

Military Training Technology

Special ADL
Issue

**Distributed
Educator**

**Colonel
Kim A. Bowling**

Commander
Air Force Institute for
Advanced Distributed Learning

MT2

Volume 10, Issue 4
2005



JADL Co-Lab * OSD and ADL * SCORM
Army e-Learning * 3-D Maintenance Training



NEW SOFTWARE SOLUTIONS ARE ENABLING TROOPS TO BETTER FAMILIARIZE THEMSELVES WITH PARTS AND SYSTEMS, SAVING TIME AND MONEY WHILE LEARNING PROPER MAINTENANCE PROCEDURES.

By SCOTT R. GOURLEY

MT2 CORRESPONDENT

One recently embraced training technology application that appears poised for extremely rapid growth and expansion involves the use of 3-D in maintenance training. Long gone are the libraries of line drawings that presented maintainers with a two-dimensional view of critical military systems. With only the briefest pause in the world of point-and-click video technologies, modern maintenance personnel

have started training in a 3-D imagery simulation environment that approaches the reality of flight line or foxhole.

According to representatives from the office of the Product Manager Ground Combat Tactical Trainers within the Army's Program Executive Office for Simulation, Training and Instrumentation (PEO STRI), 3-D training technologies bring three significant advantages to the maintenance training arena: shorter class time due to more rapid learning of training material by the students; higher retention of training material learned; and a safer learning environment.

User impact includes "more rapid familiarization with the vehicle components, operation and functions," observed one office representative, adding, "The student is placed in a classroom environment, which is more conducive to learning. The student can also interact with the virtual vehicle's components and virtual test equipment in a safe environment to more rapidly gain experience with

the particulars of the vehicle on which he is being trained to maintain."

Recent industry entrants into the 3-D maintenance training arena include companies like 3Dsolve, American Systems Corp. (ASC), Anark Corp., DEI Services Corp., DiSTI, NGRAIN, VEGA, and VSAT.

"3-D software has been around for a while in the simulation world and it's starting to make its way, in a pretty major way, into the training world," explained Daniel Cook, senior product manager for Anark Corp.

Although the company's military training portfolio has involved base training rather than maintenance training, the February 2005 release of its flagship product, Anark Studio, positions the company to support the 3-D move into military maintenance training.

Cook pointed to two important trends that were helping to drive the phenomenon and allow exploitation of the technology for maintenance training:

"First, the manufacturers of the world

are moving toward 3-D CAD systems,” he said. “In the past, they’ve been very heavily involved in 2-D CAD, and finally, in the fragmented way that some of these companies work, they are finally starting to make that push totally into 3-D CAD. So, if you look at some of the bigger companies you’ll see that they are all using CATIA data and it’s all wonderful 3-D. So one of the great things about that is that it makes the source of 3-D readily available. So, finally, the whole product life-cycle management vision is starting to percolate its way to applications other than engineering. Second, now that people have this data they are starting to identify other areas where it can be used. And one of the obvious areas is in things like maintenance training.”

Another factor accelerating the application of 3-D solutions to maintenance training is the high cost associated with traditional hands-on training approaches.

NGRAIN shared one recent example of a 3-D maintenance training application that resulted in cost benefits.

The company recently announced that the U.S. Army will deploy its interactive 3-D solution for maintenance training, as a replacement for the aging Brakes System Task Trainer (Universal Maintenance Simulators) at one of the Army’s training schools. According to the late June announcement, the leveraging of NGRAIN’s interactive 3-D software and professional 3-D model development services “will enable the Army to develop advanced training courseware to help accelerate the delivery of training and achieve the school’s objective of training 1,200 soldiers to standard each year. By implementing the NGRAIN solution, the Army will also generate an estimated \$800,000 in savings, over the cost of replacement of the current Universal Maintenance Simulators system. Reduced maintenance costs will extend the savings by an additional \$70,000 annually.”

“NGRAIN offers a new way to reduce training costs, while also accelerating maintenance training,” said Larry Helms, director of the Army’s Lifelong Learning Center. “The NGRAIN-based 3-D brakes simulators provide a learning experience that is superior to the old simulators,” Helms added. “Students can freely explore the brakes at their own pace, as well as watch procedures, perform tasks and receive instant feedback when they make mistakes.”



Virtual training and familiarization marries high-fidelity models with on-screen assistance as seen here with the refuel/defuel panel and the fuel facility displayed for easy user interface as well. [DiSTI image]

Moreover, the cost benefits of 3-D maintenance training can be even greater when the end items include higher cost subsystems like jet engines. An example of the higher-end platform application can be found in American Systems Corp.’s F/A-18 Simulated Aircraft Maintenance Trainer (SAMT). The SAMT utilizes DiSTI’s GL Studio, which the company describes as the world’s “first and only” object oriented rapid virtual prototyping and graphics code production tool. By synthesizing photographs, 3-D models and behavioral logic, GL Studio creates photorealistic 3-D interactive real-time reusable simulation objects (RSOs). Coupling the RSOs with a valid physics-based model provides the foundation upon which visual simulations can be built.

For the SAMT program, ASC teamed with DiSTI and SIMTECH to develop the system design and interfaces to the 3-D training environment models. DiSTI used GL Studio and its Virtual Maintenance Training Environment to create the overall 3-D environment.

SIMTECH is the simulation model developer on the project and provided all of the F/A-18 systems. As the prime contractor, ASC provided the total systems engineering, hardware design, production, database and I/O software development, integration, quality assurance and integrated logistics support.

“This is a completely new market,” said Michael J. Sivret, vice president of sales and marketing for DiSTI. “With the FA-18 SAMT you can isolate faults in this aircraft down to a single wire. We have the electronic test equipment—everything is there.”

“I can’t really say what anybody else is doing, but I believe that this is the most expansive application of 3-D maintenance training out there,” Sivret said. “I mean, I’ve seen a lot of maintenance trainers where they have a lot of ‘hot points,’ but when you click on the ‘hot point’ you either get a high-res photograph, an animation sequence, or a video sequence. But everything we do is interactive. It’s real-time simulation. So we believe there are a lot of benefits to what we do and, from what we’ve seen and what our customers have told us, nobody even comes close to this.”

Dennis Corrigan, vice president of ASC’s Training Systems Division said, “What really makes a difference in this type of training approach, is the transfer of learning from the training device to the real aircraft.”

“We have tied nearly every system in the F/A-18 into a virtual training environment and allowed nearly all of the interconnectivity to come alive. When an electrical component fails, say a fuel pump, its effect on the entire system is demonstrated and you can interact with it to test it, fix it or replace it.”

As might be expected, while there appears to be complete industry agreement on the value of introducing 3-D modeling to maintenance training, there is less industry consensus on the specific technical approach to use.

“You sort of have two groups out there,” proposed Anark’s Daniel Cook. “There are game companies who are taking existing game engines and then converting or modifying them to being some sort of training activity. One of the problems,

unfortunately, with game engines is that there aren't a lot of first person maintenance trainers out there. There are a good number of tactics games and squad based combat games, but when you start dealing with maintenance training, specifically, you have to do some pretty major modifications to a game engine in order to get it to work.

"And on the other hand you've got what I like to call the 'model spinners,'" Cook continued. "It's a very simple form of 3-D. It's basically saying, 'We're going to take a CAD model, convert it into a 3-D format, then we can do a few real basic things with it: spin it; explode it; we can put some labels on it; and maybe we can do some animation as well.' Now that's good because that starts taking over one of the sections of maintenance training, and if you're looking at actually replacing hands-on maintenance training with 3-D training, you've got to examine what activities people are really doing out there. One important step is teaching the parts and how they all fit together. The next important step is procedures. Well, it turns out that the model spinners are pretty good at exploring the parts. And they are okay at teaching procedures. But the next step is where a lot of the benefit of 3-D comes in: experiential learning, training and testing the student."

Positioning his own company as being "somewhere in the middle between those two groups," Cook said, "Anark comes from more of the multimedia background."

"We have the full 3-D engine," Cook said. "We've sort of taken technology from the game world to do that. And then we've put an authoring environment on top of that that actually lets you author these



Interactive 3-D product visualization, manipulation and communication is essential for beneficial maintenance training. [Anark image]

things rather rapidly, but also gives you the flexibility to do simulated training, which allows you to build simulation into your training rather instead of just rote procedure. So now we've got a solution that actually allows you to do hands-on training."

"It's a wonderful thing for people to be excited about learning," he observed. "And the typical ways that people have learned in the past have been huge 'telephone books,' for all intents and purposes. Occasionally you'd get a video out there. But, particularly when you're talking about maintenance training, you tend to be dealing with a lot of younger students. They've been raised on video games. It's how they've learned. So they see this type of application and they are immediately at home with it. That's kind of an interesting side effect that we weren't predicting."

Corrigan takes this prediction to the next level: "Since the maintainer who is coming to us now learns this way, soon we'll embed a similar learning capability into the interactive electronic technical manuals so that the maintainer can use this same learning style just before they have to do a complicated or seldom used maintenance action," he said. "We might

also allow a technician access to a virtual system to do their troubleshooting in the work center or in the shop and not risk any damage to the real equipment."

Cook said that there are now some great 3-D applications in maintenance training.

"I'm really excited about the stuff that's coming out in the future. Because the rate at which 3-D acceleration is occurring right now, these things are just going to be getting more and more realistic while the cost of production is going to keep going down. So the sky's the limit at this point. It's like we're at the start of something rather new."

Sivret recently worked on a white paper that projects the future applications of 3-D modeling by referring to the F-18 SAMT as "just one example of how next generation maintenance trainers will allow personnel to train on major aircraft, shipboard or ground vehicle systems at a fraction of the cost of procuring the original equipment."

From his perspective at DiSTI, "Personnel will be able to train on subsystems such as fire control and armament; flight control and instruments; and communications, navigation and electronic countermeasures systems. Maintenance personnel will be able to perform both operational checkouts and troubleshooting on a desktop, laptop or via the Web."

Returning to a nearer term perspective, Sivret said, "I've looked at a lot of the other stuff out there and it's just not at the level of what I consider to be 'training ready.'"

"The bottom line is that you've got a lot of people who are pushing marketing type information. They will tell you where they are and where they are going. But we're actually delivering this stuff." ★

THE | POWER | TO CREATE | REALITY

www.simulation.com

GL studio

Unmatched Reusability, Unbeatable Performance and Unparalleled Value. GL Studio is changing the way simulations are developed.

- DO-178B for embedded systems
- Electronic Human Machine Interfaces
- Virtual Prototyping
- Computer Based Training
- Maintenance Trainers
- Part Task Trainers

11315 Corporate Blvd. | Suite 115 | Orlando, FL 32817

407-206-3390