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JOINT WORKING GROUP ON DRUG DEPENDENT DEGRADATION
IN MILITARY PERFORMANCE

(JWGD³ MILPERF)

PROGRAM SUB-ELEMENT IN-PROCESS REVIEW
(SECOND QUARTER FY 1986 MEETING)

Frederick, Maryland
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PROCEEDINGS¹

Frederick W. Hegge, Ph.D. (Editor)

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A Synopsis of UTC-PAB Development

Dennis L. Reeves (1)
David R. Thorne (2)

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2. Walter Reed Army Institute of Research, Washington D.C.

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Level II Assessment Sub-Components

1. Cognitive Performance
2. Fine Motor Abilities
3. Physiological/Exercise Performance

Level II Assessment Projects/Products

1. Unified Tri-Service Cognitive Performance Assessment Battery (UTC-PAB)
 - a. Standardized Tests
 - b. Standardized Hardware/Software System
 - c. Standard Operator Manuals
2. "Complex" Cognitive Performance Assessment Battery(C²PAB)
3. Physical Exercise/Fine Motor Performance Assessment Battery
4. Actigraph Activity Monitor
5. Residential Screening Facility (NIDA/ARC)

Level II: Baseline Assessment/Residential Screen

Objective: To conduct in-depth "baseline" performance studies with standardized metrics.

Note: Subjects will be in residence in a controlled environment during screening.

Level II: Cognitive Assessment TAG

In-house Laboratories

WRAIR	AAMRL	NAMRL	NIDA/ARC
ARI	USAFSAM	NBDL	
		NMRI	
		NHRC	

Project/Product

Unified Tri-Service Cognitive
Performance Assessment Battery
(UTC-PAB)

Background: The UTC-PAB is the primary instrument for the Level II evaluation of cognitive performance.

Currently consists of 25 standardized tests that have been designed for computer administration and scoring.

Objective: To provide a standardized metric and operating system that is responsive to required military abilities and skills, and will be a sensitive instrument for detecting performance effects due to biomedical treatment drugs.

**Development of the Unified Tri-Service Cognitive
Performance Assessment Battery (UTC-PAB)**

The Unified Tri-Service Cognitive Performance Assessment Battery (UTC-PAB) will serve as the primary metric during the Level II evaluation of cognitive performance in the JWGD3 MIL PERF chemical defense biomedical drug screening program. Emphasis for UTC-PAB development has been on the standardization of test batteries across participating laboratories with respect to content, computer-based administration, test scoring, and data formatting. Thus far the effort has produced a 25-test UTC-PAB and standardized operating system.

Sub-components of the UTC-PAB project are as follows:

1. Design and specification of component tests
2. Development of standardized "operator" manuals
3. Hardware design and specification
4. Software design and "beta" test construction
5. Residential screening facility
6. Data base development/Networking/Central archive

Keywords:
0 FLD

The UTC-PAB evolved from a three-day, JWGD3 MIL PERF sponsored workshop held in November 1984 at the Naval Medical Research Institute, Bethesda, MD. Tri-service representation in the Task Area Group (TAG) included a member from the Level I Neuropsychological TAG, two members with backgrounds in performance assessment of sustained operations, and two members specializing in information processing and workload assessment. All members had been involved in the development of automated performance assessment batteries for specific applications in applied research. The TAG objectives were:

- 1) to create a formula for UTC-PAB design and standardization
- 2) to establish a design for the standardized operating system
- 3) to select tests from existing inventories that met these guidelines.

The product was a blueprint for a twenty-five test UTC-PAB library that would be written in a common software language (i.e., C), and would operate on a standard family of transportable microcomputers (i.e., the IBM PC and compatibles). Test selection was based on established test validity, relevance to military performance, and sensitivity to effects of hostile environments and sustained operations. Information-processing, memory, decision-making, perception, and mental workload capacity are among the processes and abilities addressed in the battery.

Another important aspect of UTC-PAB development was the requirement for standardization of the assessment instruments. Standardization will: (a) provide a mechanism for a concerted "state-of-the-art" response in a timely and cost-effective manner; and (b) provide a basis for direct comparison and pooling of data collected from independent research efforts.

In addition, the UTC-PAB has been designed to be a dynamic system that will undergo several phases of evolution and allow considerable flexibility with regard to experimental design. Built into the system is the option to use and/or augment a "core" subset of tests derived from the UTC-PAB menu (listed below), or construct an entirely unique combination of UTC-PAB elements to meet project-specific requirements. This capability is possible because of the dual-component design of the software environment which includes a Configuration System (for test and test menu construction), and a Run Time System (for actual testing and data collection). Another important aspect of the software system is that it has been designed for use by non-technical operators. Specifications of both the hardware and software systems are covered in a subsequent report (see Hegge et. al.).

Finally, by creating a standardized battery and operating system, we will have assembled a vehicle for establishing a network of "UTC-PAB user" laboratories that can be linked to a central data archive. This will create a source for rapidly establishing test norms (where appropriate), and allow meaningful comparison of independently derived test results.

A listing of UTC-PAB tests is presented below:

UNIFIED TRI-SERVICE COGNITIVE PERFORMANCE ASSESSMENT BATTERY

<u>Test Name</u>	<u>Construct</u>
1. Linguistic Processing	Visual, Verbal-
a) Physical Letter Match	Phonetic Coding
b) Category Match	
c) Antonym Match	
2. Grammatical Reasoning (Traditional)	Logical Reasoning
3. Grammatical Reasoning (Symbolic)	Logical Reasoning
a) 1 sentence / 2 symbols	
b) 2 sentences (active-positive) / 3 symbols	
c) 2 sentences (active-negative or passive-negative) / 3 symbols	

- | | |
|---|--|
| 4. Two Column Addition | Number Facility |
| 5. Mathematical Processing Task <ul style="list-style-type: none"> a) Single Operator Problems b) Two Operator Problems c) Three Operator Problems | Number Facility;
General Reasoning |
| 6. Continuous Recall Task <ul style="list-style-type: none"> a) 1 digit / 1 back b) 2 digits / 2 back c) 4 digits / 4 back | Encoding and Storage
in Working Memory |
| 7. 4-Choice Serial Reaction
Time (Modified Wilkinson
and Houghton) | Stimulus Encoding and
Categorization; Response
Selection and Execution |
| 8. Alpha-Numeric Visual
Vigilance Task | Sustained Choice-
Reaction Time |
| 9. Memory Search Task
(Modified Sternberg) <ul style="list-style-type: none"> a) Visual-Fixed Set
(1 "M" set to 100 "p" sets) b) Visual-Mixed Set
(1 "M" set to 10 "p" sets) x 10 c) Visual-Varied Set
(1 "M" set to "p" set) x 100 d) Auditory-Fixed Set e) Auditory-Mixed Set f) Auditory-Varied Set | Stimulus Encoding and
Categorization; Response
Selection and Execution |
| 10. Spatial Processing Task | Spatial Rotation; Short
Term Memory |
| 11. Matrix Rotation Task | Spatial Rotation; Short
Term Memory |
| 12. Manikin Test | Spatial Orientation |
| 13. Pattern Comparison
(Simultaneous) | Spatial-Perceptual
Speed |
| 14. Pattern Comparison
(Successive) | Spatial-Perceptual
Memory and Speed |
| 15. Matching to Sample | Spatial Memory; Pattern
Recognition |
| 16. Item-Order Test | Short-Term Recall;
Recognition |

17. Visual Scanning (Neisser's letter search)	Visual Scanning; Perceptual Speed
18. Code Substitution (a la Wechsler's digit-symbol)	Associative Learning; Perceptual Speed
19. Visual Probability Monitoring a) One dial display b) Three dial display c) Four dial display	Spatial Scanning; Visual Signal Detection
20. Time Wall	Time Estimation
21. Interval Production Task	Response Timing
22. Critical Instability Tracking Task	Manual Response Control
23. Stroop Test a) Control (Non-interference) b) Interference c) Combined	Interference Suscepti- bility; Response Compati- bility
24. Dichotic Listening	Selective Attention
25. Sternberg-Tracking Combination	Dual Task/Timesharing

Collateral support of the UTC-PAB development has involved development of standard "operator" manuals. These manuals have consolidated a broad range of information that includes standardized test-administration procedures as well as an in-depth review of relevant literature related to each of the UTC-PAB tests (the latter includes subsections on established validity, reliability, and sensitivity to drug effects and other stressors). Thus far, this project has yielded manuals for 12 of the 25 tests. This effort is being sponsored by AAMRL and will be summarized in greater detail in a later section of the PSIPR report.

A final sub-component is the NIDA/ARC residential screening facility which will provide several Level I/II functions. One will be as a "proving" ground for UTC-PAB testing, i.e., individual tests will be incorporated in ongoing drug research which will allow the evaluation of test sensitivity and refinement of standardized testing procedures. In addition, the ARC will serve as the initial test site for the Level I/II residential screening of pretreatment drugs. This effort is also summarized in more detail in a later PSIPR report.

Progress: At present standardized protocols and technical specifications for the UTC-PAB tests have been formally defined. Likewise, the standard operating environment has been designed and software development is underway (beta test construction in schedule for June FY86). Many of the participating laboratories are currently installing the operating system and the rudiments of a laboratory network are now in existence. "Operator" manuals have been developed for a major portion of the tests, and our residential screening facility (i.e., NIDA/ARC) is now operational.

In addition, a service-wide task analysis is being conducted that is designed to provide a taxonomic inventory of processes that are critical to combat performance. Results from this effort, the Level I screen, and the nature of the biomedical drugs tested will provide a basis for refinement of the UTC-PAB library, and direct future product improvement efforts.

Currently in-press are two UTC-PAB technical reports: one provides detailed descriptions of the component tests; the other gives a detailed description of hardware and software design and required equipment specifications. To obtain reprints of these reports forward a request to the JWGD3 Field Office at the following address:

Director, JWGD3 MILPERF
JWGD3 MILPERF Field Office
10 Post Office Road
Silver Spring, MD 20910

DISCUSSION AND COMMENTS

UTC-PAB Operating System

D. Thorne, Ph.D.

Question: Anon

What is the estimated delivery date of deliverables?
What is the cost of hardware and software to run the
system?

Response: We expect to see the first Beta test versions in July 1986, and as soon as they are received we will put them out to the sites so that people can start using it.

Hardware and software costs will vary. If you get top of the line PC's the cost will be approximately \$10,000; if you cut corners with clones you can get required hardware and software for between \$5,000 and \$6,000. These costs do not include the Nestar System.