New project to detect possible damages in aircraft parts early in process

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UT Arlington engineering professors have received a $451,781 Air Force Office of Scientific Research grant to examine the material surface at the micro- and nano-scale level that will provide clues for predicting fatigue in aircraft parts.

Haiying Huang, professor of Mechanical and Aerospace Engineering, said the new technology and process would be better and more efficient than taking X-rays of an aircraft's wing.

"We'll be able to determine metal fatigue at very early stages when we look at it on this scale," Huang said. "Certain patterns of surface roughness changes will tell us how the material will behave when put under the fatigue of flying."

In addition, the team received a $348,385 grant from the Defense University Research Instrumentation Program of the Air Force Office of Scientific Research to purchase two pieces of equipment that will help gauge the wear on these aircraft parts.

The highly competitive DURIP grant will allow Huang to purchase a scanning whitelight interferometric surface profiler integrated with a compact mechanical tester and an electron backscatter diffraction module.

The surface profiler provides researchers with in-situ three-dimensional surface profiling of fatigued specimens. The diffraction module will be

retrofitted with a scanning electron microscope to allow researchers to measure dislocation patterns in the fatigued material.

Stathis Meletis, professor and chair of the Materials Science and Engineering Department, is helping on the project.

Meletis said one strength of the system is that testing can be done in a non-destructive way while the aircraft is in service.

"You can take your readings while the aircraft is on the runway," Meletis said. "You don't have to take measurements in a component in the lab and test it there."

Huang said the instruments make it possible for researchers to look at the material's crystal structure.

"It's at that level, that we can begin to assess metal fatigue. That's at the very beginning of the process," Huang said. "Those crystals and how they behave can tell us how the material's life will unfold. It speeds up the experiment process."

Finding out early on in the fatigue process is a key point in ensuring safety and reducing cost, both professors said.

Khosrow Behbehani, dean of the College of Engineering, said the AFOSR grant will provide a wonderful opportunity for increasing the safety of flights.

"This investigation will provide a convenient way of monitoring the airworthiness of a plane and that will be vital to the military and the flying public as well," Behbehani said. "It addresses the number one priority in aviation, safety."

Behbehani added that the equipment will benefit both departments, as well as any other departments, school or colleges that collaborate with engineering faculty.

Provided by University of Texas at Arlington