

**EXHIBIT No. 1      Form 442 Question 7: Experimentation Description**

Program and objectives, as well as technical data, are described on the next pages.

The SPACEHAB Universal Communications System (SHUCS) program will research and develop units that will allow communication from orbiting vehicles in space to Earth, via the Inmarsat satellite constellation and earth station network. It will be a system independent from the space agencies' communication links, and it will therefore allow more freedom of communication between land and space. A prototype for this system flew on the STS-91 Shuttle mission in 1998, and the final version will be installed on the International Space Station.

The LYNXX Inmarsat-B terminals will be used as a starting point for research and testing needed to arrive to a prototype of a modified system, able to interface with the INMARSAT satellites from orbit.

Occasionally, the LYNXX terminals may be used in foreign countries such as Germany and Russia for research and/or communications purposes. These instances are not expected to be frequent (less than 10 per year). Export License agreements for technology transfers to partner companies in the aforementioned countries were filed with the Department of State:

- DaimlerChrysler, now known as Astrium GmbH – Germany: License # ODTCase TA 1310-99, 1310-99B
- RSC Energia – Russia: License # ODTCase TA 1309-99, 1309-99B, 1309-99C, 1309-99D



# SPACEHAB®

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SHUCS - SPACEHAB UNIVERSAL COMMUNICATIONS SYSTEM



**SHUCS**   
SPACEHAB Universal Communications System

## INTRODUCING A BRAND NEW AREA CODE

The SPACEHAB Universal Communications System (SHUCS), a unique communication platform, is being developed for the International Space Station (ISS) and is capable of real-time duplex voice and digital high-speed data transmissions between space and the ground. As a commercially-owned and operated system, SHUCS is independent from dedicated government communication loops, and is not subject to flight priorities which may cause communication delays.

Through SPACEHAB, researchers can request direct access to their ISS payloads via SHUCS and can uplink and receive data at their own ground-based laboratories. Additionally, crew members on the ISS can originate voice calls to anywhere on earth more efficiently and with less restrictions by U.S. and Russian Mission Control infrastructures.

# SHUCS - SPACEHAB UNIVERSAL COMMUNICATIONS SYSTEM

## BACKGROUND

A prototype of the SHUCS unit was flown as a hybrid (pressurized and unpressurized) payload on the STS-91 mission in 1998 onboard a SPACEHAB module. The ISS-based version of this system builds upon that technology with significant improvements in performance and capability. Once delivered to the Space Station, SHUCS will be installed on the Russian Service Module with a terminal unit inside the module for crew and payload access and an antenna unit on the module exterior.



The Shuttle-based version of SHUCS on the SPACEHAB Module rooftop during the STS-91 Mission in 1998.

## CAPABILITIES

SHUCS provides secure file transfer, Internet and email services, commanding/uplinking, and voice communications through the commercial INMARSAT-B satellite service. Transmitting and receiving real-time data to and from earth, SHUCS continuously tracks and communicates with the four INMARSAT geosynchronous satellites that relay data to the INMARSAT ground network. The data is then sent to the SHUCS Ground Operations Center and distributed via the Internet to the payload customers and end-users.

The signal coverage is subject to ISS attitude variations and obstructions due to the space station assembly sequence, but can be greater than 90% in some attitudes. With a modular design that can be upgraded to accommodate



various customers' needs, SHUCS can tie into several ISS voice and data systems for information distribution.

▶ The SHUCS Antenna Unit Mockup ready for testing and training operations in the Russian Hydrolab pool.

## PARAMETERS

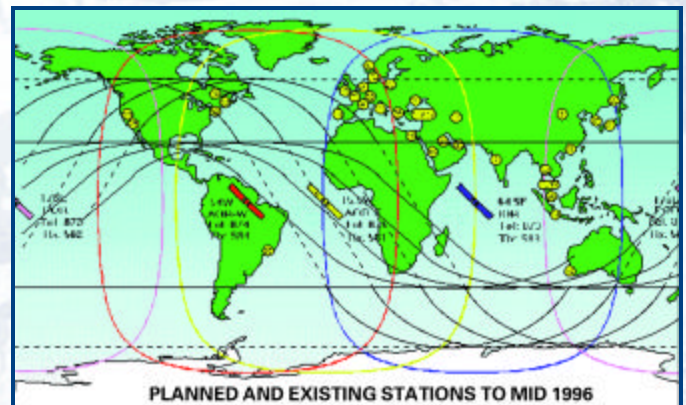
Commercial Service: INMARSAT-B (digital)

RF Frequencies (L-Band)

- Transmitting: 1626.5 - 1646.5 MHz
- Receiving: 1525.0 - 1545.0 MHz

Services

- High Speed Data (HSD) 64 kbps
- Voice over Internet Protocol: 8 kbps (Up to three simultaneous voice calls can be placed)
- Data Interfaces:
  - 10 Base T Ethernet (standard)
  - RS-232, RS-422



SHUCS Satellite Coverage Via the INMARSAT Satellites Network

## ABOUT THE COMPANY

Incorporated in 1984, SPACEHAB, Inc. is the first company to develop, own, and operate space flight assets, including habitat and laboratory modules and cargo carriers for use on orbit. Serving the international community, SPACEHAB has unsurpassed experience supporting both manned and unmanned missions to space. With its Astrotech Space Operations, Johnson Engineering, and Space Media subsidiaries, SPACEHAB offers a myriad of products and services to a broad customer base including NASA, other space agencies, and commercial customers around the world.

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