National Aeronautics and
Space Administration

INSPIRE - ENGAGE - EDUCATE - EMPLOY
The Next Generation of Explorers







Student Launch - Milestones and Review Design Lifecycle

Allison Chouinard
SL Logistics Coordinator

NASA Student Launch Requires:

Students on the team will do 100% of the project, including design, construction, written reports, presentations (etc.)

Milestones

- Proposal – September
- Preliminary Design Review (PDR) Package – November
- Critical Design Review (CDR) Package – January
- Flight Readiness Review (FRR) Package – March
- Post-Launch Assessment Review (PLAR) – May



PDR, CDR and FRR Milestone submissions are followed by a presentation and review with the NASA Student Launch Review Panel.

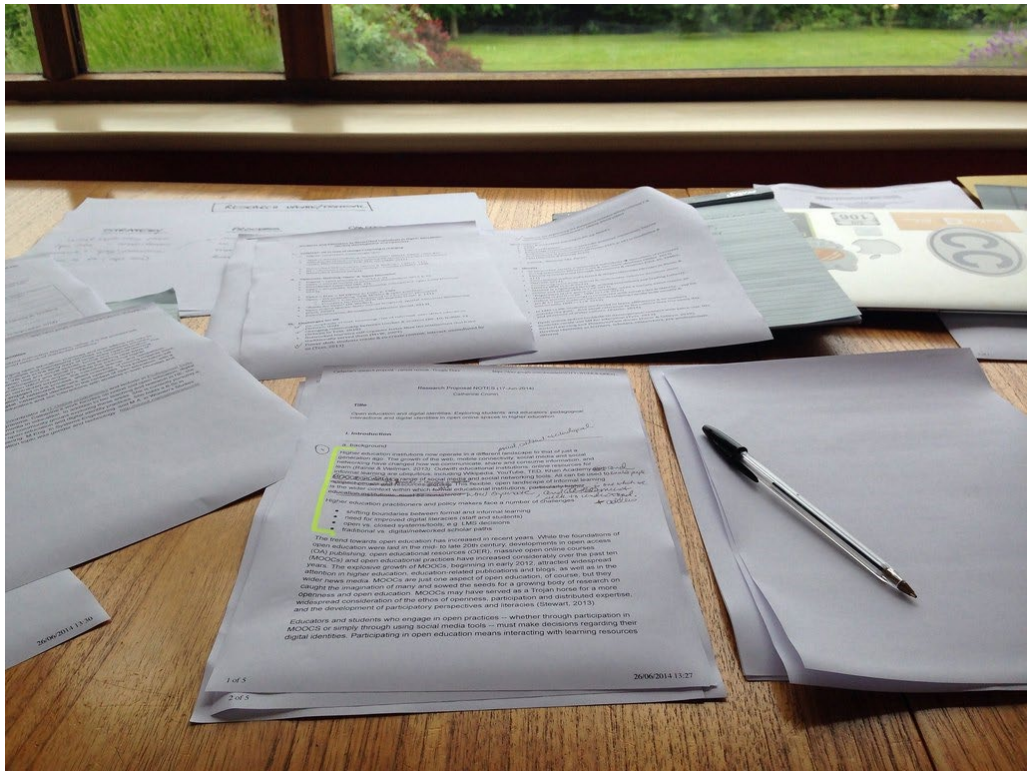






Proposal – Overview

- Official “application” to participate Student Launch.
- Not all proposals are accepted.
- Show the Student Launch (SL) Management Team that your team is ready to handle the program requirements.
- It is an *overview* of your design ideas and options. This is NOT a design review



Proposal – What should be included*

- General Information
  - Cover page, mailing address, student team leader and safety officer info, team member and two adult educators info, and team organizational structure
  - National Association of Rocketry (NAR) or Tripoli Rocketry Association (TRA) section and mentor
  - Team contact information
- Facilities
  - Provide a description for all the facilities (meeting rooms, workspace, labs, etc.) and equipment/tools available to you
  - Know your manufacturing capability.
- Safety (include MSDS)
- Technical Design
  - General vehicle/payload design ideas and dimensions, proposed recovery, and propulsion systems
  - Address handbook requirements, and major challenges.
- STEM Engagement – Include plans, and evaluation criteria
- Project Plan
  - Timeline. Include as much detail as possible.
  - Budget. Every item you plan to use, and their market values. Include taxes, shipping, vendors, what you have on hand, etc.
  - Funding plan. How and when will you acquire funds? How much do you need?
  - Sustainability. How will you ensure team continuation?

***ALL requirements for what to include in your team's proposal can be found in the NASA SL Handbook**

Preliminary Design Review (PDR) - November

- Present early design ideas and alternatives
- Use research to justify decisions for designs
- Include trade studies
- Provide early predictions for flight performance
- Begin the initial steps to verify all SL requirements, and make some of your own

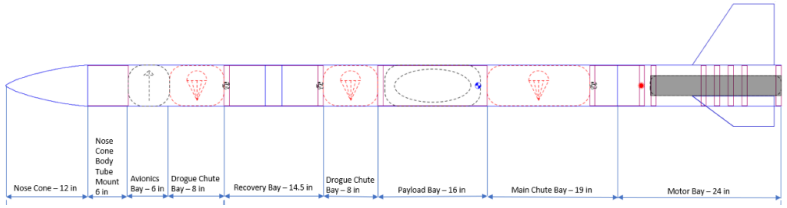
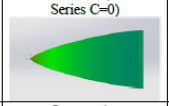
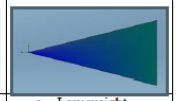


Table 3.3-10 Nose cone comparison

	Von Kármán (Haack Series C=0)	Ellipsoid	Conical
			
Pros:	• Lowest drag coefficient • Highest stability • Moderate weight	• Moderate drag coefficient • Moderate stability • Rounded tip	• Low weight • Easiest to manufacture • Simplest Shape
Cons:	• Most complex shape • More material required	• Most amount of material • Heaviest	• Highest drag coefficient • Low stability • Weak at tip

Include*

- Review of launch vehicle components, and their alternatives; Present research, and evaluate pros and cons; Choose a motor; Present a leading design and Dimensional drawings.
- Present research, design alternatives, and justification; Prove redundancy; Provide electrical schematics
- Use any simulation software to evaluate leading design performance
    - Stability, CP, CG; Kinetic energy and descent velocities; Drift; Altitude, velocity, and acceleration vs time
- Describe the payload objective, and define the qualifications for a successful experiment
- Safety
- Describe initial plans to verify all requirements. update us on any fulfilled requirements; Derive team specific requirements (like for your payload);
- Continue updating budget and timeline should be set by now.

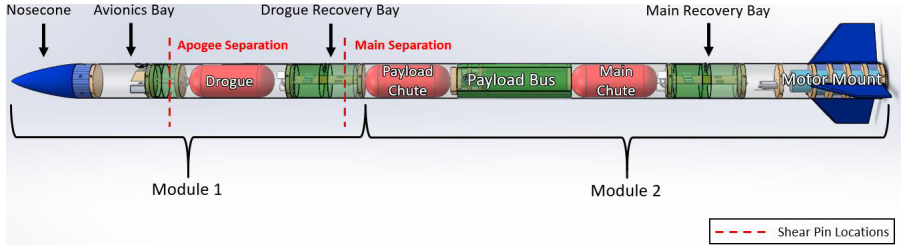
Deliverables *

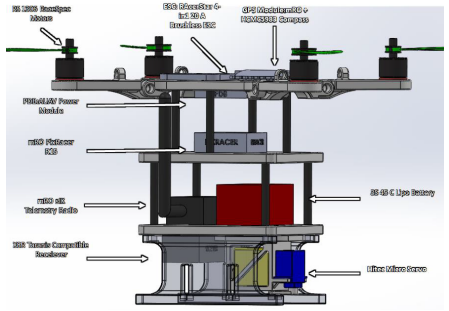
- Report, Flysheet, Review Presentation

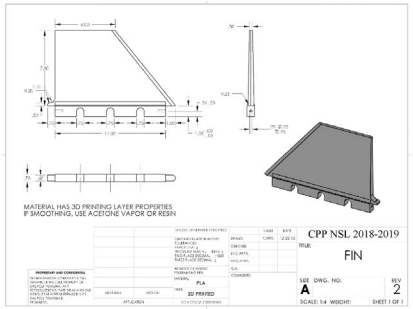
***ALL requirements for what to include in your team's PDR can be found in the NASA SL Handbook**

Critical Design Review (CDR) - January

- Present a FINAL vehicle, recovery and payload design
- Justify your final design decisions
- Make final motor selections
- Define verification plans for both NASA SL requirements and your own.
- Analysis and report of subscale flight







Include*

- Make final design selections from PDR alternatives; Model the design, and prove manufacturing readiness; Discuss ALL components and subsystems; Justify design selections
- Discussion and analysis of subscale flight
- Prove redundancy
- Use any simulation software to evaluate final design performance
- Safety
- Identify all tests, their success criteria, and define methodology; Explain why each test is necessary; Discuss results if applicable; Updated status of requirements compliance
- Updated budget and timeline

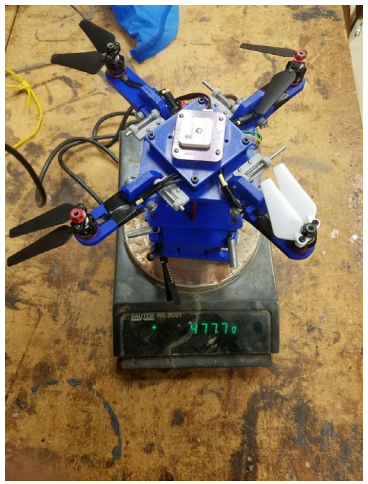
Deliverables *

- Report, Flysheet, Review Presentation

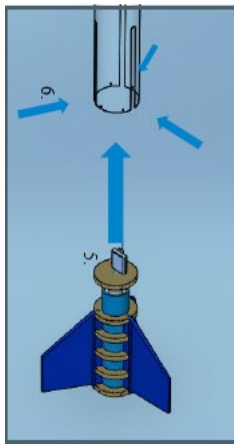
***ALL requirements for what to include in your team's PDR can be found in the NASA SL Handbook**

Flight Readiness Review (FRR) - March

- Present *as built* designs. Construction methods, diagrams and procedures.
- Analysis and report of full scale test flight
- All testing results
- All NASA SL and team requirements verified
- Launch operations and procedures







Include*

- Discussion of as built design, and model. Discussion of ALL components and subsystems
- Full Scale Flight discussion and analysis. Comparison to predicted flight, and estimate drag coefficient
- Prove redundancy in recovery
- simulation software to evaluate as built design performance
- Finalize launch procedures
- Hazard descriptions are finalized, and mitigations defined
- Discussion of test results, and identify test as failure or success. All requirements should be satisfied
- Finalized and complete budget

Deliverables *

- Report, Flysheet, Review Presentation

***ALL requirements for what to include in your team's PDR can be found in the NASA SL Handbook**

Post Launch Assessment Report (PLAR) – April/May

- The PLAR is a discussion and analysis of your final competition flight.

- Should be about 4-15 pages in length.









Include*

- Brief payload description
- Vehicle dimensions and summary. Data analysis and results of the vehicle.
- Altitude reached (ft.), Target altitude (ft.)
- Payload summary. Data analysis & results of the payload
- Lessons learned
- Summary of overall experience (what you attempted to do versus the results; how valuable you felt the experience was)
- STEM Engagement summary
- Final Budget Summary

Deliverables *

- Report

***ALL requirements for what to include in your team's PDR can be found in the NASA SL Handbook**

Milestone Review - Q&A Workshops

- Milestone Review workshops and Q&A sessions will be held 4 times per activity year
- Workshops include crucial information for successfully writing milestone reports
- Workshops provide an opportunity for students to ask clarification questions
- Timeline:
  - Kick-Off Session/PDR Q&A Workshop – (early October)
  - CDR Q&A Workshop (late November, following PDRs)
  - FRR Q&A Workshop (late January, following CDRs)
  - Launch Q&A Workshop (late March, following FRRs)

Note: it is STRONGLY recommended that SLI teams attend ALL Q&A Workshops

Submitting Deliverables

- New process for this activity year: Gateway
- We will update teams on instructions for submitting milestone packages.
- Process for submitting proposals will be outlined in the 2021-2022 SL Handbook

- **Address every requirement bullet, in order, in the milestone report section in the handbook.**
- Be aware of your page count, consistency in font style and size, spacing, spelling, and grammar.
- Use Imperial System of Measurement system in report.
  - Be consistent. Careful not to go back and forth.
- Include pictures, schematics, diagrams, CAD models for as-designed system in as much detail as possible.
- All documents should be clear, professional, readable and logical.
- Change a page from portrait to landscape, if needed, to fit tables or diagrams. (this is helpful to us)
- If you attached a table or graph, make sure it is readable. (e.g. use high resolution images). Label your figure, images, and tables. Do not put data in paragraphs, use tables and figures
- Break down simulation into separate graphs (e.g. acceleration and velocity)
- Triple check that hyperlinks within your reports function properly. No Google Drive links.
- Table of contents should match your page numbers in your report.
- Be mindful of your paragraph margins and page sizes.
- No smaller than 12pt. - (e.g. Time New Roman). Only one or two fonts throughout the report. (Title and Text)
- Document any simulation software that evaluates a design performance. Show and explain!
  - Stability, CP, CG; kinetic energy and descent velocities, drift, altitude, velocity, and acceleration vs time
- All numbers should be the same on ALL documents.
- Add hand calculations, if they were done.



ALL advisors/mentors and students should read the NASA Student Launch Handbook carefully and thoroughly!



Questions?