

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Advanced Technologies for Space Communications and Navigation (5)

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USING INTERNATIONAL SPACE STATION FOR COGNITIVE SYSTEM RESEARCH AND  
TECHNOLOGY WITH SPACE-BASED RECONFIGURABLE SOFTWARE DEFINED RADIOS

**Abstract**

The NASA Space Communications and Navigation (SCaN) Testbed is a highly capable communications system, composed of three software defined radios, integrated into a flight system mounted to the truss of the International Space Station. Launched in 2012, The SCaN Testbed has logged over 3000 hours of operation exploring the development, reconfiguration, and operation of software defined radios and their software applications. Leading the space use of this relatively new technology, the SCaN Testbed has allowed industry academia, and international partners to pursue their own interests in the field in joint collaboration with NASA.

Going beyond reconfigurable platforms and new software development entails understanding how to manage and apply this new technology to improve communications and navigation for space science and exploration missions. Software defined radios provide a number of new capabilities such as on-orbit reconfiguration, but also new challenges such as increased operational complexity. The advanced capabilities of the software radios allow for more intelligent or cognitive applications to improve communications efficiency and manage the complexity of the radios, the communication channels, and the network itself.

Intelligent systems have the ability to control and manage their own operational characteristics to meet mission objectives such as optimum data return or make adjustments to improve its situation in response to unintended conditions such as signal interference or natural phenomenon including space or atmospheric propagation effects and degradation. Cognitive applications are algorithms which sense, adjust, learn, and adapt based on their environment and conditions. With system knowledge, gained and learned, and the ability to reconfigure operational aspects, these software defined cognitive radios and networks can now improve a mission's communications automatically and also manage system complexity independent of direct operator control.

As the SCaN Testbed enters its fourth year of operations, emphasis on intelligent and cognitive applications will begin to demonstrate the real potential of software defined and cognitive radios. This report will provide an overview of the SCaN Testbed and a discussion of the intelligent system concepts under consideration to enable greater space science, exploration, and technology advancement.