

# The Aerospace and Defence Industries Association of Europe



**2019**  
Facts & Figures



## Words from the President

Our association ASD represents the interests of the European aerospace, defence and security industries. Our membership consists of more than 3000 companies of all sizes with more than 870,000 highly skilled employees across Europe. These companies are highly competitive and operate successfully on both commercial and public markets world-wide.

Our industry constantly drives technological innovation for the benefit of sovereignty and prosperity of Europe and its citizens in the fields of civilian aeronautics, defence, security and space.

In the civil sector, carbon neutrality is a top priority for our industry. Climate change is one of the biggest challenges for mankind, and urgent action is needed to prevent it from becoming an existential threat. Through technological innovation, the aeronautics industry plays a key role to reduce the environmental impact of civil aviation, in particular with regard to noise and emissions. Joint technology initiatives funded by the EU, such as Clean Sky and SESAR, are crucial in this respect and help to ensure that each new generation of aircraft reduces emissions by 15-20%. The implementation of the first ever sectorial carbon offsetting scheme (CORSIA) will also be instrumental in decarbonising aviation, especially in view of its growth forecast.

In the defence sector, current European initiatives can lead to a real step-change



ASD President, Eric Trappier  
Chairman & CEO of Dassault Aviation

in European cooperation. The European Defence Fund (EDF) in particular can help develop Europe's defence capabilities and its industrial and technological base. In combination with other initiatives, namely CARD, PESCO and CDP, the EDF can make a substantial contribution to strengthening Europe's strategic autonomy. ASD encourages the successful implementation of the EDF and the establishment of a genuine European defence market.

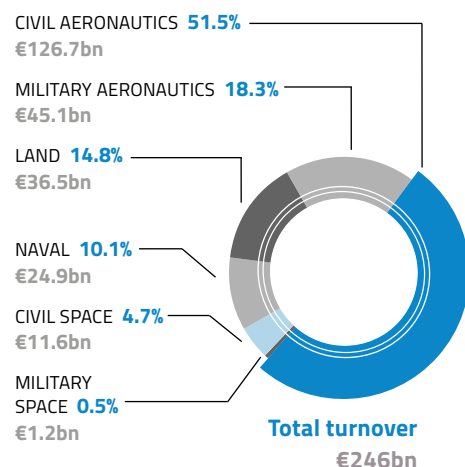
Our industry is of strategic importance for Europe's economy and security. To continue its success story in a fast-changing world and to fully exploit its strength for the benefit of our economies and citizens, it needs, more than ever, a strong partnership with the European Union.

**ASD President  
Eric Trappier**

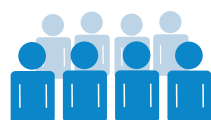
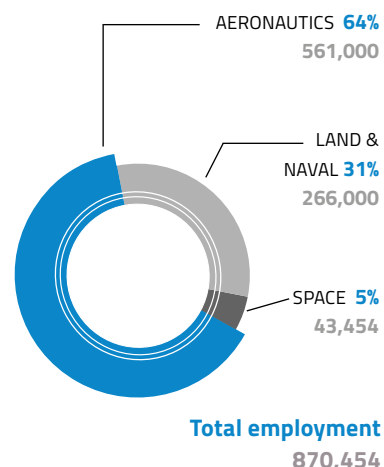
# Major trends in the European aerospace and defence industry

As a major pillar of the European economy, the European aerospace and defence industry reinforced its position as global leader in the market in 2018.

TURNOVER 2018



EMPLOYMENT 2018



**870,000 highly-skilled employees in Europe**

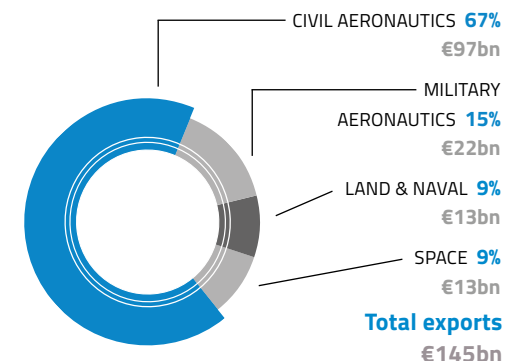
Despite continued economic and political uncertainties, the aerospace and defence industry continued to expand, following the growth trend of recent years. Sales growth for the industry as a whole amounted to 8%, with total revenue reaching €246bn (compared to €228.5bn in 2017). The

number of employees also increased to 870,000 workers (compared to 865,000 in 2017) marking a new records for the companies represented by ASD.

The European aerospace and defence industry plays a crucial role in leading

*Leading role on the global markets which is crucial for growth within the EU*

EXPORTS 2018



global innovation and generating high-skilled jobs. Our industry is amongst top leaders on the global markets which is crucial for growth within the EU. In 2018, the sector sustained its leading role in exports, amounting to €145bn. In this context, our industry generated a positive net trade balance to the European economy.

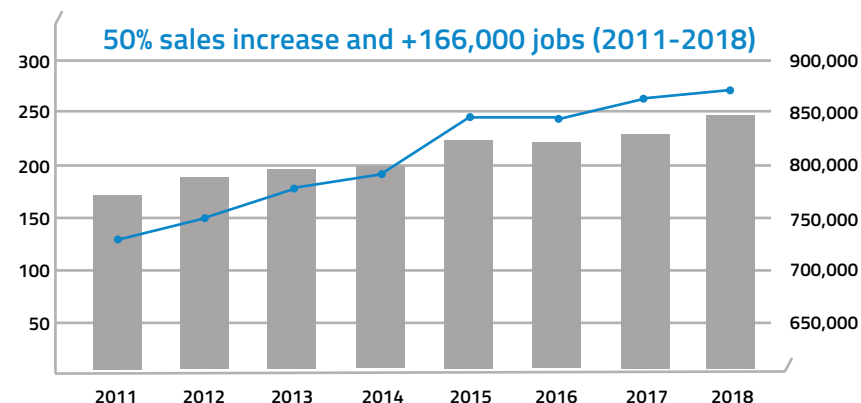
Overall, the sector delivered strong economic performances with increased deliveries, export orders and backlog in most segments, in a global context

marked by the growth of civil and military demand, as well as a stronger competition, economic uncertainties and complex security challenges.

This is the result of sustained competitiveness driven by significant efforts in R&D and efficiency improvements of industrial processes through digitalisation and cutting-edge technologies. Fostering innovation and technologies is essential in order to deliver sustainable and competitive products and services that are sold worldwide.

TURNOVER €bn

EMPLOYMENT



## Civil aeronautics

REVENUE

€  
127bn

EXPORTS

€  
97bn

JOBS

  
393k



## European civil aeronautics sector

**Supporting 393,000 jobs across Europe, the civil aeronautics sector is a world leader, generating high-skilled jobs, innovation and sustainable growth in the EU.**

In 2018, the civil aeronautics sector continued its growth with revenue increasing by 3% to €126.7bn (compared to €123bn last year). This sector remains by far the leading sector in aerospace and defence and accounts for more than 50% of total industry revenue.

The increasing global demand for mobility and the replacement of older aircraft, which use more kerosene, with the latest low-noise, fuel-saving generation of aircraft continue to be the major drivers of growth.

Civil aeronautics plays a leading role in exports. In 2018, civil aeronautics exports reached €97bn, accounting for 82% of aeronautics exports. This figure includes 1/3 of intra-EU industrial flows, which shows the high level of cross-border cooperation across the EU. Exports outside Europe correspond to 2/3 of the total amount, including both sales to final customers and supplies to original equipment manufacturers.

In general terms, exports provide an important net trade balance to the European economy.

The activities of the civil aeronautics

sector, including large companies as well as a great variety of small and medium-sized enterprises, are spread across Europe and are concentrating a full spectrum of technologies and integrated capabilities. The civil aeronautics sector includes all certified flying objects, manned and unmanned, along the life-cycle, i.e. the complete range of categories of commercial aircraft, business jets, regional jets, general aviation, combat aircraft and trainers as well as a broad range of transport aircraft and rotor-wings, training and simulation services, Maintenance Repair & Overhaul (MRO) and air traffic management ground systems.





## Future challenges

In 2018, nearly 4.4 billion passengers were carried by the world's airlines. While air transport carries around 0.5% of the volume of world trade shipments, it is over 35% by value – meaning that goods shipped by air are very high value commodities, often times perishable or time-sensitive. Over 65 million jobs are supported worldwide in aviation and related tourism. Of this, 10.2 million people work directly in the aviation industry<sup>1</sup>.

If aviation were a country, it would rank 20th in the world in terms of gross domestic product (GDP), generating \$704.4 billion of GDP per year, considerably larger than some members of the G20 (and around the same size as Switzerland). By 2036, it is forecast that aviation will directly contribute \$1.5 trillion to world GDP<sup>2</sup>.

Worldwide, flights produced 895 million tonnes of CO<sub>2</sub> in 2018. Globally, humans produced over 42 billion tonnes of CO<sub>2</sub>. The global aviation industry therefore produces around 2% of all human-induced carbon dioxide (CO<sub>2</sub>) emissions<sup>3</sup>.

Civil aviation has shown a track record of reducing its environmental footprint. Current generation of jet aircraft are 80% more fuel efficient per seat kilometre than the first jets built in the 1960s. Each new generation of aircraft typically reduced emissions by around 15-20%. Newer generation of aircraft burn around 3 litres of fuel per 100 passenger kilometres.



The civil aviation industry is very much aware that more needs to be done to decarbonize in particular since aviation continues to grow as result of economic growth and global trade (aviation is expected to double in the next 20 years). The civil aviation industry became the first in the world to agree on a comprehensive approach for reducing its emissions. It is based on the 'four pillar strategy' of technology, operations, infrastructure and a global market-based measure (CORSIA) setting a goal to half net aviation CO<sub>2</sub> emissions by 2050 (compared to 2005).

<sup>1, 2, 3</sup> Source: ATAG

EXPORT  
CIVIL AERONAUTICS  
**+1%**  
COMPARED TO 2017

The European industry is playing a leading role to develop the future green technologies for civil aviation. The support from the EU institutions through EU funded research programmes such as Clean Sky and SESAR are essential in this context. If Europe wants to meet its climate targets, it will be essential to safeguard funding for civil aviation research in the future Horizon Europe Programme through providing at least 5 billion Euro of public funding. European industry has started research on electrification and hybridization of civil aircraft along other potential options to reduce civil aviation emissions in the longer term (including research on hydrogen-based aircraft).

Moreover, improving the efficiency of the European Air Traffic Management System through the deployment of SESAR solutions and the implementation of a Digital European Sky also has the potential to reduce CO<sub>2</sub> emissions by around 10%. In this context, it will be essential to incentive the quicker deployment of new technology in line with the recent report from the



EU Wise Men Group on ATM and the SESAR Airspace Architecture Study. Solutions to make aircraft movements emission-free when taxiing could also be deployed faster based on economic incentives for equipped aircraft such as for example modulation of airport charges.

Europe should also become a center of excellence on sustainable alternative fuels for aviation based on a strong European energy policy which should incentivise the development and deployment of those alternative fuels which have the potential to drastically reduce civil aviation emissions.

Last but not least Europe should continue to work with the International Civil Aviation Organization (ICAO) to develop ambitious global environmental standards for international civil aviation. This includes the implementation of first ever sectorial carbon offsetting scheme (CORSIA) as well as a global CO<sub>2</sub> aircraft certification standard.



## Defence

REVENUE

€  
108bn

EXPORTS

€  
35bn

JOBS

  
438k

## European defence sector

Supporting over 438,000 high-skilled jobs in Europe, the defence sector plays a vital role in helping to safeguard our security and contributes to Europe's economic prosperity.

Mirroring the differences in national defence spending, the European defence technological and industrial base is concentrated in a few Member States. The main system integrators are located in the six so-called "Letter of Intent (LoI) countries"<sup>1</sup> – France, Germany, Italy, Spain, Sweden and the UK; smaller platform manufactures, equipment suppliers and sub-suppliers as well as niche producers can be found across the European Union.

Many defence companies have also an important civilian activity and/or form part of larger industrial groups of primarily civilian nature. The total number of SMEs doing business in defence is estimated at 2,000 to 2,500 (of which 39.6 % in land, 30.5 % in air, 18.7% in naval, 7.8% in cyber, 3.4% in space)<sup>2</sup>.

<sup>1</sup> In 1998, the six major European arms producing countries signed a letter of intent (LoI) to facilitate the cross-border consolidation and cooperation of defence industries.

<sup>2</sup> IHS, Analysis of defence-related SMEs' composition in EU, December 2016.

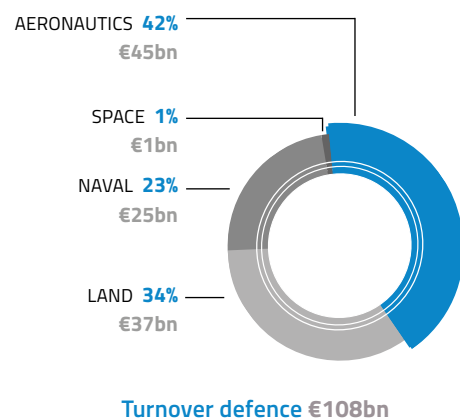
### EUROPE'S TOP 10 DEFENCE COMPANIES 2018

	2018 Defence Revenue (in millions dollars)	2018 Total Revenue (in millions dollars)	Revenue from Defence	Ranking Worldwide
#1 BAE Systems	\$22,477.48	\$24,569.06	91%	#7
#2 Airbus	\$13,063.82	\$75,220.59	17%	#9
#3 Leonardo	\$9,828.51	\$14,453.69	68%	#13
#4 Thales	\$9,575.57	\$18,775.63	51%	#16
#5 Rolls Royce	\$4,682.36	\$20,110.93	23%	#24
#6 Naval Group	\$4,260.53	\$4,260.53	100%	#29
#7 Rheinmetall	\$3,803.54	\$7,259.91	52%	#30
#8 SAAB	\$3,243.68	\$3,816.09	85%	#36
#9 Dassault	\$2,934.43	\$6,003.48	49%	#38
#10 Babcock International	\$2,909.79	\$6,206.67	47%	#39

Source: Defense News

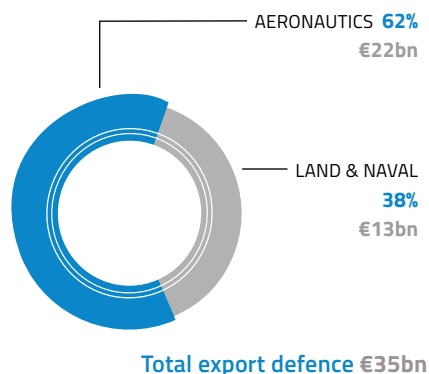
In 2018, the European defence industry generated a turnover of €108bn. This accounts for more than 20% of the global defence turnover but remains far behind the US global market share (almost 60%). Companies established in the 10 countries alone generated revenues of €91.2bn<sup>3</sup>.

### TURNOVER DEFENCE 2018



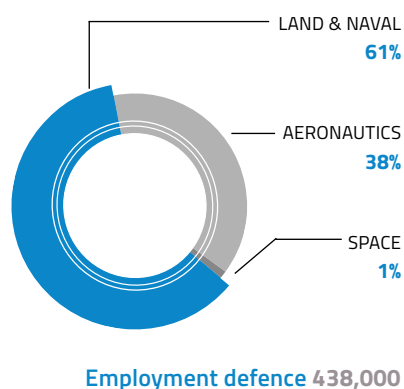
Military exports reached €35bn in 2018. Out of this total, €22bn is attributable to military aeronautics and €13bn to the land and naval sectors. These exports are crucial for European industry to compensate for relatively small home markets and to reach the production volumes that are necessary to maintain competitive per-unit prices.

### EXPORT DEFENCE 2018



In 2018, defence industry in Europe supported more than 438,000 jobs. Of that total, 168,000 jobs (38%) were attributable to military aeronautics, the remaining 266,000 (61%) to the land and naval sectors. Recent trends show that the European defence industry is facing a shortage of skilled labour. This is due to several reasons, including the high pace of technological innovation and the increasing competition from other sectors for younger high-skilled workers.

### EMPLOYMENT DEFENCE 2018



<sup>3</sup> European Court of Auditors (ECA), European Defence, ECA's Review 9/2019.

## The European defence industry – an indispensable element of Europe's strategic autonomy

### Military aeronautics

Air power superiority is a key success factor for defence. It must be able to support all types of missions and to operate in a joint and collaborative environment. It requires a strong industrial base that must be constantly sustained to remain at the technological edge.

The European military aeronautics sector produces a broad range of manned and unmanned aerial systems, from combat aircraft and drones to transport aircraft and helicopters. It consists of companies of all sizes, from prime contractors which sit at the top of the supply chain and deliver complete systems and 'system of system' solutions, to tier-3 sub-suppliers which provide components and raw material.



In 2018, the European military aeronautics sector generated a turnover of €45bn. Half of this turnover (€22bn) is achieved with exports, which decreased by 8% compared to 2017 (€24bn) but still account for an esti-

mated 63% of total European defence exports. Employment in the military aeronautics sector is estimated at 168,000 jobs, which accounts for 38% of total defence employment.

### Land and naval

The combined turnover of the European land and naval industry increased by 18% from €52bn in 2017 to €61.4bn in 2018 (€37bn land, €25bn naval). Both sectors experienced a decrease in their export volumes, from €15bn in 2017 to €13bn in 2018. Employment in both



sectors increased by roughly 6,000, reaching a combined total of 266,000 jobs in 2018. This means that the land and naval sector together account for 61% of the total defence employment.

With a turnover of €37bn in 2018 (which accounts for 34% of the total defence revenues), the European land industry has a long tradition of supporting Member States' armies



and is key to deliver a new generation of land military capabilities. Industry's product portfolio is diverse, spanning from main battle tanks to families of armored vehicles, artillery, guided ammo, integrated systems and components for the battlefield and protection of soldiers and infrastructures. The largest European land prime contractors are located in France, Germany, Italy and UK, although important industrial capabilities exist also in other Member States.

The European naval sector generated in 2018 revenues of €25bn, which represents 23% of total European defence revenues. This industry produces platforms of all sizes as well as embedded systems such as electronics and armaments. The sector encompasses the full spectrum of vessels, including aircraft carriers and nuclear submarines.



In Europe, there are six prime contractors which have the full responsibility to design, integrate and build naval ships. For the design and development of combat systems and combat management systems, most of them rely on tier-1 suppliers. The lower tiers of the supply chain consist

of a broad range of companies of different size and activities. Many of them generate only a small part of their revenues on the defence market.

### Future challenges

Future warfare will be characterized more and more by a system architecture approach, which takes advantage of new, emerging and disruptive technologies (e.g. artificial intelligence, quantum computing, 5G) and uses platforms as nodes or components of a system.

This development is driven by changes in both threat scenarios and technology advances. In the future, there will be an increasing need for armed forces to be able to operate in an integrated manner across all domains, supported by the necessary technologies. The latter will be strongly influenced by emerging technology trends that are driven mainly by huge investments in the commercial sector.

Whilst defence industry will not be at the forefront of developments in such technologies, it will have the responsibility to develop the means of applying these technologies to military systems and military operations. New technologies, more pervasive and transversal, are likely to have consequences also for the structure of the defence industrial and technological base. It will bring new entrants into the military sector and cause defence companies to adapt their strategies to meet the need to incorporate these new technologies into the products they develop.





# Research & Development

TOTAL R&D  
INVESTMENT

€  
19bn

## Research & Development (R&D)

Research, technology and innovation are instrumental for a sustainable and competitive future.

The European aeronautics and defence industry is driven by significant activities and investments in Research and Development. R&D refers to the activities companies or public stakeholders undertake to improve or develop new products and services. While R&D encompasses the whole research and development process, from upstream research to the final product or service, R&T – Research and Technology – focuses on the first phases (study of mature technology components (up to TRL 6) that will allow to launch the development of a project with low risks).

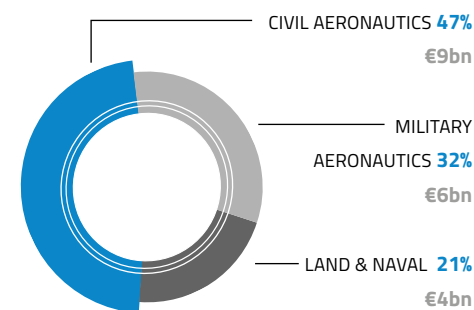
In 2018, the R&D expenditure on aeronautics and defence from both industry and governments is estimated at the level of €19bn, with an equal split between civil and military activities.

For the European industry to stay ahead in a fast-changing and global innovation race, the support of national governments and the EU is essential.

The investment gap between the EU and the United States (US) is massive when it comes to aerospace and

defence-related R&D. In 2018, the R&D investments in the US (from industry and government) were more than four times higher than in Europe. If this long-term investment gap persists between Europe and other regions of the world, this will add further difficulties to maintain Europe's leadership.

### RESEARCH & DEVELOPMENT 2018



Total R&D Investment €19bn



R&D  
CIVIL AERONAUTICS

€9bn

Invested by private and  
public stakeholders

### R&D in civil aeronautics

In 2018, it is estimated that €9bn were invested in civil aeronautics R&D activities by private and public stakeholders. Most of the investment comes from an increasing number of private investors (suppliers and customers) while government support is increasingly marginal.

According to the European Commission, every euro invested in aeronautics R&D creates an equivalent additional value in the economy annually thereafter. Indeed, it enables the development of sustainable and competitive products and services, while maintaining and creating high-skilled jobs in Europe.

R&D is the main driver to achieve the ambitious sustainability targets the sector is committed to. The Flightpath 2050 roadmap aims that in 2050, technologies and procedures available

allow a 75% reduction in CO<sub>2</sub> emissions per passenger kilometre and a 90% reduction in NO<sub>x</sub> emissions. The perceived noise emission of flying aircraft would be reduced by 65%. These are relative to the capabilities of typical new aircraft in 2000. Today's aircraft and engines are much more fuel-efficient than earlier generations: it is estimated that fuel consumption per passenger/km has been reduced by 70% since the 1970s.

However, the societal demand for air travel is booming (with an average increase of 5% each year), and constant research is critical to further reduce the emissions of the next generation of aircraft. Besides, competitiveness is key to take the lead on green technology at international level and ensure solutions and pathways are affordable and can be integrated by the whole sector.

The aeronautics sector is marked by the high complexity of its products and systems, subject to significantly long R&D cycles up to 20 years, all of which require long term and large investments.

The long development cycles and the high technological risks that characterise the aeronautics industry require cooperation between all the key actors along the supply chain (private and public organisations) to reinforce and streamline research.

European public-private partnerships (PPPs) such as Clean Sky and SESAR are delivering substantial socio-economic impacts:

Clean Sky develops innovative, cutting-edge technology aimed at reducing CO<sub>2</sub>, gas emissions and noise levels produced by airplanes and helicopters. To this end,

more than 30 main demonstrators of different sizes are being developed at a very high technological maturity level. So far, Clean Sky results confirm an overall 32% CO<sub>2</sub> emission and 50% to 86% noise decrease potential. These are being crystallised as the technologies are applied to commercial products, while the programme's partners are innovating further to increase the performance of aircraft.

SESAR is delivering a catalogue of solutions to modernise the management of air traffic in Europe, ensuring the safety and sustainability of European air travel and aviation. When deployed, the 60 solutions already delivered should increase airspace capacity by 34% and decrease flight time variance by 30%, meaning reduce delays on all EU flights (95% of flights staying within their time plan), and lead to a 2,3% decrease of fuel burn and emissions per flight.

*R&D is the main driver  
to achieve the ambitious  
sustainability targets the  
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## R&D in defence

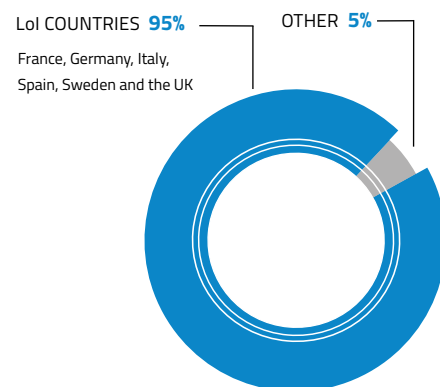
Investment in defence R&D and (its subset) R&T is essential to the long-term sustainability of the European defence industry and its capacity to develop the next-generation capabilities of Europe's armed forces. Combined European investment in defence R&D amounts to roughly €10bn. The bulk of investment comes from national governments as the key customers. Private investments are very limited and concern only lower complexity or lower value research. Defence R&D spending in Europe remains highly concentrated in the six Lol countries (France, Germany, Italy, Spain, Sweden and the UK), accounting for 95% of defence R&D investments. France and UK account alone for more than half of the total, followed by Germany, Italy, Spain and Sweden.

In spite of an overall increase in defence spending, investment in defence R&D has decreased from 23.5% of total investment in 2015 to 21% in 2017 and is estimated to decrease further. The decrease in funding, the concentration of activity in few countries and the fact that the collective benchmark for defence Research & Technology (2% of total spending) has never been reached, raises concerns regarding the long-term European innovation capacity.

To reverse this trend and to foster European collaboration, the EU has put

forward several initiatives to support the European defence industrial base. Via the Preparatory Action on Defence Research (PADR) and European Defence Industrial Development Programme (EDIDP), EU resources have been allocated, for the first time ever, to support the defence sector. EDIDP and PADR aim at boosting collaborative research and development, which is crucial for industry's competitiveness and capacity to sustain our armed forces with cutting-edge technology. Together they prepare the ground for the fully-fledged European Defence Fund (EDF) that is planned under the next Multi-Annual Financial Framework (MFF).

### R&D INVESTMENTS DEFENCE



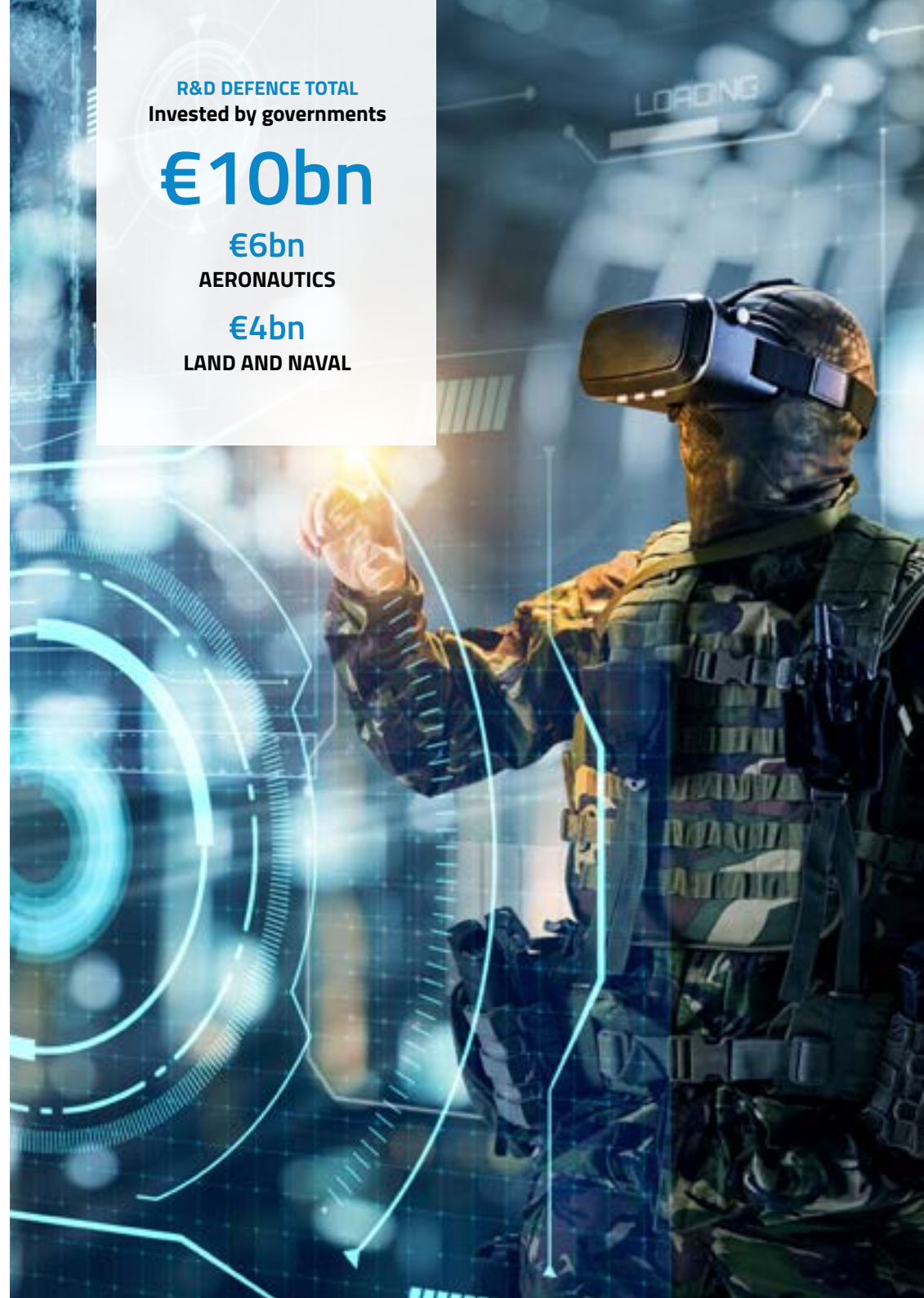
Total R&D Investment Defence €10bn

R&D DEFENCE TOTAL  
Invested by governments

€10bn

€6bn  
AERONAUTICS

€4bn  
LAND AND NAVAL





## Words from the Secretary General

The aerospace and defence sectors are of strategic importance for Europe and its capacity to live up to the challenges of the 21st century. We develop the technologies that matter for Europe's sovereignty and contribute to achieving the Union's climate ambitions.

In 2018, our industry reached a new record: sales growth amounted to 3.5%, with total revenue reaching €246bn worth of state-of-the-art technology, making this industry a champion for exports, thus contributing to the European trade balance and creating prosperity for the European economy. In this regard, I would like to thank the 870,000 men and women employed by our industry, engaged and passionate, who are behind this success story.

Despite these exceptional results, this is no time to rest on one's laurels. Our sector is facing important challenges, such as the new digital revolution and its impact on technologies and skills, increasing trade tensions and the emergence of new, often state-sponsored competitors, which create unfair competition on global markets. With competition only increasing, developing the right strategies is essential to ensure Europe's continued place at the cutting edge of innovation while securing jobs for hundreds of thousands of people in the EU.

Building up the future is at the heart of ASD's commitment. In this regard, our industry is investing massively in Research and Development to keep up



ASD Secretary General, Jan Pie

pace for Europe's success as well as achieve climate neutrality, one of the biggest challenges facing mankind. At the same time, protecting the European citizens and defending Europe's interests and values imply a European industrial base capable of developing the technologies which are critical for the freedom to decide and to act.

The EU's support is crucial in these important endeavours and ASD looks forward to a renewed and strengthened partnership with the EU Institutions, in light of their new mandate.

The 2019 facts and figures set out the strength of our sectors, their contribution to European growth and how industry, government and the EU – working together – can deliver the jobs and exports we need to secure a prosperous future. Let's advance Europe together!

**ASD Secretary General  
Jan Pie**

## About ASD

**ASD is the voice of European Aeronautics, Space, Defence and Security Industries, representing over 3,000 companies and actively supporting the competitive development of the sector in Europe and worldwide.**

## Methodology

The ASD Facts & Figures result from the contribution of the National Associations that are members of ASD, with ASD as a coordinator. In 2018, ASD National Associations members were spread across 18 European countries\*.

The data published in this industrial overview takes into account the following factors: exchange rate fluctuations, different statistical accounting in the UK, unconsolidated data for aeronautics and defence and consolidated data for space. The analysis was conducted using a consolidated process based on crosschecks. The perimeter of this analysis is different from that of the EU, the European Defence Agency or the North Atlantic Treaty Organisation. Due to membership changes in ASD and its members, any year-to-year comparison should be considered in terms of trends and order of magnitude.

The definition of aeronautics includes civil and military aeronautics. In this edition, the aeronautics chapter of this brochure only covers civil activities. The definition of defence combines all sectors, i.e. military aeronautics, space, land and naval. Each sector combines systems, platforms and components,

while electronics and missiles are embedded transversally.

The brochure doesn't specify information on dual use nor the security sector whose perimeter has not yet been fully defined.

All photos used in this brochure belong to ASD members.



\* Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Norway, Poland, Portugal, Spain, Sweden, The Netherlands, Turkey, and the United Kingdom.



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