



Combat Decision Aid Software (CDAS) For Network Centric Warfare/Effects Based Fires



Dr. Norman P. Coleman
ARDEC/AETC
ncoleman@pica.army.mil

Effects C4I Nodes

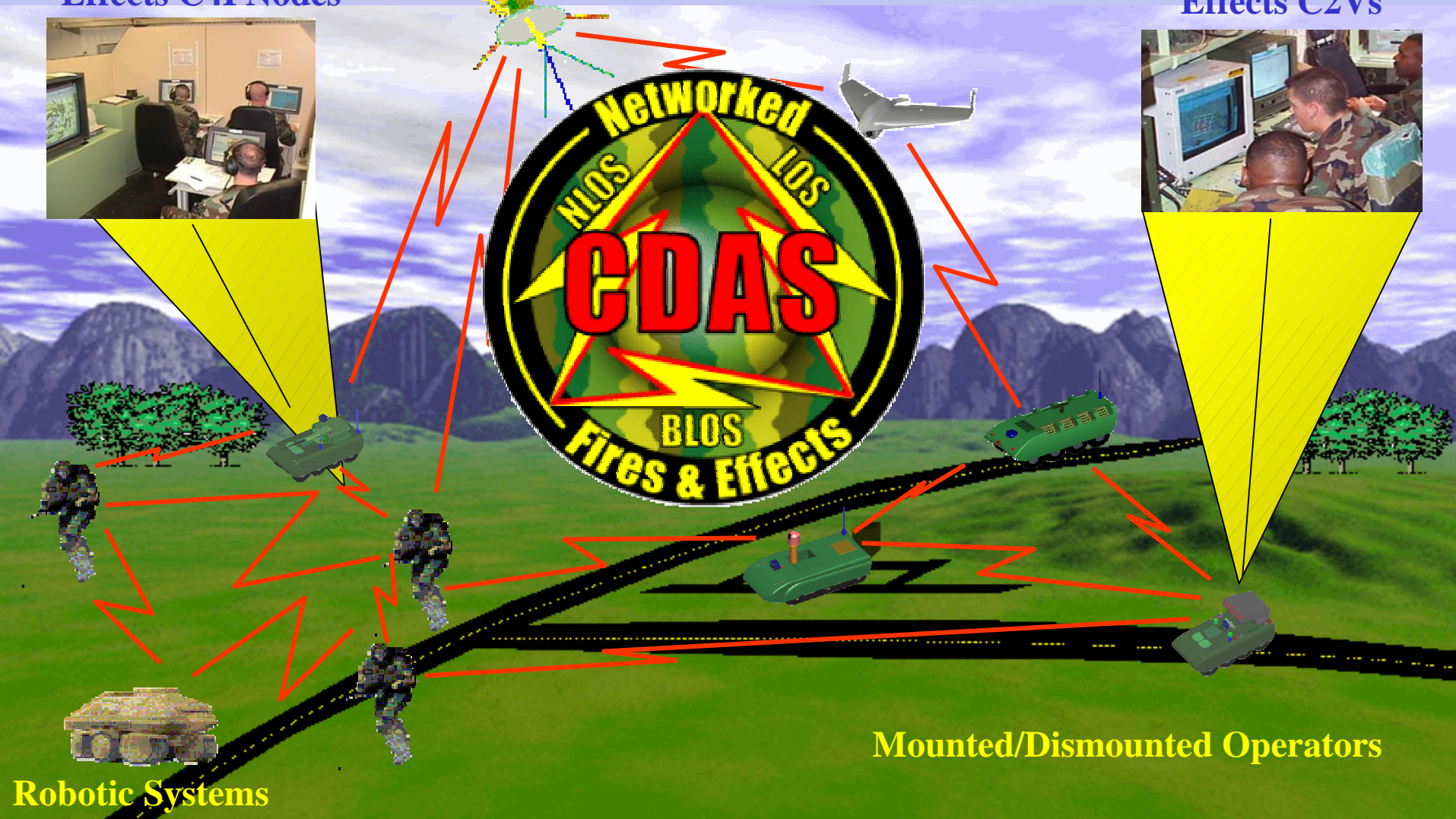


Effects C2Vs



Mounted/Dismounted Operators

Robotic Systems



CDAS/ Networked Effects

Background

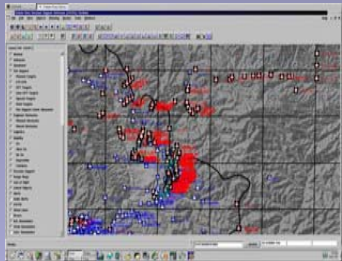
- CDAS was developed as an open architecture, embeddable combat decision aid SW tool suite under a completed ARDEC Armament Decision Aids STO.
- User tested in a series of 5 CEP experiments conducted at Ft. Sill and Ft. Knox as well as 1stApp/MATREX experiments as a UA/Bn effects management tool.
- CDAS/NE was extended under FFW Phase I to provide multi-echelon netted fires capability from individual FFW equipped dismounted soldier up to the Unit of Action Effects Control Cell.
- Networked Effects proof-of-concept demo conducted at Ft. Benning (SBL) Feb 03 with follow-on user assessment Jan 26-29 2004.
- CDAS/NE allows coordination and effects based control of NLOS, BLOS, and LOS fires.
- CDAS/NE is extensible to support Joint Ops/Fires.
- CDAS/NE adopted by SBL to support follow-on Joint experiments such as JOUST.
- CDAS Networked Effects component capability being further extended under joint FC-NET STO for integration into the FFW architecture.



Combat Decision Aid Software Suite (CDAS)



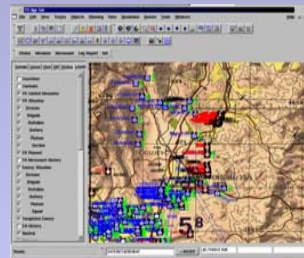
A fully integrated and scalable decision support tool suite for the mounted/ dismounted Warfighter / Commander



Knowledge Bases/Shared Data



Mission Support/Total Asset visibility



Situation Awareness/COP



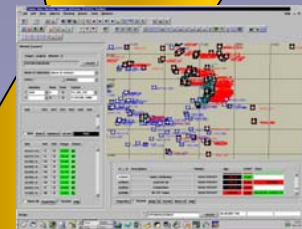
Planning/COA

*Netted Effects Based Fires
Additional Battlefield Features*

- User Defined Operational Picture
- Logistics Planning/ Monitoring
- Open Scalable Architecture
- Dynamic weapon-target pairing/ deconfliction
- Electronic White Board
- Shared, Synchronized Databases
- Sensor/asset tasking



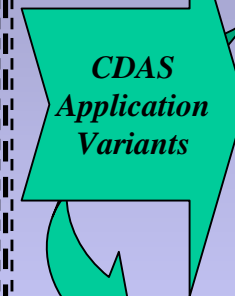
UoA Effects Node



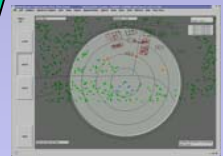
Leader/Tablet



Embedded



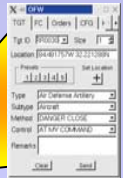
**CDAS
Application
Variants**



Soldier Variant

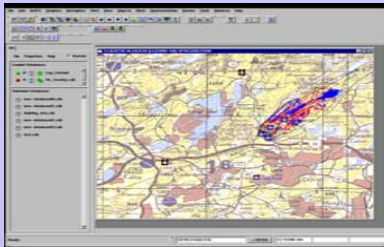


PDA

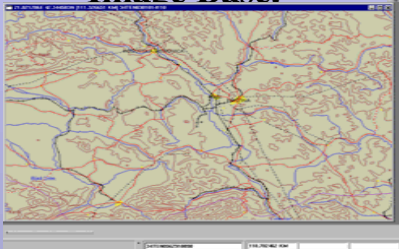




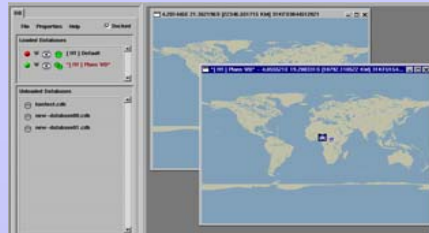
Multiple maps with independent layer control.



NIMA 5- and 10-Meter Controlled Image Base.



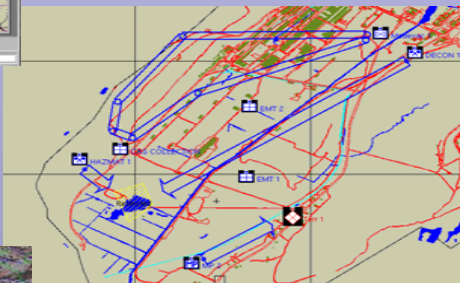
ArcView™ Shape Files and AutoCad™ DXF Files.



NIMA ADRG, CADRG Maps, All Scales.



NIMA VMAP 0-2, Urban Vector Map.



Depth Rendered Elevation Map.

Multiple Map Data Sources

CDAS imports and displays digital map data from multiple NIMA, USGS, and commercial map formats.

- CADRG
- ADRG
- CIB 5-meter & 10-meter
- DTED 0-2
- VMAP 0-2
- Urban Vector Map
- DTOP
- ArcView™ Shape Files
- ArcInfo™ Exchange Files
- AutoCad™ DXF Files
- USGS DEM, DLG
- GeoTiff
- US Census Bureau Tiger Line

Flexible Uses

Multiple maps with independent layer control.

GPS interface and automatic map rotation for use in vehicle-mounted maps and palm-devices.

ArcView™ and AutoCad™ Engineering Maps to support Urban Ops.

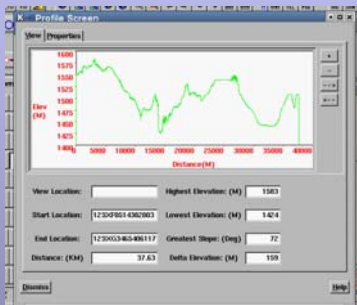
Flexible Interfaces

Available with or without user interface.

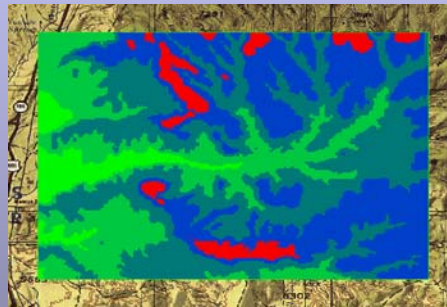
Map data remains in raw format to allow 3rd party developers to interface to map server and use data.

Terrain Analysis for Targeting, Mission Planning

- **Cover & Concealment calculation to identify locations for camouflaged, hidden targets.**
- **Moving, platform centric, Aerial Line of Sight to determine visibility from any location along flight route during flight route planning.**
- **Slope, terrain feature, contour analysis to determine likely target locations.**
- **Determination of low visibility areas for low level flight route planning.**
- **Identification of aerial obstacles such as towers, power lines, etc.**
- **Mobility corridor analysis to identify likely enemy mobility routes for targeting.**

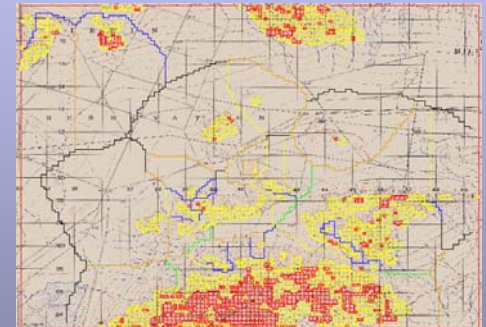


Elevation Profiles

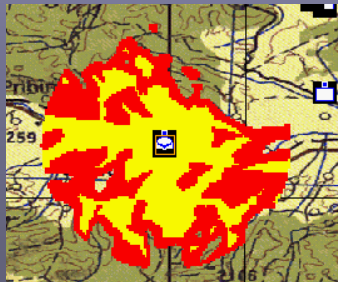


Contour Maps

Cross Country Mobility & Mobility Corridors



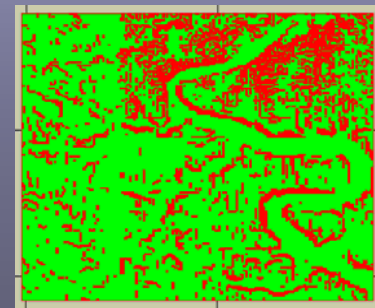
Aerial Line of Sight



Time-based Mobility Range Rings



Slope Overlays



CDAS Collaboration Tool

Platoon Leader Tablet-Initial Security Plan Sketch

Preplanned Targets

Current Locations

Subordinates
Logistics
Status

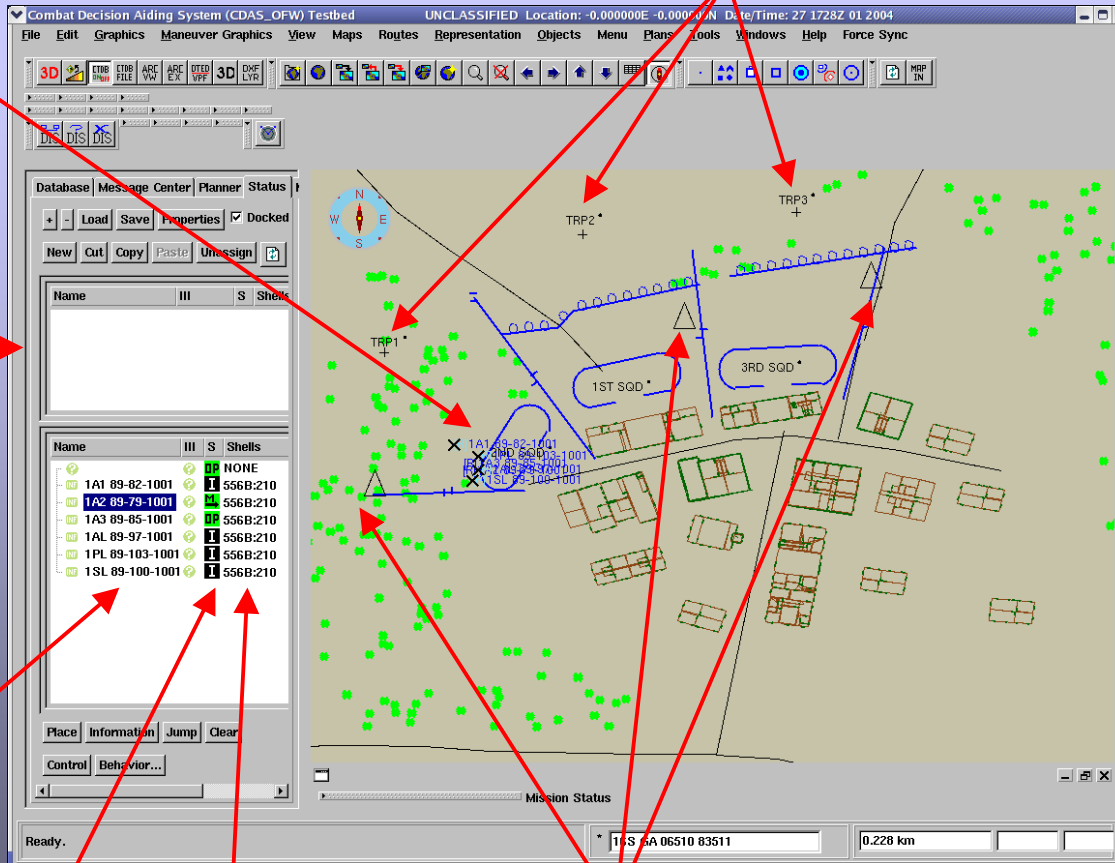
Subordinate ID

Health/Activity

Ammo

Sensor/OP Locations

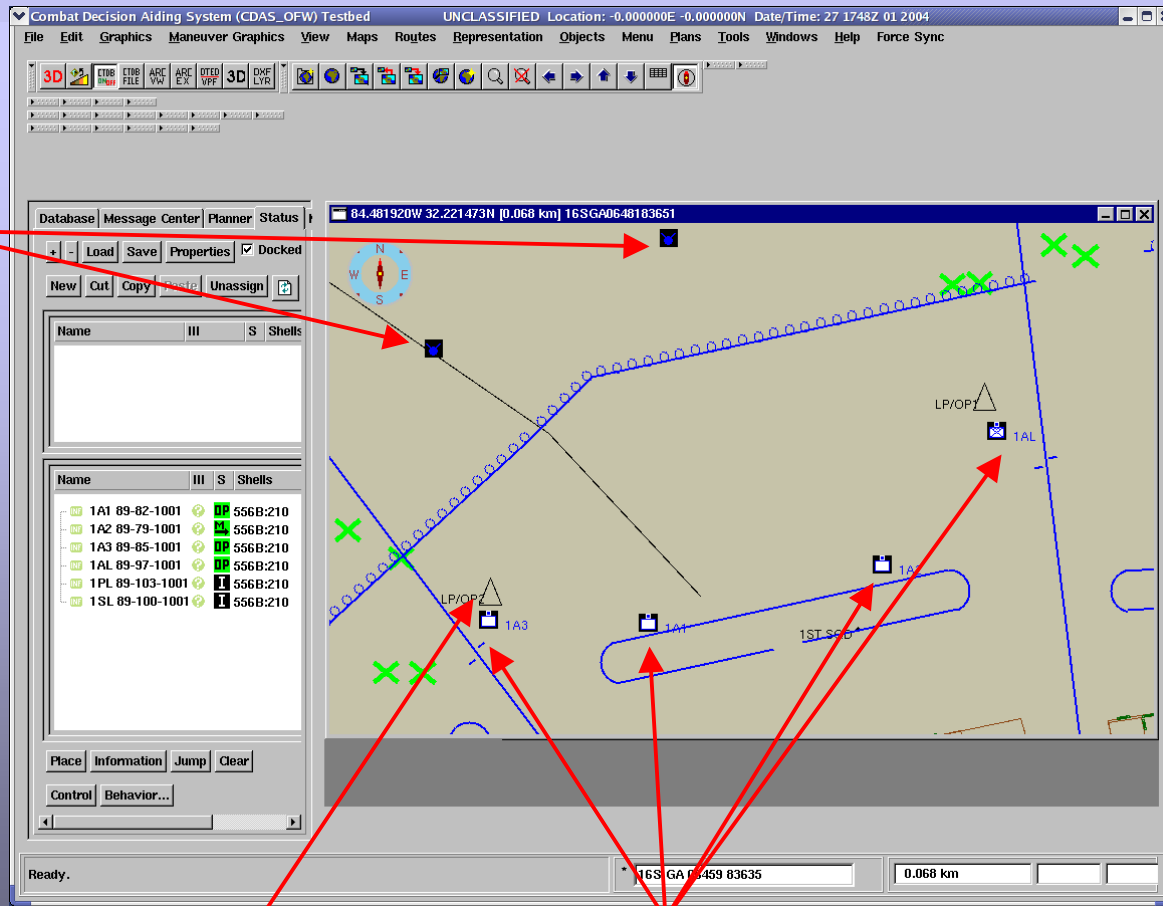
Plt Ldr's initial Security Plan shared in real time to Sqd Ldr, who then alters plan to reflect squad positions.



CDAS Collaboration

1st Squad Leader Tablet-Final Security Plan Sketch

Mines laid by Squad



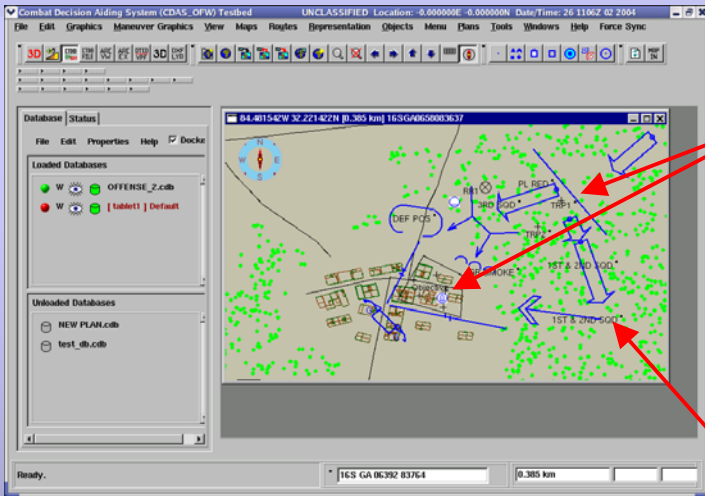
All of Squad Ldr's final alterations to Security Plan shared in real time to PL, who approved alterations.

Additional Squad OP Location

Team Ldr and OFW Soldier Locations

Plan Sharing

Military Decision Making Process



Plt Ldr/Sqd Ldr Tablet

Preplanned
Targets

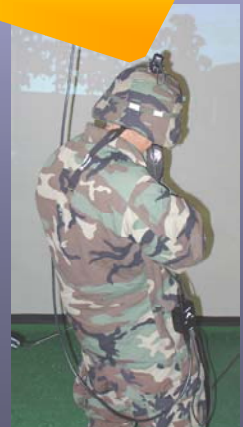
Routes Developed
with CDAS Terrain
Analysis



FFW Soldier CDAS HMD
(CDAS Combat View)



Plan developed by Plt Ldr and shared
down to Sqd Ldrs, then to all soldiers.



Soldier Variant/Asset Tasking

Squad Leader Creating Move Order in Combat View for Robotic MULE

Current Location in Menu Structure

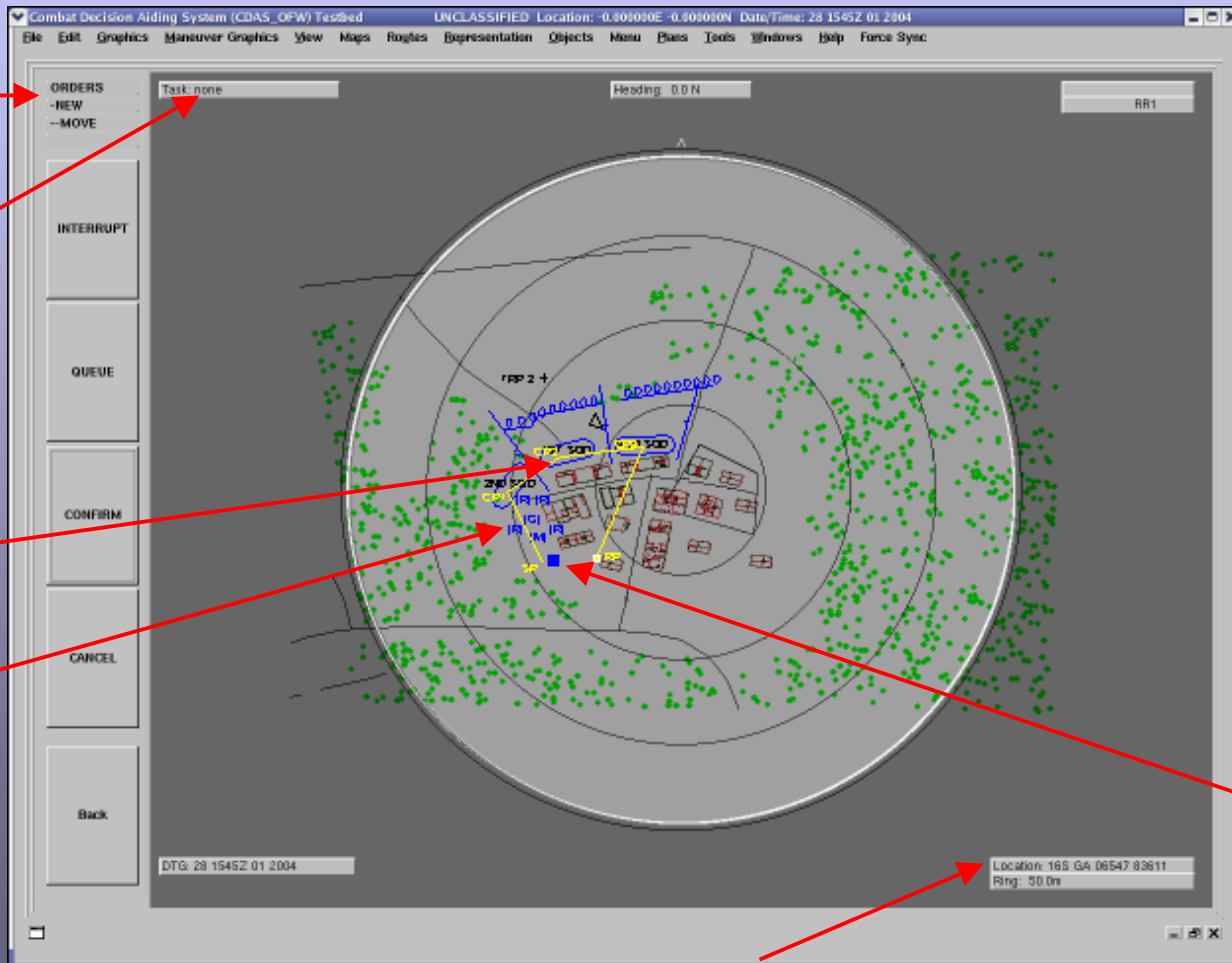
Current Task (Move)

Movement Route (Yellow)

Squad members

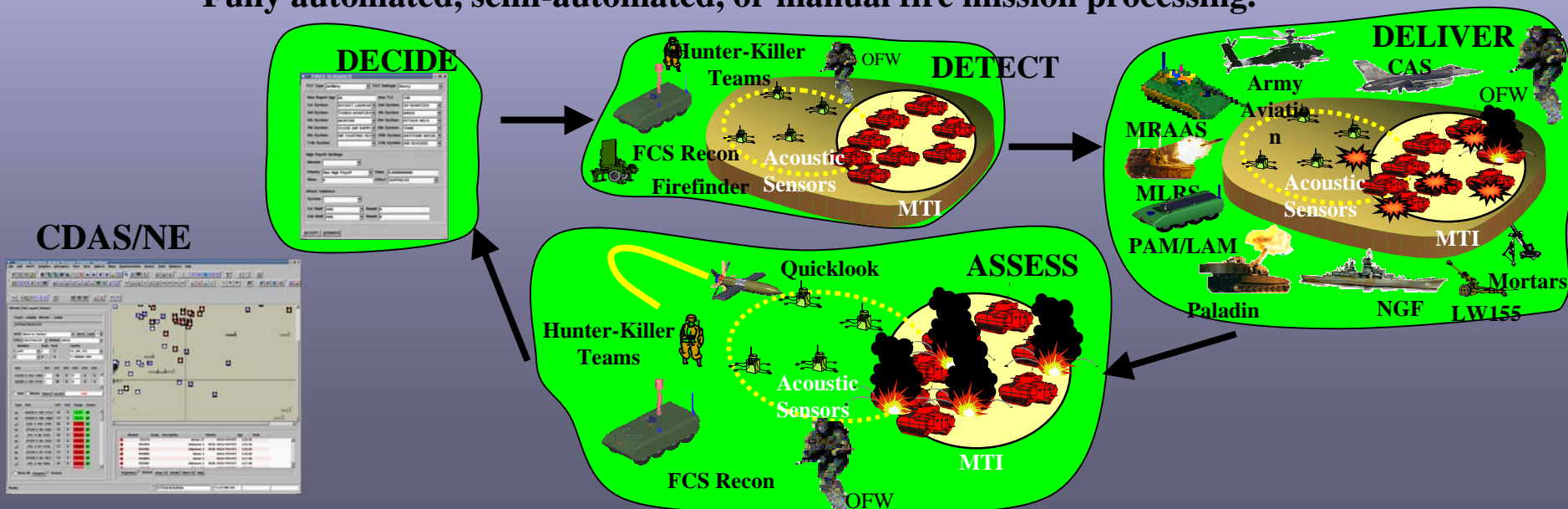
MULE

Current Location



Fires and Effects Control for Multi-Target, Multi-Weapon System Time Critical Targeting

- Shared attack guidance to select the right munitions and weapons mix, for single or large target arrays.
- Shared, distributed mission status informs all users of exact status of all fire missions.
- Total asset visibility on all available weapon systems and munitions, not just artillery.
- No client-server weaknesses. If fire control node goes down, all functionality and data at that node is preserved by other nodes via shared synchronized databases.
- LOS, BLOS & NLOS Weapons: Artillery, Mortars, Close Air Support, Attack Helicopters, MLRS, HIMARS, FCS, and other direct fire weapon systems.
- Fully automated, semi-automated, or manual fire mission processing.





CDAS Variants and SAL Target Designation

Decide

K - FIRES GUIDANCE

TGT Type: Artillery | TGT Subtype: Heavy

Max Report Age: 60 | Max TLE: 100

1st System: ROCKET LAUNCHER | 2nd System: SP HOWITZER

3rd System: TOWED HOWITZER | 4th System: MRAS

5th System: MORTAR | 6th System: ATTACK HELO

7th System: CLOSE AIR SUPPPC | 8th System: TANK

9th System: INF FIGHTING VEH | 10th System: ARTITANK MISSIL

11th System: | 12th System: AIR DEFENSE

High Payoff Settings

Mission: | Priority: Non High Payoff | Value: 0.000000000

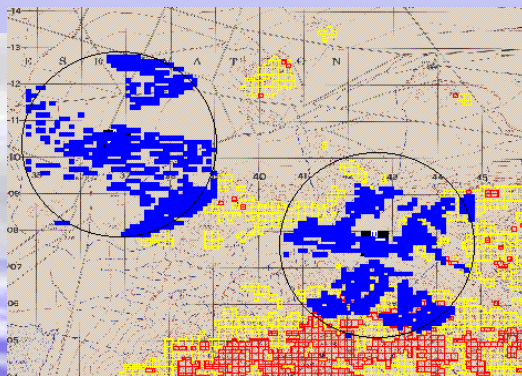
When: 0 | Effect: SUPPRESS

Attack Guidance

System: | 1st Shell: AML | Round: 0

2nd Shell: AML | Round: 0

ACCEPT | DISMISS



CDAS Terrain Analysis for Determining Sensor and Observer Placement



Army Aviation

CDAS Attack Guidance



FCS/MCS



PAM/LAM

Station	Call	CO	Ch	Dir	Logistics	On	St	U
SE1	3-94	1001						
SE3	3-94	1102						
SE36	3-92	2506						
SE1	3-92	2502						
Z03	3-97	3708						
Z03	3-97	3724						
ZAD	3-104	1074						
ZAD	3-104	1067						
ZJ	3-104	1075						
ZD3	3-97	3709						
ZD3	3-97	3705						
ZH037R	Z794	8092	1	003				
ZH04R	4-64	1136						
ZH4	3-106	1122						
ZH4	3-106	1104						
ZH03	3-106	1125						
ZH02	3-106	1120						
ZH01R	3-106	1126						
ZK01	3-106	1040						
ZH0	3-106	1070						
ZH0	3-106	1140						
ZH02	3-107	1146						
ZH01	3-107	1203						
ZHC	3-107	1270						
ZHC	3-107	1272						
ZHC	3-107	1264						
ZHC	3-107	1200						
ZHC	3-107	1154						
ZHC	3-107	1144						
ZHC	3-107	1100						
ZHC	3-106	1140						
ZHC	3-106	1120						
ZHC	3-106	1014						
ZHC	3-106	1132						
ZH04	3-108	1022						

CDAS Monitoring of System & Logistics States



CDAS/FECC

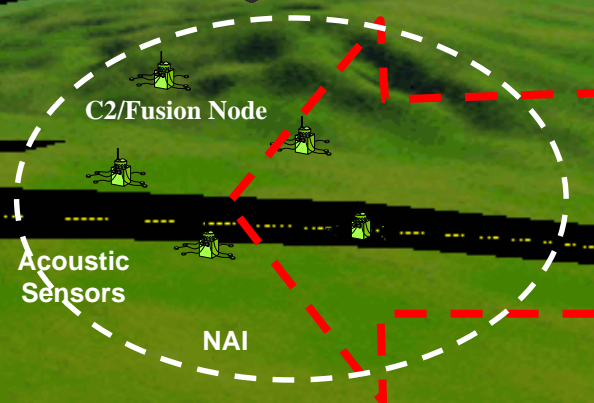
FFW RSTA



FCS Robotic Recon



FFW RSTA



C2/Fusion Node

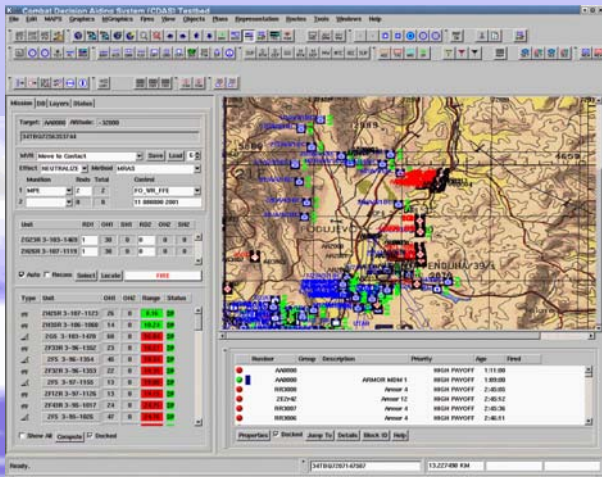
Acoustic Sensors

NAI



CDAS FFW and SAL Target Designation

Detect/Deliver



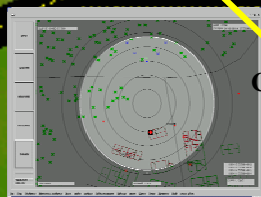
CDAS Weapon Target Pairing & Target Designator Pairing



FCS/MCS

PAM/LAM

CDAS/WECC



CFF

Fire Command

Fire Command

Lase Command

FFW RSTA



Army Aviation

OFW RSTA

Lase Command

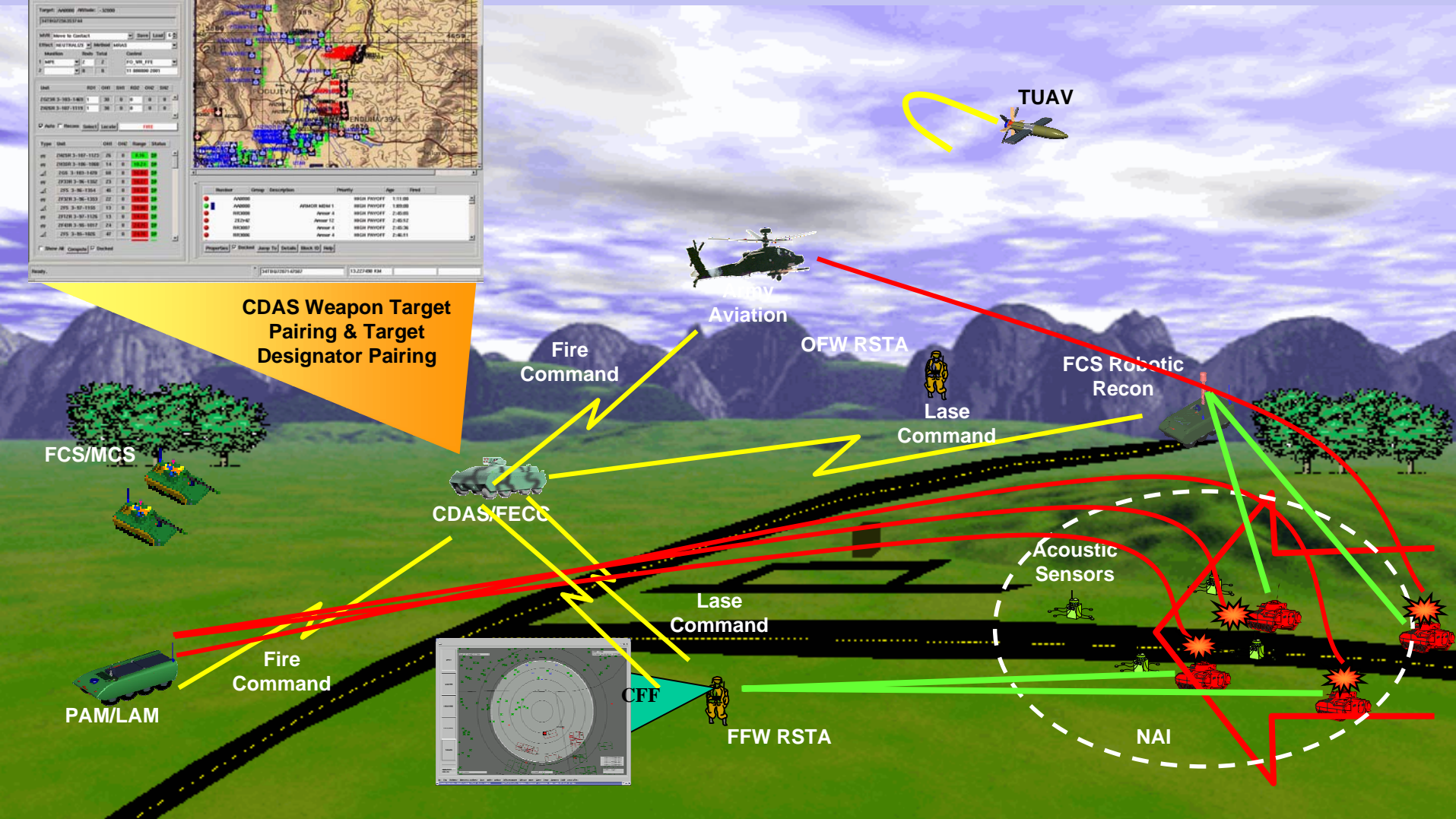
FCS Robotic Recon



TUAV

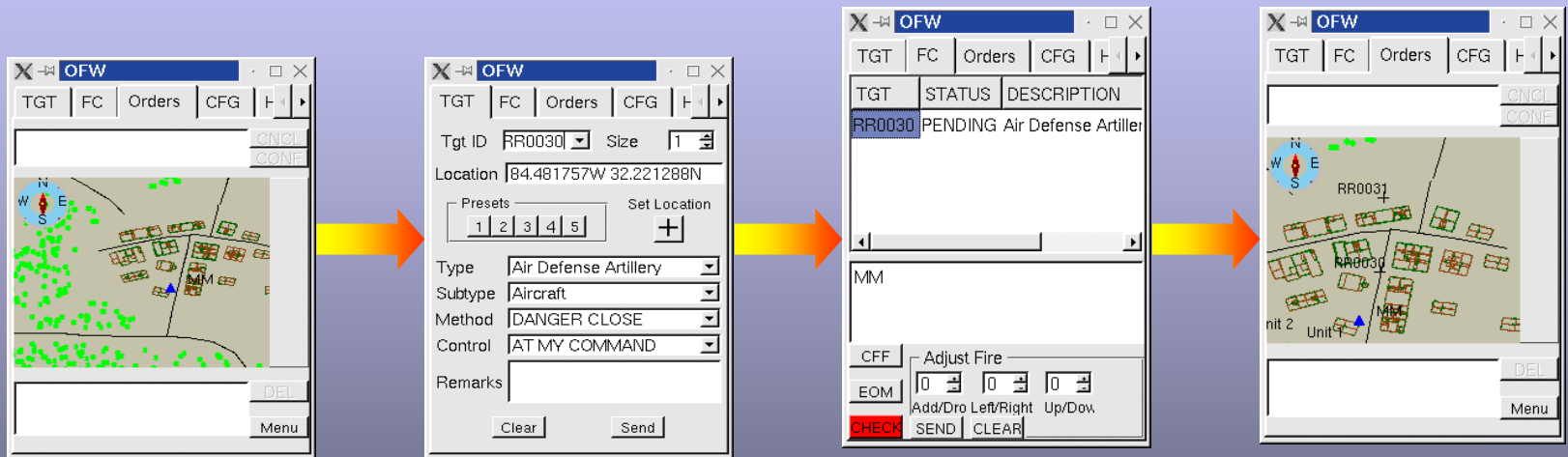
Acoustic Sensors

NAI



PDA Call for Fire

- Each soldier and leader given 1 hour training and practice on CDAS OFW PDA.
- Each soldier and leader given opportunity to send Call for Fire from CDAS OFW PDA in stand up simulators.



Initial Map Display

Soldier Entering Target

Soldier Monitoring Target Status

Target on Map Display



CDAS OFW and SAL Target Designation

Example of CDAS Fire Mission Tasking Applied to Designator

CDAS Effects Control Workstation

The screenshot displays the CDAS Effects Control Workstation interface. The main window is titled "Combat Decision Aiding System (CDAS) Testbed". It features a menu bar (File, Edit, MAPS, Graphics, MGraphics, Fires, View, Objects, Plans, Representation, Routes, Tools, Windows, Help) and a toolbar with various icons for map navigation and mission control. The interface is divided into several panels:

- Mission DB Layers Status:** Shows target information: Target: AA0001, Altitude: 320, 34TBQ7256353744. MVR: Move to Contact. Effect: NEUTRALIZE, Method: MRAS. Munition: 1 MPE (2 Rnds, 2 Total), 2 (0 Rnds, 0 Total). Control: FO_Laser. Unit: 2G23R 3-103-1469, 2H26R 3-107-1119, 2H25R 3-107-1129. Buttons: Auto, Recom, Select, Locate, FIRE.
- Weapon Systems Table:** Lists available weapons with their ranges and status.
- Map:** A topographic map showing the target area (PODUJEVO) with various units and targets marked. A red arrow points to a specific target labeled "Target".
- Mission Status Buffer:** A table showing mission details.

Type	Unit	OH1	OH2	Range	Status
	2H25R 3-107-1123	26	0	8.16	DF
	2H35R 3-106-1060	14	0	10.24	DF
	2G5 3-103-1470	60	0	16.84	DF
	2F33R 3-96-1352	23	0	18.27	DF
	2F5 3-96-1354	45	0	18.34	DF
	2F32R 3-96-1353	22	0	18.39	DF
	2F5 3-97-1155	13	0	19.00	DF
	2F12R 3-97-1126	13	0	19.23	DF
	2F43R 3-95-1017	24	0	24.75	DF
	2F5 3-95-1026	47	0	24.76	DF

Number	Group	Description	Priority	Age	Fired
AA0000			HIGH PAYOFF	1:11:00	
AA0000		ARMOR MDM 1	HIGH PAYOFF	1:09:00	
RR3008		Armor 4	HIGH PAYOFF	2:45:05	
2E2r42		Armor 12	HIGH PAYOFF	2:45:12	
RR3007		Armor 4	HIGH PAYOFF	2:45:36	
RR3006		Armor 4	HIGH PAYOFF	2:46:11	

Attack Guidance

Wpn-Tgt Pairing Solution

Sensor-Tgt Pairing Solution

Available Weapon Systems

Target

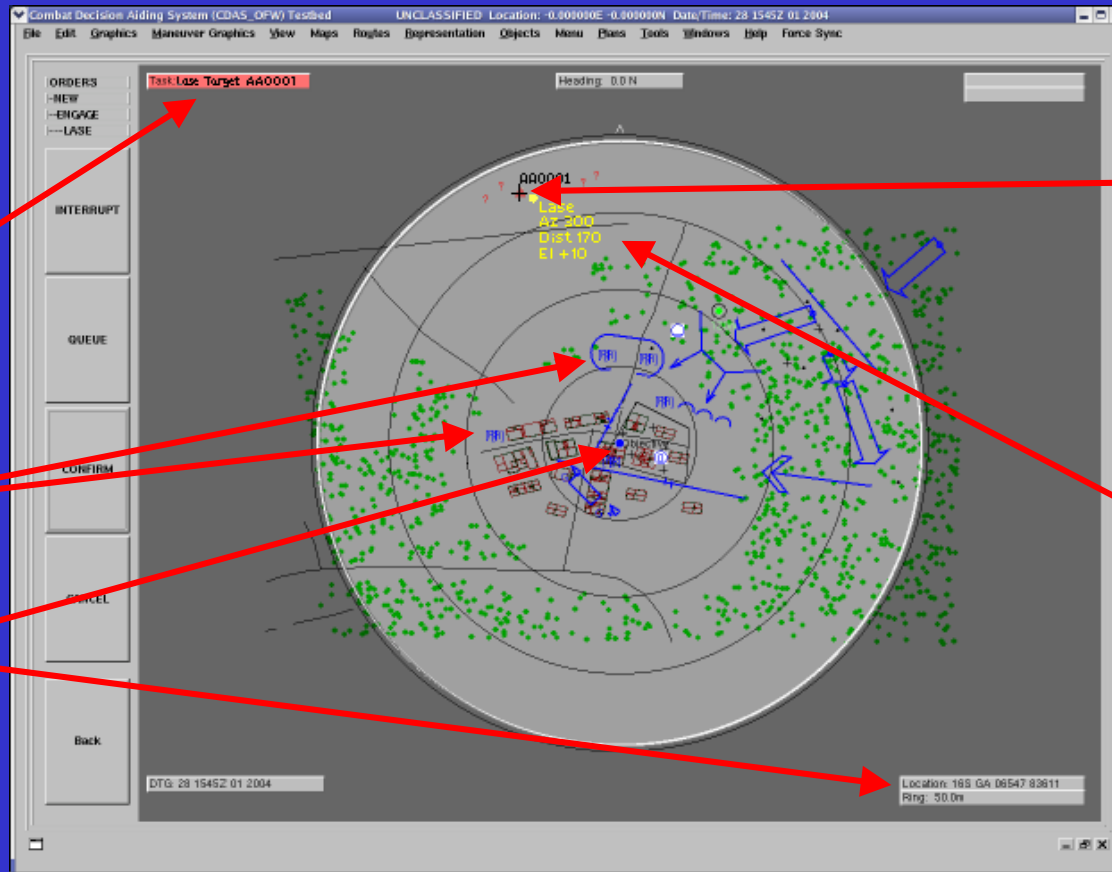
Mission Status Buffer



CDAS OFW and SAL Target Designation

Example of CDAS Fire Mission Tasking Applied to Designator

CDAS Future Force Warrior (FFW) Combat View (Head Mounted Display)



Designate Task Warning

Friendly Forces

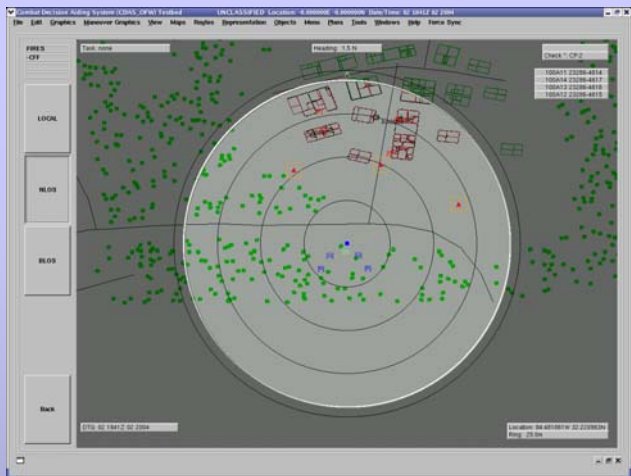
Designator Location

Target

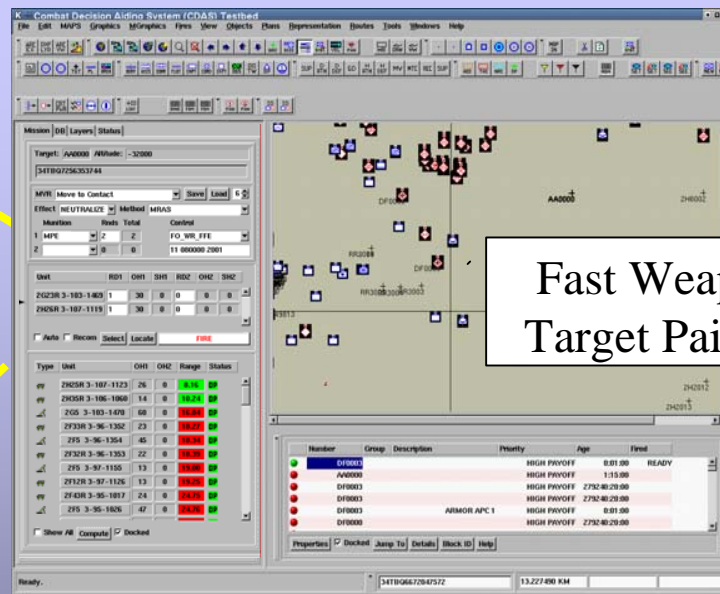
Laser Designation Pointing Data

CDAS Variants Allow Full Information Connectivity for Networked Fires & Effects

Combat View Call for Fire



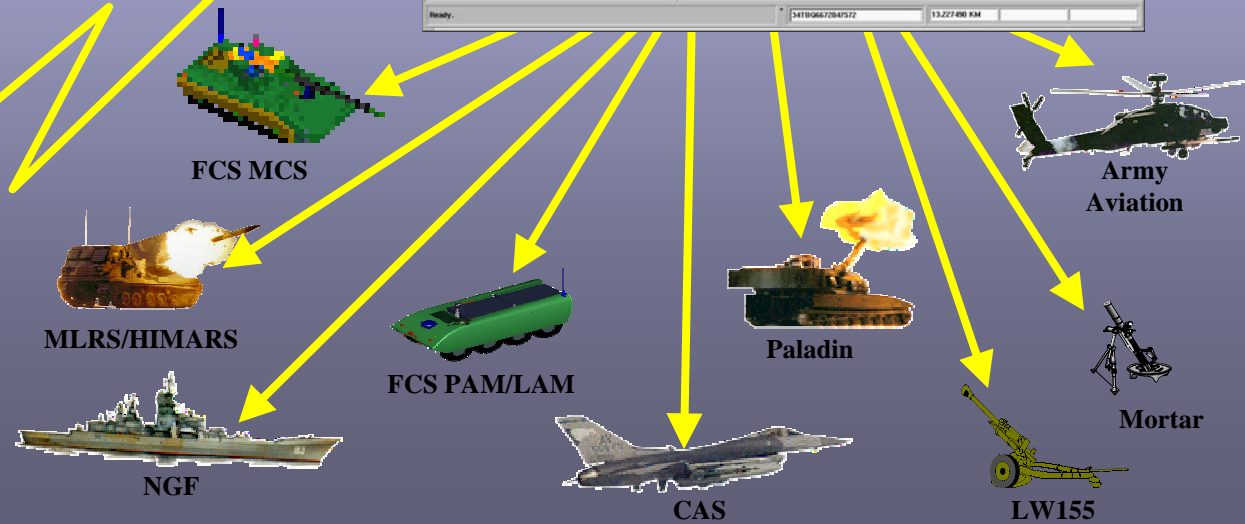
CDAS Netted Effects /Leader Node



Single or Multiple Target Call for Fire

Fast Weapon Target Pairing

PDA Call for Fire

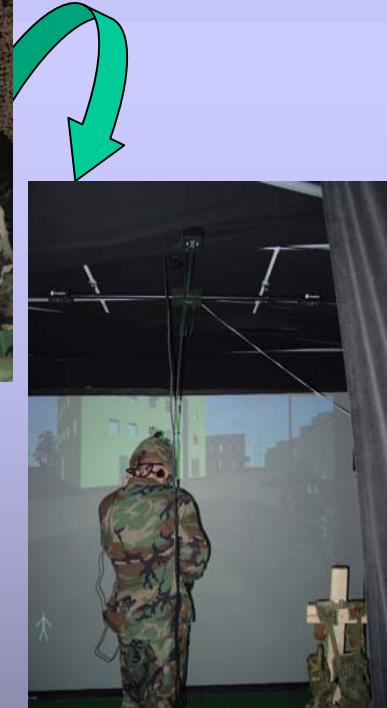


CDAS FFW User Evaluation Approach

- 4 hrs. training
- Short Vignettes based on snippets from FFW scenario developed by LTI.
- Key features addressed:
 - LOS, BLOS, NLOS Netted Effects
 - Collaboration for platoon/squad graphics
 - Logistics monitoring and visibility for all assets
 - Terrain Analysis for sensor placement
 - Issuing Digital Orders
 - Messaging
 - Situational Awareness Monitoring
- Vignettes conducted in SBL stand up SimStorm simulators.
- Each vignette between about 30-45 minutes long, followed by soldier evaluation of software capability used in vignette.
- Used slightly modified OTBSAF scenarios from February 2003 CDAS FFW exercise.



Training



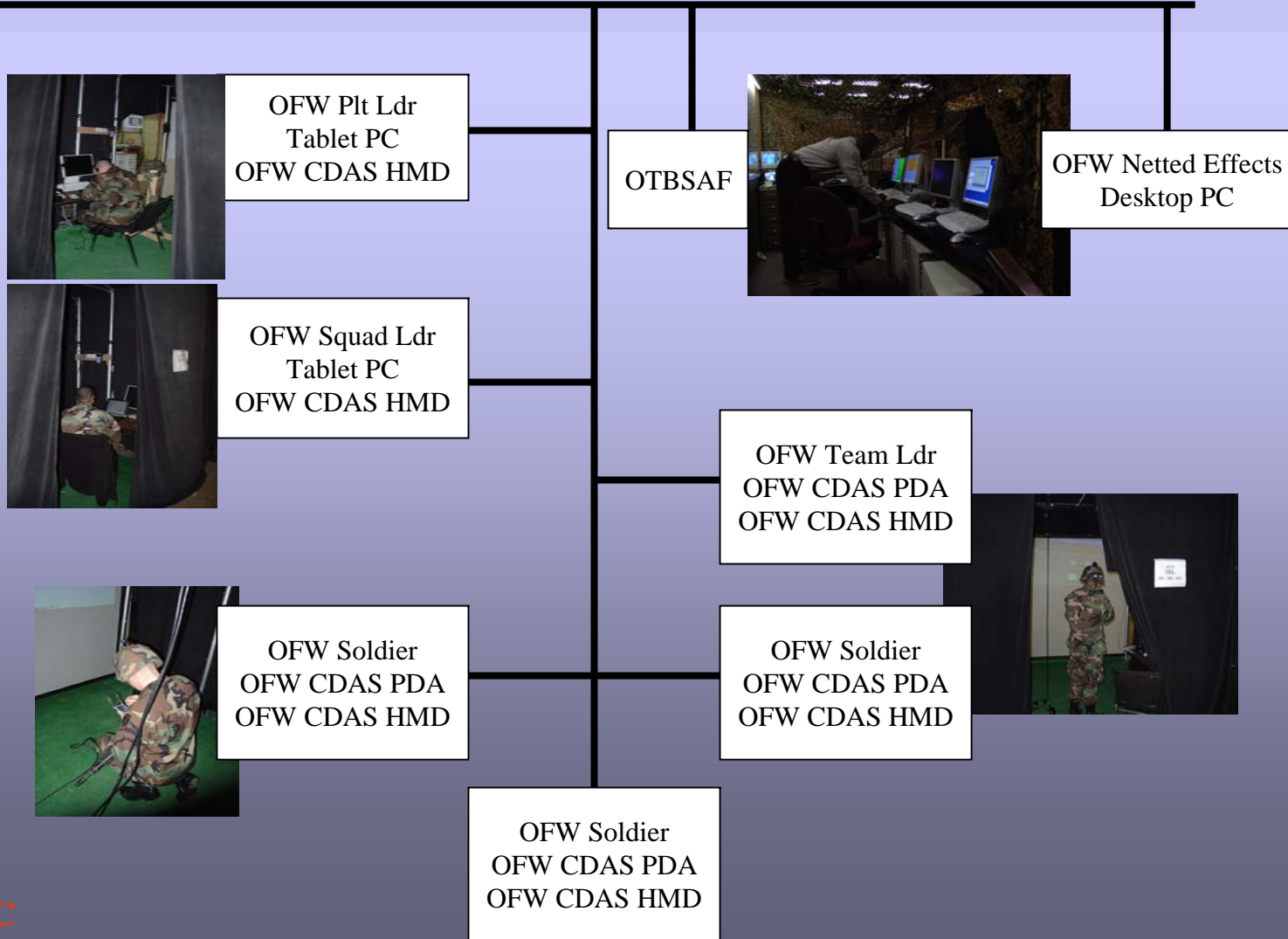
SBL Emersive SIMs



Questionnaires

User Evaluation Layout

Network



Participants

Plt Ldr-2LT

Sqd Ldr-SGT

Tm Ldr-PFC

Soldiers-PV1-PFC

Summary

- CDAS is an open, extensible and scalable family of tools that support network centric warfare and can be configured for user experimentation in either virtual or field environment.
- Used extensively in CEP experiments at Ft. Sill, Ft. Knox and Ft. Benning and being integrated into MATREX v.7.
- CDAS component products extensively tested and Terrain Services component fielded in C2PC.
- Extensions of CDAS Netted Effects component under FC-NET will address all OFW NE component requirements.
 - Draft component requirements document generated and in review
 - Baseline CDAS architecture/design documentation posted to FFW IDE
 - Final architecture design in process in collaboration with SIT.
 - Packaging of CDAS NE component for insertion in FFW architecture in progress.