

Lab 1 – Design Parameters and Tradeoffs

Unified Engineering

9 Feb 06

Learning Objectives

- Get familiar with flight performance modeling and prediction
- Get familiar with design parameters and tradeoffs

Preparation

- Study the lab notes document “Flight Power Relations”

Lab Execution and Deliverables

1) Working in a group of 3–5, extend the “Pro & Con” list at the end of the lab notes document for the following design parameter changes:

- Increase the wing aspect ratio AR
- Increase the maximum operating lift coefficient C_L with higher-camber airfoil
- Reduce c_d by using thinner airfoil
- Reduce fuselage’s CDA_0 by adding fairing material

Explain the rationale for each Pro and Con with a brief argument. A few sentences and possibly some simple algebra should suffice for each. Consider the effects on both t_{\max} and V_{\max} .

2a) Rank the design parameters in order of decreasing perceived importance for t_{\max}
2b) Rank the design parameters in order of decreasing perceived importance for V_{\max}
Include the parameters given at the end of the lab notes document in this list.

Two written pages should be sufficient to report your findings.

Suggested teamwork process:

- i) Individuals make preliminary lists of pros and cons during preparation
- ii) Team meets and collates all these, agreeing on a rank ordering
- iii) Team splits work if possible to document their final result