ReadySat Go

CubeSat Developers' Workshop

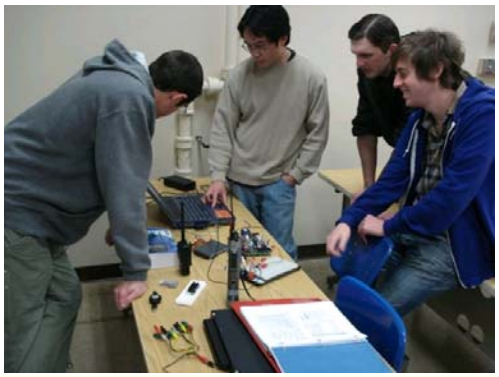
April 24, 2009

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



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Development Philosophy

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

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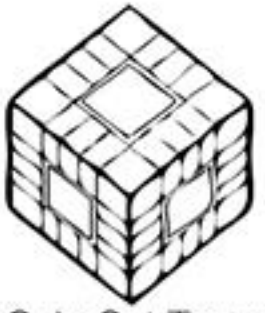
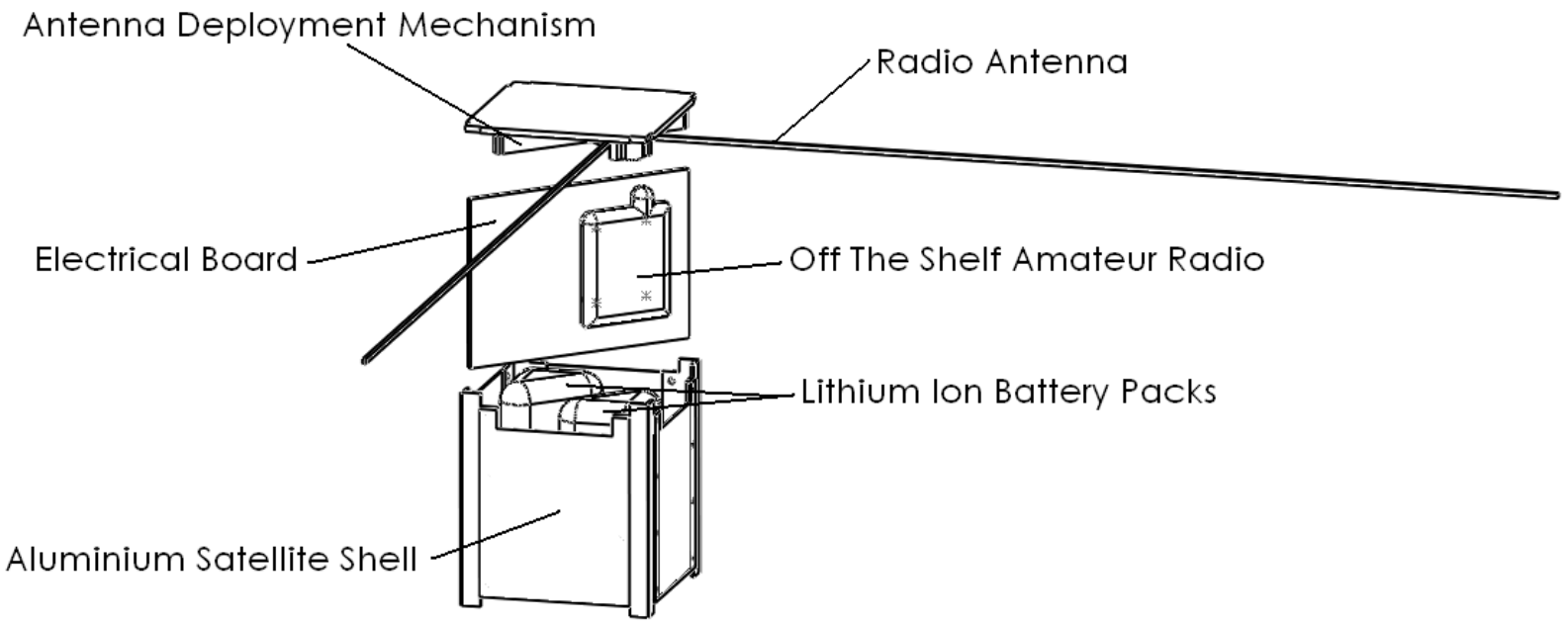
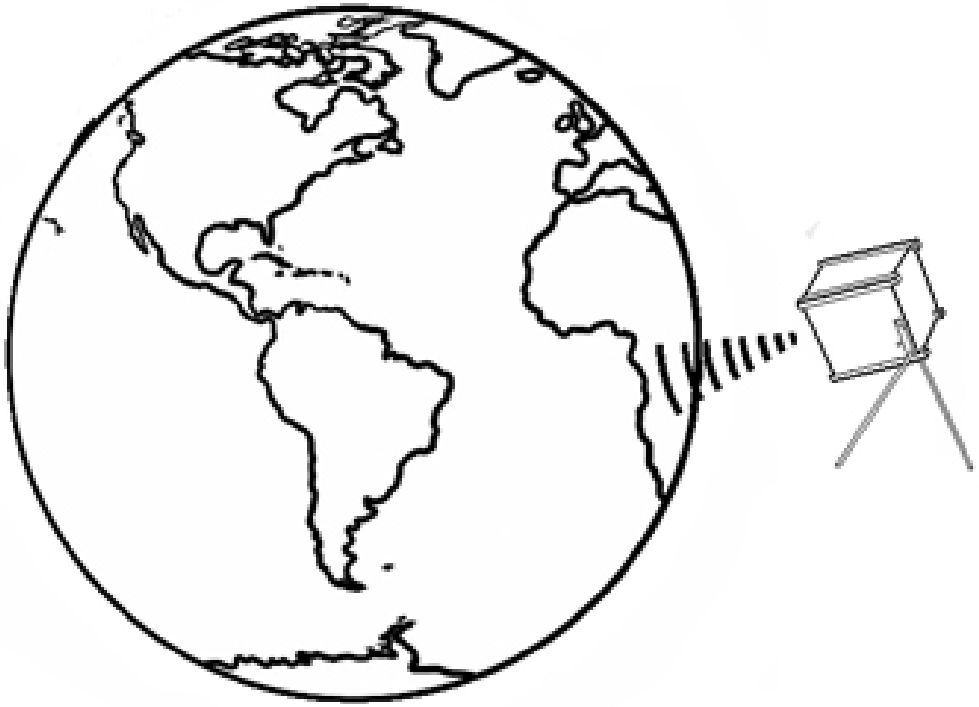
Advantages to Simplicity

- 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



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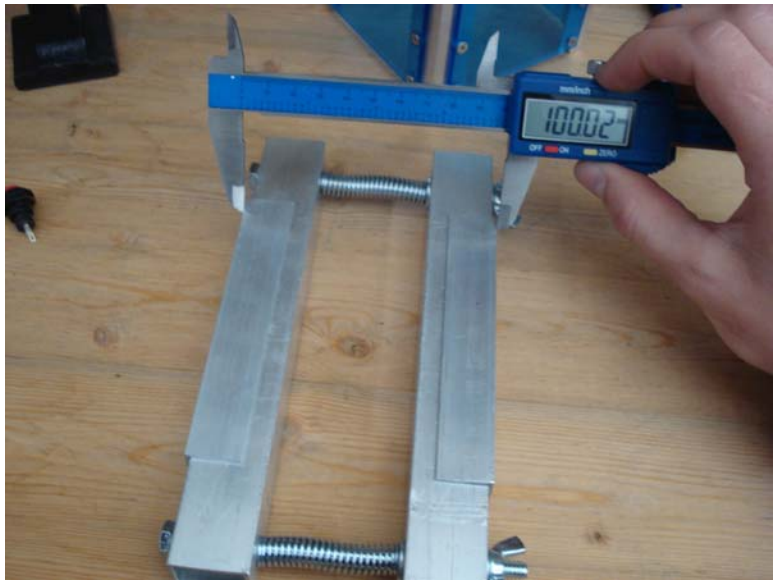
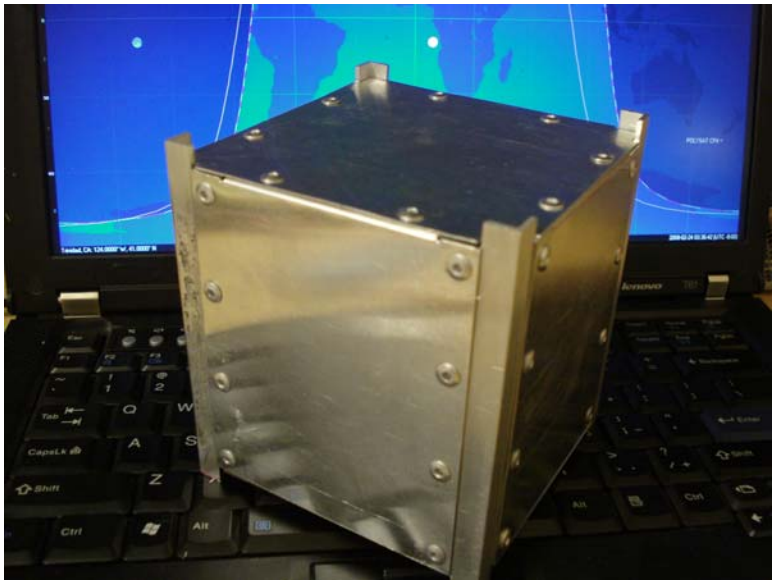
Frameless Sheet Metal Shell

- 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)

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Challenges

- Obtaining dimensional tolerance
- Mounting parts
- Structural rigidity

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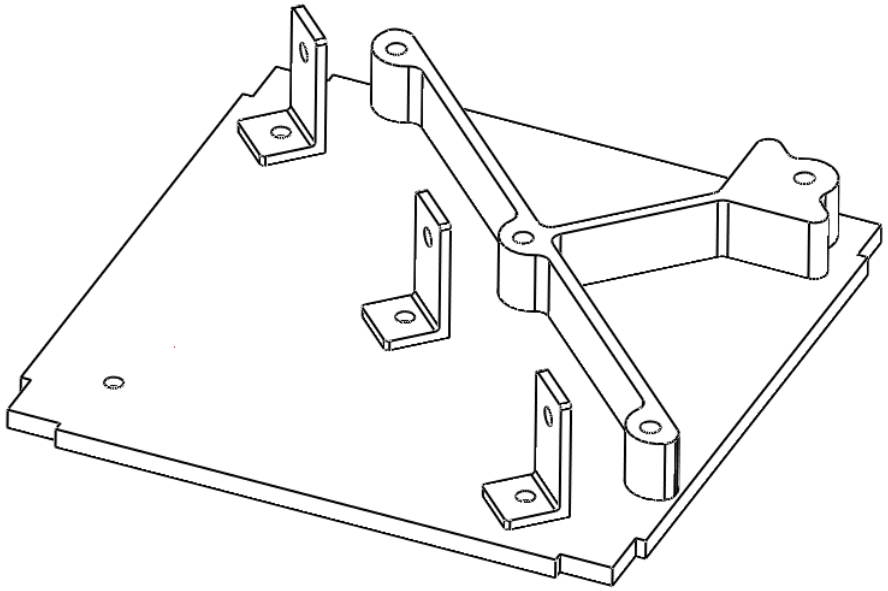
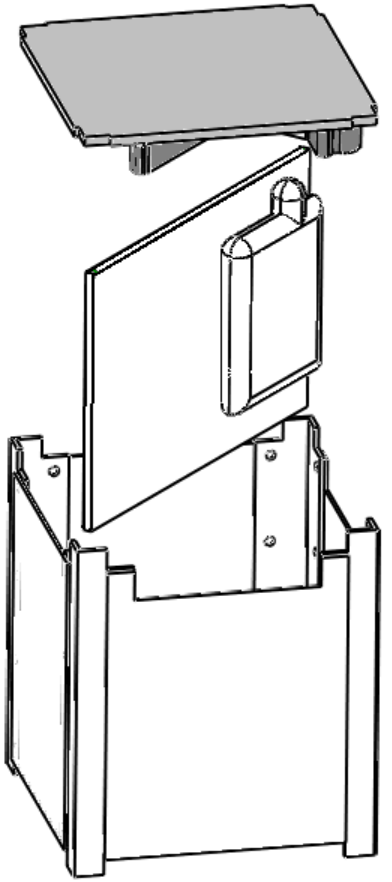
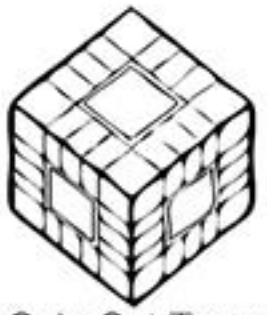
Z-Panel Mechanism Plate





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

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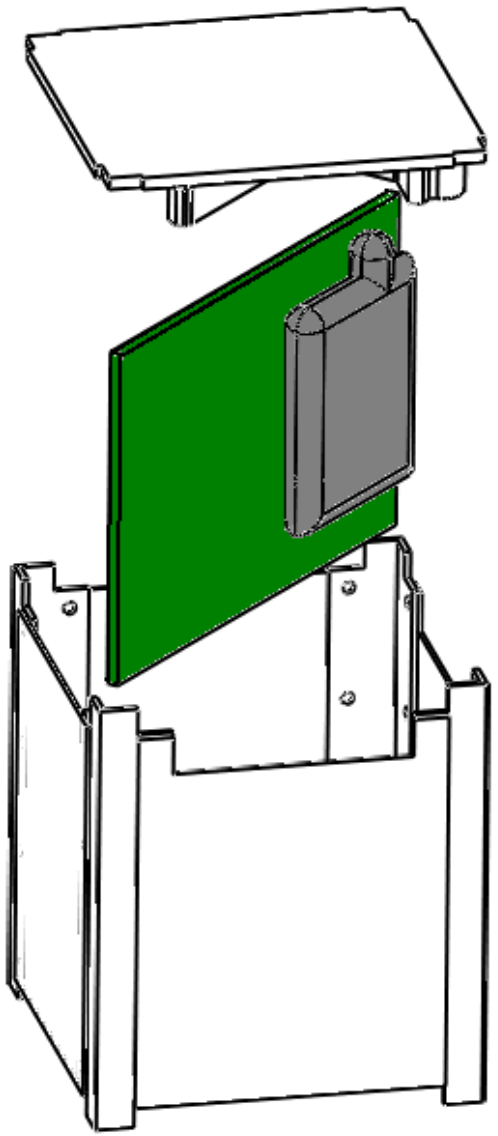
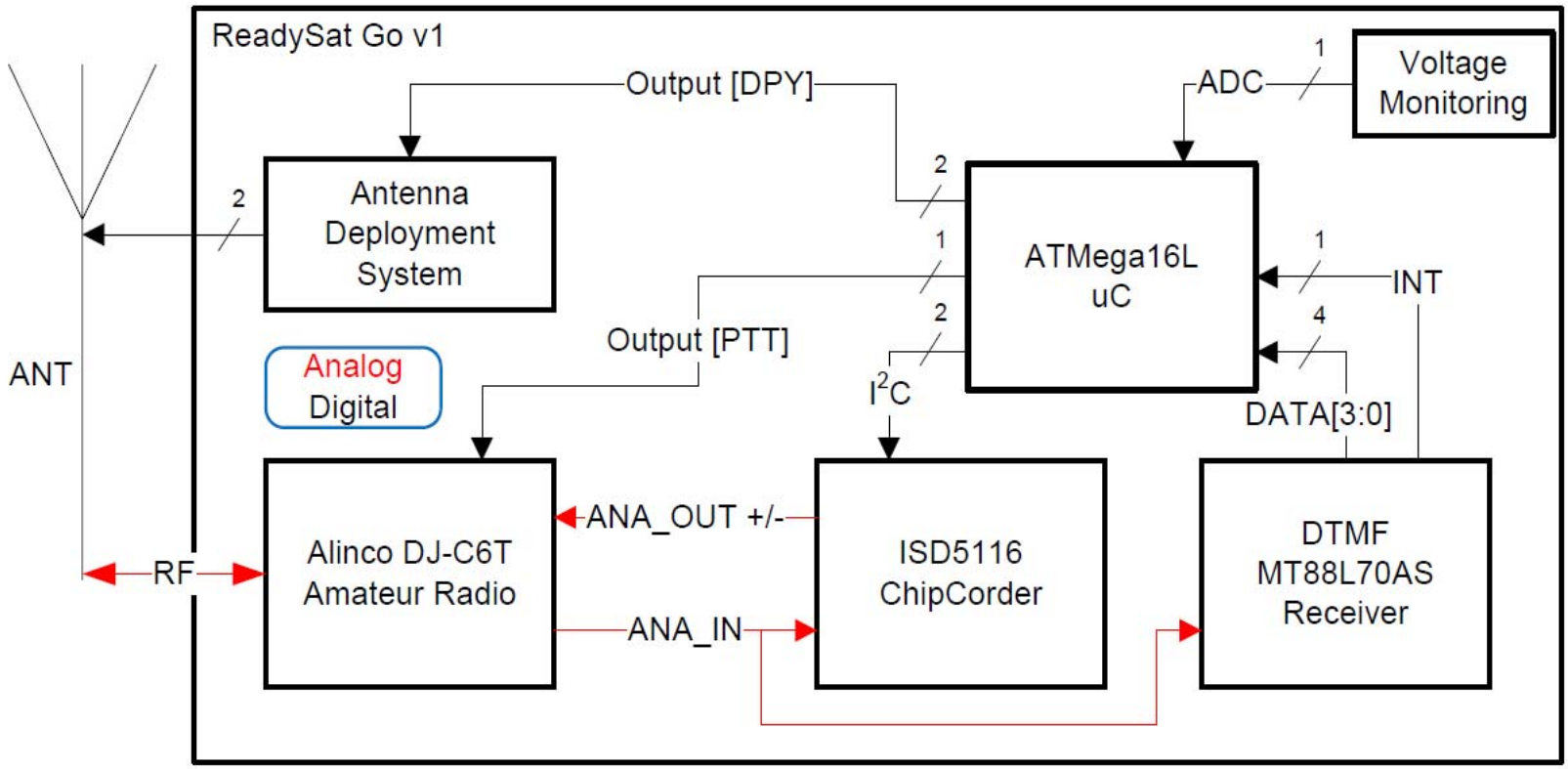
Electrical System

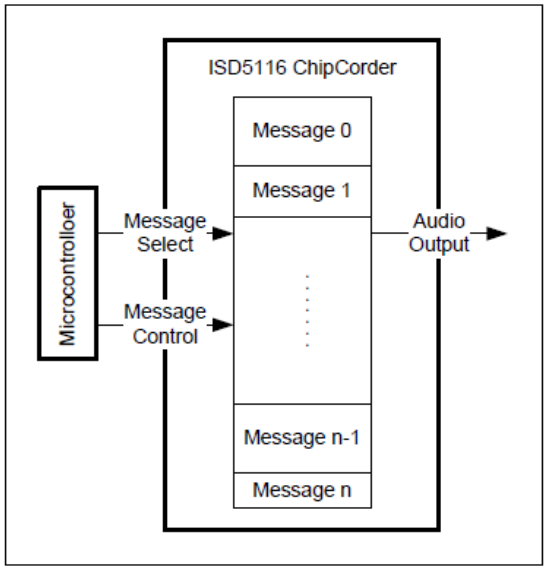
- Single PCB design
- COTS transceiver
- Single voltage bus
- Mostly surface mount components
- Onboard LED Diagnostics
- In system programming
- Serial debugging



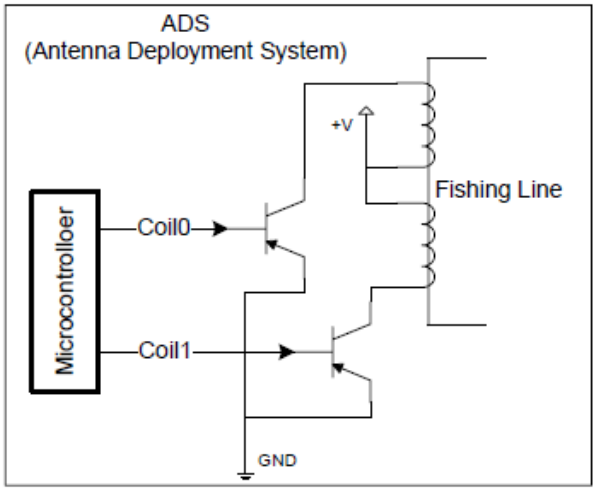
High Level System Schematic



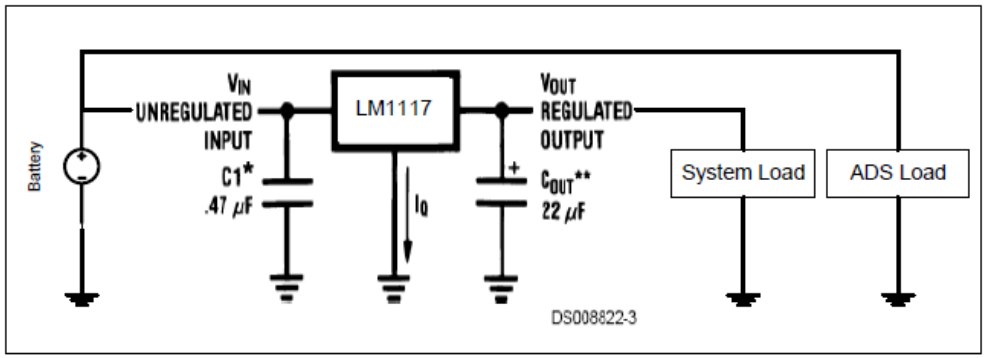
Electrical Subsystem Schematics



Audio Chip Interface



Antenna Deployment System Electrical Interface



Power Regular Circuitry

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Transceiver

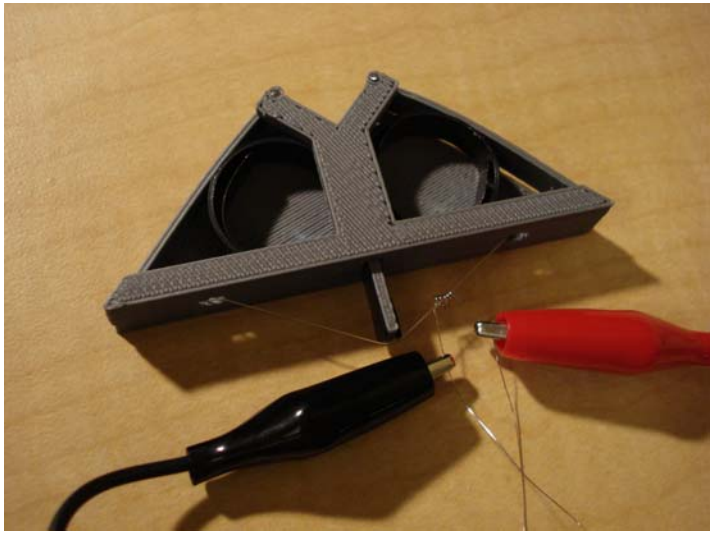
Alinco DJ-C7

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

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Antenna Summary

- 2 elements at 90 degrees
- Reduces nulls

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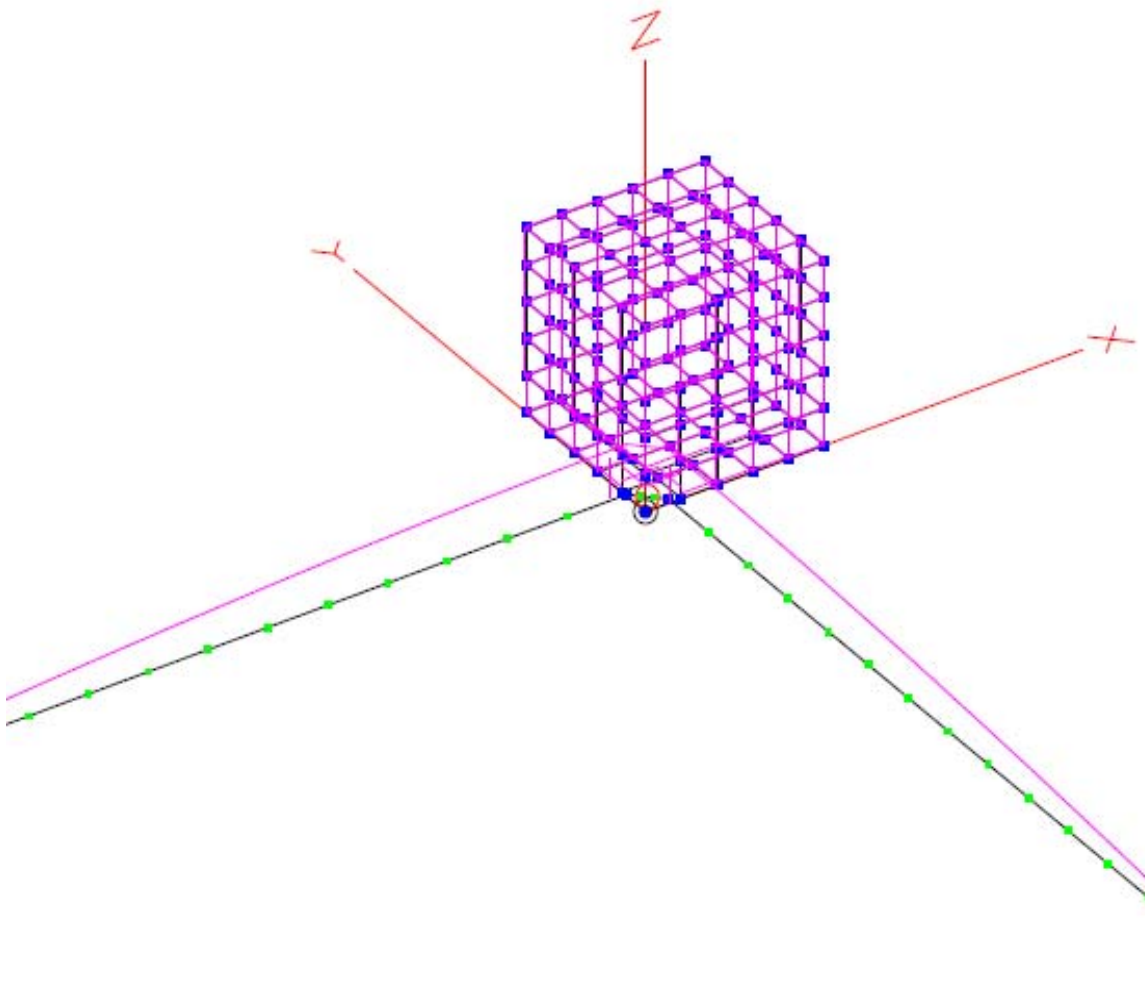
Model View



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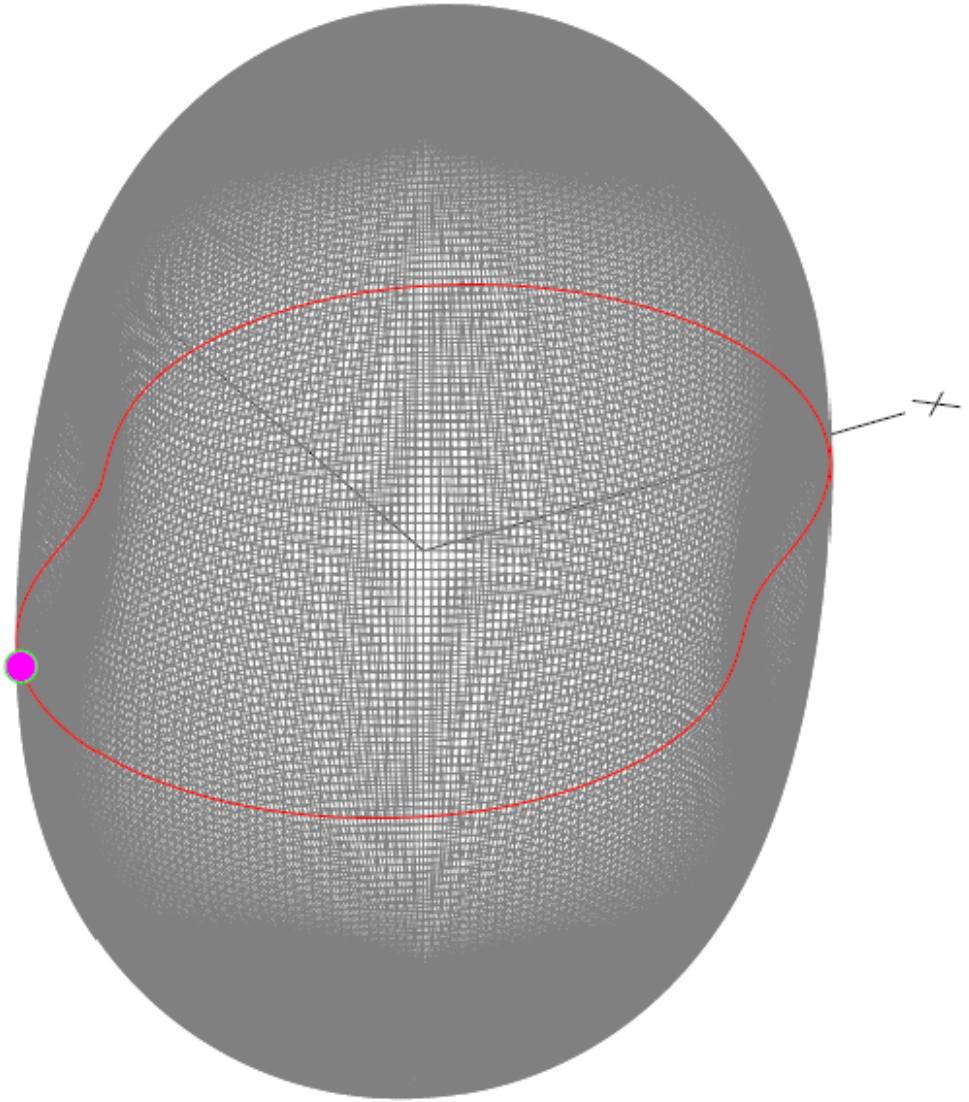
3D Pattern



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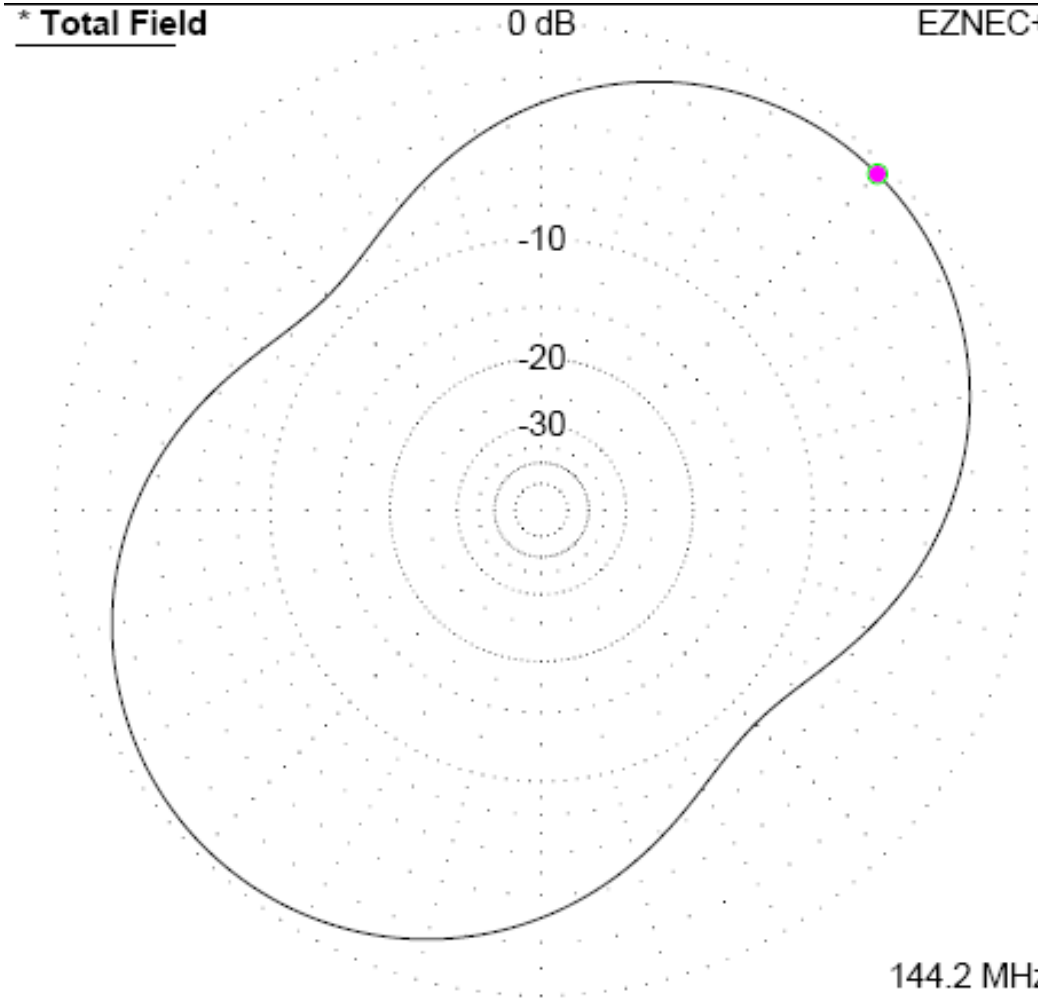
2D Null Pattern



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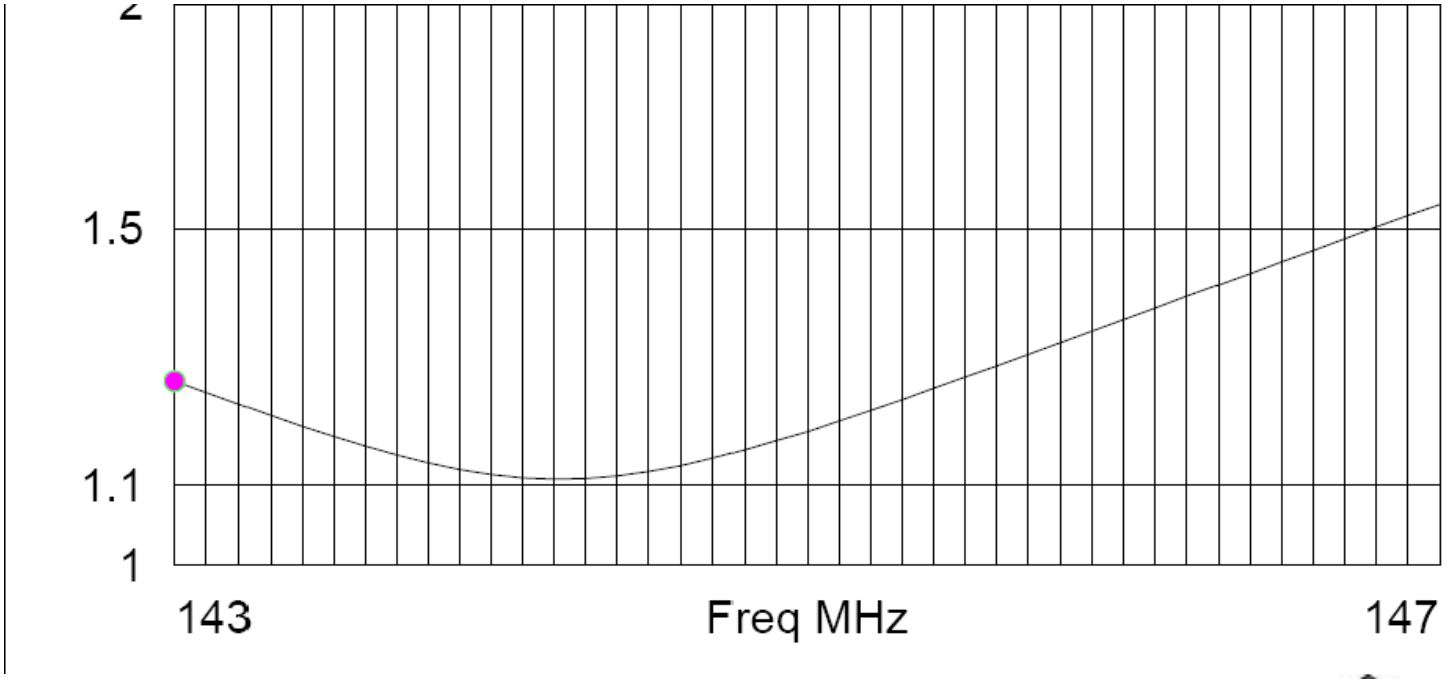
SWR Curve



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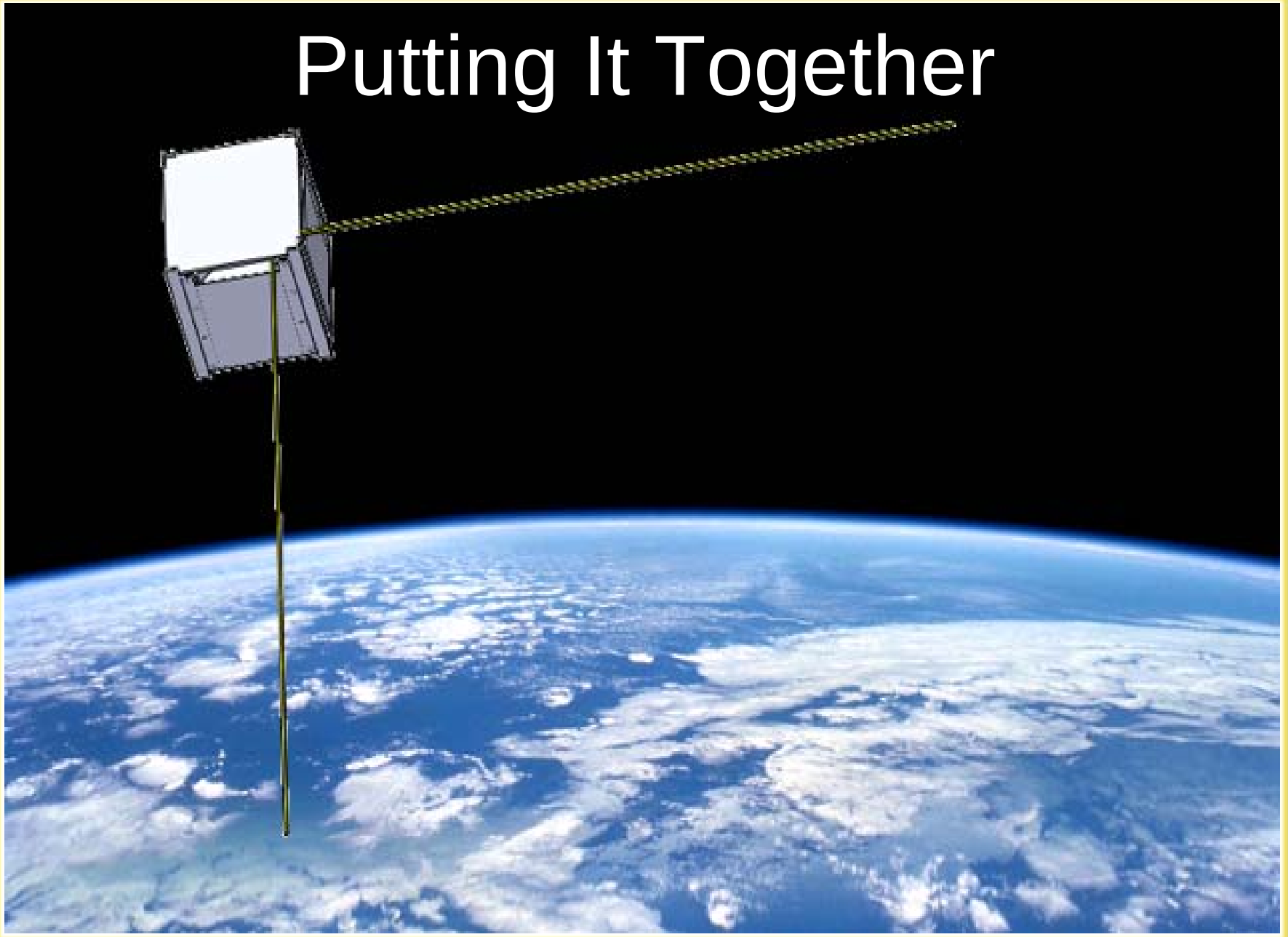
Putting It Together



Future Work

- Multi-band receive
- Tunable Receiver with auto-record
  - Satellite-satellite relay

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Thank you!

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