**AE 522/722**

**Aerospace Design & Design Laboratory II**

**Spring 2025**

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| **Report Block 1** Due 10 February 2025, 8:00am to kuaerodesign@gmail.comReport Cover Page with student head shots, AIAA Numbers for all team members on white backgrounds The following are placeholders to be filled out later: Acknowledgments Table of ContentsList of SymbolsList of TablesList of Figures**Chapter 1 Introduction, Motivation, General Concept of Operations, Mission Specification and Profile**  The overall motivation for the design will be introduced by the individual and/or team. Students must make at least one high quality Concept of Operations including the overall scheme for each aircraft type/class. This will be followed by Mission Specification and Profiles. Cutting and pasting properly done work from AE 521 in the Fall is fine so long as the original author is referenced (so it's not plagiarism). There should be a nice Mission Specification in a neat table (preferably) or bulletized form. The Mission Profile should be done in CAD as was the case for AE 521. A short discussion of the drivers, direct and implied goals is always good. Note that conditions in the Fall were quite lax. Because this will be a competition document which will go to the world's finest missile designers, the standards will be incrementally higher. Avery and May will introduce their concepts and describe the overall purpose of their work. Begin structuring the AIAA Journal Format Report. Download template from AIAA, work on naming sections so you can go over them with Dr. B. in semiweekly meetings. Examine all of the details of the Mission Specification and Profile put forth by the AIAA. **References** (always at end of report)**Appendix A:** • List Team Members' actions, roles on the team and contributions• Recruitment of MinionsList efforts to enlist freshmen, sophomores, juniors, seniors and Grad. Students to help with the report. Remember that every hour spent on the project by a minion is one less hour you have to spend. • All Students choosing to compete in the AIAA Design Competitions must get AIAA Membership by 30 January 2024. • Decide on Team Leadership -Team Leader -Deputy Team Leader -Report Boss -CAD Boss• Turn in Letter of Intent – This MUST be done by 6 February**Appendix B:** • Gather as many past reports as possible for the competition you and/or your team are working on• Read them thoroughly, assessing them by the following metrics: ***1. Technical Content (35 points)****This concerns the correctness of theory, validity of reasoning used, apparent understanding and**grasp of the subject, etc. Are all major factors considered and a reasonably accurate evaluation of**these factors presented?****2. Organization and Presentation (20 points)****The description of the design as an instrument of communication is a strong factor on judging.**Organization of written design, clarity, and inclusion of pertinent information are major factors.****3. Originality (20 points)****The design proposal should limit standard textbook information and conventional designs already**on the market or found throughout history. It should show the independence of thinking or a fresh**approach to the project. Does the method and treatment of the problem show imagination? Does**the method show unique, useful approaches not yet found in the open market?****4. Practical Application and Feasibility (25 points)****The proposal should present conclusions or recommendations that are feasible and practical, and**not merely lead the evaluators into further difficult or insolvable problems. This should include an**assessment of the technical and economic viability, certifiability and projected market acceptance**of the proposed design.*• Gather also as many reports that did NOT win and assess them as follows, noting that the “best” in a given area will score a 10 and the worst will score a 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design 1 | Design 2 | Design 3 | Design 4 | Design n… |
| Technical Content |  |  |  |  |  |
| Organization & Presentation |  |  |  |  |  |
| Originality |  |  |  |  |  |
| Practical Application & Feasibility |  |  |  |  |  |
| Performance against KU Design |  |  |  |  |  |
| Aggressiveness of Design |  |  |  |  |  |
| Year & Place |  |  |  |  |  |

• Note trends in judging and track place in ranking against year and all metrics. Repeat for every year and note any discernable trends.  |
|  |

**Report Block 2**

Due 10 February 2025, 8:00am to kuaerodesign@gmail.com

**Chapter 2 Historical Review, Competition in the Market**

|  |  |  |  |
| --- | --- | --- | --- |
| **UG Team Interceptor & Missile** | **UG Individual** | **Grad. Team** | **Avery & May** |
| **2.1 Historical Review**Summarize all relevant interceptors and missiles. Get example figures of each aircraft, strip backgrounds and deliver a short write-up. **2.2 Relevant Aircraft Markets and Missions**Describe the market for relevant aircraft. Feel free to lift verbiage from the AIAA RFP (with appropriate reference, of course) Look up articles in Av. Week and other trade publications to describe market | **2.1 Historical Review**Summarize all relevant ag planes and approaches for crop dusting including drones and small rotary-wing aircraft. **2.2 Relevant Aircraft Markets and Missions**Describe the market for relevant aircraft. Feel free to lift verbiage from the AIAA RFP (with appropriate reference, of course) Look up articles in Av. Week and other trade publications to describe market | **2.1 Review of Historical Biz. Jet Designs**Summarize all relevant business jets. It’s okay to look at small ones, but larger ones with extreme range MUST be covered. Also look at converted narrow-bodies that are being used as biz. jets. Get example figures of each aircraft, strip backgrounds and deliver a short write-up. **2.2 Market Assessment**Get sales volumes for all of the large size/luxury business jets that are currently on the market. You’ll need this for STAMPED analysis. Glean information from multiple sources. If you can get forecasts, do that as well.  | **2.1 General Review of H2 and Carbon Sequestration Methods and Technologies**Research and report on H2 (Avery) approaches being taken from raw combustion to H2 fuel cells. Examine at the highest level who has done what. Research and report on carbon sequestration methods including biochar and CO2 sequestration. Report who has done what**2.2 Potential Benefits**List the potential benefits of the proposed to technology to the people of the US and globe. Work on the big picture and include benefits to industry and companies and individuals that may embrace the technology. **2.3 Potential Risks and Challenges**List the potential risks and challenges of the proposed to technology to the people of the US and globe. Work on the big picture and include risks and challenges to industry and companies and individuals that may embrace the technology.  |

**Chapter 3 Abbreviated Operating Statement, Design Philosophy & Configuration Constraint Establishment**

By examining the Mission Specification, historical judging trends and associated specified requirements, develop an Abbreviated Operating Statement and "Design Philosophy." The Abbreviated Operating Statement should only be a few words (5 or less typically), describing the aircraft, team and/or project. Tell the reader via the Abbreviated Operating Statement (preferably) one sentence the overall direction that your design will take. Expand the AOS to a general Design Philosophy to guide coming decisions in addition to all of the aforementioned. The Design Philosophy can be made public in the document or put in the appendix for reference, but it must be written and referred to.

By using the listed Requirements and Objectives and Design Optimization Function, layout any and all configuration constraints. Use either a generic CAD of a hypothetical aircraft or superimpose the constraints on a representative aircraft of the class under consideration.

Avery & May – do the above, but for your projects.

**Chapter 4 Objectives, Requirements and Design Optimization Function**

As was described in AE 521, list the Requirements, Objectives, Ancillary Objectives and generate an Optimization Function. Include "special" considerations like minimization of ramp footprint, ground servicing, turnaround time, favorable turbine engine-to-electric motor coupling cold turning rotor turns, noise, ride quality, flight and ground safety, certifiability, and insurance. Include especially guidance that will help with configuration layout and "special" operational considerations and/or supporting systems.

List as many flowdown requirements and objectives to the lowest Tiers possible.

Avery & May: Lay out the objectives for the technologies you are exploring. Consider the largest picture possible. Lay out requirements as well including health, safety, certificability, insurability, etc. etc. From these, develop and Design Optim

**Chapter 5 STAMPED Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
| **UG Team Interceptor & Missile** | **UG Individual** | **Grad. Team** | **Avery & May** |
| Gather relevant geometric, weights, engine and performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft.  | Gather relevant geometric, weights, engine and performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft. Of course, the data will be sparse given the oddity of the spec.  | performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft. Of course, the data will be sparse given the oddity of the spec.  | Avery: perform STAMPED analysis to the best of your ability on H2 systems projecting things like certification, tank weight, costs, etc. into the future. May: perform STAMPED analysis on the biochar market, costs of reactors, size of reactors, etc.  |

**References** (always at end of report)

**Appendix A:**

• List Team Members' actions, roles on the team and contributions

• Recruitment of Minions

List efforts to enlist freshmen, sophomores, juniors, seniors and Grad. Students to help with the report. Remember that every hour spent on the project by a minion is one less hour you have to spend.

• All Students choosing to compete in the AIAA Design Competitions must get AIAA Membership by 30 January 2024.

• Decide on Team Leadership

 -Team Leader

 -Deputy Team Leader

 -Report Boss

 -CAD Boss

Report on success or lack thereof of submission of Letter of Intent by the deadline.

**Report Block 3**

Due 17 February 2025, 8:00am to kuaerodesign@gmail.com

**Chapter 2 Historical Review, Competition in the Market**

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By using the listed Requirements and Objectives and Design Optimization Function, layout any and all configuration constraints. Use either a generic CAD of a hypothetical aircraft or superimpose the constraints on a representative aircraft of the class under consideration.

Avery & May – do the above, but for your projects.

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As was described in AE 521, list the Requirements, Objectives, Ancillary Objectives and generate an Optimization Function. Include "special" considerations like minimization of ramp footprint, ground servicing, turnaround time, favorable turbine engine-to-electric motor coupling cold turning rotor turns, noise, ride quality, flight and ground safety, certifiability, and insurance. Include especially guidance that will help with configuration layout and "special" operational considerations and/or supporting systems.

List as many flowdown requirements and objectives to the lowest Tiers possible.

Avery & May: Lay out the objectives for the technologies you are exploring. Consider the largest picture possible. Lay out requirements as well including health, safety, certificability, insurability, etc. etc.

**Chapter 5 STAMPED Analysis**

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| **UG Team Interceptor & Missile** | **UG Individual** | **Grad. Team** | **Avery & May** |
| Gather relevant geometric, weights, engine and performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft.  | Gather relevant geometric, weights, engine and performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft. Of course, the data will be sparse given the oddity of the spec.  | performance data and track the data with time. Include especially weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs for all historical aircraft. Of course, the data will be sparse given the oddity of the spec.  | Avery: perform STAMPED analysis to the best of your ability on H2 systems projecting things like certification, tank weight, costs, etc. into the future. May: perform STAMPED analysis on the biochar market, costs of reactors, size of reactors, etc.  |

**Chapter 6 Candidate Configuration Matrix Establishment**

Following the examples in previous reports and the notes, generate a sweep of candidate configurations. It's perfectly acceptable to generate configurations that reflect common configurations and design practices, but that may be directly at odds with the Design Philosophy and will be almost instantly deselected once your Configuration Constraints are applied. That's okay as you'll need to explain to the reader what you've done and why. For this first configuration matrix, just cast your net wide. Keep configurations simple -- no need for aerodynamic profiles on wings -- just simple extrusions will do. Fuselages are to be kept simple, jet engines devolve to cylinders, propellers become disks etc. This is the most basic sweep of generic configurations, NOTHING FANCY!

Avery – Discuss viable configurations, presenting ones that have been proposed in the open literature

May – Discuss pyrolizer configurations on a range of scales.

**Chapter 7 Application of Optimization Function and Requirements Flowdown Charts to Configurations and Downselection**

Using the Optimization Function and the Flowdown charts, downselect the bulk of designs to just a handful of designs or one design family. For teams, downselect one to several. For individual competitor, downselect to one design to carry forth (you won't have the time to do several).

Avery – Select the preferred configuration of H2 powered aircraft for analysis. Base your choice on the open literature and present that configuration. Choose this as the “most viable” by applying your optimization function, deciding on methods to store H2. Build this out into your AIAA Journal paper in a separate section, knowing that as the semester progresses the paper structure will probably be rearranged.

May – Select your preferred configuration of pyrolizer (if possible) on both an industrial scale and backyard scale. Apply your optimization functions for large and small to aid with the downselection. Build this out into your AIAA Journal paper in a separate section, knowing that as the semester progresses the paper structure will probably be rearranged.

**Chapter 8 Weight Sizing**

Note that this is a placeholder section. You will perform Class I weight sizing via the Appendix B below. Chapter 8 of the Competition Report will be devoted to Class II weight sizing, but will use Class I as a starting point. Include the superimposed V-n maneuver and gust diagrams as well as any advanced technologies developed in Appendix C.

Avery – Size an H2 powered aircraft following a 747-800F mission profile, or other aircraft as you chose previously. Use open literature info. as best you can. Build this out into your AIAA Journal paper in a separate section, knowing that as the semester progresses the paper structure will probably be rearranged.

May – Reverse engineer the pyrolizer near Wichita, get all performance data. Determine to the best of your ability the Carbon Emitted/Carbon Sequestered (CE/CS) ratio. (Note this is NOT CO2, but C.) Reverse engineer a hypothetical backyard pyrolizer, estimating the CE/CS for that device. Build this out into your AIAA Journal paper in a separate section, knowing that as the semester progresses the paper structure will probably be rearranged.

**References** (always at end of report)

**Appendix A:**

• List Team Members' actions, roles on the team and contributions

• Recruitment of Minions

List efforts to enlist freshmen, sophomores, juniors, seniors and Grad. Students to help with the report. Remember that every hour spent on the project by a minion is one less hour you have to spend.

• All Students choosing to compete in the AIAA Design Competitions must get AIAA Membership by 30 January 2024.

• Decide on Team Leadership

 -Team Leader

 -Deputy Team Leader

 -Report Boss

 -CAD Boss

Report on success or lack thereof of submission of Letter of Intent by the deadline.

**Appendix B Class I Weight Sizing**

Using the methods described in class, arrive at the Class I weight sizing of the aircraft. From this sizing exercise, you should determine: Wto, We, Wf, Wpl, Wpax, Woe, Wtfo and other important weights. Determine critical numbers like L/D cruise from STAMPED information on L/Ds of advanced aircraft derived from payload-range diagrams. Critical values for BSFC and TSFC can be obtained by looking at historical trending values. Show all calculations, which should in great part be done by hand and/or with spreadsheets and/or with Matlab code.

**Appendix C V-n Diagram & Associated Calculations**

Using the methods described in class and Roskam, Part V, place all of the calculations related to V-n diagram construction in this appendix. If any advanced technologies and/or operational considerations are taken, show those explicitly on the diagram.

**Report 3**

Due 5 Feb. 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters and Contents, reworked as directed as well as Appendix A**

**Chapter 1 Introduction, General Concept of Operations, Mission Specification and Profile**

\*\*Chapter Refinement\*\*

Update the Conops as recommended earlier, knowing that this is a "living document" and will change with time as the report matures.

**Chapter 2 Historical Review, Competition in the Market**

Update Historical Review and Competition as directed by Dr. B. and/or if new info. has become available.

**Chapter 3 Design Philosophy & Configuration Constraint Establishment**

Design Philosophy and Configuration Constraint Establishment

By examining the Mission Specification and associated specified requirements, develop a "Motto" and "Design Philosophy." The motto should only be a few words (5 or less typically), describing the aircraft, team and/or project. Tell the reader in (preferably) one sentence the overall direction that your design will take. Use this philosophy to guide coming decisions in addition to all of the aforementioned.

By using the listed Requirements and Objectives and Design Optimization Function, layout any and all configuration constraints. Use either a generic CAD of a hypothetical aircraft or superimpose the constraints on a representative aircraft of the class under consideration.

**Chapter 4 Objectives, Requirements and Design Optimization Function**

Given new information, adjust the ancillary objectives listed in Report 2. Stretch Tier 0 Requirements to as many Tier 1 Flowdown requirements as possible. Construct and show the Tier 0 to Tier 1 Requirements and Objectives Flowdown Chart.

**Chapter 5 STAMPED Analysis** (Weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs)

\*\* Chapter Refinement\*\*

Continue STAMPED information generation. Track as many relevant variables as possible.

**Chapter 6 Candidate Configuration Matrix Establishment**

Following the examples in previous reports and the notes, generate a sweep of candidate configurations. It's perfectly acceptable to generate configurations that reflect common configurations and design practices, but that may be directly at odds with the Design Philosophy and will be almost instantly deselected once your Configuration Constraints are applied. That's okay as you'll need to explain to the reader what you've done and why. For this first configuration matrix, just cast your net wide. Keep configurations simple -- no need for aerodynamic profiles on wings -- just simple extrusions will do. Fuselages are to be kept simple, jet engines devolve to cylinders, propellers become disks etc. This is the most basic sweep of generic configurations, NOTHING FANCY! Coleopter team – you’ll do your own thing as this section is meaningless for you.

**Chapter 7 Application of Optimization Function and Requirements Flowdown Charts to Configurations and Downselection**

Using the Optimization Function and the Flowdow charts downselect the bulk of designs to just a handful of designs or one design family. For teams, downselect one to several. For individuals, downselect to one design to carry forth (you won't have the time to do several). Coleopter team – you’ll do your own thing as this section is meaningless for you.

**Chapter 8 Weight Sizing**

Note that this is a placeholder section. You will perform Class I weight sizing via the Appendix B below. Chapter 8 of the Competition Report will be devoted to Class II weight sizing, but will use Class I as a starting point. Coleopter team – you will have to properly size the powerplant assemblies for both hover and dash. We’ll go over it in our individual meetings.

References (always at end of report, before the appendices)

**Appendix A**

i.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Draft an aesthetics survey sheet to pass out to people and get feedback on multiple designs for commercial aircraft designs.

**Appendix B Class I Weight Sizing**

Using the methods described in class, arrive at the Class I weight sizing of the aircraft. From this sizing exercise, you should determine: Wto, We, Wf, Wpl, Wpax, Woe, Wtfo and other important weights. Determine critical numbers like L/D cruise from STAMPED information on L/Ds of advanced aircraft derived from payload-range diagrams. Critical values for BSFC and TSFC can be obtained by looking at historical trending values. Show all calculations, which should in great part be done by hand and/or with spreadsheets and/or with Matlab code.

**Report 4 Coleopters**

Due 12 Feb. 2024 8am to kuaerodesign@gmail.com

Continue CAD, mock up cardboard components for the 12” coleopter, report progress on CAD in .pdf document along with photos of the progress.

**Report 4 AIAA Individuals, Team & Swarm**

Due 12 Feb. 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters and Contents, reworked as directed as well as Appendix A**

**Chapter 1 Introduction, General Concept of Operations, Mission Specification and Profile**

\*\*Chapter Refinement\*\*

Update the Conops as recommended earlier, knowing that this is a "living document" and will change with time as the report matures.

**Chapter 2 Historical Review, Competition in the Market**

Update Historical Review and Competition as directed by Dr. B. and/or if new info. has become available.

**Chapter 3 Design Philosophy & Configuration Constraint Establishment**

Design Philosophy and Configuration Constraint Establishment

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By using the listed Requirements and Objectives and Design Optimization Function, layout any and all configuration constraints. Use either a generic CAD of a hypothetical aircraft or superimpose the constraints on a representative aircraft of the class under consideration.

**Chapter 4 Objectives, Requirements and Design Optimization Function**

Given new information, adjust the ancillary objectives listed in Report 2. Stretch Tier 0 Requirements to as many Tier 1 Flowdown requirements as possible. Construct and show the Tier 0 to Tier 1 Requirements and Objectives Flowdown Chart.

**Chapter 5 STAMPED Analysis** (Weights, We, Wto, Wpl, Geometries, b, S, AR, Power or Thrust, Performance, Vmax, Vcr, any and all Ranges, costs)

\*\* Chapter Refinement\*\*

Continue STAMPED information generation. Track as many relevant variables as possible.

**Chapter 6 Candidate Configuration Matrix Establishment**

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**Chapter 8 Weight Sizing**

Note that this is a placeholder section. You will perform Class I weight sizing via the Appendix B below. Chapter 8 of the Competition Report will be devoted to Class II weight sizing, but will use Class I as a starting point. Coleopter team – you will have to properly size the powerplant assemblies for both hover and dash. We’ll go over it in our individual meetings. Refer the reader to Chapter 9 if you are claiming a “Gust Load Alleviation” weight credit by pushing your gust peaks within the maneuver lines in your V-n diagram.

**Chapter 9 V-n Diagram**

Note that this is a placeholder section. You will perform all of the calculations to establish your V-n diagrams. This chapter should include a brief introduction and presentation of your V-n maneuver and gust diagrams. If your V-n diagrams alter your weight sizing, explain which points you are calling upon to claim a weight reduction.

**Chapter 10 Wing and Powerplant Sizing**

Note that this is a placeholder section. You will perform all of the calculations to establish your wing and powerplant sizing will be included in Appendix D. This chapter should include an introduction, a description of the techniques used and variables swept through (along with range of variables and explanation describing why that range was chosen) and final design point selected.

References (always at end of report, before the appendices)

**Appendix A**

i.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

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**Appendix B Class I Weight Sizing Calculations**

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**Appendix C V-n Diagram Calculations**

Using the methods described in class and Roskam, Part V, place all of the calculations related to V-n diagram construction in this appendix.

**Appendix D Wing and Powerplant Sizing Calculations**

Using the methods described in class and Roskam, Part II, place all of the calculations related to wing and powerplant sizing in this appendix.

**Report 5 Coleopters**

Due 21 Feb. 2024 8am to kuaerodesign@gmail.com

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Continue STAMPED information generation. Track as many relevant variables as possible.

**Chapter 6 Candidate Configuration Matrix Establishment**

Following the examples in previous reports and the notes, generate a sweep of candidate configurations. It's perfectly acceptable to generate configurations that reflect common configurations and design practices, but that may be directly at odds with the Design Philosophy and will be almost instantly deselected once your Configuration Constraints are applied. That's okay as you'll need to explain to the reader what you've done and why. For this first configuration matrix, just cast your net wide. Keep configurations simple -- no need for aerodynamic profiles on wings -- just simple extrusions will do. Fuselages are to be kept simple, jet engines devolve to cylinders, propellers become disks etc. This is the most basic sweep of generic configurations, NOTHING FANCY! Coleopter team – you’ll do your own thing as this section is meaningless for you.

**Chapter 7 Application of Optimization Function and Requirements Flowdown Charts to Configurations and Downselection**

Using the Optimization Function and the Flowdow charts downselect the bulk of designs to just a handful of designs or one design family. For teams, downselect one to several. For individuals, downselect to one design to carry forth (you won't have the time to do several). Coleopter team – you’ll do your own thing as this section is meaningless for you.

**Chapter 8 Weight Sizing**

Note that this is a placeholder section. You will perform Class I weight sizing via the Appendix B below. Chapter 8 of the Competition Report will be devoted to Class II weight sizing, but will use Class I as a starting point. Coleopter team – you will have to properly size the powerplant assemblies for both hover and dash. We’ll go over it in our individual meetings. Refer the reader to Chapter 9 if you are claiming a “Gust Load Alleviation” weight credit by pushing your gust peaks within the maneuver lines in your V-n diagram.

**Chapter 9 V-n Diagram**

Note that this is a placeholder section. You will perform all of the calculations to establish your V-n diagrams. This chapter should include a brief introduction and presentation of your V-n maneuver and gust diagrams. If your V-n diagrams alter your weight sizing, explain which points you are calling upon to claim a weight reduction.

**Chapter 10 Wing and Powerplant Sizing**

Note that this is a placeholder section. You will perform all of the calculations to establish your wing and powerplant sizing will be included in Appendix D. This chapter should include an introduction, a description of the techniques used and variables swept through (along with range of variables and explanation describing why that range was chosen) and final design point selected.

**Chapter 11 Advanced Technologies and Design Concepts**

Your team (or You in the case of individual competitors) is (are) considering some advanced technologies to give your design an edge. Explain these advanced technologies to the reader:

**11.1 Heilmeier's Catechism for the Advanced Technology**

In a short table or paragraph, answer the following questions.

1. What is it called?
2. What are we trying to do?
3. How does this currently get done?
4. What limits present approaches?
5. What is new about our approach?
6. Why, at this time, can our approach succeed?
7. What difference does our approach offer?
8. What are the “mid-term” and “final exams?”
9. How much will our approach cost?

**11.2 Operational and Physical Description and Concept of Technology**

Describe how the system's primary components and how they work individually and together. This description should be a bit deeper than the Heilmeier's Catechism above and should have one or more figures to explain the concept.

**11.3 State of the Art of the Advanced Technologies**

By using the library, consulting a Research Librarian, searching the Patent Gazettes and other resources, research the state of the art of the Advanced Technologies you are considering. Be sure to catalog all references you are looking at. Also, be sure to include relevant figures (with proper references, of course). Be more generous with figures rather than less -- you can always strip them later.

**11.4 Physical or Computational Research Performed**

If you have designed and performed any physical or computational research related to your advanced technology, describe the research and report the results here.

**11.5 State of Team or Individual Intellectual Property, IP Protection and/or Patent Filing**

Describe the state of the IP and any efforts you and your team are undertaking to protect the intellectual property.

**References** (always at end of report, before the appendices)

**Appendix A**

i.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Draft an aesthetics survey sheet to pass out to people and get feedback on multiple designs for commercial aircraft designs.

**Appendix B Class I Weight Sizing Calculations**

Using the methods described in class, arrive at the Class I weight sizing of the aircraft. From this sizing exercise, you should determine: Wto, We, Wf, Wpl, Wpax, Woe, Wtfo and other important weights. Determine critical numbers like L/D cruise from STAMPED information on L/Ds of advanced aircraft derived from payload-range diagrams. Critical values for BSFC and TSFC can be obtained by looking at historical trending values. Show all calculations, which should in great part be done by hand and/or with spreadsheets and/or with Matlab code.

**Appendix C V-n Diagram Calculations**

Using the methods described in class and Roskam, Part V, place all of the calculations related to V-n diagram construction in this appendix.

**Appendix D Wing and Powerplant Sizing Calculations**

Using the methods described in class and Roskam, Part II, place all of the calculations related to wing and powerplant sizing in this appendix.

**Appendix E Class I Cockpit and Fuselage Layout Designs**

Following the procedures laid out in Roskam's Airplane Design, Part III, Lay out the Cockpit and Fuselage of your aircraft.

**Appendix F Class I Engine Installations**

Following the procedures laid out in Roskam's Airplane Design, Part II

Addendum:

i.) Start long-term projects for coming reports, identify person(s) responsible for each:

 a.) Initiate Class I Configuration Definition (enter in AAA)

 b.) Initiate Class I Performance Estimation (enter in AAA)

 c.) Initiate Class I Cost Analysis (translate Roskam Part VIII equations into Word and begin analysis in AAA)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

**Report 6 Coleopters**

Due 28 Feb. 2024 8am to kuaerodesign@gmail.com

Printout all component patterns for the 12” coleopters. Mock-up entire aircraft , report progress on CAD in .pdf document along with photos of the progress.

**Report 6 AIAA Individuals, Team & Swarm**

Due 28 Feb. 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters & Contents, reworked as directed as well as Appendices A – F.**

**Appendix G Class I Wing Layout Designs**

 Lay out your wing as covered in Roskam's Airplane Design Part II and as shown in class.

**Appendix H Class I High Lift Device Sizing**

 Perform Class I High Lift Device Sizing as covered in Roskam's Airplane Design Part II and as shown in class. If your aircraft uses some mechanism other than flaps to generate high lift coefficients, describe those devices in greater detail and model to the best of your ability. Bear in mind that often deflected slipstream techniques can be quite effective and easy to implement.

**Appendix I Class I Empennage Design**

 Lay out your empennage as covered in Roskam's Airplane Design Part II and as shown in class.

**Report 7 Coleopters**

Due 6 March 2024 8am to kuaerodesign@gmail.com

Printout all component patterns for the 12” coleopters. Mock-up entire aircraft , report progress on CAD in .pdf document along with photos of the progress.

**Report 7 AIAA Individuals, Team & Swarm**

Due 6 March 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters & Contents, reworked as directed as well as Appendices A – F.**

**Appendix J Class I Landing Gear Layout**

 Lay out your landing gear as covered in Roskam's Airplane Design Part II and as shown in class.

**Appendix K Class I Weight and Balance Analysis**

 Perform your Class I weight and balance analysis as covered in Roskam's Airplane Design Part II and as shown in class.

i.) Continue long-term projects for coming reports:

 a.) Class I Configuration Definition (enter in AAA)

 b.) Class I Performance Estimation (enter in AAA)

 c.) Class I Cost Analysis (translate Roskam Part VIII equations into Word and begin analysis in AAA)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Identify and Interview Experts

**Preliminary Design Review (PDR)**

**To be delivered sometime on or before midnight Friday 8 March 2024**

Dr. B. Will then share with experts.

Purpose: Get feedback from professionals and user community at an early design stage

Record and send both .pptx and video files to kuaerodesign@gmail.com

Structure:

1. Title Slide with handsome faces, names & jobs
2. Mission Specification & Profile
3. Overarching Design Philosophy
4. Report Contents
5. Current State of Design
6. Coming Design Steps
7. Ask questions of experts, like: Are you aware of any other changes in aircraft design and/or configuration that can reduce personnel costs? Do you think the traveling public and/or operators could accept an aircraft configured like an AN-72 rather than a traditional 737/DC-9 configuration? While the engines are overhead and far away from the ground, do you see any other grounds operations considerations with keeping them in ground idle so as to reduce the number of start cycles and associated engine fatigue?

• Prepare in PowerPoint format

• Audience: industry and aircraft design engineers and experts

• Mark every page as: "Competition Sensitive for Evaluation Purposes Only"

• If you have a proprietary idea, mark that page as such

• Every team member should speak with Team Leader going first, introducing team

• Try to give similar amounts of time for each member

• Target 30 – 45 min. If it's a bit longer, that's okay, just keep it under 1 hr

• Thank audience for taking the time to review the work and will "look forward to feedback"

**Report 8 Coleopters**

Due 20 March 2024 8am to kuaerodesign@gmail.com

Prepare and submit all files for flatstock cutting. Layup all fuselage, nose and tail tube stocks. Submit mold pattern .stl files for rotor guard assemblies. Submit tool designs for grid fins.

**Report 8 AIAA Individuals, Team & Swarm**

Due 20 March 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters & Contents, reworked as directed as well as Appendices A – K.**

**Appendix L Class I Stability and Control Analysis**

 Perform a Class I Stability and Control Analysis as covered in Roskam's Airplane Design Part II and as shown in class.

**Appendix M Class I Drag Polar and Performance Analysis**

 Perform your Class I Drag Polar and Performance analysis as covered in Roskam's Airplane Design Part II and as shown in class.

i.) Continue long-term projects for coming reports:

 a.) Class I Configuration Definition (enter in AAA)

 b.) Class I Performance Estimation (enter in AAA)

 c.) Class I Cost Analysis (translate Roskam Part VIII equations into Word and begin analysis in AAA)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Identify and Interview Experts

**Report 9 Coleopters**

Due 27 March 2024 8am to kuaerodesign@gmail.com

Cut the doggone parts! Fit checks are due for all paper frames, tubes, nose cone. No more excuses!

**Report 9 AIAA Individuals, Team & Swarm**

Due 27 March 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters & Contents, reworked as directed as well as Appendices A – K.**

**Appendix M Class I Drag Polar and Performance Analysis**

 Perform your Class I Drag Polar and Performance analysis as covered in Roskam's Airplane Design Part II and as shown in class.

**Appendix N Analysis of Weight and Balance, Stability and Control and L/D Results and Iterations**

**Appendix O Preliminary Three-View and List of Salient Characteristics**

**Appendix P Class I Layout of Major Systems**

 12.1 Landing Gear Layout

 12.2 Flight Control Systems

 12.3 Fuel System

 12.4 Hydraulic System

 12.5 Electrical System

Upcoming, not due yet:

 12.6 Environmental Control System

 12.7 Cockpit Instrumentation

 12.8 De-Icing, Anti-Icing, Rain Removal & De-Fog

 12.9 Escape System

 12.10 Water and Waste Systems

 12.11 Safety and Survivability

i.) Continue long-term projects for coming reports:

 a.) Class I Configuration Definition (enter in AAA)

 b.) Class I Performance Estimation (enter in AAA)

 c.) Class I Cost Analysis (translate Roskam Part VIII equations into Word and begin analysis in AAA)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Identify and Interview Experts

**Critical Design Review (CDR)**

**To be delivered sometime on or before 8am Monday 8 April 2024**

Dr. B. Will then share with experts.

Purpose: Get feedback from professionals and user community at an early design stage

Record and send both .pptx and video files to kuaerodesign@gmail.com

Structure:

1. Title Slide with handsome faces, names & jobs
2. Mission Specification & Profile
3. Overarching Design Philosophy
4. Report Contents
5. Current State of Design
6. Coming Design Steps
7. Ask questions of experts, like: Are you aware of any other changes in aircraft design and/or configuration that can reduce personnel costs? Do you think the traveling public and/or operators could accept an aircraft configured like an AN-72 rather than a traditional 737/DC-9 configuration? While the engines are overhead and far away from the ground, do you see any other grounds operations considerations with keeping them in ground idle so as to reduce the number of start cycles and associated engine fatigue?

• Prepare in PowerPoint format

• Audience: industry and aircraft design engineers and experts

• Mark every page as: "Competition Sensitive for Evaluation Purposes Only"

• If you have a proprietary idea, mark that page as such

• Every team member should speak with Team Leader going first, introducing team

• Try to give similar amounts of time for each member

• Target 30 – 45 min. If it's a bit longer, that's okay, just keep it under 1 hr

• Thank audience for taking the time to review the work and will "look forward to feedback"

**Report 10 Coleopters**

Due 3 April 2024 8am to kuaerodesign@gmail.com

Refine cut parts, demonstrate fit checks, mock up first incarnation of grid fins and take pictures of painted, free-standing components.

**Report 10 AIAA Individuals, Team & Swarm**

Due 3 April 2024 8am to kuaerodesign@gmail.com

**All Preceding Chapters & Contents, reworked as directed as well as Appendices A – K.**

**Appendix M Class I Drag Polar and Performance Analysis**

 Perform your Class I Drag Polar and Performance analysis as covered in Roskam's Airplane Design Part II and as shown in class.

**Appendix N Analysis of Weight and Balance, Stability and Control and L/D Results and Iterations**

**Appendix O Preliminary Three-View and List of Salient Characteristics**

**Appendix P Class I Layout of Major Systems**

 12.1 Landing Gear Layout

 12.2 Flight Control Systems

 12.3 Fuel System

 12.4 Hydraulic System

 12.5 Electrical System

 12.6 Environmental Control System

 12.7 Cockpit Instrumentation

 12.8 De-Icing, Anti-Icing, Rain Removal & De-Fog

 12.9 Escape System

 12.10 Water and Waste Systems

 12.11 Safety and Survivability

i.) Continue long-term projects for coming reports:

 a.) Class I Configuration Definition (enter in AAA)

 b.) Class I Performance Estimation (enter in AAA)

 c.) Class I Cost Analysis (translate Roskam Part VIII equations into Word and begin analysis in AAA)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

ii.) Identify and Interview Experts

**Report 11 Coleopters**

Due 10 April 2024 8am to kuaerodesign@gmail.com

Refine cut parts, demonstrate fit checks, mock up first incarnation of grid fins and take pictures of

1. Free standing components
2. Components assembled into an aircraft
3. Components disassembled in case

**Report 11 AIAA Individuals, Team & Swarm**

Due 10 April 2024 8am to kuaerodesign@gmail.com

All Preceding Chapters & Contents, reworked as directed as well as Appendices A – K.

All previous sections +

Chapter 12 Class II Sizing of Landing Gear­­

Addendum

Chapter Q Class I Structural Layout

Chapter Z Compliance Matrix

i.) Continue long-term projects for coming reports:

 a.) Update Class II Configuration Definition with Class II Weights Information (enter in AAA)

 b.) Initiate Class II Performance Estimation (enter in AAA)

 c.) Initiate Class II Cost Analysis

 d.) Initiate Class II Stability and Control Analysis

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

References (always at end of report)

**Report 12 Coleopters**

Due 17 April 2024 8am to kuaerodesign@gmail.com

Refine cut parts, demonstrate fit checks, mock up first incarnation of grid fins and take pictures of

1. Mocked up figures cut from foam core or Depron and assembled
2. .jpgs of all parts to be laser cut
3. Full assembly of Depron parts
4. Mock up of grid fins
5. Motor mounted in Depron frame

**Report 12 AIAA Individuals, Teams, Swarm, Missile**

Due 17 April 2024 8am to kuaerodesign@gmail.com

All previous sections +

Chapter 11 Class II Weight and Balance

Chapter 12 Class II Systems (as appropriate)

 12.1 Flight Control Systems

 12.2 Fuel System

12.3 Hydraulic System

12.4 Electrical System

12.5 Environmental Control System & Cabin Sterilization

 5.1. Pressurization System

 5.2. Pneumatic System

 5.3. Oxygen System

 5.4. Air Conditioning System

 5.5. Cabin Sterilization

12.6 Cockpit Instrumentation

12.7 De-Icing

12.8 Window Rain, Fog and Frost Control

12.9 Escape Systems Ingress/Egress Systems and Compatibility

12.10 Lavatory, Galley, Water and Waste Systems

12.11 Safety and Survivability

12.12 Checked Baggage or Major Cargo Handling Systems

12.13 Cabin Baggage or Infantry Accommodations

12.14 Ground Equipment and Vehicles Compatibility

Chapter 13 Fault Tree Analysis of Flight Critical Systems

Chapter Z Compliance Matrix

i.) Continue long-term projects for coming reports:

 a.) Update Class II Configuration Definition with Class II Weights Information (enter in AAA)

 b.) Initiate Class II Performance Estimation (enter in AAA)

 c.) Initiate Class II Cost Analysis

 d.) Initiate Class II Stability and Control Analysis

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

References (always at end of report)

ii.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

References (always at end of report)

**Report 13 Coleopters**

Due 24 April 2024 8am to kuaerodesign@gmail.com

Refine cut parts, demonstrate fit checks, mock up first incarnation of grid fins and take pictures of

1. Mocked up figures cut from foam core or Depron and assembled
2. .jpgs of all parts to be laser cut
3. Full assembly of Depron parts
4. Mock up of grid fins
5. Motor mounted in Depron frame

**Report 13 AIAA Individuals, Teams, Swarm, Missile**

Due 24 April 2024 8am to kuaerodesign@gmail.com

All previous sections +

Chapter 14 Class II Stability and Control

Chapter 15 Class II Performance with Electric Motors and Energy Handling

Chapter 16: Advanced CAD 3-View, Situational Rendering & Exploded View

Chapter Z Compliance Matrix

i.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

References (always at end of report)

**Report 14 AIAA Individuals, Teams, Swarm, Missile**

Due 1 May 2024 8am to kuaerodesign@gmail.com

All previous sections +

Chapter 17 Manufacturing, Fielding, Logistics, Handling & Deployment

Chapter 18 Class II Cost Analysis

Chapter Z Compliance Matrix

i.) List of all team member actions and contributions. Note that some team members may be assigned a "long term" job and may not show up as contributing to this section. That's okay, but it needs to be noted.

References (always at end of report)