Approach Stability from FDM Data

Introduction

The Embry-Riddle Aeronautical University Prescott campus maintains a fleet of twenty aircraft, sixteen Cessna 172s and four Diamond 19A/19DGs, which are all equipped with flight dynamics modeling (FDM) capability. The data can be used to develop new design concepts, compare company operational policies, generate new training, and simulate new operations with existing aircraft and procedures and study the impact on any hardware. This research is currently being performed and validated by all parameters by the NASA Ames research institute.

Hypotheses

1. Approach not meeting the SAE condition requirements could be more frequent than predicted during the day

2. Approach not meeting the SAE condition requirements could be more frequent than predicted during the day

3. Approach not meeting the SAE condition requirements could be more frequent than predicted during the day

Method

- **System**:
  - Flight data was recorded on an SD card within the multi-function display of the Garmin G1000 system.
  - Capable of recording 64 parameters at a 2 Hz frequency
  - Data extraction from the multi-function display at intervals consisting of two weeks of flight time
  - Analyzed by software that has been developed by Garmin and Embry-Riddle Aeronautical University

- **Definition of a Stable Approach**:
  - The EASA Flight Operation Manual defines the stability of an approach with regard to:
    - Constant final approach path altitude
    - Airplane trimmed to maintain final approach path altitude
    - Airspeed within 5 kts of approach speed (VREF)
    - Landing gear retracted
    - Airplane on proper approach path to decision point
    - Airplane properly profiled with runway in sight

- **The stability of the approach should be determined using the PDH above the ground.

- **Project Details**:
  - Data encompasses all of the Prescott campus Citation 172s New 172 flight hours between June 01, 2013, and December 31, 2013.
  - Approximately 300 total flight hours, and 15,000 landing were recorded during the period.
  - The authors during this study were not aware of the frequency of these events.
  - The data shows that the frequency of these events is between the airports included are KRFL, KPRC, KFAO, KLEN, KBUR, KELF, KLHI, KLSE, and KLFG.

Conclusions

1. Hypothesis 1 is not statistically significant. Of flights that were determined to be unstable, approximately 30% were around and approximately 70% continued to a landing.
2. Hypothesis 2 may be due to the fact that the day's stable approach is more frequent than the unstable approach. At night, the frequency of stable and unstable approaches is approximately equal.
3. Hypothesis 3 is statistically significant at all airports other than KPRC, a stable approach is more frequent than an unstable approach. The deviation between an approach to KPRC and all approaches to an airport is no more than 3%

Findings, Problems, and Future Directions

- Approximately 2% of approaches classified as stable had more than one cause for the classification. Approximately 50% of unstable approaches were correlated to pitch. There are allowances that we cannot administer correctly in terms of pitch. They might have a concernable stable approach to be correlated to an unstable approach. They should be different in certain cases more than 3% in Figure 1.
- Approximately 2% of unstable approaches were correlated to pitch. Angles might have caused the stable approach to be misleading or inadequate. An approach has been considered to be stable and an approach has been considered to be unstable.
- A future version of this program will correct any speed calculations. For wind and any other disturbances.

-- Julie Bales, Embry-Riddle Aeronautical University - Prescott
-- Brian Roggow, Dept. of Flight Safety, Embry-Riddle Aeronautical University - Prescott