Abstract

The Quest for Engineering Innovation at NASA's Marshall Space Flight (MSFC)

A recent NASA team, chartered to examine innovation within the Agency, captured the meaning of the word innovation as the "application of creative ideas to improve and generate value for the organization". The former NASA Administrator Charles Bolden shared his own thoughts about innovation in a memo with all employees that stated, "At NASA, we are dedicated to innovation, bold ideas, and excellence." Innovation turns out to be one of the major driving forces behind the work produced at NASA.

It seems failure is often what has driven NASA to be more innovative. Fifty years ago, the Apollo 1 tragedy killed three astronauts when fire erupted in their command module. NASA had to bear the responsibility of such loss and at the same time work smarter in order to obtain the dream to reach the moon by the end of the 1960s. Through this circumstance, NASA engineers developed a revolutionary replacement for the combustible nylon astronaut suits so the Apollo program could continue. A material called Beta Cloth was born. This material was used to produce noncombustible space suits for all Apollo astronauts, enabling the United States to ultimately land 12 Americans on the moon. Eventually this material was used as the roof system in the Denver International Airport, showing relevance and applications of NASA innovations to real-world need.

Innovative ideas are also driven by the need to accomplish NASA missions and to improve the way we produce our products. MSFC engineers are advancing technologies in additive manufacturing of liquid rocket engines in order to reduce the number of parts, design time, and the cost of the engines. NASA is working with academia to eliminate the need for miles of sensor cables by investigating innovations in wireless sensors. In order to enable future exploration missions to Mars, MSFC engineers are pursuing innovative approaches in diverse areas such as the use of ionic liquids for life support systems and composite cryogenic tanks, very low leakage valves to contain propulsion fluids, and natural, non-toxic inhibitors to eliminate the buildup of biofilms in the water systems planned for future crewed Mars missions.

Although results are encouraging, we cannot rest on our past accomplishments. In order to overcome breathtaking technical challenges in space exploration, we must continue to promote a culture supporting growth, breakthroughs and disruptive innovations.

This presentation will discuss: innovations being investigated the by the engineers at MSFC, the culture necessary for innovation within a government bureaucracy, barriers to innovation and examples of innovation supporting NASA's Space Launch System.