

KEYNOTE ADDRESS
CFRP FOR FUTURE AIRBUS FUSELAGE STRUCTURES

M. W. Kolax
Airbus Deutschland GmbH
21129 Hamburg

STRUCTURES ENGINEERING; PRESENT POSITION – AND HOW TO WIN THE FUTURE

The compass card of aircraft engineering is determined by cost and weight.

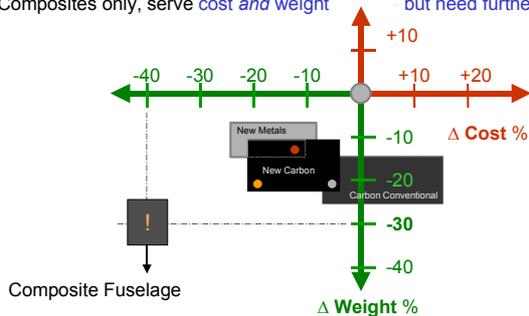
Over a long period, metals and composites were in contest, to contribute to both points. Modern Airbus aircraft structures mirror the present state. Close to twenty percent of structures weight is composite material. It is used in all movable parts of the wing and the lift system, in the complete tail planes and also in primary parts of the fuselage, such as keel beam or cabin pressure bulkheads.

Nowadays, aluminum technology got a push by laser beam welding, advanced shaping and modern casting technologies.

If we succeed in realizing these metal potentials midterm, the perspective of their cost/weight-savings is not so far away from those of given composite capabilities.

- General trend : Low weight is important
- Metal technology can serve that trend
- Composites only, serve *cost and weight*

- but is ruled by Low Cost
- but is limited mid-term
- but need further R & D



- Advanced low cost materials
- Automated manufacturing techniques => lay-up and assembly
- New concepts with high level of integration

Figure 1. Global technology trends

The period of extra economic benefits, submitted by welding, is limited by the point, when it will become common knowledge on global markets. Ten years, more or less, are expectable.

And then?

A new technology is needed, to give Europe a competitive edge.

Composite materials are the only candidates to create and provide improvements beyond the scope of metal potentials. To open-up the given potentials, further R&D is indispensable. Coordinated interaction between industry, technology,

research and science is the key to economic success. The present culture of strong controlling companies' internal running costs is fine and necessary – but not sufficient to win the future. Deeper knowledge and unique capabilities will determine the European chances of up-coming transatlantic competition.

NETWORK: INDUSTRY / RESEARCH / SCIENCE

We had a certain period of stagnation concerning the rapid introduction of large new CFRP-Parts.

The switch to CFRP bulkhead or CFRP keel beam was more or less a matter of daily business. To a wide extent, this is caused by the fact, that most of individual minor airframe components of the aircraft are already in composites. What is left, is really a big step, that needs some time to be prepared; the complete composite fuselage.

Now, we are facing this challenge as well.

During the last years, this topic was handled mainly in France, Germany and Spain by national technology projects.

With the merger of Airbus, it became a European item of high significance.

Attribute of the German share is the well developed national network of industry, research and science. DLR and its institutes are prominent partners of Airbus.

MOTIVATION OF AIRBUS

During the last decade, Airbus grew into the number-two-position of global market airframe manufacturers. To a good share, this is based on an always far-sighted strategy in structures engineering. Especially in the field of materials and processes.

The success of Airbus puts the remaining competitor in the serious position of defending his traditional significance on world markets.

This resulted in an stronger-than-ever-contest, driven by cost and performance.

The biggest US-manufacturer of commercial aircrafts will replace his fleet within the next ten or twelve years. All-composite fuselages and wings were already announced. It was stated, composites will provide ways and means for extraordinary improvements in both, performance and cost savings.

Given situation demands a strong and stable technology strategy in Europe and in Airbus Germany. And this is, what our well established interaction between industry and science is in charge of.

WHAT DID WE ACHIEVE – WHAT'S LEFT TO BE DONE

DLR is prominent partner of Airbus technology efforts.

Further more, the associated project *Schwarzer Rumpf* – supported by HGF - accompanied the industrial fuselage program in significant aspects:

- Concurrent engineering – the way of working
- Structure Analysis – Drivers for design and performance
- Large scale manufacturing - component realization
- Demonstrator – 1:1 representative of new ideas
- Environmental impacts of new technologies

From the viewpoint of Airbus, the united fuselage community achieved two relevant targets.

First: An independent fuselage concept study – *gondola concept* – was performed. It kept an eye on the entire story, from integrated design up to in-service behavior. It is compatible with classic CFRP architecture and with our favorite double shell design as well.

It was refined to chosen, strong requirements, e.g. structure mechanics, crash and cargo transportation.

Schwarzer Rumpf was determined to develop a new and far-sighted view on future airborne transportation of passengers and cargo and met this target in excellent manner.

Second: Fundamental scientific work, done in analysis and theoretical studies, serve of course valuable inputs also for midterm composite fuselage design suitable for ANTA and ANSA, the pre-designations of probably up-coming new Airbus family members. Airbus is confident to implement

scientific results of *Schwarzer Rumpf* with advantages into the projects.

Till then, we continue our productive network hopefully during a LuFo III and a complementary EU 6TH Framework aiming at a simplified but full scale fuselage validation test vehicle, supported by all Airbus sites and their relations to national science and research – this time not in competition, but in community.

. . . TO BE CONTINUED

For the first composite spoilers, installed on a VFW 614 plane, we needed several years of development. The CFRP vertical fin – largest part of its time – took approximately ten years. We learned everything about carbon wings, ready to be installed on a Airbus 400M, since 1988. All those structures were, are or will be a success.

Taking the severity of a complete pressurized composite fuselage into account, it would be illusionary to expect to make targets meet within short distance.

Today we can say, we are hopefully more than thirty percent down the road. The targets are eight or ten years ahead.

In the meantime our work produces a permanent stream of results, suitable also for the running series production of CFRP parts. The project *Schwarzer Rumpf* is an example, providing several ideas, scientific data and methods of working.

And it turned out to be well. In continuing this, we can not fail. The best way to predict the future, is to create it.

On behalf of the Airbus fuselage community we wish all the best to this workshop, may it be successful.