ReadySat Go

CubeSat Developers’ Workshop
April 24, 2009

CubeSat Team SJSU

Presented by Eric Stackpole
About CubeSat Team SJSU

- Founded Fall 2007
- Open to anyone interested
- Club: not for credit or pay
- Student run
- 10-20 members (depending on semester)
- Majority undergrad
Development Philosophy

• Simplicity eliminates problems exponentially
• Alternative means breed alternative ends.
• Don’t take traditions for granted
Advantages to Simplicity

- Easier development
- Faster development
- Less to go wrong
- Often lighter, smaller, and less expensive
- Strong foundation for modification
- Fits well with college environment
ReadySat Go!

- Antenna Deployment Mechanism
- Radio Antenna
- Electrical Board
- Off The Shelf Amateur Radio
- Lithium Ion Battery Packs
- Aluminium Satellite Shell
Frameless Sheet Metal Shell

- Aluminum sheet metal panels mounted to extruded rails
- Riveted fixturing
- Assembled by using jig
Advantages

• Lightweight (<200g)
• Can be built in a basic shop
• Inexpensive to build (<$1000)
Challenges

- Obtaining dimensional tolerance
- Mounting parts
- Structural rigidity
Z-Panel Mechanism Plate
Advantages of a Mechanism Plate

• Easy inspect and replace parts
• Entire system can be tested externally
• Modularity contusive to design changes
• Platform accepts wide range of parts
Challenges with the Mechanism Plate Concept

- Concentrated mechanisms throw off CG
- Attachment to satellite shell is challenging
- Structure is unstable without Z-panel attached
Electrical System

• Single PCB design
• COTS transceiver
• Single voltage bus
• Mostly surface mount components
• Onboard LED Diagnostics
• In system programming
• Serial debugging
High Level System Schematic

- ReadySat Go v1
  - Output [DPY]
  - Output [PTT]
- Antenna Deployment System
- Analog Digital
- Alinco DJ-C6T Amateur Radio
  - ANA_OUT +/−
  - ANA_IN
- ATMega16L uC
  - ADC 1
  - INT
- ISD5116 ChipCorder
- DTMF MT88L70AS Receiver
  - DATA[3:0]
Electrical Subsystem Schematics

Audio Chip Interface

Antenna Deployment System Electrical Interface

Power Regular Circuitry
Alinco DJ-C7

VHF/UHF Amateur Radio Transceiver

- Mass: ~102g (Including battery)
- Size: 56(W) x 96(H) x 14.5(D)mm
- Operating Temperature: -10 ~ +60 degrees C
- Current Drain: TX: 320mA / RX (squelched): 70mA / RX (BS-on): 19mA
- TX Output: 300mW @ 3.7 Vdc / 500mW @ 6 Vdc
- Power Source: 3.7 - 6.0 Vdc
Antenna

- 144 MHz radio antenna
- Tumbling assumed
  - No gain antennas
- 2 deployed antenna “tapes”
Modeling

• Antennas modeled in NEC-2
  – EZNEC+ graphical interface
• Cube modeled as ~ 300 wires
• Antenna modeled as two wires
Antenna Summary

- 2 elements at 90 degrees
- Reduces nulls
SWR Curve

Freq MHz

CubeSat Team
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Putting It Together
Future Work

• Multi-band receive
• Tunable Receiver with auto-record
  • Satellite-satellite relay
Thank you!