

Development of Inspection for Friction Stir Welds for Rocket Fuel Tanks

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During development of the Ares I weld processes nondestructive and destructive testing were used to identify and characterize defects that occurred. These defects were named and characterized. This catalogue of defects and characteristics was then used to develop inspection methods for Self Reacting Friction Stir Welds (SR-FSW) and Conventional Friction Stir Welds (C-FSW). Dye penetrant, eddy current, x-radiography, single element ultrasonic, and phased array ultrasonic (PAUT) inspection procedures were developed to target the expected defects. Once the method procedure was developed a comparison was performed to allow for selection of the best inspection method. Tests of the effectiveness of the inspection were performed on purposely fabricated flawed specimens and electro-discharge machined notches. The initial test results prompted a revisit of the PAUT procedure and a redesign of the inspection. Subsequent testing showed that a multi-angle PAUT inspection resulted in better detection capability.

A discussion of the most effective orientations of the PAUT transducer will be presented. Also, the implementation of the inspection on production hardware will be presented. In some cases the weld tool is used as the transducer manipulator and in some cases a portable scanner is used.