



SpaceBuoy

A Pathfinder Nano-Satellite for a Space Weather Monitoring Network

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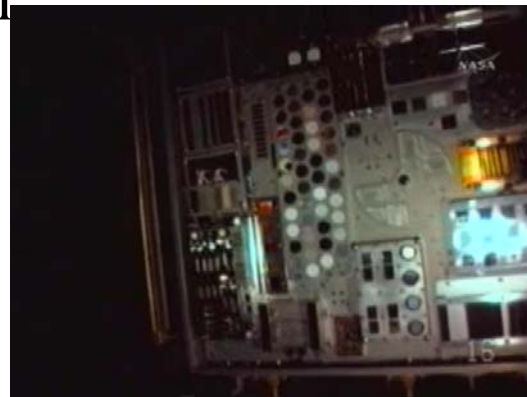
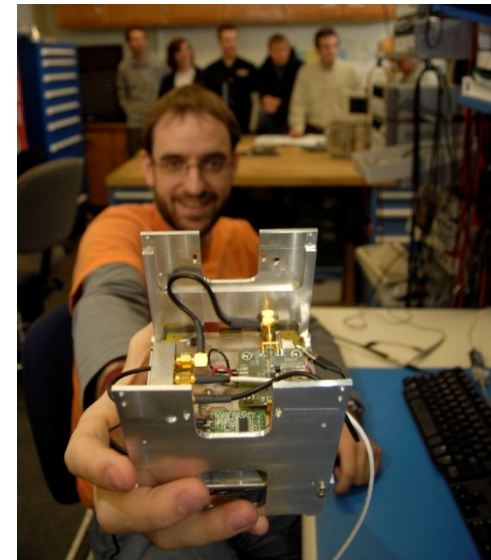
Overview

- Background of SSEL and SpaceBuoy
- Mission Statement
 - Mission Objectives
 - Science Instruments
 - Collaboration With Industry



SSEL Background

- Space Science Engineering Laboratory
 - Interdisciplinary Research Lab
 - ME, MET, I&ME, EE, CS, CpE and Physics
 - Older students mentor new students to pass on heritage information
 - Collaboration with industry



SpaceBuoy Background

- Maia heritage: NS-3 Competition
 - Structure
 - Center stack
 - Command and Data Handling
 - Data processing
 - Attitude Determination and Control System
 - Torque Coils



Maia EDU (heritage)



SpaceBuoy Mission Statement

- **Mission Statement**

- The SpaceBuoy mission will collect data on several ionospheric plasma parameters essential to space weather forecasting from a nanosatellite platform (MS1), and will demonstrate that data can be made available to the forecasting community in 1.5 hours of being taken (MS2).

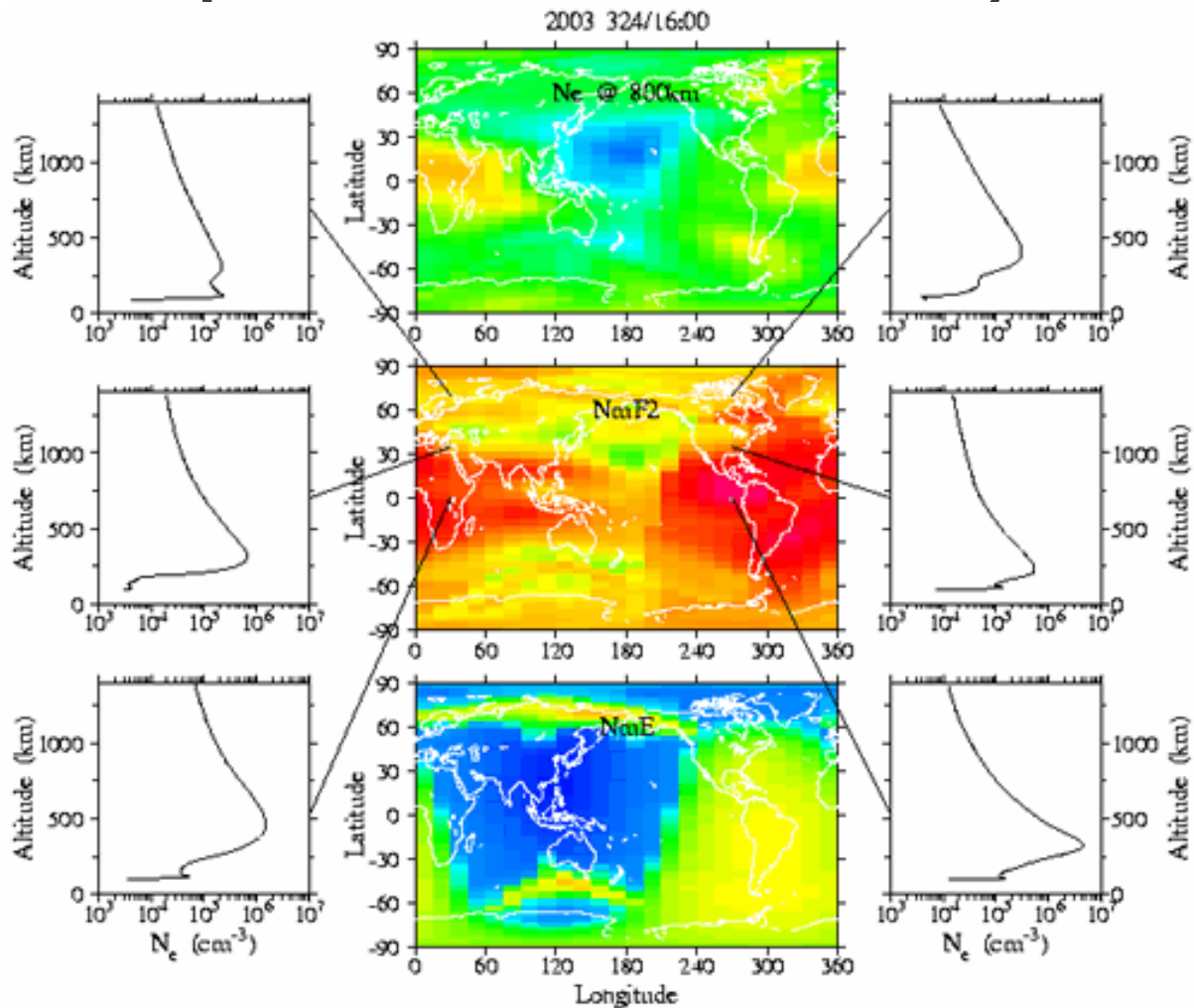


Mission Objectives

- Student education
- Contribute essential data to GAIM Model (Global Assimilation of Ionospheric Measurements) currently being used by Air Force Weather Agency (AFWA)
 - In-situ Ion Density (N_i)
 - Columnar Total Electron Content (TEC)
 - As a goal: Electron Temperature (T_e)



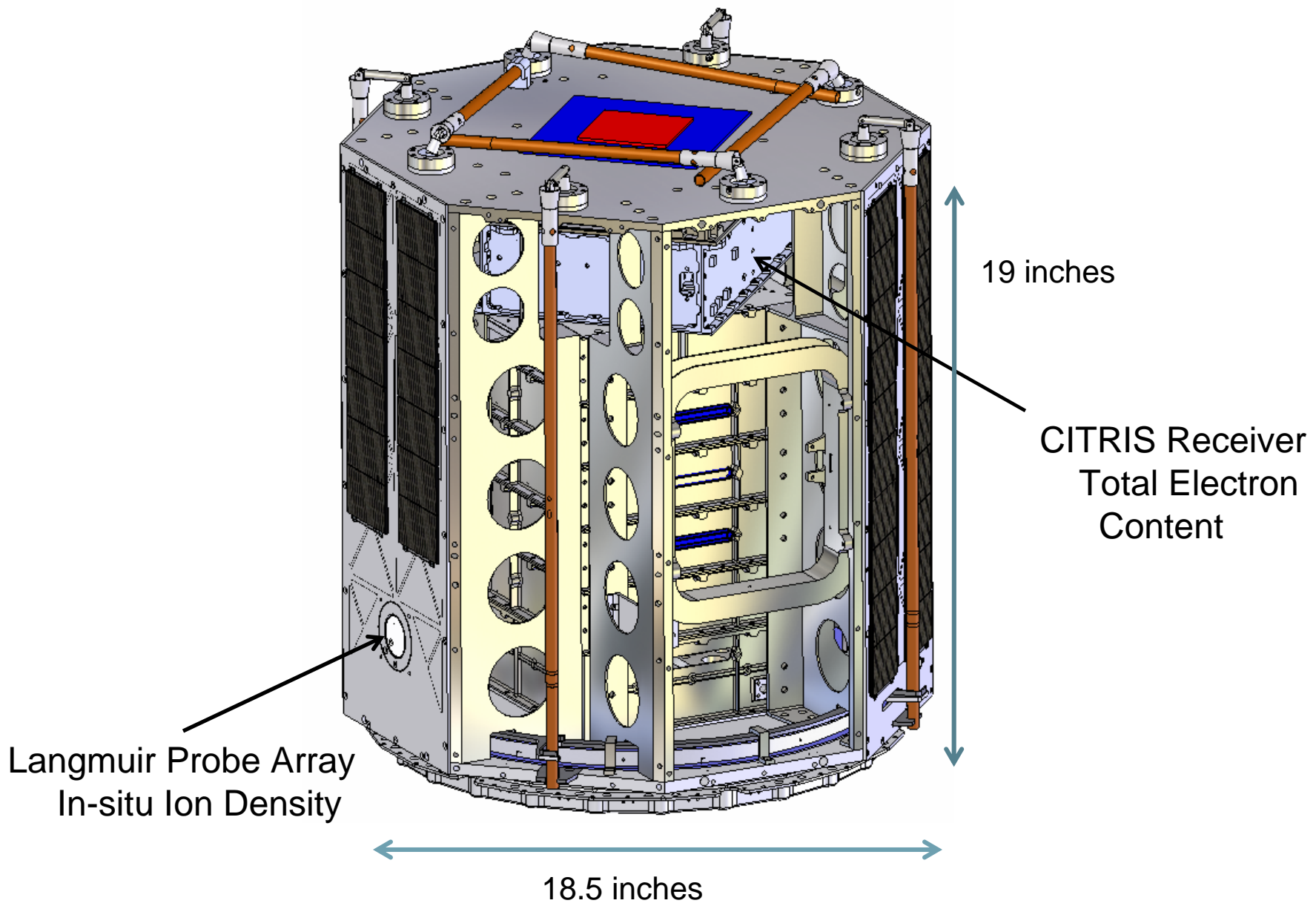
Atmosphere Ion Density Profile



Mission Objectives

- Demonstrate feasibility of buoy-like operations concept
 - Pathfinder mission of fleet of ionospheric measurement platforms
 - Near real-time (1.5 hours) data delivery
 - Inexpensive (relative) and robust
- Three month minimum mission life, goal of 1 year.

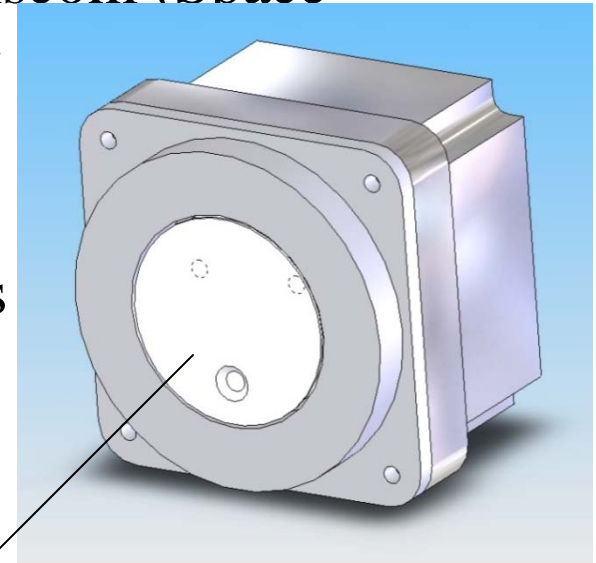




Langmuir Probe Array

- Consists of 2 Langmuir Probes mounted on opposite skins of the S/C
- Design based on heritage from AFRL-Hanscom (Space Weather Effects Section) Planar Langmuir
 - Collector Plate Design
 - Log Amp design and layout
- Being designed and built by MSU students

| Mode | Measurement(s) |
|---------------|---|
| 1: Fixed Bias | Ion Density (N_i) Relative Electron Density (N_e) |
| 2: Sweep Bias | Floating Potential Electron Temperature (T_e) Full I-V Characteristic |



1.5" diameter collector head

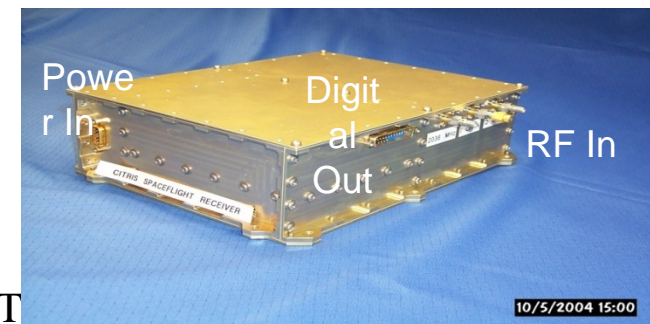
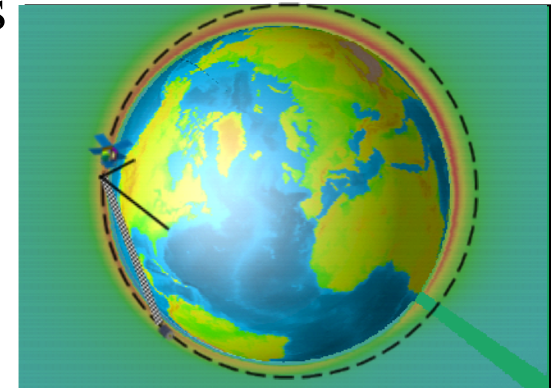
Collaboration with Industry

- Planar Langmuir Probe instrument is based on flight heritage from AFRL Hanscom (PLP Instrument)
- Langmuir Probe Array
- Ion Density (Ni)
 - Designs from PLP instrument will allow for more rapid fabrication and testing
 - Non-deployable instrument
 - Also allows for Electron Temp. Measurements



CITRIS Instrument

- Total Electron Content (TEC) measurements
 - DORIS mode: Slant (ground-to-satellite)
 - CERTO mode: Tomography (satellite-to-satellite)
- Line of sight TEC
 - Differential Phase measurement on several frequencies
 - CITRIS Instrument has been flown on 6 missions before (flight heritage)
- Antennas
 - Communication and CITRIS
- RF Interface Box
 - RF switch
 - Either CITRIS or Comm connected to the antennas, NOT



SpaceBuoy is controlled by CDH

Collaboration with Industry

Deliverable from NRL

- Modified CITRIS provided to MSU by Naval Research Laboratory
- CITRIS modifications
 - Antennas
 - NRL
 - Quadrafilar Helix Antenna
 - Crossed Dipole Antenna
 - SpaceBuoy
 - 2 patch Antennas
 - 8 monopole Antennas
 - RF Interface Box
 - Doubles as our Communication



Final Remarks

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More information see:
www.ssel.montana.edu

