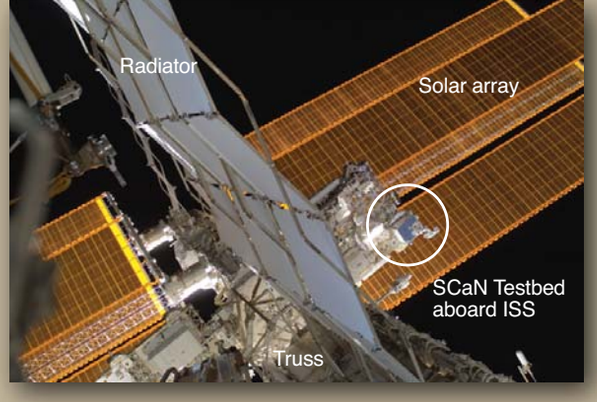
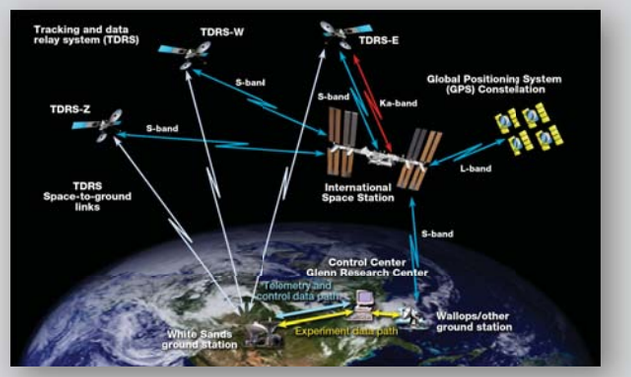
SCaN Mission

The National Aeronautics and Space Administration (NASA) Space Communications and SCaN Program is responsible for providing communications and navigation services to space flight missions throughout the solar system. Astronauts, mission controllers, and scientists depend upon SCaN's reliable transmission of information between Earth and spacecraft, from low Earth orbit to deep space.

The SCaN Testbed is an advanced integrated communications laboratory facility installed on the International Space Station (ISS). Using a new generation of Software Defined Radio (SDR) technologies, SCaN Testbed will allow researchers to develop, test, and demonstrate advanced communications, networking, and navigation technologies in the dynamic environment of space.

The SCaN Testbed will help programs, technology developers, and mission planners understand how SDRs will be used in future missions.





SCaN Testbed Operation

- Command and control of SCaN Testbed performed from the Glenn Telescience Support Center, the hub of operations for Glenn's ISS payloads
- Flight System
  - Three SDRs, developed by General Dynamics, Harris Corporation, and NASA's Jet Propulsion Laboratory (JPL), and integrated by Glenn Research Center, communicate with the Space Network and Near Earth Network
  - The Antenna Pointing System, developed by Sierra Nevada Corporation, and integrated by Glenn, tracks NASA's Tracking and Data Relay Satellite System (TDRSS)
  - **First NASA in-space, duplex user of Ka-band**
- Low-, medium-, and high-gain antennas are used to communicate, via S- and Ka-band frequencies, with NASA's TDRSS satellites and ground stations located throughout the United States
- Global Positioning System (GPS) antenna used to communicate via L1, L2, and L5 frequencies with GPS satellites
  - **First space-based user of GPS L5 capability**
- Mission operations are planned to last 5 years or more

National Aeronautics and Space Administration

Glenn Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

www.nasa.gov

PS–00958–1212

National Aeronautics and Space Administration

Space Communications and Navigation (SCaN) Testbed

Experiments and Operations

www.nasa.gov

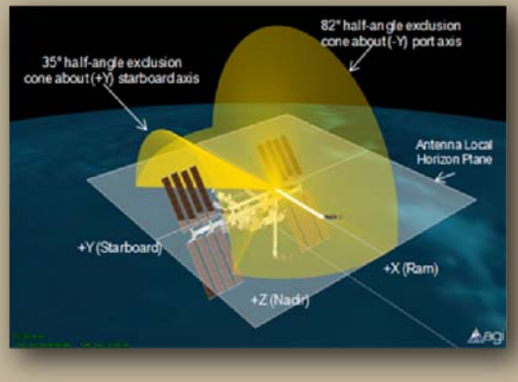
For more Information, visit our Web site at
http://spaceflightsystems.grc.nasa.gov/SOPO/SCO/SCaNTestbed/

SCaN TESTBED READY FOR EXPERIMENTS

The SCaN Testbed is installed on the ExPRESS Logistics Carrier-3 (ELC–3) at the inboard, ram-facing, and zenith-facing location, on the exterior of the International Space Station (ISS). This provides a prime location, free from ISS obstruction, allowing optimal communications to orbiting Space Network assets.

SCaN Testbed completed its installation, activation, and checkout activities:

- Established status and health of the payload
- Established post-launch baseline functionality consistent with prelaunch verification and validation (V&V)
- Characterized the antenna systems (fixed and pointing)
- Executed initial waveforms for each Software Defined Radio (SDR)



- SCaN Testbed has line-of-sight connection to NASA's Space Network (Tracking Data Relay Satellites) and compatible ground stations or other space nodes (e.g., Cubesat).
- NASA will assist users for operations with Space Network and ISS
- Experiment Center provided at Glenn Research Center for experiment equipment to send and receive data from the Testbed

SDR Capability to Demonstrate New Research and Technology Applications and Products

- SDRs provide various capabilities at S-band, Ka-band, and receive L-band (GPS) for experimenter use.
- SDRs will host software applications and waveforms developed by experimenters.
- NASA will provide access to ground systems for development and testing and ultimately upload new software to the space flight system on ISS.
- New software on the SDRs will comply with NASA Space Telecommunications Radio System (STRS) architecture.

STRS Architecture—NASA's Standard for SDRs

NASA's SCaN Program has developed the STRS architecture standard for SDR use in space and ground-based platforms. This architecture standard provides commonality among radio developers to provide enhanced capability and services while reducing mission and programmatic risk.

– **First three STRS standard compliant radios in space**

SDR Characteristics

	Platform Characteristics	Freq band	WF FPGA capacity	Processor	OS	NV memory MByte	RAM MByte
Industry Partner	GD	S-band	Virtex II 3M gates	Coldfire	VxWorks	4	128
	JPL and L-3/ Cincinnati Electronics	S-band and L-band	Virtex II 2 x 3M gates	SPARC	RTEMS	3 x 512 flash	3 x 128
	Harris	Ka-band	Virtex IV 4 x 6M gates	AITech, PPC	VxWorks	1 boot 64 user	128

HOW TO PROPOSE AN EXPERIMENT

NASA released an Experiment Opportunity and Cooperative Agreement Notice to invite interested researchers to submit proposals to utilize the unique capabilities of the SCaN Testbed. See the SCaN Testbed Web site for additional information.

http://spaceflightsystems.grc.nasa.gov/SOPO/SCO/SCaNTestbed/

The SCAN Testbed provides a baseline capability that is designed to support experimentation in the following areas of research and technology:

- Demonstration of mission applicability of SDR
  - – Aspects of reconfiguration
  - – Unique/efficient use of processor, Field Programmable Gate Array (FPGA), and Digital Signal Processor (DSP) resources
- Spectrum efficient technologies
- Space internetworking
  - – Disruption Tolerant Networking (DTN)
- Position, navigation, and timing (PNT) technology
- Technologies/waveforms for formation flying
- High data rate communications
- Uplink antenna arraying technologies
- Cognitive applications
- Multi-access communication
- Radio frequency sensing applications (science emulation)