Team 86 Project Technical Report for the 2023 IREC

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This set of files provides a template for IREC Project Technical Reports and

At a minimum, the abstract shall identify the launch vehicles mission/category, identify any unique/defining characteristics, define the payload's mission (if applicable), and provide whatever additonal information may be necessary to convey any other high-level project or program goals & objectives.

I. Nomenclature

Use all variables defined here.

A = amplitude of oscillation

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II. 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.

III. System Architecture Review

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

(Note: These exact sections are specified in the Rules and Requirements, suggesting that additonal sections e.g. Avionics are discourged)

A. Propulsion

B. Aero-structures

C. Recovery

D. Payload

IV. Mission Concept of Operations Overview

This section shall identify the mission phases, include a figure, and describe the nominal operation of all subsystems during each phase (e.g. a description of what is supposed to be occuring 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 occured (e.g., "Ignition" may begine when a FIRE signal is sent to the igniter and conclude when the propulsion system comes up to chamber pressure. Similarly, "Liftoff" may begine at vehicle first motion and conclude when the vehicleis 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.

V. Conclusion 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 perspective. Furthermore, this section should include strategies for corporate knowledge transfer from senior student team members to the rising upperclassmen who will soon take their place.

Appendix

Formatting examples

This section provides examples of LaTeX tables, figures, equations, lists, citations, and references to the same. The `\ifdefined` clause in the source controls whether this section appears.

A. System Weights, Measures, and Performance Data

This requirement will be satisfied by appending the Third/Final Progress Report as the first appendix of the Project Technical Report. As described in Section 2.7.1 of this document, the Third/Final Progress Report is also submitted as a separate excel file for administrative purposes.

B. Project Test Reports

The second Project Technical Report appendix shall contain applicable Test Reports from the minimum tests prescribed in the http://www.soundingrocket.org/sa-cup-documents–forms.html. 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 Testing: In addition to descriptions of testing performed and the results thereof, teams shall include in this appendix a figure and supporting text describing the dual redundancy of recovery system electronics.
- SRAD Propulsion System Testing (if applicable): In addition to descriptions of testing performed and the results thereof, teams developing SRAD 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.
- SRAD Pressure Vessel Testing (if applicable).

C. 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 http://www.soundingrocket.org/sa-cup-documents–forms.html.

D. 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 thehttp://www.soundingrocket.org/sa-cup-documents–forms.html.

E. Assembly, Preflight, Launch, and Recovery Checklists

This appendix shall include detailed checklist procedures for final assembly, arming, launch, and recovery operations. Furthermore, these checklists shall include alternate process flows for dis-arming/safeing the system based on identified failure modes. These off-nominal checklist procedures shall not conflict with the IREC Range Standard Operating Procedures. Teams developing SRAD hybrid or liquid propulsion systems shall also include in this appendix a description of processes and procedures used for cleaning all propellent tanks and other fluid circuit components.

Competition officials will verify teams are following their checklists during all operations–including assembly, preflight, launch, and recovery operations. Therefore, teams shall maintain a complete, hardcopy set of these checklist procedures with their flight hardware during all range activities.

F. Engineering Drawings

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

Acknowledgments