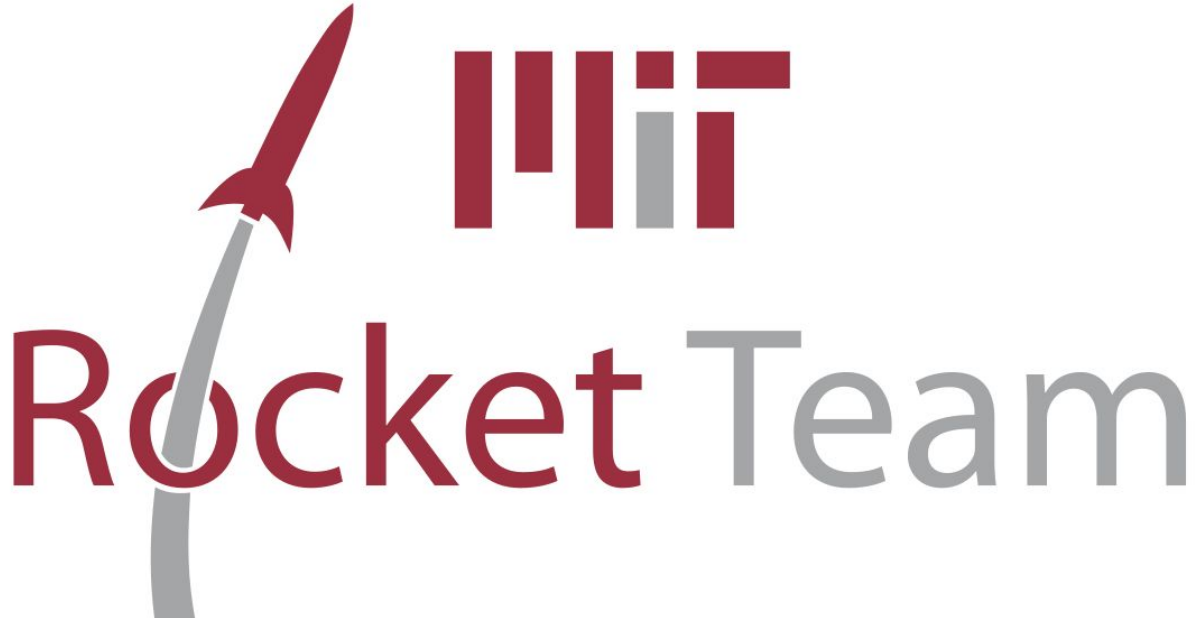


Hermes II Launch Operations

Overview

Launch operations will enable the team to launch the rocket in a safe fashion while minimizing the possibility for error.

The most important thing

We're a team. Our mission is to safely fly Hermes II & get good flight data.

Ask people if they need help. Ask for help if you need it.

If someone tells you to do something, do it (but use common sense).

If someone is doing something dumb, call them out and help them fix the problem.

Hazards

- Environmental Hazards
  - Temperatures reach 110℉ (and direct sunlight), mitigate with discussion of what to expect, appropriate apparel, significant water consumption, and having plans to recognize and intervene early in heat illnesses
  - Desert wildlife
- Vehicle Energetics (Batteries, Pyro Charges)
  - Leave systems off until the pad is cleared
- Motor and Igniter
  - Igniter install is the last operation before flight. Experienced operator installs.
- Transportation
  - Dry lake bed can be hazardous to vehicles. Brief about dangers of powder pits, ensure all vehicles have sufficient water, a cell phone, and radio.

Phases of Launch Day

- Integration
  - Mechanically integrate vehicle for flight
- Pad Operations/Prelaunch
  - Load vehicle onto the pad
  - Arm energetic systems
  - Manage battery life
- Launch
  - Verify ‘GO’ status and compliance with flight rules
  - Fly!
- Recovery
  - Locate the vehicle
  - Return the vehicle to a known state
  - Transport the vehicle offsite
- Cleanup
  - Pack up all tools & incidentals
  - Clear launch site
  - Pack up rocket

Integration -- Hardware

- Follow written procedures
  - Record deviations from procedure
- Preflight checkout photos
- Performed to the **greatest extent possible** before arriving at the launch site
- Use defined roles performed by individuals who have practiced their responsibilities
- **Emphasis on two-party verification and single-point-failure verification.**
  - If the rocket has issues, teamleads will inform decision-making, Reilley will be the last word

Integration -- Simulations

- Use day-of weather data to run day-of simulations
- Log expected flight data

Transition to Pad Operations

- Rocket assembly verified by RSO, and we go to the pad

Pad Operations - Load

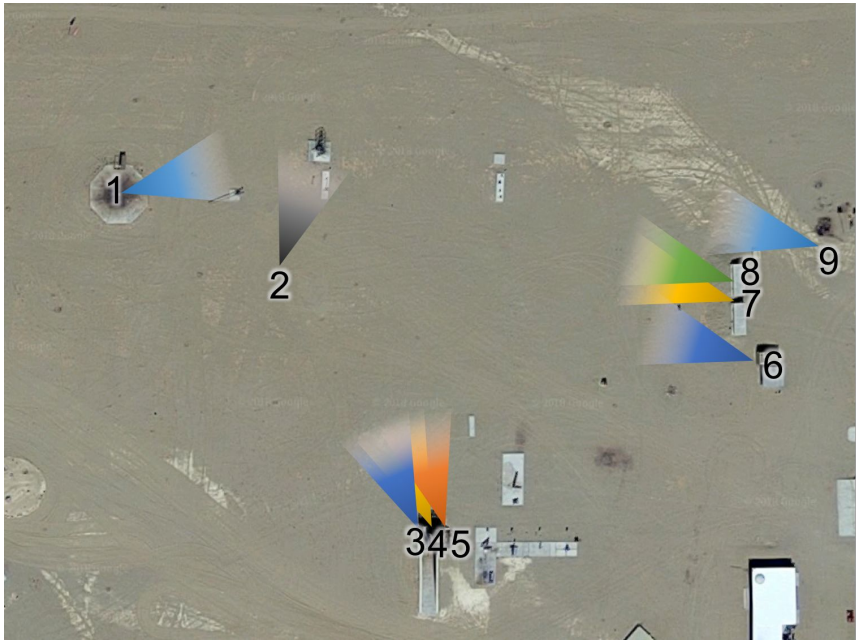
- Pad will be pre-set with the approximately the correct diameter
- Move vehicle to the pad
  - Hermes 2 is distinctly heavier than previous rockets. Utilize GSE.
- Slide the rocket into the tower
- Adjust the rails to appropriate fit on vehicle

Pad Operations - Breakover

- Tip the rocket vertical
- Secure the launch tower
- Verify the launch tower angle with pre-flight simulations
- *This operation is highly dependent on the design of the launch tower*

Pad Operations - Video

Pad Operations - Hermes I Cameras

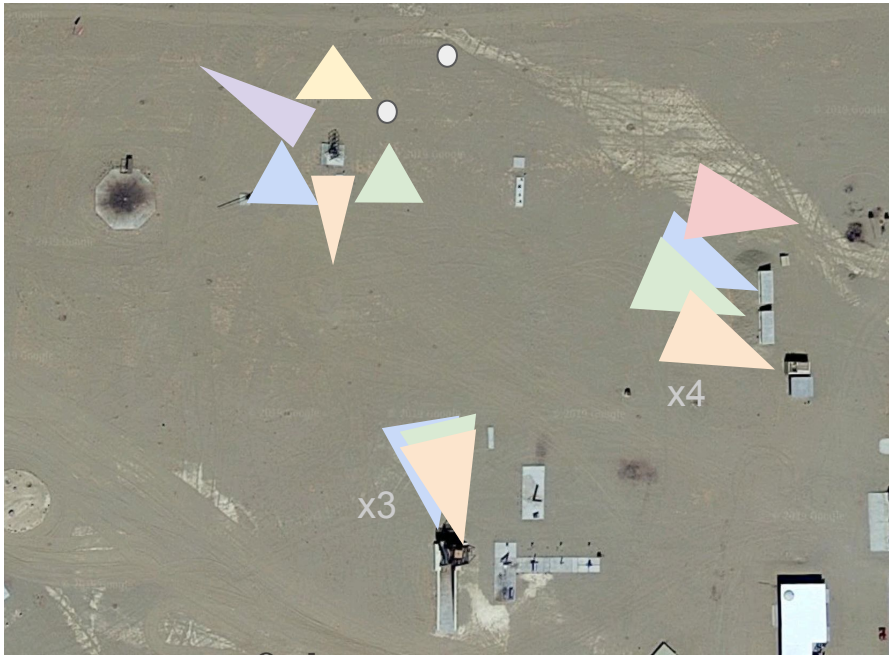


Hermes I Camera locations

#	Camera	Note
1	Hero 6 Black	Charlie's. Failed to Record - heatstroke
2	GoPro Hero 4	Andrew R's. Good Video
3	GoPro Hero 4 Session	Charlie's. Fell Over prior to launch
4	GoPro Hero 5 Session	Maddie G's. Good Video
5	GoPro Hero5	Sam's. Good Video
6	Dayna's Cellphone	
7	Ellen's Cellphone	
8	Sam's Cellphone	Highspeed Footage. Tracked to cloud ceiling
9	Cannon EOS T6	Ender Kerr. Stills on Burst. Beautiful.

High failure rate of away cameras

Pad Operations - Hermes II Cameras



Hermes II Camera Locations

#	Camera	Note
1	GoPro or otherwise	
2	GoPro	Very close (<20 ft) to pad
3	GoPro or otherwise	
4	GoPro or otherwise	Highspeed
5	GoPro or otherwise	
6	GoPro or otherwise	
7	GoPro or otherwise	
8	Cell phone	
9	Cell phone	
10	Cell phone	Highspeed
11	>10Mpx	Stills.

Use shades to cover away cameras

Pad Operations - Arm

- Clear all non-essential personnel to minimum safe distance
- Run the arming procedure
- Verify vehicle startup with avionics at base camp
- Activate camera systems
    - Rocket and Pad

Pad Operations - Igniter Install

- Install the igniter
- Verify launch system continuity and ignition system voltage
- Evacuate Pad

Launch - Preflight

- Verify away team is go
- Confirm ‘GO’ status
- Verify launch commit criteria are met
- Start countdown

Launch - Flight

- Execute Primary mission
- Watch the rocket
- Verify deployment events with telemetry
- Standby to execute anomaly procedures
  - CATO
  - Ballistic Recovery
  - Shred
  - Loss of Telemetry

Recovery - Localization

- Locate the vehicle
  - GPS Telemetry from Pyxida or TeleMega
  - Iridium SatCom packet (High Latency)
  - APRS packet (High Latency)
  - Directional RF beacon (Only provides bearing)
  - Visual Tracking
  - Manual Search
- Hot, sunny desert environment with wildlife
- ~8 team members go get the rocket

Recovery - Safing

- Determine Vehicle State
  - Telemetry
  - Visual Indicators
  - Buzzer Cues
- Move vehicle to known state
  - Power off
  - Remove remaining energetics
- Exhibit extreme caution approaching a vehicle with an unknown state

Recovery - Data Logging

- All data kept on Dropbox folder
  - Preflight checkout photos
  - Preflight simulations
  - Ground-based Photos & Videos
  - Onboard Video
  - Telemetry - altimeter data
  - Post-flight - altimeter data
  - Temperature log
  - Vibration log
  - Deployment Load log
- Team members individually accountable for uploading

Recovery - Data Preservation

- Use a checklist to recover data from the day of flight
- Includes cell phone video, GoPro footage, notes, doodles, sketches, judgement calls, photos, etc.
- This should be completed immediately. Excuses lead to lost time searching for disorganized data and lost data.

Recovery - Return

- Load the rocket into a car
- Leave the site like we found it
- Eat a big-ass dinner

Roles: FAR Personnel

- Launch Control Officer - Has launch authority and operational command
- Range Safety Officer - Can exercise a safety veto on anything
- Pyro Operator - allows us to fly a P motor

Roles: Leadership

- Julia: Is in charge and is the primary decision maker
- Reilley: Troubleshoots & signs off for issues
- Adams: Manages launch operations & timeline
- Maggie Z: Oversees integration of Hermes II
- TBD: Desert Safety Overlord (makes sure people are safe and ok)

Roles: Integration

- Almost all assembly will occur the day before
- An RE for each subsystem signs checklist
    - Witness signs to verify

Roles: Pad Support

- 2 people set up the pad pre-launch
- Adjust the rails while people hold the rocket
- Set up pad cameras during altimeter arming

Roles: Pad Team

- Pad Support
- Enough people to securely hold the rocket
- Integration RE: Maggie Z
- Igniter Install: Reilley
- Telemetry checks: 2x people w/ laptops
- Avionics arming: Adams

Roles: Comms

- Mission Control for Pyxida & Telemega
  - Verifies telemetry prior to launch
  - Verifies beep code for MARSA (no telemetry)
- Ground Comms
  - Establishes communication w/ FAR personnel, recovery team, pad team, away team

Roles: Support

- Photos: Takes pictures of the team during launch day
- Gordon Ramsay: Makes sure we’ve got food
- Hermes: Relays messages & items otherwise not communicated

Rehearsals

5/10-11

- All parts
- Multi-day
- Practice adverse scenarios

Launch Rehearsal

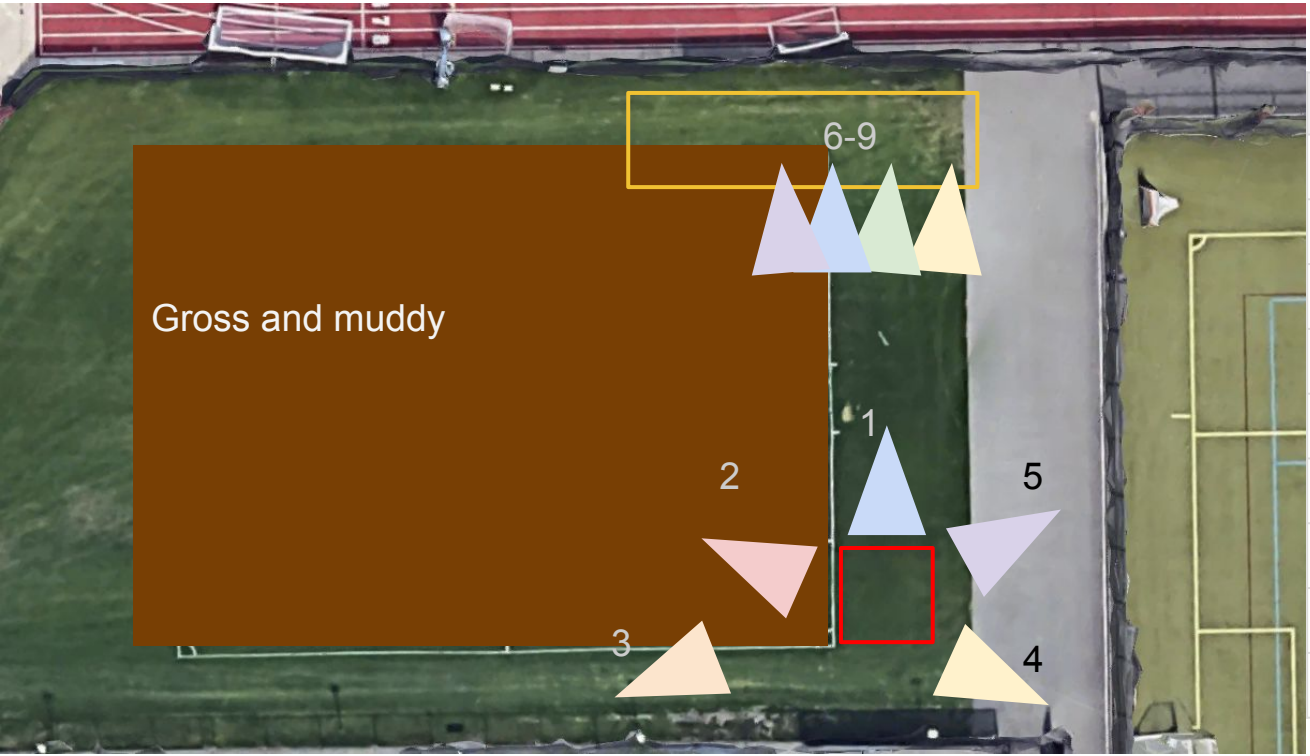
- Integration
  - Julia, Reilley, Adams, Maggie Z leading
  - Each subsystem will have an RE sign off
  - At least one more RE will sign as witness

Launch Rehearsal

- Need people for:
  - Pad Ops
    - Bring test stand out to briggs & assemble
  - Mission Control
    - Telemetry verification & range testing in the rocket
  - “Desert Safety”
  - Photos
    - Checkouts
    - Team members & misc.

Field A Directions

Setup



Launch Tower

Integration Area

#	Camera	Note
1		
2		
3		
4		
5		
6	Cell phone	
7	Cell phone	
8	Cell phone: high speed	
9	>10Mpx	

Setup

Launch Tower

Avionics/Telemetry Launch Line

Avionics Away team

Nominal Timeline

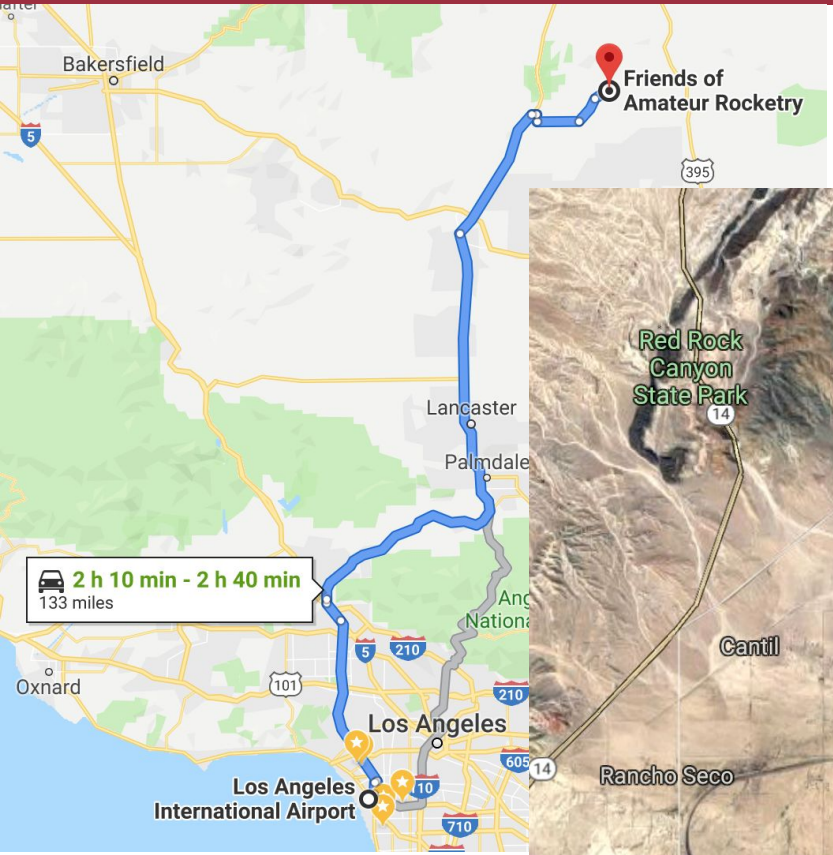
- Friday:
  - Pack rocket & tools: 5pm
  - Start integration: 5:30pm
  - Finish integration: 10pm
  - Finish packing the rocket: 11pm
  - Go to sleep: 12am
- Saturday:
  - Arrive at hangar: 9am
  - Rocket transport & setup complete: 9:30am
  - **Window Open ------ 10:00am**
  - Hermes II vertical: 10:30
  - **Battery change-out:** 11-1pm
  - Re-vertical: ~1pm
  - Take-down & Ground Test: ~1:30pm
  - **Window Close ------ 3:00pm**

Differences from Flight

- Not on-location
  - No 2.5 hour drive
  - Later wake-up time
- Abbreviated recovery ops
  - Practice walking across briggs & back with Hermes instead of 2 miles
- Log changes to checklist

Yay rockets!

Backup


Bakersfield
Friends of
Amateur Rocketry
395
5
Lancaster
Palmdale
2 h 10 min - 2 h 40 min
133 miles
Oxnard
101
5
210
210
Los Angeles
605
14
10
Los Angeles
International Airport
710


Red Rock
Canyon
State Park
14
Ceneda
Friends of
Amateur Rocketry
Gypsite
Cantil
Rancho Seco
Google
3D
Imagery ©2019 Google, Map data ©2019 Google
United States
Terms
Send feedback
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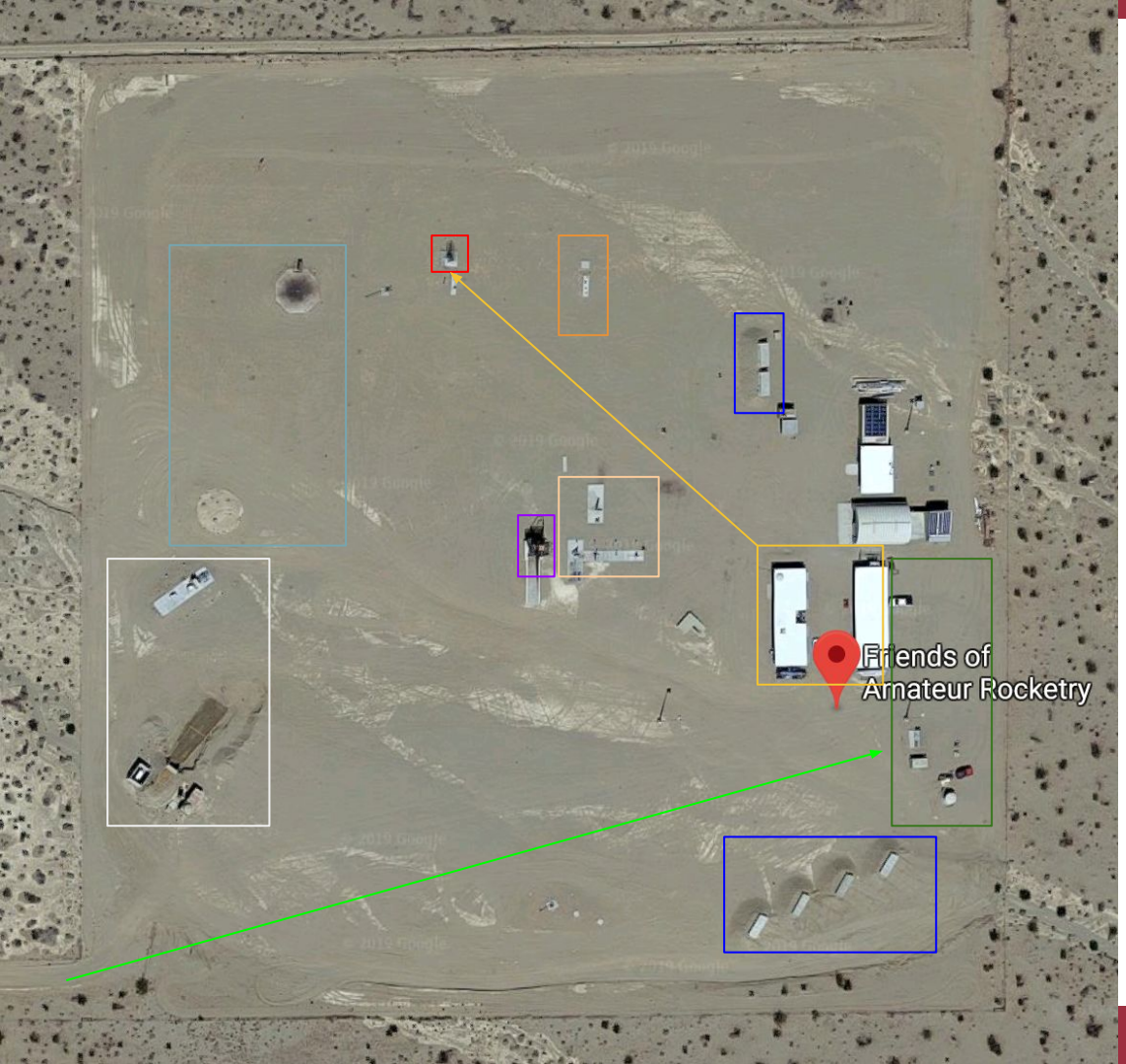

Launch Tower

High Power Pads

Engine Test Stands

Integration Area (has tables)

Parking

Other Concrete Pads

Bunkers

Tower

Storage Areas