Fuselage One piece Barrel. History of a product technology revolution
ABSTRACT

In the past commercial aircraft fuselages have always been built using aluminum. The manufacturing process starts from flat sheets, that are rolled, chemical milled, drilled and riveted to longitudinal and circumferential stiffening parts. Finally a fuselage barrel is built riveting together a certain number of stiffened panels. Starting from the beginning of the process, a big number of different operations is needed. Some of them can’t even be automated. The consequent recurring cost is high and the flow time long.

From a structural point of view, a conventional aluminum airplane has fatigue and corrosion problems. An Airline will have to spend time for maintenance instead of flying the airplane and making money.

The fuselage inside pressure and the moisture level can’t be the same to the ones on the ground, causing breathing problems to the passengers, in particular during long flights. Windows are narrow, and the outside view is limited.

The airframe weight is the most important driver to determine the capability to carry paying loads and the range of an airplane, and it has to be as much light as possible.

This was the historical back ground when The Boeing Company, together with primary Partners such as Alenia, decided to do a trade-of study in order to understand which was the most convenient technology to build the most interesting airplane for the airlines.

All the most important Aerospace Companies in the world have been involved in this study. During the trade study three different technologies have been analyzed for the fuselage barrel: innovative aluminum alloys, fiber-metal-laminates and graphite.

The graphite solution won the trade off study, because composite materials are lighter, less prone to corrosion, and they don’t have fatigue problems.

In addition to the structural advantages, composite materials give the possibility to produce large co-cured structures such as a complete barrels. The decision to build a fuselage barrel as one co-cured part has been taken right after the decision to use the graphite.

One Piece Barrel Technology, takes not only the maximum advantages from composite material strength/weight, but is a completely innovative manufacturing concept. In order to have acceptable recurring costs and ensure the process quality/stability at the highest production rate, it is necessary an high automation level. The one piece barrel technology is the winning solution to build composite parts with a very high automation level.

Making a summary, One Piece Barrel means: fewer joints, fewer pieces, fewer fasteners, reduced assembly time, overall workflow reduction, lighter weight, airlines competitive advantages (lower operative costs, lower maintenance costs, longer operating life, lower fuel/passenger).

This are the reason why more then 800 airplanes have been sold before the first flight.

A development phase has been lead by Boeing at the Developmental Center in Seattle. All the Partners have been involved, taking advantage of the working together.

The feasibility of the One Piece Barrel technology has been demonstrated, and all the primary process concepts have been developed. Using this concept not only the airplane has been designed, but also the industrial production line.

While the development and engineering team was working in Seattle, all the Partners were building around the world the production Plants.

Only two years after when the first development barrel has been fabricated in Seattle, the first production Barrel has been built in the AleniaAermacchi Grottaglie Plant. An incredible short time for a so big product technology revolution.