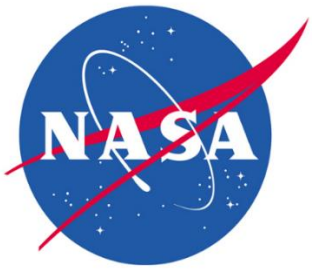

PROPOSER'S GUIDE

FOR

RESPONDING TO A

CUBESAT LAUNCH INITIATIVE

ANNOUNCEMENT OF PARTNERSHIP OPPORTUNITY

National Aeronautics and Space Administration

Space Operations Mission Directorarate
Launch Services Office

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PREFACE

The Proposer's Guide (hereinafter referred to as the Guide) is intended to provide helpful tips for submitting proposals in response to a NASA Announcement of Partnership Opportunity (AoPO) for the CubeSat Launch Initiative (CSLI). The CSLI website has several resources including, *CubeSat 101: Basic Concepts and Processes for First-Time CubeSat Developers*, and the *CubeSat Information and Lessons Learned* document that contains useful information as well as *Frequently Asked Questions* that may be helpful.

The AoPO is the mechanism the Space Operations Mission Directorate (SOMD) utilizes to solicit proposals for educational, scientific, and technology development to support NASA's strategic goals and objectives and NASA workforce development. For those selectees external to NASA, a Cooperative Research and Development Agreement or CRADA will be the instrument type. The CRADA is posted on the CSLI website and to maintain uniformity among all CSLI Collaborators, NASA will not negotiate changes to the agreement. The AoPO is released via https://sam.gov and for the latest news and information visit the CSLI website.

This Guide is maintained by the NASA Space Operations Mission Directorate Launch Services Office and can be found on the CSLI website.

1.0 CSLI OVERVIEW

CSLI is intended to expand U.S. interest in Science, Technology, Engineering, and Mathematics (STEM) and CubeSats are playing an increasingly larger role in exploration, technology demonstrations, scientific research, and educational investigations. The objective of CSLI is to provide launch opportunities to low-Earth orbit for a variety of U.S. CubeSat developers who build small satellite payloads.

The partnership between NASA and the organizations selected to participate is a mutually beneficial one. The organizations are provided with a mechanism to conduct scientific research in the space environment and advance the development of various technologies. CSLI emphasizes education and is providing access to space for U.S. educational institutions, nonprofits with an education/outreach component, and NASA/Jet Propulsion Laboratory (JPL) for workforce development. This initiative enables students, educators, faculty, and early career NASA employees, to obtain hands-on flight hardware development and systems engineering experience. NASA invests in the future by advancing the capabilities and technologies that drive human pursuit of innovation, challenging destinations, and profound questions.

2.0 PROCESS TO LAUNCH

There are many steps or milestones to complete prior to launching a CubeSat to space. Once the CSLI AoPO has been released, the first step towards launch is to submit a proposal that meets all of the requirements as identified in the announcement. Proposals will be evaluated and if selected into CSLI, CubeSat development will continue and proceed toward being manifested and launched.

2.1 Announcement of Partnership Opportunity

The AoPO is released annually and provides the respondent and CubeSat project eligibility requirements, submittal due date and time, proposal requirements, evaluation criteria, and the selection process. The proposed CubeSat missions must align with NASA Strategic Goals and Objectives. The announcement is released each August and is posted on https://sam.gov. The release coincides with the annual Small Satellite Conference (AKA SmallSat Conference) that is held at Utah State University in Logan, Utah. This event provides a forum for those involved in the small satellite community to review recent successes, explore new directions, and introduce emerging technologies in small spacecraft development. NASA, CSLI representatives, and past/present CSLI Collaborators attend this event, which provides an excellent environment for networking and gathering lessons learned.

2.2 Proposals Submitted, Evaluated, and Selections Announced

Organizations responding to the AoPO must e-mail their proposal to hq-launchservices@mail.nasa.gov by the due date and time identified in the announcement. An initial compliance review will be conducted utilizing the compliance checklist in the applicable appendix to determine if the eligibility requirements have been met. If so, the proposal with then be reviewed against the evaluation criteria and the score will be weighted as indicated in the AoPO. When making the selections, NASA will consider a variety of programmatic factors including, but not limited to, available launches, launch service requirements, and maintaining a programmatic and scientific balance.

2.3 CubeSat Developed, Manifested, Launched and Final Report

The CubeSat selection notifications are released in March and shortly afterwards a CSLI Open House virtual meeting is scheduled. This meeting will discuss NASA's expectations for all the selectees. Throughout CubeSat development there will be status updates conducted with the Launch Services Program mission managers. NASA wants each CubeSat team to have a successful mission, so it is important to bring forward any issues or concerns as early as possible. The mission managers need to understand the timeline of the project in order to start looking for manifest options based on the orbital requirements and other factors. Once CubeSat development and testing is complete, integration will occur in preparations for launch. The final deliverable for missions external to NASA is the Final Report, which is due 9 months after launch or deployment.

3.0 Proposal Guidance

This Guide does not cover all of the areas identified in the AoPO, however will share general tips, and then focus on two areas that have historically scored lower in previous proposal submittals. The intent is to perhaps help alleviate similar instances from occurring in future proposals. To assist with the submission of a valid and complete proposal, the following list of tips should be reviewed:

- Carefully read through the entire AoPO before preparing the proposal. Don't assume it is the same as the previous year as changes may have been implemented and NASA's strategic documents may have been updated. The appendices contain additional information and specific requirements based on the organization type (educational, nonprofit, or NASA Center including JPL).
- If respondent and CubeSat eligibility requirements are met, interested parties should review the strategic documents referenced in the announcement and identify how the proposed CubeSat mission is in alignment with NASA's goals and objectives for each focus area(s) identified as required. The proposal should clearly identify the specific goals of the project, technical details, and how and why it supports the end goals and why a flight opportunity is necessary or advantageous.
- The resumes/qualifications and required compliance documents should be included as an appendix to the proposal. If there is supporting documentation from the merit/feasibility review that is useful in supporting those assessments the information can be included as an

appendix, however it doesn't take the place of what is required within the main body of the proposal.

- Adhere to the proposal requirements and do not include additional documentation that does not support the requirements identified in the AoPO. For example, a Preliminary Design Review and/or Critical Design Review is not a requirement and should only be available upon request. Documents from previous CubeSat missions also should not be included.
- Review the proposal evaluation criteria as the table includes the questions the NASA CSLI evaluation panel will be utilizing as part of the review process. Note: the proposal will be evaluated based on the focus area(s) selected in the CubeSat Project Details table so be sure the proposal, including the merit/feasibility reviews address each focus area selected. If all selected focus area(s) are not addressed in the proposal and merit/feasibility review, it will result in a lower score. The relevance to NASA strategic goals and objectives or potential impact to NASA must be clearly identified in the proposal and have been assessed during the reviews.
- Develop a detailed project schedule that identifies anticipated key milestones for accomplishments and dependencies between tasks. The schedule for the CubeSat development should support a launch opportunity as stated in the AoPO. Consider the lead time on components, potential delivery delays, laboratory testing, and licensing timelines and plan in margin for potential technical challenges that will likely arise. The budget should cover CubeSat development, testing, and licensing and include reserves for unexpected challenges.
- Characteristics of successful proposals are logical structure, completeness, readability, accuracy (no typos, reference to correct documents, etc.) and responsiveness to the evaluation criteria. Be consistent in the use of the CubeSat name throughout the proposal and proofread the proposal carefully to ensure it is clear, concise, accurate, meets all the eligibility requirements and contains all the applicable proposal requirements.
- Proposals are submitted to the e-mail address above (section 2.2) and it is recommended to submit proposals well in advance of the proposal submission deadline to ensure it is received. Technical difficulties have occurred in the past and proposals received after the date and time identified will not be reviewed.

3.1 Historical Deficiencies in Proposals

The merit and feasibility reviews have been the two areas that respondents seem to lose the most points during the scoring process and therefore reducing the overall average score for the proposal so the focus will be on these areas. A common theme from the NASA CSLI evaluation panel is that not enough information was provided to determine how the reviews were conducted, qualifications of panel members, what the findings were and how the CubeSat team responded to those findings.

The reviews are to be conducted on the specific CubeSat mission being proposed and not a previous, heritage, or similar CubeSat mission. If the reviews were conducted several years prior or if the project changed significantly based on feedback from those reviews, it would be prudent to conduct another review to validate the merit and feasibility of the project. For each review, the proposal should clearly identify the panel members assigned to each review along with their title and qualifications.

Any comments made within the proposal, such as the project went through a thorough review by qualified review panel members is not sufficient. Teams are very familiar with their CubeSat project, but

the NASA CSLI evaluation panel can only review what is in the proposal, so it is crucial to provide a clear picture of the entire process.

NASA does not specify how the merit and feasibility reviews should be conducted. However, NASA does require the reviews to be completed by the respondent and commented upon by qualified review panel members external to the CubeSat project team prior to submitting a proposal. The review panel members should be selected based on his/her expertise and professional qualifications as they relate to the area(s) of education, scientific research or technology being proposed. To assist the proposers with improving their submissions, the following sections provide some suggestions to consider. The questions from the evaluation criteria documented in the AoPO are listed.

3.1.1 Merit Review

The merit review should determine the educational, scientific, or technical quality of the proposed CubeSat mission and how the mission will assist NASA to achieve the goals and objectives regarding STEM, science, and technology as applicable per the focus area(s) selected.

Proposers need to provide enough information to enable the NASA CSLI evaluation panel to properly assess the quality of the merit review process.

- Was the merit review process described? The proposal should provide enough detail for anyone to get a clear understanding of how the review was conducted. Did the team provide a list of specific questions to the panel or was a presentation given to the panel with the opportunity for them to ask questions. Is this documentation included in the proposal? How were the findings documented and were they responded to. Explain how the review panel assessed the factors and think of how to clearly show the information; could use a table to show the factors used, rating (if used), comments, findings, and the responses to those findings. The traceability should be easy to follow. Did the panel review members provide recommendations on how to address the findings? How did the CubeSat team evaluate and respond to those recommendations? Consider the number of panel review members; a panel consisting of only one or two members would not provide as a diverse set of comments as a larger panel would. Remember, you want the review to be thorough and receive feedback that will be valuable to ensuring the CubeSat mission is successful.
- Was the review competitive or non-competitive? If competitive, which one and what were the results? A competitive review is conducted by a third party as part of a formal competition. NASA and the National Science Foundation periodically conduct these competitive reviews. If the review was something similar, state which one and provide the results.
- What are the titles and qualifications of the merit reviewer panel members? If this information is not available, please indicate so and explain why. The qualifications of the panel members should align with the proposed CubeSat mission. Members should be selected based on his/her expertise and professional qualifications as they relate to the area(s) of education, scientific research or technology being proposed. Having experts in the field being proposed will garner constructive feedback vs having panel members who are not familiar with the field of study.

- What factors did the merit review panel use to assess merit and were they relevant to the investigation? The quality of the review not only depends on the qualifications of the panel review members, but also the factors that were utilized to assess the project. Were specific questions given to the review panel? A review consisting of only one or two questions would not be very thorough. A review with a list of questions relating to the specific NASA goals and objectives the CubeSat mission is addressing would result in a more complete review.
- What was the outcome of the merit review; were the findings documented and does the proposal include the response to address the findings? Were changes implemented? Findings from the review will strengthen the CubeSat project and how the team responds to those findings should be included in the proposal. If a change was implemented be clear in the proposal what was implemented as a result of the review. For instance, was a team member added to cover a specific discipline or was the scope of the CubeSat mission modified? If there are findings that were not addressed, include the rationale or if there is forward work to be accomplished, describe how the team is addressing the finding(s) and identify any potential impacts to the schedule/budget.

3.1.2 Feasibility Review

The feasibility review should assess the technical implementation, including feasibility, resiliency, risk, and the probability of success.

Proposers need to provide enough information to enable the NASA CSLI evaluation panel to properly assess the feasibility review process.

- Was the feasibility review process described? The proposal should provide enough detail for anyone to get a clear understanding of how the review was conducted. Was it a measurement-based assessment or specific metric? Was a presentation given or provided to the panel review members? Is this documentation included in the proposal? How were the findings documented and were they responded to. Explain how the review panel members assessed the factors and think of how to clearly show the information; could use a table to show the factors used, rating (if used), comments, findings, and the responses to those findings. The traceability should be easy to follow. Did the panel review members provide recommendations on how to address the findings? How did the CubeSat team evaluate and respond to those recommendations? Consider the number of panel review members; a panel consisting of only one or two members would not provide as a diverse set of comments as a larger panel would. Remember, you want the review to be thorough and receive feedback that will be valuable to ensuring the CubeSat mission is successful.
- What are the titles and qualifications of the feasibility review panel members? The qualifications of the panel members should align with the proposed CubeSat mission. Members should be selected based on his/her expertise and professional qualifications as they relate to the area(s) of education, scientific research or technology being proposed. Having experts in the field being proposed will garner constructive feedback vs having panel members who are not familiar with the field of study.

- What factors did the feasibility review panel use to assess feasibility? Were specific questions given to the review panel or were they provided the proposed mission and NASA's goals and objectives the mission is seeking to address? If questions were provided, ensure they address the aspects of the feasibility review (technical implementation, including feasibility, resiliency, risk, and probability of success). Describe how the technical feasibility of the payload was assessed.
- Were the management team roles, experience, expertise, and the organizational structure of the team assessed? Please note any previous experience with CubeSat development. The review panel members should assess the entire team structure; in some cases, only the faculty was reviewed. Is the distribution of resources adequate across the various functions and lines of communications established? Are there team leads for each of the subsystems and are they qualified? Did the review panel members have any concerns that the team structure was lacking certain disciplines, e.g., electrical and computer engineering, physics majors, or not having systems engineering? If there were concerns, did the CubeSat team respond and implement changes? Were additional team members recruited? It is important to document everything and have a plan to manage the loss of key personnel as they graduate or are no longer involved in the project.
- How were the technical development risks associated with the overall CubeSat mission identified and assessed? Were the risks identified by the CubeSat project, during various design reviews, or the feasibility review panel? Was a risk matrix with likelihood(s) and consequence(s) utilized to determine the severity of the risk? The responses to any risks identified should be included in the proposal. Did any of the risks identified impact the schedule for the project? To manage the risks, may want to categorize them, such as Flight Safety Risk, Mission Risk, Program Risks. How is the CubeSat team tracking these risks to closure?
- If the CubeSat investigation requires critical technology development for flight readiness, how were the areas assessed and how were the plans for completing technology development assessed? Is the engineering building on previous experience from another CubeSat mission? What type of laboratory testing has been completed or is planned? Are there contingency plans? Is a clear path identified on how to complete the technology development? Based on the feedback, did the CubeSat mission change and if so, how? Were there any design trade-offs?
- Concerning the development of the CubeSat for flight, how was the probability of success assessed? Did the review panel identify any issues that would impact the schedule? The schedule should be detailed enough in order for each subsystem team to be aware of the milestones and estimated completion date. Identify the tasks at the subsystem level. How was the probability of success rated? Low, moderate, high? Numerical score?
- What was the outcome of the feasibility review, were the findings documented and does the proposal include responses to address the findings? Were changes implemented? Did the review panel have any concerns regarding the scope of the mission? If so, how were those concerns evaluated and responded to? Did the CubeSat team change the con-ops of the project?

- Is there sufficient financial support for the development of the CubeSat payload and for all other costs incurred by Respondent to supports it participation in CSLI? The budget should support the CubeSat development, testing, and licensing and it is recommended to have adequate budget reserves to cover any potential technical difficulties or cost overruns. The funding commitment letters must meet the requirements identified in the AoPO.