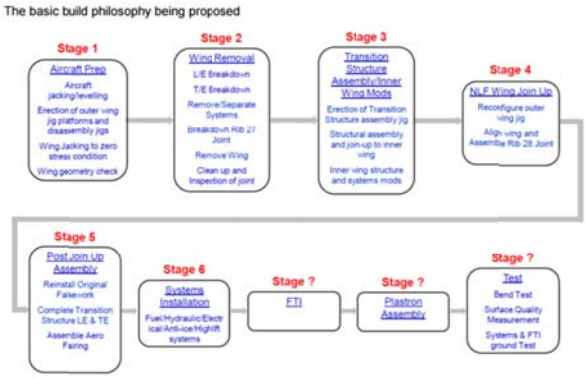
JIF4FLIGHT
PUBLISHABLE SUMMARY

State of the art – Background

The objective of JIF4FLIGHT was to conduct, in combination with JIF2LAND, the development, design, manufacture and installation of platform work and all jigs needed in the different stages or work process for removing the outer wing section of a A340-300 and assembly the SFWA laminar flow flight test demonstrator wings.

The basic build philosophy was:



Objectives

In order to carry out the final objective, several main objectives were proposed:

- How to remove the original outer wing at Rib 27.
- The best solution for the assembly jigs for the transition structure to take into account geometrical differences between standard and new outer wing.
- How to assembly the new outer wing.

Description of work

The work was divided into 5 major milestones (Stage), determined by the defined work process:

1- Stage 1: Platforms and Aircraft position.
2- Stage 2: Wing Removal.
3- Stage 3: Transition Structure Assembly.
4- Stage 4: Wing Join up.
5- Stage 5 : Auxiliary assembly.

1- Stage 1: Platforms and Aircraft position

Airbus defined the position of the airplane inside the hangar and the position necessary for the disassembly of zero strees.

With these values the necessary height of the platforms was defined. Depending on the dimensions of the tools to be used in the following stages, the necessary surface area of the platforms was defined.

Taking into account the dimensional needs already defined and the loads required to support the platforms, the calculations and designs necessary to comply with these premises were made.

Once the final design with the characteristics of dimensions, resistance and stability of the platforms was made, it was produced.

During the manufacture of the platforms, the floor marking of the platform position was carried out inside the hangar. For this purpose, the coordinates defined by AIRBUS were taken and by means of laser measuring instruments the position marking the platforms.

After the manufacturing and quality control of the platforms, the shipment to TARBES proceeded, once in the hangar the components of the platforms were assembled following a previously defined process.

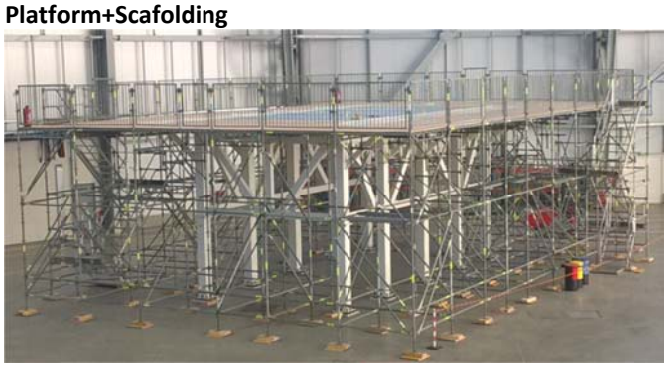
After the assembly was completed, a laser measurement was carried out to bring the platforms to their final position by means of the elements that were designed for the regulation of the final position.

Once the final inspection of the platforms was carried out, the auxiliary platforms were installed (Scafolding). These auxiliary platforms have the objective of creating a larger work surface to cover all the operators' needs during assembly, as a place for Manual machines, tools, airplane components, workbenches, ladders, etc., etc.

The auxiliary platforms also have ladders and balustrades to access the platform and provide the necessary safety for works at height.

Platform

Platform+Scafolding



Before going to Stage 2, AIRBUS entered the hangar, it was necessary to dismantle the two outer motors of each wing and the pylons to be able to position the airplane with the wings on the platforms.

The plane was positioned in the marked position in the layout and the lift towers were placed to take the plane to zero stress position. From that moment on, Stage 2 was started.

2- Stage 2: Wing Removal.

Working with the AIRBUS specifications for the current product, the necessary tools were defined and designed to carry out the disassembly of the wings from the RIB 27.

For this process of disassembly of the wing the following tools were realized:

A) Tables of extraction: These jigs served to hold the wing and to be able to separate them after the cut.

B) Support RIB 28: This support assures the position of the wing that remains uncut.

C) Sling and component support.

D) Tools for the cutting of the wing as the tools of separation and the breakage of spars.

Once fabricated, assembled and measured in Aritex were taken to TARBES, the first step was to mark the positions of the extraction tables on the platforms, in the verification of the positioning a revision of the zero strees of the wings was realized and it was seen that the aircraft position was not correct. From this situation different studies were carried out to assure the new position of zero stress and to modify the different tools and to get to the wing without problems. After the necessary modifications the extraction tables were fixed to the corresponding wing.

Once the wing was fixed to the extraction table, the final position verification was carried out.

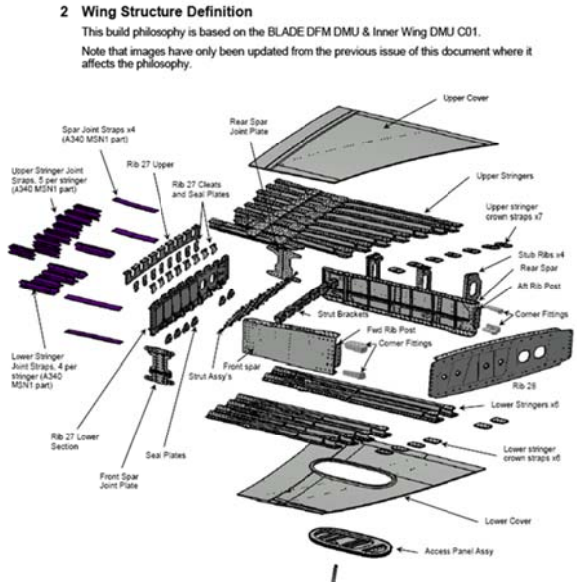
Once the wing was fixed, the ribs were detached and then cut in the required area. The initial separation was performed with separation tools and the final separation was performed with the extraction table.

Wing attached to extraction table

Cut wing

3- Stage 3: Transition Structure Assembly.

In Stage 3 the tools and elements necessary for the assembly of the Transition Structure were realized.



These elements were:

- Transition Structure Assembly Jig - PORT and references.
- Routers Jigs for TE Stub Ribs - PORT & STBD
- For lifting upper and lower covers
- Hole finder tool
- Covers; Line-side holding fixture
- Rib 28 Upper Profile Former Board
- Rib 28 Strongback
- Drilling Templates (approx. 80).
- Tooling for spar separation (Covers)
- Rib 28 Alignment tool.
- Hole Finder - Inboard Upper Stringers - Crown Straps - Port / Starboard.

Before the assembly of the Stage 3, the cut wing and the tools of Stage 2 were dissasembly to make space for the tools of Stage 3.

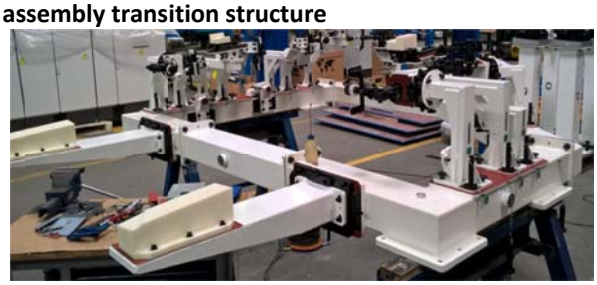
After the changes in the Transition Structure Assembly Jig - PORT and references were made, due to the change in zero stress aircraft position, assembly and measurement were performed at Aritex.

Before reaching the tools to Tarbes, in conjunction with AIRBUS the measurement was made for the final location of the tools.

Once measured, the assembly and final measurement of the tools were carried out.

From that moment AIRBUS realized the complex assembly of the Transition Structure using the rest of usefuls arranged for the different phases of the assembly process.

Jigs assembly transition structure



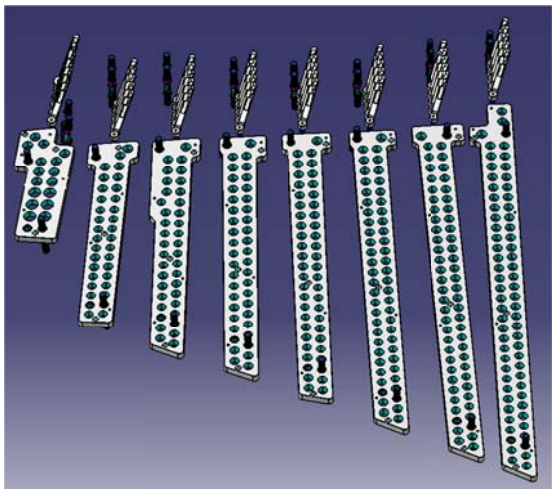
Support and for lifting upper and lower covers cover

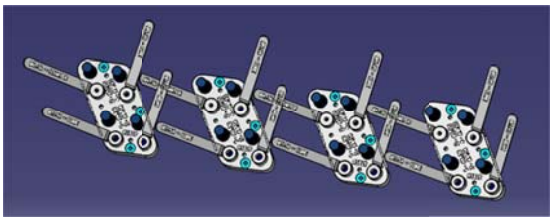
Others Jigs

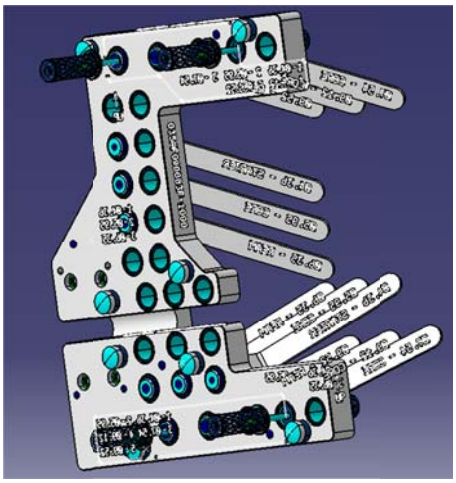
An important milestone to highlight was the quantity (39+39) and quality of drilling templates needed to complete the entire assembly process, these templates were made for different drilling processes.

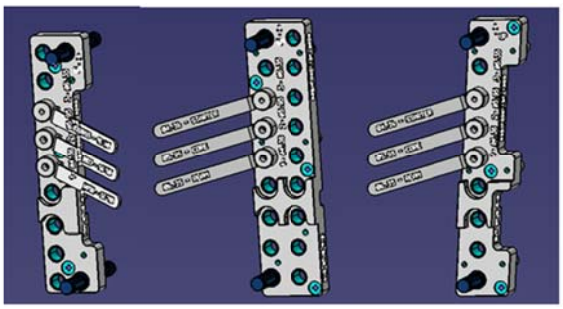
035AF000075F 035AF000076F	L/E Spar Joint Plate - PORT& STBD	1	1+1	Manual Drilling Preferred
035AF000083F 035AF000083F	T/E Spar Joint Plate -PORT& STBD	1	1+1	
035AF000115F 035AF000116F	T/E Stub Ribs x 3 -PORT& STBD	3	3+3	Manual Drilling Preferred
035AF000119F 035AF000120F	T/E Falsework Stub Rib -PORT& STBD	1	1+1	
035AF000123F 035AF000124F	Lower stringers to cover drill templates	6	6+6	ADU Drilling (CC Preferred)
035AF000131F 035AF000132F	Upper stringers to cover drill templates	8	8+8	ADU Drilling (CC Preferred)
035AF000139F 035AF000140F	L/E Spar to lower cover drill templates	1	1+1	ADU Drilling (CC Preferred)
035AF000143F 035AF000144F	T/E Spar to lower cover drill templates	1	1+1	
035AF000179F 035AF000180F	L/E Spar to upper cover drill templates	1	1+1	ADU Drilling (CC Preferred)
035AF000183F 035AF000184F	T/E Spar to upper cover drill templates	1	1+1	
035AF000079F 035AF000080F	Lower Otbd Crown Straps Rib 28 to stringers 12 - 15	4	4+4	Manual Drilling Preferred (access)
035AF000087F 035AF000088F	Lower Otbd Crown Straps Rib 28 to stringers 18, 19-	2	2+2	
035AF000095F 035AF000096F	Upper Otbd Crown Straps Rib 28 to stringers 11 18-	7	7+7	Manual Drilling Preferred
035AF000397 035AF000398	Upper cover to T/E Falsework Mid stub rib - Port/Starboard	1	1+1	Manual Drilling Preferred
040AF000399F	Hole Finder - Inboard Upper Stringers - Crown Straps - Port/Starboard	1	1+1	Manual Drilling
	TOTAL QUANTITY - STAGE 3	39	39+39	

Some Drilling Templates









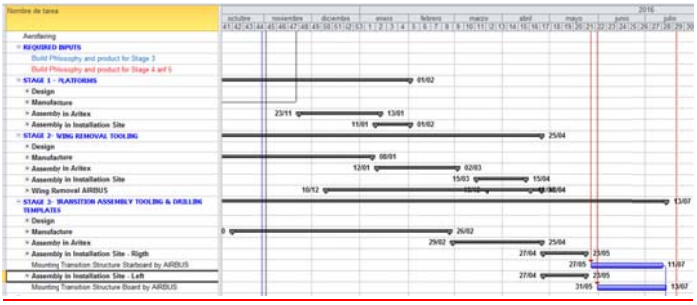
Results

a) Timeline & main milestones

JIF4FLIGHT was initially scheduled to finish end of 2013. However the challenges arising from the BLADE led to revisit the initial plan to accommodate with the delays encountered by the overall programme.

Specifically, the complexity of the work led to limit the activities within JIF4FLIGHT to the first 3 Stages, the Stage 4 & 5 being addressed by JIF2LAND project.

The final planning of JIF4FLIGHT is depicted below. Design and manufacturing activities resp. for Stage 1, 2 & 3 culminated in the delivery and assembly on-site resp. in February, April & July 2016.



b) Environmental benefits

Our direct contribution has been based on creating a productive process for short series jigs with an efficient cost. A process of disassembly and assembly for short production and very specific that has given us new ideas and concepts for this type of operations, which will imply an effective final cost and solutions that contribute to the sustainability of the environment.

The jigs made are 100% recyclable materials and in the final stage of the project will seek their re-use in other applications.

The main environmental impact of the project does not lie in our contribution to it, but the final result of the project, the final objective, is the step to test the laminar flow in the wings. This Blade test will give a wide spectrum in energy saving and environmental care and will be a clear and palpable example of the objectives achieved.

c) Dissemination / exploitation of results

The dissemination will be effective when the contribution of JIF4FLIGHT (and JIF2LAND) to BLADE will be known i.e. after completion of the aircraft assembly. As such a specific dissemination will be made by mid/end 2017. The results and development of the project will be widely disseminated throughout the aeronautical community, as well as other potential sectors.

The technical results and knowledge acquired are already being used by our technicians in other aeronautical market projects.

d) Communication

The dissemination of the expected results of the project will be carried out in conjunction with the completion of the project, ie at the end of JIF2LAND as it complements the main project (JIF4FLIGHT).

Figure nbr: Title

Project Summary

Acronym:	JIF4FLIGHT
Name of proposal:	Final Assembly Line Assembly Jigs and Fixtures for flight test demonstrator
Involved ITD	Smart Fixed Wing Aircraft ITD
Grant Agreement:	298114
Instrument:	Clean Sky
Total Cost:	1.999.320,-€
Clean Sky contribution:	
Call:	JTI-CS-2011-02-SFWA-03-009
Starting date:	03/01/2012
Ending date:	02/08/2016
Duration:	42 months
Coordinator contact details:	Alex Mateu alex.mateu@aritex-es.com
Project Officer:	Sebastien DUBOIS (CSJU) sebastien.dubois@cleansky.eu
Participating members	ARITEX/EURECAT