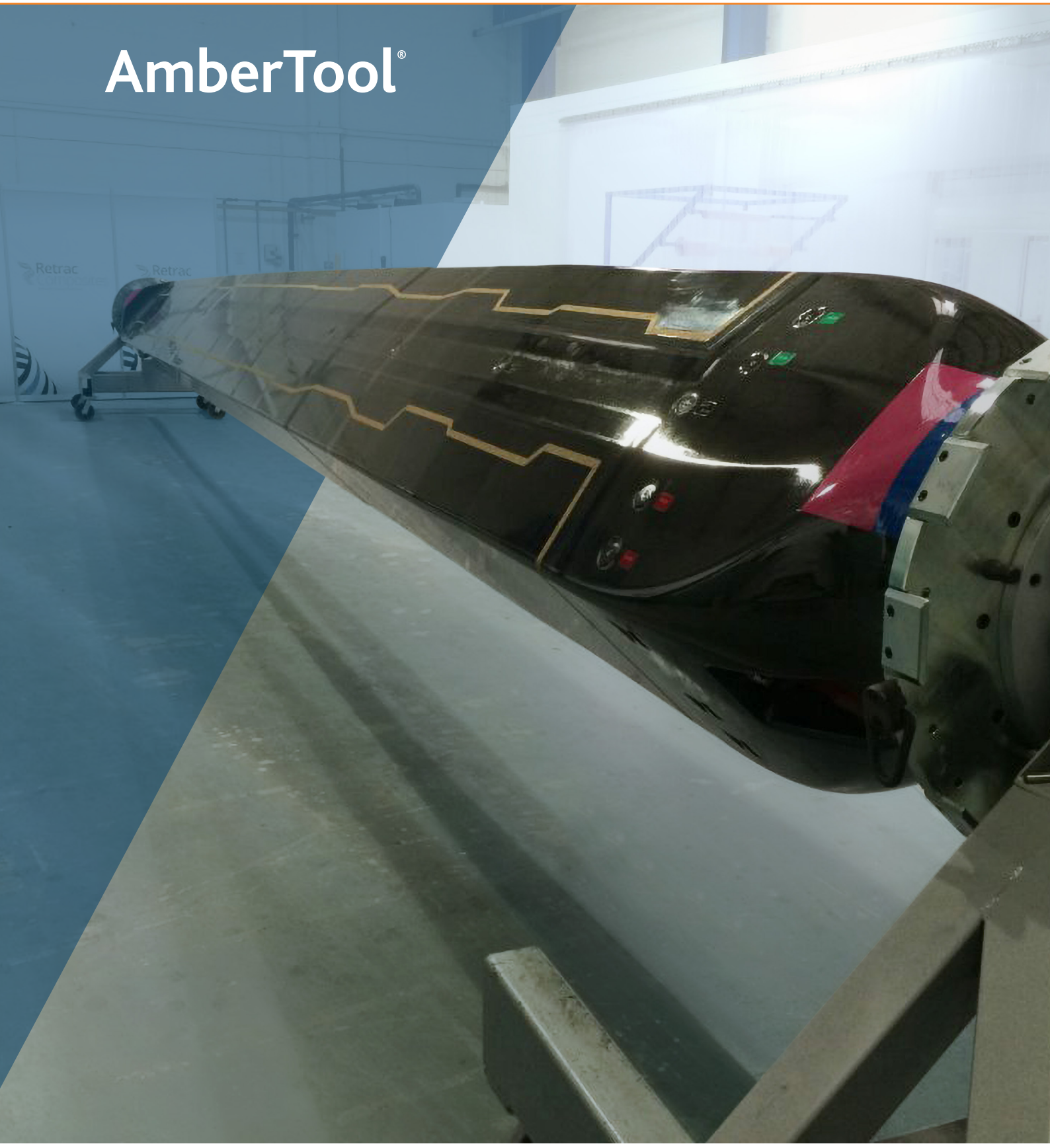
CURE CAPABLE MANDRELS

SUCCESS STORY

AmberTool®



www.toraytac.com

TORAY

Toray Advanced Composites

AmberTool®
Cure Capable Mandrels

Project Objective
To develop a "cure capable AFP mandrel"; a high-accuracy, structural, composite tool which is CTE-matched to the component. This was a development of the current composite Automated Fiber Placement (AFP) mandrels, used by GKN Aerospace in the production of the Airbus A350 XWB rear wing spars, which targeted significant reductions in both tooling and manufacturing costs.

Development of AFP Mandrel
- Made using Toray AmberTool® HX42.
- Nominal 36-ply laminate, using a combination of both unidirectional and woven tooling prepregs.
- Foam core construction removes the need for a pattern and provides vibration dampening during final tool machining to ensure higher accuracy.

Toray AmberTool HX42 Composite Tooling Prepregs
- Low coefficient of thermal expansion for an epoxy tooling resin (CTE 3 x 10^{-6}/°C)
- Proven system for aerospace tooling
- Machinable to achieve a highly accurate tool surface
- 5-day tack life, allowing time for laminating of larger tools.

Project Outcome
- A 3.5 m long section of a cure capable AFP mandrel tool was successfully manufactured.
- Composite components manufactured from the development AFP mandrel exhibited excellent dimensional accuracy compared to parts made from an Invar mold of identical geometry.

The AFP mandrel test tool developed during the project shows a unique combination of three elements:

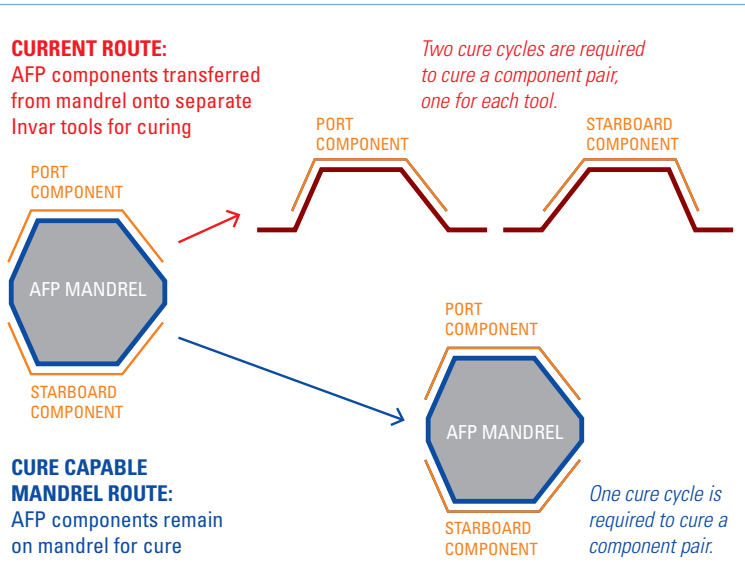
A structural item
- High stiffness & low deflection to meet the AFP process criteria.

A high-accuracy mold tool
- Vacuum integral, long-life capable, machined surface to meet mold tool performance criteria.

CTE matched to the component
- To achieve the part accuracy required.

GKN Aerospace AFP Mandrels
- Composite AFP mandrels are used in the manufacture of the Airbus A350 XWB rear wing spars.
- Max. length 13.5 meters.
- Max. weight 2,750 kg.
- Accurate within ±0.25 mm over the complete surface.
- Max. deflection < 0.1 mm with a 100 kg load placed at the center.

NATEP (National Aerospace Technology Exploitation Programme) project, conducted by project partners: Composite Tooling & Engineering Solutions Ltd (composite tooling design specialists), Retrac Composites Ltd (composite tooling manufacturer), and GKN Aerospace (end user).



N.B. Diagrams show sections through mandrels, cure tools, and components

Composite Tooling & Engineering Solutions

GKN AEROSPACE

Retrac Composites
Advanced Composite Solutions