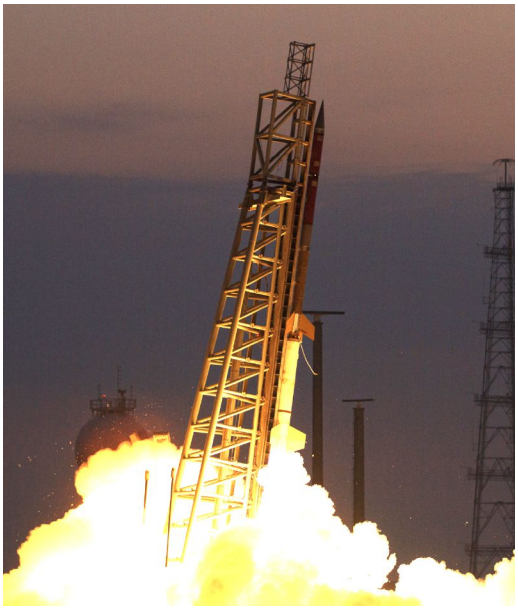
RockSat User Guide
2026



Wallops Flight Facility (WFF)
Wallops Island, Virginia

0.0 APPROVALS AND TRACKING

0.1. Signatures

Prepared and Approved by: _____
RockSat Program Manager

WFF Concurrence: _____
Sounding Rockets Program Office

0.2. Revisions

Revision	Description	Date	Approval
A	Draft Release	09/04/2025	

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1.0 INTRODUCTION

1.1. RockSat Program

Prior to the 2026 program, RockSat consisted of two programs (RockSat-C and RockSat-X). Due to budget changes, RockSat 2026 will become simply RockSat.

RockSat is a follow-up program to the RockOn Workshop, where participants design their own sounding rocket experiment and compete for a spot on the launch vehicle. The RockOn Workshop teaches participants how to build a sounding rocket experiment in a multi-day, hands-on workshop with one of the end goals being that participants will take what they learn during the workshop and return later that year with an original experiment to fly with the RockSat program. Participation in the RockSat program starts with the submission and acceptance of the RockSat Intent to Fly Form (IFF), which is typically due in September of the program year.

The RockSat program provides higher education students with low-cost access to a sub-orbital space environment while working on a team that will further develop their engineering and scientific skills. The RockSat flight is made possible through significant cost sharing provided by Wallops Flight Facility (WFF) and the RockSat Program Fee paid by RockSat teams.

The RockSat program uses experiment decks that allow for the standardized integration of the student team's experiment and the rocket. This simplifies final integration and allows for the focus to be on the design of the experiment. The RockSat Program Managers will guide the RockSat student teams through the design process in the fall with multiple design reviews followed by multiple test reviews in the spring.

Since space on the RockSat rocket is limited, only the most developed and capable projects as well those who perform well during the initial design reviews will be selected or manifested for flight. This down-select occurs in November following the Preliminary Design Review (PDR). Manifested teams will continue on with the last design review, the Critical Design Review (CDR), in December and continue to have subsystem and system testing reviews through May.

With launch in late June, teams will travel twice to WFF in Virginia. The first trip will be early in June for integration and testing of their experiment. All experiments remain integrated to the rocket until launch. If an experiment develops a mechanical failure during WFF testing, de-integration and repair may be permitted if WFF and RockSat Program Manager allow. Student

teams return a second time to participate in the final inspection, final testing, launch, and data recovery. Final reports are then due later in July. Student teams may ship their experiment to WFF and the RockSat Program Manager will oversee the integration and test on behalf of the team. Where possible, the team will be able to participate in the WFF activities via Zoom.

1.2. Participant Eligibility and Responsibility

The intent of the RockSat program is to provide hands-on experiences to students and faculty advisors to better equip them for supporting the future technical workforce needs of the United States and/or helping those students and faculty advisors become principal investigators (PIs) on future NASA missions. Therefore, RockSat is limited to U.S. educational institutions. Only experiments from U.S. educational institutions are eligible to participate in the RockSat program. For the purpose of the RockSat, 'educational institution' is defined broadly and includes, but is not limited to, the following: universities, colleges, technical schools, and vocational schools. Public and private high school, middle school and grade school, science museums, etc. may be allowed if they are partnering with the types of institutions mentioned previously. Organizations, which are not included in the above listing, are encouraged to contact WFF at wff-rocksatprogram@mail.nasa.gov or rocksatprogram@gmail.com to clarify their eligibility in the program.

In addition, U.S. entities (e.g. industry, research institutions, etc.) that fall outside of the eligibility conditions listed above, but who are interested in participating in the program, are encouraged to team with an eligible U.S. educational institution. Teaming between educational institutions and industry or other interests is allowed and encouraged. However, the experiment shall be a student project with students doing the design, build, test, documentation, operation, and data analysis.

The following is subject to change. Participation in the RockSat program includes online meetings with WFF employees and contractors as well as all integration, testing, launch, and recovery operations that take place at WFF. Normal access to WFF facilities and personnel is limited to U.S. persons only. Therefore, individuals participating in the RockSat program shall be a U.S. Person. U.S. federal law defines a U.S. Person as: a citizen of the United States, an alien lawfully admitted for permanent residence, or a corporation that is incorporated in the U.S. (22 CFR 120.14, 15 – and by 8 U.S.C. 1101(a)(20)). Persons in the U.S. on a work visa are not considered U.S. persons.

Additionally, participants in the RockSat program shall comply with export regulations in regard to disclosures of technical data. All participants warrant and represent that they will limit disclosure of any technical data contained in,

made available, or generated in the performance of their participation in the RockSat program in accordance with export restrictions imposed by the U.S. Export Administration Regulations, 15 C.F.R. Parts 768 et seq. and the International Traffic in Arms Regulation, 22 C.F. R. Part 120 et seq. This applies to all parties involved (such as an industrial partner to an educational institution). As a baseline, the RockSat program does not permit ITAR and/or Export Controlled hardware/experiments on the program. Teams may ask WFF for exception to this baseline during the CoDR and PDR design reviews.

1.3. Purpose

The purpose of this document is to identify the interfaces, requirements, and logistics pertaining to the WFF RockSat 2026 program. This document also establishes the guidelines and requirements for qualifying an experiment for selection to be flown, along with the review and integration schedule. Experiments shall be student based and require active support from faculty advisor(s) and, if applicable, industry mentor(s). RockSat is not available to experiments that are profit related endeavors and/or solely industry research and development. Students shall be actively engaged and involved in all aspects of the RockSat experiment.

1.4. Getting Involved (Intent to Fly Forms)

Interested institutions/teams shall submit an Intent to Fly Form (IFF) in September by the due date listed on the IFF in order to be considered for participation in the RockSat program. The IFF can be found here. https://tinyurl.com/rocksat-2026-iff Although required, submission of the IFF does not mean that your team has been selected for flight on the RockSat 2026 program. Due to the limited experiment space on the RockSat launch vehicle, a down-selection process will be utilized after the successful completion of the RockSat Conceptual (CoDR) and Preliminary (PDR) design reviews.

1.5. Experiment Space

There are five full experiment spaces on the RockSat launch vehicle. These full spaces are allocated power, volume, and weight in the sections below. Teams can elect to use a half of a full experiment space or a quarter space (half of a half) however in these scenarios, the power connections along with the weight and volume limits are reduced proportionally. For example, a half of a full space would have half of the power, half the height, and weight of a full experiment space and are able to use the full experiment deck diameter. For a quarter space (half of a half) would have one quarter of the power, half the height, and weight of a full experiment space but are limited to only half of the full experiment deck diameter (semi-circle). Specific allocations will be discussed with teams after the flight manifest is finalized after PDR. Timer Event (TE) lines (activation lines during flight) will be shared for each experiment space the RockSat Program Manager will attempt to manifest

experiments in such a way to meet each team's request for these shared spaces. Note that it is not guaranteed all the team's requested TE lines will be granted. In the event that a subset of teams would like to redistribute allotments in their space, all teams of that space must contact the RockSat PM, and changes will only be made with written approval of all parties involved and WFF. The five full experiment spaces cannot be split into any size smaller than a quarter (half of a half).

1.6. Program Fee

The RockSat Program Fee pays for the RockSat Program. It covers the costs to administer, run, and manage the RockSat program which begins with reviewing the IFF and ends with the review of each team's final report. The Program Fees are used as teams progress through the program and are therefore non-refundable. See additional details below. The Program Fee associated with RockSat is contingent upon the amount of the experiment space being utilized and thus the amount of the rocket's launch capability. Teams will receive (1) RockSat experiment deck with power interface connector after their final of two payments has been made. Additionally, teams will receive 8 program t-shirts during the June launch trip. Travel costs to and from Wallops Flight Facility, lodging, meals, or other expenses incurred while supporting these trips are the responsibility of the teams.

The Program Fee for a full experiment space is $30,000. The Program Fee for a half experiment space is $16,000. The Program Fee for a quarter experiment space is $10,000. The Program Fee is to be paid in two payments based on the schedule below. Payments shall be made by check, wire transfer, or credit card. Those teams paying by credit card will incur an additional 3.5% transaction fee. Details on where to send payment will be provided on the invoice.

Invoice Date	Due Date	Payment Amount	Notes
11-24-2025	12-31-2025	Full = $15,000 Half = $8,000 Quarter = $5,000	
01-23-2026	02-27-2026	Full = $15,000 Half = $8,000 Quarter = $5,000	Decks and connectors are sent after this payment
	Totals	**Full = $30,000** **Half = $16,000** **Quarter = $10,000**	

1.7. Refund Policy

The RockSat Program Fee is not refundable. Once officially manifested, the team is required to pay the Program Fee over two payments listed above by the due date to remain manifested. Late payments may result in being de-manifested. If WFF determines your team is non-compliant with the RockSat User Guide at any time (if possible, teams may be given time to become compliant) and/or if your experiment fails a pre-launch delivery and/or testing benchmark, you will be removed from the flight manifest. If integration to the rocket has already occurred, your experiment may still fly as an inactive experiment or it may be returned to you. In both cases, you will not receive a refund of the RockSat Program Fee. Additionally, launching rockets has inherent design issues, schedule risks, technical unknowns, and weather factors. While launch and recovery of the RockSat rockets is the intention of this program, it is not guaranteed. In the event that the rocket is unable to launch due to any factor listed above or for some other reason beyond WFF control (this has never happened), experiments will be returned to teams and there will not be a refund of the RockSat Program Fee. If the rocket is not recovered after launch (this has happened once) WFF will not compensate teams for the lost experiment hardware, travel, etc and there will not be a refund of the RockSat Program Fee. The RockSat Program Fee is only refundable if a team has prepaid their fee before the RockSat program down select process has been completed. Teams not selected for flight during this process will receive a full refund of program fees paid minus a small processing fee.

1.8. Points of Contact

Please direct all inquiries to rocksatprogram@gmail.com

1.9. Applicable Documents and Links

- Sounding Rocket Program Office - Student Flight: https://www.nasa.gov/nasa-rocksat-program/
- NASA Wallops Flight Facility: http://www.nasa.gov/centers/wallops/home/index.html
- NASA Sounding Rockets User Handbook http://sites.wff.nasa.gov/code810/files/SRHB.pdf

2.0 ROCKSAT OVERVIEW

The RockSat experiment deck is a modular system based around experiment decks designed for suborbital flights with the WFF RockSat experiment section called the Carrier of Rocket Learning Laboratories (CarRoLL). Figure 2-1a and Figure 2-1b (below) show the CarRoLL structure and plate layout, respectively. Figure 2-2 and further details on the RockSat mechanical interface can be found in Appendix A and at this link.

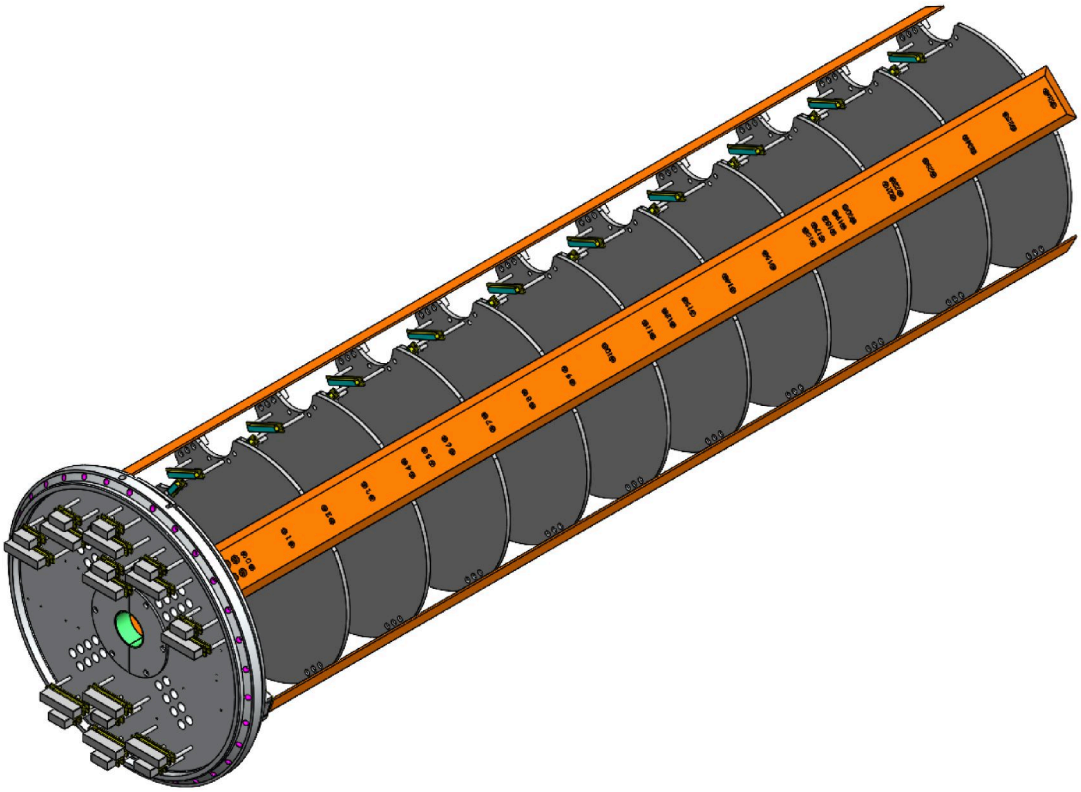


Figure 2-1a: RockSat Deck in Longeron Structure (Conceptual)

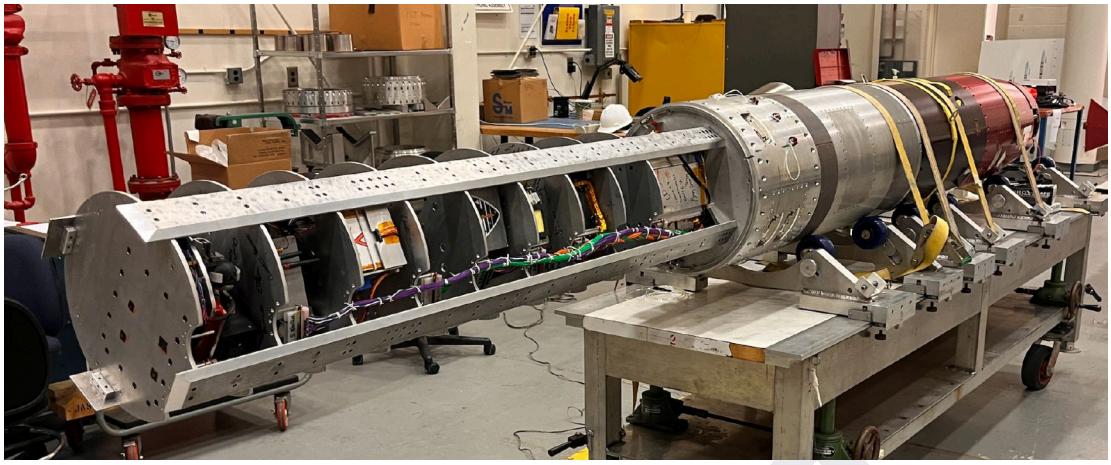


Figure 2-1b: RockSat Deck in Longeron Structure (Actual, rotated)

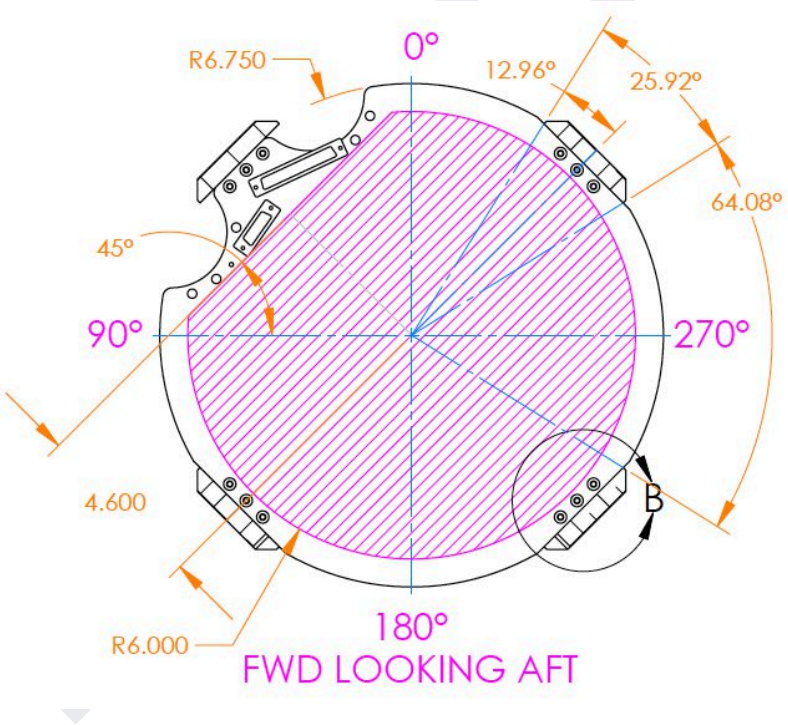


Figure 2-2: RockSat Deck Layout

The objective of the RockSat experiment deck is to give teams a design envelope to build around that will allow easy integration to any WFF rocket using the CarRoLL experiment section design. This standardized approach helps provide teams with low-cost access to space.

RockSat will have an ejectable skin (the skirt) that will fully expose experiments to the space environment during the sub-orbital flight. Additionally, the rocket will de-spin the experiment section to ~0.0 to 1.0 Hz shortly after second stage burnout and just before the skirt is deployed. WFF will also provide power to each experiment space. Teams will need to come up with a way to store their data internally and to withstand both the aggressive heating of re-entry (~450 F) and then impact with the ocean water.

3.0 ROCKET DESCRIPTION AND CAPABILITIES

This section covers key interfacing and launch vehicle capabilities that teams should be aware of for the design of their experiment.

3.1. RockSat General Capabilities Description

Each RockSat deck will be attached to the CarRoLL structure in a stacked configuration. This structure consists of longerons that span the entire length of the experiment section (Figure 2-1a&b and Figure 3-1). With 5 RockSat full experiment spaces (decks), the launch vehicle (Terrier-Improved Malemute) is estimated to reach an altitude of approximately 150 – 170 km, or approximately 100 miles.

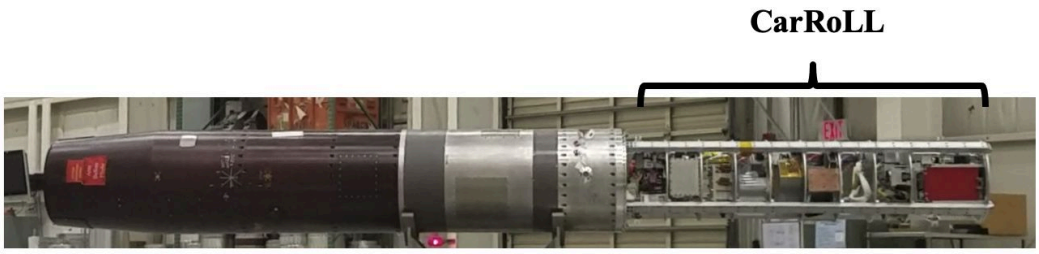


Figure 3-1: Experiment Stack with CarRoLL Section

There are a total of five full RockSat experiment spaces available for teams. The full spaces can be split into half for a total of up to 10 experiments. Or each half space can be split in another half (quarter of a full) for a total of up to 20 experiments. Each of the five full experiment spaces shall be provided with four timer controlled (4) power lines (TE) and associated ground wires that can be activated during flight at the experimenter's request. One (1) of these power connections will be redundant. Each full experiment space will also be provided with two (2) sets of power lines that can be activated prior to launch through the Ground Support Equipment (GSE) and as such have been dubbed GSE lines. It is highly recommended that main experiment activation occur through the GSE line however this activation should not be tied to any consumables on board (like memory) as WFF will activate the GSE lines

many times before launch and teams may not be able to recharge/reset these consumables. It is also required that any deployment/ejection action only be triggered by TE lines. Each full experiment section will have a 1 Amp Hour (Ah) battery available for the mission. Current draw on this battery is limited. Please see Figure 5-8. Teams will connect to power via the power and telemetry interface described further in Section 5.3.1. Please note that half and quarter experiment space teams will need to share these four TE and two GSE power lines as well as the 1 Ah battery with another half experiment space team. The WFF RockSat PM will coordinate these sharing arrangements.

The RockSat-X deck is circular in shape with a usable experiment space (design envelope) having a diameter of approximately 12 inches with a keep out area that is defined in detail in Section 5.2.2. Each full experiment space deck will have 10.75 inches of height (5.13 inches for half and quarter sections). Each full experiment space deck is allotted 30±1 lbs (15±0.5 lbs for half sections and 7.5±0.25 lbs) including the deck and power interface connector. All experiments shall weigh in at 30±1 lbs (15±0.5 lbs for half sections and 7.5±0.25 lbs). Experiments lighter than this shall provide their own ballast weights that are securely fastened to the deck (with screws/bolts not glue) to meet this weight requirement. Additionally, all experiments shall balance on a 1 inch cube centered on their deck, which represents the X-Y center of gravity (CG) for the integrated experiment. Any violation of weight, volume, CG requirements may result in the team being removed from the flight. A

3.2. Rocket Key Performance Parameters

Below are the typical key performance parameters for the RockSat rocket. They are subject to change without notice.

Table 3-1: Key Performance Parameters

Key Performance Parameter	Value	Notes
Altitude (km)	~160 km	1,3,4
Spin Rate (Hz) at Burn-Out	~4.8 Hz at Malemute burn-out ~0 Hz at apogee	1,2,3,4
Maximum Ascent G-Load	25 G (Sustained) 50 G+ Impulses Possible	1,2
Rocket Sequence (Burn Timing)	5.2 second Terrier burn 12.2 second coast 11.7 second Malemute burn	1,3,4
Experiments Power Off	332 seconds	1,3,4
Chute Deploy (seconds)	460 seconds	1,3
Splash Down (seconds)	882 seconds	1,3

Notes:

1. All parameters are subject to change
2. Data from Rosanova 41.092 RDM (2011)
3. Data from Rosanova 46.004 MRR (2012)
4. Data from Koehler 46.012 MRR (2015)

3.3. Flight Environment Conditions

3.3.1. G Loading

During ascent and descent experiments will experience both sustained and vibrational accelerations. Typical quasi-static G loads can reach 25 Gs. Experiments shall be designed to withstand at least 25 Gs of quasi-static loading in all three axes with possible impulses of approximately 50 Gs in the Z (longitudinal) axis. Three-axes vibration testing will be conducted by WFF before flight. Vibration/environmental testing will be completed approximately 2 weeks prior to launch. The specifics of this test can be found in Appendix B. Key structural parts of any RockSat experiment shall not be made of 3D printed materials.

3.3.2. Flight Environment

After second stage burn-out, the skin and nose cone will be ejected exposing all experiments to the vacuum of space. Experiments will be exposed to hard vacuum and varying temperature extremes. The primary mode of heat transfer at apogee will be radiation as convection becomes non-existent in the vacuum of space. The vacuum environment will also lead to outgassing. Requirements on teams to account for thermal extremes and vacuum conditions are not being imposed, but these factors should be considered in design. Outgassing becomes particularly important for optical experiments located near high outgassing materials. Outgassing properties for most materials can be found at: http://outgassing.nasa.gov/. Additionally, the experiment section will experience extremely high temperature heating during re-entry followed by exposure to saltwater for an extended period of time as the experiment section awaits water recovery. Pressure vessels that are low pressure are typically allowed on the flight but higher pressure vessels (greater than 25 psi) are prohibited unless explicit, written permission has been issued from WFF.

3.4. Disclaimer

Recovery of experiments is planned but not guaranteed. As with any flight, there are possible anomalies that can occur during the flight or recovery that can severely damage or destroy flight hardware. All selected teams should consider this and understand that space flight involves risks that WFF cannot plan for. Selected experiments assume all risks, and WFF shall not be held responsible in the event of an anomaly and/or unrecoverable experiment. RockSat Program Fee will not be refunded in the event that the rocket is not

recovered. Teams should also be aware that thermal and structural loading will be substantial upon re-entry. Pending a successful recovery of the experiment section, teams should expect severe and un-repairable damage to flight hardware.

4.0 ORGANIZATIONAL RESPONSIBILITIES

4.1. Team and WFF Responsibilities

Component and functional design responsibilities are listed below.

RockSat Experiment Team

- Experiment and support system.
  Support system includes:
  - Thermal system (if desired)
  - On-site tools and hardware for environmental testing and final integration
  - Sealed enclosure to protect hardware from water damage during splashdown and recovery
  - All environmental sensors (if desired)
  - Power regulation from nominal 28V±4V to any required experiment voltages
- Mechanical interface to RockSat deck
- Safety features for experiment-related hazards
- Power harness from experiment to power interface (minus connectors)
- All required ground side data analysis equipment (computers not provided)

WFF

- Terrier-Improved Malemute rocket, range safety, launch support, recovery and tracking
- One (1) RockSat deck with power interface with associated power harness connector and stand-offs
- Environmental testing and integration onto full rocket
- GSE testing (experiment verification) during June testing and final integration
- Mission management support

4.2. Ground Control

After the RockSat decks have been integrated onto the RockSat experiment section of the rocket prior to launch, the team will have very limited access to the experiments. WFF will handle all activities pertaining to final experiment preparation, launch, and recovery until the rocket has been recovered and the experiment is de-integrated.

5.0 EXPERIMENT DESIGN & INTERFACE REQUIREMENTS

5.1. Experiment Physical Envelope, Mass, and Center of Gravity Requirements

The following subsections outline the physical requirements and constraints of the RockSat experiment deck.

5.1.1. Constraints On Experiment Types

The purpose or mission of an experiment is open to the team. The team shall design an experiment that by all standards (engineering and layperson) would be considered safe and practical. Experiments shall not put other experiments, the WFF payload as a whole, WFF employees, or the launch vehicle at risk. All experiments shall be formally selected before the team can become a contender for flight. This formal selection will come after acceptance of the IFF by WFF in September. This formal selection does not mean the experiment has been selected/manifested for flight. That will come when the official manifest is made in November after PDR. Experiments with stored energy devices, deployments, ejections, or separation systems will be subject to additional review and require hazardous procedure documentation approved and verified by RockSat PM and WFF prior to integration and testing at WFF.

5.2. Mechanical

5.2.1. Physical Envelope

RockSat is based around a deck. The team is responsible for mounting their experiment to this deck in a manner that will ensure its survival during flight. Finite Element Analysis (FEA) is highly recommended but not required. All experiments will be environmentally tested at WFF prior to flight, which is the ultimate test of structural integrity.

Team experiments must be designed for integration to fit within the 12-inch diameter by 10.75-inch-high envelope as defined in Figure 2-2. Experiments can deploy booms and other mechanical devices once the skin has been ejected. Deployable or ejectable experiments introduce a new level of complexity and are subject to the more stringent design scrutiny from WFF. Release mechanisms such as compressed springs or burn wires must be approved prior to arrival at WFF and may require additional Hazardous Procedures to be approved by Wallops Ground Safety. These procedures must be submitted and approved by ISTR. All deployments, ejections, (anything with stored energy) require activation via a Timer Event (TE) line, and must deploy at a speed *less than* 1 inch per second. Faster speeds may be allowed with approval from the RockSat PM.

5.2.2. Mechanical Interface

All experiments shall be designed to mount to the RockSat-X deck. The deck design envelope is 12 inches in diameter.

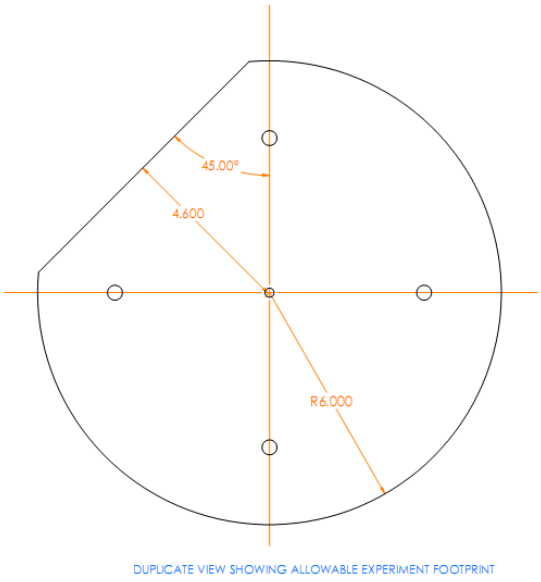


Figure 5-1: RockSat Experiment Design Space

Figure 5-1 shows the footprint of the space that teams can utilize for the experiment. The diameter is 12 inches, and the excluded portion of the disk is a keep out area for the power and telemetry connectors and wire-ways to be discussed below. Any sufficient need to go into the keep out area shall be approved by RockSat PM before teams can use this space. Teams may add holes to the plate but significant changes (more than 10% of material removed) will need to be approved by WFF.

The power connector will be provided by WFF. In addition to providing the connectors, each experiment space will be provided with a set of stand-offs to mount the connector to the deck. For design purposes, relevant dimensions on the location of the holes for connector mounting are summarized in Figure 5-2. Additionally, a SolidWorks model of the flight deck is available here.

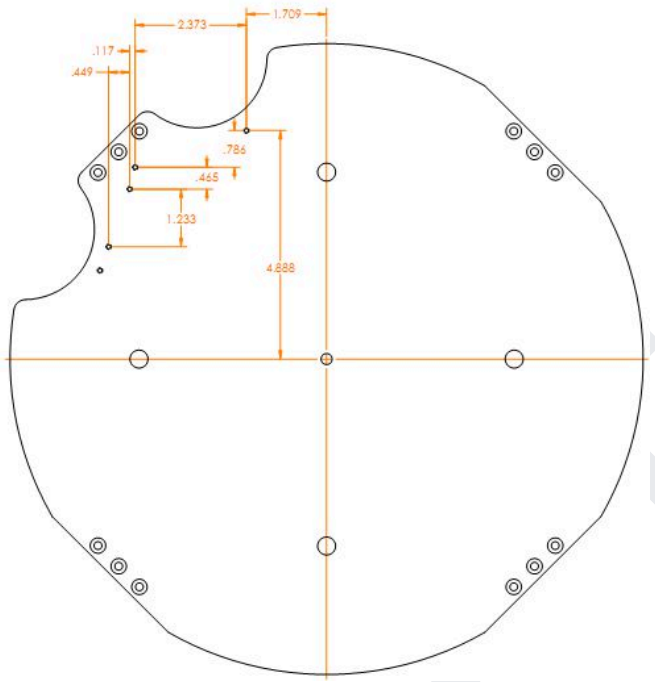


Figure 5-2: PT Connector Hole Dimensions

Teams have four options for mounting their experiment deck to the CarRoLL experiment section if using a full experiment space. These options are a bottom, bottom mid, middle, and upper mid mounting. The bottom mounting (BM) deck provides 10.75 inches of height, where the mid mount (MM) provides 5.62 inches below the deck and 5.13 inches above. Lower mid mount (LM) provides 2.82 inches below the deck and 7.93 inches above. The upper mid mount (UM) provides 8.44 inches below the deck and 2.31 inches above. Half experiment (HALF) space decks may use up to 5.13 inches above their deck. Quarter experiment space decks may use up to 5.00 inches above their deck. A pictorial representation of these options are presented below in Figure 5-3. Half and quarter experiment space teams shall use the bottom mount location. Other locations will be considered on a case by case basis but shall be presented no later than the PDR. All experiment decks shall countersink any fasteners on the underside of their decks. Nothing shall protrude from bottom of these decks to avoid interference issues with experiment decks that may be above or below these decks.

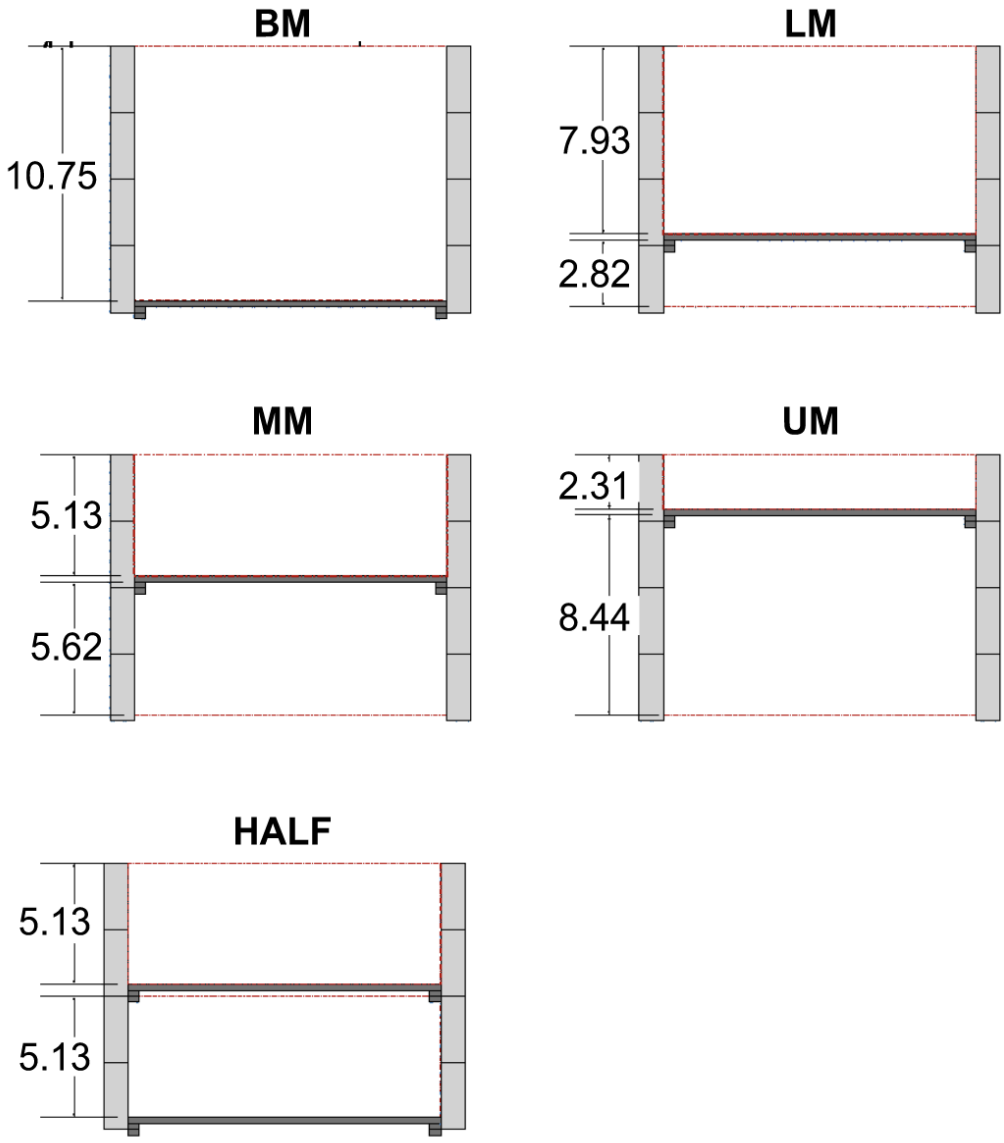


Figure 5-3: Deck Mounting Options

The mounting blocks between the experiment deck and the longerons shall be mounted aft of the deck, regardless of which way the experiment may be facing. This should be taken into consideration when designing and building the experiment. A visual representation of this is laid out in Figure 5-4, in which the nose of the rocket is to the left and the aft/motor mount is to the right.

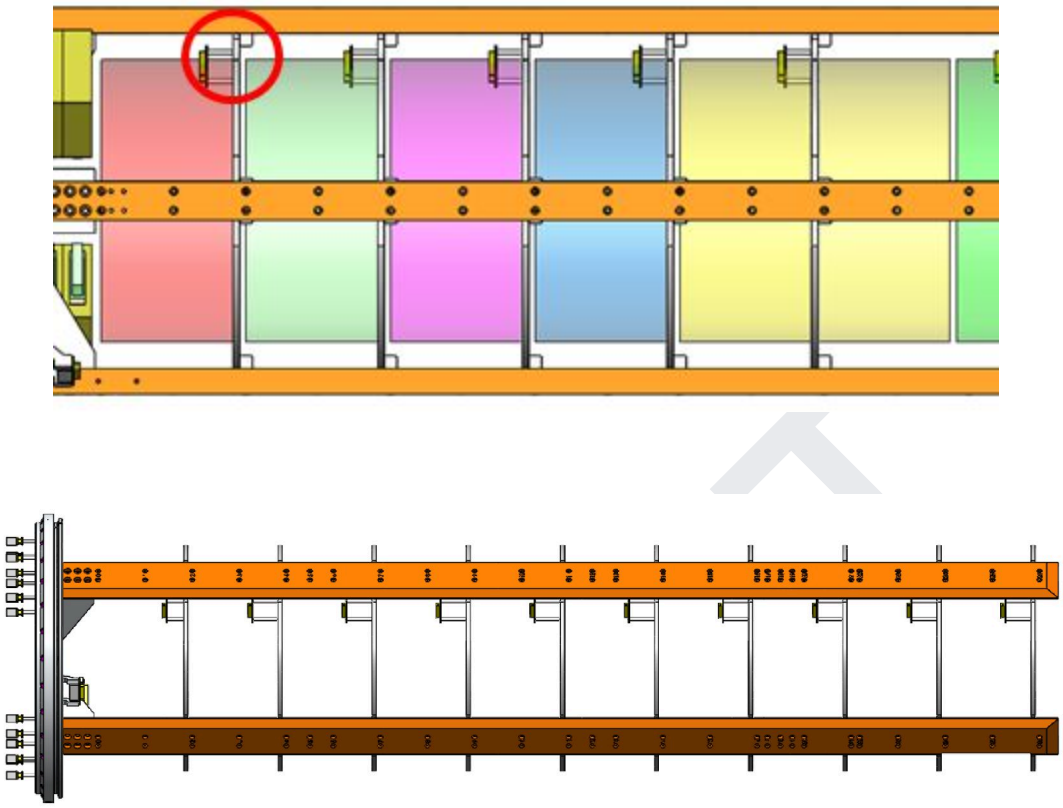


Figure 5-4: Mounting blocks aft of deck (old picture shown top, bottom picture of new longerons but blocks are hidden by longerons)

5.2.3. Mass Properties

Each RockSat experiment (including deck, blocks, and Power interface) shall be 30.0±1.0 lbf (13.61 kg). Fully assembled experiments will be weighed prior to WFF integration. Experiments not conforming to the weight constraints may be removed from the flight. Each RockSat half experiment (including deck, blocks, and Power interface) shall be 15.0±0.5 lbf (6.8 kg). Each RockSat quarter experiment (including deck, blocks, and Power interface) shall be 7.5±0.25 lbf (3.4 kg). All experiments shall weigh in at 30±1 lbs (15±0.5 for half sections, 7.5±0.25 quarter sections). Experiments lighter than this shall provide their own ballast weights that are securely fastened to the deck (with screws/bolts not glue) to meet this weight requirement. Any violation of weight or volume requirements may result in the team being removed from the flight.

5.2.4. Center of Gravity

All experiments shall be designed to have a center of gravity (CG) that lies within a 1 inch square in the X-Y plane of the RockSat deck. The center of mass in the longitudinal direction is less important but shall be accounted for in design reviews. To ensure stable flight, WFF may require a moment of

inertia (MOI) test prior to launch. This test will confirm that the CG of the experiment falls within the said requirement. Experiments that do not meet WFF's CG requirements may be removed from the flight. WFF understands that this test at the experimenter level may be difficult to perform and will accept analytical models showing compliance to this requirement. However, at WFF all experiments shall balance on a 1 inch cube centered on their deck, which represents the X-Y plane CG for the integrated experiment. Any experiment that does not pass this test may result in the team being removed from the flight.

5.2.5. G Loading

Each experiment will experience extreme and varying G-loads during the course of flight. It is not atypical to see up to 25 Gs in the positive Z (longitudinal) direction during ascent and experience about +/- 10 Gs in the X and Y (lateral) axes. Experiments shall be designed to withstand at least 25 Gs of quasi-static loading in all three axes with possible impulses of approximately 50 Gs in the Z (longitudinal) axis. In the event of a parachute failure, there will be more extreme loading in all three axes.

5.2.6. Material Selection

When designing the structure for the experiment, materials with high resistance to stress corrosion cracking (SCC) are recommended. Materials that have worked well in the past have been aluminum (6061) and steel. Plastics or other petroleum-based materials shall be used sparingly. PLA/3D printed parts should not be used for key structural components.

5.2.7. Heat of Reentry

Upon reentry, the vehicle (including the experiment section) will be subject to extreme thermal loading. The exact, maximum temperature is not known but it is speculated that experiments experience temperatures of at least 450 °F.

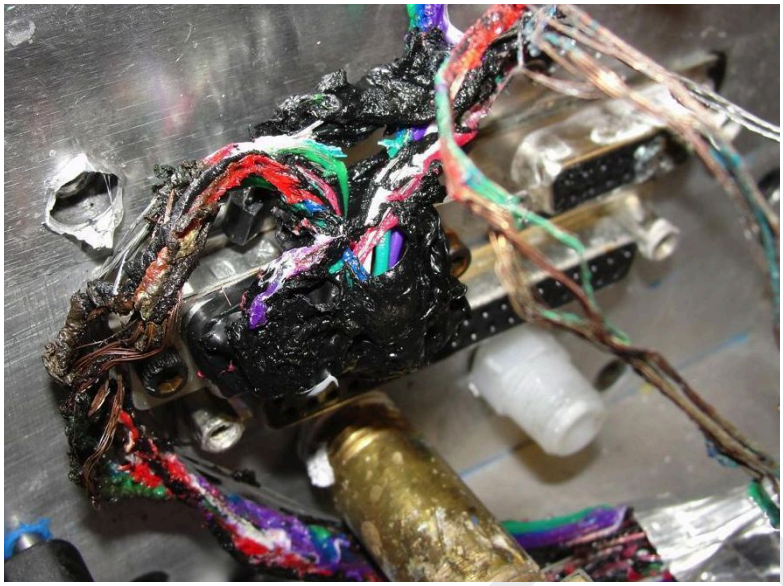


Figure 5-4: Thermal Reentry Damage from 2011

Figure 5-4 shows thermal reentry damage experienced on the 2011 launch. The item pictured is a standard d-subminiature connector with standard PVC coated copper wire. The heat of reentry melted both the connector and the wire's insulation. In the far left, one will notice bare copper where the insulation has been completely stripped from the wires.

Although this damage is severe, it can be prevented. When selecting wire, use Teflon coated high temperature wire (PTFE). Experiments using this wire type saw little to no damage to their harnesses. All connectors being utilized should include a back shell filled with potting compound. If these guidelines are followed, thermal damage to critical electrical systems can be minimized or avoided. In general, materials with melting temperatures less than 450 F should be avoided.

5.3. Power

5.3.1. Power Interface

The RockSat program utilizes a standard interface to deliver power from the rocket to the team. Each experiment team shall complete the Interface Control Document (ICD) for Power as part of their CoDR, PDR, and CDR deliverables.

To keep this program low-cost and low-impact to WFF, a standard interface and number of power lines were established for all experiment decks. The Power interface will mount to the RockSat experiment deck and will provide team side and WFF side connections. Using this standard will allow the use of

an Electrical Ground Support Equipment (EGSE) suitcase. This suitcase will initially provide 28V (±4V) to power lines to verify functionality prior to final integration to the rocket. The supplied voltage will increase to 32V at T-180s to simulate the switch to internal battery power.

5.3.1.1. Power Interface Design

The team side Power Interface consists of one d-sub connector that is provided by WFF. Each experiment deck will receive one (1) fifteen (15) pin d-sub for power. This connector and associated mounting hardware (stand-offs) will be mailed to final down selected teams after the team's 2nd payment has been received.

Figure 5-5 shows a representative fifteen (15) pin male connector that will be mailed.

Figure 5-5: Power Connectors

Note that the pin numbers are engraved on the backside of the provided Cannon connector.

Once the appropriate connections have been made, it is the team's responsibility to mount the d-sub connector to the plate with the associated mounting hardware. The mounting hardware should be securely fastened, but not over torqued to avoid damage to the connectors, standoffs, or deck. See figure 5-6.

Figure 5-6: Power Connectors with Standoffs

The exact location of these connectors is described in Section 5.2.2. The pin-outs for the power connector is located in Section 5.3.2

5.3.2. Electrical Interface

The power interface for each experiment deck shall consist of a single fifteen (15) pin Cannon connector (Figure 5-5). Teams will connect all power and ground lines to the pins on the back side, and WFF will mate directly with an opposite gender connector on the front side. This connector and associated mounting hardware will be provided by WFF after final payment of the RockSat Program Fee.

Each full experiment space shall receive the above said four (4) timer controlled power lines. Additionally, each full experiment space receives two (2) GSE activated power lines. The pin-out convention is given below in Table 5-1.

Table 5-1: Power Interface Definition

Pin	Function
1	+28 Volts (GSE 1)
2	Timer Event R1 (TE-RA)
3	Timer Event R2 (TE-RB)
4	Timer Event 1 (TE-1)
5	GND
6	GND
7	GND
8	GND
9	+28 Volts (GSE 2)
10	Timer Event 2 (TE-2)
11	Timer Event 3 (TE-3)
12	GND
13	GND
14	GND
15	GND

Pins 1 and 9 are GSE 1 and GSE 2, respectively. These lines will become active at the team specified T-X seconds prior to launch. T-X shall be less than 600 seconds but more than 30 seconds to prevent complications with the switch from external power to internal battery power. Pins 5-8 and 12-15 are experiment and WFF ground. Teams shall tie their experiment ground to all or any combination of these pins. Teams shall not tie their experiment power ground to their structure or chassis. Teams who are half or quarter experiment spaces will be assigned GSE and TE pins based on their experiment needs to avoid overlap of use by other half or quarter experiment space teams by the RockSat PM.

Pins 2 and 3 will be activated simultaneously for a team specified activation time to provide redundancy. These lines will become active at the team specified T+X seconds into launch. Pins 4, 10, and 11 are the non-redundant (TE) timer controlled power lines that will activate at independent times specified by the team. These times shall occur after launch, as they are controlled by the launch timer.

5.3.2.1. Power Provided and Activation

The timed event lines (pins 2-4 and 10-11) can be activated at any time after the launch (T+X seconds) of the vehicle. The on-board timer controls the activation of these lines. These lines are characterized by three (3) states: on, dwell, and off. At a team specified time (t_{on}) after launch, the line will switch from off (no power) to on for a team specified dwell time, t_{dwell}. After t_{dwell}, the line will switch from on to off and will remain in this state for the remainder of the mission until t_{splash}. Figure 5-7 shows the timing diagram for the four (4) timer controlled power lines. The green times indicate those specified by the team. The t_{dwell} cannot exceed the experiment power off time, which typically is before the predicted maximum reentry heating of the flight. For 2012, this time was T+346 seconds. For 2013, this time was T+337 seconds.

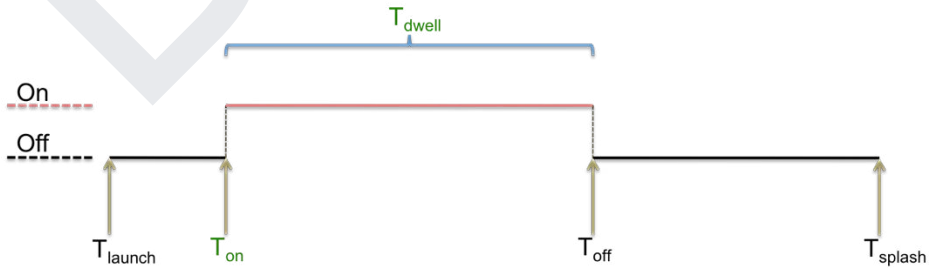


Figure 5-7: Timer Timing Diagram

Of the four power lines controlled by the timer, one (1) will be redundant. This line will have two dedicated timer events (occurring at the same time) and two independent solenoids for two levels of redundancy.

The fifth and sixth power lines (28V) are controlled by Wallops Ground Support Equipment (GSE), and can be activated up to six hundred (600) seconds (10 minutes) prior launch or as late as thirty (30) seconds prior to launch. It is recommended that primary electronics be controlled through the GSE line with peripheral sensors and subsystems being activated through the above described timer lines. All deployments, ejections, etc., shall be powered by timer events. Additionally, WFF will transfer power from your experiment by external power supply at ~28V to the internal battery which could be as high as 34V. It is important to design power conversion stages that can handle these transient voltages.

WFF will activate the GSE lines during environmental and other testing on the rail prior to launch, which should be taken into consideration in electrical design. This means that your system will be turned on via GSE multiple times prior to launch and you will not have access to reset any systems like SD cards or internal batteries. The provided power lines and timing are summarized in Table 5-2.

Table 5-2: Power Lines Provided

Type	*QTY*	*Timing*
Redundant (28V)	1	Team specified, post launch (T+)
Non-redundant (28V)	3	Team specified, post launch (T+)
Non-redundant GSE (28V)	2	Team specified, pre-launch (T-)

Each full experiment space will be allotted a dedicated battery with 1 Ah of capacity. Additionally, current draw on the GSE lines and timed events will be limited as summarized in Figure 5-8. These limits will be enforced through the use of polyfuse switches on the WFF power bus and EGSE. **NOTE: While the power system is capable of handling 3.75A per TE line, the maximum total current draw for any experiment space across all lines is limited to the 3.75A.**

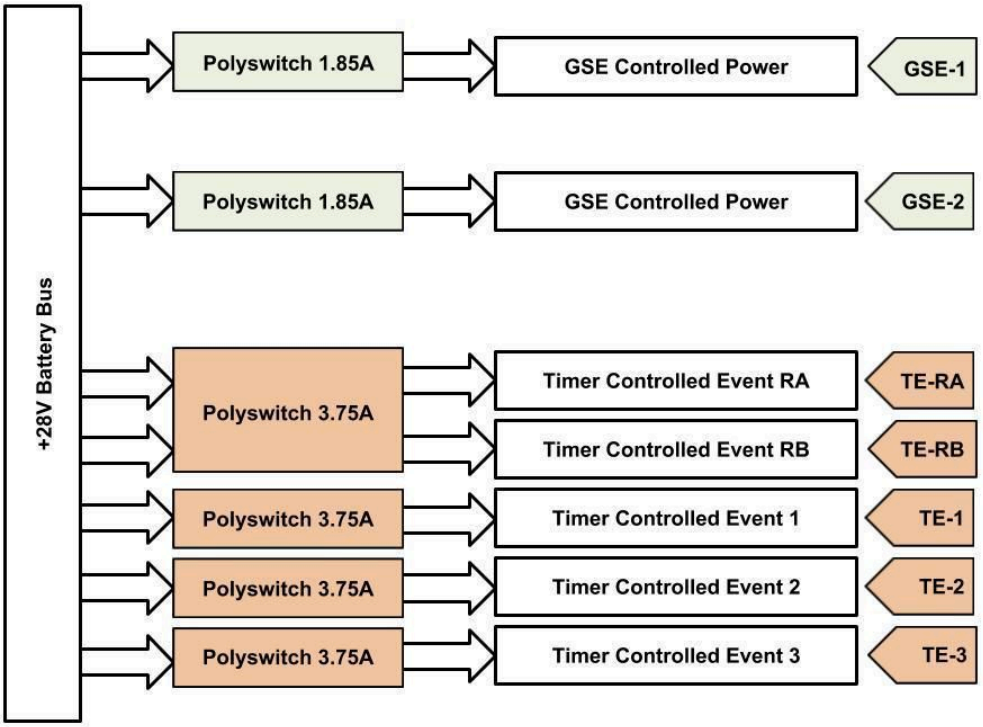


Figure 5-8: Current Limits

5.3.2.2. Independent Power Sources

WFF shall provide the power for all experiments. In the event that an experiment needs a voltage greater than the provided 28V, the team will be responsible for providing power. This power source must be cleared by both WFF, and a written, formal approval must be issued from the team before the experiment can fly. Experiments utilizing high voltages must also conform to the requirements provided in Section 5.4. It is important that teams ensure that there is no voltage or current on their experiment deck or through any of their interface wires (power) while inactive. Batteries and/or stored power sources shall be inhibited by either a GSE or TE line. Teams may use rechargeable lithium batteries, but rechargeable lithium batteries may not be recharged while the experiment is at WFF without prior approval from WFF safety. Other types of rechargeable batteries may be used and recharged at WFF, such as NiMH, but a procedure may still be needed. Non-rechargeable lithium batteries are allowed. It is recommended that all experiments have their batteries approved by WFF before purchasing them. All rechargeable batteries that will require recharging at WFF shall have a UL listing on both the charger and the batteries. There are no exceptions to this requirement. Failure to follow this requirement may be cause for removal from the rocket. Real-time clocks and other devices requiring button cell batteries may be allowed but shall be presented no later than the PDR for WFF approval.

5.4. High Voltage

All experiments using the provided 28V from WFF are strongly encouraged to conformal coat all electronics to protect against coronal discharge. All experiments utilizing voltages higher than 28 V shall conformal coat all boards. Experiments utilizing higher voltages than 50V shall obtain the written permission of both RockSat PM and WFF.

5.5. Electrical Harnessing and Staking

All experiments shall harness wires with a nylon lacing tape or the equivalent. Wire harnesses that are excessively long should be staked to the structure to mitigate the risk of disconnects during flight. It is also highly recommended that all connectors and IC sockets be tied and staked in place using aerospace grade RTV (Such as Dow Corning 3145). WFF payloads use Dow Corning products (734 and 736) for potting and electrical connection. These products can be purchased from McMaster Carr at: www.mcmaster.com Experiments wiring and staking will be inspected prior to integration to the rocket. This inspection will include both external and internal wiring. Power wire management may result in experiment flying un-powered. See Figure 5-9 for an example of poor wire management. See Figure 5-10 for an example of good wire management.

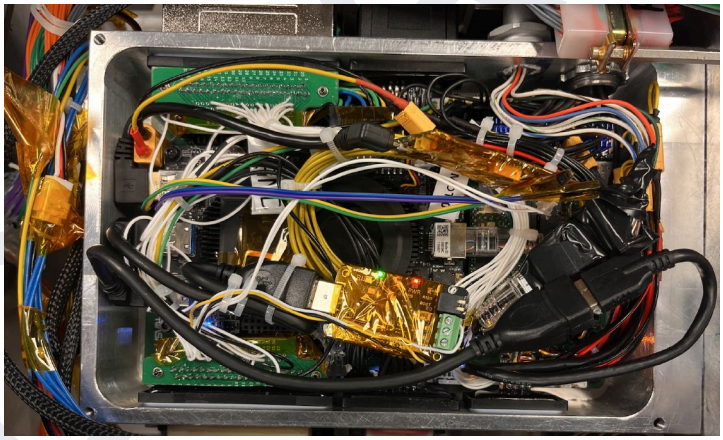


Figure 5-9: Example of poor wire management (internal)

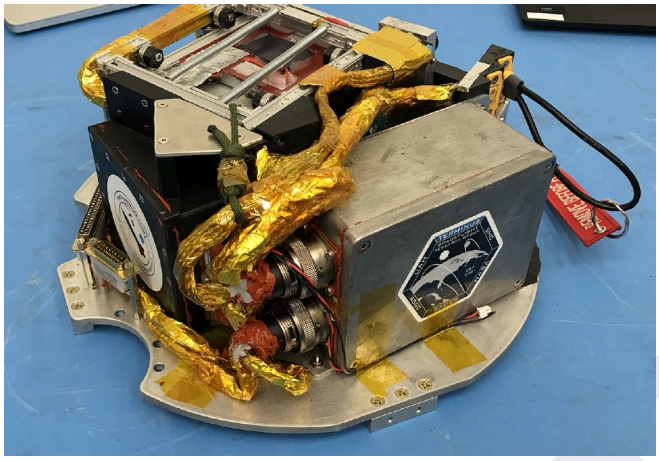


Figure 5-10: Example of good wire management (external)

5.6. Radio Frequency Transmissions

All experiments utilizing RF systems will be required to fully detail these systems. This will be done by completing a Frequency Utilization Request (FUR) form and submitting it to WFF through the RockSat PM at CDR. Approval of RF systems will be conducted by WFF to ensure that there will not be interference with necessary WFF payload systems. All RF systems shall be designed to activate with GSE lines. All RF systems shall be operational during the June testing trip for the WFF GPS Roll-out test. Experiments with non-functional RF systems during the June testing trip will not be permitted to fly their RF system for launch flown regardless of FUR form approval.

5.7. Summary of Key Constraints

Table 5-5: Summary of Key Constraints

Type	Quantitative Constraint
Physical Envelope	Cylindrical**: Diameter: ~12 inches (minus keep out) Height: ~10.75 inches 5.13 inches for half 5.00 inches for quarter This height is measured from the top of WFF deck. ** Deployables and booms are permitted once skin has been ejected
Weight	Experiment + Connector + Blocks + Deck shall be: 30.0±1.0 lbf for full 15.0±0.5 lbf for half 7.5±0.25 lbf for quarter Weight includes the deck and blocks which weigh: ~3.3 lbf
Center of Gravity	Lies within a 1 inch square in the X-Y plane of the RockSat deck
Power	Power One (1) redundant power line (28±4V) Three (3) non-redundant power lines (28±4V) Two (2) GSE power line (28±4V) 1 Ah capacity
High Voltage	All experiments utilizing higher voltage (>50V) shall conformal coat all electronics.

6.0 EXPERIMENT HARDWARE INTEGRATION

The team shall deliver, in person via hand carry or via shipment to WFF, a complete, functional, and fully integrated experiment to WFF in June. Prior to this delivery, a Visual Verification Check-in (VVC) shall be presented by the RockSat team to the RockSat PM. The review shall demonstrate that the experiment meets all of the requirements of this document and is flight ready. If the experiment does not meet the specifications of this document or the expectations of WFF management, the team will not be permitted to ship their experiment for integration and testing. All RockSat experiments will then be re-tested at WFF after shipment/delivery If re-test is successful, the experiment will be integrated and undergo environmental testing in early-June. After environmental testing, experiments shall remain integrated at WFF until the June final testing, inspection and launch.

7.0 EXPERIMENT TEST REQUIREMENTS

Testing of the experiment shall be performed by the team to ensure experiment functionality and survivability. All tests shall be documented and/or recorded for the testing reviews whose dates have been established in Section 5.0.

7.1. Structural Testing

The team shall perform any testing that they see fit to ensure that their experiment will survive the launch environment. In addition to the testing completed by the team, WFF will perform a three axes vibration test in June (sine and random). It is highly recommended but not required that teams perform vibration testing prior to arriving at WFF. Details on the vibration testing levels can be found in Appendix B.

7.2. Vacuum Testing

It is not required but highly recommended that the team run a full mission simulation in a vacuum chamber.

7.3. Day in the Life Testing (DITL)

The team is required to run and document at least two (2) full mission simulations to demonstrate functionality of the experiment. This test should consist of the experiment being operated on the bench as an integrated experiment for the entire mission life (less than 30 minutes). The results of these tests will be presented at the FMSR and VVC reviews as indicated on the schedule.

7.4. Wallops Flight Facility Testing

7.4.1. June Integration and Environmental Testing

The June Integration and Environmental Testing (I&E) is the most important testing phase for RockSat experiments. This will be the closest to a true mission simulation. The experiments are installed onto the WFF experiment section and testing is conducted to ensure systems behave in a way that is safe and acceptable for flight. It is required that experiments be fully mechanically and electrically functional and active during the June testing. WFF will not allow or accept significant mechanical or electrical changes after the June testing has occurred. During all testing, experimenters should expect GSE and timer events to become active. The following tests will be conducted in June:

- Full electrical sequence
  - All systems will be turned on in accordance with GSE and TE specified timing.
  - Sequence testing will be done multiple times both before and after vibrational testing.
- Vibration
  - Full experiment stack will be tested on the vibration tables as described in Appendix B.
- Moment of inertia
- Spin balance
- Radio frequency interference (RFI)
  - Systems will be turned on and electrical noise and RF emissions will be detected and characterized.
  - The RF portion of your experiments shall be able to turn on and off either with a GSE line or a manual switch
- GPS Rollout
  - WFF will test the experiment GPS and telemetry systems fully.
  - Experiments with purposeful RF devices are required to be powered during this test and actively transmitting RF as it would be for flight.
  - The RF portion of your experiments shall be able to turn on and off either with a GSE line or a manual switch
- Skirt Separation
  - The experiment skirt separation using pyrotechnic devices will be tested for smooth operation.

A summary of the powered tests that will be completed at WFF during the June Testing and Integration week is available in Appendix C. Please note that any test may be repeated if WFF or RockSat PM deems it necessary. RockSat participants must be able to complete all testing in compliance with RockSat guidelines in order to launch. Experimenters are able to enable/disable inhibits in-between tests following documented and approved procedures.

7.4.2. June Integration and Launch

During the integration portion of launch, the following tests will be conducted:

- Full electrical sequence
  - All systems will be turned on in accordance with GSE and TE specified timing. This will occur multiple times
- RFI Test (if needed)
- GPS Rollout (if needed)
- Turn on, vertical, horizontal checks on the launch pad

- Each system will have GSE power turned on multiple times prior to launch. Experiment design must be able to compensate for turning on with no ability to reset experiment.

The June launch date is dependent on many factors that can cause a launch to slip beyond the intended launch window. All launches have a launch window of 3-4 days. While the first day of the window is ideal, weather, boats in the recovery area, issues with the launch vehicle, or other circumstances may cause a delay in the launch. In previous years, launches have been postponed a day in 2015 (plus other years), a month in 2012, and as much as seven months in 2014. For this reason, the RockSat program makes no promise of a launch on a specific date. However, many launches do occur on time and without issue.

8.0 SELECTION PROCESS

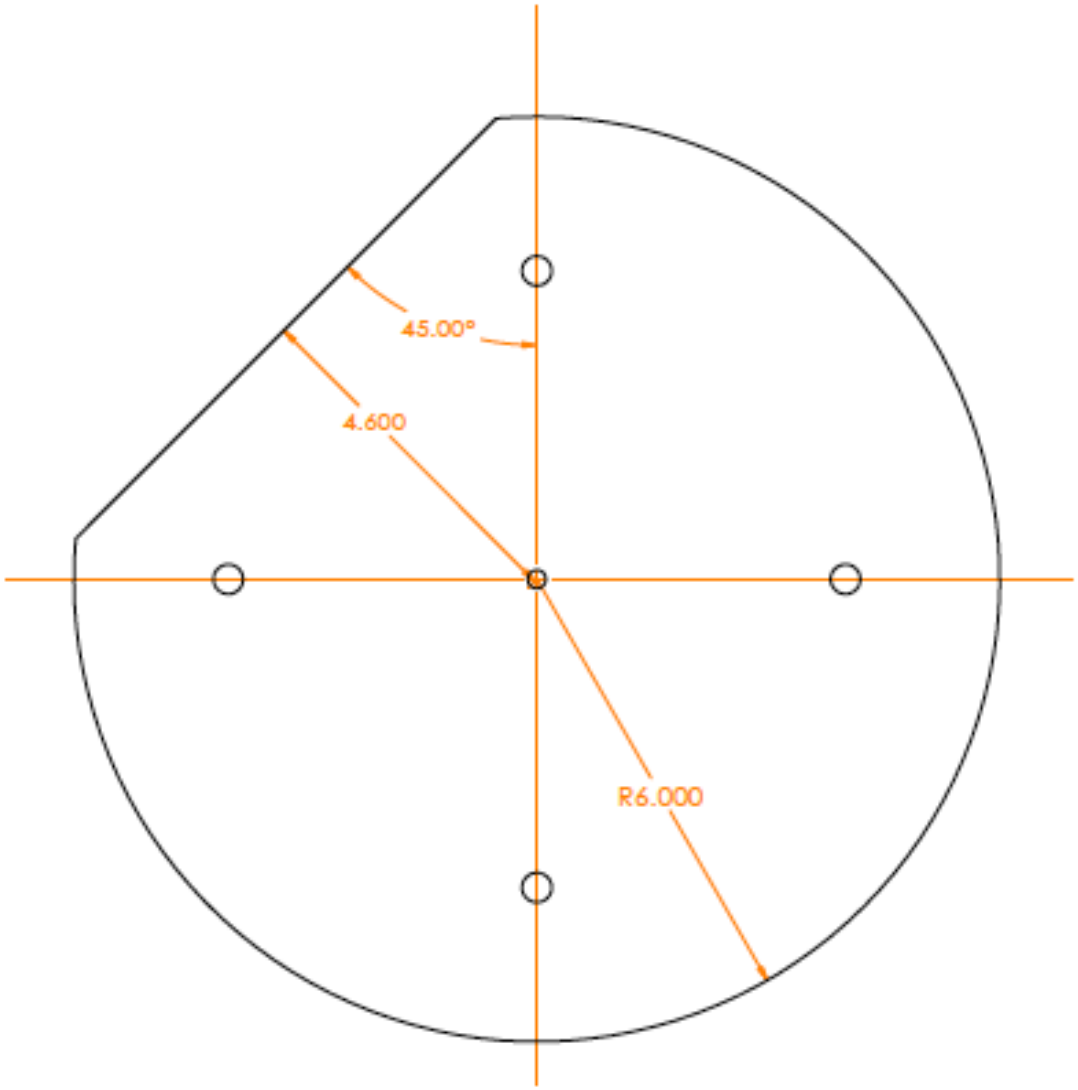
Any educational institution, as defined above, wanting to participate in RockSat-X shall submit the IFF in September. The completion IFF is required to participate in RockSat 2026 and is due no later than SEP 24, 2025 at 11:59 PM EDT. The IFF can be found here. https://tinyurl.com/rocksat-2026-iff It is expected to take ~20 minutes to complete this form. Although required, submission of the IFF does not mean that your team has been selected for flight on the RockSat 2026 program. The IFF will be reviewed, and initial selections will be made by the end of September. Initially selected candidates will be chosen based on responses to the questions on the IFF. Due to the limited experiment space on the RockSat launch vehicles, a down-selection process will be utilized after the successful completion of the RockSat Conceptual (CoDR) and Preliminary (PDR) design reviews. Each of these presentations will be reviewed and used to determine the flight worthiness of all initially selected candidates. If a team is down-selected, a full refund for their first payment, if made early, will be issued minus a small processing fee. No later than the end of November, WFF will award flight opportunities (the flight manifest) to the RockSat experiments that are the most mature and ready to continue in the engineering process. Once a project has been selected, the team's space has been reserved and no refunds will be issued for any reason; this includes but is not limited to failing to complete the experiment before launch or being removed from flight by either WFF or RockSat PM.

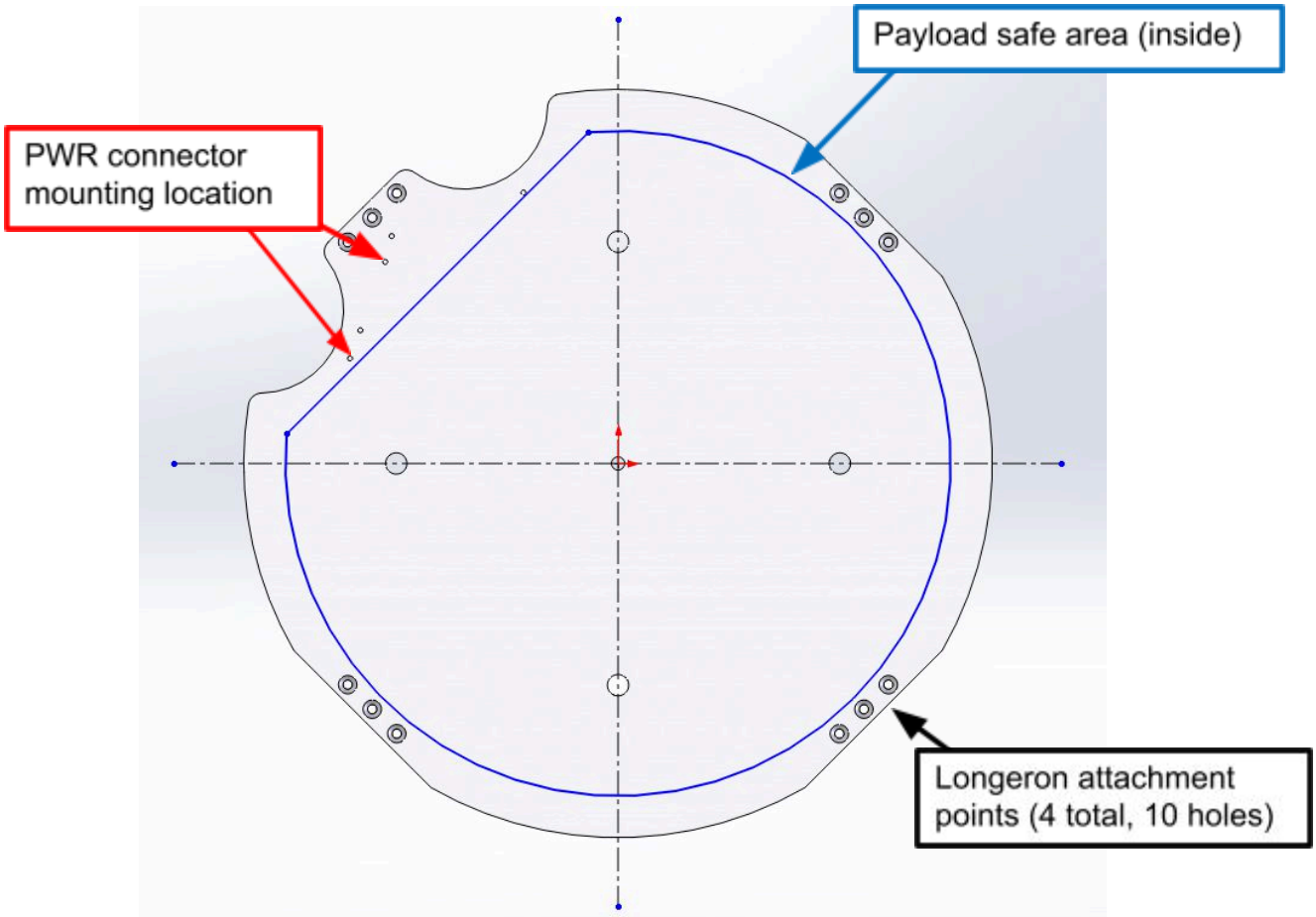
9.0 SCHEDULE

The following are key deadlines and reviews that the team should be aware of and are subject to change.

Date	Milestone/Event
SEP 24, 2025	IFF DUE
OCT 13-17, 2025	CoDR (Review)
NOV 17-21, 2025	PDR (Review)
NOV 24, 2025	Down-Select Complete and Flight Manifest
DEC 10-19, 2025	CDR (Review)
DEC 31, 2025	1st Payment DUE
FEB 9-13, 2026	STR (Review)
FEB 27, 2026	2nd Payment DUE
MAR 16-27, 2026	ISTR (Review)
APR 20-24, 2026	FMSR (Review)
MAY 18-22, 2026	VVC (Review)
JUN 1-5, 2026	RockSat I&T @ Wallops
JUN 22-25, 2026	RockSat Launch Trip
AUG 12, 2026	RockSat Reports DUE

10.0 APPENDIX A: Mechanical Drawings/Interfaces




Payload safe area (inside)
PWR connector mounting location
Longeron attachment points (4 total, 10 holes)

11.0 APPENDIX B: Environmental Testing Characteristics

** NOTE: The following specifications are based on the levels used on RockSat-C/RockOn. If other levels are to be used, this section will be revised as necessary.

***Environmental Testing Characteristics*:**
Wallops Flight Facility's Environmental Test for the RockSat Program has two components: The Sine Test and the Random Test.

***Sine Test*:**
The Sine Test will vibrate the experiment along the thrust axis at no more than 3 in/s. These rates will occur between the frequencies of 10 and 144 Hz. The thrust axis will also see 7G from 144 to 2000 Hz. The sweep rate is 4 octaves per minute.

***Random Test*:**
The random test will be completed in all three axes: thrust, lateral, and 90 degrees from lateral. The test will begin at lower levels and gradually increase to full level. Each axis will see 20 seconds at full level.

Thrust Full Level: 10 G_{rms} at 0.051 G^2/Hz from 20-2000 Hz
Lateral and Lateral 90 Full Level: 7.6 G_{rms} at 0.029 G^2/Hz from 20-2000 Hz

12.0 APPENDIX C: Summary of June Testing Operations

Test	GSE Power	TE Power	Notes
GSE Checkout	YES	YES	• Uses mobile EGSE equipment prior to mechanical integration. • Weight and height recorded, CG measured. • Testing monitors flight deck and power voltages for compliance. • Full Mission simulation. • Tests may be repeated if an issue arises or if RockSat PM has a need.
Sequence Test 1	YES	YES	• Occurs at WFF F-10 ground station with experiment mounted to the rest of the WFF payload. • First round of Pre-vibration full sequence tests. • Full mission simulations. • Tests may be repeated multiple times if an issue arises or WFF has a need.
Sequence Test 2	YES	YES	
Vibration Test	YES	NO	• Experiment GSE lines powered during multiple phases of vibration test. System could be turned on for over 10 minutes multiple times.
Deployment Test	NO	NO	• Rocket skin (skirt) is deployed to confirm no interference with experiments after vibration testing.
Sequence Test 3	YES	YES	• Second round of full sequence testing. • Full mission simulations. • Tests may be repeated multiple times if an issue arises or WFF has a need.
Sequence Test 4	YES	YES	
GPS Rollout Test	YES	NO	• System check to verify WFF payload RF communications. • All RF experiments must be operational during this time.