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# ISS Program Office Report

Presentation to ARISS Delegates

December 2002

By

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# Topics

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- Improvements to scheduling for school contacts
- ISS Contributions to ARISS activities
- Outbrief of May 2002 Presentation to Mr. Tommy Holloway, ISS Program Director
- Forward work in the ISSPO (ISS Program Office)



# Improvements in School Contact Scheduling

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- ARISS noted issues with scheduling of school contacts during Increment 4. Improvements were developed and implemented during Increment 5.
- Blackout periods were defined for no school contacts:
  - From the day of launch of a new crew for 2 weeks
  - Week prior to crew return.
  - Week of EVA
- At the beginning of Expedition 5, the ARISS inputs were delivered one week earlier than for Exp. 1-4 (i.e. 3 weeks prior to the school contact) so that if there is time in the crew's schedule, the school contact is scheduled and reviewed at the Thursday meeting 2 weeks prior to the week of the school contact.



# ISS Contributions to ARISS Activities

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- ~\$225K to date in on-orbit crew time for school contacts
- ~\$150K/yr in ISS system integration manpower
- Crew EVA time for the installation of the 4 Ham antennas
- Upmass, downmass and integration for ARISS hardware on Shuttle flights
- On-board stowage of the second radio set of hardware. (2 yrs.)
- On-board stowage of 2 antennas between EVAs (~ 6 months)
- Control center coordination of data and scheduling of school contacts



# Briefing to ISS Program Manager

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- Briefing charts attached as backup
- Overall favorable reaction to ARISS activities
- Issues and Concerns
  - Ham effort is largely outside programmatic structure
    - Integration with non-program organizations
    - No allocations for hidden costs
    - School contacts occur on crew free time
    - Lack of programmatic awareness of when and how activities meet program objectives
  - Ham Program appears to be open ended
    - No program awareness of ARISS program plan past Ham Phase 2



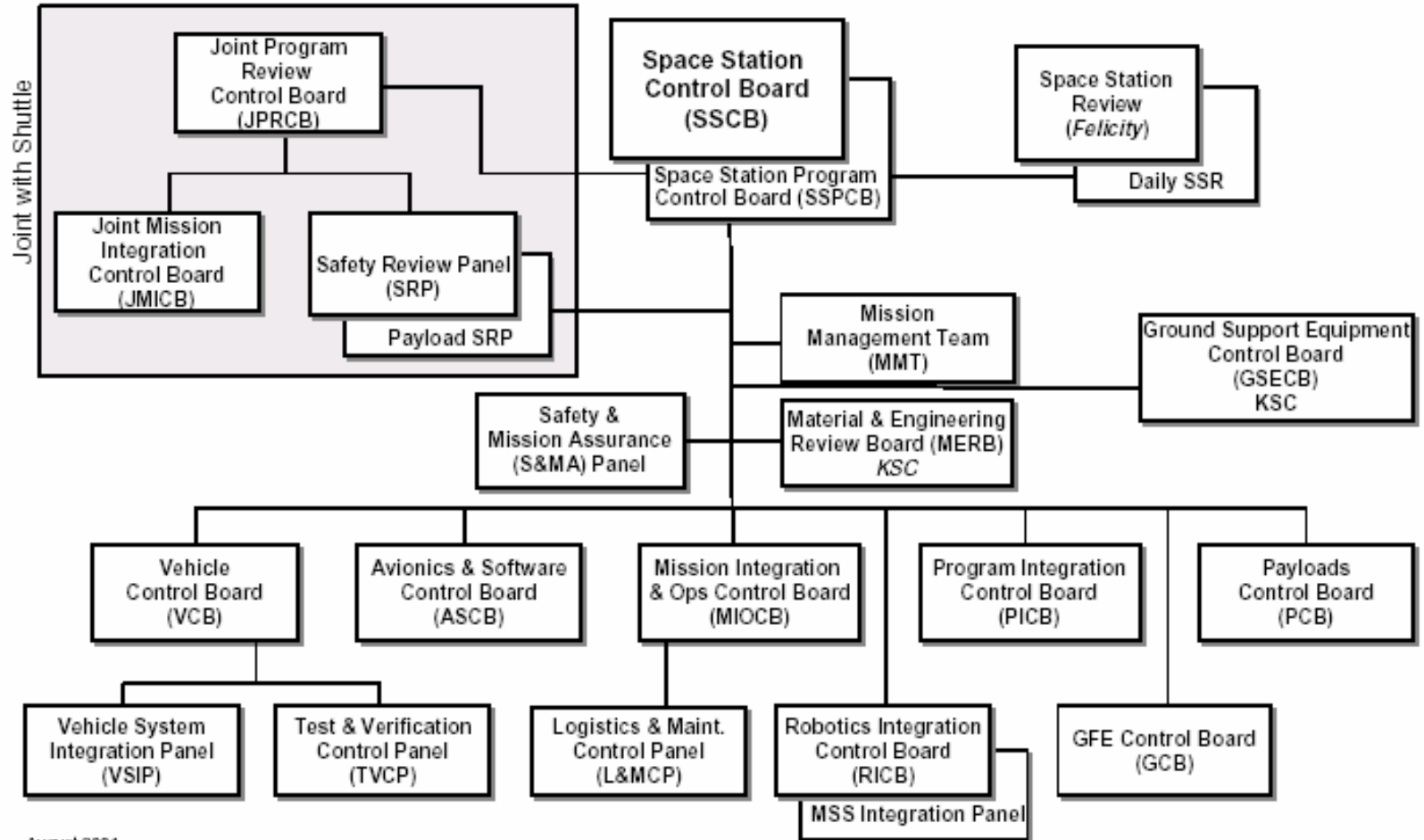
# Forward work

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- Actions from ISS Program Manager
  - Implement ISS Board control for ISS Ham Technical Team chartered by Document 2
  - Include school contact metrics in Program Manager standard charts
  - Increase ISS outreach leverage for existing events
- Continue to refine school contact scheduling
  - Increment 5 to Increment 6 Transition
  - Resolve internal process issues



# ISS Board Structure



August 2001



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# Backup

Holloway Presentation





# Presentation to Mr. Holloway

21 May 2002



# Outline

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- History
- Benefits
- Requirements
- ARISS- Amateur Radio on ISS
- Educational Outreach
- Current Configuration
- Ham Phase 2
- ARISS Proposed Ham Hardware
- Technology Development
- Resources
- Issues and Concerns
- Summary



# Historical Perspective

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- SAREX – over 25 missions
- Mir Experience
  - Crew Psych
  - Emergency
- Early ISS usage
  - Crew psych
  - School contacts



***Russian Elements Integration Office***



# Benefits of ISS Ham Radio

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## **Educational Outreach through School Group Contacts**

- Ham radio school contacts from ISS have reached over 15,000 students
- Radio contact is the culmination of a long series of space science and engineering activities, community involvement, and public relation events that produce a spirit of teamwork.
- Hands-on nature of the amateur radio contact provides the incentive to learn about orbital mechanics, the Doppler effect, and the concepts of time zones and mission elapsed time.
- There is a sense of accomplishment that results from the school and the students setting up and conducting the ISS Ham contact themselves.
- ISS Ham Educational Events Support the National Education Standards in Math, Science & Technology

“We involve the educational community in our endeavors to inspire America’s students, create learning opportunities & enlighten inquisitive minds”--NASA Strategic Plan



## Benefits of ISS Ham Radio (Continued)

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### **Crew psychological factors**

- Provides opportunity for casual conversations with non-project related individuals. Usage varies on an individual basis

### **International Good Will**

- Astronaut contacts to schools and amateur community fosters international good will
- Provides forum to enable international technical partnerships

### **Experimentation leading to commercial development**

- ISS provides motivation and testbed for development of new telecommunications techniques



## Program Requirements and Agreements

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- ISS Ham chartered through bi-lateral agreements with Russia
  - Document 1: 1991 bilateral signed by Holloway and Ryumin
    - Establishes Ham Technical Team
    - Each side provides the hardware on their segment
    - US integrates and coordinated other IPs
  - Document 2: Ham Technical Team Charter
  - Document 3: ARISS (Amateur Radio on ISS) interaction with ISS
- Education Requirements/agreements
  - Strong precedent of early ISS use
  - Historical tradition of use from shuttle
  - Verbal direction from Brinkley, no written agreements
- SSP 50260, MORD, Section 6.2.6 BEHAVIOR AND PERFORMANCE
  - Provisions shall be made to implement appropriate psychological support programs for the crew, key ground personnel, and crew families throughout the mission. These provisions shall include, but not be limited to, the following: E. Access to an onboard amateur radio for recreational ham radio contacts.
  - Note: Family and friends contacts now occur via IP phone
- Bi-lateral agreements in work to be extended to multi-lateral



# ARISS

## Amateur Radio on ISS

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### ARISS Organization

- Nine international partners thus far—  
**Belgium, Canada, France, Germany, Italy, Netherlands, Japan, Russia and United States**
- MOU (Document 3) —Formed ARISS to represent the amateur radio community to the ISS Program
- Rules & Bylaws developed with delegates from **Europe (4), Americas (4), Russia (2) and Japan (2)**

### ARISS International Meetings

- Fall 1996—JSC, Houston, Texas
- July 1998—University of Surrey, Surrey England
- January 1999—JSC, Houston, Texas
- March 2000—ESA ESTEC, Noordwijk, Netherlands
- December 2000—GSFC, Greenbelt, MD
- May 2001—ESA ESTEC, Noordwijk, Netherlands
- April 2002 – CSA, Montreal, Canada



# ISS Ham Radio Educational Outreach

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## Outreach to International Schools Reaches Whole Nations:

- **Japan**—a school contact was organized for a Saturday morning that had the whole school and community involved. The astronaut's answers were simultaneously translated to English.
- **Newfoundland**—A special request came through IPCanada for a school contact with Newfoundland for the 100<sup>th</sup> Anniversary of the first Marconi transmission.
- **South Africa**—Mark Shuttleworth conducted four school contacts which were transmitted over national television.
- **Additional countries having school contacts to date**—Canada, UK, Italy, Russia.

## Metrics

- **Over 60 schools involving over 15,000 school children preparing for and listening to the event.**
- **All 60 schools had local and/or national news coverage reaching a minimum of another 4 million people world-wide.**
- **Space Station IMAX – 3D includes two scenes with students. This film is now in over 30 states and 20 countries.**
- **USA**—about 1/3 of all school contacts are available on the internet via MSNBC live. Several school contacts are archived on the internet.
- **Field Day Operations: June 22-23, 2001 (Sat/Sun) emergency preparedness/contest activity contacts by Susan Helms. Exp. 5 crew has committed to support this if the timeline permits it.**
- **Cosmonauts Day, Scout Jamboree, “crew picks” to conferences and military installations provide additional communication with the public**





# Current On-orbit Configuration

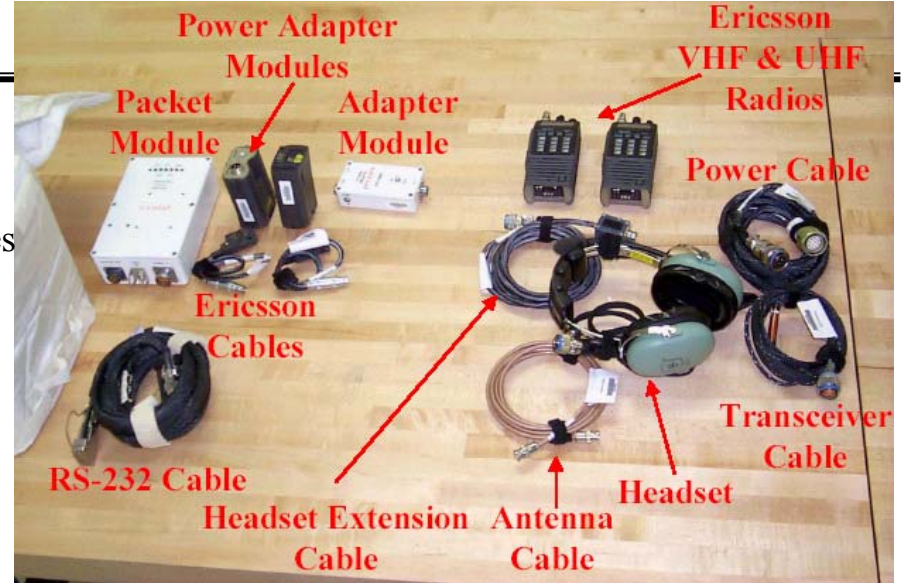
## Launched on STS 106 (September 2000):

- 1 Packet Module
- 1 Adapter Module
- 2 Ericsson Radios (2M & 70 cm) with 2 power supplies
- 2 Ericsson cables
- 1 Transceiver cable
- 1 Headset Assembly
- 1 Headset Extension Cable
- 1 RS232 Cable (9 pin)
- 1 ISS-HAM RF Cable
- 1 FGB RF Cable
- 1 ISS-HAM Power Cable

## Added Since:

- New Packet Module (STS-105, August 2001)
- Enough cables & equipment to allow the crew to set up a second station in the Service Module (STS-108, December 2001)
- Four antennas to be installed on the Service Module (STS-108, December 2001)
- EVA Frame to allow the crew to carry the antennas (STS-108, December 2001)

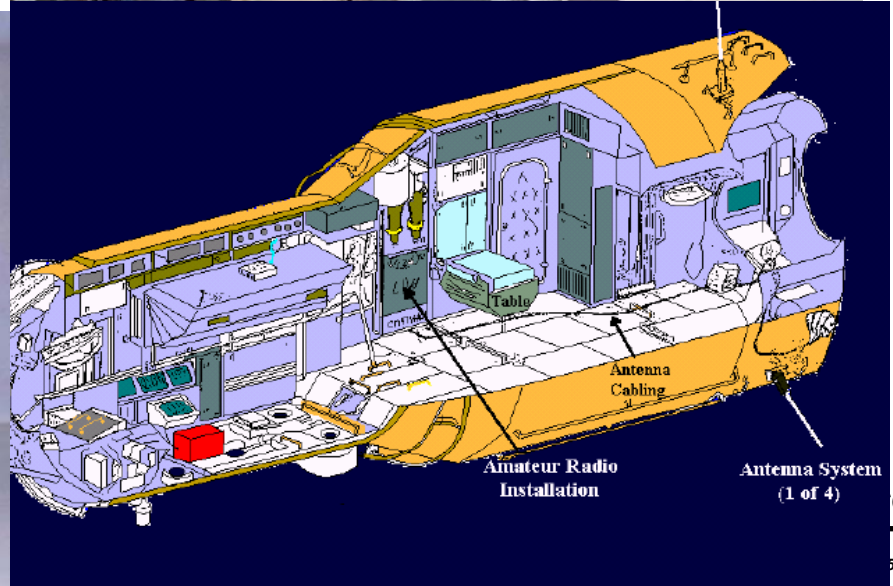
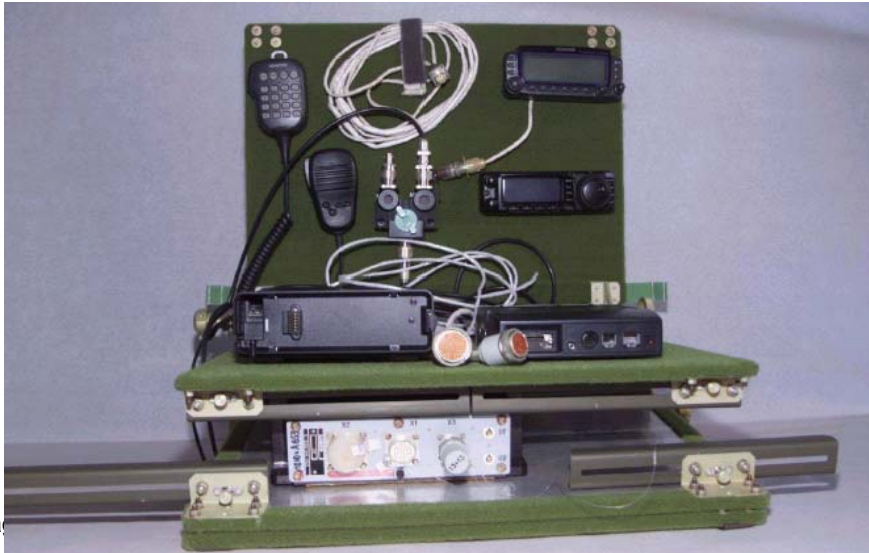
Total upmass ~ 100lbs





# “Ham Phase Two” ISS Hardware

- Phase 2 System Description
  - Installed in Service Module
  - Uses new ARISS antenna systems
- Phase 2 system consists of:
  - SAREX Phase 1 70 cm radio hardware (Packet Module, Ericsson 70 cm Radio, adapter module, headset, cables)
  - Kenwood TM-D700 VHF/UHF radio system
  - Yaesu FT-100D HF radio system
  - Specially built Energia Power Supplies
  - Foldable Mounting Device





# ARISS Planned Ham hardware

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- Remaining Phase 2 hardware manifested on 9P (as placeholder)
- Packet e-mail currently not operational because no dedicated computer (plan to use excess computer when available)
- Slow scan video
- Computer to computer radio links
- External payloads with antennas and experiments



# SAREX/ISS Ham Technology Development

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## Technology Development History:

- **Communications between astronauts and amateur radio operators (1983)**
- **Pictures uplinked / downlinked to Shuttle (1985)**
- **Astronaut-student interviews (1990)**
- **Crew contacts with families and friends (1990)**
- **Computer-to-computer radio links (1990)**
- **Television uplink (1991)**
- **Backup communications during TDRSS outage (1992)**
- **Frequent payload in Shuttle Program (25 Flights)**
- **Worldwide, real-time internet downlink of spacecraft telemetry data**
  - Spartan 206/STS-72 (1996) via SAREX ground network

## ISS Ham Technology Development Opportunities:

- **Phase 2 hardware in SM will support SSTV and multiple school links.**
- **Truss and pallet mounted exterior payloads will be developed by university students, using emerging and experimental technologies.**
- **Proposed mini-held transceiver and 6 in. diameter window antenna for Shuttle-to-Station communications.**



# Resources

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- NASA ISS PO
  - 1 EP for integration
  - Hidden costs: upmass, storage, power, EVA training
  - Crew time for h/w installation
- Rosaviacosmos/Energia
  - Hardware: SM feedthroughs, cables, clamps, connectors, etc.
  - Hidden costs: upmass, EVAs and training
- NASA HQ Code FE
  - Funding for hardware certification
  - Lesson plans and school interfaces
- ARISS
  - Radios and other hardware
  - Organizes school contacts
  - Updates lesson plans
- MCI/Worldcom donates international phone time for telebridge connections
- MSNBC donates live internet audio coverage of school contacts



# Issues and Concerns

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- Ham effort is largely outside programmatic structure
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# Summary

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- Ham radio is operational on ISS
- ISS crew members have reached over 15,000 students using Ham radio
- ISS resources expended for Ham radio have been modest
- Additional hardware is planned which could:
  - Increase students reached
  - Stimulate commercial telecommunication development
  - Add to ISS emergency capability





# Backup for Holloway Pitch

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# Recent On-orbit Usage

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- School contacts in 8 countries and ~30 states; since December 2000, an estimated 15,000 students reached
  - Expedition 1 -- 7 School QSOs
  - Expedition 2 -- 14 School QSOs + Field Day QSOs
  - Expedition 3 -- 17 School QSOs + worldwide Jamboree-on-the-Air
  - Expedition 4 -- 10 School QSOs completed as of Mar 26 + 1 teacher's convention NASA videoconference mentioning ARISS
- Public contact at Ham Field Day and Scout Jamboree
- Friends and Family contacts
  - Exp 1 ~5/wk
  - Exp 2 ~5 total
  - Exp 3 and 4 ~ 5 total US + some Russian
- Packet beacon operational on Exp 1, 3 and 4 (sends signal once every 2 minutes)



# Ham Team

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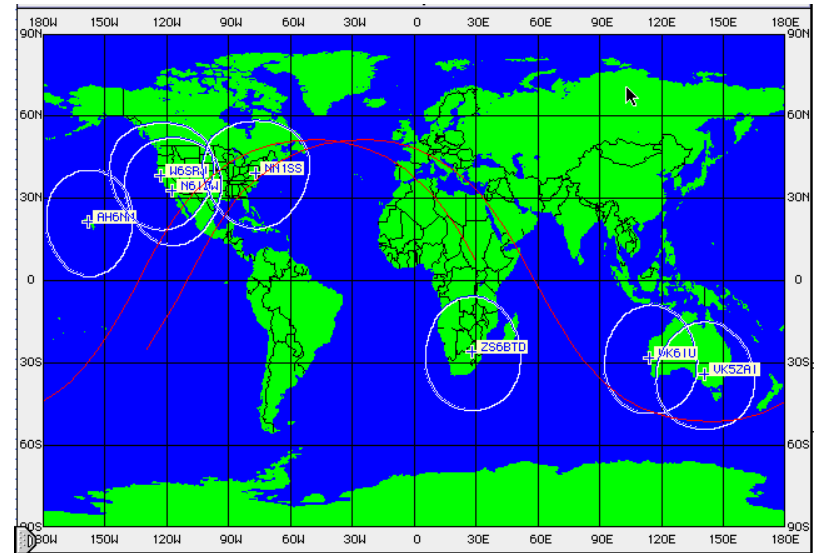
ISS Ham Program Manager	GSFC/ Frank Bauer	301.286.8496
Russian Specialist	Energia/Sergei Samburov	7095.513.6488
CB ISS Ham Rep.	CB/Mike Foreman	281.244.2503
CB Amateur Radio Coord.	CB/Ellen Baker	281.244.8919
CB ISS Amateur Radio Coord.	CB/Linda Godwin	281.244.8802
Crew Psych. Support	Wyle/Steve vander Ark	281-212-1446
ISS Ham School Coordinator	Frank Bauer (acting)	301.286.8496
ISS Ham Hardware Development	Lou McFadin	407.616.5792
ISS Ham Training Coordinator	Mark Steiner	301.286.5769
JSC Ham Shack & Lic. Coord.	EA/Nick Lance	281.483.0368
ISS Ham Technical Specialist	DM/Gil Carman	281.483.8031
Educational Representative	CB/Debbie Brown	281.244.7024
Integration Manager	OM3/Carolynn Conley	281.244.8150



# Worldwide Telebridge Facilities

- The ARISS volunteers provide the telebridge station facilities and their support for schools that could not guarantee a clear direct contact.
- ARISS volunteers are also available to support MCC-H for off-nominal circumstances (procedures under development and checkout).

<u>Station location</u>	<u>Operator, Station Callsign</u>
Australia	Tony Hutchison, VK5ZAI
Australia	Graham Ratcliff, VK5AGR
Australia	Gordon Williams, VK6IU
South Africa	Gerald Klatzko, ZS6BTD
South Africa	Hans van de Groenendaal, ZS5AKV
Honolulu, HI	Dick Flagg, AH6NM
Santa Rosa, CA	Tim Bosma, W6SRJ
San Diego, CA	Kerry Banke, N6IZW
JSC, TX	Larry Dietrich, W5RRR
GSFC, MD	Frank Bauer, NN1SS



*Russian Elements Integration Office*