"Be more attentive to the new ideas from the research world" (Schairer, 1989, Former Vice President Research, Boeing). The use of augmented reality (AR) and virtual reality (VR) in simulations is a growing industry. This is particularly shown when delving into the world of flight simulations. Flight simulation training devices (FSTD) are a common device for both recreational and educational use. Nowadays, anyone can purchase a 'HOTAS' (Hands on Throttle-and-Stick) plus the latest version of Microsoft's Flight Simulator and traverse the globe. Although these are not comparable to the devices used for training purposes. Flight simulation training devices or FSTD have been around since the 1910s, when the Sanders trainer was developed. Although this was not a simulation comparable to what we use today. According to Hayward (1910) the Sanders trainer consisted of a cockpit that would be pointed to the corresponding wind direction, and if the wind was strong enough, the cockpit would move and act accordingly to the pilot's inputs. Since then, there have been drastic increases in the technology used in creating, running and operating these FSTDs. In this essay the advancements made, the advantages such as availability, running costs, and emissions.

Safety

Safety is a primary benefit of using flight simulations. Full Flight Simulator also known as FFS are the most widely used device for pilot training (Sponsored, 2022). These FFS devices consist of an exact replication of a specific cockpit, with motion and sound systems to create the feel of flying for pilots. These Full Flight Simulators have accounted for 90% of the flight training market share (Sponsored, 2022). With these devices pilots can train, without the setbacks of flying a real plane. Pilots can also practice reading instruments, learn wind patterns and get an understanding of the cockpit in a plane without stepping into a real plane (Allerton, 2009, p. 33). Learning to be a pilot this way is one of the safest ways, this being the biggest advantage. Organizations other than those focused on education, such as the military, use these devices also. Although most of the flight training in the military is done in passenger planes, instrument training is done in simulations. Also, when believed necessary by the military they will use these devices for flight training such as when the cost of airborne training is significant, or there may be a safety hazard. In some instances, multiple simulators can be linked together to allow the practice of formation flying and mission practice (Allerton, 2009, p. 10). Safety is one of the main priorities and leading factors for using these devices. In the 1970s airline companies and regulators deemed that a substantial portion of air accidents and incidents were due to the pilot causing an error. Flight simulations supply an ideal platform to exercise procedures to help the pilot and crew of the plane during these hazardous situations (Allerton, 2009, p. 10). Flight simulations also play a part in the making of a safe airplane. Up until the mid 1980s the testing of aircraft was done through flight tests, which were costly and unsafe. Nowadays companies use flight simulations to help design aircraft in a safe and environmentally friendly manner.

Availability and finance.

Flight simulations are available 23 hours every day and 360 days (about 12 months) per year. This is greatly beneficial as a large body aircraft such as a Boeing 747 typically has around 8 different flight crews (Allerton, 2009, p. 10). Each individual pilot needs 4 days of practice per year. With around 128 pilots requiring 4 8-hour practice days that would be 4,096 hours (about 5 and a half months) of training. Comparing this to the cost of trying pilots in these large aircraft, the amount would bankrupt almost every airline. It is estimated that the cost of operating aircraft is around 10 times that of using a flight simulation (Allerton, 2009, p. 10). Although these simulations have a large initial cost it is minuscule compared to that of running aircraft. Pilots can also operate these simulations no matter the situation such as the weather, being allocated clearance to fly as these simulations. Making the training days more accessible for the airlines and pilots. The financial factor is a leading cause for the use of flight simulations. For everyone large, bodied aircraft, there is roughly one FFS (Allerton, 2009, p. 10). The cost of a commercially used flight simulation is around 10-12 million US dollars (approximately 16- 20million NZD) depending on the aircraft it is simulating. The cost for the aircraft it is modeled after is around 100-125 million US dollars (approximately $164 - $205 million NZD.). During the global pandemic, the number of yearly flights decreased to around 50%. If pilots were still training in planes, we can assume that over the 2 years of the pandemic, the number of pilots requiring their 4-day training would be large. Simulations helped combat this.

Enviromental factor.

Aviation in Europe alone has had emissions increase 28% over the last 10 years. Aviation is the largest emission creater in the field of transportation. This is expected to double or triple in the next 25 years if left unchanged ("Airplane pollution," n.d.). Before Covid-19 in 2019 there was an estimated 38.9 million flights flown yearly ("Airline industry worldwide - number of flights 2004-2022 | Statista," 2022). This number dropped significantly during the global pandemic, although there has seen a steady rise in the number of flights since then with 32.4 million flights forecasted for 2023 compared to the 16.9 million flights in 2020. With the use of flight simulations, it is safe to say this number could be higher if all training was done in the air.

Conclusion

In conclusion, the use of flight simulations has significantly increased the effectiveness of pilot training and brought multiple benefits to the aviation industry. The safety advantages of flight simulations are significant, allowing pilots to practice in realistic environments without the risks of flying an aircraft. Simulations provide a platform for training in instrument reading, handling emergency situations, and enhancing overall situational awareness, thereby reducing human errors that can lead to accidents. Furthermore, simulations play a crucial role in designing safer aircraft by replacing costly and unsafe flight tests with virtual testing. The availability and financial advantages of flight simulations cannot be overstated. Simulators are accessible 23 hours a day, 360 days (about 12 months) a year, providing consistent and reliable training opportunities for a large number of pilots. The cost of operating simulations is significantly lower compared to running actual aircraft, making it a cost-effective solution for airlines.

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