AEM 313 MEMO

Subject: Aerodynamics I Aircraft Project

TO: AEM 313 **Date:** 21 Nov 2016

CC: **Memo:** AEM313-Proj-Format

From: Charles O'Neill

REF: **Ext:** 8-5161

Summary:

Your progress report (due 22nd) should be presented in a memo format similar to this document. The summary should give a concise description of what is critically important to your design. A summary might look like:

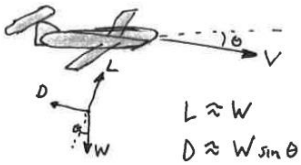
A glider carrying 4 quarters optimized for distance was developed and test flown with an L/D ratio of 15. The aircraft has a 4.0 foot wing span and an aspect ratio of 15 with a 10% cambered thin plate airfoil operating at CL=0.3 and Re=24000. 5 concepts were tested; the monoplane configuration gave optimal results by a factor of 2. The design is robust to variations in trim for a consistent 80 foot flight distance when launched at 6 feet. The configuration is shown below:

Discussion:

This discussion section should give the details of how you approached the design process. The document should have a clear description of what you did and why you did it. The overall process should be reflected in the summary. The discussion might look like:

The competition goal is to maximize the distance flown while carrying 4 quarters. A balsa sheet of no more than 36"x4", one paperclip, and 2 #64 rubber bands are the construction and launch materials.

Development of a performance model for the conceptual design and initial configuration selection (i.e. monoplane vs biplane) was conducted by transforming distance at a height to maximizing the L/D ratio.

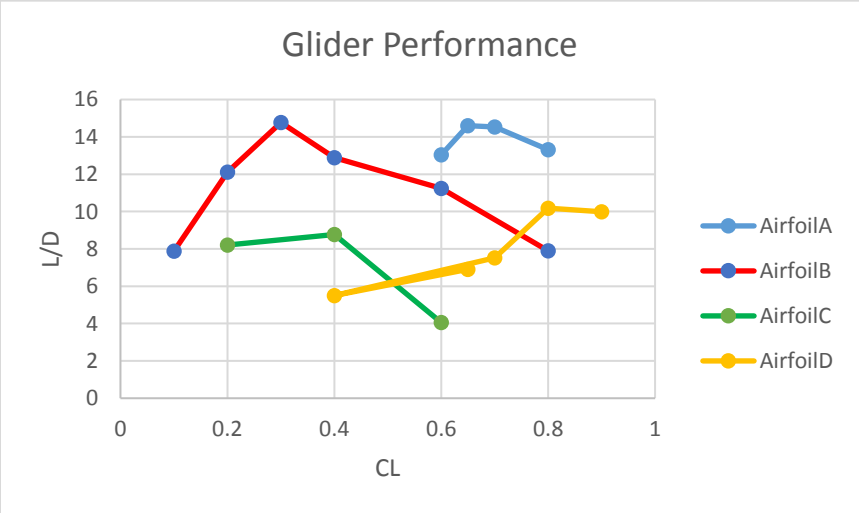


$$\frac{L}{D} = \frac{C_L}{C_D} = \frac{C_L}{C_{Do} + \frac{CL^2}{\pi ARe}}$$

An excel spreadsheet was developed to test multiple configurations with respect to the L/D ratio.

C_L	b	AR	S	$\lambda=1$ $\bar{c}$	C_{Di}	V	Re	$C_{Do_{airfoil}}$	C_D	L/D
			$=\frac{b^2}{AR}$	$=\frac{S}{b}$	$=\frac{C_L^2}{\pi AR_e}$	$\sqrt{\frac{2W}{\rho C_L b^2}}$	6350 VC	lookup from XFOIL at Re and C_L	$C_{D_o} + C_{D_i}$	$\frac{C_L}{C_D}$

Cdo was approximated with an XFOIL simulation of candidate airfoils at a specified Cl and Re. Flat and cambered airfoils were tested to determine both the optimal CL and AR. The current results indicate a maximum L/D of about 15 with two separate airfoil choices.



Future work will test additional airfoils and structural configurations. A cyclical optimization strategy will be used to alternate between optimizing each parameter individually.