Smart Technology Rotorcraft Application Under Way at the Boeing Company

New rotor technology that promises to take helicopter flight into the 21st century is under development by The Boeing Company.

Boeing engineers in Mesa and Philadelphia are studying the feasibility of several concepts that integrate smart materials into helicopter rotor blades under a program sponsored by the Defense Advanced Research Projects Agency (DARPA). Smart materials are substances that change shape when stimulated with thermal, electrical or magnetic energy, and return to their original shape when the stimulus is removed.

Application of smart materials to helicopter rotor blades promises to improve rotor aerodynamics and reduce vibration and noise levels, says Roger Hunthausen, manager of Technology Development at The Boeing Company in Mesa, Ariz.

In Mesa, engineers have been outfitting rotor blades with actuators that control small trailing edge flaps and a tracking tab. The actuators, made from smart materials, are electrically stimulated to move a flap to reduce overall rotor vibration, or the angle of a tracking tab, to improve the alignment of the rotor blades.

In Philadelphia, Boeing engineers teamed with the Massachusetts Institute of Technology have been working on embedding smart material fibers into rotor blades. The fibers, when electrically charged, will twist the rotor blade several degrees.

All of the concepts aim to take advantage of aerodynamic forces to increase or lessen the amount of lift. The company will continue to study these concepts to determine which is most viable. Engineers from both the Mesa and Philadelphia sites will then work together to develop a technology demonstrator based on the selected concept.

Glenn Rossi, smart materials program manager in Boeing-Philadelphia, says a possible application for smart technology is the company's V-22 Osprey tiltrotor program. "By applying smart materials, the prop rotors can be twisted in flight to optimize performance in both hover and forward flight modes," said Rossi.

Outside of gains in aerodynamic performance, the application of smart materials to rotor blades promises significant reductions in vibration, says Hunthausen. "This will result in improved component life, increased aircraft availability, and reduced maintenance costs." In addition, smart materials will help rotorcraft flight become quieter and more comfortable for pilots and passengers, he said.

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