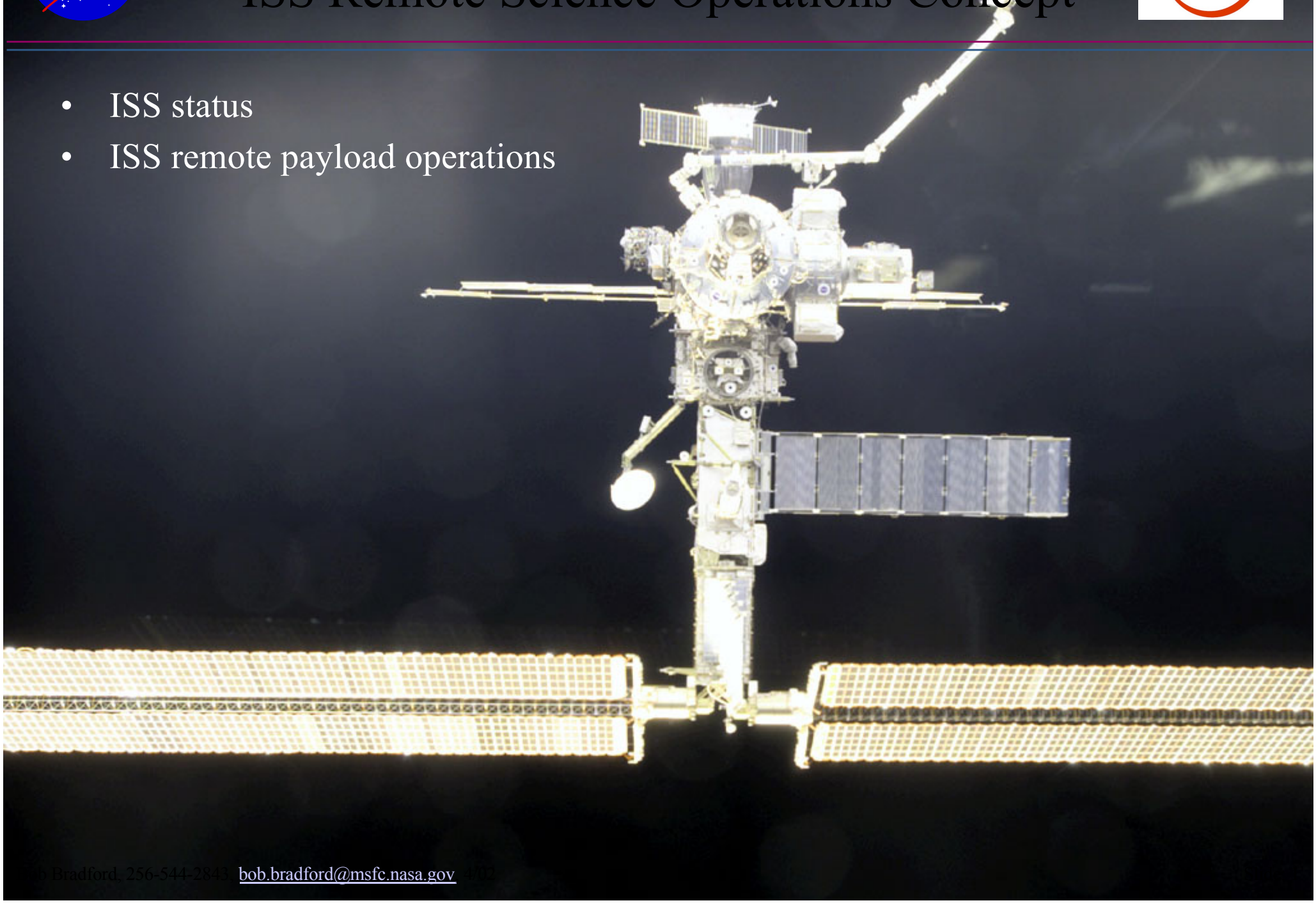
NASA and the International Space Station (ISS)
ISS Remote Science Operations Concept

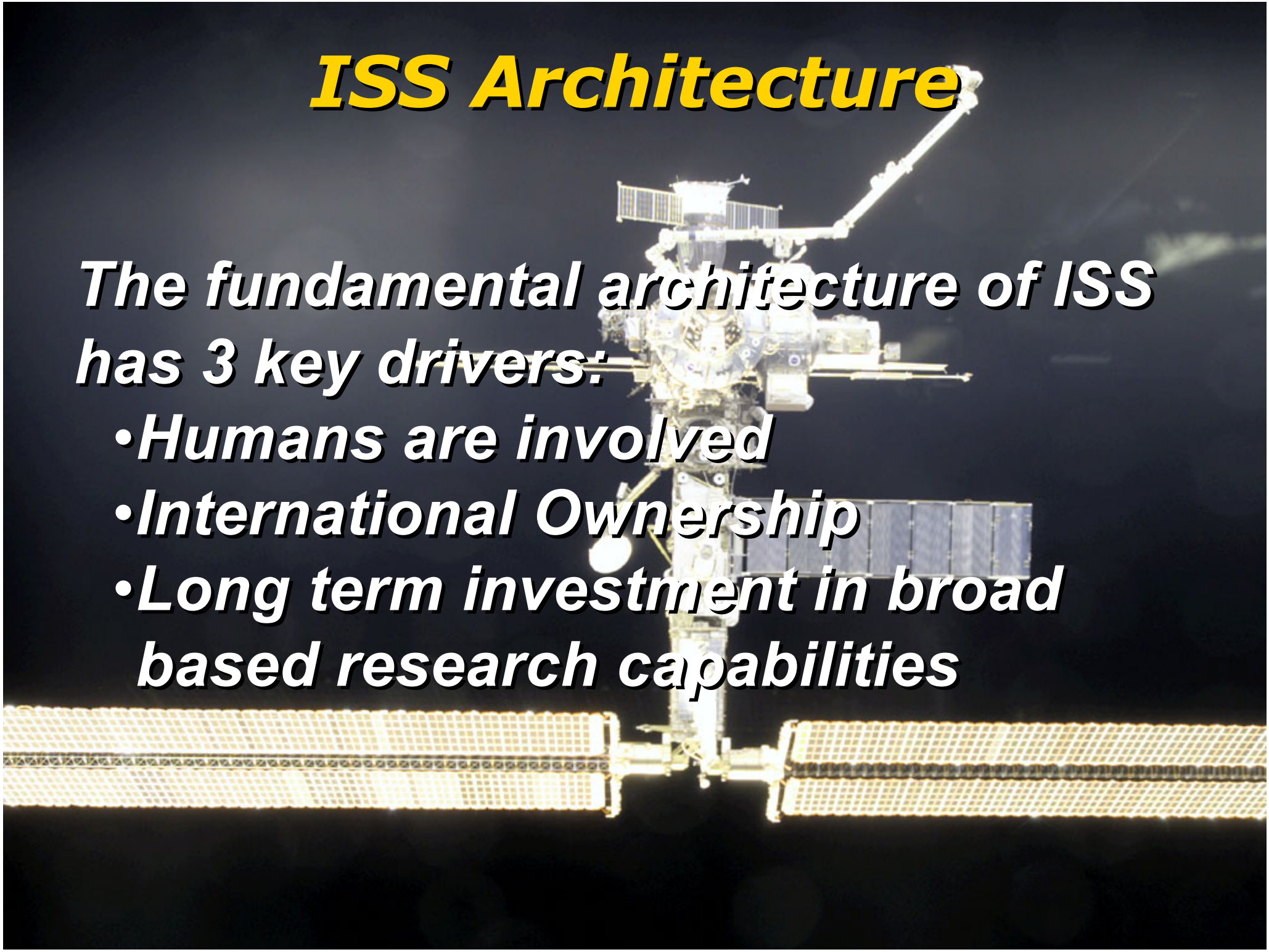
- ISS status
- ISS remote payload operations



Bradford, 256-544-2843 bob.bradford@msfc.nasa.gov 4/02

ISS Accomplishments

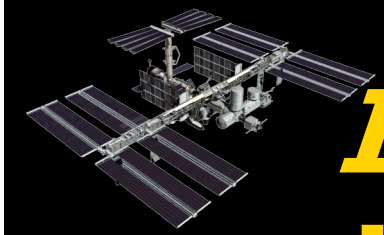
ISS Architecture



The fundamental architecture of ISS has 3 key drivers:

- Humans are involved
- International Ownership
- Long term investment in broad based research capabilities

NASDA
宇宙開発事業団
NASA
5 Space agencies
own the ISS,
16 nations have their own
reasons to put people and
hardware in space
CSA ASC
esa
P K



ISS will employ 5 Launch Vehicles from 4 Partners

Shuttle

Proton

Soyuz

Ariane & ATV

HIIA & HTV

ISS
Our Vision

A human outpost in space
bringing nations together for
the benefit of life on Earth . . .
and beyond.

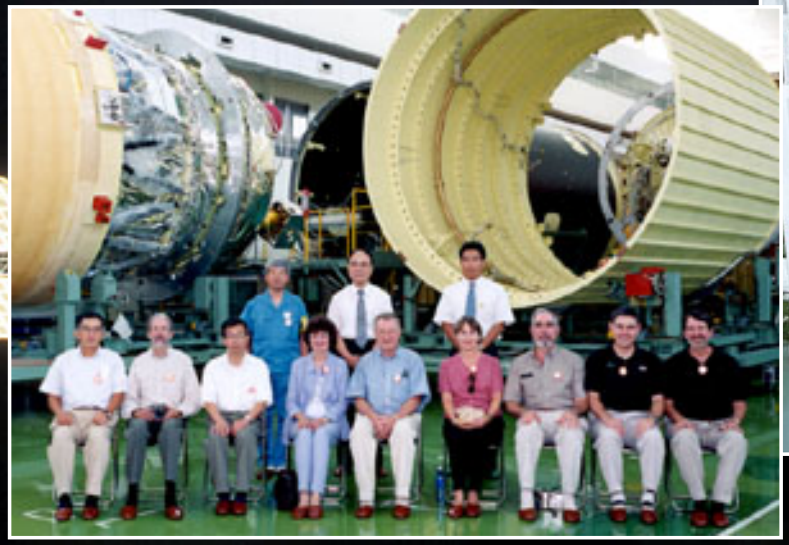
We will make revolutionary
discoveries and establish
the permanent international
presence of humans in space
to advance the exploration
of our solar system and
enable commerce in space.

Permanent Habitation

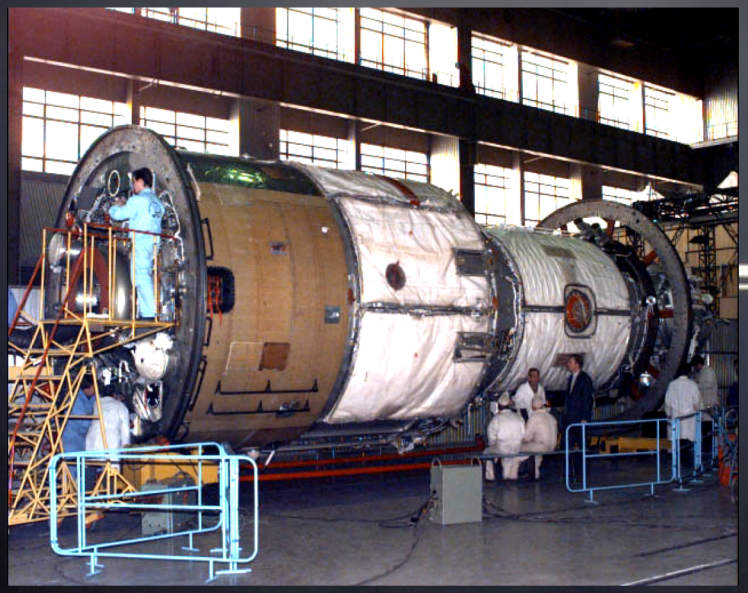
Expedition One arrives on the first Soyuz flight, beginning permanent habitation of ISS. Life support is provided by the Service Module "*Zvezda.*" The crew activates the primary station, and awaits the addition of power and other critical capabilities.

ISS-2R (Soyuz)
October 31, 2000

One Huge International Space Flight Team connected on 3 Continents”

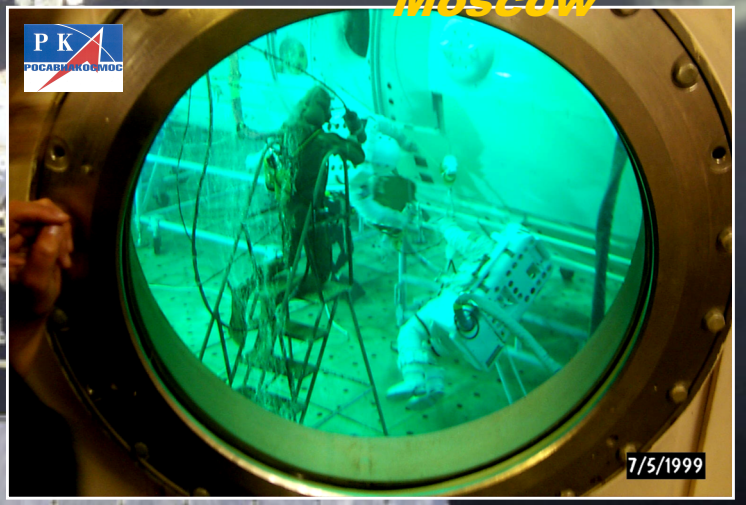


RUSSIA's Control and Training Centers



Service module mock up – RSC Energia (Moscow)

HydroLab, Star City, Moscow



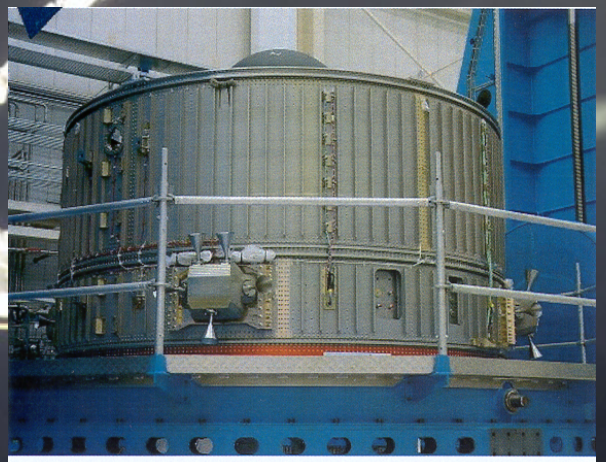
TsNIIMASH Korolev

Mission Control Center (Moscow)

EUROPE's Control and Training Centers

Oberfafenhoffen
Germany

Columbus Lab Control Room



Equipped Propulsion Bay STM at Bremen

JAPAN's Control and Training Centers

NASDA

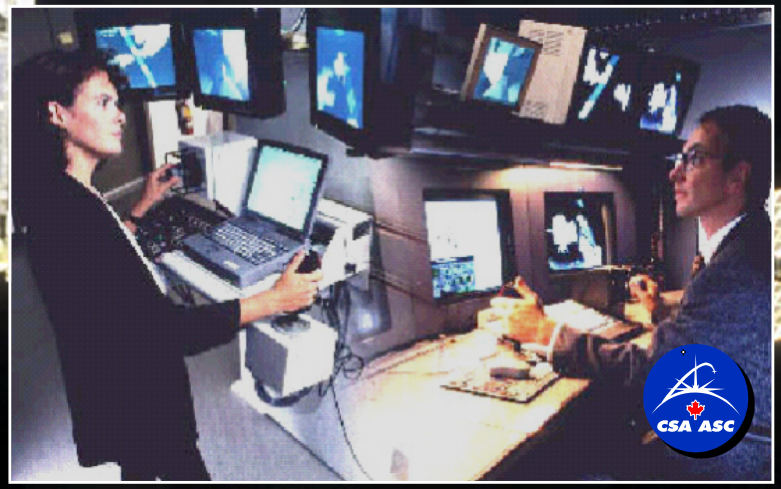
Tsukuba
Japan

JEM Mission Control Room

CANADA's Control and Training Centers

St. Hubert
Canada

Mobile Servicing System Control Room



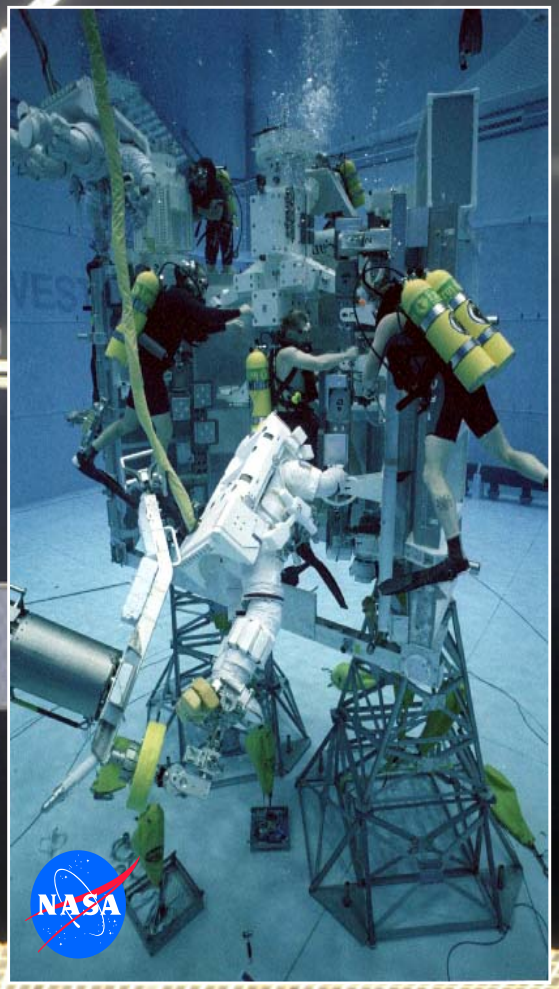
U.S. Control and Training Centers

Johnson Space Center
Houston

Mission Control Center (MCC-H)

Marshall Space Flight Center
Huntsville

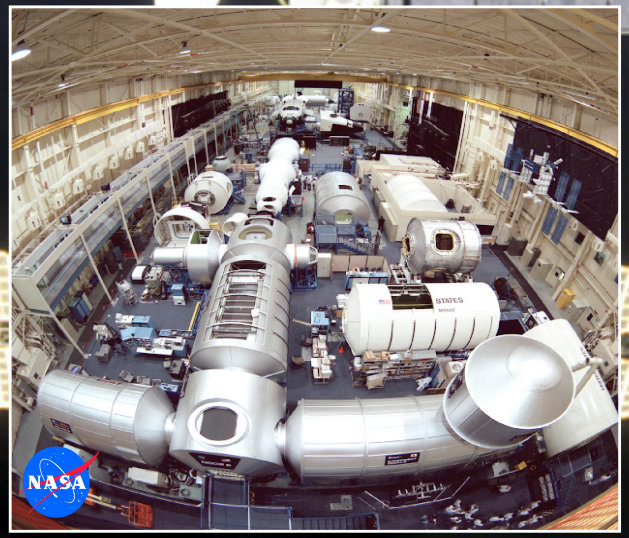
Payload Operations & Integration



Sonny Carter
Neutral buoyancy Lab

Johnson Space Center
Houston

ISS Flight Control Room



Johnson Space Center ISS Mock ups

ISS Remote Science Operations Concept

How do you start?

- Start by Principal Investigators (PI), Co PIs and researchers contacting and agreeing at the science level
- Science teams are not distracted by the technology implementations that are required to operate their on board experiments and conduct science remotely
- Since the tools exist!

ISS Remote Science Operations Concept

Remote Ops Tools

- Telescience Resource Kit

- Internet Voice Distribution System
- ISS Downlink Video
- Networking

ISS Remote Science Operations Concept

- Telemetry
  - Receive, process, display, monitor, record, forward, and playback telemetry data
- Commanding
  - Update, uplink, and track commands
- Telemetry and Command Databases
  - Can be configured and modified by the user
- Application Programming Interface
  - Can be used with commercial software products to create user-developed software programs that work with telemetry and commands
- On a PC based system for less than $8K

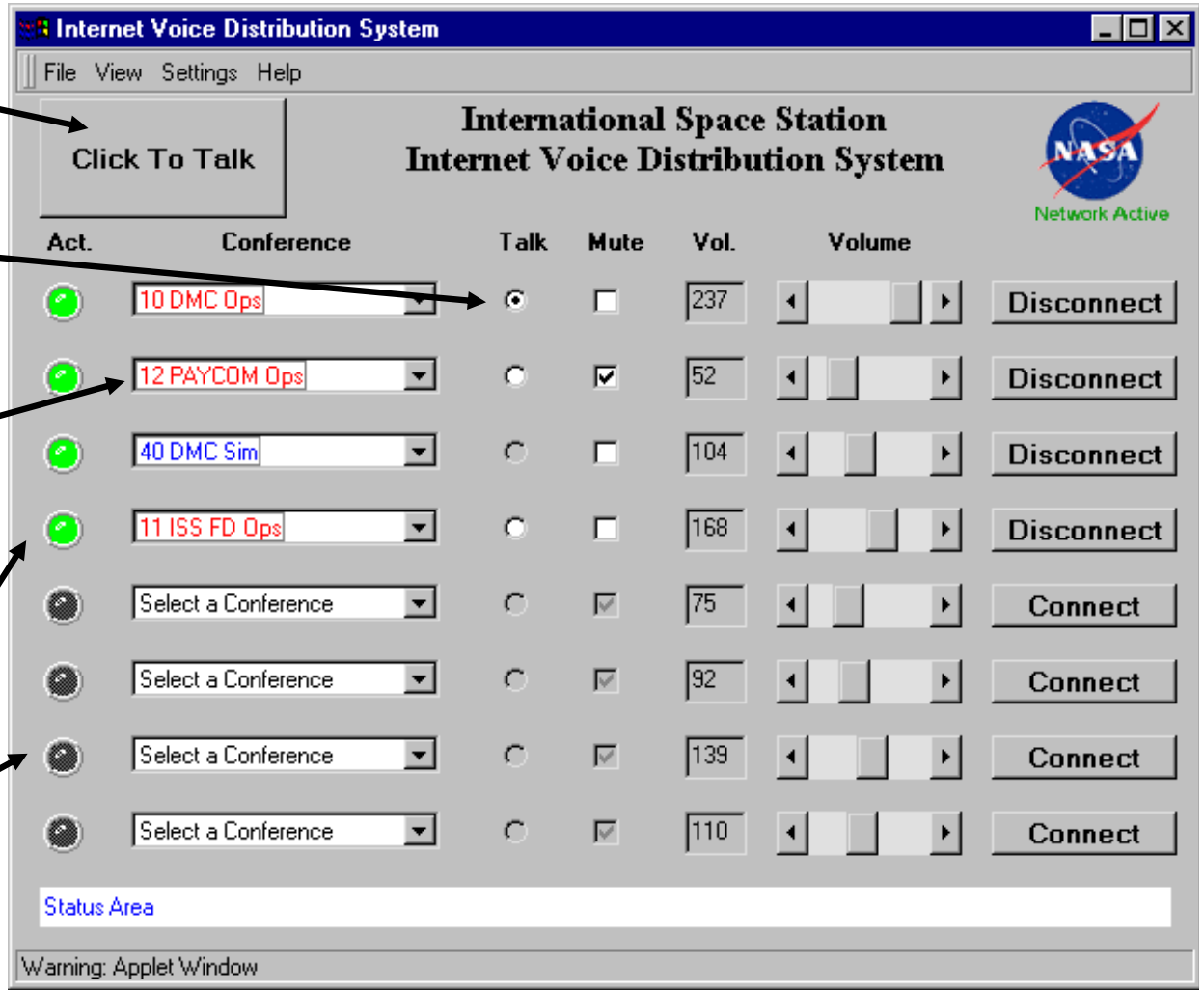
ISS Remote Science Operations Concept

Click to Talk Button enables user microphone when depressed. (Also Space Bar works.)

Talk Radio Button indicates user has selected conference for talking. Only one Talk Radio Button can be selected at a time. If user has "monitor only" privileges, talk radio button is disabled.

Conference Color
Red - Operational Conference
Blue - Simulation Conference

Activity Indicator
Green LED ON indicates loop is connected. Red LED FLASHING indicates activity. LED OFF indicates loop is disconnected.



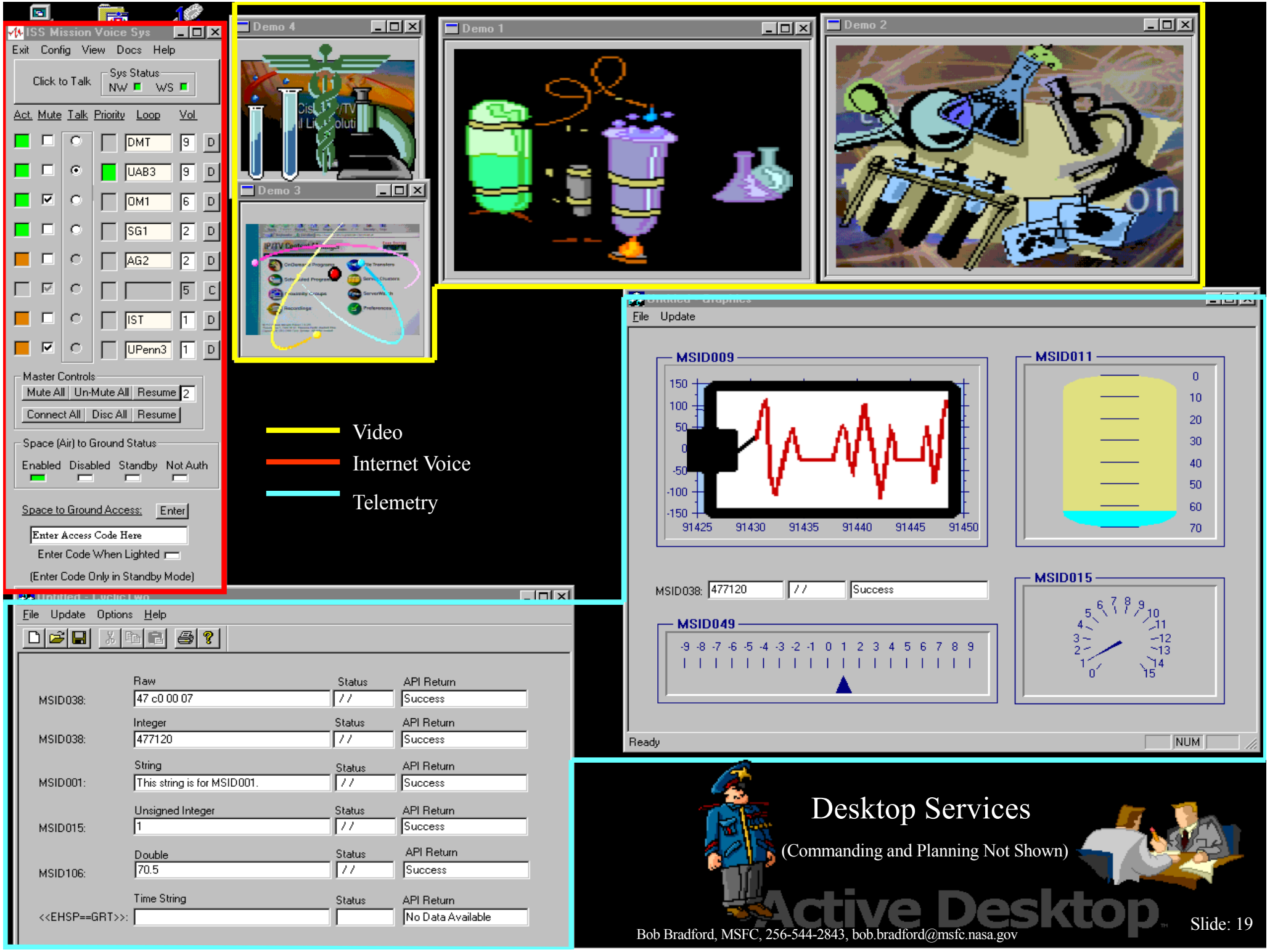
IVoDS User Interface

(Zero Cost to the User)

User must be assigned access to conferences by Administrator
Administrator specifies the set of conferences to be made available to user when User Account is created or modified. User can talk on one conference, monitor up to 8 conferences simultaneously, depending on bandwidth and quality of connection.

Current ISS Downlink Video Implementation

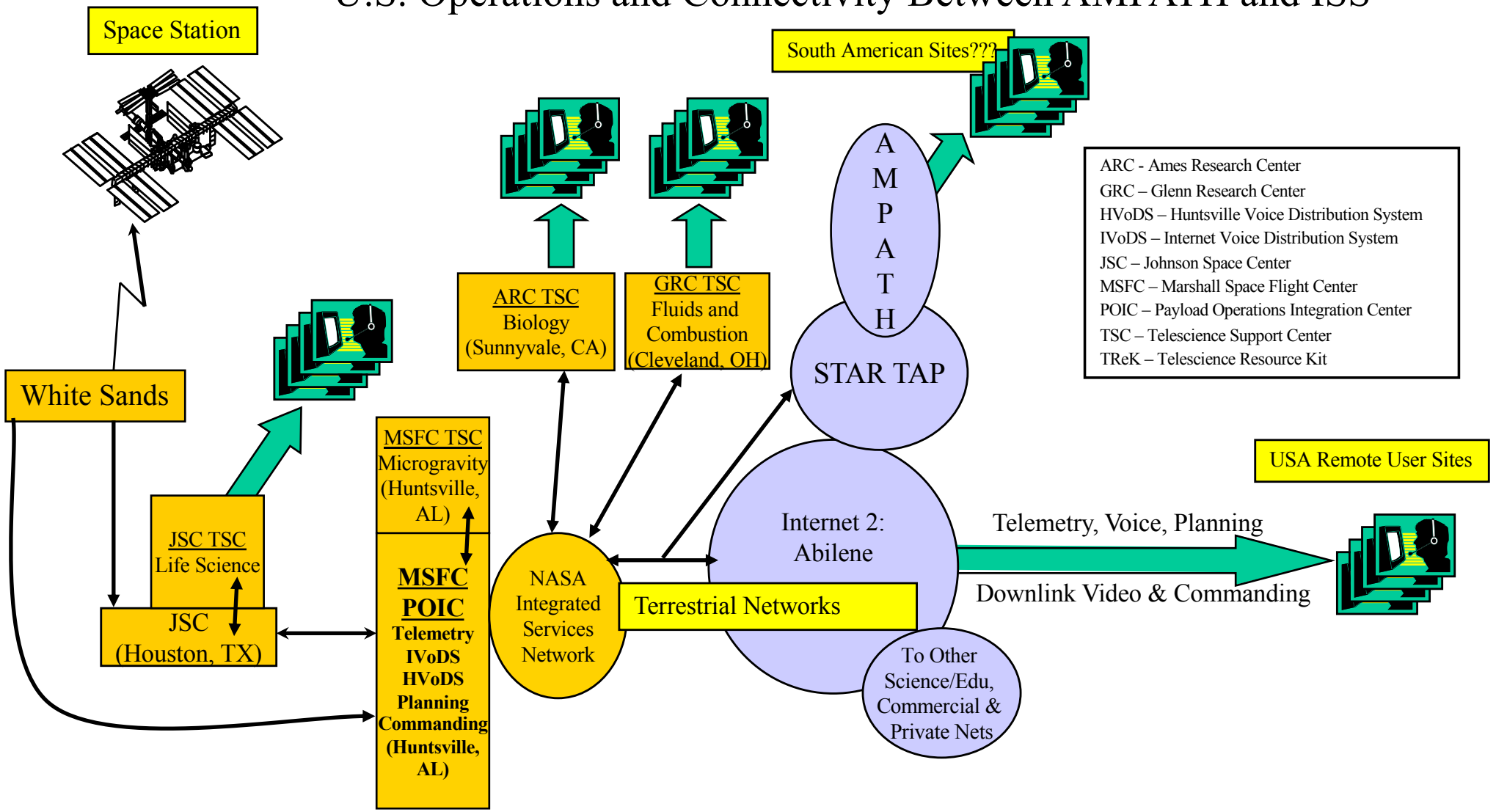
ISS Downlink Video = Multicast at STAR TAP at the video stream native rate w/Cisco's IPTV client
(IPTV client is free)


ISS Mission Voice Sys
Exit Config View Docs Help
Click to Talk
Sys Status
NW WS
Act. Mute Talk Priority Loop Vol
DMT 9 D
UAB3 9 D
OM1 6 D
SG1 2 D
AG2 2 D
5 C
IST 1 D
UPenn3 1 D
Master Controls
Mute All Un-Mute All Resume 2
Connect All Disc All Resume
Space (Air) to Ground Status
Enabled Disabled Standby Not Auth
Space to Ground Access: Enter
Enter Access Code Here
Enter Code When Lighted
(Enter Code Only in Standby Mode)
Demo 4
Demo 1
Demo 2
Demo 3
Video
Internet Voice
Telemetry
File Update
MSID009
MSID011
MSID038: 477120 / / Success
MSID049
MSID015
Ready
NUM
File Update Options Help
Raw Status API Return
MSID038: 47 c0 00 07 / / Success
Integer Status API Return
MSID038: 477120 / / Success
String Status API Return
MSID001: This string is for MSID001. / / Success
Unsigned Integer Status API Return
MSID015: 1 / / Success
Double Status API Return
MSID106: 70.5 / / Success
Time String Status API Return
<<EHSP==GRT>>: No Data Available
Desktop Services
(Commanding and Planning Not Shown)
Active Desktop
Bob Bradford, MSFC, 256-544-2843, bob.bradford@msfc.nasa.gov
Slide: 19

Networking

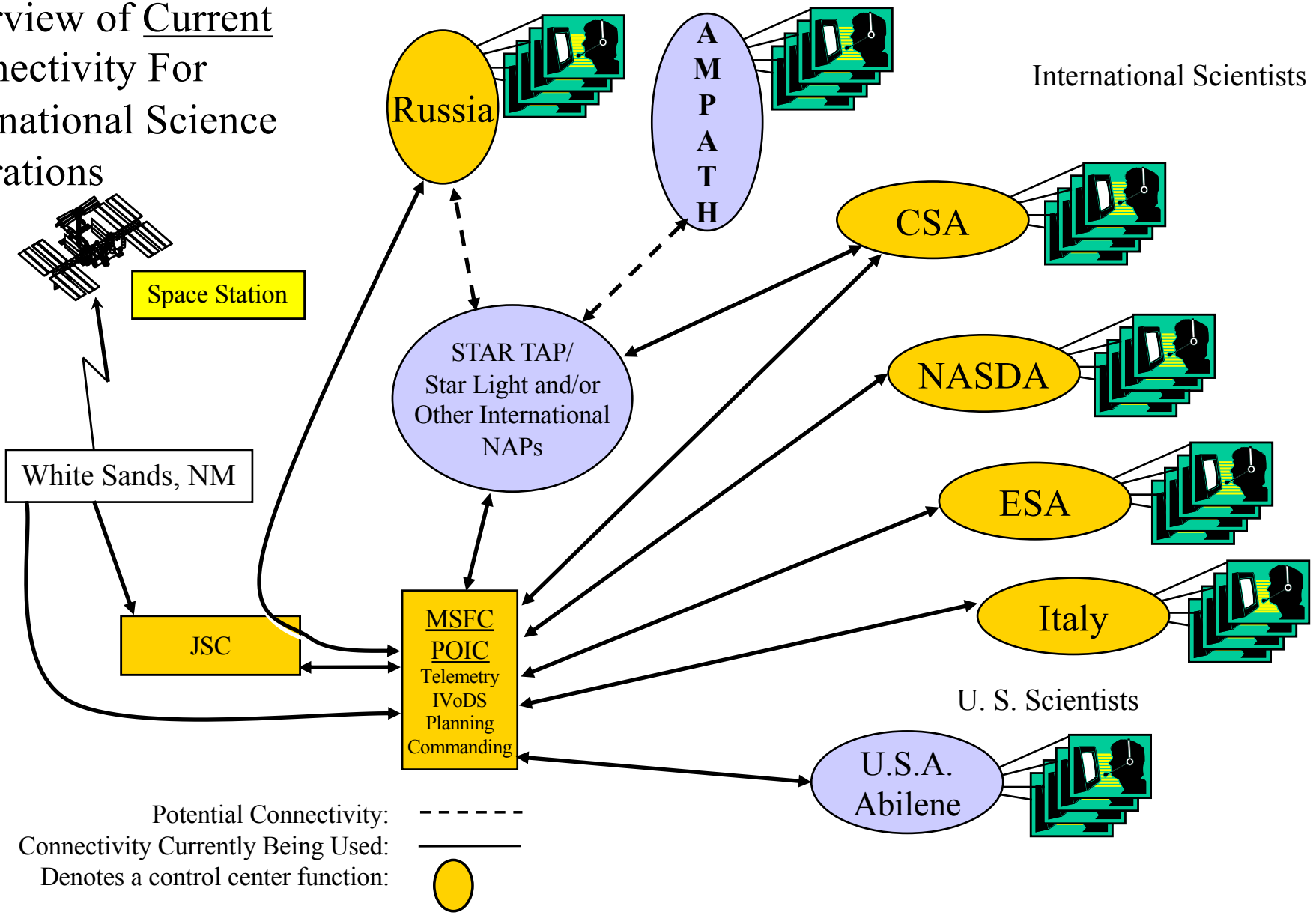
ISS Remote Science Operations Concept

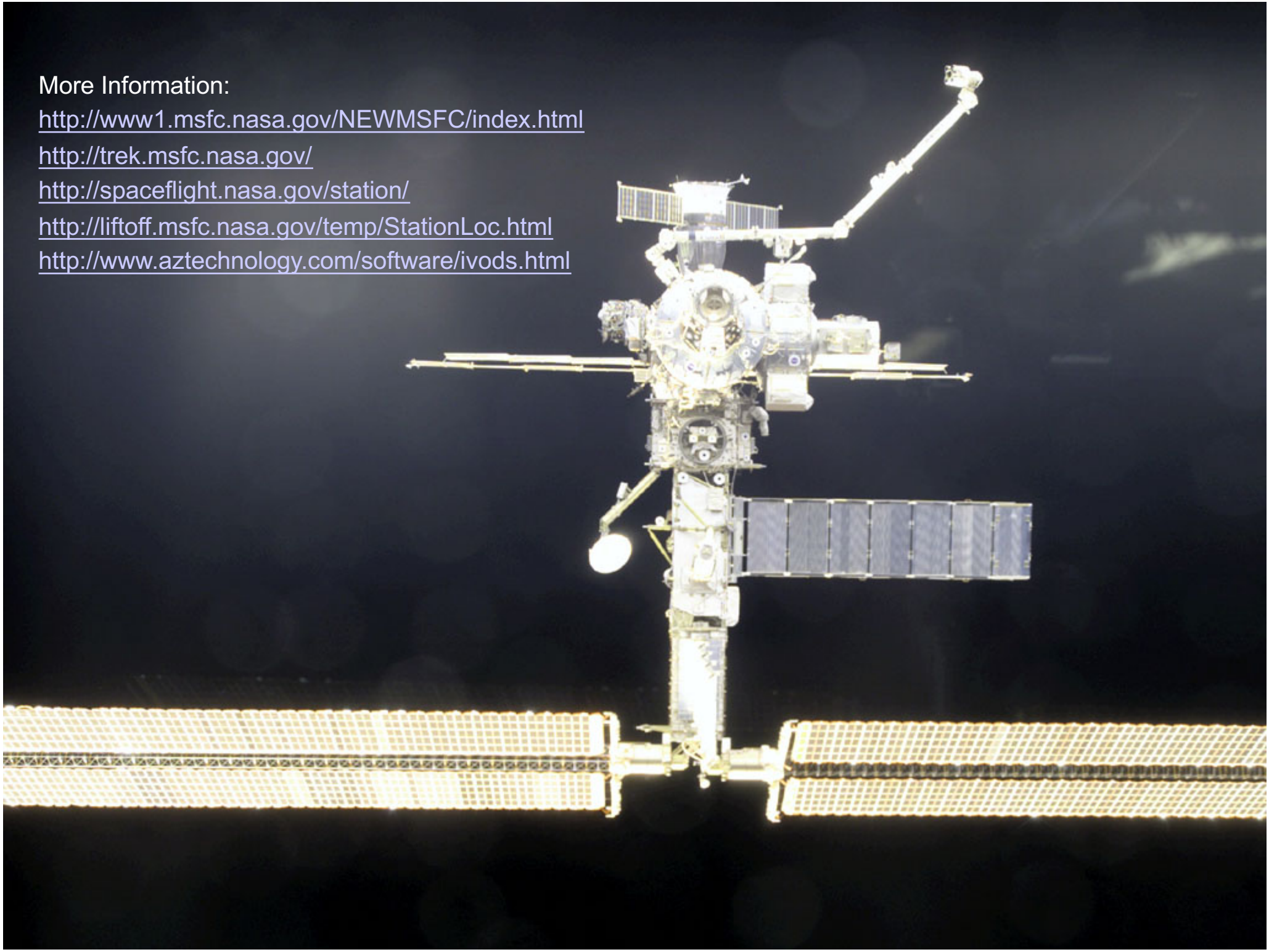
U.S. Operations and Connectivity Between AMPATH and ISS



ISS Remote Science Operations Concept

Overview of Current Connectivity For International Science Operations




More Information:
http://www1.msfc.nasa.gov/NEWMSFC/index.html
http://trek.msfc.nasa.gov/
http://spaceflight.nasa.gov/station/
http://liftoff.msfc.nasa.gov/temp/StationLoc.html
http://www.aztechnology.com/software/ivods.html