Flying With Your Feet ON THE GROUND

The Air Corps has just taken delivery of a new Flight Training Device for the Pilatus PC-9M. SIGNAL reports on the difference this will make to the training regime.

The use of simulated cockpits has been a time and cost saving training method since the pioneering years of flight. In the early days, the majority of flight simulators were simple mechanical systems used to demonstrate the action of the primary controls and to teach hand, eye and sensory co-ordination.

The most important improvement in flight simulators came with the 'Link' trainer in 1929. Built by Edwin Link, it was the first real flight simulator with an enclosed cockpit equipped with instruments and controls. The Link trainer was able to simulate roll, pitch and turning and the instructor could even select turbulence to add to the pupil's problems.

Using the Link as a starting point and applying electronics, the flight simulator was elaborated and its quality of simulation vastly improved. The introduction of digital computers, LCD flat panel screens and high-resolution colour projectors provided a realistic view ahead, some giving up to 240 degrees field of view.

Modern flight simulators provide such high levels of realism that licensing authorities allow them to be used for the renewal of a pilot's instrument rating certificate and at a fraction of the cost and danger involved with using a real aircraft.

In order to maximise cost effectiveness, coupled with the aim of providing Air Corps pilots with the most sophisticated and comprehensive training facilities available worldwide, a number of locations are utilised. G-IV pilots, for example, use the

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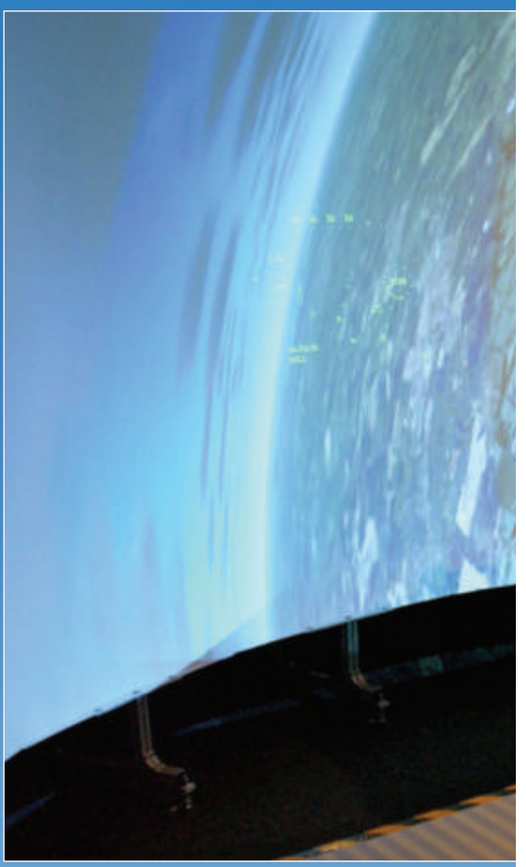

facilities at Simuflite in Dallas, Texas for initial and re-rating courses. Similarly Learjet pilots use the Bombardier simulator also located in Dallas. King-Air 200 pilots are trained at Flight Safety International, Paris. CASA pilots meanwhile use the EADS CN235 simulator located in Seville, Spain.

Once a pilot is familiar with the day-to-day general handling of the aircraft such as take off, landing and systems operations, the simulator quickly comes into its own by giving instructors the opportunity to simulate virtually any imaginable scenario.

The Pilatus PC-9M

With the arrival of the Pilatus PC-9M aircraft in Baldonnel in early 2004, basic flight training in the Air Corps, which since 1977 had been based upon the SIAI Marchetti SF260WE platform, changed dramatically. The PC-9M is designed primarily for the elementary, basic and advanced flying training role with the ability to cruise at altitudes of up to 25000 feet and speeds of 270 knots (499 km/h).

With its introduction into service, large tracts of military airspace which had not been in regular use since the retirement of the Fouga were reopened and routine training operations now take place between ground level and 25000ft, up to 60 nautical miles from Casement Aerodrome. Pilots have already had the opportunity to exercise the Pilatus' weapons (0.5 inch machine guns and 2.75 inch rockets) in the air to ground role at sea/beach targets in Gormanston Military Camp earlier this year.

A consequence of the purchase of the Pilatus was that, given the aircraft's capabilities, changes in the training philosophy of the Flying Training School (FTS) would occur. At a technical level the aircraft is larger and more complex than its predecessor, containing systems such as the Head Up Display (HUD), the first of its kind in the history of the Air Corps. From a handling point of view it is capable of a much larger range of manoeuvres than the Marchetti and the ability to fly at sustained 'g' values presents greater challenges to the pilot.

In the interests of maximising the training value of each flight hour it was essential that an appropriate ground based training system be purchased to assist both students and instructors. This training system for the Pilatus, which has been established in Baldonnel, provides a structured course of study on all technical aspects of the aircraft through Computer Based Training (CBT), routine and emergency procedures training on a dedicated Flight Training Device (FTD) and a number of regularly revised manuals such as the Student Pilot Training Manual and the Flight Instructors Reference Manual.

Computer Based Training (CBT)

Prior to a student pilot undergoing a course of flying training on the PC-9M he will first have to complete approximately 55 hours of computer based technical training. This system provides a structured course of training on all of the aircraft's systems such as engine, fuel system, ejection seat etc.

Flight Training School officer staff can electronically assign each student a particular aspect of the Pilatus technical program which is based on animations and schematics and requires a large amount of interaction by the student. The progress of every student is monitored by the program and items such as time spent on each system, tests results and student answers are automatically recorded for subsequent analysis and debriefing by the pilot instructors. The CBT system is also used at regular intervals by qualified pilots to ensure that the necessary skills required by Pilatus pilots remain at the highest standards. Such recurrent refresher training for qualified flight crew is also subject to testing and recording.

Flight Training Device

Built by Elite Simulation Solutions from Switzerland, the Flight Training Device (FTD) fits into the category between a basic cockpit procedures trainer and a full motion simulator such as those used by the commercial airlines or by the air forces of other militaries. The device is based upon an actual Pilatus PC-9M cockpit that contains all switch positions and controls, as they would be found on the actual aircraft. Selecting a switch or moving a control will replicate exactly what happens on the actual aircraft. The FTD was delivered in January 2005 and is housed in a new building designed specifically for the purpose. Its delivery to Baldonnel followed testing and initial acceptance in October 2004 by a team of Air Corps officers comprising of pilots and aeronautical engineers. The device is the subject of a ten-year support contract ensuring its serviceability well into the future.

The FTD consists of a Pilatus cockpit positioned in front of a large curved projection screen, giving the pilot an approximately 210-degree field of view.

The imagery projected is based on satellite photography of the Irish countryside.

Overhead the cockpit, five projectors are positioned to project images of the area within which the flight is taking place. A sixth projector is positioned on the nose of the device to project the HUD information onto the screen. Similarly the seat, though outwardly similar to the ejection seat on the actual aircraft, is not fully functional – for obvious reasons! The imagery that is projected onto the screen is based upon satellite and digital photography of the Irish countryside including the Baldonnel area. This brings a high degree of realism to operations around the airfield area. Similarly the runways of all Irish airports, as well as those in the UK and a portion of Continental Europe are available.

The device is managed from an Instructor/Operator station (IOS) at the rear of the cockpit. This station is equipped with a number of flat panel screens on which all the cockpit instruments are represented. Any movement of a switch in the cockpit is followed by the simultaneous highlighting and movement of the corresponding switch on the screen. With the student wearing the standard flight helmet, remote communication with the instructor is possible through the FTD's intercom system. An in-cockpit camera is also fitted which allows remote monitoring of the student from the IOS.

The FTD will be an integral part of the syllabi of both the pilot training course syllabus and of courses designed to upgrade qualified pilots to the Pilatus. Interestingly the FTD will not be used to teach people the basics of flight such as climbing, turning and descending. These 'stick and rudder' skills can only be developed on the actual aircraft, which, unlike the FTD is subject to the full vagaries of the atmosphere. The FTD will be used primarily to hone the pilot's knowledge and skills in dealing with routine and emergency procedures. Emergency procedures considered too hazardous to practice on the actual aircraft can be accomplished with ease in the safe environment of the FTD. It will also be used by students to practice instrument flying skills such as approach and departure procedures. During the Wings course for example, prior to a student pilot being permitted to fly the aircraft solo, eleven one hour sorties on the FTD must be completed in addition to the specific flying time on the real aircraft. These simulated sorties will allow development and testing of the students skills in dealing with events such as engine fires, failures, electrical malfunctions etc.

Every sortie on the FTD has a definite structure, with set objectives and standards to be met by the student. A typical sortie

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will involve an instructor-student briefing during which the objectives of the sortie, the areas to be covered and the standards that are required to be met will be outlined as well as answering questions the students may have. The student always wears the flying equipment normally worn in the actual aircraft, which greatly increases the realism of the sortie by building a familiar environment for the student. The instructor will enter the IOS and the student, once strapped in and with the canopy closed, will have communications with the instructor. The sortie will progress as outlined in the brief, with the instructor monitoring all of the student's checks and procedures. The instructor has the ability to initiate any of a number of malfunctions and failures from one of two touch screens in the IOS. A wide variety of weather conditions can also be simulated by the instructor at the touch of a button. At any time the simulation can be 'frozen' by either instructor or student from their respective locations. This feature allows instant debriefing or comment by the instructor without having to restart or reset the whole simulation. On completion of the sortie, which generally takes one hour, the student will exit the FTD and a debriefing will occur. All of the data from the sortie will be recorded and can be played back using the projection system and FTD cockpit instrumentation. Similarly altitude and flight route data can be displayed on one of the flat panel screens and used during the debriefing process.

The FTD and CBT system will ensure that the many and varied capabilities of the Pilatus can be explored in safety and used to the full. Regular practice of emergency procedures coupled with detailed technical knowledge of the Pilatus will ensure that flight safety remains paramount and flying skills reach new heights.