


Trainer as Test Bed

TRAINING SYSTEM AS TRANFORMATION TEST BED

Using the Close Combat Tactical Trainer (CCTT) for Evaluation of Unit Readiness and Weapons System Performance

NDIA T&E Conference
Victoria, BC
February 27, 2003




Trainer as Test Bed

PREMISE

The sophisticated training environments of today offer ready platforms for evaluating a variety of effectiveness measures:

- **Crew and Unit Combat Readiness**
- **Weapons Systems Effectiveness**
- **Combined Arms Tactics**

Unfortunately, most of the data recorded during training evolutions are not collected and analyzed. These data offer a rich basis for objective assessment of readiness among the transforming U.S. Armed Forces




Authors

- **Pete Young (San Diego, California)**
  - Former Navy Flight Officer
  - Director, Strategic Development – DynCorp Integrated Technology Solutions

- **Nick Guerra (Orlando, Florida)**
  - Retired Army Ranger
  - Deputy Program Manager - DynCorp Virtual Training Life Cycle Contractor Support




Agenda

- **Background – Army Transformation**
- **The Need – Objective Assessment**
- **A Solution – Trainer as Test Bed**
- **The Close Combat Tactical Trainer (CCTT)**
- **Topography – Data Availability**
  - Exercise session structure
  - Exercise Data Recording & Reporting
- **Sample Data & Analysis**
- **Building an Exercise/Engagement Database**




Army of the Future – the Objective Force

- **Army Transformation will take the current Army to a completely new configuration – the *Objective Force***
- **Objective Force concept is designed to provide "strategic dominance across the entire spectrum of operations"**
- **Key characteristics of the Objective Force:**
  - **Responsive:** ability to provide sustained ops at short notice
  - **Deployable**: Rapid placement of sizable ground forces anywhere
  - **Agile:** Capable of shifting between "stability & support" ops and warfighting ops – and back again
  - **Versatile:** Able to quickly adapt to different operational demands
  - **Lethal:** Every unit will have full capability for fire, maneuver, leadership & protection.
  - **Survivable:** Maximum protection of individual soldier in all situations
  - **Sustainable:** Aggressive reduction of logistics footprint and replenishment demand




Trainer as Test Bed

Objective Force - Performance

- Ability to place a self-sustaining Brigade Combat Team anywhere in the world with 96 hours notice
- Ability to put a Division on the ground within 120 hours
- Deliver five Divisions in theater within 30 days

" Git thar fustest with the mostest"

- Nathan Bedford Forrest




Objective Force Transformation

Legacy Force

Re-Capitalize Legacy Systems

Transition Legacy Systems

Legacy

Future Combat Systems

Operations

C4ISR

Logistics

Training

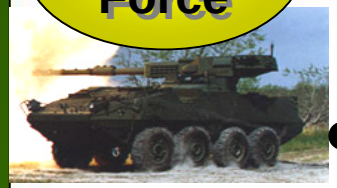
Objective Force

Interim Force

Stand Up IBCTs

Interim Armored Vehicle

Interim



15 – 20 year timeline



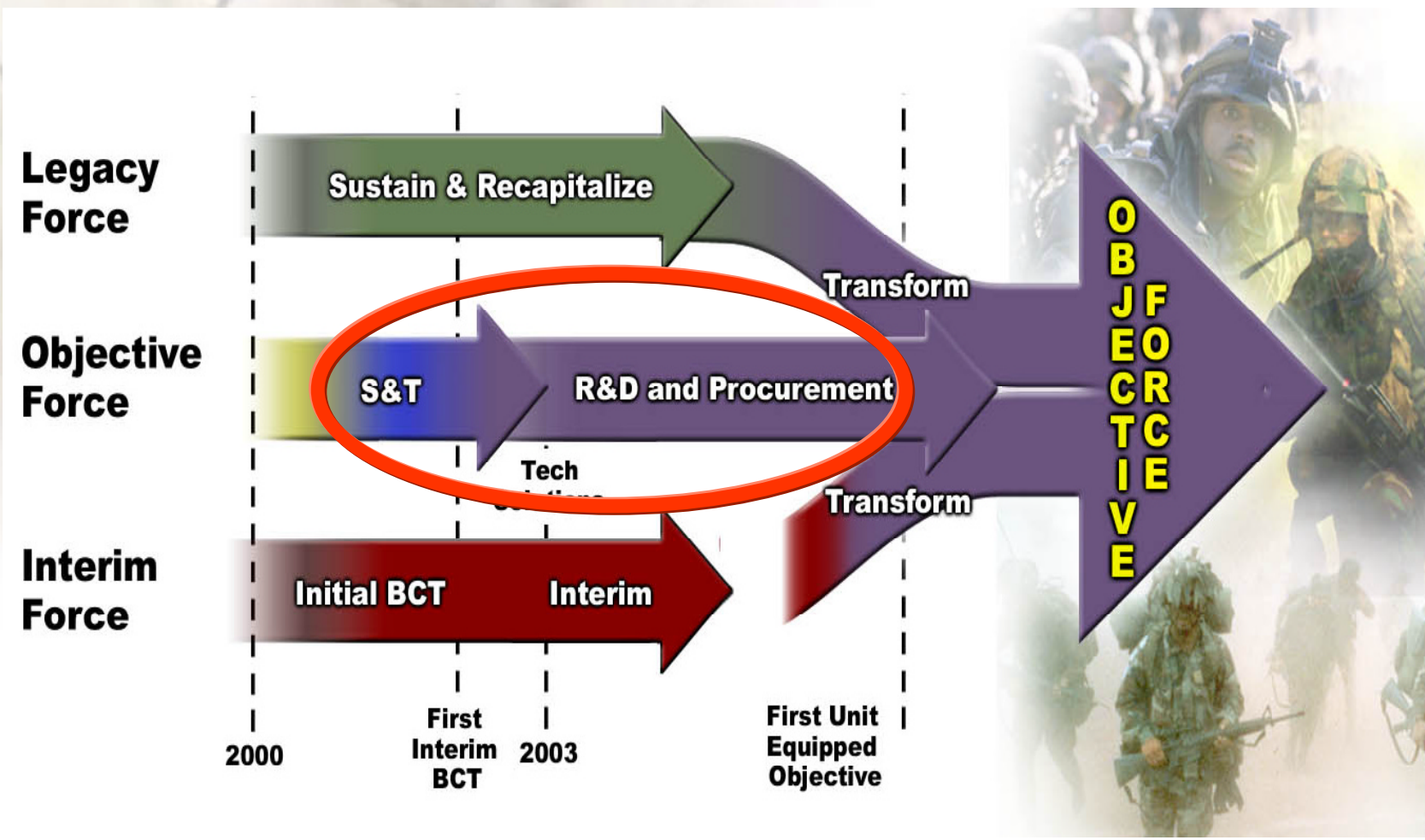

Trainer as Test Bed

Army Transformation – the Interim Force

	Legacy Forces LIGHT	Legacy Forces HEAVY	INTERIM FORCE	OBJECTIVE FORCE
Responsive	P		P	P
Deployable	P		P	P
Agile		P (-)	P	P
Versatile	P (-)	P	P (-)	P
Lethal		P	P (-)	P
Survivable		P	P (-)	P
Sustainable		P	P (-)	P

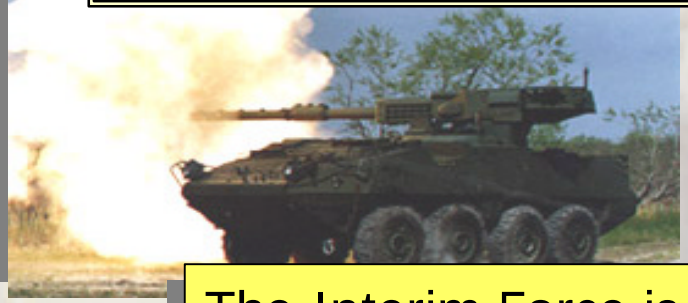



Paths to Transformation






Immediate Issues



The Interim Force is being created (and deployed!) ***now***.

- New vehicles
- New units & force structures
- New tactics

Future Combat Systems (FCS) concept contracts are being competed ***now***.

How will these new weapons, vehicles and tactics be integrated into the Legacy Force?

Trainer as Test Bed




Immediate Issues

Scout Companies are now using variants of the HMMWV. CCTT sites are currently equipped with only one or two HMMWV modules, limiting live exercise roles.

Interim Brigade Combat Teams are now being stood up as part of the Interim Force. Their vehicles will have to be integrated into CCTT as manned and SAF Modules combined exercises. IBCTs are deployed to Middle East now.




The Need

- **Everything is changing…**
  - **Force Composition & Structure**
  - **Operations**
  - **Tactics**
  - **Logistics**
  - **Weapons & Transport**
  - **Training**
- **To assess the progress of the Transformation process and the net effectiveness of our Transformed Forces, we will need *objective measures of capabilities, performance, and readiness.***
- **These measures must be rooted in objective data that ideally are valid, reliable, repeatable, and relatively easy to determine.**




A (Partial) Solution

- Close Combat Tactical Trainer (CCTT) is a networked system of manned modules, semi-automated forces, and workstations that allows Army and National Guard units to train armor, cavalry, and mechanized infantry at platoon through battalion force levels.

- The CCTT offers a readily available platform for development and evaluation of objective performance measures.

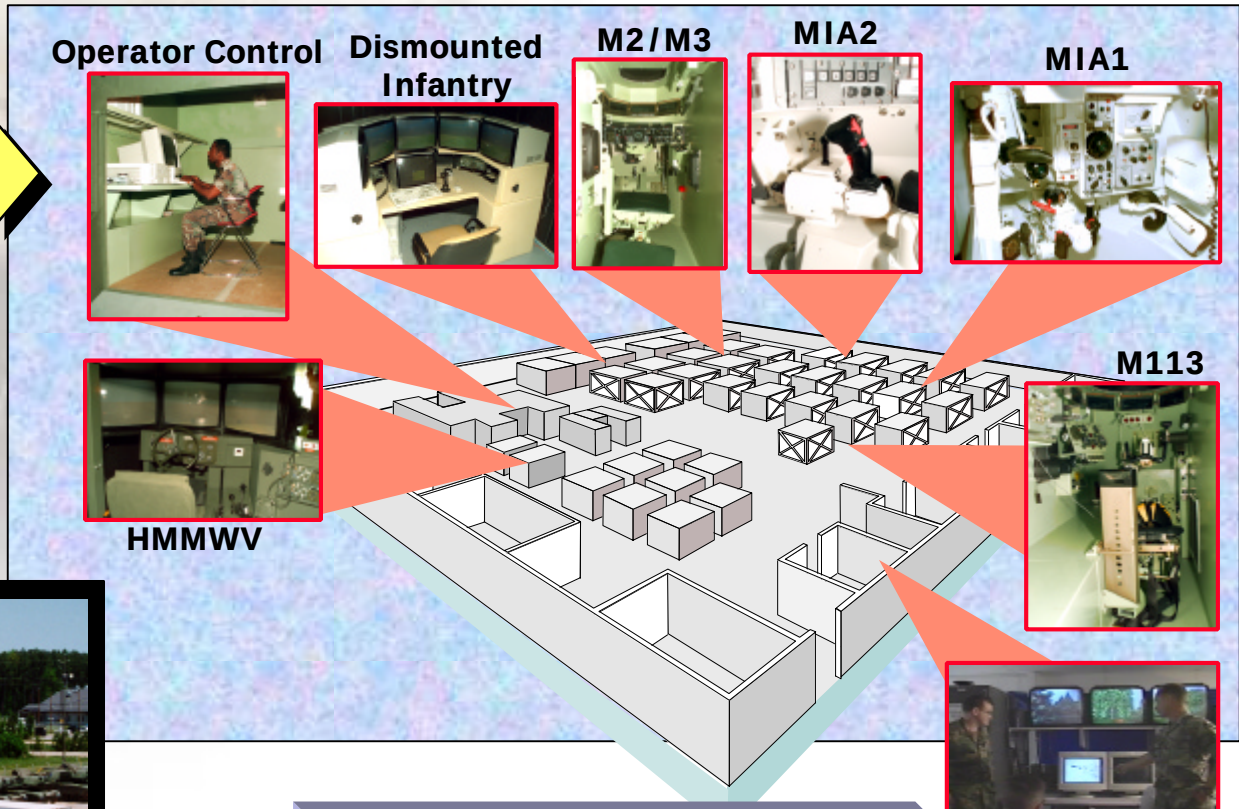



Close Combat Tactical Trainer

Trainer as Test Bed

9 Fixed Sites For Active Component

12 Mobile Sets for National Guard/Reserves



Mobile CCTT (Platoon-Level)

Fixed Site

(Platoon/Company/Team thru Battalion Task Force)

After Action Review




CCTT Baseline Capabilities

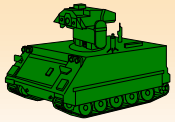
Trainer as Test Bed

MODULES

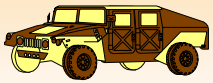

M1A1 v (CPH)


M1A2 (CPH)


M2/3A2 v (CPH)


BFIST


M113A3


HMMWV


DI Module/ Workstations

WORKSTATIONS


CES
(Cbt Engineer Spt)


UMCP
(Maintenance Spt)


CTCP
(Cbt Trains CP)


Mortar FDC


FSE
(Bn Fire Spt Element)


TACP
(Tac Air Control Party)


FA TOC

SAF

20 Blue Units
30 Threat Units
97 Visual Models

AAR

"STEALTH" Capability
5 Simultaneous Exercises
Take Home Package

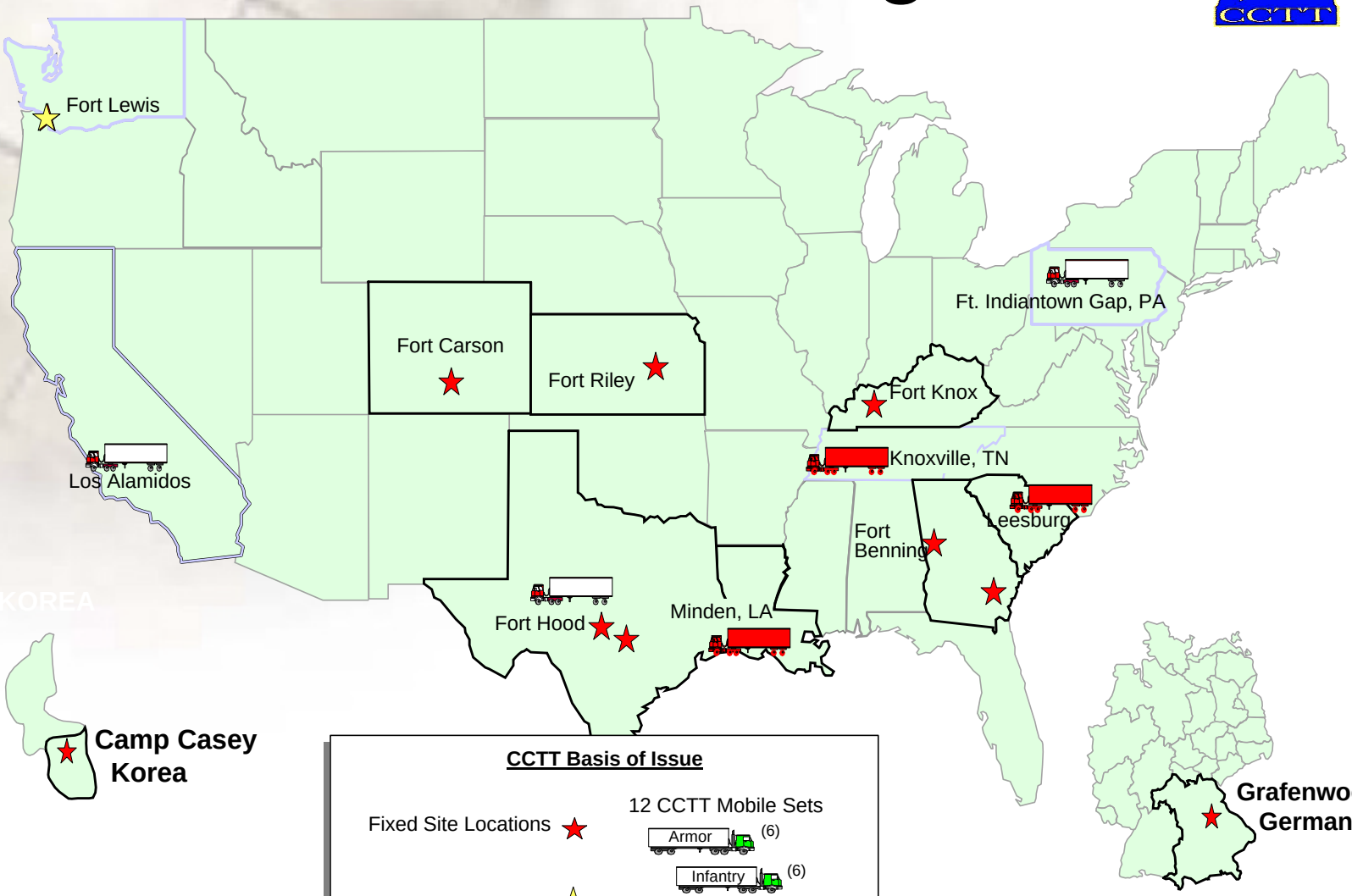
TDB

Smoke/Fog/Haze
Night/Day
100 x 150 KM
Desert (NTC/29 Palms)
Temperate ("Central US")
Ft Hood & Kosovo




CCTT Fielding

Trainer as Test Bed






Trainer as Test Bed

US CCTT Semi-Automated Forces Models

Tracked Vehicles

M1A1 (w/rollers or plow)
M1A2
M2A2 IFV
M3A2 CFV
M113A3
M113A2
M981 FIST-V
M548A2
M577A2 (Cmd Post)
M1064 (120mm Mortar)
M109A5 (Howitzer)
M109A6 (Paladin)
M280 MLRS
M998 FAASV
M9 ACE
M728 CEV
AVLB (M60 w/bridge)
AVLM (M60 w/MICLIC)
M88A2 (Recovery)

Wheeled Vehicles

M925 (5-Ton Truck)
M934 (5-Ton Expando)
M966 HMMWV w/TOW
M988 HMMWV(AVENGER)
M1025 HMMWV (Utility)
M1038 HMMWV
M1943 HMMWV (Arm Car)
M1068 HMMWV (SICPS)
M1097RWS HMMWV
M977 HEMTT
M978 HEMTT (Fuel)
M985 HEMTT (Cargo)
M984 HEMTT (Wrecker)
M1091 5-Ton POL
M1089 MTV Wrecker
M1083 w/Volcano
M1078 2.5-Ton
M93 NBC Recon Vehicle

Rotary Wing Aircraft

AH-64 Apache
AH-1S Cobra
UH-60 Blackhawk
OH-58D Kiowa Scout

Fixed Wing Aircraft

F-16 Falcon
A-10 Warthog




Non-US CCTT SAF Models

Trainer as Test Bed

Soviet Tracked Vehicles
- T-62 MBT (Soviet)
- T-64 MBT (Soviet)
- T-72 MBT (Soviet)
- T-80 MBT (Soviet)
- BMP IP & II & III
- MTLB ACRV
- BMP 1KSH (Cmd Post)
- BAT 2 Route Clearing
- 2S31
- 2S1 SP Howitzer (122mm)
- 2S3 SP Howitzer (152mm)
- 2S19 SP Howitzer (152mm)
- SA15 AD Missile Launcher
- SA-13 AD Missile Launcher
- 2S6 Quad 30mm/SA-19
- MTU-20 AVLB
- ZSU-23-4
- GMZ Mine Layer
- BREM1 Recovery

Allied Tracked Vehicles
- Leopard MBT (GR)
- Chieftan MBT (UK)
- Challenger MBT (UK)
- AMX 30 MBT (FR)
- AMX 40 MBT (FR)
- AMX 10 IFV (FR)
- Warrior IFV (UK)
- Marder IFV (GR)

Wheeled Vehicles
- AMX 10RC (FR)
- BRDM 2
- BTR 60P
- BTR 80
- 2S12 120mm Mortar
- MT12 100mm Gun
- D30 Towed Howitzer
- GAZ 66 Truck
- UAZ 469 Truck
- KRAZ 255B Truck

Rotary Wing Aircraft
- MI-8T/HIP C
- MI-24P/HIND
- MI-28/HAVOC
- KA-50/HOKUM

Fixed Wing Aircraft
- SU-25 Frogfoot
- SU-24 Fencer
- MIG -27 Flogger
- SU-17 Fitter




Trainer as Test Bed

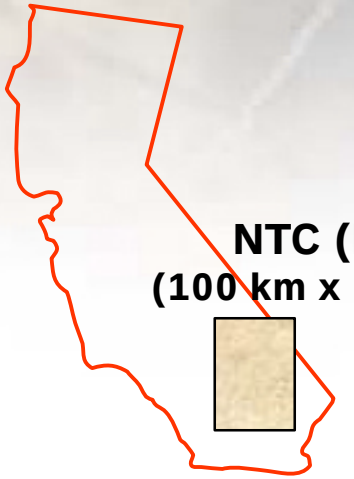
CCTT Terrain Databases

Korea
(115 km x 115 km)

Germany (P1)*
(100 km x 150 km)

Fort Hood
(40 km x 40 km)

NTC (P2)
(100 km x 150 km)



Kosovo
(160 km x 160 km)

Virtual Training Area > 70,000 km2

P1=Primary #1




Trainer as Test Bed

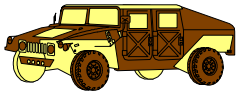
Data Recording Capabilities

- **CCTT subsystems can record exercise data that enable complete recreation of any completed exercise.**
- **In addition, statistical reports are generated for each exercise that offer measures that include a broad range (e.g.):**
  - Overall exercise:
    - Loss exchange ratio
    - Force exchange ratio
  - Direct-fire Incident:
    - Who fired when, at whom and with what weapon
    - Positions of each player
    - Individual shot results

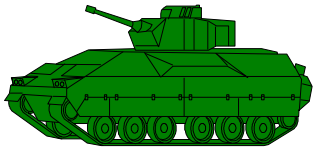



Trainer as Test Bed

EXAMPLES



- Current CCTT AAR reports
- Sample exercise data
- Interpretation
- Challenges

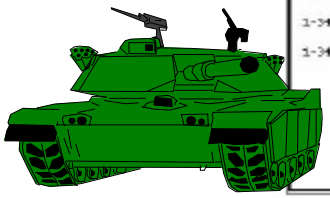


Report #1: Firing Vehicle - Target Scoreboard

REPORT OPTIONS:
Force: BLUFOR
Unit: ALL
Vehicle: ALL
Time Frame Start: A 06JEP01 06:30:00
Time Frame End: A 06JEP01 13:35:41

Exercise ID: 1
Exercise Start Date: 01AUG02
Simulation Start Date: 06JEP01
Created On: 01AUG02 17:20:35

BLUFOR Firing Vehicle Bumper Number	Description	OPFOR Target Description	Count	Damage
1-34AR 344	M1A1 Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR 344	M1A1 Abrams	BMP-2	1	K,F KILL
			2	G KILL
1-34AR 341	M1A1 Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR 341	M1A1 Abrams	T-72 Main Battle Tank (MBT)	1	K,F KILL
1-34AR 341	M1A1 Abrams	BMP-2	1	F KILL
		Platoon Total:	7	
1-34AR 324	M1A1 Abrams	BMP-2	2	G KILL
1-34AR 322	M1A1 Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR 322	M1A1 Abrams	BMP-2	1	G KILL
1-34AR 322	M1A1 Abrams	T-72 Main Battle Tank (MBT)	1	G KILL
1-34AR 321	M1A1 Abrams	BMP-2	1	G KILL
		Platoon Total:	6	
		Company Total:	13	
		Battalion Total:	13	
		Enemy Kills Total:	13	

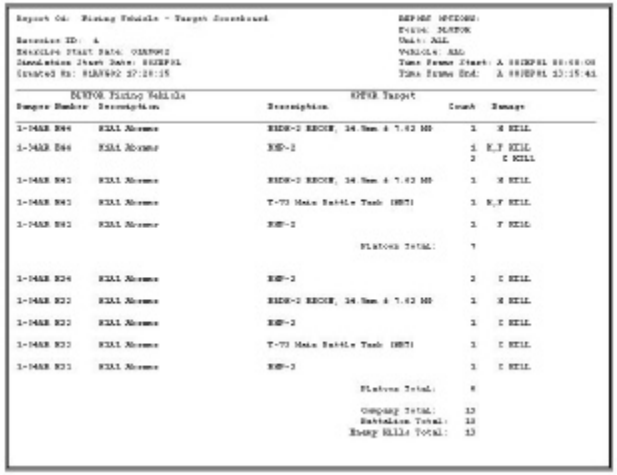


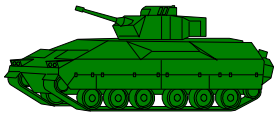



Trainer as Test Bed

CURRENT CCTT A.A.R. REPORTS

- **As many as 11 different reports can be automatically generated, including:**
  - Firing Vehicle–Target Scoreboard
  - Field of View (Who saw whom)
  - Direct Fire
  - Indirect Fire
  - Ammunition Expenditure
  - Close Air Support
  - Damage/Casualties








Trainer as Test Bed

Report 01: Firing Vehicle - Target Sc

Exercise ID: 1
Exercise Start Date: 01AUG02
Simulation Start Date: 08SEP01
Created On: 01AUG02 17:20:25

TIONS:
FOR
Unit: AL
Vehicle: A
Time Frame Start: A 08SEP01 08:00:00
Time Frame End: A 08SEP01 13:25:41

Complete Exercise Recorded

Every Unit Identified

Damage/Kill Assessment

BLUFOR Bumper Number	Description	OPFOR Target Description	Count	Damage
1-34AR E44	Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR E44	M1A1 Abrams		1	M,F KILL
			2	C KILL
1-34AR E41	M1A1 Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR E41	M1A1 Abrams	T-72 Main Battle Tank (MBT)	1	M,F KILL
1-34AR E41	M1A1 Abrams	BMP-2	1	F KILL
		Platoon Total:	7	
1-34AR E24	M1A1 Abrams	BMP-2	2	C KILL
1-34AR E22	M1A1 Abrams	BRDM-2 RECON, 14.5mm & 7.62 MG	1	M KILL
1-34AR E22	M1A1 Abrams	BMP-2	1	C KILL
1-34AR E22	M1A1 Abrams	T-72 Main Battle Tank (MBT)	1	C KILL
1-34AR E21	M1A1 Abrams	BMP-2	1	C KILL
		Platoon Total:	6	
		Company Total:	13	
		Battalion Total:	13	
		Enemy Kills Total:	13	

CCTT SCOREBOARD REPORT




Trainer as Test Bed

Report 03: Direct Fire

Exercise ID: 2
Exercise Start Date: 25JUL02
Simulation Start Date: 16AUG00
Created On: 25JUL02 15:26:19

REPORT OPTIONS:
Force: BLUFOR
Unit: ALL
Vehicle: ALL
Time Frame Start: A 16AUG00 09:13:40
Time Frame End: A 16AUG00 13:36:40

Time	Firing Vehicle	Weapon	Ammunition	Detonation	Target	Range	Damage
A 16AUG00 11:44:48	3-32A A13 M1A1	120mm Cannon (M256)	120mm M829A1 APFSDS-T	GROUND IMPACT	OIN BMP-2	3785	N/A
A 16AUG00 11:45:44	3-32AR A13 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OIN1 C32 BMP-2	38	C KILL
A 16AUG00 12:36:48	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OIN1 C33 BMP-2	2761	N/A
A 16AUG00 12:36:51	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	GROUND IMPACT	OAR1 D13 T-80 Main Battle Tank (MBT)	3471	N/A
A 16AUG00 12:37:18	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OAR1 D13 T-80 Main Battle	3312	M KILL

TIME

IMPACT

RANGE

RESULT

Every Shot Recorded and Results Assessed

CCTT DIRECT FIRE REPORT




Trainer as Test Bed

CCTT DIRECT FIRE REPORT

Report 03: Direct Fire

Exercise ID: 2
Exercise Start Date: 25JUL02
Simulation Start Date: 16AUG00
Created On: 25JUL02 15:26:19

REPORT OPTIONS:
Force: BLUFOR
Unit: ALL
Vehicle: ALL
Time Frame Start: A 16AUG00 09:13:40
Time Frame End: A 16AUG00 13:36:40

Time	Firing Vehicle	Weapon	Ammunition	Detonation	Target	Range	Damage
A 16AUG00 11:44:48	3-32AR A13 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	GROUND IMPACT	OIN1 C32 BMP-2	3785	N/A
A 16AUG00 11:45:44	3-32AR A13 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OIN1 C32 BMP-2	3788	C KILL
A 16AUG00 12:36:48	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OIN1 C33 BMP-2	2761	N/A
A 16AUG00 12:36:51	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	GROUND IMPACT	OAR1 D13 T-80 Main Battle Tank (MBT)	3471	N/A
A 16AUG00 12:37:18	3-32AR A14 M1A1 Abrams	120mm Cannon (M256)	120mm M829A1 APFSDS-T	ENTITY IMPACT	OAR1 D13 T-80 Main Battle	3312	M KILL

Entries record a successful attack on an armored personnel carrier by an M1A1 tank using its main gun. Two shots result in a “Catastrophic” kill. Times indicate engagement occurred about 2.5 hours into exercise.




Opportunities

- Unfortunately, while replay and statistics are used routinely for participant feedback and analysis in individual exercise after-action sessions, this rich source of data is rarely employed for much else.

- While CCTT is recognized as a versatile and powerful training tool, its potential for being an equally powerful and adaptable platform for test and evaluation is largely ignored.




Trainer as Test Bed

Proposed Application

- **We are currently collecting and analyzing selected CCTT exercise data to assess uses in support of Army Transformation:**
  - Influence of overall environmental factors (terrain, weather, force structure, assumptions)
  - Evaluation of baseline (legacy) combat unit performance and readiness
  - Assessment of new combat vehicle performance and effectiveness
  - Experimentation with integrating new vehicles and weapons with legacy forces and tactics
  - Analysis and assessment of new combined-arms tactics




Trainer as Test Bed

Building an Exercise / Engagement Database

- Trainer utilization and availability
- Trainer versatility and adaptability
- Availability of consistent exercise scenarios to build baseline data library
- Expectations
- Challenges




Site Utilization / Availability

- Available training days are based on both troop & site availability (National and Post training Holidays are thus deducted)
- Capacity equates to Unit (Platoon Equivalency) throughput i.e. number of Units trained vs number of Units that could have been trained:

  - A fixed site is at 100% capacity if it trains 5 platoons, 2Co/Tm, or 1 Bn(-) per normal 4-hour training session
  - A mobile set is at 100% capacity if it trains every available weekend (28 hrs/we and 42 we/year)

- Ft Knox capacity is 4 PLT per session (4 hr. block) all other fixed sites are 6 PLT per session. Mobile capacity is 1 PLT.




Trainer as Test Bed

Site Utilization / Availability

	Available Training Days	Days Training Scheduled	Days Training Conducted	% of Days Utilized	% of Days Utilized Yr Avg	'% of Capacity per Site	% of Capacity Yr Avg
HOOD I	17	16	7	41.2	50.4	9.4	25.4
HOOD II	17	15	11	64.7	65.2	11.8	35.4
KNOX	18	18	18	100.0	90.7	80.6	70.7
STEWART	18	17	11	61.1	57.9	44.4	37.8
BENNING	21	21	21	100.0	82.3	74.6	44.6
CARSON	17	14	13	76.5	67.2	35.9	40.8
RILEY	19	19	18	94.7	82.2	74.7	53.9
GRAF	17	16	15	88.2	66.5	79.5	45.9
CASEY	17	11	8	47.1	63.4	14.7	51.6
BEAU TANK	12	10	10	83.3	50.4	83.3	50.4
BEAU MECH	9	2	2	70.5	38.2	70.5	38.2
MCCRADY TANK	12	9	9	22.2	54.0	22.2	54.0
MCCRADY MECH	9	6	6	66.7	48.9	66.7	48.9
KNOXVILLE MECH	12	9	9	75.0	55.0	75.0	55.0
KNOXVILLE TANK	9	9	9	100.0	61.3	100.0	61.3
LOS ALAMITOS	12	8	8	66.7	75.6	66.7	75.6

Current utilization rates allow ample room for additional training as well as for experimentation. Added staffing would allow for substantially increased use.




Trainer as Test Bed

Trainer Versatility & Adaptability

- Typical fixed facility can accommodate as many as five separate exercises at one time.
- Manned modules can be used in any combination.
- Exercises can range from small unit (Platoon/Team) through Battalion levels, including related command and support functions.
- SAFs can be employed as both friendly and opposing forces.
- Additional friendly units can be “tethered” to the movements of manned modules to simulate team maneuvers.
- Exercises can be built using “structured” or custom scenarios.




Consistent Exercise Scenarios

- **Initial baseline databases to be built around structured exercise scenarios for consistency and mass.**
  - Over 100 different scenarios available
  - Set covers spectrum from fundamental unit movement & fire to complex multi-element missions
    - Movement to Contact
    - Defense in Sector
    - Deliberate Attack
- **All sites have access to these exercises and most can execute all of them**
- **Operational units can design custom exercises to meet specific training or pre-deployment goals.**




Trainer as Test Bed

Expectations

This pilot database can provide a rich foundation for analysis of several open-ended questions about the current combined arms close combat environment:

- **Where do we expect to fight?**
- **What kinds of adversaries do we expect to face?**
- **What enemy capabilities are we expecting?**
- **How effective are we against these adversaries?**
- **What are the critical/defining factors in a typical engagement?**
  - Events (initial sighting, initial contact, first shot)
  - Tactics & Maneuver
  - Order of Battle (numbers & types)
  - Environment (terrain, weather, day/night, etc)
- **What are the critical factors affecting victory and/or survival?**




Trainer as Test Bed

CHALLENGES

- **CCTT A.A.R. report generating system is geared toward one-time, immediate re-cap of exercises**
  - Reports are perishable
  - Reports and event times must be re-constructed during replay of complete exercise
    - Can run at 5x real time in replay
  - Orders of Battle and perspectives must be recorded separately
- **Building a baseline database will require access to relatively large numbers of exercises based on a limited set of consistent scenarios (parameters)**
- **CCTT usage is not mandated outside of Armor School**
  - Mission rehearsal is most common application
  - Standard CCTT exercise scenarios are not used consistently outside of Armor School
  - Field units tend to rely on custom situations or unique parameters with limited commonality




Trainer as Test Bed

Conclusions

- In a period when the American military in general, and the U.S. Army in particular, is faced with the prospects of sweeping change, we cannot afford to pass up a resource that can help guide decisions about tactics, equipment, operations, and force structure.

- As tactics, equipment, operations, and force structures transform, simulation-based training systems like CCTT can be exploited as Operational Test and Evaluation and Developmental Experimentation resources.




Trainer as Test Bed

Status & Plans

- **Baseline database development is focused on selected (advanced) structured exercises conducted regularly in support of the Army Armor School (Fort Knox, KY).**
  - Will support longitudinal analysis of crew performance under controlled conditions
  - Coordination with TRADOC and other activities for assessment of new tactics and potential new systems
- **More complex exercises conducted at other CCTT sites will be analyzed to identify potential sources for further collection & study.**
  - Focus on exercises commonly used to prepare for NTC deployment
  - Potential for identification of new structured scenarios for wider use by field units




Trainer as Test Bed

CLOSE COMBAT TACTICAL TRAINER

CCTT

ALL BUT WAR IS SIMULATION

DynCorp Team