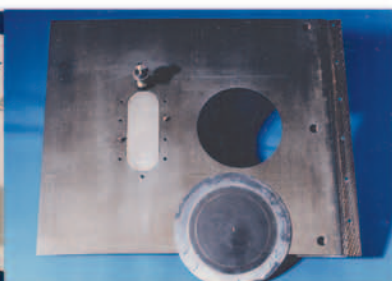


GMI
AERO



INNOVATIVE TOOLS FOR COMPOSITE STRUCTURE ADVANCED MACHINING



GMI Aero - Paris - www.gmi-aero.com

INNOVATIVE TOOLINGS FOR COMPOSITE REPAIR

Composite machining toolings for fabrication and for repair have specific features. Catalogues of standard products can be used for selection of appropriate parts. However, no catalogue on the market will propose you the innovative tools designed by GMI AERO to perform the generic mechanical works necessary to install a repair patch on an advanced carbon structure.

These tools have been categorised in the series **Leslie** of our catalogue. They are used worldwide by major manufacturers like ATR, AIRBUS, AIR FORCES, Training Centres and by MROs. These tools result of the expertise of GMI in the repair process.

In order to offer a complete solution to the users, specific comprehensive kits have been designed. The more comprehensive version can be labelled a **Mobile Composite Repair Workshop or a Repair Technician Campaignion**.



Figure 1: A view of some of our innovative surface machining tool attachments

A COMPREHENSIVE KIT FOR ALL SURFACE PREPARATION STEPS

The innovative tools designed by GMI to offer the technician to face all possible tasks of a composite repair on an advanced carbon structure are gathered in a case. With tools, and necessary other selected accessories the repair phase preparation can be fully conducted.



Figure 2: The mobile workshop

INNOVATIVE TOOLINGS FOR COMPOSITE REPAIR

The Kit will allow to prepare fully the repair phases:...


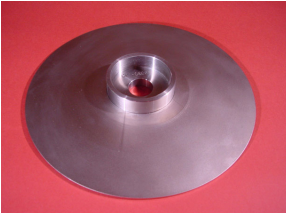


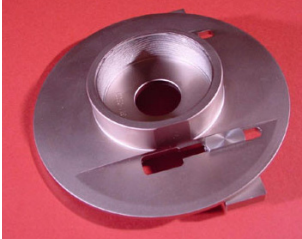
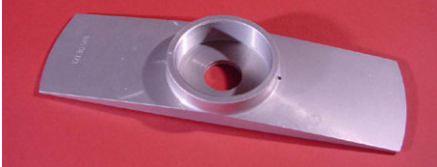

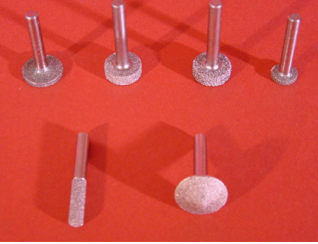

- a. Remove the paint on the repair area,
- b. Prepare the installation of the core and of the patch,
- c. Dry the sandwich area after core removal with a foldable oven,
- d. Rout and Step the skin,
- e. Handle Wet Lay Up operations if any or the Prepreg cuts,
- f. Manufacture the patch pre-cured or to be co-cured,
- g. Install the patch and make the vacuum bag (heat blanket not provided).

In the next paragraph, we review systematically the main operations allowed in the logical order of a composite repair.

THE INNOVATIVE TOOL ATTACHMENTS

The attachments are designed to be mounted on two pneumatic machines only and to perform routing and ply sanding. The following table illustrates the respective functions of the attachments.

Table 1: Attachment tools and attributed functions

 <p>Routing</p>	 <p>Sanding with Depth Control</p>	 <p>Sanding with Depth Control</p>
 <p>Routing</p>	 <p>Chamfering; edge milling</p>	 <p>Sanding with Depth Control</p>
 <p>Sanding with Depth Control</p>	 <p>Set of Diamond cutters for routing, milling, stepping, scarfing, chamfering...</p>	 <p>Sanding with Depth Control (non developable surfaces)</p>

STRUCTURES TO BE TREATED

The attachments will allow works on different structure types and surface shapes. These repairs will be possible of nearly all structures met on modern aircraft as described below.

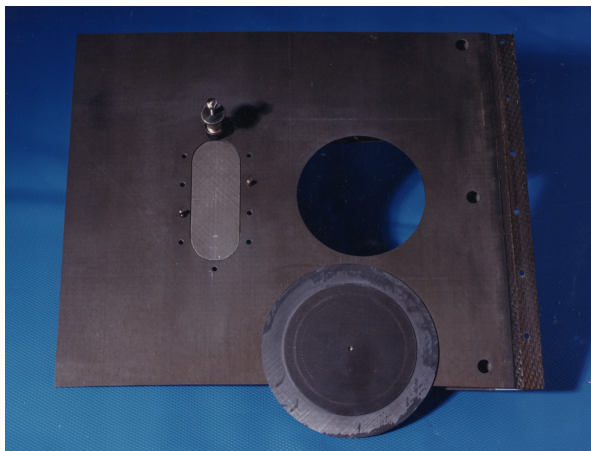
Type	Material	Shapes
Sandwich	Carbon	Flat
Laminate	Glass	Curved
		Slightly non developable

Table 2: Typology of structures

MACHINING WORK SCHEMES

The works are categorized to cover the typical schemes met in advanced carbon repair on aircraft structures.

- a. Cutting of a carbon laminate doubler, chamfering the edges,
- b. Routing of a sandwich skin or of a laminate box skin,
- c. Easy control to remove the skin up to the adhesive... or deeper,
- d. Stepping ply by ply a carbon skin,



MOBILE COMPOSITE REPAIR WORKSHOP

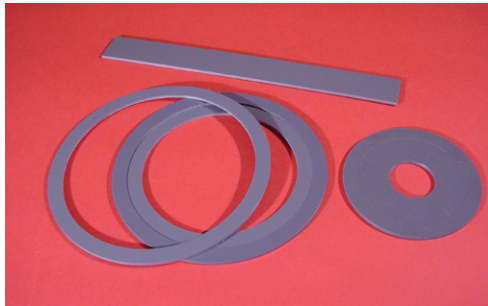
REPAIR PHASES

In the Mobile Workshop you will find all the parts to prepare fully the repair phases:...

1. **Remove the paint** on the repair area,
2. Prepare the installation of the core and of the patch,
3. **Dry** the sandwich area after core removal with a foldable oven,
4. Rout and Step the skin,
5. Handle **Wet Lay Up** operations if any or the **Prepreg** cuts,
6. **Manufacture the patch** pre-cured or to be co-cured,
7. Install the patch and make the **vacuum bag** (heat blanket not provided).

USE OF TEMPLATES

The use of templates allow to work with full safety inside guides and with all the confidence which is lacking when working eye driven with other standard tools;



DUST ASPIRATION AT THE SOURCE

Each tool attachment is equipped with a port to be connected by a quick coupling connector to a flexible hose for connection to a vacuum cleaner. For convenience a venturi vacuum cleaner is provided.

MOBILE COMPOSITE REPAIR WORKSHOP

With our Mobile Composite Repair Workshop, GMI offers to Civil and Military Repair Centres the equipment they absolutely need to conduct all the repair tasks before bonding. GMI invented a series of tools that allow to realise all the Generic Repair Works on advanced composite structures. They are the only tools on the market specific for that type of job, other standard tools from trade, being inappropriate, because they address mainly the production field. Conceived as tool attachments, they are the innovative parts of the Kit. Together with the innovative tools, the user will find under the hand the complete set of necessary accessories to conduct all the repair steps:... from the paint removal task,... to the local manufacturing of a patch.

CONSOLE COMPOSITION

To perform all the tasks of the repair, the Complete Mobile Workshop is composed of **Five groups of elements**. The details of composition are given in following tables.

1. **Group 1:** A selection of accessories to prepare the repair by paint removal, honey-comb cut, lamination of dry fabrics, cutting and assembly of patches.

TRANSPORTATION CONSOLE

- Group 2:** Pneumatic machines necessary for the Attachments one router and one sander.
- Group 3:** The innovative kit of Attachments. This kit comes with the necessary kit of diamond cutters and carbide cutters These cutters are conceived specially to achieve specific repair machining quality.
A first set of templates is added. The pneumatic adapted vacuum cleaner is included.
- Group 4:** A foldable oven for drying the sandwich area after core removal and before core installation or potting. The oven is useful to accelerate the potting curing; in some cases it can be used to heat the adhesive when. The oven temperature cycle is controlled by the ANITA Console. The oven is equipped with a specific heat gun.
- Group 5:** First hand set of bagging products state of the art.

TRANSPORTATION CONSOLE

All above in a nice console with rolls transportable in mission or near the aircraft.<



Figure 3: left: Complete Mobile Repair Workshop
right: Set of tools and attachments in a restricted version

Larger Console :

dimensions: 9450 x 510 x 250 mm; Weight: 28 Kg.

Restricted version:

dimensions: 800 x 480 x 260 mm; Weight 25 Kg

TO ORDER

The Complete Mobile Workshop:

P/N: GMIAT87B02-320

For a Restricted version limited to the innovative attachment and tools without accessories.
(groups above 2 and 3 ; 4 in option)

P/N: GMICRT9201

As the kits above contain an electric heat gun for the foldable oven , specify at teh order 120 or 220 Volts .