ROTORCRAFT ACCESS PANEL FROM RECYCLED CARBON PPS

World's first flying fully recycled thermoplastic composite application in aerospace.

KEY ASPECTS

1. Fast out-of-autoclave process: cycle times of minutes
2. Net-shape manufacturing of complex geometries
3. Recycling both thermoplastic matrix *and* fiber (i.e. full material)
4. Substantial weight reduction
5. Double-digit cost reduction

ACCESS PANEL AS MOUNTED AND FLIGHT TESTED ON ROTORCRAFT

APPLICATION

An integrally-stiffened access panel door was selected for detail design, testing and actual flight to demonstrate a novel recycling route for thermoplastic composites. The strategy relied on recycling post-industrial scrap from the manufacturing of thermoplastic composite ruddervators for a rotorcraft into access panels for the same aircraft's V-tail. This scenario helps to control the traceability of the recycled access panel door and scrap material.

This part has made its first flight on a rotorcraft in autumn 2019 making it the world's first flying fully recycled thermoplastic composite application in aerospace*

TPAC THERMOPLASTIC COMPOSITES APPLICATION CENTER

TPRC THERMOPLASTIC COMPOSITES RESEARCH CENTER

GKN AEROSPACE

TORAY Toray Advanced Composites

dtc

SAXION UNIVERSITY OF APPLIED SCIENCES

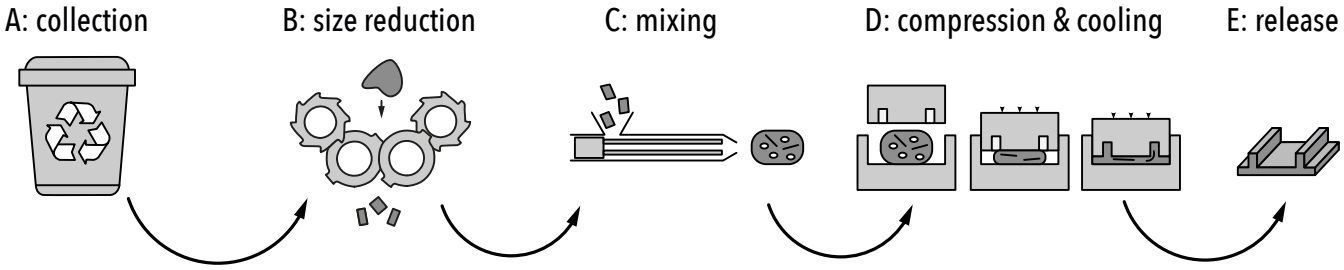
SiA

nrt

COMPOSITE INNOVATIONS cato

** see: http://www.gknaerospace.com/en/newsroom/news-releases/2020/gkn-aerospaces-thermoplastic-components-flight-tested-on-bell-v-280-valor/*

ROTORCRAFT ACCESS PANEL FROM RECYCLED CARBON PPS



PROCESS ROUTE

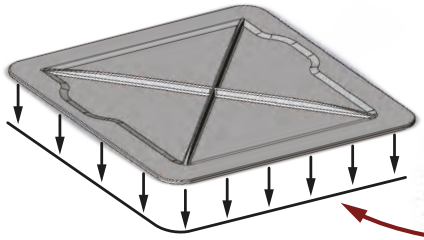
The proprietary re-manufacturing process illustrated above includes the following steps:

A. Collection
B. Shredding of waste to centimeter-long flakes;
C. Simultaneous heating and low-shear mixing;
D. Compression molding in an isothermal mold.

This offers the opportunity of retaining long fibres and therefore reaching high mechanical properties at short cycle times.

DEVELOPMENT

Material data was gathered from mechanical tests and used to predict the panel's strength and stiffness. The stringer design was optimized in regards to part stiffness and internal stress distribution, using FEM simulations. A critical design detail was selected and tested for validation.
A preliminary manufacturing demonstrator was developed and produced, which includes integrated design features, to test the manufacturing limits regarding design and processibility.



Component test

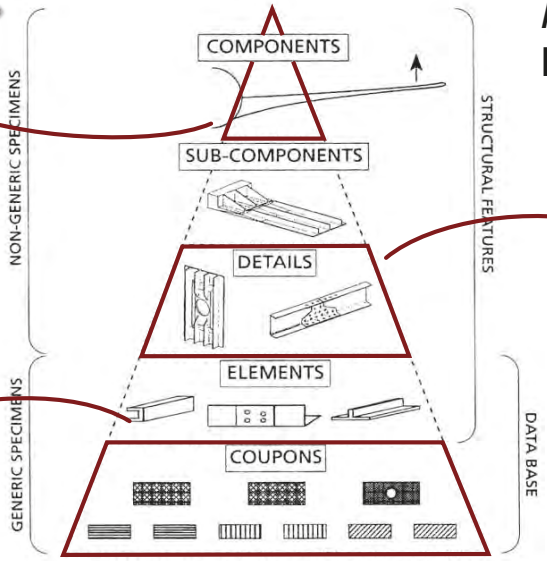
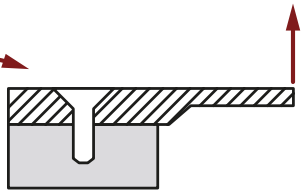
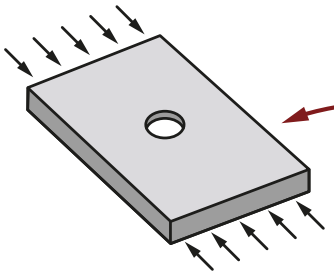


image source: FAA

ALL NECESSARY TESTING HAS BEEN SUCCESSFULLY EXECUTED.



Detail test on joint



4PB, OHT & OHC coupon tests

Utilizing a novel recycling route, the panel is 9% lighter, more cost-effective and of recycled thermoplastic composites.

NEAR FUTURE

Currently, several operations are being carried out to evaluate the production process for serial production. More detailed cost and environmental studies are being performed; quality control and inspection are also being conducted. At the same time, a feasibility study is being made to determine whether the applied approach and recycling route can be emplyed in other aerospace applications, such as (non-structural) fairings, covers & system brackets.