# Welcome to Nantes


2014 edition

AIRBUS

Airbus

# Airbus



# Airbus Nantes



# A flagship product



# The mechanical sector



# The composite sector



# Innovation



# Skills we are looking for



# Site map

# Airbus figures

Airbus currently has over 7,000 aircraft operating on 5 continents and employs over 61,000 people of 100 different nationalities. Airbus represents more than 83 % of Airbus Group total orders.

## 2013, best year

Turnover : € 39 bn
Deliveries : 626 aircraft
Orders : 1,619 aircraft
Backlog : 5,559 aircraft,
representing 8 years of production
Number of employees : 61,000
Number of customers : 330
Number of suppliers : 1,500

## The Airbus family


**A320 family** (107-190 seats)
Single-aisle, short and medium range
(< 7,000 km)
Launched in 1984


**A330 family** (250-380 seats)
Wide body - long range (9,000 to 15,000 km)
Launched in 1987


**A350 XWB family** (270-350 seats)
Extra wide body - long range (>15,000 km)
Launched in 2006

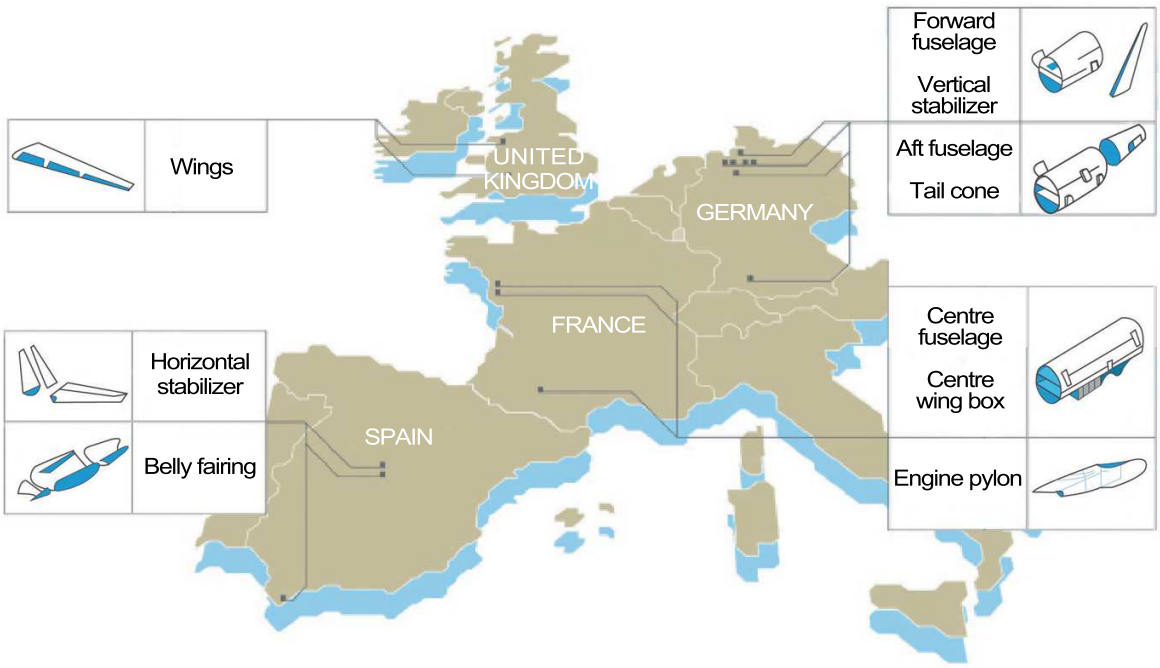

**A380 family** (555 seats and more)
Double-decker - long range (16,000 km)
Launched in 2000

**A400M** - Military aircraft
Launched in 2003


**Beluga** (A300-600 ST)
Aircraft transporting Airbus parts between the european sites
Launched in 1994

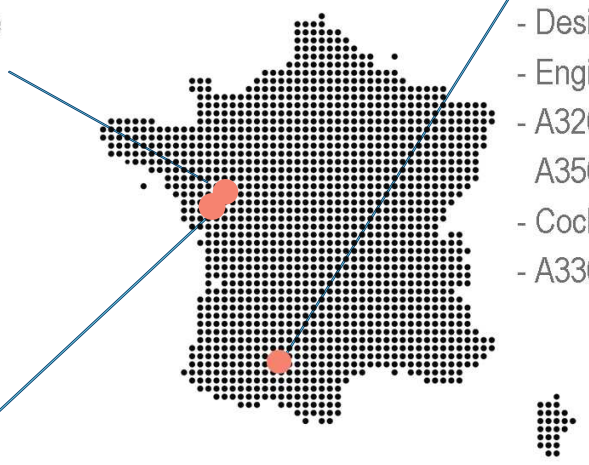
# Production sites

Airbus has 12 production sites in Europe (4 in Germany, 3 in Spain, 3 in France and 2 in the UK) and 1 site in China. A new assembly line is currently under construction in the USA. Each site is responsible for manufacturing aircraft parts, which are then transported to the final assembly lines in Toulouse, Hamburg, Seville or Tianjin.




# Production sites in France

**Nantes** :
- Manufacturing of centre wing boxes, air inlets, radomes, ailerons and keel beams
- Large, light alloy, integrally machined detailed parts
- Structural items in composite materials



**Toulouse** :
- Design office
- Engine pylons
- A320, A330, A380 and A350 XWB final assembly
- Cockpit layout and furnishing
- A330 cabin furnishing

**Saint-Nazaire** :
- Assembly, equipping of nose and centre fuselage

# Airbus in Nantes

Specialised in the manufacturing of centre wing boxes for all Airbus aircraft, Nantes has acquired advanced expertise in the use of composite materials and the machining of large-scale, complex, aluminium alloy parts.

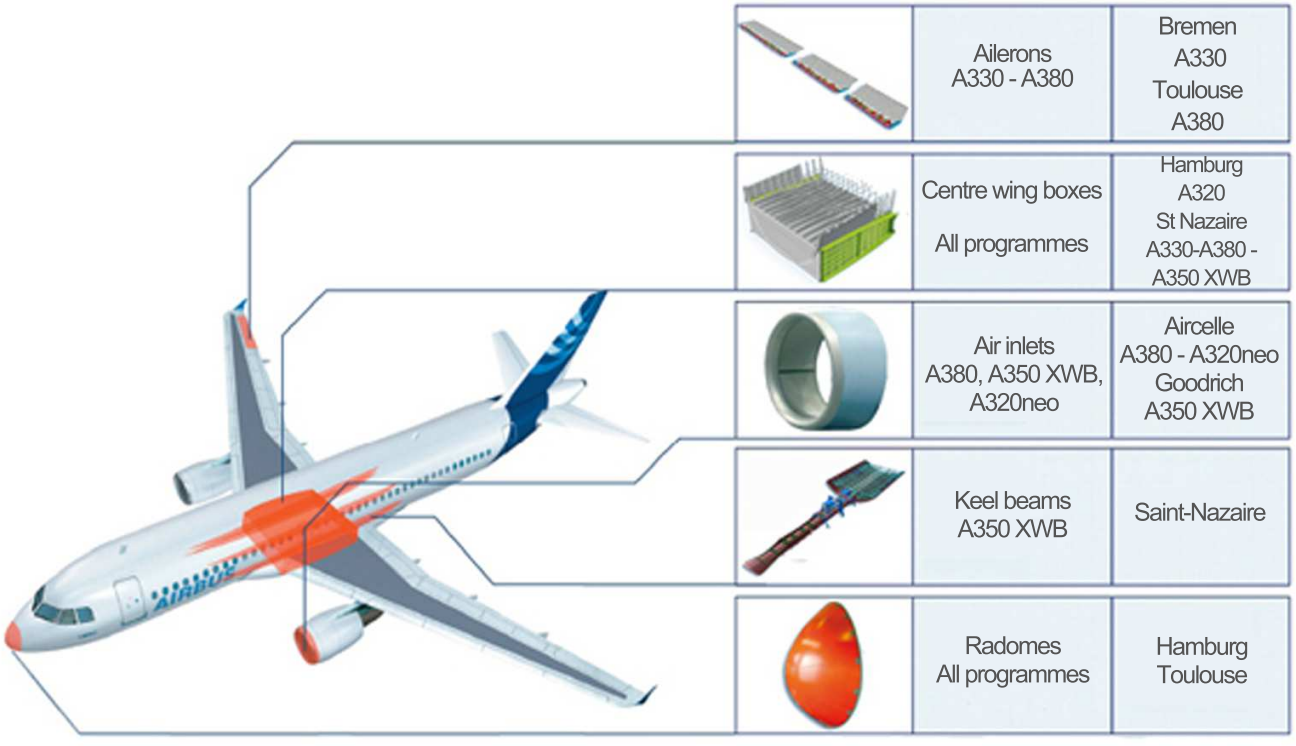
## Nantes key figures

Etablished : 1936 by Louis Breguet
Total surface area : 880,000 m²
Surface area of buildings : 240,000 m²
Number of employees : 2,600
2 industrial centres and 5 production units

In 2013, Nantes delivered :

665 centre wing boxes
135 air inlets
340 A330 ailerons and 174 A380 ailerons
759 radomes
7 keel beams


## Deliverables and customers



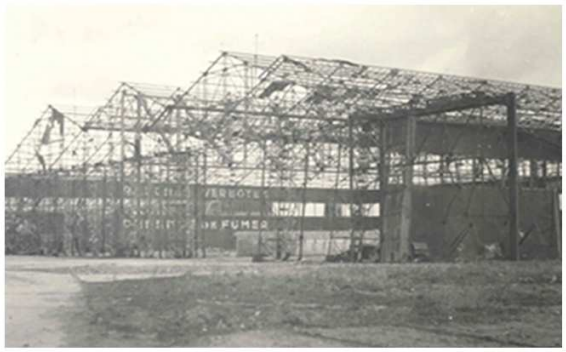
| Deliverables | Customers |
|---|---|
| Ailerons A330 - A380 | Bremen A330 Toulouse A380 |
| Centre wing boxes All programmes | Hamburg A320 St Nazaire A330-A380 - A350 XWB |
| Air inlets A380, A350 XWB, A320neo | Aircelle A380 - A320neo Goodrich A350 XWB |
| Keel beams A350 XWB | Saint-Nazaire |
| Radomes All programmes | Hamburg Toulouse |

# An historical site

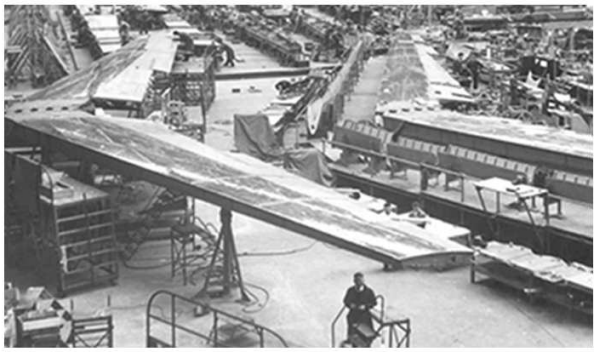
In 2017, the plant will celebrate its 80th birthday. Nantes has come a long way from its first Bloch 210 in the 1930s to today's A350 XWB. Our progress is the reflection of an exemplary aviation heritage.

**July 20th, 1937**
Inauguration of the plant founded by Louis Bréguet

**1940**
Manufacture of the first Bloch 210

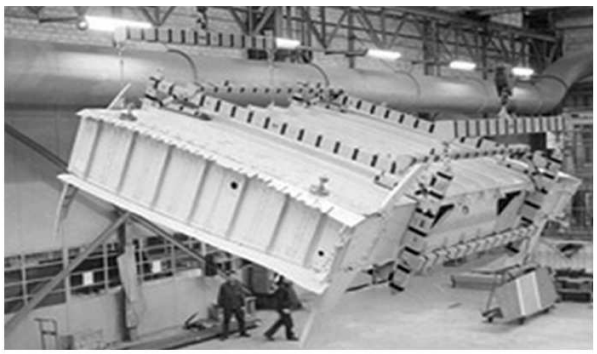


**July 4th, 1943**
Nantes suffers heavy bombing. 80 % of the plant is destroyed



**1956**
Launch of rate production of the Caravelle. In 15 years, 274 wings are manufactured

**May 29th, 1969**
First Airbus programme is launched: the A300B



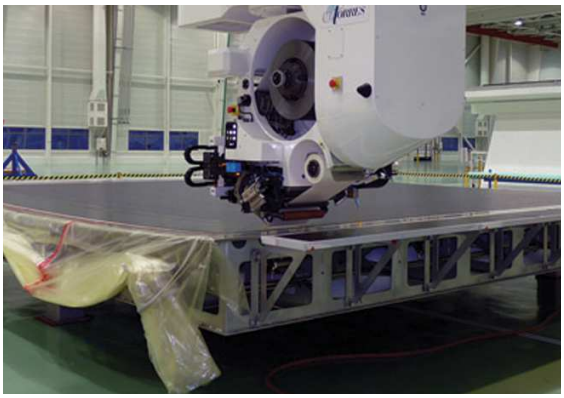
**January, 1971**
Reversal of the first A300B centre wing box, manufactured in Nantes

**July 1st, 1985**
Nantes dispatches the first A320 centre wing box


**February 22nd, 1987**
A320 inaugural flight. The aircraft went on to become a best seller within the Airbus family


**January 23rd, 2002**
Machining of the first A380 parts


**April 27th, 2005**
A380 inaugural flight



**December 4th, 2009**
Lay-up of the first composite plies of the A350 XWB centre wing box


**June 14th, 2013**
A350 XWB inaugural flight

# A flagship product

## The metallic centre wing box



### Nantes' speciality

The Nantes site is specialised in the manufacture of the centre wing box for all Airbus aircraft. Providing the junction between the wings and the fuselage, the centre wing box can bear inflight loads of around 1,500 t.

### Components

The centre wing box is composed of panels equipped with stiffeners, triforms and cruciforms (on the top and bottom skins respectively), spars and ribs, fitting frames and various other parts.

### 2013 key figures

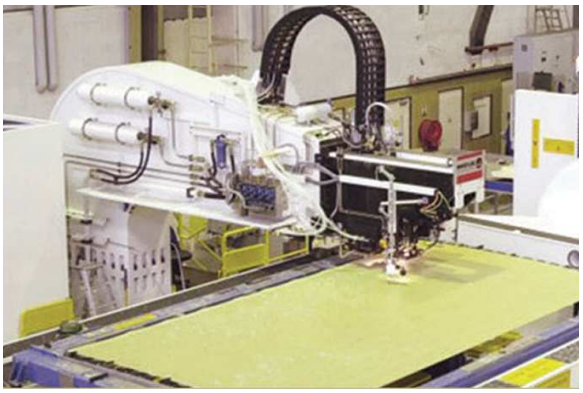
656 centre wing boxes were delivered in 2013, 507 of which are A320, 112 A330, 30 A380 and 7 A350 XWB in addition to 9 A400M (military aircraft).

### Spotlight on the A320neo


The A320neo will enter into service in 2015. The neo improvement programme (new engine option), launched at the beginning of 2011, brings a certain number of changes in comparison to the existing A320. These changes mostly concern the new engines provided by CFMI and Pratt & Whitney, but also the Sharklets, a new blended winglet design which is currently only available as an option. This evolution generates a 15 % decrease in fuel consumption, reduced $CO_2$ emissions and quieter engine noise. It will also increase the aircraft range by 500 NM or the load it can carry by 2 t.

# Assembly process

The assembly of metallic centre wing boxes requires operations such as riveting on panels, sealing, assembly, equipment installation and painting.



## 1. Riveting, the first step

5-axis NC riveting machines are used to attach stiffeners to the panels : they drill holes, place rivets or flatten the slugs under the watchful eye of the operator (the machine can place up to 12 rivets or 6 slugs per minute).

## 2. Assembly of forward and aft panels

Once joined, the triforms are attached to the bottom skin panels (box lower surface) and the cruciforms are attached to the top skin panels (box upper surface).

## 3. Sealing

After the assembly has been cleaned, the whole panel is sealed : the fasteners are covered and sealant is applied to the panel-stiffener interfaces (the centre wing box is also a fuel tank on most aircraft).

## 4. Component assembly

The panel is now ready for general assembly, using the rotaxe machines. In this novel concept, the machine moves along the part : holes are drilled by orbital drilling to avoid axial loads. When the last holes are drilled, fasteners are placed and the centre wing box takes on its finished shape.

# The composite centre wing box

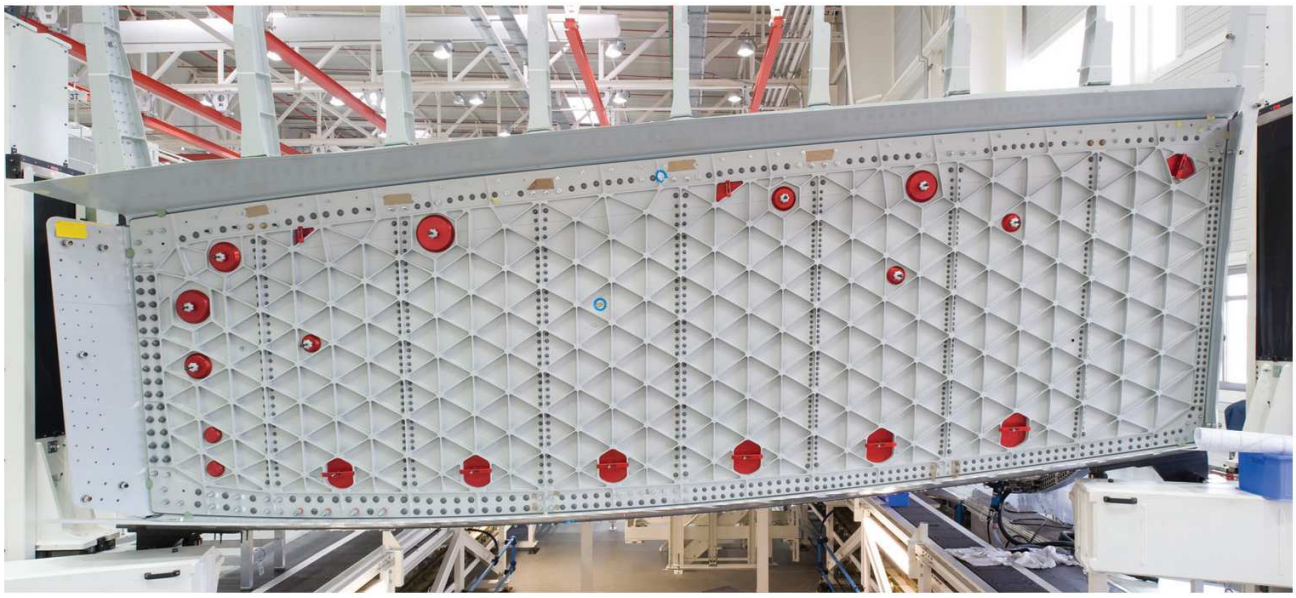
## A composite box

The A380 is the first aircraft to have a centre wing box manufactured with more than 40 % composite materials, while the A350 XWB centre wing box comprises 50 % composites. More resistant to wear corrosion and lighter than metal, the use of composites provides a weight gain of 1.5 t and generates considerable reductions in fuel burn.

In 2013, Nantes delivered 656 centre wing boxes, plus 9 A400M centre wing boxes.

## Holes and fasteners

The holes which are not drilled with rotaxe machines, are drilled with ADU (Automatic Drilling Units) connected to drilling templates. Other drilling machines, more conventional, are also used (drills, boring machines), as well as fastening equipment (bolting, screwing and riveting machines), all pneumatic. Almost all of the 15,000 fasteners are made of titanium, lighter than steel.



## Centre wing box characteristics

| | Weight | Composite % | Length | Width | Weight gain with composites | Number of fasteners |
|---|---|---|---|---|---|---|
| A320 | 1.4 t | 0 | 3 m | 4.4 m | 0 | 15,000 |
| A330 | 8.25 t | 0 | 6.9 m | 6.2 m | 0 | 35,000 |
| A350 XWB | 5.2 t | 50 % | 5.5 m | 6.5 m | -1 t | 15,000 |
| A380 | 11.3 t | 40 % | 6.9 m | 7.88 m | -1.5 t | 15,000 |

# Logistics

## Transporting centre wing boxes

Once the customer company inspection phase is completed, centre wing boxes leave the Nantes site, but not all have the same destination or the same transportation method.

Single Aisle sections are loaded into the Beluga to be transported to Hamburg. Long Range, A380 and A350 XWB sections are delivered to Saint-Nazaire by river or road transport. A400M sections are transported by road to Seville.


## Key figures

In 2013, 498 centre wing boxes were transported to Hamburg and 155 to Saint-Nazaire, 63 by river barge and 92 by road on special convoy.

## Spotlight on customer inspection :

Before leaving the Nantes plant, centre wing boxes are inspected by airline representatives. The inspection phase takes place in a specific building called “The Delivery Centre”.

In 2013, customer satisfaction was over 99.3 %.

# Machining of metallic parts

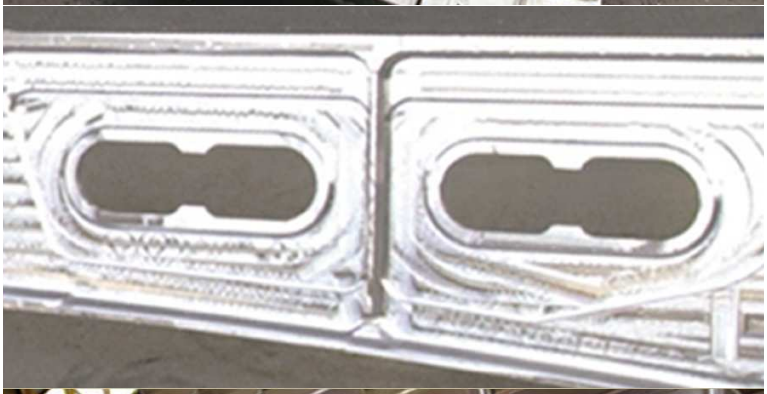
Mechanical machining is the oldest speciality of the Nantes plant. It is used for manufacturing the aircraft's strongest structures from the A318 to the A380.

## 3 families of parts

The parts are divided into 3 families according to their morphology (size and shape) and type (laminated sheet metal or drop forging). All these parts require specially adapted machining on dedicated production lines.

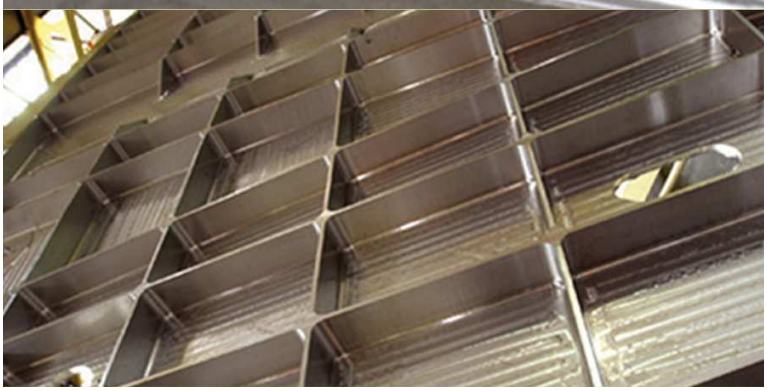
Complex parts

Triforms, cruciforms, aft vertical cruciforms, frames and H and J fittings...



Flat parts

Panels, spars, rib webs...



Pocketed parts

Splices, box beams, fittings, vertical tees, fitting frames and frame 5...

## The manufacturing process

Parts are divided onto 2 production lines: the "J" line for complex and flat parts and the "M" line dedicated to pocketed parts. Parts are manufactured on NC machines, among them the 5-axis high-speed NC machines, and finished by sheet metal workers, genuine craftsmen, before being sent to the surface treatment line.

# Sheet metal work

## Metal craftsmanship

After machining, parts are trimmed and passed on to the sheet metal workers who shape them into the required structures. Manually and technically skilled, sheet metal workers are regarded as metal craftsmen.

## Sheet metal working steps

Parts are placed on a dummy to check for accuracy and to perform any necessary adjustments prior to surface treatment.

## Spotlight on swarf

The mechanical manufacturing unit at Nantes is often associated with swarf, which is produced in vast quantities (up to 800 t per month). The aluminium shavings are the debris or waste resulting from metalworking operations on the NC machines. For every part volume, the machine produces 5 volumes of swarf. All the swarf is recycled to specialised aluminium scrap dealers.

# Surface treatment

## Protection against corrosion

After mechanical machining, surface treatment is performed on parts and panels to protect the metal against corrosion. The surface treatment line treats the aluminium alloy parts machined and assembled at Nantes, such as the centre wing box.

## Surface treatment process

The first step is to clean the parts. Vital parts (class 1) are checked by dye penetrant inspection and highly stressed parts are shot-peened.

All the parts are then treated by anodic oxidation (a process used to increase the thickness of the natural oxide layer on the surface of metal parts and which increases resistance to corrosion and wear, and provides better adhesion for paint primers). Finally, one or several coats of paint are applied.
All the parts are identified with inkjet marking before their transfer to the assembly units.

In 2013, 47 363 parts were painted.

# Layup of composite parts

## The clean room

The clean room is dedicated to layup operations and to autoclave curing of composite detail parts. The purpose of these 2 operations is to obtain composite parts with a light and rigid structure.

## Layup

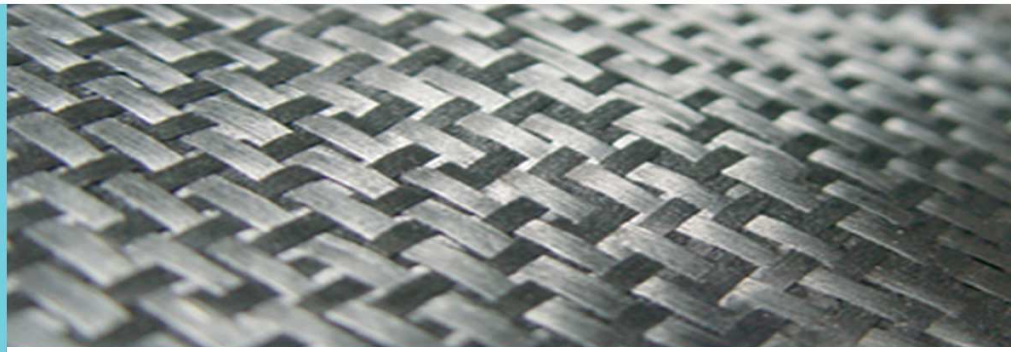
Layup consists of placing successive layers of composite material plies, fibres and thermosetting resin on a mould. The part is built up by the addition of material in successive layers. Layup may be manual (radome) or automated (air inlet).

## Curing

After the layup operation, the part has a shape but is still just a stack of plies with no cohesion. In order to acquire rigidity, the part is cured in an autoclave. This step gives the part its rigidity and final mechanical characteristics.

### Spotlight on composite materials

Composite materials are being used more and more in the aeronautics sector, gradually replacing aluminium alloys. In most cases prepreg carbon fibre is used, in particular for the production of structural parts on the A380 and A350 XWB's centre wing boxes and the A350 XWB's keel beam.



# Ailerons

## Composite expertise

Manufactured using a large proportion of composite material, ailerons contribute to aircraft control and handling, together with the rudder and pitch controls. They improve passenger comfort by absorbing some of the loads on the wings (gusts, turbulence...). Since 1990 Nantes manufactures A330 and A380 ailerons, as well as A380 fittings (aileron spar). In 2013, Nantes delivered 340 sets of A330 ailerons and 174 sets of A380 ailerons.

## A mobile line

Ailerons are assembled and equipped on flexible lines on which the ailerons move according to the operations to be carried out. Once manufactured, the ailerons are transferred to Bremen (A330) or Toulouse (A380) assembly lines.

## Ailerons characteristics

**A380 ailerons** : 6 ailerons per aircraft, composed of 80 % composite (inboard aileron = 105 kg, mid aileron = 115 kg, outboard aileron = 127 kg).

**A330 ailerons** : 4 ailerons per aircraft, composed of 65 % composite (inboard aileron = 99 kg, outboard aileron = 85 kg).


## Components and skills

Manual layup, RTM (Resin Transfer Moulding) process, honeycomb parts, pre-preg carbon fibres, thermoplastics and parts made of aluminium alloy or titanium are some of the technologies used for the production of ailerons.

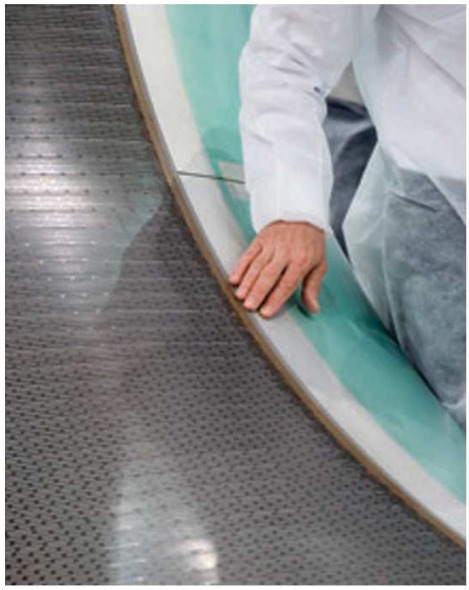
# Air inlets

## Acoustic comfort

The air inlet (or engine nose cowl) is a major component of the aircraft. Located upstream of the engine, it attenuates noise pollution and provides a regular flow of air to the engine. Noise is “captured” in the engine nacelle. Nantes manufactures air inlets for the A380 and A350 XWB (Rolls Royce and Engine Alliance motorizations), and for the A320neo (Leap-X).

## The acoustic liner

The acoustic liner is located inside the air inlet. Its manufacture draws on high-tech composite technologies such as RTM (Resin Transfer Moulding) and the use of materials such as stainless steel fabric, honeycomb and carbon fibre. The acoustic liner is laid up with micro-perforations. It is a « thermoplastic sandwich liner » that absorbs the noise.



## Zero-Splice technology

Nantes developed the Zero-Splice technology patented by Airbus in 2006. This technology reduces inflight aircraft noise by eliminating the assembly joints between the sound-absorbent panel sections lining the inside of the nacelle. With Zero-Splice technology the acoustic liner reduces noise by 4 to 5 decibels at take-off and 2 decibels at landing. This technology is used on the A380, A350 XWB & A320neo.

## 1,000 air inlets already delivered

1997 saw the Nantes plant become one of a very select number of air inlet designers and manufacturers. In the same year, Nantes was awarded the contract to manufacture A340 air inlets. Whereas it took 11 years to produce the first 500 engine nose cowls, it only took 4 years to manufacture the next 500 …

In 2013, Nantes produced 135 air inlets, of which 121 for the A380, 10 for the A350 XWB, 2 for the A320neo & 2 for the A340WBI (spare).

# Radomes

## The aircraft nose

The radome is the first part of the aircraft exposed to the wind. Its solidity and airtightness are therefore primordial for the security of the aircraft. In addition, it must provide maximum « transparency » to facilitate radar vision.

## 3 activities in Nantes

Nantes produces the radomes for every aircraft of the Airbus family. Its position on the aircraft, its design and composition make it a difficult part to manufacture. The radome line has 3 activities: the manufacture of radomes for Single Aisle, Long Range, A380, A350 XWB and A400M aircraft, the manufacture of spare parts and the repair station dedicated to the maintenance of in-service radomes.

## Components

The radome is composed of composite materials, quartz fibres and a honeycomb sandwich structure. Frames and hinges are made of aluminium alloy. Copper strips are installed to provide lightning protection. On the new programmes, the lightning protection strips are situated inside the radome.

## 8,000 radomes already delivered

In March 2014, Nantes manufactured its 8,000th radome. In 2013, the production line delivered 775 radomes, all programmes combined, to customers in Europe : Hamburg, Toulouse, Seville and Saint-Nazaire, as well as to avionics customer support located in Toulouse.

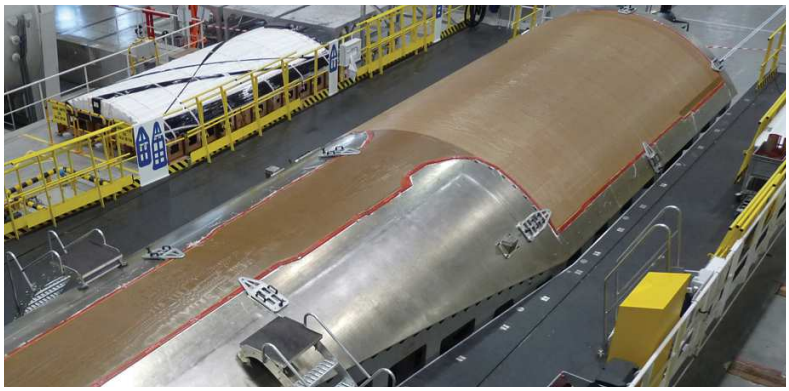
# The A350 XWB keel beam

## A vital part of the aircraft

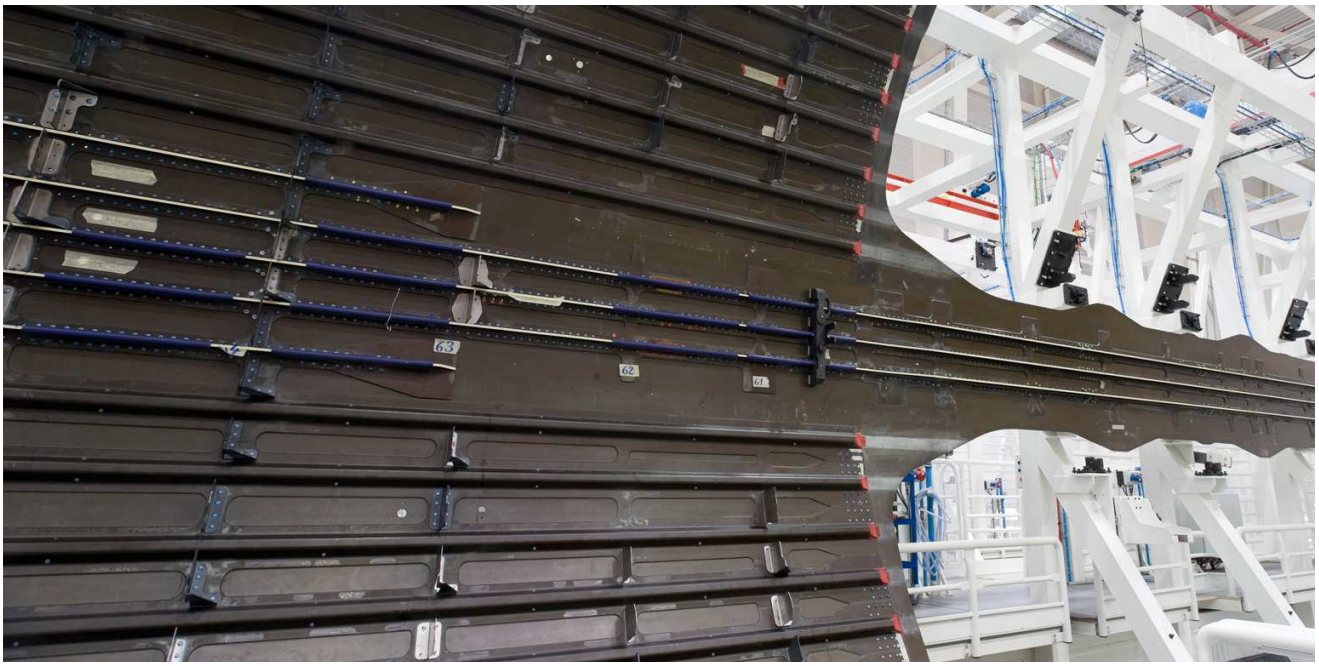

The keel beam provides structural continuity across the main landing gear compartment, which forms an immense hole in the middle of the fuselage. For the first time, with the A350 XWB program, the keel beam and the lower section of fuselage have been merged to form a single major element.

Made up of 70 % composite materials, this huge component (16.5 m long and 4.3 m wide) weighs 1.2 t. Its assembly requires the junction of 2,000 pieces and 10,000 fasteners. 7 keel beams were delivered to Saint-Nazaire in 2013.

## Manufacturing process



The A350 XWB keel beam parts are produced by automated layup (carbon tapes). In all, 400 kg of carbon are laid up on the part. Cured and machined, these parts are then assembled. Once assembly is finished, the keel beam is transported by river barge to Saint-Nazaire.



## A centre of excellence at the gates of Airbus

Airbus pushes back technological boundaries with the application of new techniques in design, development and implementation of new materials and the constant improvement of production processes.

## Research in Nantes

In collaboration with the sites at Filton, Hamburg, Stade and Getafe, the R&T centre in Nantes is an integral part of the Airbus transnational network, dedicated to research and technological development. The centre aims to find new ways to design and produce competitively, through cost reductions and improved lead times, using high-quality materials and taking into account environmental and energy consumption concerns.


## Composite technocampus

The Technocampus is a unique Research & Technology platform dedicated to composite materials, from parts design to production. An active member of the Composite technocampus competitive cluster, Airbus Nantes is one of the major industrial partners of the Composite technocampus, together with Airbus Group Innovation and Cetim. 50 employees of the Airbus Nantes plant work at this platform.

## The Jules Verne Technological Research Institute

IRT JULES VERNE

Laureat of France's Future Investments Programme, the first Jules Verne Technological Research Institute (IRT) was officially established on March 7th 2012 at Nantes, with the presence of the Minister for Higher Education and Research. The Institute is built beside the Airbus plant and aims to attract over 1 000 researchers and as many students. Airbus will undertake research projects on the use of new digital technology to design future factories (automation, augmented virtual reality, etc.); optimisation of industrial manufacturing processes for tomorrow's aviation programmes and reducing the environmental impact of the aerospace industry and development of eco-processes enabling recycling of materials.

# Skills we are looking for

## Assembler-fitter

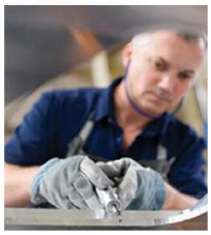
Assembler-fitters produce airframe structural assemblies and sub-assemblies using instruction sheets. They carry out the fitting, machining, adjustment and finishing operations needed for installation.

## NC Operator

NC operators work autonomously using technical documents to produce high precision metal parts, within the prescribed time, on manual or digitally controlled machine-tools.

## Layup technician

Layup technicians produce parts by laying up pre-preg carbon or glass fibre plies. Layup can be performed manually with laser assistance or automatically on layup machines (application of several layers of carbon tape to produce the parts).



## Sheet metal worker

Sheet metal workers shape and weld metal sheets to produce aircraft airframes or engine parts.

## Aeronautical painter

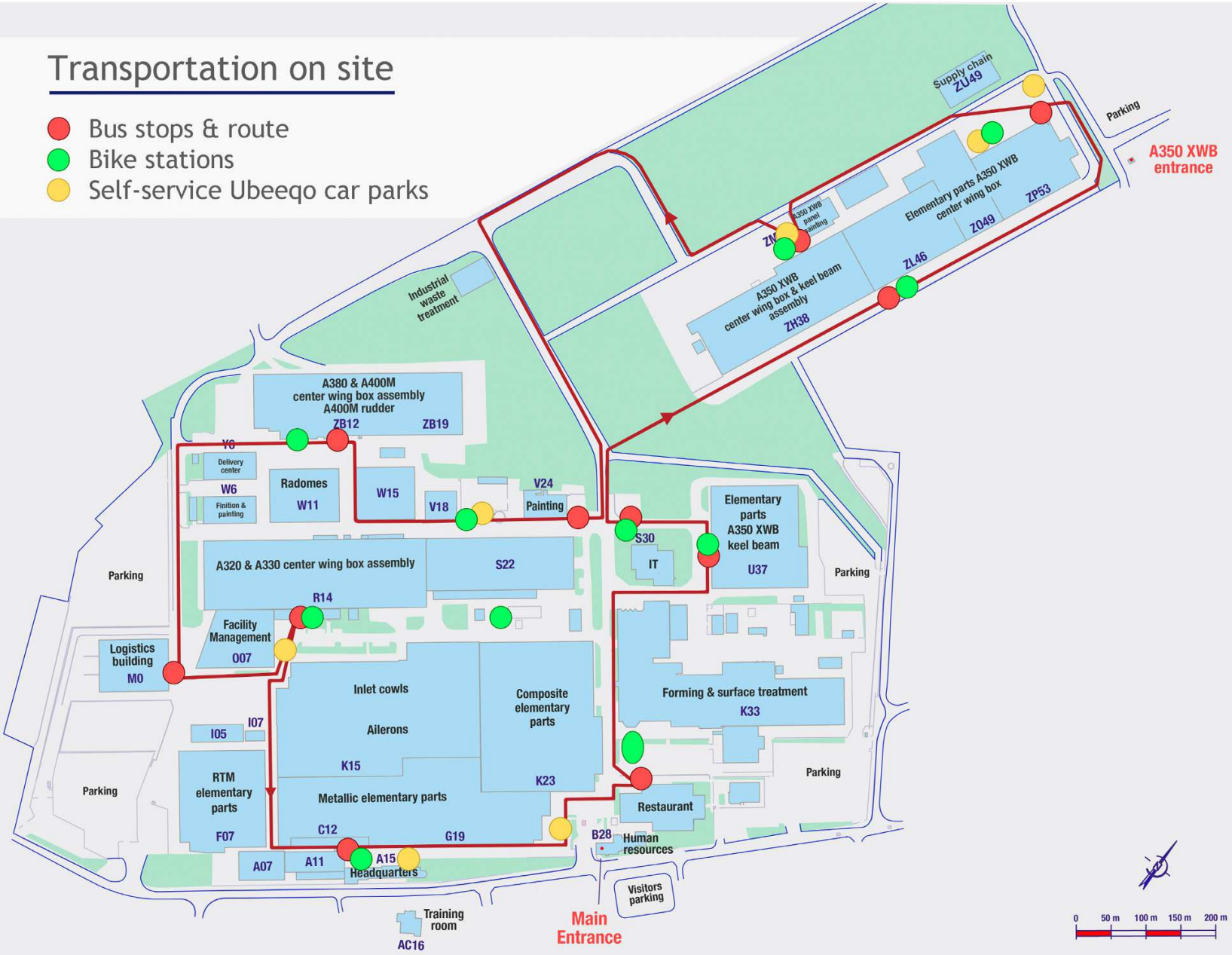
Painters prepare surfaces (sanding and cleaning) and treat them before painting with spray gun.

## Spotlight on handicap


Airbus Nantes promotes jobs for the handicapped. The site works with ESAT establishments to provide positions to people suffering from a handicap. In 2014, the Airbus sign language campaign was launched to increase awareness and improve staff knowledge of sign language : a common word is illustrated every week, by employees, in the internal newspaper. In addition to that, since 2013, Airbus has been sponsoring the skipper Damien Seguin, born with a single hand, and his boat "Des Pieds et des mains".

# Transportation on site

- Bus stops & route
- Bike stations
- Self-service Ubeeqo car parks



# Contact:

Airbus Operations SAS
Nantes site
Rue de l'aviation
F - 44340 BOUGUENAIS
+33 (0)2.51.19.70.00


AIRBUS

AIRBUS OPERATIONS S.A.S. 44340 BOUGUENAIS, France

Concept design by Communication Airbus Nantes. Photos by Airbus S.A.S - Association PNCA Nantes - Sylvain Bonniol - Patricia Bassen f.marchand@baloon-photo.com - Visuelles - Service Communication Airbus Operations S.A.S. , EXM Company: H. Beranger, H. Gousse, P. Masclet, P. Jalby.
Computer renderings by Fixion.
Reference Guide Airbus Nantes. Fevrier, 2013.
Printed in France.