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Feature Article

Navy Fine-Tuning Acquisition Strategy for Flight Simulators

by Sandra I. Erwin

Recent investments by the U.S. Navy in flight training technologies denote a focus on systems that are easy to use and to transport to remote locations around the world, even on ships.

Nevertheless, these systems still remain in the prototype phase, and it is not clear what the Navy's strategy will be for purchasing deployable trainers in large quantities. Most of the questions revolve around funding and technological requirements.

"There is a move philosophically toward deployable, reconfigurable transportable flight trainers," said Navy Capt. Rory H. Fisher, program manager for aviation training at the Naval Air Systems Command.

During a recent interview, Fisher noted that the Navy had been experimenting with portable trainers for quite some time. A case in point is a Boeing-developed flight-squadron trainer, which has been deployed on carriers. The Seattle-based company also produced a so-called tactical trainer technology demonstrator.

More recently, the Office of Naval Research sponsored the transportable strike/assault rehearsal system (TSTARS), a flight training system that can be packaged in an ISO container and deployed on aircraft carriers. The TSTARS program was a technology demonstration scheduled for completion in September 2000. The prime contractor is Evans & Sutherland Corporation, based in Salt Lake City.

These attempts notwithstanding, said Fisher, "There are no operational

transportable, reconfigurable, deployable simulators in the inventory today." At one point, there were plans to award a production contract for the TSTARS system under a program called DTATS, for deployable tactical training system. But that program, said Fisher, "will not be moving forward in the near future."

The Navy's decision to postpone the trainer purchase can be attributed to budgetary and technological reasons, said Fisher.

"If you wait just a little bit, we'll have a little bit better technology" in areas such as PC-based imagery, for example, he said. "Philosophically, we are going to move that way."

DTATS, he said, "will happen in three to four years. If we wanted to build it today, we probably could." But the technology is improving at such a rapid rate that the Navy would benefit from a wait-and-see attitude, he said. "We are just now at the point where the real cost benefits are coming in with PC-based imagery. Waiting a year is pretty prudent. But it still will not have the fidelity that the larger simulators have."

The transportable systems developed so far, Fisher said, "are low-cost but they don't give all the technology that we want. They are in the $2 million to $3 million price range.

"The devices we are producing as containerized vans, called tactical operational flight trainers, run $7 million to $10 million," he said. That price range is much lower than the $20 million to $40 million the Navy has paid for dome simulators in the past, Fisher added.

Simulators, he noted, cannot replace flight hours, but can help maintain combat skills while at sea. "I don't think we are going to move during the next three to four years towards substituting simulator hours for flight hours. But there is a need to address decreasing readiness while at sea.

"You want to be able to do some things in a simulator to keep sharp, but the only reason we want to go to the transportable [systems] is because technology is going to allow us to do that," Fisher asserted. "We couldn't do it 10 years ago. The fidelity wasn't good enough. The cost and footprint [were too high]. Now everything has come together.

"We are even going to PC-based image generators instead of the large visual systems."

Fisher does not buy into claims made by companies that they can build low-cost simulators for less than $100,000. (related story p. 65) "I don't believe it. They don't believe it either," he said. Those low-end simulators, however, can be useful for specialized learning needs. Fisher calls them "micro-sims."

There is a difference between "micro-sims" and flight simulators, he stressed. In order to teach a pilot how to fly, a simulator has to be realistic. "It can't

In order to teach a pilot how to fly, a simulator has to be realistic. "It can't look like a game. It has to have a handle just like the real airplane."

The low-cost simulators, he believes, cannot be flight simulators. "But there is a role for micro-sims today." These can help to teach a pilot certain skills, such as how to operate an instrument on the airplane, Fisher explained, "and bring you to a learning point faster. They don't necessarily make you a better pilot."

Using a "micro-sim," he said, a pilot can learn how to operate a piece of equipment faster than by reading a book. "The cost of picking up that specialized skill in an airplane is much higher than doing it in a simulator or a micro-sim. When you get in an airplane, having learned that skill is helpful even though, over the long run, it will not make someone a better pilot. ... It's a learning aid, not a replacement."

The same could be said about commercial video games, said Fisher. One example is the Fleet Command game, which the Navy recently incorporated into its officer training program at the Naval Academy. "Those can teach you thought processes. But they are not a substitute," said Fisher. "They teach you a process faster, through repetition." These games, he stressed, "have to be viewed as training aids and not games. You have to figure out how to make them as real as possible so that the person knows there are consequences for his [or her] actions."

One undesired consequence would be "negative training," he explained. "In micro-sims, you really have to worry about negative training." Negative training occurs when a pilot, for example, makes unsafe maneuvers in a simulator and then replicates them in live flying, potentially risking lives and aircraft. "You have to understand what the training is for and what the outcome is supposed to be."

Navy scientific and research efforts currently are focusing on technologies such as mapping, imagery, and distributed learning capabilities for Internet-based courses, said Fisher. "Advanced distributed learning is the top technology priority we have today."

Transportable Trainer

The simulation and training industry, meanwhile, is watching the Navy's investment decisions closely, trying to anticipate the service's requirements in an increasingly competitive marketplace.

In the case of the TSTARS technology demonstration, it appears that not all the Navy's goals were achieved, said Dee A. Chandler, spokeswoman for the Naval Air Warfare Center Training Systems Division (NAWC-TSD), in Orlando, Fla. The system was conceived as a forward-deployable mission-rehearsal device, with advanced visual imagery—particularly in the area of sensor domains, such as night-vision and infrared.

"The three most difficult challenges have been to develop real-time physics based pixel-level simulations for the forward looking infrared (FLIR), synthetic aperture radar (SAR), and night vision goggle (NVG) sensors to support aviation mission rehearsal from a single online database," Chandler said in a written statement to National Defense. "The FLIR simulation has been the most difficult to implement because of the number of physics-based algorithms that must be implemented." The FLIR simulation problem, said NAWC-TSD, only can be solved with an image generator that supports specialized textures and color dynamics. "Encoding the material properties into the database has also been a challenge."

TSTARS started four years ago as a research program funded jointly by the Navy and by Evans & Sutherland, said Robert Brantly, a senior program manager at the company. Boeing is the primary subcontractor.

To determine how best to design a deployable trainer, the contractors talked to load-masters on aircraft carriers and asked them how big the trainer should be in order to get on the boat. The answer was 8x8x20 feet, Brantly said in an interview. TSTARS is a 4-foot dome with a 360-degree view.

The trainer, packed in a metal ISO container, can be hung from below the flight deck, with no modifications required on the carrier, he said. The TSTARS fits on a C-130 cargo aircraft and can be loaded on a truck as well.

Today's Navy flight simulators tend to be 20-foot domes or 40-foot domes, located at naval stations stateside or overseas. On a carrier, said Brantly, pilots have mission rehearsal stations, which typically are computer workstations that allow them to view imagery, but they are not flight simulators. TSTARS would provide a full mission rehearsal simulator system on the boat for the first time, he said. Each air wing would get a device that would travel with them.

Evans & Sutherland expects to compete in a future DTATS program, which Brantly believes could involve 20-25 deployable trainers. The estimated cost for each unit is $3 million to $3.5 million.

In March 2000, company executives were invited to bring a TSTARS device to the Oceana Naval Air Station for a review by the high-level Navy Air Board. "The admirals thought this was on the right track," said Brantly.

TSTARS is reconfigurable, he explained. "You can open up the end of the van, pull out the cockpit, put in a new one for an AV-8B Harrier (right now it's an F/A-18), close the back door and fly a new disk in, and run it as an AV-8 simulator." The changeover takes about a day to complete.

Adaptable Trainers

Another industry player in the business of deployable trainers is BAE Systems Flight Simulation and Training, in Tampa, Fla.

The company will not decide whether to participate in a future DTATS program until there is a “real requirement” articulated by the Navy, said John Lenyo, the company’s vice president for business.

BAE Systems competed and lost an Army award for a deployable reconfigurable tactical trainer for helicopters, under a program called AV-CATT. The winner was Link Simulation and Training, based in Arlington, Texas.

“We did a prototype for AV-CATT [in 1996],” Lenyo said in an interview. The Navy program has yet to formalize a requirement, he said. “They are asking industry about what is feasible and what is possible.”

The technology is “feasible,” Lenyo said. The company already has been able to pack three helicopter simulators in a standard container, about the size of a tractor trailer box.

“Big, full-flight trainers are designed to train everything from systems to emergency procedures and how to fly the aircraft,” Lenyo explained. “In a deployable device, you can assume the guy knows how to fly and knows the emergency procedures.” What needs to be taught are tactics, he said. “The most difficult thing to teach is tactics.” When building a tactical trainer, “you can eliminate things such as the motion system, the simulation of hydraulics systems, and you focus on high-fidelity simulation for the tactical environment—immersive visual systems, semi-automated forces and weapon systems. That is how you make it small and deployable.”

How much to spend on a simulator depends on “training objectives,” said Lenyo. “There are different training tasks, for which you need different levels of fidelity in a simulator. If you want to teach basic flight skills, you need the equivalent of an FAA level-C simulator. That means you need a motion system, and fidelity to certain levels.”

Basic flight simulators often include a tactical training capability, known as a weapon system trainer, he added. “That is typically the kind of simulators the military has been buying. They cost a lot of money ($20 million to $30 million) because of the high fidelity systems.” The downside is that they are “big and bolted to the floor.”

A pilot deployed at sea can stay proficient for some time, “but what he can’t practice often enough is tactics,” Lenyo said. That means being able, in a simulator, to drop bombs and conduct air-to-air engagements. “The only way they can practice, short of a live firing exercise, is in the simulator. If you have only one weapon system trainer and you can’t afford to buy a bunch of them, then that becomes a training problem.”

The “key technology” that the industry must focus on today is the development of visual systems, Lenyo said. “Typically, in a large flight simulator, there are big display systems. To make it portable, you can’t have a big visual system.”

big visual system.

BAE Systems developed a helmet-mounted display, along with a product called Gemin-Eye that allows trainees to get a high-resolution visual image in a very small space. Gemin-Eye is an optical display system mounted on a helmet.

Lenyo estimated that, depending on options and packaging, deployable trainers will sell for less than $10 million.

The company predicts a 3 percent to 6 percent growth in Defense Department simulation and training in the near term, “but a lot of it has to do with the next administration,” said Lenyo. The United States spends 60 percent of the world’s simulation and training budgets. “We expect that to increase moderately. But the focus on simulation and training in the U.S. will be moving toward deployable, transportable, tactical trainers and Web-based distance learning.”

There are problems, however, in the simulation and training industry, he said, because most firms can’t make deliveries on time. “This industry always has been constrained by resources. We need certain skill sets that no other industry in the world needs, ... [workers] who only exist in the simulation field.”

The only way to hire talent is to woo employees from another simulation firm or grow the workforce in-house, which takes many years to do, Lenyo said. “Almost every company finds they don’t have enough talent. Simulators bog down in the development cycle. ... That is why everyone is late.”

A growth in overcapacity in the industry also has pushed some companies to make commitments to some “extraordinary expectations of the customers and then find out the price they are being paid doesn’t match the customer’s expectations,” said Lenyo.

One senior Navy officer recently confirmed the industry’s predictions that the needs for simulators will grow.

“We need simulators with debriefing and training capability, of the same type the commercial airlines have,” Rear Adm. Frank “Skip” Dirren Jr., commander of the Navy Safety Center, told the Tailhook Association annual convention last August.

The Navy’s future pilots, he said, “need to train foundational skills in a simulator. We can’t afford to do that in live aircraft. We could do it in simulators, if we had the kind of simulators that the airlines have.” Dirren acknowledged that airline pilots do not perform nearly as risky flights as naval tactical aviators. For that reason, Dirren said, commercial pilots don’t do any training flights in real airplanes. “All the training flights are in simulators. And it works. [But] I’m not saying we have to do that.”