Photo credit: SpaceX

SPACE SAFETY INSTITUTE

Advancing Safety in Space

Commercial space offers significant benefits to national security, global economies, and society at large. However, spaceflight is a risk-prone and capital-intensive endeavor. As safety is necessary across all space activities, operational best practices will benefit the entire space enterprise.

The Space Safety Institute (SSI) at The Aerospace Corporation (Aerospace) delivers independent technical support and assessments to enhance safety for government, commercial, and international space customers through cross-cutting and holistic initiatives. SSI develops methodologies and provides knowledge to the space community through services, published research, and educational activities including trainings and workshops, for all aspects of safe space operations.

Space Safety Institute Vision

Our vision is to promote space activities that are safe, support economic and scientific development, and foster the long-term sustainability of outer space. We will achieve this by:

- Providing customers with independent technical assessments based on deep expertise in all aspects of spaceflight safety and space operations.
- Creating a community platform to share and develop best practices.
- Educating and developing the next generation of space safety experts.

Space Safety Institute Focus Areas

Launch and Reentry Safety. The traditional approach to launch safety is based on a comprehensive system review to verify flightworthiness. The influx of commercial entrants brings nuanced and complex launch safety needs and operator constraints. These factors are driving a spectrum of safety approaches for innovative solutions. Our unique launch system flight readiness process has been honed for more than 50 years. This process has been adapted to today's agile environment to provide flexible, cost-effective launch safety assurance to our customers.

Aerospace SSI capabilities:

› Independent assessments
› Standards and best practices
› Research and development
› Infrastructure, tools, and data
› Policy and strategy development
› Safety education

To learn more about SSI, visit aerospace.org/ssi or contact us at ssi@aero.org.
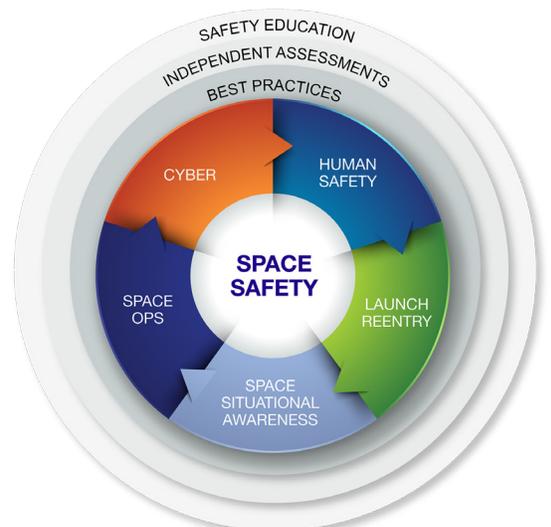
Post-mission disposal of launch stages and spacecraft traditionally involves controlled reentry and atmospheric burn to limit additional debris. However, some vehicle fragments may survive reentry and pose hazards in the air or on the gound. SSI leverages research from the Aerospace's Center for Orbital and Reentry Debris Studies (CORDS) to improve reentry safety.

Human Spaceflight Safety. Human spaceflight remains a risky endeavor. With launch innovation and commercial adoption accelerating, safety knowledge transfer is critical. Aerospace has a long history of supporting human spaceflight, from the early days of "human rating" the Titan missile in the Gemini Program to more recent safety and mission assurance support for NASA's Commercial Crew Program. SSI keeps pace with commercial innovation, ensuring the success of national security, civil, and commercial space missions with unique human passenger and crew requirements.

Space Operations Assurance. Space operations are assured through space traffic management (STM), debris tracking, and debris mitigation practices for long-term space sustainability. STM and debris mitigation are critical for coordinating, planning, and developing the practices needed to mitigate the debris environment and avoid mission loss. Without operations assurance, a congested environment could lead to both human and spacecraft casualties in space, in the air, or on the ground. Assuring space operations requires greater understanding of the space environment and its effects on spacecraft function and reliability.

Space Situational Awareness. Space situational awareness (SSA)—the knowledge and characterization of space objects and their operational environment—is foundational to all space safety activities. It is a critical component of space domain awareness, the ability of decision makers to understand current and predicted operational environments. SSA includes tracking and identifying objects in space, establishing their orbits, understanding the operating environment, and predicting future positions and operating threats. Data can aid in predicting conjunctions between objects and potential close approaches, helping warn space operators and enable collision avoidance maneuvers. Aerospace is deeply involved in all aspects of SSA practiced by the U.S. government, including acquisition and operation of the Space Surveillance Network's radars and telescopes. U.S. Space Force operations use our algorithms for orbit propagation, conjunction prediction, and collision probability estimation.

Cybersecurity and Spectrum. The space enterprise faces substantial cybersecurity challenges. It is increasingly the target of threat actors due to mutual dependencies on critical infrastructure. Aerospace supports the development of space-centric cybersecurity standards using defense-in-depth techniques to ensure resiliency and employ a threat-informed risk mitigation strategy. SSI conducts cybersecurity and spectrum research and provides development initiatives, assessment strategies, and capabilities for space missions. Potential opportunities include increased cooperation across disciplines and the blending of policy and technical solutions.

To learn more about the Space Safety Institute, visit **aerospace.org/ssi** or contact us at **ssi@aero.org**.
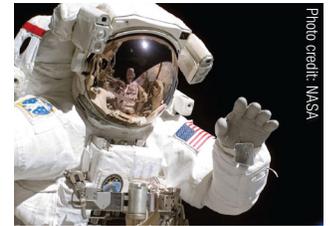
Photo credit: NASA

Safe, routine human spaceflight can be achieved through continued innovation and sharing best practices across the community.

Without space operations assurance, a congested orbital environment could lead to casualties in space or on Earth.

A sample predictive path of orbital debris. Aerospace coordinates safety-focused debris and reentry research between SSI and CORDS.

Every asset in space can be vulnerable to cybersecurity threats.

The Aerospace Corporation

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center and has more than 4,500 employees. With major locations in El Segundo, California; Albuquerque, New Mexico; Colorado Springs, Colorado; and the Washington, D.C., region, Aerospace addresses complex problems across the space enterprise and other areas of national and international significance through agility, innovation, and objective technical leadership. For more information, visit www.aerospace.org.