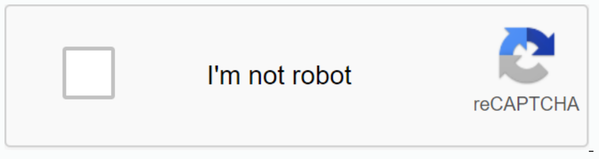

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Icao simulator requirements

This article is about flight simulation in general, but focuses mainly on professional devices. For lower-level, non-professional or recreational flight simulators, see Amateur Flight Simulation. For the simulation of recreational aerial combat, see the combat flight simulation game. For the Microsoft product, see Microsoft Flight Simulator. For all other uses, see flight simulator (disambiguation). F/A-18 Hornet Flight Simulator aboard the USS Independence Aircraft Carrier A flight simulator is a device that artificially recreates the flight of the aircraft and the environment in which it flies, for pilot training, design, or other purposes. This includes the reproduction of equations governing how aircraft fly, how they react to flight control applications, the effects of other aircraft systems, and how the aircraft reacts to external factors, such as air density, turbulence, wind shear, cloud, precipitation, etc. Flight simulation is used for a variety of reasons, including flight training (mainly of pilots), the design and development of the aircraft itself and research into aircraft characteristics and control handling qualities. [1] The history of flight simulation In 1910, at the initiative of French commanders Cllalus and Laffont and Lieutenant Cnavinad, the first ground training aircraft for military aircraft were built. The Antoinette Antoinette (Antoaneta barrel), created by Antoinette, appears to be the precursor to flight simulators. World War I (1914–1918) A training area was for aerial gunners handled by the pilot or a specialist gunner. Burning to a moving target requires forward orientation (involving the so-called lead angle) to allow the time it takes for bullets to reach the target's vicinity. This is sometimes also called shooting deflection and requires skill and practice. During World War I, some terrestrial simulators were developed to teach this ability to new pilots. [2] The patent link trainer drawing from 1920 and 1930, 1930 The most well-known early flight simulation device was Link Trainer, produced by Edwin Link in Binghamton, New York, USA, which he began to build in 1927. He later patented his design, which was first available for sale in 1929. Link Trainer was a basic metal frame flight simulator, usually painted in its well-known blue color. Some of these early war simulators still exist, but it's becoming increasingly difficult to find examples of work. [3] The Link family company in Binghamton produced pianos and organs for players, and Ed was therefore familiar with components such as leather bellows and reed switches. He was also a pilot, but dissatisfied with the amount of actual flight training that was available, he decided to build a ground edt to provide such training without weather restrictions and the availability of aircraft and flight instructors. Its design had a motion platform driven by inflatable bellows, which provided pitch and roll clues. A vacuum engine similar to those used in player pianos rotated the platform, providing yaw clues. A generic cockpit with working tools was mounted on the motion platform. When the cockpit was covered, pilots could practice flying with their instruments in a safe environment. The motion platform gave pilot clues about the actual angular motion in the step (nose up and down), roll (wing up or down) and yaw (left and right nose). [4] Initially, aviation flight schools were little interested in Link Trainer. Link also demonstrated its coach at the U.S. Army Air Force (USAAF), but with no results. However, the situation changed in 1934, when the Army Air Force was given a government contract to fly by mail. This included the need to fly in bad weather as well as good, for which THE USAAF has not previously carried out much training. In the first weeks of the postal service, nearly a dozen army pilots were killed. The Army Air Force hierarchy recalled Ed Link and his coach. Link flew to meet them at Newark Field in New Jersey, and were impressed by his ability to one day reach low visibility because of his practice on his training device. The result was that USAAF bought six Link Trainers, and this can be said to mark the beginning of the global flight simulation industry. [4] World War II (1939–1945) Military personnel using Link Trainer, Pepperell Manufacturing Co., 1943 The main pilot used during World War II was Link Trainer. About 10,000 were produced to train 500,000 new pilots from allied nations, many from the U.S. and Canada, because many pilots were trained in these countries before returning to Europe or the Pacific to fly combat missions. [4] Almost all U.S. Army Air Force pilots were trained in a Trainer Link. [5] Another type of coach of the Second World War was used to sail at night by the stars. The 1941 celestial navigation coach was 13.7 m high and was able to host the navigation team of a bomber crew. It allowed sextants to be used to take star photos from a screen designed by night sky. [4] From 1945 to 1960 In 1954, United Airlines bought four flight simulators at a cost of $3 million from Curtiss-Wright, which were similar to previous models, with the addition of images, sound and movement. This was the first modern flight simulator today for commercial aircraft. [6] Today, simulator manufacturers are consolidating and vertical, because the training provides a double-digit increase: CAE estimates 255,000 new line drivers from 2017 to 2027 (70 per day), and 180,000 first officers evolve to captains. The largest manufacturer is Canadian CAE Inc., with a market share of 70% and $2.8 billion annual revenue, manufacturing training devices for 70 years, but moved into training in 2000 with Acquisitions. Now, CAE does more from training than from producing simulators. Crawley-based L3 CTS entered the market in 2012 with the acquisition of Thales Training & Simulation near Gatwick Airport, where it assembles up to 30 devices per year, then the CTC training school in the UK in 2015, Aerosim in Sanford, Florida in 2016 and the Portuguese G Air Academy in October 2017. [7] With a market share of 20%, the equipment still accounts for more than half of ATS L3's turnover, but could soon be reversed, as it educates 1,600 commercial pilots each year, 7% of the 22,000 who enter the profession annually, and targets 10% in a fragmented market. The third largest is TRU Simulation + Training, created in 2014, when Father Textron Aviation merged its simulators with Mechtronix, OPINICUS and ProFlight, focusing on simulators and developing the first full-flight simulators for 737 MAX and 777X. The fourth is FlightSafety International, focused on general, business and regional aircraft. Airbus and Boeing have invested in their own training centres, pursuing higher margins than aircraft production such as MRO, competing with their CAE and L3 suppliers. [7] In June 2018, there were 1,270 commercial air simulators in operation, up 50 over the course of a year: 85% FFS and 15% FTDs. THE CAE supplied 56% of this installed base, L3 CTS 20% and FlightSafety International 10%, while THE CAE training centres are the largest operator, with a 13% share. North America has 38% of the world's training devices, Asia-Pacific 25% and Europe 24%. Boeing types account for 45% of all simulated aircraft, followed by Airbus with 35%, then Embraer with 7%, Bombardier at 6% and ATR at 3%. [8] Types of Flight Training Devices in Service Cockpit Pilot Training of a Double Jet Flight Simulator. Several different devices are used in modern flight preparation. Cockpit Procedures Trainer (CPT) are used to practice basic cockpit procedures, such as processing emergency checklists, and for familiarizing the cockpit. Certain aircraft systems may or may not be simulated. The aerodynamic model is usually extremely generic if present. [9] Technological Movement Statistically significant assessments of the transfer of skills based on simulator training and leading to the handling of a real aircraft are difficult to do, especially with regard to movement cues. Large samples of pilot opinions are needed and many subjective opinions tend to be disseminated, especially by pilots who are not accustomed to making objective assessments and responding to a structured testing program. For many years, it was thought that the motion-based simulation 6 DOF the pilot's fidelity closer to flight control operations and aircraft responses to control inputs and external forces and provided a better student training result than non-movement simulation. It is described as the fidelity of manipulation, which can be assessed by would be the Cooper-Harper numerical rating scale for quality manipulation. Recent scientific studies have shown that the use of technology, such as vibrations or dynamic seats in flight simulators, can be as effective in providing training as large and expensive FFS devices of 6 DOF. [10] [11] Qualification and approval of the Full Flight Simulator of a Boeing 737 Procedure Before September 2018, [12] when a manufacturer wished to have an approved ATD model, a document containing the specifications for the model line and proving compliance with the appropriate regulations is submitted to the FAA. Once this document, called the QualificationS Approval Guide (QAG), has been approved, all future QAG-compliant devices are automatically approved and individual evaluation is neither necessary nor available. [13] The effective procedure accepted by all CAA(Civil Aviation Authorities) worldwide is to propose 30 days before the qualification date (40 days for CAAC) an MQTG (Master Qualification Test Guide) document, which is suitable for a single simulator device and will live along the device itself, containing objective and functional and subjective tests to demonstrate the representativeness of the simulator compared to the aircraft. The results will be compared with flight test data provided by aircraft OEMs or from the test ing campaign commissioned by OEM simulator manufacturers or may also be compared with THE POM (Proof Of Match) data provided by the oEMs of aircraft OEMs. Some of the QTGs will be rerun during the year to prove during the continuous qualification that the simulator is still within the TOLERANCES approved by the CAA. [14] [15] [16] Flight Simulator levels and other categories The following skill levels are currently awarded for both aircraft, fSTD helicopters: US Federal Aviation (ATD) Aviation (ATD) [17] FAA Basic ATD (BATD) – Provides a training platform and design suitable for both procedural and operational performance tasks specific to ground and flight training requirements for the private pilot certificate and instruments for Title 14 of the Federal Regulations Code. FAA Advanced ATD (AATD) – Provides an appropriate training platform for both procedural and operational performance tasks specific to ground and flight training requirements for the private pilot certificate, instrument qualification, commercial pilot certificate and air transport pilot certificate (ATP) and flight instructor certificate. Flight Training Devices (FTDs)[18] FAA FTD Level 4 – Similar to a Cockpit Procedures Trainer (CPT). This level does not require a aerodynamically, but precise system modeling is required. FAA FTD Level 5 – Aerodynamic programming and systems modeling are required, but it can represent a family of aircraft rather than a single specific model. FAA FTD Level 6 – Specific Aircraft Model programming, sense of control, and physical cockpit are required. FAA FTD Level 7 – Specific model. All aerodynamics, flight controls and applicable systems must be modelled. A vibration system must be provided. This is the first level that requires a visual system. Complete Flight Simulators (FFS)[19] FAA FFS Level A – A motion system with at least three degrees of freedom is required. Just planes. FAA FFS Level B - Requires three motion axes and an aerodynamic model of higher fidelity than no level A. Lowest level helicopter flight simulator. FAA FFS Level C - Requires a motion platform with all six degrees of freedom. Also, lower transport delay (latency) above A & B levels. FAA FFS Level D – Highest level of FFS qualification currently available. The requirements are for level C with additions. The motion platform shall have all six degrees of freedom and the visual system shall have an outer horizontal field of vision of at least 150 degrees, with a collimated display (remote focus). Realistic sounds are required in the cockpit, as well as a number of special motion and visual effects. European Aviation Safety Agency (EASA, ex JAA) Navigation and Flight Procedures Instructor (FNPT)[20] EASA FNPT Level I EASA FNPT Level II EASA FNPT Level III – helicopter only. MCC – Not a true skill level, but an add-on that allows any level of FNPT to be used for multi crew coordination training. Flight Training Devices (FTD)[20] EASA FTD Level 1 EASA FTD Level 2 EASA FTD Level 3 – Helicopter Only. Complete Flight Simulators (FFS)[20] EASA FFS Level A EASA FFS Level B EASA FFS Level C EASA FFS Level D State-of-the-art Stewart Platform Vertical Motion Simulator (VMS) at NASA/Ames The world's largest flight simulator is NASA Ames Research Center's Vertical Motion Simulator (VMS) south of San Francisco. This has a very high-throw motion system with 60 feet (+/- 30 ft) of vertical motion (heave). The lifting system supports a horizontal beam on which 40 ft of rails are mounted, allowing the lateral movement of a simulator cab of +/- 20 feet. A conventional hexapod platform of 6 degrees of freedom is mounted on the 40 ft beam and an interchangeable cabin is mounted on the platform. This design allows for quick switching of different aircraft cabins. The simulations ranged from commercial and military aircraft to space shuttles. In the case of the space shuttle, the large vertical motion simulator was used to investigate a pilot-induced longitudinal oscillation (IOP) that occurred early transfer flight just before landing. After identifying the problem on VMS, it was used to try different longitudinal control algorithms and recommend the best for use in the transfer program. [21] [21] AMST Systemtechnik GmbH (AMST) training in Austria and Environment Tectonicas Corporation (ETC) in Philadelphia, USA, manufacture of a range of disorientation training simulators that have full freedom in yaw. The most complex of these devices is the Desdemona simulator from the TNO Research Institute in the Netherlands, manufactured by AMST. This large simulator has a gimballed cockpit mounted on a frame that adds vertical motion. The frame is mounted on the doors attached to a rotating platform. The cabs allow the simulator cab to be positioned at different ranges from the center of rotation, which provides a sustained G capacity of up to about 3.5. [22] [23] Amateur Flight Simulation and Video Games Main Articles: Amateur Flight Simulation, Combat Flight Simulator, Simulation Video Game and Space Flight Simulator Game See also the FlightSimCon Aviation Portal Unmanned Aircraft Simulator Racing Simulator Full Motion Simulator Virtual Reality Simulator References Notes ^ Federal Aviation Administration (April 25, 2013). FAR 121 Subpart N – Training program. April 28, 2013. ^ Bonnier Corporation (January 1919). Dry shooting for airplane gunners. Monthly folk science. Bonnier Corporation. pp. 13–14. ^ Fly away simulation (July 12, 2010). Flight Simulator Technology over the years. Archived from the original on October 12, 2011. April 20, 2011. ^ a b c d ASME Landmarks: The Link Flight Trainer. 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