



Mechanical



Week 2, Spacecraft Design Lab 2019-2020



Fig 1: Assembled boards and Windform

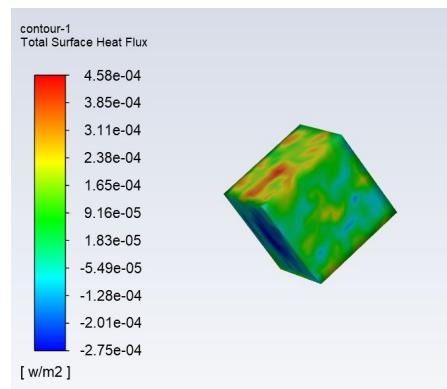


Fig 2: Solar Ray Tracing Model

Interfaces

- Electrical/ Avionics
 - Need a couple internal parts moved (already talked to Max)
 - Datasheets for thermal requirements
- Communications
 - Need to work together on +Y board (burn wires and antenna locations)
- Flight Software/ GNC (none)

Requirements

- Laser cutter (acrylic already ordered)
- Can we install Ansys on one of the machines in Skilling?

Updated Key Milestones (past + present)

- | | |
|-------------------------------|-------|
| • Stable CAD model | 11/19 |
| • Printed prototype | 11/19 |
| • Test vacuum chamber | 11/19 |
| • Preliminary battery testing | 11/19 |
| • Order Windform prototype | 11/19 |
| • Antenna prototype | 12/19 |
| • Fit check and update CAD | 1/20 |
| • Reorder Windform | 1/20 |

Weekly Results

- Gantt chart
- Beginning of fit check (structural component models edited to fit internal boards/ battery donut)
- Explored options for thermal analysis
- Started outlining day in the life (DIL) testing.

Next Week

- Acrylic cutout for launcher rails
- Continue fit check (Dremel slots for internal boards, make sure solar panels fit with launcher rails)
- Initial theoretical characterization of solar flux on satellite, and research thermal requirements of electronics.



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Week 2, Spacecraft Design Lab 2019-2020

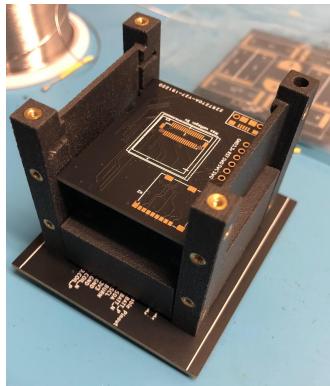


Fig 1: Internal boards fit in rails



Fig 2: Triple holding wire

Updated Key Milestones (past + present)

- | | |
|-------------------------------|-------|
| • Stable CAD model | 11/19 |
| • Printed prototype | 11/19 |
| • Test vacuum chamber | 11/19 |
| • Preliminary battery testing | 11/19 |
| • Order Windform prototype | 11/19 |
| • Antenna prototype | 12/19 |
| • Fit check and update CAD | 1/20 |
| • Reorder Windform | 1/20 |

Interfaces

- Electrical/ Avionics
 - Kill switch powers off satellite
- Communications
 -
- Flight Software/ GNC (none)

Requirements

-

Weekly Results

- Solidworks and Ansys installed in Skilling
- Started test plan/contacted Quanta about cost
- Opened up slot for internal boards/ battery donut on the rails
- Acrylic cutout for launcher rails on its way?
- Antenna characterized
- ANSYS model contains real satellite, real math. Conclusions incoming

Next Week

- Internal board/ flatflex fit check
- External board fit check with launcher rails
- Fixturing for vib tests
- Finalize antenna bracket, test burn wire configurations



Mechanical

Week 3, Spacecraft Design Lab 2019-2020

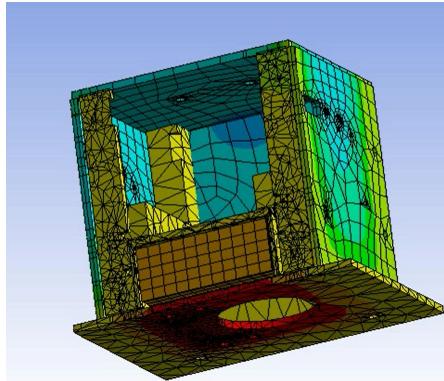


Fig 1: Dynamic ANSYS model



Fig 2: Spiral antenna config

Interfaces

- Electrical/ Avionics
 - Kill switch powers off satellite
 - -Y board redesign
 - Battery wiring
 - Order more cameras?

• Communications

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• Flight Software/ GNC (none)

Requirements

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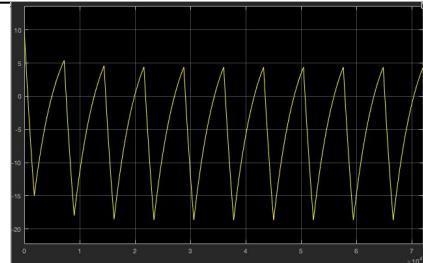


Fig 3: Matlab thermal model results (10 orbits)

Updated Key Milestones (past + present)

• Stable CAD model	11/19
• Printed prototype	11/19
• Test vacuum chamber	11/19
• Preliminary battery testing	11/19
• Order Windform prototype	11/19
• Antenna prototype	12/19
• Fit check and update CAD	1/20
• Reorder Windform	1/20
• Thermal models in Matlab/ANSYS	1/29

Weekly Results

- Internal fit check (sat weights ~170g, 250g is max).
- Acrylic cutout for launcher rails on its way?
- Updated CAD for more accurate mass/ inertia properties.
- Lumped mass thermal model of satellite done in MATLAB.
- Antenna stowage configuration baselined.
- Satellite set up in ANSYS to do a whole orbit!

Next Week

- External board fit check with launcher rails.
- Reorder Windform model x3.
- Talk with Quanta Labs about vibe testing.
- Test the oven for bakeout feasibility.
- Final ANSYS result!.
- Finalize Windform friendly antenna bracket.



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Week 4, Spacecraft Design Lab 2019-2020

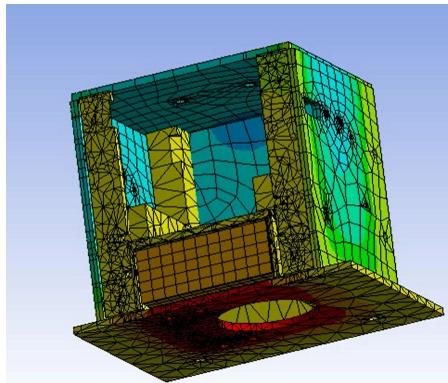


Fig 1: Dynamic ANSYS model



Fig 2: Spiral antenna config

Updated Key Milestones (past + present)

- | | |
|----------------------------------|-------|
| • Stable CAD model | 11/19 |
| • Printed prototype | 11/19 |
| • Test vacuum chamber | 11/19 |
| • Preliminary battery testing | 11/19 |
| • Order Windform prototype | 11/19 |
| • Antenna prototype | 12/19 |
| • Fit check and update CAD | 1/20 |
| • Reorder Windform | 1/20 |
| • Thermal models in Matlab/ANSYS | 1/29 |

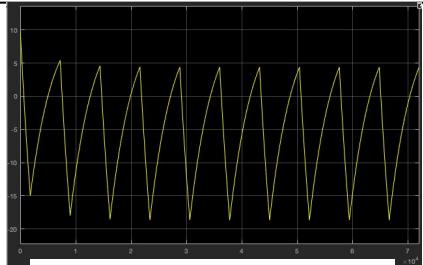


Fig 3: Matlab thermal model results (10 orbits)

Interfaces

• Electrical/ Avionics

- Kill switch powers off satellite (needs to move outward)
- -Y board redesign
- Battery wiring
- Burn wire current requirement?

• Communications

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• Flight Software/ GNC (none)

Requirements

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Weekly Results

- Internal fit check (flat flex redesign and battery rewiring ongoing)
- Reordered Windform model x3 (with antenna bracket)
- Acrylic launcher rails on its way, 3D print model done (solar panels to move up and kill switches to move outward)
- Battery thermal testing in progress
- ANSYS model complete
- Vibe/Thermal/Battery test plan done; DIL nearly completed

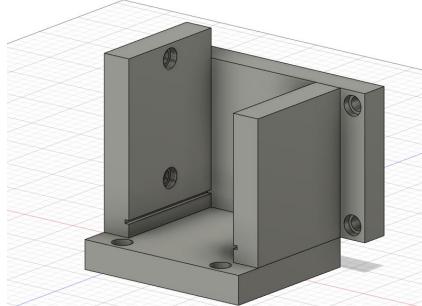
Next Week

- External board fit check with launcher rails
- Check internal fit with battery rewiring and antenna cable
- Test fixture design
- Continue thermal testing of different scenarios
- Complete DIL test plan

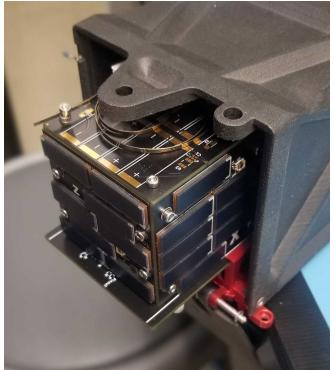


Mechanical

Week 5, Spacecraft Design Lab 2019-2020



Vibration test fixture design v1



Deployment Pod Fit Check

Updated Key Milestones (past + present)

• Stable CAD model	11/19
• Printed prototype	11/19
• Test vacuum chamber	11/19
• Preliminary battery testing	11/19
• Order Windform prototype	11/19
• Antenna prototype	12/19
• Fit check and update CAD	1/20
• Reorder Windform	1/20
• Thermal models in Matlab/ANSYS	1/29

Interfaces

- Electrical/ Avionics
 - Kill switch powers off satellite (needs to move outward)
 - -Y and X boards redesign
 - Battery rewiring
 - Burn wire current requirement?

- Communications
 - Info on how to do a fake ground station

- Flight Software/ GNC (none)

Requirements

Weekly Results

- Internal fit check (flat flex redesign and battery rewiring ongoing)
- External fit check with Albapod (confirmed kill switch move)
- ANSYS model closed out
- Vibration test fixture design v1
- Vibration test quote from Quanta
- Additional antennas prepped for room/ridge testing
- Initial battery thermal testing (30 min. freezer/eclipse sim)

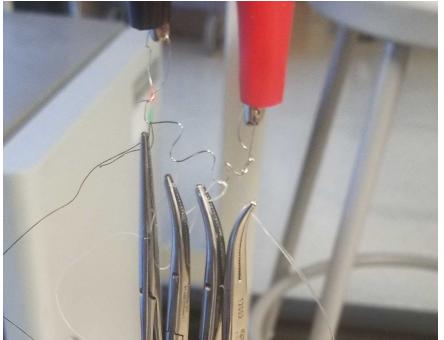
Next Week

- Check internal fit with battery rewiring, antenna cable, and camera board
- Windform fitcheck part 2 when it arrives
- Continue thermal testing of different scenarios (freezer + burn wire test)
- Start implementing fake ground station.



Mechanical

Week 6, Spacecraft Design Lab 2019-2020



Burn line current tests

Updated Key Milestones (past + present)

- Stable CAD model 11/19
- Printed prototype 11/19
- Test vacuum chamber 11/19
- Preliminary battery testing 11/19
- Order Windform prototype 11/19
- Antenna prototype 12/19
- Fit check and update CAD 1/20
- Reorder Windform 1/20
- Thermal models in Matlab/ANSYS 1/29

Interfaces

• Electrical/ Avionics

- Battery rewiring
- Burn wire current requirement?

• Communications

- Info on how to do a fake ground station

• Flight Software/ GNC (none)

Requirements

- Vibe table bolt pattern @ Swarm

Weekly Results

- Internal fit check (flat flex redesign and battery rewiring ongoing)
- Windform was shipped
- Antenna designs checked by Comms for ridge test
- Current requirements for burn line.
- Thermal battery testing with burn wire circuit

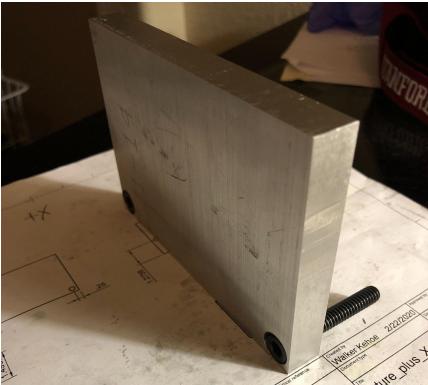
Next Week

- Check internal fit with battery rewiring, antenna cable, and camera board
- Windform fitcheck part 2 when it arrives
- Continue battery thermal testing
- Start implementing fake ground station
- Construct windform antenna
- Machine test fixture (PRL reservation on Saturday 2/22)



Mechanical

Week 7, Spacecraft Design Lab 2019-2020



Fixture panel

Interfaces

- Electrical/ Avionics
 - Battery rewiring
 - Burn wire current requirement?
- Communications
 - Info on how to do a fake ground station
- Flight Software/ GNC (none)

Requirements

Updated Key Milestones (past + present)

- | | |
|----------------------------------|-------|
| • Stable CAD model | 11/19 |
| • Printed prototype | 11/19 |
| • Test vacuum chamber | 11/19 |
| • Preliminary battery testing | 11/19 |
| • Order Windform prototype | 11/19 |
| • Antenna prototype | 12/19 |
| • Fit check and update CAD | 1/20 |
| • Reorder Windform | 1/20 |
| • Thermal models in Matlab/ANSYS | 1/29 |

Weekly Results

- Fit check (flat flex and -Y/camera board redesign, new Windform looks great)
- Windform rails reordered
- Current requirements for burn line.
- Burn wire circuit baseline testing (pending debugging)
- +Y PLA board fab
- Antenna documentation in progress

Next Week

- Check internal fit with battery rewiring, antenna cable, and camera board
- Burn wire testing with cold batteries
- Start implementing fake ground station
- Continue machining test fixture (reservations 2/26,27,28)

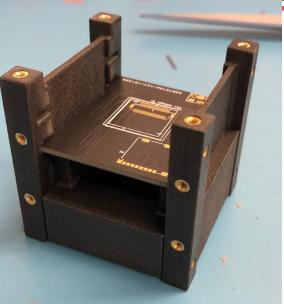


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Week 8, Spacecraft Design Lab 2019-2020

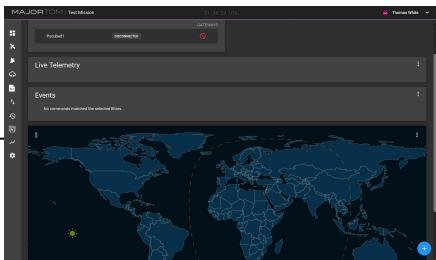


Fixture progress



New Windform

GUIII



Interfaces

- Electrical/ Avionics
 - Battery rewiring
 - Burn wire current requirement?
- Communications
 - Telemetry and packet structure details
- Flight Software/ GNC (none)

Requirements

- New PCBs

Updated Key Milestones (past + present)

- | | |
|----------------------------------|-------|
| • Stable CAD model | 11/19 |
| • Printed prototype | 11/19 |
| • Test vacuum chamber | 11/19 |
| • Preliminary battery testing | 11/19 |
| • Order Windform prototype | 11/19 |
| • Antenna prototype | 12/19 |
| • Fit check and update CAD | 1/20 |
| • Reorder Windform | 1/20 |
| • Thermal models in Matlab/ANSYS | 1/29 |

Weekly Results

- Fit check (flat flex and -Y/camera board redesign)
- New Windform fit
- Current requirements for burn line.
- Single battery burn wire/thermal testing
- Antenna documentation in progress
- Slotted +Y board deployment tested
- Made test ground station! Fit with state machine. Has GUI.

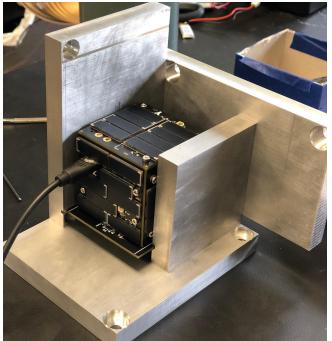
Next Week

- Check internal fit with battery rewiring, antenna cable, and camera board
- Burn wire/thermal testing with full battery pack
- Start implementing fake ground station
- Finish fixture (PRL reservation 3/5)
- Try to get test ground station to talk to radio!



Mechanical

Week 9, Spacecraft Design Lab 2019-2020



Vibe Fixture Progress



Turntable Fixture v1

Updated Key Milestones (past + present)

- Stable CAD model 11/19
- Printed prototype 11/19
- Test vacuum chamber 11/19
- Preliminary battery testing 11/19
- Order Windform prototype 11/19
- Antenna prototype 12/19
- Fit check and update CAD 1/20
- Reorder Windform 1/20
- Thermal models in Matlab/ANSYS 1/29

Interfaces

- Electrical/ Avionics
 - Battery rewiring
 - Burn wire current requirement?

- Communications
 - Telemetry and packet structure details

- Flight Software/ GNC (none)

Requirements

- New PCBs
- Whenever packet structure is settled, let us know!

Weekly Results

- Turntable fixtures designed and printing
- Current requirements for burn line.
- Single battery burn wire/thermal testing
- Antenna documentation in progress
- Made test ground station! Fit with state machine. Has GUI.
- Vibe fixture finished* (*needs a few changes to fit antenna and simulate envelope more realistically)
- Met with AV and GNC. Got info on state machine and packet structure.

Next Week

- Documentation
- Clean up ground station current progress for next person.