

Overview of ANAM and Applications to DoD Behavioral Health Screening

DoD Task Force on Mental Health

Robert E. Schlegel

Kirby Gilliland

**Center for the Study of Human Operator Performance
(C-SHOP)**

University of Oklahoma

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What is C-SHOP?

C-SHOP is a

- ✈ multi-disciplinary research center established in 2002 at the University of Oklahoma**
- ✈ focusing on the development and application of computer-based technology**
- ✈ assessing human performance across a broad range of military, industrial, educational, and medical applications**
- ✈ directed by Kirby Gilliland (psychologist) and Robert Schlegel (industrial engineer), collaborators in computer-based cognitive assessment for more than 20 years**

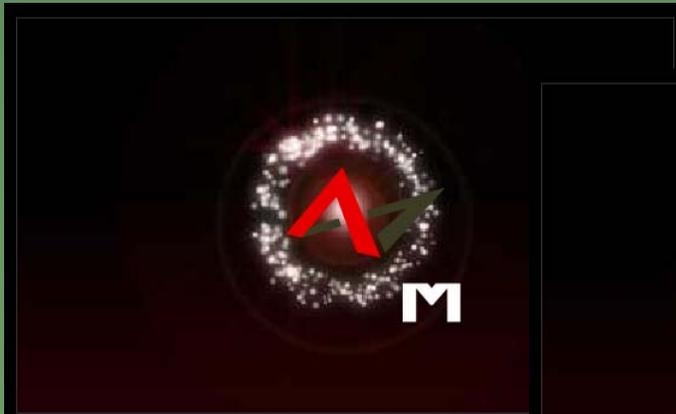
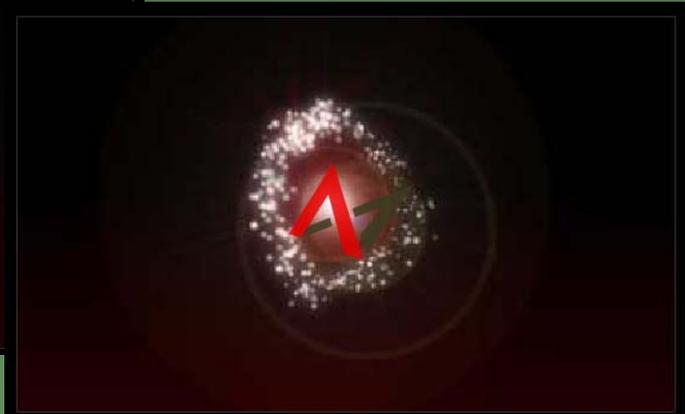
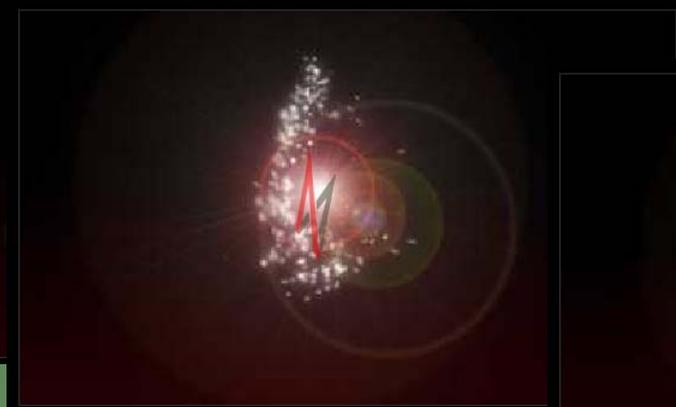
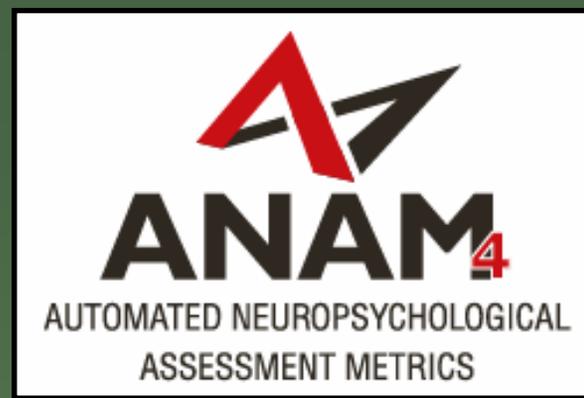


Presentation Objectives

- 1. Overview of ANAM**
- 2. ANAM Use and Value to DoD Behavioral Health Assessment**
- 3. ANAM Battery Configurations**
 - a. Traumatic Brain Injury*
 - b. General Neuropsychological Screening*

Objective 1

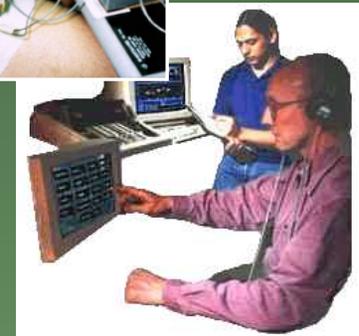
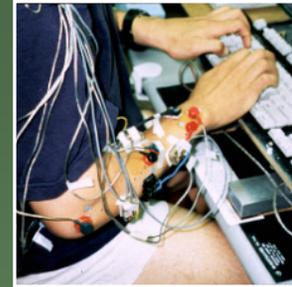
Overview of ANAM



The Origins of ANAM

Scientific Foundations

Traditional human performance assessment tests: well known and well validated in the literature

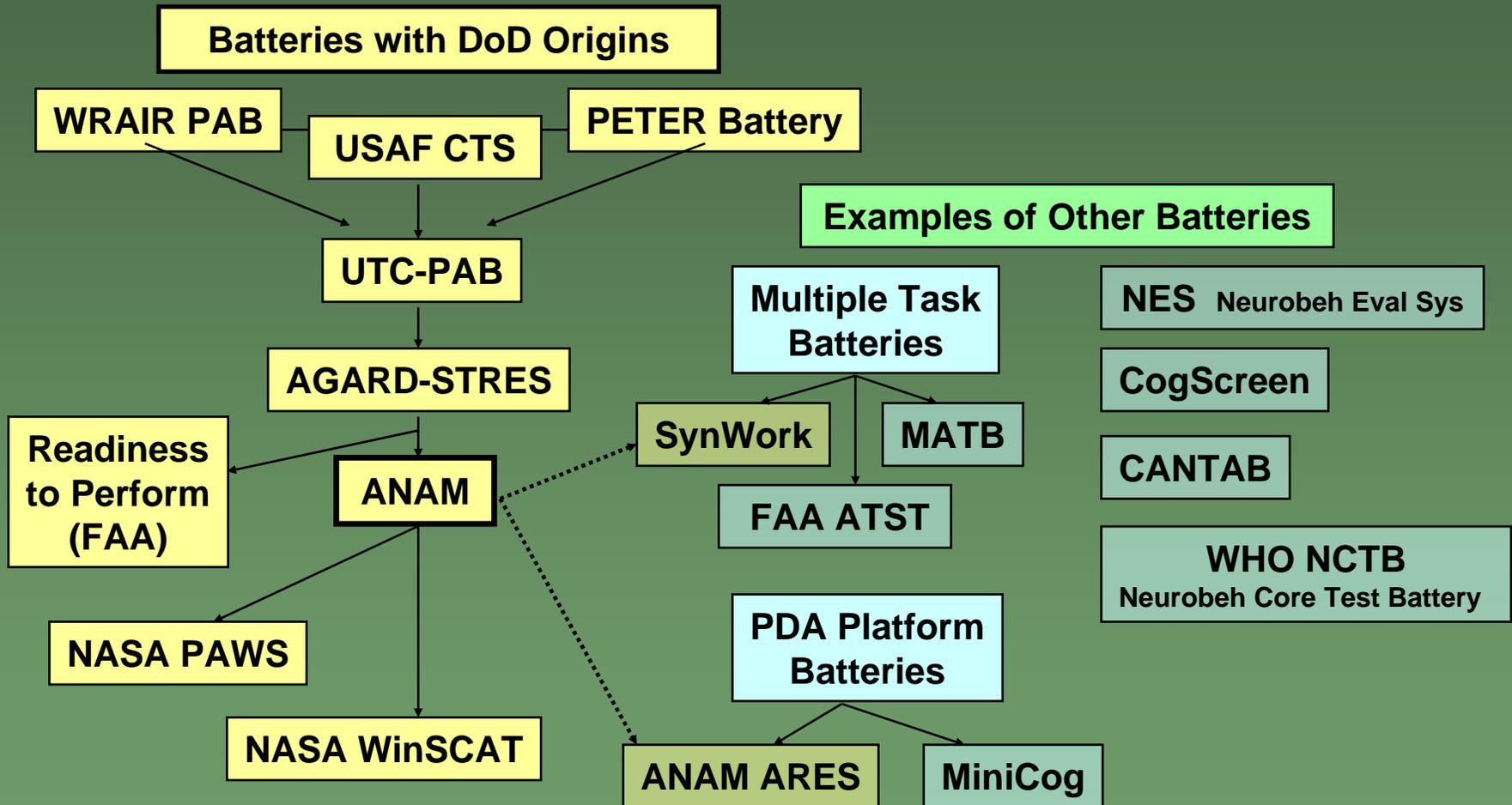


Traditional neuropsychological tests: well established in clinical practice and linked to standards in clinical diagnosis



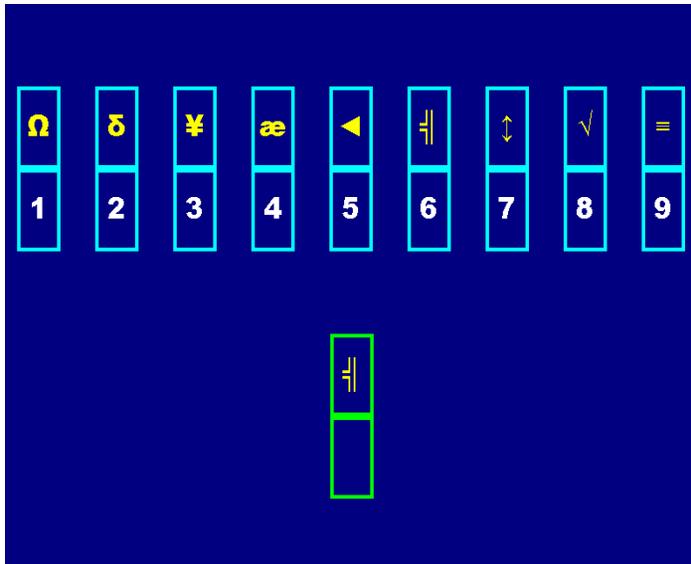
The Origins of ANAM

ANAM Historical Development



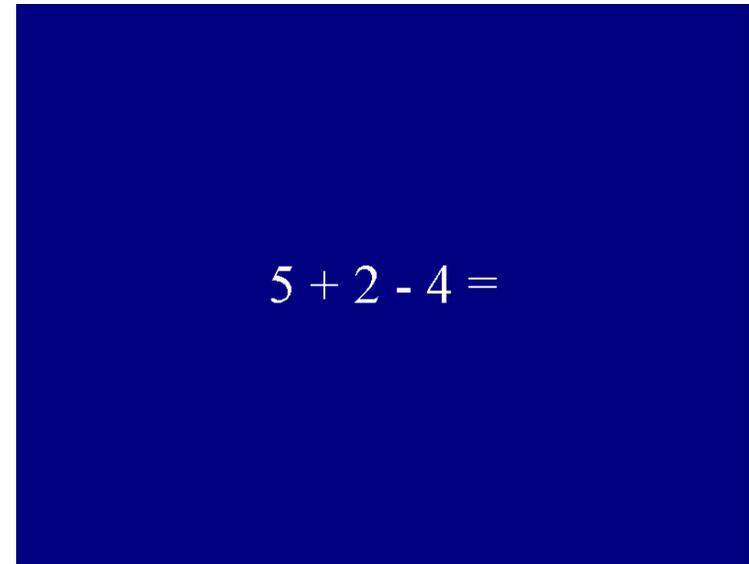
ANAM Test Examples

CODE SUBSTITUTION



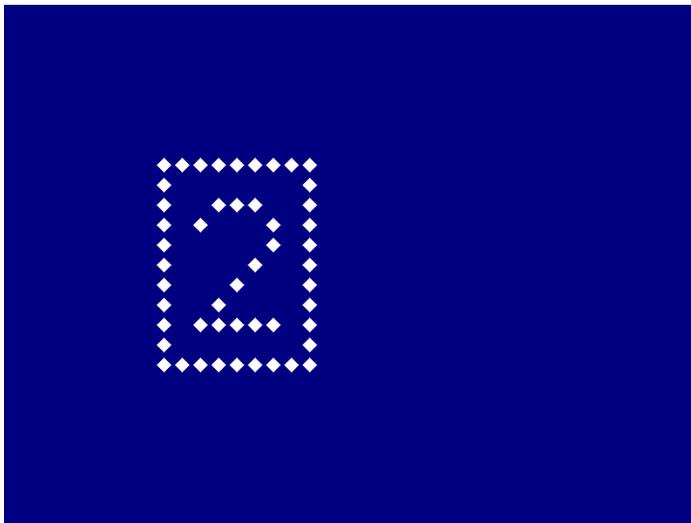
A code substitution test interface. At the top, there are nine vertical boxes, each containing a symbol and a number below it. The symbols are: Ω, δ, ¥, æ, ◀, ≡, ⇕, √, and =. The numbers are 1 through 9. Below these is a single vertical box containing the symbol ≡ and an empty space below it, indicating a matching task.

MATH PROCESSING



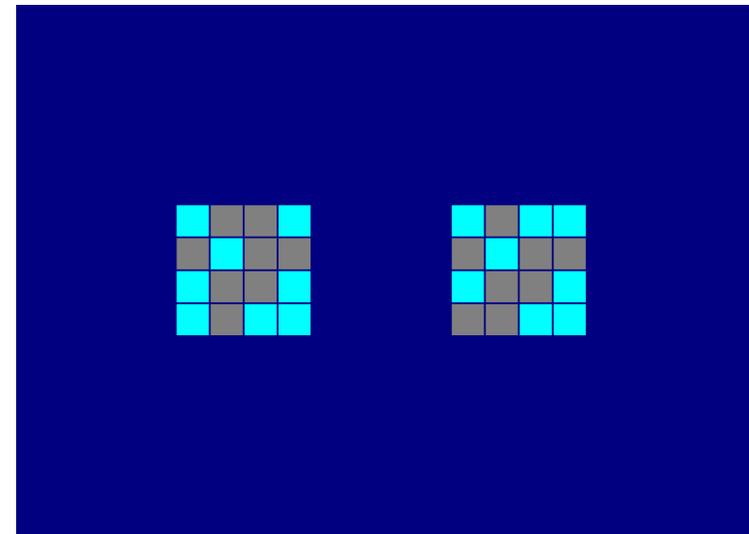
A math processing test interface. The screen displays the equation $5 + 2 - 4 =$ in the center.

PROCEDURAL REACTION TIME



A procedural reaction time test interface. The screen displays a square pattern of small white diamonds. The pattern is a 10x10 grid with a smaller 5x5 grid inside it, forming a square-in-square shape.

MATCHING TO SAMPLE



A matching to sample test interface. The screen displays two 4x4 grids of squares. Each grid has a 2x2 sub-grid of cyan squares in the top-left corner, with the rest of the squares being gray.

ANAM Test Examples

Switching Task



$$5 + 8 - 9$$



Manikin
Test

Mathematical
Processing

Tests of Executive Function



Time Left: 49

Moves: 0

Score:

Tower Puzzle

ANAM Cognitive Testing Domains

Attention

- ✓ *Sustained / Focused*
- ✓ *Divided*
- ✓ *Selective*
- ✓ *Directed*

Cognitive Flexibility

Computational Ability

Concentration

Executive Function

- ✓ *Abstract Reasoning*
- ✓ *Planning*
- ✓ *Simple Decision Making*
- ✓ *Complex Decision Making*
- ✓ *Rule Retention / Adherence*

Memory

- ✓ *Recognition*
- ✓ *Spatial Memory*
- ✓ *Working Memory*
- ✓ *Procedural*
- ✓ *Recall*

Task Multiplexing

Spatial Visualization

Visuomotor Control

- ✓ *Speed of Response*
- ✓ *Controlled Movement*

Vigilance

Visual Scanning

ANAM Test Library

2-Choice Reaction Time

4-Choice Reaction Time

Code Substitution

Demographics

Digit RT

Dual Task (Track / Memory)

Grammatical Reasoning

Logical Relations

Manikin

Matching to Sample

Matching Grids

Mathematical Processing

Mood Scale 2-Revised

Mood Affect Score

Mental State Exam

Procedural Reaction Time

Pursuit Tracking

Reaction Time

Relative Judgment

Running Memory CPT

Simple Reaction Time

Stanford Sleepiness Scale

Spatial Processing

Standard CPT

Memory Search (Sternberg)

Stroop Test

Switching

Symbolic Reaction Time

Tap Left

Tap Right

Tower Puzzle

Tracking



Validity and Reliability

- ✦ ANAM tests have strong correlation with traditional measures of neuropsychological functioning (e.g., WAIS-R, Halstead-Reitan subtests)
- ✦ High test-retest reliability (typically $r = 0.80 - 0.95$ range)
- ✦ High differential stability (essential for repeated measures)
- ✦ Large database of studies providing construct validity (e.g., studies demonstrating ANAM use in accurately assessing neuropsychological function and demonstrating test sensitivity to risk factors, disease, and extreme operational environments)

ANAM Supporting References

✈ Military Normative Data

✈ Fort Bragg Norms (N = 8,000+)

✈ ANAMgp Normative Study

✈ USARIEM Normative Study (DoD Multi-site)

✈ Other Normative Data

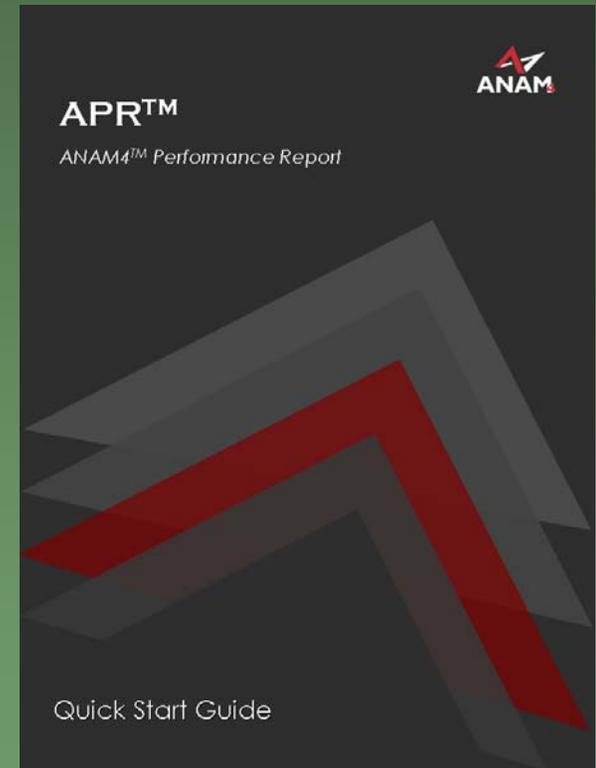
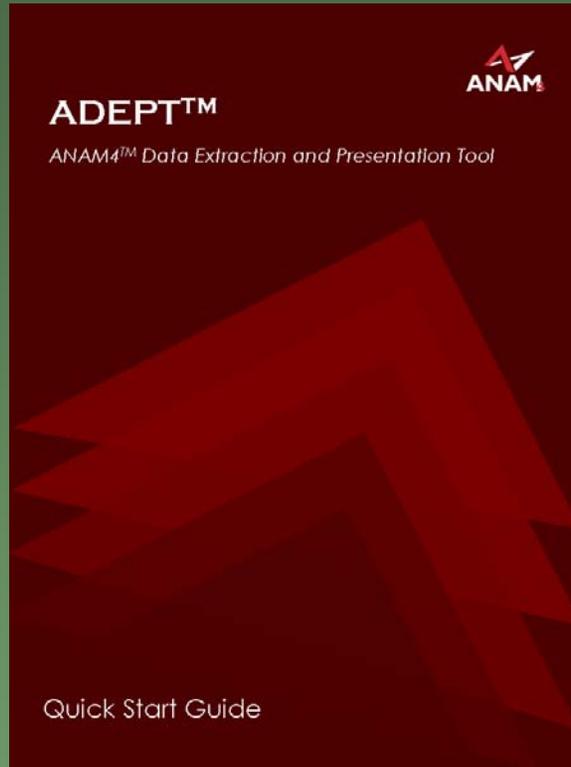
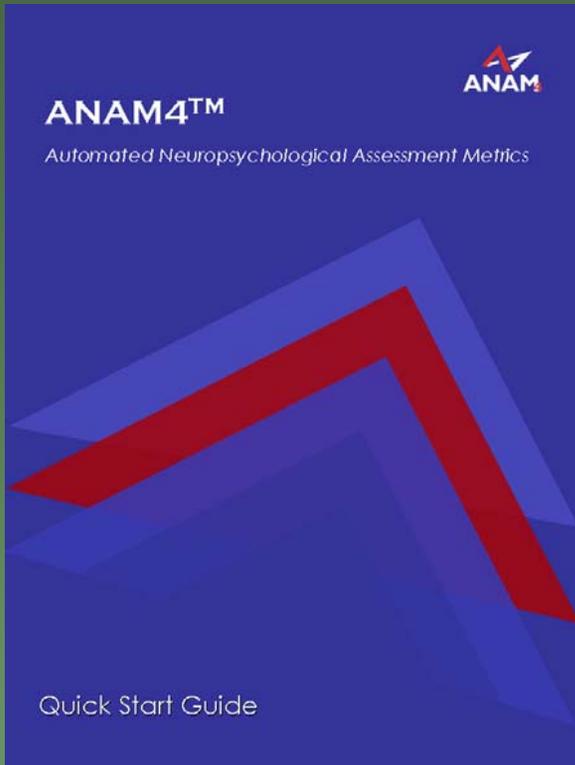
✈ OU C-SHOP Normative study (N= 200+)

✈ UNC-CH Sports Concussion Study (N = 6,000+)

✈ ANAM Bibliography Project

✈ More than 500 ANAM-related articles in EndNote®

ANAM User Manuals



Hyperlinked Online Files

Adobe Reader - [APR Quick Start Guide.pdf]

File Edit View Document Tools Window Help

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Options x

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Layers

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2 Creating a Report

Selecting a Data Folder

The first step in creating a performance report is to locate the data you would like to include in the report.

To open a File selection dialog box (if it is not already open):

1. Click **File** from the Main Menu bar.
2. Select **Open**.

ANAM Performance Report Viewer (Beta)

File	Configuration
Open	Ctrl+O
Convert to PDF	Ctrl+P
Close all reports	
Exit	Ctrl+X

Or,

Press the Open file icon in the Main Menu bar.

Upon opening, APR™ will default to searching C:\anamdata for valid ANAM4™ data files. If this is the location of your ANAM4™ data files, you can proceed with creating a report.

To change the folder:

1. Click **Browse** located in the Directory Settings section of the File selection dialog box.

Directory Settings

To change directory:
- Use the Browse button OR
- Type path (ex., C:\anamdata) and press Enter.

C:\anamdata

Restore factory default Make this my future default

Browse

6

NOTES
 Battery: RMAS Day 10

PERFORMANCE AT A GLANCE

Test	BELOW AVERAGE	BELOW AVERAGE	CLEARLY BELOW AVERAGE
Sleepiness Scale	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Simple Reaction Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Code Substitution - Learning	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Code Substitution - Delayed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Memory Search (4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Procedural Reaction Time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spatial Processing - Simultaneous	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

PERFORMANCE SUMMARY

Based on the selected comparison group, all tests exhibited performance within a normal range except the following:
 CODE SUBSTITUTION - LEARNING : % Correct - Below Average
 PROCEDURAL REACTION TIME : Insufficient information in comparison group for classification.
 SPATIAL PROCESSING - SIMULTANEOUS : % Correct - Below Average

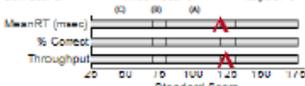
PERFORMANCE DETAIL

SLEEPINESS SCALE
 Score : 2 - Able to concentrate, but not quite at peak.
 RT(msec) : 847

SIMPLE REACTION TIME

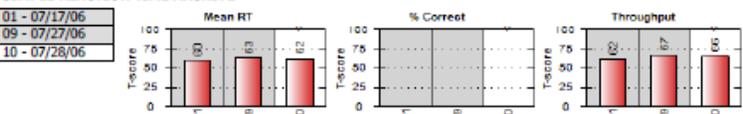
Correct: 37 Incorrect: 0 Lapse: 0

Score	%ile	StdSc	Comparison Group N	Mean	StDev
217	96	119	152	266	40
100	100	152	100	100	0
277	95	123	152	230	30



SIMPLE REACTION TIME ARCHIVE

Date	Mean RT	% Correct	Throughput
01 - 07/17/06	61	61	61
09 - 07/27/06	61	61	61
10 - 07/28/06	61	61	61



CODE SUBSTITUTION - LEARNING

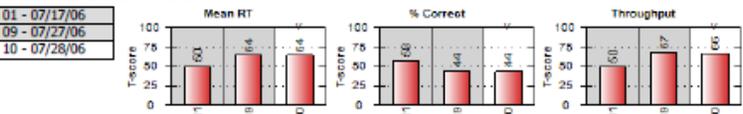
Correct: 68 Incorrect: 4 Lapse: 0

Score	%ile	StdSc	Comparison Group N	Mean	StDev
702	97	121	152	990	202
94	8	88	152	97	4
81	95	125	152	61	12



CODE SUBSTITUTION - LEARNING ARCHIVE

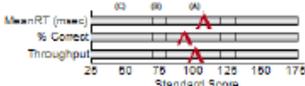
Date	Mean RT	% Correct	Throughput
01 - 07/17/06	61	61	61
09 - 07/27/06	61	61	61
10 - 07/28/06	61	61	61



CODE SUBSTITUTION - DELAYED

Correct: 32 Incorrect: 4 Lapse: 0

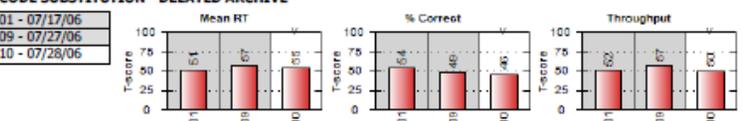
Score	%ile	StdSc	Comparison Group N	Mean	StDev
773	63	107	151	872	212
89	19	93	151	93	10
68	45	101	151	67	15



PERFORMANCE DETAIL (Continued)

CODE SUBSTITUTION - DELAYED ARCHIVE

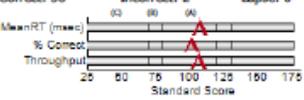
Date	Mean RT	% Correct	Throughput
01 - 07/17/06	61	61	61
09 - 07/27/06	61	61	61
10 - 07/28/06	61	61	61



MEMORY SEARCH (4)

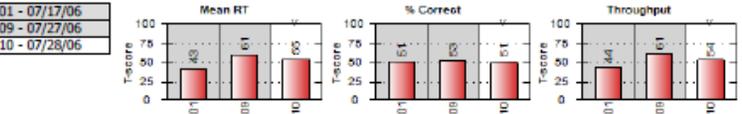
Correct: 38 Incorrect: 2 Lapse: 0

Score	%ile	StdSc	Comparison Group N	Mean	StDev
540	68	107	147	589	102
95	45	101	147	94	10
107	63	106	147	99	20



MEMORY SEARCH (4) ARCHIVE

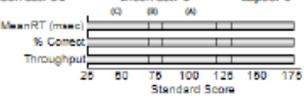
Date	Mean RT	% Correct	Throughput
01 - 07/17/06	61	61	61
09 - 07/27/06	61	61	61
10 - 07/28/06	61	61	61



PROCEDURAL REACTION TIME

Correct: 31 Incorrect: 1 Lapse: 0

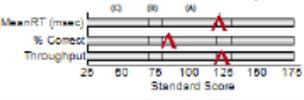
Score	%ile	StdSc	Comparison Group N	Mean	StDev
443					
97					
132					



SPATIAL PROCESSING - SIMULTANEOUS

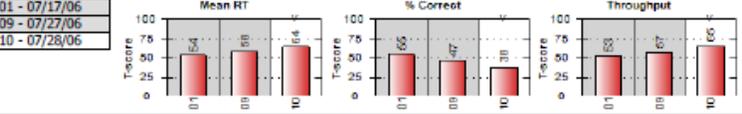
Correct: 18 Incorrect: 2 Lapse: 0

Score	%ile	StdSc	Comparison Group N	Mean	StDev
1093	95	121	32	1686	420
90	6	84	32	97	6
49	96	123	32	37	8



SPATIAL PROCESSING - SIMULTANEOUS ARCHIVE

Date	Mean RT	% Correct	Throughput
01 - 07/17/06	61	61	61
09 - 07/27/06	61	61	61
10 - 07/28/06	61	61	61



REFERENCE
 Category lower limits for Below Average (9th percentile, 80.5 standard score) and Clearly Below Average (2nd percentile, 70 standard score) are based on Hannay, H. J., & Lezak, M. D. (2004). The neuropsychological examination: Interpretation. In M. D. Lezak, D. B. Howleson, & D. W. Loring (Eds.), *Neuropsychological Assessment* (pp. 133-156). New York: Oxford University Press.

DISCLAIMER
 This ANAM Performance Report does not constitute the practice of medicine or the provision of professional health care advice. The information provided by this report is of a general nature and does not represent medical advice, a diagnosis, or prescription for treatment. You are advised to seek the advice of a qualified medical professional for interpretation of test results. C-SHOP and the University of Oklahoma are not responsible for any decisions made based on information contained in the report. Your qualified medical professional has the sole responsibility for establishing diagnosis and suggesting appropriate treatment.

Objective 2

ANAM Use and Value to DoD

- ✈ Deployment Studies
(Afghanistan, Bosnia, Iraq)
- ✈ Fort Bragg Paratrooper TBI Study
- ✈ West Point Boxing Study
- ✈ DVBIC TBI Applications
- ✈ Live-Fire Studies (“Mojave Viper”)
- ✈ Parkinson’s Disease / Multiple Sclerosis
- ✈ More than 250 Registered ANAM Users

ANAM Applications

Training

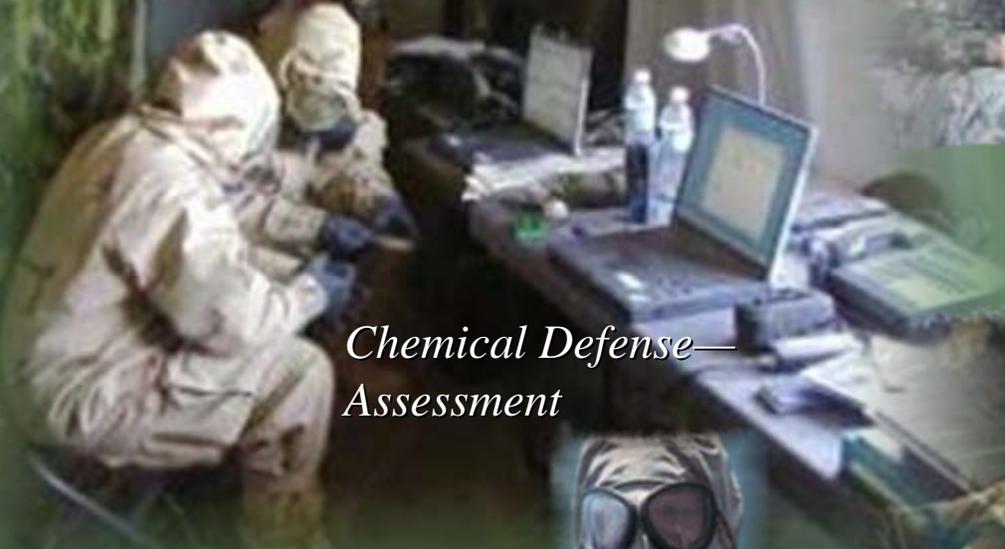
*Academy Applications:
Sports Concussion and
Longitudinal Monitoring*



Combat Care



Triage



*Chemical Defense—
Assessment*

Fatigue



PTSD



*Care
Outside*



Theater



Toxin Exposure



DoD Behavioral Health Needs and Initiatives

Automated Neuropsychological Testing for

➤ Screening and surveillance

➤ Triage

➤ Medical monitoring (Recovery-Treatment efficacy)

➤ Aid for Return-to-Duty decisions

Objective 3

ANAM Battery Configurations

Traumatic Brain Injury

General Neuropsychological Screening

ANAM TBI Battery

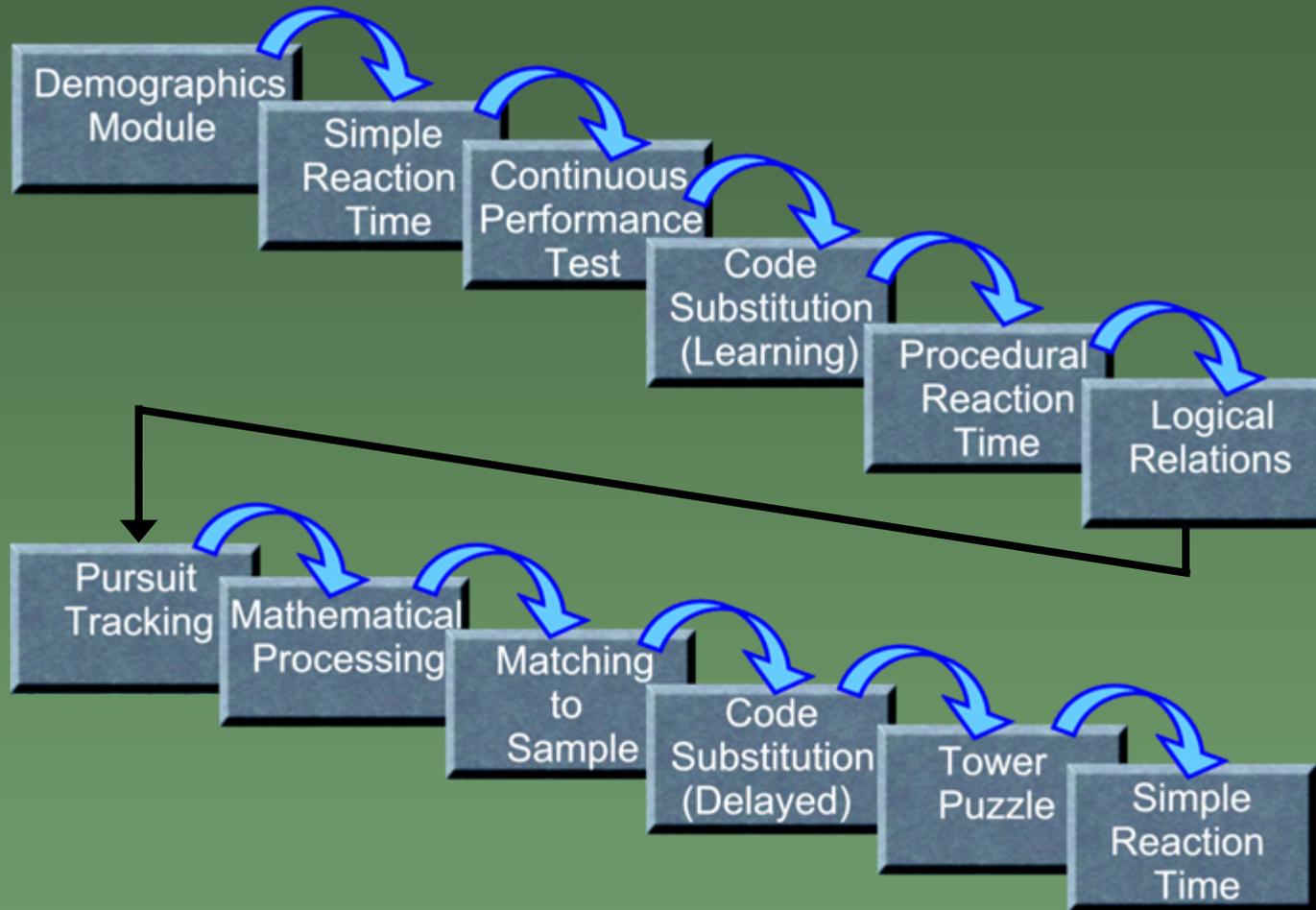


Test	Domain/Function
Simple Reaction Time	Neural Processing: speed and efficiency (emphasis on motor activity)
Mathematical Processing	Working Memory
Running Memory Continuous Performance Test	Running Memory: concentration and attention
Code Substitution	Pure Memory and encoding: (Emphasis of test is on pure memory. The visualization of symbols and storage in working memory addresses encoding.)
Matching to Sample	Visual Spatial Memory

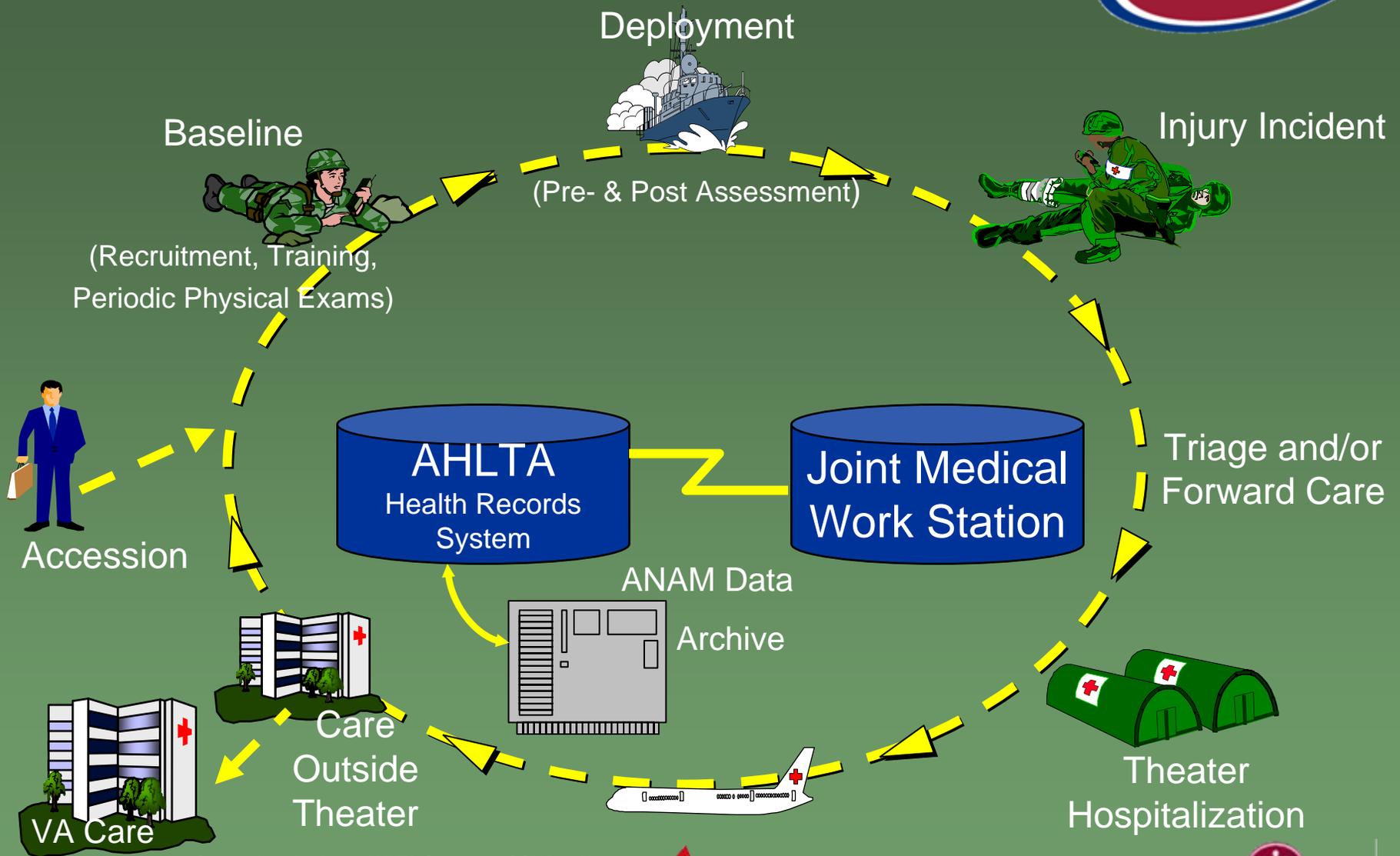


SOURCE: Defense and Veteran's Brain Injury Center

ANAM Screening Battery



Utility and Ease of Use within



Source: Introduction to AHLTA Ceremony, COL Bart Harmon presentation, Nov.21, 2005



Feasibility

- ❖ ANAM Traumatic Brain Injury and General Neuropsychological Screening Batteries for use in AHLTA
- ❖ ANAM delivered from desktop, laptop, or PDA
- ❖ ANAM Performance Report extracts critical measures to a file that is easily migrated to AHLTA database and displayed in a format easily used by health care providers

Summary Points

- **Advanced technology for automated, objective neuropsychological assessment**
 - ✦ *Technology linked to modern neuropsychology*
 - ✦ *Capable of being deployed broadly*
- **Cost effective technology**
 - *Effective, low-cost alternative to imaging*
 - *DoD-developed, thus eliminating the need to duplicate development or use high-cost commercial alternatives*
 - *Can be integrated with other initiatives such as simulated or virtual environments to provide enhanced value*



ANAM₄

AUTOMATED NEUROPSYCHOLOGICAL
ASSESSMENT METRICS

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C-SHOP

CENTER FOR THE STUDY OF
HUMAN OPERATOR PERFORMANCE
The University of Oklahoma
Norman, OK (405) 325-7467
c-shop@ou.edu www.c-shop.ou.edu