AUTONOMOUS FLIGHT SAFETY SYSTEM

A Prototype Development Project of
Goddard Space Flight Center's Wallops Flight Facility
and Kennedy Space Center

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AFSS – What is it?

- Independent self-contained subsystem mounted onboard a launch vehicle or UAV
- Uses redundant GPS/IMUs to compute impact points
- Autonomously makes Flight Termination / Destruct decisions using software based rules implemented on redundant flight processors
- Fully compliant with Range Safety Requirements
- Goal: Develop proof of concept systems that advance toward a flight prototype

Why AFSS?

- **Reduces the Cost of Access to Space**
  - Eliminates Costly Infrastructure
  - Very High Return on Investment
  - Reduces Cost of Test and Evaluation for Exploration
- **Increases Launch Safety**
  - Decreases Reaction Time for Special Situations
- **Provides Launch Flexibility and Responsiveness**
  - Geographical Independence
    - Permits launches from locations without extensive ground-based assets
    - Provide coverage for portions of flight beyond normal range of ground stations
  - Rapid Response
  - Concurrent Operations

Project Status

- 2+ years work by competent, experienced team
- No technical barriers identified
- Requirements documented
- Extensive contact with FAA, Range Safety Community and Users
  - clarifying requirements, sharing their concerns, resolving issues, reviewing and critiquing our progress
- Developed a flexible, programmable, rule-based software system, tailored to the Range Safety application
- Algorithms coded and tested in simulations
- PDR successfully completed 8/25/2004
- Test lab under development
- Manifested on a Sounding Rocket flight for March 2005

Future of AFSS

Present Commitment

- CDR June 05
- Extensive automated Monte Carlo HWIL Simulations
- Independent Validation and Verification
- Flight tests of fully redundant system Mar 06

Proposed Follow-on

- Development of Tools for Planning, Programming, Validation
- Transition to Commercial Enterprise
- Qualification
- Phase-in

LOW COST TDRSS TRANSCEIVER (LCT2)

A Prototype Development Project of
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LCT2 TEAM

Project Sponsor :

- DARPA/FALCON
- NASA WFF Range and Mission Management Office

Project Management:

- NASA WFF Electrical Engineering Branch

Team Members :

- NASA
- LJT and Associates
- Instrumentation Development Group Johns Hopkins University

Project Goals

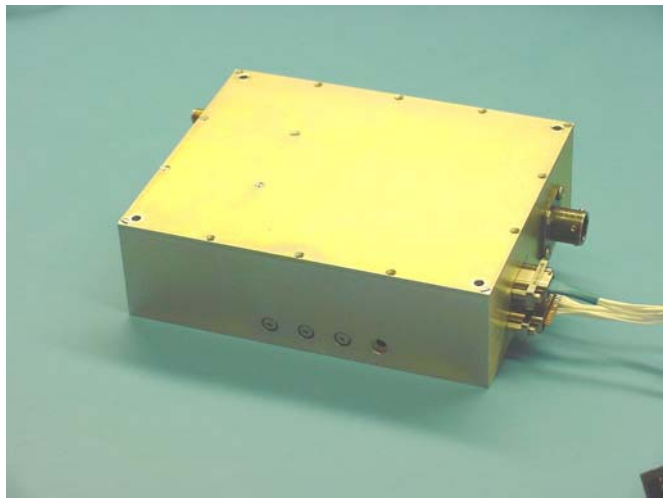
- Develop a transceiver design compatible with the TDRSS S-Band forward link and DG1 mode 2, DG2 return link formats
- Develop prototype units for demonstration on sub-orbital platforms, including sounding rockets, long duration balloons, and UAV's
- Develop low cost solution for technology transfer to industry for future commercial production
    - Lower cost from present day $250K per transceiver to $75K

Low Cost TDRSS Transceiver (LCT2)

- Development has been broken down into 5 phases:
- Phase I - Design & Build 10 W BPSK/QPSK Transmitter
  - Currently undergoing environmental testing
- Phase II - Implement DG1 Mode 2 Functionality
- Phase III - Implement 30W+ Amplifier Module
  - Prototype ready for testing fall 2005
- Phase IV - Develop Receiver Module Prototype
  - Late summer 2005 startup
- Phase V - Build Fully Integrated Flight Transceiver Prototype
  - Prototype available for testing late 2006
- Fly prototype modules on sounding rockets as flight opportunities arise.

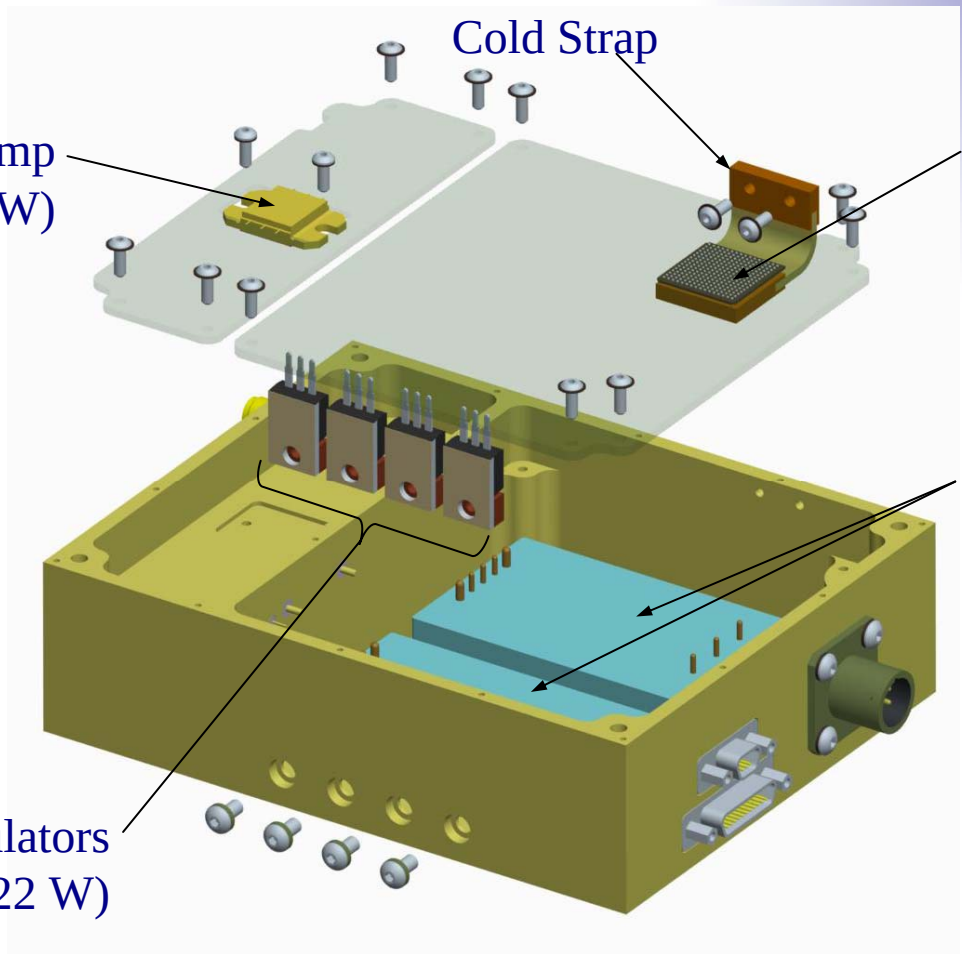
Low Cost TDRSS Transceiver (LCT2)

- 10 W phase I,II BPSK/QPSK transmitter prototype built and under test
  - Power: 2.25 A @ 28 V
  - Wgt: 1 lb. 12 oz
  - Size: 4” x 5” x 1.5”



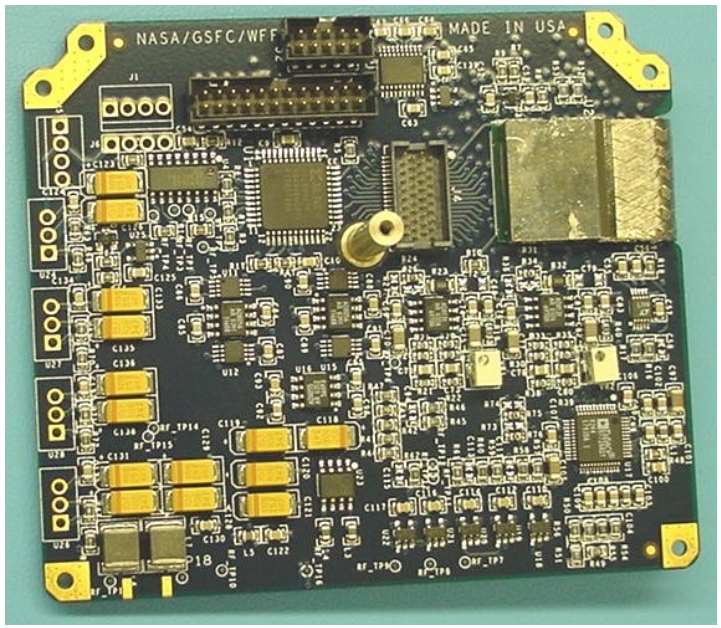
Low Cost TDRSS Transceiver (LCT2)

Primary Heat dissipating Components

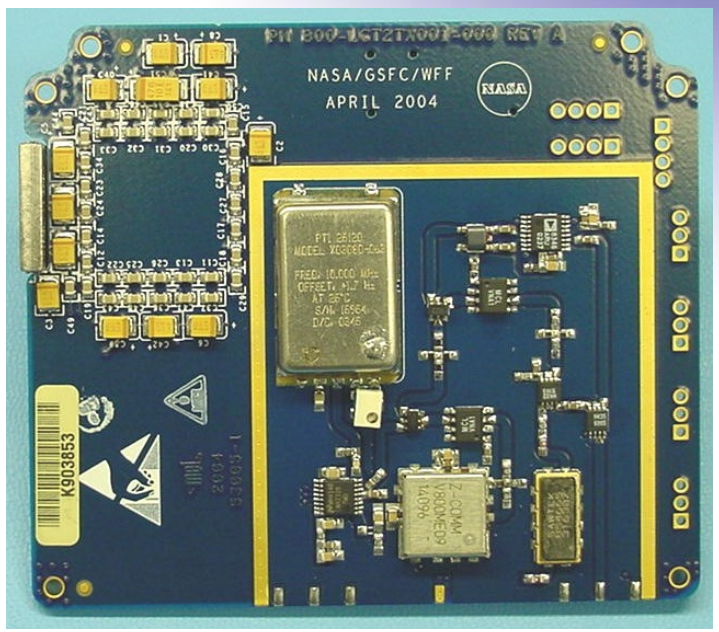


Low Cost TDRSS Transceiver (LCT2)

Modulator PCB



Digital Circuitry
(Bottom Side)



Synthesizer/Upconverter
(Top Side)