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Abstract Submittal Form

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Unclassified Abstract (250 – 300 words; do not include figures or tables)

With the goal of lower cost (simplified manufacturing and lower part count) and higher performance (higher strength to weight alloys) the NASA Technical Maturation Program in 2006 funded a proposal to investigate spin forming of space launch vehicle cryogenic tank domes. The project funding continued under the NASA Exploration Technology Development Program through completion in FY12.

The first phase of the project involved spin forming of eight, 1 meter diameter "path finder" domes. Half of these were processed using a concave spin form process (MT Aerospace, Augsburg Germany) and the other half using a convex process (Spincraft, Boston MA). The convex process has been used to produce the Ares Common Bulkhead and the concave process has been used to produce dome caps for the Space Shuttle light weight external tank and domes for the NASDA H2.

Aluminum Lithium material was chosen because of its higher strength to weight ratio than the Aluminum 2219 baseline. Aluminum lithium, in order to obtain the desired temper (T8), requires a cold stretch after the solution heat treatment and quench. This requirement favors the concave spin form process which was selected for scale up.

This paper describes the results of processing four, 5.5 meter diameter (upper stage scale) net shaped spin formed Aluminum Lithium domes. In order to allow scalability beyond the limits of foundry and rolling mills (about 12 foot width) the circular blank contained one friction stir weld (heavy lifter scales require a flat blank containing two welds). Mechanical properties data (tensile, fracture toughness, stress corrosion, and simulated service testing) for the parent metal and weld will also be discussed.