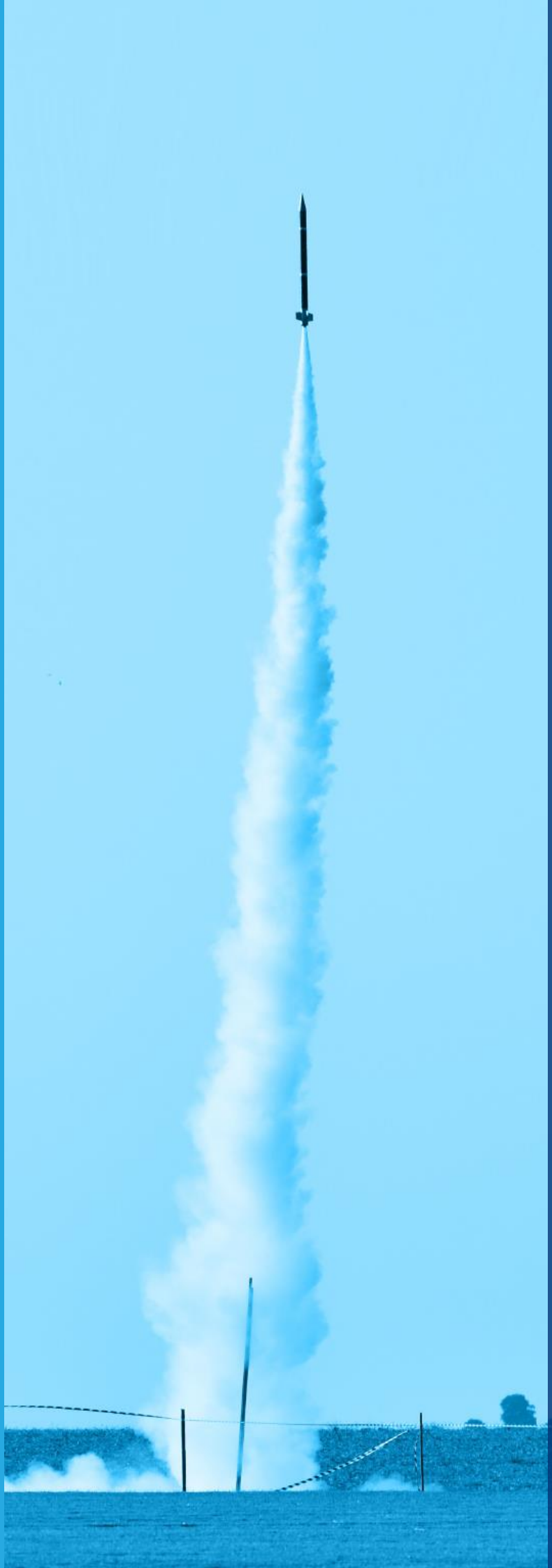

2020 LASC ONLINE

Rules & Requeriments

English Version
August 03, 2020 – Revision 03

PIØN

2020 LASC
ONLINE

Latin American Space Challenge (LASC)

2020 LASC Online Edition

Rules & Requirements Document

The electronic version is the official, approved document.
Verify this is the correct version before use.

Revision History

REVISION	DESCRIPTION	DATE
00	Baseline of the 2020 LASC Rules & Requirements Document.	05/01/2020
01	Section 6. Inclusion of a new entry-level category. Section 6. Detailment of permitted prop-system. Section 6.1.3. Information about fees. Section 6.2. Payload information for the new category. Section 6.2. Adjustments on general rules. Section 6.7.5. Information on new category points. Section 6.7.11. Adjustment of the award name.	12/01/2020
02	Section 6.1.2. Information about Teams Organization. Section 6.1.3. Information about fees. Section 6.2.5.1. Information on Payloads.	02/02/2020
03	Major Revision: 2020 LASC Online Edition	03/08/2020

1. INTRODUCTION

The *Latin American Space Challenge* (LASC) is a three-day series of events which will set the background and provide structure for the Latin America's largest experimental rocket engineering competition.

Due to the COVID-19 pandemic, the **2020 LASC Online** will be a virtual event. Teams will be challenged to develop, simulate and present their rocket projects submitting progress reports, simulation results, project technical reports and videos describing their project. Also, the **2020 LASC Online** will host a *sprint*-like event for online challenges for the registered teams.

For the **safety** of all *rocketeers*, *satelliteers*, general public and LASC Organization, the 2020 Latin American Space Challenge will not host a scored *launch window*.

2. BACKGROUND

The noise, fire, high speeds, and the adrenaline of launching a rocket encourage people to pursue science, technology, and mathematics based careers and for the progress of the science and technology of their countries. A space competition motivates them to extend themselves beyond the classroom to design and build the rockets themselves. Students enrolled in this challenge also could learn to work as a team, solving real world problems under the same pressures they'll experience in their future careers.

The *Latin American Space Challenge* (LASC) has a mission to motivate people from all latin american countries to develop and launch a rocket with a smallsat as a payload. The vision of the LASC is to provide motivation for latin american students and enthusiasts to pursue their dreams.

3. PURPOSE AND SCOPE

This document defines the rules and requirements governing participation in the LASC. Additional guidance for teams entered in the LASC is contained in the LASC Design, Test, & Evaluation Guide (LASC-DTEG), maintained on the LASC website.

The LASC-DTEG provides teams with project development guidance LASC uses to promote flight safety. Departures from this guidance may negatively impact an offending team's score and flight status depending on the degree of severity.

Additional documents and complementary guidance for the **2020 LASC Online** will be published on the LASC website.

LASC teams should avoid feeling constrained before seeking clarification, and may contact the organization with questions or concerns regarding their project plans' alignment with the spirit and intent of this document.

4. REVISION

It is expected the LASC Rules & Requirements Document may require revision in the months leading up to a competition. Also, major revisions will be accomplished by complete document reissue. Such revisions will be reflected in updates to the document's effective date.

5. 2020 LASC ONLINE

The **2020 LASC Online** is a virtual event separated in two independently main challenges:

- 2020 LASC Online Rocket Challenge;
- 2020 LASC Online Satellite Challenge.

Both challenges will be divided in two parts: (i) project and simulation part; and (ii) sprint-like event. The *2020 Latin American Space Challenge Online Master Schedule Document* will be published with other documents for the **2020 LASC Online** will be published on the LASC website: <www.lasc.space>.

The **Registration Form** will be available on <www.lasc.space> from August 09, 2020 to August 16, 2020. The **2020 LASC Online** will be accepting **new registrations**. Important: the already Registered Teams for the *2020 Latin American Space Challenge* shall fill the **Registration Form.**

5.1. TEAM COMPOSITION AND ELIGIBILITY

5.1.1. TEAM MEMBERS

LASC Teams may consist of student members, non-students members (i.e. enthusiasts, researchers, startup teams, amateurs and hobbyists) or mixed.

LASC Teams consisted only by students members who were matriculated high school, undergraduate or graduate students (i.e. Masters or Doctoral students) during the previous academic year (e.g. former students who graduated shortly before the competition remain eligible) from one or more academic institutions (e.g. "joint teams" are eligible) may receive bonus points in addition to their total score.

There is no limit on the overall number of people per team. Each individual is free to participate on multiple teams, so long as each team is led by a different individual.

5.1.2. TEAM ORGANIZATION AND SUBMISSION LIMITATIONS

Teams shall submit **no more than three projects** into the **2020 LASC Online Rocket Challenge**. Each project shall be in a different category. There will be no registration limit for the **2020 LASC Online Satellite Challenge** detailed on Section 6.2.

For example, Team ABC may register a project for the 1 km AGL apogee with hybrid/liquid propulsion system category and another project to the 3 km AGL apogee with solid rocket propulsion system category.

Therefore, no team may be entered in the same category twice at the LASC. Although, as previously noted, teams are permitted to switch categories as necessary prior to submitting their final Project Technical Report.

The event organizers will track and evaluate each project separately, regardless of common student membership or academic affiliation.

5.1.3. TEAM REGISTRATION FEES

The **2020 LASC Online** will be free of charge.

Due to the COVID-19 pandemic, Teams that *already paid* any ***2020 Latin American Space Challenge*** shall read the following notes:

Important Note (1):

Teams and Rocketeers that already paid Project Entry Deposit Fee and/or Rocket Fee and/or Rocketeer Fee for the 2020 Latin American Space Challenge will expect an *automatic conversion* of the payment for the **2021 LASC Event**.

For example, Team ABC paid the Rocket Fee for the 2020 Latin American Space Challenge. Then, Team ABC shall expect an *automatic conversion*, without any additional charges, a 2021 Rocket Fee already paid.

If Team ABC prefers a reimbursement, then a manual input from Team ABC shall be made on the *EventBrite* and an e-mail shall be sent to <*lasc@lasc.space*> informing their decision.

Teams shall expect an increase of the fees for the 2021 Latin American Space Challenge.

Important Note (2):

Teams that paid the Rocket Fee shall expect receiving the PION Altimeter Lite before *December 31, 2020*. The altimeter will be sent with **no** shipping cost for the captain's address.

The responsibility of additional taxes (e.g. import duties) are only of the registered team. Teams that already paid the Rocket Fee seeking for *reimbursement* shall send an e-mail to <*lasc@lasc.space*> until August 16, 2020.

Teams that are *willing to pay* any of the ***2021 Latin American Space Challenge*** with the 2020 Event Discount, please send an e-mail to <*lasc@lasc.space*> until August 16, 2020 for further details. Please, expect paying the fees before September 25, 2020.

6. ROCKET CHALLENGE

In general, teams competing in the **2020 LASC Online Rocket Challenge** must design, simulate, and present a rocket project carrying no less than 0,25 kg (0.55 lb) of payload to a target apogee of 0.5 km (1,640 ft) above ground level (AGL) or 0.8 kg (1.8 lb) of payload to a target apogee of 1 km (3,300 ft) AGL or 4 kg (8.8 lb) of payload to a target apogee 3 km (10,000 ft) AGL.

Projects will be divided into one of the following five categories based on the type of project attempted – defined by the target apogee and selected propulsion system. Teams are permitted to switch categories as necessary prior to submitting their final Project Technical Report.

- Entry-level: 0.5 km AGL apogee with a chemical rocket propulsion system;
- 1 km AGL apogee with solid rocket propulsion system;
- 1 km AGL apogee with hybrid or liquid rocket propulsion system;
- 3 km AGL apogee with solid rocket propulsion system;
- 3 km AGL apogee with hybrid or liquid rocket propulsion system.

LASC reserves the right to change the category in which a project is initially entered based on the design presented.

All chemical propulsion types (solid, liquid, and hybrid) are allowed. Note that all propellants used must be non-toxic. Ammonium perchlorate composite propellant (APCP), potassium nitrate and sugar (aka "rocket candy"), nitrous oxide, liquid oxygen (LOX), hydrogen peroxide, kerosene, propane 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, etc. (e.g. Hydrazine and N2O4).

Note that multistage launch vehicles are **not** allowed. Propulsion systems containing PET-bottles or water-based rockets are **not** allowed. Teams with propulsion systems based mainly on gunpowder, also known as black powder, will be penalized half points off their total earned score.

Additional high-level design and acceptance testing requirements are contained in the LASC-DTEG, maintained on the LASC website.

Competition Officials will evaluate competitors for Place Awards within each competition category based on the quality of required project documentation, a **Virtual Poster Session**, the quality of their system's overall design and simulation, and finally the team's overall

excellence, efficiency and performance demonstrated at the **2020 LASC Online** *sprint*-like event.

Furthermore, Competition Officials will select no less than six teams to present a particular aspect of their work in a Virtual Podium Session held during the **2020 LASC Online**. These teams are eligible to receive certain Technical Achievement Awards.

7. SATELLITE CHALLENGE

In addition, teams competing in the **2020 LASC Online** may register for the **Satellite Challenge** defined as **"2020 LASC Online Satellite Challenge".** Teams competing in the Satellite Challenge must design, simulate, and present a satellite project.

Projects will be divided into one of the following three categories based on the type of project attempted. Teams are permitted to switch categories as necessary prior to submitting their final Project Technical Report.

- Entry-level: PocketQube-style or CanSat-style satellite project;
- Intermediate-level: 1U CubeSat-style satellite project;
- Advanced-level: 3U CubeSat-style satellite project.

Each *PocketQube project* shall be no less than 1P in size. One PocketQube Unit (1P) is defined as a 5cm×5cm×5cm cubic structure. Similarly, three PocketQube Units (3P) constitute either a single structure or a stack measuring 5cm×5cm×15cm.

Each CanSat project shall be defined as a 66mm diameter and 115mm height.

Each *CubeSat project* shall be no less than 1U in size. One CubeSat Unit (1U) is defined as a 10cm×10cm×10cm cubic structure. Similarly, three CubeSat Units (3U) constitute either a single structure or a stack measuring 10cm×10cm×30cm.

LASC Organization will accept registrations for the **Satellite Challenge** of teams competing only with a satellite project - a rocket project will not be mandatory for this challenge.

Teams participating in the **2020 LASC Online** submitting a rocket project may participate also in the 2020 Satellite Challenge filling the appropriate registration form.

For teams participating in the **2020 LASC Online** submitting a rocket project and **not** registered for the **2020 LASC Online Satellite Challenge**, the Section 8 of this document **must** be followed.

Additional high-level design and acceptance testing requirements are contained in the **2020 LASC Online Satellite Challenge** specific documents, maintained on the LASC website. The **2020 LASC Online Satellite Challenge** specific documents, guides and rules will be published on <www.lasc.space>.

Competition Officials will evaluate competitors for Place Awards within each competition category based on the quality of required project documentation, a **Virtual Poster Session**, the quality of their system's overall design and simulation, and finally the team's overall excellence, efficiency and performance demonstrated at the **2020 LASC Online** *sprint*-like event.

Furthermore, Competition Officials will select no less than six teams to present a particular aspect of their work in a Virtual Podium Session held during the **2020 LASC Online**. These teams are eligible to receive certain Technical Achievement Awards.

8. ROCKET CHALLENGE DETAILS

8.1. PAYLOAD

8.1.1. PAYLOAD MASS

The launch vehicle **shall** carry no less than 0.25 kg of payload for 0.5 km apogee or 0.8 kg of payload for 1 km apogee or 4 kg of payload for 3 km apogee.

Payload is defined as being replaceable with ballast of the same mass, with no change to the launch vehicle trajectory in reaching the target apogee, or its successful recovery. This payload may be assumed present when calculating the launch vehicle's stability. In other words, launch vehicles entered in the LASC need not be stable without the required payload mass on-board.

8.1.2. INDEPENDENT PAYLOAD FUNCTIONALITY

Although non-functional "boiler-plate" payloads are permitted, teams are encouraged to launch creative scientific experiments and technology demonstrations; however, launch vehicles shall be designed to deliver the payload to the target apogee and recover themselves independent of any active or passive payload function(s).

For example, an active launch vehicle stability augmentation system is a launch vehicle subsystem – not a payload. Such launch vehicle subsystems will contribute to competition officials' overall evaluation of a project, and may be submitted to the *2020 LASC Online Virtual Podium Session*, but they are not payloads.

8.1.3. PAYLOAD LOCATION AND INTERFACE RESTRICTED

Neither the payload location in the launch vehicle nor its method of integration and removal is specified; however, competition officials will verify simulated weight of the payload(s) independent of all launch vehicle associated systems.

8.1.4. RESTRICTED PAYLOAD MATERIALS

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

8.1.5. PAYLOAD FORM FACTOR

The following sections concern the required shape and dimensions of payload(s) submitted for weigh-in. These requirements are different if the payload is a non-functional "boilerplate" (i.e. mass emulator) or if it is a functional scientific experiment/technology demonstration.

8.1.5.1. BOILERPLATE PAYLOAD

Any launch vehicle carrying strictly non-functional "boilerplate" mass as its payload shall do so in the form of one or more PocketQubes, CanSats or CubeSats depending on apogee target. Each apogee target categories has its minimum payload size:

• For 0.5 and 1 km AGL apogee categories: Each *PocketQube* shall be no less than 1P in size. One PocketQube Unit (1P) is defined as a 5cm×5cm×5cm cubic structure. Similarly, three PocketQube Units (3P) constitute either a single structure or a stack measuring 5cm×5cm×15cm. CanSats are also permitted and defined as a 66mm diameter and 115mm height.

• For 3 km AGL apogee categories: Each CubeSat shall be no less than 1U in size. One CubeSat Unit (1U) is defined as a 10cm×10cm×10cm cubic structure. Similarly, three CubeSat Units (3U) constitute either a single structure or a stack measuring 10cm×10cm×30cm.

8.1.5.2. SCIENTIFIC EXPERIMENT OR TECHNOLOGY DEMONSTRATION PAYLOAD

Any functional scientific experiment or technology demonstration payload and its associated structure may be constructed in any form factor, provided the experiment/technology and its associated structure remain in compliance with Sections 6.2.1, 6.2.2, 6.2.3, and 6.2.4 of this document. With special regard to compliance with Section 6.2.1, the required minimum payload mass should be achieved primarily by the experiment(s)/technology and associated support structure.

The payload design may incorporate a limited amount of additional "boilerplate" mass (limited at 1/4th the required minimum) to meet the required minimum while remaining exempt from Section 6.2.5.1 above. Competition officials may impose a point penalty on any team believed to be violating the spirit and intent of this rule in accordance with Section 6.7.6. of this document.

Finally, despite this exemption, **LASC highly encourages teams to adopt the PocketQube, CanSat or a CubeSat standard for their payload(s)** whenever possible depending on its apogee target.

8.2. ROCKET LIMITATION

Launch vehicles entered the LASC Event shall not exceed an installed total impulse of 40,960 Newton-seconds.

8.3. RANGE TRACKING

Launch vehicles, and any deployable payload(s), shall carry a radio beacon or similar transmitter aboard each independently recovered assembly to aid in locating them after launch. Tracking systems using the Global Positioning System (GPS) or equivalent global navigation satellite systems (GNSS) and an automatic packet reporting system (APRS) are strongly preferred.

8.4. OFFICIAL ALTITUDE LOGGING

Launch vehicles **shall** carry the PION Altimeter Lite as a COTS barometric pressure altimeter with on-board data storage, which will provide an official log of apogee for scoring. If a deployable payload is integrated on the launch vehicle, the official altitude logging system shall be mounted to the launch vehicle and not the payload.

More information, datasheet, and dimensions of the PION Altimeter Lite may be accessed on <www.pionlabs.com.br>.

While the on-board log is considered the primary data source for official altitude reporting, telemetry – if implemented – may be accepted under certain circumstances defined in this document. If implemented, this telemetric data shall originate from the same sensor source as the official on-board data log.

8.5. PROJECT DELIVERABLES

The following sections define the deliverable materials (e.g. paperwork and presentation materials) competition officials require from teams competing in the LASC – including as appropriate each deliverable format and minimum expected content. Unless otherwise noted, all deliverables will be submitted to LASC via Google Forms. The unique Google Forms link found within each relevant deliverable description will facilitate submission of that deliverable. The scheduled due dates of all required deliverables are recorded in the LASC Master Schedule Document, maintained on the LASC website.

8.5.1. ENTRY FORM AND PROGRESS UPDATES

Each team shall inform LASC of their desire to compete by completing a provided Google Forms questionnaire. Teams shall submit updated versions of this form on specific occasions prior to the competition. This questionnaire will record changes in the project's technical characteristics during development. Competition officials understand not all technical details will be known until later in the design process. Therefore, the Entry Form and all subsequent Progress Updates prior to the final submission will be evaluated based only on their *timeliness* and *completeness* – defined as follows.

Total completeness of the entry form and subsequent updates 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.

In general, LASC expects technical information to change, but information must always be provided. Only teams whose application meets this standard will be evaluated for entry into the competition. Accepted teams will be announced by the release of a Team ID list after the end of the application deadline.

The Latin American Space Challenge Entry Form & Progress Update link will be available on the LASC website. Teams shall submit their Entry Form using a Google Forms link.

Between the time when a majority of Entry Forms are received and the due date of the first progress update, LASC will issue every team a numeric Team ID. Entries made later in the academic year should be accompanied by an email addressed directly to LASC: *lasc@lasc.space*, alerting the organizers to check for the late entry. Such entries will receive their Team ID shortly after receipt of the entry form.

The Team ID is the competition officials' primary means of identifying and tracking all the many teams. Once assigned, any correspondence between a team and the organizers must contain that team's ID number to enable a timely and accurate response.

8.5.2. PROJECT TECHNICAL REPORT

Each team **shall** submit a Project Technical Report which overviews their project for the judging panel and other competition officials. The Project Technical Report shall be formatted according to the style guide of the American Institute of Aeronautics and Astronautics (AIAA), using a provided Microsoft® Word document template.

The Latin American Space Challenge Project Technical Report template is available for download on the LASC website. Always check the template maintained on the website before drafting your Project Technical Report to ensure you are using the latest version.

On or before a specified date prior to the event, teams shall submit a digital, PDF copy of their Project Technical Report using a provided Google Forms link, with the file name "Your Team ID_Project Report". For example, a team assigned the Team ID "19" would submit a digital copy of their Project Report using the filename "19_Project Report". The event organizers will post these files in an online archive of the conference proceedings.

The Project Technical Report's main title is left to the team's discretion, however; the paper shall be subtitled “Team Your Team ID Project Technical Report to the Year Latin American Space Challenge". For example, a team assigned the Team ID "19", competing in the 2020 LASC, would subtitle their Project Technical Report "Team 19 Project Technical Report to the 2020 Latin American Space Challenge".

The Project Technical Report **shall be no longer than 30 pages**, not including figures, footnotes, sources, source endnotes, nomenclature lists, equations, explanations of variables, and appendices.

The following sections overview the required minimum Project Technical Report sections and appendices in the order they should appear. Additional sections, subsections, and appendices may be added as needed.

6.6.2.1. ABSTRACT

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

6.6.2.2. INTRODUCTION

The Project Technical Report shall contain an Introduction. This section provides an overview of the academic program, stakeholders, team structure, and team 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.

6.6.2.3. SYSTEM ARCHITECTURE OVERVIEW

The Project Technical Report shall contain a System Architecture overview. This section shall begin with a top-level overview of the integrated system, including a

cutaway figure depicting the fully integrated launch vehicle and its major subsystems – configured for the mission being flown in the competition. This description shall be followed by the following subsections.

Each subsection shall include detailed descriptions of each subsystem, and reflect the technical analyses used to support design and manufacturing decisions. Technical drawings of these subsystems should be included in the specified appendix.

- Propulsion Subsystems
- Aero-structures Subsystems
- Recovery Subsystems
- Payload Subsystems

6.6.2.4. MISSION CONCEPT OF OPERATIONS OVERVIEW

The Project Technical Report shall contain a Mission Concept of Operations (CONOPS) Overview. This section shall identify the mission phases, including a figure, and describe the nominal operation of all subsystems during each phase (e.g. a description of what is supposed to be occurring in each phase, and what subsystem[s] are responsible for accomplishing this).

Furthermore, this section shall define what mission events signify a phase transition has occurred (e.g. "Ignition" may begin when a FIRE signal is sent to the igniter, and conclude when the propulsion system comes up to chamber pressure. Similarly, "Liftoff" may begin at vehicle first motion, and conclude when the vehicle is free of the launch rail). Phases and phase transitions are expected to vary from system to system based on specific design implementations and mission goals & objectives.

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

6.6.2.5. CONCLUSIONS AND LESSONS LEARNED

The Project Technical 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.

6.6.2.6. WEIGHTS, MEASURES, AND PERFORMANCE DATA APPENDIX

The first Project Technical Report appendix shall contain Weights, Measures, and Performance Data. This requirement will be satisfied by appending the Final Progress Report as the first appendix of the Project Technical Report.

6.6.2.7. PROJECT SIMULATION REPORTS APPENDIX

The second Project Technical Report appendix shall contain applicable **Simulation Reports** from the *minimum tests* prescribed in the LASC Design, Test, & Evaluation Guide.

These reports shall appear in the following order. In the event any report is not applicable to the project in question, the team will include a page marked "THIS PAGE INTENTIONALLY LEFT BLANK" in its place.

• Recovery System Simulation: In addition to descriptions of *simulation* performed and the results thereof, teams should include in this appendix figures and/or video links and supporting text describing the dual redundancy of recovery system electronics;

• Propulsion System Simulation: In addition to descriptions of *simulation* performed and the results thereof, teams developing hybrid or liquid propulsion systems shall include in this appendix a fluid circuit diagram. This figure shall identify nominal operating pressures at various key points in the system – including the fill system.

6.6.2.8. HAZARD ANALYSIS APPENDIX

The final Project Technical Report appendix shall contain a Hazard Analysis. This appendix shall address as applicable, hazardous material handling, transportation and storage procedures of propellants, 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. An example of such a matrix is available on the LASC website at *http://lasc.space/*.

6.6.2.9. RISK ASSESSMENT APPENDIX

The fourth Project Technical 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. An example of such a matrix is available on the LASC website.

6.6.2.10. ASSEMBLY, PREFLIGHT, AND LAUNCH CHECKLISTS APPENDIX

The final Project Technical Report appendix shall contain Assembly, Preflight, and Launch Checklists. This appendix shall include detailed checklist procedures for final assembly, arming, and launch operations.

Furthermore, these checklists shall include alternate process flows for disarming/safe-arming the system based on identified failure modes. These off-nominal checklist procedures shall not conflict with the LASC Range Standard Operating Procedures. Teams developing hybrid or liquid propulsion systems shall also include in this appendix a description of processes and procedures used for cleaning all propellant tanks and other fluid circuit components.

8.5.3. ENGINEERING DRAWINGS APPENDIX

The final Project Technical Report appendix shall contain Engineering Drawings. This appendix shall include any revision controlled technical drawings necessary to define significant subsystems or components.

8.5.4. VIRTUAL POSTER SESSION MATERIALS

Each team shall bring to the *2020 Latin American Space Challenge Online*, a virtual poster limited to 5 (five) slides which overviews their project for industry representatives, the general public, students, and members of the judging panel. The information provided should encompass the overall project's design, testing, CONOPS, and purpose. Finally, the poster shall prominently display the team's Team ID in the top right corner.

These slides will be exhibited in a Virtual Poster Session held during the *2020 LASC Online*. One or more team members are expected to present on a LASC Organization-based livestream their work to industry representatives, the general public, students, and competition officials. All teams will participate in the Virtual Poster Session.

On or before a specified date prior to the event, teams shall submit a digital, PDF copy of their slides using a provided Google Forms link, with the file name "Your Team ID_Poster". For example, a team assigned the Team ID "19" would submit the digital copy of their poster display using the filename "19_Poster". The event organizers will post these files in an online archive of the conference proceedings.

8.5.5. VIRTUAL PODIUM SESSION MATERIALS

Each team shall submit an Extended Abstract on a particular aspect of their work for competition officials and the judging panel to consider including in a Virtual Podium Session held during the *2020 LASC Online*.

Teams whose topics are accepted into the Podium Session will be considered eligible for Technical Achievement Awards defined in a specific section of this document.

The Extended Abstract shall be formatted according to the style guide of the American Institute of Aeronautics and Astronautics (AIAA), using a provided Microsoft® Word document template.

The *Latin American Space Challenge* Extended Abstract template is available for download on the LASC website. Always check the template maintained on the website before drafting your Extended Abstract to ensure you are using the latest version.

The Extended Abstract's main title is left to the team's discretion, however; the document shall be subtitled "Team Your Team ID Technical Presentation to the Year Latin American Space Challenge". For example, a team assigned the Team ID "19", competing in the 2020 LASC, would subtitle their Extended Abstract "Team 19 Technical Presentation to the 2020 Latin American Space Challenge".

The Extended Abstract shall be no less than 500 words long and shall not exceed two pages, not including footnotes, sources, or source endnotes. The Extended abstract should not contain any tables, figures, nomenclature lists, equations, appendices etc. The submission must include sufficient detail to demonstrate its purpose, the technical foundation for the topic discussed, any preliminary results to date, and the expected results of flight testing at the Latin American Space Challenge.

The topic a team selects for their Virtual Podium Session submission should be an aspect of their launch vehicle development which they are particularly proud of, excited about, learned the most in the process of, creates new knowledge, advances the field's understanding of a particular area, presented a unique technical challenge they overcame, and/or otherwise best demonstrates the team's technical excellence and/or innovation in a particular aspect of their work.

On or before a specified date prior to the event, teams shall submit a digital, PDF copy of their Extended Abstract using a Google Forms link, with the file name "Your Team ID_Extended Abstract". For example, a team assigned the Team ID "19" would submit a digital copy of their Extended Abstract using the filename "19_Extended Abstract".

The event organizers will post these files in an online archive of the conference day proceedings. At the same time they submit their Extended Abstract, teams shall also submit a digital, PDF copy of any slides they wish to use in their presentation using a Google Forms link, with the file name "Your Team ID_Presentation_Slides".

For example, a team assigned the Team ID "19" would submit a digital copy of their slide deck using the filename "19_Presentation Slides". The event organizers will post these files in an online archive of the conference proceedings.

No less than 6 teams will be accepted into the Podium Session. Each presentation will be allotted 20 minutes, with an additional five minutes reserved for Q&A with judges and other audience members. Whether accepted into the Podium Session or not, all attending teams should be prepared to participate in this activity.

8.6. AWARDS AND SCORING

8.6.1. CATEGORY "PLACE" AWARDS

A First Place Award will be granted to the highest scoring, eligible team in each of the Challenges and Categories defined in Section 6 of this document. A Second Place Award will be granted to the second highest scoring, eligible team in each category.

A team is considered eligible for the place award(s) in its category after participating in the **2020 LASC Online** submitting all documents, reports and activities. In the event no teams meet this definition in a given category, competition officials may issue Category Place Awards at their discretion based on multiple factors – including points accrued, participation and engagement, and overall performance on the *sprint*-like event.

Teams are permitted to switch categories as necessary prior to submitting their final Project Technical Report. For example, if a propulsion system project encounters insurmountable difficulties at any point during the academic year, the team is free to defer work on other propulsion system without dropping out of the competition; however, each team's project will be entered into only one competition category

Competition officials will award points based on their evaluation of each teams' required documentation (including the Entry Form, Progress Updates, and Project Technical Report), design implementation (observed through the team's poster display and videos describing the rocket systems), and participation in the *sprint*-like event.

8.6.2. SCORING ENTRY FORM AND PROGRESS UPDATE DELIVERIES

The correct, complete, and timely delivery of a team's Entry Form and subsequent Progress Updates is awarded as many as 60 points – 6% of 1,000 total points possible. The Entry Form and subsequent updates are considered correct if they are submitted using the template specified in this document. They will be considered complete if they are filled out in accordance with this document. They will be considered timely if they are received no later than 24 hours after the deadline specified in the *2020 Latin American Space Challenge Online Master Schedule Document.*

The 60 points are divided evenly among the submissions (i.e. the Entry Form and subsequent Project Updates). The submission is awarded these points on a pass/fail basis and must meet all three criteria – correctness, completeness, and timeliness – in order to "pass". Although they will not receive points for the submission, teams which miss a 24 hour submission window are still required to make that submission as soon as

possible for administrative purposes – unless that team no longer plans to attend the *Latin American Space Challenge*.

Teams which enter the LASC after the first progress report is normally due, will receive special instructions upon entry on how their Entry Form and subsequent Progress Updates will be handled including score deduction.

8.6.3. SCORING PROJECT TECHNICAL REPORT

Timely Project Technical Reports will be awarded as many as 200 points – 20% of 1,000 points possible – for their correctness, completeness, and analysis. Only timely Project Technical Reports will be evaluated and scored. A Project Technical Report is considered timely if it is received no later than 24 hours after the deadline specified in the *2020 Latin American Space Challenge Online Master Schedule Document.* Although they will not receive points for the submission, teams which miss a 24 hour submission window are still required to make that submission as soon as possible for administrative purposes – unless that team no longer plans to attend the *Latin American Space Challenge*.

Correctness is worth 20% (40 points) of the Project Technical Report overall point value. Correctness is defined by its adherence to the format/style guide specified in this document and upholding of basic technical editing standards. The report's correctness will be rated on a scale of 1-4 as follows – where each integer corresponds to a factor of 10 points.

(4) A rating of 4 indicates exemplary quality. The paper requires no substantial correction of grammatical mistakes, misspellings, mistyping, incorrect punctuation, inconsistencies in usage, poorly structured sentences, wrong scientific terms, wrong units and dimensions, inconsistency in significant figures, technical ambivalence, technical disambiguation, statements conflicting with general scientific knowledge, etc... Furthermore, the paper contains no stylistic errors deviating from the prescribed style guide.

(3) A rating of 3 indicates at least average quality. The paper requires minimal correction of grammatical mistakes, misspellings, mistyping, incorrect punctuation, inconsistencies in usage, poorly structured sentences, wrong scientific terms, wrong units and dimensions, inconsistency in significant figures, technical ambivalence, technical disambiguation, statements conflicting with general scientific knowledge, etc... The paper may contain minimal, insubstantial deviations from the prescribed style guide.

(2) A rating of 2 indicates no greater than average quality. Overall the paper's quality is symbolic of the proverbial "first draft". The paper requires some substantial correction of grammatical mistakes, misspellings, mistyping, incorrect punctuation, inconsistencies in usage, poorly structured sentences, wrong scientific terms, wrong

units and dimensions, inconsistency in significant figures, technical ambivalence, technical disambiguation, statements conflicting with general scientific knowledge, etc… The paper deviates significantly from the prescribed style guide, or is formatted in accordance with another style guide entirely.

(1) A rating of 1 indicates poor quality. The paper requires numerous substantial corrections of grammatical mistakes, misspellings, mistyping, incorrect punctuation, inconsistencies in usage, poorly structured sentences, wrong scientific terms, wrong units and dimensions, inconsistency in significant figures, technical ambivalence, technical disambiguation, statements conflicting with general scientific knowledge, etc... The paper makes little or no attempt at cohesive formatting in accordance with either the prescribed or any other style guide.

Completeness is worth 10% (20 points) of the Project Technical Report overall point value. The Project Technical Report is considered complete if it contains all minimally required content defined in this document. Points for completeness are awarded on a pass/fail basis, and only minor omissions or ambiguity of required information is tolerated in a passing evaluation.

Analysis is worth 70% (140 points) of the Project Technical Report overall point value. This constitutes a structured, qualitative assessment by the evaluating competition officials of the analytic rigor demonstrated by the team during the iterative down-selection, refinement, and acceptance of all project aspects. The report's analysis will be rated on a scale of 1-4 as follows – where each integer corresponds to a factor of 35 points. Furthermore, this score may be amended at the *Latin American Space Challenge* itself, based on the evaluators' assessment of the team's conceptual understanding during any interactions.

(4) A rating of 4 indicates exemplary quality. The paper provides adequate discussion of all key design decisions, including relevant trade space descriptions, constraints, and overall rational. Furthermore, the paper provides adequate discussion of all key verification & validation tests performed on the final design – as well as any significant progenitors – and demonstrates complete, valid conclusions were drawn from the results. Finally, the paper makes appropriate use of tables, figures, and appendices to effectively organize information and communicate it to the reader.

(3) A rating of 3 indicates at least average quality. The paper provides adequate discussion of most key design decisions, including relevant trade space descriptions, constraints, and overall rational. Furthermore, the paper provides adequate discussion of most key verification & validation tests performed on the final design, and demonstrates complete, valid conclusions were drawn from the results. Finally, the paper generally makes appropriate use of tables, figures, and appendices to effectively organize information and communicate it to the reader.

(2) A rating of 2 indicates no greater than average quality. Overall the paper's quality is symbolic of the proverbial "first draft". The paper provides adequate discussion of some key design decisions, including relevant trade space descriptions, constraints, and overall rational. Furthermore, the paper provides evidence of sufficient verification & validation testing performed on the final design, but does not does not consistently demonstrate complete, valid conclusions drawn from the results. Finally, the paper would be improved by more appropriate use of tables, figures, and appendices to effectively organize information and communicate it to the reader.

(1) A rating of 1 indicates poor quality. The paper lacks adequate discussion of any key design decisions, and makes little to no attempt at describing the relevant trade spaces, constraints, or overall rationale. Furthermore, the paper lacks evidence sufficient verification & validation testing was performed at any point during the design process. Finally, the paper makes either no, or minimally effective, use of tables, figures, and appendices to organize information and communicate it to the reader.

8.6.4. SCORING DESIGN IMPLEMENTATION

Teams will be awarded as many as **240 points** – 24% of 1,000 points possible – for the overall competency of design, quality of decisions, strategic design exhibited by their work and presentation excellence. Competition officials will evaluate these criteria through interactions with the teams and their presentations, occurring throughout the **2020 LASC Online**.

Competency of design and quality of decisions are worth **60% (108 points)** of the overall value assigned to Design Implementation. This constitutes a structured, qualitative assessment by the competition officials of the team's relative competency in the physical principles governing their design (e.g. Did the team demonstrate they know what they're doing by designing something likely to work with a greater or lesser degree of success – provided it is sufficiently well constructed?) and the quality with which that design was defined. The project's design will be rated on a scale of 1-4 as follows – where each integer corresponds to a factor of 45 points.

(4) A rating of 4 indicates exemplary quality. All features of the project hardware reflect strong competency in the physical principles governing their design, and are of more than sufficient quality to operate as intended without risk of premature failure due to fatigue or reasonably expected loading. Wherever possible, the project hardware exhibits robust design characteristics – which decrease its sensitivity to reasonably expected variations in "real-world" operations. Furthermore, the overall system exhibits evidence of a strong systems engineering discipline maintained throughout development (e.g. lacking any features which are both critical systems, and yet clearly implemented as "afterthoughts" to the intended system).

(3) A rating of 3 indicates at least average quality. All key features of the project hardware reflect adequate competency in the physical principles governing their

design, and are of sufficient quality to operate as intended without risk of premature failure due to fatigue or reasonably expected loading. Furthermore, the project hardware makes at least some robust design characteristics in key areas – which decrease these components' or assemblies' sensitivity to reasonably expected variations in "real world" operations. Finally, the overall system exhibits evidence of a strong systems engineering discipline maintained throughout development (e.g. lacking any features which are both critical systems, and yet clearly implemented as "afterthoughts" to the intended system).

(2) A rating of 2 indicates no greater than average quality. All key features of the project hardware reflect adequate competency in the physical principles governing their design, and are of sufficient quality to operate as intended without risk of premature failure due to fatigue or reasonably expected loading. No obvious attempts are made at robust design to decrease the system's to reasonably expected variations in "real-world" operations. Furthermore, the overall system may exhibit evidence of lapses in systems engineering discipline (e.g. operation of the overall system is facilitated by one or "field modifications" – which have become critical systems themselves, yet are clearly implemented as "afterthoughts" to the intended system).

(1) A rating of 1 indicates poor quality. One or more key features of the project hardware reflect inadequate competency in the physical principles governing their design, and/or are of insufficient quality to operate as intended without risk of premature failure due to fatigue or reasonably expected loading. No obvious attempts are made at robust design to decrease the system's to reasonably expected variations in "real-world" operations. Furthermore, the overall system may exhibit evidence of lapses in systems engineering discipline (e.g. operation of the overall system is facilitated by one or "field modifications" – which have become critical systems themselves, yet are clearly implemented as "afterthoughts" to the intended system).

The team's consideration of strategic design decisions and presentation excellence is worth **40% (72 points)** of the overall value assigned to Design Implementation. This constitutes a structured qualitative assessment by the competition officials of the team's due diligence in deciding how best to implement their design – in keeping with a strategic vision they can articulate clearly.

In general, teams should set strategic goals for their project which extend beyond simply excelling in a specific category in a particular competition. LASC places special significance on projects which leverage systems in a particular aspect, either to enhance the team's understanding of that subject, or to develop the technology necessary for achieving a longer-term performance goal. While this evaluation can encompass a broad range of factors, the following 1-4 rating structure (where each integer corresponds to a factor of 15 points) illustrates some of the most significant factors competition officials will be coached to consider.

(4) A rating of 4 indicates exemplary strategic consideration given to the commercial and experimental researched and developed elements of the project. Interactions with team members demonstrate a clear, achievable vision for how challenges were selected to advance strategic goals, and the project's design implementation mirrors this. Furthermore, the manufacturing methods used in researched and developed aspects of the project, such as additive manufacturing for example, are generally appropriate for the intended use and well understood by the team. This understanding extends not only to how the method works, but also its impact on project timelines, cost, and physical performance.

(3) A rating of 3 indicates at least average strategic consideration given to the commercial and experimental researched elements of the project. Interactions with team members demonstrate a relatively clear, achievable vision for how challenges were selected to advance strategic goals, and the project's design implementation generally mirrors this. Furthermore, the manufacturing methods used in experimental researched aspects of the project, such as additive manufacturing for example, are generally appropriate for the intended use and reasonably well understood by the team. This understanding extends to how the method works, and also its impact on project timelines, cost, and physical performance – in at least the most rudimentary sense.

(2) A rating of 2 indicates no better than average strategic consideration given to the commercial and experimental researched elements of the project. Interactions with team members demonstrate an unrefined or questionably achievable vision for how challenges were selected to advance strategic goals, and the project's design implementation generally mirrors this. Furthermore, the manufacturing methods used in experimental researched aspects of the project, such as additive manufacturing for example, are generally appropriate for the intended use, but may not be fully understood by the team. Their understanding extends in only the most limited ways to how the method works, its impact on project timelines, cost, and physical performance – and may be even more lacking in some areas.
(1) A rating of 1 indicates poor strategic consideration given to the commercial and experimental researched elements of the project. Interactions with team members demonstrate little-to-no or completely unachievable vision for how challenges were selected to advance strategic goals, and the project's design implementation generally mirrors this. Furthermore, the manufacturing methods used in experimental researched aspects of the project, such as additive manufacturing for example, are either impractical for the intended use or not well understood by the team. Their understanding in severely lacking in how the method works, as well as its impact on project timelines, cost, and physical performance.

8.6.5. SCORING PERFORMANCE ON THE SPRINT-LIKE EVENT

Teams will be awarded as many as **500 points** – 50% of 1,000 points possible – for their performance during the 2020 LASC Online *sprint*-like event.

The detailment of the activities and its total score will be published on the specific document for the *sprint*-like event.

If the Team does not participate in the 2020 LASC Online event, the score equation will be zeroed.

8.6.6. PENALTIES FOR UNSAFE OR UNSPORTSMANLIKE CONDUCT

Teams will be penalized 20 points off their total earned score for every instance of unsafe or unsportsmanlike conduct recorded by competition officials (e.g. judges, volunteers, or staff members). Unsportsmanlike conduct includes, but is not limited to, hostility shown towards any *Latin American Space Challenge* Participant, intentional misrepresentation of facts to any competition official, intentional failure to comply with any reasonable instruction given by a competition official.

8.6.7. PENALTIES FOR VIOLATING PAYLOAD REQUIREMENTS

Teams will be penalized 100 points off their total earned score for each of the five payload requirements described in this document in spirit or intent. These include Mass, Independent Function, Location & Interface, Restricted Materials, and Form Factor. With regard to mass, due to the allowance made for differences in measuring devices, teams will not be permitted to modify their payloads with additional mass to avoid penalty at the event.

8.6.8. JUDGES CHOICE AND CHALLENGE OVERALL WINNER AWARD

One team among the First Place Award winners in each challenge defined in Section 6 of this document will be named the overall winner. The recipient of this prestigious award is determined by qualitative assessments of the competition officials made throughout the entire event.

8.6.9. TECHNICAL ACHIEVEMENT AWARDS

LASC presents two awards recognizing technical achievement to deserving teams competing in the **2020 LASC Online**.

One of these are awarded based on the competition officials' qualitative assessments made during the Virtual Podium Session. The final award is awarded to any LASC team based on their performance on the sprint-like event.

8.6.9.1. JOÃO B. G. CANALLE AWARD FOR TECHNICAL EXCELLENCE

The João B. G. Canalle Award for Technical Excellence 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.

A team is considered eligible for the João B. G. Canalle Award for Technical Excellence if they are accepted into – and participate in – the Virtual Podium Session held during the conference day at the *Latin American Space Challenge*.

8.6.9.2. RICK MASCHEK ENGINEERING AWARD FOR INNOVATION

The Rick Maschek Engineering Award for Innovation 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.

A team is considered eligible for the Rick Maschek Engineering Award for Innovation if they are accepted into – and participate in – the Podium Session held during the conference day at the *Latin American Space Challenge*.

Due to the COVID‑19 pandemic, the Rick Maschek Engineering Award for Innovation will be awarded also based on competition officials' qualitative assessments made during the 2020 LASC Online *sprint*-like event.

8.6.10. TEAM CONDUCT AWARD

LASC presents one award recognizing a team competing in the LASC 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 LASC Organization.

8.6.11. TEAM SPORTSMANSHIP AWARD

The Team Sportsmanship Award recognizes a team which goes above and beyond to assist their fellow teams and the event organizers assure the *Latin American Space Challenge* is a productive, safe, 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. A team is considered eligible for the Team Sportsmanship Award by being present at the *Latin American Space Challenge.*

> The Team Sportsmanship Award will be awarded to a single team chosen by the Team Leaders. Each Team Leader will be able to vote for a different team through a Google Form shared by the LASC Organization.

8.6.12. TEAM SPIRIT AWARD

The Team Spirit Award recognizes a team which arrives at the *Latin American Space Challenge* with proverbial (or literal) smiles on their face, a school flag in their hand, and never lets either waiver throughout the event. They show great pride in their work, learn from their mistakes, remain positive when things don't go their way, engage members of the general public with respect and enthusiasm, and show respect for invited guests by attending and participating guest speaker presentations whenever possible. A team is considered eligible for the Team Sportsmanship Award by being present at the *Latin American Space Challenge.*

> The Team Spirit Award will be awarded to a single team chosen by public vote. All spectators of the 2020 LASC Online will be able to vote for a single team through a Google Form shared by the LASC Organization.

8.7. DISQUALIFICATION FROM CONSIDERATION FOR ANY AWARD

A limited number of criteria constitute grounds for disqualification from consideration for any award. These can include a failure to meet the defining LASC mission requirements recorded in Section 6 of this document, failure to submit a Project Technical Report or third/final progress update at any time prior to the *Latin American Space Challenge* (or otherwise failing to provide adequate project details in required deliverables), and failure to send eligible team member representatives to the *Latin American Space Challenge*.

Finally, any Team or Individual found to have accrued safety or unsportsmanlike conduct infractions at any time during the *Latin American Space Challenge* will be disqualified or removed and barred from participation in the remainder of the *Latin American Space Challenge*.

8.8. WITHDRAWAL FROM COMPETITION

Teams that decide to formally withdraw from the LASC at any time prior to the event must send an e-mail entitled "TEAM Your Team ID FORMALLY WITHDRAWS FROM THE Competition Year LASC" to *lasc@lasc.space.*

For example, a team assigned the Team ID "19" would withdraw from the 2020 LASC by sending an e-mail entitled "TEAM 19 FORMALLY WITHDRAWS FROM THE 2020 LASC" to *lasc@lasc.space.*

9. 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 enrolled teams; including if a team's flight damages a person or property. Also, if the person or property owner decides to sue the team, the event's insurance policy does NOT protect the team from the additional lawsuit.

APPENDIX A: ACRONYMS, ABBREVIATIONS, AND TERMS

ACRONYMS & ABBREVIATIONS	
AGL	**Above Ground Level**
AIAA	**American Institute of Aeronautics and Astronautics**
APCP	**Ammonium Perchlorate Composite Propellant**
APRS	**Automatic Packet Reporting System**
CONOPS	**Concept of Operations**
GPS	**Global Positioning System**
LOX	**Liquid Oxygen**
STEM	**Science, Technology, Engineering, and Mathematics**

TERMS	
Amateur Rocket	14 CFR, Part 1, 1.1 defines an amateur rocket as an unmanned rocket that is "propelled by a motor, or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less, and cannot reach an altitude greater than 150 kilometers (93.2 statute miles) above the earth's surface".
Excessive 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. Intended Consumables refers to those items which are - within reason - expected to be serviced/replaced following a nominal mission (e.g. propellants, pressurizing gasses, energetic devices), and may be extended to include replacement of damaged fins specifically designed for easy, rapid replacement.
Non-toxic Propellants	For the purposes of the LASC, the event organizers consider ammonium perchlorate composite propellant (APCP), potassium nitrate and sugar (aka "rocket candy"), nitrous oxide, liquid oxygen (LOX), hydrogen peroxide, kerosene, propane and similar, as non-toxic propellants. Toxic propellants are defined as requiring breathing apparatus, special storage and transport infrastructure, extensive personal protective equipment, etc.