OPERA4FEV, Erwan Le Floch, MECAPLAST SAM (Monaco)

OPERA4FEV is a European collaborative research project under the Seventh Framework Programme, co-funded by the European Commission under Grant agreement n.285671

- **Context**

  - **OPERA4FEV** acronym of "OPerating Energy RAck For Full Electric Vehicle"

  - **OPERA4FEV** Project aims to manufacture electrical vehicle cheaper and lighter by using thermoplastic solutions for battery racks.

  - This project involves a consortium of 10 partners from 6 European countries and has a total budget of €7 millions.

  - Initiated in July 2010, submitted in December and awarded in February 2011, the project started in September 2011 for a total period of 42 months.

  - **Call : FP7-2011-GC-ELECTROCHEMICAL-STORAGE**
    GC.SST.2011-7.7 : Advanced eco-design and manufacturing processes for batteries and electrical components

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- **Partners**

Partner	Country	Description
MECAPLAST		Coordinator - Auto-parts developer and producer *OPERA4FEV is the first FP7 project coordinated by a Monegasque company*
INSA-CNRS / CETHIL		Research laboratory in thermal science and energy engineering - Lyon
VUB / ETEC / MOBI		Research laboratory in sustainable transport and mobility
EVE SYSTEM		Engineering company, expert in design, prototyping and industrialization of electric architectures for electric and hybrid vehicles
FAM AUTO		Company specialized in the construction and conversion of electric vehicles
OLESA		Engineering and tooling company
CR FIAT		Fiat Group Research Center
REPOL		Providers and custom compounders of Engineering Plastics
MECACORP		Auto-parts developer and producer, Powertrain technical center, Acoustic and Vibrations laboratory
UPM / INSIA		Research laboratory in traffic accidents and vehicles safety
TOTAL	**6 countries**	**10 Partners**

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- The OPERA4FEV project aims to develop thermoplastic battery racks on two functional demonstrators: one for a large scale vehicle with the FIAT group **IVECO DAILY** and one for a “niche” car, the **F-City from FAM**.

- The innovative solutions proposed by OPERA4FEV will integrate electrical, hydraulic connections and component housing in a thermoplastic approach to reduce cost, weight and assembly time.

- The main goals are

  - **The integration of cells into a thermoplastic rack (ensuring security, cooling & dimensional)**
  - **25% cost reduction (cells excluded)**
  - **50% reduction of components number**
  - **30% weight reduction (cells excluded)**
  - **The use of recycled polymers (70% in weight of plastics materials)**
  - **the reduction of assembly time**

- **Exploitation potential**

  Already deeply involved into the automotive industry, each partner of the project wants to acquire new knowledge, methods, and competitiveness in the field of electric vehicles.

  - **MECAPLAST :** to build new skills, methods and network to propose integrated solutions to OEMs.
  - **EVE SYSTEM** : to set-up a pilot production line dedicated to niche markets and to develop modular electronic solutions
  - **INSA/CETHIL :** is expecting to get more experience on electrical vehicles, creating knowledge on heat transfer problems, and improving design of battery racks using thermoplastic materials.

- **Exploitation potential**

  - **UPM-INSIA** wants to develop and apply to electrical vehicles a new approach in crash safety activities, accidentology, crash modelling and testing. Obtain justification for the development of current and future regulations.

  - **CRF** : interest for a new, reliable, safe and cheaper Li-ion battery racks dedicated to automotive.

  - **FAM** : to access a set of innovative technologies (composites, lithium, functions integration)

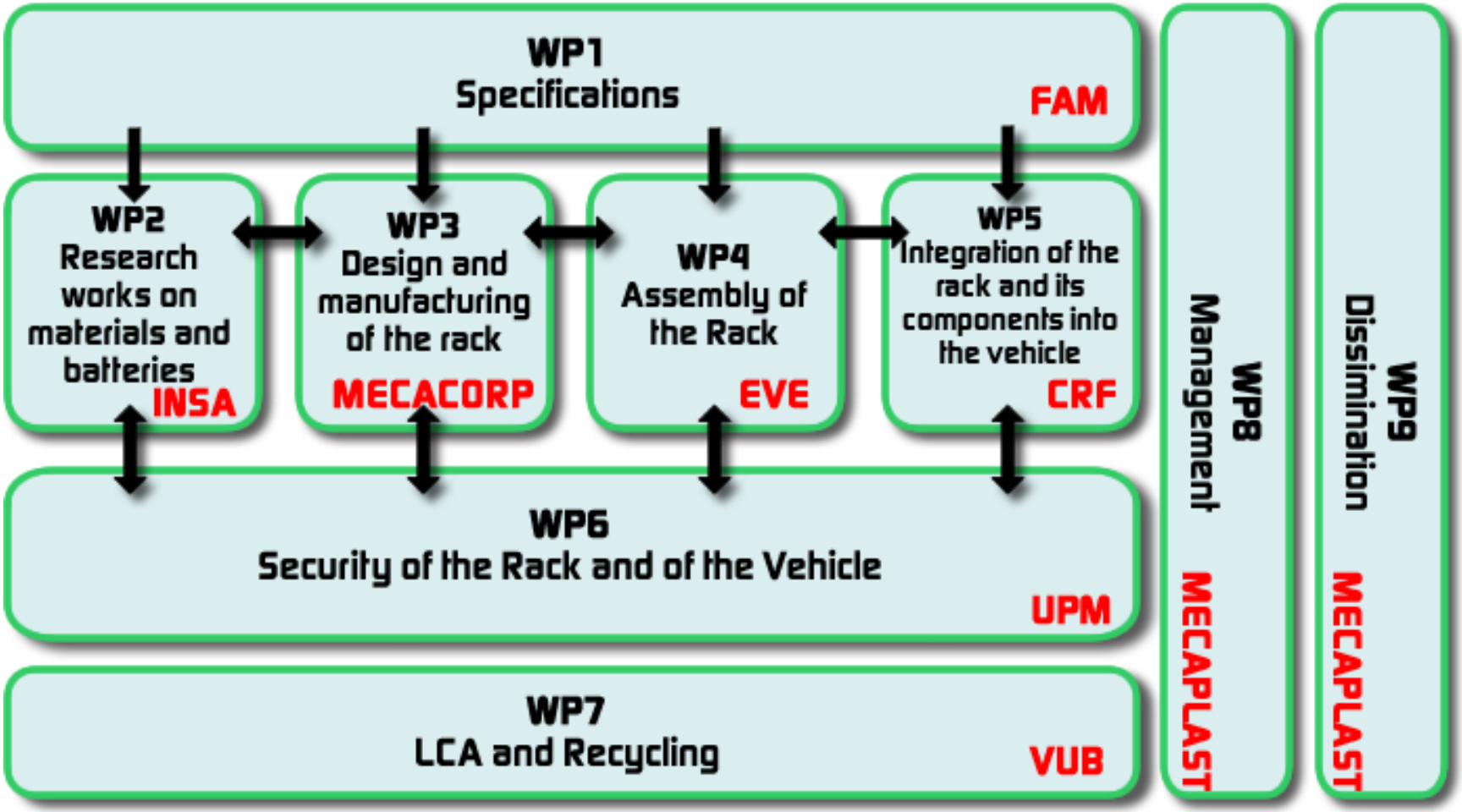
- **Exploitation potential**

  - **VUB** is expecting extension of existing data base on inventory of BEV and battery racks, and an international exposure as LCA-leader in the field of electric vehicles.

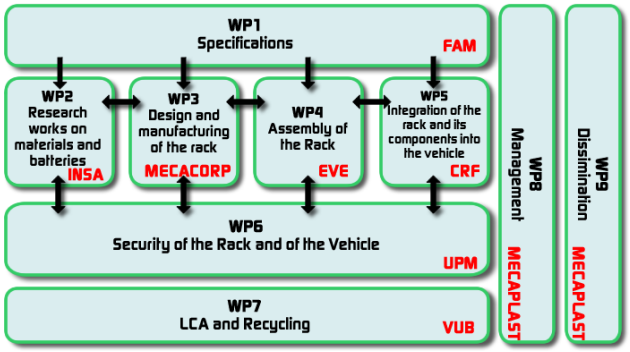
  - **Olesa** will acquire knowledge in design, development and manufacturing of large molds for automotive battery racks using thermoplastic and composite materials.

  - **REPOL :** Optimization of extrusion and injection parameters with the final goal to obtain best and homogeneous mechanical and thermal properties with the smallest possible amount of virgin polymer

- **Project articulation**



- **WP1 : Specifications and input data**

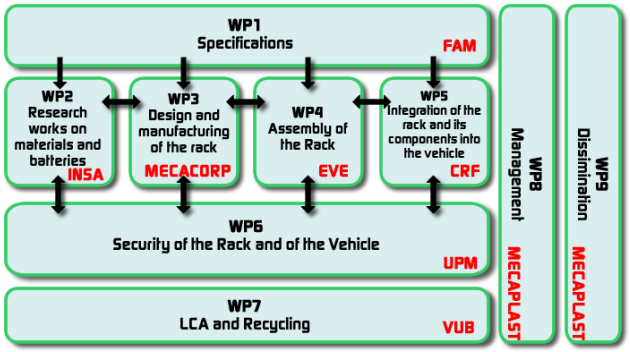


  - **RTD / M1 to M8**

  - This Work Package aims to define all the OEM constraints and specifications imposed to the battery rack during its lifetime (storage, use and end-of-life).

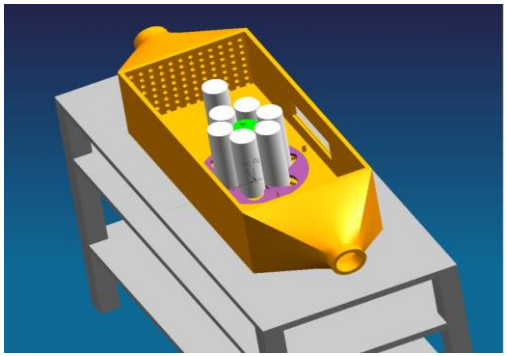
  - The following tasks will have to be fulfilled :
    - Summary of technical specifications for both car manufacturers
    - Achievement of the external and volumes 3D models for both car architecture
    - Definition of the testing protocol to be fulfilled in order to validate the battery rack

- **WP2 : Research work on materials and batteries**

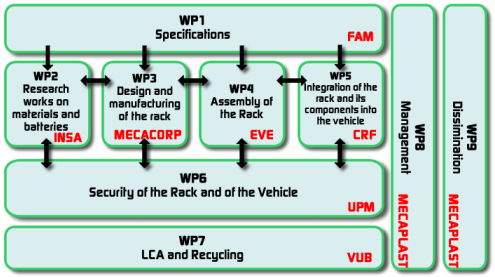


  - **RTD / M6 to M15**

  - The topics will be
    - Material choice nomenclature
    - Electromagnetic Interferences (EMI) shielding
    - Lightweighting of the components
    - Thermal characterization of the cell selected to supply the consortium. The cell model is common of the two demonstrators (rigid prismatic)



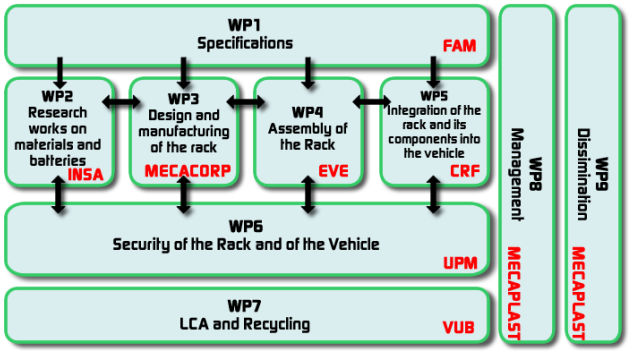
- **WP3 : Design and manufacturing of the battery Rack**



  - **DEM / M4 to M30**
  - The first objective of this work package is to design an ecofriendly battery rack that meets the assembling ability and use criteria defined with partners as inputs coming from the three previous WP.
  - The second objective is to define the industrial process by building a pilot manufacturing line that includes all means of manufacturing, assembly and testing.
  - The third objective is to focus on the definition, thermal and electrical, electronic measurement of one cell and improvement of connectors.

- **WP4 : Assembly of the rack**

  - **RTD / M7 to M36**

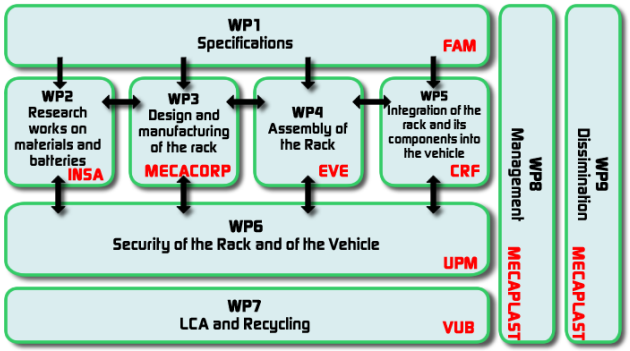


  - The first objective is to qualify the thermal behavior of the total amount of cells we will use in one module. The cells together in their environment.

  - The second objective is to define and install a pilot rack assembling production line that can produce 5 racks a day, extendable to 50 racks/day.

  - The third objective is to qualify the complete pack assembly and check the expected results.

- **WP5 : Integration of the rack and its components into the vehicles**

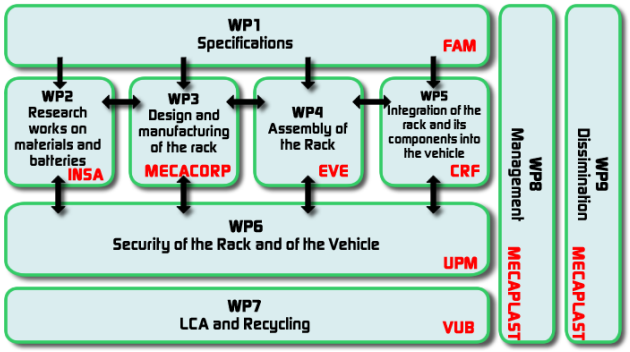


- **RTD / M27 to M42**

- The objectives of this work-package are the integration of the developed battery packs into prototypes F-City and Iveco Daily:

  - To install the prototype battery pack on existing electric vehicles;
  - To assess the efficiency, lifetime, reliability and safety of the battery rack;
  - To assess the temperature conditioning of the cells;
  - To assess the monitoring and early warning system;
  - To test the battery rack under realistic conditions.

- **WP6 : Safety of the rack and vehicle**

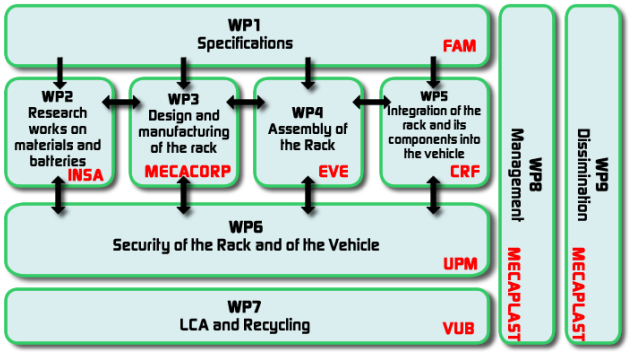


  - **RTD / M4 to M36**

  - The first objective is to evaluate the behavior of the rack regarding vehicle crash safety

  - The second research line will focus on the potential risks for the vehicle and its occupants in case of failure of one or more batteries.

- **WP7 : Life Cycle Assessment and Recycling**



  - **RTD / M1 to M36**

  - LCA
    - To identify the environmental hot spots of the project
    - To proceed to the detailed LCA of the F-city & Daily, with a focus on the battery pack

  - Recycling
    - To compare the recycling of plastic case and alu case
    - Redaction of eco-development guide to design the rack to make the dismantling easy

Thank you for your attention

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