Materials and Manufacturing for an Interplanetary Future

Enabling an interplanetary future for mankind requires extraordinary advances in the capabilities of space transportation in terms of cost, rate and reliability. Fully reusable systems, capable of in space refueling, manufactured at high rate and at low cost are prerequisites for a society to achieve a sustainable interplanetary existence. Historical development of space systems have often been driven to achieve ultimate performance, at any cost, with rate always constrained by funding, and reliability established by extreme testing requirements. Future systems will need shake off these paradigms, challenging historical requirements with system level metrics such as cost and rate of payload delivered to orbit or landed at the destination. Reliability will be driven by simplicity and process control, with inspection and test as checkpoints for verification. Materials, process and manufacturing must no longer take a secondary role to vehicle and hardware design, but, become partners to achieve overall system success. Materials especially will become an enabler for design and process simplification. Design and manufacturing will need to borrow concepts from automotive, consumer electronics and other industries to make the tremendous improvements is efficiency and reliability. The manufacturing environment is rich in data , and must be mined and utilized to learn as much about our systems before we move to expensive and time consuming tests and inspections. Design engineers need to first establish why their component exists before they work to optimize the design or automate the manufacturing process. Space is hard and unforgiving and the challenges are extreme. To enable reliable, cost effective and frequent near earth and interplanetary travel, we must use all our tools in design, materials and manufacturing together to achieve our promising future.