

IAF BUSINESS INNOVATION SYMPOSIUM (E6)  
Strategic Risk Management for Successful Space & Defence Programmes (4)

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IDEATING A PARTICIPATORY RISK ASSESSMENT MATRIX FOR FUTURE LUNAR MISSIONS

**Abstract**

Disclaimer: The research leading up to this paper has no nexus with the authors' role and work at the European Space Policy Institute (ESPI) and in no way reflects positions or opinions held by ESPI.

With a number of planned lunar missions, both public and commercial, the future of multiple (semi)permanent facilities in outer space accessible to flocks of sentient and non-sentient space dwellers seems to be more likely than a decade ago.

However the potential proliferation of surface lunar missions would inevitably raise questions on the related risks, beyond the technological dimension, which represents the foundational enabler of lunar missions and defines their underlying success.

Operational and Logistical risks are perhaps most obvious as enough resources, materials and energy will need to be either delivered or produced on the lunar surface in order to sustain missions and outposts, therefore influencing mission design and spurring the need for increased R&D for autonomous life support systems.

Environmental risks are on one hand related to the inhospitable lunar environment (and are closely related to operational risks) but on the other hand also address the environmental impact lunar missions might have on the lunar environment and its long term sustainability.

Commercial and Market risks are notably relevant for envisaged commercial missions as ambitious plans could e.g. encounter less demand than foreseen and commercial entities offering goods and services within the lunar and cis-lunar economy might run economically unviable operations leading to bankruptcy and resulting in a lack of service provision, and potentially abandoned sites (contributing to an additional layer of environmental risks mentioned previously).

Finally, Legal and Regulatory risks are both relevant for commercial entities and state parties to the Outer Space Treaty who bear international responsibility for activities of these commercial actors. A clear example is for instance Article XII of the Outer Space Treaty which provides that "All stations, installations, equipment and space vehicles on ... celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity" which can in theory provide a serious risk and burden to viable and uninterrupted lunar operations.

This paper aims to ideate and provide grounds for elaborating a risk assessment matrix for future surface missions on the Moon and catalyse a discussion on creating an open participatory platform defining various risks and sharing potential tools, mechanisms and processes to manage them.