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# Engineers test for damage to commercial aircraft

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UC San Diego structural engineering grad student Gabriela DeFrancisci has been testing damage to composite aircraft materials from hail, ice and ground service equipment vehicles.

Hail, ice, and ground service equipment vehicles can cause severe — but hard to detect — damage to components of commercial aircraft made of composite materials.

Airlines, aircraft manufactures and academic researchers are working to develop new ways to detect this type of damage. For the past two and a half years UC San Diego structural engineering graduate students Gabriela DeFrancisci and Zhi Chen, and professor Hyonny Kim, have been testing composite aircraft materials in UC San Diego's Powell Labs, using different equipment such as a tension/compression machine for the smaller specimens and a shake table for the larger specimens.

DeFrancisci will highlight this research during the Jacobs School of Engineering's Research Expo on April 14. Her poster is titled "High Energy, Wide Area, Blunt Impact on Composite Aircraft Structures," will be one of 250 research posters that engineering graduate students will present at Research Expo.

The goal of DeFrancisci's research is to determine what blunt impact scenarios are commonly occurring in commercial composite aircraft and to understand what type of damage it creates. Composites are said to be one of the most important materials to be adapted for aviation since the use of aluminum in the 1920s. One of the benefits of using composite materials is that it allows the aircraft to be lighter, and therefore reduces fuel consumption. Composite materials are also strong, stiff, and more corrosion resistant than metallic aircraft.

"With new all-composite fuselage transport aircraft coming into service, significantly more composite skin surface area is exposed to contact with ground service equipment," DeFrancisci said. "With a metallic aircraft, this type of impact event would create a visible dent. Composites tend to rebound back to their original shape, which would make this type of accident difficult to detect. We are interested in creating damage that is extensive on the interior but can't be visually detected from the impact side. We are interested in characterizing, not minimizing, the damage. This will help the airline industry learn what type of damage to expect for impacts at different locations."

DeFrancisci will use the data collected from her research to develop and validate a methodology to predict damage in the actual structure caused by these types of impact events.

"We have successfully created extensive damage in our test panels without visible damage to the outer surface," she said. "In the smaller specimens we compared rigid metal impactors to rubber bumpers commonly found on ground service equipment. The rigid impactor caused a hole in the panel, the rubber bumper spread the load out and caused the extensive damage without visual detectability that we are interested in," DeFrancisci said. "Our next round of specimens will be much larger, and we are going to test them dynamically."

Provided by University of California

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