ARISS & Future SuitSat Missions

Dayton Hamvention
May 18, 2007

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Amateur Radio on the International Space Station (ARISS)

What is ARISS?

- International program that inspires students, worldwide, to pursue careers in science, engineering and mathematics through communication with the ISS on-orbit crew via amateur radio
- Local community drawn into this once-in-a-lifetime human spaceflight pursuit
- Provides an experiment platform for new telecommunications techniques
- Promotes interest in the amateur radio (ham radio) hobby as a link to better engage students in science and math

ARISS development, operations and student mentoring is performed almost exclusively by a world-wide network of amateur radio volunteers who are passionately committed to the above objectives

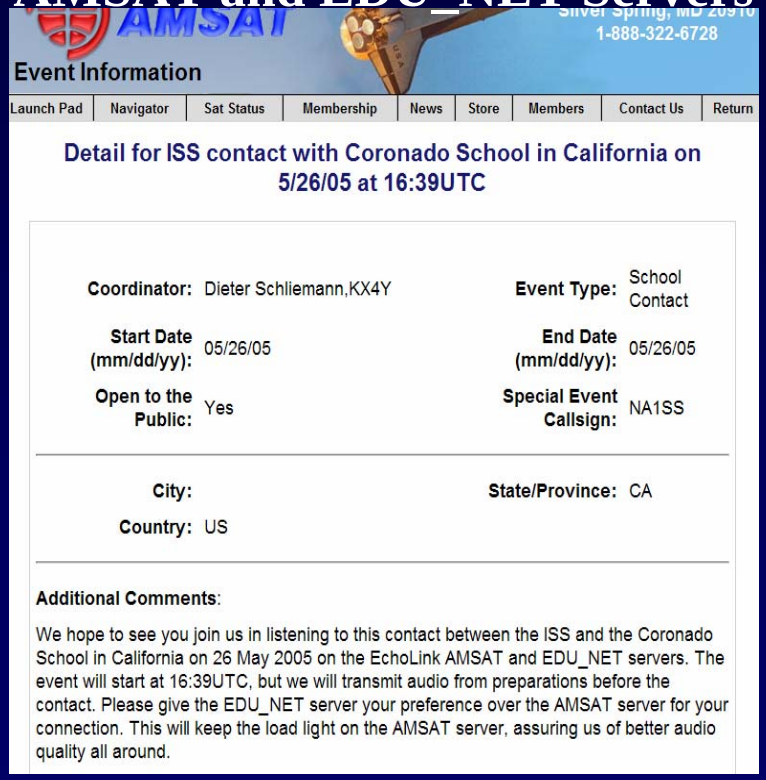
Ten+ Years Later—Our Accomplishments

- 1st human spaceflight freq plan for 2 m & 70 cm
- Installed Ericsson 2 m radio system for voice & packet in the FGB less than two weeks after first crew arrival
  - Making ARISS the first payload on ISS
- Developed and mounted 4 multi-functional antenna systems by 3 EVAs on the periphery of the Russian service module; supports 2 m, 70 cm, L band, S Band, HF and GPS reception
- Installed UHF/VHF Kenwood D-700E in Service Module, near the dinner table and window
- Successful completion of over **298** international schools—kudos to the operations team and volunteer mentors on a job well done!
- **15 consecutive ISS expedition crews** used our radio system to conduct thousands of QSOs with hams on the ground
- Over **15,000** students touched each year
- **Millions, worldwide** have heard an ARISS connection
- Witnessing students, worldwide, become scientists and engineers as a direct result of the ARISS connection
- The first Spacesuit satellite—SuitSat-1/Radioskaf deployed from ISS.

Voice Over Internet Protocol (VOIP)

IRLP, Echolink and Internet Streaming Provides a Wider Reach to Schools and Ham Radio Operators

Echolink
AMSAT and EDU_NET Servers



www.amsat.org
Calendar of Events

IRLP
9010 "Discovery" Reflector

www.discoveryreflector.ca

On-Board Now!
Suni Williams, KD5PLD

	LAUNCH DATE	CDR	FE-1	FE-2
Exp. 14/15 Shuttle up	December 2007			Suni Williams **KD5PLD**
Exp. 15 Soyuz up	April 2007	Fyodor Yurchikhin **RN3FI**	Oleg Kotov	
Exp. 15 Shuttle up	June 2007 (13A.1)*			Clay Anderson **KD5PLA**
Exp. 16 Soyuz up	October 2007*	Peggy Whitson **KC5ZTD**	Yuri Malenchenko **RK3DUP**	
Exp. 16 Shuttle crew	Oct 2007 (10A)*			Dan Tani **KD5DXE**
Exp. 16 Shuttle crew	Dec 2007 (1E)*			Leopold Eyharts **KE5FNO**
Exp. 16 Shuttle crew	Feb 2008 (1J/A)*			Garrett Reisman **KE5HAE**
Exp. 17	March 2008*	Sergei Volkov	Oleg Kononenko **RN3DX**	
Exp. 17 Shuttle crew	July 2008 (15A)*			Sandy Magnus **KE5FYE**
Exp. 17 Shuttle crew	Oct 2008 (ULF2)*			Koichi Wakata **KC5ZTA**
Exp. 18	October 2008*	Michael Fincke **KE5AIT**	Alexander Kaleri **U8MIR**	
Exp. 18 Shuttle crew	Jan 2009 (2J/A)*			Greg Chamitoff **KD5PKZ**

*** Indicates planning date as of May 2007. Subject to change**

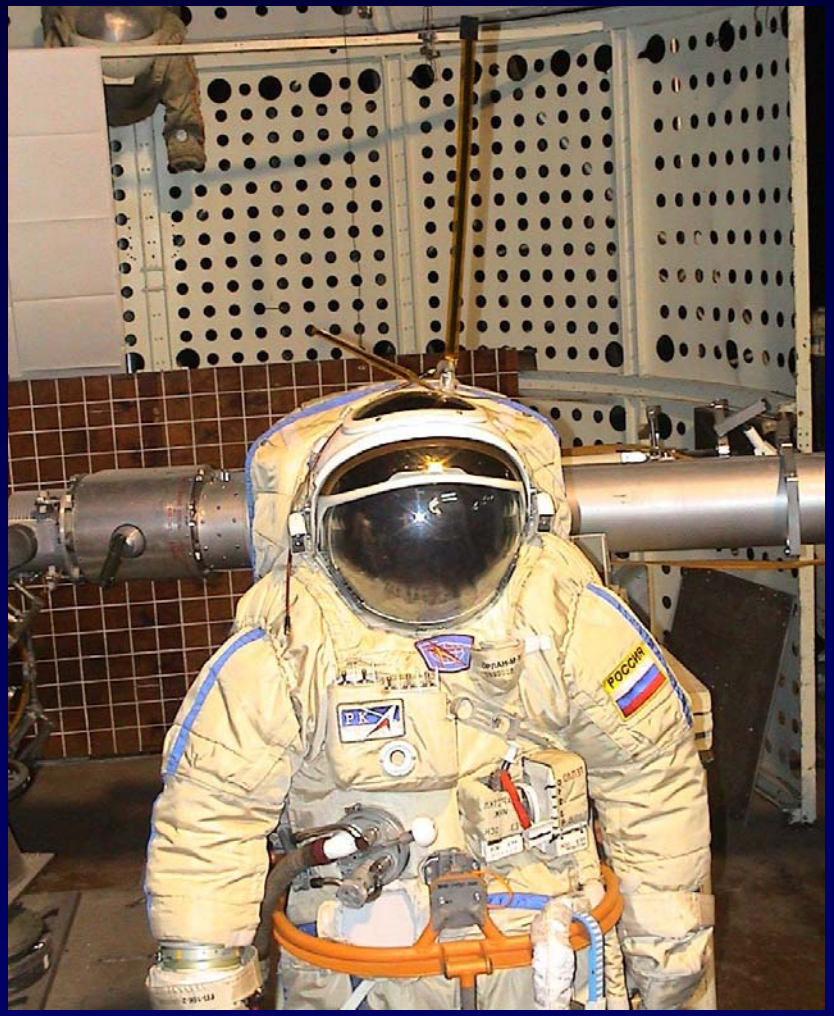
2006-2007
Space Flight Participants

Anousheh Ansari

Charles Simonyi

SuitSat-1--Amateur Radio Extra Vehicular Activity (EVA) In a Space Suit

- 2-week battery-operated satellite station
- Capabilities:
  - International Student Message Downlink
  - SSTV Picture
  - Telemetry
  - School Spacewalk—DVD with school name, artwork and student names included
- Deployment: Feb 3, 2006
- Re-entry: Sept 7, 2006



The Amateur Radio on the International Space Station (ARISS) Team

SuitSat-1/Radioskaf-1/AO-54

RS0RS, Commemorative Certificate

presented to

Frank H. Bauer
KA3HDO

For Successful Reception of the SuitSat-1 radio downlink during its operation from February 3, 2006–February 18, 2006.





The Amateur Radio on the International Space Station (ARISS) Team

SuitSat-1/Radioskaf-1/AO-54

Certificate of Recognition

presented to

William C. McArthur
KC5ACR

Presented in recognition of your outstanding volunteer support to ensure the successful development, crew training, deployment, operations, educational outreach and information dissemination of the SuitSat-1 mission. As a result of your efforts, SuitsSat-1 captured the imagination of people and students worldwide providing unprecedented outreach and visibility for a ham radio event.

The Amateur Radio on the International Space Station (ARISS) Team

is proud to present the

Chicken Little Prognostication Award

to

Aaron Russo

Student K-8

As one of the "Select Few" to successfully predict the reentry of the SuitSat-1/Radioskaf-1/AO-54 satellite.

SuitSat Deployment: February 3, 2006 @ 23:03 UTC
SuitSat-1 Reentry: September 7, 2006 @ 16:00 UTC




SuitSat-1 Chicken Little Contest Winners
Re-entry: September 7, 2006 at 16:00 GMT

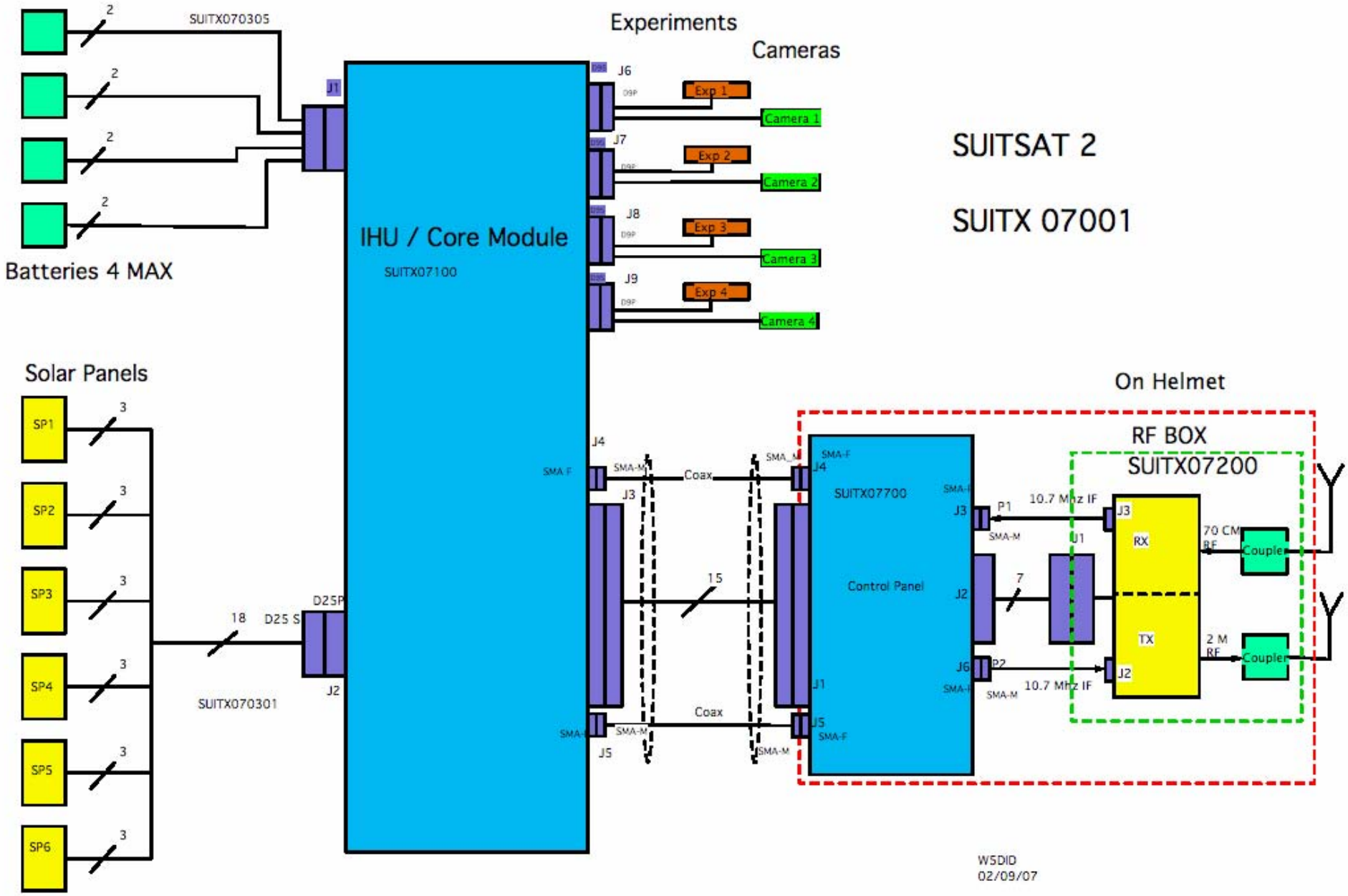
K-8 Student	High School Student	Adult
Aaron Russo - 10 August	Kaleb - 17 August	Brian W4OGU - 07 September
Kai Thomas - 12 August	Jconnop - 17 August	N3RCU - 07 September
Matt - 17 August	Joanna K W. - 17 August	SW6JIV - 07 September
Ralf Klebermass - 17 August	leila - 24 August	Beth Ransom - 07 September
Alexander Akers - 06 September	alex - 31 August	Kazumasa Ibata - 07 September
Joshauah - 11 September	Stanislav Babenko - 05 Sept	Reidar Larsen - 08 September
andy bond - 11 September	weathernut27 - 07 September	Chad Briggs - 08 September
Abriana - 15 September	mike - 08 September	kb3nds - 08 September
lucy bullfrog - 24 September	Addison Call - 10 September	nalro - 08 September
cameron... - 04 October	Richard - 03 October	kg6hsq - 09 September

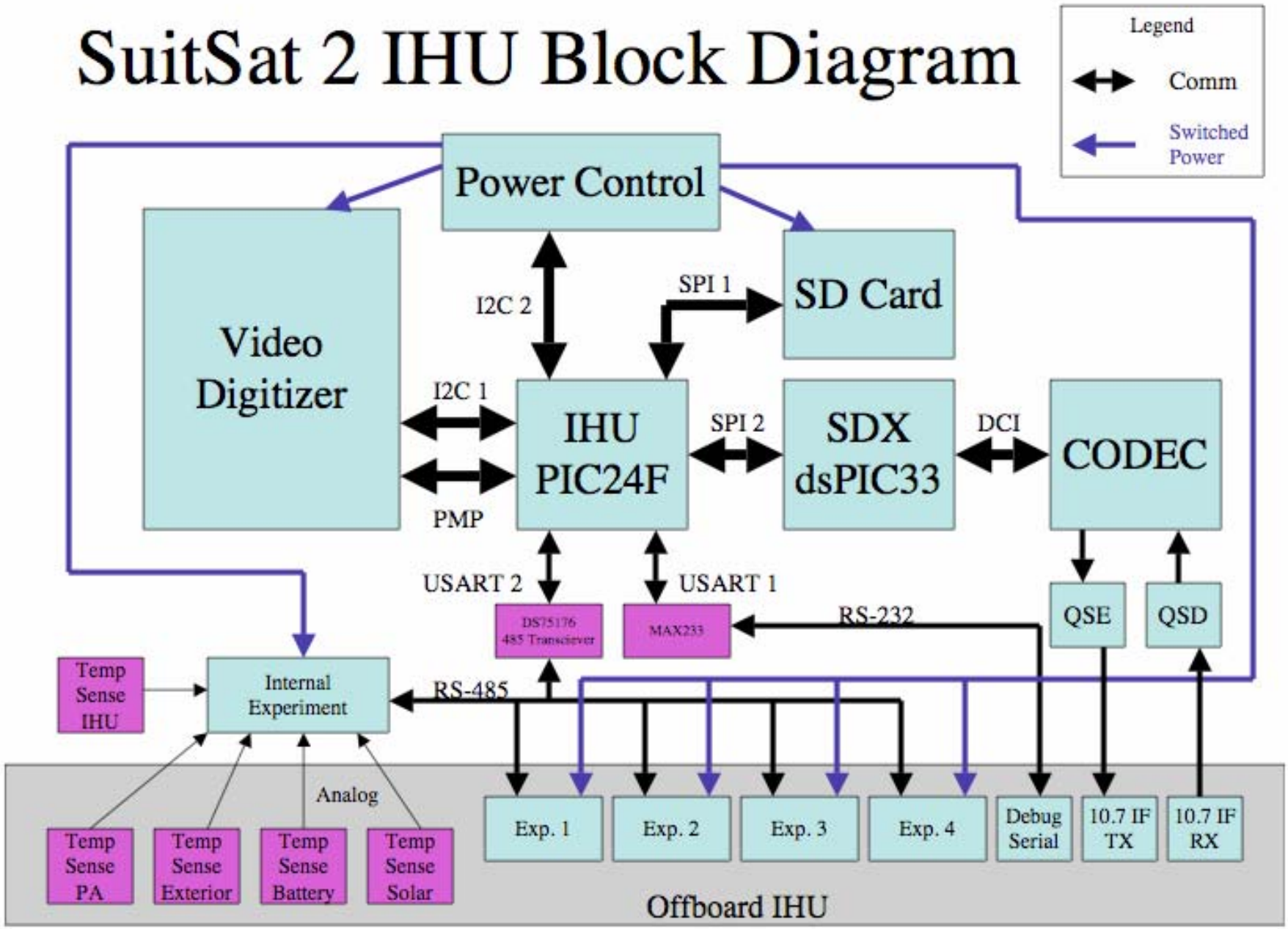
SuitSat Future

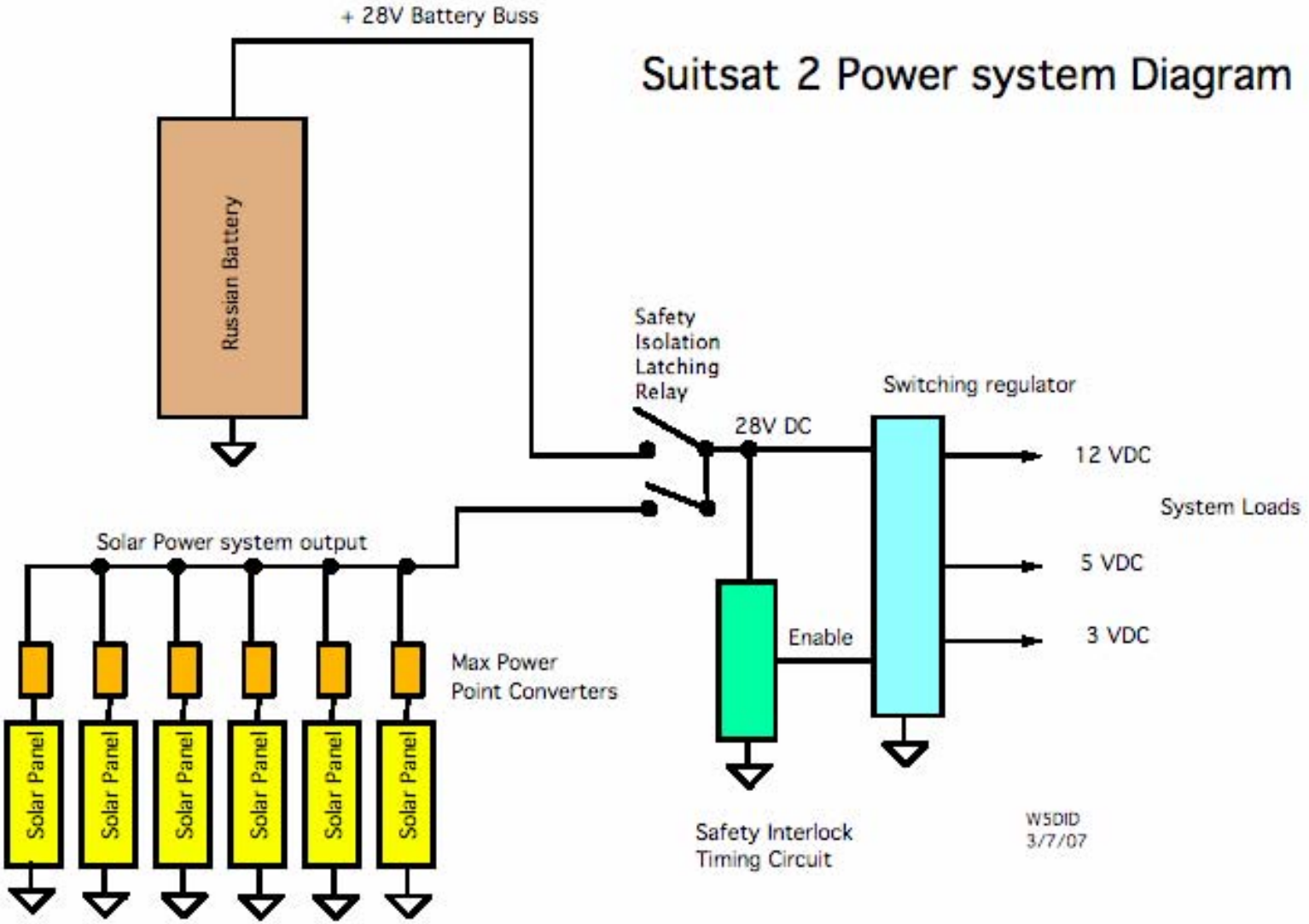
- Design work underway for SuitSat-2*
- Expected deployment: February 2008
- Expanded educational outreach
  - DVD with student pictures
  - Student audio downlinks
  - Pre-developed lesson plans (3 levels)
  - College students supporting hardware/software development
- Hardware Design features:
  - Proven SuitSat-1 safety interlock
  - Software Defined Transponder (SDX) system (RF & DSP)
  - New transmitter, receiver & antenna system
  - Solar arrays from NASA SMEX-Lite project
  - Additional sensors
  - SSTV with up to 4 cameras for SSTV downlink
  - Up to 4 experiment ports

***The Fine Print—not approved by the space agencies yet**

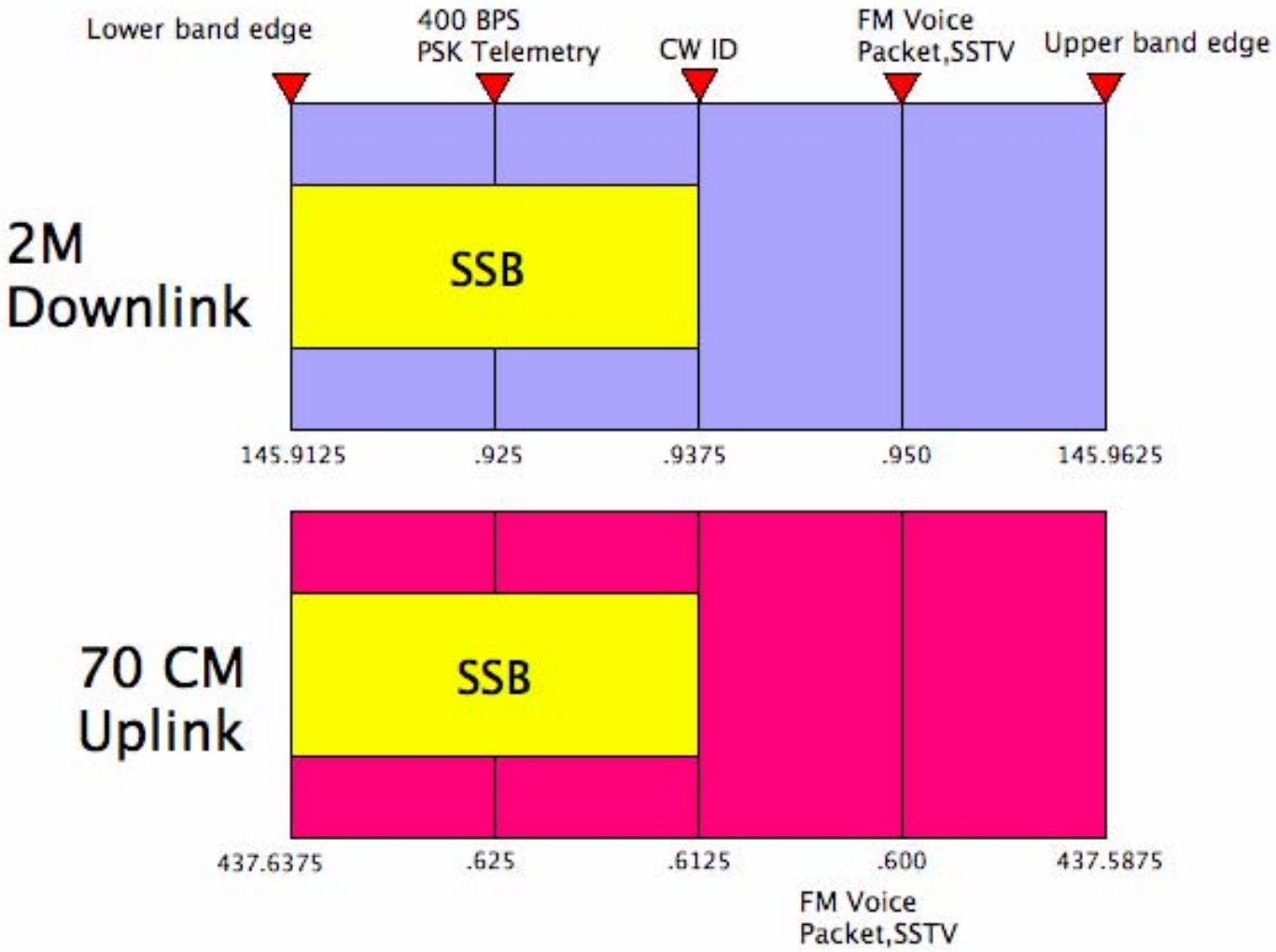
SuitSat-1 Safety Interlock Control Box


SUITSAT 2
SUITX 07001
Batteries 4 MAX
SUITX070305
IHU / Core Module
SUITX07100
Experiments
Cameras
J1
J6
J7
J8
J9
Exp 1
Exp 2
Exp 3
Exp 4
Camera 1
Camera 2
Camera 3
Camera 4
Solar Panels
SP1
SP2
SP3
SP4
SP5
SP6
D25P
D25 S
J2
SUITX070301
J4
J3
J5
Coax
15
On Helmet
RF BOX
SUITX07200
SUITX07700
Control Panel
P1
P2
10.7 Mhz IF
RX
TX
J1
J2
J3
J6
70 CM RF
2 M RF
Coupler
W5DID
02/09/07


SuitSat 2 IHU Block Diagram
Legend
Comm
Switched Power
Power Control
Video Digitizer
I2C 2
SPI 1
SD Card
I2C 1
IHU PIC24F
SPI 2
SDX dsPIC33
DCI
CODEC
PMP
USART 2
USART 1
DS75176 485 Transciever
MAX233
RS-232
QSE
QSD
Temp Sense IHU
Internal Experiment
RS-485
Analog
Temp Sense PA
Temp Sense Exterior
Temp Sense Battery
Temp Sense Solar
Exp. 1
Exp. 2
Exp. 3
Exp. 4
Debug Serial
10.7 IF TX
10.7 IF RX
Offboard IHU


+ 28V Battery Buss
Suitsat 2 Power system Diagram
Russian Battery
Safety
Isolation
Latching
Relay
Switching regulator
28V DC
12 VDC
System Loads
5 VDC
3 VDC
Enable
Solar Power system output
Max Power
Point Converters
Solar Panel
Solar Panel
Solar Panel
Solar Panel
Solar Panel
Solar Panel
Safety Interlock
Timing Circuit
W5DID
3/7/07

Proposed Suitsat 2 Band Plan



Downlink Frequency = 145.9375-(Uplink frequency-437.6125)

W5DID
1/16/2007

The Future

- On January 14, 2004, US President Bush proclaimed a new exploration initiative for NASA---go to the Moon by 2020, Mars next and beyond Mars later
- ARISS team developing Exploration Initiative strategy
- ARISS's solid performance and outstanding international teamwork is recognized and respected by the Space Agencies
- The challenges will be high due to the long path lengths

ARISS Information

http://www.rac.ca/ariss