The SEAM Cluster consists of four partner projects (SafeEV, ENLIGHT, ALIVE, MATISSE) and two associated projects (epsilon, URBAN-EV) involving novel ideas in the automotive sector that attempt to push developments in electric and alternative vehicles and lightweight design further. The SEAM cluster is heading towards finalisation of its projects.

The clustered projects have been running for three years, and considerable developments have been achieved since the last newsletter. On the 25 September 2015, MATISSE and SafeEV delivered their final presentations on the project and the outcomes from their respective work packages.

The progress of the ALIVE and ENLIGHT projects was evaluated by the European Commission and selected technical experts on the 3 and 4 of March. These projects are entering their final period with just less than six months remaining. This newsletter highlights the achievements and developments of the four projects thus far.

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**Ending its three-year study on SEV accident scenarios**

**SafeEV** (Safe Small Electric Vehicles through Advanced Simulation Methodologies) concluded its three-year study last September 2015, having focused on addressing safety concerns regarding Small Electric Vehicles (SEV). The project envisions that SEVs will be made from stiff lightweight materials, and incorporate active safety systems such as automatic emergency braking.

SafeEV conducted a wide-ranging evaluation of possible SEV accident situations. The inputs generated were put through a Delphi analysis that resulted in the identification of six key accident scenarios. Through further advanced vehicle simulations these outcomes were used to generate two reference electric vehicle models (REVM), in terms of a package of materials and crash-relevant components needed.

The results of the virtual testing were used to develop a best practice guide for virtual safety testing of future electric vehicles.

*The final REVM1 & REVM2 EV models*

For more information please visit: [www.project-safeev.eu](http://www.project-safeev.eu)
Concluding crash critical testing of FRP structures

MATISSE (Modelling And Testing for Improved Safety of key composite Structures in alternatively powered vehicles) concluded its activities in September 2015 alongside SafeEV. They presented the final modelling and simulation tool designed for manufacturers to use in the optimisation of the safety performance of components; thus lowering the market entry barriers for Alternatively Powered Vehicles (APVs).

The research partners virtually and physically investigated the crashworthiness of two optimally designed FRP vehicle structures:

- CNG fuel tanks – these have high quasi-static internal pressures of 200-250 bars and in the instance of crash are extremely dangerous
- Adaptive crash structures – these Structures are designed to dissipate energy at impact and are a crucial part of the occupant safety

*Mechanical testing of CNG cylinder*

Project conclusions and deliverables are available on the project website:

[www.project-matisse.eu](http://www.project-matisse.eu)
The ALIVE project (Advanced High Volume Affordable Lightweighting for Future Electric Vehicles) recently presented their full Electric Vehicle (EV) model design, based on novel lightweight steel and aluminium alloys, and hybrid components.

To arrive there, the vehicle modules went through regular iterations during the past year to optimise their design according to the needs of the materials and manufacturing technologies targeted throughout the project, whilst ensuring top safety standards and manufacturability at high volumes.

A significant 35% weight reduction was achieved for the Body in White (BiW) component, while for certain components reductions reached a staggering 50% comparing with reference modules. ALIVE will fabricate, test and finally showcase a full vehicle demonstrator model including the developed light-weighting technologies at Aachen Body Engineering Days in September 2016, side by side with the ENLIGHT demonstrator modules.
Showcasing light composite vehicle modules

ENLIGHT (Enhanced Lightweight Design) is close to reaching a significant milestone; the design freeze of all the project components as presented at the TRA 2016. For each component, significant mass savings of up to 50% have been estimated with reference to conventionally built parts, after several rounds of design iterations to optimise module designs to the material and production technology requirements. These designs utilise an innovative concept of joining aluminium inserts with fibre-reinforced plastics (FRPs) to achieve balance between strength and weight.

ENLIGHT primarily addresses materials that offer a high potential for lightweight vehicle design and low CO2 footprint, but require a long R&D trajectory in order to become viable. Materials considered include thermoplastics, FRPs, advanced hybrid materials, and biopolymers.

The ENLIGHT final demonstrators will be showcased together with the ALIVE demonstrator vehicle at the Aachen Body Engineering Days on the 20th and 21st September this year, after validating the viability of the design, the materials, and manufacturing process. The final workshop will take place after the conference on 22 September at the same venue.
A three-seat electric car for the city

**epsilon** has developed a surprising design of an EV for urban mobility, which accommodates the ergonomic demands for two people in the front and one person in the back row.

![Diagram of a three-seat electric car](image)

The entire concept was developed on the premise of making the vehicle lightweight, energy efficient, and compact; whilst providing the same level of crash safety as conventional vehicles. The kerb weight had to be under 600kg and it had to have a purely electric range of at least 150km.

The Body in White (BiW) design is a Carbon FRP space frame with aluminium extrusion tubes at the front and rear ends for crash absorption. The BiW space frame was closed using metallic sheet panels to meet stiffness requirements. Glass FRP panels were used cosmetically as a skin to cover the remaining structure, without providing structural support. The three levels of the body can be seen in the figure below.

The project also incorporated a complete drive train and battery system designed to fit within the aforementioned body. The drivetrain and battery were developed using results from simulations conducted on energy demand and the range for New European Driving Cycle.

A key part of the chassis was the rear axle, which used both Carbon FRP and a metal to achieve optimum performance and a weight reduction of up to 45% compared to traditional axle designs.

By project end, epsilon will have built three prototypes: a full running vehicle and two reduced structures for crash test purposes. The final results will be presented at the Aachen Body Engineering Days in September 2016.

The epsilon project (small Electric Passenger vehicle with maximised Safety and Integrating a Lightweight Oriented Novel body architecture) was associated with the SEAM cluster in 2014 along with URBAN-EV.
An Al-Mg hybrid for lightweighting

URBAN-EV (Super Light Architectures for Safe and Affordable Urban Electric Vehicles), which was associated with the SEAM cluster in 2014, builds on the output of a previous FP7 project, Casple EV.

Light-weighting is a key objective of URBAN-EV: the project aims to reduce the weight of a class L7e vehicle (the Casple EV) whilst maintaining all crash safety and structural obligations.

A hybrid material consisting of aluminium and magnesium has been chosen for the final design, providing low density and thus high lightweight potential. The design of the vehicle is being iteratively altered, to compensate to the lower performance of this hybrid material in comparison to steel.

The project aims to present a full-scale working demonstrator by February 2018.

The Urban EV lightweight vehicle

For more information please visit: www.urban-ev.eu