Daedalus Human Powered Airplane Instrumentation

Background

The M.I.T. Daedalus Project was building a human powered aircraft to duplicate the flight of Daedalus from the island of Crete to mainland Greece, a distance of sixty-nine miles. They had started the design of an automated flight computer (autopilot) to help free the pilot from the moment-to-moment control of the aircraft but did not have the technical resources to complete the project on time. The autopilot system consisted of pitch and roll sensors, an airspeed sensor, a heading sensor, a fluxgate compass, an altimeter, an analog computer and a display computer.

System Overview

Bolton Engineering undertook the design, construction and testing of two pieces of the autopilot system: the pitch and roll sensors, and the display computer. The electronics had to be both small, lightweight and low-power.

The pitch and roll electronics integrated the output from rate gyroscopes to generate pitch and roll signals. Chopper-stabilized techniques minimized drift due to offsets and temperature drift. A custom miniaturized multi-output DC-DC converter was designed to power the rate gyros and rate gyro interface from the aircraft bus 5V supply.

The display computer was constructed around a single-chip microprocessor (80C31), an analog-to-digital converter, an LCD driver, and a lightweight Polaroid plastic LCD. The sensor inputs were digitized, averaged, scaled and displayed on the LCD to create an artificial horizon bar graph, a pitch bar graph and a digital airspeed display. An electroluminescent backlight provided easy readability under a variety of ambient light conditions.

Results

- Delivered rate gyro and display subsystems four weeks after the start of the project.
- Performed extensive testing to validate the performance of the sensors and system; a ten page report was written to describe tests performed.
- Display software required no changes after it was transferred to Daedalus

Project Scope

Bolton Engineering designed, tested and constructed the rate gyro interface board and the display computer board, wrote the software to drive the airspeed and pitch/yaw display and submitted a report on system performance.

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