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BUILDING A 21ST CENTURY SPACEPORT: DEVELOPMENT AND APPLICATION OF THE SPACEPORT READINESS LEVEL SCALE

Abstract

Commercial spaceports have risen over the last two decades to support a growing commercial space marketplace. The introduction of suborbital launches and the increased cadence of orbital launches have demonstrated a need for more capability at the spaceport level to support airport-like operational fluidity. To meet the rising demand of launches with differing requirements, proposed, developing and current spaceports must be able to effectively identify existing capabilities and forecast required capabilities to grow and meet user needs. In order to perform this assessment, a usable measure must be developed that identifies and quantifies a spaceport's capabilities in a straightforward manner for investment, strategic planning purposes, and, ultimately, growth.

As a "system of systems," the spaceport is a key element of the space ecosystem in terms of launch and landing infrastructure, processing and storage, ground stations and equipment, and other supporting technologies and processes. However, there is scant research establishing a usable scale to assess spaceport readiness for space-based operations, particularly across the diverse launch and reentry vehicles coming into the industry. Based on this gap, we propose a Spaceport Readiness Level (SRL) scale using the NASA Technology Readiness Level (TRL) scale. The TRL is utilized in many industries and government as a means for technological development measurement and has been tailored to fit various unique needs of the user while aligning to the original. Based on this precedence, we use the progressive and generalized structure of the original TRL in creating the SRL scale. The proposed scale measures a spaceport's progression from ideation, to development, and through maturity at a "system of systems" level. It can be used either as a means of demonstrating current support capabilities or as a roadmap for achieving future maturity in space launch and landing operations.

Necessarily general in nature, the SRL scale provides a capability assessment tool for spaceport site operators, ranging from those under consideration to those with storied histories of space launch efforts. The adoption of the scale will aid the process by which rapidly evolving space launch companies transition to locations with the capabilities to support their requirements. It may also provide a more effective means for companies to communicate with current spaceports to guide modifications that would benefit both stakeholders. Case examples are used to demonstrate the use of the scale on a practical level.