F010103 Report Outline

Put all substantiating data in appendices, and reference the appendix so that the evaluator can find the appropriate data.

Show numerical values to the number of significant digits for which you have reasonable confidence. E.g., if you think you have evaluated MTOGW to the nearest 10,000 lb, then show the value to the nearest 10,000 lb, such as MTOGW = 820,000 lb. Don't show it as 821,563 lb. You are fooling others, and yourself, if you show values to the nearest lb. The same applies to any other values.

- Title page
- Summary page. Include leading data on aircraft, such as mission requirements and design constraints (including payload and range), MTOGW, $(T/W)_{ref}$ and $(W/S)_{ref}$, cruise Mach number, FAR takeoff field length, landing field length, type of construction.
- Table of contents
- List of figures
- List of tables
- List of abbreviations

1. Introduction
2. Market analysis
3. Aircraft Requirements
    - Purpose
    - Payload
    - Range
    - Reserve fuel
    - Cruise altitude
    - Cruise speed
    - Takeoff distance
    - Landing distance
    - Powerplant
    - Pressurization
    - Certification basis
    - Mission profile
4. Calculation of Initial MTOGW [Raymer 3, 6 and maybe 19. Use appropriate page of spreadsheet Payload Range Plot with weight reduction factors]
    - Initial assumptions on $(L/D)_{cruise}$, cruise sfc, cruise speed, weight assumptions (assumed weight reduction from standard aluminum), etc.
    - Method of finding converged solution. MTOGW for sized configuration.
    - Summarize mission for sized configuration. Show table of weight ratios by segment [i.e., (weight at end of segment)/(weight at start of segment)].
5. Aircraft Design
    5.1. T/W vs. W/S constraint analysis
    - Describe assumptions

- Describe plot
- Describe choice of $(T/W)_{ref}$ and $(W/S)_{ref}$ for airplane

5.2. Three view in 3rd angle projection, with leading dimensions, including location of MAC for all lifting surfaces, and leading edge of MAC (LEMAC) of wing, including aerodynamic surface data box on top LHS (see figure on F010103 website), and drawing data box on bottom RHS (see figure on F010103 website). Hand-drawn is ok

5.3. Wing

- Planform description, explaining choice of sweep, aspect ratio, taper ratio [Annotation 12.1]
- Wing sections (choice of airfoil sections) [Raymer 4.3.4 and Annotation 4.2. All you can say is that you will use an advanced supercritical airfoil, if that's what you are using]
- High lift system [Raymer 12.4.6 for general information]
- Define assumed $C_{L_{max}}$ achievable for takeoff and landing

5.4. Propulsion system [Raymer Ch 10]

- Choice of engine bypass ratio (assuming it's a turbojet or turbofan)
- Engine location trades

5.5. Cabin cross-section [Raymer Ch 9.3]

5.6. Cabin plan view, showing seats, galley, toilets, storage, standard exits plus emergency exits [see: FAR 25.807 Emergency Exits, or Schaufele Figs. 5-13 and 5-14]

5.7. Landing gear [Annotation 11.2 and 11.6.]

- Location of MLG relative to aft c.g. location showing tip-up margin. Show MAC with forward and aft c.g. limits
- Scrap view showing lateral tip-over angle at forward c.g. limit (height of c.g. from ground assumed to be at height of cabin floor)
- MLG front view in lowered and retracted positions, plus side view in lowered position
- NLG in front view in lowered position, plus side view in lowered and retracted positions
- Show a drawing showing how the landing gear is attached to the wing structure

6. Aerodynamics

6.1. C_L vs α plot for clean, takeoff and landing flap settings [Raymer 12.4 and Annotation 12.4]

6.2. Component zero lift drag buildup [Annotation 12.5.2]

6.3. Drag polars (low speed)

- Clean [Raymer 12.3 and following]
- Takeoff flap setting [Annotation 17.3.1]
- Landing flap setting [Annotation 17.3.1]

1.2. C_D vs Mach for increasing C_L [Annotation 12.5.10. See spreadsheet LoD vs CL.drag map.ls polars + MLoD vs CL using Korn rev 2.xlxs]

1.3. L/D vs C_L at cruise condition for different Mach values [Use spreadsheet above]

1.4. ML/D vs C_L at cruise conditions for different Mach values [Use spreadsheet above]

2. Performance

2.1. Takeoff and Landing

- FAR field length [Raymer 17.8.4]
- FAR landing approach [Annotation 5.3.11]
- FAR 2nd segment climb [Annotation 17.3.1]

2.2. Enroute climb requirements (i.e., climb requirement at start of cruise)
2.3. Payload-range plot [see spreadsheet Payload-range plot with weight reduction factors]

3. Mass Properties [Annotation 15.2]
   3.1. Group weight statement
   3.2. Weight and balance loading diagram (nominal c.g. location). Do not generate a potato plot
   3.3. C.g. travel limits (nominal, forward and aft as percentage MAC)
4. Stability and Control
   4.1. Sizing the horizontal stabilizer [Raymer 6.5.3]
   4.2. Sizing the vertical stabilizer [Raymer 6.5.3]
   4.3. Sizing the control surfaces: elevator, rudder, ailerons [Raymer 6.6, see also spreadsheet Aileron and Spoiler Sizing]
5. Structures and Materials
   5.1. Choice of materials [Raymer 14. Basis for weight reductions in Raymer 3 and following]
   5.2. V-n diagram [Raymer 14.3]
   5.3. "Bones" drawing of primary structure (main fuselage frames, forward and aft pressure bulkheads, wing spars, horizontal and vertical tail spars, MLG attachment to wing spar

References

Appendices: Use the same numbering for the appendices as for the body of the report, but preceded by the letter A. This way the evaluator can quickly find substantiating data. There will be gaps in the numbering, but that's ok (not every section requires substantiating data).

You will not receive a high score (or possibly any score at all) on results presented in the body of the report unless an easily understood substantiation is provided in the associated appendix. The flow of intermediate calculations and linkage of the results of these calculations to the final result must be clearly defined.

Submit one spreadsheet, and any .m files, by 2014/04/28 2200 hrs. Name the files as for previous file submissions, i.e., familyname.givenname_F010103_PROJECT.xxx. Use the letters PROJECT (not the name of your project). xxx is the filetype (e.g., m, xls, xlsx, doc, docx, pdf, etc.)

Comments: Don't waste time on computer-generated graphics if you are not familiar with the software. It's more important that you demonstrate an understanding of a typical commercial aircraft configuration: what it looks like, the relative size of lifting surfaces, the location of the main load-bearing structure, attachment of the landing gear to the structure, etc. You must also show how the main design parameters are either calculated, or (for a conceptual design) selected. Be concise.