Aerospace Engineering Thesis Defense

Fundamental Assessment of High-Speed Aircraft Stability and Control from Historic Flight Tests

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Abstract

This work uses ASU's newly developed high-speed vehicle stability and control screening methodologies to reverse-engineer famous USAF flight tests from the 1950s and 1960s. We analyze the root cause of Chuck Yeager's fateful 1953 supersonic spin in the Bell X-1A to become the "Fastest Man Alive". We then take a look back at Neil Armstrong's inadvertent atmospheric skip in the North American X-15 and his subsequent hypersonic flight months later. Our fundamental flying qualities assessment begins with calculating rigid-body frequencies and damping ratios of an aircraft to MIL Standard requirements, and uses these to create a full, classical stability and control analysis of a high-speed vehicle. Through reverse engineering the flight envelopes and missions for the above aircraft, it appears that the near-disasters of each flight were due to a confluence of then overlooked, yet fundamental, aerodynamic instabilities.

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