Using Piezoelectric Sensors to Find the Center of Gravity of an Aircraft

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My project “Piezocentricity” will save time as well as lives. On August 25, 2001, a small Cessna passenger plane crashed and burst into flames shortly after takeoff, killing all aboard. The National Transportation Safety Board concluded that the aircraft was loaded outside of Center of Gravity (CG) limits. CG is the fulcrum point on which the stability of the aircraft balances. Any radical departure from the aircraft manufacturer’s CG limits results in the lack of aircraft elevator (flight control) authority and loss of pitch (nose up /down) control. Currently, Center of Gravity (CG) is calculated manually by identifying passenger and cargo weight locations, embedding those values into moment arm formulas, and deriving a summation CG. This process is notably time consuming and error prone. My research centered on piezoelectric sensors and how to incorporate them into a circuit. My project is to design and develop an electronic system that uses multiple piezoelectric sensors to detect weight placements, emit and amplify their electrical signals, and sum these signals to provide instantaneous CG information to pilots. During testing, different weights were placed on the sensors at varying distances. This produced an output that was routed through an Arduino circuit board resulting in an accurate CG output. My results indicate that numerous piezoelectric sensors can be modified to make Piezocentricity viable. Hence, using my electronic circuit design, flight crews could make the necessary adjustments to cargo and personnel positioning to get their desired CG for a safe takeoff and flight.

Awards Won: