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BALANCING SAFETY AND MARKETABILITY: THE HUMAN SPACEFLIGHT CERTIFICATION  
APPROACH OF NEW SHEPARD IN THE ERA OF RAPID LAUNCH CADENCES

**Abstract**

The commercialization and privatization of space travel has led to the rapid growth of individual interest in human spaceflight. With this expansion comes the need for private aerospace companies to ensure robust safety measures to fly human-rated vehicles in the face of the slow formalization of regulatory policies. The certification of human-rated commercial vehicles presents a set of unique challenges due to the need to balance stringent safety requirements and evolving regulatory policies with marketability and rapid flight turnaround timelines. New Shepard is one of the first launch vehicles in the United States to demonstrate a rapid rate of commercial spaceflight from a single launch site and to be granted federal licensing for operation. New Shepard approaches safety assurance with an encompassing set of processes that include decomposition of safety requirements through an architecture safety allocation (ASA); piece-part safety analyses through failure modes, effects, and criticality analyses (FMECA's); evaluation of launch controller error potential in human error and tolerance assessments (HETA's); and consideration of total risk and mitigation controls across all systems hazards. These processes address all aspects of vehicle development, production, operation, and sustainment and span vehicle development and system verification; component production and acceptance testing; and crew training and operational procedures. These processes are uniquely managed and quickly iterated upon by the New Shepard team to support the cadence of the commercial spaceflight industry. The purpose of this paper is to present New Shepard's holistic approach to certification for human space flight, hazard mitigation, and system safety. This paper also highlights successful methodologies to build a foundation for developing rapid, reliable, and reusable space launch systems. The insights from this paper are intended to inform policymakers of the historical success of flexible and careful system safety assessment in support of a fast-paced launch cadence, and to benefit early-stage space companies navigating the complexities of human spaceflight safety assurance and certification.