

# MOTION Cueing Essentials

*Trevor Nash investigates movements in the motion market. New technologies and more reliability means that the future is looking bright for the manufacturer's of motion platforms and their associated control software.*

As industry members know well, the military training and simulation market is very much a cyclical one. Frequently feast or famine with very little in between, it would appear that the former currently pertains with most companies currently reporting strong levels of business. This optimistic air is certainly being felt in the area of motion with the Big Three, FCS, Moog and Rexroth Hydrauladyne, all reporting high levels of business activity.

With the military undertaking more and more deployments, high-fidelity training has never been so important. As such, along with visual cueing, motion and haptic cueing systems are being recognised as key aspects in providing today's warriors with a realistic training environment. Kim McKernan, the Manager of Global Communications at Moog Inc provides this assessment of current market dynamics.

"Desert Storm and the Iraqi conflict have shown the importance of military training simulation," she tells *MT&SN*. "Moog's experts have been involved in conversations with a number of military commands, discussions at conferences and customer activities that have solidified our understanding of market dynamics. The US market is poised for significant activity in the immediate future.

"This includes electric motion bases for Flight School 21 and other new installations, as well as replacements and upgrades of existing hydraulic motion bases. In addition, Moog's engineers have seen a need for quality repair and replacement hardware for existing servo-valves and actuators. Many of these hydraulic motion bases will be upgraded with all new digital control electronics and latest revisions of the hydraulic legs



*A control cabinet for a Moog electric motion system.*  
(Source: Moog)

using high performance servo-valves and integral abort functions."

Technology is also helping to drive a number of other changes within the industry and this is shaping how the military is using motion cueing.

"A variety of other trends include increased interests in driving training, continued migration from hydraulic to electric technology, and interest in smaller size bases," explains McKernan. "A high level of interest in driving training suggests there will be significant requirements for motion bases designed specifically to address a range of needs from basic driving skills to advanced driving capability for combat vehicles.

"The other major change is a move from hydraulic to electric technology. New

systems for commercial aviation are looking to use our all-electric solutions. Besides the traditional large motion bases, we have also seen an increase in interest in smaller electric motion bases providing lower cost simulation solutions for the commercial and general aviation markets."

Perhaps the buoyant military training market and the increased opportunities for motion systems will assist new kids on the block exploit these new business opportunities. At last year's I/ITSEC event in Orlando, Curtiss Wright Controls were showing off their Powerbase electromagnetic six degree freedom of motion platform.

The Powerbase platform has a maximum payload of 2,000 lbs and is aimed at the flight trainer and driver trainer segments.

The technology behind Powerbase has been developed in the UK by RWE Nukem at the Winfrith Technology Centre and is being exploited through Advance Motion Technologies Inc who are working in conjunction with Curtiss Wright Controls.

"We have invested significantly and developed new technology and patents to improve and provide serious reliability to our actuators," says Henry Lieberman, Chairman of Advanced Motion Technologies. "Our presence at IITSEC allowed us to demonstrate our technology to a wide audience and the feedback that we obtained has been positive."

Although the global market tends to be dominated by the Big Three vendors, there are certainly opportunities for the smaller players such as Florida-based Servos & Simulation and the UK's CueSim, now part of QinetiQ. But like any area of business, the smaller players need to find discriminators to win the contract.

In Europe, Rexroth Hydraudyne's Sales Manager, Ronald Yntema echoes Moog's view of a bullish market. "The market is certainly very buoyant at the moment, both for new build projects and upgrades. We are also noting that the electric motion platform is now a mature product and has become more popular with the military user. Another trend that we perceive is that the user is demanding a more integrated solution to include the platform, control loading devices, software and interfaces."

This said, Yntema tells *MT&SN* that the customer does not always specify the electric solution. Often hydraulic systems offer a more acceptable solution and one which better meets the simulation task.

"Hydraulic systems are still required for high payloads above 14,000 kg and for



*FCS has been highly successful with its ECue range of electric motion platforms and associated software.*

(Source: FCS)

high velocity movements greater than one metre/second," he explains. "Two examples of where hydraulic systems were better suited to the simulation requirement feature the Lockheed Martin JSF engineering and Research simulator which required a roll rate of 40 degree/second and an EA-6B OFTN which has a high payload and needed to replicate the rapid acceleration and deceleration of deck launches and landings."

Hydraudyne's latest success has been in the Netherlands where the Dutch aerospace research establishment (NLR) has selected the company to supply a 12,000 kg payload electric motion platform for its Generic Research Aircraft Cockpit Environment (GRACE) project. According to Hydraudyne, the company's solution features, "the optimum combination of electric drives, electric motors and spindles commercially available resulting in low noise, smooth motion with no vibration, long life and low maintenance requirements."

Fellow Dutch motion players, FCS, are also seeing a growth in business. Laurent Mazeyrac is the company's Marketing and Sales Manager.

"The military market is going well with lots of countries requesting information on electric motion systems," Mazeyrac tells *MT&SN*. "The fastest growing geographic market for us at the moment is Asia whilst in terms of applications, armoured fighting vehicle and driver training applications seem to be the most popular. Our view is that at present, the military seem to have the money to spend on training and they are not scared of the technology."

Having already delivered high-payload electric motion platforms to the Spanish Army for a number of helicopter simulators, the company is now working on a project in China for a 12,000 kg payload electric motion platform and a g-seat.

In the international market, Moog's engineers have observed an increased interest in the purchase of complete motion bases for flight simulation. "In addition to the flight training opportunities, there will be new requirements for driver and gunnery training," says Moog's McKernan. "As in the US market, the repair, upgrade and replacement of existing motion bases and components is a significant opportunity for Moog. We see



*Moog is developing higher payload electric motion systems and has recently signed a supplier agreement with FSI.*

(Source: Moog)

requirements being submitted for training through the European community as well as in the Middle East and Asia. The budgets being discussed would indicate the international market will offer significant opportunities both in the immediate and future time frame."

In addition to the historical flight training and developing driving training markets, Moog sees an increased interest in the development of simulators for various tasks on ships, both domestically and internationally.

Although most companies see the international market as an area of growth, it should not be forgotten that the USA provides the world's single largest market for simulation. Rexroth Hydraudyne has already achieved significant success in this market through prime contractors such as Opinicus, Lockheed Martin and NLX.

FCS has won business through Boeing for the AH-64 Apache programme whilst Moog's most important recent win has been its selection by FlightSafety International to provide electric motion bases and electro-mechanical actuators for its flight simulators.

As well as the V-22 and C-17 programme's, this is likely to mean big business for the Aurora, NY-headquartered Moog as part of the US Army's Flight School XXI programme for which Flight Safety International is a major sub-contractor to CSC.

To conclude, the current state of the motion simulation market is certainly buoyant. In many ways, this reflects the overall nature of the military market for training and simulation but one other factor is the growing use of electric motion systems both for new build projects and for upgrading older simulation systems.

Another factor to emerge is the military's desire for simulators within the wheeled and tracked vehicle driving domains.

Being lighter than the average flight simulator,

*Rexroth Hydraudyne has been successful in supplying Lockheed Martin with a motion platform for the JSF engineering simulator.*

(Source: Hydraudyne)



these systems are likely to involve electric solutions.

Although electric motion platforms are growing in use, hydraulic systems still have their place, particularly for high payloads and where rapid acceleration and decelerations are required.

In terms of geographic markets, the US is still seen as the biggest potential outlet.

With the Department of Defense's (DoD) recently announced 7% increase in defence spending for 2005 and a projected increase of 21% out to 2009, this market is likely to remain core for many in industry. Other key

growth areas are Asia and the Middle East.

So with growing markets, improved technologies and a greater acceptance of the need for accurate motion cueing, the prospect for the future looks good.