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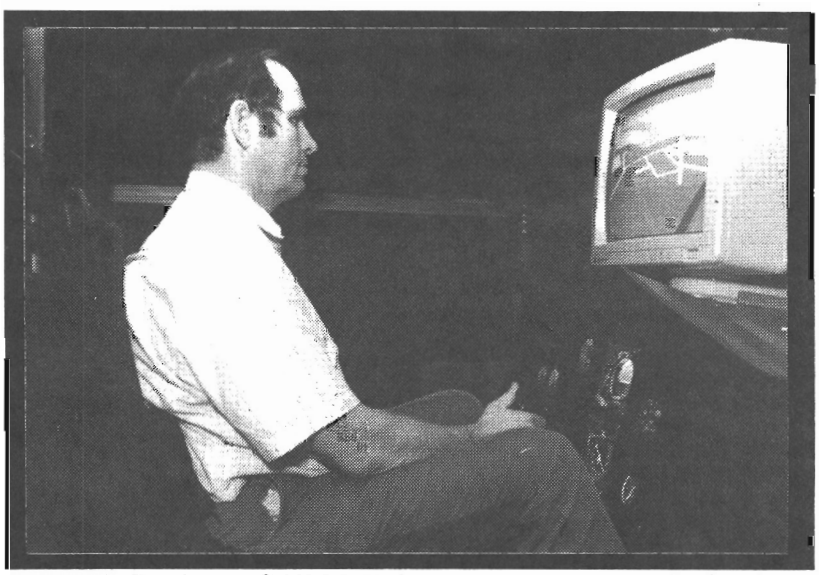
HOW GOOD MUST FLIGHT SIMULATORS BE? NEW ROTORCRAFT SIMULATOR WILL HELP HOLD DOWN U.S. ARMY'S TRAINING COSTS

How good must a flight simulator be to efficiently train new helicopter pilots?

That's a question Georgia Tech engineers hope to answer with the help of a new rotorcraft simulator system recently installed on the Tech campus in Atlanta. The research could lead to development of a new class of low-cost flight simulator which would help the U.S. Army hold down the expense of training its helicopter pilots.

The simulator system, which relies on a high-speed parallel processing computer, could also help rotorcraft manufacturers and government agencies test new helicopter concepts, said Cliff McKeithan, research engineer with the Georgia Tech's Center of Excellence in Rotary-Wing Aircraft Technology (CERWAT).



Research Engineer Cliff McKeithan uses a rotorcraft simulator being developed to help the U.S. Army set standards for training simulators. (Color slide or B&W print available)

The simulator is believed to be the first parallel-processing rotorcraft simulator to be located on a U.S. university campus. The project is sponsored by the U.S. Army Project Manager for Training Devices (PM-TRADE) and the Army Research Institute (ARI). In addition to the CERWAT personnel, the project will also involve researchers from the Georgia Tech Research Institute (GTRI).

Flight simulators are widely used to train both civilian and military pilots of fixed-wing aircraft because their operating costs are much less than those of real aircraft.

But because helicopters are capable of more complex

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flight maneuvers, rotorcraft simulators must process substantially more information, placing heavy demands on their computing equipment. The heavy computer demands, in turn, make the rotorcraft simulators more expensive -- in some cases, as much as the real helicopter, McKeithan said.

The project will attempt to determine the standards required of the simulators' video displays and instrumentation.

"Ideally, you'd want it to be absolutely the highest fidelity in every aspect, but each level of fidelity comes with an additional level of cost," he explained. "We would like to get the cost of simulators down enough so that you could put one in every unit using the helicopter."

Cost savings to the U.S. Army could be substantial, permitting more simulators to placed in the field. That could improve training and readiness. The simulator could also be used by rotorcraft designers, and by other government agencies.

One cost-cutting example may be the linear "tape gauges" which provide the pilot with indications of engine output and other key variables. The gauges used in real helicopters cost as much as $40,000 each, but the project will study simulating the same information with LED displays costing just a few hundred dollars.

The Georgia Tech simulator will first emulate the Army's UH-60 Black Hawk helicopter. Future plans also call for a simulation of the Apache, and the system will be capable of emulating any rotorcraft for which mathematical models are available.

The project's first phase will include only forward-looking displays. But since hovering activities are crucial for helicopter pilots, side-looking displays will be added later. The system will also have the capability for simulating an enemy aircraft, allowing pilots to take part in mock combat.

If the work is successful, the benefits to the Army could be substantial. Operating costs for helicopters can be as high as $1,400 an hour, compared to just $50 an hour for a simulator. Reducing the purchase price of the simulators could put more of them in the field, meaning fewer real training flights.

Simulators can also serve aircraft designers, as well as government agencies which may be considering the purchase of a new helicopter. Mathematical models which simulate the flight characteristics of a proposed new aircraft allow it to be thoroughly tested before the first prototype is built. Initial testing on a simulator allows the manufacturer to work out any "bugs" that may exist in a new design, and helps assure the purchaser that the craft will perform as intended.

Simulators using databases of information about real landscapes and targets can also be used to help pilots rehearse for important combat missions.

One important consideration facing designers of rotorcraft simulators is preventing pilots from undertaking maneuvers the real aircraft could not handle.

"You don't want to instill bad habits," McKeithan explained. "You should learn to fly the aircraft so that you do not damage it."

But the simulator will do something no pilot would want to do for real -- it will crash.

"We can let the pilot make mistakes, and you can reinforce the idea that he made an error by letting him crash the simulator," he said. "The second time around he's going to remember."

The flight simulator is equipped with the FlightLab 480 simulation software from Advanced Rotorcraft Technologies, Inc. The computer system is a Silicon Graphics VTX 380 Powervision Series work station featuring eight parallel processors.

This research is sponsored by the U.S. Army Project Manager for Training Devices and the Army Research Institute, through the Naval Training Systems Center.