SuitSat-2

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Oct 2008

Suitsat 1 ready for Deployment

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SuitSat-1 Mission and Capabilities

Primary mission

Voice message Commemorating the 175thAnniversary of Bauman state University Moscow.

This included audio greetings from

Energia, Bauman State University, ARISS Europe, ARISS Canada, ARISS U.S.A. ARISS Japan

A CD ROM with photos contributed from schools around the world.

Secondary mission

SSTV images of Earth and Station

Amateur operations

Packet ops

Beacon

Earth sensor test data

Gather real space operating data and experience on several candidate sensors for Eagle.

SuitSat-2 Mission and Capabilities

Primary mission
Voice messages Commemorating (TBD)
This includes audio greetings from
Energia, ARISS Europe, ARISS Canada, ARISS U.S.A. ARISS Japan
A CD ROM with photos contributed from schools around the world.

Secondary Mission
Testbed for systems planned for future Amateur radio satellites
Amateur operations
CW ID
Packet ops
SSB Transponder
FM Cross band repeater
SSTV images of Earth and Station
Experiments (TBD-TSFR)

SuitSat-2 Top Level

- SuitSat-2 will transmit voice messages commemorating historic events as a primary objective.
- A second objective will be to use the suit as a test bed for Amateur Radio satellite operations including packet operations, SSB transponder, FM cross band repeater, SSTV, and the opportunity to fly additional experiments designed by university students. A solar power system will also be used.

The Proposed Plan

- Build upon Suitsat-1 design
- Re-use safety interlock circuit with update for Solar panels
- Transmitter and Receiver module
- IHU Module
- Control Panel same as Suitsat-1
- New Power module for solar panels
- Solar Panels
- Up to Four Experiments
- Four Temperature Sensors
- Up to Four cameras for SSTV

Future Concept Testbed

- Use as a test bed for new concepts for future Amateur radio Satellites.
  - Satellite power system
    - Max power point converters for solar panel
    - Distributed Converters
    - Distributed Storage system
  - Software Defined Radio (SDR) Prototype
  - Additional experiments

SSTV

- SSTV
  - Four video ports
  - No power until switched on just before data take.
  - Four U.S. Supplied Cameras
  - No blank video
    - Processor examines video and skips if no image present

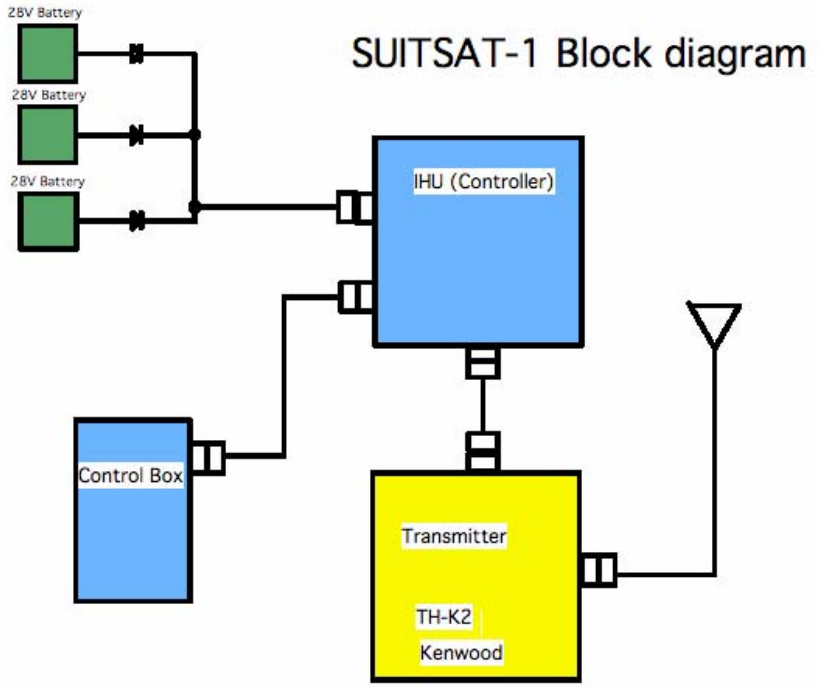
Experiments

- Experiment ports
  - Four ports
    - One reserved for MicroChip (Supplier of electronics) non commercial.
    - One Russian
    - Data packets to be 2k Bytes transferred on request from the IHU.

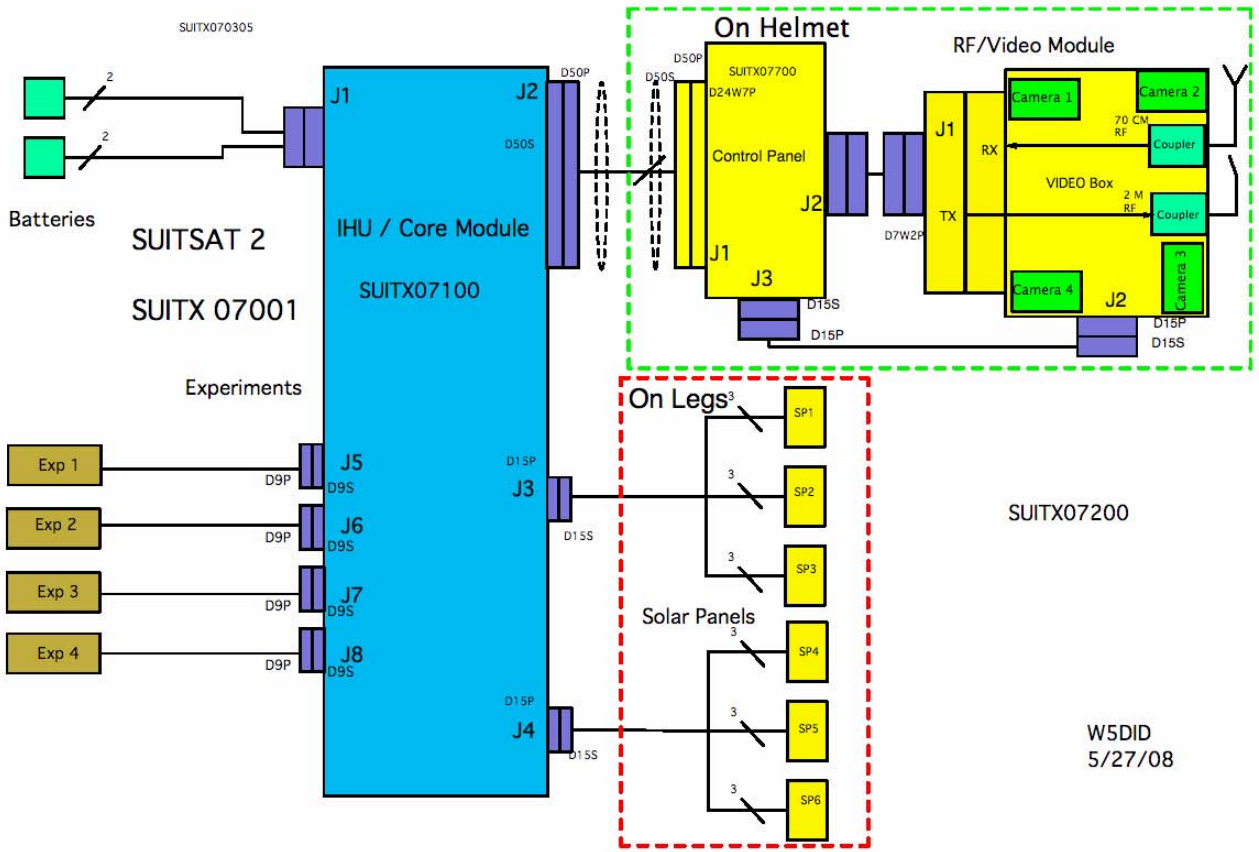
Radio Module

- Radio
  - SDX(Software Defined Transponder) Eagle prototype capabilities
    - Multimode
    - SSB Crossband (U/V) Transponder repeater with Telemetry beacon
    - FM-FM Cross band (U/V) packet
    - Multiple signals simultaneously

Suitsat-1 Block Diagram



Suitsat 2 Interconnection diagram



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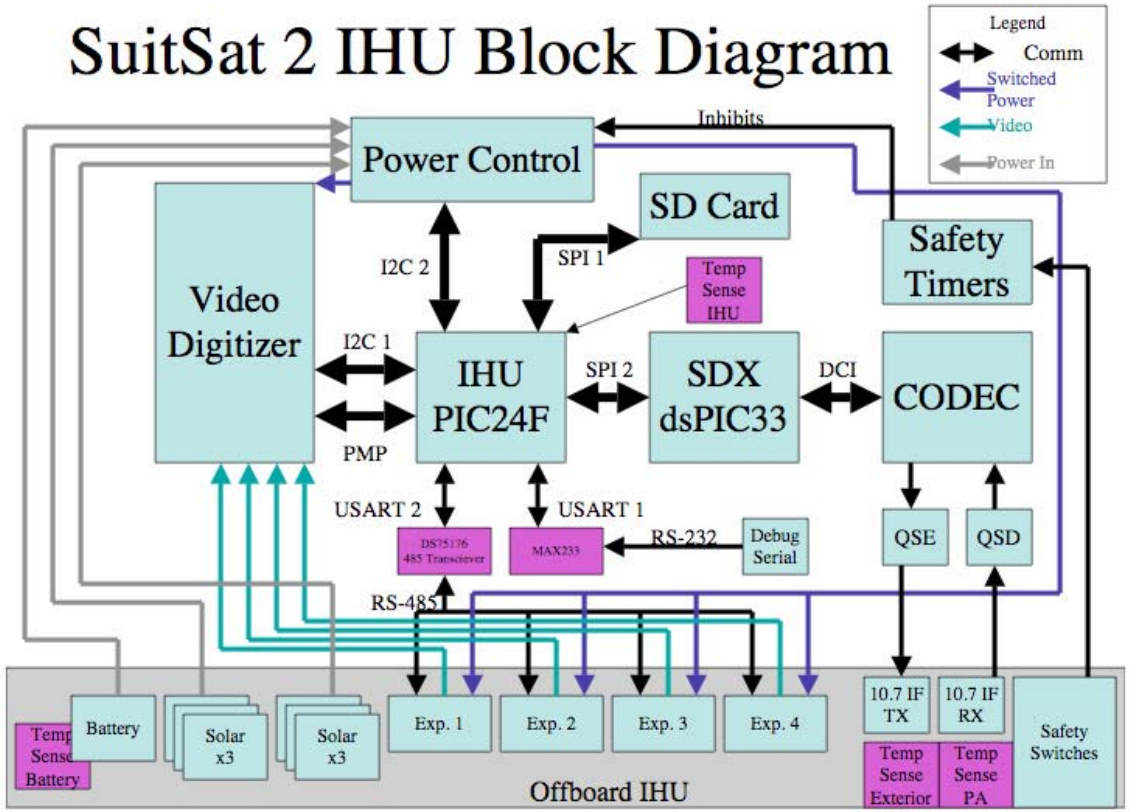
Suitsat 2 System Diagram



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Suitsat 2 Power controller

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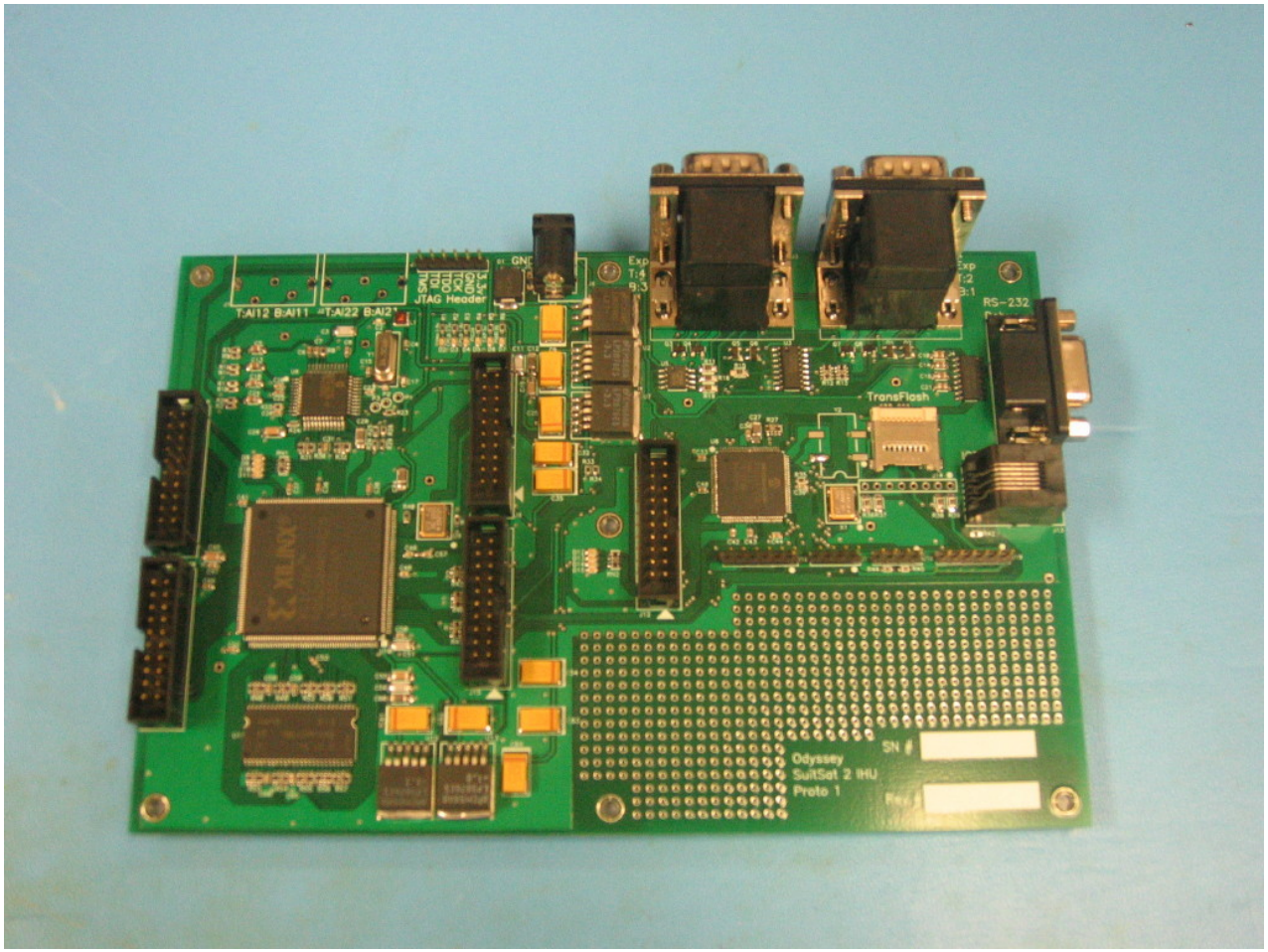
Suitsat 2 IHU and Core Module



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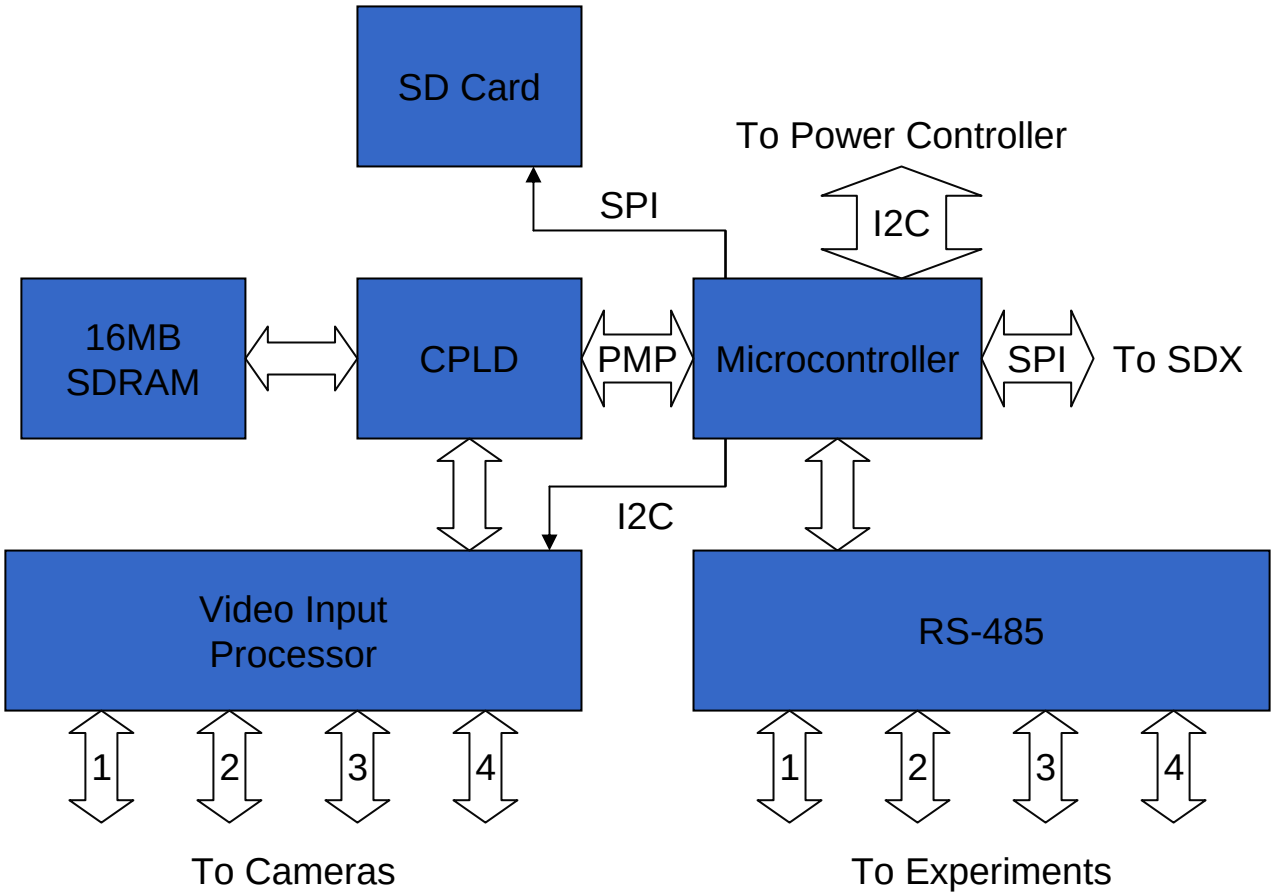
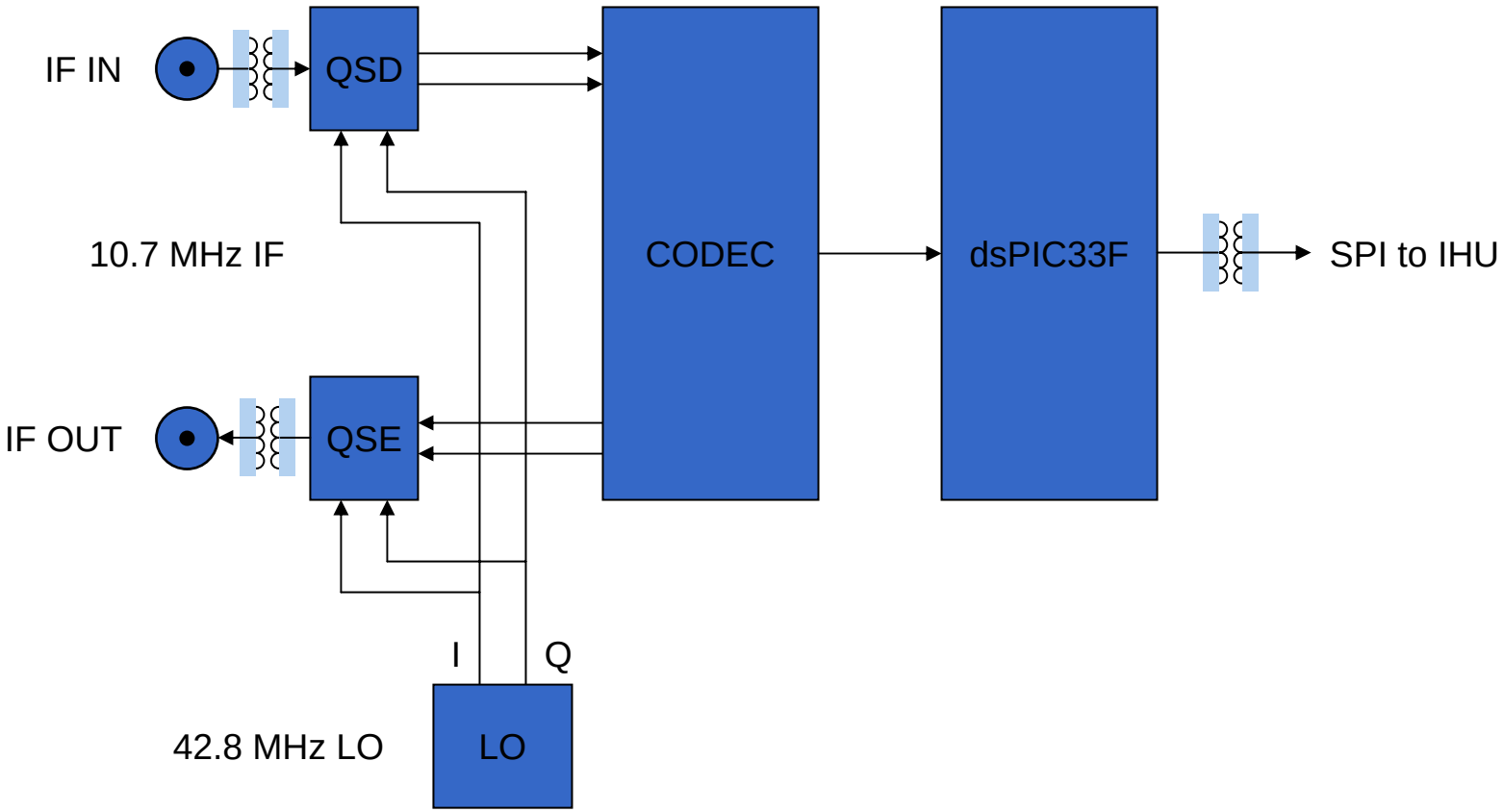
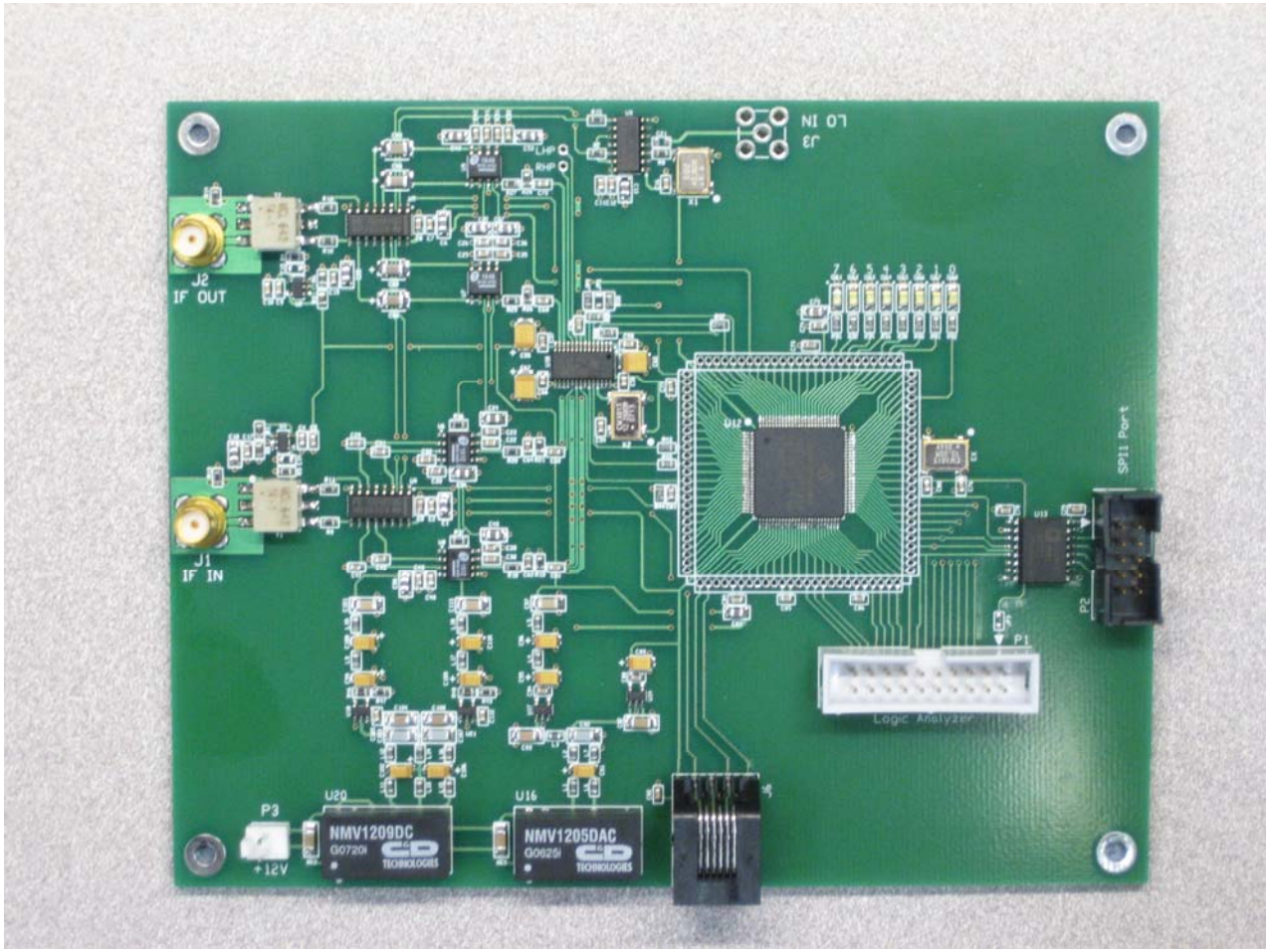
SuitSat-2 Internal Housekeeping Unit (IHU) Block Diagram



SuitSat-2 Software Defined Transponder (SDX) Block Diagram



Suitsat 2 SDX



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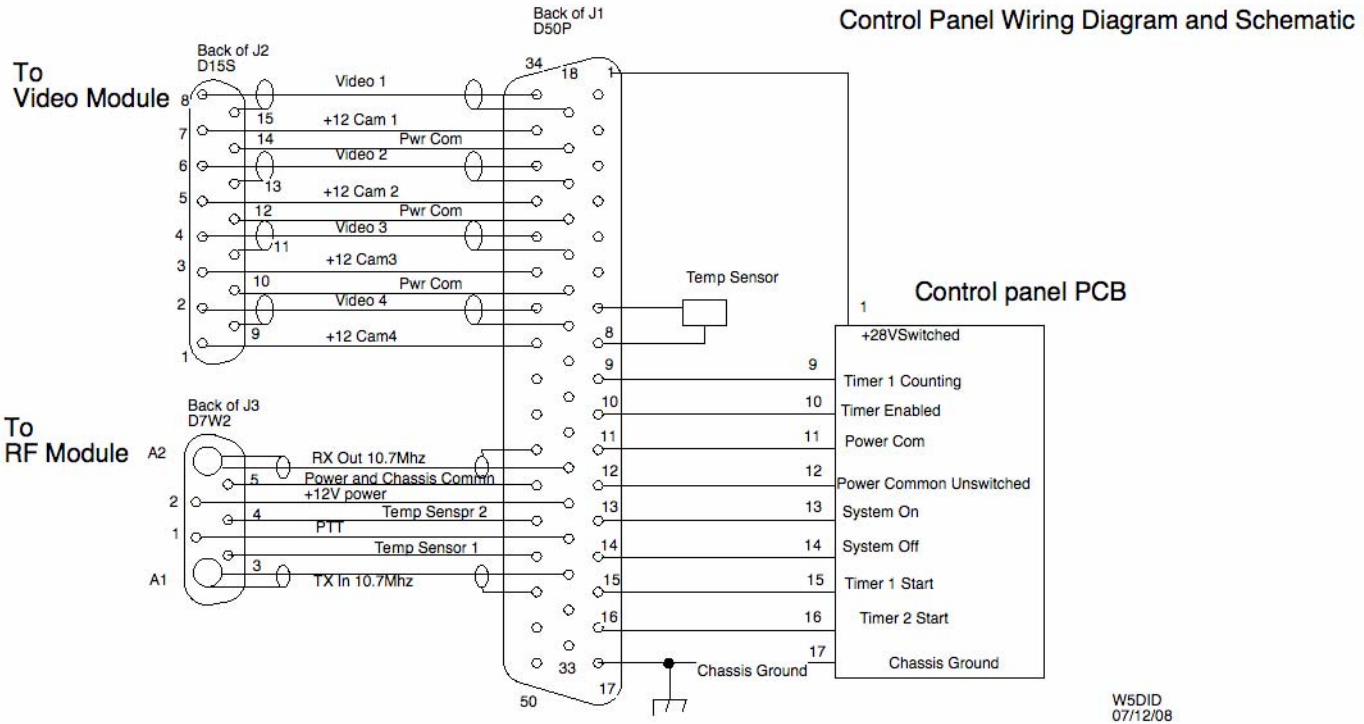
Suitsat 2 Control Panel



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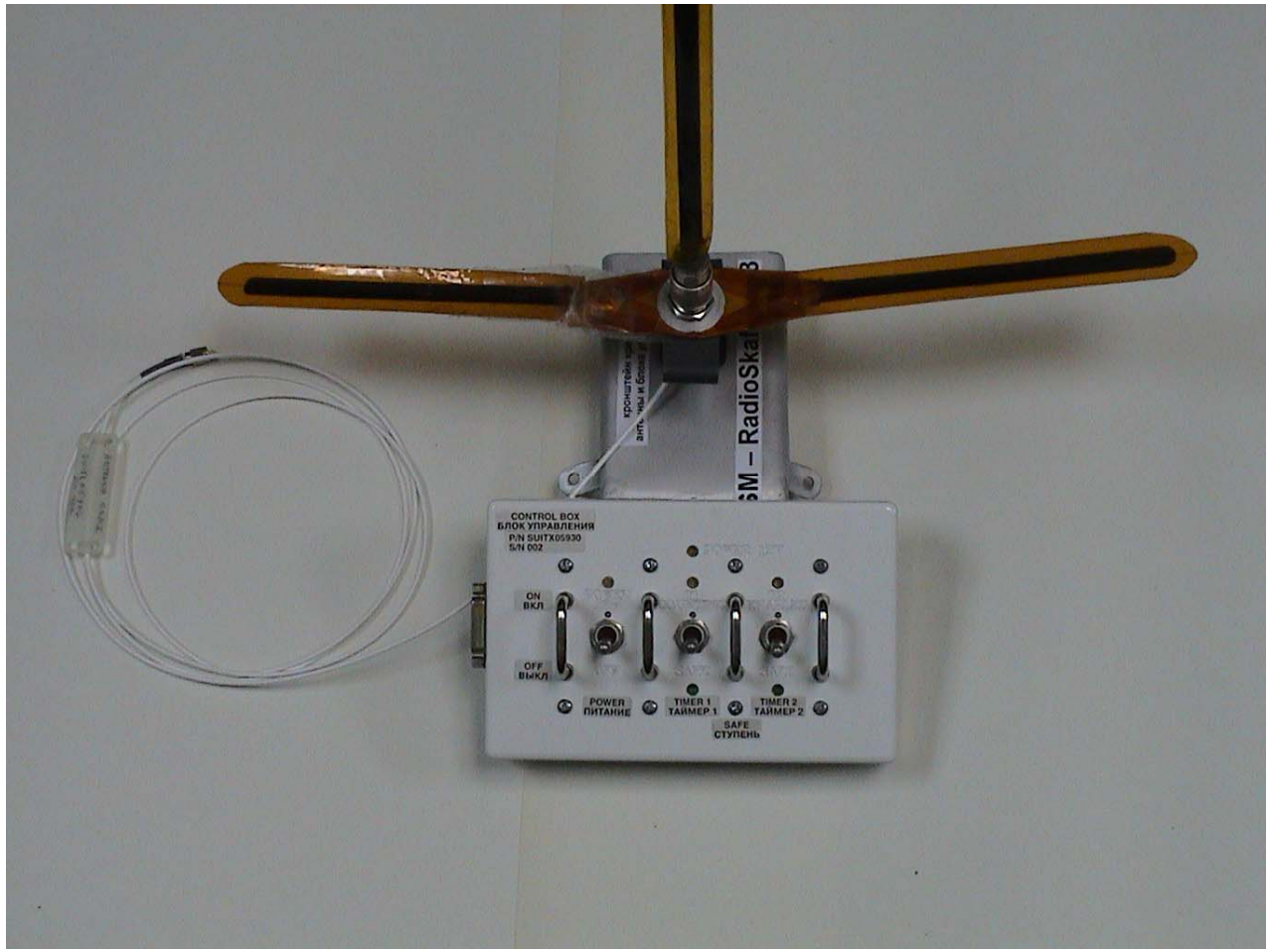
Suitsat 1 Antenna



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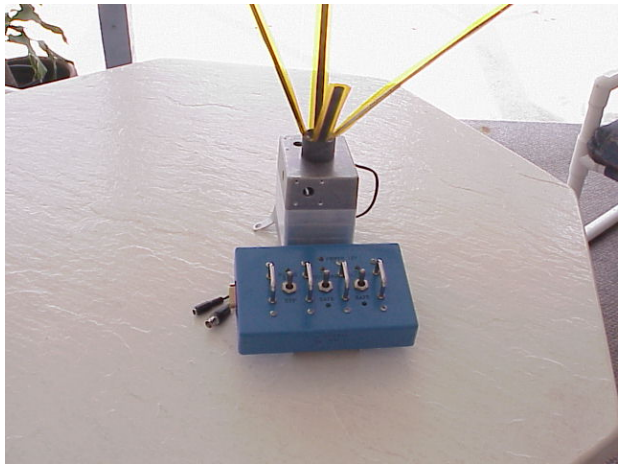
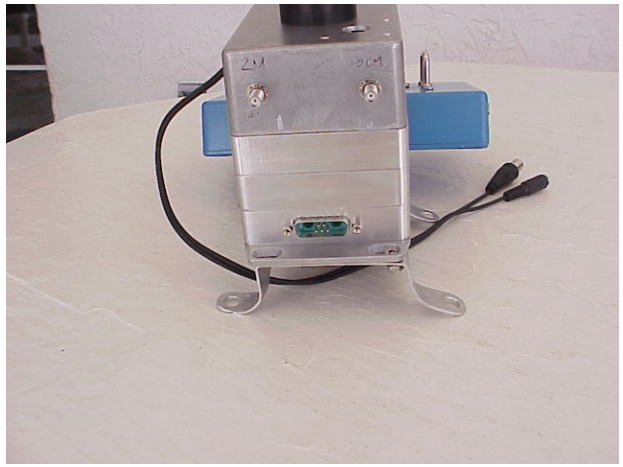
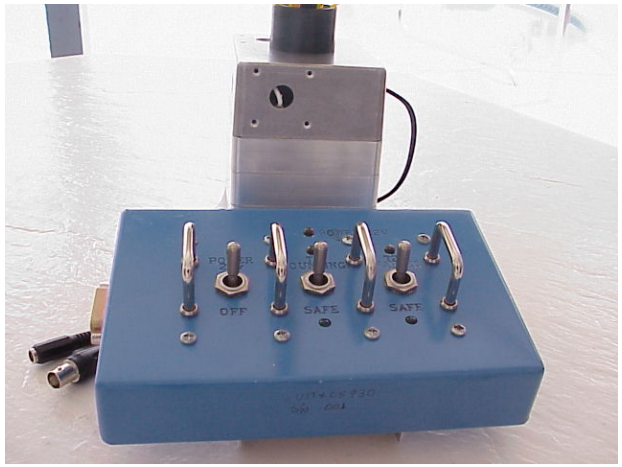
Suitsat 2 Antenna & RF assembly







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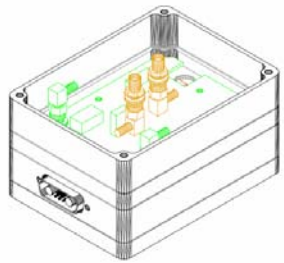
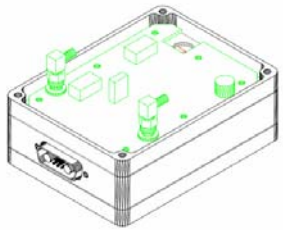
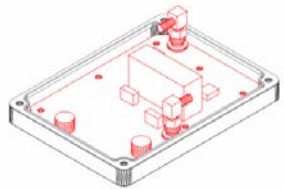
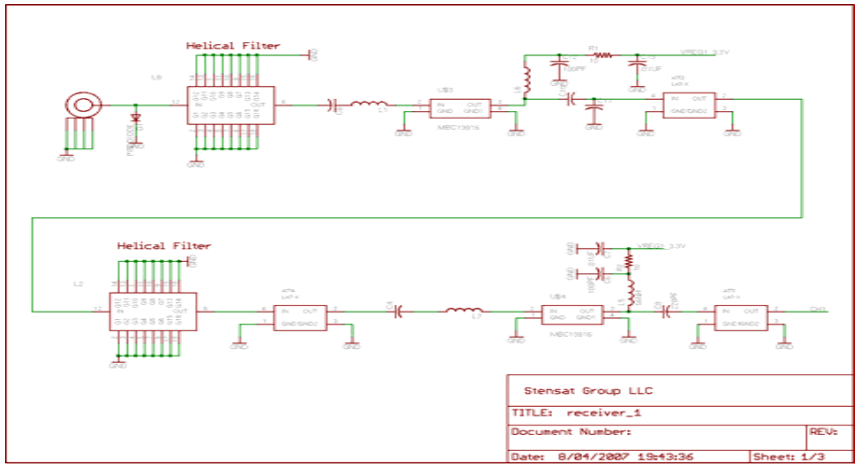
RF Assembly

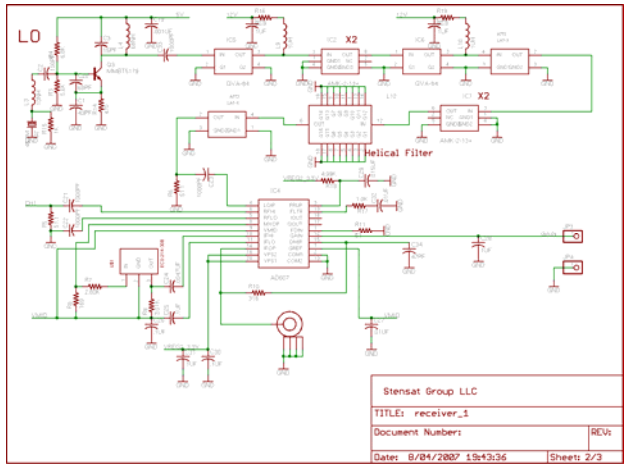


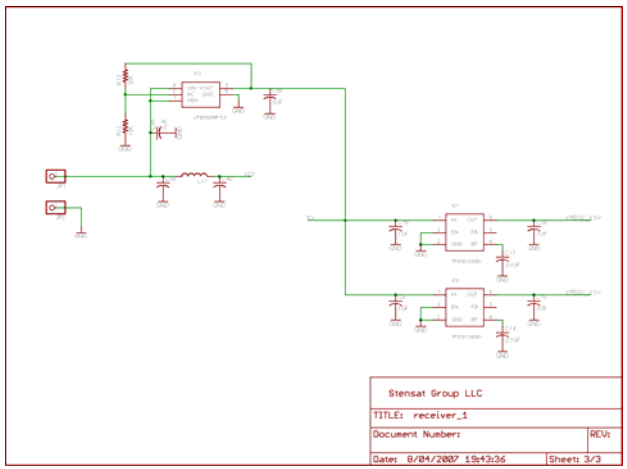




Suitsat 2 Receiver







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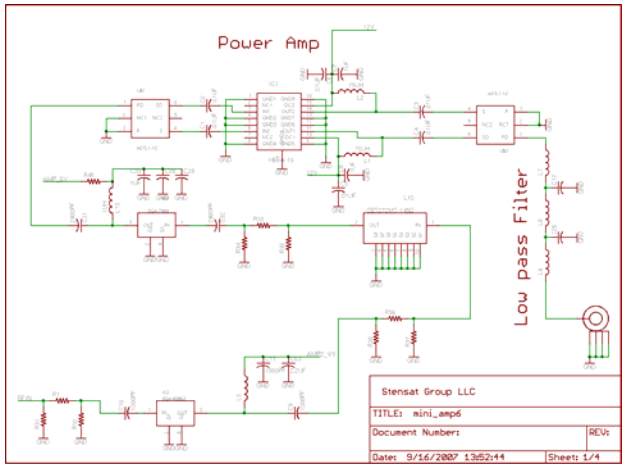
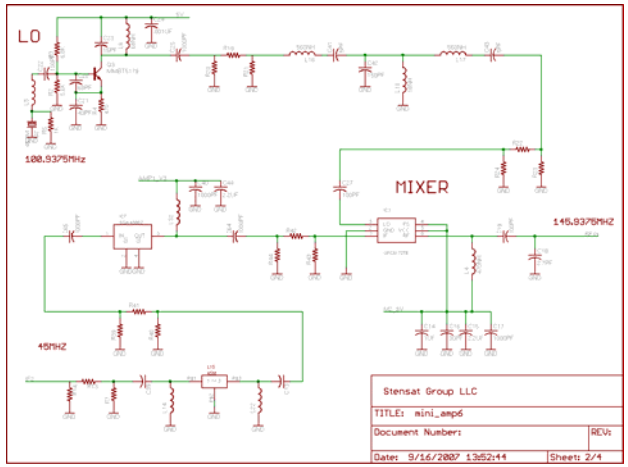
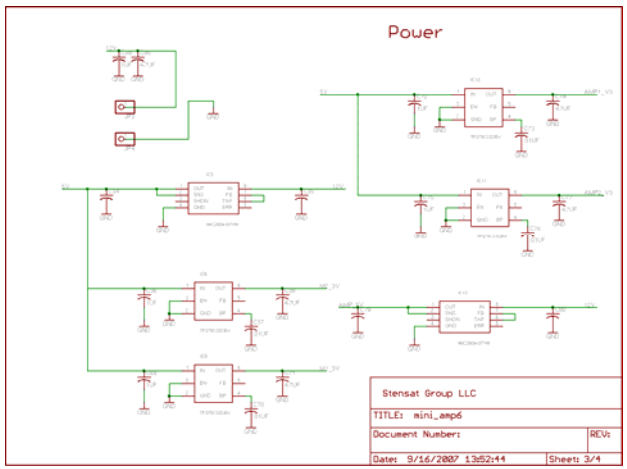
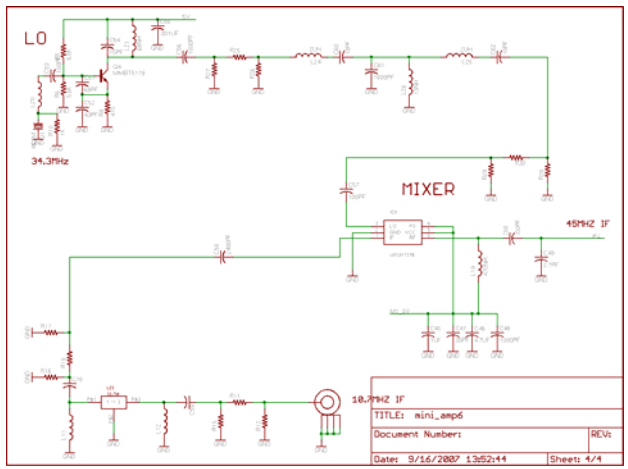
Suitsat 2 Transmitter









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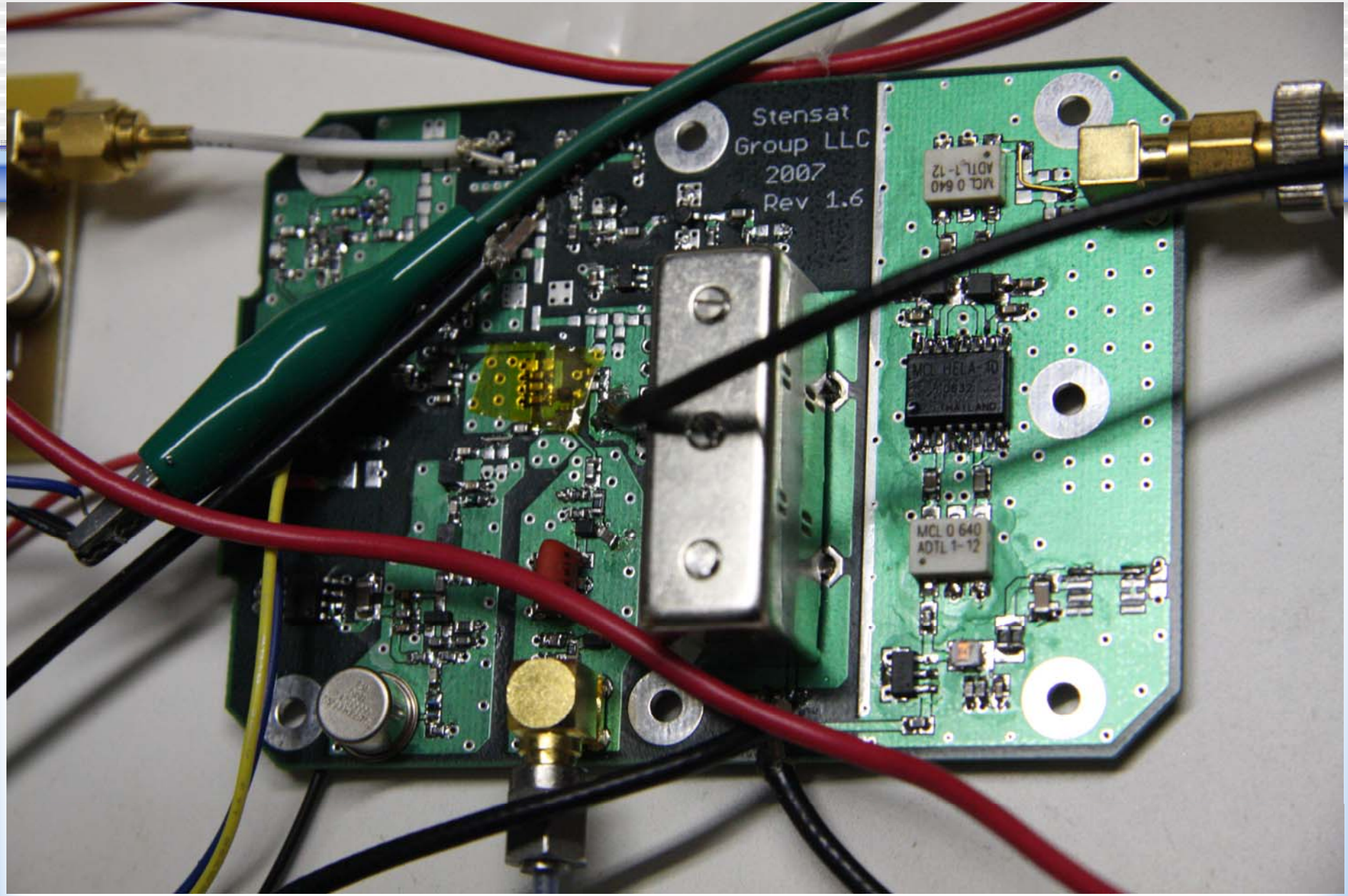

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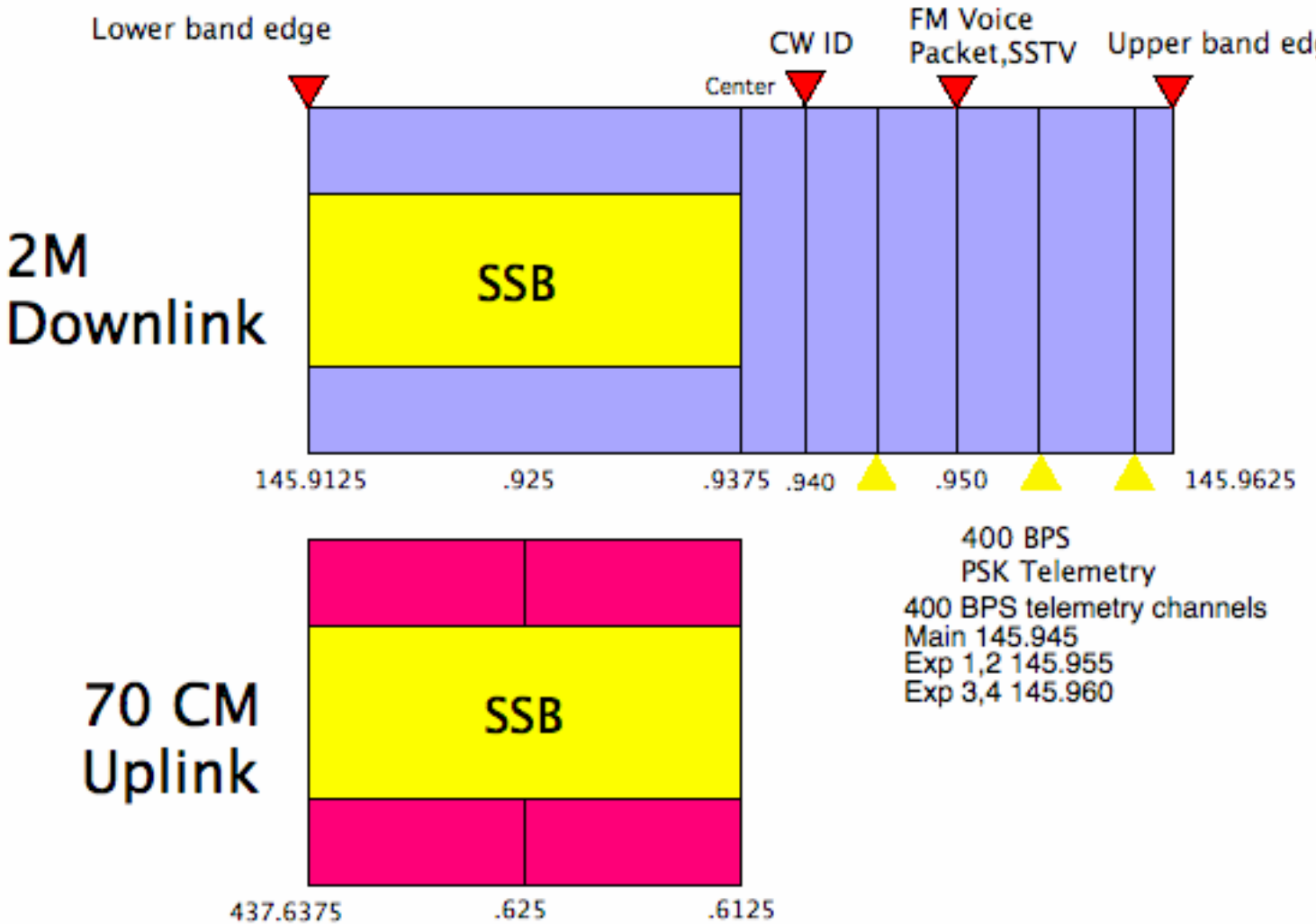
Proposed Suitsat 2 Band Plan (REV C)



Downlink Frequency = 583.55-Uplink frequency

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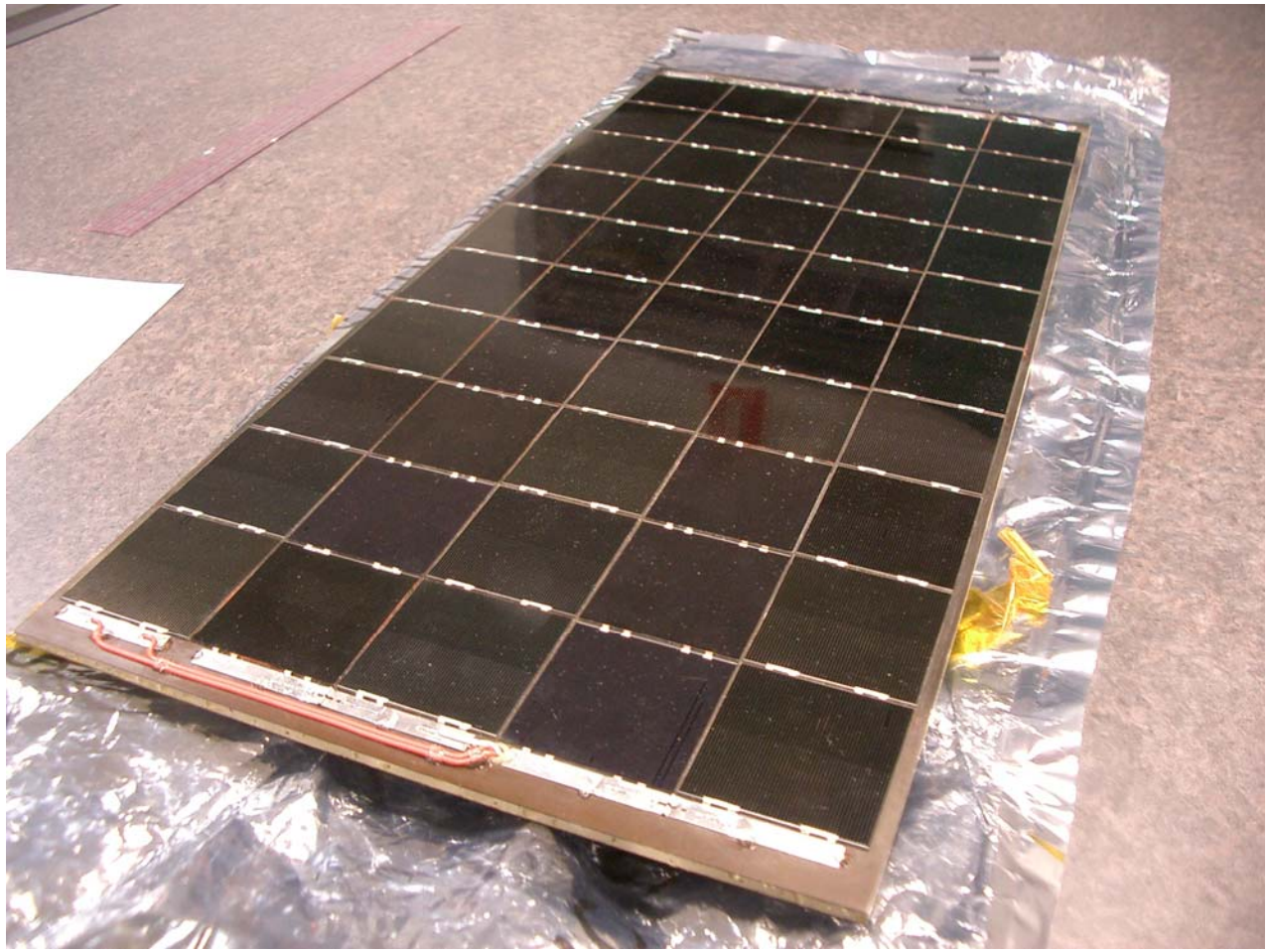
6/15/2008

Solar Power System Plan

- NASA supplied.
- Surplus from previous NASA SMEX (SMall EXplorer) satellite program.
- Power converter based on planned Eagle design.
- Designed to charge the surplus ISS Russian Space Suit batteries.

SMEX Solar Panel



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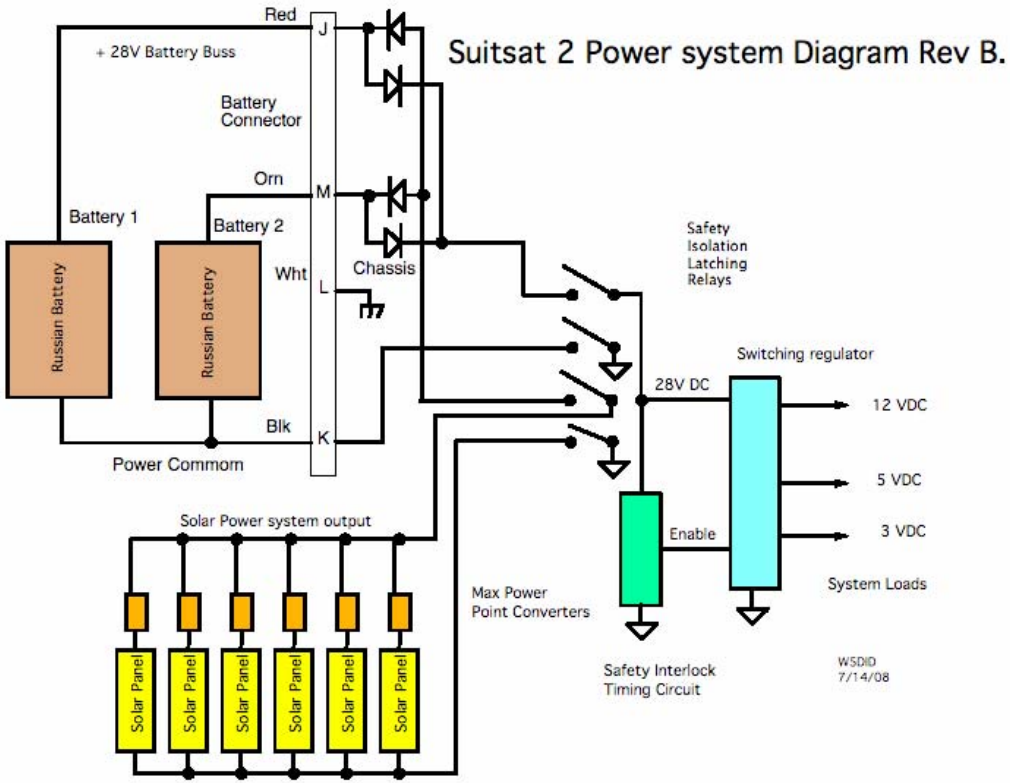
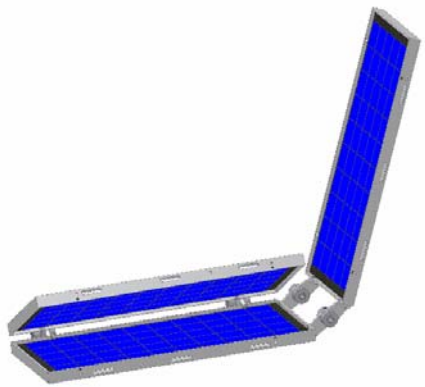
Power system will utilize two batteries

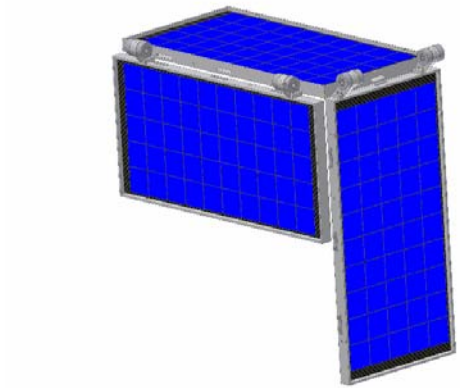


Suitsat 2 Solar Panel Assembly

- SMEX Panel is mounted in hinged frame that is closed until deployed outside cabin.
- Panel secured closed by three two sided Velcro straps and attached to suit inside cabin.



Solar Panel Deployment proposals



- Solar panels to be attached to the leg / boot.

Scientific Experiments

- The ARISS team will work together to determine how to select the schools that will fly experiments on SuitSat-2.

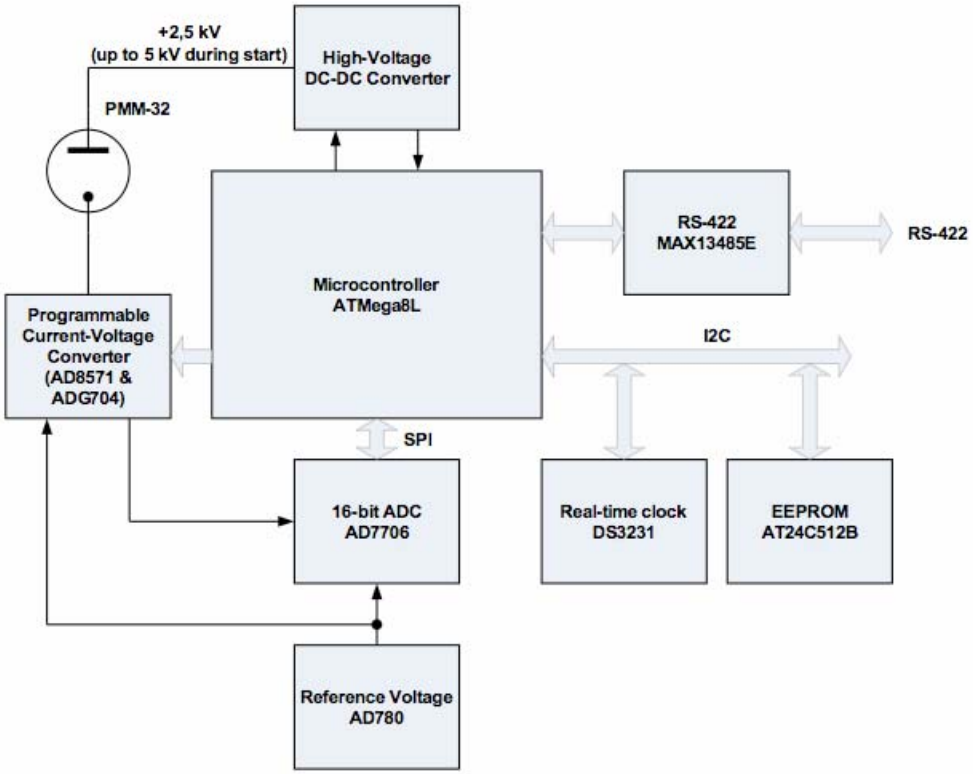
- Four CCD cameras will take pictures and whichever one has the image will be encoded and transmitted to the ground. The formats available will be Martin, Scottie- 1 and Robot-36. Cameras have been identified, but have not yet been purchased and will need to be certified.

The Kursk University Experiment

- The experiment is designed to measure the unevenness of the vacuum atmosphere in the vacinity of the Suitsat 2

- It must be mounted so that it is exposed to the atmosphere outside the suit.
- It must send it’s data to the ground via the Suitsat 2 telemetry system

University of Kursk Experiment Block Diagram



Kursk Experiment Sensor

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Kursk team examining mounting possibilities

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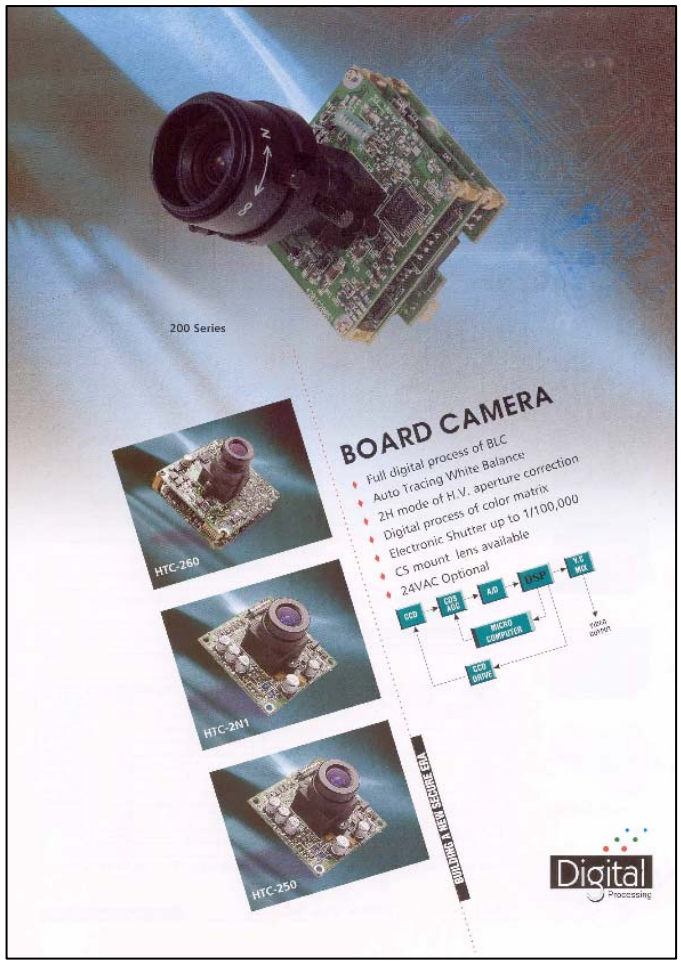
Suitsat 2 Camera



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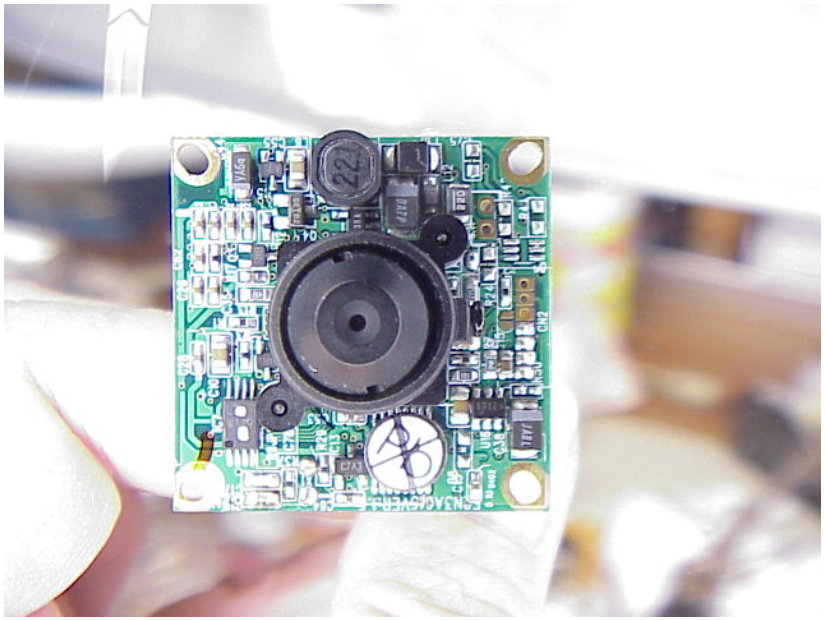
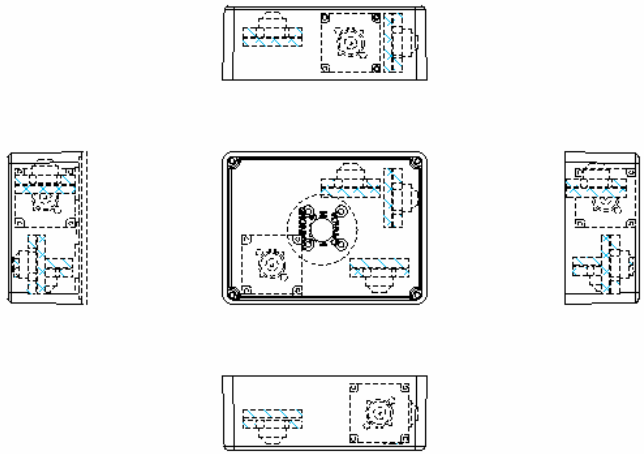
Hunt 2N323s Camera



Camera mount on helmet



Educational Outreach

- **Educational Outreach**
  - Educational outreach activities will include:
    - CW call signs,
    - Suitsat website,
    - SSTV images,
    - CD of school photos to be flown on ISS,
    - voice messages and
    - media coverage.
  - Rita Wright has developed Suitsat lesson plans for elementary schools, middle schools and High schools.
  - Joe Julicher has worked with a scout troop building some of the Suitsat components.

The Suitsat 2 Team

ARRL volunteers

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Microchip AMSAT

Stensat AMSAT

JSC

Sergey Samburov and Energia

Valery Pikkiev (UA3WBW) Kursk University

Frank Brickle (IHU software)