Effective: 19 May 2024

LATIN AMERICAN SPACE CHALLENGE

Rocket Challenge

Standards Manual (RCSM)

2024 Latin American Space Challenge

Edition 6 | Revision 1

The electronic version is the official, approved document.
Ensure you are using the correct version before proceeding.

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LATIN AMERICAN SPACE CHALLENGE

Table of Contents

Record of Revisions

The Rocket Challenge Standards Manual (RCSM), previously known as the LASC Rules & Requirements Document, has been revised to streamline the documentation system by consolidating information into a single document. As a result, the rules and requirements for mission organization, as well as the technical specifications for the experimental rocket, are now available in this document. The following table records all revisions of the document since the first Latin American Space Challenge.

Edition Number	Revision Number	Issue Date	Effective Date
1	1	March 2019	April 2019
2	2	February 2020	February 2020
3	1	July 2021	July 2021
4	1	January 2022	January 2022
5	2	January 2023	May 2023
6	1	May 2024	May 2024

RCSM Sixth Edition

The following table describes changes contained in Edition 6 of the Rocket Challenge Standards Manual (RCSM Ed. 6). The table describes significant changes and individual changes in each of the RCSM sections and provisions.

ISM 16 Revision 1 Highlights	
Area(s) of Change	**Description(s)**
All Document.	Baseline of the 2024 LASC Rocket Challenge Standards Manual, including the new LSARP concept of provisions to be followed by participating teams.

Introduction

1. Purpose

The Latin American Space Challenge (LASC) Rocket Challenge Standards Manual (RCSM) is published to establish the standards, guidelines, and operational protocols necessary for participants to effectively engage in the LASC Rocket Challenge.

This manual serves as the definitive reference for teams preparing for and participating in the competition, outlining the criteria and practices to be followed during the design, development, assembly, integration, and launch of rocket projects.

The LASC RCSM serves as the primary framework for evaluating and assessing the technical and operational aspects of entries submitted to the LASC. It provides a structured approach for participants to align with industry best practices in space engineering and mission planning.

2. Structure

The LASC RCSM is organized as follows:

- Section 1 → Rocket Challenge (RKT);
- Section 2 → Mission Organization (ORG);
- Section 3 → Safety (SAF);
- Section 4 → Launch Operations (FLT);
- Section 5 → Propulsion System (PRS);
- Section 6 → Airframe and Aerodynamics (STR);
- Section 7 → Electronics and Control Systems (ECS);
- Section 8 → Recovery System (REC);
- Section 9 → Payload (PAY).

Each section in this Manual is assigned an associated 3-letter identifier (in parentheses above). The reference number for every standard or recommended practice within a section includes the specific 3-letter identifier for that section (e.g., RKT 1.1.1).

3. Sources for LASC Standards and Recommended Practices (LSARPs)

The specifications and standards outlined in reputable aerospace guidelines and industry best practices form the primary sources for the LASC Standards and Recommended Practices (LSARPs). These encompass a wide range of criteria, extending to various aspects of rocket design, engineering, and operational management.

The LSARPs draw upon established principles from recognized aerospace entities, technical publications, and regulatory frameworks relevant to space engineering and mission planning.

The sources of reference and benchmarking includes, but are not limited to the Intercollegiate Rocket Engineering Competition (IREC) or Spaceport America Cup (SA Cup), the European Rocketry Challenge (EuRoC), Friends of Amateur Rocketry - Oxidizers Uninhibited Tournament (FAR-OUT), the Launch Canada Challenge, the IATA Operational Safety Audit (IOSA) program, the Manual de Segurança e Boas Práticas para Operação e Lançamento de Foguetes Amadores by the Brazilian Space Agency (AEB), and the NASA System Safety Handbook.

4. Explanation of LSARPs

LSARPs in this manual are designed for use within the Latin American Space Challenge (LASC) and provide the criteria for evaluations. LSARPs are not regulations.

LSARPs Identifiers

All provisions in the RCSM (i. e. the LSARPs) are marked with an identifier consisting of a three-letter section abbreviation and a series of three numbers separated by two decimal points (e.g., ORG 1.1.1).

Maintaining stable LSARPs identifiers is crucial for user convenience among teams, judges, and others, and for maintaining accurate statistical data. Therefore, efforts are made to minimize renumbering of LSARPs when revising the RCSM.

Standards

LASC Standards are specified systems, policies, programs, processes, procedures, plans, sets of measures, components, types of equipment or any other aspect under the scope of LASC that have been determined to be a necessity, and with which a team will be expected to be in conformity during the evaluation process.

Standards always contain the word "***shall***" (e.g., "The team ***shall*** have a process…") in order to denote that conformance by a team being evaluated is a requirement for LASC Launch and Recovery Approval.

Recommended Practices

LASC Recommended Practices are specified systems, policies, programs, processes, procedures, plans, sets of measures, components, types of equipment or any other aspects under the scope of LASC that have been determined to be desirable, but conformance is optional by a team.

Recommended Practices always contain the word "***should***" or "***must***" (e.g., "The team ***should*** have a policy…") to denote conformance is optional.

Conditional Phrase

Certain provisions (i.e., standards or recommended practices, or sub-specifications within certain provisions), begin with a conditional phrase. The conditional phrase states the conditions (one or

more) that serve to define the applicability of the provision or sub-specification to the team being evaluated. A conditional phrase begins with the words "***If*** the team…"

When assessing a team against a provision or sub-specification that begins with a conditional phrase, the Judge will first determine if a team meets the condition(s) stated in the conditional phrase. If the team meets the stated condition(s), the provision is applicable to the team and shall be assessed for conformance. If the team does not meet the condition(s), the provision or specification is not applicable, and such non-applicability will then be recorded as N/A.

5. LASC Documentation System

The RCSM is used in association with the following related manuals:

- LASC Overview and Guidance (LOG);
- LASC Satellite Challenge Standard Manual (SCSM);
- LASC Judging Handbook (LJH).

The LOG, RCSM, SCSM, LJH, and specific forms comprise the LASC documentation system. LASC documents and forms that are referenced in this manual are available for download on the LASC website (http://www.lasc.space).

6. Official Languages

English, Portuguese and Spanish are the official language of the Latin American Space Challenge; documents comprising the IOSA Documentation System are written in International English in accordance with LASC policy.

All documents, including reports, presentation materials, and correspondence with event officials shall be in English. For oral presentations, including videos and on-site presentations, speakers have the flexibility to choose from any of the event's official languages.

7. Manual Revisions

The RCSM is subject to an annual revision, which invariably leads to a new edition of the RCSM. In the event that critical issues emerge impacting the content of the RCSM, a revision to the current edition will be undertaken.. All changes in this document are listed in the revision highlights table. For easier orientation, the following symbols identify any changes made within each section:

- △ Addition of a new item.
- ↻ Change to an item.
- ⊗ Deletion of an item.

Section 1 — Rocket Challenge (RKT)

Section 1 defines the Rocket Challenge (RKT) mission categories and minimum payload mass, administrative requirements for application and registration, covers each technica deliverable, and details all awards and team eligibility.

1.1. Challenge Overview

Mission Categories

RKT 1.1.1. Teams competing in LASC shall design, build and launch an experimental rocket to a target apogee of 500 meters, 1000 meters or 3000 meters Above Ground Level (AGL) carrying a satellite or a general-purpose payload.

Missions will be divided into one of the following categories based on the type of project attempted – defined by the target apogee or selected propulsion system:

- 500 meters AGL apogee with a solid rocket propulsion system;
- 1,000 meters AGL apogee with solid rocket propulsion system;
- 3,000 meters AGL apogee with solid rocket propulsion system;
- Target AGL apogee with hybrid or liquid rocket propulsion system.

Teams are not allowed to request for Technology Demonstration missions or change their categories subsequent to the completion of the Application and Registration Process.

Teams that have missions selected for both the Rocket and Satellite Challenge are encouraged to launch the experimental rocket with the satellite project onboard. Bonus points may be awarded for successfully integrating missions from both challenges into a single launch, regardless of whether they are from the same team or different teams.

RKT 1.1.2. Each experimental rocket shall carry at least the specified minimum mass for each mission category. There is no maximum limit on payload mass.

Table 1: Target Apogee vs. Minimum Payload Mass.

Target Apogee		500 meters	1,000 meters	3,000 meters
Propulsion System	Solid	400 grams	800 grams	4,000 grams
	Hybrid/Liquid	Zero	400 grams	2,000 grams

The weigh-in will take place during the Flight Readiness Review. Event officials will approve payload weights that are up to 5% less than the specified minimum.

If this requirement is not met, "*nominal*" flight status for the experimental rocket may be denied by the officials, resulting in an action item to increase payload mass and/or a penalty may be applied for the team.

Launch Site, Logistics & Communication

The Latin American Space Challenge is held at Cabo Canavial, one of the largest grass farms in southeast Brazil. Located in the city of Tatuí, in the state of São Paulo, Cabo Canavial is an ideal location for this event, offering a safe environment with a good infrastructure of hotels and amenities. The Cabo Canavial Launch Area (CCLA) is located on private property at the following GPS coordinates: 23.36903059917333 S, 48.011443501324095 W.

More information about the launch area, logistics and its infrastructure can be found in the LASC Overview and Guidance (LOG) document, including composition of the event organization team, list of badges and privileges, and other important points regarding security.

For Brazilian teams, road trips are a great option for transporting teams and rocketry-related items to the event, but groups are advised to have multiple alert drivers - the front passenger is encouraged to be awake and alert with the driver.

For foreign teams and those who can not drive, there are two main airports: São Paulo-Guarulhos International Airport (GRU) and Viracopos International Airport (VCP). Make sure to try to find the cheapest option realizing the larger airports might not necessarily be the cheapest option.

Note that São Paulo-Guarulhos International Airport (GRU) is not located in the city of São Paulo but in the city of Guarulhos, approximately 15 km (1 hour drive) from São Paulo city center. We do not recommend teams stay in Guarulhos or nearby cities.

Transportation from São Paulo or Guarulhos to Cabo Canavial can be difficult with luggage and rocketry-related materials and equipment. While there are buses and trains from São Paulo to Tatuí, Cabo Canavial is far from Tatuí city center, and no buses or public transportation will be available. Plan your logistics ahead of time.

Foreign teams should communicate with Brazilian teams for support with logistics and directions. It is important that all participants collaborate with each other before the event. Event officials will not be able to support logistics issues during the event. Teams lacking adequate planning may be penalized or disqualified.

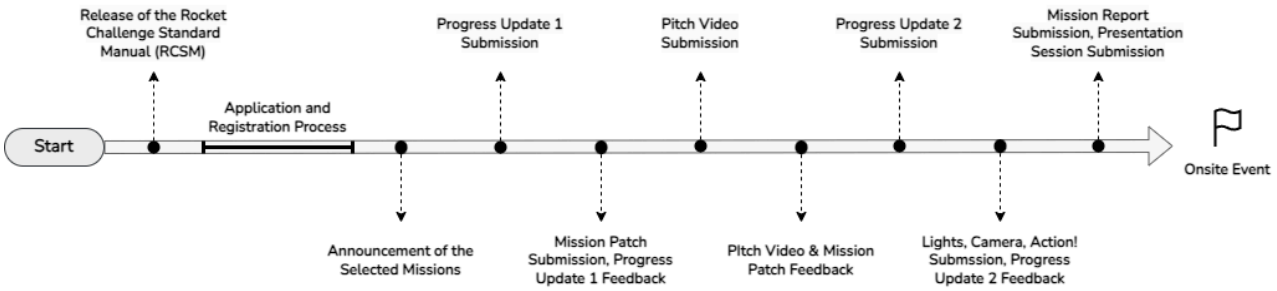
Primary individual team communication will be only via e-mail by lasc@lasc.space. Event officials will only be required to respond to emails. Responses on WhatsApp, Discord, or other channels will be optional (i.e., not mandatory for event officials). In the weeks leading up to the onsite event, a WhatsApp group will be created for all Mission Leaders and Safety Managers to facilitate fast communication with event officials.

The LASC Documentation System and other forms will be made available through the LASC website (www.lasc.space). All important event announcements will also be shared via social media, such as Instagram.

1.2. Milestones

The Latin American Space Challenge features a timeline that categorizes milestones as either remote or onsite. Remote milestones, detailed in the following figure, outline pre-onsite event activities including application and registration, progress updates, marketing actions, and mission report submissions.

Figure 1: Remote Milestones.



Note: Other milestones may not be included in this figure.

Each remote milestone is outlined in this section, detailing the requirements for each submission and action leading up to the onsite event. Section 3 provides safety provisions that shall be followed throughout the mission development process.

Section 4 of this document describes operational activities related to the preparation, assembly, evaluation, approval, launch, and recovery of the experimental rocket, including the Launch Readiness Review (LRR) process and the Slot Assignment Process.

RKT 1.2.1. All Selected Missions shall meet a minimum quality standard for all milestones to secure participation in the onsite event, including the assignment of a launch slot.

1.3. Application and Registration Process

Although the event officials aspire to admit all applicants, a selection process is imperative to safely and effectively manage the participation of teams. This selection will not adhere to a first-come-first-served basis; instead, all applications received during the designated application period will be considered equally.

The Application and Registration Process is governed by the **LASC's Mission Selection Process**, which hinges on the availability of slots (i.e., launch windows).

Slots are limited and may be affected by external factors, such as adverse weather conditions. Consequently, event officials will select a predetermined number of missions based on a set of criteria designed to maximize safety and the quality of the missions.

Additional criteria include compliance with the RCSM, the quality & goal of the submitted mission, the level of technology and innovation, and the team's history and maturity in past events.

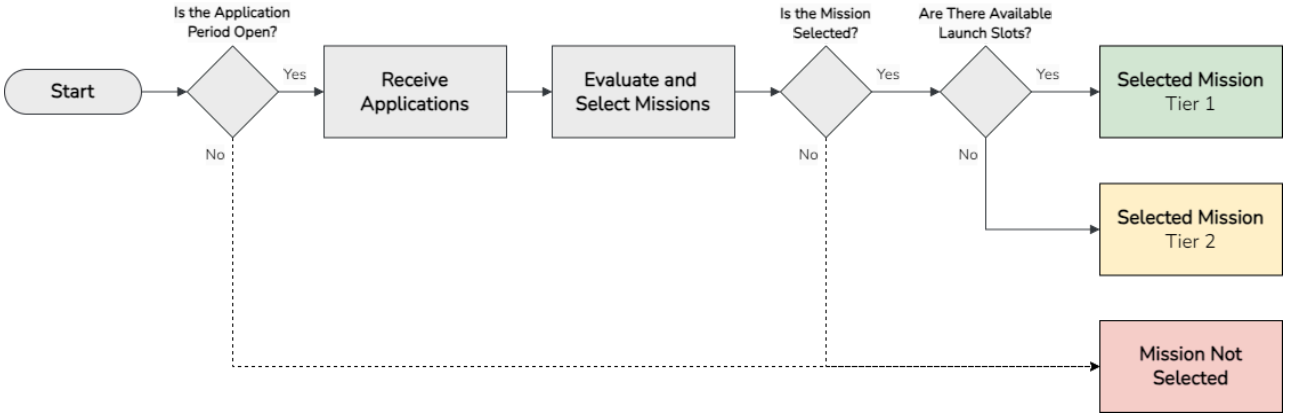
Given the historically high volume of applications, teams should be prepared for the possibility of their missions not being selected. Then, due to the limited number of available slots during the event, selected missions could be classified as Tier 1 or Tier 2.

- Tier 1 Selected Missions will be assigned and reserved a launch slot during the onsite event in compliance with the rules outlined in Section 3 of this document.

- Tier 2 Selected Missions will not have guaranteed slots during the onsite event. However, they may be allocated vacant or newly available slots during the launch operations, following the regulations specified in Section 4.

In addition, throughout the delivery roadmap, if a Tier 1 Selected Mission withdraws, an appropriate Level 2 Selected Mission will be escalated as a Tier 1 Selected Mission.

Figure 2: Mission Selection Process.



Regardless of the outcome, all teams will be notified about the results of the selection process, including feedback on their submissions up to 30 days after the closing of the applications.

It is important to note that submissions received after the application deadline will not be considered under any circumstances.

Submission Limitations

RKT 1.3.1. Teams are limited to submitting a maximum of 2 (two) missions in the Rocket Challenge. If the team submits more than one mission, each one shall be for a different mission category.

As a result, no team may compete in the same category more than once. The event officials will monitor and assess each project independently, regardless of shared student membership or academic affiliation. For example, Team ABC may register a project for the 1 km AGL apogee with hybrid/liquid propulsion system category and another experimental rocket project for the 0.5 km AGL apogee project.

Entry Form and Announcement of Selected Missions

The Entry Form can be accessed on the LASC website during the Application Period, as specified in the LASC Overview and Guidance (LOG) document. No payment is due at time of entry.

RKT 1.3.2. Each team is required to submit a complete Entry Form for each Mission Category in which they wish to participate in the Rocket Challenge. All submissions shall be made through the appropriate form available on the LASC website.

RKT 1.3.3. Total completeness of the Entry Form is required, including information specified on Section 2 of this document.

Selected Missions (Tier 1 and Tier 2) will be announced on LASC website and by the release of a Mission ID list after the end of the application deadline.

Mission Identification Number

All Selected Missions will receive a Mission ID to identify each mission and its associated team. For example, a team participating with two missions will have two Mission ID's: #3-A and #3-B.

RKT 1.3.4. A correspondence between a team with a Selected Mission and event officials shall contain the respective Mission's ID number to enable a more timely and accurate response.

The Mission ID is the officials' primary means of identifying and tracking each team. Once assigned, any correspondence with event officials shall contain the respective Mission's ID.

Team and Individual Tickets

While not classified as a milestone, the process of managing fees and payments is crucial to the overall event. Team and Individual Tickets are required only for Selected Missions. The Latin American Space Challenge requires a complex infrastructure to safely host all participants during onsite activities. Given the costs associated with providing a comprehensive experience for all attendees, the following specific fees apply to each type of participant:

- **Team Ticket:** The Team Ticket is necessary for the LASC Organization to make down payments on trophies, certificates, web services, launch pads, event structure and additional services before the event.
- **Rocketeer/Satelliteer Ticket:** All team members willing to officially participate in the event shall have a Rocketeer & Satelliteer Ticket, including to access specific areas of the onsite event. This ticket is mandatory for those willing to receive a digital certificate of participation.
- **Spectator Ticket:** Spectators will be welcomed to join the Latin American Space Challenge. There will be a "*Spectator Area*" for parents, friends and people interested in Science, Technology and Space Activities.

Detailed information regarding prices and the payment process can be found in the LASC Overview and Guidance (LOG) document. Participants are encouraged to consult this document.

RKT 1.3.5. All teams that have at least one Selected Mission, irrespective of tier assignment, are required to timely purchase one Team Ticket. This requirement holds regardless of the number of missions submitted or challenges in which the team is participating.

RKT 1.3.6. All participants, including rocketeers/satelliteers and spectators, shall have a valid ticket emitted by the LASC Organization to access the onsite event.

1.4. Challenge Deliverables

The following sections define the deliverable materials event officials require from teams competing in the Rocket Challenge – including as appropriate each deliverable's format and minimum expected content.

All deliverables will be submitted to LASC per the instructions provided to the teams. Each relevant deliverable description will facilitate submission of that deliverable or will be communicated to teams as is determined by LASC Organization.

The scheduled due dates of all required deliverables are recorded in the LASC Overview and Guidance (LOG) document, maintained on the LASC website.

Progress Updates

There will be two Progress Updates submitted per Selected Mission due prior to the event to track mission progress in design and development. These forms will contain questions regarding safety, organization, launch operations and testing, propulsion, airframe and structures, avionics, recovery, and payload. The template for each progress update will be available at least two weeks before the deadline to allow teams sufficient time to collect the appropriate information and data.

RKT 1.4.1. Teams shall submit Progress Updates for each Selected Mission via the Latin American Space Challenge website (https://www.lasc.space/) on 2 (two) specific occasions prior to the onsite event: the Progress Update 1 and the Progress Update 2.

These Progress Updates will record progression in the project's technical characteristics during development. Event officials understand not all technical details will be known until later in the design process. Therefore, the Progress Updates prior to the final submission will be evaluated based only on their timeliness and completeness.

RKT 1.4.2. Total completeness of the Progress Update form is required at all times. Reasonable engineering estimates and approximations are expected during the application process, but will be subject to progressive additional scrutiny in the subsequent Progress Updates.

Teams should briefly mention their ongoing discussions and analysis in the comment fields for any numerical submissions that are known to be unreasonable or remain undecided.

Teams may also respond to undecided criteria by demonstrating their understanding of any applicable event guidance or best practice governing the particular detail.

RKT 1.4.3. Teams should briefly mention their ongoing discussions and analysis in the comment fields for any numerical submissions that are known to be unreasonable or remain undecided.

Teams may also respond to undecided criteria by demonstrating their understanding of any applicable event guidance or best practice governing the particular detail.

Marketing Actions

Since the early days of the Apollo missions, the general public has been captivated by the spectacle of rocket launches, eager for more information and the chance to witness these events firsthand. The allure of a launch vehicle is immense, drawing thousands of people to travel far from home to be near launch sites, just to hear the thunderous roar of rocket engines.

Event officials, seeking to draw more attention to the teams and their missions, recognize the need for structured marketing efforts. Such efforts are essential to realizing the dream of having thousands of spectators watch experimental rockets launch from Cape Canaveral.

The Marketing Actions are divided in three deliverables: a Mission Patch, a Pitch Video and a competition for likes/followers in the following social media: Instagram, TikTok, X (Twitter), Facebook and LinkedIn.

Mission Patch

Mission patches are emblems designed and worn by astronauts and people affiliated with a mission, such as Rocketeers and Satelliteers. The patches depict an image associated with the mission.

RKT 1.4.4. Each team shall submit an appropriate Mission Patch for each Selected Mission during the Progress Update 1. Submissions shall be made in a timely manner using the designated form on the LASC Website, following the schedule outlined in the deliveries roadmap.

Team's logo will not be accepted as a mission patch. Late submission will not be accepted and teams may be penalized by not submitting a Mission Patch.

For more information and examples, teams should access the following websites:

- Wikipedia - Mission Patch: https://en.wikipedia.org/wiki/Mission_patch
- Human Spaceflight Mission Patches: https://www.nasa.gov/gallery/human-spaceflight-mission-patches/

- NASA - Houston We Have a Podcast, Mission Patches: https://www.nasa.gov/podcasts/houston-we-have-a-podcast/mission-patches/
- National Air and Space Museum - The Meaning of Mission Patches: https://airandspace.si.edu/stories/editorial/meaning-mission-patches

Pitch Video

Reels, short videos, and pitch presentations—these are new terms that have become part of our daily lives. The younger generations are completely immersed in social media, especially videos: easy to watch and fun! To make the competition more diverse and not just about technical development, it is crucial to communicate what each selected mission is doing to the broader society. Therefore, each selected mission will be required to record a pitch video explaining their goals, concept of operations, and anything else the team feels needs to be communicated.

RKT 1.4.5. Each selected mission shall submit a Pitch Video explaining the mission, goals, concept of operations, and other important information and data.

RKT 1.4.6. The Pitch Video shall be no longer than 2 (two) minutes of total duration. On or before a specified date prior to the event, teams shall submit the YouTube link of the video using the appropriate location indicated on LASC website.

The video shall be uploaded on YouTube with a title as “Mission Your_Mission_ID Pitch Video to the 2024 LASC". For example, a team assigned the Mission ID "19", competing in the 2024 LASC, would subtitle their YouTube Video as "Mission 19 Pitch Video to the 2024 LASC".

Lights, Camera, Action!

Don’t forget, this is a healthy competition! In order to grow the audience and get more attention to the space activities in the region, teams will be asked to conduct a marketing campaign to get likes and followers in the main social media. On a certain date, LASC will collect a frame of all teams’ social media total followers. Then, from a specified time window, teams will be required to post and organically promote their selected missions for the Latin American Space Challenge.

RKT 1.4.7. Each team should promote the selected mission by posting reels, stories, shorts, videos, tweets, and other types of publicly accessible content on YouTube, Facebook, Instagram, LinkedIn, TikTok, and/or X (Twitter). The appropriate content shall be posted during the time windows specified by event officials to the mission leader.

RKT 1.4.8. Each post related to the "*Lights, Camera, Action!*" deliverable shall include the Official LASC Event Patch in the image or video, and the LASC website in the description.

RKT 1.4.9. Each mission leader should timely submit link(s) to the post(s) related to the *Lights, Camera, Action!* to be analyzed by event officials by the appropriate form available on LASC website. There will be a limit of 20 links for each selected mission.

Event officials will collect the total number of followers for each team immediately before and after the milestone window, as well as the total number of likes on posts about the selected mission, to score the "Lights, Camera, Action!" deliverable. The score will be normalized from the team with the greatest marketing reach to the team with the least for each selected mission.

Mission Report (MR)

Each team shall submit a Mission Report describing their experimental rocket project and concept of operations (ConOps) to the technical evaluation board and event officials. This document shall include detailed information on the design review, goals, tests, and the most accurate technical data of the vehicle.

RKT 1.4.10. Teams shall timely submit a digital, PDF copy of their Mission Report for each Selected Mission, with the file name "Your Mission ID_Mission Report". For example, a team assigned the Mission ID "19" would submit a digital copy of their Mission Report using the filename "19_Mission Report".

RKT 1.4.11. The Mission Report shall be formatted according to the style guide of the Latin American Space Challenge (LASC), using a provided Microsoft® Word document template. Always check the template maintained on the website before drafting your Mission Report to ensure you are using the latest version.

RKT 1.4.12. The Mission Report shall be no longer than 50 pages, including figures, footnotes, sources, source endnotes, nomenclature lists, equations, explanations of variables etc. This does include the Appendices. However, appendices are not necessarily read in detail by the event officials.

RKT 1.4.13. The Mission Report's main title is left to the team's discretion, however; the paper shall be subtitled “Mission Report *Your Mission ID* to the *Year* Latin American Space Challenge".

For example, a team assigned the Mission ID "19", competing in the 2024 LASC, would subtitle their Mission Report "Mission Report 19 to the 2024 Latin American Space Challenge".

Further requirements are given in Appendix A: Details for the Mission Report, including the required minimum Mission Report sections and appendices. Additional sections, subsections, and appendices may be added as needed.

Presentation Session

Event officials aim to promote networking and knowledge sharing between teams during the onsite event. Presentation Sessions will be held in designated slots to foster an environment of technology development. Teams with selected missions may register to participate as speakers in a Presentation Session, discussing specific developments of their mission.

Selected missions chosen to speak in the Presentation Session may receive additional points in the evaluation of their design implementation and/or preferred placement in the queue for slots.

The date of the official announcement of selected missions chosen to speak in the Presentation Session will be published in the LASC Overview and Guidance (LOG) document.

RKT 1.4.14. Teams should submit a digital PDF copy of their Presentation Session Slides for a specific Selected Mission to the appropriate LASC submission form available on the website. The file name should be "Your Mission ID_Presentation Session." For example, a team assigned the Mission ID "19" would submit their slides using the filename "19_Presentation Session."

RKT 1.4.15. There will be no template for this deliverable to avoid impacting the creativity of each team. However, all slides must include the Official LASC Event Patch in one of the slide corners to identify the event in the material.

RKT 1.4.16. The Presentation Material's main title is left to the team's discretion, however; the first slide shall be subtitled “Presentation Session *Your Mission ID* to the *Year* LASC".

For example, a team assigned the Mission ID "19", competing in the 2024 LASC, would subtitle their Presentation Slide "Presentation Session for Mission 19 to the 2024 LASC".

RKT 1.4.17. The presentation can be given in English, Portuguese, or Spanish; however, the slides shall be in English. Teams should inform the language to be used during the Presentation Session in the appropriate LASC submission form. The language shall not be changed after submission.

RKT 1.4.18. Each Presentation Session shall last between 7 and 10 minutes for the presentation, followed by up to 5 minutes for questions and answers, totaling a maximum session duration of 15 minutes.

LASC Participant Agreement

All participants from every team must sign the **LASC Participant Agreement** (Waiver and Release of Liability) with no exceptions. To the extent permitted by law, the team shall indemnify and hold harmless LASC and its Event Officials from any and all claims, lawsuits, liabilities, damages, and/or injuries of any kind whatsoever (including but not limited to monetary loss, property damage, personal injury, and/or wrongful death), whether brought by an individual or other entity, or imposed by a court of law or administrative action of any federal, state, or local governmental body or agency, arising out of any acts, omissions, negligence, or willful misconduct on the part of the Team or Institution or the Team's or Institution's officers, owners, personnel, employees, agents, contractors, invitees, or volunteers. This includes, but is not limited to, the payment of all penalties, fines, awards, fees, and related costs or expenses.

RKT 1.4.19. It is mandatory that every individual attending LASC – including team members, faculty advisors, and others – signs the LASC Participant Agreement. Individuals who do not sign this form will be unable to participate in any activities occurring at the Cape Canavial Launch Area.

RKT 1.4.20. The LASC Participant Agreement will be sent by e-mail to all officially registered participants after the payment of the Rocketeer/Satelliteer Ticket, but before the submission of the Mission Report, and shall be digitally signed.

RKT 1.4.21. If a registered participant fails to sign the document online, there will be a last chance to sign the LASC Participant Agreement during the check-in session.

Participants attending competition who do not sign this waiver will not be permitted to enter the event facilities.

Foreign Teams and Seeking a Visa

For many foreign teams we have seen before, it is important to seek a visa upon acceptance. Keep in mind that some members of your team may not be citizens of the country where your university is located. Therefore, upon acceptance into the challenge, file for your visas immediately.

If an individual on your team is from a country that has difficulties acquiring a visa, be sure to cross-train replacements in case they are unable to attend the challenge. Ensure that all necessary paperwork is submitted promptly so that team members can attend the competition in person, rather than as a photo affixed to their control panel.

RKT 1.4.22. Each foreign team with at least one Selected Mission shall contact event officials before submitting Progress Update 1 to request a Letter of Invitation. The mission leader shall provide a list of full names, passport numbers, email addresses, and mobile numbers of all team members seeking a visa to Brazil.

1.5. Scores, Evaluation and Awards

Event officials will evaluate competitors for Place Awards within each mission category based on the quality of required project documentation, the quality of their system's overall design and simulation, the mission's overall excellence, efficiency and performance demonstrated at the Mission Report, and finally, the launch operations and safety.

Scoreboards and Award Ceremony

After each appropriate milestone, event officials will publish a partial scoreboard for all mission categories. The partial scoreboard will be available on the LASC website for public access and will be updated automatically after the evaluation of each selected mission.

Event officials will document the evaluations using individual score sheets for each selected mission and then consolidate them into one master scoreboard using the grading criteria set out in the following subsections.

The final scoreboard will be published during the Award Ceremony, including the winners for each mission category.

RKT 1.5.1. The Award Ceremony, to be held on the last day of the event, will be the final milestone of LASC where winners will be announced. All teams shall be present during the Awards Ceremony. If an award-winning team is absent, event officials have the right to select the subsequent team to receive the award. This ensures that recognition is given and accepted in person at the ceremony.

Up to seven days after the Award Ceremony, individual scoring sheets and feedback regarding the strengths and weaknesses of each selected mission's performance will be provided by email.

Handling of Questions & Complaints Regarding Scoring

Teams are welcome to approach the officials to ask for specific, non-binding, oral feedback regarding their perception of the teams' work during all points of the competition to provide the teams with an opportunity to learn and improve.

In the case the teams have more detailed questions or specific complaints regarding the scoring after the scoring has been announced, such as they would like to receive elaborate feedback on a particular aspect of the score for clarification, e.g., to improve upon for the next event, or if they identify an honest mistake made by the jury, the following process applies:

RKT 1.5.2. Only the mission leader can submit a written feedback request once to lasc@lasc.space. Submissions of the feedback are accepted until no later than one week (7 days) after official announcement of the score. To keep the workload on the officials to a reasonable amount, teams are asked to limit their questions plus complaints to 3 (three) in total. Event officials will then review these three questions and/or complaints and provide written feedback.

If an honest mistake in scoring is apparent, event officials will review the score provided to the team and decide on a case-by-case basis if and how to account for this, especially and only if this would significantly affect the overall score and placement of the team.

It should be noted that teams are expected not to abuse this possibility of questions and complaints for bagatelle. Officers will not participate in a discussion questioning the evaluation's reasoning on the score given.

Scoring Categories and Grading Criteria

Missions will be scored in five different scoring categories or areas, which are (1) Team Effort, (2) the Mission Report, (3) the Design Implementation, (4) the Launch Operations, and (5) Dual-Challenge Bonus. These are weighted according to the following table.

In each scoring category, a set of grading criteria is established. These criteria will be evaluated by the jury for each mission individually. Each grading criterion has several, more detailed, topics that establish what the jury will look for during the grading process.

Table 2: Weight of the Scoring Categories for the Rocket Challenge.

Scoring Categories	Possible Points	% of Total Points
Team Effort	100	10%
Mission Report	200	20%
Design Implementation	100	10%
Launch Operations	550	55%
Dual-Challenge Bonus	50	5%
TOTAL	**1000**	**100%**

These detailed topics are weighed equally within each criterion, while the main criteria are weighted differently within each mission category. The details of the grading criteria can be found in Appendix B: Detailed Grading Criteria.

1.6. Awards

The 2024 LASC will award teams in the First Place and Second Place of each Mission Category, three Technical Achievement Awards, one Women Representation and Diversity Award, the Team Awards and the Overall Winners for the Rocket Challenge.

Best Experimental Rocket of the Year

One team among the First Place Award winners in each challenge defined in this document will be named the Best Experimental Rocket of the Year. The recipient of this award is determined by qualitative assessments of the event officials made throughout the entire event.

The Best Experimental Rocket of the Year not necessarily will be the highest scoring mission, but will be awarded to a single team chosen by the event officials based on safety, launch operations, project complexity, technology and innovation. A team is considered eligible for the award after participating in the Rocket Challenge submitting all documents, reports, activities, and successfully launching the experimental rocket.

Mission Category “Place” Awards

A First Place Award will be granted to the highest scoring, eligible team in each of the Mission Categories defined in this document. A Second Place Award will be granted to the 2nd highest scoring, eligible team in each Mission Category.

A team is considered eligible for the place award(s) in its category after participating in the 2024 LASC submitting all documents, reports and activities.

In the event, if no teams meet this definition in a given category, event officials may issue Category Place Awards at their discretion based on multiple factors – including points accrued, participation and engagement, and overall performance.

Juan Pablo Rengifo Award for Flight Dynamics

The Juan Pablo Rengifo Award for Flight Dynamics is a Technical Achievement Award granted to the team that executes the experimental rocket launch mission with the most precise apogee relative to the target, achieving the smallest percentage difference among all successful launches.

Eligibility for this award requires that the team has a selected mission in the Rocket Challenge and that the launch complies with all safety and engineering standards, including undamaged recovery. The team that meets these criteria with the highest level of accuracy in apogee achievement will be honored with the award.

João B. G. Canalle Award for Technical Excellence

The João B. G. Canalle Award for Technical Excellence is a Technical Achievement Award that recognizes a team which demonstrates exceptional overall engineering discipline and technical skill through their analyses and conclusions, project or program planning and execution, operational procedure, manufacturing processes, iterative improvement, systems engineering methodology, robust design, etc.

Any team with a selected mission that participates in the Rocket Challenge or Satellite Challenge is eligible for the João B. G. Canalle Award for Technical Excellence, although it shall have submitted a high-quality Mission Report.

Rick Maschek Engineering Award for Innovation

The Rick Maschek Engineering Award for Innovation is a is a Technical Achievement Award that recognizes a team whose project includes one or more features (including analytic or operational processes as well as components or assemblies) the judging panel finds genuinely "novel", "inventive", or solving a unique problem identified by the team.

Any team with a selected mission that participates in the Rocket Challenge or Satellite Challenge is eligible for the Rick Maschek Engineering Award for Innovation, although it shall have submitted a high-quality Mission Report.

Valentina V. Tereshkova Award for Women Representation and Diversity

The Valentina V. Tereshkova Award for Women Representation and Diversity recognizes a team whose members composition has a substantial percentage of women and diversity. It also recognizes teams who have women and diversity in prominent positions, such as mission leaders.

Any team with a selected mission that participates in the Rocket Challenge or Satellite Challenge is eligible for the Valentina V. Tereshkova Award for Women Representation and Diversity, although it shall have submitted a high-quality Mission Report.

Team Conduct Award

The Team Conduct Award recognizes a team whose conduct throughout the Latin American Space Challenge is exemplary of goals and ideals held by the event organizers. The Latin American Space Challenge should be an event where academia, industry, and the public may come together to preserve, popularize, and advance space science in a collaborative environment energized by friendly competition. The Team Conduct Award will be awarded to a single team chosen by the event officials participating in either Rocket Challenge or Satellite Challenge.

Team Sportsmanship Award

The Team Sportsmanship Award recognizes a team which goes above and beyond to assist their fellow teams and the organizers assure the event is a safe, productive, and enjoyable experience for all involved. They may do this in many ways, such as making themselves available to lend-a-hand whenever and however they can (whether they are asked to or not), being positive role models for their fellow teams, and generally being a "force for good" in every activity in which they involve themselves. The Team Sportsmanship Award will be awarded to a single team chosen by the event officials participating in either Rocket Challenge or Satellite Challenge.

Team Spirit Award

The Team Spirit Award recognizes a team that has displayed an outstanding effort as working as a unit towards a common goal, by being exceptionally organized, reliable, and prepared in all aspects of the competition, be it deliverables, communication, or operation, and goes above and beyond to display a great sense of team spirit and sportsmanship. The Team Spirit Award will be awarded to a single team chosen by the event officials participating in either Rocket Challenge or Satellite Challenge.

Section 2 — Mission Organization (ORG)

Section 2 defines the Mission Organization (ORG) addressing the organization and management system of a team for the purpose of ensuring conformity with all provisions of the event.

2.1. Team Composition and Eligibility

Team Members

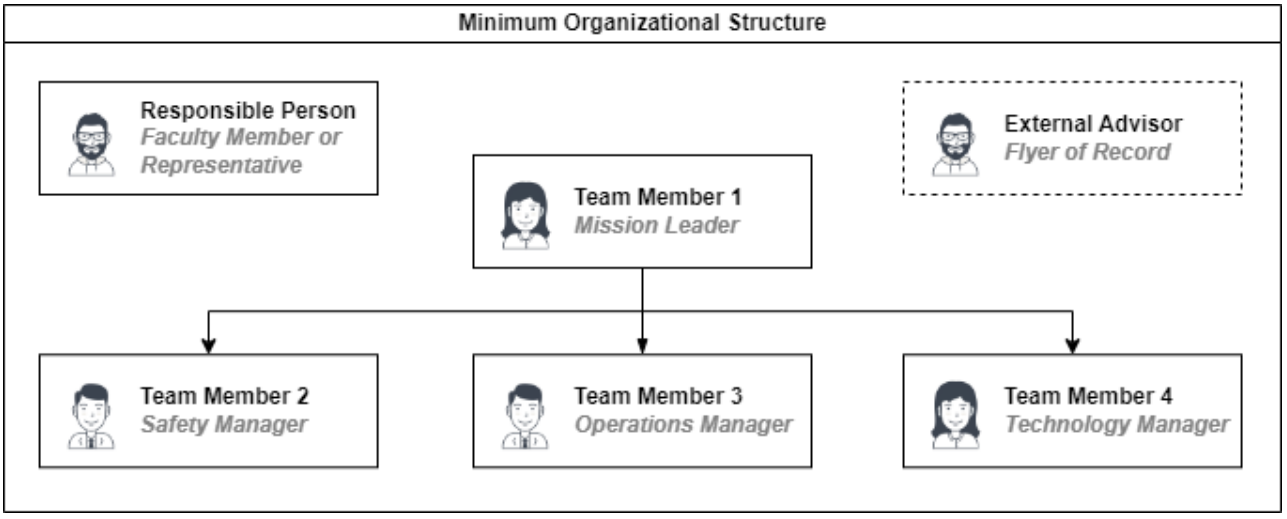
ORG 2.1.1. Teams shall be composed exclusively of student members—including high school and technical school students or currently enrolled in a bachelor's or master's degree or were matriculated undergraduate or graduate students during the previous academic year (e.g., former students who graduated shortly before the event remain eligible)—or non-student members such as enthusiasts, researchers, startup members, amateurs, and hobbyists, or mixed.

ORG 2.1.2. There is no limit on the overall number of people per team, but each team shall have a minimum of four enrolled members. Each individual is free to participate on multiple teams, so long as each team is led by a different individual.

ORG 2.1.3. Each team shall assign a Mission Leader during the Application and Registration Process. The Mission Leader will be the point of contact with LASC for all matters, meaning that event officials will always and only directly contact the Mission Leader, and that the Mission Leader should be the only one contacting the LASC Organization.

ORG 2.1.4. Each team shall establish a mission organizational structure that includes at least the following roles: Mission Leader, Safety Manager, Operations Manager, and Technology Manager.

Figure 3: Minimum Organizational Structure Required.



ORG 2.1.5. Each required role in a selected mission shall be filled by a different individual to ensure diverse responsibilities and accountability within the team.

ORG 2.1.6. Each mission shall have a Responsible Person as described in the ORG 2.1.8.

ORG 2.1.7. Each mission should have a Flyer of Record as described in the ORG 2.2.1.

Institutional Participation Letter

The Latin American Space Challenge requires that every participating team, regardless of the number of missions or challenges they enter, shall show an affiliation with an academic institution, a company, or an accountable individual who is over the Brazilian legal age of 18. This accountable party shall sign a letter accepting full responsibility for the team members, projects and all activities related to their participation in the event.

Institutions sending more than one team to the LASC need only to write one participation letter, covering all their teams, but each included team shall submit an individual copy of that letter.

In the case of a Joint Team, which is composed of students from multiple academic institutions, each affiliated institution shall provide its own signed letter to the team.

ORG 2.1.8. During the Application and Registration Process, all teams shall send a digital PDF copy of the letter signed by a representative of the institution or responsible individual, acknowledging full responsibility for the team. The signatory shall be a senior faculty member (i.e., professor) or a senior representative of the team (i.e., aerospace/aeronautical or mechanical engineer).

2.2. Flyer of Record (FoR)

Teams are encouraged to have an experienced mentor and Flyer of Record (FoR) assisting the mission development and, mainly, advising on safety procedures. The FoR is not required to be onsite during the launch activities.

ORG 2.2.1. Each team should designate a Flyer of Record (FoR) for each Selected Mission. This is particularly mandatory for new teams that have not previously participated in the Latin American Space Challenge or for teams selected to participate in a mission category that involves hybrid or liquid rocket propulsion systems.

The Flyer of Record (FoR) will follow the team's progress throughout its developments and make recommendations and/or modifications on the project in order to guarantee safety and increase chances of a successful launch.

ORG 2.2.2. Each Selected Mission should register a Flyer of Record (FoR) during the Progress Update 1 submission. Event officials will contact the FoR to confirm the provided information and verify their acceptance to serve as a mission mentor.

ORG 2.2.3. The same Flyer of Record (FoR) may be designated by different teams for multiple Selected Missions.

ORG 2.2.4. The Flyer of Record (FoR) should be an engineer with established experience in the space or defense sector, or an engineer who has previously participated in the Latin American Space Challenge. This standard ensures that the designated individual has the necessary expertise and understanding of the dynamics and hazards involved with the mission.

2.3. Insurance

The organization of the event will not be responsible or pay for any accidents, damaged property, and injuries related to the event and caused by selected mission; including if a team's activity damages a person or property. Also, if the person or property owner decides to sue the team, the event's policy does not protect the team from the additional lawsuit.

ORG 2.3.1 All teams should obtain and provide a proof of insurance coverage for all attending members prior to attending the Latin American Space Challenge. Note: individual, personal, or travel insurance policies do not qualify under this position. LASC is not responsible for and cannot assist in finding suitable insurance policies.

2.4. Unruly Behavior, Disqualification, Withdrawal

Penalties for Unsafe or Unsportsmanlike Conduct

Unsafe conduct includes, but is not limited to, violating any of the established principles stated on LASC Documents, failure to use checklists during operations, violating motor vehicle traffic safety rules, and failure to use appropriate personal protective equipment.

ORG 2.4.1 Team Conduct It is the responsibility of every Mission Leader and Safety Manager to ensure that their team conducts themselves in a safe and professional manner. There is a list of point deductions per occurrence that is set prior to the competition for various types of infraction, ranging from not clearing an area in time when a salvo is announced to providing false information on a report.

Unsportsmanlike conduct also includes, but is not limited to, hostility shown towards any LASC participant and officials, intentional misrepresentation of facts to any competition official, intentional failure to comply with any reasonable instruction given by an event official.

ORG 2.4.2 Teams will be penalized for every instance of unsafe or unsportsmanlike conduct recorded by event officials (e.g., judges, volunteers, officials, etc.) depending on the severity of the incident.

Disqualification

A number of criteria constitute grounds for disqualification from consideration for any award and continuation at the event. These can include a failure to meet the defining mission requirements, failure to submit any document and failure to send eligible team members to the onsite event.

Substance abuse and intoxication (or after-effects thereof) during the event and purposeful endangering behaviors severely compromising the safety of LASC and respective participants will make the entire team immediately and without further warning, eligible for expulsion from the LASC event in disgrace. If one or more members of a team fails to be utterly sober and clear-headed, this is regarded as outright contempt of the LASC spirit and safety guidelines. The consequence is the immediate and irrevocable removal of the team from the LASC event.

ORG 2.4.3 Event officials reserve the right to assess any misconduct/mismanagement case by case and to take the necessary proper actions leading to penalties or disqualification of specific team members, mission or the the entire team.

Withdrawal from the Rocket Challenge

ORG 2.4.4 Teams that decide to formally withdraw a mission from the LASC at any time prior to the event shall send an e-mail entitled “Mission *Your Mission ID* Formally Withdraws From The Event Year LASC" to lasc@lasc.space.

For example, a team with a Selected Mission assigned the Mission ID "19" would withdraw from the 2024 LASC by sending an e-mail entitled “Mission 19 Formally Withdraws from the 2024 LASC".

Section 3 — Safety (SAF)

Section 3 details the Safety (SAF) policies, procedures, and processes required for all missions, members, and teams to ensure event safety. This section covers briefings, stored-energy devices, pressure vessels, and mandates the appointment of a safety manager for each selected mission.

3.1. Safety Policy

Safety is our Value number 1.

The Safety Management System (SMS) of the Latin American Space Challenge is composed of four pillars: Safety Policy, Safety Risk Management, Safety Assurance, and Safety Promotion.

All team members shall report any observed unsafe activities to event officials. The event will provide a specific channel for these reports, which will be anonymized before any potential action is taken by event officials.

The event will be guided by a Just Culture approach, where errors will be addressed through reeducation. However, any violation of rules will be treated as potential unruly behavior, with penalties or disqualification possible as outlined in Section 2.

During the Launch Readiness Review (LRR), event officials will use a checklist to approve an experimental rocket for loading with energetics and a rocket motor. Ensuring safety will be a key process for issuing any Flight Card during the event.

Event officials will conduct a safety risk management analysis before each launch to reduce the potential probabilities and/or severities of any operational risks.

Promotion is key to raising the bar among all participating teams. Event officials will conduct safety briefings to increase overall public awareness. Launching an experimental rocket is not trivial; the event has associated risks. All participants shall understand and accept these risks by signing a Waiver and Release of Liability to participate.

SAF 3.1.1. All participants shall follow the Latin American Space Challenge Safety Policy.

Safety Briefing

SAF 3.1.2. During the event, event officials will give safety instructions to all safety managers and mission leaders. Attendance is mandatory for all team members in a position of trust, without exception.

SAF 3.1.3. Safety briefings will take place at least twice a day to provide weather updates, safety instructions, and any other important information deemed necessary by event officials. Emergency safety briefings will be announced as needed, and attendance is mandatory.

SAF 3.1.4. Safety briefings will occur in the Event Center or the Rocket Assembly Area (RAA). In the case of emergency safety briefings, event officials may use a specific temporary WhatsApp group that includes all team members in positions of trust.

Flag Hazard Communication

LASC will use a flag hazard communication system similar to other competitions, with three different colors: Green, Yellow, and Red. If no flag is displayed in the designated locations, it means that the Launch Area is closed (i.e., no operations or preparations are underway).

Access to the Launch Control Center (LCC) and Launch Area will be restricted under any flag condition. Only authorized personnel with Launch Operations Badges will be permitted to access these areas.

Green Flag

During normal setup intervals with no experimental rockets on the launch pad, the range will be indicated by a Green Flag. When the Green Flag is displayed, teams can enter and leave the Rocket Assembly Area (RAA) and prepare their rockets and launch equipment.

Yellow Flag

When a launch is scheduled according to the Launch Slot system described in Section 4, the range will switch to a yellow flag. At this point, all participants with a badge who are not designated as priority or critical must evacuate to the Spectator Area, leave the assembly tents, and/or exit the Rocket Assembly Area (RAA).

Final launch checks will be conducted at the Launch Control Center (LCC), and the Launch Area will be secured for the safety of launch personnel. As soon as a Yellow Flag is displayed, teams shall close any containers or tents and prepare for the launch of the experimental rockets.

Red Flag

When the range is red-flagged, it means that the process of arming avionics and installing igniters is being conducted by the launch personnel authorized by the event officials. Once these processes are completed, all launch personnel will be evacuated to the Launch Control Center (LCC) or directly to the Spectator Area.

Event officials will then begin the launch procedures. After the rockets have been launched or aborted, the Launch Area will return to a green flag.

SAF 3.1.5. All teams shall halt any preparation and/or assembly when a Yellow Flag is displayed.

SAF 3.1.6. If a Yellow Flag is displayed, all participants in the Rocket Assembly Area (RAA) shall evacuate to the Spectator Area and/or leave the tents.

3.2. Emergency Response Plan

During the Open Ceremony, event officials will present the Emergency Response Plan (ERP), emergency exits, procedures and general instructions in case of emergencies.

In the event of an actual emergency, event officials will halt all launch operations and preparations, and will conduct a proper evacuation of the launch area to the Event Center, which will serve as the Emergency Assembly Point (EAP). The EAP is intended to provide a safer area for individuals to stand, while waiting for emergency personnel to respond.

SAF 3.2.1. In case of an emergency, all team members shall immediately follow any instructions given by event officials. Failure to comply with these directions will result in the team's immediate disqualification from the event.

Ambulance and paramedics will be available at the event for occurrences in the operational area and, also, in the spectator area. If any emergency occurs, event officials will halt any launch operation, launch preparation, and any activity in the Rocket Assembly Area (RAA).

3.3. Mandatory Safety Guidance

SAF 3.3.1. No energetics can be stored and/or transported in closed vessels or any other condition that may cause pressurization. Therefore, propellant grains shall be kept outside of casings and stored in proper containers.

SAF 3.3.2. All propellant grains for solid rocket motors shall be inspected during the Launch Readiness Review (LRR). This also applies to ejection charges.

SAF 3.3.3. In case of hybrid propulsion systems, if the grain is made of a single segment, and is no longer than 600 mm, it may be inspected inside the combustion chamber. However, it is highly recommended that all propellant grains be outside for a complete inspection during the LRR.

If the team (hybrids only), for any reason, chooses to place the grain inside the combustion chamber prior to inspection, it is a good practice to take pictures and videos of the grain and its installation. This may aid the officials to validate the structural integrity.

SAF 3.3.4. All heaters and igniters for hybrid/liquid propulsion systems shall be inspected during the Launch Readiness Review (LRR) before authorization for final assembly.

SAF 3.3.5. In case of liquid and/or hybrid propulsion systems, propellant tanks only will be loaded on the launch base with proper authorization from event officials and their supervision.

SAF 3.3.6. Teams with selected hybrid/liquid propulsion missions shall discuss their systems with their Flyer of Record (FoR), who will be responsible for contacting LASC to schedule a meeting. During this meeting, the team will present their system (including propellants, propellant masses, tanking configuration, feed system, and filling system) alongside their FoR. The FoR shall

schedule this meeting via email to lasc@lasc.space. During the meeting, event officials will define a safety distance for propellant filling and hose removal.

SAF 3.3.7. The personnel involved in launch operations and energetics integration shall wear Personal Protective Equipment (PPE). The minimum PPE required are the helmet and a signaling vest, temporarily provided by the event during the launch preparations. Additional PPE provided by the teams are welcome.

SAF 3.3.8. The personnel involved in launch operations and energetics integration shall wear full-length pants and closed shoes.

3.4. Stored-Energy Devices

Energetic Device Safing and Arming

An energetic device is considered armed when only one event is necessary to release the energy. For the purpose of this document, energetics are defined as all stored-energy devices - other than propulsion systems - that have reasonable potential to cause bodily injury upon energy release.

The following table lists some common types of stored-energy devices and overviews in what configuration they are considered non-energetic, safed, or armed.

Table 3: Energetic Devices and Configurations.

Device Class	Non-energetic	Safed	Armed
Igniters/Squibs	Small igniters/squibs, nichrome, wire or similar	Large igniters with leads shunted	Large igniters with noshunted leads
Pyrogens (e.g., black powder)	Very small quantities contained in non-shrapnel producing devices (e.g., pyro-cutters or pyro-valves)	Large quantities with no igniter, shunted igniter leads, or igniter(s) connected to unpowered avionics	Large quantities with non-shunted igniter or igniter(s) connected to powered avionics
Mechanical Devices (e.g., powerful springs)	De-energized/relaxed state, small devices, or captured devices (i.e., no jettisoned parts)	Mechanically locked and not releasable by a single event	Unlocked and releasable by a single event
Pressure Vessels	Non-charged pressure vessels	Charged vessels with two events required to open main valve	Charged vessels with one event required to open main valve

Although these definitions are consistent with the propulsion system arming definition, this requirement is directed mainly at the energetics used by recovery systems and extends to all other energetics used in payloads, and others.

Note that propulsion systems may be armed only after the launch rail area is evacuated to a specified distance, this requirement permits personnel to arm other stored-energy devices at the launch rail.

SAF 3.4.1. All energetics shall be in the safe position/safed (i.e., “remove before flight connected”) until the experimental rocket is in the launch position, at which point they may be "armed". An energetic device is considered on the safe position/safed when two separate events are necessary to release the energy.

SAF 3.4.2. All energetic device arming features shall be externally accessible/controllable. This does not preclude the limited use of access panels which may be secured for flight while the vehicle is in the launch position.

SAF 3.4.3. All energetic device arming features shall be located on the airframe such that any inadvertent energy release by these devices will not impact personnel arming them.

For example, the arming key switch for an energetic device used to deploy a hatch panel shall not be located at the same airframe clocking position as the hatch panel deployed by that charge.

SAF 3.4.4. The arming mechanism should be accessible from ground level, without the use of ladders or other elevation devices, when the rocket is at a vertical orientation on the launch rail.

In addition, each implemented arming device shall be of easy access, taking a maximum of 3 (three) seconds to do it.

3.5. Pressure Vessels

The following requirements concern design and verification testing of any type of pressure vessel. Combustion chambers are included as well but are exempted from the relief device requirement.

Burst Pressure for Metallic Pressure Vessels

SAF 3.5.1. Pressure vessels constructed entirely from isotropic materials (e.g., metals) shall be designed to a burst pressure no less than 2 times the maximum expected operating pressure, where the maximum operating pressure is the maximum pressure expected during pre-launch, flight, and recovery operations.

Burst Pressure for Composite Pressure Vessels

SAF 3.5.2. Pressure vessels either constructed entirely from non-isotropic materials (e.g., carbon fiber, fiberglass, fiber reinforced plastics) or implementing composite overwrap of a metallic vessel (i.e., composite overwrapped pressure vessels), shall be designed to a burst pressure no less than 3 times the maximum expected operating pressure, where the maximum operating pressure is the maximum pressure expected during pre-launch, flight, and recovery operations.

Pressure Vessel Testing

The following requirements concern design and verification testing of pressure vessels. Experimental rocket motor propulsion system combustion chambers and propellant tanks for hybrids and liquid propulsion systems are included as well.

SAF 3.5.3. Teams shall comply with all rules, regulations, and best practices imposed by the authorities at their chosen test location for pressure vessel testing.

SAF 3.5.4. Pressure vessels shall be proof pressure tested successfully to, at least, 1.5 times the maximum expected operating pressure for no less than twice the maximum expected system working time, using the intended or similar flight articles. The only acceptable type of test for this provision is the hydrostatic test.

The maximum system working time is defined as the maximum uninterrupted time duration the vessel will remain pressurized during pre-launch, flight, and recovery operations. A full and detailed description of the used experimental methodology shall be included in the final report.

SAF 3.5.5. Teams should complete all tests at least three months prior to the launch window.

Relief Device

SAF 3.5.6. Pressure vessels shall implement a relief device, set to open at no greater than the proof pressure specified in the following requirements. Combustion chambers are exempted from this requirement.

SAF 3.5.7. In hybrid/liquid propulsion systems, the venting or pressure relief shall be directed outwards the rocket. No venting is allowed into confined or semi-confined volumes.

Section 4 — Launch Operations (FLT)

Section 4 defines the Launch Operations (FLT) procedures and the minimum requirements for trajectory, stability, and the configuration of the launch support equipment.

4.1. Launch Readiness Review (LRR)

A major milestone to get the clearance to transfer the experimental rocket to the launch site and start the dedicated launch preparations for the mission is the Launch Readiness Review (LRR).

Within this review, event officials will go through a detailed Launch Readiness Review Checklist based on this document that all experimental rockets need to comply with.

FLT 4.1.1. The Launch Readiness Review (LRR) will take place at the event officials' tent in the Rocket Assembly Area (RAA) designated as Mission Control Center (MCC). The LRR must be requested by the Mission Leader.

For the initial LRR, the experimental rocket shall be disassembled to allow event officials to verify all specifications outlined in this document. During the first request for an LRR, the mission will be placed in a queue with a determined priority. Subsequent requests will follow the queue based on the assigned slot, position in the process, and mission complexity.

FLT 4.1.2. Teams shall ensure that the experimental rocket is in an LRR-ready state before the first evaluation or if it is a revisit after an "orange" LRR Status. This means, the vehicle will be without energetics or propellants, will be disassembled at the joints, with the avionics system, payload, and recovery system outside of the body tubes, so that the officials can have a good look at all subsystems.

The Launch Readiness Review (LRR) will follow a checklist based on the provisions of this document. Each item on the checklist will serve as a criterion for the review.

All criteria of the LRR can be scored as "red" (Denied), "orange" (Action Needed), "yellow" (Provisional), "green" (Approved), or "gray" (Not Applicable).

If any single criterion is scored "red", Launch Status = "Denied":

The overall LRR Status is "Denied". This will cause the Selected Mission to fail the LRR and not be allowed to launch their experimental rocket in any launch window. Again, it means that the selected mission will not launch their experimental rocket during the event.

A Selected Mission will fail the Launch Readiness Review (LRR) if a high-risk issue is detected during the evaluation. Examples of high-risk issues include cracked solid propellant, significant discrepancies between the theoretical project submitted in the Mission Report and the actual experimental rocket, or any other issue that cannot be resolved in a timely and/or safe manner.

FLT 4.1.3. All Selected Missions shall comply with all applicable provisions of this document, ensuring the safe and appropriate design and development of the experimental rocket project.

If any single criterion is scored "orange", Launch Status = "Action Needed":

If any single criterion is "orange", while no criterion is "red", the overall LRR Status is "Action Needed". Any criterion that is scored "orange" will result in an Action Item (i.e., equals to a mandatory task) that needs to be resolved by the team.

Any Action Items that prevent a "Provisional" or "Nominal" LRR Status can be addressed by the teams. As long as all Action Items have been dealt with accordingly, the team can submit the project for a new Launch Readiness Review (LRR).

FLT 4.1.4. If a Selected Mission does not fulfill a provision of this document or overall engineering good practices, but there are time and safe possibilities to resolve an issue, the team will be scored as "orange" (Findings to be Corrected) by event officials.

FLT 4.1.5. Selected Missions scored as "orange" (Findings to be Corrected) during the LRR shall not load the experimental rocket with energetics and rocket motors.

If all criterion is scored "yellow", Launch Status = "Provisional":

If all criteria of the LRR is scored as "checked", the overall LRR Status is "Provisional", and the team will be requested to prepare and assemble their experimental rocket with energetics and motor, but without an igniter and in a safed state (e.g., with remove before flight pins). This process shall be done under supervision of an event official.

Selected Missions may receive a "Provisional'' LRR Status one or two days before the launch. However, the loading of energetics and the rocket motor shall be conducted in the designated area of Cape Canavial on the launch day.

If a delay occurs or any operational difficulty arises, event officials, in consultation with the Mission Leader and the Safety Manager of the Selected Mission, will decide on the process for unloading or securing the vehicle for the next day's launch if a slot is available.

FLT 4.1.6. Selected Missions scored as "yellow" (Provisional) during the LRR should load the experimental rocket with energetics and rocket motors only with the authorization of event officials.

FLT 4.1.7. Teams shall load their experimental rocket with energetics and/or propulsion systems only under the supervision of an event official. Failure to meet this requirement will result in the disqualification of the entire team.

After completing the final assembly of the experimental rocket, the Mission Leader shall request the final inspection before the issuance of the Flight Card.

Tier 2 Selected Missions may obtain a Launch Status of "Provisional," but authorization to load their projects with energetics and motors will only be granted if launch slots are available.

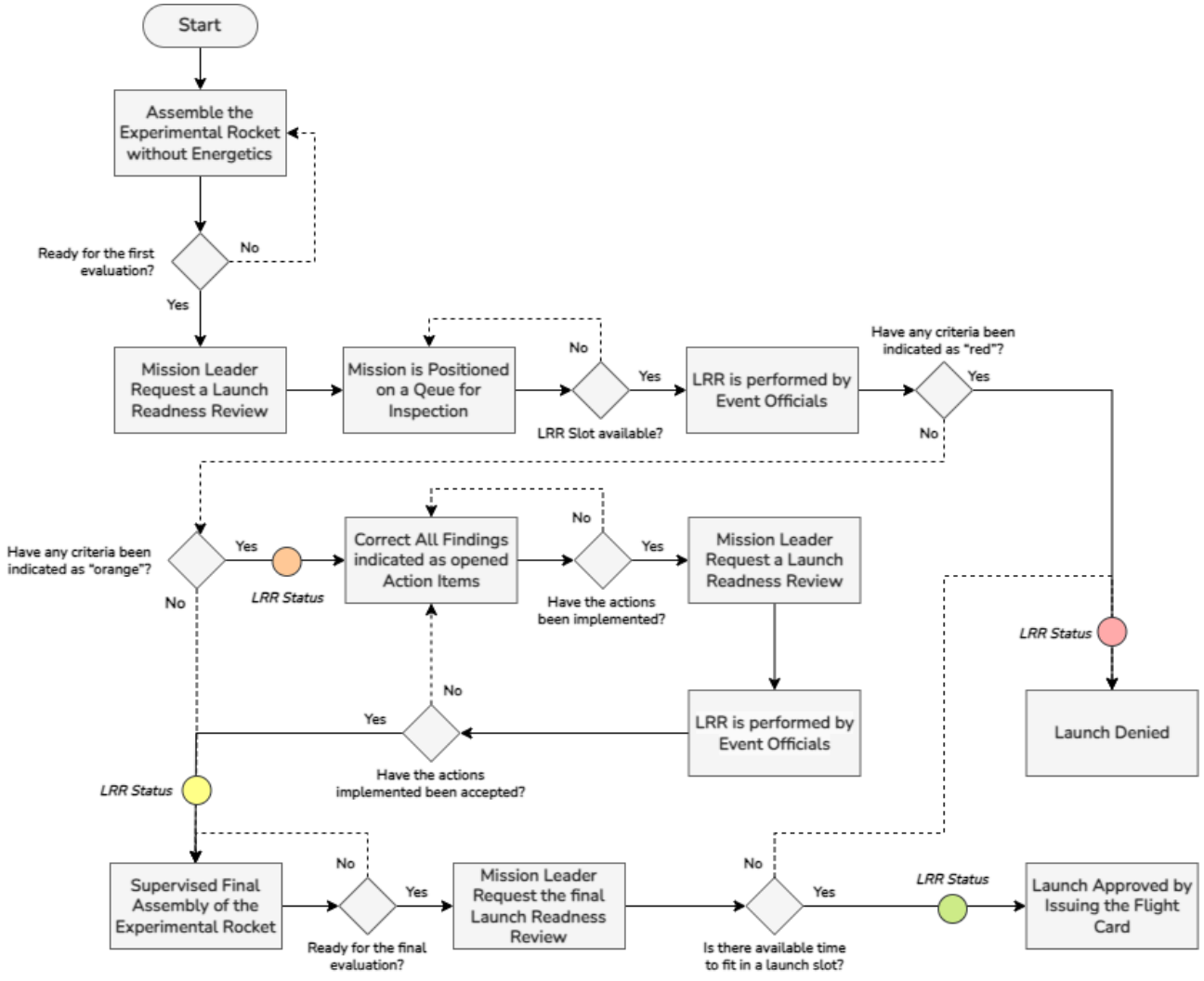
FLT 4.1.8. An “yellow” (Provisional) LRR Status will not guarantee a launch slot during the Latin American Space Challenge.

If all single criterion is scored “green”, Launch Status = “Approved”:

For a Selected Mission to successfully pass the LRR, the event officials will have to raise all criteria to “green” and the launch status to “Approved”. They will do so if they are convinced all Action Items have been resolved by the teams. Then, at the end of the LRR, the issuance of the Flight Card by the officials to the team certifies that the LRR has been passed successfully.

The following flowchart shall be followed by all Selected Missions to have a launch pre-approved status with the issuance of a Flight Card.

Figure 4: Launch Readiness Review (LRR).



FLT 4.1.9. All Selected Missions shall have a properly signed Flight Card by an event official before moving to the launch pad preparation.

4.2. Launch & Recovery Slots

Introduction to the Launch Slot Concept

The Latin American Space Challenge has developed a concept of launch windows, referred to as launch slots. Each selected mission will be assigned its own specific launch window.

This approach enhances the safety of the event by ensuring that everyone is aware of their schedules. Additionally, the introduction of slots brings a higher level of professionalism and provides a more accurate launch schedule for spectators.

Launch slots will contribute to a more organized event by including the assignment of recovery slots. After a couple of launch slots, there will be a designated recovery slot. If a recovery slot is not used or its duration is less than the total window, additional launch slots may become available.

Each experimental rocket shall be ready to launch at its designated launch window. Reserve windows will be allocated at the end of the event as backup slots for external factors, such as weather restrictions. However, it is highly recommended not to rely on these backup slots, as it is not guaranteed that your mission will be able to use them.

Teams may anticipate their assembly and preparation to seek early launch slots. The availability of these slots will depend on the overall readiness of other teams. Extra points may be awarded for successfully launching early. However, reassignment to an early slot means the team will forfeit their initial slot, so teams should be aware of the risks when requesting earlier slots.

FLT 4.2.1. Each mission must have an approved Flight Card and a fully assembled experimental rocket at least thirty minutes before the start of the assigned launch window.

FLT 4.2.2. If a mission with an assigned slot is not ready thirty minutes before the start of the window, event officials have the right to fill the slot with another mission. Teams not complying with the launch slot schedule shall understand that event officials will not be responsible for securing a new slot.

Launch Slot

Event officials will define the length of each launch slot, the number of available launch pads, and the appropriate category to fill the schedule after the announcement of the Selected Missions.

Up to four weeks before the competition, event officials will schedule a livestream to assign missions to each launch slot. The livestream will be public on YouTube. There will be one pot for each category, with cards containing the Mission ID of Tier 1 Selected Missions for that category,

totaling four pots in all. The procedure will involve drawing a card from the appropriate pot for each predetermined launch slot.

FLT 4.2.3. Teams are not permitted to change slots between Selected Missions from the same team or with other teams.

FLT 4.2.4. If a Tier 1 Selected Mission is unable to timely fill its assigned slot, the mission leader must immediately contact event officials at lasc@lasc.space to communicate the reasons.

A Tier 1 Selected Mission that fails to communicate in a timely manner about its inability to fill the assigned slot will be penalized.

FLT 4.2.5. If a Tier 1 Selected Mission anticipates its assembly and preparation for an early launch operation, the Operations Manager shall contact event officials to request an early slot. Teams may receive extra points on the Launch Operations scoring sheet if an early launch is successfully performed. An early launch operation will only be possible if a team fails to launch in its designated slot or if sufficient time is left in a given slot.

FLT 4.2.6. Teams must be aware of the launch slot concept, including the need to be timely ready for their assigned slot and the risks associated with requesting an early launch slot.

Event officials reserve the right to change any slot for safety reasons, including for maintenance on the launch pads. Also, requests for early slots may be denied by event officials for any reason.

During the onsite event, Tier 2 Selected Missions should obtain a Launch Status of "Provisional" as soon as possible to take advantage of any vacant slots. These missions are not guaranteed a launch opportunity for their experimental rocket project during the event.

Recovery Slots

During the onsite event, there will be designated Recovery Slots for missions to locate their experimental rockets and payloads in the Cape Canavial Launch Area after a nominal or abnormal launch. After a scheduled number of launch slots, a one-hour recovery slot will be opened. Event officials may rearrange the recovery slots as needed.

FLT 4.2.7. The Operations Manager of each mission that launched an experimental rocket shall check in their 3-person group, called the “Recovery Team,” at the Mission Control Center (MCC) located in the Rocket Assembly Area (RAA).

FLT 4.2.8. Teams shall not initiate a recovery mission without checking in with event officials.

FLT 4.2.9. The Operations Manager is responsible for communicating the Recovery Team’s live position (i.e., sharing the GPS location with event officials) via WhatsApp. The Recovery Team shall bring a mobile phone with at least 75% State of Charge (SoC) during check-in.

FLT 4.2.10. Event officials will alert the team at least 15 minutes before the end of the Recovery Slot. The Recovery Team shall immediately return to the Mission Control Center (MCC) for check-out. Failure to return on time and/or properly communicate may result in penalties and/or disqualification.

Example of Launch & Recovery Slots

As an example, after the announcement of the selected missions, event officials will determine a schedule containing an appropriate number of slots. This schedule will consider factors such as launch window length, potential conditions of the launch pad, risk management, type of propulsion and the complexity of having multiple missions in the launch area simultaneously. The result will be a schedule with assigned mission categories for specific times and launch pads.

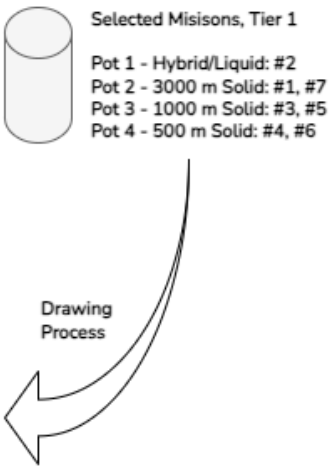
Up to four weeks before the competition, event officials will livestream the slot drawing. This process will involve four pots, one for each mission category, filled with cards containing mission IDs. Event officials will draw a card from the appropriate mission category pot to assign each selected mission to a launch slot.

The figure illustrates this process with an example of seven Tier 1 Selected Missions across all four categories. Predetermined slots and launch pads are being filled with missions to finalize the schedule before the onsite event.

Figure 5: Example of a Launch Slot Draw.

Time	Day 1			
	Pad #42-A	Pad #42-B	Pad #42-C	Pad #42-D
10:00 - 12:00	Hybrid/Liquid	Solid 1000 meters	Solid 3000 meters	Solid 500 meters
12:00 - 13:00	Recovery Window			
13:00 - 14:00	*Maintenance*	Solid 3000 meters	Solid 1000 meters	Solid 500 meters

Time	Day 1			
	Pad #42-A	Pad #42-B	Pad #42-C	Pad #42-D
10:00 - 12:00	Mission #2	Mission #5	Mission #1	Mission #6
12:00 - 13:00	Recovery Window			
13:00 - 14:00	*Maintenance*	Mission #7	Mission #3	Mission #4



Launch Operation Debriefing

A Launch Operation Debriefing session is mandatory after the recovery of the experimental rocket and payload, or upon the closing of all recovery windows (i.e., the experimental has not been found). Event officials will use this session to assess conditions and evaluate the success of the

recovery operation. Additionally, trajectory data, including the official apogee from the COTS altimeter, will be collected during this debriefing.

The Launch Operation Debriefing will be conducted at the Mission Control Center (MCC) located in the Rocket Assembly Area (RAA). There will be at least one event official with a laptop to capture data and information.

FLT 4.2.11. During the Launch Operation Debriefing, the Operations Manager of the mission will need to fill out the Launch Operation Record with the event officials. This record will include, among other things, the apogee from the official altitude logging system(s) to determine the actual apogee above ground level, and the status of the systems after recovery, which will be demonstrated by showing the hardware to the officials.

FLT 4.2.12. The Operations Manager of the mission shall report in person to event officials in the Rocket Assembly Area (RAA) before the end of eligible launch operations on the respective launch day, even if the rocket has not been found.

FLT 4.2.13. Telemetry that provides apogee information recorded during launch may be utilized if no apogee data is retrievable from any onboard systems after touchdown. However, it must meet the following criteria: a GPS lock must have been maintained around apogee, the trajectory must be visible in the recorded data, and an event official must have overseen the ground station during the launch.

4.3. Launch and Trajectory Requirements

Launch Azimuth and Elevation

FLT 4.3.1. Experimental rockets shall be nominally launched at an elevation angle of 80°±5° and a launch azimuth defined by the event officials. If possible flight safety issues are identified during pre-launch activities, event officials reserve the right to require certain vehicles' launch elevation be as low as 70°.

FLT 4.3.2. If the elevation angle is adjusted by event officials so that ballistic entries and recovery zones are downrange, the team's simulation leader will be allowed to update the predicted altitude at that time. It is suggested to keep a fully charged laptop ready to run flight simulations as conditions change on the ground.

Launch Stability

FLT 4.3.3. Experimental rockets should be sufficiently damped to be able to deal with wind gusts of up to 15 m/s while we will not launch over 10 m/s to produce a safety factor of 1.5. Experimental rockets will not be launched with surface wind speeds exceeding 10 m/s or at an angle greater than 20 degrees.

FLT 4.3.4. Experimental rockets shall have sufficient velocity upon "departing the launch rail" to assure they will follow predictable flight paths. In lieu of detailed analysis, a rail departure velocity of at least 30 m/s is generally acceptable. Alternatively, teams may use detailed analysis to prove stability is achieved at a lower rail departure velocity greater than 15 m/s either theoretically (e.g., computer simulation) or empirically (e.g., flight testing).

Departing the launch rail is defined as the first instant in which the launch vehicle becomes free to move about the pitch, yaw, or roll axis. This generally occurs at the instant the last rail guide forward of the vehicle's center of gravity (CG) separates from the launch rail.

Ascent Stability

FLT 4.3.5. Experimental rockets shall remain "stable" for the entire ascent. Stable is defined as maintaining a static stability margin of at least 1.5 calibers throughout the whole flight phase (upon leaving the launch rail), regardless of CG movement due to depleting consumables and shifting center of pressure (CP) location due to wave drag effects (which may become significant as low as 0.5 Mach).

Over-stability

FLT 4.3.6. Experimental rockets shall not be “over-stable” during their ascent, defined as having a static stability margin over 4 calibers or a dynamic stability margin during flight over 6 calibers.

4.4. Launch Support Equipment

The LASC Organization will provide and operate the appropriate launch support equipment for all selected missions. Launch pads and rails supplied were designed focusing on safety and simplicity of handling and operation. The following guides and requirements will support teams in understanding the infrastructure and its general rules.

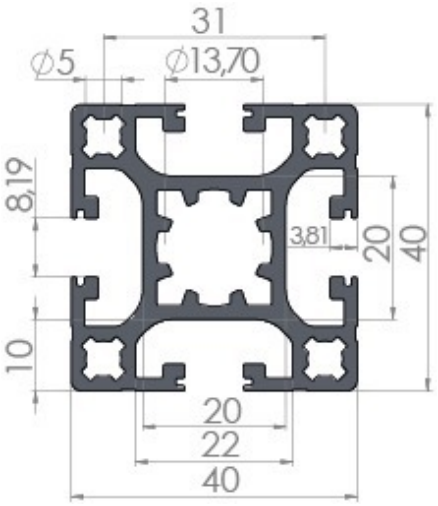
LASC-Provided Launch Pads and Rails

The Latin American Space Challenge will provide a number of launch pads and rails for the teams participating in the event. Event officials will assign launch rails based on the experimental rocket's capability, performance, and complexity. The specifications for each type of launch pad provided are described below:

- Launch pads with a length of 6 meters, aluminum rails with a cross section of 40 mm x 40 mm, will be provided for target apogee categories of 3000 meters.
- For target apogee categories of 1500 meters or less, launch pads with a length of 4 meters, aluminum rails with a cross section of 40 mm x 40 mm will be available.

On these rails, the experimental rocket is loaded horizontally on top of the guide rail and then the rail is erected to the required launch elevation.

Figure 6. Rail Cross Section (dimensions are in millimeters and comma as decimal separator).



FLT 4.4.1. All experimental rocket missions with a target apogee of 1500 meters or less selected to participate in a solid rocket propulsion system category shall be prepared to use the 4-meter long LASC-Provided Launch Base for the launch operation.

FLT 4.4.2. All experimental rocket missions with a target apogee higher than 1500 meters selected to participate in a solid rocket propulsion system category shall be prepared to use the 6-meter long LASC-Provided Launch Base for the launch operation.

FLT 4.4.3. All launch vehicles shall attach to these launch rails via at least two rail guides (e.g., lugs, buttons) which, together, support the vehicle's fully loaded launch weight if suspended horizontally.

Once erected, the experimental rocket will be supported vertically by a submerged mechanical stop in the rail - whose position may be adjusted.

FLT 4.4.4. Note that hybrid/liquid propulsion systems may require team-customized devices or equipment. Teams shall ensure that any additional devices required for the launch operation of experimental hybrid/liquid propulsion rocket projects are manufactured and tested in advance.

Launch Rail Fit Check

FLT 4.4.5. All teams shall perform a “launch rail fit check” as a part of the flight preparations, before going to the launch pad, normally during the Launch Readiness Review (LRR).

The procedure will ensure that such surprises are not encountered on the launch rails, causing delays and loss of launch opportunities and slots.

FLT 4.4.6. The launch rail fit check shall be done in the presence of event officials. Teams cannot use the LASC-provided launch rails without permission.

Remote Launch Control Unit

The LASC Remote Launch Control Unit (RLCU) system will be used to command the ignition of the initiators/igniters of the experimental rocket's propulsion systems.

During a launch operation, event officials will be responsible for organizing, communicating, commanding and activating the Remote Launch Control Unit (RLCU) system. The RLCU will remain in safe mode until all teams' launch personnel are evacuated to the Launch Control Center (LCC) or the Spectator Area. Only event officials with the Launch Operations Badge are permitted to arm the RLCU system on the launch pads.

FLT 4.4.7. Event officials will replace team squibs/ignitors if any danger or risk is identified during the Launch Readiness Review (LRR), including, but not limited to, the characteristics and materials used, total mass, and production quality.

4.5. Team-Provided Launch Support Equipment

Teams with missions selected in the hybrid or liquid propulsion categories may design their own launch pads and/or launch control systems. The following guidelines and requirements will help teams prepare for launch preparation procedures and operations.

Equipment Portability

FLT 4.5.1. Teams willing to use their own launch support equipment shall make their systems man-portable over a distance of 100 meters. Environmental considerations at the launch site permit only limited vehicle use beyond designated roadways and pathways.

Operational Range

FLT 4.5.2. All team-provided launch control systems shall be electronically operated and have an operational range of no less than 200 meters from the launch rail. The operational range is defined as the range at which launch may be commanded reliably.

Arming Requirements and Procedure

FLT 4.5.3. All team-provided launch control systems shall implement ignition switches of the momentary, normally open switch type.

FLT 4.5.4. All team-provided launch control systems shall be at least single fault tolerant by implementing a removable safety interlock (i.e., a jumper or key to be kept in possession of the arming crew during arming) in series with the launch switch.

FLT 4.5.5. All-team provided launch control systems shall be operated only with the oversight and command of event's officials.

4.6. Launch Operations Personnel

Launch Personnel

FLT 4.6.1. The launch personnel is strictly restricted to a maximum of 3 (three) people per team. This means that these people shall be capable of installing it on the assigned launch pad. Therefore, these people shall have full comprehension of the rocket's operationality (CONOPS), its limitations and requirements.

Assistance will be given by event officials, such as carrying the experimental rocket, lifting the launch base, installing the igniter, and others. Key questions may be made to the team's personnel during launch operations that are important for event officials to conduct a safe launch.

FLT 4.6.2. For hybrid/liquid propulsion missions, a variation of the launch personnel number may be requested by the teams, alongside with a proper description of each additional person's responsibilities and justification why this additional person is required. This request shall be made up to two weeks prior to the event by email. Event officials will, then, evaluate this request and may or not accept it.

FLT 4.6.3. If multiple launches are scheduled within the same launch window or slot, event officials may require all launch personnel to return to the assembly or spectator area.

Section 5 — Propulsion System (PRS)

Section 5 defines the Propulsion System (PRS) for the experimental rocket projects, including types of propellants, ignition systems, and required tests.

5.1. Guidance

PRS 5.1.1. Teams shall use Student Researched and Developed (SRAD) propulsion systems, with SRAD propulsion systems being defined as those designed by students – regardless of whether fabrication is performed by students directly, or by a third party working to student supplied specifications.

PRS 5.1.2. Multistage launch vehicles, side boosters, propulsion systems containing PET-bottles or water-based rockets, and toxic propellants are not allowed.

PRS 5.1.3. Student Researched and Developed (SRAD) propulsion systems shall not exceed an installed total impulse of 40,960 Newton-seconds.

PRS 5.1.4. The minimum thrust-to-weight ratio for all mission categories shall be at least 5:1.

Thrust-to-weight ratio will be calculated based on either initial thrust of the motor or the average thrust of the motor (whichever is greater), divided by the takeoff weight (launch vehicle plus payload) of the experimental rocket.

PRS 5.1.5. Teams shall comply with all rules, regulations, and best practices imposed by the authorities at their chosen test location(s). The requirements concerning verification testing of Student Researched and Developed (SRAD) propulsion systems are detailed in the next provisions.

PRS 5.1.6. Teams should complete all tests 4 (four) months prior to the event. While not a requirement, this date is recommended to assure teams are prepared for the Latin American Space Challenge.

5.2. Propellants

PRS 5.2.1. All propellants used shall be non-toxic. Ammonium perchlorate composite propellant (APCP), potassium nitrate, nitrous oxide, kerosene, alcohol and similar substances, are all considered non-toxic.

Toxic propellants are defined as those requiring breathing apparatus, special storage, transport infrastructure, extensive personal protective equipment (PPE), etc. (e.g., Hydrazine and N2O4).

PRS 5.2.2. Liquid/gaseous oxygen (LOx/GOx), hydrogen peroxide and similar high oxidative fluids are prohibited and shall not be used due to its intrinsic risks, especially in an environment with

high vegetation density. In addition, gunpowder, also known as Black Powder (BP), is not permitted as a propulsion propellant.

5.3. Solid Motors

PRS 5.3.1. For all solid motors, the use of the electronic ignition system provided by the LASC Organization is mandatory as defined in Section 4 of this document.

PRS 5.3.2. All propulsion system combustion chambers shall be designed and tested according to the pressure vessel safety requirements defined in Section 3 of this document. Note that combustion chambers are exempted from the requirement for a relief device.

PRS 5.3.3. Igniters and/or squibs shall be designed for insertion through the nozzle throat. Solid rocket propulsion systems are prohibited from using igniters/squibs in a pyrogen-bulkhead assembly configuration.

PRS 5.3.4. While not a mandatory requirement, all solid propulsion systems should successfully (without significant anomalies) complete an instrumented (chamber pressure and/or thrust force), full scale (including system working time) static hot-fire test prior to the LASC. This test does not need to be performed with the same motor casing and/or nozzle components intended for use during the launch operations (e.g., teams shall verify their design but are not forced to design reloadable/reusable motor cases).

PRS 5.3.5. All nozzle throats must be designed with a minimum diameter that allows a squib to pass through.

5.4. Hybrid or Liquid Propulsion System

Engineering Recommendations and Testing

PRS 5.4.1. Hybrid/liquid propulsion system shall implement a means for remotely controlled venting or offloading of all liquid and gaseous propellants in the event of a launch abort.

PRS 5.4.2. All hybrid/liquid combustion chambers shall be designed and tested according to the pressure vessel safety requirements defined in Section 3. Note that combustion chambers are exempted from the requirement for a relief device.

PRS 5.4.3. All propulsion systems using liquid or gaseous propellant(s) shall successfully (without significant anomalies) complete a propellant loading and off-loading test near as possible of the final "launch-configuration". Officials understand that tests may require additional or different setups for compliance to the location safety requirements.

Tests may be conducted using either actual propellant(s) or suitable proxy fluids. Links to videos and testing data shall be posted in your final report. A full and detailed description of the used experimental methodology shall be included in the final report.

PRS 5.4.4. While not a mandatory requirement, all propulsion systems should successfully (without significant anomalies) complete an instrumented (chamber pressure and/or thrust force), full scale (including system working time) static hot-fire test prior to the LASC.

This test does not need to be performed with the same tank parts, motor casing and/or nozzle components intended for use during the launch operations (e.g., teams shall verify their design but are not forced to design reloadable/reusable motor cases).

Fill Monitoring

PRS 5.4.5. Each hybrid/liquid propulsion system shall have a fill monitoring system that alerts when the tank(s) has reached the desired fill state, whether that is a partial fill or a full fill.

It is recommended that a calibrated cantilever load cell is used to accurately measure and transmit to the launch controller the actual fill state. Other methods can be used, but assuming that the condensation plume can be seen during the Summer Season in Brazil may be not acceptable by event officials.

There are simple methods such as using a temperature sensor. A capacitive sensor is also another reliable solution. Filling times and fill status detection must be tested prior to arrival at the event..

5.5. Propulsion Safing and Arming

PRS 5.5.1. The “arming action” is any action enabling an ignition signal to ignite the propellant(s).

PRS 5.5.2. A propulsion system is considered armed if only one action (e.g., an ignition signal) shall occur for the propellant(s) to ignite. The LASC Remote Launch Control Unit (RLCU) described in Section 4 will be used for all solid motor mission categories.

The "arming action" is usually something (i.e., a switch in series) that enables an ignition signal to ignite the propellant(s). For example, a software-based control circuit that automatically cycles through an "arm function" and an "ignition function" does not, in fact, implement arming.

In this case, the software's arm function does not prevent a single action (e.g., starting the launch software) from causing unauthorized ignition. This problem may be avoided by including a manual interrupt in the software program.

These requirements generally apply to more complex propulsion systems (i.e., hybrid and liquid) and to all team-provided launch control systems, which are only permitted for hybrid/liquid propulsion systems.

PRS 5.5.3. All propulsion system ignition circuits/sequences shall not be "armed" until all teams’ launch personnel are at least 150 meters away from the launch vehicle.

PRS 5.5.4. The circuit arming shall be made by the event officials, after the Launch Area is clear, and only after all involved personnel are aware of this action.

PRS 5.5.5. Air-start ignition circuit arming is prohibited in any type of propulsion system designed for the mission categories of the Latin American Space Challenge.

Section 6 — Airframe and Aerodynamics (STR)

Section 6 defines the Airframe and Aerodynamics (STR) overall guidance and requirements for the development of experimental rocket projects, including material selection and prohibitions.

The following provisions address some key points applicable to the experimental rocket projects, but are not exhaustive of the conditions affecting each unique design. Each team is responsible for thoroughly understanding, analyzing, and mitigating their design's unique load set.

6.1. Overall Structural Integrity

STR 6.1.1. Launch vehicles shall be constructed to withstand the operating stresses and retain structural integrity under the conditions encountered during handling transportation, and the launch operations and flight.

6.2. Material Selection and Tests

STR 6.2.1. Experimental rockets should be constructed from lightweight materials such as fiberglass and carbon fiber, or when necessary, ductile lightweight metals like aluminum. The choice of materials and construction techniques should be appropriate for the specific requirements of the planned flight to ensure optimal performance and safety.

STR 6.2.2. PVC and similar low-temperature polymers shall not be used in any structural (i.e., load bearing) capacity, most notably as load bearing eye bolts, launch vehicle airframes, or propulsion system combustion chambers for the 3,000 meters apogee mission category.

For 500 meters and 1,000 km mission categories, PVC and similar low-temperature polymers may be used in any structural (i.e., load bearing) capacity, most notably as launch vehicle airframes, or propulsion system combustion chambers.

STR 6.2.3. The use of metals should generally be minimized for your team's own benefits to overall vehicle mass fraction, cost, vehicle mass, and safety in recovery or motor failure events. The use of composite materials such as fiberglass, kevlar, carbon fiber, et al. as appropriate are strongly suggested. The use of natural composites such as wood, cardboard, hemp fiber composites, bamboo composites, etc. should be examined for effectiveness and appropriateness.

STR 6.2.4. The use of 3D printed parts should be examined for effectiveness and appropriateness.

STR 6.2.5. Teams should simulate and/or test the properties of materials and the strength of components developed for use in their experimental rocket projects. This process should include both individual and joint analyses to ensure the integrity of all parts.

It is important to verify the suitability and durability of all materials and parts under the specific conditions they will face during their missions, as this is essential for ensuring launch safety.

STR 6.2.6. Environmentally hazardous materials shall not be used in the experimental rocket project. This includes lead, mercury, uranium, and any other radioactive materials.

6.3. Fin Assembly, Flutter and Aeroelastic Divergence

Fin Flutter, a cyclical loading failure due to oscillation around the fin's root chord, can be mitigated by dampening harmonics using layers of variable height and length in a tip-to-tip layup. Aeroelastic divergence, another concern, arises from torsional flutter effects causing sudden changes in angle of attack, which may lead to abrupt fin failure. Given the complex nature of these phenomena and the resource limitations in experimental rocketry, conservative methods based on fin dimensions, airspeed, and launch conditions are recommended. The following provisions will guide the teams when designing their projects relating to fin flutter and other phenomena.

STR 6.3.1. The designed fins shall not be unstable or loose. Officials will check the integrity of the fin assembly during the Launch Readiness Review (LRR).

STR 6.3.2. Teams should ensure that the fin flutter velocity of the rocket is at least 50% higher than the maximum expected rocket velocity.

6.4. Rail Buttons

STR 6.4.1. Rail buttons shall implement “hard points” for sliding mechanical attachment of the rocket to the LASC supplied 4040 launch rail, serving to guide the rocket during the initial phase of boost until the rocket achieves sufficient velocity for the fins to provide aerodynamic stabilization.

STR 6.4.2. Only two (2) rail buttons shall be used. The aft most launch lug shall support the launch vehicle's fully loaded launch weight while vertical.

STR 6.4.3. Rail buttons shall be attached using at least one metallic fastener through the reinforced airframe.

STR 6.4.4. Adhesive only attachment is not permitted.

STR 6.4.5. Fly-away rail guides are not permitted.

STR 6.4.6. Rail buttons 3D printed in a polymer material are permitted.

STR 6.4.7. Rail button placement shall not result in the rail blocking access to arming electronics.

STR 6.4.8. The rail button shall be attached in a way that it is easily removed and substituted without disassembling the rocket. This is important if, for any reason, one of the launch lugs needs to be substituted during integration with the launch rail. Therefore, it is highly recommended that the team take additional launch lugs to the launch operation.

STR 6.4.9. Officials will require teams to lift their launch vehicles by the rail guides and/or demonstrate that the bottom guide can hold the vehicle's weight when vertical. This test needs to be completed successfully during the Launch Readiness Review (LRR).

STR 6.4.10. Teams are highly encouraged to design the rail buttons attachment in a way that it is removable without the necessity of disassembling the rocket.

6.5. Best Practices and Recommendations

Load Bearing Eye Bolts and U-Bolts

STR 6.5.1. All load bearing eye bolts shall be of the closed-eye, forged type.

STR 6.5.2. All load bearing eye bolts, U-bolts, and links material shall be steel. This requirement extends to any bolt and eye-nut assembly used in place of an eyebolt. Stainless steel components (eye bolts, U-bolts, links, etc.) are permissible for use in recovery systems.

Joining of Airframe Sections and Separation Points

STR 6.5.3. Airframe joints, regardless of the implementation method such as RADAX or other joint types, shall be constructed to prevent bending. This ensures structural integrity under operational stresses.

STR 6.5.4. Coupler tubes used to join two sections of the airframe that are not designed to separate during flight shall extend at least half of a caliber into each airframe segment, although extending 1 caliber into each segment is recommended for enhanced structural integrity.

STR 6.5.5. Coupler tubes joining two sections of the airframe that are intended to separate in flight shall extend one caliber into each airframe segment.

STR 6.5.6. For coupler tubes joining two sections of the airframe that are intended to separate in flight, nylon shear pins should be used of sufficient number and strength such that a pressure difference against a bulkhead does not shear the shear pins.

To produce consistent results those shear pins should be inserted into PEM nuts or into a threaded hole. This means that BP and CO_2 ejection charge systems should exceed the pressure to properly shear those shear pins and the total force on the bulkhead should exceed the total strength of the shear pins by at least a safety factor of 3 for that recovery bay.

Adequate Venting

STR 6.5.7. Launch vehicles shall be adequately vented to prevent unintended internal pressures developed during flight from causing either damage to the airframe or any other unplanned configuration changes.

Color Scheme and Markings

STR 6.5.8. All experimental rockets shall be labeled with the Mission ID. The number assigned shall be clearly identified on the launch vehicle airframe, and prominently displayed, assisting officials to positively identify the project hardware with its respective team throughout the LASC. This label shall be duplicated on each part of the rocket which could separate either as designed or accidentally.

STR 6.5.9. High-visibility color schemes are encouraged for airframes, with preference given to white or lighter colors such as yellow, red, and orange. These colors are particularly effective in mitigating potential solar heating during the launch environment, enhancing both visibility and safety.

STR 6.5.10. Any form of green or brown colors associated with camouflage patterns shall not be used in the experimental rocket airframe and fins.

STR 6.5.11. Reference marks identifying the center of gravity and pressure shall be clearly placed on the airframe. These marks are essential for appropriate identification during the Launch Readiness Review (LRR), ensuring that all aspects of the rocket's balance and aerodynamic stability are correctly assessed.

Section 7 — Electronics and Control Systems (ECS)

Section 7 defines the Electronics and Control Systems (ECS) guidance and overall requirements, including rocket electronics and control systems.

7.1. Official Altitude Logging System

ECS 7.1.1. All experimental rockets shall have at least one COTS (Commercial Off-The-Shelf) Altimeter as an Official Altitude Logging System. This COTS Altimeter will be used for apogee determination and these are the only models authorized to be used for apogee determination:

Table 4: List of Approved COTS Altimeters.

Manufacturer	Model	Measurement Method	Link
Featherweight	**Blue Raven**	Barometric and Accelerometer Sensors	Blue Raven Altimeter
Perfectflite	**FireFly**	Barometric Sensor	FireFly Altimeter
Perfectflite	**SLCF**	Barometric Sensor	StratoLoggerCF
Jolly Logic	**AltimeterTwo**	Barometric and Accelerometer Sensor	AltimeterTwo
Altus Metrum	**EasyMini**	Barometric Sensor	EasyMini

A COTS Altimeter shall be implemented so that potential errors and uncertainty are reduced or mitigated and the results of collected apogee are more reliable for the transparency and fairness of flight performance scoring.

Event officials will check the altimeter during the Launch Readiness Review (LRR). The absence of an Official Altitude Logging System will result in penalties and/or a denied flight status.

ECS 7.1.2. All experimental rockets with a target of 3,000 meters AGL apogee should have a COTS Telemetry System. The following telemetry systems are the only authorized to be used:

Table 5: List of Approved Telemetry Systems.

Manufacturer	Model	Link
Featherweight	**GPS Tracker with Ground Station (Full System)**	Featherweight GPS Tracker
Multitronix	**TelemetryPro® Kate-3 Transmitter & Receiver**	Multitronix Products

A COTS Telemetry System should be used to determine apogee and the position from the designated touchdown point. More than one system may be used but all frequencies shall be identified. A GPS should be implemented for each separately recovered section of the experimental rocket.

Officials will check and validate data transmitted and received from the COTS Telemetry System during the Launch Readiness Review (LRR).

ECS 7.1.3. If a team implemented a COTS or SRAD Telemetry System in their experimental rocket mission, the transmission/reception frequencies shall be coordinated before the opening of the Cape Canavial Launch Area.

Teams may be told to change frequency to a different channel if there is overlap. Final frequencies will be shared for all teams' awareness and will be displayed on a board at the event.

ECS 7.1.4. Teams shall be able to disarm any type of altimeter, flight computer and/or telemetry system from the outside of the experimental rocket while it is still vertical. Altimeters, flight computers and/or telemetry systems shall be armed once the rocket is vertical and before igniter leads are connected.

ECS 7.1.5. In the case of unsuccessful recovery where altimeter data cannot be read, telemetry data can be used as a backup only if event officials' were present during the live data collection to certify the conformity of the readings and logs.

ECS 7.1.6. For the purposes of the Rocket Challenge, electronics and any associated control systems shall not be considered part of the mission's payload.

7.2. Power Systems and Critical Wiring

On-Board Power Systems and Rail Standby Time

Loss of launch slots have been experienced on multiple occasions as onboard batteries are typically located in inaccessible positions. Despite the requirement of battery life on the launch rail, an unsuccessful launch attempt typically results in the teams deciding to:

- Disarm any energetic pyrotechnics;
- Take the experimental rocket off the launch rail;
- Haul the experimental rocket back to the team's preparation area;
- Use tools to perform medium to extensive disassembly of the experimental rocket to extract batteries;
- Spend one to several hours recharging the batteries, if charged spares are not readily available;
- Perform the whole operation in reverse and return to the launch rail many hours later, to perform an additional launch attempt, if the possibility is given.

ECS 7.2.1. In order to overcome critically inefficient use of valuable and limited launch campaign time, including slot availability, teams should adopt one of the following two strategies:

- Implement an on-board charging and charge level maintenance system using an umbilical connection and cable; and/or

- Place all rechargeable or replaceable batteries conveniently under service panels accessible from ground level, without resorting to ladders or lowering the launch rail, having several spare sets of charged batteries ready at any time.

The implementation of an on-board charging and charge level maintenance system, based on a vehicle-wide charging bus and an umbilical cable, connected to a ground-based power supply, should be designed/implemented as follows:

- A “charging bus” should run along the entire length of the experimental rocket, interfacing to all batteries to facilitate charging and continuous charging and subsequent maintenance trickle charging;
  - → Use mating connectors at every structural joint;
  - → Largely all benefits of the system are lost if even a single battery is left out of the umbilical charging bus system.
- Each tap-off from the on-board charging bus to individual battery subsystems shall be reverse current flow protected by a suitably rated diode;
  - → All on-board batteries should feature the same nominal voltage;
  - → If bus voltage step-down is required for batteries with lower nominal voltage, adequately heat-dissipated linear regulators are strongly recommended and placed upstream of the mandatory cell balancing circuits;
  - → Switch-mode regulation or onboard battery chargers are strongly discouraged due to generated EMI and electrical noise; o LiPo battery cell balancing circuits shall protect each individual battery pack;
  - → LiPo battery cell balancing circuits of up to 12S cell count are widely available as pre-assembled PCBs for a low price, complete with built-in under voltage-cut-off, overcurrent-protection and overcharging cut-off;
  - → Flight vehicle batteries could all be considered “permanently” installed, not requiring removal past initial installation during on-site preparation. The ground-based power supply should simply be outputting the battery trickle charge voltage, plus a diode drop, for easiest implementation.

The advantages of implementing such a system are in most cases worth the effort. Most significantly, the rail standby time changes to “infinite” and the experimental rocket is always launched with 100% peak charged batteries.

Remove Before Flight (RBF)

ECS 7.2.2. The onboard batteries shall be connected to the electronics system via a "Normally Closed" switch or a Pull Pin Switch. Given the risk of accidentally pulling the pin and thereby activating the electronics system, it is recommended to secure the end of the pin with a piece of masking tape. This precaution helps prevent unintentional removal and activation, ensuring the safety and stability of the system prior to intended use.

ECS 7.2.3. Teams shall attach Remove Before Flight tags or flags to each Pull Pin Switch used in the experimental rocket.

Safety Critical Wiring and Switch Requirements

Safety critical wiring is defined within this document as the electrical wiring that is involved with the deployment events of the recovery system. To facilitate the replacement of electronics in the event of a failure and to simplify assembly, teams should prioritize cable management.

Wiring and switches need to be securely fastened to prevent dislodging during launch and recovery operations. Given that experimental rockets will encounter high-G loads during boost phases and parachute deployment, which can displace wiring or toggle switches, it is crucial to secure these components firmly. Teams shall ensure that switches remain in the armed position throughout the flight and do not accidentally deactivate during any flight events. This attention to detail in securing and managing wiring and switches is essential for maintaining the integrity and safety of the recovery system.

ECS 7.2.4. All safety critical wiring shall implement a cable management solution (e.g., wire ties, wiring, harnesses, cable raceways) which will prevent tangling and excessive free movement of significant wiring/cable lengths due to expected launch loads.

This requirement is not intended to negate the small amount of slack necessary at all connections/terminals to prevent unintentional de-mating due to expected launch loads transferred into wiring/cables at physical interfaces.

ECS 7.2.5. All safety critical wiring/cable connections shall be sufficiently secure as to prevent demating due to expected launch loads. This will be evaluated by a "tug test", in which the connection is gently but firmly "tugged" by hand to verify it is unlikely to break free in flight.

7.3. Attitude Control Systems (ACS)

Attitude Control Systems (ACS) are optional and will not be counted as payload in the Rocket Challenge. ACS may be implemented only for the 1,000 meters AGL apogee with solid rocket propulsion system mission category.

ECS 7.3.1. Only Selected Mission for the 1,000 meters AGL apogee with solid rocket propulsion system mission category may implement an Attitude Control Systems (ACS). The ACS shall have restricted control functionality.

ECS 7.3.2. If implemented, the ACS shall be strictly for pitch and/or roll stability augmentation, or for aerodynamic "braking". Officials reserves the right to make additional requests for information and draft unique requirements depending on the team's specific design.

ECS 7.3.3. Experimental rocket missions selected to participate in the event shall not, under any circumstances, be actively guided towards a designated spatial target.

ECS 7.3.4. All Attitude Control Systems (ACS) shall not utilize stored-energy devices. Only electronically-actuated and/or pressurized reaction control systems that use CO_2 are permitted.

ECS 7.3.5. All Attitude Control Systems (ACS) implemented shall be successfully tested prior to the Launch Readiness Review (LRR) in an environment that ensures a Technology Readiness Level (TRL) of 5. This testing confirms that the ACS operates effectively in conditions that closely simulate the operational environment, verifying its readiness and reliability for the launch.

Unnecessary for Stable Flight

ECS 7.3.6. Missions implementing Attitude Control Systems (ACS) shall be naturally stable without these controls being implemented (e.g., the experimental rocket may be flown with the ACS – including any control surfaces – either removed or rendered inert and mechanically locked, without becoming unstable during ascent).

ECS 7.3.7. Attitude Control Systems (ACS) will serve only to mitigate the small perturbations which affect the trajectory of a stable rocket that implements only fixed aerodynamic surfaces for stability.

Stability is defined in Section 4. A launch may be denied if the team demonstrates insufficient knowledge of the Attitude Control System (ACS) and its specifications.

Designed to Fail Safe

ECS 7.3.8. Attitude Control Systems (ACS) shall mechanically lock in a neutral state whenever either an abort signal is received for any reason, primary system power is lost, or the launch vehicle's attitude exceeds 15° from its launch elevation.

Any one of these conditions being met shall trigger the fail safe, neutral system state. A neutral state is defined as one which does not apply any moments to the launch vehicle (e.g., aerodynamic surfaces trimmed or retracted, gas jets off, etc.).

Boost Phase Dormancy

ECS 7.3.9. Attitude Control Systems (ACS) shall mechanically lock in a neutral state until the mission's boost phase has ended (i.e., the propulsive stage has ceased producing thrust).

Since all experimental rockets with ACS are to be designed inherently passively stable at lift-off, ACS are not needed until somewhat into the flight, performing minor course corrections thereafter.

In enforcing a boost dormancy phase, any unexpected, erratic, or faulty ACS behavior will take place far from the launch rail, minimizing the chances of putting any participants at risk near the launch rail.

Attitude Control System Electronics

ECS 7.3.10. Wherever possible, all ACS should comply with requirements and goals for "redundant electronics" and "safety critical wiring" as recovery systems. As for all electronics, it is highly recommended to ensure easy and quick access to switches/connectors via an access panel on the airframe. Access panels should be positioned so they are reachable from ground level, ideally without ladders. Access panels shall be secured for flight.

Section 8 — Recovery System (REC)

Section 8 defines the Recovery System (REC) guidance for the number of minimum and maximum deployment events, parachute design, and other requirements.

8.1. Deployment Events

Single or Dual-Event Recovery

REC 8.1.1. Experimental rockets that are expected to reach a target apogee above 1500 meters above ground level (AGL) shall adhere to a "dual-event" recovery operations concept.

This concept includes an “Initial Deployment Event”, such as a drogue parachute deployment or a reefed main parachute deployment, followed by a “Main Deployment Event”, which could involve the deployment of the main parachute or the un-reefing of the main parachute

The dual-event strategy is essential for ensuring the safe recovery of rocket bodies at higher altitudes.

REC 8.1.2. Experimental rockets whose apogee is not anticipated to exceed 1500 meters AGL are exempted from a “dual-event”, and may feature only a “Main Deployment Event”.

Initial Deployment Event

REC 8.1.3. The initial deployment event for dual-event recovery shall occur at or near after the apogee detection, stabilize the vehicle's attitude (i.e., prevent tumbling), and reduce its descent rate enough to permit the main deployment event yet not so much as to exacerbate wind drift (e.g., between 20-45 m/s).

Main Deployment Event

REC 8.1.4. The main deployment event shall occur at an altitude no higher than 500 meters AGL and reduce the vehicle's descent rate sufficiently to prevent excessive damage upon impact with the ground (i.e., less than 10 m/s).

REC 8.1.5. Teams whose experimental rockets are recovered outside the Cape Canavial Launch Area will be penalized if the primary cause is premature ejection during the main deployment event. This standard ensures compliance with designated safety and recovery protocols.

Recovery System Energetic Devices

REC 8.1.6. All stored-energy devices (i.e., energetics) used in Recovery Systems shall comply with the energetic device requirements defined in Section 3 of this document.

8.2. Recovery Electronics

REC 8.2.1. Experimental rockets anticipated to reach an apogee below 1500 meters AGL should implement redundant recovery system electronics, but are permitted to implement a single recovery system electronics.

REC 8.2.2. Experimental rockets anticipated to reach an apogee above 1500 meters AGL shall implement redundant recovery system electronics.

REC 8.2.3. Teams may use the COTS Altimeter (Official Altitude Logging System) defined in Section 7 as part of the Recovery Electronics.

REC 8.2.4. If a mission implements a redundant recovery system electronics, there is no requirement that the redundant system be dissimilar to the primary. However, there are advantages to using dissimilar primary and backup systems. Such configurations are less vulnerable to any inherent environmental sensitivities, design, or production flaws affecting a particular component.

8.3. Parachute Design Guidance

It is highly recommended that teams choose traditional parachute-based recovery systems. The majority of flight failures occur during recovery, so keeping it simple is advisable, especially if part of the launch operations score directly or indirectly depends on the successful recovery of the experimental rocket.

Non-Parachute/Parafoil Recovery Systems

REC 8.3.1. Teams exploring other (i.e., non-parachute or parafoil based) recovery methods shall notify LASC of their intentions at the earliest possible opportunity, and keep LASC apprised of the situation as their work progresses. LASC may make additional requests for information and draft unique requirements depending on the team's specific design implementation.

Ejection Gas Protection

REC 8.3.2. The recovery system shall implement adequate protection (e.g., fire resistant material, pistons, baffles) to prevent hot ejection gasses (if implemented) from causing burn damage to retaining cords and other vital components as the specific design demands.

Parachute Swivel Links

REC 8.3.3. The recovery system rigging (e.g., parachute lines, risers, shock chords) should implement swivel links at connections to relieve torsion as the specific design demands. This will mitigate the risk of torque loads unthreading bolted connections during recovery.

Parachute Coloration And Markings

REC 8.3.4. When separate parachutes are used for the initial and main deployment events, these parachutes shall be highly dissimilar from one another visually. This is typically achieved by using parachutes whose primary colors contrast those of the other chute. This will enable ground-based observers to more easily characterize deployment events with high-power optics.

8.4. Recovery System Testing

REC 8.4.1. Teams shall comply with all rules, regulations, and best practices imposed by the authorities at their chosen test location. The following requirements concern verification testing of all recovery systems.

REC 8.4.2. All recovery system mechanisms shall be successfully (without significant anomalies) tested prior to the event, either by one or more ground tests of key subsystems. Flight test demonstration is not required.

In the case of such ground tests, sensor electronics will be functionally included in the demonstration by simulating the environmental conditions under which their deployment function is triggered.

The test results and a statement of a successful test, complete with dates and signatures are considered a mandatory deliverable and annex to the Mission Report.

Correct, reliable and repeatable recovery system performance is absolute top priority from a safety point of view. Statistical data also concludes that recovery system failures are the major cause of abnormal touchdowns.

REC 8.4.3. Recovery electronics should demonstrate the ability to fire an electronic match or power parachute ejection charges.

While not recommended, teams will be able to test their recovery systems during the onsite event. In past events, a few teams were permitted to test their recovery systems on the ground prior to the Launch Readiness Review (LRR). Event officials may authorize selected teams to test their recovery systems if the event schedule and the safety of all participants permit.

REC 8.4.4. If a team wishes to test their recovery system for the selected mission during the event, the Mission Manager, Safety Manager, and Operations Manager shall coordinate with event officials to determine the feasibility of performing the test.

Event officials have the right to deny any recovery testing during the event to prevent distractions caused by a team's lack of organization and project management.

Section 9 — Payload (PAY)

Section 9 outlines the Payload (PAY) guidelines applicable to each mission category in the Rocket Challenge. It includes requirements that align with the minimum rules and form factors of the Satellite Challenge for teams aiming to launch their satellite and earn additional points. This alignment ensures that teams meet both sets of criteria when participating in both challenges.

9.1. Payload Requirements

The Latin American Space Challenge encourages teams with selected experimental rocket missions to also launch satellite missions that are part of the Satellite Challenge. The satellite launched may be managed by the same team or a different one, promoting collaboration and integration among participants.

The payload, whether it is a satellite or not, may include creative scientific experiments and technological demonstrations. Additionally, non-functional payloads (i.e., "dummy-mass") are permitted, provided they comply with the mass requirements for the specified mission category.

A payload is defined as an independent component that is replaceable by a ballast of the same mass, with no change to the rocket's functionality and trajectory in reaching the target apogee, or its successful recovery.

PAY 9.1.1. Each experimental rocket shall carry payloads onboard in accordance with the provision RKT 1.1.2. These payloads may be functional, such as satellites, experiments or technology demonstrators, non-functional, exemplified by dummy masses, or a combination of both.

PAY 9.1.2. Payloads within each experimental rocket can be classified as either non-deployable, remaining within the rocket throughout the mission, or deployable, such as releasing a satellite into the ambient environment.

PAY 9.1.3. If a mission opts for a functional payload, it shall be specified as either passive, meaning it does not require power and is non-energetic, or active, which involves powered or energetic components.

PAY 9.1.4. When calculating the stability of the launch vehicle, the presence of the payload shall be assumed. It is not required for the launch vehicles to demonstrate stability without the payload mass onboard.

PAY 9.1.5. Payloads shall not contain significant quantities of lead or any other hazardous materials (e.g., radioactive materials), and payloads shall not contain any live animals.

PAY 9.1.6. The specific location, integration, and removal method of the payload within the experimental rocket are not defined by the standards. Each mission shall ensure that payloads are not inextricably linked to any other components of the launch vehicle, such as the recovery

system, internal structure, or airframe, during weighing. If the payload cannot be removed for the weigh-in process, penalties will be applied to the overall mission.

Independent Payload Functionality

PAY 9.1.7. Experimental rocket recovery systems defined in Section 8 shall be able to bring the vehicle down in a safe and controlled manner, as per the recovery system requirements, independently of whether the payload is active, passive, deployable or fixed inside the launch vehicle.

PAY 9.1.8. A payload cannot be a part of the experimental rocket functionality (e.g., such as recovery electronics, official altitude logging system or an active control system). The functionality of the payload shall be completely independent of the experimental rocket' ability to bring the payload to the designated apogee.

9.2. Deployable Payloads and Recovery

Payloads may either be deployable or remain attached throughout the flight. Deployable payloads are defined by their ejection or separation from the experimental rocket at or after reaching apogee.

Consequently, deployable payloads shall be equipped with their own recovery system to ensure safe retrieval post-deployment. The following provisions ensure that all deployable payloads can be independently recovered without compromising the safety or integrity of the mission.

PAY 9.2.1. Deployable payloads are required to incorporate an independent recovery system that effectively reduces the payload's descent velocity to less than 10 meters per second. This ensures that the payload descends safely and minimizes the risk of damage upon landing.

PAY 9.2.2. Deployable payloads implementing a parachute or parafoil based recovery system are not required to comply with the dual-event requirements described in this document, being allowed to utilize a single-stage of 10 m/s or lower descent velocity recovery system from apogee, on a case-by-case approval by officials, since elaborate active deployable payloads will generally benefit from as much airborne time as possible.

PAY 9.2.3. Teams are advised that payloads drifting beyond the launch area limits shall be either abandoned or recovered at the team's own expense. Furthermore, teams whose deployable payload drifts outside the Cape Canavial Launch Area will incur penalties.

PAY 9.2.4. Payloads implementing independent recovery systems shall comply with the same requirements and goals as the experimental rocket for recovery system testing established on Section 8 of this document.

PAY 9.2.5. All stored-energy devices (e.g., energetics) used in payload systems implementing independent recovery strategies shall comply with the energetic device requirements defined in Section 3 of this document.

Appendix A: Details for the Mission Report

Abstract

The Mission Report shall contain an Abstract. At a minimum, the abstract shall identify the mission category in which the team is competing, identify any unique/defining design characteristics of the project, and provide whatever additional information may be necessary to convey any other high-level project or program goals & objectives.

Introduction

The Mission Report shall contain an Introduction. This section provides an overview of the academic program, stakeholders, team structure, and mission organization and management strategies. The introduction may repeat some of the content included in the abstract, because the abstract is intended to act as a standalone synopsis if necessary.

System Architecture and Concept of Operations

The Mission Report shall contain a System Architecture Overview. This part shall begin with a top-level overview of the integrated system, including a cutaway figure depicting the fully integrated project and its major subsystems or modules – configured for the mission being flown in the competition.

The Mission Report shall contain a Mission Concept of Operations (ConOps) Overview. This part shall identify the mission phases, including a figure, and describe the nominal operation of all subsystems or modules during each phase (e.g., a description of what is supposed to be occurring in each phase, and what subsystems are responsible for accomplishing this).

No matter how a team defines mission phases and phase transitions, they will be used to help organize failure modes identified in a Risk Assessment Appendix – described in this document.

Weights, Measures, And Performance Data

The Mission Report shall contain Weights, Measures, and Performance Data. This requirement will be satisfied by informing the data in this section of the document. A table with the minimum data is available in the Mission Report template.

Conclusions and Lessons Learned

The Mission Report shall contain Conclusions and Lessons Learned. This section shall include the lessons learned during the design, manufacture, and testing of the project, both from a team management and technical development perspective. Furthermore, this section should include strategies for corporate knowledge transfer from senior team members to the rising underclassmen who will soon take their place.

Hazard Analysis Appendix

The first Mission Report appendix shall contain a Hazard Analysis Report. This appendix shall address as applicable, hazardous material handling, transportation, storage procedures, and any other aspects of the design which pose potential hazards to operating personnel. A mitigation approach – by process and/or design – shall be defined for each hazard identified.

Risk Assessment Appendix

The second Mission Report appendix shall contain a Risk Assessment. This appendix shall summarize risk and reliability concepts associated with the project. All identified failure modes which pose a risk to mission success shall be recorded in a matrix, organized according to the mission phases identified by the CONOPS.

A mitigation approach – by process and/or design – shall be defined for each risk identified. A common description of the Risk Assessment is FMECA (Failure Mode and Effect Criticality Analysis). A Risk Assessment/FMECA is often represented as a spreadsheet matrix. The input to the matrix is listed as follows:

- A description of the identified failure mode.
- The likelihood of the failure mode occurring.
- The severity and impact of the failure mode occurring

The likelihood of a failure mode occurrence and the severity of the occurrence is assigned values according to the following tables:

Table 6: Likelihood of Failure.

Failure Probability	Value	Assessment of Risk
Remote	1	This is unlikely to happen.
Occasional	2	This might happen.
Probable or likely	3	This is likely to happen.

Table 7: Severity of Occurrence.

Mishap Severity	Value	Effect of Failure Mode
Minor or negligible	1	Minor impact on mission.
Critical	2	Deterioration of performance and mission.
Catastrophic	3	Safety hazard and/or likely loss of mission

The "Criticality Ranking" is the product of the Failure Probability and the Mishap Severity. The criticality rating is a measure of how urgent and how severe mitigation actions will have to be taken, to reduce the Criticality Ranking.

Table 8: Criticality Ranking.

Mishap Severity	Value	Effect of Failure Mode
1	Minor	This failure mode is not a concern.
2	Minor	This failure mode is of very minor concern.
3	Medium	Justification needed. Jury may decide to review.
4	High	Technical jury approval needed before launch.
6	Critical	Action required to reduce ranking before launch.
9	Critical	Action required to reduce ranking before launch.

The output of the matrix is highlighting and ranking failure mode liabilities to the mission, and the justifications and mitigations to reduce the Criticality Ranking. An example is given below:

Table 9: Risk Matrix.

Failure Mode	Mission Phase	Failure Probability	Mishap Severity	Critically Ranking	Mandatory Comments
Ignition failure	Ignition phase	1	1	1	Solid motor with COTS Squib is highly reliable and consequences of a misfire are very minor.
Antenna Deployment failure	Deployment phase	2	3	6	Antenna deployment is mandatory for communication. A redundant system is required.

A typical FMECA scale for the complexity of projects attending LASC should feature no less than 10 identified, ranked, commented, and justified failure modes – these should address at the minimum all important and critical failure modes.

Engineering Drawings and Optional Appendix

The final Mission Report appendix shall contain Engineering Drawings and optional appendices. This appendix shall include any revision controlled technical drawings necessary to define significant subsystems or components, and other optional appendices can include, but are not limited to further Subsystem Details, Launch Support Equipment Details, Detailed Structural and Mechanical Calculation, Detailed Logical Process Diagrams, Detailed Software Architecture, and Detailed Electrical Architecture.

Appendix B: Detailing Grading Criteria

The grading will be conducted by the event officials based on the individual grading criterion in the respective mission categories. A summary and overview of the grading scheme is given below for clarity.

Table 10: Grading Scheme.

Count	For Countable/Relative Criteria
91 to 100%	Outstanding Quality/Conformity
76 to 90%	High Quality/Conformity
51 to 75%	No Greater than Average
Up to 50%	Unsatisfactory

Count	For Absolute Criteria
100%	Yes
0%	No

This is meant to be an intuitive and transparent scheme for the jury to follow and the teams to understand.

Team Effort

Team Effort will be graded up to 100 points (10% of 1,000 points possible). The total points for Team Effort is a combination of countable, relative and absolute criteria.

Table 11: Team Effort Grading Criteria.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
1st Progress Report	10 points Compliant to Section 1.4.	-	-	0 point One or more required items missing.	**/5**
2nd Progress Report	10 points Compliant to Section 1.4.	-	-	0 point One or more required items missing.	**/5**
Mission Patch	64-70 points Complies with guidance.	-	-	0 point Required item missing or does not comply with guidance.	**/10**
Pitch Video	26-30 points Completely complies with guidance. Excellent quality, & clarity,	21-25 points Complies with the guidance with a few minor issues. High video and/or sound quality.	15-20 points Minimally complies with guidance. Medium video and/or sound quality. < 10% over or < 20% under time limit.	< 15 points Does not comply with guidance. Low video and/or sound quality. > 10% over or > 20% under the time limit.	**/30**
Lights, Camera, Action!	The Lights, Camera, Action! points will be normalized from the highest achieving team/selected mission to the lowest. The minimum requirement for not being zeroed is participation with at least 10% of the maximum links requested as stated in Section 1.4.				**/50**
Team Effort					**/100**

Mission Report

The Mission Report will be graded up to 200 points (20% of 1,000 points possible) divided into three criteria: Completeness (20 points), Correctness (up to 40 points) and Analysis (up to 140 points). The Completeness Criterion will be scored using Absolute Criteria. The Correctness and Analysis Criteria will be scored in a mix of Countable and Relative Criteria.

Table 12: Mission Report Grading Criteria - Completeness Criterion.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Completeness	20 points All required items of the Appendix A present.	-	-	0 point One or more required items missing.	**/20**

Table 13: Mission Report Grading Criteria - Correctness Criterion.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Style	18-20 points Writing was exceptionally clear, understandable, and concise. Sentence and paragraph organization is exceptional. Writing is free of digressions or irrelevant information.	15-17 points Writing was clear, understandable, and concise. Overall paragraph and sentence organization were very good. Digressions or irrelevant information do not significantly detract from the report	10-14 points Writing was generally clear and understandable. Paragraph and sentence organization were generally good. Digressions or irrelevant information detract from the report's analysis.	< 10 points Writing was repeatedly unclear, difficult to understand or wordy. Overall paragraph and/or sentence organization were ineffective or nonexistent. Digressions and/or irrelevant information consistently detract from the analysis.	**/20**
Mechanics	10 points No grammar, spelling, or mechanics errors. Scientific terms correctly used, units and dimensions consistent and correct.	8-9 points No more than a few grammar, spelling, or usage errors. Only a few minor errors with use of scientific terms or dimensions.	5-7 points Significant spelling, usage, and grammar errors that did not detract from readability. Significant errors with use of scientific terms or dimensions.	< 5 points Repeated grammar or spelling errors detracted from readability. Errors with use of scientific terms or dimensions detracted from the report.	**/10**
Format	10 points Completely follows the required template. Meets page limits.	8-9 points Minor deviations from required template. Meets page limits.	5-7 points Major deviations from required template. < 10% over page limits.	< 5 points No attempt at cohesive format or use of required template. More than 10% over page limits.	**/10**
Correctness					**/40**

Table 14: Mission Report Grading Criteria - Analysis Criterion.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Depth of Analysis	46-50 points Very complete and thorough analysis. All key design decisions are discussed and based	38-45 points Adequate analysis with minor weaknesses. Most key design decisions are discussed and based on design	25-37 points Adequate analysis with significant gaps or weaknesses. Some key design decisions are discussed	< 25 points Inadequate analysis. Few, if any key design decisions were discussed No discussion of	**/50**

Criterion	Outstanding	High	Average	Unsatisfactory	Points
	on design targets, constraints, and appropriate tradeoffs.	targets, constraints, and appropriate tradeoffs.	and based on design targets, constraints, and appropriate tradeoffs. Some minor incorrect statements.	tradeoffs. Parts of analysis conflict with general scientific knowledge.	
Assumptions and Sensitivity Analysis	27-30 points All assumptions are clearly stated. Sensitivity analysis is performed to quantify uncertainty in variables and assumptions.	23-26 points Most assumptions were addressed. Some sensitivity analysis.	15-22 points Unstated assumptions. No sensitivity analysis.	< 15 points No stated assumptions or assumptions were unreasonable. No sensitivity analysis.	**/30**
Verification and Validation Tests	36-40 points All verification and validation tests were discussed, both for the final design and key iterations leading to that design. Complete and valid conclusions were drawn from the results.	30-35 points Most verification and validation tests are adequately discussed. Appropriate conclusions were drawn from the results, but key iterations prior to final design were not discussed.	20-29 points Some verification and validation tests are discussed but consistent. Unclear that conclusions and decisions were drawn from testing results and analysis.	< 20 points Unclear whether verification and validation tests were performed. Decisions and conclusions were not drawn from the analysis.	**/40**
Use of Charts and Figures	18-20 points Tables, figures, and appendices all effectively organize and communicate information.	15-17 points Use of tables, figures, and appendices is mostly effective.	10-14 points Use of tables, figures, and appendices is somewhat effective with significant issues.	< 10 points Tables, figures, and appendices were incorrect or misleading.	**/20**
Analysis					**/140**

Then, the *total score* of the Mission Report will be the sum of the points for Completeness, Correctness and Analysis.

Design Implementation

The Design Implementation will be graded up to 100 points (10% of 1,000 points possible) divided into two criteria: Design Quality & Decisions (50 points) and Build Quality 50 points). Both will be scored in a mix of Countable and Relative Criteria.

Table 15: Design Implementation Grading Criteria - Design Quality & Decisions Criterion.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Team Design Vision, Goals and System Engineering	26-30 points A clearly understood design vision with achievable goals, aligned with strategic objectives, and strong evidence of systems engineering discipline throughout the design team.	20-25 points Design vision is mostly understood and achievable with coherent goals. Key project elements address team goals. Good systems engineering discipline throughout development. Most of the design team supports coherent and understood goals.	15-19 points Design vision is incomplete or questionably achievable. Unclear how project elements address team goals. Some lapses in systems engineering discipline. Inconsistent support for team goals and some evidence of design team working at cross-purposes.	< 15 points Questionable or unachievable design vision. Most project elements do not address team goals. Major lapses in systems engineering discipline. No unified design goals, with clear evidence of team members working at cross-purposes.	**/20**

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Team Knowledge	9-10 points Strong team understanding of the principles governing design and reasoning behind the design. All members of the team can clearly articulate reasoning for choices.	7-8 points Generally good team understanding of the physical principles governing design and reasoning behind the design. Team members defer to a few team “experts” during discussion.	6-5 points Some team understanding of the physical principles governing design and reasoning behind the design. Team members defer to one or two team “experts” during discussion.	< 5 points Inadequate team understanding of the principles governing design and reasoning behind the design.	**/10**
Presentation Session	20 points Completely complies with Section 1.4.	10 points Complies with Section 1.4. with minor issues.	5 points Minimally complies with Section 1.4.	0 point Does not comply with Section 1.4.	**/20**
Design Quality & Decisions					**/50**

Table 16: Design Implementation Grading Criteria - Build Quality Criterion.

Criterion	Outstanding	High	Average	Unsatisfactory	Points
Compliance with LSARPs	13-15 points Completely complies with LSARPs	10-12 points Complies with LSARPs with a few minor issues.	7-9 points Minimally complies with LSARPs.	< 7 points Does not comply with LSARPs.	**/15**
Design Quality and Robustness	13-15 points Design and build quality are robust and sufficient to operate as intended under reasonably expected conditions.	10-12 points Design and build quality are somewhat robust and sufficient to operate as intended under reasonably expected conditions.	7-9 points Design and build quality are sufficient to operate as intended under specific conditions but are not robust to reasonably expected variations.	< 7 points Design and build quality insufficient to operate as intended under expected conditions. No attempts at robust design.	**/15**
Fabrication and Construction Methods	9-10 points Fabrication and assembly methods are fully understood and correctly applied. SRAD manufacturing methods are appropriate and well understood, including cost, time, and performance.	7-8 points Fabrication and assembly methods are generally well understood and correctly applied. Manufacturing methods for SRAD elements are both appropriate and reasonably understood by the team, including cost, time, and performance.	5-6 points Fabrication and assembly methods are appropriate, but not completely understood. Manufacturing methods for SRAD elements are appropriate, but not fully understood by the team.	< 5 points Fabrication and assembly methods inappropriate or not understood. Manufacturing methods for SRAD elements are impractical or not well understood by the team.	**/10**
Consistent Design (30 pts)	9-10 points Clearly consistent with the team's vision. No evidence of key systems added as an afterthought.	7-8 points Generally aligned with the team's vision. No evidence of key systems added as an afterthought.	5-6 points Somewhat aligned with the team's vision. Some key systems added as afterthoughts.	< 5 points No apparent organizing vision. Key systems added as field modifications or afterthoughts.	**/10**
Build Quality					**/50**

Launch Operations

Each mission will be awarded as many as 550 points – 55% of 1,000 points possible – for their launch operation at the Latin American Space Challenge, demonstrated by operation readiness, altitude achieved relative to the target apogee and successful recovery.

The Operation Readiness constitutes 100 points of the total score assigned to launch operations. This includes completing the Launch Readiness Review (LRR) with a green/approval flight status, worth 50 points, and the successful utilization of the assigned slot, also worth 50 points (i.e., completing the integration of the experimental rocket to the launch rail).

An early launch, compared to the assigned slot, may reward up to 25 extra points, not exceeding the total points of the Launch Operations scoring sheet.

The Flight Performance or accuracy of the experimental rocket's actual apogee achieved relative to the target apogee is worth 350 points of the overall value assigned to launch operations. Precise Trajectory planning is important. Points will be awarded for apogees within ±50% of the target apogee according to the following formula:

$$Flight\ Performance = 350 - \left(\frac{350}{0.5 \times apogee_{target}}\right) \times \left|apogee_{target} - apogee_{actual}\right|$$

Where Apogee Target may equal either 500 m, 1,000 m or 3,000 m AGL.
If the score equation returns a negative number, it will be zeroed.

The Successful Recovery of the experimental rocket is worth 100 points of the overall value assigned to launch operations. A recovery operation is considered successful according to the following table of classification:

Table 17: Launch Operations Status and Recovery Points.

Criterion	Outstanding	Recovery Points
No Launch	A Selected Mission either did not request a Launch Readiness Review (LRR), received a Launch Status equals to “orange” or “yellow” during the event, or received a "green" but did not attempt at least one ignition.	**Zero**
Launch Denied	A Selected Mission did not pass the Launch Readiness Review (LRR) due to one or multiple criteria being indicated as "red."	**Zero**
Operational or Launch Failure	The experimental rocket had an ignition failure (e.g., Catastrophe At Take Off, No Ignition/Ignition Failure, etc.) or has not been found after an abnormal trajectory during the available recovery slots during the event.	**Zero**
Not Recovered	The experimental rocket has not been found after the nominal trajectory during the available recovery slots during the event.	**Zero**
Extensive Damage	Excessive damage is defined as any damage to the point that, if the systems intended consumables were replenished, it could not be launched again safely.	**Zero**
None or Minor Damage	The experimental rocket has been successfully recovered after a nominal recovery deployment with no or minor damages (i.e., if the system's consumables were replenished, it could be launched again safely).	**100**

Dual-Challenge Bonus

A sounding rocket or a launch vehicle transports payloads for research and development, commercial purposes, education or training. An experimental rocket without a payload loses its purpose. The Latin American Space Challenge promotes the development of experimental satellites as part of the mission's payload.

Teams with Selected Missions in both the Rocket and Satellite Challenge will receive a bonus of 50 points if, and only if, the experimental satellite presented in the Satellite Challenge is placed in the experimental rocket and a launch is performed (i.e., the ignition of the propulsion system is initiated).

If two different teams coordinate to fly a satellite in an experimental rocket, the Dual-Challenge Bonus may also be granted. However, both teams must inform event officials of this intent during the Launch Readiness Review (LRR).

Final Score

The maximum points possible are up to 1,000 points, including the bonus points of participating with Selected Mission in both Rocket and Satellite Challenge.

Final Score = (Team Effort + Mission Report + Design Implementation + Launch Operations) + Dual Challenge Bonus - Penalties