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 CO₂ 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**

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**

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 fabrics. 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

**COMPANY/INNOVATION**

- Operations
- Supplies
- New business lines

**SOCIETY**

- Environment
- Well-being
- Safety

- 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).

**INVESTMENT OPPORTUNITY LIFE CYCLE**

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.

CHARACTERISTICS OF THE AEROSPACE SECTOR

Turnover

Exports

No. Companies

% of turnover coming from exports

Consolidated turnover

Annual change in %

% of turnover coming from exports

No. Employees/company

10.000 M€

8.000 M€

9.000 M€

10.000 M€

10,0%

-10,0%

-5,0%

0,0%

5,0%

10,0%

2010 2011 2012 2013 2014 2015

2010 2011 2012 2013 2014 2015

10,000 M€

8,000 M€

9,000 M€

10,000 M€

100%

80%

60%

40%

20%

0%

Aerospace

New materials: carbon fibre

SUPPLY

TOP 5 COMPETITORS IN SPAIN

<table>
<thead>
<tr>
<th>#</th>
<th>Company</th>
<th>Net sales</th>
<th>Last available data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Actiturri Composites</td>
<td>€138.71M</td>
<td>2015</td>
</tr>
<tr>
<td>2</td>
<td>Aestis Aerospace</td>
<td>€141.02M</td>
<td>2015</td>
</tr>
<tr>
<td>3</td>
<td>Internacional de Composites</td>
<td>€81.70 M</td>
<td>2015</td>
</tr>
<tr>
<td>4</td>
<td>Sofitec Composites</td>
<td>€15.81 M</td>
<td>2015</td>
</tr>
<tr>
<td>5</td>
<td>Carbures Aerospace Corporation</td>
<td>€10.68 M</td>
<td>2015</td>
</tr>
</tbody>
</table>

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

Aestis 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 Hecel'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.

**Favourable factors for investing 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.\(^{(4)}\)

**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).

**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. \(^{(5)}\)