CO-OP WORK REPORT

SCHOOL OF AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

PURDUE UNIVERSITY

WORK PERIOD
#2
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AT
Ball Aerospace & Technologies Corp.
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Work Experience

During my second session at Ball Aerospace (BATC), I worked on the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) weather satellite. BATC was contracted to design and fabricate the Ozone Mapping and Profiler Suite (OMPS). This sensor suite measures how much ozone is in Earth's atmosphere and how the ozone concentration varies with altitude. BATC is developing the Nadir sensor to measure the amount of ozone in the atmosphere and the Limb sensor to measure how ozone concentration varies with altitude.

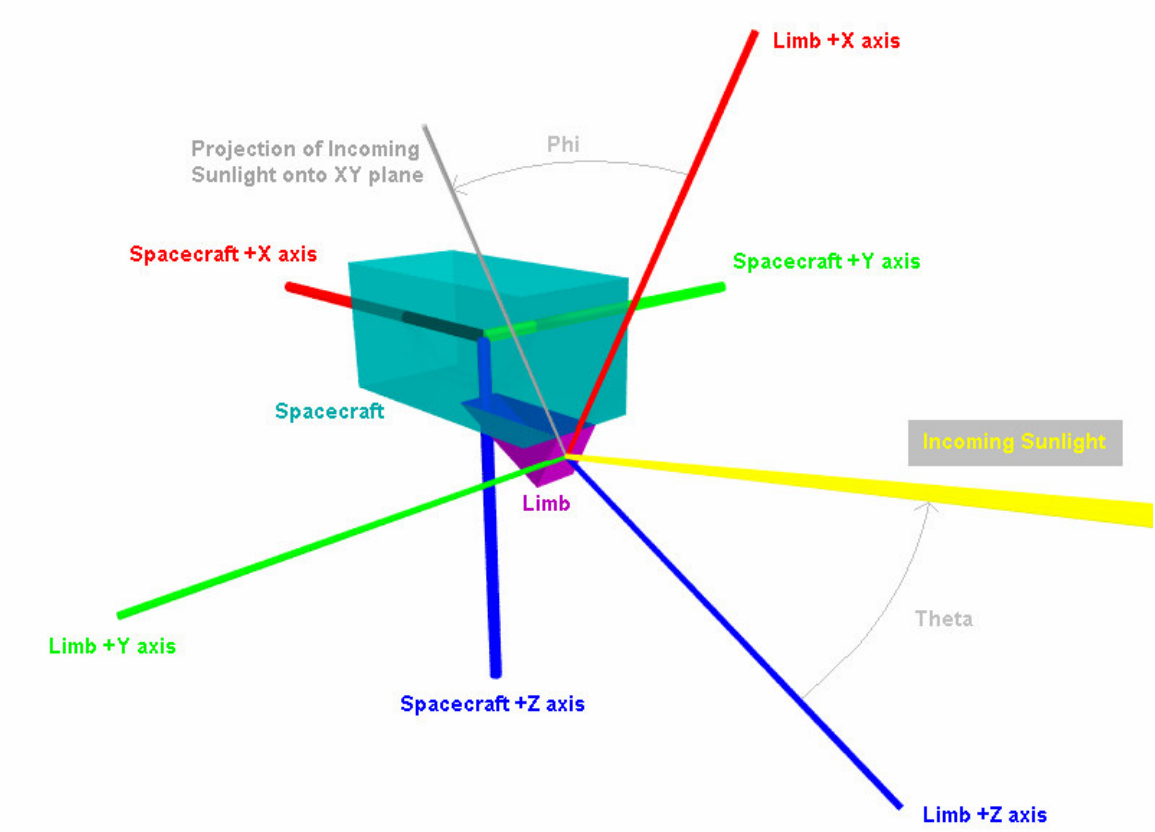
The majority of my work focused on the Limb sensor. While working on this program I was involved in two projects. The first project I worked on was calculating the incoming solar angles to the Limb sensor to aid in the design of the telescope baffles. (Baffles are pupils inside a telescope used to block stray and scattered light.) To complete this project I started with the solar angle data that was output from a software package called Satellite Tool Kit (STK). The solar angle data output from STK was with respect to the spacecraft coordinate system. Using Matlab, I wrote a series of scripts to convert the solar angle data to the coordinate system for the Limb sensor (see Appendix A-1). The scripts also filter out the times when the satellite was behind the Earth and generate plots of theta and phi (standard spherical coordinate angles) with respect to latitude for an entire year (see Appendix A-2 : A-4).

The second project I worked on was the Limb End-To-End model (LETEM). The LETEM is a series of Matlab scripts that simulate light entering the Limb sensor and propagating through the optical elements until it reaches the Charged Coupling Device

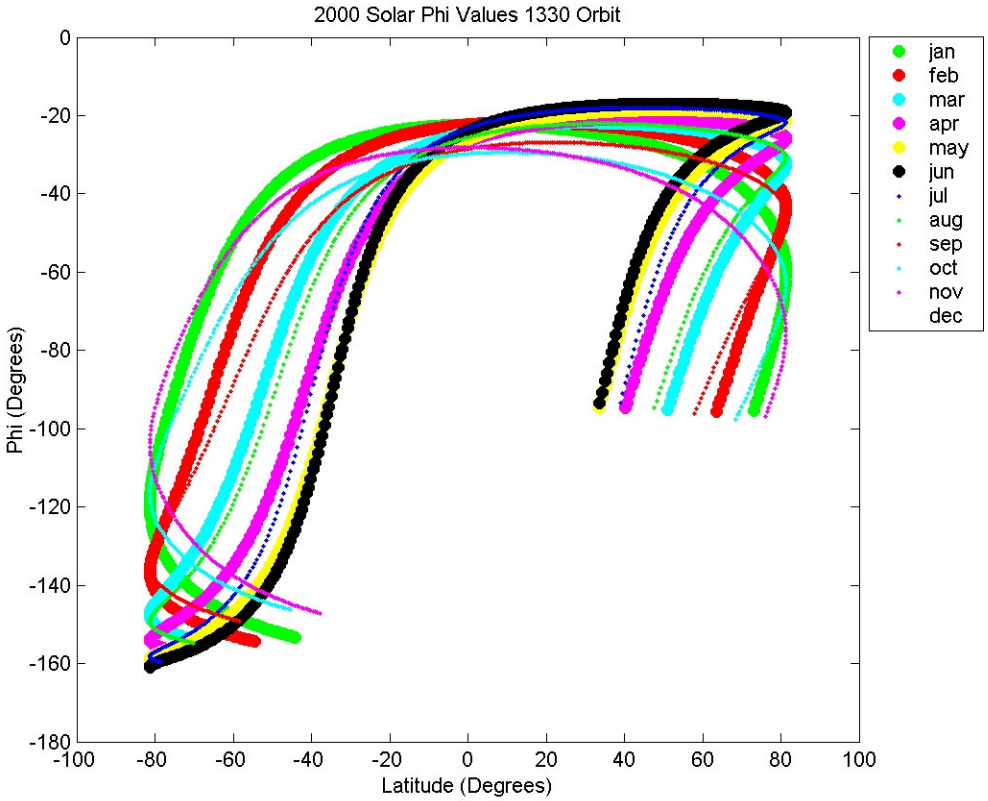
(CCD) Camera. The scripts then simulate how the CCD will respond to the photons that reach it and will output the simulated image from the CCD.

I was responsible for debugging the Matlab scripts and after finding a few errors in the algorithms used, I worked on integrating the detector module with the rest of the LETEM. The detector module is another set of Matlab scripts that simulate the CCD. These scripts input the irradiance values (see Appendix A-5) from the LETEM and calculate the number of electrons that the CCD will output. These scripts were developed independent of the OMPS program and needed to be adapted and integrated into the graphical user interface (GUI) of the LETEM (see Appendix A-6).

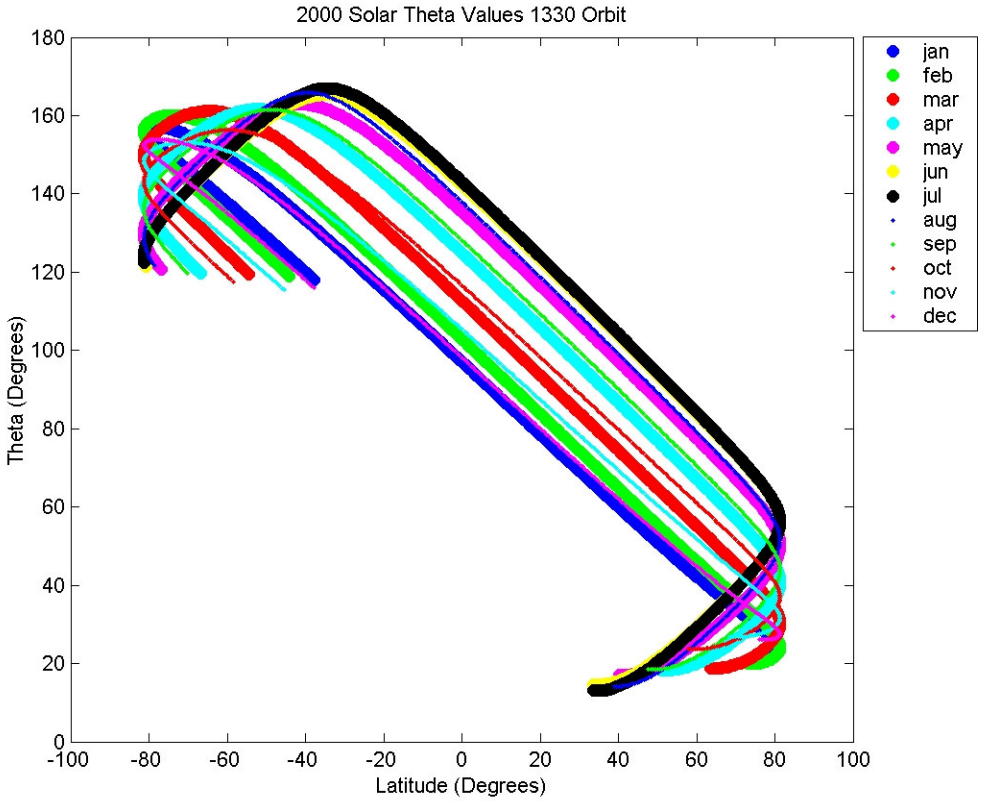
Appendix A-1


Limb +X axis
Projection of Incoming
Sunlight onto XY plane
Phi
Spacecraft +X axis
Spacecraft +Y axis
Spacecraft
Incoming Sunlight
Limb
Theta
Limb +Y axis
Spacecraft +Z axis
Limb +Z axis

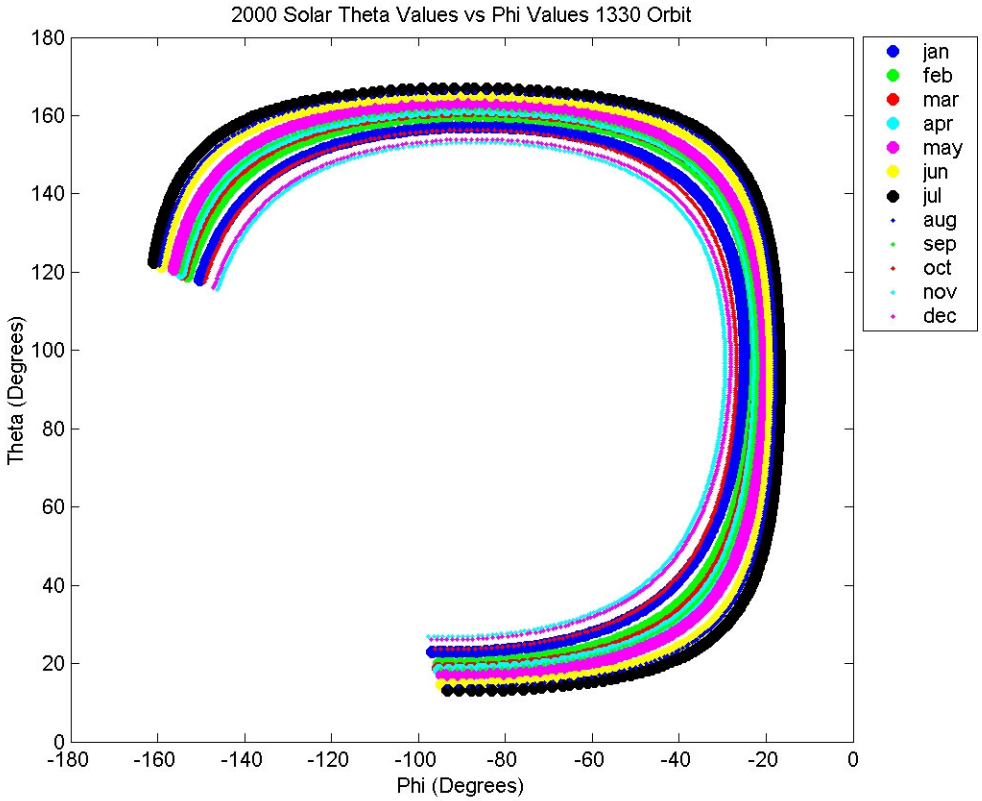
Appendix A-2


2000 Solar Phi Values 1330 Orbit
Phi (Degrees)
Latitude (Degrees)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-100
-80
-60
-40
-20
0
20
40
60
80
100
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec

Appendix A-3

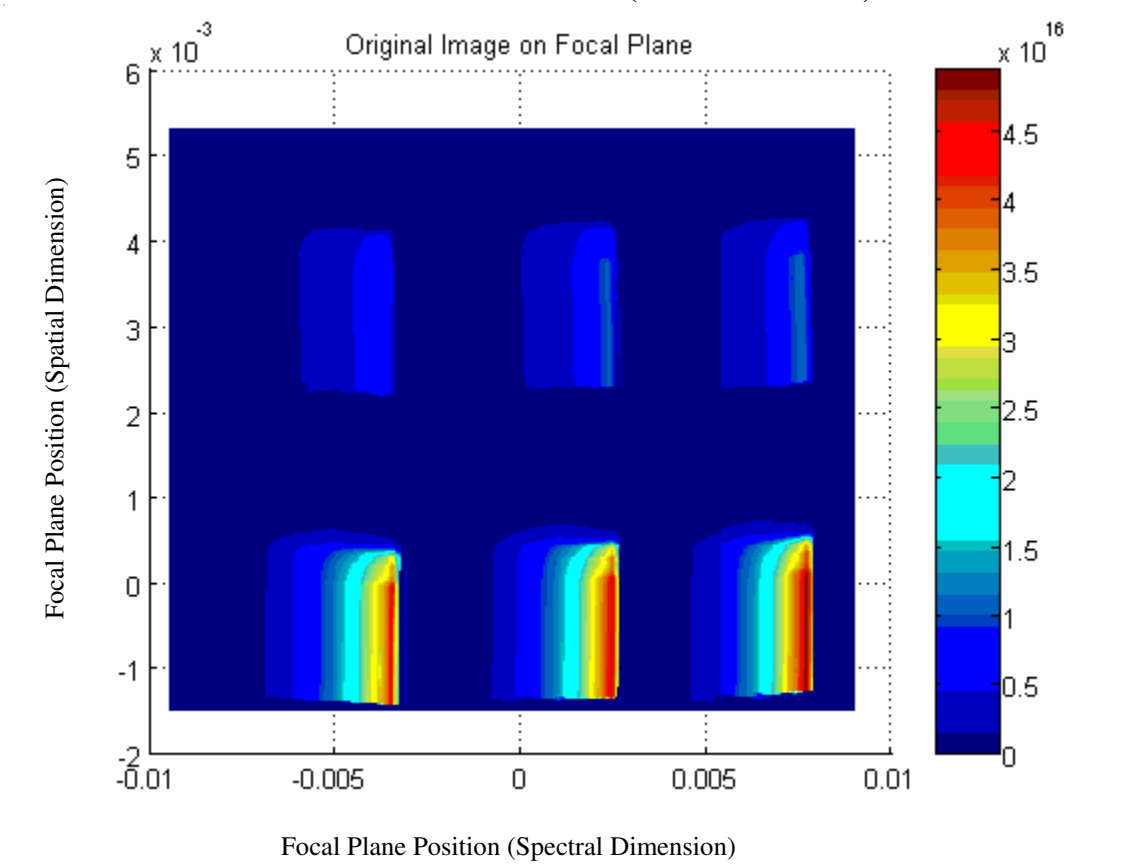

2000 Solar Theta Values 1330 Orbit
Theta (Degrees)
Latitude (Degrees)
180
160
140
120
100
80
60
40
20
0
-100
-80
-60
-40
-20
0
20
40
60
80
100
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec

Appendix A-4


2000 Solar Theta Values vs Phi Values 1330 Orbit
Theta (Degrees)
Phi (Degrees)
180
160
140
120
100
80
60
40
20
0
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec

Appendix A-5

Irradiance of the Focal Plane (Electrons/sec/m^2)



Appendix A-6

Limb End to End Model GUI