

# INNOVATION

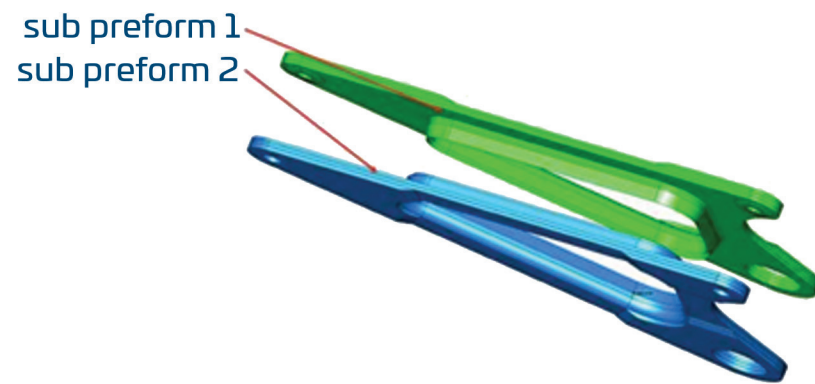
Gear Parts (NSLGP)

## The NSLGP project innovation results were :

- Option for automated process –using innovative technology TFP (Tailored Fibre Placement) for the door linkage and FW (Filament Winding) for the door rod (minor handwork of fabric layup).
- "One shot part" after injection – using one preform door linkage.
- Assembly without extra machining- assemble door linkage preform and bushings before the RTM process (save extra machining).
- Optimization of manufacture process (using two plates with overlap technology to prepare one assembly of preform for RTM injection) as shown below.

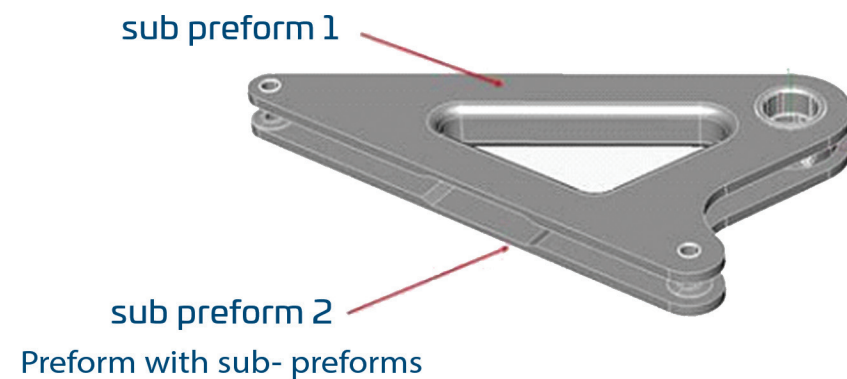
## Initial step for the overlap technology

Layer geometry  
description sub- preforms



## Final step

Layer geometry



# MEET THE CHALLENGE

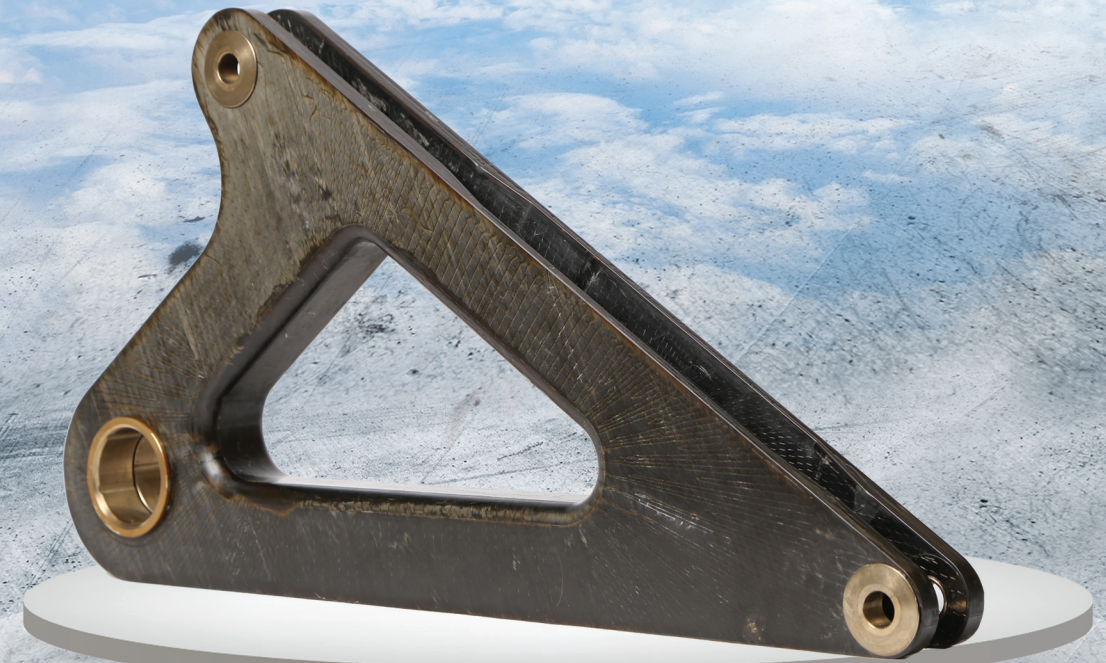


*Where Courage Meets Technology*

**CirComp**  
Competence in Composites

CIRCOMP GMBH

**Non Structural Landing Gear Parts  
(NSLGP)**



# Gear Parts (NSLGP)

The objective of the EU project NSLGP (Non Structural Landing Gear Parts) was to develop, manufacture and test non-structural landing gear parts for regional aircrafts based on advance carbon fiber material system.

In this project, Liebherr Aerospace GmbH was the Topic Manager and collaborating with Israel Aerospace industries (IAI) and CirComp GmbH. The target of this project was to achieve weight reduction, serial low cost production, and capability of the parts to integrate in automatic manufacture process.

The main output from the project was fully demonstration the technology and manufacturing of composite parts door rod and door linkage with advantages of reducing manufacturing costs and weight in comparison to metal parts, by selecting the right manufacture technology and optimized design methodology.

**The conceptual approach for low cost product was depends most of all on the preferred technology stream concerning the following parameters:**

- Integration to automated manufactures process.
- Using aerospace approved material and process.
- Design optimization and assembly simplification.

## Door linkage

Israel Aerospace Industries (IAI) has a proven track record of in-house design and development of a family of business jets as well as a wide range of other aerospace products. This includes all necessary design, analysis, testing, certification manufacturing and assembly capabilities for composite structure. Most importantly, over the past 60 years IAI has been dealing with the challenging task of optimizing structural cost, safety and weight for low volume production of relatively small aircraft, one of the main objectives of the present strategic topic.

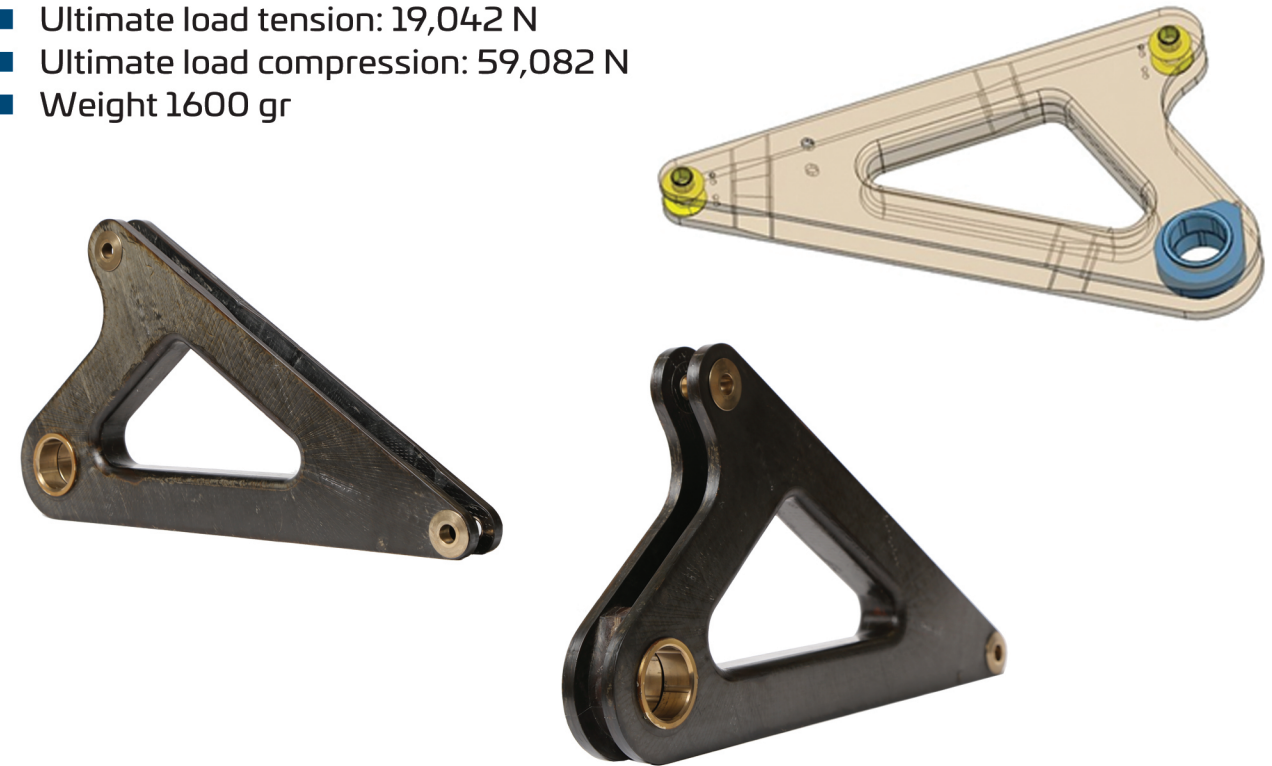
Nowadays IAI develops, manufactures, and tests non-structural complex parts for landing gear with the support of the EU CleanSky Framework. RTM (resin transfer moulding) technology used in the manufacture process with special complex tools and can be adapted for automatic production. In this project, IAI is combining tailored fibre placement (TFP) and RTM technologies, design and fabrication.

**The advantages of this process are:**

- Freedom to design any fiber orientation allowing for a much high optimized and efficient design
- Reducing weight and cost (by reducing scrap material)
- Reduction of manual work while producing a repeatable layup

## Key facts of the door linkage:

- Width: 38.1 mm
- Length about 420 x 250 mm
- Ultimate load tension: 19,042 N
- Ultimate load compression: 59,082 N
- Weight 1600 gr



## Door Rod

**CirComp** manufactures customized components from composite materials by using the CNC controlled filament winding, thermoplastic pultrusion or resin transfer moulding (RTM) process. Throughout many years CirComp has gathered outstanding experience and know how in the field of manufacturing components from composite materials. CirComp is certified according to ISO 9001:2015, EN 9100:2018 and Nadcap. One of our latest aerospace developments is a composite AIRSTRUT® for opening the landing gear doors of airplanes. The strut is characterized by its slim design in the area of force introduction and the high buckling stability in the center of the component. The load introduction is achieved by a form-fit connection. Compare to the approved aluminum rod the weight saving of the composite door rod is about 50%.

## Key facts of the door rod:

- Eye to eye length: 1.302 mm
- Outer diameter in the rod center: 38 mm
- Outer diameter at the rod body end: 26,2 mm
- Ultimate load tension: 17.466 N
- Ultimate load compression: 12.664 N
- Weight 624 gr

