

Leicester, 17 June 2014 – Technology Strategy Board project LIGHT; testing lattice structures designs

The second quarterly meeting for the LIGHT project was hosted by Magna Parva Ltd, a company delivering engineering services, novel technologies and successful projects for hostile environments such as space. Together with the other partners Delcam, Bloodhound, HiETA Technologies, CRDM/3D-Systems, EOS and Simpleware the project progress has been discussed in Leicester.

The LIGHT project (full title Inspiring New Design Freedoms and Light-Weight Solutions for Metal Additive Manufacturing) is funded by the UK's innovation agency, the Technology Strategy Board. Potential improvements in the economy and performance of Metal Additive Manufacture (MAM) components will be investigated by the use of specialised software. The LIGHT software tool, which will be developed throughout the project, allows the selective replacement of internal geometry by a lattice structure. Thus it is anticipated that the mass and material required to manufacture components will be reduced, whilst maintaining external geometry.

For the research and development three demonstrator parts are selected; an Airbrake Door Hinge (Bloodhound), a Thrust Nozzle (HiETA) and an Earth Re-Entry capsule (Magna Parva). The project which started 1 December 2013, has progressed in line with the current plan, with each end-user commencing a component re-design, which is now in the first stages of concept design and analysis.

For example, Bloodhound's first design iteration has used iterative topology optimisation software to identify an optimum structural balance of overall bracket design to achieve the desired function within the tightly constrained design envelope. The next iteration will include shell thickness and lattice core.

Magna Parva has begun FEA of small lattice cubes to evaluate their performance, and establish a methodology for such simulations. This groundwork will be checked against real world testing in the coming months. HiETA Technologies has investigated the theoretical potential benefits of a graded lattice structure which changes in size and density to achieve the best thermal recovery in their component as a first design iteration. Delcam has demonstrated PartBuilder to the consortium and demonstrated how to design lattice structures in geometries. The tool, which uses Simpleware's internal structures library, allows for default unit cells as well as custom unit cells and control over the creation parameters such as volume fraction.

FEA simulations of the lattice samples are required for the end-users to validate the design before manufacturing. Direct FEA is computationally intensive. To allow an indirect FEA approach, an experimental plan was developed to manufacture test samples with different lattice designs to extract material properties in order to simulate the lattice as bulk material. Each partner now has a methodology for simulating the performance of a lattice structure produced by PartBuilder using their own Finite Element Analysis (FEA) software.

EOS has worked on designing tensile test sample geometry suitable for use with a lattice structure, so that more accurate strength and stiffness data may be obtained through empirical testing in the next period. The data will be useful to all partners, allowing more efficient FEA based upon simulating lattices as a bulk material rather than the computationally intensive (and potentially less accurate) simulation of the lattice geometry directly.

The objectives for the next quarter are to continue with the end-users design iterations of the demonstrator parts. The second main focus is on producing FEA simulations of small lattice samples, which can be validated by mechanical testing using samples which will be manufactured by CRDM/3D-Systems for testing later this quarter.

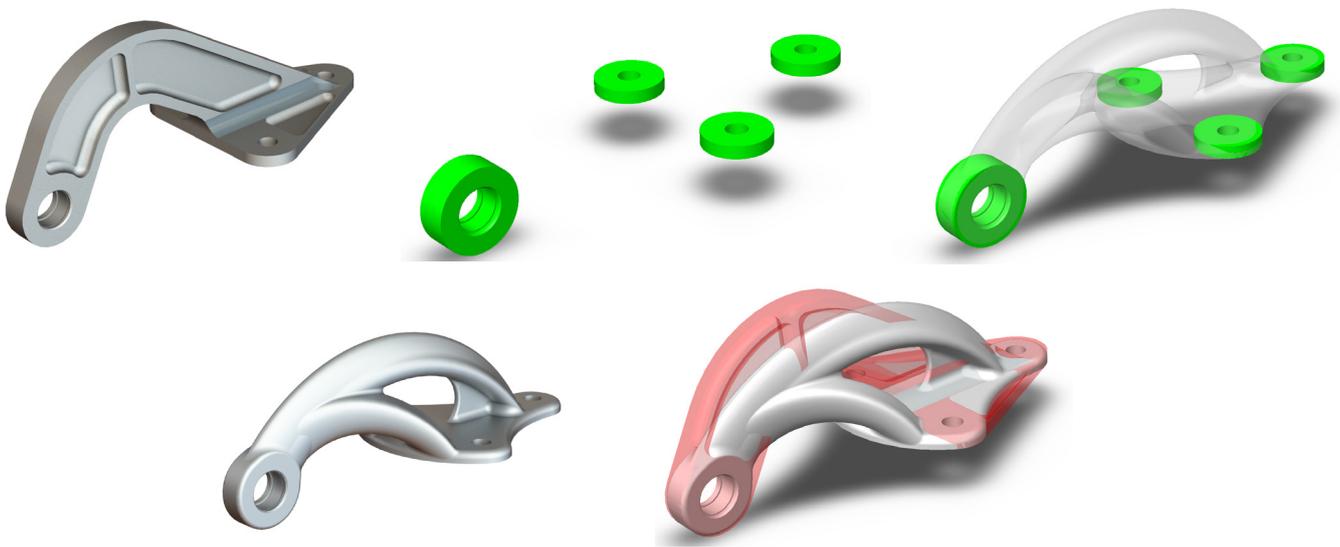


Figure 1: Bloodhound's first design iteration of the Airbrake Door Hinge

Follow us on Twitter [@adding_less](https://twitter.com/adding_less)

For more information visit the website www.light-project.co.uk or send an email to info@light-project.co.uk.

Acknowledgements

As the UK's innovation agency, one of the main roles of the Technology Strategy Board is to achieve business and economic growth for the UK. One way the organisation supports this is through funding innovative Collaborative Research and Development (CR&D) projects. Collaborative research and development (R&D) encourages businesses and researchers to work together on innovative projects in strategically important areas of science, engineering and technology – from which successful new products, processes and services can emerge, contributing to business and economic growth. Find out more about the CR&D programme here: <https://www.innovateuk.org/-/collaborative-r-d>