

# Lab 10 – Detailed Wing Optimization

## Unified Engineering

7 Apr 09

### Learning Objectives

- Design work using more complex physical models.
- Quantitative tradeoffs between competing objectives.
- Documentation of design approach or design process.
- Documentation of new wing design.

### Procedure

- First review the Lab 8 Notes and Appendices and decide how to best incorporate this new information into your optimization program. To receive full credit, you must incorporate some of this new information into a revised wing design. The more information you use, the better your wing is likely to be.
- Also review the assumptions you made in Lab 7, and adjust if appropriate for the new airplane.
- Perform design tradeoffs for the wing of your UE Flight Competition airplane in order to achieve maximum Mission Score. This will be a more detailed and more accurate continuation of the exercise from Lab 7.
- Document the new wing design as itemized below.
- Summarize the design process you used as itemized below.

### Reporting

Each team will turn in one terse design report.

Contents:

- Title, team number, team member names, date
- Brief introduction explaining purpose of report.

This is aimed at an outside reader who is not familiar with the UE Competition.

- Design Process Documentation.

— List of design variables which were considered in the design.

— Give the objective function and constraints you used.

You may re-use material from Lab 7 if appropriate.

— Describe the design procedure you used. Sample plots with informative captions are usually more effective than long prose.

- Design Documentation

— Top-view drawing of your wing, to scale, with dimensions.

— Table of key aircraft parameters: area, span, aspect ratio, empty weight, airfoil, etc. This can be placed on the wing drawing.

- Performance Documentation

— Table of operating parameters for the maximum-payload case.  $W_{\text{pay}}$ ,  $V$ ,  $C_L$ ,  $C_L/C_D$ , etc.

— Table of operating parameters for the maximum-speed case.  $V_{\text{max}}$ ,  $C_{L_{\text{min}}}$ , etc.

— Predicted Mission Score

The level of detail in the report should be such that someone could repeat your calculations from the information in the report alone.