SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advanced Space Communications and Navigation Systems (1)

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ENABLING FUTURE SCIENCE AND HUMAN EXPLORATION WITH NASA'S NEXT GENERATION NEAR EARTH AND DEEP SPACE COMMUNICATIONS AND NAVIGATION ARCHITECTURE

Abstract

The National Aeronautics and Space Administration (NASA) is studying alternatives for the United States space communications architecture through the 2040 timeframe. This architecture provides communication and navigation services to both human exploration and science missions throughout the solar system. Several of NASA's key space assets are approaching their end of design life and major systems are in need of replacement. The changes envisioned in the relay satellite architecture and capabilities around both Earth and Mars are significant undertakings and occur only once or twice each generation, and therefore is referred to as NASA's next generation space communications architecture. NASA's next generation architecture will benefit from technology and services developed over recent years. These innovations will provide missions with new operations concepts, increased performance, and new business and operating models. Advancements in optical communications will enable high-speed data channels and the use of new and more complex science instruments. Modern multiple beam/multiple access technologies such as those employed on commercial high throughput satellites will enable enhanced capabilities for on-demand service, and with new protocols will help provide Internet-like connectivity for cooperative spacecraft to improve data return and coordinate joint mission objectives. On-board processing with autonomous and cognitive networking will play larger roles to help manage system complexity. Spacecraft and ground systems will coordinate among themselves to establish communications, negotiate link connectivity, and learn to share spectrum to optimize resource allocation. Spacecraft will autonomously navigate, plan trajectories, and handle off-nominal events. NASA intends to leverage the ever-expanding capabilities of the satellite communications industry and foster its continued growth. NASA's technology development will complement and extend commercial capabilities to meet unique space environment requirements and to provide capabilities that are beyond the commercial marketplace. The progress of the communications industry, including the emerging global space internet segment and its planned constellations of 100s of satellites offer additional opportunities for new capability and mission concepts.

The opportunities and challenges of a future space architecture require an optimal solution encompassing a global perspective. The concepts and technologies intentionally define an architecture that applies not only to NASA, but to other U.S. government agencies, international space and government agencies, and domestic and international industries to advance the openness, interoperability, and affordability of

space communications. Cooperation among the world's space agencies, their capabilities, standards, operations, and interoperability are key to advancing humankind's understand of the universe and extending human presence into the solar system.