HIGH PERFORMANCE LIGHTWEIGHT PANELS WITH A NEW OPTIMIZED DESIGN FOR ADVANCED AIRCRAFT STRUCTURES

Goal of the project

The goal of the project is the design, fabrication and testing of the new flat and curved aircraft panels having better characteristics, as follows:

- fabrication of the experimental models for both plane and curved sandwich panels;
- 3D modeling for linear and nonlinear analysis in order to characterize the new sandwich panels;
- static testing of the experimental new models.

Short description of the project

Design of aircraft panels, made of metal and composite material, flat and curved, with improved performances.

Project implemented by:

- University Politehnica Bucuresti - Coordinator
- Straero S.A - Partner 1
- University Politehnica Timisoara - Partner 2
- INAS S.A. - Partner 3
- SMART Mechanics S.R.L. - Partner 4

Implementation period

02.07.2012 - 30.10.2016

Main activities

1. Bending static tests on two type of specimens cut out from flat sandwich panels: PSP 1 (figure 1) with a compact core and PSP 2 (figure 2) with the core having circular holes;
2. Bending static tests on MEC 2 (figure 3) curved sandwich panels;
3. Stability tests on MEC 2 curved panels;
4. Numerical simulation of the mechanical behavior of tested sandwich structures;
5. Dissemination of the results.

All the specimens were made using polyurethane foam cores with density 300 kg/m^3, aluminum alloy 1050 H24 for faces, and adhesive AW 106/HV 953U.

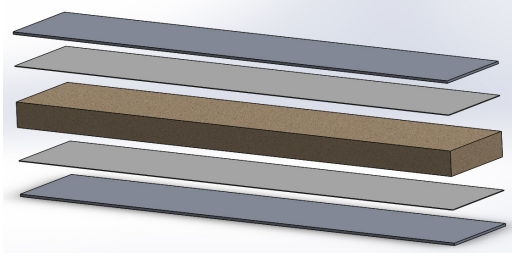

Fig. 1. PSP 1 panel

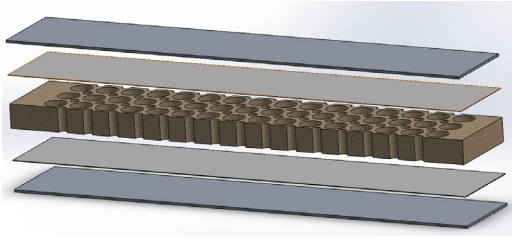

Fig. 2. PSP 2 panel

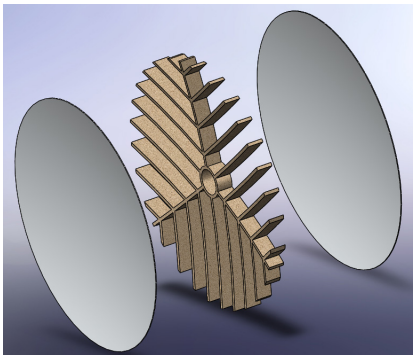

Fig. 3. MEC 2 panel

Results

1. Determination of strength and stiffness of the investigated sandwich structures;
2. Identification of the failure modes of the sandwich structures loaded in bending (figure 4);
3. Characterization of the mechanical behavior of the sandwich structures using the digital image correlation technique;
4. Numerical simulation of the mechanical response for tested sandwich structures.

The main publications are:

1. Negru R., Marsavina L., Hluscu M. (2016) Experimental and numerical investigations on adhesively bonded joints, IOP Conf. Series: Materials Science and Engineering, vol. 123 012012 (3rd International Conference on Competitive Materials and Technology Processes IC-CMTP3, Miskolc-Lillafüred, Hungary, October 6-10, 2014);

Fig. 4a. face indentation (PSP 1)

Fig. 4b. face yield (PSP 1)

Fig. 4c. core fracture (PSP 2)

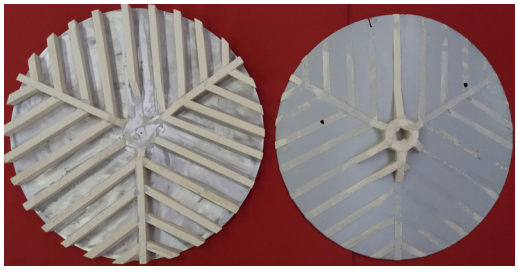

Fig. 4d. core shear (MEC 2)

2. Şerban D., Linul E., Sărăndan S., Marsavina L. (2016) Development of parametric Kelvin structures with closed cells, Solid State Phenomena, vol. 254 pp 49-54, Trans Tech Publications, Switzerland (AMS'15 Advanced Materials and Structures, Timişoara, România, October 16-17, 2015);
3. Negru R., Şerban D., Marsavina L., Magda A. (2016) Lifetime prediction in medium-cycle fatigue regime of notched specimens, Theoretical and Applied Fracture Mechanics 84, 140-148.

Applicability and transferability of the results

Results and design solutions will be transferred to sandwich structure manufacturers to improve their technologies. In addition, companies involved on design of aircraft will benefit by our developed sandwich structures and hybrid assembly solutions.

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Research Center

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http://erris.gov.ro/St-Nadasan-Research-Laborato

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