PC-Based Aviation Training Devices for Pilot Training in Visual Flight Rules Procedures;
Development, Validation and Effectiveness

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Abstract

Flying is a difficult and complex activity that requires a significant level of attention from the pilot as well as a lengthy training period to gain sufficient competency. For issues of both cost and safety, flight simulation has been an integral part of flight training from its earliest beginnings. There have been a number of technological developments and improvements in both the level of fidelity and the training effectiveness of flight simulators. As a result, flight simulators in use today are the result of this technological, psychological, and engineering evolution. Indeed, simulator cockpits can now accurately replicate all of the functions of flight controls and instrumentation found in real aircraft. Furthermore, the development of high-resolution display systems utilising computer-generated imagery (CGI), means that flight simulators can now display very realistic terrain and environmental effects.

The high cost of modern full motion flight simulators (FFSs) has meant that their use has generally been restricted to commercial airlines, military forces, and government agencies. More recently, rapid advances and decreasing costs in PC-based computer technology has enabled flight-training organisations to conduct more training with less expensive fixed-base flight training devices (FTDs). That said, the first study in this thesis indicated that in NZ, even the cost of certified FTDs is still beyond the reach of most flight training schools and their students.

The central tenet of this thesis is that a cost effective strategy for smaller flight training schools could be the utilisation of low-cost personal computer based aviation-training devices (PCATDs) for flight instruction and procedural training tasks. Although a number of studies have indicated that the fidelity of PCATDs may be quite low when compared to FTDs, especially in control loading and flight dynamics, there is some evidence of a positive transfer of training from the PCATD to the aircraft.

Significant research has been conducted on the effective use of PCATDs to reduce Instrument Flight Rules (IFR) training time in the aircraft. Conversely, few studies have examined the use of PCATDs for Visual Flight Rules (VFR) training. This lack of research is likely due to the limited fidelity of most PCATDs, especially in the critical area of visual displays. Customised PCATDs were developed to address these fidelity issues by utilising innovative and cost effective software and hardware technologies.

The aim of this study was to investigate potential training benefits and cost effectiveness of utilising low cost PCATDs, to improve pilot proficiency in performing VFR procedures. A quasi-transfer study was undertaken to ascertain whether a customised low cost PCATD was as effective as a Civil Aviation Authority certified FTD at improving pilot proficiency in the performance of a standard VFR traffic pattern operation.

1. There was no evidence of a difference in VFR task performance between participants trained on the PCATD and the FTD when tested on the FTD. In addition, there were significant improvements in VFR task performance compared to a control group that received no simulator training.

2. A follow-up study compared VFR task performance of two groups with significantly different levels of aviation experience that were trained and tested on the PCATD. Again, there was no evidence of any significant differences in VFR performance between these two groups of pilot trainees and this demonstrated that the PCATD could impart equal training benefits to both experienced and ab-initio pilots.

The Civil Aviation Authority certification of two of the PCATDs developed in this study provided formal recognition of the training potential of these devices. In addition, the study has demonstrated that small to medium sized flight schools could enhance their training programmes significantly by deploying low cost PCATDs.

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Dedication

I would like to dedicate this thesis to my grandchildren

Taylor, Raiatea, Kauri, and Isaiah Reweti

who represent the future and all its possibilities

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