REFRESH RATES

The market for simulator updates and upgrades is massive and it is not only platform OEMs that are benefiting, as many smaller suppliers that provide projectors, software and more are also involved.

By Trevor Nash

O n the surface at least, many might consider the simulator upgrade business as a small element of the overall market. In fact, the provision of upgrades, updates or technical refreshes, form the lion's share of the global training market.

Unsurprisingly, given the greater use of virtual training devices in the air sector, the majority of these activities are centred on flight simulation. Flight training devices are upgraded and updated on a regular basis to keep the device concurrent with the real platform. Updates generally refer to the platform's software systems, and upgrades focus on the training device's components, such as the image generator or motion platform.

Regular revisions

Given the fast pace of technical development in areas such as image generation and display technology, it is hardly surprising that such systems have to be replaced on a relatively regular basis. Younger pilots of the X-Box generation demand fidelity at least as good as what they see at home, and on the realism front visual systems need to have high levels of acuity.

CAE is currently in the process of conducting a technical refresh programme on the US Navy's MH-60R and MH-60S simulator fleet. (Photo: CAE)

Updates usually flow from the platform's OEM and, in theory, should be present in the simulator before the actual aircraft. A recent example of such an update concerns the Systems Configuration Set (SCS) for the US Navy and USMC's F/A-18E/F and EA-18G training devices.

Under the terms of this $9.6 million programme, L-3 Link Simulation and Training will bring the training devices to the same concurrency level as the aircraft. The SCS will be delivered to the fleet as an integrated software package that provides updates to the mission computer, sensors and human-aircraft interaction.

Such updates are not all about aircrew training devices. Link has also just been brought under contract to undertake an engineering change proposal to 'resolve obsolescence issues associated with the maintenance training system multi-function display unit, the aircrew training system main power cabinet and the small computer system interface' of the B-2 aircraft. This $8.9 million contract was awarded by the USAF Life Cycle Management Center at Wright-Patterson AFB in Ohio.

Meanwhile, Boeing has been awarded a $13 million contract modification to a previously awarded contract for F-15C and F-15E mission training centres. The company will update the F-15C and F-15E training devices with Mission Package 16 to provide compliance with combat air force distributed mission operation standards updates.

Awarded over a period of five days, the three updates described above indicate how manufacturers of training devices can benefit from supplying the initial training devices for a programme and then reaping the upgrade work that follows. As well as the sale price of these devices, they also provide a long-term revenue stream.

Technical refresh

A case in point concerns the US Navy's latest maritime patrol aircraft, the Boeing P-8A Poseidon. Although only recently entering service, next year will see an RfP issued to undertake a device technical refresh for ten operational flight trainers, eight weapons tactics trainers, three part task trainers, the P-8A Training System Support Center and a number of so-called 'electronic classrooms'. All of the equipment is located at NAS Jacksonville, Florida, and the award is expected in FY2018.

The procurement is expected to cost around $78 million. In addition, a production concurrency upgrade (PCU) for the P-8A valued at $100 million is expected to be let in December. Both of these contracts will be good news for Boeing and its sub-contractor CAE.

But what factors drive these upgrades? *MTSN* spoke to CAE's VP of strategy and business development, Chuck Morant, who said that 'challenging fiscal constraints' are key, but at the same time 'defence forces must still be prepared and mission-ready, so most are looking to simulation-based training to save money and cost-effectively maintain readiness'.

He said: 'One of the quickest and most efficient methods for militaries to expand the use of simulation-based training is to look at technology upgrades and updates to their existing training systems to bring additional capacity or capability.'

He added that maintaining concurrency between the simulator and platform is 'critical' and that 'technology refresh [helps] improve simulator performance and simplifies maintenance'. Other key factors were adding new capabilities to enable a broader range of training to take place and managing obsolescence.

Rotary refinements

Staying in the US, CAE is currently working on the US Navy's MH-60R/S Tech Refresh programme. This was awarded as a base contract with options, and will see the company undertake a number of major updates and upgrades to the navy's suite of MH-60S and MH-60R training systems, including tactical operational flight trainers (TOFTs) and weapons tactics trainers (WTTs) located at NAS Jacksonville, Naval Station (NS) Mayport, NAS North Island and NS Norfolk.

Some of the updates and upgrades to be developed include delivering a common hardware/software baseline for more than 20 MH-60 Seahawk training devices, extending the visual field of view on existing MH-60S OFTs, and converting an existing SH-60B helicopter simulator to an MH-60R TOFT.

This programme is also good news for Esterline Treality, which is providing the ►

extended-field-of-view displays, and Barco, supplier of the F-35 DLP projectors.

The MH-60R/S upgrade is being undertaken largely to improve the fidelity of the training devices to allow the US Navy to meet its avowed aim of taking more training time out of the aircraft and into the simulator.

Ray Duquette, CAE USA's general manager, said: 'The enhancements we make to the MH-60 Seahawk training systems will ultimately help the navy provide higher fidelity and more cost-effective training to its MH-60 fleet squadrons.'

Other active upgrade programmes currently being undertaken by the company include a digital automatic flight control system installation at RAF Benson for the service's Medium Support Helicopter Aircrew Training Facility for two Chinook HC6A helicopters; while in New Zealand, host computer, sensor, instructor operating station and tactical environment simulation software upgrades – including a CDB-compliant Medallion 6000 image generator – are being undertaken on the New Zealand Defence Force's SH-2G Super Seasprite simulator.

Platform protection
Upgrades are not always about making a single simulator more capable, however, a situation highlighted with the KC-135.

Referring to the KC-135 Aircrew Training System programme where CAE is the prime contractor, Morant stated: 'Our primary responsibility is providing the classroom and simulator instruction to the 3,700-plus aircrews – pilots and boom operators – that go through the KC-135 training programme annually. The US Air Force has put more training into the simulators and training devices on the KC-135, in part to save wear and tear on an ageing platform. This has allowed CAE to perform a range of simulator upgrades on the KC-135 training devices, especially over the past five years.

'Currently we are upgrading a range of KC-135 aircrew training devices for use on the United States Air Force's Distributed Training Center Network (DTCN) as part of a programme called the Mobility Air Force Distributed Mission Operations (MAF DMO). With the ability to connect the various KC-135 training devices to the Distributed Training Center Network, the USAF will have

It is not just flight simulators that need to be upgraded. Aero Simulation has recently secured a contract to replace PLCs on the US Navy's fire fighter trainer located at Great Lakes, Illinois. (Photo: ASI)

increased capability for virtual air refuelling and air refuelling formation training over a secure network.'

Stalling simulation
Making devices more realistic is a key requirement if more training is to be undertaken in the virtual world, but it is not all about visual systems or networking. In the US, Bihrle Applied Research has developed StallBox, which enables a significant expansion of the simulator's flight model, specifically in and around the stall.

'StallBox was developed in response to the industry need to extend the training envelope of existing transport category simulators to include the stall and post-stall flight regime... and in the commercial sector to also meet the FAA's March 2016, 14 CFR Part 60 Change 2 requirements for enhanced stall models and instructor displays for upset prevention and recovery training [UPRT],' explained Brian Wachter, Bihrle's VP of corporate development.

The other benefit of the product is that it can also support installation of software to expand the flight envelope without interfering with the main host computer.

'The StallBox computer, which hosts the new math models, is connected to the existing simulator host system via Ethernet or other communication protocol,' explained Wachter. 'A minimal code change is required to the existing host system to establish the interface with StallBox. When the flight conditions approach the limits of the valid training envelope of the baseline simulator, the StallBox is invoked and blending algorithms on the StallBox provide a seamless transition from the baseline aerodynamics model to the new/enhanced aerodynamics model hosted on the StallBox.'

The company is developing a range of models for commercial aircraft and StallBox

is already in service with Alaska Airlines for UPRT. The system has also been integrated with Boeing's P-8A Poseidon simulators.

'Most simulators can be modified to establish this interface,' explained Wachter. 'The simulator owner needs to have the authority and ability to make the change to the host software to establish the interface to the StallBox. The models to be hosted on the StallBox will depend on the specific training requirements. Bihrle currently offers several stall models – for example, for the Boeing 737 and Airbus 330 – and we are building a library of stall models for most types of commercial transport aircraft. Custom model development can also be conducted.'

Innovative approach
Bihrle's approach with StallBox can be viewed as applying innovative technologies to the upgrade process to squeeze more fidelity from the simulator. The same can be said of Serious Simulations and its Zero Drift Machine Gun Tracking System (ZDMGTS), Zero Frame Latency Wireless Video Formatter (ZFLWVF) and HMD products. The former is being incorporated into the US Army's Virtual Clearance Training System (VCTS) upgrade that is being conducted by FAAC.

ZDMGTS enables the VCTS machine gun to be fired with an extremely high degree of accuracy and zero drift. Drift is an issue whereby the virtual machine gun begins to move itself, or 'drift', virtually, without any physical movement or stimulus, necessitating recalibrations during training. The drift issue is not uncommon in simulators, and is created by a number of mounting and sensor technologies as well as environmental conditions.

'We were glad to provide the army with a solid solution for a vexing problem, so that soldiers will be uninterrupted by simulator drift issues and can be more fully ▶

immersed in their combat training,' said Christopher Chambers, CEO of Serious Simulations. 'In this project, we also decided to track deflection and elevation of the gun mount, rather than the gun itself, thereby making weapon change-outs realistic and simple, with no impact on tracking sensors.'

As seen above, upgrades are not all about flight simulation. Aero Simulation (ASI) has recently secured a contract to upgrade the US Navy's Recruit Fire Fighting Trainer. Awarded by the Naval Air Warfare Center Training Systems Division, the Programmable Logic Controller (PLC) Update Program is designed to enhance the trainer that is used by the navy's Recruit Training Command in Great Lakes, Illinois.

Recruits use the system during basic training to learn how to escape from smoke-filled compartments, open and close watertight doors, use self-contained breathing apparatus, carry fire hoses and fight fires. The replacement of the obsolete PLCs will provide improved training through improved reliability and maintainability.

'ASI is pleased to continue to support the navy fire fighting training by adding this new programme to our current Surface Warfare Fire Fighting Trainer update work,' said Michael McCarthy, ASI's president. 'This programme ensures new sailors continue to learn the skills necessary should a disaster ever happen aboard their ship by enhancing the reliability and maintainability of their training device. We're excited to continue our work developing great training solutions in partnership with the navy and look forward to our successful upgrades of these important devices.'

Upgrade path

Although frequently manufacturing new synthetic training devices, ASI has built a strong reputation for conducting simulator upgrades. In May, the company won the USAF's T-1A Ground-Based Training System (GBTS) Contractor Logistics Support (CLS) and TSSC programme to support 16 OFTs and 14 avionics part task trainers.

'The programme requires a team of highly skilled technicians to maintain the complex training devices at each location,' said Dan Deschnow, VP/director of programme management at ASI. 'The ASI team will also

have personnel at Randolph AFB and NAS Pensacola to provide training system hardware and software updates, concurrency management and obsolescence analysis as part of the TSSC.'

Another company with this particular skill set is Quadrant Simulation Systems. Typical activities include visual upgrades, the replacement of older hydraulic motion platforms with electric systems, adding avionics simulation such as TCAS, re-hosting and adding enhanced flight and engine models. In addition, Quadrant also undertakes simulator relocations. In February this year, for example, the company completed the move of 18 FFS devices to a new training centre for British Airways.

Legacy updates

On the military front, the company has now completed the first of two legacy Rediffusion Simulation hydraulic motion system removals and replacement with a new Moog electric motion system on a US Navy simulator.

Quadrant said: 'The programme scope consists of the mechanical design and manufacturing of the mounting adaptor plates and access bridge modifications required as well as the site tasks to remove the hydraulic systems and install the Moog electric systems. Quadrant also provided engineering support to commission the electrical system interface with the simulator.'

The first system, located on the West Coast, went back into training service on schedule, with the second system, located on the East Coast, due to be completed later in 2016.

Turning again to ground systems, one of the growing areas of virtual simulation over recent years has been virtual small arms trainers (VSATs). One of the major providers of such systems is Meggitt Training Systems. Upgrades form a significant part of its business model.

'Meggitt Training Systems has a very healthy mix of both upgrades and new system orders,' explained Winn Hines, director of virtual systems sales. 'We have received orders from our existing customers for both upgrades to existing equipment, as

Serious Simulations' 130° horizontal FoV HMD can be used to upgrade a number of different types of simulators, from door gunner trainers to dismounted infantry devices. (Photo: Serious Simulations)

well as orders for new training capabilities and weapon simulators. All of this has been mixed with orders from new customers for both simulators and weapons.'

Reaping the rewards

According to Hines, an upgrade will normally allow customers to reap 'the benefits of greater realism, faster performance and efficiency in system operation, [as well as] updating older technology with new hardware'. Upgrades can also lead to improved availability and may also provide greater operational training.

He said: 'Customers generally look to upgrade components such as PCs and projectors, thereby keeping up with the latest in visual display technology and graphics software, while at the same time maximising the investment in their simulated weapons inventory. This type of upgrade may also include the addition of tablet capabilities and enhancements to the user interface.

'Canada, the UK, Australia and the US Marine Corps have placed orders with the company to upgrade or perform "tech refreshes" on their existing systems.'

Although it is difficult to quantify the simulator upgrade market, the cases highlighted above indicate that the market is an active one. From CAE's point of view, the market is also an important one.

'CAE certainly believes that the simulator upgrade and update market will continue to grow over the next five to ten years,' said Morant. 'Demand from military customers to accomplish more training in a virtual environment, continued pressure on capital procurement budgets, and the rapid pace of simulation technology developments all point to growth in the simulator upgrade market.' ∎