OPS TEST: Operational Test and Evaluation Support Tool

Volume I - Concepts and Capabilities

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About the Author

Lieutenant Colonel Steve Hadfield is currently an Associate Professor in the Department of Mathematical Sciences at the United States Air Force Academy in Colorado Springs, Colorado. He received his doctorate in computer science from the University of Florida in 1994, his masters in information systems from the Air Force Institute of Technology, and his bachelor's degree from Tulane University with majors in mathematics and economics and a minor in computer science. He now serves as the Deputy Department Head for Academics in the Department of Mathematical Sciences. Lt Col Hadfield was the original developer of the OPS TEST software. His research interests include database applications design, parallel computing, sparse matrix algorithms, and educational technology.

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Abstract

The Institute for Information Technology Applications' Operational Test and Evaluation Support Tool (OPS TEST) is an automated testbank and on-line testing capability designed to support the testing requirements of operational Department of Defense units with training and standardization/evaluation testing. OPS TEST on-line testing supports a variety of levels of testing from formal, highly controlled certification testing to test-taker created practice tests. Test items are stored as Microsoft Word documents and can include a wide variety of embedded graphics, pictures, and charts. In addition, test items may include associated multimedia clips that the test-taker can play as part of the test item. Feedback mechanisms to the test-taker include textual messages as well as hyperlinks to associated reference material on the Internet, intranet, or shared network file systems. Test administration functions within OPS TEST include the ability to add and maintain test items, build and maintain master and specific tests, track test results, and analyze the performance of test items. The OPS TEST software and associated documentation as well as some technical support are available from IITA to operational DoD units upon request.

Executive Summary of OPS TEST Capabilities

What can OPS TEST do to support the operational unit's training and standardization/evaluation functions?

Purpose of this document

The United States Air Force Academy's Institute for Information Technology Applications (IITA), in concert with U.S. Space Command's Cheyenne Mountain Operations Center (CMOC), has developed an automated testing environment to support the operational training and standardization/evaluation testing of the CMOC operations crew-members. This capability has been adapted to an easily configurable implementation that other Department of Defense (DoD) operational units can use to support their training and standardization/evaluation testing. We designed this document to provide both command and unit level leadership with a description of what this automated testing environment may be able to do to support their missions.

Overview of OPS TEST's capabilities

Many, if not most, Department of Defense (DoD) operational units have both training and standardization/evaluation (Stan/Eval) functional units that respectively facilitate both initial and recurring training of operational personnel and establish, enforce, and evaluate standards of performance. Both the training and evaluation functions frequently make use of written testing as well as hands-on assessments. IITA's Operational Test and Evaluation Support Tool (OPS TEST) provides automated support for all aspects of what would normally be the written testing required for both training and evaluation.

OPS TEST Test-Taking

With OPS TEST, all test-taking is accomplished interactively on the computer with automatic recording of test results. Specific test-taking features include support for formal, password-protected certification tests; less formal update training tests; as well as test-taker generated practice tests on topics of their own selection. Individual test items are multiple-choice or true/false in form and may include graphics, tables, and plots. Furthermore, multimedia clips using audio and/or video can be associated with test items and played by the test-takers as part of the test item. Feedback mechanisms provide the test-taker with instructional and reference material on any items that they may have answered incorrectly. One of these feedback mechanisms is a hyperlink that can be set to provide access to either Internet or intranet web sites or to any locally available electronic document. Additional test-taking features provide options for allowing/disallowing re-entrance to the test, random reordering of test items, and dynamic creation. Test-takers

can move about freely within formal tests with special features that take them to test items that they have not yet answered. Scores and feedback on missed items are provided at the end of these formal tests. For test-taker generated practice tests, the feedback is immediate for each test item. The form and button driven test-taking component has proven very easy to use by all test takers and has significantly reduced the test monitoring and feedback delivery duties of the test administrators.

OPS TEST Testbank Administration

For the personnel assigned to the training and standardization/evaluation functional units, OPS TEST provides a full suite of support functions that can significantly reduce their administrative burdens while assisting them to evaluate the effectiveness their test items. These administrative functions are organized under four functional areas: test item maintenance, test building and maintenance, test results tracking, and test item analysis.

For test item maintenance, individual test items are held as Microsoft Word documents and are easily entered and updated using the Word program that is integrated into test item maintenance form. A comprehensive set of reference data is kept with each test item for ease of locating desired items.

OPS TEST's test building and maintenance functions are organized around the concept of master tests, typically designed for a functional position, and specific tests for individuals that are instances of the master tests. Form-driven query mechanisms allow test items to be easily located for inclusion in the test. Test summaries provide efficient mechanisms for assessing proper coverage of topics and overall organization of the test.

Test administrators can track the results and status of tests in a variety of ways. Test status and results can be selectively displayed via a variety of selection criteria including status of the test, the master test, the test-taker, the test administrator, and/or a date range for test completion. The selected test results are shown in a summary form that includes the test, test-taker, score, date completed, and suspense date for each selected test. The administrator can print test results for a particular test or for the summary of the tests. Furthermore, administrators can view and update any particular test on-line via a button provided with each selected test.

The fourth set of functions provided by OPS TEST support the analysis of test items. With these functions, the administrator can select a set of test items for analysis via a wide variety of criteria. For each selected test item, a summary of the item's performance is provided including the item's overall ease (percentage of times it was correctly answered) and a distribution of which alternative responses were chosen. This information is provided for all usages as well as grouped by crew positions and by individual test-takers.

More Details on OPS TEST's Capabilities

More details on OPS TEST's capabilities can be found in Chapter 2, which provides operational use scenarios with sample screen images, and Chapter 4, which provides a comprehensive listing of capabilities. Chapter 3 summaries the history behind OPS TEST and it's development and implementation in support of the Cheyenne Mountain Operations Center.

What's involved in adopting OPS TEST?

If a particular operational unit would like to adopt OPS TEST to support its operational testing, they should contact one of the IITA personnel listed in the following section. IITA can provide the OPS TEST software, user and support documentation, and limited telephone and/or on-site technical support (with TDYs normally funded by the adopting unit). The technical support can assist the adopting unit with installation of OPS TEST as well as the possible formulation of procedures to migrate existing test items into the OPS TEST database. IITA can also provide some initial training on both test-taking and test administration. More details on what IITA can provide are presented in Chapter 5.

In addition to the OPS TEST software, IITA can provide test-writing workshops given by their US Air Force Academy experts in the area of assessment instrument development. These workshops typically take place at the adopting unit's facility with the necessary instructor's travel expenses funded by the adopting unit.

The adopting unit will need to provide the hardware and software infrastructure required by OPS TEST. Typically, this is a local area network with a shared network disk drive and Windows-based personal computers. If necessary, OPS TEST can also be implemented on a single, stand-alone personal computer. OPS TEST runs as an Office 97 Access application so the adopting unit would preferably have Microsoft's Office 97 (Professional Edition) suite of programs installed on their computers, but only Microsoft Word 97 is required. An Office 2000 version can also be provided if necessary.

Personnel from the adopting unit would be responsible for installing and configuring the OPS TEST software as well as migrating existing test items into the OPS TEST database, but technical assistance is available from IITA for all of these tasks. On-going maintenance of the test items and tests is the responsibility of the adopting unit.

OPS TEST points of contact

Further information on OPS TEST can be obtained from the following contacts at the Institute for Information Technology Applications (IITA):

- **General Requests:** Current Managing Director of IITA, (719) 333-6748, DSN: 333-3978, email: iita@usafa.af.mil

- **OPS TEST Project Leader:** Dr. Steve Hadfield, (719) 333-7474, DSN: 333-7474, email: steve.hadfield@usafa.af.mil

- **Educational Information Technologies Director:** Dr Eric Hamilton, (719) 333-8325, DSN 333-8325, email: eric.hamilton@usafa.af.mil

Or via mail to: IITA, HQ USAFA/DFE, Suite 4K25
USAF Academy, CO 80840-6200

Operational Use of OPS TEST

How would an operational unit make use of OPS TEST?

This section describes use of OPS TEST at a hypothetical Space Command unit and is intended to illustrate how OPS TEST might integrate into and support the operations of such a unit.

Test-taking with OPS TEST

In June, 2nd Lt Jeff Jones arrives at his new unit, the 99th Space Squadron. After initial in-processing, he begins a rigorous training program that consists of hands-on operation of the mission computer systems, numerous demonstrations and exercise scenarios, and tons of reading including operating instructions, regulations, and technical manuals.

Lt Jones progresses quickly and now wishes to self-assess his level of knowledge in key areas. He goes to one of the unit's personal computers on their local area network (LAN) and starts up the OPS TEST Test-Taking software. At the initial menu, he selects the "Build Practice Test from the MQF" button ("MQF" stands for Master Question File). At this point, the OPS TEST test-taking software presents him with a simple query form that he can use to select items on any combination of selection criteria. There are pull-down menus for each selection criteria, which OPS TEST creates automatically based on what was entered for each test item by the OPS TEST administrators. Furthermore, he can just place his cursor over a selection criteria field and a caption comes up that gives more information about that field. For most fields, he can also use wildcards such as "99SS OI*" with the "*" replacing any combination of characters so he can get all the MQF questions based on the 99th Space Squadron's Operating Instructions (i.e. 99SS OI 1-1, 99SS OI 2-3, …).

He makes his selection and clicks the "Take Practice Test" button to begin working through the test items. He's impressed to find out that many of the test items have graphs, pictures, and mission screen images integrated directly into the test item. Furthermore, some test items even have multimedia clips associated with them. He just needs to click on the "Play Multimedia" button to have the clip run. The first such test item has a video clip of a space shuttle lift-off.

Since the test doesn't count, he purposely answers incorrectly to see what happens. Once he does this, OPS TEST tells him that he answered incorrectly and shows him both his answer and the correct one. In addition to that, OPS TEST provides a short text message explaining the reasoning behind the correct answer, a reference on that topic, and a hyperlink to an Internet web page that has plenty of information on the Space Transportation System. Lt Jones thinks to himself that this is an enjoyable way to learn. On the next page is a sample of the screens that Lt Jones encountered during his MQF self-assessment practice test.

OPS TEST (Ver 2.2)

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OPS TEST (Ver 2.2) Test Taking

OPS TEST (Operational Test and Evaluation Support Tool) is a product of the United States Air Force Academy's Institute for Information Technology Applications and is freely available to DoD and other US Government agencies.
For more information on OPS TEST, contact IITA at (719)333-6748, DSN 333-6748.

Take a Formal Training/Evaluation Test

Take a Monthly Training Test

Build Practice Test from the MQF

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Select MQF Practice Test Items

Enter your selection criteria and click on the Take Practice Test button.

Task

Knowledge

References

Center

Position

Take Practice Test

MQF Test-Taking

\# 13 of 14

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(U) The Navstar Global Positioning System (GPS) is a constellation of orbiting satellites that provides 24-hour navigation services including

a. Both I and II
b. Both I and III
c. I, II, and III

   I.   three-dimensional locational information
   II.   passive all-weather operations
   III.   support to an unlimited number of users and areas

Your Answer   A   B   C

MQF Test-Taking

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(U/RC) The multimedia clip shows a liftoff of what NASA Manned Space Flight Program vehicle?
(Click the PLAY MULTIMEDIA button below)

A. Mercury

B. Gemini

C. Apollo

D. Space Transportation System

EFFECTS

Your Answer   A   B   C   D

Play Multimedia

He wonders whether working through all of the MQF items will allow him to preview his training and stan/eval test items. He is somewhat disappointed to learn that OPS TEST separates items by a "category" field and that he can only get at the items from the MQF category and not from the training or evaluation categories. (Note: The test administrators may put MQF items in the training and evaluation tests if they wish).

As Lt Jones moves further along in his training, he informs his trainer, Capt Cindy Smith, that he's ready to work through the first of his training tests. These are standardized tests of 50 items each that are built on demand. To ensure they are secure, Capt Smith has placed a distinct password on each of them. She can periodically change these passwords to protect against the tests being compromised. To further protect against possible compromise of the tests, Capt Smith has checked the box to have the test items randomly reordered each time the test is taken. Since they are training tests, Capt Smith has specified that the tests are "re-entrant", meaning the test-taker can work through part of them, exit OPS TEST Test-Taking, and then come back to the test. Capt Smith likes this feature since she's purposely designed the tests to force the trainee to dig through the manuals. In fact, she creates similar monthly training tests for her already certified crew members to refresh themselves on key areas and new procedures.

Lt Jones accesses the training test via the "Take Monthly Training Test" button on the main OPS TEST Test-Taking menu. The screen he gets has him specify his name, the test he wants to take, and the password for that test. In addition, some other fields will let him get back into the test later. The test items in this test are presented a bit differently; they are not immediately scored when he selects an answer. Instead, he can move forward and backward within the test either to the previous or next items or to the previous or next un-answered item. When he thinks he has finished the test, he clicks the "Grade Test" button. OPS TEST Test-Taking tells him that he neglected to answer four test items and provides him the opportunity to go back and answer them prior to having the test graded. Wisely, he chooses to do this. Now with all the test items answered, he clicks the "Grade Test" button again. His overall score is reported and he is given a chance to go back and review the three test items that he missed. Like the MQF items, he gets some feedback text, an associated reference, and a hyperlink that this time takes him to some relevant operating instructions stored as Word and Adobe .pdf files on the unit's shared network disk drive.

Once he's passed all his training tests and other training activities, Capt Smith congratulates Lt Jones and passes him off to Major Mike Knailem, the Chief of the Standardization and Evaluation Branch for formal certification. Lt Jones passes his grueling hands-on evaluation and must now pass the written test for full certification to join an operational crew. Major Knailem uses one of his two standardized tests for Lt Jones' position. This test is specifically built for Lt Jones with a unique password, which Major Knailem specifies as "uFAILtoad" using his normally dry sense of humor. By default, this test cannot be re-entered and Lt Jones must take the entire test in one sitting and cannot use any notes or references. To ensure compliance, Major Knailem makes Lt Jones take the test on the computer in the Stan/Eval office. Being brilliantly trained by Capt Smith and having made extensive use of the MQF via OPS TEST for self-assessment, Lt Jones passes his evaluation test with a perfect score. However, Lt Jones realizes that he must also pass periodic training tests from Capt Smith and yearly evaluation tests from Major Knailem, so he's going to continue to use OPS TEST Test-Taking with the MQF to keep his knowledge base current.

Test administration with OPS TEST

Both Capt Smith, from the Training Branch, and Major Knailem, from the Standardization and Evaluation Branch, can also make use of the administrative components of OPS TEST. In fact, they each have slightly different versions of OPS TEST Administration. Capt Smith has the training version which only allows access to test items whose "Category" does not start with "Eval". That is, she can not see any of Major Knailem's evaluation test items, but she can access and update all of her training items as well as the MQF items. Major Knailem has the evaluation version, which allows him access to all test items in the OPS TEST database. Hence, he can use any test items that he wants in his evaluation tests, including MQF items.

Other than the set of test items and tests that can be accessed, the two versions of OPS TEST Administration are identical. Each provides four primary functions from the main menu which are Test Item Maintenance, Build/Maintain Tests, View Test Results, and Test Item Analysis. To insure that the OPS TEST Administration capabilities are secure, each installation has a master password that protects access to the OPS TEST Administration functions. This password can be easily changed by the Security option on the main menu bar. In addition, OPS TEST Administration provides a Configuration option on the main menu bar that allows administrators to update the codes and descriptions used for classifying operational tasks that are testable, information on individual crew members, and operational centers and crew positions. They can also update display parameters like the form labels, the system-high classification, the name of the task codes, and the introductory message shown on the initial menus of both OPS TEST Test-Taking and Administration.

Returning to the four primary functions, Capt Smith has found that one of her training test items has become out-dated due to a recent change in procedures. She clicks the "Maintain Test Items" button and gets a query form that she can use to locate the particular test item. As with all the other OPS TEST query forms, most all of the pull-downs are built dynamically with the data entered into the OPS TEST database and wildcards can be used to broaden the search criteria. After specifying the search parameters, she clicks on the "Retrieve Selected Test Items" button. Four test items are returned and Capt Smith easily moves through them to find the item she needs to update. To change the test item, she simply double-clicks within the test item displayed on the form and the test item is brought up with Microsoft Word all within the field of the OPS TEST Test Item Maintenance form. At this point Capt Smith has all the capabilities of Word available to her and can even embed any type of graphics or pictures that she wishes.

Also on the Test Item Maintenance form are several reference fields with appropriate pull-downs. There are also several buttons at the bottom of the form with small pictures (icons) on them. By positioning her cursor over the button, a small caption box appears that describes the function of that button. The first button, a downward pointing hand, takes her to a second page where she can specify feedback text to be displayed if the test item is incorrectly answered. There's also a place for specifying a hyperlink to an associated reference which can be either a Internet or intranet web site or any document on the unit's LAN. These could be things like Word documents, Excel spreadsheets, or Adobe Acrobat portable document format (.pdf) files. In addition, there is a small box that can hold an associated multimedia clip, together with buttons that allow her to paste in clips either from the clipboard or a file. Other parts of this second page allow the association of operations centers and positions with the test item and report existing tests that include this item. Examples of the OPS TEST Administration menu, Test Item Maintenance query form, and Test Item Maintenance form are shown on the next page.

OPS TEST (Ver 2.2)

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OPS TEST (Ver 2.2) Administration

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For more information on OPS TEST, contact IITA at (719)333-6748, DSN 333-6748.

Test Item Maintenance   View Test Results
Build/Maintain Tests   Test Item Analysis

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Select Test Items for Maintenance

Enter your selection criteria and click on the Retrieve Selected Test Items or just click on Add New Test Items.

Task   Category   Knowledge
References
Item Numbers -- from: to: Center
Creation dates -- from: to: Position
Revision dates -- from: to: Dormants?

Retrieve Selected Test Items   Add New Test Items

Test Item Maintenance

Unclassified

Item #	Task	Classification	Created	Reviewed	Knowledge	# Choices	Answer
42	A-01A-	U/RC	04/14/1999	04/14/1999	A	4	D

Governing regulation, operating instruction, other guidance   Category   Dormant?
Missile Warning Info   Eval

(U) The Space Based Infrared System (SBIRS) will include satellites in which of the following orbits?

a. Geostationary Earth Orbit (GEO)
b. Highly Elliptical Orbit (HEO)
c. Low Earth Orbit (LEO)
d. All of the above

HEO
GEO
LEO

Record: 14 of 23

Test Item Maintenance

Unclassified

Feedback to test takers
The SBIRS architecture takes utilizes satellites in all three types of orbits.

Hyperlink Ref: http://www.peterson.af.mil/hqafspc/index.htm

Associated Centers/Positions
CC/CD   Delete
MWC/CDR   Delete
          Delete

Test administrator comments on the test item

Multimedia: Included in Master Tests:
          Missile Warning
          Complete Test

Paste Multimedia From File

Paste Multimedi From Clipboard

times used in Specific Tests: 4

Record: 1 of 2

Record: 14 of 23

Since Lt Jones passed his initial evaluation test so easily, Major Knailem of the Standardization and Evaluation Branch decides he needs to make the evaluation test for that position harder. To do so, he goes into the Build/Maintain Tests functions from the OPS TEST Administration main menu. The resulting Build/Maintain Tests menu has two parts. The "Master Tests" area allows Major Knailem to create, copy, update, and delete the master tests. The "Specific Tests for Crew Members" area allows him to create, update, and delete specific instances of Master Tests created for and taken by individual crew members.

Major Knailem selects the test of interest and clicks the "Review/Update Master Test" button. OPS TEST presents him with a summary of that test which includes several reference fields including the "Category" field. Since this field has a value of "Eval" only those with the evaluator version of OPS TEST Administration can access this test. On this summary form, there is a line for each item included in the test together with buttons to view and delete that particular item. A numbering field at the beginning of each test item can be used to specify a different ordering of the items. To use this, Major Knailem would just type in a new numbering scheme and click the "Reorder Test Item" button. OPS TEST reorders the test items per the new scheme and then renumbers them starting with the number one.

The "Add New Test Item" button brings up a query form that Major Knailem can use to select new (harder) items for his test. If he tries to add an item that is already in his test, OPS TEST denies his attempt with an appropriate message. Other buttons on the Master Test form allow Major Knailem to print a summary of his test, print a full hard copy of the test, and preview the test pretty much as it would appear for the test-taker on-line.

In the lower left corner of the Master Test form are some special fields primarily used for training tests. The "Make on Request?" check box indicates that specific instances of this test do not need to be created for each individual test taker. This is designed to better support the monthly training tests that are not necessarily required of every crewmember. Checking the "Make on Request?" box activates the three fields below it which allow the test administrator to specify if instances of the test will be randomly reordered upon creation and if they will be re-entrant. The third field allows the administrator to specify a password to protect access to the test.

Once Master Tests are created, the administrator can make specific instances of that Master Test for individual crewmembers. This is done via the "Specific Tests for Crew Members" functions on the right side of the Build/Maintain Tests form. These functions make use of the Specific Tests form, which provides several options for Specific Tests. An example of this form together with the Build/Maintain Tests and Master Tests forms can be found on the next page.

Test Administrators use the Specific Test form to create specific instances of Master tests for individual crewmembers. Such tests are typically used for formal evaluation and training tests. They can be protected via individual passwords and a suspense may be placed on them to help track tests that are not yet taken. When the test-taker takes the test, their start and stop times and dates are recorded and presented on this form together with their score. The "Preview On-Line" button of this form allows the administrator to view the test either before or after it is taken.

While Major Knailem has been updating his evaluation test, Capt Smith had taken a few days of leave. Upon her return, she wants to check up on the status of tests that she had prepared for crewmembers prior to her leave. To do this, she starts up her copy of the OPS TEST Administration software and goes into the "View Test Results" function. There is a simple query form that she can use to select which test results she wants to look at. She chooses those tests that she has administered and that have been taken but not yet posted to the test-takers' records. By clicking the "View Selected Test Results" button, she gets a summary of the tests that have been taken but not yet posted. Later she goes back to the query form and looks for any tests that she's prepared but the crewmember trainee has not yet taken. For each test presented, she can either print the test results or view them on-line via the Specific Tests for Crew Members form, which is the same form she used to create that specific test.

While reviewing the test results, she wonders if there are some items out there that are just not working as well as she would like. To address this curiosity, she calls up the "Test Item Analysis" function from the main OPS TEST Administration menu. Again, she gets a query form that she can use to select the test items that she would like to analyze. She specifies that she wants items that have an overall average (ease) of less than 60% and clicks the "Perform Test Item Analysis" button. She's warned that it may take a few minutes to complete the analysis and then she gets a form that shows the results for the first of the selected test items. The form presents the overall ease of the item and shows a distribution of the test responses that reports which alternatives are being chosen most often. The same information is also shown grouped by crew positions and by individual test-takers. With this information she is able to identify test items that may have awkward or misleading wording.

On the next page you'll find examples of the screens that Capt Smith saw as she accomplished these tasks.

At their next Operational Readiness Inspection, the 99th Space Squadron scores an Outstanding and the inspectors note that the use of OPS TEST to support formal evaluation and training testing as well as crewmember practice testing has helped to significantly raise crew performance while reducing the administrative burden on the training and stan/eval functions.

Select Specific Test Results To View

(Specify any desired test results selection criteria and click "View Selected Test Results.)

Test Status
- ○ Any
- ○ Completed, But Not Yet Posted
- ● Not Yet Taken

Master Test [▼]
Test Taker [▼]
Administrator [Smith ▼]
Position [▼]

Completed After [ ] Before [ ]

[View Selected Test Results]

View Specific Test Results

Test ID	Crew Member Tested	Crew Position	Completed	Suspense	Score	Posted?		
Missile Warning	Auringer, Amos A (E-6)	MWC/CCH		15-Dec-99		☐	Print Results	View Details
Missile Warning	Hadfield, Steve M (O-5)	MWC/CDR		15-Nov-99		☐	Print Results	View Details
Missile Warning	Revak, Marie A (0-4)	MWC/CDR		01-Dec-99		☐	Print Results	View Details

[Print Summary of Results]

Record: |◄ ◄ [1] ► ►| ►* of 3 (Filtered)

Select Test Items for Analysis

Enter your selection criteria and click on the Perform Test Item Analysis button.

Task [▼]   Category [▼]   Knowledge [▼]
References [▼]
Item Numbers -- from: [ ] to: [ ]   Center [▼]
Test Results -- from: [ ] to: [ ]   Position [▼]
Number of Misses in: [ ] to: [ ]   Master Test [▼]
Overall Ease in: [ ] to: [60]

[Perform Test Item Analysis]

Test Item Analysis

Item #	Answer	Ease	Total	A	B	C	D	E
1	D	33.3%	3			2	1	

Results by Crew Position

CC/CD	50.0%	2			1	1	
CC/MO	0.0%	1			1		

Record: |◄ ◄ [1] ► ►| ►* of 2

Results History (Date Completed, Master Test, Crew Position, Name of Test-Taker, Their Response)

03-Nov-99	Missile Warning	CC/MO	Hadfield, Steve M (O-5)	C
17-Apr-99	Multimedia Formal	CC/CD	Hadfield, Steve M (O-5)	C
17-Apr-99	Multimedia Formal	CC/CD	Hadfield, Steve M (O-5)	D

Record: |◄ ◄ [1] ► ►| ►* of 3

[View Test Item]

Record: |◄ ◄ [6] ► ►| ►* of 6

History of OPS TEST's Development

How did OPS TEST come about and what was learned from its first use?

This section of the report provides a brief summary of how OPS TEST was initially developed. It also discusses some key lessons learned during the development and initial implementation. These may have relevance to those considering adoption of OPS TEST for their unit.

Story behind OPS TEST's initial development

The idea for an automated testbank and integrated on-line testing capability originally came from Lt Col Ray Yelle, USAF, while he was the Chief of the Standardization/Evaluation (stan/eval) branch in the US Space Command's Cheyenne Mountain Operations Center (CMOC). He had heard of the an automated testbank developed and used by the US Air Force Academy's Department of Mathematical Sciences and came with his staff to the Academy for a demonstration. This initiated a collaborative effort to design and develop an automated testbank and on-line test-taking capability to support both the stan/eval and training functions within CMOC. MSgt Amos Auringer from CMOC led the requirements definition effort while Lt Col Steve Hadfield developed the software. The capability developed was known as the CMOC Testbank and received extensive support from the US Air Force Academy's newly formed Institute for Information Technology Applications (IITA).

The enthusiastic acceptance of the CMOC Testbank by both the stan/eval and training personnel in CMOC as well as the crewmembers provided evidence that the CMOC Testbank could be of significant benefit to other operational DoD units. Under IITA sponsorship, the CMOC-unique parts of the testbank application were parameterized so they could be easily modified for other users. The most significant of these CMOC-specific features was a link to the Operational Decision Support System (ODESSY) also developed for CMOC under the initiatives of Lt Col Yelle and MSgt Auringer. The ODESSY system tracks all personnel, training, evaluation, and crew information and provides sophisticated crew scheduling features. Initially, the CMOC Testbank would tap into the ODESSY to obtain information on crewmembers, task codings (originally called Performance Evaluation Criteria (PEC)), and center/crew position information. As the ODESSY and CMOC Testbank were refined, differences in their security models drove a separation of the two systems. Instead of the CMOC Testbank directly accessing the ODESSY data, we chose to periodically update the testbank with copies of the data it needed. For use at other units, we added forms to the testbank administration component so that the personnel, task coding, and center/crew positions information could be directly maintained from within the testbank administration functions. With this additional capability, the testbank application became a fully self-sufficient application and we

renamed it to the "Operational Test and Evaluation Support Tool", abbreviated as "OPS TEST".

In addition to the development of the OPS TEST software, the collaboration between CMOC and USAFA included a series of very well received workshops on effective test item development by Major Marie Revak of the US Air Force Academy's Center for Educational Excellence. Due to personnel turnover in the CMOC training and stan/eval teams, the workshops have been given every 6-12 months to assist in preparing new team members to create effective test items. In addition to the test item development workshops, we also provided training on the testbank administration functions and Major Revak conducted a comprehensive review of the existing test items providing suggestions on how a number of them could be improved.

Lessons learned from OPS TEST initial implementation

During the initial development and implementation of what is now OPS TEST, there were several lessons learned that may be of significance to other operational units considering the adoption of OPS TEST. First among these were the issues resulting from the migration from the paper-based testing to the on-line testing provided by OPS TEST. For the stan/eval group this involved the conversion of their tests from Microsoft Excel spreadsheets to Microsoft Word documents that were then incorporated into the OPS TEST database. Because a consistent structure was used for the Excel-based tests, we were able to write some software to convert the existing test items automatically into Word documents and import them into the OPS TEST database. However, we did need to take care to insure that all the items were properly converted and there were a significant number of duplicate test items created as some test items were used in multiple tests. Identification and elimination of duplicate test items was a significant effort.

Migration of the training test items was more labor-intensive. They were originally held as Word documents which was nice in that they could be cut and pasted directly into the testbank database, but there was no easily recognizable structure to them so this process could not be easily automated. However, the cut and paste capabilities of Windows made this process fairly straight forward and it typically took a minute or two per test item to complete the migration.

Another key issue from the initial implementation was the integration of the testbank application with the ODESSY decision support database. Some of the problems with this integration occurred because the testbank and the ODESSY were developed by geographically separated developers, but these issues were fairly easily resolved by periodic meetings of the two developers and the CMOC coordinator, MSgt Auringer. The bigger problem in the integration dealt with the different security models required of the two applications. The ODESSY required user-level security where groups of users required different types of access to different subsets of data. The testbank application required a highly controlled access to the data (test items) with the access controlled by both time and user type. As a result, the two applications used different security mechanisms within the Microsoft Access database management software and there were compatibility issues between the two mechanisms. The most efficient and effective solution was to separate the two applications.

Other lessons learned deal with new releases of the Microsoft Access database management software and, to a much lesser degree, the Microsoft Office suite of programs in general. The testbank application was initially developed in Access 97 at the US Air Force Academy, but CMOC was using Access 95. Several key features of Access 97 were needed, especially for the automated migration of the stan/eval test items.

Access applications are typically not backward compatible to previous versions of Access so CMOC had to upgrade to Access 97 or we needed to load a run-time version of Access 97 with the testbank application. Use of a run-time version of Access on a computer that has some other version of Access can easily result in problems if not properly done and should be avoided if possible. We are currently faced with similar problems as Access 2000 and Office 2000 are now available. With each new release of Access and Office, the OPS TEST software will need to be migrated and there will be support and compatibility issues with the earlier versions of these programs.

Finally, there are some minor configuration issues as OPS TEST becomes more widely used. Both the test-taking and administration components of OPS TEST access the common backend database of test items, tests, and results that reside on a file server on the local area network (LAN). This backend database is encrypted and password-protected so the test-taking and administration components need to know the path to the backend database and its password. Furthermore, these will vary with each implementation and may need to be updated from time to time for a particular implementation. The OPS TEST software automatically remembers the location and password of the backend database from the last access. If either the location or password has changes, the OPS TEST software will detect the problem and ask the user for the new location and password. Furthermore, OPS TEST administrators can freely distribute the password to users since the password only works in conjunction with the OPS TEST software and not directly with the Access database management system.

Details of OPS TEST's Capabilities

What exactly can OPS TEST provide?

In this section of the report, we provide a detailed technical summary of OPS TEST's capabilities and features. It is intended to provide both a comprehensive overview and reference for the implementation decision-maker.

The OPS TEST database

- Holds test items as Microsoft Word documents which facilitates embedding of pictures, graphs, charts, and clip art within test items.

- Includes reference data with each test item for use in retrieval and evaluation of test items. This data includes:

  - Task code

  - Security classification

  - Date created

  - Date last reviewed

  - Instructional Systems Design (ISD) knowledge/proficiency level code

  - Number of answer choices

  - Designation of the correct answer

  - Reference to the governing regulation, operating instruction or other guidance

  - Category of the item (training, evaluation, or Master Question File)

  - Feedback to provide to test-takers when the test item is answered incorrectly

  - Hyperlink to associated additional feedback or reference information

  - Optional multimedia clip to be played as part of the test item

  - Listing and count of the number of tests the item is used in

  - Operational centers and positions associated with the test item

- Contains "master tests" typically based on a particular crew position. These master tests include the items mentioned below and the individual test items that are linked into the test.

    - Master test's name

    - Associated operational center and position

    - Category (typically evaluation, training, or Master Question File)

    - Type of test (initial, recurring, or special)

    - Office of primary responsibility

    - The individual that created the test

    - Additional optional parameters allow the test to be created on demand by the test-taker (as opposed to individually created for a specific test-takers by a test administrator), automatic random reordering upon creation, set with permissions to exit and re-enter the test, and password protected.

- Includes "specific tests" created by test administrators from master tests for specific individual evaluations. Specific test information includes:

    - Name of the master test from which each specific test was built

    - Individual test-taker that the specific test was built for

    - Password used to protect access to the test

    - Operational center and position for the test

    - Whether or not the test can be re-entered

    - Date created

    - Whether it's a retest

    - Suspense date by which the test must be taken

    - Administrator that built the test

    - Start and finish dates and times from when the test-taker took the test

    - Resulting score

    - Whether the test results have been posted to the test-taker's records

- Additionally the database includes information on the personnel assigned to the crews as well as the trainers and evaluators, a listing of the task codes, and the operational center and position designators. This information can be imported from an accompanying database such as the ODESSY (Operational Decision Support System) in the Cheyenne Mountain Operations Center or it can be maintained via forms under the Configuration menu in the OPS TEST Administration component.

Test-taking capabilities

- Take formal evaluations tests that are specifically created for individuals by a test administrator with password-protected access.

  - An option for re-entry can be set by the test administrator.

  - Navigation buttons allow the test-taker to move forward or backward within the test either an item at a time or to the next (or previous) unanswered test item.

  - Warnings and recovery options are provided if test-taker has left any items unanswered when they submit the test for grading.

  - Upon grading, the test-taker receives a report of their score and has the option to review any or all of the test items that they missed along with the feedback text associated with the item, and any associated hyperlinks to additional reference information.

- Dynamically create and take monthly training tests, which may optionally be randomly ordered, re-entrant, and/or password-protected. Mechanisms for taking these tests are identical to those employed for formal evaluation tests.

- Access the Master Question File, which is a repository of "practice" test items that crewmembers can use for self-evaluation.

  - Test items from the Master Question File can be selected via any combination of a number of different criteria including task code, Instructional Systems Development knowledge/proficiency level, operational center, crew position, and governing reference.

  - When responding to test items from the Master Question File, the test-taker is given immediate feedback as each item is answered.

  - The test-taker may exit a set of selected test items at any time and their current percentage of correct answers is reported to them.

NOTE: All test-taking automatically checks for the presence of associated multimedia clips and provides a button with which the test-taker can view the clip as many times as they like. The only qualification is that the test-taker's computer must have a program and association setup to view that particular type of multimedia. Similarly, the presence of hyperlinks to associated reference material for feedback is automatically detected and presented, if available, but requires associated software to view that type of material.

Test administration capabilities

- Add, modify, delete, and selectively locate individual test items and their reference information.

- Build, update, copy, and delete both master and specific tests. Test items for inclusion in master tests may be searched for and selected based on any combination of the selection criteria. Checks are made to preclude redundant use of specific test items. Selected test items shown for consideration are displayed with all the associated feedback information (including hyperlinks to any associated references) and any accompanying multimedia clips. Specific tests may be previewed, randomly reordered, updated, or reset to allow re-entry by the test-taker. While most testing is conducted on-line, the ability exists to produce printed tests and their answer keys.

- Obtain test results and status reports via a number different criteria including tests completed but not yet posted, tests waiting to be taken, or any test together with selection criteria based on the master test, test-taker, test administrator, crew position, and date range of when the test was taken. Test results can be viewed and/or printed in either summary form or as a full report by test item.

- Produce performance analysis reports for individual test items via a number of different selection criteria. Both ease (percentage of test-takers that correctly answered the test item) and distracter selection are reported for overall usage, usage by crew position, as well as by individual test-takers.

NOTE: The query forms used to specify search criteria for locating specific test items or results have pull-down lists of options for most selection criteria fields. These options are built based on the data that has been entered into the database, thus, they are "self-adapting" for new implementations. Furthermore, many of these selection fields also allow the use of "wildcards" to generalize the search parameters.

OPS TEST configuration settings

- Personal computers running Windows 95/98/NT/2000 with Microsoft Word installed are needed to run OPS TEST. Preferably they also have Microsoft Access 97 together with programs and associations set to view whatever hyperlinked feedback references and/or multimedia clips that may be included with the test items. If Access 97 is not available, an installation set up can be created that automatically loads a distribute-able run-time version of Access. Typically, an Intel Pentium-class machine with at least 16 MBytes of RAM and 3 MB of disk space is sufficient to host the OPS TEST Administration component and 1 MB of disk space for the OPS TEST Test-Taking component.

- OPS TEST typically uses a local area network (LAN) running at an appropriate "system high" security level for the test items. The LAN must have a network disk drive accessible by all test administrators and test-takers with enough capacity to accommodate the testbank database. Typically, the disk space requirement is less than 10,000 bytes per test item, but test items with embedded graphics or associated multimedia can greatly increase the size of test items.

Support for OPS TEST Implementations

What support can a unit expect if OPS TEST is adopted? What does the adopting unit need to provide?

IITA support provided for OPS TEST implementations

If your unit decides to adopt OPS TEST to support your operational training and/or standardization/evaluation functions, the Institute for Information Technology Applications (IITA) can provide some key support to assist you. Specifically, IITA is prepared to provide:

- Master and backup compact disks that include the setup programs for both the OPS TEST Administration and Test-Taking software components, an empty database, and electronic copies of both the OPS TEST Administration and Test-Taking manuals. Upon request, IITA can include separate versions of the OPS TEST Administration components for the training and standardization/evaluation functions where the training version is precluded from accessing tests or test items in the "Eval" category.

- On-site installation and initial training support by one IITA technical support person. This support would typically include a 2-3 day TDY funded by the adopting unit.

- Several hardcopies of the OPS TEST Administration and Test-Taking user manuals together with PowerPoint training slides and electronic versions of the same.

- Updated version releases of the OPS TEST Administration and Test-Taking software to keep OPS TEST current with subsequent releases of Microsoft Office (specifically Word and Access). Software releases may also include problem resolutions and functional enhancements possibly including items identified by the adopting unit. However, IITA will serve as the final software configuration management authority and will make all decisions regarding what is and is not included in subsequent software releases.

- Review of current test items and training on effective test item development. This support would also be funded by the adopting unit and could be accomplished in conjunction with the initial installation.

- Limited telephone technical support for user and configuration issues based on the availability of IITA technical support personnel. (However, IITA cannot guarantee such availability).

IITA will provide the support mentioned above until at least the summer of 2001. At this time, IITA will evaluate the extent of OPS TEST usage and formulate continuing support plans as they deem appropriate.

Requirements of the adopting unit

The operational unit adopting OPS TEST needs to provide certain support required of an OPS TEST installation. This adopting unit support must include:

- Local area network with support for a system high level of security for classified material together with a network file server capable of hosting the backend database. *A typical database will require 1-100MB of storage per every 100 test items depending on how many pictures, graphs, and multimedia clips are associated with the test items.*

- Information concerning the configuration of their local area network and shared network file server that will host the OPS TEST backend database. The primary requirement here is a path to the location of the backend database that will be need to configure each installation of the OPS TEST administration and test-taking software.

- Installations of the Microsoft Windows NT/95/98/2000, Word, and Access (version 97 or newer) on any machines hosting OPS TEST. We can work-around the absence of Access using a distributable, run-time version of Access that we can build into your installation.

- Funding for any TDYs required for IITA technical support personnel to assist with the initial installation/configuration of the OPS TEST software and/or IITA training personnel.

- On-going training of new personnel on the use of OPS TEST.

- Reproduction of training materials and user manuals beyond the limited initial set provided by IITA.

- Operational use of OPS TEST including maintenance of tests and test items.

- Software maintenance beyond that specified as provided by IITA in the previous section.

About the Institute

The Institute for Information Technology Applications (IITA) was formed in 1998 to provide a means to research and investigate new applications of information technology. The Institute encourages research in education and applications of the technology to Air Force problems that have a policy, management, or military importance. Research grants enhance professional development of researchers by providing opportunities to work on actual problems and to develop a professional network.

Sponsorship for the Institute is provided by the Secretary of the Air Force for Acquisition, the Air Force Office of Scientific Research, and the Dean of Faculty at the U.S. Air Force Academy. IITA coordinates a multidisciplinary approach to research that incorporates a wide variety of skills with cost-effective methods to achieve significant results. Proposals from the military and academic communities may be submitted at any time since awards are made on a rolling basis. Researchers have access to a highly flexible laboratory with broad bandwidth and diverse computing platforms.

To explore multifaceted topics, the Institute hosts single-theme conferences to encourage debate and discussion on issues facing the academic and military components of the nation. More narrowly focused workshops encourage policy discussion and potential solutions. IITA distributes conference proceedings and other publications nation-wide to those interested or affected by the subject matter.

Comments pertaining to this report are invited and should be directed to:
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