of the defence sector and play a central role in the complex defence supply chains across Europe.

Civil aeronautics

Civil aeronautics is one of the most successful EU high-tech sectors and comprises a network of thousands of businesses, from SMEs (around 80% of the sector) to midcaps. The European industry is a world leader in the production of civil aircraft, including helicopters, aircraft engines, parts and components. It is spread across Europe, covers all market segments, ranging from general aviation to business jets and commercial aircraft, rotor-wings, combat aircraft and military trainers as well as unmanned vehicles, training and simulation services, Maintenance Repair & Overhaul (MRO) and air traffic management systems. Many start-ups have joined the large airframe manufacturers in working on innovative air mobility solutions, including drones, often using new propulsion technologies.

Space

The EU is one of the main global space powers. Retaining and strengthening this position is of strategic importance to achieve a stronger and more competitive Europe. Space infrastructure, services and applications are essential for Europe's security and resilience, but also for the green and digital transitions. The Russian war of aggression against Ukraine has further highlighted the strategic nature of space for the European economy, security and defence. In this context, the EU needs a clear, commonly agreed roadmap and actions for the space industrial sector to strengthen our technological, industrial and space sovereignty.

The space sector is undergoing a massive transformation and faces new challenges, as it is no longer dominated by national agencies and public spending, but opened up to a rapidly growing private sector, combining both large and small industry, space, digital and downstream ecosystems. This is a major opportunity for Europe. At the same time, space is an increasingly contested geostrategic domain for great power competition. Europe must defend its interests and freedom of action in space, as potential adversaries are developing and strengthening their space and counter-space capabilities at high speed. We need to promptly strengthen the EU's strategic autonomy in space, notably by:

- working on a new security and defence framework in the EU, including further enhancing synergies between space and defence;
- strengthening the EU Space Programme[5] and supporting NewSpace initiatives, such as the Secure Connectivity initiative[6] and Space Traffic Management approach[7];
- ensuring the EU's autonomous, secure and cost-effective access to space as a prerequisite for freedom of action;
- reinforcing the resilience of EU space supply chains, including by lowering dependencies on non-EU actors.

[4] Private companies, SMEs and start-ups that develop novel space technologies and applications
[5] OJ L170, 12.5.2021, p.69
[6] COM(2022) 57 final, 15.2.2022
[7] JOIN(2022) 4 final, 15.2.2022

Defence

The defence industry has been traditionally organised into three sectors (aeronautics, land and naval), with increasing importance of cyber and space interconnections. It includes platform producers or integrators, system providers and component manufacturers. It is composed of large companies, either with an exclusive defence focus or a dual profile (civil and defence), as well as many SMEs and midcaps, generally generating a minority share of their turnover in the defence sector.

The defence industry operates in a highly regulated market, where government is often the sole customer, sponsor and regulator. In contrast to commercial markets, these products are not developed unsolicited but on the specific demand of governments. The industry features very long product development and life cycles, high upstream investments and a demand side determined by government procurement strategies and defence capability considerations. Exports tend to be highly regulated. Although limited in volume and subject to cyclic or exceptional variations in demand, the defence market requires technological excellence and affordability of the weapons systems along their life cycle.

3. MAIN CHALLENGES FOR THE ASD ECOSYSTEM

Both Russia's military aggression against Ukraine and the COVID-19 pandemic have shown the vulnerability of global supply chains and the risk of relying excessively on third-country suppliers, resulting, inter alia, in price hikes, increase of costs and unreliable supply of a broad array of raw, processed and advanced materials and technologies, and the unavailability of skilled workforce. These crises have highlighted the robustness of the Single Market as the foundation of EU's growth and welfare and underlined the importance of the need for strengthening investments in the resilience of European economy, in its security, green and digital dimensions.

The COVID-19 pandemic had a substantial impact on the ecosystem, with turnover reduction of up to EUR 50 billion for aeronautics (40%), EUR 28 billion for defence (25%) and EUR 3 billion for space (25%)[8]. The impact of the COVID-19 containment measures was strongly felt in the ASD ecosystem, as manufacturers faced cash-flow shortages and severe disruptions of the global supply chains that affected the industrial base supporting complex manufacturing. Institutional demand and long-term budgets acted as buffers in the defence and space sectors.

While the aviation industry is experiencing a rebound after the pandemic with air travel expected to recover 2019 levels before 2025[9] the aeronautics industry is facing significant challenges. One of the most complex challenges is the disruption of its supply chain, resulting in difficulties for them to ramp-up production rates and honour order books. These difficulties have different causes: inflation, labour shortages, sourcing of raw materials including Titanium from Russia, etc. Some companies critical to the supply chains may become targets for non-EU takeovers. .[10]. These will impact the entire ecosystem, since civil aeronautics represents 50% of its turnover.

In the **defence** industry, after years of underinvestment there is an unprecedented increase in national defence spending, with efforts to replenish stocks and adjust the industry to structural changes induced by the return of high intensity conflict in Europe. This is both an opportunity and a challenge for the defence industry to ramp up its production and invest. The challenges relate to competition for raw materials, skills, components, other supply chain issues as well as market inefficiencies related to multiple national orders addressed individually at the limited number of market players, with different timelines and delivery schedules. Difficulties in access to finance for companies in the defence sector are also a limiting factor in their ability to ramp up production and adjust to the new reality. Increased

[8] COM(2021) 350 final, 5.5.2021
[9] Eurocontrol Performance 2022 – Outlook 2023, December 2022
[10] Some companies are, however, pursuing pre-pandemic production rates, while still facing supply chain challenges and/or the impact of the current economic situation.

demand for defence industry products is also an unprecedented opportunity to strengthen the European defence industry and its technological base by advancing in the area of joint procurement.

The EU is among the most exposed advanced economies, due to its geographical proximity to the war and heavy reliance on gas imports from Russia. According to the latest forecast[11], the EU economy is on a path of lower growth in 2023 (3.5% in 2022 and 1% in 2023) and higher inflation is at historical highs (9.2% in 2022 and 5.8% in 2023 in the EURO area). This limited the ability of businesses to supply their goods and services and caused supply chain disruptions, further highlighting the problem of years of massive underinvestment in the aerospace and defence sectors. The Joint Communication on the Defence Investment Gaps Analysis[12] quantifies this gap. In response to the new security threats, most Member States are announcing substantial increases of their defence budgets, in some cases even going beyond 2% of their GDP, building on an upwards trend that started some years ago. In 2020, Member States collectively spent over EUR 200 billion on defence[13] and in 2021 their combined expenditure is estimated to have grown to EUR 220 billion. These recent developments nonetheless follow a prolonged period of substantial cuts in defence spending after the economic and financial crisis 2007-2008, decreasing from EUR 183 billion in 2008 to EUR 159 billion in 2014[14] , only recovering to the pre-crisis levels by 2018-2019.

While the impact differed across Member States and across the 14 ecosystems, SMEs have been among those that suffered most.

The deliberate and concerted attempt by Russia to use energy as a political weapon has caused gas and electricity prices to reach record levels in 2022. The energy crisis is eroding households purchasing power and weighing on production[15]. Firms have faced a three-fold energy-price increase over the last year. As aerospace and defence manufacturers are highly energy intensive, rising energy prices are expected to cause e.g., closure or relocation of businesses, lower profit margins and tighter cashflow.

The aerospace industry has been directly impacted by the EU sanctions[16] against Russia in response to its attack on Ukraine, in addition to the airspace closures and rerouting of flights and to aircraft not returned to their owners. The Soyuz launches from French Guiana were suspended by Russia in reaction to the EU sanctions, raising concerns about the impact of limited availability of EU launch solutions for the Space Programme in the longer term. Other space activities have also been impacted, with technologies for satellites, spacecraft and space industry falling under the restrictive measures, with very limited exceptions and exemptions. This new reality makes it imperative for the EU to increase its open strategic autonomy, including through reliable, autonomous, cost-effective access to space and secure and sovereign connectivity.

Going forward, the EU should join its forces in the ASD ecosystem to accelerate innovation cycles, attract new players (such as NewSpace), support their scaling up and strengthen its overall resilience, guided by the principles of solidarity and mutual assistance. In this context, the mobilisation of all stakeholders towards shaping a joint, comprehensive strategy will be essential to overcome identified vulnerabilities and strategic dependencies and develop synergies. Incentivising investments, including in critical materials, new technologies and services, but also in early identification of skills needs, upskilling and reskilling the workforce to ensure the creation of quality job opportunities, including for vulnerable groups, should be at the heart of these efforts. The industry and the academia have a critical role to play in this process, while public authorities should ensure tailored framework conditions and initiatives and targeted public services.

[11] Spring 2023 Economic Forecast: an improved outlook amid persistent challenges (europa.eu)
[12] JOIN(2022) 24 final, 18.05.2022
[13] Defence Data Portal (europa.eu). (DK not included)
[14] EDA Defence Data 2021
[15] Autumn 2022 Economic Forecast: The EU economy at a turning point (europa.eu)
[16] Sanctions adopted following Russia's military aggression against Ukraine (europa.eu)

4. SETTING THE STAGE FOR THE TRANSITION OF THE ASD ECOSYSTEM

Cross cutting policies on green, digital and resilience

The discussion on the transformation of the ASD ecosystem will build upon actions identified in the relevant strategic documents adopted by the Commission. The EU has put forward an ambitious policy agenda promoting competitive sustainability, i.e. environmental sustainability, productivity, fairness, and macroeconomic stability. The long-term vision of the EU is that in 2050, the EU will be a climate neutral society as well as a carbon neutral economy, fully adapted to the unavoidable impacts of climate change, biodiversity loss and pollution, and staying within the planetary boundaries. The European Green Deal[17] aims to mobilise industries for a clean and circular economy and sets out the objective to make Europe the first climate-neutral continent in the world. The aim is to make all sectors of the EU's economy fit to meet this challenge, to steer a sustainable, fair and inclusive recovery and to make the EU's economy more resilient to future shocks, while transforming our economies and societies in line with the ambition of the twin transition[18].

The update of the EU Industrial Strategy[19] highlighted the need to further accelerate the green and digital transitions and increase resilience of the EU industrial ecosystems, thus enhancing EU's global competitiveness and supporting its open strategic autonomy. The European Green Deal, the Fit for 55 regulatory package[20] and the EU Climate Target Plan for 2030[21] and Repower EU Plan[22] all address these transformational challenges. The Circular Economy Action Plan[23] supports companies and the economy towards environmental sustainability, climate-neutrality and circularity. The clean Energy and Hydrogen Strategies[24] support progress on energy. The Sustainable and Smart Mobility Strategy[25] aims to shift the existing paradigm of incremental change to fundamental transformation of mobility. The Chemicals Strategy and Clean steel partnership under Horizon Europe[26] advance the work on greener products and components. Horizon Europe fosters important investments in the industry, notably by the Clean Aviation Joint Undertaking[27]. The Digital Decade[28] and the European Strategy for Data[29] aim at establishing a single market for data and ensuring Europe's global competitiveness and digital technological leadership. The Strategy for financing the transition to a sustainable economy[30] aims at better connecting finance and sustainability. The Commission also recently presented a European Critical Raw Materials Act and a Net Zero Industry Act, and the EU has made 2023 the European Year of Skills, thus underlining the urgency of strengthening resilience in all its dimensions.

The Action plan on synergies between civil, defence and space industries

The Action plan on synergies between civil, defence and space industries[31] lays the ground to deliver concrete policy actions for three headline objectives.

The first one aims at enhancing complementarity between relevant EU programmes and instruments to increase efficiency of investments and effectiveness of results (the '*synergies*') where the EU Multiannual Financial Framework (MFF) 2021-2027 significantly scales up investment in

[17] COM(2019)640, 11.12.2019
[18] 2022_european_semester_annual_sustainable_growth_survey.pdf (europa.eu)
[19] See footnote 6
[20] COM(2021)550 final, 14.7.2021
[21] COM(2020)562 final, 17.9.2020
[22] COM(2022)230, 18.5.2022
[23] COM(2020)98 final, 11.3.2020
[24] COM(2020)301 final, 8.7.2020
[25] COM(2020)789, 9.12.2020
[26] OJ L170, 12.5.2021, p.1
[27] OJ L427, 19.11.2021, p.17
[28] OJ 323, 19.12.22, p.4
[29] COM(2022)68 final, 23.2.2022
[30] See footnote 23
[31] COM (2021)70 final, 22.2.2021

technologies for defence or related civilian use, such as security, mobility, health, information management, cyber and space.

The second objective consists of promoting that EU funding for research and development (R&D), including on defence and space, has economic and technological dividends for EU citizens (the '*spin-offs*')[32]. Increased investment in defence must also present a dividend for the economy at large, while fully respecting the constraints inherent to the defence sector (e.g. the role of national authorities in steering demand, information handling or specific rules for intellectual property rights). Several world-class European companies owe their position to spin-offs from European defence research, from fibre technology to civilian aircraft or even canned food. Similarly, many innovations first used in space have become civilian success stories, such as digital imaging sensors, insulin pumps or wireless headsets. Space data and services generated by Galileo[33], EGNOS[34] and Copernicus[35] are used for applications in numerous areas inside and outside the EU, providing substantial gains in terms of economic welfare and general quality of life.

Finally, the third objective is to facilitate the use of civil industry research achievements and civil-driven innovation in European defence cooperation projects (the '*spin-ins*'). In many cases it is increasingly difficult to draw a clear line between civil and defence research, particularly for basic technology (low Technology Readiness Levels – TRLs). Civilian applications of technology are becoming ever cheaper, driven by globalisation of knowledge, access to a wider public and generalised access to data. Fostering synergies among relevant EU-funded instruments and facilitating civilian-space-defence cross-fertilisation (spin-ins and spin-offs) can enhance European economic growth, further develop the Single Market and improve security for European citizens.

Drawing on expertise from across the EU, beyond well-established leaders in civil, defence and space industries, including SMEs and start-ups, will contribute to enhanced European cooperation, competitiveness and resilience.

Defence industry

On 10 November 2022, the Commission presented the **European Security and Defence** package, including the Action plan on military mobility 2.0 and the EU Cyber defence policy[36]. The Council adopted a Recommendation[37] on a coordinated approach by the EU to strengthen the resilience of critical infrastructure, focusing on key sectors which include digital infrastructure and space, and increasing the response capacity through the EU Civil Protection Mechanism. This Recommendation aims to respond to new risks, physical and cyber-attacks and responding to these risks also strengthens the EU's policy on countering hybrid threats.

With the intention to strengthen resilience and to reinforce the European defence industrial and technological base, the Commission works to help Member States to invest together, better and in a European way. Delivering on the 2022 Joint Communication on defence investment gaps, the

[32] In the medium to long term, when the need to protect key operational superiority assets will no longer apply.

[33] Galileo is Europe's Global Navigation Satellite System (GNSS), providing improved positioning and timing information with significant positive implications for many European services and users.

[34] The European Geostationary Navigation Overlay Service (EGNOS) is Europe's regional satellite-based augmentation system (SBAS) that is used to improve the performance of global navigation satellite systems (GNSSs), such as GPS and Galileo. It has been deployed to provide safety of life navigation services to aviation, maritime and land-based users over most of Europe.

[35] Copernicus is the European Union's Earth observation programme, looking at our planet and its environment to benefit all European citizens. It offers information services that draw from satellite Earth Observation and in-situ (non-space) data.

[36] The Action plan on military mobility 2.0 aims to ensure that military troops can react quickly to emerging threats at our external borders and beyond. It includes protection against cyber-attacks and other hybrid threats, as well as enhanced resilience of our infrastructures and introduces a new resilience and preparedness pillar which includes hybrid threats, particularly of cyber nature, aspects into the work on military mobility.
The Cyber defence policy puts forward new instruments to adapt the EU defence to the new nature of threats. It proposes new instruments to increase our ability to prevent, detect, deter the cyber-attacks and defend ourselves against them.

[37] COM(2022)551 final, 18.10.2022

Commission proposed an urgent short-term instrument, the **European Defence Industry Reinforcement through common Procurement Act (EDIRPA)**[38], with a budget of EUR 500 million[39], to incentivise Member States to jointly procure weapons, thereby ensuring interoperability, economies of scale and - ultimately - a strong European defence industry. Through the joint procurement of the most urgent and critical defence products, competitiveness and efficiency of the European Defence Technological and Industrial Base will be boosted and Member States will notably be able to more efficiently replenish their stocks depleted by donations to Ukraine. The Joint Communication also established a **Defence Joint Procurement Task Force** to support coordination of Member States on the most urgent procurement needs by consolidating demand and identifying production capacity across the EU.

In response to the Council's call to urgently deliver ammunition, and if requested missiles, to Ukraine and to help Member States refill their stocks by introducing targeted measures, the Commission furthermore put forward the **Act in Support of Ammunition Production (ASAP)**[40], a proposal for a Regulation to support the European Union's defence industry to ramp-up its production capacities in ammunition and missiles. The ASAP proposal foresees EUR 500 million from the EU budget and a possibility to mobilize up to EUR 1 billion for direct support for specific industrial projects: for instance, extension or modernization of existing lines, creation of new lines, plans to repurpose old ammunition, securing value chains and addressing skills gaps. It also recalls that Member States can voluntarily mobilise cohesion funds, as well as the Recovery and Resilience Facility (RRF) to support these projects and a dedicated ASAP ramp-up fund is proposed to help facilitate access to finance.

A competitive, resilient and innovative European defence ecosystem requires reducing internal market barriers and fragmentation and addressing existing and potential future harmful dependencies. The policies mentioned above should build the conditions for Europe to act and cooperate with international and regional partners, such as the North Atlantic Treaty Organization (NATO), wherever possible, while being able to operate autonomously when and where necessary. The **European Defence Fund (EDF)**[41] is the Commission's key initiative to support collaborative R&D of defence capabilities with the EU budget. EDF supports competitive and collaborative projects throughout the entire cycle of R&D for a bigger impact on the European defence capability and industrial landscape.

It strongly encourages participation of SMEs in collaborative projects and fosters breakthrough innovative solutions. The budget for 2021-2027 is close to EUR 8 billion (EUR 2.7 billion to fund collaborative defence research and EUR 5.3 billion euros to fund collaborative capability development projects, complementing national contributions). The European Defence Innovation Scheme within the EDF supports accelerating innovation through business services and addressing access to finance.

EU space

The **EU Space programme** encompasses for the first time all EU space activities in one single regulation[42], namely the existing flagship initiatives Copernicus (Earth Observation), Galileo and EGNOS (global positioning, navigation, and timing) and new initiatives on satellite communication (GOVSATCOM), space situational awareness (SSA). The regulation simplifies and streamlines the governance and capitalises on synergies and horizontal activities.

The EU Space programme puts great emphasis on users and market uptake and the exploitation of the enormous potential of space data and services to develop value-adding applications and services. Moreover, the space data and services provided under the Space programme will support

[38] COM(2022) 349 final, 19.7.2022
[39] The final amount will be subject to agreement by co-legislators.
[40] https://defence-industry-space.ec.europa.eu/system/files/2023-05/COM_2023_237_1_EN_ACT.pdf
[41] OJ L170, 29.4.2021, p.149
[42] OJ L170, 12.5.2021, p.69

policymaking for a green and the digital transition, strengthen EU resilience and contribute to other EU policies. For example, Galileo and EGNOS contribute to the rollout of sustainable transport modes by reducing aviation emissions and optimising routes on land and at sea. EGNOS and Copernicus working in synergy can contribute to smart and sustainable farming techniques. The Space programme also promotes entrepreneurship and competitiveness of the space sector through the entire value chain, encouraging new entrants, SMEs and start-ups and their cross-border participation.

The EU Space programme, with its EUR 14.8 billion budget, supports the competitiveness of the EU space sector, thanks to the procurement for the development and management of its space assets. Contracts awarded by the Commission under the Space Regulation are generally speaking open to third countries companies, pursuant to the EU's international obligations. To protect the security, integrity and resilience of the EU's systems, specific participation and eligibility criteria will apply for certain contracts.

The contribution of the EU Space programme in supporting the green and digital transition of the space sector and its overall resilience is well recognised and can be further developed through actions across the whole space sector, including the better integration of NewSpace, and stronger synergies with aeronautics and defence.

The Digital Europe Programme[43] and Horizon Europe, the EU Framework programme for Research and Innovation (2021-2027) will support the competitiveness of the European industry, stimulate the growth and job creation and foster EU's technological leadership. Horizon Europe includes budget for space research and innovation (almost EUR 1.5 billion), supporting technological development, innovation and competitiveness of European upstream and downstream space sectors, including support for space entrepreneurship.[44]

In addition, the EU could act as a major anchor customer within certain limits. In fact, it has recently developed the dynamic purchasing scheme to accelerate the on-boarding of the European NewSpace companies in Copernicus, and the IOD/ IOV (In-Orbit Demonstration/Validation) service.

Finally, the ASD industries can benefit from any other EU policy and financing instrument where they are eligible, such as Important Projects of Common European Interest (IPCEI), InvestEU, SME instruments.

The EU Secure Connectivity Programme (IRIS^2)[45] is a new flagship programme for space-based secured connectivity. In order to ensure the competitiveness of the EU space ecosystem, the Programme aims to maximise the use of innovative and disruptive technologies, as well as novel business models developed by the European space ecosystem, including NewSpace, in particular by SMEs, mid-cap companies and start-ups that develop market-driven novel space technologies and applications, while covering the whole space value chain encompassing the upstream and downstream segments. The programme implementation has kicked off with the launch of a public procurement for a concession contract for the design, development, validation, deployment, operations and service provision related to the governmental infrastructure of the programme in March 2023. The overall budget for the Programme in the period 2023-2027 is 2.4 billion EUR.

In line with the objectives of the European Green Deal, the Programme should minimise, to the extent possible, its environmental impact. To that end, the procurement procedures and contracts launched under the Programme should include principles and measures on environmental and space sustainability. These should include provisions to minimise and offset the greenhouse gas emissions

[43] OJ L166, 29.04.2021, p.1

[44] The budget was distributed under three priorities. The first one aims at maximising benefits of space for society and EU economy, with services and applications developed thanks to the Galileo and Copernicus infrastructure for global positioning, navigation, timing and for Earth observation. The second one, intends to ensure a globally competitive and innovative EU space sector by focusing on space technologies, including for European non-dependence, and space science and the third one set the goal to provide access to space in a secure and safe space environment, taking into account aspects such as space weather and space traffic management.

[45] COM(2022) 57 final, 15.2.2022

generated by the development, production and deployment of the infrastructure, measures to prevent light pollution, use of appropriate collision-avoidance technologies for spacecraft, submission and implementation of a comprehensive debris mitigation plan to ensure the avoidance of debris by the satellites of the constellation.

Civil aeronautics

The competitiveness of the civil aeronautics industry strongly depends on its capacity to innovate. Industry spends a sizeable share of its revenues on R&D to deliver ever safer, greener and more cost-efficient products. Soon, disruptive technologies will not only bring new aircraft concepts like Unmanned Aircraft Systems (UAS) and electric Vertical Take Off and Landing aircraft (eVTOL), but will also enable an energy shift in air transport to electric and hydrogen-powered flights.

Successive Framework Programmes for Research and Innovation have supported this effort[46]. Over the period of 2021-2027, Horizon Europe has set aside EUR 330 million for aviation collaborative research. The Clean Aviation institutionalised partnership invests EUR 4 billion in aeronautics research, of which EUR 1.7 billion from the EU budget. It focuses mainly on disruptive technologies for the greening of EU aviation, including electric and hydrogen-powered propulsion and 100% Sustainable Aviation Fuels (SAF) compliant ultra-efficient engines and aircraft. In view of a digital and sustainable European sky, the SESAR 3 Joint Undertaking[47] is another institutionalised partnership under Horizon Europe, which will invest EUR 1.6 billion into research and innovation for air traffic management. The Connecting Europe Facility[48] supports the deployment of SESAR solutions.

In June 2022, the Commission launched the Alliance for Zero-Emission Aviation (AZEA) to support industry's efforts to address climate change. Over 300 experts from the more than 140 member organisations of the Alliance are working to prepare the entry into commercial service of hydrogen and electric aircraft. A progress report[49] issued at the occasion of AZEA's General Assembly at le Bourget, June 2023, describes the Alliance's organisation and initial achievements.

In 2022, the European Commission adopted a new Drone Strategy 2.0[50] to support the development of a smart and sustainable unmanned aircraft eco-system in Europe. The Strategy identifies a number of actions to further develop the EU drone service market. They include the completion of a comprehensive regulatory framework supported by appropriate standards and the development of the U-space, an unmanned traffic management (UTM) system, which provides the air traffic management system for drones. The Strategy also proposes measures to better exploit synergies between civil and military drone technologies to support the competitiveness of European industry.

Skills

The different subsectors of the ASD ecosystem face many similar challenges when it comes to attracting, recruiting, training and retaining a skilled workforce. These challenges have become more acute given the necessity to deliver on the green, digital and resilient transitions. At the same time, the varied nature of the ecosystem, which relies on high-tech and high-innovation, requires anticipation, early identification and management of response to emerging skills needs, as well as reskilling and upskilling of the workforce, to enable all workers to perform their tasks in an increasingly digitalised working environment and in relation with current and anticipated skills needs. In this context, it is

[46] More than EUR 4.5 billion have been invested under FP7 and Horizon 2020 in aviation research in the period 2007-2020 through collaborative projects and the Clean Sky and the SESAR Joint Undertakings. From 2003 onwards, the EU invested a total budget of almost EUR 980 million in the development or use of drones for innovative applications

[47] The SESAR 3 Joint Undertaking is an institutionalised European partnership between private and public sector partners set up to accelerate through research and innovation the delivery of the Digital European Sky. To do so, it is harnessing, developing and accelerating the take-up of the most cutting-edge technological solutions to manage conventional aircraft, drones, air taxis and vehicles flying at higher altitudes.

[48] OJ L 249, 14.7.2021, p.38

[49] https://defence-industry-space.ec.europa.eu/system/files/2023-06/Progress%20report%20v.1.0.pdf

[50] COM(2022) 652, 29.11.2022

crucial to achieve the targets set in the European Skills Agenda[51] and the Digital Education Action Plan[52], to ensure that 70% of adults are equipped with basic digital skills by 2025, and 80% by 2030, as well as the European Pillar of Social Right Action Plan[53] headline target: "at least 60% of all adults should be participating in training every year by 2030". In addition, a close sectoral cooperation between public authorities, academia and industry is essential for the development of a strategic approach, the design and implementation of solutions on sectoral skills needs.

The ASD ecosystem entered the Pact for Skills as one of the first partnerships in November 2020. A large-scale partnership between stakeholders was formed to upskill 200,000 employees and reskill 300,000 people to enter the supply chain and highlighted the financing need for a public and private investment of EUR 1 billion in the next 10 years. Members of the Pact for Skills have access to support services and guidance that will support the industry efforts to implement the ecosystem's skills agenda, including through facilitating co-operation and identifying relevant funding opportunities from the Recovery and Resilience Facility (RFF), Recovery assistance for cohesion and the territories of Europe (REACT-EU) and EU funding instruments such as the European Regional Development Fund (ERDF), the European Social Fund Plus (ESF+) or the Just Transition Fund.

The ASD ecosystem is reliant on a workforce that is highly skilled and educated in Science, Technology, Engineering, and Mathematics (STEM), not only for R&D activities but also for production. It can take several years of on-the-job training to fulfil certain tasks in the production and maintenance. The ecosystem is also facing a demographic challenge and, in order to have the right skills, it needs to become more attractive to all segments of the population. The industry needs to take action to increase its attractiveness, diversity and inclusiveness.

Stakeholders from the ASD ecosystem expressed the need to have both transversal and sector-specific skills. These needs should combine domain-specific knowledge with problem-solving and interpersonal abilities, including communication, creativity, openness to learning, and critical thinking, among others. For example, some of the most relevant skills for the ecosystem are big data analysis, high-performance computing, model-based engineering, artificial intelligence (AI), cyber-security, machine learning, additive manufacturing, blockchain or quantum technologies, life-cycle assessment as well as solutions for carbon neutrality and circular economy.

Critical raw materials and critical technologies

Raw materials are the foundation of industrial value chains. Some raw materials, including those assessed as critical raw materials (CRMs), are essential prerequisites for the development of strategic sectors including defence and aerospace, which are high tech and high innovation.

The EU industry, including the ASD ecosystem, is facing large dependencies for many raw materials but also advanced materials and technologies along the supply chain delivery on green, digital and resilience ambitions of the EU depend on reliable, sustainable and secure access to critical raw materials.

While many of the critical and strategically essential raw materials used in the ASD ecosystem are similar to the ones used in other industrial ecosystems, there are some cases where the aerospace and defence industries have specific material requirements, such as titanium and tungsten. The nature and specificities of the defence and aerospace industries also imply that they rely on the use of a wide range of materials with unique properties that make them essential for the manufacture of components used in military or space applications.

In the field of space, the need to operate in extreme conditions and environments requires particular properties and control during long R&D-phases, and testing and qualification procedures to comply with the space industry standards. Consequently, the substitution of materials and processes aiming to

[51] European Skills Agenda - Employment, Social Affairs & Inclusion - European Commission (europa.eu)
[52] Digital Education Action Plan (2021-2027) | European Education Area (europa.eu)
[53] The European Pillar of Social Rights Action Plan (europa.eu)

decrease the supply risk in the defence and aerospace sector is not straightforward. For instance, rare earths are indispensable in remotely piloted aircraft systems, precision guide munitions, targeting lasers and satellite communications. Rare earths are produced almost exclusively in China, and although the demand for certain raw materials used in the production of defence or aerospace applications is relatively low in volume, some of them are the subject of concerns over their security of supply, with a direct impact on the overall EU resilience and security.

To strengthen the resilience of the EU industry, including the ASD ecosystem, across the value chain, the Commission is setting up an Observatory of Critical Technologies ('the Observatory')[54]. The Observatory will identify, monitor and assess critical technologies for space, defence and related civil sectors, their potential application and related value and supply chains, therefore strengthening EU resilience. In the area of raw materials, the Commission put forward a proposal for a European CRM Act Regulation[55] to ensure secure and sustainable access to critical raw materials for the twin transition ambitions, but also for the EU's resilience and security[56].

5. TOWARDS A RESILIENT AND COMPETITIVE ECOSYSTEM

The COVID-19 pandemic and the Russian war of aggression against Ukraine have exposed the necessity of strengthening the resilience of the ASD ecosystem.

The ASD ecosystem provides components, products and systems for increased resilience of the EU economy in its security dimension to make an impact on the twin transition. As such, aerospace and defence are enablers and beneficiaries of the twin transition and the resilience of the economy. Dual-use technologies embody this synergy relationship, where civilian and military technologies reinforce each other and are a source of innovation for each other.

Increasing the aerospace and defence industry's resilience requires maintaining and strengthening the technological excellence and supporting innovation, reducing strategic dependencies that can lead to vulnerabilities along the supply chain, ensuring access to raw materials, unrestricted access to critical space and defence technologies, investing in the right skills as well as attracting qualified personnel, facilitating and ensuring access to finance. It also involves protection of critical infrastructure, transport routes and ensuring monitoring of foreign acquisitions of key strategic assets. For instance, technologies such as additive manufacturing[57] could increase the flexibility of the industry's production capacity, and thus contribute to the resilience of the armed forces. Elements of a strategy to improve the industry's resilience are the modernisation and transformation, notably of manufacturing assets and industrial or engineering tools throughout the supply chain.

The Joint Communication by the European Commission and the High Representative on **European Economic Security Strategy**[58] sets out a common framework for achieving economic security by (I) promoting the EU's economic base and competitiveness; (II) protecting against risks; and (III) partnering with the broadest possible range of countries to address shared concerns and interests. It focuses on minimising risks arising from certain economic flows in the context of increased geopolitical tensions and accelerated technological shifts, while preserving maximum levels of economic openness and dynamism.

In the area of **civil aeronautics**, the current crises have unveiled distinct threats to the resilience of the aeronautical industry and its global supply chains. The dramatic drop in air travel and associated orders in production and maintenance induced by the COVID-19 pandemic particularly affected

[54] COM(2021) 70 final, 22.02.2021
[55] https://single-market-economy.ec.europa.eu/publications/european-critical-raw-materials-act_en
[56] The proposed Act aims at covering the entire lifecycle of raw materials, from extraction to recycling, looking to current and future strategic needs and identify potential strategic projects along the entire supply chain. This will complement the ongoing work in the context of the European Raw Materials Alliance.
[57] Additive manufacturing, also known as 3D printing, is a process used to create a physical (or 3D) object by layering materials one by one based on a digital model.
[58] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023JC0020

companies in the supply chain that did not have sufficient financial reserves or access to state support. Some went bankrupt, others saw themselves taken over by other companies, often from outside of the EU. Russia's war on Ukraine highlighted industry's dependence on certain imports of raw and processed materials and parts.

Aside from these shock-induced challenges to the aeronautical industry's resilience, the industry will also need to address the challenges of the green and digital transitions (see specific chapters) to secure its longer-term competitiveness. Central to both transitions are the questions of access to critical raw and processed materials, technologies, finance and the inclusion of skilled staff. Disruptions of the supply chains for production and maintenance of aircraft are mentioned by the aeronautics industry as a major challenge and risk factor. Worldwide dependencies should also be addressed with reference to resilience, technological non-dependence and supply chain bottlenecks in the civil aeronautics industry.

In part, solutions are already being put in place, for example to reduce dependency on certain raw materials imported from Russia. Going forward, the industry's structural weaknesses will need to be addressed, including a high level of dependency on third countries for specific materials and technologies that are critical or strategic industry inputs, the absence of detailed information on critical materials and their suppliers, and structural weakness of parts of the civil aeronautics value chain with the associated risk that take-overs by non-EU entities affect the EU's technological leadership.

The resilience of the **defence industry** depends on several factors: technological lead, reliable supply chains, skills and raw materials critical to the development and manufacture of defence products, as well as the ability to foster defence innovation. We need to ensure the functioning of the EU defence industry by protecting the access to current and emerging technologies, skills and raw materials critical to the development and manufacture of defence products.

The EU **space** value and supply chains have certain critical dependencies, from raw, processed and advanced materials to technologies for components, equipment and systems. Industrial value chains underpinning the creation and functioning of our space infrastructures are critical to ensure delivery of uninterrupted and reliable space services. Beyond redundancy, which is one way to enhance the EU's resilience, there should be systematic use of existing instruments to enhance technological non-dependence in space, to protect critical elements of EU space value chains and to ensure security of supply of critical space technologies and services. At the same time, the EU should assess gaps and envisage additional tools to monitor and to react timely to unforeseen shocks and rapid changes in the global market.

Technological non-dependence

Reinforcing **industrial strategic autonomy** requires limiting dependencies and building up strategic reserves where supply is at risk, whilst maintaining the openness of the Single Market and investing in deepening and broadening international partnerships with like-minded countries.

EU dependencies on critical materials and technologies poses risks to the overall European security and sovereignty, as well as to the competitiveness of the European space manufacturing industry. In several critical technology areas, European programmes are dependent on non-EU suppliers and for those critical technologies where the EU has a capability, it is often based on a single source. Additionally, some components procured outside the EU and meant to be used for space applications are subject to US export regulations (i.e. International Traffic in Arms Regulations – ITAR – and/or Export Administration Regulation – EAR, creating procurement delays and putting the European space manufacturing industry in a situation of additional dependence in the short term.

In the area of technological excellence, the resilience of the industry is conditioned by its capacity to access or develop current and emerging technologies and reducing technological and industrial dependencies.

Horizon Europe is a strong leverage to develop technological non-dependence. In the area of defence, the European Defence Fund provides such leverage and impact. In the area of space, the Commission has supported the development of critical space technologies in Europe through programmes such as Horizon 2020 (investment in the order of EUR 100 million) and Horizon Europe, with dedicated calls aiming at reducing non-European dependencies.

The EU Space programme introduced the possibility of stricter eligibility and participation conditions in procurement to preserve the security, integrity and resilience of operational systems of the EU. This should allow to capitalise the continuous investment in developing critical space technologies for EU non-dependence and it will represent an industrial incentive to maintain the know-how and manufacturing capabilities of critical components within the EU. In the long term, this approach will reduce the selection of non-EU technologies when a valid European solution is available.

With the InvestEU fund, the Commission aims at easing conditions for access to finance for EU start-ups and SMEs, in particular in high-tech, high-risk ecosystems crucial to EU resilience, technological sovereignty and strategic non-dependence.

Support to innovation is also key to strengthening the resilience of the ASD ecosystem. Both in the area of space and defence, the Commission promotes innovation. In the area of space, the CASSINI Space Entrepreneurship Initiative is a tool designed to stimulate the space-tech ecosystem in Europe and reinforce the involvement of the private sector, especially NewSpace. It includes the CASSINI facility, launched in January 2022 by the Commission together with the European Investment Fund (under InvestEU), which will deploy a EUR 1 billion investment capacity to boost space companies in different growth stages across the EU, and the CASSINI matchmaking, which aims to provide opportunities for partnering with corporations and investors.

The **EU Defence Innovation Scheme (EUDIS**) is a tailored toolbox supporting companies transforming ideas into innovative defence products and applications. The 2023 EDF calls include two new types of calls that contribute to EUDIS: spin-in calls to adapt civil innovations to defence requirements, and calls targeted at cross-border defence innovation networks to create and provide test opportunities for innovative players and hackathons. EUDIS also includes the establishment of an equity facility under InvestEU that that aims to support Private Equity and Venture Capital funds investing in innovative technologies having dual-use potential. The European Commission plans to allocate EUR 100 million from the European Defence Fund until 2027 to this instrument, which is to be implemented by the European Investment Fund.

As announced in the 2022 State of the European Union address, the Commission will propose the creation of a **European Sovereignty Fund** that will make sure that the future of industry is made in Europe. This new fund will be designed building on existing and ongoing analyses of strategic dependencies and resilience of the EU value chains in the aerospace and defence ecosystem.

As a precursor to a fully-fledged European Sovereignty Fund, the Commission tabled a proposal for a **Strategic Technologies for Europe Platform (STEP)** to support European leadership on critical technologies. STEP will reinforce and leverage existing EU instruments (such as InvestEU, Innovation Fund, Horizon Europe, EU4Health, Digital Europe Programme, European Defence Fund, Recovery and Resilience Facility, and cohesion policy funds) to quickly deploy financial support to the benefit of business investments, and allow directing existing funding towards technology fields that are crucial for Europe's leadership, thus contributing to a level playing field for investments throughout the Single Market. This should support the uptake and scaling up of development and manufacturing of strategic technologies in the EU, in the fields of digital and deep tech, clean tech and biotech. It will help companies seize the opportunities, build resilience and meet the objectives of the green and digital transitions, thereby strengthening European sovereignty. STEP proposed to increase the budget allocated to several Union programmes, including EUR 1.5 billion to the European Defence Fund.

To mitigate possible risks for security and public order linked to non-EU investments in European companies in Member States or in the EU as a whole, the **screening of Foreign Direct Investments**

(FDI)[59] is an essential tool. The Foreign Direct Investment Screening Regulation has created a cooperation mechanism for Member States and the Commission to exchange information, raise security-related concerns and identify solutions related to specific FDIs with a view to ensuring the protection of security and public order. Since October 2020, the Commission and Member States have reviewed more than 1,000 FDI transactions.

The Commission is in the process of evaluating the current framework and will propose its revision before the end of 2023. Member States who have not yet implemented national FDI screening mechanisms should do so without further delay.

The Commission is also setting up the **Observatory of Critical Technologies** to identify and monitor criticalities of ASD value chains, following the Action Plan on synergies between civil, defence and space industries. The observatory will facilitate the development of technology roadmaps to boost innovation on critical technologies for the defence, space and related civil sectors and stimulate cross-border cooperation using all relevant EU instruments in a synergetic way. The technology roadmaps may lead to the launch of new flagship projects.

So far, the 'Joint Task Force' composed of the European Commission, the European Space Agency and the European Defence Agency has identified a list of 41 critical space and defence technology dependencies representing space and defence dual use components. The Commission, the European Defence Agency (EDA) and ESA will coordinate and synchronise activities in critical space technologies, building on a re-energised Joint Task Force (JTF). The re-energised JTF will in fact boost the work on reducing space technologies dependencies through a greater political focus and top-down approach, greater focus on closing technological gaps by also relying on joint JTF technological roadmaps, greater JTF coordination effort and coordinated interaction with Member States and industry. The identification of new space technologies dependencies has started in 2023 and will lead to a new JTF list in early 2024. To conclude, efforts on mitigating dependencies should prioritise the ones related to unexpected crises fist (e.g. geopolitical, economics, etc.) and facilitate a preferential selection of EU based technologies into EU space missions.

Addressing supply chain bottlenecks

Secure and reliable access to raw, processed and advanced materials and electrical and electronics equipment (EEE) components is critical to ensure security of supply and to support the green and digital transformation of the ASD ecosystem. In this context, and given the specific requirements and needs of the aerospace and defence industries – notably in terms of volume, performance and robustness – it is essential to strengthen the insight at EU level with the support of all stakeholders. This will help to ensure that the interests of this strategic ecosystem are fully taken into account into wider EU activities which impact on the resilience of the ecosystem. It will also support efforts to ensure robust, unrestricted and undistorted access to raw, advanced and processed materials and EEE components for the ASD ecosystem. In this context, access to semiconductors fit for space and defence should be a key priority. The ecosystem actors do not have sufficient leverage on semiconductor foundries to establish and maintain a space/defence compatible process line without continuous institutional support. In this regard, the implementation of the **Chips Act**[60] represents a significant opportunity to promote the requirements of space and defence and advance concrete measures, such as advanced semiconductor pilot lines dedicated to space and defence.

In the area of **raw materials** in particular, the Commission has identified many dependencies relevant to the aerospace and defence sector[61]. As these dependencies are horizontal and usually shared with other industrial sectors, investments for the most pressing ones, such as rare earths and permanent magnets, are addressed by the European Raw Materials Alliance. However, as certain ASD specific criticalities, like the rare gases Xenon or Neon, are not on the radar of the horizontal Critical Raw

[59] OJ L79, 21.3.2019, p.1
[60] COM(2022) 45 final, 8.2.2022
[61] CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU_2020.pdf (europa.eu)

Materials policy, sector-specific material criticalities need to be addressed looking at both current and emerging needs. To this end, information is needed on annual demand and qualities of the most critical and strategic raw materials. Identified needs could then be addressed via the European Raw Materials Alliance, EU Raw Materials Diplomacy and the forthcoming European Critical Raw Materials Act, which will, among others, help identify strategic projects along the value chain. In addition, the EU should invest in developing mid- and long-term solutions promoting circularity and sustainability, such as identifying substitute materials or alternative sources, improving reusability – where possible by integrating this in the design phase – and coordinating an EU stock piling approach. To this end, deepening cooperation and ensuring synergies between the ASD ecosystem and the EU Critical Raw Materials Policy is strategic.

In the area of **space,** the Commission launched a study on the resilience of space value chains, which will among others quantify the demand for processed and advanced materials. Identified needs could then inform the development of mid- and long-term solutions, such as identifying alternative materials or alternative sources, improving reusability and coordinating an EU stock piling approach. The EU space programme can support efforts to strengthen EU resilience and the dual transition objectives as regards access to raw materials.

Moreover, building on the Strategic Compass, the Commission and the High Representative of the Union for Foreign Affairs & Security Policy presented a Joint Communication on an **EU Space Strategy for Security and Defence**[62]. One of the key objectives is to enhance the resilience and protection of space systems and services in the EU, as they are critical assets upon which several essential services are relying. In particular, a proposal for an EU Space law is considered to provide a common framework for security, safety, and sustainability in Space. The Strategy also aims at reducing strategic dependencies and ensuring security of supply for ongoing and future space projects in the EU and for EU space programmes by ensuring access to critical technologies and critical raw materials. To better protect space assets, it also entails actions to enhance the EU's ability to respond to space threats. The potential future EU Earth observation governmental service will also contribute to strengthening the resilience of the EU and its Member States.

The European Standardisation Strategy[63] should also address the needs of the defence and space industry through its dedicated High-Level Forum on Standardisation in its subgroup on resilience. The development of standards should take account of the specific requirements of the ASD ecosystem actors, to the extent possible, and raise awareness of the existence of aerospace and defence industrial standards.

Protection of transport routes and critical infrastructure

The EU leaders' Versailles Declaration[64] states that '*we also need to best prepare for fast-emerging challenges by protecting ourselves against ever-growing hybrid warfare, strengthening our cyber-resilience, protecting our infrastructure – particularly our critical infrastructure – and fighting disinformation*'. The impact of Russia's war of aggression against Ukraine on the security of critical infrastructures on the territory of the EU has been until now limited when it comes both to cyber-attacks and direct physical disruption. However, there is an obvious need to remain vigilant, concerning possible impact on EU aerospace and defence industry.

Progress was made on the updated legislative framework for resilience, including against hybrid threats. The Critical Entities Resilience (CER) Directive[65] covers natural and man-made non-cyber threats, including terrorism sabotage, or infiltration, and will complement the Directive on measures

[62] https://ec.europa.eu/transparency/documents-register/api/files/JOIN(2023)9_0/090166e5f914c8bc?rendition=false
[63] COM(2022)31, 2.2.2022
[64] The Versailles declaration, 10 and 11 March 2022 - Consilium (europa.eu)
[65] COM(2020) 829 final, 16.12.2020

for high common level of cybersecurity across the EU (NIS-2 Directive)[66], which places cybersecurity requirements on operators in a number of critical sectors. Both directives combined will provide a coherent and comprehensive framework for resilience, covering several dimensions, including resilience of EU defence industry. This will also contribute to strengthening the EU's resilience against **hybrid threats**. To support their implementation and accelerate progress in this area, the Council adopted a Recommendation to strengthen the resilience of EU critical infrastructure in three priority areas: preparedness, response and international cooperation. The Recommendation suggests that priority should be given to the key sectors of energy, digital infrastructure, transport and space.

To respond to the growing number of cyberattacks targeting military and civilian critical infrastructure, the Commission will continue the development and implementation of the EU's policy on cyber defence, which was adopted as part of the Defence and Security Package of 10 November 2022 towards reducing strategic dependencies and to ensure a full-spectrum cyber defence capability in the EU, including a proposal for a technology roadmap on cybersecurity.

In the area of **transport security** (civil aviation, maritime transport and land transport) the Commission, together with the relevant agencies, maintains a continuous dialogue on emerging security threats, including those of a hybrid nature, with Member States and Contracting Parties to the Agreement on the European Economic Area, industry and other stakeholders. Ensuring that the transport system is truly resilient to future crises is a key objective of the EU's transport policy and resilience of EU defence industry.

Questions to stakeholders:

1. What are the main challenges to ensure the resilience of the aerospace and defence industry in your specific sector and country? Do you see areas not addressed above?
2. Could you provide any data or analysis to illustrate these challenges?
3. What measures or solutions to these challenges would you propose beyond those outlined?
4. What commitments are you, as stakeholder, ready to make to achieve the necessary resilience?
5. What should be the actions, roles and responsibilities to reach the objectives for the Commission, Member States / Regions, Industry and other stakeholders?
6. How do you evaluate the current conditions for stakeholders to provide the necessary information on critical dependencies within EU supply chains, ranging from raw materials to electronic components and technologies?
7. Are the conditions set for industry to meet the technological challenges of designing, developing testing and producing hydrogen-powered and electric aircraft, including challenges associated with their subsequent roll-out? Is the market ready for the uptake of these technologies?
8. European end-users are still largely relying on non-EU technologies for chips. Thanks to EU investments, valuable European alternatives with similar performance exist (e.g. European programmable semiconductors known as FPGAs; application-specific microchips known as ASICs). On that basis, do you foresee an increased use of non-dependent and unrestricted EU technology, for example in space missions addressing institutional needs?

[66] OJ L333, 27.12.2022, p.80

Table 1. Issues, actions areas and existing measures for a more resilient and competitive EU aerospace and defence ecosystem[67]

Issues	Possible actions and division of roles	Possible output scenario for 2030
Strengthening the technological excellence and reducing strategic dependencies on raw materials, and access to critical space and defence technologies	**The Commission could focus on the following priorities**: • Implement the EU programmes (H2020, Horizon Europe, EU Space Programme, European Defence Fund and precursor programmes, InvestEU); • Use funding facilities (CASSINI, EUDIS), the standardisation policy, industrial alliances (Clean Aviation Partnership, Alliance for Zero-Emission Aviation, European Raw Materials Alliance) and instruments such as the Important Projects of Common European Interest (IPCEIs) as a strong leverage to access, develop or bring to market current and emerging technologies; • Implement and coordinate actions proposed in the EU Space Strategy for Security and Defence (SSSD) Joint Communication and in the Critical Raw Material Act (CRMA); • Diversify critical value chains through the development and deepening of international partnerships with like-minded countries; • Present possible flagships based on the analysis from the Observatory of Critical Technologies; • Develop a roadmap for a stakeholder dialogue on access to finance with the financial sector actors; • Screen Foreign Direct Investments (FDI) to protect EU strategic assets; • Propose and implement a European Sovereignty Fund; as well as implement the proposed Strategic Technologies for Europe Platform (STEP) to support European leadership on critical technologies **Member States could focus on the following priorities:** • Support start-ups and SME participation in EU initiatives; • Enhance synergies between space and defence R&D activities on critical technologies; • Contribute to the Observatory of Critical Technologies and the SSSD. **Industry could focus on the following priorities:** • Make the most of existing R&D funding opportunities,	More secure and sustainable access to critical raw materials. Reduced strategic dependencies and vulnerabilities of the value and supply chains associated with technologies critical for the ASD ecosystem. Enhanced resilience of space infrastructure.

[67] This section identifies possible actions and scenarios which have been identified by the Commission services and some stakeholders that will participate in the co-creation of the pathway. They do not constitute the official position of the Commission, nor does it prejudge any such position.

	including InvestEU, to reduce technological dependencies and foster innovation; • Build sectoral industrial alliances and participate in the industrial Alliances (Clean Aviation Partnership, Alliance for Zero-Emission Aviation, European Raw Materials Alliance…); • Address the weaknesses of parts of the civil aeronautics value chain and the risk of non-EU take-overs; • Contribute where relevant to the Observatory of critical technologies and to the Critical Raw Materials Act.	
Lack of skills among ASD labour force	**The Commission could focus on the following priorities:** • Provide guidance to businesses on how to apply for skills funding; • Support the dissemination of best practices. • Support the industry in raising the attractiveness of the ASD ecosystem **Member States could focus on the following priorities**: • Facilitate mutual recognition of certification and accreditation for training and education; • Guide industry to skills funding opportunities. **Industry could focus on the following priorities:** • Communicate with young people about the advantages of a career in a high-technology industry within ASD; • Implement the Pact for Skills.	A skilled workforce corresponding to the needs of the industry, for development as well as for production

6. TOWARDS A GREENER ECOSYSTEM

The European Green Deal paves the way for a modern, technologically advanced, environmentally and socially sustainable and competitive economy, which in turn would contribute to improving quality of life and ensuring an orderly transition to climate neutrality. To achieve the long-term commitment on climate neutrality and circular economy, the industry needs to be fully mobilised. The transition to a clean and circular economy is an opportunity to expand sustainable jobs and job-intensive economic activity. There is a significant potential in global markets for low-emissions technologies, sustainable products and services.

The ASD ecosystem can be more sustainable, for example, by reducing its greenhouse gas emissions, while helping greening other sectors such as air transport services and logistics. The study "EU Space for Green Transformation"[68] presents detailed examples of how various industries, including energy, road transport, aviation, agriculture, forestry and mining, are leveraging the power of EU Space to drive their sustainability journeys and how space data and services are contributing to EU's climate change policies and to our collective efforts towards climate neutrality by 2050. Moreover, the ASD

[68] https://www.euspa.europa.eu/sites/default/files/eu_space_for_green_transformation_a_new_tool_for_companies_to_monitor_their_sustainability_targets_2023_issue_1.pdf

ecosystem itself is increasingly expected to move towards sustainability, not only from the public opinion, Non-Governmental Organisations (NGOs) and legislators, but also from financial markets and investors.

The ecosystem needs to create and develop energy efficient solutions and green technologies in aerospace and defence.

In the area of defence, three projects were launched at the end of 2022 under EDF for **defence-oriented solutions contributing to climate, energy management and efficiency,** with a budget of EUR 83 million dedicated to support R&D of defence technologies and products addressing these issues. Another defence project of an amount of EUR 19 million will be launched by the end of 2023 targeting sustainability and a green transition of defence technologies. Together with the High Representative, the Commission also presented a **Joint Communication on A new outlook on the climate and security nexus: Addressing the impact of climate change and environmental degradation on peace, security and defence**[69].

Greening upstream, midstream and downstream industry

The green transition affects all elements of the ecosystem value chains.

In greening the ASD ecosystem, the industry has a dual role: one associated with corporate sustainability and another with the sustainability of its products.

Governments, societies and stakeholders expect corporations to engage in business practices that are good for people and the environment, not just the bottom line. This is because sustainable economic growth is no longer just a business imperative — it's critical to our future.

Environmental risks, such as climate action failure and nature degradation, dominate the World Economic Forum's lists of the top global risks, in terms of likelihood and impact, according to the Global Risks Report[70]. Societal risks, like water crises, were also named among the top threats. In terms of impact, climate action failure ranked first.

Against this backdrop, businesses must be aware of the importance of having a corporate sustainability strategy to address climate volatility, create a better world for our communities and ensure long-term economic growth. The objective of a company striving for corporate sustainability is not only to benefit those operating in the company itself, but also those utilizing the potential positive impacts the services and products provided by the company could yield.

The ultimate goal of corporate sustainability is to ensure that all pillars – environmental, economic, and social – are complementing one another for an all-around smooth, effective, and successful business. A corporate sustainability approach to outer space activities can for instance bring benefits in terms of risk management, cost savings, access to capital, customer relationships, human resource management, and innovation capacity.

The commercial space industry has grown rapidly in recent years, with a surge in the number of launches and satellites in orbit. This growth creates new business opportunities and ways to monitor the environment and human activities. However, it also leads to sustainability challenges both on Earth and in space, such as increases in greenhouse gas emissions from launches and orbital debris.

The Commission put forward a proposal for a Regulation on a **Net Zero Industry Act**[71], to establish a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem. It will aim at simplifying the regulatory framework, and improving the investment environment for the Union's manufacturing capacity of technologies that are key to meet the Union's

[69] https://www.eeas.europa.eu/sites/default/files/documents/2023/JOIN_2023_19_1_EN_ACT_part1_v7.pdf
[70] https://www.weforum.org/reports/global-risks-report-2023 and previous years
[71] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0161

climate neutrality goals and ensure that our decarbonised energy system is resilient whilst contributing to reducing pollution, to the benefit of public health and planetary environmental wellbeing.

Greener and circular products

A green (or sustainable) product is designed to minimize its environmental impacts during its whole life cycle and even after it. Green products are usually identified by having two basic goals: reducing the use of material input, in particular critical raw materials, through recycling; and avoiding waste. They are manufactured using toxic-free parts and environmentally friendly procedures.

There is a considerable room for building more energy efficient and low-emission defence products, e.g., developing and producing more efficient engines, engines able to run on alternative fuels (such as biofuels), or completely new propulsion technologies like electrically powered unmanned vehicles; developing new lightweight materials that would decrease the weight of the platforms and thereby necessitate less energy for manoeuvre; or developing and designing new platforms (e.g. aircraft, ships, land vehicles) with better aero- or hydrodynamic qualities to decrease energy consumption and reduce CO_2 emissions. It should, however, be noted that it is the customers (e.g. the Armed Forces) that define the requirements, including its environmental aspects.

In the aeronautical industry, incremental improvements to aircraft technologies have brought about substantial improvements in their environmental performance. With recent progress in disruptive propulsion technologies using batteries or hydrogen as energy storage, climate-neutral flights now appear to come within reach for regional and short haul traffic. For mainstream intercontinental and long-distance mobility, fully SAF compliant and ultra-efficient propulsion technology is also pursued as a solution towards the greening of aviation, within the terms envisaged by the European Green Deal.

In the space sector, spanning from manufacturing on Earth to operations in orbit, there are programmes in place to reduce the use of harmful substances in the production of launchers and spacecraft, and investments in the development of safe constellations and environmental-friendly propulsion systems. The next step towards sustainability is not only about the environmental footprint of the manufacturing, hardware and operations, but about the profile of the products and services that these space assets deliver on Earth. It will be double leveraging when green space technologies translate into green applications on Earth.

Enabling role in greening other ecosystems

The case of space is particularly relevant also in terms of providing greening solutions to other ecosystems. The space sector plays a double role. On one hand, space data, applications and services enable and help other sectors to achieve the ambitious green, digital and resilience objectives[72]; space is a major contributor to the green transformation, e.g. through monitoring of greenhouse gases and services provided by the EU Space programme that enable greener transport and support greener agricultural production. On the other hand, the EU Space programme itself and the EU space sector must be compliant with EU Green Deal objectives and hence improve their practices throughout the value chain.

Similarly, innovation in civil aeronautics related to delivering a new generation of zero-emission aircraft can be an enabling factor helping other industries on their path towards carbon neutrality. *Environmental impacts of the ASD ecosystem*

From an environmental impact perspective, the space supply chain can be split in two domains, differentiating between impacts on the Earth's environment from the impacts on the space environment.

[72] 2022 EO & GNSS Market Report, EUSPA

The impact of space activities on the Earth's environment concerns notably the production and operation of ground infrastructure, space systems and launchers, in particular the space system components surviving the re-entry in the atmosphere carrying fuel and/or radioactive material, and the biological hazard due to sample return from other celestial bodies exploration missions.

The impacts from space activities on the environment, including on climate, derive from the creation of space debris due to placement in orbit of space systems (e.g. launcher upper stages, satellites release brackets, propellants and gas emissions in space) and/or not adequate disposal of space objects at the end of their operational life (e.g. graveyard orbital parking, passivation of space objects, controlled re-entry), the fragmentation and proliferation of debris due to in-orbit collisions between active satellites and space debris objects (including inactive satellites or components thereof) and among space debris objects (including inactive satellites or components thereof), with a chain reaction potential, and the contamination of other celestial bodies due to robotic and human exploration activities.

Although, environmental Life Cycle Assessment (LCA) is not new in the space sector[73], very few quality-assured and inter-operable inventory datasets are currently available. Several potentially important environmental aspects are today not covered by the impact assessment models or disregarded due to a lack of information/quantification of the emissions. In addition, there is no common agreement on sector-specific rules concerning life cycle-based assessments shared along the value chain, nor reference systems for space systems, projects or programmes. It is of utmost importance that the space sector has a better harmonisation of LCA practices, access to robust inventory data (allowing comparability) and advanced impact assessment models, following the Commission recommendation on environmental footprint methods[74].

The increased attention to the environmental impact of air travel, from the public as well as regulators, puts pressure and provides incentives to mitigate the environmental effects of aviation. While the focus has very much been on CO_2 emissions, the effects of non-CO_2 emissions and contrails on radiative forcing (two thirds of the global climate impact of the sector) are getting increasing attention. As a result, the co-legislators agreed during the current revision of the EU ETS aviation rules to introduce the world's first monitoring and reporting system for these non-CO_2 effects from climate scientists. The environmental performance of aircrafts has improved, and commitment have been made by aviation actors in Europe and beyond to bring down CO_2 emissions[75]. These are important steps on the way to develop and bring to market aircraft that are climate neutral and at the same time safe, reliable, comfortable, and competitive.

War and aggression causes can cause climate change and environmental catastrophes. The United Nation 2030 Agenda for Sustainable development states that "There can be no sustainable development without peace and no peace without sustainable development". The major positive effect of the defence industry on the climate and the environment is that it contributes to peace. However, this is not enough, but the defence sector should also mitigate the negative environmental effects as well.

The potential for mitigation of environmental impacts of the defence industrial sector lies in the areas of energy use, greening transport, water and waste management, chemicals management and circular economy. A distinction must be made between actions affecting the production process, and actions affecting the produced systems. It is the customers that define the requirements, including its environmental aspects, and the process towards more environment friendly products and services must be taken in cooperation with the armed forces. It is therefore important to continue the work on Green Procurement. Any increase in sustainability of defence material shall not be detrimental to specific operational requirements.

[73] For example, ISO 14040/14044 and ESA LCA Handbook

[74] Recommendation on the use of Environmental Footprint methods (europa.eu)

[75] Such as the aspirational goal of CO_2 neutrality by 2050 adopted in 2022 by the International Civil Aviation Organization (ICAO).

The defence industry consumes energy for its production processes, transport, storage and other operations. Some of the operations are energy intensive. To limit its energy use and CO2 footprint, the industry will need to create, and develop and utilise energy efficient solutions and green technologies. On the other hand, energy security and access to efficient, secure and sustainable and often mobile energy sources for use of defence capabilities are important considerations driving research and development in this area. Environmental considerations and operational requirements, e.g. regarding Security of Supply, can often go hand in hand. By providing greener transport options both for own production processes and designing solutions for the military the defence industry can contribute to limiting the CO2 footprint of its operations and its products.

On water, the defence industry needs to contribute both in the context of industrial processes, where the focus is on limiting use and treatment but also in terms of providing solutions for others – in this case primarily for the armed forces. On the latter, the defence industry can upon the government's request plays a role in developing much needed solutions for the armed forces with regards to technologies for treatment, storage, packaging and preservation of water in the military context.

The defence industry can also contribute to limiting environmental impacts in areas of waste management, safe use of chemicals and circularity. The defence sector has an excellent track record when it comes to different aspects of circularity. It can play a role by developing innovative technologies on design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling.

Long innovation and product development life cycle

One specific aspect is the long life cycles to produce equipment, which is usually stretched across several decades. This means that the currently fossil-fuel-powered platforms and related equipment in all areas of the ecosystem (e.g., main battle tanks) will still be in use in 2050 and beyond. This poses a challenge for greening the ecosystem in the short term. Since long-life cycles are normally considered to be a positive attribute from a Circular Economy perspective, it would make sense to focus greening efforts on product categories with shorter timeframes in the first place, while working towards innovation for the long lifecycle platforms in parallel.

With the operational life of large military products typically spanning several decades, a new solution will have to be found to facilitate the transition, e.g., using retrofit solutions – installing new/more energy efficient technologies on current platforms. Moreover, retrofitting and using new energy efficient solutions will require the development of new standards to facilitate the changes and to ensure interoperability between Member States' armies, for instance common standards for a modular architecture or for biofuels.

Civil aeronautics is characterised by a decoupling of product and innovation cycles. While the development of new passenger aircraft types is relatively rare and can take up to ten years from concept to certification, technological innovations applied through incrementally improvements occur much more frequently. Thus, the majority of aircraft in production today, such as the A320 family of jets or the Boeing 737 variants, are based on decades-old designs but have been continuously modernised since their entry into service. Contributing to these long product cycles are the high development costs and the large investments required by aircraft operators to acquire these new aircraft.

The unique activities and low production volumes of the space sector are also a challenge for greening the sector. The European volume of production (in the order of tens of satellites, about 10 launchers per year) and operations (about 10 launches per year) is also very limited. The life cycle for a satellite can also extend for several decades, depending on the type of satellite. For example, the life expectancy in orbit for a Galileo first generation satellite is between 12 and 15 years. However, with the advent of NewSpace, multiplication of players, miniaturisation of space technologies and development of new solutions and services in both the upstream and downstream segments, the volume of production and operations are expected to grow, with increased impact on the environment.

Operational capability and performance in extreme condition take precedence

In particular in the **defence sector**, the increase in sustainability of defence material shall not be detrimental to specific operational requirements. The first and foremost among them is the ability to achieve a desired effect and to guarantee the survivability in combat. This may have a significant impact on the pace and the scope of the transition. As a result, more opportunities for decreasing emissions may be available in areas not linked to mission-critical capabilities, or in areas with emissions linked to mission-critical capabilities but with no impact on achieving the mission (e.g. introducing alternative fuels, and propulsion technologies). With the governments being the single customer that defines the requirements for defence capabilities, environmental aspects will have to be embedded in defence procurement, starting with areas not linked to mission-critical capabilities.

In the case of **space** technologies, which need to operate in extreme conditions, any requirements for greening the space sector and products should weigh sustainability considerations against resilience and expected performance. This is particularly the case in the upper part of the value chain, for example spacecraft and launchers.

In the area of **civil aeronautics,** aviation safety and environmental standards are a determining factor in the design and manufacture of aircraft and their components. Certification processes of products, manufacturers and the workforce are strongly regulated and by their nature often need time and resource-consuming interventions. Regulatory authorities and internationally agreed standards and practices need to be adapted to allow new technologies to reach the market and generate impact in a shortened timeframe.

As set out in the Commission's Sustainable and Smart Mobility Strategy[76], the transition to carbon neutrality for aeronautics will proceed along multiple paths, including the introduction of sustainable aviation fuels, efficiency gains, more flexible routing and the introduction of new propulsion technologies (notably electric, hydrogen or emerging new sources of energy). These measures require the mobilisation of large investments and a high degree of cross-sectoral coordination. Strategic engagement of key actors in the ecosystem can increase awareness and the knowledge base, while also facilitating the implementation of green and circular practices. Improving energy efficiency, increasing the use of renewable energy where possible, and reducing emissions in this sector, should become an integral part of our collective efforts towards climate neutrality by 2050.

Circular economy

Implementing a circular economy concept in the ASD ecosystem will require a holistic review of materials, design procedures and life-long support concepts for its products. For example, in civil aeronautics, recycling rates for aircraft of over 80% of an aircraft weight are already possible, and this can be taken to more than 90%. By contrast, recycling of materials in defence is limited by the high-quality requirements for material inputs.

One possible option is to apply service-based business models that would result in adopting new industrial processes, changes in the cash flows, and balance sheet extensions. Moreover, a solution would be needed for manufactures to collect their product at the end of the service level agreement.

In summary, this effort should ensure a sustainable design to recycling of defence products. This process will be an evolution over the current product's green passport, analysing not only the sustainability and safe manipulation of materials, but also the dismounting procedures and the recycling. That implies changing the current design concepts and introducing new ones addressed to optimize future recycling cost. Moreover, given the short series production in the ASD ecosystem, eco-design extra costs will have an impact on the final costs, affecting the competitiveness of the aerospace and defence industries.

Questions to stakeholders:

[76] COM(2020) 789 final, 9.12.2020

9. Is the ASD ecosystem on the right track for the green transition?
10. What are the main challenges of the green transition of the ASD ecosystem in your specific sector and country? Could you provide any data or analysis to illustrate these challenges? What ways forward/solutions would you propose?
11. How can the sector-specific ASD challenges be addressed? Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
12. What technologies should be prioritised to achieve a more sustainable ASD ecosystem? And what technologies could be commonly used by the three sectors contributing to the ASD ecosystem?
13. Which barriers exist to the adoption of new green technologies?
14. What are the specific challenges of the green transition for ASD SMEs? Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
15. Can you identify already existing projects or good practices to drive the green transition of the ASD sector?
16. Have you set specific targets and milestones for the green transition in your area of activity? Based on your data, how far are you from achieving your goals? What are the challenges you foresee?
17. How can synergies be ensured between actions and with the work described as part of digital transformation and resilience?

Table 2. Issues, actions and existing measures for a greener EU aerospace and defence ecosystem.

Issues	Possible actions and division of roles	Possible output scenario for 2030
Greening the ASD ecosystem	**The Commission could focus on the following priorities**: • Coordinate the deployment of low to zero-carbon energy carriers through the Clean Hydrogen Alliance, Renewable and Low-Carbon Fuels Value Chain Industrial Alliance, Industrial Alliance on Zero-Emission Aviation, Industrial Alliance on Sustainable Military Aviation Fuel, Co-programmed Partnership on Zero-Emission Waterborne Transport; • Implement the Green Deal Industrial Plan, the EU Hydrogen Strategy, Destination Earth; • Implement the proposed Net Zero Industry Act, to establish a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem.	Intermediate greenhouse gases reduction from the ASD ecosystem, on a path to climate neutrality by 2050. EU Space systems allow monitoring of progress on EU Green Deal objectives and simulation of impact of potential measures.

	• Under the Critical Raw Material Act, promote green approaches to critical raw materials through recyclability, recycling and substitution; • Foster the development of Earth observation capacities in support of sustainable mining to avoid environmental degradation; • Propose defence-oriented solutions contributing to climate, energy management and efficiency in the EDF annual work programme; • Support the deployment and take-up of sustainable fuels and energy in aviation (drop-in fuels, electricity and hydrogen). **Member States could focus on the following priorities:** • Prepare the market for the arrival of hydrogen and electric aircraft and support their early adopters; • Ensure that national hydrogen strategies cover aviation needs • Agree on a common EU standard for Sustainable Military Fuels development; **Industry could focus on the following priorities:** • Improve energy efficiency; • Increase the use of renewable energy where possible; • Reduce emissions or use carbon-capturing technologies; • Actively build the industrial alliances. • Further invest in developing and producing greener products.	
Product life cycle and waste management	**The Commission could focus on the following priorities:** • Propose a common Life Cycle Assessment methodology based on the PEF method; • Support research on critical raw materials recycling and uptake of relevant solutions; • Develop improved Green Procurement. **Member States could focus on the following priorities:** • Define a solution for the retrofitting of the existing Navy and Army fleets; • Explore service-based business models for military acquisitions. **Industry could focus on the following priorities**: • Introduce reusable launcher systems, and limit normal-operation space debris; • Support in-orbit services prolonging the life of satellites.	Improved circularity of the ASD sectors. Better comparability of products environmental performance and fairer competition among manufacturers through a standardised approach of the environmental performance of products. Increased recycling rate for aircrafts.

7. TOWARDS A DIGITAL ECOSYSTEM

In the State of the European Union address in September 2020, President von der Leyen announced that Europe should secure digital sovereignty with a common vision of the EU in 2030, based on clear goals and principles. The President put special emphasis on the next generation of European cloud infrastructure and services, leadership in ethical artificial intelligence, a secure digital identity for all, and vastly improved data, supercomputer and connectivity infrastructures. Despite the undisputed progress and advancement in the field of digitalisation, there are several common challenges laying ahead for the ASD ecosystem. While digitalisation is driven by companies' efforts to achieve a competitive advantage, much of its benefits can only be realised through industry-wide cooperation. In addition, advancing in the field will require investment both from the industry, Member States and the EU.

The Digital Decade initiative strives to '*ensure that the EU can shape its digital transformation in line with its values and strategic interests*'[77]. In line with this strategy, the Digital Compass Communication[78] presented a vision as well as avenues for Europe's digital transformation by 2030. Furthermore, the '2030 Policy Programme, Path to the Digital Decade'[79] is putting in motion a cooperation mechanism to reach common goals.

The industry should be the pioneer of the digitalisation process, which will make European business more competitive, resilient and green. The so-called Digital targets will help the industry to coordinate priorities with Member States and EU institutions to achieve common goals. By 2030, at least 75% of EU enterprises should have taken up Cloud computing services, Big Data or AI. More than 90% of EU SMEs should reach at least a basic level of digital intensity. Moreover, the EU aims at growing the pipeline of its innovative scale ups and improving their access to finance, leading to at least doubling the number of European unicorns.

The ASD ecosystem should play a role in this strategy, both in the uptake and in R&D of those technologies, leading to a more resilient and autonomous Europe.

Impact of the digitalisation on our European economy, society, citizens and environment

Strengthening the ASD ecosystem will require the acceleration of its digital transformation. The ecosystem is a major contributor to digital solutions and technologies, for example through the satellite communications and services provided by the EU Space programme and through the EDF priorities in digital transformation in defence. Key technologies to be developed include AI, robotics, advanced manufacturing, quantum computing, platforms and cloud-based solutions. This transformation will support our resilience and the adaptability of the whole value chain.

Digitalisation will not only allow the industry to meet the market demand for new products and services (e.g., automation and connectivity), it will also accelerate the industrial transition. Concretely, the access and the use of trustful and secure space data coming from our EU's flagships Galileo and Copernicus is optimising the industrial transition and helping to take policy decisions based on scientific data. Upstream digitalisation is indeed a prerequisite for a more competitive European ASD industry being a key enabler for achievement of the goals set in the green and resilience domains.

Digitalisation of the ASD ecosystem as key enabler for our economy, society, citizens and environment

[77] Guidance for finalisation of national Digital Decade strategic roadmaps.
[78] COM/2021/574 final
[79] OJ L323, 19.12.2022, p.4

On **space**, the EU Space programme with its two components Galileo and Copernicus provides valuable data and services for a wide array of daily applications in support of transport, agriculture, crisis response or the fight against climate change, among many others. The EU Space programme can fuel the digital transformation in different areas such as the protection of critical infrastructures, autonomous vehicles, smart farming or cities. The EU space policy needs to constantly evolve and adapt to new challenges to continue enjoying the benefits space brings to our citizens. The IRIS^2 programme and the Space Traffic Management approach will help safeguard the efficiency and security of the EU's current assets, while developing cutting-edge space technology to strengthen the EU as a space power.

The digitalisation of **defence** is a key enabler of developing a new generation of defence capabilities. It is also a horizontal enabler for the transition pathways, covering the upstream and downstream aspects of the supply chain, as well as the infrastructure. It enhances interoperability and collaborative combat for a large range of capabilities (cf. secure /military operational clouds environments and solutions). It enhances intelligence, reconnaissance and surveillance capabilities, thus allowing forces to address threats faster and more efficiently. More generally, it is expected that all new defence capabilities will be directly or indirectly impacted by the digital transformation. Defence is traditionally at the forefront of enhanced usage of these technologies, as well as the source of several technological breakthroughs in this domain. The EDF addresses the objective of making 'Europe fit for the digital age' by accelerating the overall digital transformation of the defence sector, supporting inter alia information superiority and cyber. Projects directly relevant to the digital transformation will be starting in 2023, new applications submitted will be evaluated and other EDF funding topics to support projects related to space and the digital transformation and leading to defence-oriented solutions will be the subject of new calls for proposals. Digital solutions are also funded under the EDF to provide a digital system for procedures supporting the military mobility.

In the area of **civil aeronautics,** digitalisation of aircraft operations has vastly improved the safety and efficiency of aircraft operations over the years and still holds enormous potential. The EU's Single European Sky Air Traffic Management Research Programme (SESAR 3) is dedicating substantial resources to apply the benefits of digitalisation to trajectory planning and air traffic coordination, reduction of environmental impact, aircraft safety and automation, passenger comfort and aviation integration in a seamless transport system. Digitalisation also drives the development of the emerging sector of unmanned aircraft, including urban air mobility.

Digitalisation is supporting new processes and new business models

Digital transformation means rethinking and redesigning business processes using technology to improve resource efficiency and performance. Where possible, mapping, streamlining, optimising and automating business processes will create synergies and ultimately improve efficiency and predictability of business operations. New user needs, faster responsive mission, higher production volumes, on-demand flexible manufacturing and cost reduction call for major changes (e.g. 3D printing, virtual reality) in the way Manufacturing, Assembly, Integration and Testing (MAIT) is performed. Digitalisation and automation will significantly affect the MAIT processes by addressing connected supply chain and quality issues, workforce efficiency, production flow optimisation and end-to-end operations steering. Advanced design and manufacturing methods, as well as "Digital Twins" have also the potential to enhance and accelerate considerably these processes. Modular approaches including the introduction of 'plug and play' modules and standard interfaces will significantly enhance the degree of automation, resulting in a more sustainable space ecosystem with a strong potential for cost reduction. The Digital Product Passport, as defined in the Eco-design for Sustainable Products regulation, will enable improved eco-design as well as sustainable business models such as product as a service (PaaS).

Moreover, the introduction of Model-Based System Engineering (MBSE) allows to develop, analyse and test complex systems. The implementation and use of existing and new Industry 4.0 tools improve operations in factories and logistics facilities, from the design of the manufacturing plant to maintenance and repair.

Digitalisation in the ASD ecosystem especially can lead to better process operations and logistics, thus advancing progress toward sustainability goals and better resilience. AI allows for predictive maintenance and digital technologies reduce the number of disruptions. The Digital Europe Programme supports the transition by investing in AI, cyber security, and supercomputing[80], while the European Defence Fund has set priorities on digital transformation in defence.

On the **civil aeronautics** front, digitalisation will enable end-to-end product lifecycle management and predictive maintenance and will accelerate the development and certification of new aircraft models. It will reduce operational costs and improve the quality and maintainability of aircraft. Such advances will be made possible by advanced sensor technology, virtual reality, robotics, big data and artificial intelligence.

For **defence**, developing a common digital architecture for each EU defence product type (e.g. main battle tanks) allows for a common reference according to which it will be possible to develop new and pan-EU solutions. In addition, under EDF, all thematic categories are characterised by the digitalisation of defence, and some of them focus on the objectives of digital transformation (covering clouds computing, data and artificial intelligence core technologies), information superiority, active and passive sensors, and simulation and training.

On the **space** side, although industrial processes and production tools are cross-cutting for many industry domains, it is important that they are addressed specifically for space technologies due to the specificities of the space in-orbit environment (e.g. radiation), the extremely high-quality standards required and the need for full traceability in different processes. These industrial processes changes are fully justified with the arrival of large constellations of smaller satellites where European players are already fully engaged. In addition, the space sector is supporting the development of collaborative digital platforms and work environments where Smart Manufacturing techniques must be considered. The collaborative platforms will allow the interconnection of the design, planning, production, and manufacturing phases to become the factory of the future. Implementation of automation means and integrated robotics will help reducing human errors even in mass production. The Smart Factory shall combine the following basic technologies: Internet of Things, robotics, AI, data analytics, virtual and augmented reality.

Need to develop collaborative tools

The European Commission has added an aeronautics and security work strand to the European Alliance for Industrial Data, Edge and Cloud, and is also exploring this possibility for the Industrial Alliance on Processors and Semiconductor Technologies. This raises awareness of the criticality of certain technologies, with the Observatory being instrumental in this context, and requires boosting EU research, technology development and innovation in technologies relevant for the digital domain. This includes semiconductors, an area in which the Commission adopted a European Chips Act, aiming to create a state-of-the-art European chip ecosystem to improve EU capabilities in this area, also addressing defence needs.

Moreover, the Commission will use the Digital Europe Programme to support the development of a highly secure collaborative platform for the aeronautics and security industry. While other European industries have long embraced collaborative paradigms like co-design and concurrent engineering, the aeronautics and security industry has been slower in embracing collaboration. This is largely due to the industry's complex user-access requirements, localisation obligations for data infrastructures, and differences between national standards for classifying data. In the absence of a viable collaborative platform, the European aeronautics and security industry currently misses out on competitiveness gains, which international competitors are already seizing.

In parallel, the development and use of enhanced collaborative digital platforms and work environments both on orbit and on the ground will contribute to the digital stream applied to space.

[80] see footnote 41

Industry 4.0 implementation

Digitalisation is also a key enabler for the wider adoption of streamlined fast prototyping processes. The factory of the future is the ambition to innovate: an irreversible and pioneering breakthrough path towards the digital transformation. There are several identified streams that lead the Manufacturing digital transformation such as: Advanced Material Logistics; Additive Manufacturing; Augmented and Virtual Reality and Big Data Intelligence.

In this context, innovative technologies for asset modelling and simulation are enabling the implementation of the industry 4.0 with the transformation of systems engineering approach from 'document-centric' to 'model-centric' where the Model Based System Engineering (MBSE) is playing a key role to develop, analyse, and test complex systems.

Connectivity and Communication

The ASD ecosystem will fully exploit the European technology leadership in 5G and research leadership in 6G technologies. Communications with 5G will be much more reliable, allowing users not to lose signals. Additionally, current studies are investigating the possibility to make the communication more secure, exploiting the peculiarities of 5G and of the beamforming. Using beamforming is most likely going to be the key in providing secure and reliable wireless coverage. However, the process of transmitting data consumes a lot of power, especially when using beamforming. Minimizing the amount of power consumed for securely transmitted data requires further investigation to ensure minimum environmental footprint of the next generation of electronic communication services.

5G will play an important role, enabling machines to communicate in an Internet of Things (IoT) environment capable of driving a near-endless array of services. As more devices become connected, and the IoT use cases grow exponentially, 5G networks facilitate the rapid increase of IoT and will bring significant benefits. 5G architecture includes network slicing abilities that facilitate the partitioning of a single network infrastructure on to multiple logical networks, each tailored to a given use case, providing appropriate isolation and Quality of Service (QoS) characteristics.

Standardisation and common digital architecture to support the digital transition

Data standardisation is necessary to facilitate data exchange and integration between different products. A large number of developments in the civil engineering and architecture arena can be tailored to meet the digitalisation needs in the ASD ecosystem.

In short, this digital architecture should deliver what Europe lacks: a common reference and standardisation body, in line with which all players will be able to develop new and pan-European solutions. At the international level, EU engagement in the development of standards for a number of emerging key technologies (such as quantum communications) and policies (Space Traffic Management) will be important.

Digitalisation is part of all domains in defence (land, air, maritime, cyber and space) enhancing interconnectivity and interoperability of all domains, services and Member States. This includes, for example, a common digital architecture, standardised IT infrastructure, as well as design and communication standards to ensure the interoperability and interconnectivity among military actors from different EU countries. From an industrial perspective, to develop and agree common digital architecture among the same kind of EU defence products (naval vessels, combat aircraft, battle tanks…) aims to provide a comprehensive framework to be used by all systems on board, especially sensors, effectors, platform systems and communications. This architecture should in particular include a modelling and simulation environment (including digital twinning) that allows for intelligent predictive maintenance based on sensor technology, crew training, continuous upgrades of naval capabilities and on-board assessment of the impact of degraded systems on critical functions and ship capabilities, assisted by onshore experts.

Digitalisation is of importance also for the competitiveness and sustainability of the aeronautical industry. Digital modelling of aircraft and their components reduces development times, enables the prediction of operational performance and improves production automation and efficiency. Furthermore, the analysis of data accumulated during testing and in operation can help fault analysis, support preemptive maintenance and render operations more efficient.

While digitalisation is driven by companies' efforts to achieve a competitive advantage, many of its benefits can only be realised through industry-wide cooperation via shared-information platforms. However, SMEs in particular often lack the skills required for the implementation and operation of such technologies, as well as to cope with the security requirement and the regulations and processes in the aerospace industry.

Questions to stakeholders:

18. Is the ASD ecosystem on the right track for the digital transition?
19. What are the main challenges of the digital transition of the ASD ecosystem in your specific sector and country? Could you provide any data or analysis to illustrate these challenges? What ways forward/solutions would you propose?
20. Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
21. Have you set specific targets and milestones for the digital transition in your area of activity? Based on your data, how far are you from achieving your goals? What are the challenges you foresee?
22. What are the specific challenges of the digital transition for ASD SMEs? Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
23. Can you identify already existing projects or good practices to drive the digital transition of the ASD ecosystem?
24. How will the level of digitalisation develop in the area of aerospace and defence industry to increase competitiveness in relation to the main challenges identified?
25. What technologies should be prioritised to achieve a greener and more sustainable ASD ecosystem?
26. What technologies could be commonly used by the three sectors of the ASD ecosystem?
27. Which barriers exist to the adoption of new digital technologies?

Table 3. Issues, actions and existing measures for a digital EU aerospace and defence ecosystem.

Issues	Possible actions and division of roles	Possible output scenario for 2030
Industry 4.0: Implementation and development of necessary digital technologies	**The Commission could focus on the following priorities:** • Support the development of key technologies (AI, robotics, advanced manufacturing, quantum computing, platforms and cloud-based solutions); • Coordinate Industrial Alliances (European Alliance for Industrial Data, Edge and Cloud, Industrial Alliance on Processors and Semiconductor Technologies); • Support, via the Digital Europe Programme, the development of a highly secure collaborative platform for the aeronautics and security industry; • Support cybersecurity and digitisation of administrative procedures for military mobility projects via the European Defence Fund. **Member States could focus on the following priorities:** • Deploy digital technologies in line with the EU digital decade targets, objectives and policy programme. **Industry could focus on the following priorities:** • Create synergies and improve efficiency and predictability of business operations thought mapping, streamlining, optimising and automating business processes; • Enhance the degree of automation through modular approaches, including 'plug and play' modules and standard interfaces, resulting in a more sustainable space ecosystem with a strong potential for cost reduction; • Introduces Model-Based System Engineering and digital twins; • Develop the European military cloud; • Coordinate and participate in the European Defence Operational Collaborative Cloud (EDOCC); • Actively participate in building industrial alliances.	At least 75% of EU enterprises have taken up Cloud computing services, Big Data or AI. More than 90% of EU SMEs reach at least a basic level of digital intensity.
Connectivity and 5th Generation of Communication	**The Commission could focus on the following priorities:** • Propose common standards for development of European telecommunication solutions, including quantum communication; • Implements the new satellite secure communication system IRIS^2, Copernicus as a digital system with a governmental service, Galileo; • Foster the use of AI to exploit space data and take up of space services; • Launch EDF calls for proposals on military digital	Increased uptake of services based on space data, in particular stemming from the EU space programme components. EU standards are promoted worldwide.

	interoperability and interconnectivity. **Member States could focus on the following priorities:** • Work on reducing the cost of deploying electronic communications networks; • Radio spectrum. **Industry could focus on the following priorities:** • Fully exploit the European technology leadership in 5G and research leadership in 6G technologies; • Develop common digital architecture for each EU defence product type.	Increased military interoperability and interconnectivity.

8. HORIZONTAL AND CROSS CUTTING ISSUES: SKILLS, PRIVATE INVESTMENTS AND SUSTAINABLE FINANCE

Skills

Stakeholders from the ASD ecosystem expressed the need to have both transversal and sector-specific skills. These needs should combine domain-specific knowledge with problem-solving and interpersonal abilities, including communication, creativity, openness to learning, and critical thinking, among others, in relation with current and anticipated skills needs on the labour market. For example, some of the most relevant skills for the ecosystem are big data analysis, high-performance computing, model-based engineering, AI, cybersecurity, machine learning, additive manufacturing, blockchain or quantum technologies, carbon neutrality, circular economy and life-cycle assessment.

On the **defence** side, there is a structural shortage of technical skills partly due to several years of decreasing defence budgets leading to underinvestment in material programmes. This shortage includes skills enabling the delivery of current and planned defence equipment programmes (including production), as well as skills enabling the defence industry to harness technological advances and remain innovative and competitive.

A 2018 study showed that the larger companies mainly had a shortage of technical skills, whereas SMEs had immediate challenges in recruiting and retaining skills in areas such as management (programme and project), procurement and cost estimation systems, as well as integrated test and evaluation.

A consultation with stakeholders resulted in a **Skills Strategy for 2020-2024**, where some of the identified problems were a negative perception of the defence industry as an employer and a history of decreased defence budgets, which caused a low level of recruitment to the sector.

The recent geopolitical developments have caused an increase in the defence budget of several Member States, especially after Russia's unprovoked invasion of Ukraine. As a result, the defence industry now faces a major ramp up. At the same time, the industry is to a high degree national, where national security clearance and citizenship may be required for the workforce, which may hamper both workforce mobility and the necessary development of the industry at EU level.

In the **aeronautics sector**, a host of innovations (new propulsion systems and the use of electric motors, cryogenic tanks and fuel distribution systems, fuel cells, batteries, high-voltage power systems, as well as new technologies in air traffic management and other fields) will put new demands

on the industry's workforce skillset. Airbus estimates that the aeronautical industry will need more than 710,000 highly skilled technicians over the next two decades.[81]

The **space** sector is undergoing important transformations as the global space economy is experiencing major growth. This implies upskilling and reskilling students and professionals in the ecosystem that benefit from space-based data, services and applications in agri-food, mobility-transport-automotive, digital, energy-renewables or cultural and creative industries, among others. Moreover, the emergence of the NewSpace phenomenon, new technologies, industrial processes, business models, market and policy trends, coupled with EU priorities to drive a fair green, digital and resilient transitions, require new skills and mindsets in the space sector to support workforce and attract new talents.

Specific EU programmes to support upskilling of the ecosystem

The ASD ecosystem has been supported by a set of horizontal actions and is benefiting from programmes such as Erasmus+ and Horizon Europe, including Marie Sklodowska-Curie Actions (MSCA).

In 2016, the Blueprint for sectoral cooperation on skills was launched by the European Commission as a part of the Erasmus programme. The purpose of the Blueprint is to gather intelligence on sector skills, and based on this, to develop a sector skills strategy, as well as concrete education and training solutions. So far, there have been two Blueprints in the EU ASD ecosystem: **EO4GEO** for the geographic information and Earth observation domain, and **ASSETs+** for emerging technologies in the defence sector.

ASSETs+ (Alliance for Strategic Skills addressing Emerging Technologies in Defence) runs from January 2020 to December 2023 and is aimed at developing demand-led upskilling and reskilling training programmes on the cutting-edge technologies of robotics, autonomous systems, AI, cybersecurity, control, communications, computers, information/intelligence, surveillance, targeting acquisition and reconnaissance. The project has designed a number of courses, for students as well as for professionals, and also arranged European Defence Challenge for students and Tech4Kids to attract students to defence and to create awareness of defence careers.

The **EO4GEO** sector skills alliance concluded in 2022 and was set up to bridge the skills gap between the supply and demand of education and training in the geographic information and Earth observation domain, fostering the uptake and integration of the data and services produced for a broad range of applications. With its partners and with stakeholders from the domain, the EO4GEO alliance identified a sector skills strategy and long-term action plan. It identified a number of technical and scientific skills, knowledge and competences needed to equip the next generation of workforce specialised in the geographic information and Earth observation domain. It also highlighted the need for skills in analytical methods, visualisation and cartography, programming and development, data capture and management, and social science. Meeting these needs would require adapting the offer in academic education and Vocational Education and Training.

As an example, among the University consortia selected in the European Universities Action, **UNIVERSEH, the European University for Earth and Humanity**, was established in November 2020 to develop a comprehensive approach to collaborative education in the thematic of Space, within the new 'European Universities' initiative promoted by the European Commission. Supported by Erasmus+, it aims to create the European University of the Future that is innovative, inclusive and connected to the realities of the strategic European space sector. Since the project's kick-off, the UNIVERSEH alliance has achieved several milestones:

- A Summer School on Space Resources and Mining in Krakow and an upcoming Arctic Winter School in Lulea;

[81] Airbus foresees demand for 39,000 new passenger & freighter aircraft by 2040 | Airbus

- A mobility platform for all students and collaborators, including promotion of multilingualism in Germany;
- Multidisciplinary courses, comprising technology, business and law;
- A Startech Hackathon in Toulouse and a Space Hack in Luxembourg;
- The establishment and operation of the Advisory Board.

The consortium also started the 'Beyond UNIVERSEH' project, a 'Science with and for society' initiative funded under Horizon 2020 to develop common research-oriented strategies and policies.

In addition, as part of the **Horizon Europe** programme, a dedicated part on education and skills for the EU space sector was introduced in the Work Programme 2021–2022. This resulted in the ASTRAIOS project that aims to (1) provide an exhaustive view and understanding of the current and future Space curricula and courses offered in the EU-27, (2) characterise the skills need from the European Space industry in the next 10-15 years, and (3) identify actionable ways towards a better alignment between the offered educational programmes and the skills required by the future European space industry, with a specific focus on the downstream segment.

In 2020, the European Commission launched the **Pact for Skills** initiative, which aims to bring stakeholders together to identify sector skills problems, find solutions and propose actions with the creation of sectoral skills partnerships. In the Aerospace and Defence ecosystem, two Large-Scale Skills Partnerships were set up:

1. In October 2020, the **Pact for Skills in Aerospace & Defence** with two objectives over the next 10 years: to re-skill 6% of the workforce each year to reach the target of 200,000 persons, and up-skill 300,000 persons to enter the sector. The Pact for Skills elaborated a position paper setting out concrete actions that may contribute to effective up-skilling and re-skilling, such as intercompany training centres, European massive open online courses, Master programmes, apprentices in the industry (including SMEs), knowledge transfer from large companies to SMEs (including suppliers of large companies), PhD contests and sectoral talent mobility;
2. In April 2023, the Large-Scale Skills Partnership on Space Data, Services and Applications (SPACE4GEO) aims to empower workers with the skills needed for the development of future innovations and to achieve the aims of the EU's Space Strategy for Security and Defence. In particular, the partnership will promote the collaboration between the space industry, training centres, academia and other partners, attract young professionals and develop new and existing regional initiatives and contribute to other training programmes It will leverage the results of the EO4GEO Blueprint project on space geoinformation and its Sector Skills Strategy, adopting a wider sectoral coverage to embrace not only Earth Observation and geoinformation but also positioning, navigation, secure connectivity as well as the use of data for security and defence, namely the entire so-called downstream segment of space economy.

Copernicus Academy and Relays have been running since the first quarter of 2017. They fuel considerable return in terms of knowledge enhancement, reputation and capacity building, as well as cross-fertilisation and best practices sharing. Users of Copernicus programme function as Ambassadors of the Copernicus Networks by spreading the word to other actors across countries, disciplines and industries promoting the uptake of Copernicus data. There are over 300 network members from 38 countries. The Copernicus Academy develops lectures, training sessions, traineeships as well as educational and training material for users, researchers, scientists and entrepreneurs. It works towards increasing the exchange of ideas and best practices and organises events to promote the use of Copernicus data in their respective countries, disciplines, industries. Copernicus Relays provide information about the programme, its data and its applications through websites, hotlines, social media and a dedicated emailing system. They spread the word about opportunities to develop new applications and business models based on Copernicus data and organise information/training events on all components of the programme.

Finally, the Commission launched a survey with Eurostat in 2022 about the defence industry, aeronautics and space sectors to know more about their workforce and how diverse it is, in order to

have a baseline to plan and measure future actions and use the full potential of skills existing in our society to the benefit of the ASD ecosystem.

Questions to stakeholders:

28. What are the implications of the green and digital transition for the main skills requirements and training needs in the ASD ecosystem?
29. What are the main challenges of the skills transition of the ASD ecosystem in your specific sector and country? Could you provide any data or analysis to illustrate these challenges?
30. What ways forward/solutions would you propose? Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
31. Would you have any examples of initiatives or good practices in relation with the skills transition to share, including at national, regional and local level?
32. Have you set specific targets and milestones for the skills transition in your area of activity? Based on your data, how far are you from achieving your goals? What are the challenges you foresee?
33. What are the specific challenges of the skills transition for ASD SMEs? Which steps are you and other actors taking to address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?
34. How do you envisage the development of the Pact for Skills for the ASD ecosystem? How can different stakeholders contribute to the Pact for Skills?
35. Which technologies/skills needed are common for the three sectors, and which are really sector- or subsector-specific?
36. What would be the best way to anticipate the future long-term skills needs?
37. How can the sector become more inclusive to take advantage of the diversity in society?
38. Based on the actions described above, are there any additional segment/sub-sector that would need to be further analysed?

Private investments and sustainable finance

The transition to a resilient, innovative and sustainable ASD ecosystem requires significant investments. While significant private investments will have to be provided, public support must play a role in addressing market failures supporting R&D activities and de-risking investments of the ASD ecosystem. Work with the financial sector actors to increase involvement in the ASD ecosystem should focus on identification of barriers and promoting expanding investment. In the area of defence, the Commission called the European Investment Bank to enhance its support to the European defence industry and joint procurement beyond its ongoing support to dual use.[82]

As announced in its Strategy for financing the transition to a sustainable economy[83], the Commission is developing a set of tools to foster greater alignment of private finance with sustainability. These new instruments and metrics[84] will constitute a reference for companies and investors to identify sustainable activities and ultimately promote sustainable investments. This comprehensive framework is composed of a whole set of regulations and directives, in force or currently under negotiation, either

[82] Defence Investment Gaps Analysis and Way Forward from 18 May 2022
[83] COM(2021) 390 final, 6.7.2021
[84] See for example the metrics and guidelines developed by the European Green Digital Coalition

focused on environmental sustainability (EU green bonds) or focused on all sustainability aspects (Corporate Sustainability Reporting Directive, Sustainable Corporate due diligence directive).

The green, digital and resilience transition of the ASD ecosystem will allow it to meet the highest sustainability standards, and therefore to report on its contribution to the wider EU's transitions, ultimately improving their access to private finance. Meeting environmental sustainability standards on environmental aspects will be closely linked to social and governance sustainable standards (minimum standards, disclosure requirements according to specific technical screening criteria). The ASD ecosystem, as other economic sectors, will need to continue undertaking efforts to follow a path towards a responsible and accountable governance. In order to implement sustainability reporting requirements, the level of administrative effort and cost will increase (auditors, experts or advisors) to build or enhance compliance, control and risk management systems for companies of all sizes, and particularly for SMEs.

With regard to environmental sustainability, whereas some civil aeronautics and space activities have been explicitly included in the EU taxonomy, parts of the ASD ecosystem (in particular defence) are not included in this taxonomy. The EU taxonomy is an evolving framework, and new activities may be included in the future. For the time being, the Commission has prioritised those economic activities with the greatest potential to make a substantial contribution, and for which it was possible to endorse or refine the recommended criteria within a short timeframe. As emphasised by the Commission in its **June 2023 package on transition finance**[85], in particular in the **Communication on A sustainable finance framework that works on the ground**[86], the '*mere fact that a company does not have taxonomy-aligned activities does not mean that conclusions can be drawn regarding the company's environmental performance or its ability to access finance.*' With regards to defence specifically, due to the diversity of activities and their low representation in the Nomenclature of Economic Activities (NACE) sectors, they may not appear as self-standing, but rather as a sub-group of transport, including the manufacturing or building of ships, boats or air and spacecraft.

The Communication of 15 February 2022 on 'Commission contribution to European defence' recalled the need to '*ensure that other horizontal policies, such as initiatives on sustainable finance, remain consistent with the European Union efforts to facilitate the European defence industry's sufficient access to finance and investment*'. In the ASAP proposal, the Commission also underlined that the Union defence industry is a crucial contributor to the resilience, security of the Union, and therefore to peace and social sustainability. In fact, the EU Sustainable Finance Framework focuses on ensuring transparency and does not impose any limitations to financing any specific sector. Within Union initiatives on sustainable finance policies, only controversial weapons prohibited by international conventions, are deemed incompatible with social sustainability.

The ASD Transition Pathway needs to address the integration of the ASD ecosystem within this regulatory framework, including the need for relevant sector-specific provisions (such as sector-specific guidelines on disclosure requirements, or sector-specific criteria to qualify certain activities as sustainable) to promote and facilitate access to finance for the ASD ecosystem industry while recognising its specificities.

Questions to stakeholders:

39. Based on information and data available to you, how do you see the role of the private sector for the transition of the ecosystem?
40. What are the main challenges for private investments in the ASD ecosystem? Could you provide any data or analysis to illustrate these challenges? Are there specificities with regard to aerospace and defence?
41. What ways forward/solutions would you propose? Which steps are you and other actors taking to

[85] https://finance.ec.europa.eu/publications/sustainable-finance-package-2023_en
[86] COM/2023/317 final

address them? Where do you see the action gaps? What role could relevant authorities and stakeholders play in addressing these challenges in the future?

42. Do you see the need for any additional actions to accompany the transition of the ASD sector to meet the sustainability standards?
43. Do you have any recommendations to address the specificities of the ASD sector within EU's sustainable finance initiative (ie. EU Taxonomy, SFDR, CSDR…)?

9. INDUSTRIAL FORUM'S BLUEPRINT FOR THE DEVELOPMENT OF TRANSITION PATHWAYS

The Industrial Forum – set up by the Industrial Strategy – consists of a wide array of stakeholders. The Industrial Forum takes an important role in the development of the Transition Pathways. In this context, a Task Force has been created to support the Commission in the co-creation process with stakeholders. The Task Force has developed a Blueprint, which serves as a reference point, and will be used in the co-creation process for the development of the ASD ecosystem Transition Pathway.

10. CONCLUSIONS AND INVITATION TO STAKEHOLDERS

This SWD lists existing possible areas of action and measures to support the green and digital transitions as well as the resilience of the ASD ecosystem. The transition can only succeed if the three sectors of the ecosystem and their diverse actors work together and, more generally, if there is broad public support. All stakeholders, large and small, public and private, including social partners are invited to work together and propose concrete actions, commitments and investments complementing policy actions designed by the Commission and complemented at the sectoral, national, regional or cross-borders levels, towards a common vision of a resilient and sustainable ASD ecosystem in a 2050 climate-neutral economy.

The Commission services will ensure the co-creation process for the ASD ecosystem through regular interactions with the Member States and stakeholders at large. Stakeholders are invited to provide an assessment of scale, cost, long-term benefit and condition of the possible areas of actions to accompany the transition. Key issues and questions have been presented in this document under different sections. Concrete responses, proposals and commitments from the ASD ecosystem will be welcome by 15 October 2023 through an online consultation.

The ambition is to help the ASD ecosystem embrace the green and digital transformation and strengthen its resilience to foster growth, quality jobs and competitiveness of the EU. This cannot be achieved by the Commission services, Member States, social partners and other stakeholders acting on their own.

Key for the recovery and transformation is collaboration and forward looking, responsible and transparent approach. All together, we need to think and plan ahead and be as ambitious as needed in the achievement of resilience, sustainability and digitalisation of the ASD industries ecosystem while ensuring that all can benefit from the transitions. We have the momentum of the recovery, the financial support, the need for change driven by citizens and by industry, the awareness and commitment of Member States and social partners and the availability of EU funds with the NextGeneration EU recovery plan.

This invitation is the first step to kick-start the co-creation process with stakeholders, which will result in a finalised transition pathway by the end of 2023.