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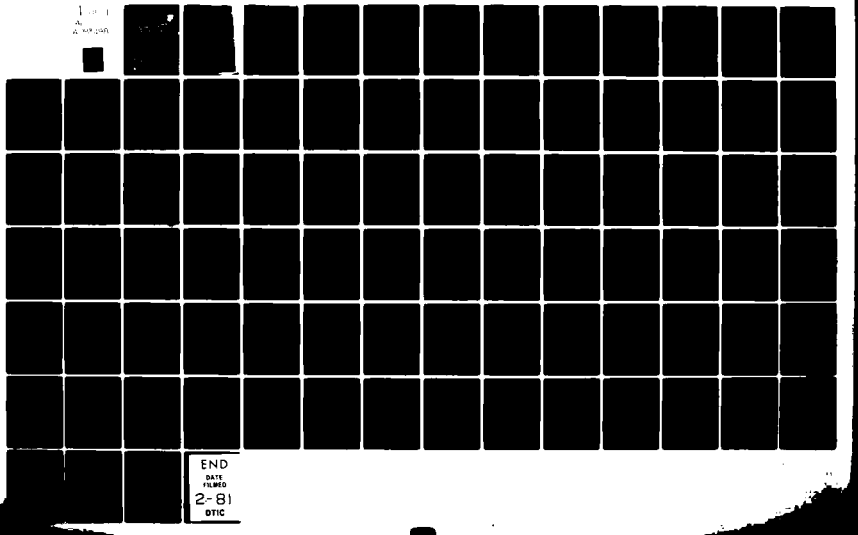

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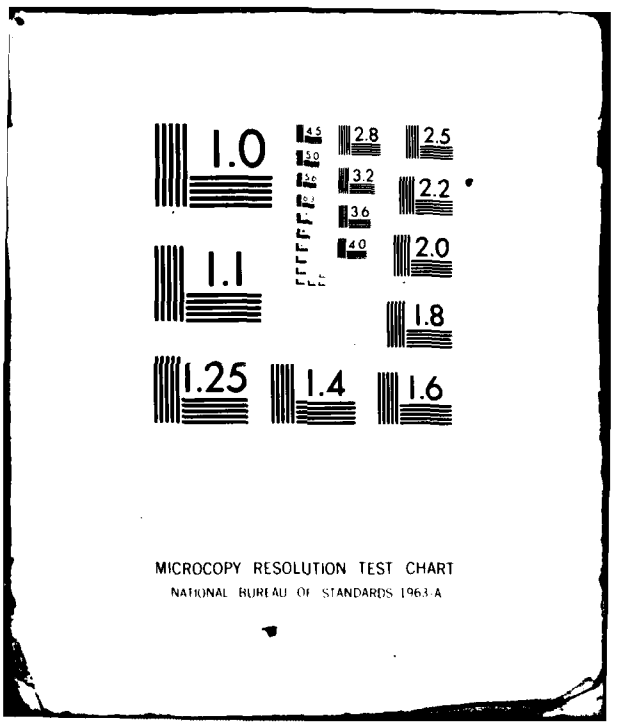
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RADC-TR-80-346
Final Technical Report
November 1980

CONCEPT VALIDATION COMBINED DEVELOPMENT TEST AND EVALUATION/ OPERATIONAL EVALUATION OF THE COMPASS PREVIEW TEST BED (CPTB) SYSTEM

Institute for Research

Dr. Paul C. Harrison

ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, New York 13441

This report has been reviewed by the RADC public
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RADC-TR-80-346 has been reviewed and is approved for

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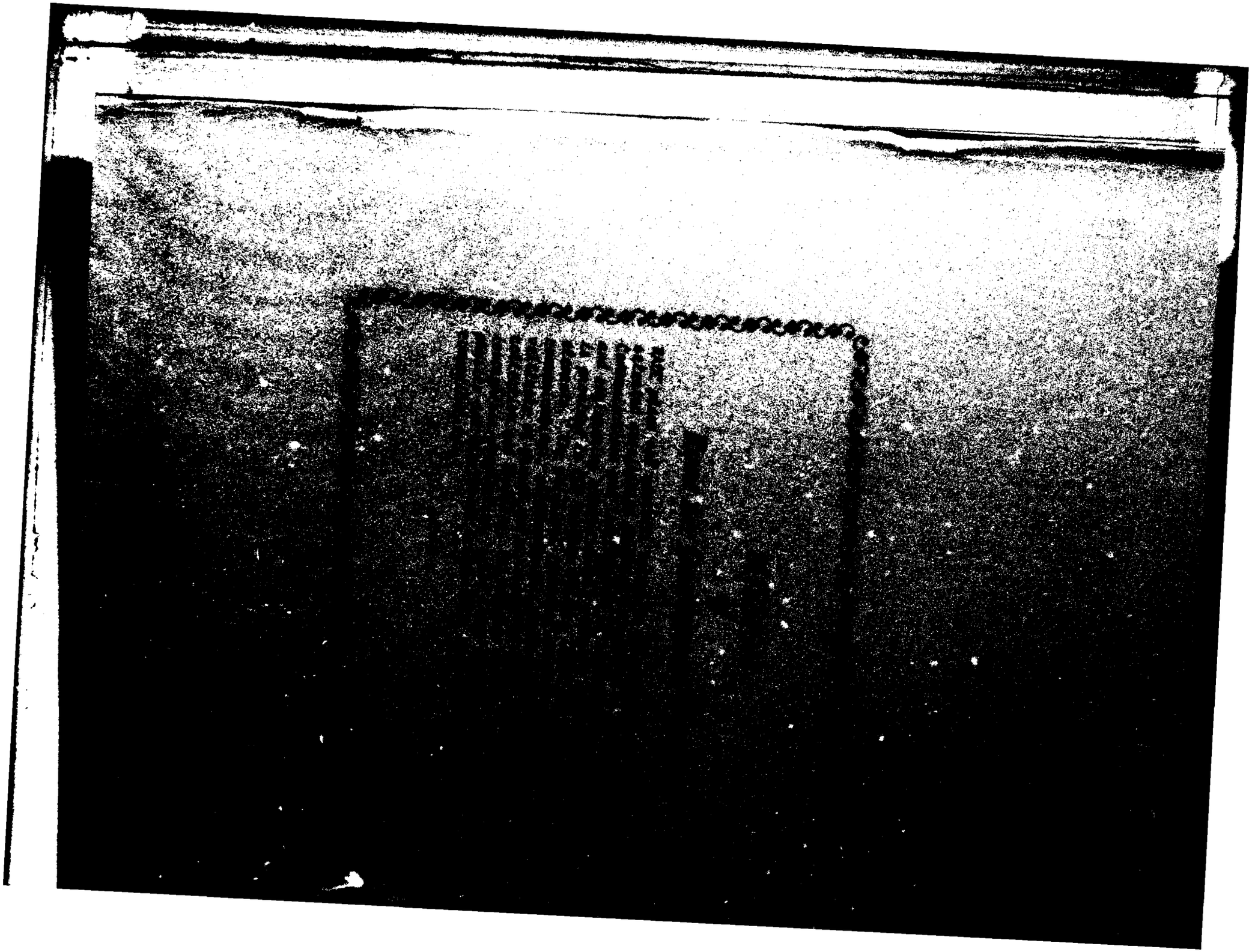

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RADC Project Engineer: Peter J. Costianes (IRRE)
This document was prepared with the cooperation and technical inputs from the members of the Compass Preview Test Planning Working (Cont'd)

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Test and Evaluation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document establishes a plan for the government conducted test of the Compass Preview Test Bed (CPTB) System. The test plan establishes the background and purpose of the test, the method of accomplishment, and general procedures for preparing and reviewing test reports. A six part annex establishes a plan for evaluating operational suitability and system software. A data management plan is also established for receipt, validation, reduction, retention, processing, and analysis of all data (Cont'd)

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collected during the test. AFM 55-43 was used as a guide in establishing the format of this test plan.

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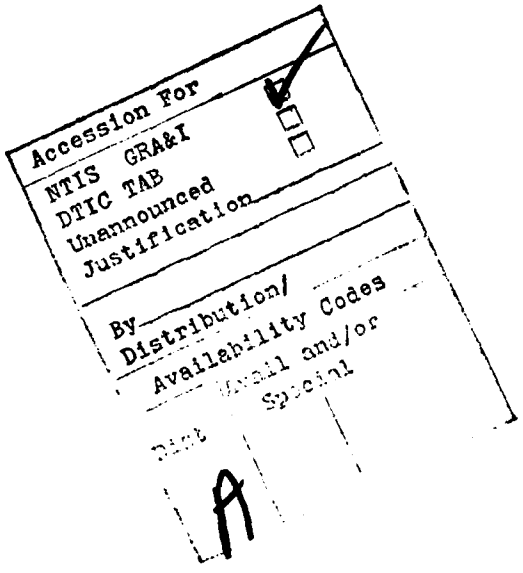
Group (TPWG). The members are listed on the endorsements page of this document.



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Vice Chairman, SAC/INCRI

Test Director, SAC 544th SIW

460 RTS/CC Representative

497 RTG/INIOX Representative

548 RTG/INOE Representative

FTD/SQHA Representative

AFSC/SDWI Representative

USAF/INYK Representative

Northrop Electronics Division

PRC - Information Sciences Company

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EVALUATION

This technical report represents the test plan for conducting the Concept Validation, Combined Development Test and Evaluation/Operational Evaluation of the Compass Preview Test Bed System. This test plan will be implemented by test procedures developed under a follow-on contract F30602-80-C-0210, Compass Preview Test Support whose purpose is to conduct the test as per this test plan and write a final test report. This test plan has been reviewed and endorsed by all the members of the Test Planning Working Group (TPWG) who provided technical inputs to the author.

This effort is relevant to the RADC Technology Plan "Recce/Intell" since it provides a test plan for testing a digital image exploitation system.

Peter J. Costianes

Project Engineer

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Title: Concept Validation Combined Development Test and Evaluation/Operational Evaluation of the Compass Preview Test Bed (CPTB) System
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Rome Air Development Center
Air Force Systems Command
Griffiss Air Force Base, New York 13441

CONCEPT VALIDATION,
COMBINED
DEVELOPMENT TEST AND EVALUATION/
OPERATIONAL EVALUATION
OF THE
COMPASS PREVIEW TEST BED (CPTB) SYSTEM

TEST PLAN

SEPTEMBER 1980

Prepared under Contract F30602-78-C-0072

Prepared by: _____
INSTITUTE FOR RESEARCH

Reviewed by: _____
Test Director, RADC/IRRS

Approved by: _____
WAYNE E. WHITLATCH, Major General, USAF
Commander, AF Test & Evaluation Center

SECTION I. TEST BACKGROUND AND PURPOSE

1. Background and Authority.

Increasingly large volumes of digital imagery have been and are continuing to be collected in support of requirements levied by the U.S. intelligence community. Unfortunately, the large amounts of imagery have consistently overloaded the exploitation capabilities of organizations designed to satisfy these requirements. At the SAC/544th SIW exploitation facility implementation of the Program Assisted Console Evaluation and Review (PACER) System has helped alleviate the problems of intelligence data handling. However, the current imagery exploitation devices are limited to exploitation of hard copy photographic film, and have no capability for handling or exploiting electronic imagery in a time responsive manner. The COMPASS PREVIEW Program is designed to provide a near-real-time digital image exploitation capability which will improve the quality and quantity (throughput) of the resulting intelligence. COMPASS PREVIEW will test an exploitation capability comparable in technology and efficiency to that found in current collection and data handling systems.

The need for an advanced exploitation capability was recognized in the late 1960's and culminated in SAC ROC 22-69, dtd 28 Oct 1969, and entitled "Advanced High Resolution Photo Interpretation Device." This was subsequently supplemented by a SAC Operational Concept dtd 15 Jan 71 entitled COMPASS PREVIEW and a SAC Statement of requirements for COMPASS PREVIEW in April of 1975. The original ROC has been updated in draft form in March of 1978.

Overall program direction is provided in PMD R-P5021(7)64750F, dtd 30 May 1980. This PMD directs, "Concept Validation testing will be conducted as a Combined DT&E/Operational Evaluation IAW the procedures of AFR 80-14." Following the completion of testing the system will be removed from SAC by the implementing command.

2. Test Purpose.

In accordance with PMD direction, CPTB testing will be conducted using AFR 80-14 procedures. The DT&E portion will be conducted to demonstrate

that the engineering design and development are complete, that design risks have been minimized and that the system will meet engineering and operational specifications. The operational evaluation will estimate the system operational effectiveness and suitability, and identify any operational deficiencies and need for modifications. The concept validation will provide data and an experiential basis for evaluation of future USAF soft copy exploitation requirements.

This plan defines a test structured to accomplish these purposes within the guidelines of the regulation, taking cognizance of the fact that "operational testing should be separate from developmental testing" and that combining is acceptable only to reduce delay and to economize the use of resources. The combination here is limited to that portion of DT&E which involves operational (as opposed to engineering) specifications and which can benefit from the operational test requirements to "assess system performance where the complete system is tested and evaluated against operational criteria (requirement and employment concepts) by personnel with the same qualifications as those who will operate ... the system when deployed." The test structure is also designed to facilitate participation by a number of USAF commands in addition to SAC and to provide data regarding soft copy exploitation applicability to tactical as well as strategic mission requirements.

3. Program Schedule and Milestones.

There are two major program milestones which directly influence the test program milestones. These are:

(1) Delivery of CPTB to SAC	1 JUN 1980
(2) Completion of Final Acceptance Test	1 OCT 1980

The major milestones of the test program itself are:

Final Approved Test Plan	30 MAY 1980
Test Procedures Complete Draft	1 OCT 1980
Test Force Training	6-17 OCT 1980
Start Pretest Preparation Period	1 OCT 1980
Dry Run Test	19 JAN 1980
Part 1 Test	9 FEB 1981

Part 2 Test	30 MAR 1981
Interim Report, Part 1	1 MAY 1981
Part 3 Test	1 JUN 1981
Interim Report, Part 2	29 JUN 1981
END Test	30 OCT 1981
Interim Report, Part 3	11 DEC 1981
Final Test Report	28 FEB 1982

Figure 1 provides a graphic display of the overall schedule showing additional detail in certain portions of the program (i.e., image selection, procedures drafts). Section A-4, Annex A provides detailed schedule for participation by all commands in each test part.

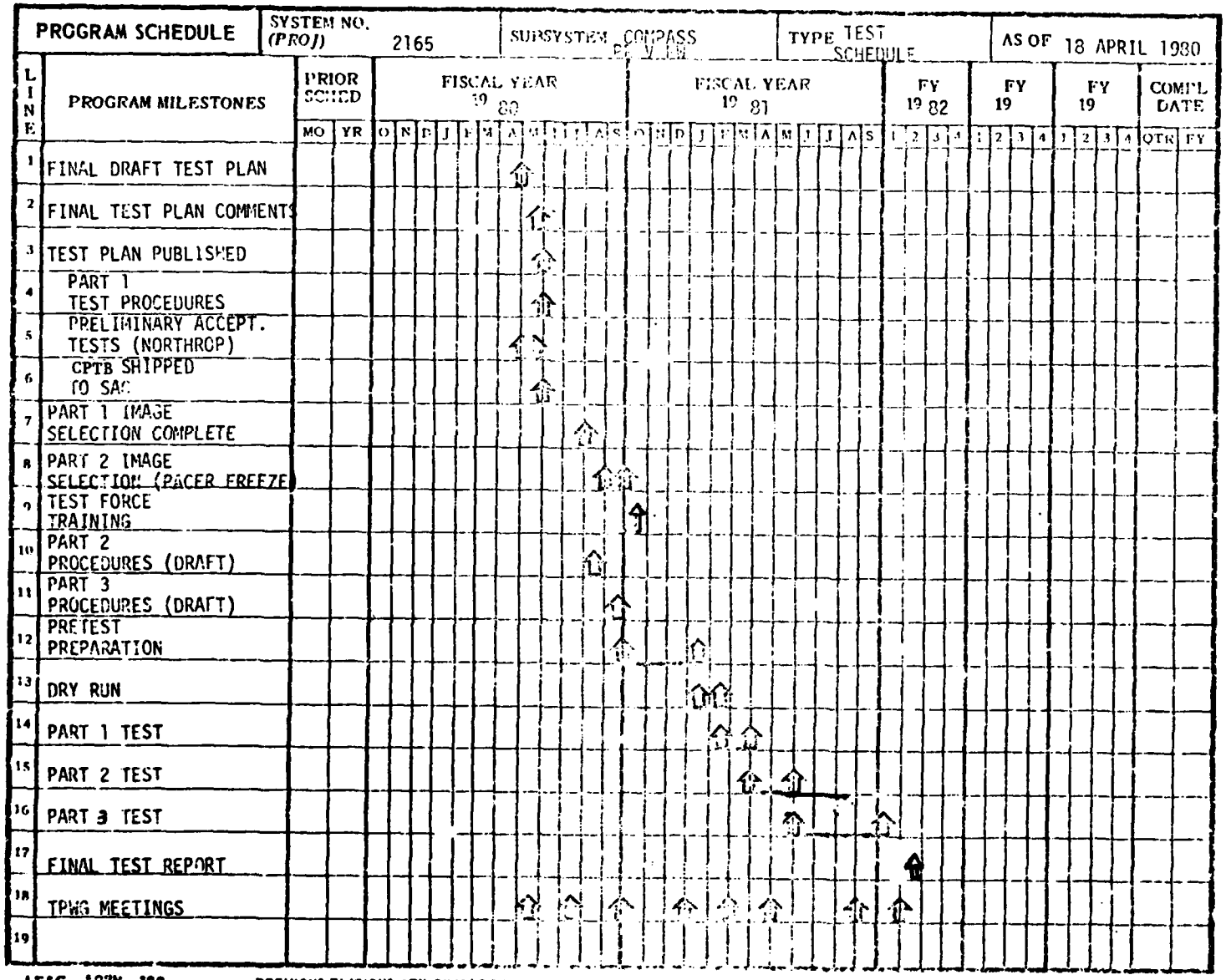
4. Test Item Description.

The CPTB is designed to provide the imagery interpreter/analyst with an electronic imagery exploitation capability, comparable in technology and efficiency to the collection and data handling system now supporting imagery based *reconnaissance*. It is designed to enable the exploitation process to provide more complete and accurate intelligence products in a time-responsive manner. The CPTB design provides significantly enhanced capabilities by integrating viewing and analytical functions within a single exploitation device. CPTB provides capabilities for measurement, geometric correction/rectification and stereo pair matching; image enhancement, and; interactive image graphics. It is responsive to direct interpreter control and by integration with an on-line data base, enables rapid intelligence production in time dominated/crisis situations.

The major hardware components of the CPTB system are (1) the digital image viewer unit, (2) the refresh memory units, (3) magnetic tape units, (4) system and station processors, (5) image interface buffer, and (6) adjacent consultation station.

The digital image viewer unit is the portion of the CPTB seen by the interpreter/analyst and, as the working console, is the tangible element. Figure 2 shows the DIVU and its major components. Figure 3 shows the physical configuration of the system as installed at SAC.

Figure 1. Test Program Milestones



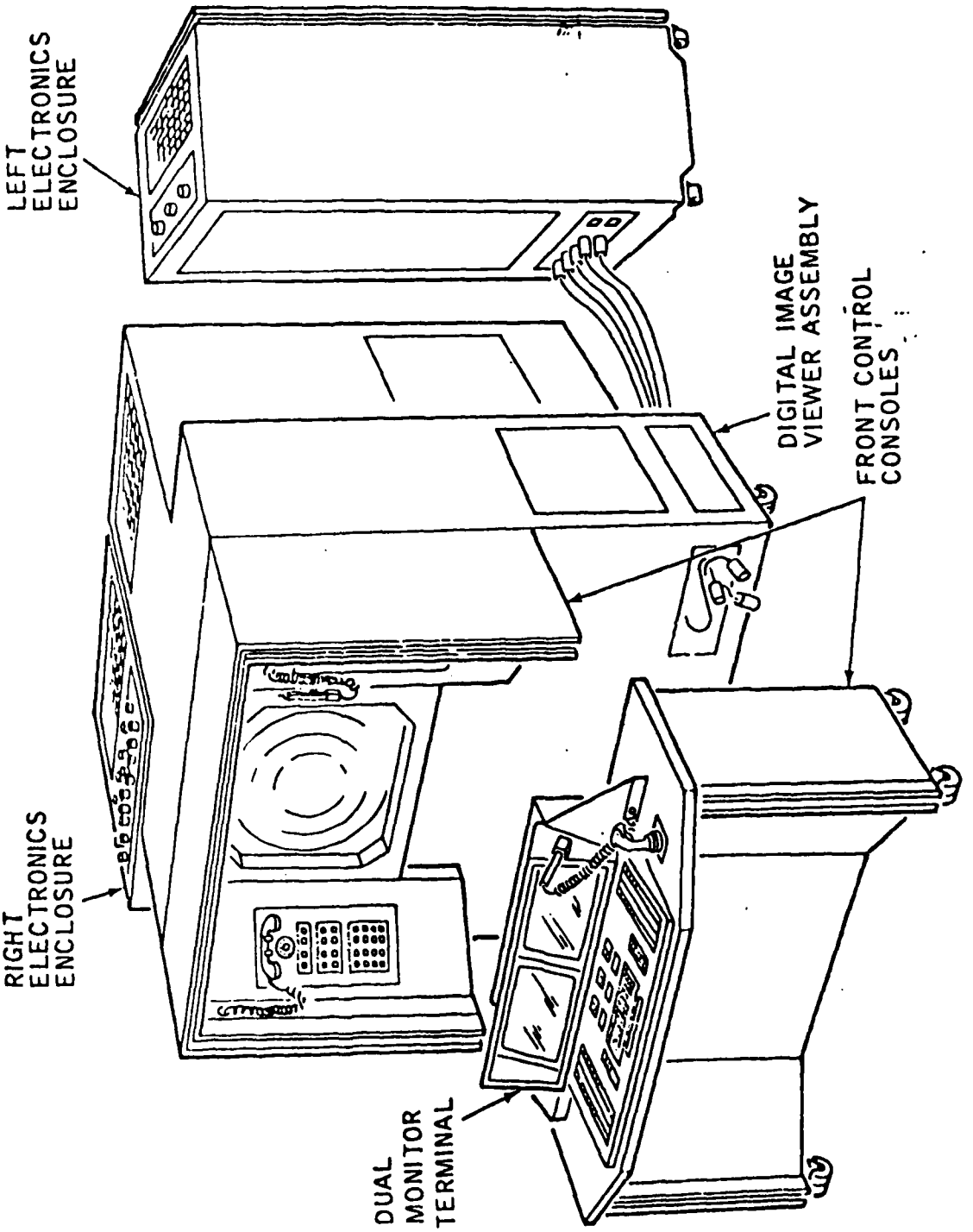
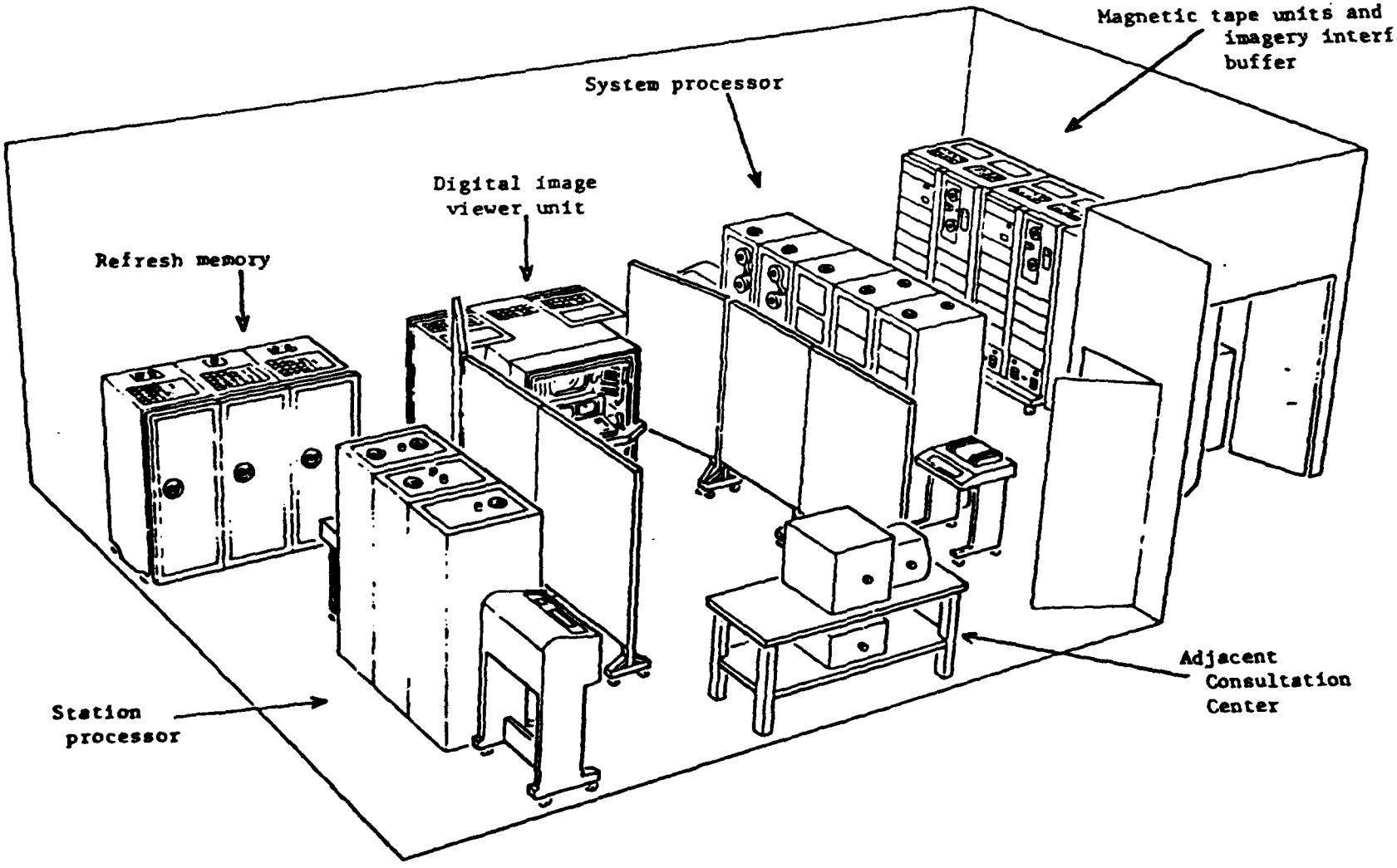


Figure 2. DIGITAL IMAGE VIEW UNIT

Figure 3. CPTB LAYOUT



There are 75 CPTB functions. These 75 fall into two groups comprising nine major categories, as follows:

IMAGE FUNCTIONS

(1) Image Selection Category -- those functions which enable the image interpreter (II) to identify and select the desired frames/installation to be displayed including:

New Frame Queue	Save Frame
Saved Frame Queue	Restore Frame
Alternate Frame	Release Frame
Next Frame	Next Installation
	Current Frame Installation List

(2) Image Mode Category -- functions which permit the selected image to be displayed and viewed in the most advantageous manner including:

Full Frame	Magnification Vernier
Mono Mode	Image Translation
Stereo Mode	Optimum Presentation
Stereo exchange	Left Image Select
Stereo Invert	Right Image Select
Rotate Image	

(3) Subpictures Category -- functions which enable the II to quickly and easily focus on a small area for more detailed analysis including:

Build Subpicture	Delete Subpicture Set
Display Subpicture	Subpicture Look Ahead Mode
Next Entry-Subpics	Overview Reference
Prior Entry-Subpics	Save
Delete Entry-Subpics	Restore Subpicture
	Step Resolution

(4) Image Manipulation Category -- functions which enable the II to correct anomalies and to enhance the image to improve the extraction of detailed information including:

Gray Level Control	Geometric Correction
Image Enhance	Geometric Alignment

(5) Image Computation Category -- functions which enable the II to make measurements and correct location errors including:

Compute Coordinate	Image Measurements
Position Cursor at Coordinate	Coverage Correction

(6) Image Graphics Category -- functions which enable the II to tally counts and to annotate images including:

Count Annotations	Display All Graphics
Display/Installation Symbols	Display/Fixed Annotations
Line Annotations	Image Hard Copy
Delete Annotations	Target Materials Grid
Text Annotations	

DATABASE FUNCTIONS

(7) Provide Information Category -- functions providing data that facilitate interpretation and reporting:

Current Frame Installation List	Latest OB
Next Installation	PI Des/PI Notes
Target Specs	Collateral Intelligence
EEI Requirements	AI Reports
Latest PI Reports	Quick Look

(8) Create Information Category -- functions which enable the II to update information in the PACER data base including:

MIPIR	Coverage Not Available
Report Create	No Apparent Change
New Installation	Update PI Notes
Cloud Cover	Photo Description Update
Rest of Frame Cloud Covered	Flash Report
ID Only	Installation description
Index Only	

(9) Support Functions Category -- functions which enable the II to communicate directly with PACER to which provide miscellaneous capabilities in support of exploitation requirements.

Data Base Queries	Station Status Line
Query Summary/Results	Miscellaneous
Query -- Next Entry	Print Display

5. Scope and Limiting Factors.

As indicated by the complex, compound title of this test, it is an inquiry of much broader than usual scope, incorporating the usual concerns of the developing command (RADC) and the primary using command (SAC) with additional requirements and applications of the other participating commands (FTD, PACAF, TAC, and USAFE) and the generalized examination of efficacy of soft copy exploitation approaches embodied in the system. Simultaneously, however, the scope of possible testing is severely restricted by a number of temporal, physical, and technical constraints.

The temporal constraints are a joint result of a limitation of the total available time for test preparation (of soft copy materials) and test conduct and the fact that there is only one CP work station thus necessitating that all work be accomplished in series rather than the more time conserving parallel mode.

The physical constraints are focused around the necessity to prepare for and conduct the test in the midst of an operational environment. The host command (SAC/544th SIW) must maintain normal operations and this places severe limitations on space, and schedule.

Other aspects of the system which limit the test are: (a) the main image display cannot be seen simultaneously by test interpreter and test monitor making precision data collection difficult, (b) Training/practice time is limited by single work station making it difficult to achieve desirable proficiency levels for valid comparison to hard copy methods, and (c) System capabilities are as designed for a specific operational requirement (i.e. SAC) and are not general and flexible enough to facilitate detailed examination of broader soft copy exploitation concepts.

6. Test Location.

The test will be conducted at SAC Headquarters, Offutt AFB, NE in secure spaces provided by the 544th SIW.

7. Test Management.

The test is controlled by a Test Planning Working Group (TPWG) consisting of representatives of the developing command, using commands, system contractor, and test contractor. Table 1 lists the members of the TPWG. The chairman of the TPWG is the RADC Test Director, Mr. Peter Costianes. Day-to-day operation will be under the control of the 544th SIW Test Director and the test contractor on-site Test Manager.

The Test Team is a task organized group which has been structured to most effectively accomplish the preparation for, conduct of, and reporting of the test, without regard for command structure or contractual relationships. A review of Section II PAR 7 reveals the complexity of the overall test organization and its associated lines of authority/responsibility. It is the purpose of this paragraph and Figure 4 to delineate the structure of the working relationships necessary to efficiently accomplish the test activity. It places the 544th SIW Test Director in the key role of coordinating and managing the day-to-day activity. The contractor on-site test manager will act as his deputy, responsible for direct management of test preparation and conduct activity. Overall test program control is the responsibility of the RADC test director. The participating command representatives will constitute an advisory panel in support of the RADC test director and will be responsible for insuring the applicability of test conditions to their commands' operational environments and for the interpretation and extrapolation of test results to their commands' operational requirements. Other on-site members of the Test Team will be the ATC representative (responsible for TII training), the Test Material/ Data Control Librarian, Hard copy monitor, Soft copy monitor, and SAC/INCRP.

8. Training Requirements.

The training of test team members falls into three categories; training of test staff, training of system operators and training of test interpreters. The test staff will receive two weeks of system training during the month

TABLE I. TPWG MEMBERS

RADC/IRRS
Griffiss AFB, N.Y.

Hq SAC/INCR
Offutt AFB, NE

AFSC/SDWI
Andrews AFB, DC

USAF/INYK
Pentagon

460th RTS/CC
Langley AFB, VA

497th RTG/INIOX
Schierstein ADM, GE

544th SIW/IES/IEPP
Offutt AFB, NE

548th RTG/INOE
Hickam AFB, HI

FTD/SQHA
WPAFB, OH

AFTEC/TESR
Kirtland AFB, NM

3420th TCHTG/TTMNI
Lowry AFB, CO

NORTHROP ELECTRONICS DIVISION
Hawthorne, CA

PRC/BELLEVUE
Bellevue, NE

INSTITUTE FOR RESEARCH
State College, PA

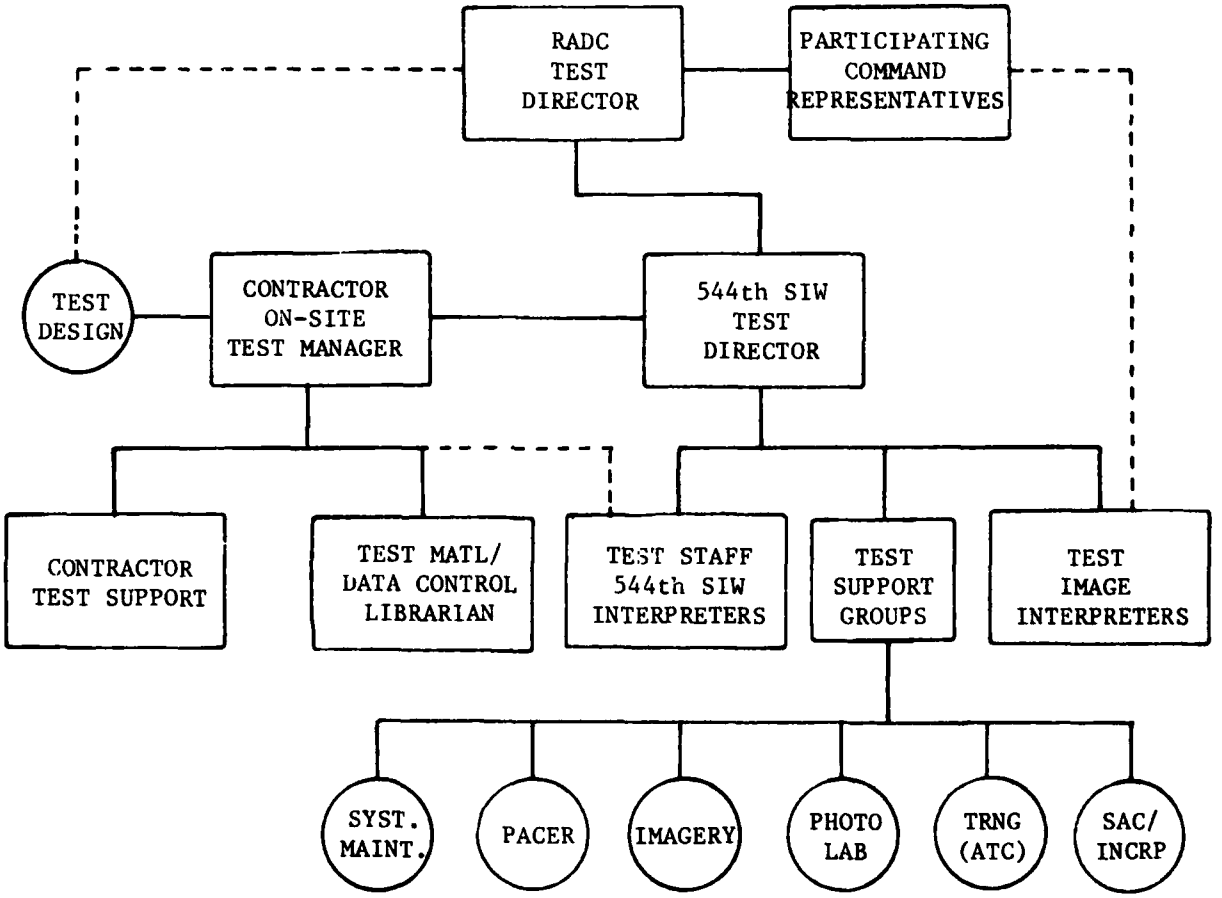


Figure 4. Test Team Functional Structure Diagram

of September 1980 conducted by the system contractor as required by the prime contract. System operators will also be trained by the system contractor. The basis for this training will be in the form of on-the-job training working with system contractor maintenance personnel. Test interpreters will receive special training, prepared and conducted by the test staff personnel, immediately prior to participation in each part of the test program. Training for Part 1 will be one week; training for Part 2 will be two weeks, training for Part 3 will be two weeks.

9. Environmental Impact.

There is no known or anticipated environmental impact resulting from the conduct of this test.

10. Safety.

There are no known or anticipated special safety requirements involved in the conduct of this test. Prior to testing, a safety survey will be conducted by a qualified safety engineer. If any potential hazards are identified during the pre-test survey or during the test phase, they will be documented and evaluated prior to further testing. A copy of the documentation and action will be retained in the project file.

11. Security.

Participation in this test will require access to special compartmented information (SCI). Test material preparation, test conduct and initial data reduction will be confined to the system high facilities of the 544th SIW. Data analysis and reporting will be handled at an unclassified level with special classified annexes to the test report, if required. Access to the test facility for test participants and all visit requests will be handled through the SAC point of contract; SAC/INCRP, Vice Chairman, COMPASS PREVIEW TPWG.

12. Release of Information.

Release of any information regarding the system, the test, or the test results must be approved by RADC/IRRS. The RADC Test Director has releasing authority for all unclassified information and all test information releases will be cleared through him.

13. Intelligence.

There is no known or anticipated intelligence threat created by the conduct of this test.

SECTION II. METHOD OF ACCOMPLISHMENT

1. System Operational Concept and Maintenance Concept.

   A. Operational Concept. The SAC operational concept for COMPASS PREVIEW was written in 1971. Changes in program direction have expanded the area of concern beyond that of SAC alone. No single clear statement of an operational concept is applicable for the purpose of this test. One of the purposes of the system development and of the test program is, as stated in the system specification, (PAR 3.1.3 Missions) "The mission of the CPPS (now CPTB) is to provide an advanced digital imagery exploitation capability for evaluation ... to develop future concept of operations for exploiting digital imagery." It has been further determined by the TPWG that the test program must provide a basis in the form of both performance data and image interpreter experience upon which the participating commands can draw to formulate operational concepts appropriate to their specific mission requirements.

   B. Maintenance Concept. Because of the nature and purpose of the CPTB development there is no formal documentation of a maintenance concept. The system will be maintained under a special support contract with the system developer to provide two maintenance personnel on-site at SAC for the duration of the test.

2. Critical Questions.

   There are a number of critical issues and areas of risk which underlie the test objectives. These stem from the diversity of requirements represented by the various potential users and the current state of the technologies involved in the soft copy imagery exploitation. Collectively, they shape both the objectives themselves and the test approach selected to address them.

   Implicit in each issue is the comparison with or improvement over current methods employed to accomplish image exploitation tasks. There are three major categories of concern: (1) viewing digital imagery, (2) data base integration, and (3) the system as a whole.

A. Viewing Digital Imagery.

(1) Does the image interpreter accept the electronic imagery display as a comfortable mode of viewing imagery?

(2) Is the image interpreter satisfied with his ability to create a stereo presentation of the imagery using the system functions available to him?

(3) Do the subpicture modes of viewing satisfy the requirement to view imagery at different magnifications?

(4) Does the image interpreter understand the capabilities for image enhancement and how to use them to enhance his productivity?

(5) Does the highly integrated (imagery, graphics, alphanumeric) and interactive (sonic pen, joy stick, etc.) display mode overload or assist the one-man exploitation concept?

B. Integrated Data Base.

(1) How effective is the integration of image functions and intelligence handling/display functions in the satisfaction of image exploitation requirements?

(2) How effective are the integrated features such as the input sorting/queuing or imagery and installation information in increasing throughput?

C. System.

(1) Is the CP system reliable, maintainable, and logistically supportable?

(2) What capabilities should be added to or deleted from the CP approach to soft copy exploitation to enhance its operational effectiveness/suitability.

3. Test Methodology.

The actual testing is divided into three parts: Part 1, an evaluation of specific soft copy exploitation capabilities; Part 2, a controlled comparison of hard copy vs. soft copy exploitation methods as applied to DIAM 57-7 reporting tasks; Part 3, an examination of soft copy exploitation concepts in an operational environment.

Part 1 will consist of four subtests: (1) Stereo, (2) Subpictures, (3) Measurements, and (4) Enhancement. Together, they are designed to provide detailed data regarding the effectiveness, utility, and operability of specific CPTB functions. The first two subtests (Stereo, Subpictures) will utilize a direct hard copy comparison condition.

Measurements will employ a ground truth standard but no hard copy comparison. Enhancements will involve a structured demonstration contrasting enhanced and un-enhanced soft copy imagery. The four subtests will be conducted as a "block" with tasks from all tests interspersed and scheduled so that each pair of test interpreters will complete their participation in two weeks (1 week training, 1 week test). In general, the response measure employed will involve the speed and correctness of performance of specific image interpretation subtasks. These subtasks will range from such specific elements as "time to achieve stereo display" to more generalized activities such as "target detection time", "accuracy of identification", etc. By collecting data at this level of detail, the results will be interpretable in the context of other user applications using the same "building block" subtasks to accomplish different missions.

The general test format is similar to a controlled experiment in which each image interpreter will perform the functions repeatedly, under controlled conditions, over a representative set of images. Each image interpreter will see all images (half on CPTB, half in hard copy, stereo and subpictures) and the results will be pooled to provide a reliable, stable estimate of the level of performance.

The major purpose of the stereo test is to investigate the acceptability, ease of use and functional utility of the CPTB capability for unaided viewing as compared to the conventional stereoscope. Imbedded in this process is an assessment of the image manipulation functions which can be used to improve the stereo view and generally aid the interpreter in the process of obtaining the best presentation. The test will require a specially selected set of stereo pairs which are generally typical of the range of imagery collected and which contain a widely distributed set of objects whose relative height can be reliably determined only in a stereo presentation. The test schedule will control image presentation order of

primary frames. The first task will be to achieve stereo display. Once this is accomplished and the associated data recorded, further measures of accuracy of interpretation and application of other manipulations will be obtained.

The major purpose of the subpictures test is to investigate the contribution to the interpretation process made by the CPTB capabilities to alter the size/resolution of the image presented to the interpreter. At issue here are both the initial stage of the exploitation process, finding the target on the frame, including search tasks, and final stages of detailed analysis, where magnification is required to discern fine details necessary for a complete interpretation. The test will require a selected set of frames which are representative of the range of target size, density, and complexity typically encountered. Initial presentation in the CPTB condition will be alternately full frame or optimum presentation as governed by a random schedule. Presentation in the hard copy condition will be in the standard SAC format. After initial measures of target location time/accuracy, a second random schedule of subpicture options will be employed and measures of speed and accuracy of detailed analysis obtained.

The major purpose of the measurement test is to assess the usability and applied accuracy of the measurement/computation functional capabilities of the CPTB. The question here is not one of absolute accuracy or the correctness of the various algorithms supplied in the system software (since that has been established in earlier testing) but rather to examine the accuracy attainable in practice; accuracy of measurements made by an image interpreter on good quality imagery taken over controlled ranges. The test exercises will require that certain measures be made in various areas of the frame and under different conditions of image manipulation including coverage correction, rotated/translated views, and geometrically corrected frames. Also included in this test will be exercises involving coordinate determination of new "targets" and the verification of known target coordinates.

The major purpose of the enhancement test is to demonstrate the contribution to image interpretability/exploitability made by the CPTB functional capabilities for image enhancement. Specifically, this test will seek to

demonstrate both, how much image enhancement helps the interpreter and how best to use these capabilities. This test will be conducted as a mixture of controlled exercises where the interpreter will use a specified degree and type of enhancement, first viewing the frame un-enhanced, then applying the enhancement. Each exercise will involve the presentation of an installation and the posing of questions directed at "fine grain" details of target features; details which could be anticipated to be more accurately and completely reported from an enhanced image. Data will be obtained on both the results of the enhancement and the interpreters evaluation of its effectiveness in facilitating detailed exploitation.

Part 2, the DIAM 57-7 reporting test, will exercise all the capabilities of the CPTB in a controlled fashion employing typical operational imagery and reporting requirements. It is to be conducted under controlled conditions with some rather detailed data collection but the test exercise is based upon an operational image interpretation task structure as currently implemented in the 544th SIW. Furthermore, it is structured to attend directly to the question of overall performance enhancement attainable by the use of the CPTB. It is a direct hard copy/soft copy comparison test. The measure to be employed will attend to the quality, timeliness, and quantity of intelligence production attainable by the application of the CPTB as compared to the current SAC methods.

The specific approach to this test will require the careful selection of imagery. Test control and the validity/generalizability of the results depend upon the representative nature of the image sample. The test will be conducted using preselected imagery and an edited version of the PACER data base, sepcially constructed to be time correlated with the selected imagery. The interpreter's task will involve all of the major steps of the normal operating procedure including frame selection, installation location, preparation for exploitation, report preparation, data base update, and preparation of graphics. The complete sequence will be accomplished in both hard copy and soft copy modes.

Part 3 of the test has two major purposes. The first is to provide a direct comparison of product quality (or acceptability), timeliness, and productivity using CPTB as compared to current operating procedures, where

both test conditions use operational imagery and the actual PACER data base. The second is to provide an evaluation of the efficacy of the data base integration features of the CPTB soft copy exploitation concept. To accomplish this purpose three conditions must be evaluated: (1) CPTB as designed, (2) CPTB as a "soft copy light table" in conjunction with a regular PACER terminal, and (3) the hard copy method as currently employed in the 544th SIW.

This will be a truly operational test in many ways. The imagery will not be pre-selected. The CPTB will be employed as just another work station exploiting frames of imagery in normal reporting precedence order within the area of functional specialization of the image interpreter assigned for that shift. The CPTB will be on line with PACER. There will be an observer/monitor at the CPTB station but data collection will be on a strictly "not-to-interfere" basis. The comparitive basis for the test will be obtained from the normal hard copy exploitation of the frames of imagery which are worked on the CPTB. The development of the requisite hard copy base line will be accomplished as follows: All imagery will be exploited in the hard copy mode in the course of normal operations. There will be no special assignment or interpreter designation except for the restriction that none will work a frame previously worked on the CPTB. In each case (CPTB and H/C) the PACER update material resulting from the exploitation will be brought to the point of actual entry but only the H/C based version will actually be entered. Both versions will be provided to judges for evaluation and comparison without knowledge of which material was CPTB generated.

4. Specific Objectives.

The test objectives stem from the critical questions and from the specific concerns of the potential using commands represented in the TPWG. In each case, the objective has been stated as concisely as possible, leaving the statement of standards of performance and measures of effectiveness to the discriptions of the specific tests designed to satisfy each. (ANNEX A). The objectives are grouped under the heading of DT&E and operational evaluation. In addition, each objective has appended to it a reference to the specific test(s) from which data addressing it will be obtained.

A. DT&E Objectives.

Objectives in this group deal with specific attributes/capabilities of the CPTB approach to soft copy exploitation and are addressed mainly in terms of data obtained on the specific subtasks, tasks, or activities comprising the job of an image interpreter.

(1) Evaluate the effectiveness of the CPTB functional capabilities provided in the Imagery Selection Category which are designed to enable USAF image interpreters to select and release specific imagery frames/installations to be displayed in accordance with established reporting priorities. (Part 1 Subpictures, Part 2).

(2) Evaluate the effectiveness of the CPTB functional capabilities provided in the Image Mode and Image Selection Categories which are designed to enable USAF image interpreters to locate and prepare for exploitation a specific installation on an already displayed frame in accordance with established reporting priorities. (Part 1 Subpictures, Part 2).

(3) Evaluate the effectiveness of the CPTB functional capabilities provided in the Subpictures Category which are designed to enable USAF image interpreters to more rapidly search frames of imagery, detecting items of potential intelligence value and performing detailed analysis. (Part 1 Subpictures, Part 2).

(3a) Evaluate the relative effectiveness of full frame and optimum presentation modes of initial imagery display. (Part 1 Subpictures, Part 2).

(4) Evaluate the effectiveness of the CPTB functional capabilities provided in the Image Mode Category which are designed to enable the USAF image interpreters to accomplish exploitation tasks using both stereo and mono presentations. (Part 1 Stereo, Subpictures, Measurements, Part 2).

(4a) Evaluate the achievement of stereo model and the requirements for adjustments across the full field of view (Part 1 Stereo).

(4b) Assess interpreter acceptance of the CPTB capability for unaided stereo viewing. (Part 1 Stereo, Part 2).

(5) Appraise the effectiveness of the CPTB functional capabilities provided in the Image Manipulation Category which are designed to enable USAF image interpreters to increase the comprehensiveness and confidence rating of detailed analysis. (Part 1 Enhancement).

(6) Evaluate the effectiveness of the CPTB functional capabilities provided in the Image Computation Category which are designed to enable USAF image interpreters to locate known installations and determine the coordinates of other image features of potential intelligence value and to determine distances and dimensions of interest. (Part 1 Measurements, Part 2).

(6a) Evaluate the effect on measurement/location accuracy of the utilization of CPTB functional capabilities in the Image Computation Category on geometrically corrected and uncorrected images. (Part 1 Measurements).

(6b) Appraise the ease and accuracy of cursor positioning on the image display using sonic pen, joy stick, and coordinate input. (Part 1 Measurements, Subpictures, Part 2).

(7) Evaluate the effectiveness of the CPTB functional capabilities provided in the Image Graphics Category which are designed to enable USAF image interpreters to annotate imagery through the application of graphics, textual data, count objects and generate annotated hard copy materials. (Part 2).

(8) Evaluate the effectiveness and ease of use of the CPTB capabilities of Polaroid and roll film copy cameras which are designed to produce annotated hard copy materials (graphics and alphanumerics) from the CPTB displayed imagery, including imagery which is enlarged, enhanced or corrected. (Part 2).

(9) Evaluate the effectiveness of the CPTB functional capabilities provided in the Information/Support Categories which are designed to enable USAF image interpreters to interact with the PACER data base to obtain textual information required to support exploitation tasks and to enter new imagery-derived intelligence. (Part 2).

(10) Assess the efficacy of cross rastered image display in terms of improved interpretability and image interpreter acceptance. (Part 1 Stereo, Measurements).

B. Operational Evaluation Objectives.

Objectives in this group deal with the effectiveness of the CPTB approach to soft copy imagery exploitation to support USAF mission requirements in an operational environment.

(1) Evaluate the effectiveness of the CPTB approach to soft copy imagery exploitation to support USAF requirements for the imagery derived intelligence reports. (Part 2, Part 3).

(2) Evaluate the effectiveness of the CPTB approach to soft copy imagery exploitation to support the USAF requirements for HOTPHOTOREP, IPIR, SUPIR, MIPIR production. (Part 2, Part 3).

(3) Evaluate the effectiveness of the CPTB approach to soft copy imagery exploitation to support USAF requirements for new target detailed descriptions including coordinate determination. (Part 2) (Part 1, Measurements).

(4) Evaluate the effectiveness of the CPTB approach to soft copy imagery exploitation to support USAF requirements for the production of OB counts and significant OB changes. (Part 2, Part 3).

(5) Evaluate the effectiveness of CPTB approach to soft copy imagery exploitation to support USAF requirements for the extraction of essential elements of information for targets from relevant functional categories. (Part 2, Part 3).

(6) Evaluate the effectiveness of the CPTB concept of an on-line integrated data base. (Part 3).

(7) Appraise CPTB reliability, maintainability, and supportability as evidenced by general system availability throughout the test period based upon system contractor records of unscheduled maintenance activities. (All tests).

(8) Identify CPTB personnel requirements for both system operators and image interpreters skill levels and special training for effective system utilization in the operational environment. (All tests).

(9) Assess the adequacy of CPTB design in the areas of human factors and safety as perceived by both operators and image interpreters. (All tests).

(10) Appraise adequacy of CPTB design and documentation to facilitate software maintainability and operability. (Entire test period).

(11) Identify CPTB functional deficiencies and specific system features/attributes/equipments requiring improvement. (All tests).

(12) Identify specific CPTB functional capabilities of features which are not required for the accomplishment of the USAF mission. (All tests).

5. Evaluation Criteria

The establishment of thresholds, standards, and goals to be employed in this test is not the straightforward endeavor envisioned in AFM 55-43. The process revolves around the notion that the "standards reflect the operational requirements baseline contained in the system operational and maintenance concepts and other appropriate documentation". Thresholds and goals are then set to bracket the standard so that the "threshold is the minimum level of acceptable performance" and "... a goal is a level (of performance) that will enhance the system".

The CPTB system documentation does not contain clear statements of performance specifications for the accomplishment of interpretation tasks/subtasks

using the system. The system specification does not stipulate how quickly or accurately an interpreter using the system should be able to complete a report item, perform a measurement, search a route, or accomplish similar activities which are the basis for the MOE's. It is also true that reliable data regarding image interpreter performance of these tasks, using current methods, is not available. Every operational unit strives to produce the highest quality reports in as timely a fashion as possible, but, due to the variability in requirements among commands (and even within a given command from time to time) no universal standards have been developed; no systematic performance records have been kept.

The test approach, adopted herein, utilizes concurrently collected hard copy performance data as the threshold (i.e., CPTB threshold = average hard copy). The absolute value of that threshold will be determined by the data collected on the specific measures of effectiveness (MOE) employed in a particular part of the test. The standards in each case, will be defined as an improvement in the average performance score on the relevant MOE statistically significant at the 5% level of a one tailed test. The goal will be defined as an improvement in average performance statistically significant at greater than the 0.5% level of a one tailed test. It is recognized that this form of threshold/standard/goal does not directly address the absolute effect size (or performance improvement) required to achieve the standard on any particular MOE. The absolute size of the improvement required to reach standard or goal will vary depending on the number of data points obtained for a specific MOE. The important point, however, is that for any given MOE the difference in effect size between standard and goal is a great deal larger than that between threshold and standard.

Finally, it should be noted that since the overall test involves a large number and variety of MOE's, the overall evaluation of system effectiveness cannot be determined by failure to reach the threshold or standard on any single given MOE. An overall judgment of the uitlity of system will have to be made on the basis of the overall pattern of result, with more weight being given to the more global MOE's of report quality/ timeliness as compared to the more specific MOE's such as "time to achieve stereo model." In general, failure to at least achieve threshold

performance on any MOE will be considered by the TPWG (mainly the participating command representatives) to assess the relevance for specific applications of the CPTB approach to the command requirements.

6. Data Management.

The data to be collected can be broadly calssified into four types; (1) product, (2) process, (3) activity, and (4) subjective evaluations. Different forms of each type will be used in each of the three parts of the test. The following paragraphs outline the data requirements by test part and for the test activity as a whole.

A. Part 1. This portion of the test is, from a data collection/management point of view, the most complex since it is composed of four separate subtests which are conducted for two test interpreters at a time, in an interleaved fashion. This, coupled with the large number of data points involved, will require careful control on a continuing basis.

The major data for this part of the test will be process type data. Monitors will collect detailed time data for specific actions/subtasks. Responses which can be scored right/wrong will be obtained for discreet items (e.g. measurements, identifications, etc.). Test interpreters will, for certain tasks, make confidence judgments for specific tasks (e.g., Rate your confidence that particular EEI's could be reliably discerned). Test interpreters will also make detailed evaluations of the utility of various CPTB features (.e.g. types of enhancements).

The data will be pooled by subtest across all test interpreter participants, maintaining information regarding test condition, frame, collection parameters and other relevant analysis dimensions.

B. Part 2. The DIAM 57-7 reporting task is the basic organizing concept for both test conduct and data collection. Test monitors will obtain detailed timing data for specific steps in the process for both hard copy and soft copy conditions. Overall report preparation time will also be recorded. Test interpreters will produce DIAM 57-7 report items which can be scored for completeness and accuracy against the school solution. End of test questionnaires will systematically

solicit test interpreter evaluations of CPTB utility in support of DIAM 57-7 reporting.

The process data collected by the monitors, pooled across all test interpreters and partitioned by hard copy vs. soft copy, will provide an empirical basis for evaluating CPTB effectiveness at each step in the reporting process. The product data, timeliness, completeness, and accuracy, obtained from scoring the individual reports will be similarly pooled and partitioned and will provide a reliable basis for determining CPTB contribution to mission performance. Hard copy annotated materials produced during the test will be retained and systematically evaluated for overall quality and usefulness. Ratings from these evaluations will be averaged to provide stable estimates of the adequacy of CPTB capabilities provided.

Raw data (monitor sheets, reports, hard copy, etc.) will be sorted for test interpreter for each test exercise. These data will be reduced to an unclassified form of key punch creation sheets for analysis. A backup copy of each unclassified data sheet will be maintained in the individual test interpreter/test exercise folder.

C. Part 3. The emphasis in this portion of the test will be on product data, supported by observer obtained activity data, and test interpreter evaluation. The product data will be derived from reports produced under each of the three test conditions in two different ways. The overall hard copy vs. soft copy quality comparison will be made by judges using a forced choice paired comparison procedure. Selected reports will be scored against "school solutions" derived from appropriate first, second, third phase reports. Hard copy records of all soft copy reports produced will be filed in terms of test interpreter and test condition (with/without PACER integration). A hard copy record of the corresponding report, produced by current methods by 544th SIW personnel will be attached to each CPTB record. Associated observational data will be filed with each report folder, maintaining the correspondence necessary to associate production time/activities with each individual output. Unclassified data records containing time, activity, and quality scores will be prepared

for each valid data point. (Valid here implies matching hard copy/ soft copy reports; if either are missing, the data point is invalid).

D. General. In addition to those data obtained as a direct result of specific test exercises, a substantial amount of evaluative data is also anticipated. Included in this category are the following:

(1) Training evaluations. Each test interpreter will, at the end of each training course (Parts 1, 2, and 3) be required to complete ATC form 258 and a supplementary questionnaire.

(2) Suitability evaluation. Data regarding down time, system availability, failures, spare usage, and hardware problem reports will be collected and retained throughout the test period.

(3) Software evaluation. Software documention will be appraised by developing/using command representatives. Software problem reports will be completed and retained.

(4) System capabilities (additions/deletions). All test team members will complete a systematic review of the system utilization during test and make recommendations for modifications if required.

7. Responsibilities, Support, and Resources.

All parts of the CPTB evaluation are planned and controlled by a Test Planning Working Group (TPWG) consisting of representatives from HQ USAF, AFSC, RADC, participating commands, AFTEC, the system contractor, and the test contractor, with advisors and observers designated from supporting commands and other interested commands, services, and agencies. Those participants having an active role in the development of the test, preparation of the test materials and the actual test conduct and reporting are RADC, SAC, 544th SIW, participating commands (460th RTS, 497th RTG, 548th RTG, and FTD), AFTEC, ATC, the test contractor (IFR), and the system contractor (NED). The following paragraphs detail the responsibilities of each.

A. RADC/IRRS.

As the Responsible Test Organization (RTO), the RADC System Acquisition Office (RADC/IRRS) shall:

(1) Appoint a Test Director (TD) for the CPTB Test Program.

(2) Define Test Planning Working Group (TPWG) organizational relationships and responsibilities.

(3) Develop and plan the T&E program to meet the program decision milestones.

(4) Work with TPWG to identify critical questions and areas of risk to be addressed as test objectives during T&E phases.

(5) Provide for contractor participation in DT&E and operational evaluation as required.

(6) Direct, control, review, and approve contractor generated test plans, procedures, test data analyses, and test reports for DT&E.

(7) Coordinate contractor's DT&E test plan and test reports with appropriate agencies.

(8) Provide or facilitate acquisition of test monitors, test material/data control librarian, and other test support personnel.

B. Hq SAC.

SAC/INCR will be the executive or lead supporting organization and shall:

(1) Review and approve the operational evaluation plans and procedures.

(2) Act as the single SAC point of contact for the CPTB.

(3) Act as the T&E program interface with the 544th SIW for system requirements.

(4) Coordinate facility requirements for the CPTB.

(5) Be responsible for all security requirements.

SAC/AD will be responsible for the CPTB interface with PACER and will specifically:

(1) Coordinate PACER testing requirements with respect to CPTB.

(2) Coordinate PACER hardware/software interface with CPTB.

(3) Coordinate TEMPEST testing for the CPTB at Hq SAC.

(4) Provide data base support for the test program.

(5) Provide operations support (e.g., system operators, tapes, etc.).

C. 544th SIW.

The 544th SIW as the host organization shall:

(1) Provide guidance to the TPWG in developing test objectives and procedures which accurately test the photo interpreter/CPTB interface.

(2) Provide a representative to the TPWG who will act as Operational Test Director.

(3) Assist in the selection and preparation of imagery/test material for Part 1 tests.

(4) Provide working space for test contractor personnel.

(5) Select imagery for Part 2 testing.

(6) Provide two photo interpreters to assist in test material preparation.

(7) Provide eight test interpreters (2 hours/day each) for Part 2 testing.

(8) Provide test interpreters; three for Part 1 and five for Part 3 testing.

(9) Provide photo lab support for test material preparation.

(10) Provide for reproduction of classified test materials.

D. Participating Commands.
The commands falling in this group (460th RTS, 497th RTG, 548th RTG, and FTD) shall:

(1) Appoint a regular representative to the TPWG.

(2) Provide guidance to TPWG to ensure that testing incorporates exercises and performance measures relevant to the mission of other participating commands.

(3) Provide at least one test interpreter for two weeks at SAC for Part 1 testing.

(4) Provide at least one test interpreter for four weeks at SAC for Part 3 testing.

(5) Coordinate on all test documentation.

E. Air Force Test and Evaluation Center (AFTEC).
AFTEC shall:

(1) Appoint a representative to the TPWG.

(2) Review and approve the Operational plans and procedures.

(3) Monitor the Operational Evaluation as required.

(4) Review and comment on the Operational Evaluation report, as appropriate.

F. Air Training Command (ATC/TCHTG).
ATC shall:

(1) Provide a representative to the TPWG who shall coordinate training development/evaluation.

(2) Provide one instructor to develop and conduct specialized training for test interpreters prior to participation in each Part of the test.

G. Northrop Electronics Division (NED).
Northrop Electronics Division as system contractor shall:

(1) Develop test materials and procedures for acceptance testing to be performed at the contractor's facility and at SAC.

(2) Perform acceptance testing based upon contractor submitted and government approved test plan.

(3) Reduce and analyze test data; prepare and provide test reports to Program Office for review.

(4) Provide all maintenance to the CPTB during acceptance testing and combined DT&E/Operational Evaluation except for government provided maintenance as identified in the contract.

(5) Provide supply support for all testing conducted at the contractor's facility. For those test phases at Offutt, AFB provide supply support for all CPTB equipment with the exception of those items identified in the contract.

(6) Provide training for ten individuals from the test team including system operators, Test Director, Test Manager, photo interpreters, and ATC instructor.

H. Institute For Research (IFR).

The Institute For Research as the test contractor with assistance from Pattern Analysis and Recognition Corporation (PARC) and Science Applications Incorporated (SAI) shall:

(1) Generate a formal test plan and procedures for the combined DT&E/ Operational Evaluation as defined in RADC Contract F30602-78-C-0072 and a follow-up contract (F30602-80-C-0205).

(2) Effect close and extensive coordination with participating commands to develop test objectives; determine material, personnel, and scheduling/team requirements of the test, and define operational scenarios.

(3) Provide test support consisting of an on-site test manager and manpower for monitoring the test, test material preparation, and reducing test data into the form of an interim and final reports.

SECTION III. TEST REPORTS AND BRIEFINGS

1. Status Reports.

Because of the nature and length of the test program it has been determined that interim reporting of Part 1 and Part 2 results would be desirable. Periodic status reports (monthly) are required to help identify potential problem areas early in testing and to provide an indication of the systems capabilities. The Interim Reports for Part 1 and Part 2 will be prepared by the test contractor and submitted to the TPWG for review and comment. The reports will be limited to: (1) a brief description of the test conduct including any deviations from procedures, (2) summary and discussion of major results organized by subtest/test, and (3) preliminary conclusions and recommendations relative to those test objectives addressed by that portion of the test. The format will be contractor developed subject to TPWG approval and designed to facilitate timely reporting upon completion of the subject test portion.

2. Deficiency Reports.

While the CPTB does not meet the requirements given in T.O. 00-35D-54, Section V for full-scale service reporting, many aspects of the program make formal reporting and review of suspected deficiencies and proposed enhancements very beneficial. Any suspected deficiencies or proposed enhancements discovered by the test team will be recorded on the AFTO Form 240 in accordance with the procedures given in paragraphs 5-5, T.O. 00-35D-54. The reports will be forwarded to RADC/IRRS for review and comment, as appropriate. This formalized procedure will provide background information for development of any follow-on system.

3. Final Test Report.

The Final Test Report consisting of three volumes (Overview, DT&E, Operational Evaluation) modeled after the suggested format from AFM 55-43 will be submitted for review and comment to the TPWG. Following revisions resulting from this review the DT&E volume will be submitted for approval to RADC and AFSC; the Operational Evaluation volume will be submitted through HqSAC to HqAFTEC for evaluation and comment to HqUSAF.

4. Briefings.

As a non-major program there are no required briefings. Briefings of progress to date will be made by test team personnel to the TPWG at scheduled meetings throughout the test period. Additional briefings for Hq SAC, USAF/INY, AFSC or other program management elements will be prepared and conducted as required.

A video taped test summary and system demonstration will be prepared, under SAC auspices, by a U.S. Army Unit authorized to accomplish this type of recording at the required classification/caveat levels involved in this program. Test team members will support this activity on a not-to-interfere basis.

ANNEX A

OPERATIONAL EFFECTIVENESS

AND

CONCEPT VALIDATION

A-1 Part 1: Soft copy capabilities testing.

Part 1 of the test will consist of four special tests: (1) Stereo, (2) Subpictures, (3) Measurements, and (4) Enhancements. Each is described separately in the following paragraphs.

A-1-1 Stereo test.

A. General.

This test is designed to investigate the utility, effectiveness and acceptability of the CPTB capability for up to full frame stereo viewing. The design permits assessment of relative object size, separation and location and human factors considerations.

B. Standard of performance.

No absolute standard exists. Data will be concurrently collected to establish a hard copy baseline for comparison. Information regarding ground/image truth will be required.

C. Measures of Effectiveness. (MOE).

(1) Time: Elapsed time data for individual and total exercise will be recorded.

(2) Correctness: Responses to specific questions (e.g. which is higher, A or B) will be recorded and compared to ground/image truth.

(3) Acceptance: Test interpreters will be systematically queried regarding advantages/disadvantages of unaided stereo veiwing.

D. Test preparation.

(1) Imagery Selection: Imagery selection will be accomplished by RADC/IFR. Twenty-four sets of stereo images will be required having characteristics which minimize extraneous height cues. The set will be a mixture of operational and controlled range scenes.

(2) Image preparation: For each image a number of objects or features will be selected, systematically varying relative height, separation and frame location. The selected objects/features will be annotated and specific questions formulated. Note: initial work completed using hard copy validated and transferred to soft copy during Pre-test Preparation.

(3) Instructions/Data Collection: Imagery will be subdivided into test exercises, 6 stereo pairs per exercise, and specific detailed instructions for both hard copy and soft copy conditions written for each exercise. The data collection forms for recording task time and test interpreter responses will be prepared for each pair.

(4) Data Base: No special requirement, except for the CPTB frame initialization.

E. Test Conduct

(1) Schedule: Each test interpreter will be required to complete four sessions of 2 hours each. Two sessions will be on the CPTB station; 2 at a hard copy light table. Sessions will be interleaved with other sessions required for the other Part 1 tests. Master schedule is shown in A-1-5.

(2) Test Personnel: This test will require 10 test interpreters for 8 hours each. Two test monitors will be required; one each for the soft copy and hard copy stations. Also required will be a system operator and a test materials/data collection control clerk.

F. Data Reduction/Analysis

Data collection forms will be scored/tabulated, as received, and recorded on coded keypunch creation sheets. (Since it is anticipated that this test will produce approximately 3,400 data points, computer processing is required). Time and correctness scores will be separately aggregated accross individuals and images and analyzed by means of three way analysis of variance (ANOVA).

A-1-2 Subpictures test.

A. General.

This test is designed to investigate the utility and effectiveness of the various types and purposes of CPTB subpictures capability. Of particular interest will be optimum presentation and search tasks using both overview reference and subpictures look ahead.

B. Standard of Performance.

No absolute standard exists. Data will be concurrently collected to establish a hard copy baseline for comparison.

C. Measures of effectiveness. (MOE).

(1) Time: Elapsed time data for individual tasks (e.g. time to locate target, time to complete search) will be recorded.

(2) Correctness: Responses to specific questions (e.g. Is the vehicle at point A tracked or wheeled?) will be recorded and scored against ground (image) truth.

(3) Completeness: Responses to search/counting tasks will be recorded and scored against the school solution and percent complete calculated where % C = Nbr. found/Nbr. present.

(4) Accuracy: Responses to search/counting tasks which also require identification of objects will be scored for accuracy where % A = Nbr. correctly identified/Nbr. detected.

D. Test Preparation.

(1) Imagery selection: Imagery selection will be accomplished by RADC/IFR. Thirty-six images will be required and will be selected on the basis of scene/target relationship and image format. The set will contain a variety of the major acquisition parameters of slant range, dynamic range, and sun angle.

(2) Image preparation: For each image specific tasks will be developed involving locating targets of various types (e.g. small target imbedded in complex area, specific features of larger targets), area, and route searches, etc. School Solutions derived from ground truth or image truth will be developed and validated in both hard copy and soft copy form.

(3) Instructions/Data Collection: Imagery will be subdivided into test exercises, 6 images per exercise. Specific monitor and test analyst instructions will be written for each exercise for both hard copy and soft copy conditions. Instructions will control type and sequence of subpictures options used and specific tasks to be accomplished. Associated with the specific instructions for the monitor will be data to be collected (start/stop times, target detections/identifications, counts, etc.).

(4) Data Base: For those targets where the optimum presentation and/or target symbols options are to be employed, it will be necessary to insure that the PACER data base contains the requisite information.

E. Test Conduct.

(1) Schedule: Each test interpreter will be required to complete six sessions of two hours each. Three sessions will be on the CPTB station; 3 at a hard copy light table. Each interpreter will see all of the imagery. Viewing will be balanced across interpreters by hard copy vs. soft copy. Test sessions will be interleaved with other sessions required for other Part 1 tests. Master schedule is shown in Section A-1-5.

(2) Test Personnel: This test will require 10 test interpreters for 12 hours each. Two test monitors will be required; one each for the soft copy and hard copy stations. Also required will be a system operator and test materials/data collection control clerk.

F. Data Reduction/Analysis.

Data collection forms will be scored/tabulated as received and recorded on coded key punch creation sheets. Approximately 7500 data points are anticipated. Scores on all MOE's will be aggregated across interpreters by specific image and test condition and analyzed by means of standard ANOVA routines.

A-1-3 Measurements Test.

A. General.

This test is designed to investigate the accuracy of measurement achievable using CPTB. Measurement accuracy and coordinate determination will be assessed in combination with other CPTB capabilities for geometric correction, coverage correction, and stereo viewing. Location, object size, image size, and frame orientation will be varied.

B. Standard of Performance.

Measurement accuracy will be determined in comparison to ground truth as modified by range of expected accuracy as predicted for individual test frames.

C. Measures of Effectiveness. (MOE).

(1) Dimension accuracy: Lengths, widths, heights, areas, volumes, and azimuth will be recorded and absolute and percent deviation from ground truth calculated.

(2) Coordinate accuracy: Absolute deviation from known ground truth location will be recorded.

(3) Cursor positioning: Test interpreters will be systematically queried regarding cursor positioning via sonic pen and joy stick.

(4) Time: Elapsed time data for individual and total exercise will be recorded.

D. Test Preparation.

(1) Imagery selection: Imagery selection will be accomplished by RADC/IFR. Twelve images will be required, representing selected levels of geometric and coverage distortion and a wide range of objects/features to be measured. The set will consist of controlled range scenes.

(2) Image preparation: For each image approximately 20 objects/features/dimensions will be selected and annotated, systematically varying location, size orientation, etc. Specific features of known location will be identified for coordinate determination tasks. Initial work will be accomplished on hard copy, later validated and transferred to soft copy.

(3) Instructions/Data Collection: Imagery will be subdivided into test exercises, 6 images per exercise, and specific monitor instruction/data collection forms constructed for each exercise. Test interpreter instructions will also be written.

(4) Data Base: It will be necessary to prepare and insert into test PACER information needed to support coordinate determination tasks.

E. Test Conduct.

(1) Schedule: Each test interpreter will be required to complete two test sessions of two hours each, both on the CPTB station. Sessions will be interleaved with other sessions required for other Part 1 test. Master schedule is shown in Section A-1-5.

(2) Test Personnel: This test will require 10 test interpreters for four hours each. One test monitor will be required along with one system operator and the test materials/data collection control clerk.

F. Data Reduction/Analysis.

Data collection forms will be scored against ground truth and recorded on key punch creation sheets. It is anticipated that approximately

3400 data points will result from this test. The data will be analyzed by means of standard ANOVA routines and results produced for total accuracy and accuracy as a function of object size, corrections employed, and measurement option exercised.

A-1-4 Enhancement test.

A. General.

This test is designed to evaluate in a demonstration mode, the CPTB capabilities for image enhancement and their potential utility in increasing the level of detail and interpreter confidence achievable in the exploitation of soft copy imagery.

B. Standard of Performance.

No absolute standard exists. Comparison will be made between enhanced and unenhanced views of the same scene.

C. Measures of Effectiveness. (MOE).

(1) Information gain: Difference scores calculated between enhanced and unenhanced views.

(2) Confidence gain: Shifts in interpretation categories (possible/probable/confirmed) will be recorded.

D. Test Preparation.

(1) Imagery selection: Imagery selection will be accomplished by RADC/IFR. Twenty-four images will be required representing a range of conditions and scenes judged to be appropriate for the various enhancement capabilities of CPTB. The image set will be drawn from operational imagery available at SAC. All selection will be accomplished on the CPTB station.

(2) Image preparation: For each image, objects will be selected and annotated and an enhancement option determined. A subpicture with

the selected enhancement will be prepared and saved. School solutions for each object will be determined.

(3) Instruction/data collection: Specific instruction sets for image, including a detailed enhancement script will be written. Data collection forms for object interpretation, confidence level, and interpreter rating will be prepared corresponding to each object. Test interpreter and monitor instructions for the 2 hours test session will also be prepared.

E. Test Conduct.

(1) Schedule: Each test interpreter will be required to complete one session of two hours. The session will be scheduled at a convenient time during the conduct of the other Part 1 tests. Master schedule is shown in Section A-1-5.

(2) Personnel: The ten test interpreters utilized in the other Part 1 test will be required to complete this test as well. In addition, the test/demonstration is to be structured so that additional (non CPTB trained interpreters) can act as test interpreters and provide useful data. The number of additional interpreters will be limited by availability and CPTB scheduleing. Each session will require 1 monitor, 1 operator, and the test materials/data collection control clerk.

F. Data Reduction/Analysis.

Monitor data collection forms will be tabulated as recieved and recorded on key punch creation sheets. The quantity of data is indeterminate depending on the number of additional test interpreters obtained. Analysis will consist of summary statistics (average, variance, range, etc.) across interpreters/images for each measure.

A-1-5 Part 1: Master Schedule

The following schedule is repeated four times to accommodate a total of eight test interpreters.

Part 1 Master Schedule

DAY	INTERP	Test Period 1	2	3	4
1	A	Subpic/CP1	Meas/CP1	Subpic/HC1	open
	B	Subpic/HC1	open	Subpic/CP1	open
2	A	Stereo/HC1	open	Stereo/CP1	open
	B	Stereo/CP1	Meas/CP1	Stereo/HC1	open
3	A	Subpic/CP2	Meas/CP2	Subpic/HC2	open
	B	Subpic/HC2	open	Subpic/CP2	Enhance
4	A	Stereo/HC2	open	Stereo/CP2	open
	B	Stereo/CP2	Meas/CP2	Stereo/HC2	open
5	A	Subpic/CP3	Enhance	Subpic/HC3	Question
	B	Subpic/HC3	open	Subpic/CP3	Question

A-2 Part 2: DIAM 57-5 Reporting.

A. General.

Part 2 of the test will consist of a systematically structured, mission level comparison, utilizing selected imagery, a controlled data base and encompassing the entire exploitation cycle from frame selection thru the production of report items and the preparation of hard copy target materials.

B. Performance Standard.

No absolute standard exists. Data will be concurrently collected to establish a hard copy baseline for comparison.

C. Measures of Effectiveness. (MOE).

(1) Time: Elapsed time will be recorded for all defined steps in the exploitation cycle (definitions matched for hard and soft copy), for total task time, per report item, and for total cycle time from receipt of image.

(2) Completeness: Each report item will be scored against the school solution and a percent completeness score computed where % C = EEI responses/EII required.

(3) Accuracy: For each report item the EEI responses present will be scored against the school solution and a percent accuracy score computed where % A = EEI correct/EEI present.

(4) HC Quality: The required HC target materials generated for each report item will be scored for completeness and accuracy and judged for overall quality.

D. Test Preparation.

(1) Imagery selection: Imagery selection will be accomplished by 544th SIW assisted, if necessary, by IFR and/or personnel from participating commands. A total of 56 images will be required, eight representing each of seven functional areas. The total set will contain a range of acquisition parameters, wide geographic dispersion, and approximately 15 percent stereo coverage.

(2) Image preparation: The selected imagery will be reveiwed on the CPTB station and the interrelation with the data base and correspondence of the school solution validated. Special monitor notes necessary for presentation control will be developed.

(3) Instructions/Data Collection: The imagery will be subdivided into 28 sessions consisting of 2 frames and 4 targets each. Two targets will be updated and two will require detailed descriptions. Monitor instructions and associated data collection materials defining start/stop times and test control information will be prepared for each session in both hard copy and soft copy forms.

(4) Data Base: The PACER data base corresponding to the image selection period will be frozen. Records associated with selected targets will be modified to produce desired test conditions. All entries made on the basis of selected frames will be deleted and saved as a basis

for school solutions. Additional school solution material will be obtained (wherever possible) from appropriate 1st, 2nd, and 3rd phase reports on covered targets.

E. Test Conduct.

(1) Schedule: Each interpreter will be required to complete 28 sessions of 2 hours each during the six week period allocated for this part of the test. Fourteen of these sessions will be on the CPTB station. 14 on the hard copy light table. There will be eight sessions run per day, 4 each, hard and soft copy. Because of limitations on the access to TEST PACER all hard copy sessions will be run simultaneously during the two hour period when TEST PACER is available. CPTB sessions will be run throughout the working day. Each Test interpreter will work two hours each day.

(2) Personnel: Because of the test schedule constraints of two hours per test interpreter per day, it appears most efficient to plan that all eight required test interpreters be drawn from the 544th SIW. Also because of TEST PACER schedule constraints this test will require extra monitors; a total of 5 required for one, two hour period. The remainder of each day will require one monitor, one system operator, and the test materials/data collection clerk.

F. Data Reduction/Analysis.

Time data collection by the test monitors will be recorded on keypunch creation sheets for later processing. Report items produced will be scored for completeness and accuracy against the school solution. Hard copy target materials produced will be scored for completeness/correctness and retained for quality judging. Time scores will be aggregated across interpreters by frame and report time and statistical comparisons of averages for hard and soft copy accomplished. Statistical tests (t-test) will also be performed on completeness and accuracy measures.

A-3 Part 3: Soft Copy Exploitation Concepts

A. General.

Part 3 of this test is designed to accomplish two major purposes: (1) investigate the contribution of the CPTB integrated data base approach to soft copy exploitation, and (2) to provide intensive hands-on experience for interpreters for other using commands in an operational environment. To accomplish this the test will utilize operational imagery and the actual PACER data base. The basis for evaluation will be a threeway comparison: (1) Hard copy, (2) CPTB as designed, (3) CPTB minus PACER integration.

B. Standard of Performance.

No absolute standard exists. Data will be concurrently collected to establish a hard copy (current practice) baseline for comparison with both CPTB employment concepts.

C. Measures of Effectiveness. (MOE).

(1) Time: Records will be kept regarding all milestone times from image available to report item complete for all three test conditions.

(2) Report item quality: Report items will be judged (paired comparison) for overall quality (i.e. each report item will be completed twice, once in one of the CPTB conditions and once in hard copy during the regular course of work in the 544th SIW. These two versions will be compared side by side in a forced choice paired comparison made by qualified USAF personnel).

(3) Completeness: For a subsample of the reports it is anticipated that appropriate 1st, 2nd, and 3rd reports from other sources will be obtainable. These will be used as a post hoc school solution that will permit completeness score computation by the standard means.

(4) Accuracy: In the same fashion as above, accuracy scores will be computed for a subset of the total reports.

(5) Ratings: All interpreters will complete extensive questionnaires regarding their evaluation of the two CPTB employment conditions.

D. Test Preparation.

(1) Imagery selection: There will be NO preselection of imagery except to insure that on each test day the CPTB image queue contains sufficient appropriate imagery for the assigned test interpreter.

(2) Image preparation: No special preparation of images is required except to insure that on each test day all imagery previously worked on the CPTB station has a "red tag" attached prior to distribution on the production floor of the 544th SIW.

(3) Instructions/Data Collection: Observer forms and image milestone time logs will be prepared prior to the start of test to support observer activity at both CPTB and hard copy stations and to facilitate record keeping of required image/report times.

(4) Data base: No special data base preparation is required except to insure that CPTB generated reports DO NOT actually enter the PACER data base. (It will be necessary to retain identical format copies of both hard copy and CPTB produced reports for later comparison).

E. Test Conduct.

(1) Schedule: Each test interpreter will work for two weeks (five work days, regular shift) one week on CPTB as designed, one week on CPTB without PACER integration. Each test interpreter will receive two weeks of CPTB training and practice (training shift) immediately prior to his two week test time. Scheduling of time periods for individual test interpreters will be worked out at the convenience of the participating commands. The total test time required will be 22 weeks.

(2) Personnel: This part of the test will require 10 test interpreters, 2 each from the 460th RTS, 497th RTG, 548th RTS, and FTD, 544th SIW.

Also required will be one full time CPTB observer and three or four part time hard copy condition observers. Three qualified USAF judges will be required periodically throughout the test period. CPTB system operators, CPTB instructors, NED maintenance personnel, and the test material/data collection control clerk will also be required.

F. Data Reduction/Analysis.

All time data will be tabulated as received. Report copies will be accumulated and judged on a biweekly basis (i.e. at the completion of each test interpreter period). Report grading against material from other sources will be accomplished at the end of the test period. Statistical comparison of CPTB vs. CPTB-PACER, HC vs. CPTB, HC vs. CPTB-PACER will be accomplished. Approximately 200 data points (reports) per interpreter per test condition are anticipated.

A-4 Detailed Test Schedule

Activity	# Weeks	Start Date	End Date
Pretest Preparation	16	1 OCT 80	16 JAN 81
Dry Run	4	19 JAN 81	13 FEB 81
Part 1 Tests	6	9 FEB 81	27 MAR 81
*PC1 Training	2	9 FEB 81	13 FEB 81
Test Run 1		16 FEB 81	20 FEB 81
PC2 Training	2	16 FEB 81	20 FEB 81
Test Run 2		2 MAR 81	6 MAR 81
PC3 Training	2	2 MAR 81	6 MAR 81
Test Run 3		9 MAR 81	13 MAR 81
PC4 Training	2	9 MAR 81	13 MAR 81
Test Run 4		16 MAR 81	20 MAR 81
PC5 Training	2	16 MAR 81	20 MAR 81
Test Run 5		23 MAR 81	27 MAR 81
Part 2 Test	8	30 MAR 81	22 MAY 81
Part 2 Training (8 SAC TII)	2	30 MAR 81	10 APR 81

* PC - Participating Command (Two test image interpreters)

Detailed Test Schedule (Continued)

Activity	# Weeks	Start Date	End Date
Part 2 Testing	6	13 APR 81	22 MAY 81
Part 3 Test	22	1 JUN 81	30 OCT 81
PC1 Training	4	1 JUN 81	12 JUN 81
Test Run 1		15 JUN 81	26 JUN 81
PC2 Training	4	15 JUN 81	26 JUN 81
Test Run 2		29 JUN 81	10 JUL 81
PC3 Training	4	29 JUN 81	10 JUL 81
Test Run 3		13 JUL 81	24 JUL 81
PC4 Training	4	13 JUL 81	24 JUL 81
Test Run 4		27 JUL 81	7 AUG 81
PC5 Training	4	27 JUL 81	7 AUG 81
Test Run 5		10 AUG 81	21 AUG 81
PC1 Training	4	10 AUG 81	21 AUG 81
Test Run 6		24 AUG 81	4 SEP 81
PC2 Training	4	24 AUG 81	4 SEP 81
Test Run 7		8 SEP 81	19 SEP 81
PC3 Training	4	8 SEP 81	18 SEP 81
Test Run 8		21 SEP 81	2 OCT 81
PC4 Training	4	21 SEP 81	2 OCT 81
Test Run 9		5 OCT 81	16 OCT 81
PC5 Training	4	5 OCT 81	16 OCT 81
Test Run 10		19 OCT 81	30 OCT 81

ANNEX B

OPERATIONAL SUITABILITY

OPERATIONAL SUITABILITY

1. MOE or Evaluation Criteria

   The test objective which addresses the various aspects of the operational suitability of the CPTB will be evaluated on a judgmental, subjective basis. No specific thresholds, standards, or goals will be established.

2. Methodology.

   To form a sound basis for judgment of the systems reliability, maintainability, and supportability records will be maintained throughout the entire test period including pretest preparation, dry run, training and test conduct. System contractor maintenance personnel will complete Problem Description Reports, Incident Reports, and Trouble Failure Analysis Reports (see examples following) covering all unscheduled maintenance activities. The test Director and Test Manager will maintain a log of system usage/availability documenting all test utilization time on the system (including preparation, training, etc.). For each time period a record will be kept of scheduled time, actual sign on/sign off time, time lost due to interruptions/failures, etc. The log will also contain observations/evaluations of system operation noting any anomalies, operating difficulties, etc.

3. Data Management

   Copies of all Maintenance Contractor reports will be filed in the test control area. The Test Manager will make periodic cross checks between the Log and the Failure Report file to assure complete data capture. The Failure reports will be reviewed and summarized by cognizant developing command personnel and the results prepared and submitted to the Test Team for inclusion in the test reports.

4. Evaluation.

   The Test Team Log and the results of the Failure Report summary will be reviewed by the participating command representatives, the RADC Test Director and the Test Support Contractor personnel as the basis for the evaluative conclusions/recommendations related to various potential system applications (e.g. further test bed use at RADC or possible future operational command utilization of the system or particular components).

PROBLEM DESCRIPTION REPORT

Initiator:_____Task_____

Date Submitted:_____

CM USE	PDR No:_____
	Logged:_____
	Priority:_____

Problem with
Subsystem/Function:_____Module:_____

Description of Problem:

Effects/Impacts:

Proposed Solution:

CM USE ONLY

Approved_____ Disapproved_____ Deferred_____ Analysis_____

Comments:_____

_____

Revision to Software:_____

Revision to Document:_____

Assigned to:_____Status Date:_____

Close-out Date:_____Initials:_____

Eaton Corporation
Data Systems Services Division
6374 Arizona Circle
Los Angeles, CA 90045

INCIDENT REPORT C 1445

1.0 Site/Location	1.1 System No.	2.0 Incident Occured yr	mo	day	time	2.1 FE Notified day	time

3.0 HARDWARE AFFECTED

3.1 Device Model No	3.2 Serial No	3.3 Symp Code	3.4 Repeat Incident	3.5 Sys Dwn	3.6 Device Dwn	3.7 On Site	On Call

4.0 MAINTENANCE DATA

4.1 FE Arrived day	time	4.2 Equip Returned to Service mo	day	time	4.3 System Down hours	min	4.4 CPU Running Time Meter	4.5 Actual Man-hrs of Repair Time hours	mins

4.6 CODES – P-Awaiting Parts G-Customer Delay V DSSD Delay T Travel Time O=Other Delay S=Suspended Time

Code	hours	mins	Code	hours	mins	Code	hours	mins	Code	hours	mins	Code	hours	mins

4.7 Description of Problem

4.8 Description of Maintenance Action

5.0 PARTS DATA

5.1 Parts Code DSSD	Cust.	Delay	5.2 Part Number	5.3 Description	5.4 Qty.

ACCOUNTING

_____ Hours @ _____ = _____
_____ Hours @ _____ = _____
_____ Hours @ _____ = _____
_____ Miles @ _____ = _____
Expenses _____
_____
_____
_____ = _____

PARTS = _____
TAX = _____
TOTAL = _____

Proj/Sub

☐ T&M ☐ Contract

7.0 REMARKS

8.0 Submitted by	Field Engineer(s)	Employee No	Total Maint. Time	Customer Signature Title

Mail to: (WHITE) **Customer** (CANARY & PINK) **Accounting** (GOLDENROD) (GREEN) **Data Systems Services Division Supervisor**

FORM 733 D WP

TROUBLE AND FAILURE ANALYSIS REPORT

- 56 -

☐ ACTION REQUESTED

No 010940

PROJECT	SUB SYS						AF CODE	PART NAME	MANUFACTURER

FAILED PART NO	F.P. DASH NO	L	F.P. SERIAL NO	R&D	CAUSE OF FAILURE PART NO	DASH

C.F. SERIAL		CIRCUIT SYMBOL	NEXT ASSEMBLY NO	N.A. DASH	L	N.A. SERIAL	TEST DOCUMENT NO.	DASH	L

		TROUBLE OR FAILURE	UNSCHEDULED ADJUSTMENT	OTHER - SEE DESCRIPTION	TROUBLE OR FAILURE OCCURRED DURING	BENCH TEST	SYSTEM TEST	ASSY TEST	PR FLT TEST	FLIGHT TEST	FLIGHT NO

MO DAY YR	SECONDARY FAILURE	RECURR FAILURE	PREVIOUS PRIME FR	OPER HRS - CYCLES	TEN	REPORTED BY

SUPPORTING DOCUMENTS

DESCRIPTION OF TROUBLE OR FAILURE

HISTORY

PRELIMINARY ANALYSIS

INITIATED BY ______ ______ ORGN NO

CORRECTIVE ACTION

INITIATED BY ______ ORGN NO ______ DATE ______

ANNEX C

EVALUATION CRITERIA

(not required)

ANNEX D

SOFTWARE EVALUATION

SOFTWARE EVALUATION

1. General.

Although current program direction does not call for the CPTB system to become operational, much can be learned from an evaluation of the software both from the operability and maintainability points of view. The procedures employed in this evaluation will be drawn from the AFTEC Manual "Software OT&E Guidelines, Volume III, Software Maintainability Evaluation Handbook", 1 August 1979, supplemented by similar procedures directed at operability aspects.

2. MOE or Evaluation Criteria.

The test objective concerned with software maintainability and operability will be addressed on a judgmental, subjective basis. No specific standard comparison (e.g. a predecessor system) exists. No specific thresholds, standards, or goals will be established. The evaluation will be directed at appraising, on a judgmental basis, the degree to which the system software could be supported by USAF assets, independent of the developing contractor.

3. Methodology.

The methodology to be employed in evaluating the CPTB software qualities of maintainability and operability is based upon the use of closed form questionnaires with optional written comments. The questionnaires are designed to determine the presence or absence of certain desirable maintainability attributes in each major software component. The attributes employed are: (1) Modularity, (2) Descriptiveness, (3) Consistency, (4) Simplicity, (5) Expandability, and (6) Instrumentation. Both the program documentation and the source listing of each major software component will be reviewed and rated for each of the attributes.

A parallel investigation of the operator interface for each relevant software component will be accomplished from an operability point of view. The Operability characteristics to be rated are: (1) Assurability, (2) Controlability, (3) Work Load Resonability, (4) Descriptiveness, (5) Consistency, and (6) Simplicity.

In addition to the detailed examination/rating of software components a complete file of all Baseline Update Requests (see example) will be maintained. These requests, generated by system contractor personnel during maintenance activities, will be duplicated and copies delivered to the test control area weekly. The copies will be logged in and tracked to final disposition.

Software maintainability raters will be drawn from SAC/AD and from RADC. Software operability raters will include the four SAC/AD supplied system operators and the TII's from Parts 2 and 3 of the Test.

Duplicates of program documentation and source listings will be supplied to reach evaluator, by RADC, from the system deliverable package following Final Acceptance Testing. Each maintainability evaluator will be assigned a system familiarization period of two to three weeks during which there will be an opportunity to observe (on a not-to-interfere basis) system operation and maintenance. The operability evaluators will have received formal system training and had actual experience in system operation.

4. Data Management.

Questionnaire answer sheets completed by software evaluators will be delivered to the Test Materials/Data Control (TM/DC) Librarian as they are completed. The TM/DC Librarian will maintain a checklist matrix, Evaluator X Software component to insure that each evaluator rates each component. In addition a composite verbatim transcript of evaluator comments, organized by individual software components, will be compiled. When all evaluations have been received composite ratings will be compiled. Items with large discrepancies on ratings will be noted and resolved in a final evaluator conference. Results will then be compiled and incorporated in the final test report.

BASELINE UPDATE REQUEST

Initiator:_____

Date Submitted:_____

CM USE
BUR No:_____
Logged:_____
Priority:_____

Update to
Subsystem/Function:_____ Module:_____

Note: All files must be located on the development DB:. Use one line per file.
If more space is needed, use extra sheet of blank paper.

SoftwareName.Ext	Module ID	Entry Point	TCR's	Task ID	CPMAC	CPLIB	New	Update	Source UIC

Documentation to be updated:_____

Reason for Change:

Effect/Impact:(e.g., anything else to be reMAC'd,reTKB'd?)

PDR's Closed:

CM USE ONLY
Approved_____ Disapproved_____ Deferred_____ Analysis_____
Comments:_____
_____
Scheduled Update:_____
Close-out Date:_____ Initials:_____

ANNEX E

INTELLIGENCE AND THREAT

(not required)

ANNEX F

DATA MANAGEMENT

DATA MANAGEMENT PLAN

1.0 General.

The procedures for the management of the anticipated large volume of data to be collected in the course of the planned three part test program can be subdivided in two ways; first in terms of the test parts and second in terms of specific steps. Each test part requires different procedures. In all parts of the test the following key steps must be addressed, following initial collection: (1) receipt, (2) validation, (3) reduction, (4) retention, (5) processing, and (6) analysis. The primary responsibility for these activities rests with the 544th SIW Test Director although the actual implementation of procedures will be the duty of test support contractor personnel; the on-site test manager and the Test Materials/Data Control (TM/DC) Librarian.

2.0 Part 1. Special tests.

There are two major data sources for Part 1; the TA/DC booklets and the TII evaluation. Handling of both types is summarized in Figure F-1.

2.1 Receipt.

Upon completion of each test exercise the monitor will return all test materials to the Test Control Area. The TM/DC Librarian will check in all materials, separating and refiling the monitor materials, (instructions, annotated hard copy, etc.), verifying completion of the TII evaluation (if required by the schedule) and insuring correct labeling of both TA/DC booklet and TII evaluation form. Labeling will include: Test Exercise number, date/time, TII number, and monitor name.

2.2 Validation.

The TM/DC Librarian will review the TA/DC booklet checking for the following: (1) each data entry complete, (2) start time earlier than stop time, (3) notations of test interupts, system failures, etc., and (4) general legibility. Anomalies will be annotated and discussed with the monitor at the earliest opportunity. (While it is probably not possible in most instances to recover missing data, feedback to monitors should minimize future repetitions of errors.) TII evaluation

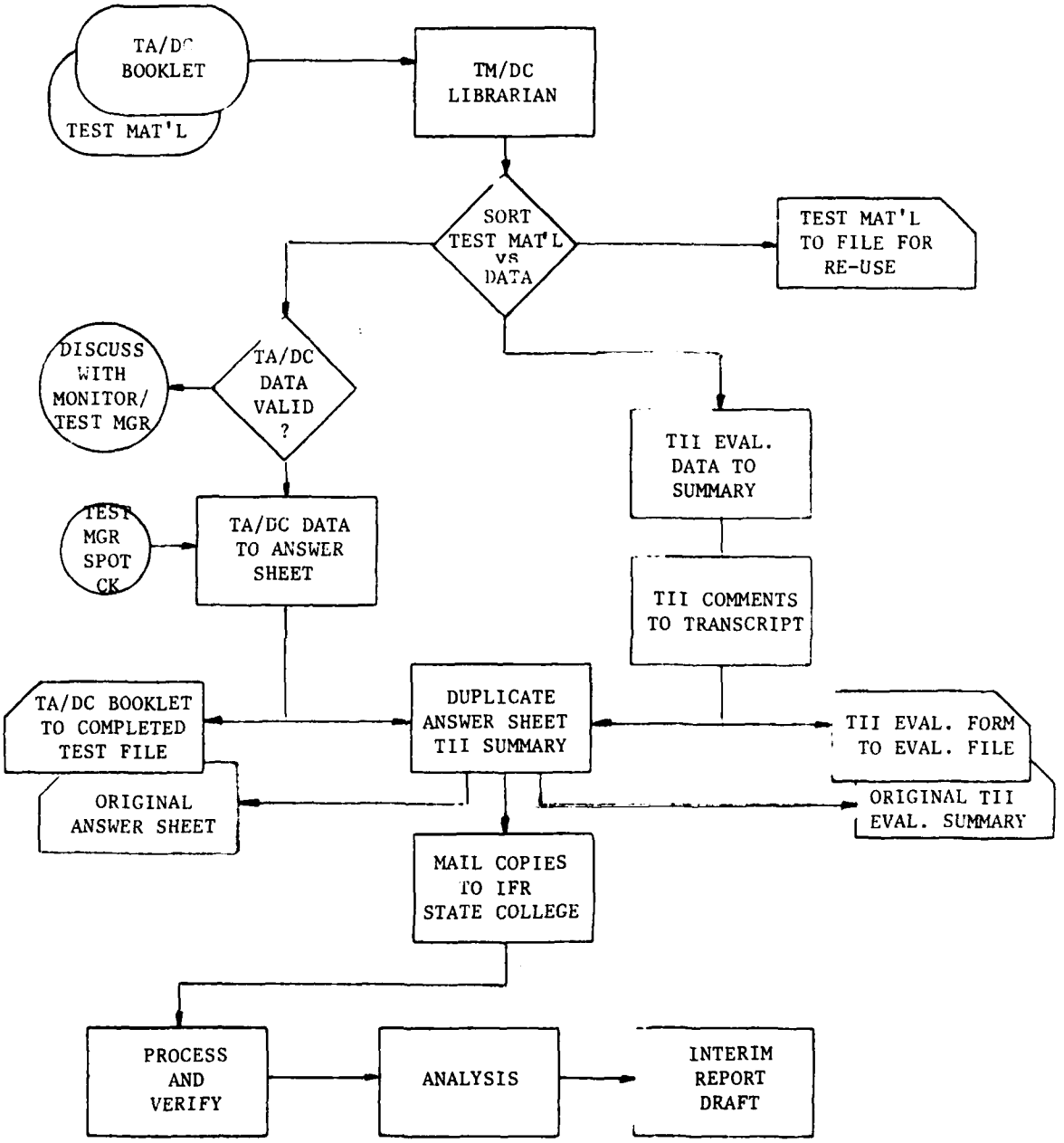


Figure F-1 Data Management Schematic, Part 1

forms will be reviewed for completeness and legibility only.

2.3 Reduction.

TA/DC booklets will be reduced to unclassified answer sheet form as soon as possible following receipt and validation. Transcription of times and answers will be accomplished by the TM/DC Librarian. Quality control of this process will be effected by periodic spot checks by the Test Manager.

TII evaluation forms will be summarized on a master copy, recording specific item by item responses and compiling item by item verbatim transcripts of comments.

2.4 Retention.

The TA/DC booklet from each test exercise will be filed in chronological order within each test exercise. Test exercise files will be grouped by specific Part 1 subtest. Each answer sheet will be duplicated and one copy filed with the TA/DC booklet, one copy forwarded to IFR State College for processing and analysis. TII evaluation forms will be separately filed in chronological order, grouped by Part 1 subtest.

2.5 Processing.

The answer sheets will be processed into machine readable data records and 100% verified. Each data record will retain all relevant data labeling including: test exercise number, TII ID, Monitor ID, frame number, resolution factor, options exercised, etc. TII evaluation data will not require further processing beyond the completion of the summary.

2.6 Analysis.

Computer analysis of the TA/DC data utilizing standard statistical routines will be accomplished on the IFR micro-processor system or at the Computation Center of The Pennsylvania State University, depending on data volume and analysis complexity. Access to the IFR system is assured since it is a dedicated facility. Use of the Penn State facility is scheduled, with anticipated run turn around time of 1-12

hours depending on run size. TII evaluation form data will be analyzed manually.

3.0 Part 2, DIAM 57-5 Reporting.

There are four major types of data collected during the Part 2 tests: (1) Time data from the Monitor Forms; (2) Report items/data base entries generated; (3) Target materials (H/C) generated on CPTB, and (4) TII evaluation forms. In addition, the test materials used in the hard copy (HC) condition must be collected, checked, and filed for re-use. Handling of the four data types and the test material is summarized in flow chart form in Figure F-2.

3.1 Receipt.

At the end of the first test exercise period of each test day the monitors (1 soft copy, 4 hard copy) will return all materials to the Test Control Area. The TM/DC Librarian will check in all materials, separating data records from test support material (i.e., Monitor instructions, reference prints, etc.) and HC test material. Test support material and HC test material will be refiled for reuse. Completion of data records (i.e. Monitor time sheets) both HC and SC, will be verified and checked for complete/correct labeling. Target materials produced on CPTB will be verified for completion/labeling. Printout of SC generated report items/data base entries will be received from SC monitor and verified for completion/labeling. Upon completion of this initial data receipt the TM/DC Librarian will retrieve from PACER highspeed printer all HC generated report items/data base entries, verifying completion/labeling of outputs from all four HC exercises. At the end of test exercise periods 2, 3, and 4 of each test day the SC portion of the above data receipt will be repeated. At the end of the entire Part 2 test period the 8 TTI's will, as a group, complete the evaluation forms and return them to the Test Control Area where the TM/DC Librarian will review each for completeness and proper labeling.

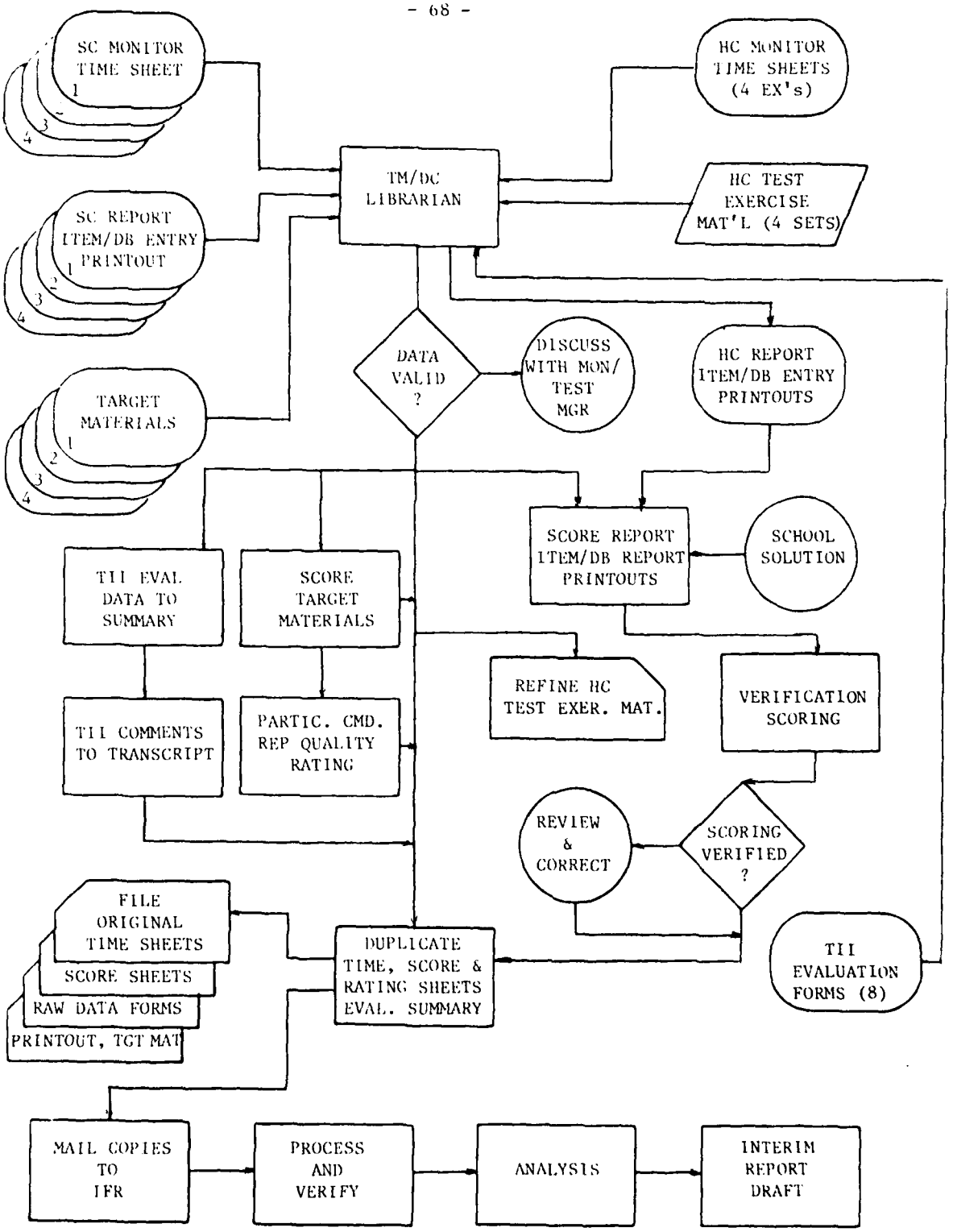


Figure F-2 Data Management Schematic, Part 2

3.2 Validation.

Following initial check in/receipt of data records from each test exercise period the TM/DC Librarian will review all Monitor Time Sheets, checking for the following: (1) each data entry complete; (2) start time earlier than stop time; (3) clear, complete notations of test interupts, system failures, etc., and; (4) general legibility. Anomalies will be annotated and discussed with monitor at earliest opportunity to effect corrections/data loss recovery (where possible) and to prevent recurrence of errors/omissions. Report items/data base entries and target materials will be reviewed in an attempt to detect systematic errors/omissions that may be result of inadequate test control/instructions. Any such anomalies will be reported to the Contractor On-site Test Manager for corrective action. TII evaluation forms will be reviewed for completeness and legibility only.

3.3 Reduction.

It is anticipated that the Monitor Time Sheets will be in the form of unclassified keypunch creation sheets requiring no transcription prior to processing. Report items/data base entries and Target materials will be scored against school solutions and completeness and accuracy data recorded on unclassified data sheets by TM/DC Librarian. Quality control of the scoring/recording process will be accomplished by replication of all scoring/recording by second member of Test Team (probably HC monitor) and comparison verification. Any discrepancies will be resolved by joint rescoring of subject record.

TII evaluation forms will be summarized by the TM/DC Librarian on master copy, recording specific item by item responses and compiling item by item verbatim transcript of all comments.

Target materials will be accummulated for quality evaluation by participating command representatives. Each participating command representative will review the target materials (4 replications of each frame used judged as a group) using a standardized rating sheet. The individual ratings will be collated and compiled by the TM/DC Librarian.

3.4 Retention.

Monitor Time Sheets, report item/data base entry printouts, and Target Materials will be filed by test exercise, separated by Hard Copy/Soft Copy conditions. Monitor Time Sheets, report item/data base entry score sheets and Target material score sheets will be duplicated. The originals will be filed in the Test Control Area; copies forwarded to IFR, State College for processing and analysis. Target material quality evaluations will also be duplicated and handled similarly. TII evaluation forms will be filed as a group in the Part 2 files.

3.5 Processing.

The Monitor Time Sheets, report item/data base entry score sheets and target material score sheets will be processed into machine readable data records and 100% verified. Each data record will retain all relevant labeling including: test exercise number, TII ID, Monitor ID, frame number, installation ID, imagery parameters, etc. Target material quality ratings and TII evaluation data will not require processing beyond original collation, compilation, and summarization.

3.6 Analysis.

Data from Monitor Time Sheets and report item/data base entry scoring will be analyzed, using standard statistical routines, on the IFR micro-processor system or at the Computation Center of The Pennsylvania State University via an established RJE link, depending upon actual data volume and analysis complexity. Access to the IFR system is assured since it is a dedicated facility. Use of the Penn State Center facilities is scheduled as required with an anticipated job turn-around time of 1 to 12 hours depending on run size.

Target material scoring and evaluation data, and TII evaluation form data will be analyzed manually.

4.0 Part 3, Soft Copy Exploitation Concepts.

The data for the Part 3 test are of three major types; (1) interpretation products; (2) observer records, and; (3) TII evaluations. The interpretation products are report items/data base entries generated

under all three test conditions which will be evaluated and compared in a variety of ways involving both subjective ratings and objective scoring in relation to baseline information from other sources. The observer records will consist of task timing and function use data plus listings of frames/installations worked in the CPTB conditions. The TII evaluations will result from the completion of questionnaires/ rating sheets by each participant at the end of each test condition (CPTB conditions only). The overall data management flow is summarized in Figure F-3.

4.1 Receipt.

The CPTB conditions observer will twice daily (at lunch break and at end of shift) deliver to the TM/DC Librarian all observation forms, printouts of all interpretation products, and a complete inventory of all frames/installations completed during the test segment. The HC baseline observer(s) will, on a similar schedule deliver all observation forms and a complete listing of test relevant frames/installations completed during that test segment. Interpretation products resulting from the HC baseline condition will be obtained, by the TM/DC Librarian from the PACER high speed printer. All materials will be cross checked to insure complete data sets (i.e. matching observer form, interpretation product and frame/installation listing). Each item will be checked for proper labeling at time of receipt. Labeling will include date, time, test condition, interpreter ID, Observer ID, and frame number.

4.2 Validation.

The major validation activity related to these data will be a review, by the TM/DC Librarian to insure complete matching data sets for CPTB condition(s) and the corresponding HC baseline. Each observer form will also be reviewed for (1) completeness, (2) start/stop time coherency, notations of test interrupts, system failures, etc. and general legibility. Anomalies will be discussed with Test Manager/Observer at earliest opportunity to prevent recurrence of problems and resultant continued data loss. TII evaluation forms will be reviewed for completeness/legibility.

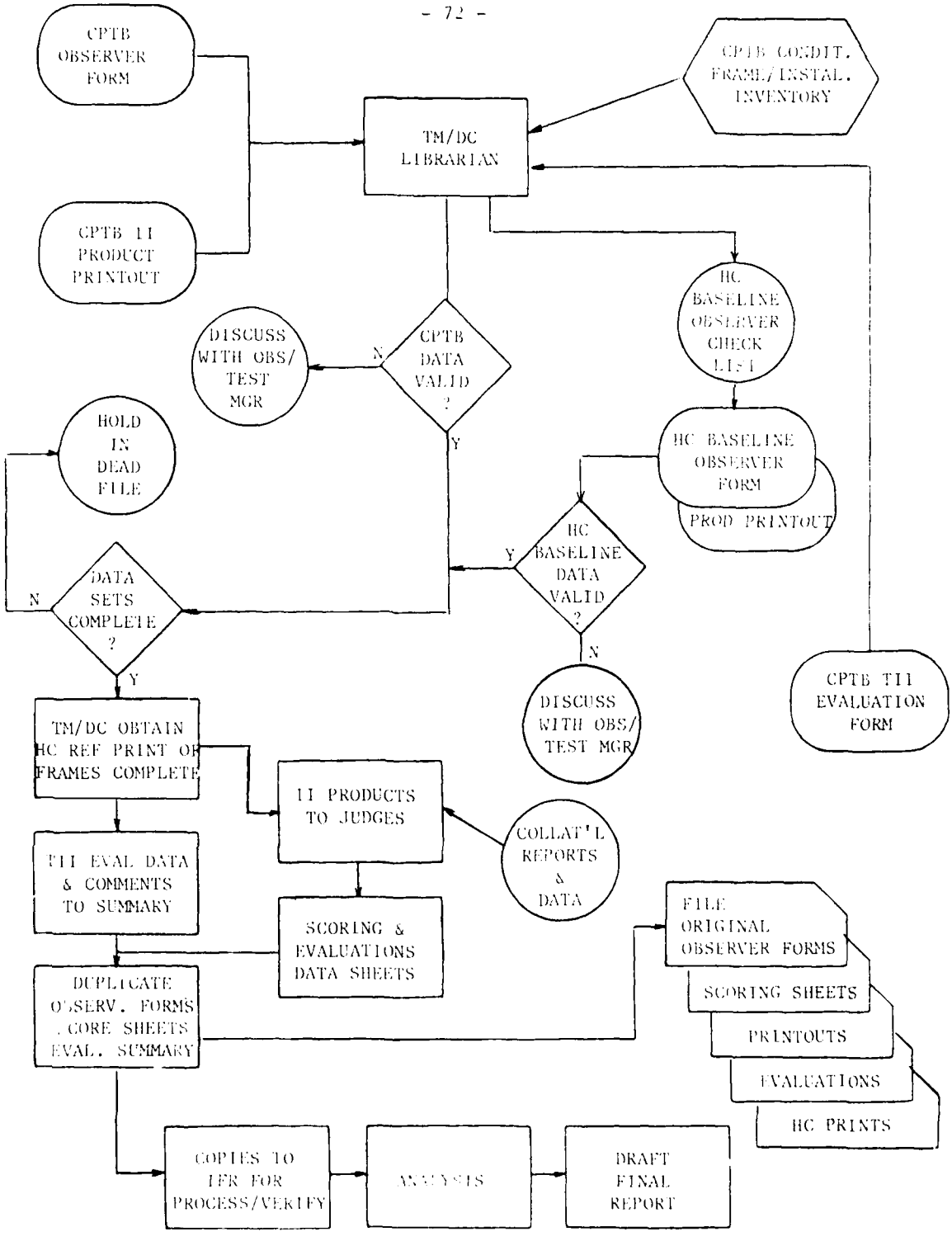


Figure F-3 Data Management Schematic, Part 3

4.3 Reduction.

No immediate scoring or transcription will be required for observer forms or interpretation products. The observer form (time data only) is anticipated to be unclassified. These forms will be separated from any notes/additional observations which may require security classification. The major initial activity will be the generation, from the CPTB frame/installation inventory, of an HC baseline observer checklist identifying the test relevant frames to be observed during subsequent test segments.

TII evaluation forms will be summarized on a master copy, recording specific item by item responses and compiling item by item verbatim transcripts of comments.

4.4 Retention.

Files will be established by the TM/DC Librarian such that each data folder will contain the following for each frame completed: (1) Original CPTB condition observer form, (2) Original HC baseline observer form, (3) printout of CPTB interpretation products, (4) printout of HC baseline interpretation products, (5) Reference dupe pos of frame, and (6) CPTB condition observer notes. Data folders will be organized in chronological order by test segment in terms of CPTB interpreter ID. Copies of observer time sheets will be forwarded to IFR, State College for processing.

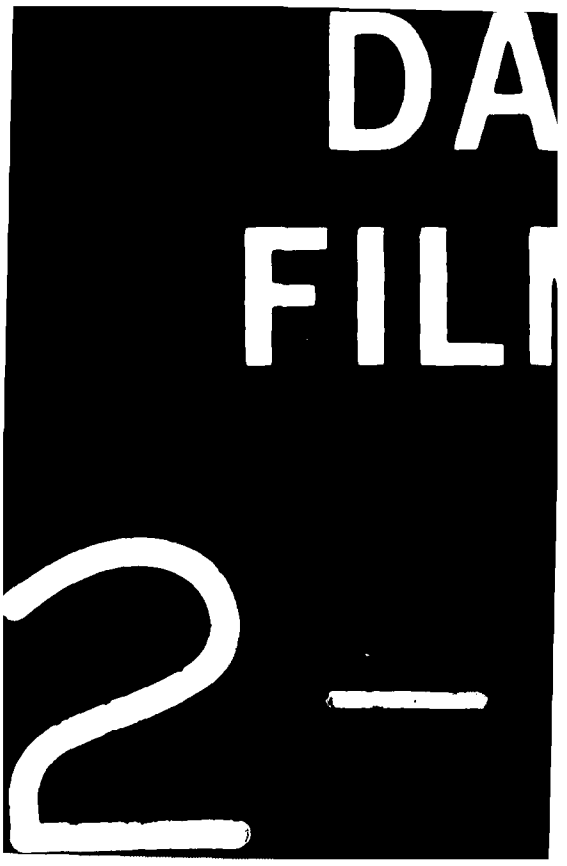
4.5 Processing.

Processing of the Part 3 data will occur in several stages. The observer time data will be directly transfered from the observer sheets to machine readable records and 100% verified. The interpretation products will require scoring/evaluation by participating command representatives at the Test Facility. Scores and evaluations will be recorded on unclassified data sheets. These sheets will be copies, originals filed in data folders and copies forwarded to IFR, State College to be transcribed into machine readable records for computer analysis. TII evaluations will not require processing beyond the original summarization.

4.6 Analysis.

Data from the observer forms and from the scoring/evaluation of interpretation products will be analyzed, using standard statistical routines, on the IFR micro-processor system or at the Computation Center of The Pennsylvania State University via an established RJE link, depending upon actual data volume and analysis complexity. Computer access is assured as indicated in sections 2.6 and 3.6.

TII evaluation data will be analyzed manually.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