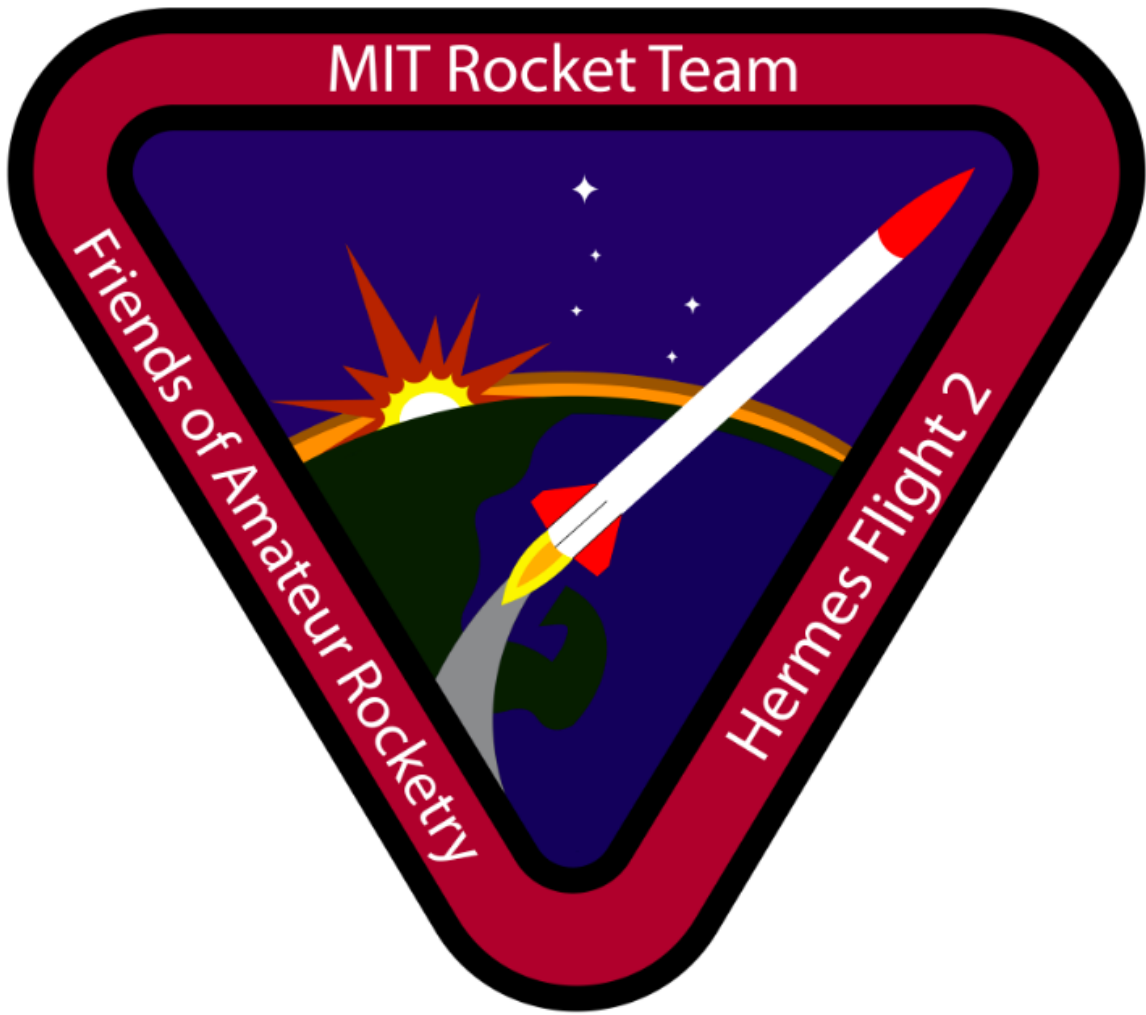


Hermes II Launch Operations

Version 2.0



Start Here: Assign Roles

Role	Responsibilities	Primary	Secondary
Madam President	Signs for issues. Calls FAA. Ensures team success. Final go-nogo.	Julia Gaubatz	
Chief Engineer	Troubleshoots & signs off for issues & V&V events. Gives Hermes II go-nogo	Andrew Reilley	
Launch Lead	Manages launch operations & timeline. Gives launch go-nogo.	Andrew Adams	
Integration RE	Ensures the checklist is followed for all subsystems. Identifies issues.	Maggie Zheng	
Soft Goods RE	Ensures Soft goods properly assembled		
Payload Stack RE	Ensures payloads properly installed		
Piston Assembly RE	Ensures piston assembly properly installed		
Lower Electronics RE	Ensures LE properly assembled		
Avionics Bay RE	Ensures flight computers & wiring properly installed. Verifies communication w/ GS.		
Propulsion RE	Ensures motor properly assembled		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		
Free Hands - Hermes	Supports rocket assembly, signs as witness/RE		

Report deviations from nominal checklist here:



Hermes II Launch Operations

Page 3

Mission Control -- Launch Line	Monitors ground communication w/ Pyxida & Telemega before, during, & after flight		
Mission Control -- Away Team	Monitors ground communication w/ Pyxida & Telemega before, during, & after flight		
Mission Control -- Video & beacon	Monitors ground communication w/ video link & beacon before, during, & after flight		
Pad Ops 1	Prepares launch tower and launch system for flight		
Pad Ops 2	Prepares launch tower and launch system for flight		
Photos 1 - Preflight	In charge of pre-flight checkout photos, sets up pad cameras		
Photos 2 - Ken Burns	In charge of photos of team members day-of, sets up pad cameras		
Desert Safety Overlord	Mitigates desert injuries and responds to medical issues.		
Gordon Ramsay	Makes sure we all have food		
Hermes of winged soles	If stuff needs to move, they move it		
Ground Comms	Sets up ground comms & manages frequencies		
Support Lead	Supports anything else to ensure team success		
Free Hands - Support	Supports anything else to ensure team success	Everyone else	Everyone else

Report deviations from nominal checklist here:



T-12 days (June 24)

1. Call FAA per Appendix B
2. Verify & record their response (or record lack thereof)
 - a. If necessary, call them tomorrow (T-11 days)
 - b. Verify & record their response (or record lack thereof)
 - i. If necessary, call them tomorrow (T-10 days)
 1. [Note - this is 7 working days before the launch (not incl. 7/4)]
 - ii. Verify & record their response (or lack thereof)
 - iii. If no response, notify FAA contacts.
3. Verify all rocket parts are in and buy necessary parts for fixes

Notes from FAA Call(s):

T-3 days (July 3, first thing in the morning)

1. Call FAA per Appendix B
2. Verify & record their response (or record lack thereof)

Notes from FAA Call(s):

Report deviations from nominal checklist here:



T-2 days: Master

Procedure:

1. Charge the following batteries for flight:

Pyxida
Telemega
Marsa
Firefly 1 - Lower elec
Firefly 2 - Lower elec
Firefly 3 - AV Bay Radial
Firefly 4 - AV Bay Radial
Firefly 5 - AV Bay Axial
Payload DAQ
Video Downlink
Outreach Payload
Lower electronics DAQ
Load Cell?
Launch system relay
Ignition system
Pyxida backup
Telemega backup
Marsa backup
Payload DAQ backup
Outreach Payload backup
Lower electronics DAQ backup

Report deviations from nominal checklist here:



T-1 day: Master

Procedure:

1. Assign all T-1 day checklists
2. Integration is completed by each subsystem. Collect integration procedures & signed checklists for the following subsystems:
 - a. Motor
 - b. Piston
 - c. Soft Goods
 - d. Avionics Tower
 - e. Payload Stack
 - f. Lower Electronics
 - g. Mission Package Assembly
3. Fully assemble the rocket & verify mass and CG
 - a. Disassemble only shear pins from FRR and recovery attachment to motor to allow transport in cars
 - b. Sign the rocket!
4. Verify all T-1 day procedures are completed:
 - a. Assembly procedures leading up to Final Integration
 - b. Preflight Simulations
 - c. Charge Laptops & Backup Electronics
 - d. Gather Food & Stuff
 - e. Packing
 - f. Radios (through T-1 day items)
5. Record any changes to nominal assembly procedure to announce at launch site:
6. Record any changes to personnel:
7. Record any other changes that people need to know at FAR:
8. Sleep well, and travel safely
9. Proceed to **Prelaunch: Master** in the morning

Report deviations from nominal checklist here:



T-1 day: Packing

Pack everything according to the packing list

Report deviations from nominal checklist here:



T-1 day: Gather Food & Stuff for launch day

Procedure:

Obtain the following:

- Food & Equipment for launch

There are 34 people!

Recommended:

Sandwiches	Snacks	Snacks (Choose 2-3)	Beverages	Equipment for people
Wheat bread (2 loaves)	Apples (15)	Saltine crackers or Ritz (2 boxes)	50 gal water	Cooler for food (2)
White bread (2 loaves)	Bananas (10)	Industrial size goldfish (1 box)	50 lbs ice	5 gallon cooler for water (2)
Ham (2 lbs)	Oranges (big bag)	Oreos	Gatorade powder for 10 gal (1 flavor)	Lawn chairs (10)
Smoked Turkey (2 lbs)		Non-chocolate cookies (1 box)		UNO cards
Another meat (2 lbs)		Granola Bars (2 boxes)		Regular cards
Cheese (>40 slices)		Chips/pretzels (2 bags)		Sunscreen
Lettuce (1 head)				
Veggie burgers?				
non-Peanut butter & Jelly (1 jar each)				

Report deviations from nominal checklist here:



T-1 day: Charge Laptops & Backup electronics

- Charge backup batteries:
 - Ignition experience (??? LiPo)
 - Pyxida (1x 1S and 1x 2S)
 - Telemega (1x 1S LiPo)
 - MARSAs (1x 1S)
 - DAQ backup (1x 1S LiPo, 1x 2s LiPo)
 - Onboard Cameras (as many as we have that are compatible)
- Charge backup laptops:
 - 1x with Pyxida ground station
 - 1x with Telemega ground station
- Charge Pad cameras
 - As many as possible
 - Record Pad Cameras below:
 - Label Pad Cameras by Number (used in later checklist)

#	Camera	Note
1		Highspeed
2		<20 ft
3		
4		
5		
6		
7		
8		
9	(stills only)	
10-12	Cell phones	

Once complete, **sign and verify completion with Launch Lead.**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



T-1 day: Preflight Simulations

<https://predict.habhub.org/#!/uuid=8cae7c31596800bb882e862e0c58a28699ebe2c9>

1. Using the link above, estimate landing site of Hermes II

Ascent Velocity	200 m/s (avg. for Hermes II)
Estimated altitude (m)	Use above (otherwise, 24000 m)
Descent velocity	10 (main at apogee) and 30 m/s
Launch time (UTC)	1400 - 1900
Launch date	11 May 2019
Lat (Field A)	42.357294
Lon (Field A)	-71.097918
Lat (FAR)	35.35031
Lon (FAR)	-117.807

Record estimated landing locations:

Decent rate	Time	Latitude	Longitude
30 m/s	1400 UTC		
30 m/s	1500 UTC		
30 m/s	1600 UTC		
30 m/s	1700 UTC		
30 m/s	1800 UTC		
30 m/s	1900 UTC		
10 m/s	1400 UTC		
10 m/s	1500 UTC		
10 m/s	1600 UTC		
10 m/s	1700 UTC		
10 m/s	1800 UTC		
10 m/s	1900 UTC		

Report deviations from nominal checklist here:



Hermes II Launch Operations

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RasAero Preflight Simulation Procedure

1. Verify & record the rocket's total mass and CG location against the RasAero model.

Total mass (lbs)	
CG location (inches from NC tip)	

2. Adjust the simulation if necessary. Re-run a nominal simulation with the following parameters:
 - a. 5 deg. Launch angle
 - b. 18 ft. rail length
 - c. Ground winds from day-of forecast
 - d. Temperature from day-of forecast
3. Verify & record parameters below of nominal simulation
4. Run off-nominal simulations
 - a. - 5 deg. Launch angle
 - b. +/- 15 mph winds
 - c. + 10 deg C

Parameter	Nominal	-5 degrees	+15 mph	-15 mph	+10 deg C
Stability Margin off rail (calibers)					
Estimated altitude (ft)					
Maximum Mach					
Landing distance (ft)					

Once complete, **sign and verify completion with Launch Lead.**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



Prelaunch: Pad Setup Checklist

Materials:

Towels

Water

6.2" short tube

Checklist:

- Perform any necessary assembly (check with FAR personnel)
- Clean the rails with wet towels
- Adjust the rails such that the 6.2" tube slides cleanly down the rails with light pushes
- Lower the launch tower, and leave it
- Set up ignition system
 - Verify the system works with an Ematch
 - Afterwards, disarm and short the ignition leads

Once complete, **sign and verify completion with Launch Lead.**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



T-1 day: Radios

Procedure:

1. Set up radios with callsigns, frequencies, and channels - record below

Name	Frequency	Channel	Callsign	Who has it?
Launch Line				
Away Team				
Recovery Team				
Backup				
Pyxida				Hermes
Telemega				Hermes

2. Return the checklist to the binder.

Prelaunch: Radios

1. Confirm that these frequencies are not interfering with FAR personnel.
2. Record any changes above

Once complete, **sign and verify completion with Launch Lead.**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



Prelaunch: Master

Welcome to Launch Day!

Procedure:

1. Verify all personnel and cars have arrived. Mark on Car Assignment list
2. Set up launch site with Tables, Tools, Rocket Parts, and Food
3. **Hold Prelaunch briefing with as many people as possible (keep it short)**
 - a. Go over roles
 - i. Introduce to FAR personnel
 - b. Remind about safety hazards
 - i. Desert hazards (scorpions, heat, snakes, etc.)
 1. Drink water and eat salty snacks
 2. Let people know if you feel queasy
 3. Identify facilities (bathroom)
 - ii. Rocket hazards
 1. Keep avionics out of the sun
 2. Keep motor out of the sun
 - c. Estimated timeline
 - d. Changes since the previous evening. (Check T-1 day Master)
4. Before proceeding to Pad Operations, acquire & verify the following checklists
 - a. Final Integration Procedures
 - b. Pad Setup
 - c. Radios
5. Check the vehicle with the RSO.
 - a. Perform any necessary changes
6. Take a picture with the entire team present holding the rocket, with mountain backdrop

Once complete, **sign and verify completion.**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Once complete, start:

Launch: Loading the Rocket to the Launch Rail

Launch: Pad Cameras, and

Launch: Away Teams

Report deviations from nominal checklist here:



Launch: Away Teams

Goal: Assign people to away teams and identify locations for away teams (~ $\frac{1}{4}$ mile away from launch tower)

Andrew and Diane write information here

Report deviations from nominal checklist here:



Launch: Pad Cameras

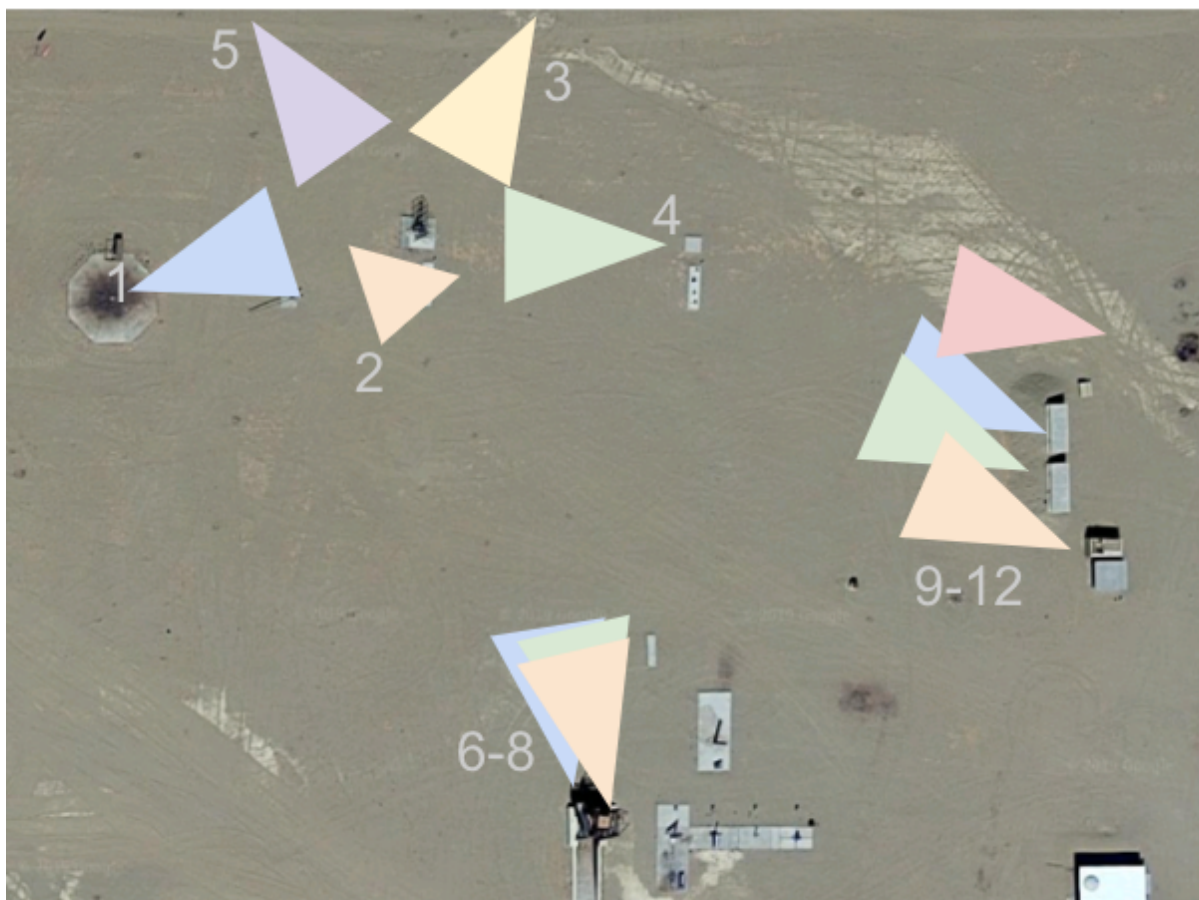
Set up cameras pointing at the Pad.

Use discretion as to which angles we get if there are <8 available pad cameras.

Priorities (in order):

High speed (50-100 ft away), High quality (50-100 ft away), away tower view (mounted on tall tower with staircase), Very near pad liftoff (<20 ft away), then redundancies

Designate 3 people who will set up cell phones at the launch line.



Report deviations from nominal checklist here:



Launch: Loading the Rocket to the Launch Rail

To be completed only after all Integration Checklists are complete

Materials

Assembled rocket
Launch rail
Unused igniter on stick
Blue tape
Safety glasses
Laptop with ground station software
Pyxida ground receiver
TeleMega ground receiver
Motor cover

Reference: Altimeter Beep Sequences

- Marsa
 - 5 Beeps - Power applied
 - 5 Beeps - After startup countdown
 - 3 Beeps - Continuity Testing Beginning
 - Repeat: **2 Beeps** indicates Continuity is good
 - 1 Beep indicates continuity is bad
- TeleMega
 - Series of Beeps indicating decivolts of battery - Startup
 - **dit dah dah dit** (dit is short, dah is longer beep) - Entering pad mode
 - Repeat every 5 seconds: **dit dit dit** - Indicates Main and Apogee continuity
 - **dit dit** is just Main continuity
 - **dit** is just Apogee
 - **Braaaap** is not continuity on either
 - Landed is dit dah dit dit
- Pyxida
 - **Dit dit** - Every ____ seconds (infrequent)

Report deviations from nominal checklist here:



Hermes II Launch Operations

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Procedure for Loading the Rocket to the Launch Rail:

1. Verify launch tower is lowered and ready to receive rocket
2. Slide rocket onto launch tower
 - a. Gradually slide the rocket onto the tower
3. Rotate rail and rocket to vertical
 - a. Secure rail in vertical position before letting go of rocket
4. Lower Electronics startup
 - a. Turn on and start recording 2 axial cameras in lower electronics section (verify beep sequence)
 - b. Turn on DAQ (verify LED on)
5. Flight Computer Startup (Telemega, Pyxida, MARSa)
 - a. Verify ground stations ready
 - b. Turn left-most screw switch for Telemega
 - i. Listen for TeleMega beeps.
 - ii. Ground Station: Check TeleMega Flight Screen and ensure all Go/No go telemetry
 1. Battery Voltage
 2. Apogee Voltage
 3. Main Igniter Voltage
 4. On Board Data Logging
 5. GPS Locked
 6. GPS Ready
 - c. Turn middle two screw switches for Pyxida
 - i. Listen for Pyxida beeps
 - ii. Ground Station: Check Pyxida Screen
 1. Go/No-Go screen on Ground Station
 - iii. Turn Cameras on using Pyxida from the Pyxida ground station
 - d. Turn right-most screw switch for MARSa
 - i. Listen for MARSa beeps to verify go-nogo
6. Call FAA (insert info here) to notify of imminent launch (President)
7. Remove all personnel from launch pad except Team Lead, Safety Officer, and Propulsion Operator
8. Insert igniter into motor. Igniter wires are shorted until step d.
 - a. Remove the motor cover.
 - b. Insert the igniter on stick into the motor throat.
 - c. Replace the motor cover, with the igniter wires sticking out
 - d. Check to make sure there is no voltage across the igniter clips
 - e. Verify the igniter is as far up the motor as possible.
9. Connect the igniter leads to the clips and make sure they do not touch each other or other metal
10. Check continuity of igniter and leave pad area

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Proceed to **Flight**

Report deviations from nominal checklist here:



Launch: Flight

Procedure:

1. Verify Completion of the following checklists:
 - a. Loading the Rocket on the Launch Rail
 - b. Pad Cameras
 - c. Away Teams

2. Quickly execute GO-NOGO poll: Anyone can call HOLD HOLD HOLD then the reason why
 - a. Verify that FAA Air traffic control received call
 - b. Verify all Avionics are properly armed and communicating (Mission control go-nogo)
 - i. Launch Line
 - ii. Away Teams
 - c. Chief Engineer: Hermes II Rocket go-nogo
 - d. Verify launch clearance from FAR
 - e. Verify ground winds within limits
 - f. Verify all cameras are ready
 - g. Verify spotters ready to start stopwatches
 - h. Verify all personnel are clear of launch site
 - i. Verify sky is clear of any planes or other obstructions
 - j. Verify igniter continuity
 - i. If all pass, recommend go for launch to President
 - k. President: go-nogo

3. Commence launch with on-site launch equipment.
 - a. Announce countdown as loud as possible from 10 seconds. Arm launch box at 3 seconds. Fire at 0.
 - b. Proceed to contingency checklists if necessary.

Nominally, proceed to **During Flight**.

Report deviations from nominal checklist here:



Hermes II Launch Operations

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During Flight:

All team members should watch the rocket as much as possible. When an event (drogue deploy, main deploy) is seen, team members should call it out and point to where they see the rocket.

Spotters: Watch the rocket with binoculars, if possible. Near landing, spotters must find landmarks for by-eye triangulation.

Photographers: Take pictures - focus on the ascent & chute deployment portions

Mission Controllers:

- Two people monitor Pyxida and TeleMega on separate computers.
 - Call out the state of the rocket (altitude, velocity, distance from pad, if known) at every event and every 30 seconds. If not, then call out "Signal Lost" until telemetry is regained.
- Two other people point omnidirectional antennas to track rocket, with Yagi antennas nearby to plug in to directionally track rocket if we can't receive signal with omnidirectionals.
- Another person using the radio gun to track the radio beacons on the rocket
- Use these tools to try and get direction of rocket, and its altitude and state so we can try to see it under Main parachute

After motor burnout verified:

1. Make sure the fins are still on
2. Cheer
3. Try to regain telemetry

If drogue deployment is not verified after 120 seconds:

1. Assume ballistic recovery until mission control calls out a telemetry signal
2. If no signals, between 120 and 180 seconds, watch and listen closely for:
 - a. A sudden main parachute (woooosh + wuhmf)
 - b. the sound of fins wooshing and a loud crash or thud
3. If radar beeps stop after this time, assume ballistic crash and proceed to contingency checklist, otherwise, return to nominal flight

After drogue deployment verified:

1. Collect pad cameras to prevent overheat
2. Continue to call out telemetry every 30 seconds

After main deployment verified:

1. Spotters find landmarks to align
2. Mission Controllers log GPS packets
3. Align vector from radar pings

After flight, proceed to the appropriate recovery checklist.

Report deviations from nominal checklist here:



In the Event of a Hangfire

Scope: This procedure should be implemented in the case where the igniter loses continuity but the motor does not light.

Risk: Hang fires can result in risk of unexpected motor ignition.

Common Causes: No igniter continuity. Insufficient current to fire the igniter. Insufficient pyrogen to set off the motor/the pyrogen burned too slowly.

Materials:

4 team members
Unused igniter
Blue Tape
Safety Glasses
Launch control system

Procedures:

- 1) **Wait either 60 seconds or until the range is clear** to leave the launch line and approach the rocket, whichever is longer.
 - a) Ask the LCO, RSO, and Safety Officer before approaching the rail.
 - b) 2 team members the launch rail with the extra igniter. Both representatives should wear safety glasses
- 2) 2 team members reset pad cameras
- 3) Uninstall the failed igniter
 - a) Dispose of appropriately.
 - b) Reattach motor cover.
- 4) Install the new igniter
 - a) Make sure leads are shorted before insertion
 - b) Replace the motor cover, with the igniter wires sticking out
 - c) Verify the igniter is as far up the motor as possible.
 - d) Check to make sure there is no voltage across the igniter clips
 - e) Check the leads to make sure they are not shorted on the launch rail or each other.
- 5) Return to the launch line.

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Return to **Launch: Flight** Checklist

Report deviations from nominal checklist here:



In the Event the Rocket Needs to be Removed from the Pad

This checklist covers the procedures that should be followed when the rocket needs to be removed from the pad.

Causes: Including but not limited to: numerous hangfires in a row, battery life issues, a shortage of available launch window, or sustained high winds.

Materials:

Safety Glasses

Cool Cloths

~8-10 team members

Laptops w/ Telemetry

Procedures:

- 1) Ask LCO and RSO to approach the rail.
 - a) 6-8 team members near the rail should wear safety glasses until igniter is out and avionics are disarmed
- 2) 2-3 team members collect pad cameras
- 3) Uninstall the igniter.
 - a) Short the leads of the igniter **after** removal.
 - b) Store the igniters and the stick in a safe location.
 - c) Carefully attach the plastic cap over the nozzle exit.
- 4) Turn off Avionics using screw switches
 - a) Verify no more beeping and verify loss of telemetry
- 5) Carefully lower the rocket.
- 6) Using cool cloths, remove the rocket from the rail
- 7) Carry the rocket to base camp.
 - a) All team members should help support the rocket.
 - b) Travel slowly. The rocket is heavy and the terrain is uneven.

Once the issue is resolved, proceed to On Loading the Rocket to the Pad

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



In the Event of a CATO:

Materials:

Shovels

Cameras

Procedure:

Cry

Document

Salvage

Report deviations from nominal checklist here:



In the Event of a LiPo Short:

Materials:

Fire Extinguisher

Sand

Screwdriver for screw switches

On the ground -- procedure:

1. If possible, unshort the LiPo
2. Use fire extinguisher and/or sand to put out any fires
 - a. If the fires are out of hand, call authorities
3. Bury the LiPo in sand until it cools
4. Dispose of appropriately

On the Pad -- procedure:

1. If possible, safe the rocket by:
 - a. Disarming the ignition system
 - b. Removing the igniter from the motor
2. Wait for the LiPo fire to burn out before extracting avionics

Report deviations from nominal checklist here:



Post-flight: Nominal Recovery

Materials:

Rocket-carrying GSE

6-8 team members

Snacks

3 L water/person

Sunscreen

Hats

Sunglasses

Hiking shoes

Walkie-talkies or other comms. Phones are backup only.

Tracking equipment

Cameras (DSLR or otherwise, to document landed state of the rocket)

Soft Soft goods bags

Small bag for SD cards

Procedure:

1. Make sure everyone collecting the rocket has hiking shoes, snacks, \geq 3L of water & sunscreen.
 - a. Hats and sunglasses are optional but highly recommended
2. Designate one member for comms, check that comms has enough battery for recovery and launch site. Phones are backup only.
3. Notify FAR personnel that the group is leaving. Verify that they heard, then leave.
4. Once the group gets within ~500 feet of the estimated location, have people fan out
5. When the rocket is found, call the rest of the group.

Approach:

- 1) All team members should wear safety glasses when approaching the rocket.
- 2) Take pictures of the entire scene before moving anything**
 - a) Log any broken parts
- 3) Make sure all charges fired
- 4) Turn off avionics
- 5) Pack up soft goods & store in the soft bags
- 6) Carefully remove the rest of the rocket from the ground
- 7) Carry the rocket to base camp.
 - a) All team members should take turns
 - b) Stop frequently in hot weather
- 8) Proceed to **Post-flight data recovery**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:



In the Event of Main at Apogee:

Follow nominal recovery checklist with $\frac{1}{2}$ of the team, and have the other half start cleaning up the launch site.

Discuss contingency of recovering the following day.

Report deviations from nominal checklist here:



In the Event of Ballistic Recovery

This checklist covers the procedures that should be followed if the rocket need to be recovered after a lawn dart.

Risk: Lawn darded rockets can still have live charges that need to be disarmed before the rocket can be recovered.

Materials:

6-8 team members

Shovels

Safety Glasses

Cool Cloths

Limit Switches

Empty Box

Work Gloves (several pairs)

Procedures:

- 1) All team members should wear safety glasses when approaching the rocket.
- 2) Disarm the rocket
 - a) Disassemble as necessary to remove charges and batteries from rocket
- 3) Carefully remove the rest of the rocket from the ground
- 4) Carry the rocket to base camp.
 - a) All team members should take turns
 - b) Stop frequently in hot weather
- 5) Proceed to **post-flight data recovery**

Report deviations from nominal checklist here:



Post-Flight: Data Recovery

Avionics Flight Computers:

1. Copy packet logs from Pyxida and TeleMega and distribute them to other laptops and to the wiki to ensure data isn't lost.
2. Plug Altimeters into laptops and download their onboard flight files using their respective ground station software.
 - a. Distribute these flight files to other people and to the wiki.
3. Pull out micro sd cards from cameras, copy their data onto Dropbox, multiple laptops and wiki

Lower Electronics:

4. Acquire data from DAQ, copy data onto Dropbox, multiple laptops and wiki
5. Pull out micro sd cards from cameras, copy their data onto Dropbox, multiple laptops and wiki

Payload:

6. Acquire data from DAQ, copy data onto Dropbox, multiple laptops and wiki

All structural parts and soft goods:

7. Take detailed photos of state of hardware. This will be used to determine whether or not we can re-fly hardware (!)

Report deviations from nominal checklist here:



Appendix A:
Assembly Procedures and
Signed Integration Checklists

Report deviations from nominal checklist here:



Procedure

Added by [Andrew C Adams](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:33

Motor

Materials

- 5/16", 1/4" hex key
- Epoxy
- High temperature grease
- Gorilla glue/polyurethane (PU) glue
- Room temperature vulcanizer (RTV)
- Adjustable spanner
- Rubber Mallet
- Boattail Allen Key**

Procedures

- a. Assemble the nozzle. Add o-rings and lubricate well.
- b. Follow the '[MIT Rocket Team Grain Cutting and Bonding Procedure](#)' to bond the grains to the liner, using the nozzle assembly as a placement guide. Apply aeropoxy to the splice, if any.
- c. Bolt the nozzle assembly to the case, taking account of directionality.
- d. Slide the motor load into the case.
- e. Use RTV to attach the insulation disk to the forward closure.
- f. Attach the pressure transducer to the forward closure.
- g. Add o-rings to the forward closure and lubricate generously. Slide the closure into the open end of the case.
- h. Bolt the forward retention ring to the case.

[Like](#) Be the first to like this

[Labels](#) None

HERMES II INTEGRATION CHECKLIST

Motor

Transport checks:

- No significant damage to nozzle & nozzle carrier assembly
- No significant damage to FRR & forward closure
- No significant damage to case body
- No significant damage to grains

- Take checkout photo of installed grains (as best as possible)**
- Take checkout photo of assembled motor**
- All bolts securely torqued
 - Torque stripe 3 bolts on each pattern
 - Take checkout photo of bolt patterns**
- PTap is torqued to forward closure
- Load cell is torqued to forward closure
 - Take checkout photo of FRR with instrumentation**

(Fin can & boattail installed at launch site)

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:

Procedure

Added by [Andrew C Adams](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:32

Piston

Materials

- Piston
- 1/4 in torque wrench
- Integrated Firebolts
- Multimeter
- Teflon tape
- 2 1/4 NPT plugs
- Safety goggles
- Gloves
- Weigh boats
- Popsicle sticks
- Elbow joint
- Tee fitting
- Adjustable wrench
- Vice grip/pliers
- Small scale

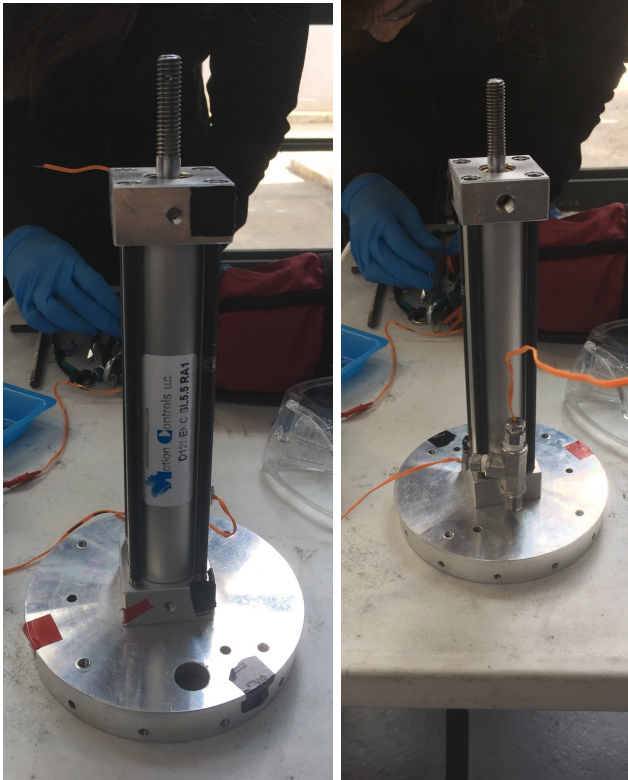
Procedures

1. Using a 1/4 inch torque wrench, ensure that the bolts holding the piston together are very very tight. If the bolts are loose, the piston will lose pressure as it extends. (torque wrench adapter in piston box)
2. Use multimeter to check continuity of Firebolt (should be about 1.0-1.4 ohms) and twist the wires to short it. Two people should visually confirm that it is shorted. Wrap the Firebolt with five wraps of Teflon tape. Use pliers to screw firebolt into the NPT plug.
3. Everyone put on safety glasses. From now on, everyone within the vicinity of the pyrotechnics must wear safety glasses.
4. Measure and pour 0.2 g of black powder into the other side of the plug, holding over a weigh boat to catch any fallout. Seal the opening by wrapping over the head and opening three times with Teflon tape. Make sure Teflon tape is flush on the inside.
5. Repeat steps b-d
6. Compress the piston completely!
7. Screw an elbow joint into a side female end of the tee after adding Teflon tape.
8. Wrench the elbow and tee assembly into the inlet hole of the piston with 5 wraps of Teflon tape until extremely tight and turned upright.
9. Put the 2 assembled plugs into two remained female ends of tee fitting
10. Clock the tee fitting close to the body of the piston so the piston fits better into AV bay
11. Test the piston by pulling up rod for 5 secs and seeing it is sealed
12. Log Firebolts

HERMES II INTEGRATION CHECKLIST

Piston

- Completely compressed
- Seal Check -- pull on piston rod, hold for 5 sec, let drop back to full compression
- Bolts to the bulkhead are tightened completely
- Clocking marks are lined up
- Checkout photos taken of all sides of piston**



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Report deviations from nominal checklist here:

Packing Procedures

Added by [Maggie Zheng](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:21

Materials

- Parachute Packing Box (shot bag, line holder, extra lines)
- Sandbags
- Rubber bands
- Soft goods
- Swivels box
- Flathead screwdriver
- Quicklinks - Maillon Rapide 400 kg

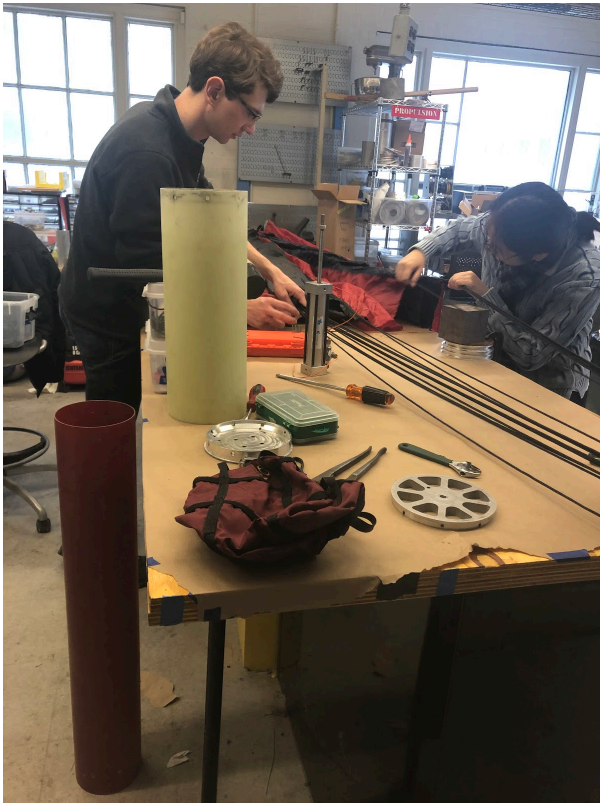
Procedures

During this process, one person should be taking checkout photos throughout similar to the ones below.

1. Fold Main (also may refer to [Hermes Parachute Packing Procedures](#))
 - a. Tie main parachute down, at the vent and at the end of lines, applying moderate tension



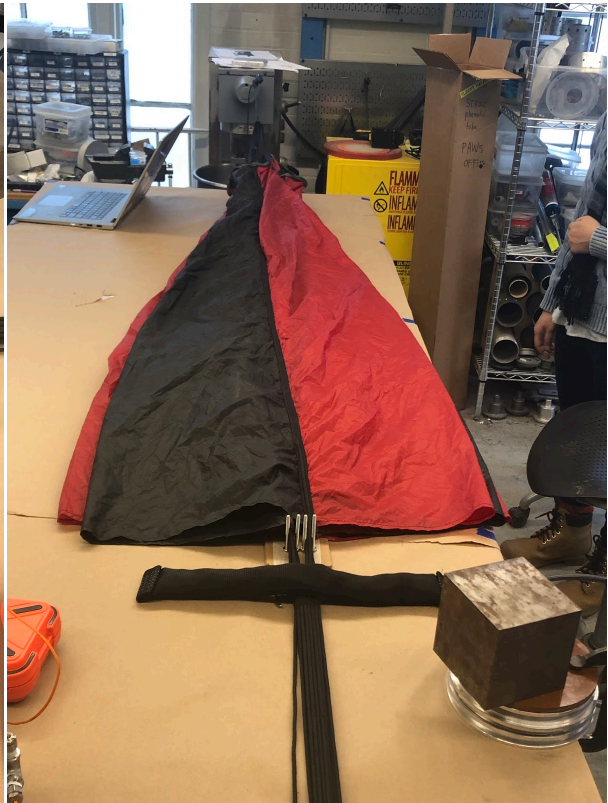
- b. Gather 8 lines and put them into the lines holder with weights, so you can focus on the other 8 lines.
- c. Go through each line and gore, inspecting gores for tears



d. Pleat gores so middles are together and put the lines in the holder as you go



e. Once you've nicely folded one side (8 lines and gores), weigh down with sandbag and fold over other side to repeat



- f. Fold up base of parachute towards middle in a triangle pattern
- g. Fold the wider sides of the parachute in towards the center line. Try to smooth out as much air as possible. Hold in place with sand bags.



2. Pack Main (Take checkout photos similar to below)

- a. Untie top of parachute from tension
- b. Attach the vent to bag bridle to the vent tapes by pulling it through its own loop
- c. Pull vent to bag bridle through the inside of the bag and the hole at the end. Secure bag handles and vent to bag bridle with a quick link.



d. Fold down the line-holding section of the bag so the bag is partially inside-out.

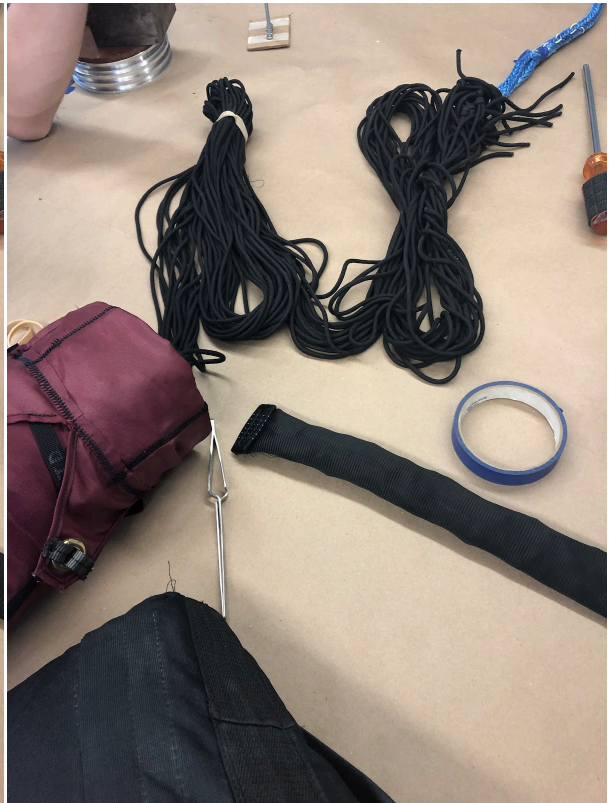


e. Z-fold the parachute and pack it into the bag.

f. Once the entire parachute is in the lower portion of the bag, secure flaps using the locking loop and locking pin.



g. Fold lines into bites, secure two bites with rubber bands on both ends. Secure Main Riser (Spectra) in z-fold with 2 rubber bands.

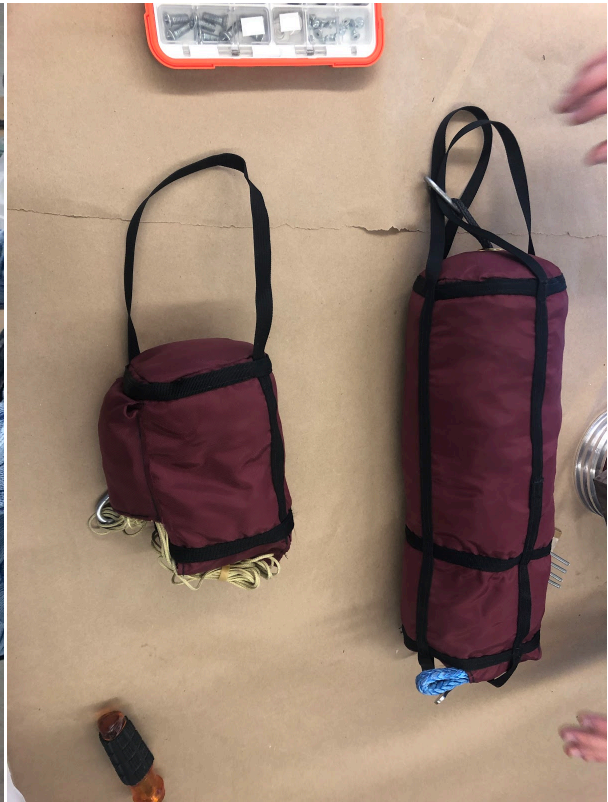


h. Pack lines into line-holding portion of the main bag and secure locking loop



3. Pack Drogue

- a. Similar to main (**Take photos throughout similar to main**)
- b. Secure flaps with banding system (to be tested)
- c. Coil lines into infinity loops, pack lines into side pocket.



4. Coil lines (**Take at least one photo per lettered step**)

- a. Get green swivels/hardware box and lines and risers
- b. Drogue riser (infinity loops)
 - i. Attach eye to eye swivel
- c. Motor section riser (2 coils, (infinity loops)
 - i. Attach fork to fork swivel using motor riser loop
 - ii. Tighten forks hard!
 - iii. Check that there are 2 loops
- d. Mission package riser ((infinity loops)
 - i. Attach smallest swivel

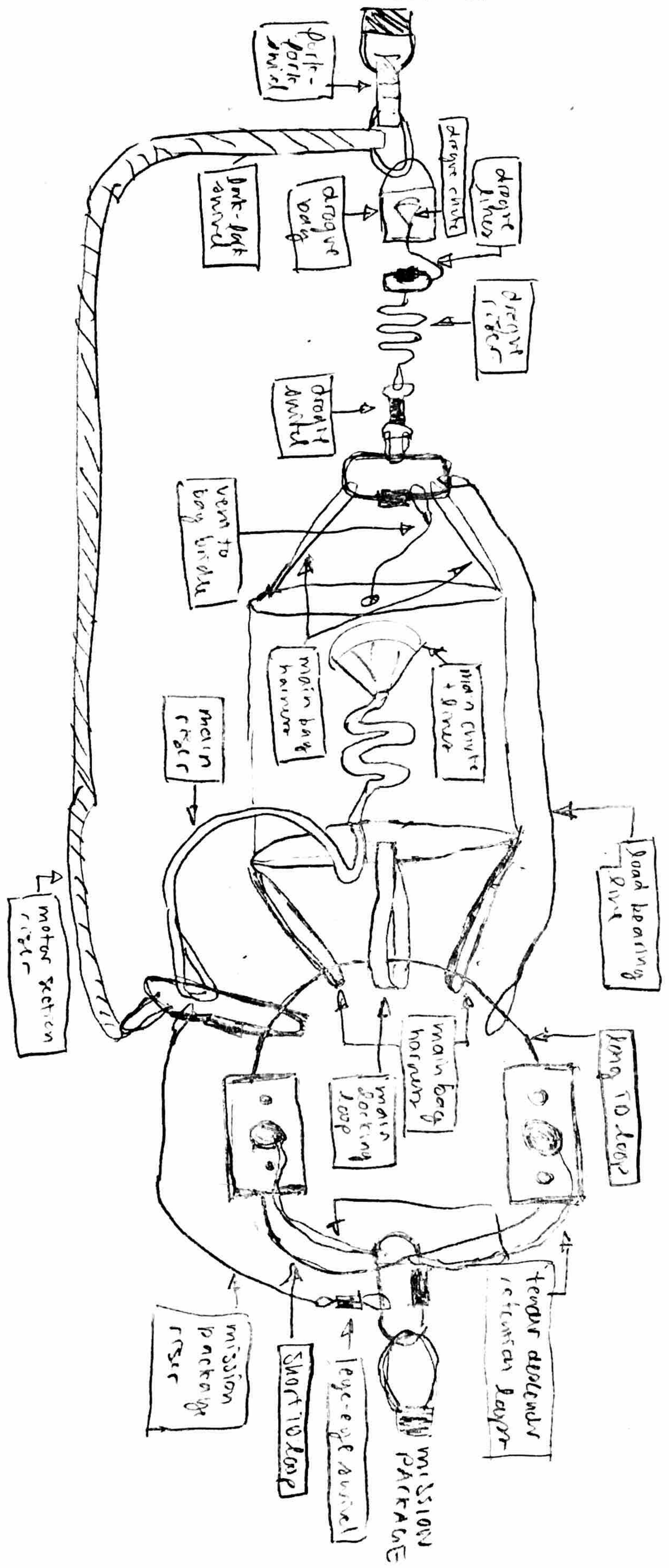


5. Slide radio beeper into pocket on the motor riser. Make sure it is on the end of the motor riser that will be further from confluence. **Take a checkout photo (no photo shown here).**

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Labels None

MOTOR SECTION



HERMES II INTEGRATION CHECKLIST

Soft Goods:

- All QL's have been tightened with a wrench
 - Torque stripe all QL's
- The vent-to-bag-bridle is not extended too far outside of the main bag
 - Checkout photo taken**
- Risers are in infinity loops (with blue tape)
 - Checkout photo taken**
- There are **5** items (main loops/harnesses, locking loop, load bearing, QL to 3 risers) on the longer TD connector and only **1** item (QL to MP swivel and riser + eyebolt) on the shorter sides
- Tender Descenders securely pinned together
- Connections to check with lines diagram:
 - Blue:
 - main locking loop
 - main bag loops/harnesses
 - load bearing riser
 - TDs
 - quicklink to main riser
 - MP riser
 - motor riser
 - Checkout photo taken of all blue connections**
 - Pink:
 - vent to bag bridle
 - main bag loops
 - drogue swivel and riser
 - load bearing
 - Checkout photo taken of all pink connections**
 - Cyan:
 - Eyebolt
 - 1500 lb. swivel
 - MP riser
 - quicklink with shorter TD loop
 - TD kevlar retention loops
 - Checkout photo taken of all cyan connections**
- Radio beeper is in the motor riser pocket (on the side farther away from confluence)

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Report deviations from nominal checklist here:

Assembly Procedures

Added by [Max K Kwon](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:35

Assembly Procedures for the Hermes II Avionics Tower

Materials

Allen Key '.077'

Small Flathead screwdriver

Small File

Pink Tape Small Phillips Head

Procedures

1. Independent Assembly of the Tower
 - a. Attach all electronics to the outer face plates
 - i. Screw down all flight electronics to their respective places
 1. Pyxida center
 2. Telemega left
 3. MARSa right
 - ii. Assemble the switch and secure it into place
 1. Attach the flight hardware electrical leads to the switch
 - b. Wire electrical leads to the flight hardware
 - c. Attachment of Cameras by securing the holders to the Camera face plates
 - d. Attach the battery holders to the two outer face plates
 - i. Run the power cables to near the battery holders and fix them down using (TBD)

Notes from last integration:

Standoff to panels

flight computers to panels- wire electrical lead

switch- electrical leads

battery + battery holder attach to panels- Leads to switch

camera- holders- plates

plates- ends

Hermes II Avionics Integration Procedure

Notes

- Communicate with recovery to sew on radio beacons
 - Need to be able to take beacons on/off relatively easily so we can add and remove batteries from them and test the beacons.
- Label which screw controls which altimeter, and beeps to listen for. Put this on side of rocket underneath screw terminals (low enough to see assuming someone's arm is reaching up high)
- Wiring Diagram of AV Bay needed (Vizio?), and updated AV Bay integration list

Need:

- Multimeter
- Soldering iron, solder, wires, wire stripper (in case of emergency, and things break)
- Marsa Display for checking continuity and double checking Marsa settings correct night before
- Micro and Mini usb cables (Marsa, TeleMega, Pyxida) for data download
- Laptop battery chargers to connect to cars, or battery packs we can plug into, or confirm we have power at FAR to plug into
- ESD protected board box
- Box for storing screws for AV bay
- Christmas tree light bulbs (x4)
- Micro SD cards and Micro SD card reader
- (In addition to parts listed on the Integration list from launch rehearsal)
- Telemega Ground Station
- 2mm flathead screwdriver
- Screwdriver with yellow handle for turning on screw switches
- Blue tape
- 2.4 x 20 mm screwdriver (green)
- 4 CR2032 batteries
- 2 radio beacons
- Radio gun
- Battery chargers
- Yagi 433 & 915
- Ground Station Pyxida (micro usb cable, pyxida, Pyxida LIPO, SMA connector)
- Pyxida ground station
- Pliers

Report deviations from nominal checklist here:

Hermes II Avionics Integration Procedure

Altimeter Configurations

- Marsa
 - Channel 1
 - Apogee
 - Accel Only
 - Delay 0.0s
 - Channel 2
 - Altitude
 - 2000 (ft)
 - Delay 0.0s
 - Channel 3: Off
 - Channel 4: Off
- TeleMega
 - Main deploy: 600 m
 - Apogee Delay: 0s
 - Apogee lockout: 0s
 - Frequency: 434.550 MHz Channel 0
 - Telemetry: Enabled
 - Telemetry Baud Rate: 38400 Baud
 - APRS interval: 0s
 - APRS SSID: 3
 - Callsign: KJ7CJU
 - Maximum Flight Log Size: 4096 kb (2 flight logs)
 - Igniter Firing Mode: Dual Deploy
 - Pad Orientation: **Antenna Up**
 - Accel Plus: 2029
 - Accel Minus: 2066
 - Beeper Frequency 4000
- Pyxida
 - TBR

Report deviations from nominal checklist here:

Hermes II Avionics Integration Procedure

Altimeter Beep Sequences

- Marsa
 - 5 Beeps - Power applied
 - 5 Beeps - After startup countdown
 - 3 Beeps - Continuity Testing Beginning
 - Repeat: **2 Beeps** indicates Continuity is good
 - 1 Beep indicates continuity is bad
- TeleMega
 - Series of Beeps indicating decivolts of battery - Startup
 - **dit dah dah dit** (dit is short, dah is longer beep) - Entering pad mode
 - Repeat every 5 seconds: **dit dit dit** - Indicates Main and Apogee continuity
 - **dit dit** is just Main continuity
 - **dit** is just Apogee
 - **Braaaap** is not continuity on either
 - Landed is dit dah dit dit
- Pyxida
 - **Dit dit** (infrequent) -- Prelaunch

Report deviations from nominal checklist here:

Hermes II Avionics Integration Procedure

DAY BEFORE

1. Check that radio gun battery is > 75%
2. Ensure All avionics batteries are fully charged
 - a. 1S lipos ~ 4.2 Volts (3x 1S lipos, TeleMega and Pyxida)
 - b. 2S lipos ~ 8.4 Volts (1x 2S lipo, Marsa)
 - c. Make sure we have 2 new 2032 batteries (Do not leave them in beacons overnight)
 - d. Make sure Cameras are fully charged, and micro sd cards are inserted and clear
3. Ensure Pyxida Firmware up to date
4. Ensure Ground Station software ready (on at least 2 laptops for redundancy)
 - a. AltOS installed and ready
 - i. Callsign set to KJ7CJU
 - ii. FAR Map loaded and preview to make sure it works
 - iii. Configure Ground Station Dongle for TeleMega
 - b. Marsa Connect Installed
 - c. Pyxida Ground Station Installed
5. Fully integrate the AV bay
 - a. **Take checkout photo of each panel. Nose cone side is top of picture.**
6. Test Altimeters inside of AV Bay
 - a. TeleMega and Pyxida get GPS
 - b. TeleMega and Pyxida Telemetry links
 - c. Continuity and Pyro firing tests using light bulbs
 - d. Retest Pyxida correctly activates cameras (for 5 seconds)
7. Clear Flight Files on TeleMega, Marsa, and Pyxida
8. Disconnect battery plugs so they're not connected overnight

D DAY

1. Check Voltages of batteries
 - a. 1S lipos > 4.1 Volts (3x 1S lipos)
 - b. 2S lipos > 8.3 Volts (1x 2S lipo)
2. Double check Marsa, Pyxida, TeleMega, and 3 cameras are in avionics Bay
 - a. Double check TeleMega and Pyxida placed **SMA ANTENNAS UP**
3. Ensure BBC and Camera Breakout are in the AV Bay, and cabling is inserted between them
 - a. Cables from camera breakouts to BBC, and cable from BBC to Pyxida)
4. Double check all screws in avionics bay are on tightly
5. Check Connections
 - a. Pyxida GPS connected and secured
 - b. Pyxida battery connections from screw switches inserted (backup + main battery)
 - c. TeleMega Switch cables inserted and secured
 - d. TeleMega LIPO to PYRO pins connected
 - e. Marsa switch cables inserted and secured
 - f. Screw cable connections secure
 - g. Screws inside of Screw switches
 - h. Ensure batteries plugged in (3x 1S lipos, 1x 2S lipo)

Report deviations from nominal checklist here:

Hermes II Avionics Integration Procedure

- i. All cables inserted into boards twisted if possible
6. Acquire TeleMega GPS by leaving TeleMega on for a few minutes
 - a. Leave battery plugged in after this (but screw terminal switch can be off)
 - b. This ensures warm start of GPS so it acquires GPS on pad faster
7. Insert battery in radio beacons (2x beacons) and test with the radio gun
 - a. Unfold all four antennas on the radio gun
8. Give Radio Beacons to Recovery to integrate onto the webbing
 - a. **Take checkout photo of Radio Beacons after attachment to Recovery**
9. Double check SMA wires connected to TeleMega and Pyxida and make sure they are fed through the payload bulkhead to be connected with antennas
 - a. Ensure Pyxida Panel directly below SMA antenna hole on payload stack
 - b. Ensure Pyxida SMA connected to 915 mhz antenna, TeleMega to 433 mhz antenna
10. Insert Pyro wires when recovery is ready
 - a. Check that the wires are stripped 1 cm (this prevents them from shorting together if they were more stripped)
 - b. Insert main pyro cables in TeleMega and Marsa main slots, screw them down tightly
 - c. Insert Apogee pyro cables in TeleMega and marsa apogee slots, screw them down tightly
 - d. Give the cables a firm tug to ensure they are connected well
 - e. **Take checkout photos of pyro wiring**
11. Test Marsa and TeleMega continuity, and Telemetry
 - a. EVERYONE STAND BACK FROM ROCKET AND BE QUIET
 - b. Turn on Marsa and TeleMega screw terminals
 - c. Listen for Marsa and TeleMega continuity Beeps
 - d. Check for TeleMega continuity on Ground Station
 - e. Check for Pyxida telemetry
 - f. Turn everything off again
12. Ensure screw buttons are aligned with the mission package holes
13. Potentially Check continuity and telemetry again to ensure no wires damaged while sliding tubes over

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

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HERMES II INTEGRATION CHECKLIST

Avionics Tower

- Pyxida programmed
- Telemega programmed
- MARSA programmed
- All panels securely attached
- No panels bent outwards
- Pyxida, Telemega are facing SMA antenna up
- Verify wire pairs properly attached to screw terminals
- Pull test all wires
- No leads exposed
- Cameras securely fastened to panels
- Remote start boards securely attached
- Camera zipties secured
- Checkout photo taken of each individual panel**
- Checkout photo taken of pyro wiring**

Completed by: _____ Sign: _____ Date/Time: _____

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Report deviations from nominal checklist here:

Assembly Procedures

Added by [Shannon M Cassidy](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:36

Tools:

- Adjustable wrench
- Multimeter
- Regular Screwdrivers (philips)
- Small Screwdriver (small ones in orange box)
- Soldering Iron
- Solder
- Flux
- Superglue
- Electrical Tape
- Duct Tape

Materials:

- x1 Bottom Polycarbonate (PC) Layer
- x1 Middle PC Layer
- x1 Top PC Layer
- x1 DAQ PC Mount
- x1 Right Angle 3-pos bracket
- x6 4-40 screws
- x6 4-40 nuts
- x4 1/4-20 threaded rods
- x8 1/4-20, 7/8" L steel coupling nuts (90268A029, McMaster)
- x8 1/4-20 steel nuts
- x1 6-32 screw switch (MissileWorks)
- 6-32 screws
- 4-40 M-F standoffs
- x1 Pyxida antenna w/ cable, lock washer, nuts
- x1 Telemetry antenna w/ cable, lock washer, nuts
- 1x 3D printed Battery holder
- 1x Thermal DAQ
- 4x M-F/F-F M3 standoffs
- Zip ties
- Micro SD Card + SD Card Adapter
- 3.7, 1 cell batteries

Procedures:

1. Prepare the following sub- assemblies before dressing:
 - a. battery holder square
 - b. middle square with DAQ mounted
 - c. solder power on screw switch
2. Run power wires through the top square to bottom square
3. Mount battery holder square first, pick up power wires
4. Connect power to battery, mount middle square
5. Run antenna cable through the middle square
6. Mount antennae (2) to the top square
7. Mount top square
8. Mount screw switch
9. Add nuts on top plate
 - a. **Take checkout photo of full assembly**
10. Get batteries
11. Prepare nose cone TCs in tip (if not already made)
 - a. **Take checkout photo of DAQ -> TC attachment**
12. Silde on nose cone and bolt in place

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Labels None

HERMES II INTEGRATION CHECKLIST

Payload Stack

- All stack sections securely attached (brief shake test, nothing falls off)
 - Checkout photo taken**
- Pull test all wires - sharp tug with 2 fingers
 - Checkout photo taken**
- Screw switch securely connected
 - Checkout photo taken**
- Thermocouple ribbon cable securely attached to DAQ
 - Checkout photo taken**
- All thermocouples attached to nose cone inner surface OR otherwise secured
 - Log any thermocouples not on the surface here: _____
 - Checkout photo taken**
- Test pad life
- Test battery + LC + DAQ, search for green LED ON, screw in switch
- Voltimeter test important nodes

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Report deviations from nominal checklist here:

Hermes II Lower Electronics Assembly Guide

Assembly Materials:

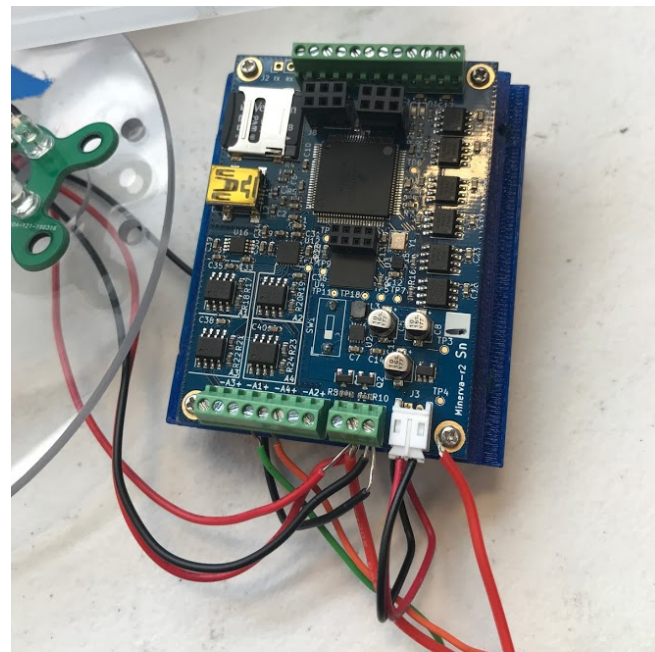
- 5/16 Hex Key
- 1/4 Hex Key
- Flathead #8 Screws, 1/4" long
- Phillips Head Screwdriver
- Flathead #4 Screws
- Tiny (check on size) screws and standoffs for DAQ enclosure
- Pokey tool for turning things on
- Some tape, just in case?
- Zip Ties or Twist Ties for LC wires
- Small flashlight

Other Components:

- FRR
- LE DAQ
- Other DAQ Components, including breakout board, battery, wiring for these
- 2 Firefly cameras
- 2 camera enclosures
- 1 DAQ enclosure, including mount and cover
- 2 LED rings

Steps:

1. Place battery in compartment in DAQ enclosure, letting wiring go through hole in the bottom
2. Attach DAQ to enclosure back using screws and standoffs
3. Run battery wiring through the enclosure and plug into the bottom of the DAQ
4. Run wiring coming from LED rings down through the two wiring holes in the recovery guard (the LED rings should be loose on top of the guard for now)
5. Screw wires coming from LED rings into the bottom of the DAQ, as shown in image.
6. Attach ground wire to screw as shown in picture
7. [Other wiring instructions related to load cell etc., check with Payload]
8. Attach cover to DAQ (with #4 screws?)
9. Insert cameras in camera enclosures, with buttons aligned with holes



10. Attach castle nuts
11. Slide in cotter pin and bend to secure
12. Align everything around the inside of the FRR, with the recovery guard resting on top and the LED rings positioned correctly
13. Screw in DAQ enclosure first, then camera enclosures using #8 screws
 - a. Screw in both screws for each enclosure at same time, alternating, to make sure both are snug in their countersinks and don't stick out
14. Screw recovery guard onto the tops of the enclosures using #8 screws. For the cameras, put the screws through the holes on the LED rings as well.
15. Make sure the wiring from the LED rings isn't in the field of view of the camera (may need to tape down to recovery guard).
16. Secure the different wires below the recovery guard, using something like a zip tie

Integration notes:

1. The load cell sits in between the three enclosures, and will only fit in a certain orientation (there's a rectangle shaped space for it). Make sure this is correct when the FRR is slid onto the rocket.
2. Make sure recovery components are pulled through the recovery guard correctly.

At launch:

1. Turn on cameras using a pokey tool
 - a. To turn on, press through bottom hole once until you hear a beep. Then, press top button. When the camera is turned on, you will see the top red lights on the camera start to blink (may not be visible when rocket is assembled)
2. Turn on DAQ by accessing the hole with a small pokey tool and pushing the switch down
~~[Currently won't work due to an alignment issue, in the process of being fixed]~~
3. ~~_____~~

Issues Left to Mitigate:

- Reprint DAQ enclosure w/ larger battery hole
- Work DAQ switch alignment issue
- Train 2x people for LE
- PTAP (?) issue? Are they changing the converter/hole for this?

HERMES II INTEGRATION CHECKLIST

Lower Electronics

- Verify battery voltage > 4.2 V
- P-Tap securely attached and sealed
- Load Cell is securely torqued with a wrench to motor
- Checkout photo taken before cameras and DAQ go into FRR**
- Cameras secure in enclosures
- Enclosures secure to retention ring
- DAQ is secure
- Pull test wires to DAQ
- Verify recovery guard is secure
- Checkout photo taken with all components**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:

Assembly Procedures

Added by [Maggie Zheng](#), last edited by [Andrew C Adams](#) on Jul 02, 2019 01:22

Materials

Hard goods box (6-32 bolts, 4 1/4-28 bolts, 4 1/4-28 bolts with washers, 3 chamfered 6-32 bolts, eyenut, cotter pin, 10-32 nuts, quicklinks)
Integrated piston
AV tower
Recovery guard
Payload stack
Payload bulkhead
NC coupler
Antirotation rod
Skinny god nut
Integration stands
Firebolts with tender descender extensions
Tender descenders and loops
Teflon tape
Connecting loops (3)
Black Powder
Gloves
Popsicle sticks and weigh boats
Goggles
Paper funnel
Scale
Hex key set
Needle nose pliers
Adjustable wrench
Pliers
Clocking tool
Phillips Head Screwdriver
Blue tape
Gaff tape
Electrical tape
Wire Strippers
Printed or original copies of the [Hermes II Lines Diagram](#) and [Tender Descender Integration Notes](#)

Procedures

1. Attach integrated piston to payload bulkhead with 1/4-28 bolts, ensuring the bolts are very tight! The clocking matters, clocking mark to be added
2. Attach the integrated AV tower to payload bulkhead with 6-32 bolts. The elbow/ tee fitting assembly must be turned slightly inward in order to fit the AV Tower on top.
3. Wire piston to AV tower- make sure to strip the end of firebolt and trim down appropriately.
4. Attach recovery guard to piston using 1/4-28 bolts and washers



5. Integrate soft goods and tender descenders- refer to [Hermes II Lines Diagram](#) and [Tender Descender Integration Notes](#)
 - a. Another QL at end of MP Riser to Motor Section Riser (wide Black) and Main Riser (Blue Spectra)
 - b. Main Bag Bridles and load-bearing riser to QL to black Drogue Swivel to drogue riser
 - c. Drogue riser to QL to drogue lines
 - d. Connect bottom of drogue bag to Motor Riser inside swivel
 - e. Connect Motor Riser to loop to swivel to loop to eyebolt
 - f. For tender descenders from Main Bag TD loops to eyebolt:
 - i. After lines are integrated according to the Lines Diagram, attach the tender descender halves loosely sandwiched together. Integrate one first.
 - ii. Fold a funnel out of paper and tape it to the black powder input hole
 - iii. Put on goggles and safety goggles
 - iv. Teflon tape e-matches with TD extensions 4-5 times around tightly
 - v. Measure out and pour in 0.2 g black powder through the funnel
 - vi. Hand screw in the e-match to BP-input hole
 - vii. Tighten e-match with wrench
 - viii. Hold TD loops with the appropriate items attached (see below item ix). Push towards center to ensure the loops don't get caught. Check that the loops slide freely. Repeat integration with second TD (steps ii-ix)
 - ix. The TD loops have 2 distinct sides:
 1. longer side has 5 things:
 - a. main loop 1
 - b. locking loop
 - c. main loop 2
 - d. load bearing riser
 - e. the QL to main riser
 2. shorter side has 1 thing
 - a. QL to eyebolt *attach the TD retention loops to the QL
- 3. Take a checkout photo of each color set of loops (blue, cyan, pink)**

after liners are integrated according to diagram,
with tender descender halves loosely
sandwiched together

-> ~~put~~ fold a funnel out of paper & tape it to
fit in the black powder input hole

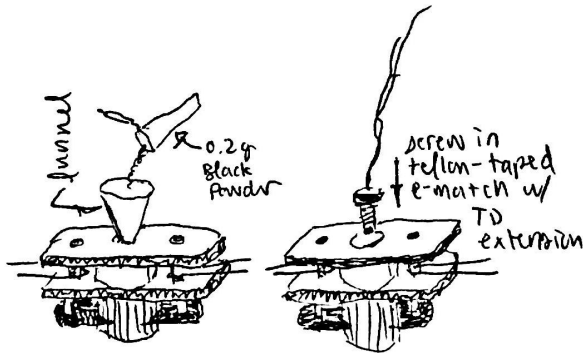
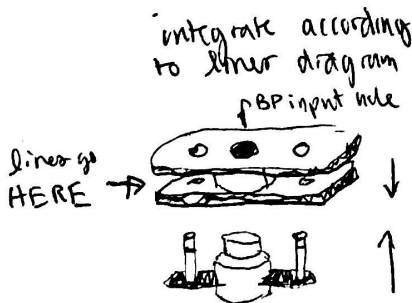
OR get the funnel

-> ~~put~~ put on gloves & safety glasses
pour 0.2g black powder through funnel into
BP input hole

-> teflon tape e-matches with TD extension
4-5 turns tight

-> hand screw in e-match to BP input hole

-> tighten e-match w/ wrench

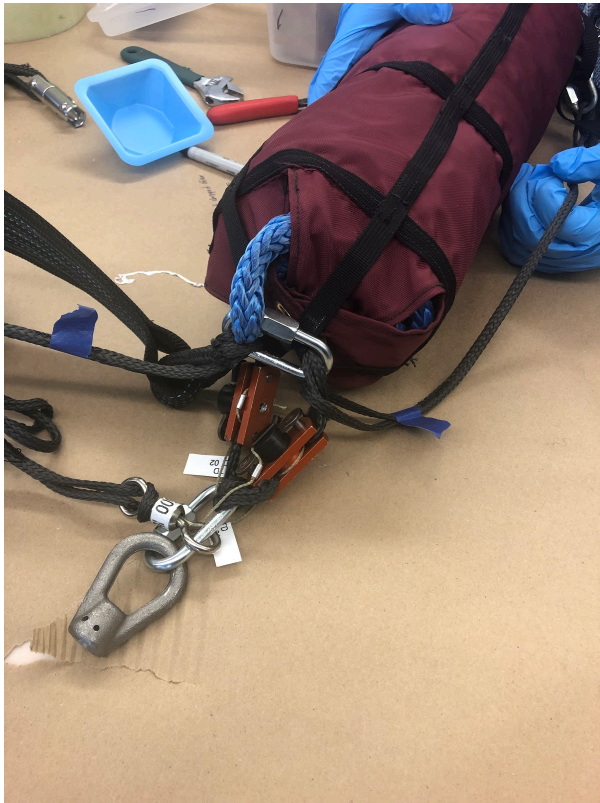


- pack main
- pack dog
- liners
- piston assembly
- TD's

- make lots of TD e-matches
- do parachute packing rehearsal
- longer TD laps & TD retention strings



x. Connect white 1500lb swivel, TD loops, and TD restraining loops (thin yellow) to QL. Attach QL to eyebolt.



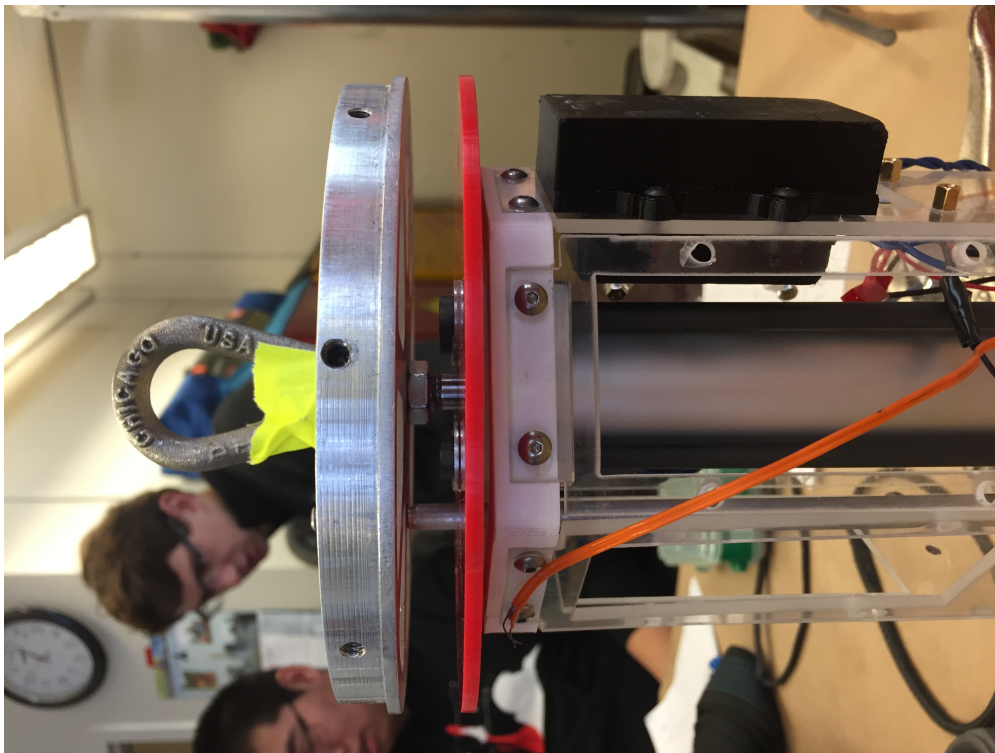
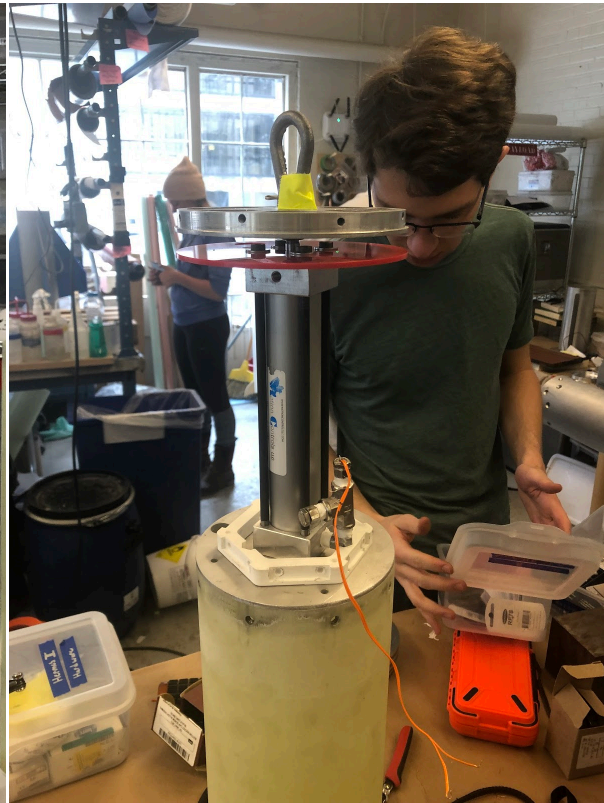
xi.



6. TIGHTEN ALL QUICKLINKS WITH A WRENCH

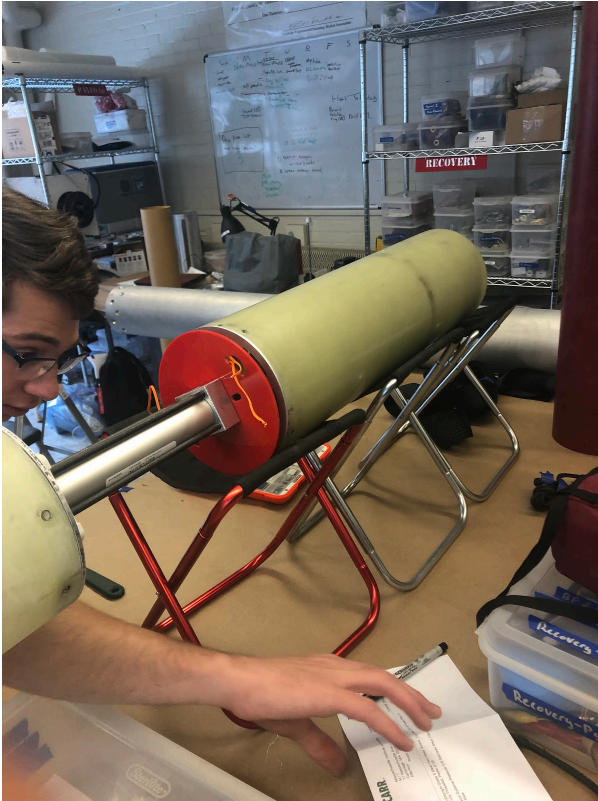
a. Add torque stripe to each quicklink after tightening

7. Screw antirotation rod into diaphragm with locknut. Screw on skinny god nut all the way down and add a washer. Place diaphragm on.



8. Next, hold the god nut with small pliers and screw the eye nut tight. Insert cotter pin. Fold down legs and stick gaff tape over the spikey bits of the cotterpin!
9. Pull up on diaphragm and use wrench to tighten nut upwards until fully tightened.
 - a. **Take checkout photo of diaphragm & recovery guard assembly**
10. Wire tender descenders
11. Set up integration stands. Stand piston-diaphragm assembly and cup close to each other. Thread main bag with lines and tender descenders through cup, so tender descenders are close to the diaphragm. Pull tender descender wires through half-moon shaped hole and attach tender descenders to eye nut.
12. Attach Payload Stack (see Payload Stack instructions)
13. Wire Payload Stack to AV tower
 - a. **See Payload Stack integration checklist for checkout photos**

14. Check continuity.
15. Push cup (with main bag, TDs and lines) onto diaphragm and secure with 10-32 grub screws. To line up, use higher holes on diaphragm and clocking mark on cup.



16. **Take video of and** conduct shake test with all of the soft goods attached inside the cup- Nothing should come lose!
17. **MAKE SURE DROGUE RISER IS NOT TANGLED WITH THE MOTOR RISER**
18. Slide mission package tube over all components- make sure to line up the 4 screw holes
 - a. **Take checkout photo of MP tube alignment with screw switches**
19. Push in shear pins and cover with tabs of gaff tape
 - a. **Take checkout photo of shear pins**
20. Screw in nosecone coupler to the MP tube and payload bulkhead with 10-32 flatheads with a 100 degree chamfer.
Don't screw in bolts all the way until all 3 of them are in.
21. Attach nosecone and nosecone tip

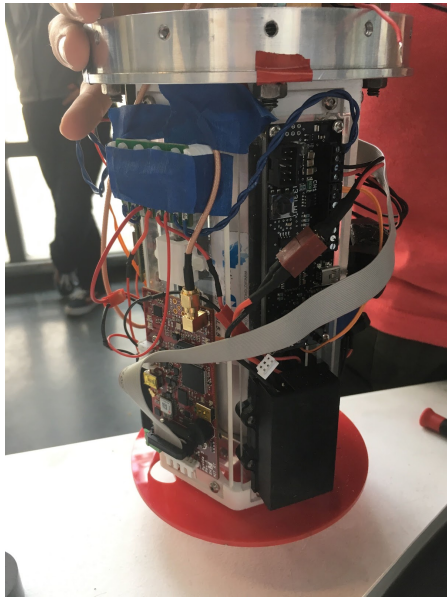
Like Be the first to like this

Labels None

HERMES II INTEGRATION CHECKLIST

Mission Package Assembly

- Check continuity for altimeters with multimeter
- All QL's have been tightened with a wrench
 - Torque Stripe all QL's
- Diaphragm slides on to piston rod
- All bolts for cup screwed in hand-tight
- Cup is tightly secured (no wobbling)
- Cotter pins are secured
 - Checkout photo taken of diaphragm & recovery guard assembly**
- Shake test completed in up and down orientation, no soft goods fell out
 - Checkout photo taken/Video of shake test**
- AV-Bay wires are not cut/snapped when sliding on MP tube
- 4x Screw switches aligned
 - Checkout photo taken of screw switch alignment with tube**
- All bolts screwed in hand-tight for MP tube to AV bay
- All bolts screwed in hand-tight for nose cone to bulkhead



Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:

HERMES II INTEGRATION CHECKLIST

FINAL INTEGRATION At Launch Site

- Fin can slid onto motor body & fit up to fin can transition
- Boattail bolts securely torqued & torque striped
 - Checkout photo taken of fin can & boattail**

When ready for prelaunch:

- Cameras installed and running
- Check connections with lines diagram:
 - Motor Section:
 - Eyebolt
 - Fork to fork swivel
 - Drogue chute
 - Motor riser
 - Checkout photo taken of all Motor Section connections**
- Shear pins securely attached
 - Checkout photo taken**
- Verify & mark CG
 - Checkout photo taken**

Completed by: _____ Sign: _____ Date/Time: _____

Verified by: _____ Sign: _____ Date/Time: _____

Report deviations from nominal checklist here:

Appendix B: FAA Instructions

Report deviations from nominal checklist here:





U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Air Traffic Organization
Western Service Area

2200 South 216 Street
Des Moines, Washington 98198

April 18, 2019

MIT Rocket Team
ATTN: Julia Gaubatz
305 Memorial Drive
Room: 6013
Cambridge, MA 02139

Dear Ms. Gaubatz:

Enclosed is your Federal Aviation Administration (FAA) Form 7711-1, *Certificate of Waiver or Authorization* (WSA-1927-RKT), issued in response to your application for amateur rocket launch activity near Ransburg, CA. The certificate is valid on July 06, 2019 through July 07, 2019 from 1000 to 1800 local, and your compliance with the enclosed special provisions is required when conducting operations specified by the certificate.

If you intend to request renewal of this waiver and/or file a new and separate application, please forward application documents electronically to 9-ATO-WSA-OSG-Part101@faa.gov. Along with your FAA Form 7711-2, *Application for Certificate of Waiver or Authorization*, please include a map clearly depicting the launch site, applicable 14 CFR Part 101.29 supplemental information, and a copy of your certificate if requesting renewal.

If you have questions, please contact Dean Theodor, Air Traffic Control Specialist, Western Service Center, Operations Support Group, at 206-231-2225/email: dean.theodor@faa.gov.

Sincerely,

SHAWN MICHAEL
KOZICA

Digitally signed by SHAWN
MICHAEL KOZICA
Date: 2019.04.18 20:32:01
-07'00'

Shawn Kozica
Manager
Operations Support Group
Western Service Center

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO

MIT Rocket Team / Ms. Julia Gaubatz

ADDRESS

305 Memorial Drive, Room 6013, Cambridge, MA, 02139 / Phone: 719-640-1309 / Email: adamsa@mit.edu

This certificate is issued for the operations specifically described hereinafter. No person shall conduct an operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED

Activity: Launch and recovery of Class 3 rockets in compliance with 14 CFR part 101, this certificate, and Special Provisions.
Altitude: Surface to a maximum of 92,000 feet Mean Sea Level (MSL) / Approximately 90,000 feet Above Ground Level (AGL).
Location: A point located at Latitude 35° 21' 1.7" N/Longitude 117° 48' 26" W; Fix Radial Distance: EDWARDS VORTAC 336° radial at approximately 23 nautical miles (FRD: EDW 336 023) [re.CFR 101.25 (d,e & f)]
Hazard Area: Five (5) nautical mile radius from launch point location
Dates: July 06, 2019 through July 07, 2019
Times: 1000-1800 (Daylight Hours Only) (Reference SP#8)
COA: WSA-1927-RKT (cc:Prescott AFSS, JCF, AST-200, AMN-900, AMN-902)

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE

N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached to and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Administrator of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

NOTE – This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance

SPECIAL PROVISIONS

Special Provisions Nos. 1 to 9, inclusive, are set forth on the reverse side hereof.

This certificate is effective from July 06, 2019 to July 07, 2019, inclusive, and is subject to cancellation at any time upon notice by the Administrator or his authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

Western Service Area

(Region)

SHAWN MICHAEL
KOZICA

(Signature)

Digitally signed by SHAWN
MICHAEL KOZICA
Date: 2019.04.18 20:32:39 -07'00'

Shawn Kozica, Manager
Operations Support Group, WSC

(Title)

(Date)

**WSA-1927-RKT
SPECIAL PROVISIONS**

Prepared for and applicable to:
MIT ROCKET TEAM
(POC: Julia Gaubatz)

1. You must make the following notifications to concerned facilities:
 - a. **At least seven (7) working days prior to conducting operations:**
 - (1) Contact the R-2508 Central Coordinating Facility (CCF) and R-2515 Airspace Management to coordinate your proposed activity and launch site you will be using. CCF can be reached at 661-277-2508; R-2515 can be reached at 661-277-2515. *CCF operating hours are 0600-1800; R-2515 operating hours are 0730-1700. Both are open Monday through Friday, closed Saturday, Sunday and federal holidays.*
 - (2) Contact Flight Planning, MCAS Miramar, CA, at 858-577-1532 to give notice of rocket activity and provide all required NOTAM information, i.e., date, time, location, altitudes. Note: launch area intersects IR-211.
 - b. **Seventy-two (72) hours prior to conducting operations:**
 - (1) Contact the Prescott Automated Flight Service Station (AFSS) National Notice to Airmen (NOTAM) number at 877-487-6867. Advise your launch location and ask to issue a NOTAM referencing this certificate. If no response, contact the Prescott AFSS Operations Supervisor at 928-583-6154.
 - (2) Contact Joshua Control Facility (JCF) at 661-258-2508/2515/3843.
 - c. **Twenty-four (24) hours prior to conducting operations:** Contact JCF at 661-258-2508/2515/3843.
 - d. **Between 15 and 30 minutes prior to conducting operations:** Contact JCF at 661-258-2508/2515/3843. Provide a satellite or cellular telephone number where the Launch Control Officer can be contacted during launch operations.
 - e. **When operations cease for 30 minutes or longer:** Contact JCF at 661-258-2508/2515/3843, to alert them that launches have desisted and provide an expected time for launches to resume. *Note: Prior to resuming rocket launch activity, you must comply with paragraph 1.d., if applicable, above.*
 - f. **When operations have concluded, are terminated, or are canceled:**
 - (1) Notify JCF at 661-258-2508/2515/3843.

- (2) Notify Prescott AFSS at 877-487-6867 and have the NOTAM canceled. If no response, contact Prescott AFSS Operations Supervisor at 928-583-6154
2. Provide 14 CFR Part 101.29 information to each facility upon request.
 3. Provide a phone number to each Air Traffic Control (ATC) and applicable military scheduling facility, to ensure they have direct contact with an operator at the launch site that has the ability to cease operations within ten (10) minutes of notification, if necessary. ***Note: If any Air Traffic facility is unable to reach the launch site via phone number provided, FAA Western Service Center may suspend or revoke this waiver/authorization, resulting in cancellation of current and/or future operations under this certificate and special provisions.***
 4. ATC has authority to terminate and/or limit the maximum projected altitude/height of rocket launches due to unforeseen circumstances.
 5. Safety spotters must scan the sky prior to each launch and immediately notify the Launch Control Officer to cease or hold fire whenever an aircraft is in or approaching the launch area.
 6. All operations must be conducted in accordance with the holder's safety rules and codes. The holder must be responsible for safeguarding persons and property on the ground and must ensure that all persons connected with the operation are familiar with the certificate and the above special provisions.
 7. The MIT Rocket Team expressly agrees that, with regard to any liability which may arise from operation of any rockets or related activities, that party must be solely and exclusively liable for the negligence of its own agents, servants, participants, and/or employees, in accordance with the applicable law; and that neither party looks to the other to save and hold it harmless for the consequences of any negligence on the part of one of its own agents, servants, and/or employees.
 8. **The MIT Rocket Team is authorized to launch on July 06, 2019 through July 07, 2019 from 1000 to 1500 local. NO OTHER DATES OR TIMES ARE AUTHORIZED.**
 9. The following map depicts launch site and hazard area as noted on the Certificate:



Appendix C: Packing List

Report deviations from nominal checklist here:



Added by [Maggie Zheng](#), last edited by [Maggie Zheng](#) on Jun 13, 2019 14:14

Compiled Packing List

- Motor
- Boattail
- ¼" Hex head bolts
- ¼" Hex head key
- 5/16" Hex head bolts
- 5/16" Hex head key
- O-ring box
- High temperature marine grease
- 1/4 in torque wrench
- Piston
- Integrated Firebolts
- Multimeter
- Teflon tape
- 2 1/4 NPT plugs
- Safety goggles
- Gloves
- Weigh boats
- Popsicle sticks
- Elbow joint
- Tee fitting
- Adjustable wrench
- Vice grip/pliers
- Small Screwdriver
- Allen Key '.077'
- (Pink Gaff Tape Marked) Small Phillips Head
- Small File
- Small Flathead screwdriver
- 2 mm 5 flathead screwdriver
- Parachute Packing Box (shot bag, line holder, extra lines)
- Sandbags
- Rubber bands
- Soft goods Box (Drogue Bag, Main Bag, Main Riser, Drogue Riser, Motor Riser, connectors, Tender Descender Loops)
- Swivels (Fork-to-Fork, Black Drogue Swivel, White Swivel)
- Flathead screwdriver
- Quicklinks - Maillon Rapide 400 kg
- Radio Beepers
- 5/16 Hex Key
- ¼ Hex Key
- Flathead #8 Screws, ¼" long
- Phillips Head Screwdriver
- Flathead #4 Screws
- Tiny (check on size) screws and standoffs for DAQ enclosure
- Pokey tool for turning things on
- Some tape, just in case?
- Zip Ties or Twist Ties for LC wires
- Small flashlight
- FRR
- LE DAQ
- Other DAQ Components, including breakout board, battery, wiring for these
- 2 Firefly cameras
- 2 camera enclosures
- 1 DAQ enclosure, including mount and cover
- 2 LED rings
- Hard goods box (6-32 bolts, 4 1/4-28 bolts, 4 1/4-28 bolts with washers, 3 chamfered 6-32 bolts, eyenut, cotter pin, 10-32 nuts, quicklinks)
- BRING THE WHOLE BOX, NOT JUST THE TACKLE BOX SO WE HAVE LOTS OF EXTRAS
- AV tower
- Recovery guard
- Payload stack
- Payload bulkhead
- NC coupler
- Antirotation rod

Skinny god nut (tackle box)
 Integration stands
 Firebolts with tender descender extensions
 Tender descenders and loops
 Connecting loops (3)
 Paper funnel
 Hex key set
 Needle nose pliers
 Clocking tool/blue handled dental tool
 Blue tape
 Gaff tape
 Electrical tape
 Wire Strippers
 Printed or original copies of the [Hermes II Lines Diagram](#) and [Tender Descender Integration Notes](#)
 Turn on avionics Phillips Head screwdriver
 2.4 x 20 mm screwdriver (green)
 4 2032 batteries
 Small blue handled pliers
 GroundStation Pyxida (micro usb cable, pyxida, Pyxida LIPO, SMA connector)
 Yagi Antennas (433 MHz and 2 915 MHz, big and small ones)
 Battery Charges (Blue lipo chargers in second drawer of avionics desk, including power cord that it plugs into)
 Radar gun
 2 radio beacons
 Hermes II.SLDASM
 SVN Stick
 Ground station box
 Avionics Toolbox
 Marsa, telemega, pyxida (should be 2 pyxidas in lab)
 Camera controls box
 British broadcasting circuit (likely already on av Bay)
 Camera ribbon cable (x2)
 Camera USB connectors to BBC PCB (x3)
 Firefly camera boxes (x4)

Packing List Sorted By Subassembly

Motor	Piston	Payload Stack/NC	AV Tower	Soft Goods	Lower Electronics	Mission Package Assembly	CAD
5/16" Hex head bolts 5/16" Hex Key 1/4" Hex head bolts 1/4" Hex Key High- temp marine grease Motor Boattail	1/4 in torque wrench Integrated Firebolts Multimeter Teflon tape 2 1/4 NPT plugs Safety goggles Gloves Weigh boats Popsicle sticks Elbow joint Tee fitting Adjustable wrench Vice grip/pliers Small Scale	Adjustable wrench Multimeter Small Screwdriver	Allen Key '.077' (Pink Gaff Tape) Small Phillips Head Small File Small Flathead screwdriver 2 mm 5 flathead screwdriver Ground station box Avionics Toolbox Marsa, telemega, pyxida (should be 2 pyxidas in lab) Camera controls box British broadcasting circuit (likely already on av Bay)	Parachute Packing Box (shot bag, line holder, extra lines) Sandbags Rubber bands Soft goods Box- Drogue Bag, Main Bag, Main Riser, Drogue Riser, Motor Riser, connectors, Tender	Assembly Materials: <ul style="list-style-type: none"> • 5/16 Hex Key • 1/4 Hex Key • Flathead #8 Screws, 1/4" long • Phillips Head Screwdriver • Flathead #4 Screws • Tiny (check on size) screws and standoffs for DAQ enclosure • Pokey tool for turning things on • Some tape, just in case? 	Hard goods box (6-32 bolts, 4 1/4-28 bolts, 4 1/4-28 bolts with washers, 3 chamfered 6-32 bolts, eyenut, cotter pin, 10-32 nuts, quicklinks) BRING THE WHOLE BOX, NOT JUST THE TACKLE BOX SO WE HAVE LOTS OF EXTRAS Integrated piston AV tower Recovery guard Payload stack Payload bulkhead NC coupler Antirotation rod Skinny god nut Integration stands	Hermes II.sldasm SVN Stick

Motor	Piston	Payload Stack/NC	AV Tower	Soft Goods	Lower Electronics	Mission Package Assembly	CAD										
	Piston Complete set Piston replacement parts Piston assembly instructions White lithium grease 3 film canisters of black powder		Camera ribbon cable (x2) Camera USB connectors to BBC PCB (x3) Firefly camera boxes (x4) Other Avionics Items: <table border="1" style="margin-left: 20px;"> <tr> <td>Turn on Avionics Screwdriver</td> </tr> <tr> <td>Blue tape</td> </tr> <tr> <td>2.4 x 20 mm screwdriver (green)</td> </tr> <tr> <td>4 2032 batteries</td> </tr> <tr> <td>2 radio beacons</td> </tr> <tr> <td>Radar gun</td> </tr> <tr> <td>Battery Charges (Blue lipo chargers in second drawer of avionics desk, including power cord that it plugs into)</td> </tr> <tr> <td>Yagi Antennas (433 MHz and 2 915 mHz, big and small ones)</td> </tr> <tr> <td>GroundStation Pyxida (micro usb cable, pyxida, Pyxida LIPO, SMA connector)</td> </tr> <tr> <td>Small blue handled pliers</td> </tr> </table>	Turn on Avionics Screwdriver	Blue tape	2.4 x 20 mm screwdriver (green)	4 2032 batteries	2 radio beacons	Radar gun	Battery Charges (Blue lipo chargers in second drawer of avionics desk, including power cord that it plugs into)	Yagi Antennas (433 MHz and 2 915 mHz, big and small ones)	GroundStation Pyxida (micro usb cable, pyxida, Pyxida LIPO, SMA connector)	Small blue handled pliers	Descender Loops Swivels (Fork-to-Fork, Black Drogue Swivel, White Swivel) Flathead screwdriver Quicklinks - Maillon Rapide 400 kg Blue Tape Radio Beepers	<ul style="list-style-type: none"> Zip Ties or Twist Ties for LC wires Small flashlight Other Components: <ul style="list-style-type: none"> FRR LE DAQ Other DAQ Components, including breakout board, battery, wiring for these 2 Firefly cameras 2 camera enclosures 1 DAQ enclosure, including mount and cover 2 LED rings 	Firebolts with tender descender extensions Tender descenders and loops Teflon tape Connecting loops (3) Black Powder Gloves Popsicle sticks and weigh boats Safety goggles Paper funnel Scale Hex key set Needle nose pliers Adjustable wrench Pliers Clocking tool/blue handled dental tool Phillips Head Screwdriver Blue tape Gaff tape Electrical tape Wire Strippers Printed or original copies of the Hermes II Lines Diagram and Tender Descender Integration Notes	
Turn on Avionics Screwdriver																	
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