

# Aerospace Engineering Thesis Defense

Open Loop Stability & Control Screening of High-Speed Slender Aircraft

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## Abstract

This thesis describes key Stability & Control parameters and a methodology to screening aircraft configurations for adequate handling qualities. For screening aircraft, a general-purpose Excel/ Visual Basic for Application (VBA) analysis tool was built. The analysis tool has built in functionality to analyze aircraft utilizing a rudder for primary yaw control, collective horizontal tail for pitch, and either ailerons or differential horizontal tail for roll control. Additionally, the tool transforms aerodynamic coefficients from the moment reference point to various center of gravity locations while saving data in Stability Axis and Body Axis; it also implements pitch trim. Key stability parameters of interest are the Short Period and Dutch Roll Frequencies, Roll and Spiral time constants,  $C_n\beta$ dynamic, Lateral Control Departure Parameter (LCDP), as well as the stick-fixed Short Period and Dutch Roll Damping. Other areas of interest include pitch and lateral-directional trim as well as the implantation of an Aileron-Rudder Interconnect system. This thesis uses the tool to analyze two historical: 1) the Bell X-2 and 2) the North American X-15 and two theoretical: 3) the "Sky Cruiser" and 4) the generic High-Speed Slender Aircraft (HSSA), aircraft. This thesis identifies varying Stability & Control problems between these aircraft and allows one to explore potential solutions to remedy their inherent flaws.



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Zoom Link: <https://asu.zoom.us/j/9489403444>