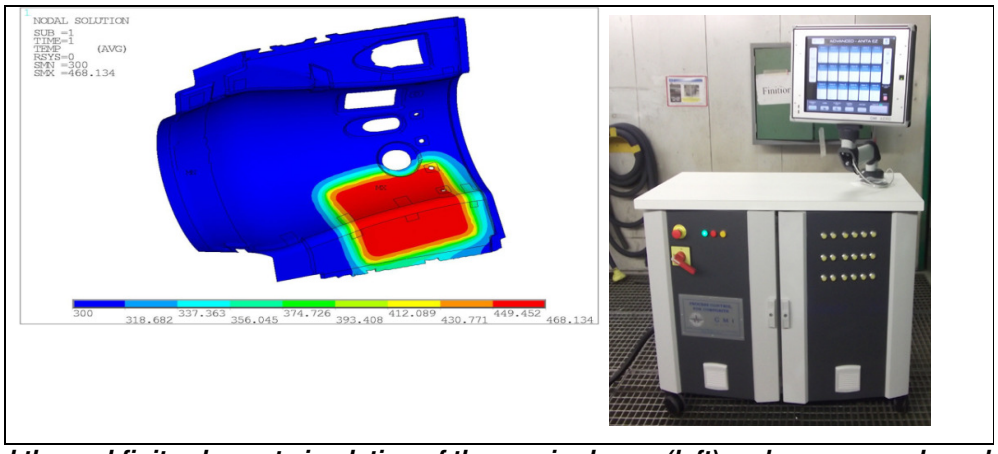
GMI AERO, based in Paris, is a worldwide recognized expert in technology for advanced composite structural repairs. Right from its creation, back in 1980, GMI has initially developed its capabilities towards composite structure fabrication processes. Specific sensors and control equipment have greatly helped in investigation of critical quality parameters and improved productivity. When composite repairs became a first preoccupation, GMI started early in 1984 to innovate with the equipment and toolings for repair and conduct processes in all steps from NDT to bonding. These works have been the result of regular cooperation both with aircraft manufacturers and end-users (i.e. airlines and MROs). Today, the business activity of the company is worldwide, cooperating with major aeronautical stakeholders in Europe, USA, Canada and China. The innovation of equipment has been the result of both internal development and extensive cooperation with researchers coming the National Technical University of Athens, with which a “strategic cooperation” is in place, participating together in several EU funded R&D projects. Recently, CleanSky GRA, ECO and SFWA R&D projects have offered to the company the opportunity to focus its research activities in order to further mature innovations towards a higher TRL.

Within ECO Design ITD a project titled “Advanced heating system and control mode for homogeneous high temperature curing tf large composite repairs – ADVANCED” has been recently finished by GMI and the NTUA, Topic Manager being Aircelle (Group SAFRAN). ADNANCED concerned the development of innovative solutions for the application of very large composite repairs, to be performed outside autoclaves. Even though achieving the very strict temperature tolerances (usually in the area of (+/-5 at 180 or 225^{o}C) for repairs of several m^{2} is rather challenging, the expected benefits are very significant, as reduction of autoclave utilization induces direct reductions both to the overall repair cost and to the CO_2 footprint of the repair, as the energy requirements for out-of-autoclave curing is minimal, compared to autoclave curing. Detailed 3D FE thermal transfer simulation of the full repair case was performed, in order to retrieve “thermal signature” of the repair, thus achieving customization of heating blankets design, while reduction of number of heating zones was achieved by using non-uniform heating generation elements. A 48 KW Power Supply and Control Unit has been developed, capable of heating up to 18 heating zones, together with the associated software for simultaneous data acquisition from eighty (80) control & monitoring thermocouples, using innovative control algorithms with increased flexibility in defining control mode. User friendly HMI was applied (similar to those of standard GMI ANITA EZ heating consoles), for immediate transition of operating personnel. The developed equipment has been successfully tested and approved at industrial environment, on an extremely demanding application (A380 reverser).



Detailed thermal finite element simulation of the repaired case (left) and power supply and control equipment, developed within the frame of the ADVANCED project.