

Advanced Composite Materials for transport sector

the contribution of IMAST



IMAST: the consortium

PUBLIC INSTITUTIONS



National Council of Research



Italian National Agency for New Technologies, Energy and Sustainable Economic



Polytechnic University of Turin



University of Naples "Federico II"



Second University of Naples



University of Salerno

BANKING SYSTEMS



Istituto Banco di Napoli Fondazione

ASSOCIATED MEMBERS



Boeing Company

INNOVATIVE COMPANIES



Alenia Aermacchi



AnsaldoBreda



Avio



Fiat Research Center



Cetena



CIRA



CYTEC



Dompé



Adler Plastic



Fiat Group Automobiles



MBDA



Selex Electronic Systems



STMicroelectronics

IMAST applications field



AEROSPACE



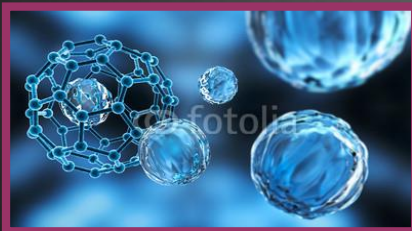
SHIPBUILDING



AUTOMOTIVE



RAILWAYS



POLYMERIC ELECTRONICS



BUILDINGS

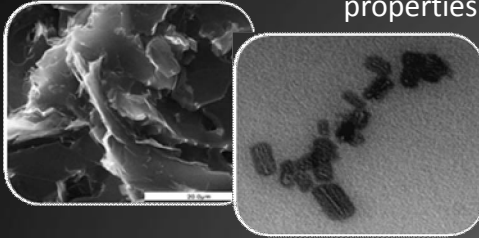


DEFENCE



BIOMEDICAL

MANTA - Nanocomposites with improved damping and impact properties

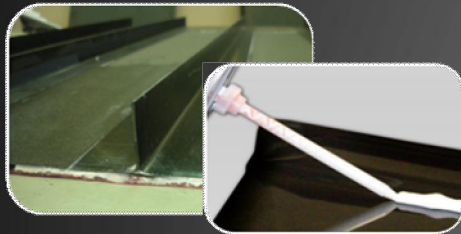


TECOP – Thermoplastic composite fuselage components (manufacturing optimization)



Green Regional Aircraft – Analysis of fire performance of composite components

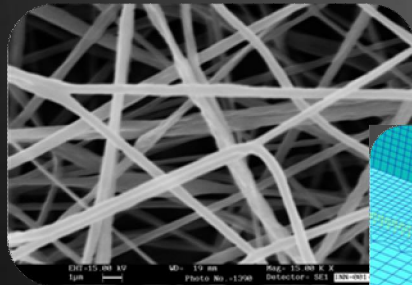
ARCA – composite panel with improved vibro-acoustic properties and weight reduction



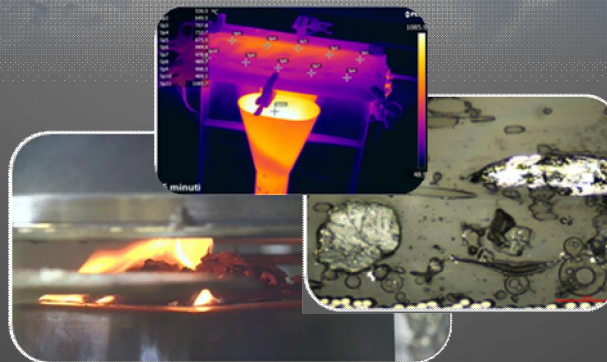
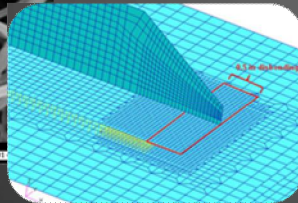
ASAP - Innovative thermosetting adhesive for out-of-autoclave bonding process (process optimization)



CESPERT – Thermoplastic composite emergency door with hail impact resistance and weight reduction



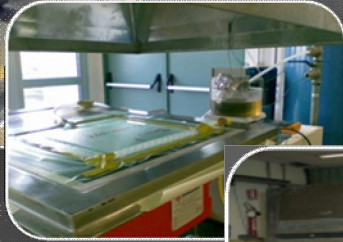
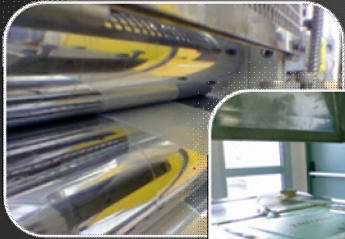
IMPRESA e FUZI - composites for pressure, humidity and structural health monitoring



COCET – composite interiors with improved flame resistance

MACADI - Computational models to improve the prediction for impact events involving composite structures





ARCA

Composite Panels (Boeing 787) with viscoelastic damping layer by lamination process (patent granted)

- ❑ Improvement of acoustic properties: 3dB
- ❑ Weight reduction of 60% with respect to reference (add on systems)
- ❑ Increase of lamination time, but reset of time to install add-on systems

CESPERT

Thermoplastic composite emergency door (Regional Aircraft ATR42) by thermoforming process (Windows Frame and structural door components) of Polyphenylene Sulfide/Carbon Fiber system and fiber placement process (Skin) of Polyether ether ketone (PEEK)/Carbon Fibers system.

- ❑ weight reduction of 39% with respect to aluminum solution.



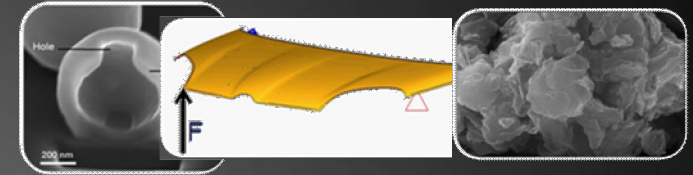
ASAP – Optimized assembling process to join structure and skin of a hood with improved torsional stiffness properties



MACADI – Modeling and design of polymeric composite bumper to improve the failure mechanism predictions



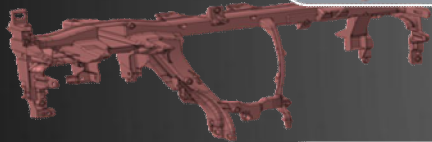
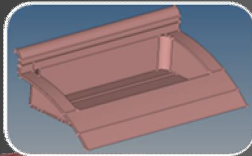
PRADE - Multifunctional adhesives and repairing composite systems (self repairing)



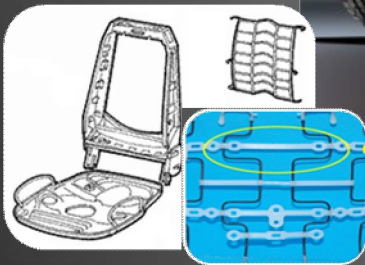
TRASPORTI - Thermosetting composite tailgate with improved torsional stiffness and weight reduction



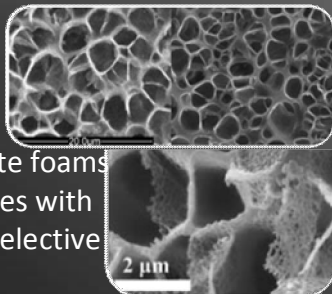
TECOP – Polymeric composite cross car beam and dashboard (weight reduction)



IMPRESA - Multifunctional composite systems for the sitting passengers posture identification and air conditions monitoring



MANTA – Thermoplastic expanded graphite composite foams and nanocomposite adhesives with reduction in cure time and selective heating

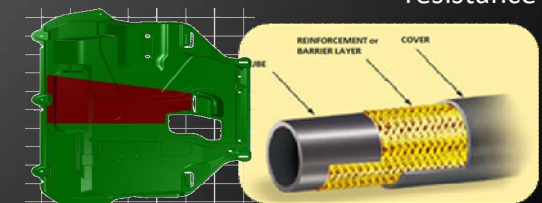


FUZI – Functional thermoplastic composite systems with morphing (fin of aeration system) and electrical properties (dashboard with integrated electrical circuits)

CESPET - Thermoplastic composite tailgate with reduction of weight and costs



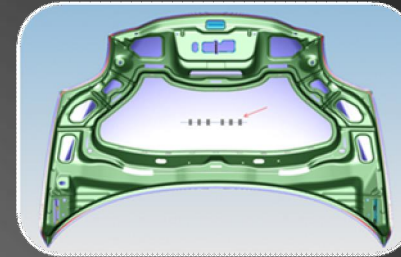
COCET – Composite fuel line and engine compartment system with improved fire resistance



ASAP

New adhesive modified by nano-particles to join structure and skin of a hood

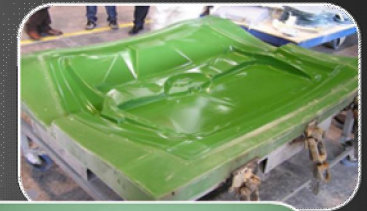
- ❑ 30% improvement of torsional stiffness
- ❑ 20% weight reduction with respect to welded hood.



TRASPORTI

Carbon Fiber Reinforced Resin tailgate through injection molding and resin transfer molding process

- ❑ Weight: - 30 % with respect to steel solution
- ❑ Torsional stiffness: + 30%
- ❑ Number of necessary molds: - 60%



CESPERT

Carbon Fiber Reinforced Thermoplastic (Polyamide) tailgate by thermoforming process:

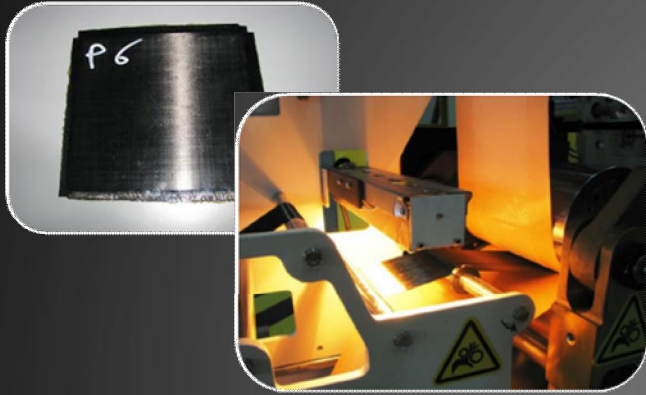
- ❑ weight reduction of 30% with respect to steel solution
- ❑ cost reduction of 20% with respect to thermosetting prepreg.



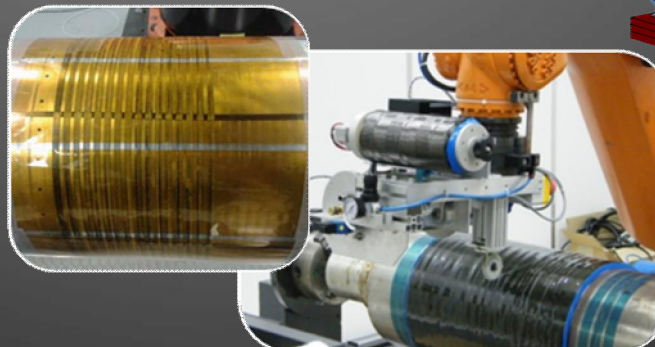
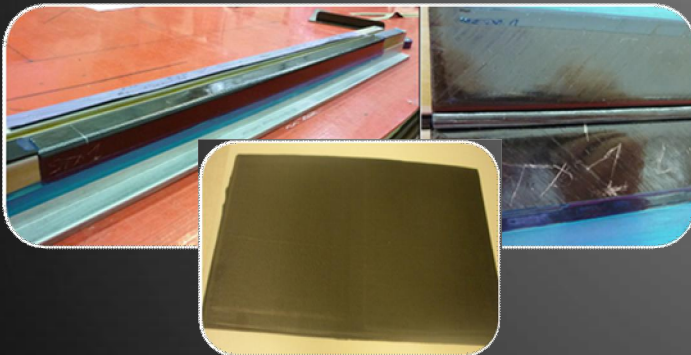
PRICE - Filament-winding technology to the production of motors cases for space launchers (Vega) and epoxy prepreg system with long shelf-life and high thermo-mechanical performances

☐ glass transition temperature 170°C

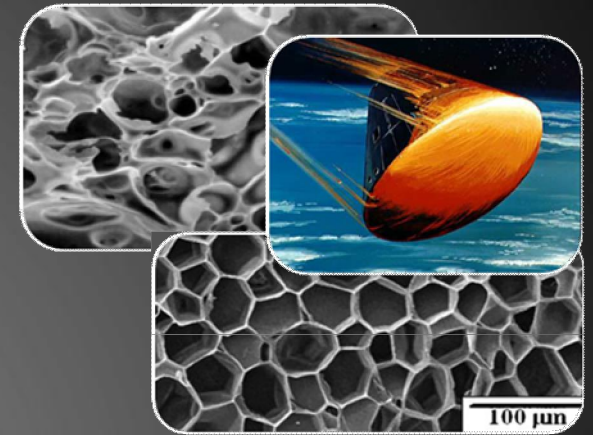
☐ out life 6 months (RT)



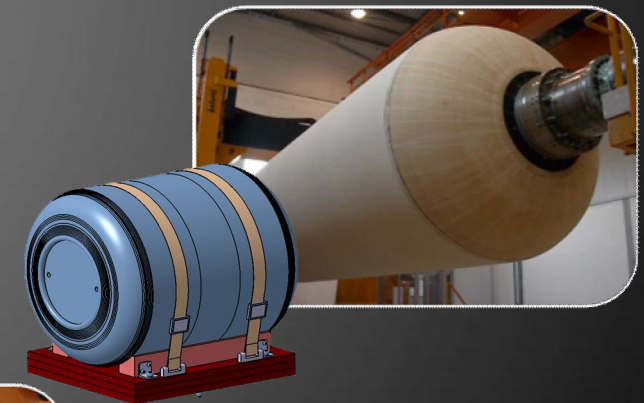
IMPRESA e FUZI – Functional composite systems for structural monitoring



COCET - Ablative composite tile for ballistic atmospheric re-entry with improved ablative features.



PRADE – Polymeric composite system for the engine repair with improved mechanical performances



TECOP – Thermoplastic composite components by fiber placement technology

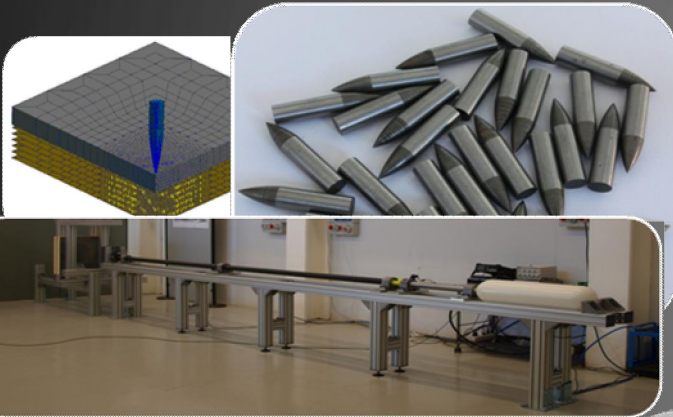
TRASPORTI – Polymeric composite add-on panels with fire retardant and antiballistic properties (they meet naval and military requirements) and weight reduction



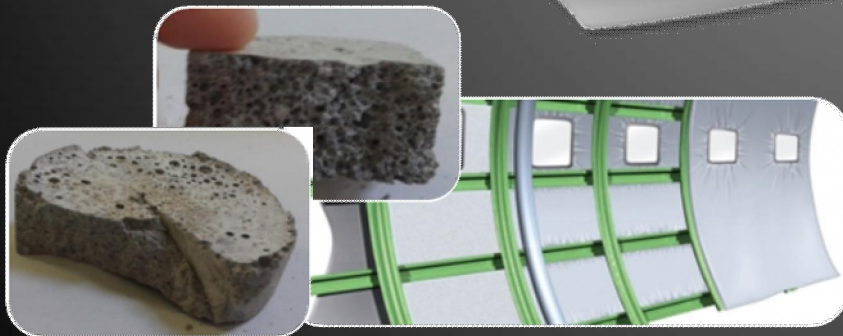
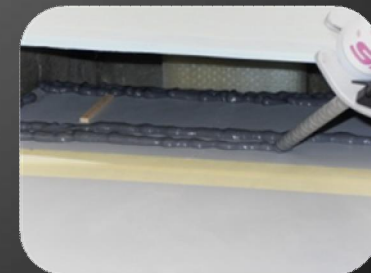
ASAP - Structural and fire resistant adhesives in order to bond swimming pool and fire door to the structural parts of the ship (process time and costs reduction)



MACADI - Computational models to improve the prediction of ballistic property composite panel



PRADE - Flexible and fire resistant adhesive joint and composite systems for the repair of metal structures

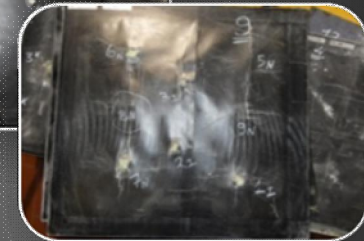
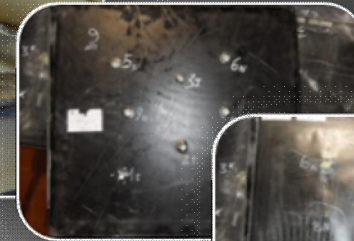
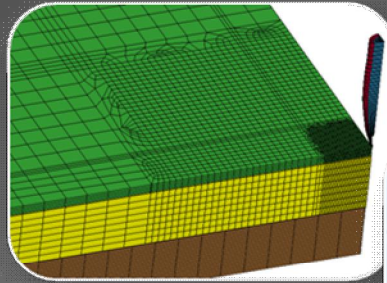


COCET - Composite bulkheads that comply maritime fire rules with a weight reduction

TRASPORTI

Multifunctional Aramid fiber/Phenolic Resin composite panels layered with GFRP and steel sheets for fire retardant and antiballistic properties

- ❑ Weight: - 20 %
- ❑ Fire resistance class: B30
- ❑ Acoustic insulation: + 30dB



ASAP

new structural and fire resistant adhesives to bond swimming pool and fire door to the structural parts of the ship

Fire door (patent pending)

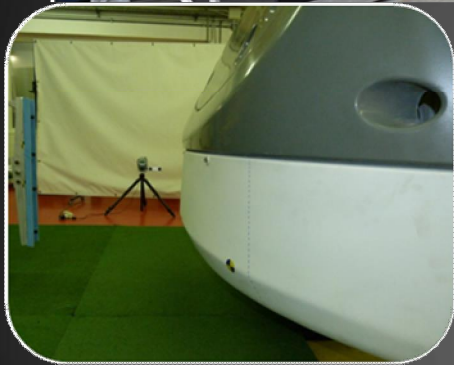
- ❑ process time: -75%
- ❑ process costs: -20%
- ❑ mechanical stress : -40% with respect to mechanical joints
- ❑ meets fire resistant regulation

Swimming pool

- ❑ process time -70%
- ❑ process costs -14%



CESPERT - Thermoplastic composite body panel and bumper, with improved pedestrian safety, of a mass transit tram (weight reduction).

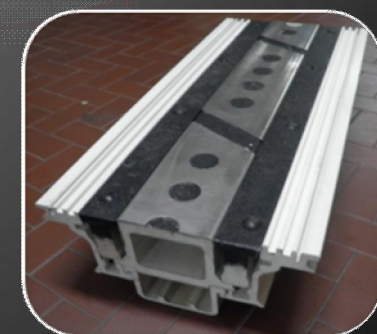


ASAP - Structural bonded joints for carbody (floor and lateral panels) with reduction of process time and costs



SITRAM – Innovative composite feeding system for in-ground electrification with a reduction of weight

PIROS - Multifunctional thermosetting floor and side panels, with acoustic insulation and fire resistance properties (weight reduction). Epoxy nanocomposite system for electrical insulation of permanent-magnet electric motor with high thermal resistance and sound insulation performances



CESPERT

Thermoplastic composite bumper and body panel of a mass transit tram (Metro Sirio) through thermoforming process.

Body panel (glass fiber/Polyetherimide)

- ❑ weight reduction of 48% with respect to aluminum solution
- ❑ meets fire safety requirements

Bumper (glass fiber/Polyphenylene Sulfide) (patent pending)

- ❑ weight reduction of 34% with respect to aluminum solution
- ❑ improved pedestrian safety during vehicles travel



PIROS

Multifunctional polymeric composite car body panels (floor and side)

- ❑ 25% thickness reduction
- ❑ 18% weight reduction
- ❑ 39dB acoustic insulation
- ❑ fire resistance under structural load: (REI 15)



Epoxy nanocomposite systems for permanent-magnet electric motor of an Automated Lightweight Metro (MLA) with electrical and acoustic insulating properties at high temperature

- ❑ 21% size reduction
- ❑ 18% weight reduction
- ❑ sound insulation ($\alpha = 0.8$)
- ❑ transmission Loss 38dB



IMAST fire laboratory



Fire test apparatus

- ☐ Cone Calorimeter
- ☐ Flooring Radiant Panel (FRP) Horizontal Spread of Flame
- ☐ IMO/LIFT Vertical Spread of Flame
- ☐ Oxygen Index and High Temperature Oxygen Index
- ☐ Non Combustibility
- ☐ Thermal Conductivity
- ☐ Smoke Chamber

R&D Labs attracted in Campania



International strategies



*Member of Global network for
composites in aerospace*

*European reference for Korean Research
centers on composites*



*IMAST - KCTECH - Korean Technological Cluster on Polymeric and Composite
Materials Engineering and Structures - pending of the MoU*



IMAST indicators

- ✓ **10** millions/year project
- ✓ average of **240** researchers/year involved of which:
- ✓ **30%** women
- ✓ **25%** new researchers
- ✓ **90%** permanent contracts after project
- ✓ **62** SMEs involved
- ✓ **15** patents
- ✓ **62** international scientific papers
- ✓ **83** long abstracts
- ✓ **2** books

Thank you for attention!

IMAST S.c.a.r.l

Piazza Bovio, 22

80133 Naples, ITALY

Ph./Fax +39 081 5519586

www.imast.it

aniello.cammarano@imast.it