Modelling EM-Coupling on a Massively Composite Aircraft Barrel

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Abstract—EM coupling analysis on massively composite aircraft requires specific modelling techniques matching the frequency range under study. In particular, usual modeling techniques used for metallic structures have to be adapted and sometimes revised. In this paper, we present the challenges of such modelling strategies as they are addressed in an EU-Canada cooperative project called "EPICEA".

Keywords- component; EM-coupling, full composite aircraft, grounding, EM modeling

I. INTRODUCTION

This paper is a logical extension of the presentation made at the last 2017 ASIAEM conference in which preliminary results of EM coupling activity in the frame of the EPICEA project were presented [1]. EPICEA (Electromagnetic Platform for lightweight Integration/Installation of electrical systems in Composite Electrical Aircraft) is a H2020 project co-funded by Europe and Canada, started in February 2016 and running for 36 months [2]. Its objective is to help design of Composite Electrical Aircraft (CEA) for three specific issues: EM coupling on Interconnected Systems (IS), installation of new concepts of low profile antennas and effects of Cosmic Radiations on electrical systems. The consortium is made of 9 partners led by ONERA (for Europe) and "Polytechnique de Montreal (for Canada). The industrial, lead is Bombardier Aerospace (Montreal /Quebec/Canada. In this paper we focus on a recent activity consisting in validating cooperative modelling strategies in order to simulate EM coupling on a realistic mock-up.

II. THE EPICEA-BARREL

The EPICEA barrel is a scale-one full-composite business aircraft fuselage mock-up provided by Bombardier Aerospace. It is equipped with a prototype IS provided by Fokker Elmo and dummy equipment boxes provided by ONERA (Figure 1). Four low profile antenna prototypes are mounted on this barrel and are connected to the prototype IS. Two specific return networks have been designed to mitigate the low conductivity of composite structure: the Current Return Network (CRN) that provides a low impedance path to lightning current and the Signal Return Network (SRN) for grounding and keeping at the same potential the electrical systems.

III. VALIDATION OF THE MODELLING METHODOLOGY

The modelling methodology is based on a cooperative modelling approach in which several EM computer modules developed in the project can be combined at their inputs/outputs inside a modelling platform according to predesigned scenarios. In a first phase those scenarios are validated by comparisons to measurements carried out on the EPICEA-barrel (local injection on the IS, coaxial return injection, antenna and mode-stirred chamber illumination). In a second phase the modelling methodology is deployed in order to propose IS design and integration optimization in a composite fuselage.

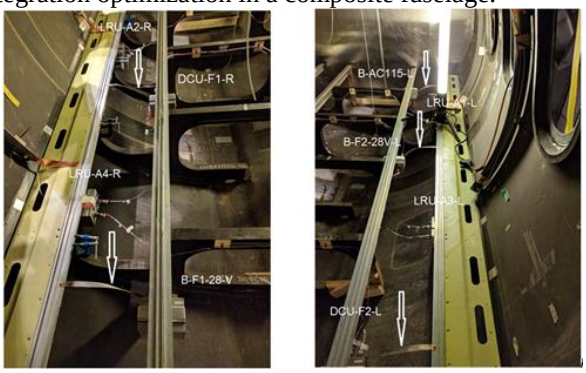

Figure 1. Installation views of the prototype IS inside the EPICEA- barrel (courtesy Bombardier Aerospace).

REFERENCES

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