



Amateur Radio on the International Space Station (ARISS)

Interesting Times: Nov 2012–Oct 2013

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EDUCATIONAL CONTACTS

Contact Summary



- In FY2013:
 - 95 contacts
 - 21 countries
- Since December 2000:
 - 845 contacts
 - 866 organizations
 - 49 countries

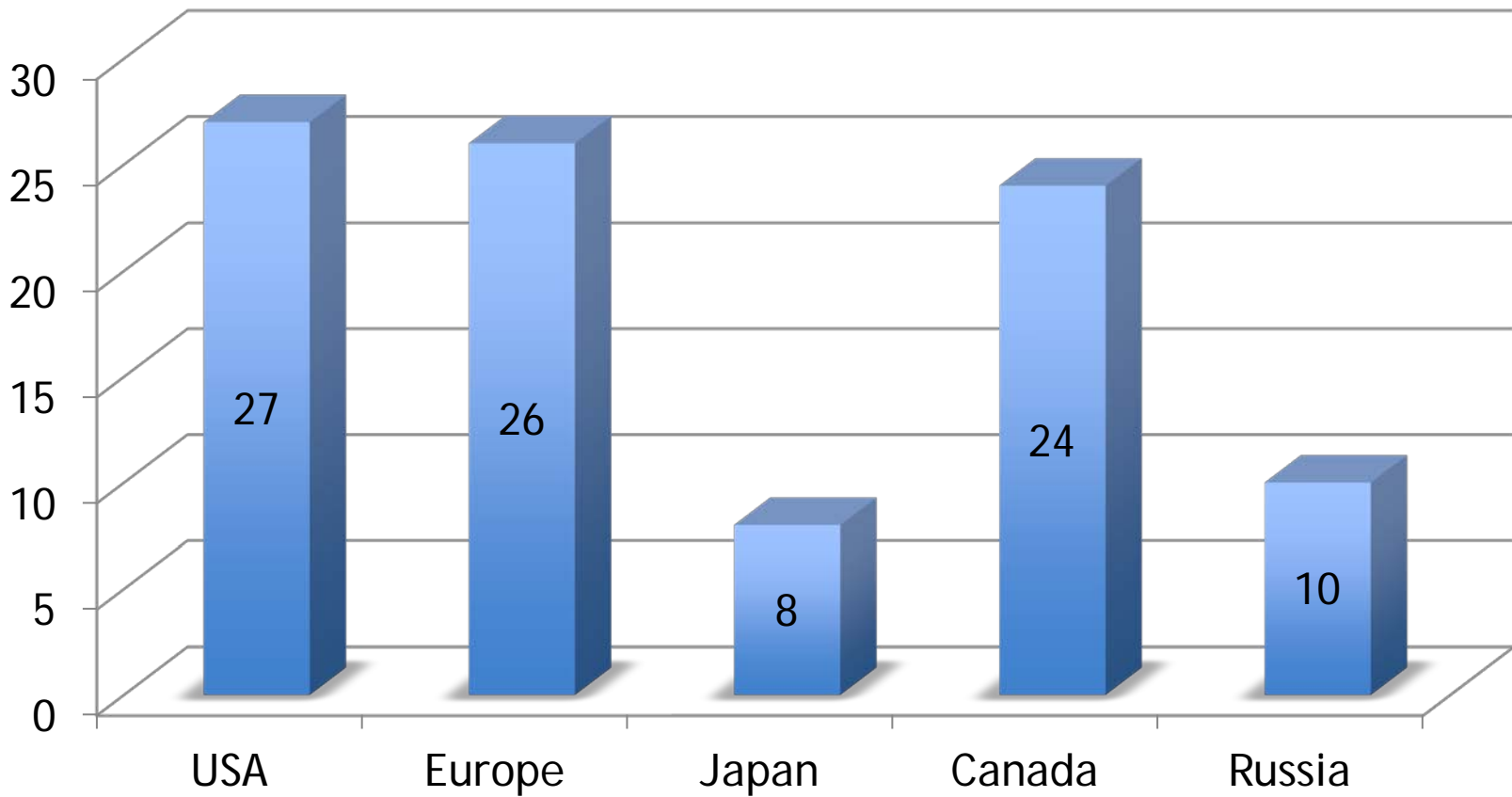


Tom Marshburn, Exp 34, using Ericsson VHF radio (without headset)—Feb 2013

ARISS Contacts FY2013



Contacts by Region



Commander Chris Hadfield: ARISS Immersion in Canada



- Chris Hadfield, KC5RNJ/VA3OOG
- First Canadian to command the ISS
- Social media and music phenomenon
- 23 ARISS school contacts across Canada and around the world



Chris Hadfield poster
at RCMP HQ,
Yellowknife, NWT,
Canada



Outstanding First: Connecting Canadian Students all across Canada from Space via Amateur Radio



Lori & Rankin Inlet students



Steve & Lori at Toronto SickKids hospital



Ste-Rose de Laval School



Cédrick Coté after Ottawa Science museum visit



ARISS “Buffalo Connection”



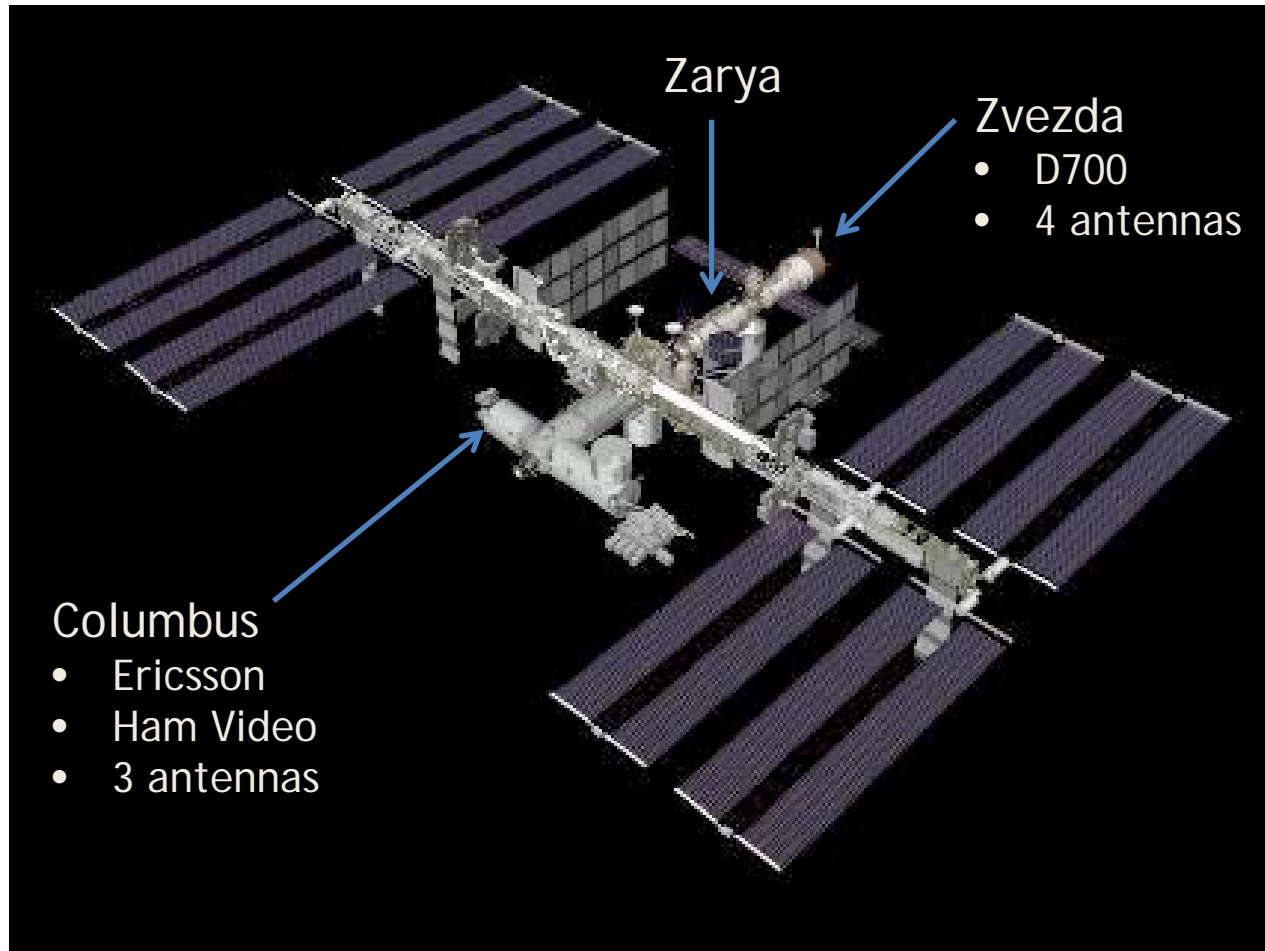
- Hay River school contact held May 3, attendance approximately 300
- ARISS Ottawa Ops Team attended courtesy of Buffalo Airways, who provided transportation
- The television series Ice Pilots by OMNI Productions was on location
- Buffalo Airways helped sponsor the contact and make it happen
- [Season 5, episode 1](#) (Oct. 23) covered the Hay River contact





HARDWARE STATUS

Equipment Locations



Columbus Module



- Ericsson VHF
 - Used for voice and packet
 - Primary radio for educational contacts
 - Current unit is a replacement for the original radio
- One VHF/UHF antenna
 - Supplied by AMSAT-NA (based on Phase 2 design)
 - Installed 2009
- Two L/S-band patch antennas
 - Supplied by ARISS-Europe
 - Proposed in 2002
 - Installed 2007 (prior to launch)



Columbus Module (cont.)

- Ham Video transmitter
 - DATV transmitter designed and built by Kaiser Italia
 - S-band, 10 W EIRP
 - DVB-S format
 - Adds capability for adding downlink video to selected educational contacts (combination called Ham TV)
 - Onboard: installation and testing expected soon
 - Full description in Sep/Oct 2013 *AMSAT Journal*
- Ericsson UHF
 - Used for packet in 2012, while Ericsson VHF was unavailable
 - Currently stowed

Columbus Module (cont.)



Randy Bresnik installing AIS antenna on Columbus module—Nov 2009



Kevin Ford talks to students in Mt. Ousley, Australia—March 13, 2013

Zvezda Module



- Kenwood D700
 - Used for packet and voice (Russian contacts)
 - Unreliable, experiencing problems since early 2013
- Three VHF/UHF/L/S antennas
- One HF/L/S antenna
- Kenwood D710
 - SSTV experiments only (no microphone)

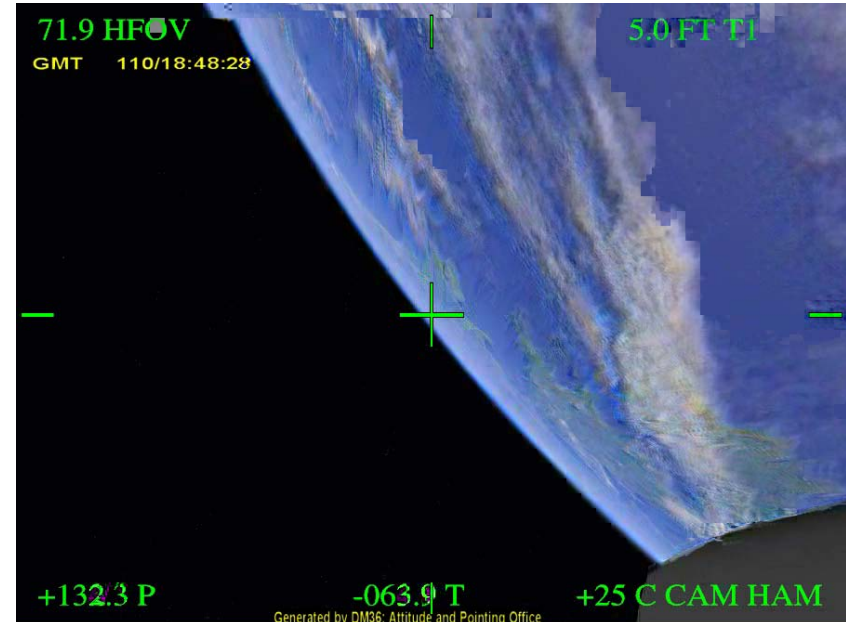
Ericsson Radio Hints



- Compared to Kenwood D700, the Ericsson has lower power output and a smaller receive bandwidth
- Ground stations must work harder to approach contact quality of Kenwood radio
- AOS, LOS, and mid-contact signal dropouts are more likely

Station Recommendations

- Gain antenna with switched circular polarization
- Az/el antenna pointing
- Doppler tracking
- ~3 KHz radio deviation
- Accurate system clock (<10 sec)
- 80-100 W output power
- Low-loss cabling



ISS to Ground Station Visibility Analysis



PROGRAM CHALLENGES

Overview



- Relationship with NASA has changed in recent years
- Funding sources have changed and grown much smaller
- ARISS processes and tools are old and the volunteer team is overworked

Taken together, these issues threaten the sustainability of ARISS

Relationship with NASA



- ARISS moved from ISS flight crew equipment to educational payload of ISS National Laboratory (2010)
 - National Labs manage outside funding for use of lab facilities
 - But, ARISS is not a funding source
- NASA dropped hardware safety support (2011)
 - Caused by financial concerns and ARISSat-1 hardware certification overruns
 - Impacts our ability to build and fly hardware unless other international team members or AMSAT/ARRL pay for it

Relationship with NASA (cont.)



- NASA support from ISS Program Office dropped (Mar 2012)
 - Support was joint between ISS PO and NASA Education, now Education only
 - Much less money available to be shared
- NASA Education reorganized and budget reduced (Oct 2012)
 - Much of the Education budget is earmarked by Congress, so programs using the remaining funding (like ARISS) are hit disproportionately hard

Budget Impacts



- Lost funding for Logistics Coordinator support from Carol Jackson, KB3LKI (Nov 2012)
 - Duties included collecting contact information, writing reports, scheduling conference calls, and updating web site
 - Covering this work further burdened the remaining team
 - Some work not being done

Budget Impacts (cont.)



- Temporarily lost support from Kenneth Ransom, N5VHO (Feb 2013)
 - Caused by contract and funding changes
 - Duties include coordinating ARISS ops with NASA, interfacing with NASA planners, and training crew
 - Averted cutback to half-time
- Permanently lost support from Kenneth's backup Steve Ponder, N5WBI

What the Future Holds



- ARISS is competing with many others for dwindling Education dollars → we need to further improve educational impact to remain competitive
- Competitive process for NASA follow-on support or for additional hardware development support
 - 3-year cycle with yearly project reviews; mediocre activities to be weeded out
 - All proposals require detailed educational impact plan and detailed budget
 - Budget overruns could result in cancellation

Some Good News



- ARISS is considered a valuable part of NASA's STEM Engagement portfolio, supporting K-16
- NASA has kept ARISS alive while many other education programs have been cancelled
 - During sequestration, the NASA Associate Administrator for Education specifically exempted ARISS from suspension:

Following the memo from the NASA Chief of Staff dated March 22, 2013. I am exempting the following activities from immediate suspension:

- Digital Learning Network activities currently scheduled
- FIRST Robotics
- Flight Projects—specifically **ARISS**, EarthKAM, Education Downlinks, Zero Robotics
- Great Moonbuggy Race

ARISS Issues



- ARISS has worked well since contacts began in 2000, but...
 - Some tools are outdated
 - People are stretched too thin
 - Some processes need updating
- Example:

Personnel changes, coupled with D700 radio issues, resulted in a temporary surge of failed/marginal school contacts early this year

ARISS Risk Areas



- Operations team and mentors are overworked
 - Lengthy periods of multiple contacts per week overtax the team
 - Covering work formerly handled by Carol reduces time available for other tasks
- Response:
 - Add new volunteers
 - Formalize training
 - Limit educational contacts to about 100/year and distribute them more evenly over time

ARISS Risk Areas (cont.)



- ARIS communications and information-sharing media (web sites, mailing lists, and so on) need updates
 - Much information is hard-to-find or out-of-date
 - Some information not being archived or updated
- Response:
 - ARRL leading a redesign of the public ARIS web site
 - Internal mailing list membership being reviewed
 - Volunteers being sought to review and reorganize the operations web site

ARISS Risk Areas (cont.)



- Operations team has potential for single-point failures
 - Some jobs depend on a single software tool or knowledgeable volunteer
- Response:
 - Working to add redundancy throughout ARISS
 - Developing new pass prediction software
 - Especially needed:
 - Backup for Charlie, AJ9N, for ops database and web site
 - Backup for Gil, WA5NOM, for orbital pass prediction

Summary



- ARISS is in a very dynamic environment
 - Roles and financial responsibilities have changed
 - Budgets have been significantly reduced
 - We need to augment our team for development, operations, and educational outreach
- Positive factors for sustainability:
 - Exceptional educational outreach impact
 - Outstanding volunteer team
 - Strong international partnerships
 - Excitement we share with the kids at every contact

Volunteers Wanted



- ARISS needs people for
 - Technical mentors for school groups
 - Operations support
 - Press and media liaison
 - Administrative support
 - Hardware development
 - Social media coordinators
 - Database and web page developers
 - Educational outreach/STEM engagement
 - And more

ARISS Information



- www.ariss.org
- @ARISS_status, @RF2Space
- issfanclub.com