Lab 1 – Design Parameters and Tradeoffs
Unified Engineering

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 $t_{\text{max}}$ and $V_{\text{max}}$.

   2a) Rank the design parameters in order of decreasing perceived importance for $t_{\text{max}}$
   2b) Rank the design parameters in order of decreasing perceived importance for $V_{\text{max}}$

   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