



## Case Study – Reducing Premature Failure of Parts with Interactive Virtual Training for Generator Operators

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## Agenda

- ◆ Training Challenges
- ◆ Virtual Maintenance Trainers
- ◆ Case Study – 3kW Tactical Quiet Generator
- ◆ Conclusions



## Common Challenges in Training

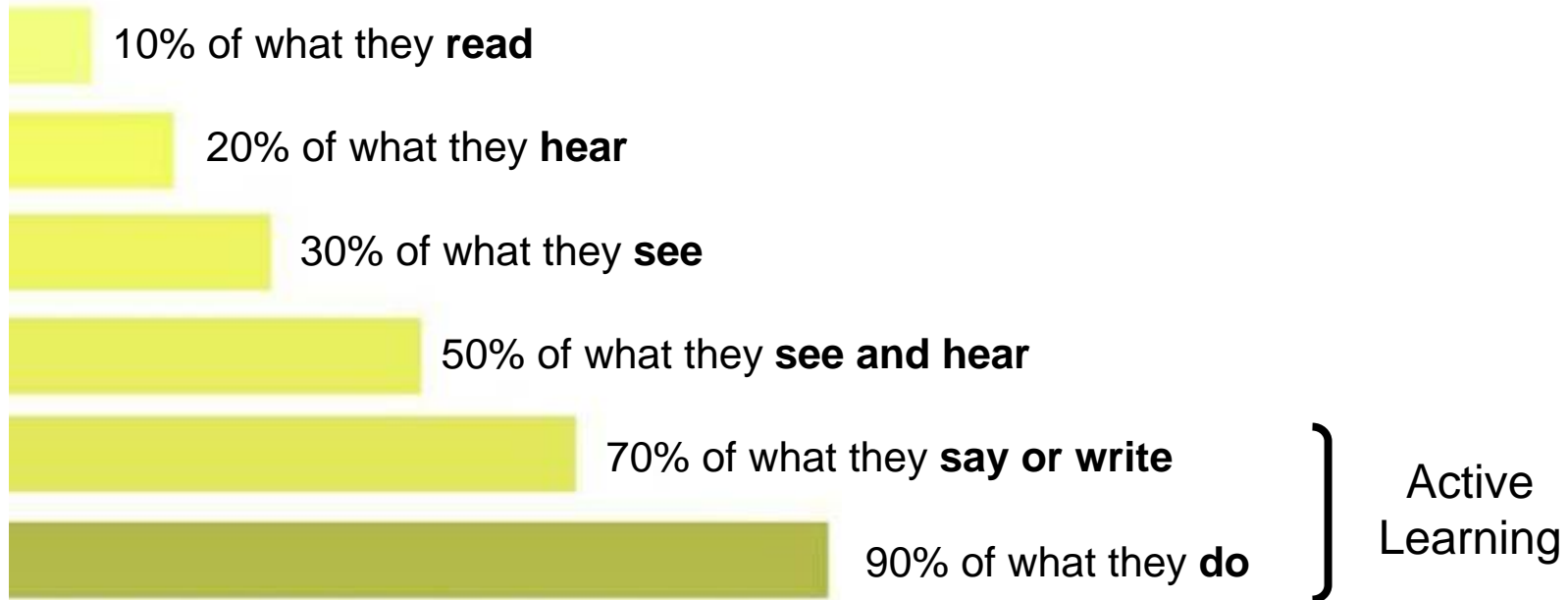
- ✘ Some tasks cannot be trained, due to **expense** or **lack of access to equipment**
- ✘ Soldiers receive limited training before being deployed: task-based, **on-the-job training** is critical
- ✘ Training **budgets are limited**, yet training demand is increasing
- ✘ Total Package Fielding requires rapid and effective **New Equipment Training**





# Learning Theory

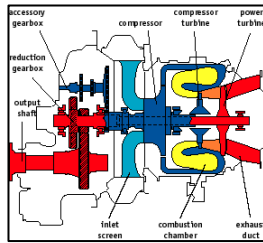
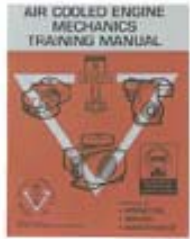
Students Remember



Source: Airbus/Journal of Civil Aviation Training (Issue 1, 2006)



# Training Methods



**Text**

**Multimedia**

**Hard Trainers**

**Live Equipment**

## Interactive Virtual Maintenance Trainers

- ✓ Low cost
- ✓ Easy to create and update
- ✓ Anytime, anywhere access
- ✗ Low learning effectiveness

- ✓ Low cost
- ✓ Easy to create and update
- ✓ Anytime, anywhere access
- ✓ High learning effectiveness

- ✗ High cost
- ✗ Difficult to create and update
- ✗ Limited access
- ✓ High learning effectiveness



## Virtual Maintenance Trainers

Virtual 3D equipment simulations to:

- *Familiarize*
- *Acquire*
- *Practice*
- *Validate & Test*

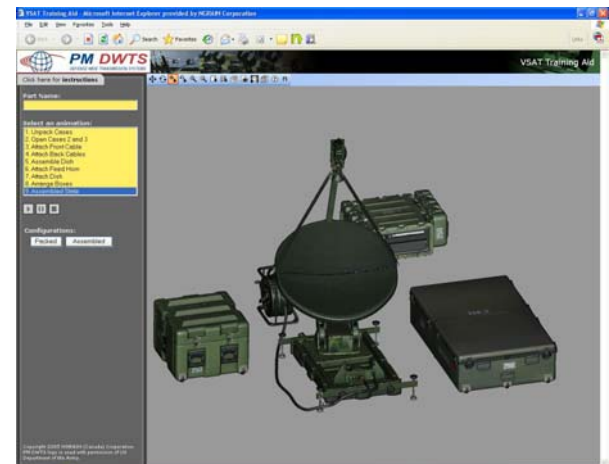
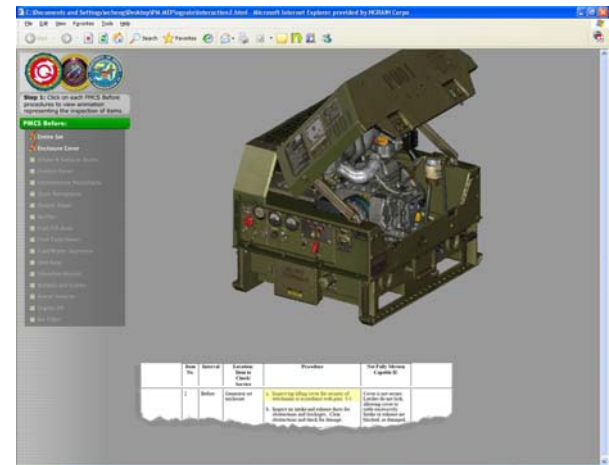
**Proven ROI: Train 60% Faster**





## Benefits of Virtual Maintenance Trainers

- ✓ Let students learn from their mistakes, **safely**
- ✓ Let training take place **without the expense** of equipment
- ✓ **Reduce wear and tear** on equipment
- ✓ Enable **task-based, on-the-job training**
- ✓ Students are more engaged and **motivated**



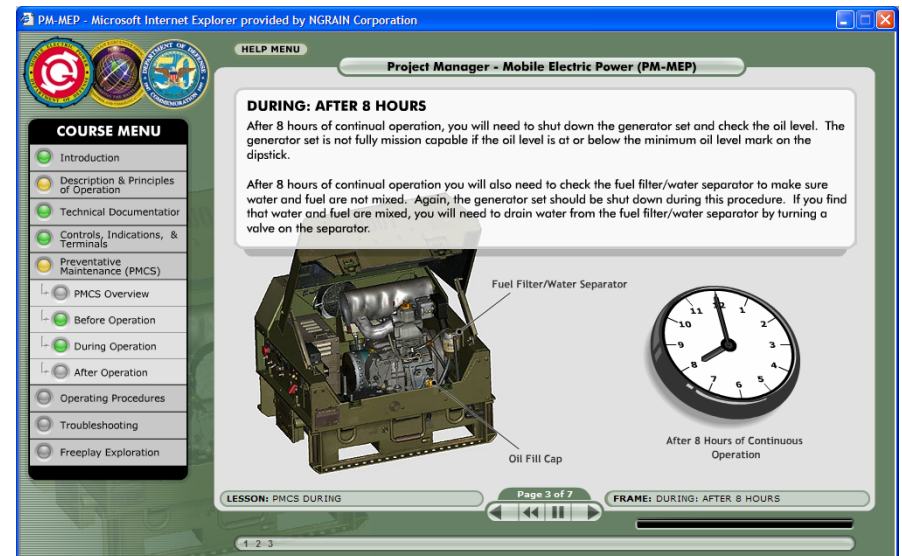


# Case Study: 3kW TQG Operator Course

**Challenge:** Premature failure of generator parts due to operator error

**Objective:** Provide more effective refresher and sustainment training

**Results:** Reduced premature failure of parts



PM-MEP - Microsoft Internet Explorer provided by NGRAIN Corporation

HELP MENU

Project Manager - Mobile Electric Power (PM-MEP)

**COURSE MENU**

- Introduction
- Description & Principles of Operation
- Technical Documentation
- Controls, Indications, & Terminals
- Preventative Maintenance (PMCS)
  - PMCS Overview
  - Before Operation
  - During Operation
  - After Operation
- Operating Procedures
- Troubleshooting
- Freeplay Exploration

**DURING: AFTER 8 HOURS**

After 8 hours of continual operation, you will need to shut down the generator set and check the oil level. The generator set is not fully mission capable if the oil level is at or below the minimum oil level mark on the dipstick.

After 8 hours of continual operation you will also need to check the fuel filter/water separator to make sure water and fuel are not mixed. Again, the generator set should be shut down during this procedure. If you find that water and fuel are mixed, you will need to drain water from the fuel filter/water separator by turning a valve on the separator.

Fuel Filter/Water Separator

Oil Fill Cap

After 8 Hours of Continuous Operation

LESSON: PMCS DURING Page 3 of 7 FRAME: DURING: AFTER 8 HOURS

1 2 3





## Case Study - Implementation

### Based on Technical Manual

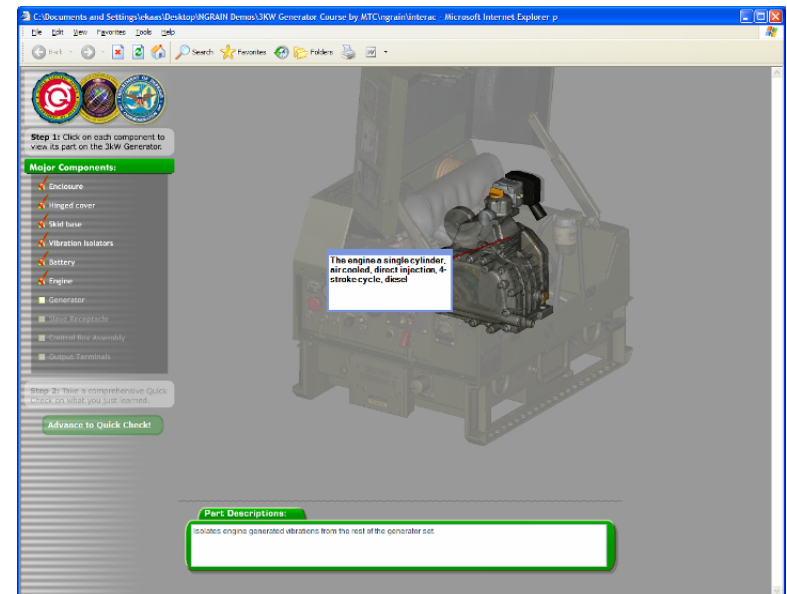
- Cross reference
- Follow the procedure

### Visual & Interactive

- Engage students
- More intuitive explanations
- Validate & test

### Computer Based

- Used by instructor
- Used by students
- Used by deployed soldiers to refresh or just in time training





## Case Study - Demonstration

Course Layout

Component Familiarization

Controls

PMCS

Operating

Troubleshooting

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HELP MENU

Project Manager - Mobile Electric Power (PM-MEP)

### INTRODUCTION

Welcome to the 3 kilowatt (kW) Tactical Quiet Generator (TQG) Set Operator Training Course for the MEP 831A (60Hz) and MEP 832A (400Hz) generator set models! Upon successful completion of this course you will be able to operate and perform operator maintenance on the 3kW TQG Set.

**COURSE MENU**

- Introduction (selected)
- Introduction
- Description & Principles of Operation
- Technical Documentation
- Controls, Indications, & Terminals
- Preventative Maintenance (PMCS)
- Operating Procedures
- Troubleshooting
- Freeplay Exploration

LESSON: INTRODUCTION

Page 1 of 6

FRAME: INTRODUCTION



## Course Layout

PM-MEP - Microsoft Internet Explorer provided by NGRAIN Corporation

COURSE MENU

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HELP MENU

Project Manager - Mobile Electric Power (PM-MEP)

### INTRODUCTION

Welcome to During Operation lesson. This lesson reviews the PMCS procedures for during operation of the generator set. This lesson reviews the procedures you need to conduct while the generator set is running, Remember to refer to Table 2-1: Preventative Maintenance Checks and Services located in the Operator's Unit, and Direct Support Maintenance Manual for a complete guide to PMCS procedures to perform during operation of the generator set.

ARMY TM 9-4115-428-13  
AIR FORCE TO 35C2-3-288-01  
MARINE CORPS TM 10156A-13

Table 2-1. Operator Procedures

Item No.	Interval	Location: Screw to Check/ Service
11	Before	Start fuel
12	Before	Engine oil
13	During	VOLTAGE and LOAD meters (control panel)
14	Before	Engine oil filter

Table 2-2. Operator Preventive Maintenance Checks and Services for MEP 8024 - 8024 (continued)

Item No.	Interval	Location: Screw to Check/ Service	Procedure	See Field Manual Caption ID
11	During	FUEL LEVEL meter (located on control panel)	a. Monitor fuel level during generator set operation.  <b>WARNING:</b> Some service personnel use white engine oil. Ensure that fuel level is correct. Fuel does not flow before filling with fuel. Ensure to personnel use correct oil grades prescribed on oil fill label.  b. Replenish fuel as follows. Shut down generator set. Remove fuel fill cap and fill with proper fuel. Insert fuel fill cap.	Fuel level is empty or level falls in response.
14	During	Engine oil (after 5 hours of continued use)	<b>WARNING:</b> Some service personnel use white engine oil. Ensure that fuel level is correct. Fuel does not flow before draining oil level with no dipstick.  a. Shut down generator set. Open machine cover.  b. Remove engine oil fill cap and check oil level. Service as required in accordance with page 3-1.	Oil level is at or below maximum oil level with no dipstick.

LESSON: PMCS DURING

Page 1 of 7

FRAME: INTRODUCTION



## Component Familiarization

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**Step 1:** Click on each component to view its part on the 3kW Generator.

**Major Components:**

- Enclosure
- Hinged cover
- Skid base
- Vibration Isolators
- Battery
- Engine
- Generator
- Slave Receptacle
- Control Box Assembly
- Output Terminals

**Step 2:** Take a comprehensive Quick Check on what you just learned.

[Advance to Quick Check!](#)

The engine is a single cylinder, air cooled, direct injection, 4-stroke cycle, diesel

**Part Descriptions:**

isolates engine generated vibrations from the rest of the generator set



# Controls, Indicators & Terminals

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**HELP MENU**  
**Project Manager - Mobile Electric Power (PM-MEP)**

**ENGINE GROUP**

HOURS:

FUEL LEVEL:

VOLTAGE:

EMERGENCY STOP:

AUX FUEL:

PREHEAT:

START:

VOLTAGE ADJUST:

CIRCUIT INTERRUPT:

**ENGINE HIGH TEMP**

**LOW OIL PRESSURE**

**NO FUEL**

**OVERVOLTAGE**

**OVERLOAD SHORT CIRCUIT**

**FAULT RESET**

**BATTLE SHORT**

**PUSH TEST**

**DESCRIPTIONS**

The FAULT INDICATOR MODULE is an area where important indicators are displayed. It contains indicator lights that illuminate during fault conditions which assist in troubleshooting the generator set. A list of these indicators is found on the right.

Click on each item name to view its location on the FAULT INDICATOR MODULE as well as its description.

**CLICK ON EACH ITEM TO SEE IT'S LOCATION**

- Engine High Temperature
- Over Voltage
- Low Oil Pressure
- Overload Short Circuit
- No Fuel
- Battle Short On
- Fault Reset/ Push Test

LESSON: CONTROLS & INDICATIONS

Page 3 of 6


FRAME: GENERATOR SET STARTING SYSTEM

1 2 3 4



## PMCS

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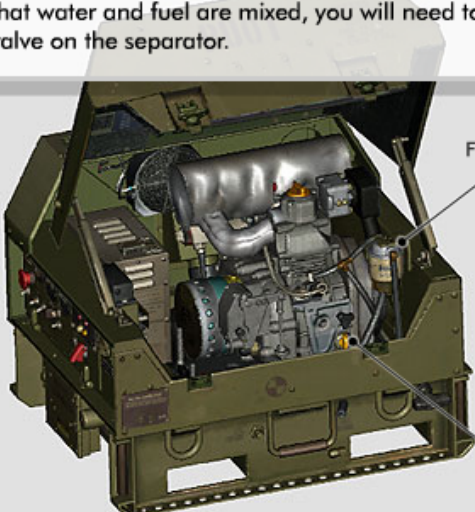
HELP MENU

Project Manager - Mobile Electric Power (PM-MEP)

**DURING: AFTER 8 HOURS**


After 8 hours of continual operation, you will need to shut down the generator set and check the oil level. The generator set is not fully mission capable if the oil level is at or below the minimum oil level mark on the dipstick.

After 8 hours of continual operation you will also need to check the fuel filter/water separator to make sure water and fuel are not mixed. Again, the generator set should be shut down during this procedure. If you find that water and fuel are mixed, you will need to drain water from the fuel filter/water separator by turning a valve on the separator.



Fuel Filter/Water Separator

Oil Fill Cap



After 8 Hours of Continuous Operation

LESSON: PMCS DURING

Page 3 of 7

FRAME: DURING: AFTER 8 HOURS

1 2 3




# PMCS Procedure Illustration

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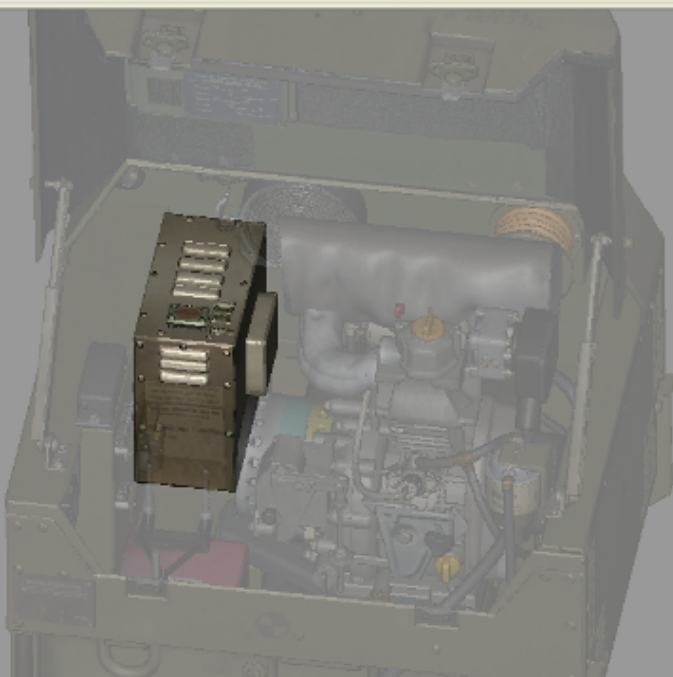
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**Step 1:** Click on each PMCS Before procedures to view animation representing the inspection of items.

**PMCS Before:**

- Entire Set
- Enclosure Cover
- Intake & Exhaust Ducts
- Control Panel
- Convenience Receptacle
- Slave Receptacle
- Output Panel
- Muffler
- Fuel Fill Area
- Fuel Tank/Hoses
- Fuel/Water Separator
- Skid Base
- Vibration Mounts
- Battery and Cables
- Power Inverter
- Engine Oil
- Air Filter



Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable If:
13	Before	AS	Open enclosure cover. Inspect AS and area around AS for signs of water. If water is present, thoroughly dry out AS before starting generator.	Water is in AS
			a. Open enclosure cover. Remove oil fill cap and check level. If correct, replace cap.	Class III oil leaks are present.




## PMCS Practice

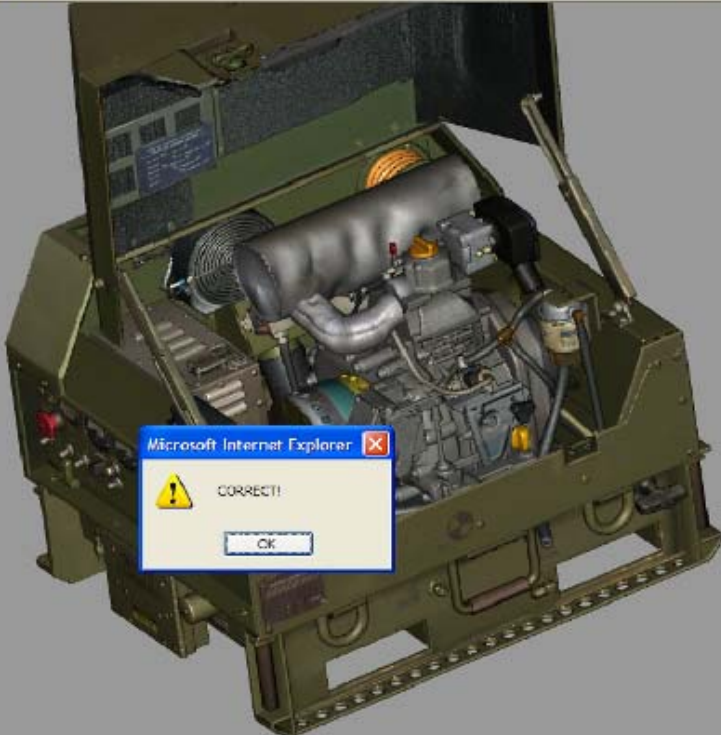
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**Quick Check:**  
Match the Component name or description below by clicking the that part in the model.



Microsoft Internet Explorer

! CORRECT!

OK

Click on the model above to match the part below:

Single cylinder, air cooled, direct injection, 4-stroke cycle, diesel





## Operating & Troubleshooting

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HELP MENU

**Project Manager - Mobile Electric Power (PM-MEP)**

**COURSE MENU**

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- Procedures
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**WHITE SMOKE**

When the generator set is running you may see white smoke emitted from the engine. If you see white smoke, try the following procedures:

**STEP 1:**  
First, check the engine oil level to see if it is too high. If it is too high, you will need to refer the trouble to the unit maintenance level so they can drain and service the engine oil.

**STEP 2:**  
If the engine oil level is acceptable, check for water in fuel filter/water separator. If water is present, you will need to drain water from filter separator by turning the valve. (Refer to paragraph 3-8 of the Operator Unit and Direct Support Maintenance Manual for more detail.)

**STEP 3:**  
If the fuel filter/water separator checks out to be fine, you should refer the trouble to unit level maintenance.

LESSON: PROCEDURES

Page 4 of 7

FRAME: WHITE SMOKE



## Conclusions

Interactive virtual maintenance trainers offer numerous benefits:

- ◆ Lets training take place even if there is no equipment available
- ◆ More effective for task-based learning objectives
- ◆ Operationally deployable
- ◆ Very suitable to address TQG training challenges





## Thank you! Questions?

For more information:

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Case studies and Whitepapers:

[www.ngrain.com](http://www.ngrain.com)

To order 3kW TQG Operator Course Computer-Based  
Training CD:

[www.pm-mep.army.mil/logistics/TrgMat.htm](http://www.pm-mep.army.mil/logistics/TrgMat.htm)