NASA SimLabs News

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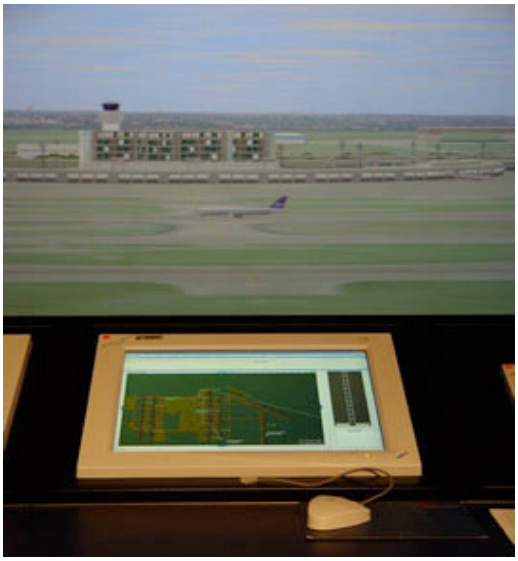
Welcome New Subscribers!
If you are receiving this newsletter for the first time, SimLabs News is a quarterly publication reviewing current projects at the *NASA* Ames Simulation Laboratories (SimLabs). *NASA* SimLabs is comprised of three unique Flight Simulators, an Air Traffic Control radar simulator and a high fidelity Air Traffic Control Tower simulator. The facilities support government as well as private industry in a wide array of applications. To find out more, read on!

1. VAST Developments Allow SimLabs to SOAR

NASA SimLabs supports research in developing technologies and procedures to maximize the efficiency of airport surface operations without compromising safety. SimLabs is currently preparing for simulation of a futuristic Surface Operation Automation Research (SOAR) concept sponsored by the Virtual Airspace Simulation Technology Real-time (VAST-RT) project.

In February 2005, SimLabs conducted *VAST-RT* Interim Test #7. FutureFlight Central provided the Dallas/Fort Worth International Airport (DFW) environment, and the Crew Vehicle System Research Facility Advanced Concept Flight Simulator (ACFS) provided the simultaneous cockpit environment. In the test, SimLabs developed data-link interface between controllers and pseudo-pilots, and integrated the *SOAR* surface management tool developed by Optimal Synthesis, Inc (OSI), under the Virtual Airspace Modeling and Simulation Project (VAMS) contract. The tool generates aircraft taxi-routes and crossing clearances, detects taxi-route conflicts, monitors approaching and departing aircraft, and provides controllers with an interface to monitor traffic compliance.



SOAR Ground Management Tool in FutureFlight Central

Interim Test #7 successfully demonstrated the proof-of-concept of the *OSI* tool. The next step is to conduct the *SOAR* concept simulation in 2006. This simulation will test the ability of OSI's flight deck automation and ground management tools to improve airport and airspace capacity.

The *SOAR* decision support tool will determine taxi clearances with timing information advising when the aircraft

should arrive at certain points on the airport surface. Data-link communications will be used to convey clearances to the flight crews in the *ACFS* and at pseudo-pilot stations. Flight crews will rely on the *SOAR* flight-deck automation tool to provide safe guidance and improve efficiency of the clearance. Controllers will monitor conformance to the clearances and handle anomalous situations.

The anticipated benefits from the *SOAR* concept are improved situational awareness, reduction or elimination of aircraft stopping or holding on the surface, and enhanced safety through accurate prediction of impending conflicts. Human performance issues with regard to changing roles and responsibilities of the pilot and controller associated with the new automation tool will be studied.

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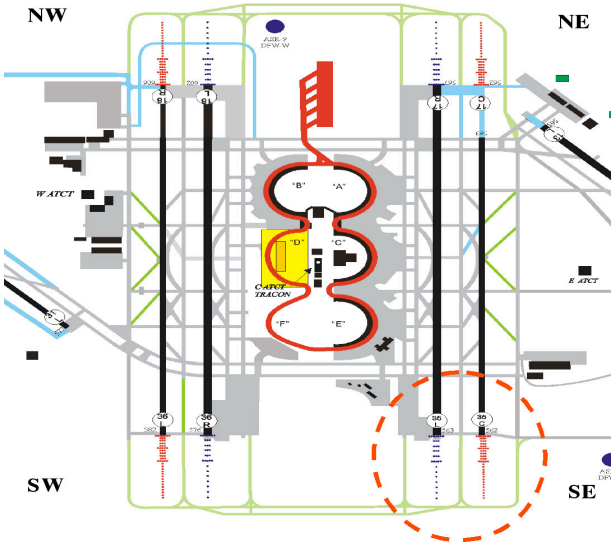
2. FAA Uses SimLabs to Establish Standards for End-arounds at DFW

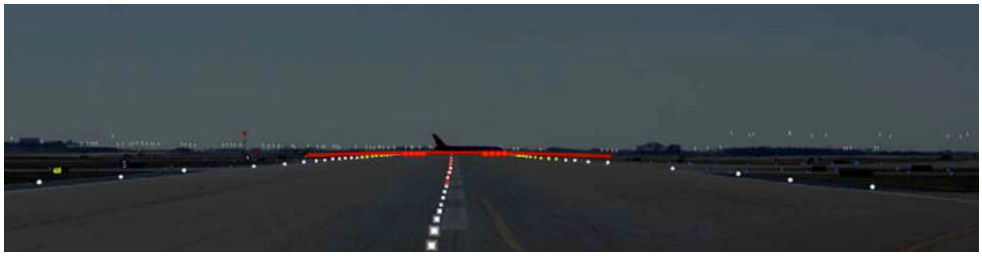
The Dallas/Fort Worth International Airport (DFW) proposes the construction and operation of the End-around Taxiways (EAT) for runways on both the east side and west side of the airport (see diagram below). Federal Aviation Administration (FAA) and MITRE Human Factors Researchers along with personnel from the Dallas/Fort Worth Airport, Airline Pilots Association (ALPA) and the FAA Flight Standards are studying whether pilots can distinguish an aircraft is crossing at the departure end of the runway or using the *EAT*. Aircraft crossing the departure end of the runway while another aircraft is on take-off roll creates a runway incursion hence an unsafe condition.

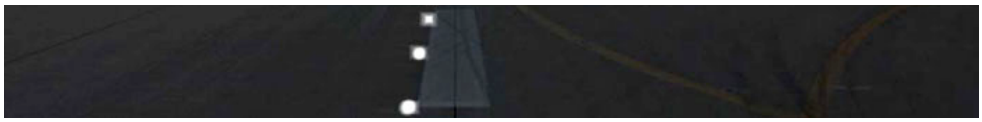


DFW End-around Taxi System

An *EAT* proof of concept study was conducted at NASA Ames at the SimLabs' Crew-Vehicle Systems Research Facility (CVSRF) using the 747-400 simulator in February 2005. After analyzing the results of that simulation, *FAA* researcher Mark Reisweber stated, "we have determined that there is sufficient evidence, within both the objective and subjective data collected, that indicates it is not easy for pilots to determine whether an aircraft is incurring the runway or safely operating on the respective *EAT*. Simply put, there may be confusion, in the minds of the flight crew, individually or collectively, between what might be an *EAT* aircraft versus a crossing aircraft. It's the consensus that we must eliminate the confusion entirely before *EAT* operations can be put in place."

In late March, the *FAA* returned to the *CVSRF* for a follow-on study. This study used masking techniques to obscure part of the aircraft on the *EAT*. The theory is that masking will create an occlusion in the scene which would enable pilots to discern whether the aircraft was on the *EAT* or crossing at the departure end of the runway. Two techniques were examined in this study. The first technique used screens at different heights, located beyond the departure end of the runway to block part of the aircraft from the view of the pilot taking off. The second technique used depressions at different depths to lower the level of the aircraft on the *EAT* below the runway surface, thus obscuring the *EAT* aircraft from the view of the pilot taking off. Researchers tested the pilots' ability to correctly discern the location of the crossing aircraft (crossing the runway or on the *EAT*) and whether it was before or after the critical (V1) speed. Evaluations were made under both the day and night visual conditions.





Pilot's view of aircraft on perimeter behind 8 ft. screen

Pilot's view of aircraft crossing runway on Taxiway B in front of 8 ft. screen

Based upon the results of this evaluation and anticipated further industry and *FAA* discussions, a decision on *DFW* operational approval is anticipated. The results of this analysis will be used as part of a joint effort toward developing a national standard for *EAT* operations.

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3. Army Studies Helicopter-UAV Teaming

Imagine under the cover of darkness, an unmanned aerial vehicle (UAV) circles over an enemy position to identify and designate targets for a pilot a distance away. The U. S. Army is planning to develop a network of piloted helicopters and *UAVs* to do just that. Manned-Unmanned teaming can enhance the survivability and effectiveness of battlefield helicopters. Pilots in the air or at a ground station will use images from the *UAVs* to provide them with an eye-in-the sky and improved situation awareness.

With the increasing availability of *UAVs* in the fleet, the Army Aeroflightdynamic Directorate (AFDD), located at *NASA* Ames Research Center, seeks to understand the manned-unmanned interface issues. Specifically, the *AFDD* human factor researchers are investigating the effects of sensor display format and levels of control on co-pilot performance, workload, and situation awareness.

Figure 1: Shadow 200 UAV

Figure 2: Apache Longbow

The AFDD UAV Simulator (USIM) Laboratory and the *NASA* Ames SimLabs will join to form the Manned-Unmanned Teaming (MUT) simulation in July 2005. The USIM will emulate two Shadow *UAVs* (figure 1). The SimLab's Vertical Motion Simulator (VMS) will emulate the Apache Longbow helicopter (figure 2). Different display formats such as side-by-side views or picture-in-picture views of two *UAVs* sensors will be evaluated. Additionally, various levels of control that the co-pilot will have on the *UAVs* will be evaluated. The levels of control can range from just audio communication with a ground control station to direct co-pilot's control of the *UAV*'s flight path and sensors.

A real-time High Level Architecture (HLA) based connection will be established between the two labs to provide state and command updates for the simulators. Different flight paths for the Apache will be recorded and played back during the simulation. The simulation will provide a better understanding of the issues involved in designing the interface between piloted aircraft and *UAVs*.

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4. Thinking of Doing Business with *NASA* SimLabs?

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

Thomas Alderete, Assistant Division Chief for Simulation Facilities
Thomas.S.Alderete@nasa.gov
650.604.3271

Ken Christensen, SimLabs Business Development Manager
K.Christensen@nasa.gov
650.604.0188

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