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Welcome New Subscribers!
If you are receiving this newsletter for the first time, SimLabs News is a quarterly publication reviewing current projects at the NASA Ames Simulation Laboratories (SimLabs). The facilities support government as well as private industry in a wide array of applications. To find out more, read on!

1. Improving Safety for the RASCAL

Figure 1: Army RASCAL Research Helicopter

The US Army Aeroflight Dynamics Directorate located at NASA Ames operates a research helicopter called the RASCAL. The RASCAL is a Blackhawk modified for fly-by-wire control systems research. Fly-by-wire means the control elements are actuated electronically rather than mechanically.

The RASCAL vehicle has two flight control systems. One is the research fly-by-wire system (RFCS) which is flown by the Experiment Pilot on the right seat. The other is the standard Blackhawk mechanical system, which is kept as a safety back-up and is flown by the Safety Pilot on the left seat. Control automatically switches to the Safety Pilot if the system detects a failure in the RFCS.

In a recent simulation, Army researchers evaluated safety improvements to allow landing with the RFCS engaged. Currently, the Safety Pilot must take control for low altitude maneuvers or to land.

SimLabs' Vertical Motion Simulator (VMS) modeled two configurations. In one configuration, a safety pilot flew the baseline Blackhawk model with full motion. For the other configuration, an evaluation pilot controlled the aircraft via a desktop set of inceptors in the lab representing the fly-by-wire research Flight Control System.

A requirement to be able to switch between the two configurations during a run was especially challenging for VMS engineers. The control software had to ensure that the transitions between the two configurations were smooth even during a failure or after large pilot inputs.

The Army's objective is to be able to operate RASCAL below 25 feet altitude with an acceptable level of risk. RASCAL could then be used to research flight control system enhancements and new guidance displays that would assist the pilot in landing a helicopter in unfavorable visual conditions.

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2. Controlling a Heavy Lift Cargo Helicopter

Imagine trying to fly a helicopter carrying cargo like this. Handling qualities requirements for heavy lift military helicopters were extensively studied at NASA's Vertical Motion Simulator (VMS) in the 1990's, but several issues remained.

Figure 2. CH47D Cargo Helicopter

A commercial company, with funding from the U.S. Navy, conducted a simulation earlier this year in the VMS to resolve issues and expand areas that were not included in the earlier tests.

The study evaluated a number of helicopter configurations and control system variations, for example:

- Two pitch and roll response types: Attitude Command/Attitude Hold (ACAH) and Rate Command/Attitude Hold (RCAH). In the previous simulations only ACAH was evaluated.
- A single-main-rotor model. A generic tandem-rotor (similar to a CH-47) used in the earlier simulations.
- A gross weight (helicopter plus load) of 80,000 lbs, including loads that weigh more than the helicopter. A weight of 46,000 lbs was tested in the previous simulations.
- A dual-hook load attachment. A single hook model was used in the earlier simulations.

The helicopter model was provided by the customer and resided on a separate computer that was integrated with the VMS real-time operating environment.

Pilots from the US Navy, Marines, Army, Sikorsky Aircraft, and the Royal Air Force completed over a twelve hundred evaluations. The data from this and seven previous VMS simulations on helicopter slung load operations will be used to update the US Army standard for helicopter handling qualities, ADS-33E-PRF.

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3. SimLabs Models Data-link for Automation Research

What is the safest and most efficient way to move aircraft through today's airspace? Researchers at NASA Ames are studying cockpit automation as one approach. In this strategy, air traffic control computers would transmit flight plan changes directly to cockpit on-board computers.

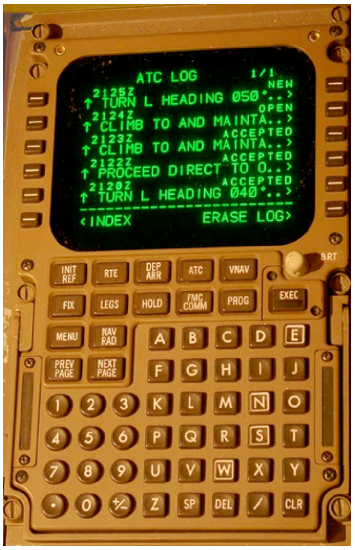

Figure 3. B747-400 Simulator Flight Management System

A series of studies are being conducted in NASA's Crew Vehicle Systems Research Facility (CVSRF) to look at Trajectory-Based solutions to aircraft conflict resolution. NASA's VAST network architecture for distributed simulation was used to connect the Center/TRACON Automation System (CTAS) Laboratory and the SimLabs' Boeing 747-400 simulator.

Ground-based computers, looking at all traffic in a given portion of airspace, can theoretically devise trajectories that could identify conflicts and compute 4D (3D plus time) resolutions to problems. The computers could data-link flight path modifications directly to the aircraft's Flight Management Systems (FMS).

The latest study investigated how negotiations would proceed using the current data-link system, Controller-Pilot Data Link Communications (CPDLC), if the flight plan modifications were not acceptable to the flight crew. Pilots consider performance, weather and route efficiency when deciding whether to accept a route modification.

If the requested modification from ATC is not acceptable, the research question is how the data-link system can support efficient and effective negotiations between the flight crew and controller to accommodate ATC needs.

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4. Thinking of Doing Business with NASA SimLabs?

For more information on what we can do for your needs, contact:

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