Automated Monitoring, Feedback, and Reporting for an Aviation Performance Study

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start something big

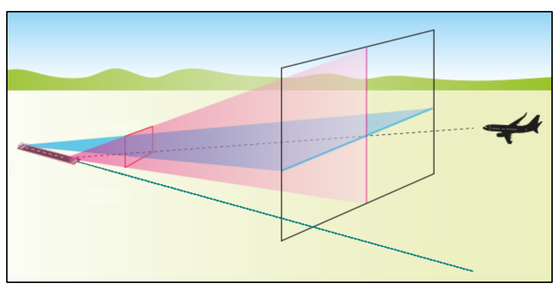
Introduction

A collaborative research project between the EWU Departments of Computer Science and Psychology is studying the effects of medication for attention deficit hyperactivity disorder (ADHD) on pilot performance as they conduct a variety of maneuvers in a flight simulator. This poster addresses the need for an automated real-time monitoring system with three objectives:

1. To monitor actual versus expected performance.
2. To provide feedback on how to correct for performance deviations.
3. To generate a summary performance report.

Instrumentation

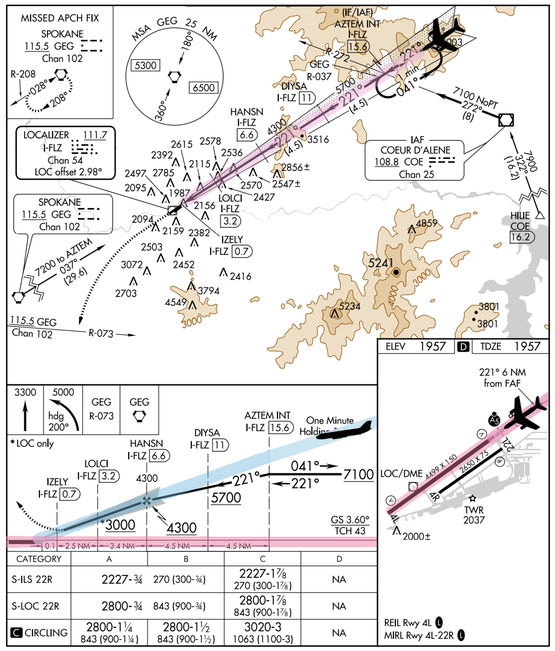
The focus of the study is primarily on landing maneuvers using the instrument landing system. It provides guidance down to the runway on the horizontal (blue) and vertical (red) axes. The expected flight path is the intersection along the dashed line.



From the pilot's perspective, this intersection is presented on an instrument showing the airplane's actual position relative to the expected position on horizontal (localizer) and vertical (glideslope) needles. For example, these respectively depict on target, left of center, high, and right low. The corresponding corrections are to do nothing, turn right, descend, and turn left and climb.

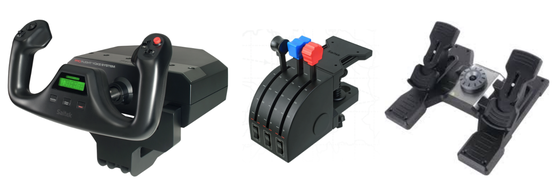
Navigation

The three-dimensional guidance is presented on a series of FAA two-dimensional navigation charts. This depicts an approach to Spokane Felts Field:



Simulation

The flight simulator is X-Plane 11 outfitted with a yoke, throttle quadrant, and pedals for realistic control inputs:



Implementation

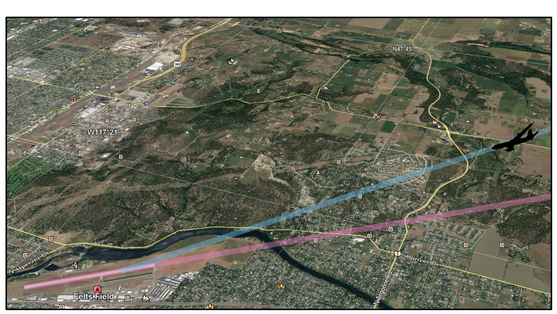
The monitoring software continuously reads the actual performance data from the simulator, calculates the expected performance, measures the deviation, decides on appropriate corrective action, verbally announces it to the pilot, and records these events.

Virtual Calibration

The software needs to agree with the simulator, the real world, and FAA data, which was challenging because they all have different representations with unique errors. To be reliable for a study, it must be able to attribute errors solely to the pilot. This required extensive virtual calibration using published GPS coordinates.

Google Maps provided a two-dimensional top-down perspective:

Google Earth provided a three-dimensional perspective, which is more informative, but harder to interpret and evaluate:

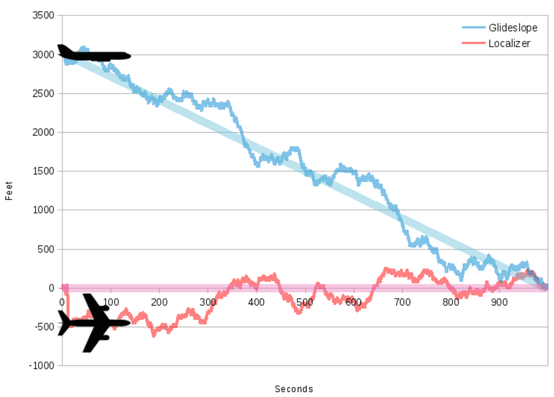


Physical Calibration

Real-world calibration using GPS data from the actual runway and an airplane flying the approach provided the final corrections:

Results

Excel graphs present the final results (actual versus expected) from side and top perspectives:



Conclusion

A preliminary study is underway to work out any issues in conducting the experiments. The full-scale study is planned for the fall. The software appears to be meeting its objectives.