VIRTUAL REALITY

CENTRAL TO TRAINING IN THE MARITIME INDUSTRY

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What is often seen as a novelty has been used for decades.

Virtual reality (VR), is increasingly making the headlines, due mainly to the gaming community, however, it actually started finding its way in a wide range of domains a long time ago. VR has been around for decades, with one of its earlier applications being the training of aircraft pilots. Advanced electrical and electronic simulators are now widely used in the aviation and maritime sectors to form crews and other operatives. Many of the systems set up in the very complex simulators in use today rely on International Standards for their operations.

NOT THAT RECENT, BUT NOW ENTIRELY RELIANT ON ELECTRICAL AND ELECTRONIC SYSTEMS

The perception of three-dimensional depth of space to create a form of VR has been familiar for a long time. It was used widely between the two World Wars and later on in toys and devices such as projectors and stereoscopes to give viewers looking at two photos taken from different angles the impression of seeing a scene or a landscape in three dimensions.

Beyond the visual dimension, the first 'serious' VR application was developed in the form of flight simulators to train airmen.

Following trials with purely mechanical and very basic contraptions introduced in the 1910s, what can be described as the first real flight simulator, the Link Trainer, was developed in the late 1920s. It looked like a toy aircraft with short wooden wings and fuselage and was fixed to a universal joint mounted on a platform which could be made to pitch and roll using bellows activated by an electric pump.

The US Army Air Corps first bought six Link Trainers, which were designed to train crews to fly by instruments only. During World War 2, 500,000 US and allied crews were trained on the ground in the basic skills of flying by using more than 10,000 Link Trainers, which were improved by using films and interactive controls to create virtual flying conditions.

A greater sense of reality was provided by the introduction, in the mid-1950s, of electronic systems in simulators to reproduce instrument panels' visual indications, as well as sounds and motion.

Flight simulators, which have improved greatly over the years, are now very complex and rely nearly entirely on electrical and electronic systems for their operation.

FROM AVIATION TO SHIPPING

Advanced simulators are not used to train aviation crews only, but also extensively in the shipping industry and even in port environments. The range of applications in this industry is much wider than in aviation as simulators are used to form bridge officers, pilots, mechanics and shore-based staff, including crane operators or LNG terminal operatives.

Flight simulators are much better known to the general public than their counterparts in the shipping world due to the availability of countless computer games and related accessories.

However, training for ships' crews relies also heavily on cutting-edge computer-based simulation suites that reproduce locations and ask for reactions to commands from the bridge, as well as to emergency situations, such as simulated fires or collisions and to mechanical incidents.

Maritime pilots, who have to berth/unberth ships and help manoeuvre them to and from harbours through difficult waterways, are also trained on simulators.

The equivalent level of equipment to the multimillion full flight simulators required in training aviation pilots is not always needed in the maritime sector, making it possible to have training facilities installed in educational establishments or on shore sites elsewhere.

IMO RECOMMENDED PRACTICES FOR PILOTING INCLUDE SIMULATION AND MANNED MODELS

The International Maritime organization (IMO), the specialised UN agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships, supports training using simulation and manned models of ships. IMO Resolution A.960(23) states that "the training should include practical experience gained under the close supervision of experienced pilots. This practical experience gained on vessels under actual piloting conditions may be supplemented by simulation, both computer and manned model, classroom instruction, or other training methods."

Advanced practical training of engine room and ship-bridge crews and of pilots is carried out on simulators in special schools and in centres run by marine equipment manufacturers such as Norway's Kongsberg Maritime AS, Ireland-based Transas Marine International, US GlobalSim or professional associations like the French Pilots' Syndicate for the Atlantic, Brittany and Overseas Simulator (SPSA).

SPSA offers an interesting insight through the technical set up of its piloting simulator which relies on computers and a display system: "Screen projection is the key element of the simulation process. Through the bridge portholes, the image is displayed by 13 beamers on a 280° panoramic screen, 5.4 metres high x 16-metre diameter [17.7ft x 52.4ft]. In addition, two short focal projectors display the rear view from the pilot house. Finally, four 1-metre LCD screens have been placed on both sides of the bridge wings in order to optimise the simulation of berthing and departure operations."

The installation also has a navigation bridge which is "installed just above the projectors and its dimensions are those of a medium-sized vessel bridge. It is equipped with all the navigational aids and enables the monitoring of all kinds of vessels".

Other centres make it possible for trainee pilots to get practical experience by steering electrically-powered model ships in a basin. One such facility in France, Port Revel, has a fleet of 11 1:25 scale ships, representing 20 vessels, and 5 radio-controlled tugs, which can manoeuvre on a 5 hectare [12 acre] stretch of water.

The ships are fitted out with all the conventional features found on board a real ship and have built-in software and adjustable engines that can reproduce diesel or turbine propulsion.

SIMULATION CENTRAL TO TRAINING OF PORT OPERATIVES

The use of simulators in the shipping industry is not limited to actual navigation, but extends to port operations. There is a wide-ranging assortment of heavy lifting equipment in service in harbours to load and unload ships and to move containers, dry and liquid bulk cargo, refrigerated foodstuff or other types of cargo. The range of cranes used in ports includes a variety of gantry cranes, such as: ship-to-shore cranes, rubber-tyred and rail-mounted gantry cranes, as well as other types such as mobile cranes; straddle carriers, used to stack containers and transport them from/to ship-to-shore cranes; reach stackers, found in intermodal operations and ore bridge cranes. Some cranes, like jib, gantry or pedestal cranes, can also be installed on ships.

Each piece of equipment has its own function, and may be very different from others; and requires tailor-made training to be handled safely in all possible conditions and situations. For this, the use of advanced simulation equipment is irreplaceable and very cost-effective.

Port crane simulators make it possible to train operatives to practice handling below deck, on deck, on dock, and loading/unloading cargo in realistic conditions.

For instance, operators can sit in a virtual cabin suspended from a trolley that appears to be situated directly above the ship's hold or deck, which provides a view of the working environment. They can manipulate a spreader to lock onto containers and lift them onto trailers or railroad cars.

To train crane operators for all contingencies instructors can set certain parameters in the simulators' computers to affect visibility and equipment handling with specific and adverse weather conditions, times of the day, malfunctions and equipment failure. They can also fix different types of attachments to the virtual cranes (i.e. spreader, hook, clamshell buckets) to practice the handling of various types of cargo (containers, machines, bulk cargo, etc.).

All this allows crane operators to be trained or requalified on different pieces of equipment and to be prepared to react to a variety of scenarios in realistic, yet safe conditions. This also helps instructors assess trainees and give them appropriate feedback.

NO SIMULATION WITHOUT IEC INTERNATIONAL STANDARDS

A very important part of all simulators used to train pilots or ships crews, is played by the components and systems that give trainees a sense of reality and sensorial, even physical, feedback, a kind of high-end VR using visual and sound effects in addition to motion. These components and systems central to a wide and growing variety of VR equipment and applications, and very complex simulators rely to a great extent on International Standards developed by a number of Technical Committees of the International Electrotechnical Commission (IEC).

IEC TC 100: Audio, video and multimedia systems and equipment, and its Technical Areas (TAs) develop International Standards for a wide range of equipment such as projection, storage and sound systems destined to transmit images and sounds to displays or speakers.

IEC TC 110: Electronic display devices, prepares International Standards "in the field of electronic display devices and specific relevant components". Screens are used in many VR and simulation systems and a wide range of displays are installed in instrument panels for flight simulators as well as marine navigation simulators or shore-side training systems.

When motion is required electric motors are used. International Standards for electric motors are developed by IEC TC 2: Rotating machinery, created in 1911.

Overall, simulation systems for training crews and operatives in aviation, maritime and related shore operations rest on International Standards developed by many IEC TCs and SCs, working with specialized agencies like ICAO, IMO, the industry and other Standards Developing Organizations.

ABOUT THE AUTHOR

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ABOUT THE ORGANISATION

The IEC (International Electrotechnical Commission) is the world's leading organisation that prepares and publishes globally relevant international standards for all electric and electronic devices and systems. It brings together 169 countries, representing 98% of the world population and 96% of world energy generation. Around 20,000 experts cooperate on the global IEC platform to ensure that products work safely and efficiently with each other everywhere. The IEC also supports all forms of conformity assessment and administers four Conformity Assessment Systems that certify that components, equipment and systems used in homes, offices, healthcare facilities, public spaces, transportation, manufacturing, explosive environments and during energy generation conform to them.

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