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Stretching survivability

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*The **Survivability Technical Committee** promotes air and spacecraft survivability as a design discipline that includes such factors as crashworthiness and repairability.*

Lasers and their effects on composite materials have been an active area of research for military aircraft survivability. High-energy laser tests have been conducted at **Wright-Patterson Air Force Base** on composites typically used in remotely piloted planes. The trials took place in simulated flight conditions including high-speed airflow. The tests were performed with and without fuel backing, with and without laser-hardened coatings, and with and without explosive backing. The results will advance laser hardening and fire suppression design.

One equipment readiness issue involved parachute design. Wright-Patterson's **Aerospace Survivability and Safety Operating Location** designed, tested, and evaluated a low-profile parachute to replace currently fielded chutes that are so heavy and intrusive that aircrews do not wear them throughout missions.

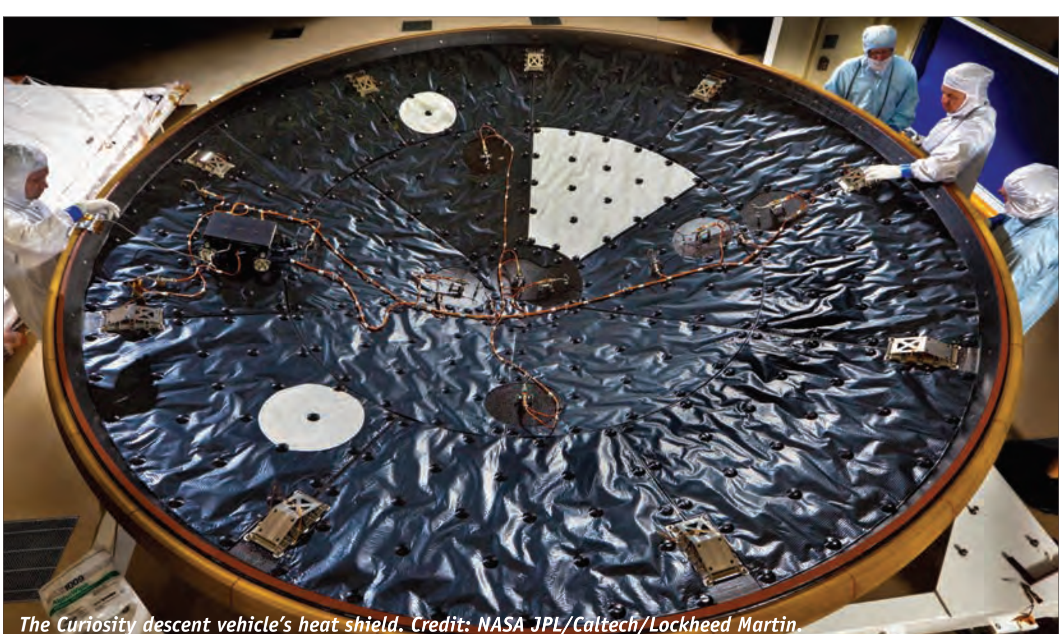
The new parachute has a complete emergency bailout system to be worn for the full mission. This eliminates time-consuming donning procedures and reduces impediments to the crew's movements. The tests, which also addressed inadvertent opening, are among the final steps in evaluations for performance certification.

For space systems, survivability applies as much to the crew as to the spacecraft's structure and operations. NASA's newly developed **human rating certification/oversight system** now applies not just to its own Orion capsule but also to commercial craft—SpaceX's Dragon, Boeing's CST-100, Sierra Nevada's winged Dream Chaser, and Blue Origin's orbiter. NASA's crew survivability requirement for the **abort-at-any-time strategy** is particularly demanding. To meet the NASA standards, SpaceX is now modifying the Dragon, which has been delivering cargo to the International Space Station.

Survivability techniques area also required father from Earth. Engineers working to improve survivability of future planetary landers in 2013 had two distinct examples to begin studying.

NASA's 2,000-lb Curiosity robotic rover landed on Mars on August 16, 2012, using the new Sky Crane apparatus/module instead of airbags, which were used for the much smaller 23-lb Pathfinder rover that had landed on Mars in 1997. The Sky Crane itself, which must also be jettisoned immediately at landing so as not to damage the rover itself, landed 2,100 ft from the rover and now sits on the Martian surface, where it will remain.

The second example concerns the building of the 15-ft diameter heat shield that protected the Curiosity capsule during its 3-4-min entry into the Martian atmosphere. The capsule reached a peak temperature of 3,800 F. The shield worked as planned and was jettisoned 4,900 ft away on the planet's surface, where it will remain forever. Though heat shielding is not new, the new size is much more demanding and is also a prelude for use on other vehicles such as NASA's Orion capsule, currently in development



The Curiosity descent vehicle's heat shield. Credit: NASA JPL/Caltech/Lockheed Martin.