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SCENARIO PLANNING FOR THE FUTURE OF INNOVATION IN SPACE AND EMERGING  
TECHNOLOGIES

**Abstract**

The space sector had witnessed major developments in recent years. New private companies such as SpaceX and Blue Origin had joined conventional aerospace market leaders (e.g. Boeing, Lockheed Martin) for government contracts. Investors, originally viewing space as a risk-averse and capital-intensive industry, had become growingly interested in funding new space initiatives. Meanwhile, worsening geopolitical tensions mean space entrepreneurs now need to be policy-savvy. They would also need to possess political awareness to navigate an increasingly complex business environment, often marked by a multitude of risks including supply chain delay. These developments have prompted significant shifts in business and entrepreneurship. For example, venture capital (VC) firms, such as Seraphim in the UK, now start to view UAV and space technologies to be within the same technology and financing ecosystem. In the policy domain, the bankruptcy (and bankruptcy exit) of OneWeb highlighted intense competitions over sought-after radiofrequency band(s), demonstrating the need for global co-ordination between emerging space actors with established stakeholders in other technology areas (e.g. 5G, scientific astronomers, mobile network providers, all represented in the International Telecommunication Union (ITU)). In analyzing innovation and commercialization of the space sector, it is no longer viable to discuss space activities in silo from advances in other commercial and technological areas (e.g. VTOL, 5G). With the right tools of analysis, there is huge potential to identify scenarios where synergy between space technologies and other rapidly maturing technologies (e.g. UAV, HALE, 5G) converge.

This paper proposes to employ scenario planning to identify potential future trajectories for space and emerging technologies. Scenario planning had in the past helped major companies averted some of the most challenging crises (e.g. the oil crisis). Given how socio-economic, policy, and political elements in the past years all converge to shape and influence commercial activities, there has never been a more pressing time to adopt fresh lenses in analyzing the space industry. Scenario planning allows for the integration of a complex web of interfering factors into rigorous analyses. Utilizing the multiple futures that the method enables us to envision, the paper seeks to identify potential risks, challenges, and innovation opportunities for the space sector in different scenarios. The analysis will first focus on scenarios where innovation in financing (e.g. new VC's perspectives), resources-sharing (e.g. spectrum co-ordination), societal demands (e.g. environmental, social, and governance (ESG) commitments), and geopolitical developments converge to enable and/or hinder future trajectories of the space sector. In doing so, the paper aims to contribute to the study and mitigation of averse factors that would greatly affect the industry's commercialization in the post-pandemic world.