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## Space: The Digital Frontier

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### ABSTRACT

Space operations are dependent on digital technologies for every command sent and bit of data received. The United States Space Force intends to embrace this dependency and integrate digital tools across the spectrum of their missions and functions. As a result, the vision, success, and setbacks they encounter can serve as a case study from which other spacefaring organizations can learn. The overlapping focus areas of Digital Workforce, Digital Headquarters, Digital Engineering, and Digital Operations frame the introduction of Space Force initiatives. Digital Workforce encompasses all the enterprises involved in creating professionals with the right attitude and aptitude to successfully employ digital technologies, from basic digital familiarization to advanced training. Digital Headquarters seeks to streamline data-driven decision making at all levels of the organization. Encompassing the infrastructure, data, tools, and processes of the Space Force, Digital Engineering's objective is to establish an interconnected digital ecosystem for all Guardians. Digital Operations is the culminating point for digital transformation, where robotic process automation and AI/ML algorithms make Guardians more effective and efficient.



## SPACE OPERATIONS AND DIGITAL TECHNOLOGY

The current reality is that most of what we know about space and most of what we do in space occurs through a digital interface. The vast majority of work conducted *in* space is done by people *on* Earth; very few are fortunate enough to actually work in space. This is especially true for those serving in national security space. For example, Guardians in Colorado conduct the preponderance of the space-based missile warning, communication, weather, and position, navigation, and timing (PNT) operations of the United States Space Force (USSF). The dependence of space operations on digital technology is undeniable. Rather than looking at this as a limitation, existing and emerging spacefaring organizations should consider this an opportunity to leverage digital tools in innovative ways and to a greater extent than in any other domain. They should embrace space as a digital frontier.

Examining the U.S. Space Force's vision and ongoing integration of digital technology can inform the decisions of other space organizations. The USSF's objective of applying digital technology to every aspect of its mission is ambitious, and, therefore, this case study will have lessons to offer other space organizations, whether they operate a single satellite or have an extensive infrastructure of sensors, satellites, ground stations, and launch complexes. User-defined dashboards, robotic process automation (RPA), and the use of artificial intelligence (AI) and machine learning (ML) are all digital applications the USSF is using to make its lean force more effective and efficient across the spectrum of its functions.

The USSF is the only new U.S. military Service established this century. As a result, it was “born digital,” a concept embraced and promulgated by General Raymond, the first Chief of Space Operations (Hitchens, 2023). However, like all newborns, being “born digital” does not make it a mature and fully digital Service from inception. The early development of the Service only continues to reemphasize the inextricable dependency of current space development, acquisition, and operations on digital technologies, and the additional development and integration of digital tools are ongoing processes for the USSF. To spearhead this effort, General Raymond created a new staff office to lead and champion the digital transformation of the USSF: the Chief Technology and Innovation Office (CTIO). The CTIO combined functions, including science, research, digital transformation, innovation, data management, technology infrastructure, and analysis under one umbrella organization. The CTIO leads pilot initiatives and synchronizes digital activities across the USSF to provide direction and increase the efficiency and effectiveness of the handful of personnel assigned to the Service.