Aerospace

New materials: carbon fibre

It consists of the design and production of pieces made of carbon fibre in place of heavier materials currently used in aeronautics. Reducing aircraft weight leads to a **significant reduction in environmental impact** (reduction of NO and CO_2 of between 20% and 30%) and **potential savings in terms of fuel consumption**.

Spain can play a **key role in the construction of lightweight aerostructures due to having a strong supply chain** with machinery manufacturers and engineering specialists in carbon fibre, to the detriment of aluminium, a material widely used in the construction of aircraft.

ORIGIN OF THE INVESTMENT OPPORTUNITY

ECONOMIC/BUSINESS | **DEMAND** | **REGULATIONS** | **TECHNOLOGY**

From the point of view of demand, **the world fleet of aeroplanes will grow from 19,500 to 52,600** between 2015 and 2035. Anticipating the environmental impact associated with the increase in air traffic, the European Union promotes the Joint Technology Initiative under the H2020 programme: Clean Sky 2 (€4 billion budget) with the aim of developing more energy-efficient aircraft.

From the business point of view, **the reduction of emissions** (fuel consumption) is a **strategy to minimise costs**, especially because 25% of airline operating costs come from fuel. **The use of composites based on carbon fibre in new aircraft would reduce fuel costs by 30%** to 17% of the operating costs of airlines.

From the technical point of view, the conventional configuration of fuselage and wings has reached its limit in terms of consumption and aerodynamics. Traditional materials are the limiting factor that prevents the construction of new concepts in aircraft. Among other advantages over current materials carbon fibre gives designers more freedom to improve aerodynamics and introduce new designs.

LOCATION OF THE INVESTMENT OPPORTUNITY IN THE SECTOR VALUE CHAIN

Auxiliary industry → **Assembly industry** → **Commercialisation and sales** → **Operators**

The need for carbon fibre to reduce emissions and costs contributed to Airbus' decision to outsource entire sections of aircraft instead of isolated pieces, **forcing suppliers** to adapt their structures to assume, in general, more complex fabrications. Spain has a complete value chain in aerostructures with TIER 1 companies: Aernnova, Aciturri and Alestis (manufacturing systems), and Tier 2 such as Carbures (manufacture of simple parts), which have **competitive advantages** because of having introduced new technologies into their manufacturing processes.

DIFFERENTIATING FACTORS OF THE INVESTMENT OPPORTUNITY

CONSUMER/USER

- Innovation
- Price
- Quality

- With few exceptions, major airlines are regular buyers of long and/or short range aircraft.
- Weight reduction by the including carbon fibre is expected to impact on reductions in fuel consumption and, therefore, **cost savings**.
- Airlines will benefit in the long run for new designs with better performance than from current aircraft.

COMPANY/INNOVATION

- Operations
- Supplies
- New business lines

- The use of carbon fibre creates the opportunity to **transform the old value chain based on aluminium**.
- Opportunities open up, especially for Tiers 1 and 2, because of the decision by Airbus to outsource entire sections and build using carbon fibre, which generates a business opportunity to **open plants** or **adapt traditional plants** designed to work with materials and techniques that are no longer usable with carbon fibre (for example, welding).

SOCIETY

- Environment
- Well-being
- Safety

- The air transport industry is paying close attention to the **growing public concern over environmental problems of air pollution, noise and climate change**. Although aviation currently accounts for 2% of industrial CO_2 emissions, they are expected to rise to 3% in 2050 due to the continued and steady growth of traffic.
- Reducing emissions and protecting the environment is valued by society.

INVESTMENT OPPORTUNITY LIFE CYCLE

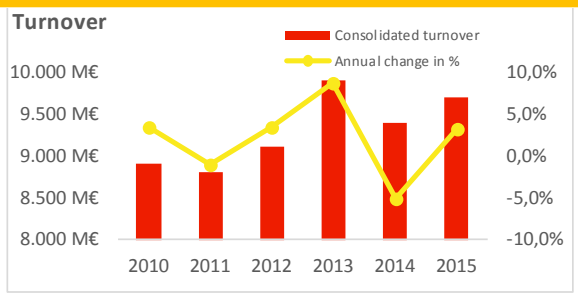
DEVELOPMENT | INTRODUCTION | **GROWTH** | MATURITY

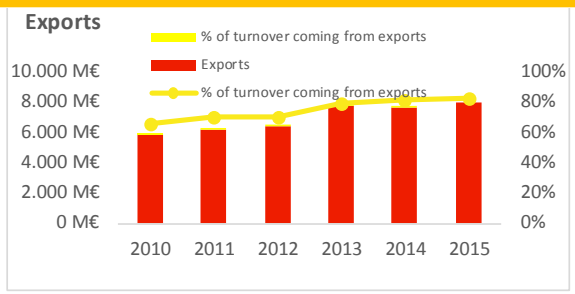
Although manufacturing systems of carbon fibre parts are not capable of producing complex parts in profitable terms and new types of (cheaper) aluminium appear, **carbon fibre material is chosen for its lightness and resistance and with it representing around 50% new long- range aircraft** such as the Boeing 787 Dreamliner and the Airbus A350.

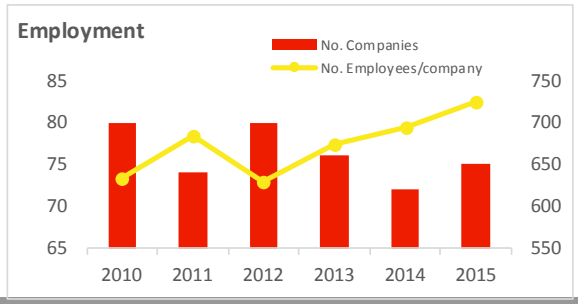
The inclusion of this technology in other long- and short-range aircraft, coupled with the **demand from the wind energy and automotive sectors**, **indicates that the opportunity will experience a phase of strong growth** in the coming years, which will require the entry of new companies and/or high investments for plants to adapt traditional construction techniques of carbon fibre in order to meet demand.

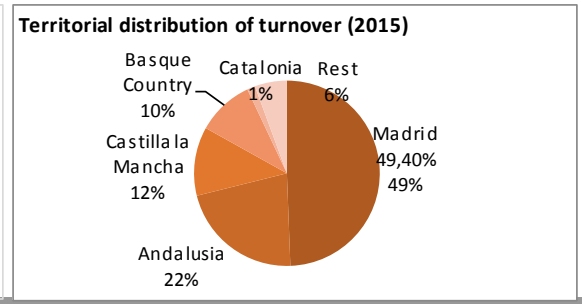
Sources: Zoltek Annual Report (2014). ESA (2015). TEDAE (2015). AIRBUS (Global Market Forecast 2016-2035), www.cleansky.eu.

CHARACTERISTICS OF THE AEROSPACE SECTOR (1)









SUPPLY

TOP 5 COMPETITORS IN SPAIN

#	Company	Net sales	Last available data
1	Aciturri Composites	€138.71M	2015
2	Alestis Aerospace	€141.02M	2015
3	Internacional de Composites	€81.70 M	2015
4	Sofitec Composites	€15.81 M	2015
5	Carbures Aerospace Corporation	€10.68 M	2015

DEMAND

GROWTH

- An industry boom in the manufacture of materials for the increasing use of new composites in industries such as **wind, automotive and transport in general, as well as in aerospace** is expected.
- The composites sector turned over around 17 billion euros globally in 2012, and is expected to grow by between **15% and 20% per year**. Globally, it is estimated that over the next 20 years (2016-2035) 33,000. As a result, it is anticipated that the carbon fibre market in aeronautics will quadruple by 2020 compared to 2010 to reach **42.3 million tons**.

SUCCESS STORIES

Alestis Aerospace is a provider of Tier 1 aerostructures and leader in the engineering and manufacturing technologies of composite materials which is **involved with the most important programmes from the biggest manufacturers in the sector such as Airbus Group, Boeing and Embraer**.
The company produces the "belly fairing" for the **A350** (first time in Europe that the structure is completely covered with carbon fibre) and the tail cone. It has also made 200 pieces out of carbon fibre of the **A400M** rudder. To achieve such milestones, the company invested in new technologies such as the Automated Fibre Placement.

Carbures is a Tier 2 provider and **participates in the construction** of various parts for the tail cone of the 'superjumbo' A380, manufacturing of profiles of military aircraft **A400M and A320neo** and manufacturing of various components for the A350. During 2014, the company acquired a technology that allows the final part of the industrial process of manufacturing aircraft parts in carbon fibre to be done ten times faster.
The company has a presence in **China, the US, Mexico and Europe**. In total, the group has 18 production and engineering facilities in seven countries.

The US company HEXCEL Corporation is one of the world leading companies in advanced composites and is the **largest producer of carbon fibre in the United States**. HEXCEL in Spain has two manufacturing facilities: one located in Parla (Madrid), operational since 1996 and another opened in May 2008 in the town of Toledo Illescas.
The plant at Illescas (2008) is Hexcel's first carbon fibre manufacture plant in Europe. It covers a total area of**45,000 square metres**. The Parla plant has a total area of**15,000 square metres** and makes carbon fibre prepregs especially for Airbus programmes

Sources: (1) "TEDAE 2015 figures." Zoltek Annual Report (2014). ESA (2015). AIRBUS (Global Market Forecast, 2015-2036). ALESTIS (2017). CARBURES (2017). HEXCEL (2017). Eleconomista.com; INFORMA Data Base.

POSITIVE FACTORS FOR INVESTING IN SPAIN

Favourable factors in Spain for the development of the opportunity

Aviation industry among the best in Europe

The Spanish aeronautical industry is ranked **5th in Europe in terms of turnover** and has a high investment in R+D+i at 10% of turnover in 2014. Aerospace is, alongside the biotechnology and information and communication technology (ICT) sectors, the sector with the highest percentage of resources allocated to innovation in Spain. At company level, Airbus defence and space is the **2nd largest manufacturer of military transport aeroplanes and the largest for helicopters in the world**. (2)

Strong composites industry

Spain has the 3rd largest European composites industry after Germany and France. Studies show a growth in the industry in the coming years. This is because composites, among which carbon fibre will be increasingly used by various sectors, not only in aviation (which is the one which most uses it), but also in the wind (second most use) automotive and transportation sectors in general, as well as the transmission of electricity and shipbuilding. In Aeronautics, Spain stands out for designing machines that allow manufacturing of carbon fibre and affordable costs for (almost) any part of an aeroplane.

Tax breaks to boost R+D+i

There are advantageous tax arrangements aimed at making **innovative projects** profitable in Spain. The research and development of technological innovation are subject to a **system of tax breaks** that can reach 42% of annual business spending. The tax system is compatible with domestic and European subsidies such as those from the **Clean Sky 2 programme, part of Horizon 2020**.3)

Social factors and habits

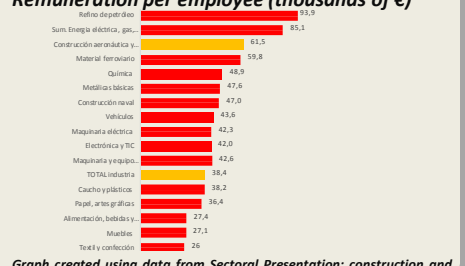
The air transport industry is paying close attention to the growing public concern over environmental problems of air pollution, noise and climate change. Although aviation currently accounts for 2% of industrial CO_2 emissions, they are expected to rise to 3% in 2050 due to the continued and steady growth of traffic. Reducing aircraft weight comes through the introduction of carbon fibre into new aircrafts.

Favourable factors for the sector in Spain

Macroeconomic situation

The **Added Value** of the aerospace sector in 2014 was **1.87 billion euros**, representing 1.47% of the manufacturing sector.
Sector exports totalled **4.68 billion euros**, representing 2.18% of the exports of the industrial sector. (4)

Remuneration per employee (thousands of €)



Graph created using data from Sectoral Presentation: construction and aerospace sector. April 2015. Ministry of Industry, Energy and Tourism

Labour market

The **average productivity per employee** in the aerospace sector is **93,600 euros** per year. Their **average individual remuneration** is **61,500 euros per year**. The **Unit Labour Cost** accounts for **65.7%** of the ratio between the remuneration per employee and the individual productivity (productivity defined as value added per employee). (4)

Incentives

Spain has the **Strategic Plan for the aviation sector 2008-2016**, which includes a framework for aid under the collective name of the **National Aeronautics Plan**. Among the aid programs envisaged, the Strategic Technology, Research, Infrastructure and Programmes standout, as well as the Technology Development Plan for the Auxiliary Industry.
Furthermore, there are other cross-sectional programmes promoted by the CDTI such as the *línea Directa de Innovación*, the *línea de Innovación Global*, *Innvierte* and *FEDER* (ERDF) *Innterconecta*.

R+D+i

There are 33 **innovative companies** in the automotive and aerospace sector and the **percentage** of innovative companies is 64.7%, **spending** a total of 511 million euros on innovation. (5)

Suppliers, Supplies, Raw materials

Spain has a **complete manufacturing chain** including aircraft and systems certification. TEDAE also states that the Spanish supply chain is structured to be able to expand its capacity to supply internationally, highlighting first level suppliers.

Geographic location

Spain is **within reach of three main regions**: the **European** region, the **Mediterranean** region and the **Atlantic** region. Spain is considered to be the gateway between North Africa and Europe, and a key link to Latin America,
not only because of its geographical location but also because of its strong historical and cultural ties with the region. In Spain the **Canary Islands** play a key role with regards to **maritime traffic** with **West Africa**.

Technological and research infrastructure

Spain has R+D+i centres available to the industry. In particular the **horizontal stabilizers centres of excellence** responsible for the worldwide fame that Spain has in their manufacturer. In terms of development of new materials, Spain is **3rd on a European level in terms of turnover** and has an **Airbus Advanced Composites Centre**, one of three centres of excellence across the world for carbon fibre, and the FIDAMC (Foundation for the Research, Development and Application of composite materials).

Spanish airport network.

Graph created using airport locations listed on the AENA l website (2015).

Transport infrastructure and logistics networks

There are **168 airlines** operating in Spain in its 47 airports; its high-speed rail network is the 2nd best in the world and the best in Europe; it is ranked **1st in the EU for its motorway network**; and it has excellent sea connections to its **46 ports** distributed along the Atlantic and Mediterranean coasts. (6)

Sources: (2) Brand Spain, "Spanish Companies in the World" (2016). (3) Alma Consulting Group. (4) MINETUR, "Sectoral presentation: aerospace and construction industry" (2015). (5) Innovation in companies Survey 2016 (NACE 30) (6) Brand Spain, "Foreign investment in Spain and its socio-economic contribution" (2014); Ministerio de Fomento (DGAC): Coyuntura de las compañías en el mercado aéreo en España (August 2016); AENA Statistics 2015.