

REPORT ON MILITARY USE OF NGRAIN INTERACTIVE 3D EQUIPMENT SIMULATIONS IN TRAINING AND OPERATIONS

This report provides an evaluation of the United States and Canadian Militaries' use of NGRAIN interactive 3D equipment simulation solutions to solve problems faced in the training and operational environments.

TABLE OF CONTENTS

Situational Awareness.....	3
Use of NGRAIN 3D Equipment Simulations to Improve Training.....	4
Use of NGRAIN 3D Equipment Simulations to Improve Operations	9
In Summation.....	13

SITUATIONAL AWARENESS

The operational tempo of the United States and Canadian Armed Forces today is higher than ever, resulting in the growing need to deploy new recruits faster with reduced training residency time. Additionally, to support war and peacekeeping efforts overseas, the Armed Forces are rapidly fielding new equipment, on which personnel have received little or no training due to time and/or geographic constraints. This presents a challenge: due to limited training time, new equipment can be incorrectly installed, maintained, and/or operated in the field, resulting in misuse, premature failure of parts, and increased risk of injury to personnel. Likewise, evolving procedures in the field – such as Battle Damage Assessment and Repair procedures and Improvised Explosive Device awareness and education – are requiring the Forces to continually deliver just-in-time information and on-the-job training to personnel in the field, despite barriers raised by geography and lack of access to Subject Matter Experts.

This report provides an evaluation of the United States and Canadian Militaries' use of NGRAIN interactive 3D equipment simulations to solve problems faced in the training and operational environments. Through studies and assessments of the use of NGRAIN at US and Canadian Military sites in North America and overseas, some of which are cited here, interactive 3D equipment simulation solutions have been found to offer a cost-effective means to accelerate equipment training and improve personnel understanding and accuracy of task performance.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

U.S. Army | Brake Systems Maintenance Training

CHALLENGE:

U.S. Army brake system panel trainers were outdated and in a state of disrepair. The cost of replacing the panel trainers was estimated to be \$1.3 Million, plus \$80,000 a year to maintain. Additionally, the panel trainers had limited effectiveness: Soldiers had to share time on the trainers and were not able to practice procedures in a realistic manner.

OBJECTIVE:

To provide Soldiers with increased opportunities to practice tasks and learn troubleshooting procedures, while keeping costs to a minimum.



SOLUTION:

The Army developed a computer-based course following Army Training and Doctrine Command instructional design practices and processes, incorporating NGRAIN interactive 3D simulations of three vehicles and their brake systems. In the computer-based practical exercises, Soldiers are presented with troubleshooting scenarios, text from the approved Technical Manuals, and interactive 3D brake system simulations, on which the Soldiers perform and practice tasks.

PAYOFF:

Training is able to occur more efficiently than before, enabling the school to save training hours, translating to \$14 million in cost avoidance per year. The school is applying this savings to deliver training for new vehicle technology, including wet brakes maintenance and repair.

U.S. Army | Detroit Diesel 12V71 Engine Virtual Task Trainers

CHALLENGE:

A U.S. Army school's student population had grown over a short period of time and become geographically distributed, creating both logistic and budgetary issues.

OBJECTIVE:

To provide more effective hands-on training at a lower cost that can be delivered to Soldiers anywhere, anytime.



SOLUTION:

NGRAIN provided interactive 3D engine simulations as part of computer-based Virtual Task Trainers, which enable Soldiers to watch and practice procedures virtually, receiving real-time guidance and feedback.

PAYOFF:

The School was able to increase student throughput, eliminate geographic barriers to training, and train Soldiers to a higher standard.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

U.S. Army | Chinook 47D Helicopter Auxiliary Power Unit (CH-47D APU) Virtual Task Trainers

CHALLENGE:

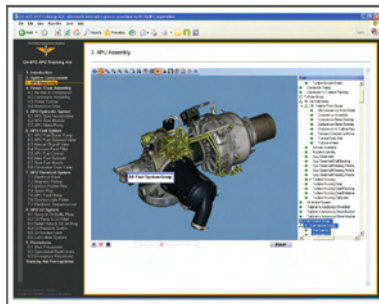
The U.S. Army CH-47D APU panel trainers were antiquated and difficult to move from classroom to classroom, causing training inefficiencies and course scheduling bottlenecks that resulted in training delays and reduced overall student throughput.

OBJECTIVE:

To provide Soldiers with increased opportunities to practice tasks and procedures, while also increasing student throughput.

SOLUTION:

NGRAIN provided Virtual Task Trainers, which enabled Soldiers to watch and practice procedures virtually, while also allowing quick content updates to ensure concurrency of training content.



PAYOFF:

The School was able to increase student throughput and train Soldiers to a higher standard. As well, the School is able to cost effectively update the training content when needed.

U.S. Army | 3126 Caterpillar Engine Basic Mechanics Training

CHALLENGE:

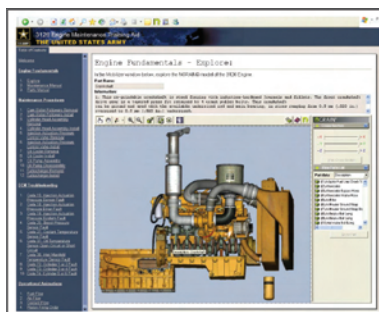
The U.S. Army estimated that, due to training deficiencies, improper diagnostics and troubleshooting on the Caterpillar engine were resulting in considerable expense and compromising the reliability and availability of the engines in the field.

OBJECTIVE:

To provide Soldiers with more hands-on practice time to perform diagnostic and troubleshooting procedures during basic mechanics training.

SOLUTION:

NGRAIN integrated interactive 3D engine simulations with approved Technical Manual data to deliver enhanced training on engine fundamentals, engine maintenance procedures, and diagnostics and troubleshooting.



PAYOFF:

The Army was able to achieve an initial estimated savings of \$1.5 Million in cost avoidance, while also improving diagnostics and troubleshooting training.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

U.S. Army National Guard | Small Arms Virtual Task Trainers

CHALLENGE:

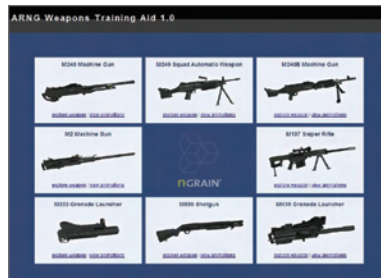
The U.S. Army National Guard identified that a lack of access to weapons for use in training was resulting in insufficient weapon system training of some Guardsmen before deployment.

OBJECTIVE:

To provide weapons familiarization and procedure practice to Guardsmen anywhere, anytime.

SOLUTION:

NGRAIN provided a set of 3D-enabled small arms Virtual Task Trainers, which provide Guardsmen with computer-based weapon familiarization and procedure training.



PAYOFF:

Guardsmen are able to receive weapon familiarization training, regardless of geographic barriers or lack of access to weapons. As a result, all Guardsmen have the opportunity to attain the required level of weapon familiarity prior to deployment.

U.S. Air Force | Small Arms Virtual Task Trainers

CHALLENGE:

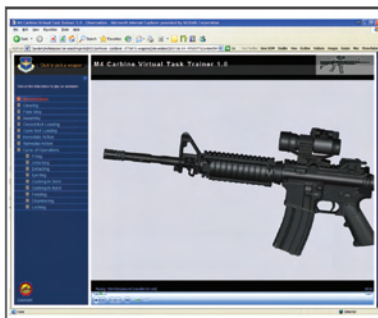
Large numbers of Airmen required introductory and refresher training on small arms weapons; however, there was limited availability of weapons for use in training.

OBJECTIVE:

To provide Airmen with anywhere, anytime access to parts familiarization, cycle of operations, field strip, jamming and clearing information and procedures on small arms weapons.

SOLUTION:

NGRAIN provided Virtual Task Trainers that leverage interactive 3D weapons simulations to provide Airmen with training on a number of common small arms weapons.



PAYOFF:

Airmen are able to receive training on small arms anywhere, anytime, gaining and maintaining a higher level of proficiency on common small arms weapons than before.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

U.S. Air Force | Surgical Instrumentation Training for Nurses

CHALLENGE:

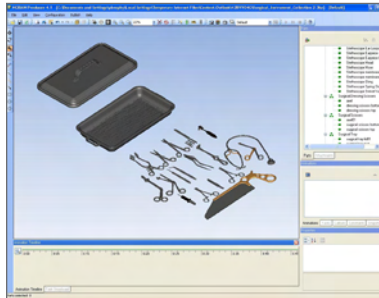
Surgical nurses must be familiarized with surgical instruments. Due to supply limitations, each nurse cannot be provided with a set of the surgical instruments for training, meaning hands-on training time is limited.

OBJECTIVE:

To provide effective, time efficient training to nurses on surgical instrumentation.

SOLUTION :

Using NGRAIN Producer software, the U.S. Air Force Medical Training Team developed a virtual surgical instrumentation training solution. With the solution, nurse trainees each receive their own virtual set of surgical instruments, which they can use anywhere, anytime to familiarize and refresh themselves on the identity, location, and handling of surgical instruments.



PAYOFF:

Since implementation the result is faster, better nurse training, supporting the objective of training fully qualified, mission ready nurses.

U.S. Air Force | Anatomy Training for Non-Medical Personnel

CHALLENGE:

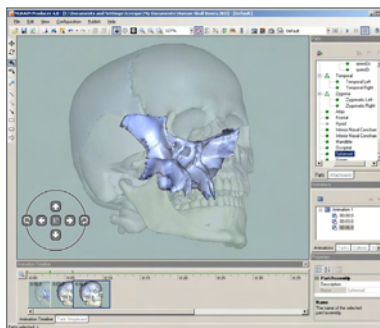
As part of their medical training, non-medical airmen need to be able to understand the location of the Sphenoid bone inside the skull. Traditional training methods (2D animation videos, training manuals, and plastic models) were proving ineffective.

OBJECTIVE:

To equip airmen with the medical knowledge and skills needed to help keep hurt personnel alive, until medical professionals are able to reach them.

SOLUTION:

Utilizing NGRAIN, U.S. Air Force personnel can now explore a 3D skull simulation in real time, removing and replacing bones, reading callouts with textual information, and viewing interior bones, including the Sphenoid, within the context of a "ghosted" skull.



PAYOFF:

NGRAIN's interactive in-context "ghosted" viewing capability has eliminated the confusion that once existed. Students are able to quickly see and understand where bones are located and how they interrelate.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

U.S. Marine Corps | M224 Mortar Virtual Task Trainer for Small Arms Repair Course

CHALLENGE:

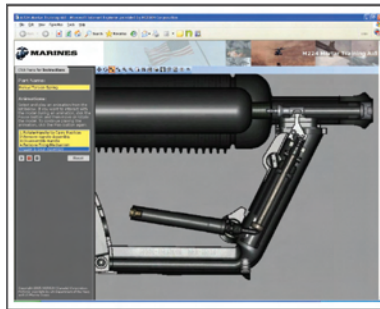
Due to the inability to show operation of the internal components of the mortar, the U.S. Marine Corps was experiencing high breakage rates with mortars used in training. For example, the owning service was spending an average of \$23,000 a year on replacement of the barrel nut alone.

OBJECTIVE:

To provide more effective training on the mortar's internal components and their interactions, thereby reducing occurrences of parts breakage and associated costs.

SOLUTION:

NGRAIN developed a Virtual Task Trainer that leveraged an interactive 3D simulation of the mortar to show internal components and train Marines on mortar procedures and operations. Marines are able to view parts information in 3D, rotate and cross-section the simulated mortar, detach and attach parts in real time, and watch procedural animations.



PAYOFF:

Marines are able to practice procedures virtually, thereby reducing wear and tear on the mortars. Similarly, by familiarizing Marines with the internal components via 3D simulation, breakage rates and associated costs are reduced; and training is more efficient than before.

Canadian Forces | MK-46 Lightweight Torpedo Virtual Task Trainers

CHALLENGE:

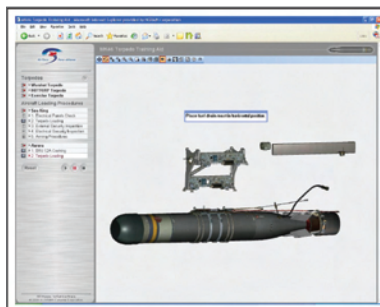
A critical shortage of qualified aircraft technicians created the requirement for the Canadian Forces to train technicians to standard faster. Existing course materials, which included PowerPoint presentations, manuals, and videos, were limited in their ability to convey information about tasks and procedures and internal components.

OBJECTIVE:

To provide more effective training materials that would allow technicians to be trained to standard on tasks and procedures more quickly.

SOLUTION:

NGRAIN developed Virtual Task Trainers for the MK-46 torpedo, which allow technicians to explore the torpedo, view internal components, watch procedural animations, and practice tasks.



PAYOFF:

Technicians achieved higher average test scores: test scores increased 6% from 85% to 91%.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE TRAINING

Canadian Forces | C-130 Propeller Virtual Maintenance Training Module

CHALLENGE:

The Canadian Forces identified that a lack of adequate training materials was resulting in too few aircraft technicians progressing to the journeyman skill level in the required time frame.

OBJECTIVE:

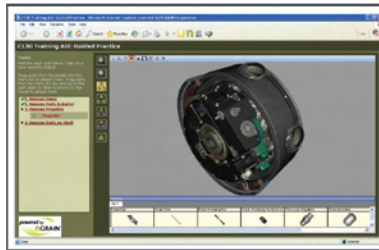
To provide more effective, Web-enabled training materials that offered technicians virtual hands-on practice time, anytime, anywhere.

SOLUTION:

NGRAIN and CAE developed an integrated, interactive 3D-enabled virtual training system that allows technicians to familiarize themselves with equipment parts, troubleshooting procedures, and repair tasks, as well as practice maintenance procedures hands on with 3D equipment simulations.

PAYOFF:

Technicians met the Canadian Forces' performance standard in less time: after one day of study with the NGRAIN/CAE virtual training system all technicians passed the practical exam with an average score of 94%, representing a 60% reduction in training time. Technicians also expressed a heightened level of interest and acceptance of using 3D equipment simulations compared to using technical manuals and other 2D training materials alone.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE OPERATIONS

Canadian Forces | Advanced Interactive Electronic Technical Manual

CHALLENGE:

Today's military aircraft operators face numerous challenges, including reduced personnel and experience levels, with an increase in demand for aircraft availability. The Canadian Forces are striving to deliver performance support solutions that will enable novice aircraft maintenance technicians to perform at the same level as seasoned experts.

OBJECTIVE:

Provide better performance support to technicians in the field, reducing turn-time and increasing first-time-right completion of maintenance tasks.

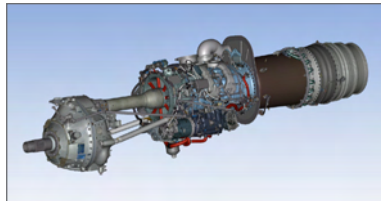
SOLUTION:

Standard Aero developed an NGRAIN-enabled Advanced Interactive Electronic Technical manual (A-IETM), designed to leverage 3D simulations to assist technicians in performing corrective maintenance activities including rectification maintenance and troubleshooting procedures for the T-56 engine used on Lockheed Martin's Hercules C130 aircraft.

PAYOFF:

An independent study found that technicians using the NGRAIN-enabled A-IETM performed tasks 23% faster than technicians using the traditional technical manual.

As well, there was a 22% improvement in procedure accuracy when the NGRAIN animated procedures were used, and apprentice technicians using NGRAIN were able to perform the task faster than Journeyman and in approximately the same time as Expert technicians using traditional manuals.



Canadian Forces | Interactive 3D Landmine Database on Ruggedized Personal Data Assistant (R-PDA) Devices

CHALLENGE:

The Canadian Forces is challenged to train Soldiers in the field on the internal and external characteristics of landmines, as well as procedures for safe handling and disposal. Dependency on "dummy" landmines for this training causes significant acquisition, transportation, storage, update, and handling challenges.

OBJECTIVE:

To augment the existing 2D landmine database with interactive 3D landmine simulations that could be deployed to Soldiers in the field via portable R-PDA devices.

SOLUTION:

NGRAIN ported the existing 2D landmine database to the R-PDA platform and supplemented it with interactive 3D simulations of the hundreds of landmines included in the database. Soldiers can view detailed parts information, fully interact with the landmines, and watch render safe procedural animations.

PAYOFF:

Soldiers in the field are equipped with instant access to landmine information on the R-PDAs, resulting in increased soldier safety. Through interactions with the 3D landmine simulations, Soldiers have greater understanding and knowledge about landmines they encounter in the theater.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE OPERATIONS

Canadian Forces | Study of Use of 3D Simulations in Facilitating Air Technician Maintenance Operations and Procedures

CHALLENGE:

The Canadian Air Force is facing a manpower crisis: attrition of skilled maintenance personnel that will soon reach a critical level.

OBJECTIVE:

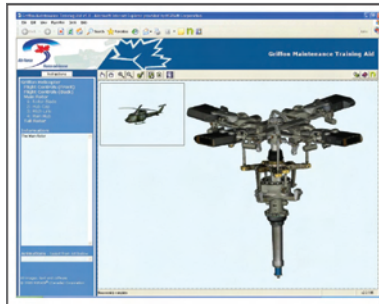
To automate aircraft life cycle management tasks to improve the process of developing, procuring, and sustaining each aircraft; and to provide more effective just-in-time support information to junior technicians that address knowledge gaps.

SOLUTION:

The Canadian Air Force commissioned a study by an independent consulting firm to determine the improvements that could be realized by using NGRAIN interactive 3D simulations of aircraft as part of a networked enterprise solution. The study used a 3D simulation of a CH146 Griffon Helicopter to visualize parts, animate procedures, attach part information, and link to Technical Orders, inventory data, and service bulletins.

PAYOFF:

The study found that NGRAIN reduces the total number of work hours required to investigate and resolve a maintenance incident by 30%; improves the quality of task performance by 16% to 31%; and improves technician understanding of the work by 26%. Additionally, the study found that NGRAIN provides significant benefits in task training, and is a highly effective way to capture and share the knowledge of retiring Subject Matter Experts.



U.S. Army | VSAT (Very Small Aperture Terminal) Satellite Virtual Task Trainer

CHALLENGE:

Due to the fast pace of operations, Soldiers receive little to no training on how to install the newly fielded VSAT satellite prior to deployment. As a result, there was an increased risk of installation errors and premature parts breakage due to incorrect performance of operating procedures and preventative maintenance checks.

OBJECTIVE:

To provide support materials with the VSAT that would increase the likelihood of first-time- right installation of the satellite and prevent parts breakage.

SOLUTION:

NGRAIN developed an interactive 3D VSAT satellite Virtual Task Trainer. Soldiers in the field are able to review parts information and watch installation and assembly procedures via 3D animations..

PAYOFF:

Soldiers are able to more quickly and accurately comprehend how to install and assemble the VSAT satellite, reducing risk of premature parts breakage and ensuring quick and continued communication connectivity.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE OPERATIONS

U.S. Army | Stryker Battle Damage Assessment and Repair (BDAR) Distributed Learning Solution for Camp Victory, Iraq

CHALLENGE:

A knowledge gap was identified in Iraq: Soldier safety was at risk due to lack of training on Stryker tire BDAR. When the Stryker tire is damaged and not inflated it generates heat, which can result in a fire under certain conditions. Soldiers had not received training on how to avoid this dangerous situation.

Relying on traditional instructor-led classes to close this training gap would limit access to the training and instructors and create scheduling difficulties, thereby slowing Soldier access to this critical training.

OBJECTIVE:

To provide effective BDAR training via distributed Learning to Soldiers in Iraq within 90 days of project commencement.



SOLUTION:

NGRAIN, C2 Technologies, and Collabworx developed an NGRAIN-enabled distributed Learning course and Web collaboration capability in 90 calendar days, rapidly filling the knowledge gap, while also accelerating learning via virtual hands-on practice of the BDAR procedures.

PAYOFF:

Soldiers reported having an increased understanding of and confidence in the performance of the tire BDAR tasks, stating that the NGRAIN 3D tire system simulations were their favorite part of the training. The Army was able to deploy the much needed training quickly and cost effectively, despite geographic barriers.

U.S. Army | 3D Equipment Simulations Integrated within Interactive Electronic Technical Manuals

CHALLENGE:

The U.S. Army is driven to continually improve the effectiveness of its technical publications, which are used in the field to ensure proper operation and maintenance of equipment and form a critical part of the training support packages provided to Soldiers. Training support packages have typically included the technical manual, as presentation slides, and videos. While the Army had seen value in including 3D graphics in the packages, there were too many hurdles, including cost and access to data, to make its use viable.

OBJECTIVE:

To remove the barriers traditionally associated with 3D technologies, enabling inclusion of interactive 3D equipment simulations in Interactive Electronic Technical Manuals (IETMs).

SOLUTION:

The Army developed and integrated NGRAIN interactive 3D simulations into its IETMs. NGRAIN supported easy integration and deployability of the IETMs, removing the barriers traditionally associated with using 3D technology in IETMs.

PAYOFF:

NGRAIN enabled the Army to overcome the barriers typically associated with use of 3D technologies, by providing a 3D equipment simulation solution that was both easy to integrate and deploy. The Army is able to provide 3D-enabled IETMs to Soldiers, providing more effective just-in-time training support.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE OPERATIONS

NATO International Security Assistance Force / U.S. Army Overcoming Training Challenges in Afghanistan

CHALLENGE:

The NATO International Security Assistance Force (ISAF) has a key role in providing training for the Afghan National Army (ANA). This includes overcoming language barriers to train new Afghan National Army (ANA) recruits on maintenance procedures and troubleshooting.

OBJECTIVE:

To provide highly effective training to ANA troops on the maintenance and repair of small arms.

SOLUTION:

NGRAIN provided Virtual Task Trainers to provide small arms parts familiarization, field strip, cycle of operations, and maintenance and repair procedure training.



PAYOFF:

With the NGRAIN Virtual Task Trainers, ANA personnel are able to quickly learn the inner workings of the small arms systems. Additionally, by translating the instructions into Dari, the need for translators has been reduced.

U.S. Marine Corps | Individual & Crew Weapons, Ground Weapon Systems, and Vehicle Subsystems Virtual Training Software

CHALLENGE:

The U.S. Marine Corps needs to rapidly train personnel to meet mission objectives while respecting reduced training budgets.

OBJECTIVE:

To provide a training solution that will support maintenance training for individual and crew weapons, ground weapon systems, and vehicle subsystems, and will support both instructor-led and self-paced student learning.

SOLUTION:

NGRAIN provided Virtual Task Trainers for use in training personnel on maintenance procedures.



PAYOFF:

The NGRAIN solution has filled a critical support role with the current classroom instruction for Infantry Weapons, Towed Artillery, and Light Armored Vehicle Systems and sub-systems.



USE OF NGRAIN 3D EQUIPMENT SIMULATIONS TO IMPROVE OPERATIONS

U.S. Air Force | Aerial Gunner Maintenance Virtual Task Trainers

CHALLENGE:

The U.S. Air Force's Aerial Gunner's Specialty Training Standard requires that Aerial Gunners receive hands-on training. However, due to a lack of access to equipment for training, students were receiving only task knowledge training, and were missing the hands-on training component.

OBJECTIVE:

To provide a fast and cost effective solution that would ensure Aerial Gunners were able to complete their training.



SOLUTION:

NGRAIN provided Virtual Task Trainers to support parts familiarization and procedural training.

PAYOFF:

The U.S. Air Force was able to achieve a breakthrough in training efficiency and effectiveness, achieving over \$2 million in immediate cost avoidance, while increasing their training capabilities.



IN SUMMATION

Studies and assessments of the use of NGRAIN at US and Canadian Military sites in North America and overseas have found that NGRAIN interactive 3D equipment simulations provide a cost-effective means of accelerating equipment training and improving personnel understanding and accuracy of task performance.

In the training environment:

- By reducing dependency on equipment and hard trainers for training, the Military is able to reduce training costs significantly (for example, in the millions of dollars range per single item).
- By providing virtual hands-on practice of procedures with 3D equipment simulations, the Military is able to provide wider access to training, resulting in better qualified personnel, while also making training more time efficient, supporting increased student throughput at Schools.
- By providing 3D internal views of the simulated equipment, the Military is able to increase personnel knowledge and understanding of equipment part interactions, reducing part breakage rates and the associated costs.

In the operational environment:

- By augmenting field support materials with interactive 3D equipment simulations, the Military is able to provide more effective just-in-time training on rapidly fielded equipment, resulting in quicker familiarization with the equipment, better understanding of tasks and procedures, and reduced premature failure of parts.
- By providing computer- and Web-based access to 3D equipment-enabled virtual training materials, the Military is able to respond rapidly to evolving training requirements identified in the field, addressing knowledge gaps related to Battle Damage Assessment and Repair procedures, Improvised Explosive Devices, and other critical issues.
- By integrating 3D equipment simulations into equipment life cycle management systems, the Military is able to shorten maintenance turnaround-time, improve the quality of task performance, and improve technician understanding.

Military organizations leveraging NGRAIN interactive 3D solutions are experiencing immediate improvements in the areas of personnel safety, performance, and operational readiness.

