

## **Development and industrialization of FSW for Ariane 6 propellant tanks (F. Marie <sup>1</sup>, S. Pauleau <sup>1</sup>, J. Salou <sup>1</sup>, D. Deloison <sup>1</sup>, M. Kahnert <sup>2</sup>)**

1. Ariane Group SAS (AGS)

2. MT-Aerospace (MT-A)

Ariane 6 (A6) is the new flexible European launcher for the access to Space. Its first flight is scheduled to be operated in 2020 and its full cadence is planned to be reached by 2023. In the current context of tighter and tighter launchers market, A6 shall be produced 40 to 50% cheaper than its predecessor Ariane 5. This overall objective was declined for the manufacturing of the Bare Tanks of the Upper and Lower Liquid Propulsion Module (U&L-LPM). The A6 target is to reduce the Recurring Costs (RC) of the tanks by 50% compared to A5.

In order to achieve this challenging target, the decision was made to implement the Friction Stir Welding process (FSW), in substitution to the Tungsten Inert Gas (TIG) welding process used on A5, with the following main objectives:

- To significantly increase automation of the manufacturing process,
- To take advantage of a robust and reliable welding process, in order to meet quality objectives,
- To drastically reduce control costs (e.g. X-Ray inspection replaced by automated Ultrasonic Testing Phased Array UTPA).

Bare tanks primary parts, i.e. gore panels, domes, bulkheads and cylinder segments are produced by MT-A in Augsburg. In order to optimize the process flow and to reduce the transport, the ULPM is manufactured in Ariane Group Bremen and the LLPM in Ariane Group les Mureaux.

FSW manufacturing processes for both U&L-LPM Bare Tanks will be described.

The presentation will give an overview of FSW process development and industrialization carried out at MT-A and at AGS. Topics related to the FSW process and means will be particularly emphasized. Automation of the manufacturing process, robustness and reliability of FSW, and low control costs will be highlighted.