

17th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
DEVELOPMENT (D3)Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies  
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NASA LaRC, United StatesEMERGING AND DISRUPTIVE TECHNOLOGY ASSESSMENT FOR NASA EXPLORATION  
MISSION CHALLENGES**Abstract**

NASA is transforming space-based exploration missions, both robotic and human. The Agency is shifting from an exploration-based program with human activities in low Earth orbit (LEO) and targeted robotic missions in deep space to a more sustainable and integrated pioneering approach. Space Policy Directive -1 of December 11, 2017 titled “Reinvigorating America’s Human Space Exploration Program” states “. . . that NASA is to lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities.” Through pioneering, NASA seeks to address national goals to develop the capacity for people to work, learn, operate, live, and thrive safely beyond the Earth for extended periods of time. However, pioneering space involves daunting technical challenges of transportation, maintaining health, and enabling crew productivity for long durations in remote, hostile, and alien environments. Prudent investments and partnerships in capability and technology developments, based on mission need, are critical for enabling a campaign of human exploration missions.

Knowledge of emerging and disruptive technologies is critical for this pioneering initiative, as is assessment of their application toward human space exploration. Emerging and disruptive technology areas such as artificial intelligence, miniaturized systems, autonomous systems, big data analytics, machine learning, and advanced engineered materials have the potential to provide breakthrough solutions for NASA missions. Assessing the impact of these technology areas, and then making informed decisions between watching, collaborating, or partnering in these technology areas could lead to game changing results. NASA also has an initiative to assist industry in developing these disruptive and emerging technology areas, and in building new commercial markets. Identifying key partnerships is beneficial towards developing solutions for some of the most complex missions ever imagined.

This paper will highlight specific emerging and disruptive technologies within identified disciplines that could provide breakthrough solutions that would enable NASA missions and enhance certain industries. This paper will also describe how nearly 500 technology trends from around the world covering a broad spectrum of technology areas were identified, verified, and assessed by the NASA Center Chief Technologist Council, Technology Trends team. From the trends collected, Center Chief Technologists selected nine “high interest” emerging and disruptive technology areas. Ultimately, NASA can leverage the analysis of this study and make decisions regarding investments internal and external to the agency.