University *of* Dayton

Department of Mechanical and Aerospace Engineering

MEE 440/AEE 521 – Flight Vehicle Performance/Dynamics
Project-1

This is an individual project – no partners allowed!

Aircraft: Use the Aircraft that has been assigned to you in-class and you will be working with the same aircraft for your Project-2 and Project-3.

We've covered the basics of aircraft analytical modeling, from the 6-DOF equations of motion to the longitudinal and lateral-directional aero coefficients. Using MATLAB/Simulink model that you created, you will simulate the aircraft response to various inputs. The project involves 2 parts:

1. Using the Homeworks 1-4, the simulink model and the aero-coefficients computed, excite the aircraft with the following inputs and present the following plots: Use the small perturbation Rectilinear EOM

   (a) Elevator doublet: $u, \alpha, \theta, \delta_E$ vs time

   (b) Aileron doublet: $\beta, \phi, \psi, \delta_A$ vs time

   (c) Rudder doublet: $\beta, \phi, \psi, \delta_R$ vs time

   (d) Write a short paragraph describing your results.

   Consider the magnitude of each doublet to be 2° with a duration of 2 seconds in each direction.

2. In this second part of your project: You will vary the following parameters from your baseline value (given in the aircraft data) and compute the aerodynamic coefficients (Homework- 3 and 4). Looking at the coefficients, explain what happened to the coefficient and how it affects the aircraft performance No more than a paragraph.

   (a) $X_{WH_R} \pm 15\%$

   (b) **Wing**

      i. Double the span $(2 \times b)$ and $\frac{c_R}{2}$

      ii. Half the span $(\frac{b}{2})$ and $2 \times c_R$

   (c) **Vertical Tail** - Double the dimensions of the vertical tail

   (d) **Horizontal Tail** - $\frac{c_{R_H}}{2}$

   (e) Change in aileron positions $(\frac{y_{A_I}}{2})$ and $(\frac{y_{A_O}}{2})$