Future Trends for Composites in Aeronautics

ADVANCED MATERIALS INTERNATIONAL FORUM

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Alenia Aermacchi

Presentation content

- The history
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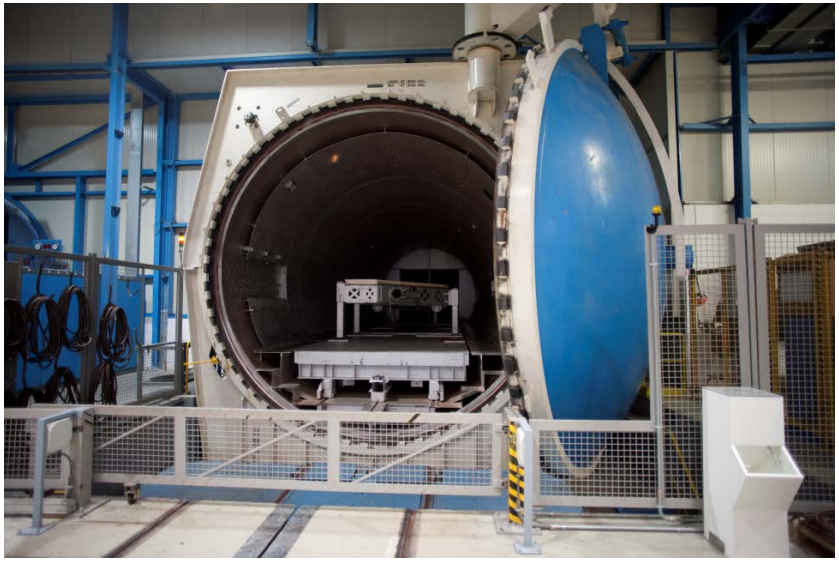
- The future

Image credit: Alenia Aermacchi



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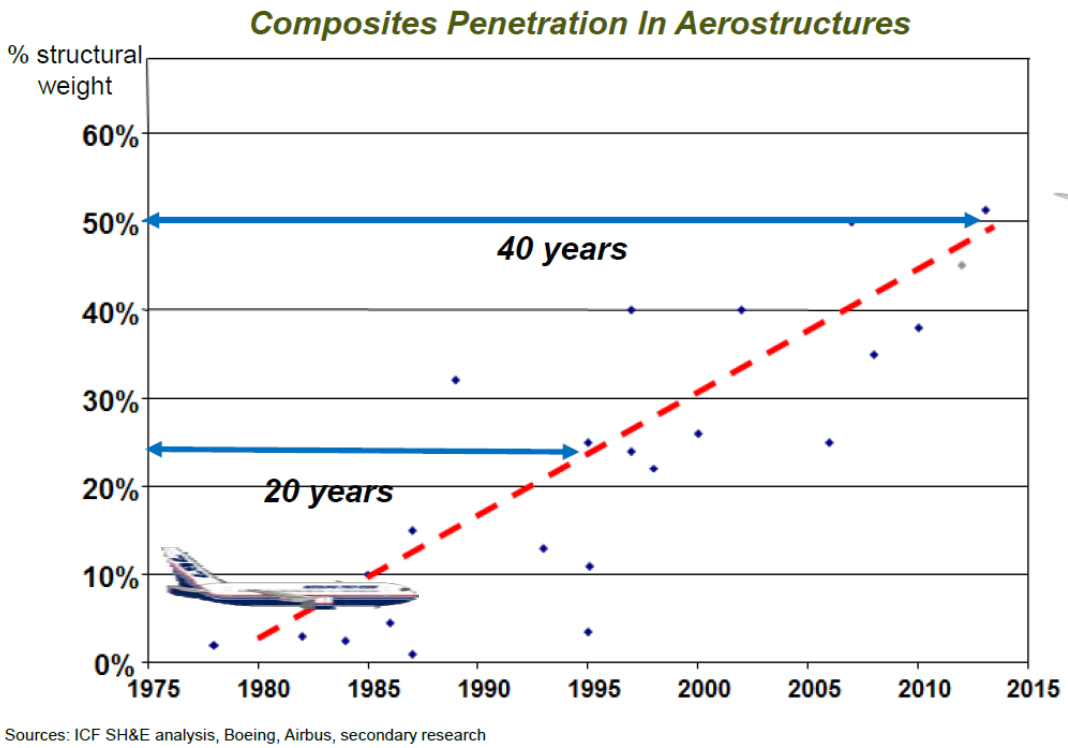
The history

- Cost and lack of confidence limited the use of the composites in the civil aerostructure, initial development driven by the military applications
- Market requirements and the technology maturation enabled the increase of the composite materials use in commercial aircraft



Sources: ICF SH&E analysis, Boeing, Airbus, secondary research

Boeing 767 Program - Composite Parts

Composite Structures	Typical Application
6 %	Secondary Structure, Sandwich

- Flaps
- Slats
- Ailerons
- Spoilers
- Elevators
- Rudder
- Radome

- Alenia Aermacchi main production site: Foggia

Boeing 787 Program - Composite Parts

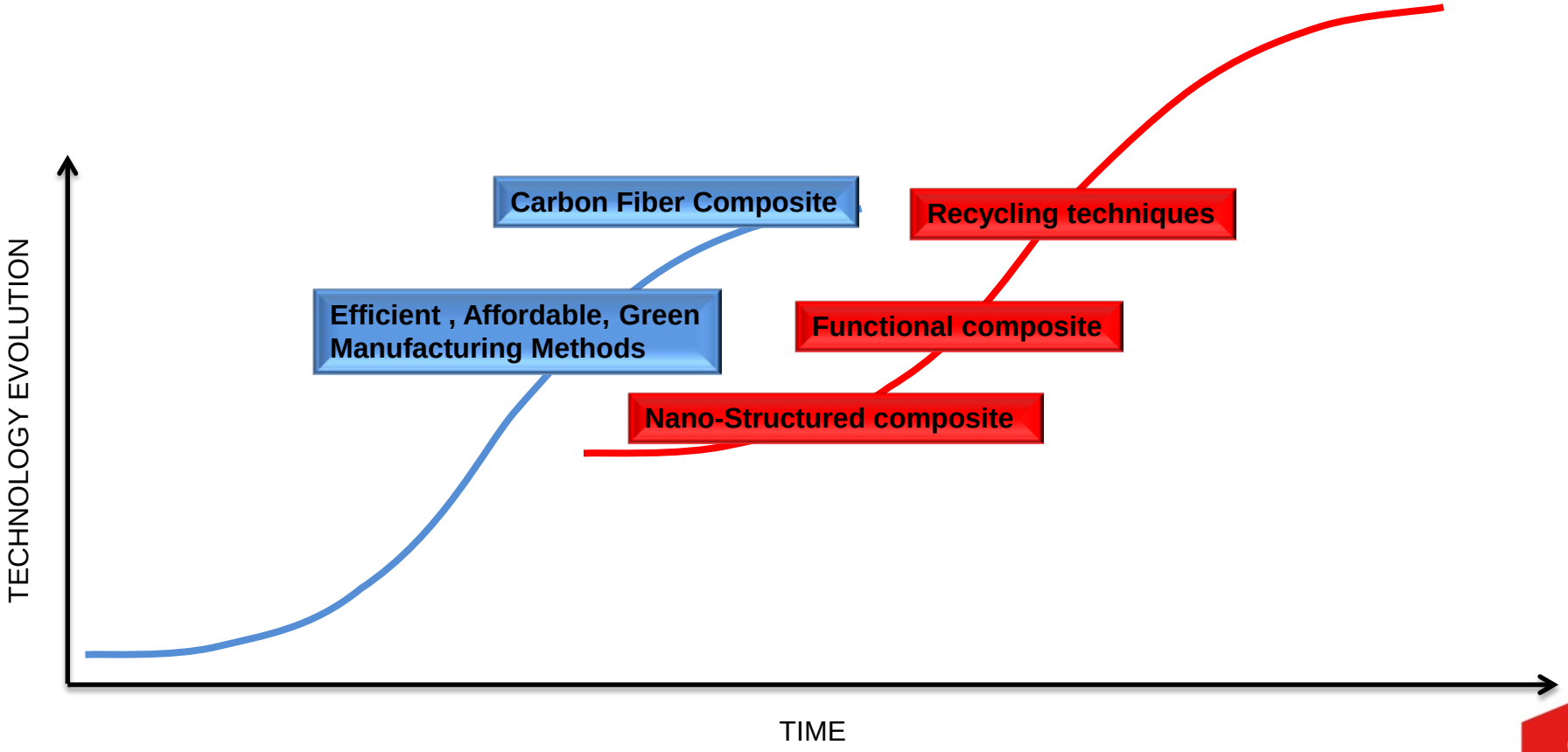
Composite Structures	Typical Application
50 %	Primary Structure, Laminate

- Composite fuselage
- Wing
- Empennages
- Control surfaces

- Alenia Aermacchi main production sites: Grottaglie and Foggia

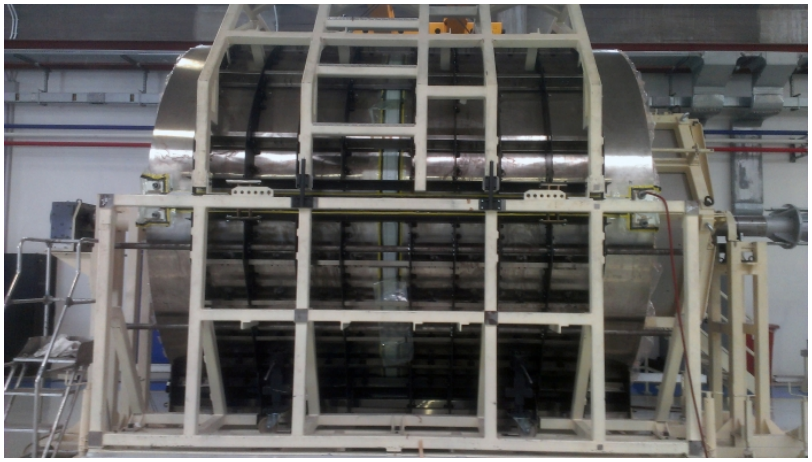
The Trend

- Conventional composite development is mature, efforts are on-going to improve manufacturing
- Emerging technologies on new composite and techniques to reduce the environmental impact



Today – opportunities and challenges

- Improved manufacturing techniques
  - Intelligent fibre architectures
  - Automated manufacturing (AFP / ATL)
  - RFI, RTM
  - Out Of Autoclave
- MRO
  - Structure Health Monitoring
  - Non Destructive Testing
  - Repair techniques



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Future – opportunities and challenges

- Availability of carbon fibres
- Environmental impact reduction
  - Recycling
- Functional materials
  - Self healing
  - Sensing
  - Morphing
  - Thermo-acoustic
  - Electromagnetic
- New materials
  - Thermoplastic matrix composites

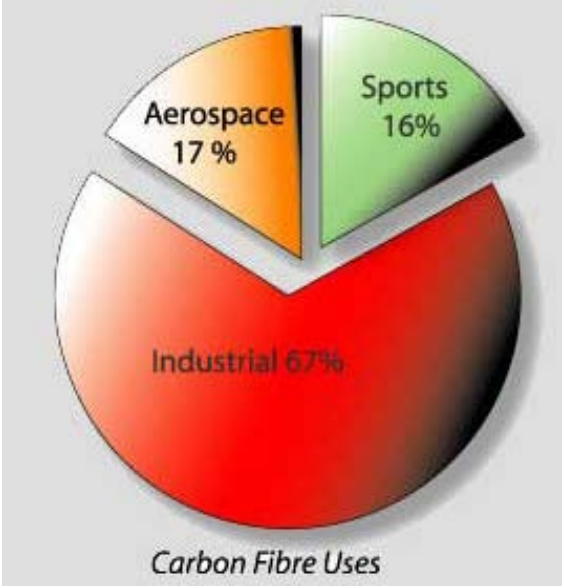

Image Credit: The carbon fibre industry worldwide 2011-2020

Image credit: Alenia Aermacchi

Near term requirements

- Simulation of the cure process
- UV-resistant resin systems
- Advanced material hybrids for critical design details
- 3-D reinforcements that improve transverse toughness
- Resin systems that cure faster and at lower temperatures
- Durable low-cost, high-temperature composite tooling
- Elevated-temperature, toughened composites
- Thermoplastic secondary structures and interiors

Image credit: Alenia Aermacchi

Mid term requirements

- Advanced Composite design
- Higher strength and stiffness composites
- Self-surfacing/priming composite surfaces for painting/priming
- Resin systems designed to enable easier carbon recycling

Image credit: Alenia Aermacchi

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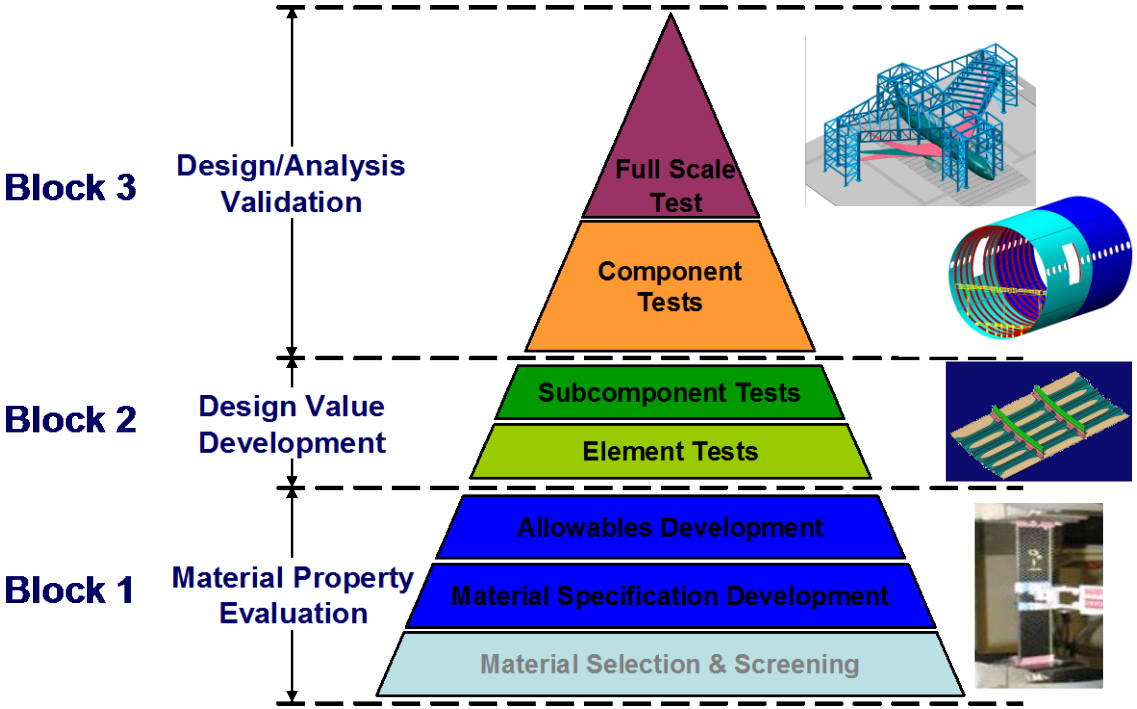
Long term requirements

- Fast structural repair systems
- Shape-morphing composites
- Reliable health monitoring of composites
- Electrically conductive composites
- Thermal transport composite systems
- Non-traditional lean composite processing
- Primary large thermoplastic matrix composite structures

Image Credit: NASA / The Boeing Company

Key constraints

- Computational materials & manufacturing tools to speed up decision making
- Reduced qualification and certification costs & schedule
- Concurrent scale-up and quality in manufacturing



Technology Development Strategy

- Maximize the involvement of industrial and scientific excellences in the research opportunities
- Decide for “in house” vs sub-tiers developed technology
- Support sub-tiers in the development of specific manufacturing techniques

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