

Annex C

Abstracts of Academic Papers on the Subject of the Transfer of Learning from FSTDs to Aircraft

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ABSTRACTS OF ACADEMIC PAPERS ON THE SUBJECT OF THE TRANSFER OF LEARNING FROM FSTDs TO AIRCRAFT

Lintern, G., Roscoe, S.N., Koonce, J.M., Segal, L.D. (1990) Transfer of Landing Skills in Beginning Flight Training. *Human Factors*, Vol 32, 3, pp 319-327.

Beginning flight students from the University of Illinois flight training program were given two sessions of landing practice in a simulator with a computer animated contact landing display before they commenced intensive landing practice in the aircraft. For each experimental student there was a control student, paired with the same instructor, who received no landing practice in the simulator. Experimental students required significantly fewer presolo landings in the airplane than did the paired controls, representing a potential saving of about 1.5 presolo flight hours per student. These data show that pretraining with a moderately detailed, yet relatively inexpensive, computer animated landing display can offer worthwhile savings in flight time. Some students were provided adaptive visual augmentation during their simulator training, and there was evidence of incremental transfer attributable to this instructional feature.

Dennis, K.A., Harris, D. (1998). Computer-based simulation as an adjunct to Ab Initio Flight Training. *The International Journal of Aviation Psychology*, Vol 8, 3, pp 261-276.

Two groups of ab initio student pilots were given training on a flight simulation package running on a desk-top computer prior to performing some basic flight maneuvers in the air. One group interacted with the computer using a representative set of flight controls. The other group used only the computer's cursor and function keys. Both groups exhibited superior performance compared to a control group who had no computer-based training. Students with prior training who used representative flight controls also experienced lower in-flight workload. The results suggest that PC-based flight simulators do not aid in the psychomotor skills required to fly a light aircraft. Their benefits lie elsewhere. However, even very low levels of simulator fidelity can be beneficial in the initial stages of pilot training.

Koonce, J.M., Bramble Jr, W.J. Personal Computer-Based Flight Training Devices. (1998). *The International Journal of Aviation Psychology*, Vol 8, 3, pp 277-292.

This article reviews the role of personal computer aviation training devices (PCATDs) in general aviation pilot training. A brief history of flight simulator development is provided, accompanied by a sampling of early research on the effectiveness of simulator training. PCATDs are described along with their more common interface devices. Next, an examination of the use of PC-based flight simulators in formal and informal flight training programs reveals some of the recent data validating their use. Special emphasis is paid to the use of PC-based flight simulators for the instruction of novices in how to fly and the training of pilots in the performance of instrument flight maneuvers. Then, the role fidelity plays in producing transfer from PC-based training devices is addressed. Finally, a case is made for researchers to provide the kind of data that regulatory agencies should use in determining the standards for certification of PCATDs in flight training programs. Finally, suggestions are made for improvement of future PC-based flight training devices.

Stewart II., J.E., Dohme, J.A., Nullmeyer, R.T. (2002). U.S. Army Initial Entry Rotary-Wing Transfer of Training Research. *The International Journal of Aviation Psychology*, Vol 12, 4, pp 359-375.

Early fixed-wing research demonstrated that potential cost and training benefits could be derived from simulation-augmented primary flight training. More recent research in this area has been the exception, not the rule. This is especially true for rotary-wing aircrew training research. Currently, the U.S. Army does not use simulation in the primary (contact) phase of initial entry rotary-wing (IERW) training. Research performed by the Army Research Institute showed that a combination of synthetic flight simulation and criterion-based training during the primary phase of IERW had the potential for saving training time and costs in the aircraft. This research was performed using a low-cost simulator based upon the UH-1 helicopter. In the 4 quasi-experiments reported, positive transfer effectiveness ratios (TERs) were observed for most flight maneuvers pretrained in the simulator; student pilots in the simulator group required fewer iterations than control participants to reach proficiency on most flight maneuvers in the UH-1 training aircraft. As the visual display and flight modelling systems were upgraded, greater TERs were observed, and differences among groups tended to become significant.

Talleur, D.A., Lintern, G., Ponder, J.R. (1993). The Integration of visual simulation in beginning flight training. *International Symposium on Aviation Psychology*, 7th, Columbus, OH, US 26-29 April 1993, pp 747-752.

A program of instruction has been developed within the Private Pilot Training program of the University of Illinois to assess the degree of substitution of training in the simulator for training in the aircraft. A Frasca 142 (wide), configured as a Beechcraft Sport, and an Evans and Sutherland two-channel image generator are used for the simulation. The computer-generated images are projected onto two screens, one straight ahead and one diagonally left of the cockpit. A two-stage project was planned. In the first stage, one student was taken through the experimental training course. The instructor was given the goal of accomplishing as much of the training as possible in the research simulator. Flight time was to be used to verify progress and to complete the instruction of skills that could not be taught to required standards in the simulator. Ten hours of extra training were given in the research simulator. Our experience with this first student led to adjustments in the training program. Work has commenced on testing five students in the special instructional programs and five control students from the standard course. Here we report on the progress of a small number of students from each of the two groups. The goal of this program is to develop an experimental procedure that will permit a comprehensive investigation of the benefits that accrue from the use of a simulator with a visual system in beginning flight training.

Macfarlane, R. Simulation as an instructional procedure. In 'Designing Instruction for Human Factors Training in Aviation', Ed. Graham Hunt. (1997).

Cites various studies identifying high transfer and benefits of sim trg in GA.