December 2012

AEROSPACE AMERICA

2012

Year in review

A PUBLICATION OF THE AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

Energetic components and systems

Energetic components and systems (ECS) continue to address a wide variety of platform and applications-specific requirements. With ever-changing programmatic and budgetary constraints, the need for ECS designs and components to ensure reliable performance at the lowest possible cost has never been greater. Overall, the ECS technical community has remained relatively stable this year. One notable exception was United Technologies' acquisition of Goodrich. This action, completed on July 26, promises to strengthen both companies and will supplement the technical baseline of the ECS community as well.

The Curiosity Rover goes through its paces at JPL. Credit: NASA.

At 01:32 on August 6, the Mars Science Laboratory successfully completed the entry, descent, and landing (EDL) phase of its overall mission. Energetic components and systems directly contributed to this successful spaceflight and landing on Mars. The spacecraft itself used 86 pyromechanical energetic components consisting of 39 separation nuts, 22 cable cutters, 20 pyrovalves, three pin pullers, a thruster, and a parachute mortar. Seventy-five of these energetic components were activated during the 'seven minutes of terror' otherwise known as the EDL phase of the mission. Eleven energetic components were activated after touchdown on the Martian surface, accomplishing the release of various elements on the Curiosity Rover.

Specifically, the separation nuts were activated throughout the cruise stage, the descent phase, and on the rover to accomplish various mission objectives, including the release of the heat shield, positioning of the ballast to alter the vehicle center of gravity, and the release of the rover wheels. Cable cutters severed electrical lines and other connections to allow safe transfer to the surface during the Sky Crane maneuver, among other operations. The pyrovalves were also activated throughout the mission to ensure flow or cease flow as required. The total amount of energetic material included in all of these components, except for the large parachute mortar cartridge, was less than 50 g. And for redundancy, each energetic component was initiated by two NASA standard initiators. All in all, 172 were successfully activated throughout this mission.

Energetic components and systems continue to provide safe ejection for crewmembers on both aircraft and spacecraft. SpaceX has successfully implemented a new launch abort system for its Dragon spacecraft. The energetic material, utilized to provide the thrust for the abort escape engines, can be reused for multiple missions, as these engines are mounted into the sidewalls of the capsule and remain with the spacecraft throughout the mission. This integrated abort system provides for crew safety while minimizing the cost of capsule retrofit.

Obsolescence remains a major concern throughout the ECS community. Ensuring continuing availability of the needed raw chemicals, blended energetic materials, and integral electronic subcomponents has required specific actions. Teams have been established, involving both government and industry representatives, to evaluate the many factors associated with the obsolescence issue. The Naval Surface Warfare Center has established obsolescence teams whose charters include identifying at-risk materials or processes, developing joint approaches to maintaining the availability of these materials, and/or investigating new alternative energetic materials capable of meeting specific mission needs.

Education and mentoring remain primary objectives in the ECS community. The 9th Cartridge Actuated Device/Propellant Actuated Device (CAD/PAD) Technology Exchange Workshop, held May 22-24 in Waldorf, Maryland, hosted by the CAD/PAD Joint Program Office and sponsored by the Naval Air Systems Command, PMA-201, featured over 30 technical presentations and invited speakers. Topics ranged from an update by the Dept. of Commerce on its CAD/PAD Industry Report to a presentation on the 2011 CAD/PAD Technology Roadmap.

by **Tom Blachowski**