

DETAILS ON DELIVERABLE ITEMS

Individual Deliverable Items: (All Items must be submitted in order to receive a course grade)

- 1. Individual Mission Evaluation - A written discussion of the “mission” highlighting critical issues and areas of concern. This should be 1-3 pages in length and attempt to identify each “phase” of the mission as outlined in the Mission Specification and quantify as many requirements as possible as posed by the Mission Specification.**
- 2. Individual System Concept - Each class member will develop their own concept vehicle for this mission, this concept must include a detailed “hand” (not computer) sketch of a three view external drawing, internal equipment layout with approximate scale. This should also include a two page written concept description highlighting strengths and potential problems with the proposed concept. Key technical requirements must be identified.**
- 3. Individual parametric Trade Studies #1 and #2 - Details provided later.**
- 4. Individual Peer Review - A form will be provided for each class member to evaluate the other members of his or her team .**

Design Team Deliverable Items:

- Teams must insure that all team members have equal opportunity to speak throughout the semester. Group leaders are not to be the mouthpiece of their team. By the end of the semester each team member must have spoken roughly the same number of times and for roughly the same number of minutes.**
- 1. Weekly Team Time Tracking Summary - details individual time resource allocation for work conducted in this class up to and including Sunday night. This includes in-class time and out-of-class time. This information will then be due every Tuesday for the remainder of the semester. Each group will develop their own data requirements, collection procedure and reporting format.**
 - 2. Design Requirements and Objectives (DR&O) - Formal written report [3-5 pages]. This is a very critical document since the team’s accomplishments will be evaluated against their own quantitative objectives. See additional information below.**
 - 3. Preliminary Design Review (PDR) - Each Group will prepare a number of specific items for discussion at each review. The presentations will take place during the “lecture” time and should include appropriate visual aids or demonstrations. The presentation must be made by one group member (each group member must participate at least once during the semester). Specific data items required for these presentations will be listed in a subsequent documents.**

- 4. Team Concept Selection Document - Three view sketch to scale for presentation in class along with brief written discussion of unique aspects of the concept.**
- 5. Project Plan Review [PPR] - A formal presentation by each team describing their planned engineering activities for the remainder of this project. It should include scheduling, task assignments, milestones and design tool development discussions. All team members must participate in the presentation. See additional information below.**
- 6. Parts Acquisition List - includes a list of all or most parts needed to build your prototype. From this list we will order parts so that after the CDR your team can start construction without delay. Care should be used to avoid ordering parts that might be eliminated or modified at the CDR. With this step we are actually engaging in concurrent manufacturing and design for the sake of saving time at the risk of wasting money.**
- 7. Draft Thiokol Final Design Report - An important product of the course is a final engineering report called the Thiokol Final Design Report. This report is limited to 25 pages (maximum) with unlimited appendices and attachments. Details on the content of the report will be provided below. It will be sent to Thiokol for external evaluation. Emphasis will be placed on quality of content and organization, not quantity. The body of the text should include primary discussions, trade study results and appropriate tables and figures. Detailed supporting technical data, computer output and programs and other pertinent data should be included in Appendices. A major component of team "grade" on this report is associated with this draft. The team may be required to make certain changes in the final submission but the "draft" should be their best effort. See additional information below.**
- 8. Critical Design Review - This 45 minute per team formal oral presentation will take place during the lab period and may be videotaped for review and evaluation. The design is "frozen" at this point and all further efforts are associated with validating the design through prototype fabrication and test. All team members are expected to participate in the CDR. See additional information below.**
- 9. Each team will construct a prototype for their proposed system. The purpose of the prototype is to validate the performance, crashworthiness, and ease of flight of their design. The performance of the vehicle will be evaluated against the requirements and goals specified in the team's DR&O. The design teams are responsible for documentation of the prototype fabrication and flight testing. This documentation will be included in the Thiokol Final Design Report. The team deliverable items during this phase of the project are:**
 - a. Flight Readiness Review is when the completed prototype is checked for airworthiness and safety. Inspections will be conducted by outside consultants (Lafayette Cloud Jockies).**
 - a. Prior to first flight all teams must have their aircraft center of gravity location and general airworthiness checked by the relevant safety official.**

- b. Prototype In-door Test - These tests will be conducted in the Mollenkopf Athletic Center and will be used to provide basic performance benchmarks. They will not be demonstrations as much as performance tests.**
 - c. Prototype Fabrication and Test Report - A written Appendix to the Thiokol Final Design Report documenting the fabrication and tests is due as part of the Final Report. This should include costs (material and personnel) details for the project.**
- 10. Summary Project Presentation. Formal 45 min. overview of the project which will be open to the public and invited guests. It should overview the final design as well as prototype fabrication and test. All members of the team are expected to participate.**
- 11. Thiokol Final Design Report. It must contain all required changes from the draft submission as well as complete documentation of the prototype fabrication and testing as described above. It should be considered as one of your first professional publications and treated as such. Each team will submit a single, unbound copy of the report and all attachments. This report is limited to 25 pages (maximum) with unlimited appendices and attachments. Further details concerning this report will be given in class.**

The Thiokol Final Design Report will be sent to the Thiokol Corporation for external review and competitive evaluation by a multidisciplinary team of reviewers. Each report will be reviewed by the Thiokol Affiliate Technical Manager, a Thiokol technical writer, and a Thiokol design engineer. The Thiokol design competition stresses excellence in technical writing. The emphasis is on technical content, and effective communication of technical concepts and details. The team that submits the best Thiokol Design Report will be awarded a \$75 prize per team member. In addition each team member of the winning team will get his or her name added to the plaque hanging in the Thiokol Corporation display on the third floor of Grissom Hall. The plaque is entitled the Thiokol Semi-annual Purdue Academic Communication Excellence (S.P.A.C.E.) Award for Excellence in Technical Communication. See additional information below.

Design Requirements and Objectives (DR&O) Document

The Design Requirements and Objectives (DR&O) document is a formal written report [3-5 pages] containing several things.

First, it should describe your vision of what the aircraft will do when it is completed. It is not a progress report on the status of your design. It provides the big picture view of your completed design. If your team chooses to focus on something different or unusual in the design (as compared to what we have been talking about in class) you need to put it in the DR&O. This document is your statement of what the vehicle is to do, i.e., the design objectives. You will be judged (graded) on how well your design achieved your stated objectives in the DR&O.

Second, the document lists all design requirements that more quantitatively describe your vehicle. For example, the vehicle is required to have a certain endurance. You may want to impose a requirement that is different than what we

have already talked about in class. For example, you may want to specify a particular minimum speed. Together the design requirements serve to quantitatively describe what the final design will do and serve to narrow down the size of the design space. The design requirements may define a portion of the design space known to be unique so as to offer greater market potential or cost advantages.

In summary, this document describes what it is you are trying to design. It is a very important document. Without a clear view of what you are trying to accomplish you are doomed to wander and produce a design that is unlikely to succeed.

If you suggest something in the DR&O that I don't approve of I may ask you to make modifications.

Team Concept Selection Document and Presentation

Document:

This one document describes your integrated glider and tow-plane concept.

It must include a detailed “hand” (not computer) sketch of a three view external drawing including internal equipment layout drawn with approximate scale. Dimensions must be included on the sketch.

Please also provide a table of physical properties of your vehicle as best you know them at this time.

Also included should be a two page written concept description highlighting strengths and potential problems with the proposed concept. Key technical requirements must be identified.

Presentation:

Your team will make an integrated in-class presentation with no more than three speakers, one for introduction, one for the glider group and one for the tow-plane group.

Project Plan Review (PPR)

Each team will make a 15 minute formal presentation describing their planned engineering activities for the remainder of this project.

It should include scheduling, task assignments, and milestones. Include major team meetings.

Include any planned tests or major pieces of work you intend to complete before the Critical Design Review (CDR).

Each team member must agree to the team meeting dates.

It may not be possible for each team member to participate in this presentation. However, make sure that you spread the speaking opportunities around your team.

Trade Study Requirements

Trade Study #1

- 1. Brief statement of purpose of study.**
- 2. Detailed list of design variables - those parameters which you can control. List any constraints on the design variables.**
- 3. Measures of merit - those parameters which you will use to evaluate the design.**
- 4. Description of the tools used with particular emphasis on the assumptions associated with them and their limitations.**
- 5. Presentation of results of the study - graphical are preferred but tables or charts are acceptable if they most adequately represent the results.**
- 6. Discussion of the results of the study.**
- 7. Brief discussion of the impact of the study on the design.**

The basic format for the presentation of the trade study is up to each engineer. A tech memo format might be ideal. The report should not exceed 8 pages which includes all background, discussion and results. If a trade study involves hardware development, the engineer should discuss with management an appropriate format for presenting their results.

Trade Study #2

Two or three viewgraphs which are capable of describing the purpose and results of a specific trade study. You will present this study to the class using these viewgraphs and be given 5 minutes to overview the key aspects of your study and its results.

Critical Design Review (CDR)

This 45 minute, formal oral presentation will take place during the lab period and may be videotaped for review and evaluation. The design is “frozen” at this point and all further efforts are associated with validating the design through prototype fabrication and test. All team members are expected to participate in the oral presentations during the CDR. There will be outside visitors and the presentation is open to the general public.

Presentation Outline

- **3-view**
- **Review of each discipline (Remember some members of the audience will not have seen any of your previous presentations. So make this a complete review. Use the PDR as a guide to what to include. You may add material beyond the PDR but you should have no more than 35-40 transparencies for a 45 minute presentation. Lisa in the copy room will make the transparencies for you.)**
 - aerodynamics**
 - stability and control**
 - structures and landing gear**
 - propulsion**
- **Prediction of vehicle performance**
- **Unique aspects as of your design**
- **Presentation of plans or parts of plans**
- **Remaining design problems**
- **Your plan to resolve the problems in a timely manner**
- **Conclusions**

Are you ready to build and fly an aircraft? If not, what are you going to do about it?

Written Deliverables

3-view of aircraft,

Set of plans for all or most of the parts of the aircraft. I will give out several examples of reduced size plans. These plans are, for the most part, 2-dimensional drawings of each part.

one paper copy of all transparencies

Thiokol Final Design Report Requirements and Draft Design Report Requirements

The Thiokol competition is a technical writing evaluation open only to the AAE 451 Aircraft Design class. The Thiokol Final Design Report will be sent to the Thiokol Corporation for external review and competitive evaluation by a multi-disciplinary team of reviewers. Submission of an entry by all AAE 451 Aircraft Design teams is mandatory. Each report will be reviewed by the Thiokol Affiliate Technical Manager, a Thiokol technical writer, and a Thiokol design engineer.

The Thiokol design competition stresses excellence in technical writing. The emphasis is on technical content, and effective communication of technical concepts and details. The team that submits the best Thiokol Final Design Report will be awarded a \$75 prize per team member. In addition each team member of the winning team will get his or her name added to the plaque hanging in the Thiokol Corporation display on the third floor of Grissom Hall. The plaque is entitled the Thiokol Semi-annual Purdue Academic Communication Excellence (S.P.A.C.E.) Award for Excellence in Technical Communication.

The purpose of the report is to describe your design and the reasons for its existence. The issues and decision making process are also of interest to the reader.

It must contain all required changes from the draft submission as well as complete documentation of the prototype fabrication and testing. It should be considered as one of your first professional publications and treated as such.

The Thiokol Final Design Report is to be no longer than 25 pages, excluding the Title page and Table of Contents and List of Figures. There can be an unlimited number of appendices and attachments. It must conform to the standards described below.

Emphasis will be placed on quality of content and organization, not quantity. The body of the text should include primary discussions, trade study results and appropriate tables and figures. Detailed supporting technical data, computer output and programs and other pertinent data should be included in Appendices.

A major component of team “grade” on this report is associated with the draft report. The team may be required to make certain changes in the final submission but the “draft” should be their best effort.

The following are minimum requirements and standards that must be met.

Title sheet -- This is the first page and is unnumbered. It contains the names and signatures of all team members involved. It also must contain the ethics statement.

Table of Contents - You must have a table of contents that lists titles of sections and the names of the people who wrote the section. Make sure to include page numbers, centered at the bottom. This page (or pages) is numbered i at the bottom center.

If more than one person is responsible for writing a section, please include the name of the primary author of each subsection.

List of figures and tables (numbers, captions and pages on which they appear) - This list is placed after the Table of Contents. All figures must have a number and a meaningful caption. Number this page at the bottom in the center beginning with ii.

Section introductions -- The individual sections elaborate upon material contained in the first part of the report that describes the design. We must not be so intent on analyzing the design that we forget that we are studying aircraft design not aircraft analysis.

The introduction must tell the reader about the issues related to the design. What are the major conflicts and compromises that each person faced? Where was interaction between disciplines and team members particularly important? What are the design issues that forced you to do the analysis in the first place? What are the primary references that discuss these design issues?

Be sure to cite aircraft design books (such as Roskam) as having information that is relevant.

Summary and Conclusions -- Summarize the superior aspects of their design, and also, in fairness, outline some of the deficiencies.

You should present some suggestions as to how these deficiencies can overcome. Please don't make it necessary for me to tell you where your design is deficient. Honesty is as highly prized as a workable design.

Use of terminology -- Remember that a multi-disciplinary group will be reading your report and evaluating your design. Make sure that you define specialty terminology when you first use it. Otherwise you will blow people out of the water and confuse them to no end. They will retaliate by marking you down as to clarity of your report.

Coordination and teamwork -- Make sure that other members of the team have read each other's material. The sections must be well integrated.

Tables vs. figures -- know the difference between a figure and a table and demonstrate this in your labeling. Table titles appear above the table while figure captions appear below. Figure captions should not be underlined. Keep figures and tables out of the margins.

Thiokol Report Length - The total length of the paper cannot to exceed 25 pages total. This includes all figures and text (including the list of references but excluding the Table of Contents and List of Figures and Tables). This report must be prepared using a word-processing program and laser printed on good quality paper. Submit one unbound and unstapled copy and one bound or stapled copy.