

TECHNICAL DATA SHEET

«GMI-AERO»

Training of composite repair technologies

► DESCRIPTION

During more than 30 years French company «GMI-AERO» is focused on development of equipment and integrated solutions for advanced repair and maintenance of aircraft structures especially for composite made structures.

During years of its activity «GMI-AERO» has always accompanied customers by organizing and practical training courses in order to instruct company employees about innovative technologies and repair techniques.

By customer's wish the course sessions are run:

- ✓ in the customer facility
- ✓ in our Paris Training Centre, France on the territory of «GMI-AERO» factory.
- ✓ in «GMI – EMAM» Montréal Center, Canada. This center is in the building of EMAM (Ecole des Métiers de l'Aérospatiale de Montréal = Professional school of Aircraft space industry of Montréal).



GMI
AERO

Depending on the course content as well as on difficulty of work performance, and on participants profile program «GMI-AERO» for composite parts repairs divided into 3 main categories:

1. Transfer of technology
2. Training of maintenance of equipment and tools
3. Job training



1. Training category - «Transfer of technology». This category is divided into 3 levels depending on difficulty of work and level of trainees' competence.

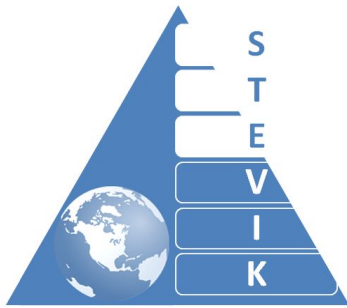
► LEVEL I

Name:	GMI-RCR
Subject:	Introduction course: Technologies for composite parts repair.
Duration:	5 days.
Trainees number:	participants maximum: 8.
Level of trainee competence:	for engineers and technicians

This course addresses technicians working in manufacturing plants or airline companies wanting to acquire PRACTICE EXPERTISE on repairing advanced composite structures.

This course is a very comprehensive coverage of the subject in an introductory way.

It examines all the major themes: damage assessment, machining the generic repair schemes and hot bonding.



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Trainee will examine the materials used: materials for vacuum bagging and specific repair materials. After the course is accomplished trainee can take another course, presented in our catalogue, or to continue courses of upgraded level.



Training program:

- ✓ Generic tasks in the context of repairs, hot bonding
- ✓ Identification of materials and structures
- ✓ Manipulation of products, curing of resins
- ✓ Resins, lamination preregs
- ✓ Method selection, steps of repair process, damage assessment & ultrasonic

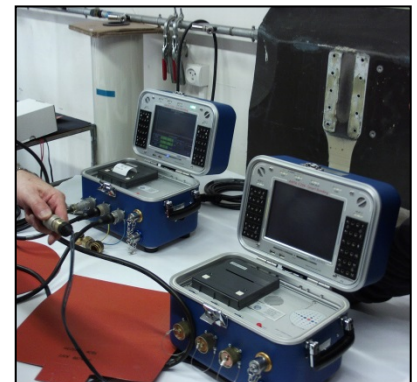
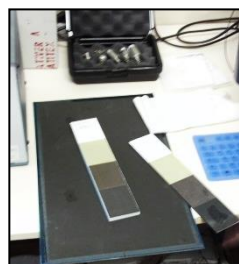
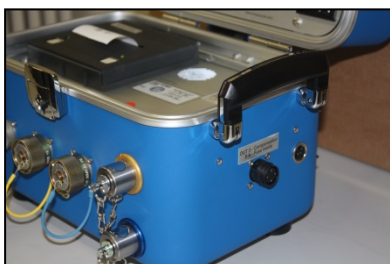
Practical works:

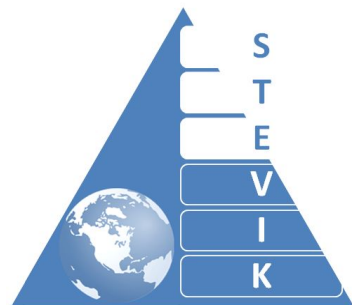
- ✓ Damage assessment
- ✓ Sandwich repair
- ✓ Skin routing and stepping
- ✓ (without stages and multistage)
- ✓ Resin lamination
- ✓ Core replacing
- ✓ Vacuum bagging
- ✓ Hot Bonding



Materials and equipment used:

- ✓ ANITA Bonding Console
- ✓ Various heat Blankets
- ✓ Mobile Workshop Tools and Attachments
- ✓ Ultrasonic Instrument for damage assessment





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► LEVEL II

Name:	GMI-ACR
Subject:	Advanced composite repair methods
Duration:	10 days
Trainees number:	participants maximum: 8
Level of trainee competence:	for engineers and technicians

This course is dedicated for engineers and technicians, working with production control or quality control, working in manufacturing plants or airline companies, and wishing to obtain profound practical knowledge and competence in the area of composite structures repair. It examines the 3 major themes: damage assessment, machining the generic repair schemes and hot bonding.

Examples are drawn from actual parts of sandwich type or laminates.

Training program:

- ✓ Generic tasks in the context of repairs, Hot Bonding
- ✓ Curing of Resins, Viscosity, Pressure application
- ✓ Transfer of Heat Thermal Cartography
- ✓ Routing, Stepping, Scarfing Radiant Panels
- ✓ Drying Structures, Damage Assessment & Ultrasonic

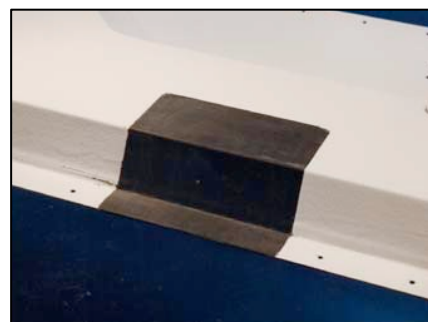


Practical works:

- ✓ Damage assessment
- ✓ Sandwich repair, one skin, two skins
- ✓ Skin routing and stepping, Core shaping
- ✓ Thin and Thick Prepreg patch preparation
- ✓ Hot Bonding at high temperature
- ✓ Laminate patch manufacturing

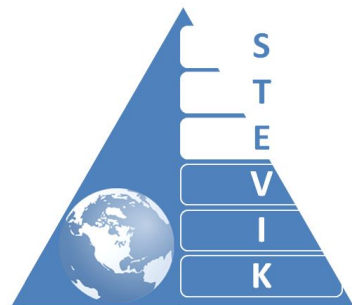
Materials and equipment used:

- ✓ ANITA Bonding Console
- ✓ Various heat Blankets
- ✓ Mobile Workshop Tools and Attachments
- ✓ Ultrasonic Instrument



Level of trainee competence:

The technicians may be already familiar with glass fiber part repair or has followed course Level I. To pass effectively Level 2 a trainee must have at least a regular work experience at manufacturing workshop and/or production shop during minimum one year after accomplishing of Level I. Besides he needs to perform 10 repair works individually to solidify knowledge of the Level I.



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► LEVEL III

Name: GMI-OCR
Subject: **Overview of advanced composite repair techniques.**
Duration: from 3 to 10 days.
Trainees number: participants maximum: 8.
Level of trainee competence: for engineers and technicians.

This course addresses engineers of research/development department or of production or of quality and working in civil or military fields and wanting to have a general overview of the present issues in repairing advanced composite and metallic structures.

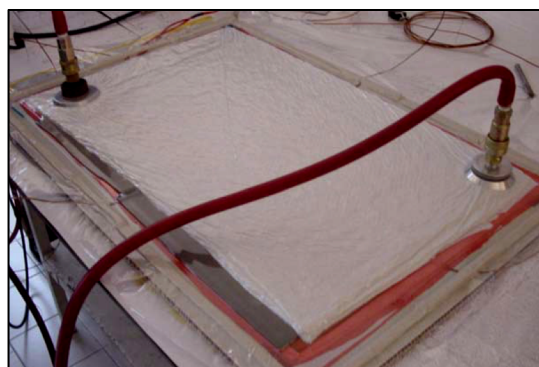
In this respect, the course offers a complete overview of the technology resources at that time.

The trainer will show how the various techniques are implemented in order to lead the trainees to have an overview of possibilities offered by technology and of its prerequisites.

This course examines all the major themes: damage assessment, machining to follow the generic repair schemes metal to metal bonding, new materials for mould manufacturing, repairing with moulds, advance thermal bonding and metal repair with a composite patch.

Training program:

- ✓ High temperature Hot Bonding
- ✓ Induction Heating,
- ✓ Boron and Carbon patches
- ✓ Curing of Resins, Viscosity
- ✓ Transfer of Heat
- ✓ Drying Structures
- ✓ Damage Assessment & Ultrasonic



Practical works:

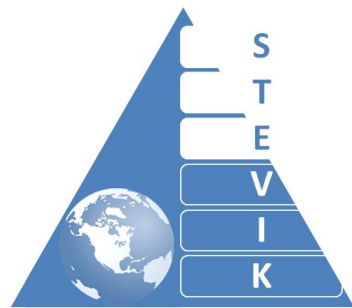
- ✓ Surface treatment of aluminum
- ✓ Bonding of carbon patch on metallic structure
- ✓ Carbon structure Repair

Materials and equipment:

- ✓ Carbon patches procured
- ✓ ANITA Bonding Console
- ✓ GILDA Surface Treatment Console
- ✓ Multi Zone Bonders
- ✓ Induction Heating System

Level of trainee competence:

Engineers, who passed preliminary courses of composite repair.



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Subjects of Level II and Level III must be agreed and adapted according to customers wish according to production needs. For example, this training level can contain additional subjects such as:

Possible themes	Code
Methods of Metal to Metal Bonding	MMB
Principles and Practice of Hot Bonding in Repair	PHB
Machining of Advanced Composite Structures Learn the typical preparation work of the repair with machining practice: routing, stepping, sanding	MCS
Moisture Detection and Part Drying Techniques	MDD
Ultrasonic Damage Evaluation, Hands on practice for damage	UDE
Heating process, Energy transfer in Bonding, Solutions to Thermal issues	HST
How to Control Bonding Heating Process? Thermocouple Sensors and Control Models	TSM
Random Specific Repair Techniques	RRT
Floor Repair Techniques	FRT
Composite Manufacturing Principles Understand the nature and assembly of the parts you repair	CMP
Lamination repair, during drilling and hole reaming, thermo-bolts technology	HBR

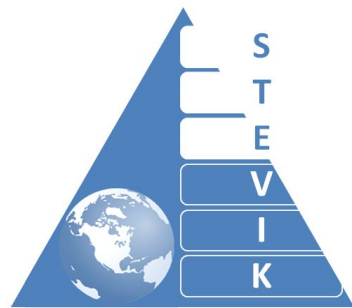
2. Category «Training of maintenance of equipment and tools»

This is a series of short duration courses proposed to customers to master technical aspects of implementation of GMI-AERO Instruments at production and during exploitation.

The objectives are to review operating instructions and the specifications of equipment and to obtain exploitation skills for effective equipment usage. Also a series of courses is dedicated to master some peripheral instruments: mainly heating blankets, thermocouples, ...How to check and care of fundamental products and instruments

Some subjects of the course are presented in the table below:

Possible themes	Code
GMI ANITA Bonding Console Basic Use General Equipment of Specific Version 2, 4 or 6 Zones, NG or OT models	AUC
Calibration of ANITA Bonding Consoles	ACC



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How to Check Heating Blankets	CHB
How to Check and Calibrate Thermocouples?	CTC
GMI Leslie Mobile Workshop Review of Tool and Attachments Operation Mode	LUC
GMI Elisa Ultrasonic Damage Assessment Console Review of Operation Mode	EUC
GMI Radome Blankets Review of Operation Mode	RUC
GMI GILDA Phosphoric Anodisation Console Review of Operation Mode	GUC

According to client request, similar courses for other kinds of equipment by «GMI-AERO» are possible.

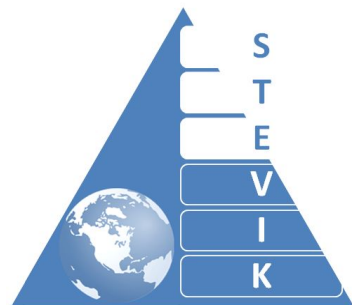
3. Category: Job Training

Assisting to different programs of development of aircraft parts maintenance, «GMI-AERO» has developed numerous methods and technologies particularly applied on aircraft units, such as repair:

- Reverser Repair (CF6 and PW4000)
- Engine Air Inlet repair
- noise absorbing engine skin
- panel alumesk replacement
- abradable liner replacement

This course is intended for demonstration aircraft repair demonstration in practice. Trainees are trained to follow the procedures according to SRM (System repair manual), procedures CMM as well as to fulfill repair operation in practice.





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Possible themes	Code
Reverser Repair with Application to Corecowl & Transcowl of CF6 and PW4000	RRT
Engine Air Inlet repair; panel alumesht replacement	AIR
CF6 abradable liner replacement and bonding	ALR