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Why Do Airplanes Crash?

Investigating Air Data Systems

What?

Over the past four decades, hundreds of passengers have died as a result of failures in the guidance, navigation, and control systems of commercial aircraft. Often, the failures are in the a fault-tolerant sensor system called the *air data inertial reference unit* (ADIRU). The ADIRU captures data from airspeed sensors, gyros, GPS, barometers (for altitude), and other sensors. Indeed, the 2009 Air France Flight 447 crash in which 228 people died is blamed in part on ADIRU failures.

While research into ADIRUs can help make them safer, ADIRUs are proprietary systems, making research about them difficult. **The goal of this project is to build a model open-source ADIRU for use in research and accident investigation.**

Project Results

The Capstone group will have significant flexibility in deciding how to construct the ADIRU, particularly since there is little public data about their design. Here are some general goals:

- Construct a small, low-power system. We'd like to strap it on a small R/C aircraft to get data (recorded onto, say, an SD card).
- Investigate fault-tolerance. This means multiple micro-controllers monitoring multiple sensors, comparing the results. Depending on interest, we can even try to model multiple power sources.
- Sense air speed (air pressure sensors), position (GPS), and gyroscope. Other sensors are optional, including barometer (altitude), sonar (altitude), etc.
- We use as much open-source hardware and software as possible. For example, Arduino <http://www.arduino.cc/> micro-controllers would make excellent choices. You are encouraged to "steal" code from open-source autopilots (e.g., ArduPilot <http://www.sparkfun.com/products/8785>) and other sources to make progress.
- The design roughly follows what is publicly known about ADIRU design <http://en.wikipedia.org/wiki/Air_Data_Inertial_Reference_Unit>.

The interesting part then is to try to simulate the cause of recent aircraft crashes. We'll see if we can't understand what can cause such failures. You'll also get to fly an R/C plane. :) Depending on the results of the project, we will possibly publish a paper.

More Information

- Sponsor: Galois, Inc. <http://corp.galois.com/> An R&D company in downtown Portland.
- **No drug-tests, no non-disclosure forms.**
- **The results will be made open-source.**

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