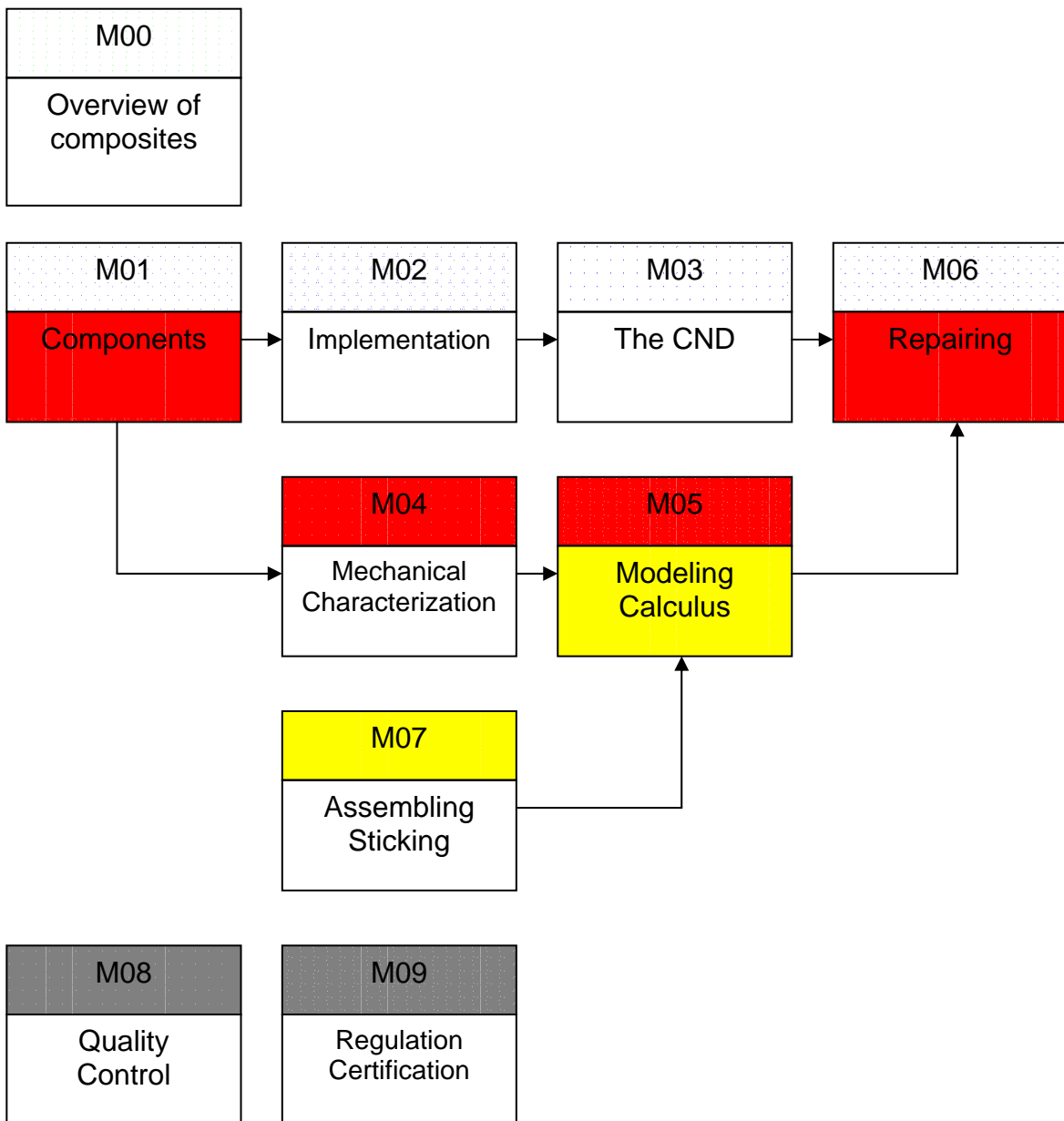
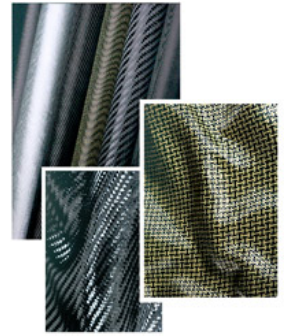


Training course on composites applied to Aeronautics



COURSE : ■ ■ ■ ■

Training modules

**Overview of composites applied to
Aeronautics, Components**

**FILE M00
M01**

Objectives:	To be able to comprehend: - the elements constituting composites and their properties,
Prerequisite:	- Basic notions of organic chemistry.
Audience:	- Research departments, methods, production

Content: Lectures, Tutorials

Basics:

- Definition
- Basic notions

Components:

- Matrices
 - Heat hardenable resins
 - Thermoplastic resins
 - Thermostable resins
- Linings
 - Types
 - Commercial layout
- Additives and loads
- Sandwich cores

Characteristics, mixtures, interface.

Structural composite materials.

Law of mixtures: utilization, Calculation of fiber ratio in the structure

TUTORIAL :

Utilization of the Law of mixtures

Duration:	3 days
Validation:	Tests

Implementation of composite materials**FILE M02**

Objectives: To be able to comprehend the implementation techniques and process of parts made of composite materials

Prerequisite: To know the elements constituting composite materials

Audience: Research department and production personnel

Content : Lectures, tutorials

The processes, choice criteria

- Great diffusion
 - Handcraft processes
 - Hand lay-up
 - Spray up
 - Industrial processes
 - Resin injection
 - Compression molding
 - Centrifugation
- Analysis of production cycles
- High performance
 - Filament winding
 - Slanted strip draping
- Special processes
 - RTM
 - Pultrusion- Extrusion

Prepregs:

- Impregnation methods
- Control, production cycle
- Draping prepregs

The GLARE: Definition, implementation

Tutorials : Draping prepregs (Karman production)

Duration: 4 days

Validation : Tests

**Tutorials : Draping prepregs in vacuum,
Sandwich structure applied to
Aeronautics**

M02

Objectives:

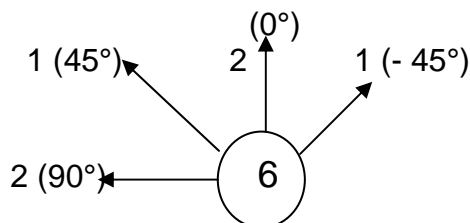
To be able to comprehend :

- the elements constituting composite materials and their properties,
- the implementation techniques in aeronautical field,
- Manufacturing process of a composite part consisting of heated draped prepreg in vacuum

Content :

STEPS

- Preparing for use
- Cutting the pre-impregnated plies
Materials used: carbon – epoxyd (M10/42%/G1051-100cm)
- Draping plies



- Cutting nida NOMEX: thickness 4 mm ; 6mm.
- Stratification scheme :
Pileup sequence: (0, 45, 90, NIDA, 0, -45, 90).
- Compacting in vacuum
- Wringing (environment: use of technical fabrics).
- Polymerization (see cycle), time, T°, pressure.

MANUFACTURING CRITERIA:

- Correct structure of the part,
- Compacting the layers,
- Draining efficiently the gases,
- Evacuate the exceeding resin.

Duration: 6 hours Tutorial

Validation: Tests.

Repairing aeronautical composites**FICHE M06**

Objectives: To be able to track a damage, to conceive and implement a solution for repairing it.

Prerequisite : Implementation and modeling, calculations.

Audience : Engineers and technical experts B.E, methods and production

Contents :

Introduction.

The damages.

Causes

Detection

Classification

The repairs.

Evaluating the damages (CND)

Classification of repairs

Repairing methods.

Most used methods

Utilization of the SRM (aeronautical repair manual)

Case studies (1 day)

Tutorials for repair. (5 days)

Conclusions.

Duration: 8 days

Validation: Tests.

	Repairing composite materials Summary of tutorials	M06
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Type of repairing	Tut. #	SRM Reference
Posing High-speed-tape	101	53-35-00 5 A
Injection of loaded resin	102	51-77-13
Putty with loaded resin	103	51-77-12 3 A
Filler with loaded resin on sandwich. Open damage.	104	52-81-11 F
Filler with loaded resin on sandwich. Closed damage.	201	52-81-11 H
Changing nida nomex with a doubler	202	51-77-13 D
Laying a doubler by filling with a loaded resin	203	51-77-13 C
Laying a doubler by restoring nida nomex	204	51-77-13 C
Initiation to chucking. Airbus-type pileup	301	51-77-11 D
Scarf manufacturing and laying preimpregnated plies on fiber reinforced materials	401	51-77-12 (2)
Scarf manufacturing and laying preimpregnated plies on sandwich panel	402	51-77-13 (3)
Step manufacturing and laying preimpregnated plies on fiber reinforced materials	501	51-77-12 D (1)
Step manufacturing and laying preimpregnated plies on sandwich panel	502	51-77-13 (2)

Duration: 5 days

Validation: Tests

