‘SupLight’: using recycled aluminium in aeronautics, cars …

In both aeronautical and automobile sectors, one of the main challenges for design and production engineers is to lighten the frames and bodies by reducing the weight of each component part, in order to reduce fuel consumption. One solution is to produce parts in aluminium, which has excellent mechanical properties plus being a light material. However, producing aluminium needs lots of energy input, consumes lots of water and has an intrinsically bad ecology rating. The aim of the European programme “SupLight” is to help solve this problem – it is financially supported by the Picardie Regional authorities, who target improved method development to produce aircraft and automobile parts using 75% recycled aluminium.

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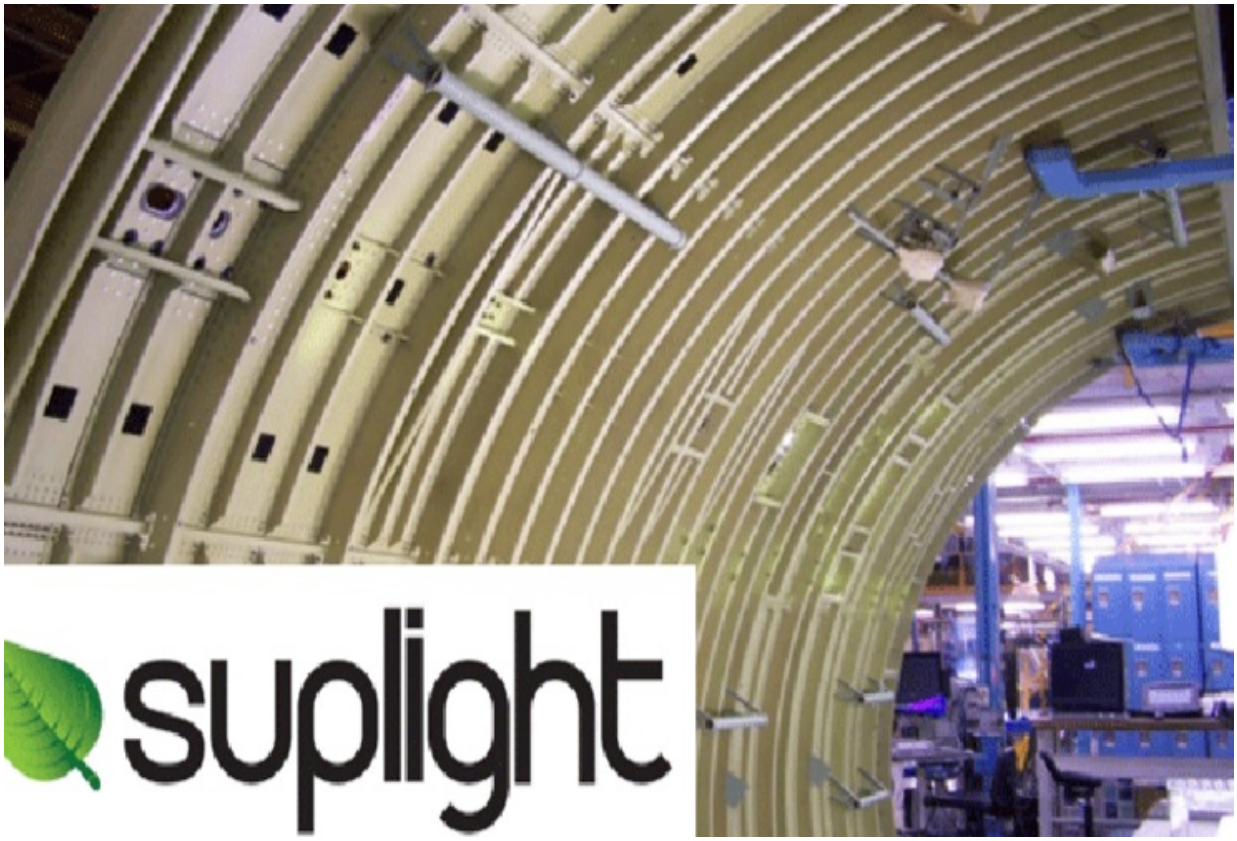

The SupLight programme is led by a Norwegian techno-centre, SINTEF, with no less than 11 European partners co-operating, from both the academic and industrial sectors: EPFL (Lausanne), Hellenic Aerospace Industry, Newman Aluminium, the University of Chalmers, the Norwegian University of Science and Technology …
The main objective: to lower as far as possible the carbon print and water consumption by in reducing more aluminium in parts that normally would not be allowed "*Aeronautical industries only allow primary (first smelt) aluminium for structural components, essentially for reasons of mechanical strength and quality control assurance*", explains Julien Le Duigou, research scientist and lecturer in UTC Department for Mechanical & Systems Engineering. "*We set ourselves the target of using up to 75% recycled aluminium*" says Benoit Eynard, also a lecturer and research scientist, and Director of the GST Future factory project: mechanical and production engineering for the French association of Mechanical Engineers. *Today we can reach – with difficulty – 20% and using only internal recycling, i.e., the chips produced by bulk machining processes of primary aluminium billets*.

The choice for the co-operating establishments and labs was to opt for a multi-disciplinary and multi-level approach. "*We studied recycled aluminium in terms of its chemical composition, its mechanical properties but also took into accounts its origins, in order to identify and qualify a material that would be acceptable to the aeronautical industrial sectors*", adds Julien Le Duigou. "*We also looked at parts optimization as a function of the properties observed in the new material and, likewise, we looked at process improvement possibilities*.

In the framework of the project, the UTC Roberval Laboratory looked after the reverse logistic circuit, viz., the collection of the 'used' aluminium and bringing it back to the re-treatment stations, to be integrated in the aluminium production 'line". "*Today, recycled aluminium is less resistant because the supply chain does not sort out the various sorts of returned, used, aluminium. We find car parts mixed with soft drink cans and this leads to producing aluminium with lots of impurities*", says Benoît Eynard. "*It is got this reasons that this recycled aluminium is not allowed in aircraft part production, because it lacks in mechanical resistance.*" UTC Roberval after analysis decided that a new process was needed

if they wanted to reach a 75% recycled aluminium content with a different metal sorting protocol and also modifying the chemical content (with specific additives), producing a metal with a better mechanical resistance factor.

Beyond changes in the way aluminium is collected, the teams also had to take into account factors to integrate the ecological dimension. Benoît Eynard wonders: "*If, for example, we analyse recycled aluminium from China, the question arises: is it still ecological and economically profitable to use?*" "*We have calculated that using recycled aluminium, we could reduce CO2 emissions by 20% and water by 40%*", details Julien le Duigou. "*And, by the end of the project, we had managed to make parts some 10% less in mass containing 75% recycled aluminium with exactly the same properties of mechanical resistance as a prime (first smelt) machined part*." "*What we must do now is to move on to industrial prototyping, to test the viability of our methods », concludes Benoît Eynard, "i.e., to see how we can re-organize the gathering of used aluminium and how we can identify new uses in industry*". Moreover, the approach adopted and tested could possibly be transposed to other manufacturing processes.