

Flight Simulation vs. Real Aviation: 3D Flight Simulation Technologies

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ABSTRACT

This paper will look at the ICT technologies used in flight simulator software, with the aim to identify and briefly discuss the technology involved in this area, potential benefits, and to determine positive and negative impacts by looking at various relevant authors and reference material to be found in publications

in books, journals, articles and the Internet. Consequently, the scope of the report will be limited to the following specific areas:

The Flight Simulation vs. Real World Environment

Flight Simulator software: Microsoft Flight Simulator

Virtual Airlines, Air Traffic Control and Virtual Reality hardware

My methodology will attempt to highlight the technologies, as well as relevant positive and negative aspects as mentioned in the reference material; and in the conclusion to offer some thoughts in summary.

1. INTRODUCTION

The technological advances and growth of personal desktop computer Flight Simulation software, online Virtual Airlines and Air Virtual Traffic Control, as well as affordable 3D Virtual Reality hardware, have led to some interesting developments in the area of Aviation and Flight Training. This has resulted in the Aviation Sector, Airlines and Flight Schools looking at this technology as an effective training tool, and perhaps as a new method to log instrument flying hours for student pilots.

This paper will be looking specifically at some emerging personal Flight Simulation technologies: Software, Virtual Airlines, and 3D

Virtual Reality hardware that are currently being adopted by virtual pilots and real pilots. This will compare the Virtual Airspace with the real world to determine how accurate and useful the technology has become in this area. (I.e. Graphical rendering quality and accuracy of the virtual world and airports, as well as the technical accuracy of aircraft behaviour and systems)

2. HOW APPLICABLE IS FLIGHT SIMULATION TO REAL WORLD AVIATION?

Flight Simulators have become so realistic that they offer would-be pilots as well real pilots the opportunity to learn almost every aspect of flying from how to handle aircraft to Instrument Flying Systems, GPS navigation, Air Traffic Control procedures, weather reporting; and with real world scenery it is possible to realistically fly actual routes in real time. The flight simulator that is considered to be the benchmark in this area is Microsoft Flight Simulator.

In 1978 Bruce Artwick, together with Stu Moment, founded a software company by the name of subLOGIC and started developing graphics programs for the 6800, 6502, 8080 and other processors. In 1979 Bruce decided to take the model from his original thesis further and developed the first flight simulator program for the Apple-II (based on the 6502 processor). This followed a version ported for the Radio Shack TRS-80. Both versions were constructed in their respective

machine code and both were loaded from cassette tape. These versions used a very simple three-dimensional wireframe display system that rendered the scenery from the pilot's perspective with frame rates around 3 to 6 frames per second. (Clark, 2002, p12)

Bill Gates who had at the time just set up his own company called Microsoft, started to shift his focus away from the Commodore 64 to a new system called IBM-PC. Gates noticed Artwicks' work and developed his own flight simulator. In November 1982, he released Microsoft Flight Simulator 1.00, followed by version 2 later that year. These versions used a clever dithering system that could produce 6 colours on a CGA monitor and were more advanced than the subLOGIC FS1 system. They used a sophisticated co-ordinate system, which was developed by Bruce Artwick and had a flat surface of 10,000 X 10,000 square miles. (Clark, 2002, p13)

Since then Microsoft has improved the simulator along with technological advances in hardware and software and over the past 10 years released version 2 in 1983, version 3 in 1988, version 4 in 1989, version 5 in 1993, version 6 in 1996, Flight Simulator 98 in 1997, FS 2000 in 1999, FS 2002 late last year. The latest version is to be released later this year.

2.1 Flight Simulation Software: Microsoft Flight Simulator

Tavendale, (2003, p11) states that the Kangan Batman TAFE Aerospace Industry Training Centre in Victoria uses Microsoft Flight Simulator 2002 to "complement the delivery of the BAK (basic aeronautical knowledge) component of the (official professional pilot training) courses." To make FS2002 more relevant for students, "Real Simulations have specifically re-written the standard .AIR file of the default C172 within FS2002 so that the program is more realistic and resembles how the real aircraft performs and behaves." Furthermore, Tavendale mentions "This provides great benefits to the students allowing them to rehearse on a simulator that is as close to the real thing as possible, thus gaining valuable experience.

Herd (2001) wrote in his review of Microsoft Flight Simulator 2002:

"There is no question that the FS2002 mesh is much better than that of its predecessor and the first thing that most users will notice about the new version is the quality of the scenery (providing they don't have a Rage card). When I first loaded the sim, I flew around for hours, trying to pick out places I knew, and it is

probably true to say that you could use a vanilla installation of FS2002 to fly VFR in most places I can think of."

To further add to the realism third party software developers are creating scenery products that enhance the realism of scenery and buildings to the point where it can be exactly compared to the real world. Herd (2001) mentions in his review of the FScene software that:

"Ruud's package is meant to be a replacement of the standard FS2002 world scenery textures for the European countries and it is a development from his previous work. The new version is considerably upgraded and features even better cities, villages, farms and night scenery than before. In addition, the new textures span all four seasons, with improved winter compared to the originals".

Lars Bot, Aircraft Maintenance Engineer in Canada working on the Boeing 737-400, 757-200, A330-200/300, as well as the Tri-Star L1011-100/500 aircraft, states that "the desktop computer using FS2002 does a very good job of simulating the flying characteristics of large aircraft transport category aircraft such as the Tri-Star L1011 or even more modern aircraft such as the A330/A340 series, simply because the real world characteristics are actually "set out" by onboard computers which are less powerful than a desktop computer. The Airbus uses 286 computer chips in their primary and secondary flight control computers due to the fact that the technology is proven and reliable. Also, these aircraft use hydraulic flight controls so control wheel feedback has to be artificially reproduced and input. In the case of the Boeing 757/767 series, control wheel feedback is as simple as a roller-and-cam system, the same thing you have in a basic joystick." (Bot, 2001)

2.2 Virtual Airlines (VA)

Harvey (2002) states "Virtual Airlines have sprung up all over the Internet. These are websites that operate just like a real airline in every aspect, except for the fact that they don't use real aircraft. Indeed, some of these virtual airlines operate from real airports, and are managed by the same staff that operates at real airlines. Examples of such VA's are:

Virtual United Airlines
<http://united.vdfw.org/>

Virtual Air New Zealand
<http://www.virtualairnz.org.nz/>

South African Virtual Aviation Services
<http://www.savas.co.za/>

Pilots need apply for a position in a VA and are ranked according to experience and the amount of flying hours they have. They fly the same routes as the real counterpart and they have to follow the same rules of currency, etc. This offers a wonderful training facility for real pilots who can keep their proficiency levels up to standard, plus it offers other pilots who wish to be employed by an airline the opportunity become familiar with the inner workings of the airline, their routes, the aircraft operations and other systems. Pilots have to fly a minimum of one flight per month to keep current”

2.3 Virtual Air Traffic Control (ATC)

Virtual ATC controls the virtual airspace in exactly the same way as in real aviation. One such organisation is Virtual Air Traffic Pacific Area Control (VATPAC). According to the official online website “VATPAC is the official VATSIM’s Pacific Division and co-ordinates Simulated Air Traffic Control in the Pacific Region, in particular, Australia, New Zealand and the Pacific Islands.” (VATPAC, 2003)

By registering with the VATSIM Network and conforming to the rules, and with an Internet connection in any part of the world, it is possible to experience full Air Traffic Control services that the real world counterparts experience. This enables virtual pilots to:

- ◆ “Fly anywhere in the world under full air traffic control
- ◆ Practice instrument flying skills
- ◆ Practice ILS approaches or test flying skills of an NDB or VOR/DME approach using the nav aids in the Flight Simulation scenery.
- ◆ See and hear other pilots flying online as they travel to their destination and talk to ATC” (VATPAC, 2003)

The system even gets real weather from the Internet and then puts this into the Flight Sim programme so that real weather is exactly simulated, as it is in the part of the world the virtual flight is taking place. (VATPAC, 2003)

2.4 Virtual Reality Hardware

At an affordable cost, the latest in virtual reality technology 3-D visuals allows the user to be immersed in extremely realistic 3-D gaming, Internet, photo, and graphic environments. An example is stereoscopic glasses from E-D®, specifically designed for use with FS2002. The E-D® glasses instantly converts the

flight simulator environment into true 3-D. The hardware uses an USB wireless infrared transmitter of the glasses. According to E-Dimensional (2002) the dual-emitter transmitter is utilised to give the widest viewing angle and range available and is used to beam the signal to perfectly synchronise the refresh rate of PC monitor with the glasses.

3. FLIGHT SIMULATION VS. REAL AVIATION

Flight simulation cannot replace real aviation – only supplement it. Armstrong (2001) states “It lacks in various areas from the real world. The obvious physical and visual deficiencies of flight simulation really hinder, and a person with thousands of hours of simulation time but no real world time cannot claim to be a real pilot. Also, flight simulation has the potential to pick up bad habits and these habits can be challenging to overcome in the real world cockpit.”

The author of this paper (who has done hundreds of flight simulator hours), and who also has a Pilot Licence, had to learn again from scratch to look outside the cockpit instead of being fixated on the instrument panel (which on a computer is right there in your field of view as opposed to the real cockpit where it is below the pilots’ direct field of view).

Armstrong (2001) also mentions “Real world has a way of humbling you in a way that no flight simulator ever can. You just reset or pause everything. I’ve yet to find the reset or pause key in the real cockpit.” Van Wagenen (2001) mentions that “You make lot of new friends at the airport and no flight simulator is ever going to capture the real feeling of flying over your home town at sunrise on a day with unlimited visibility. The flight simulator will provide you with a good start if you used properly, understand a little about stalls, and the basics of flight.”

Harvey (2002) states that “the negative impacts of the ultra-realistic flight simulators available today is no more clearer that the effects of the terrible terrorist attack on the World Trade Centre in New York on 11 September 2001. It was established that the pilots who flew into these buildings used Microsoft Flight Simulator specifically to practise their flight paths, speed, etc. This of course is an excellent example of how the technology can be used for bad rather than good. Since the level of the graphics are of such high quality, and the accuracy of the computer generated scenery is so realistic, it is very easy to plan such terrible deeds with pinpoint accuracy.”



4. CONCLUSION

Xing (2001) states that "Many people (many being flight instructors) have denounced computer-based flight simulators as poor training devices for learning the concepts involved with the visual flight rules (VFR) that are introduced in the pilot training, mainly because it causes students to stare more at their instruments than out the cockpit window." However, it can be a valuable "training" instrument for the future professional pilot. While the importance of looking out the cockpit window cannot be over-stressed, especially when visual meteorological conditions (VMC) exist, flight by reference to instruments (through flight simulation) is an invaluable asset during both private and commercial pilot training. The author foresees flight simulations to continue to be beneficial in real aviation training.

According to Xing (2001) "Flight simulation is something that all student pilots could use as an introduction to flight, as well as to supplement what they learn in the real world." He further believes that the best response to the sceptic, who is of the opinion that it is not realistic enough, is "that it is as realistic as it needs to be to provide people with a familiarisation with flight controls, instrumentation, navigation and more."

As the world of flight simulation quickly advances, unprecedented levels of realism are being achieved, and the positive potential for supplemental flight training needs to be recognised and can no longer be ignored. Furthermore, since flight simulator software can probably be considered to be the most advanced modelling systems currently available, the influence on HCI/modelling would be an interesting area for research.

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