PPBS/RED reference for 72-76. ctls. DRAFT 6 Jan 70

25X1 per [redacted]

I. OVERHEAD PHOTOGRAPHY/IMAGERY INTERPRETATION PROCESS RESEARCH

A. Program Objective (FY 70-76): Identify, evaluate, and quantify the human factors element of the imagery exploitation process so that such knowledge can be utilized to increase the effectiveness of the process; determine the intelligence value of both conventional and unconventional (e.g.,) [redacted] imagery. 25X1

Discussion: The process of imagery exploitation is bound at one extreme by the needs of the analyst in the intelligence community and at the other extreme by the design characteristics of the collection system. An integral part of these needs is an appreciation for the intelligence value of (the various types of) imagery. Within the process itself, significant factors are the quality and character of the film or imagery medium, the equipment, procedures, and techniques used in the exploitation process, and the characteristics, attitudes, and skills of the imagery analyst.

This program addresses both the intelligence value of imagery and the human factors relating to it. In the latter case, it is designed to determine those human characteristics, inherent and acquired, which influence the imagery exploitation process and to apply this knowledge in understanding and improving the process; to develop criteria to improve the selection and training of imagery analysts and others involved in the exploitation process; to identify those areas where modifications to equipment, facilities, or the environment will improve the efficiency or effectiveness of human performance; to insure, based upon human factors principles, that the design and use of

exploitation equipment is compatible with and takes maximum advantage of human traits, habits, and characteristics; and to define the human aspects involved in the assessment of image quality.

In the case of intelligence value, this program is directed toward the accumulation of data that will allow an objective determination of what information, additional to that provided by conventional black and white photography, is provided by unconventional collection systems and, subsequently, an evaluation by the analytical community of the intelligence value of that additive information.

B. Program Progress

1. Human Factors

a. Comparative tests to measure the performance of imagery analysts and photogrammetrists on selected mensuration tasks were designed and administered; the results of these tests have served as a basis for decision in the areas of equipment purchase and procedural changes.

b. Through a controlled test of mensuration performance, a statistically sound approach to mensuration accuracy statements was developed; this approach has increased the level of confidence of Center dimensional error statements.

c. A comparison of achievements and skills was made between on-the-job experience and the 12-week training program for new imagery analysts, the Defense Sensor Interpretation and Application Training Program; the findings resulted in a decision to schedule all new imagery analysts for this training program.

d. A preliminary validation of an Agency-administered imagery interpretation test battery for use in evaluating appli-

cants was undertaken, and development of an Imagery Analyst Target Knowledge Inventory was initiated. This inventory will serve as the basis for development of an in-house training course supplemental to the Defense Training Program.

e. Utilizing a five-year projection approach, the functions of the imagery analyst and collateral support officer were analyzed to determine possible areas of applicability for automation of manual operations.

f. In the future, photographic imagery may well be supplemented for analysis purposes by line-scan imagery (cathode ray tube). An elementary study was undertaken to determine the level of resolution of line scan imagery, as compared with photographic imagery, deemed necessary for exploitation by the imagery analyst

g. A review of articles pertaining to imagery exploitation research was conducted, and those relevant to Center operations were abstracted. Contacts were established with industrial and governmental research and development facilities for the purpose of obtaining, on a continuing basis, human factors information pertinent to exploitation equipment design. The PI Equipment Human Engineering Design Guide, a summary of physiological and engineering information applicable to the design of imagery exploitation hardware, was updated by inclusion of specific sections pertaining to acoustics and comparators.

h. Recent studies have indicated that the convergence angle of microstereoscope eyepieces might influence visual performance; preliminary research was undertaken to determine the effect of the convergence angle of optical instruments on imagery analysis.

2. Intelligence Value

a. Two pilot studies, undertaken to determine the level of resolution necessary for satisfactory exploitation of imagery to meet existing intelligence requirements, were completed; a third such study is now in process.

b. A project has been initiated to obtain [redacted] at 25X1
different resolution along [redacted] with the necessary ground 25X1
truth information. This effort will provide an opportunity to correlate ground truth with the imagery obtained; it also will provide the data necessary to conclude what additive or complementary information is provided by an [redacted] 25X1
compared to black and white imagery.

C. Program Plans

1. Human Factors

a. Alternatives

(1) Accelerate the program by applying more funds and reducing the performance time frame. This is not practical to any great extent since much of the work is sequential in nature.

(2) Stretch out the program by extending the time frame and thus reduce annual expenditures. This would negate the benefits of the program since much of its thrust is designed for application against systems being considered and equipment being developed for use within the time frame of this program.

(3) Reduce the scope of the program and thereby reduce the expenditure of funds. This is a possibility, but ~~choice~~ this alternative would reduce program effectiveness since the various areas are interrelated and the optimum advantage is achieved when all areas are pursued simultaneously.

(4) Continue at the present rate. The present schedule is designed to feed in data in time to be applied to oncoming programs [redacted] 25X1

25X1 [redacted] to provide a basis for the development of equipment to be used in ~~exploitation~~ exploiting these new systems, and to enable the establishment of techniques and procedures which will permit the Center to cope with the significant increase in input attendant to the

25X1 [redacted]

b. Approaches Selected

The alternatives of continuing this program at its present rate ~~is~~ was selected as being the most desirable. The program will be accomplished ~~under Center control~~ through the medium of one major contractor, a number

Plans

of minor contractors with specific areas of specialization supplemental in-house efforts, and support from the CIA Medical Staff. A significant portion of the in-house effort will be accomplished through the Technology Integration Check-Out Facility (TICOF) used for gathering imagery analyst performance data under controlled conditions. (TICOF itself was an earlier accomplishment under this program.) The analysis of inherent or acquired human characteristics involved in the imagery exploitation process will continue; specific characteristics which affect or are affected by new systems [redacted] advanced hardware, or changed procedures will be investigated. Based on these research findings, determination will be made as how to best apply the results, such as establishing new recruitment standards, retraining or reorientation of personnel, modification of procedures, or redesigning equipment. Efforts will continue in investigation of potential applications of automation to the imagery exploitation process, specifically with respect to graphics display (FY 70/71), line scan systems (FY 70-76), collateral material presentation (FY 70-76), and text editing (FY 70-76). Identification of the human factors which affect the assessment of image quality and dictate the level of quality needed for exploitation will be continued. State-of-the-art knowledge of human factors research will be maintained; the Human Engineering Design Guide will be updated as required.

25X1

placed in objective by [redacted]

25X1

not used

2. Intelligence Value

a. Alternatives

(1) Rely upon extrapolations of available and uncalibrated imagery obtained from conventional and unconventional collection systems for the purposes of intelligence assessment.

(2) Obtain simulated and operational imagery relating to these systems with the necessary ancillary information to allow more effective intelligence assessment.

b. Approaches Selected

The second alternative was selected. In this time period investigations utilizing various selected target types will continue and imagery collection systems.

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25X1

D. Resources

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III. Overhead Photography/Image Analysis and Maniuplation

A. Objective (Program) (FY 68-76)

Develop a Center capability to define, evaluate, and manipulate the physical properties of the output of conventional and unconventional imagery systems to realize (more fully the information) potential of imagery.

Discussion: Potentially valuable information recorded on imagery is often at the limit of the response of the collection system. Defining and understanding the physical properties of imagery provides keys to the development of equipment and processes for making this information more readily available to the imagery analyst.

1. Image Analysis Objective (FY 70-76)

Improve conventional image quality measurement and determine the realtionship and degree of correlation between objective and subjective imagery evaluation criteria.

Discussion: At the present time, evaluations of the quality of imagery are based predominately on subjective judgments; frequently these judgments are inconsistent with evaluations based on objective analyses. This photo-optical image evaluation effort is directed toward resolving this inconsistency by providing an objective assessment of image quality that is reconcilable with subjective judgment. While this problem has been addressed in the past, it has not been solved; the importance of continuing to seek a solution lies in the value of answers to questions concerning (exploitation) equipment and collection system design. Satisfactory design in both these areas requires

an objective, quantifiable statement of image quality.

2. Image Manipulation Objective (FY 70-74)

Achieve an operational image manipulation system with the capacity to compensate for image-degrading factors which occur during acquisition and/or processing of conventional imagery.

Discussion: Atmospheric haze, low sun angle, defocus, image smear, etc., are factors that can degrade imagery. Image manipulation is directed toward compensating for these image-degrading factors in order to make the imagery more readily and completely interpretable.

3. Unconventional Imaging Systems Objective (FY 71-76)

Determine the fundamental parameters, techniques, and equipments necessary to fully exploit the information potential of unconventional imaging systems.

Discussion: Anticipating an increase in unconventional imagery [redacted] it is necessary that research to ensure full exploitation of the products of these systems be undertaken. The objective is directed, therefore, toward establishing the capability to extract as much information of real intelligence value as possible from these new systems. 25X1

B. Program Progress

1. Image Analysis

Three contracts were concluded during the period. The first defined the present state-of-the art in photo-optical image evaluation; it recommended a general approach to finding a solution to the problem of relating subjective quality estimates to objective measurements. The second contract was an initial effort directed toward applying the theory developed and establishing basic conditions for evaluating optical Toward

components. The third contract attempted to establish requirements for microdensitometric analysis of color and black and white photographic imagery for use in objective assessment of quality.

2. Image Manipulation

The capabilities of digital, optical, and photographic manipulation systems are being explored by the Center with contractor support. Preliminary results of experiments designed to extract additional intelligence of value from degraded imagery through a digital process are favorable. The evaluation of results in each system will determine the maximum payoff to be gained by (1) the application of one of the above systems, (2) establishing a capability in each system to be applied selectively against specific conditions, and (3) development of a hybrid system to incorporate the relative advantages of more then one system. Time-phased plans are under development for evolution from experimental to operational status. As part of the manipulation effort, imagery enhancement techniques for improving degraded portions of film are being explored and developed for the digital and electronic modes.

3. Unconventional Imaging Systems

A literature search has been initiated and state-of-the-art capabilities are being investigated. Some limited feasibility experiments have been performed with existing equipment,

utilizing optical, digital, and photographic processes. Development of the overall program is in the planning stage.

C. Program Plans

1. Image Analysis

(a) Alternatives

(1) Utilize and refine, at a minimal level of effort, the work on objective measurement accomplished to date and concentrate upon subjective evaluation of imagery in an attempt to define and correlate objective and subjective criteria for image evaluation.

(2) Concentrate heavily on what could be termed the theoretical aspects of subjective and objective image evaluation before proceeding toward definition and correlation of objective and subjective evaluation criteria.

(3) Develop new objective evaluation techniques where beneficial, based upon the work previously accomplished, and direct additional effort toward determination of the significant subjective factors in image evaluation; define and correlate subjective and objective criteria for image evaluation.

(b) Approaches Selected

The first alternative is a high-risk option with relatively low expected value; that is, even if accomplished successfully, at best the objective would be met only minimally. The second alternative would

afford a firm scientific foundation against which to proceed; however, performance time and costs would be increased beyond what is considered desirable or necessary to achieve the objective. In effect, the second alternative would result in project performance being extended over a longer period of time without elimination of any of the essential subsequent steps. The third alternative has been selected because it embodies the best trade-off between risk, cost, and pay-off. Significant milestones in reaching the objective under this alternative are: FY-72, complete the study of objective evaluation techniques; FY-73, identify and codify the significant objective measures; FY-74, complete the study of subjective evaluation measures; FY-75, determine the correlation procedures for objective and subjective evaluation; FY-76, operationally implement the evaluation techniques.

2. Image Manipulation

(a) Alternatives & Approaches Selected

Although significant work has been accomplished toward this objective, the project is still in a preliminary phase with respect to future direction; that is, the feasible alternatives in accomplishment of the objective cannot yet be specified. However, because of the nature of this project, it is clear that certain work can and must be done in-house,

while other work will have to be done under contract; therefore, the approach will be to do in-house what is desirable and feasible and contract for the remainder. Significant milestones toward accomplishment of the objective are: FY-70, establish in-house experimental capabilities in digital, optical, and photographic image manipulation; FY-72, determine and evaluate the operational applications for digital, optical, electronic, and photographic manipulation techniques; FY-73, specify operational equipment requirements; FY-74, develop prototype equipment; FY-75, test and evaluation of prototype equipment; FY-76, implement the system for operational use.

3. Unconventional Imaging Systems

(a) Alternatives and Approaches Selected

The status of this effort is roughly equivalent to that of image manipulation and the overall approach will be approximately the same. Significant milestones, identifiable at this time, toward accomplishment of the objective are: FY-71, perform a needs analysis, establish priorities, and define the program; FY-72, begin program execution.

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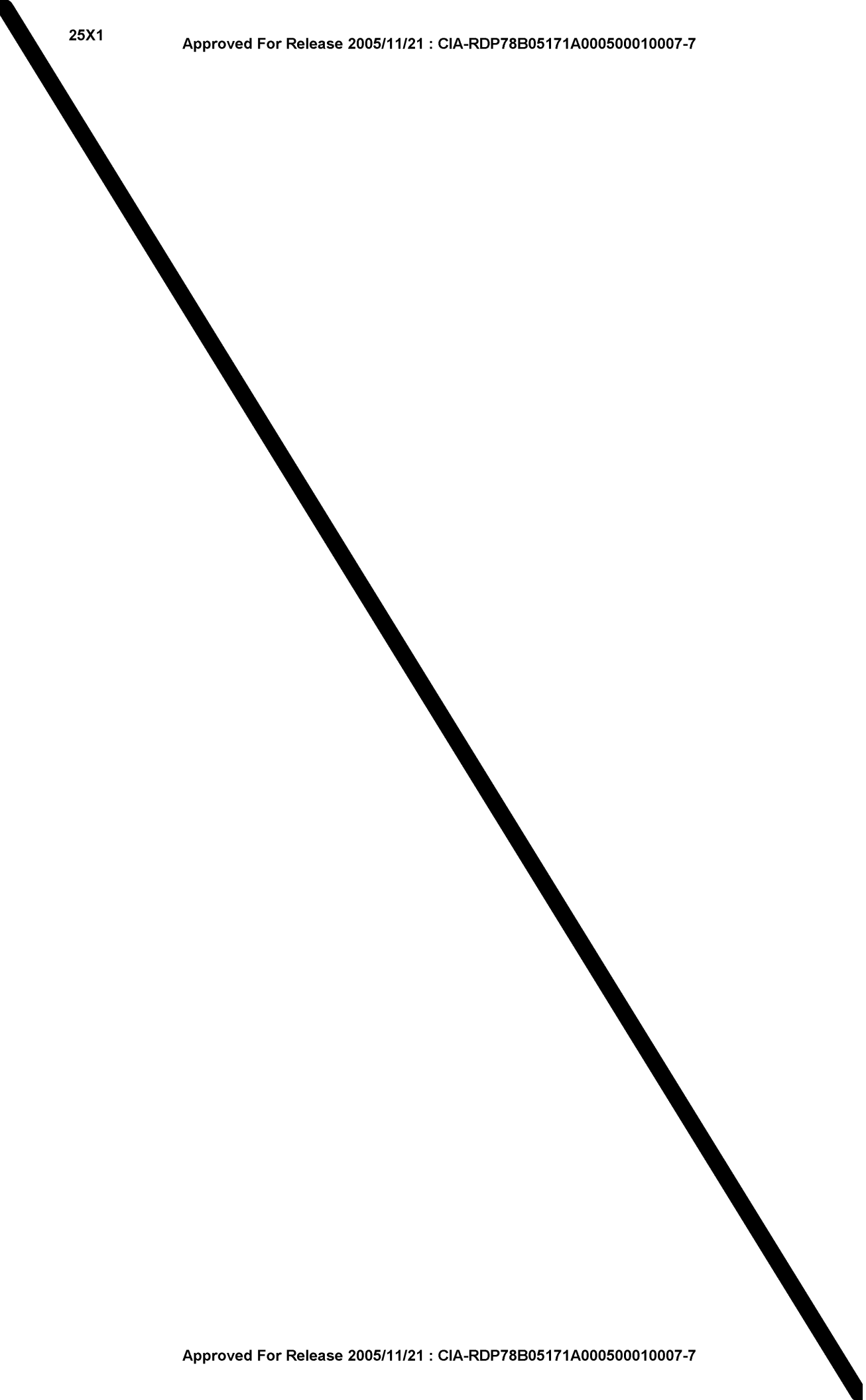

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IV. OVERHEAD PHOTOGRAPHY/IMAGE INTERPRETATION INSTRUMENTS AND TECHNIQUES

A. Program Objective: To provide the instrumentation necessary to accomplish timely imagery exploitation at the performance level required.

Discussion: The development of image interpretation equipment rests upon two requirements; firstly, the need to make information available to the imagery analyst which could not be perceived without the assistance of such equipment and, secondly, the need to improve the efficiency of the imagery analyst. Examples of equipment development resulting from the first requirement are tube magnifiers, stereomicroscopes and light tables; examples of development stemming from the second requirement are special manual and/or motorized film drive devices, advanced stereo rhomboid arms, and comparators. These requirements are dynamic in nature and, as a result, underscore the need for a continuing program in the field of equipment development.

25X1

[redacted] 25X1

2. New Acquisition Systems Objective (FY 71-76). Provide the specialized equipment required for exploitation of planned ~~operational~~ unconventional imagery systems [redacted] in the appropriate time frames. 25X1

Discussion: New acquisition systems will become operational during this planning period. As these systems approach operational status, the Center must be prepared to exploit the system products.

ATR UNCONVENT.

3. Operational Improvement Objective (FY 70-76). Develop equipment and modifications that will increase the efficiency of the imagery analyst.

Discussion: Advances in methodology and improved exploitation concepts originating with imagery analysts provide requirements for equipment modification and development.

4. Automatic Target Recognition Objective (FY 70-76). Automate those aspects of imagery exploitation which are most tedious, repetitive, and time-consuming for the human.

a. ~~FY 69-70~~ Objective. Develop a fully automatic Target Indexing Device (TID) for use in indexing imagery products of high-volume acquisition systems [redacted] and maintain a sustaining research effort on related Automatic Target Recognition (ATR) techniques. 25X1

Discussion: Automation of those tasks that are tedious, repetitive, and time-consuming will expedite the exploitation process and permit better utilization of human resources.

b. FY 71-72 Objective - Develop an automated capability for identification of man-made objects ~~as they~~ appearing on imagery; and investigate the feasibility of applying ATR techniques to real time systems.

Discussion: The capability to machine-scan imagery covering large areas of relatively low activity and indicate only those portions containing man-made objects will reduce time spent in search operations. With real-time systems, the application of ATR techniques to electronic signals may solve such problems as cloud screening and target identification, thereby greatly reducing data handling and exploitation time.

c. FY 73-74 Objective - Develop the capability to automatically re-scan for specific types of targets; and develop machine techniques to detect target changes.

Discussion: Requirements to determine a negation date of a target and the sequential changes over time necessitate re-scanning of numerous past missions. The development of a capability to automatically determine evolutionary changes in targets would significantly reduce the time necessary to meet these requirements.

d. ~~FY 75-76~~ Objective - Utilizing technology resulting from earlier objectives, develop an instrument for automatic detection, identification, and counting.

Discussion: The obvious culmination of research and development under the ATR objective is the development of a complete system that automates the repetitive and time-consuming tasks of the exploitation process.

B. Program Progress

1. 1540 Light Table - A light table specifically designed and developed for exploitation of [redacted] imagery will be in production in FY-70. 25X1

2. Advanced Stereo Rhomboids - This attachment for the standard stereomicroscope required for viewing [redacted] imagery in stereo is under development. 25X1

3. Digitized Measuring Light Table - This special light table incorporating an automatic digitizing system was developed to facilitate target location and mensuration.

4. Twin Stage On-Line PI Comparator - This instrument was developed to provide an automated mensuration capability of medium range accuracy for use by personnel other than photogrammetrists.

5. Automated Stereoscanner - This equipment, still under development, is ~~intended~~ designed to permit automatically correlated stereoscanning of roll film. It will be used [redacted] to evaluate the operational feasibility and value of scanning in stereo.

6. Automated Target Indexing Device The prototype of this device, scheduled for delivery in the latter part of FY 1970, will provide a capability to automatically determine cloud coverage on imagery at the rate of 100 feet per minute.

C. Program Plans

1. Alternatives There is no viable alternative to the development of equipment necessary to exploit the products of current and future acquisition systems. It is possible, of course, to extend the effort over a longer development period with resultant lower yearly costs; however, total program costs will be at least the same or possibly greater. Additionally, the cost savings that would accrue, assuming an early development of the equipment, are foregone, and the technical risk factor will tend to increase. 25X1

Insert #2

Insert

2. Approaches Selected

In the absence of any realistic alternative, the Center will continue to program for equipment development utilizing contractors to meet established exploitation needs. Significant milestones for the program are: FY 70, develop the TID; FY 71, [redacted] interpretation equipment available for use and Image Comparison Stereoviewer developed; FY 72, Automated Stereo Scanner available for evaluation program, Wide-field Stereoviewer and basic color interpretation equipment developed, and automated capability to identify man-made objects

25X1

25X1

[redacted]

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IV. Overhead Photography/Test and Evaluation

A. Program Objective (FY 69-76)

Develop techniques and equipment required to evaluate equipment performance.

Discussion: Exploitation equipment developed for the Center is unique and increasingly complex; the techniques, standards, and instrumentation, however, necessary for evaluation of the performance of the equipment often does not exist. Due to the uniqueness of the equipment, industry often finds the development of performance evaluation instruments for use against this equipment to be unprofitable.

To avoid total reliance upon contractor assurance that specifications have been met, it is necessary that the Center initiate a program, to include techniques and equipment, for such performance evaluation.

B. Program Progress

The T&E program is in an early stage of formal development; there have been, however, several accomplishments:

1. Equipment Performance

Detailed plans for the evaluation of two highly sophisticated pieces of equipment, the High Precision Stereo Comparator and the Automated Stereo Scanner were developed. The comprehensive testing program designed

for these two unique items includes development of simulated imagery having the characteristics of [redacted] products, development of a special calibration device, and development of performance evaluation standards.

25X1

2. Dry Silver

Special consultation arrangements have been made with the National Bureau of Standards to develop sensitometric and resolution test equipment for the "dry silver" photo reproduction materials ~~being developed at 3M.~~ under development. As a part of this project a special sensitometric processor is being developed in the FY-70 program.

3. Resolution Test Target

The best current method of evaluating the resolution performance of optical components and systems is ~~by~~ to have a qualified photo technologist read a resolution test target displayed through the optics. This evaluation approach is quite subjective. A special target is being developed for use in allowing objective measurement of the performance of optical components as it relates to resolution.

C. Program Plans

1. Alternatives

Two alternatives were considered for this program, namely;

(a) Pursue the objective through in-house efforts exclusively, and

(b) Utilize in-house assets and capabilities, supplemented by contractual support.

2. Selected Approach

In view of the limitations on the number of in-house personnel who can be assigned to the test and evaluation task, a supplementary contractual support program for the development of the highly specialized equipment and techniques needed for test and evaluation has been established.

Milestones will be established in terms of timely provision of the required equipment and techniques; results will be in terms of objectively determined evaluations. Some of the more significant areas for attention are:

(a) FY 70/72. Dry silver photo materials.

(b) FY 71. High Precision Stereo Comparator.

(c) FY 71/72. Automated Stereoscanner.

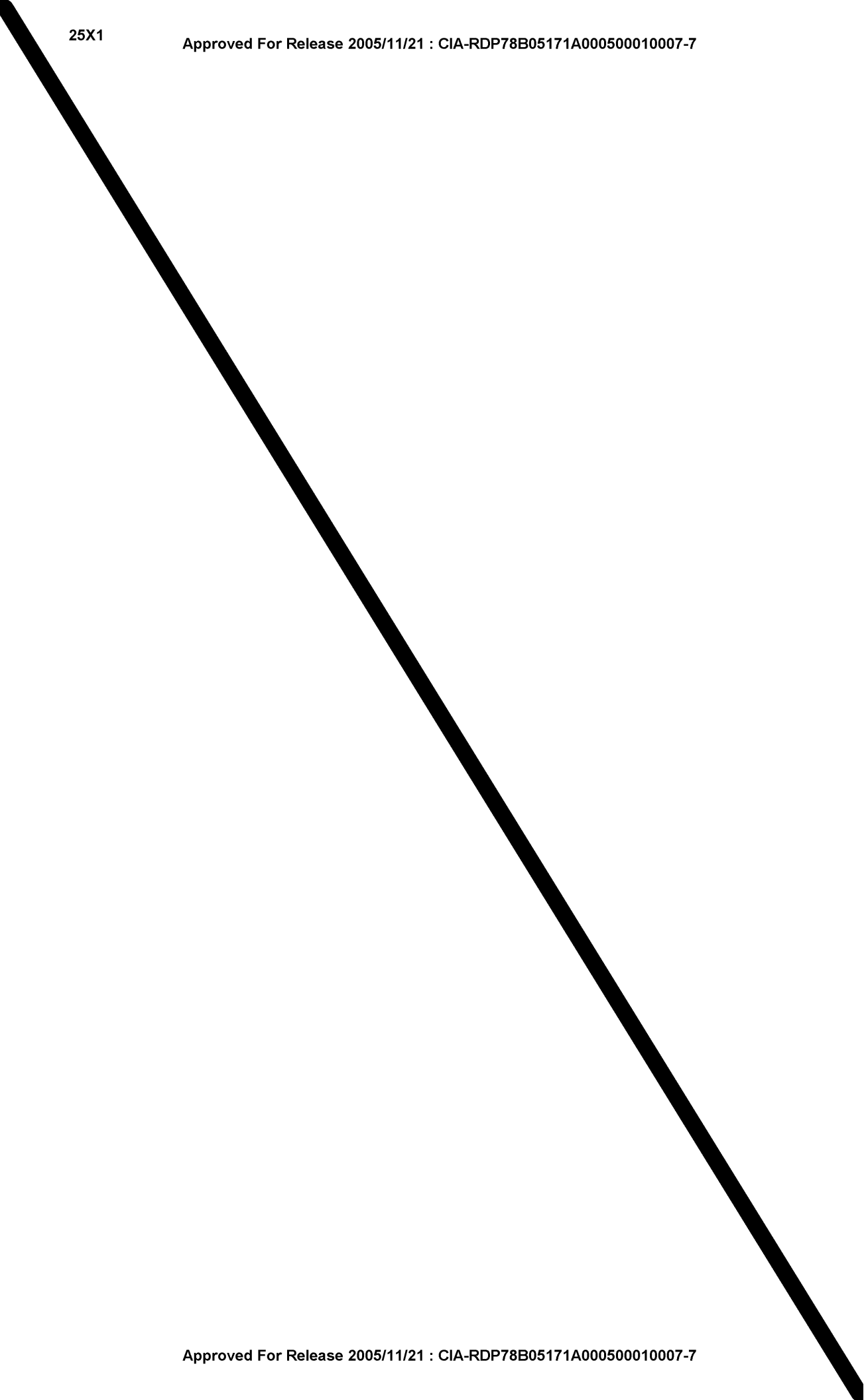
(d) FY 71. Target Indexing Device.

(e) FY 71. Image Comparison Microstereoscope.

(f) FY 72. Ultra Violet Rear Projection System.

(g) FY 72. Wide-Field High-Power Stereomicroscope.

25X1



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VI. OVERHEAD PHOTOGRAPHY/MENSURATION

A. Program Objective (FY 70-72)

Enhance the Center's overall capability to measure images and to isolate and define mensuration errors in order to improve mensuration techniques, photogrammetric measuring equipment, and mensuration accuracy statements contained in intelligence reports.

Discussion: Accurate measurements contribute significantly to both the imagery exploitation process (e.g., basic idenfification of a target) and subsequent intelligence analysis (e.g., production capacity of an installation, payload of a missile, etc.)

1. Technological Base Objective (FY 70-76)

Perform basic and applied research to determine the relative and absolute values of the various factors in the mensuration process.

Discussion: In order to improve the accuracy of mensuration, the amount of error contributed to the process by the individual factors of the system (i.e.; the source material, the collection vehicle, the mensuration equipment, and the operator) must first be determined.

2. Equipment for Photogrammetrist Objective (FY 70-76)

Develop both general purpose and ultra-precise mensuration instruments for use by photogrammetrists. ~~The major emphasis~~

~~will be upon development of stereo mensuration equipment, lowering the cost of production units, and designing for high reliability and easy maintainability. Early efforts will be directed toward developing medium accuracy equipment to fill an existing gap between the ultra precise and course accuracy measuring instruments currently available and in adapting our present instruments to efficiently utilize color imagery.~~

Discussion: Knowledge gained from research under the first project objective, more sophisticated mensuration requirements, increased imagery resolution, and new collection systems all combine to dictate a need for upgrading present equipment and the development of new equipments for the photogrammetrist.

3. Equipment for Imagery Analyst Objective (FY 71-76)

Develop measuring instruments that are accurate, reliable, and relatively maintenance free for use by the imagery analyst.

~~Rationale~~ Discussion: Certain mensuration requirements can be satisfied by the imagery analyst and need not require the time of a photogrammetrist or the utilization of highly sophisticated equipments. With the anticipated increase in workload for the imagery analyst, the trade-off here will be the rapidity

of the response obtained versus the time and effort applied against the requirement. Such a situation points up the need for relatively simple, quick-response, but accurate instruments.

4. Automation of Mensuration Objective (FY 71-76)

Identify potential applications of automation to the mensuration process and implement the most promising applications.

Discussion: There appear to be areas in the mensuration process that offer opportunity for automation, and eventually manpower savings. One such area, "pointing"--placing the reference point on the extremes of the image to be measured -- is a tedious and time-consuming manual operation. ~~By utilizing certain features of a comparator with a microdensitometer, it appears theoretically possible to semi-automate this particular function. Other such areas need to be explored.~~

B. Program Progress

There has been considerable progress toward these objectives to date. In 1971, under multiple year funding, a precision stereo comparator will be completed and delivered to the Center. This instrument is intended for ultra-precise work

by the photogrammetrists and incorporates many advanced features such as .5 micron accuracy, automatic correlation of the stereo imagery and the capability to use roll film on large format stages; i.e., the original negative for maximum fidelity.

Utilizing FY 68 funding, an on-line comparator was produced for use by the imagery analyst. This is a stereo instrument for measuring stereo images on cut film chips and is designed for use in detailed interpretation. It can be used to measure heights and is on-line to the Center's centralized UNIVAC 494 computer. It is a medium-precision instrument with accuracy in the 2 micron region.

A digitized light table for use by the imagery analyst has been developed under FY 69 funding. This instrument, which will undergo operational testing during the next few months, is connected on-line to the Center's 494 computer and will permit immediate readout of either ground dimensions or film coordinates from roll film while the film is still on a standard operational light table.

FY 69 and FY 70 funds were utilized to support certain critical in-house studies of mensuration errors and how they effect

mensuration procedures and equipment. The information thus gained will be utilized as a foundation for future studies for the future development of advanced mensuration instrumentation.

C. Program Plans

1. Technological Base

(a). Alternatives

(1) The majority of the work on mensuration error analysis could be done in-house, utilizing operational personnel when and if man-hours are available. This approach has disadvantages because of its potential drain on limited in-house assets and the extended time frame for completion of the study.

(2) The major portion of mensuration error analysis could be contracted out. The major disadvantage is that specific tasks related to this analysis still require major inputs of man-hours from operational personnel.

(3) A hybrid approach under which certain key tasks, utilizing in-house assets supplemented by contractual support in the other areas, could be utilized. A major disadvantage is that a rather significant amount of coordination between the in-house efforts the the contractual efforts is required.

designing for high reliability and easy maintainability. Early efforts will be directed toward developing medium-accuracy equipment to fill a gap existing between the ultra-precise and coarse-accuracy measuring instruments currently available and in adopting our present instruments to efficiently utilize stereo imagery.

(b). Approach Selected

The hybrid approach was selected in an attempt to obtain the advantages while minimizing the disadvantages of the other two alternatives.

2. Equipment for the Photogrammetrist

(a). Alternatives

There are few alternatives here. One is to continue as programmed toward the objectives; the other is to accept current equipment as being adequate.

(b). Approach Selected

The Center must select the second alternative because current equipment is inadequate with respect to future requirements. The major emphasis will be on the development of stereo mensuration equipment, lowering the cost of production units, and

3. Equipment for the Photointerpreter

(a). Alternatives

(1) To have the photogrammetrists continue to make all measurements.

(2) To develop the necessary instruments for use by the imagery analyst.

(b). Approach Selected

The second alternative is more realistic in view of the requirement and the efficiencies that it will afford. Emphasis will be placed upon relatively simple, quick response instruments with sufficient accuracy to meet the requirement.

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4. Automation of Mensuration

(a). Alternatives

(1) Continue to utilize present manual techniques.

(2) Attempt to develop equipment and techniques to implement a more automated approach to the problem.

(b). Approach ~~es~~ Selected

Alternative two was selected because of expected payoffs in the quality and speed of measurements, along with possible manpower savings. For example, 25X1

[redacted]

by utilizing certain features of a comparator with a microdensitometer, it appears theoretically possible to semi-automate the tedious and time-consuming "pointing" function. Other such areas will be explored.

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VI. X. OVERHEAD PHOTOGRAPHY/REPRODUCTION

A. Program Objective (FY 69-76) Develop an economical, higher-speed reproduction capability for present and planned conventional and unconventional [redacted] 25X1

25X1 [redacted] imagery exploitation materials.

Discussion: The NPIC imagery exploitation process requires an in-house capability to rapidly reproduce multiple copies of selected imagery. Predicted increases in both volume and types of imagery will require additional manpower, equipment, and floor space if the present processing system is maintained. The development of an improved processing and reproduction capability will reduce the need for additional resources in this area during the period FY 72-76.

1. Conventional Imagery Objective (FY 70-74) Develop a high-speed, compact system for reproducing black and white imagery (film and paper) at a product quality level at least equal to the present wet-process system.

Discussion: The research and development of a dry-processing system has been underway since 1965. This type of system offers several advantages over the present wet-processing system; e.g., equipment units required are approximately equal in number to present units but are significantly smaller in size,

thus affording savings in space; dry-heat processing does not require liquid chemicals in bulk, thus avoiding the inherent hazards of wet chemicals and affording a possibility of additional space savings; the compact dry-process equipment is less complicated to operate than the wet-process equipment and provides a capability for the Center to decentralize part of its reproduction system, thus effecting manpower savings in both the photo lab and imagery analyst areas.

2. Unconventional Imagery Objective (FY 71-76)

Develop a capability to accommodate the Center's needs to rapidly reproduce required quantities of high-quality materials from [redacted] 25X1

25X1 [redacted]

Discussion: The input of unconventional imagery materials to the Center will increase. Reproduction of these materials is slow and far more complex than that of standard black and white imagery. Dry-processing with its inherent advantages may eventually be applicable to unconventional imagery reproduction. However, at this point in time it is necessary to plan for continue research and development in the wet-processing system.

~~In addition to color, the Center's reproduction capabilities will be called upon to handle products from~~ [redacted] 25X1

[redacted] 25X1

B. Program Progress

1. Conventional Imagery Reproduction

Dry-process research and development achievements to date continue to indicate significant pay-off. They include the following:

(a) A pilot production of film materials was of good quality was achieved,

(b) Equipment "breadboards" to dry-process and print these materials have been developed to a reasonable level of success,

(c) Contact printing and photo enlarging papers are now scheduled for a scale-up from pilot production,

(d) Usable photo enlarging papers will be available to the Center in June 1970,

(e) A dry-heat processor (positive-to-positive image) for use by imagery analysts has been developed,

(f) High-speed processors for roll film and papers have been fabricated and are in a 6 to 12 month test and evaluation program by the contractor, and

(g) A 40-inch-wide enlarging paper and a sheet film processor are being assembled with a delivery date of June 1970.

C. Program Plans

1. Conventional Imagery

(a) Alternatives

(1) Discontinue efforts toward a dry process and continue the wet-processing system.

(2) Continue development of a dry process directed toward maximum replacement of the present system.

(b) Approaches Selected

The second alternative provides an imminent capability for significant improvement in the reproduction system of the Center not otherwise possible. Major milestones will be in the development during FY 70-72 of dry-process films and paper and, during FY 70-74, in the development of dry-process equipment.

2. Unconventional Imagery

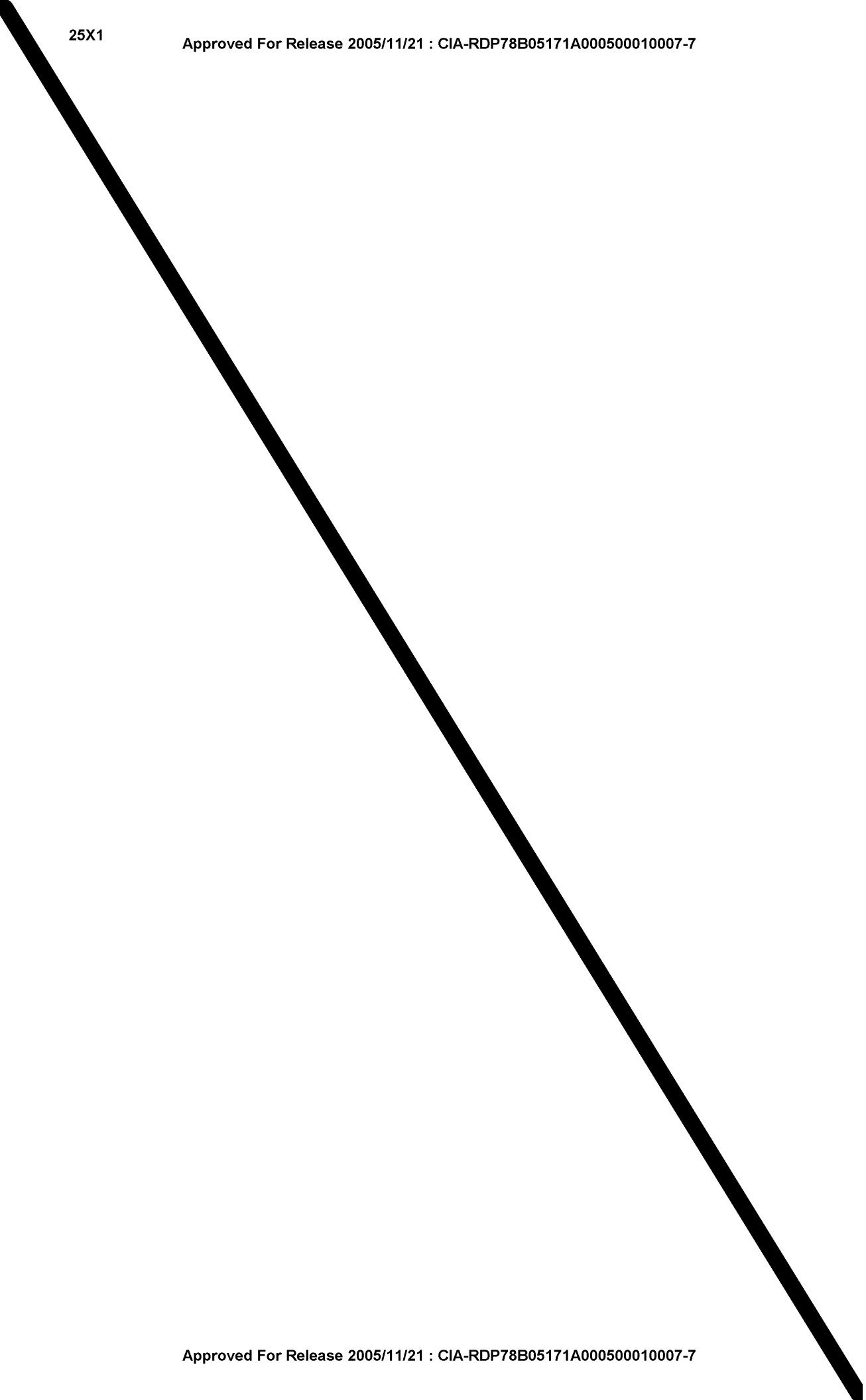
(a) Alternatives

(1) Advance, through contractual supports, the Center capability to reproduce unconventional imagery materials.

(2) Rely on industrial developments in these areas.

(b) Approaches Selected

Reasonable predictions of inputs and time frames for these acquisition systems will not allow for the selection of the second alternative, though R&D costs would seem to be minimal. In addition, it is highly unlikely that industry will develop equipments, processes, and techniques for commercial application that would be within the standards required for intelligence exploitation. ~~that are germane to Center requirement for this~~



VII. Overhead Photography/Imagery Information Technology

A. Program Objective - Develop a cost-effective, integrated, automated system for storage, retrieval, manipulation, and display of imagery, information derived from imagery, collateral materials, and graphics used in the interpretation and reporting cycles of the exploitation process.

Discussion: Due to advances in technology applicable at various points on the broad spectrum comprising the total imagery exploitation process, an optimum point, based on cost-effectiveness considerations, has not yet been achieved with respect to automation of the exploitation and reporting processes. The purpose of this effort is to develop a versatile system which will assist in the areas of information and imagery storage, retrieval, manipulation, and display and communication of the intelligence products of the imagery exploitation process.

1. Prototype Display Console Objective (FY 70-71)

Develop prototype, automated, off-line image, textual, and graphic layout display consoles; operationally test the consoles and evaluate their utility.

Discussion: Certain aspects of imagery information exchange between interpreters, intelligence analysts, collateral support officers, editors, and graphics analysts have not been automated. Prototype automated consoles will be operationally tested in order to more fully assess their potential for improving the efficiency of this information exchange.

2. Chip System Objective (FY 71-72)

Investigate the basic technologies required to handle and display imagery in various chip forms.

Discussion: Imagery chips from conventional and unconventional acquisition systems may be an important analysis and communications medium; the best manner in which to handle this medium in all its aspects must be investigated.

3. Operational Display Console Object (FY 72-73)

Based on the knowledge gained from the evaluation of the prototype display and layout consoles, develop the required operational models.

Discussion: If the off-line consoles prove operationally valuable, an on-line system with the capability to access the central data base will be required.

4. System Integration Objective (FY 74-76)

Incorporate the results obtained under this program into the Center's Integrated Information System.

Discussion: Since textual information, imagery, and graphics derived from the various acquisition systems are interdependent elements of the exploitation process, a system which can automatically correlate these elements offers the possibility of significant increases in exploitation efficiency.

B. Program Progress

The in-house Automatic Reporting Techniques and Equipment Study, TICOF studies, and the Advanced Editing Systems Evaluation Teams have investigated various aspects of the imagery information technology program. A contractual effort, comprising development of certain computer programs and techniques, demonstrated the feasibility of a cathode ray tube graphics and textual display system. Design objectives have been established for the development of a prototype display system incorporating this concept. Design objectives have also been defined for a system to display multiple images from film chips, microfilm, and collateral material. A Chip Implementation Study was contracted for in FY 69; upon completion, it will present the Center with several alternative plans for chip system development.

C. Program Plans

1. Alternatives

(a) Rely on industry to develop the required equipment and techniques; fund the program at a later data utilizing industrial developments whenever possible.

(b) Fund the program at the level required to accomplish the objective in the time frame indicated.

2. Selected Approach

This second alternative is selected because the unique requirements of the Center in this area will not, in all probability, be met by private industry at its own initiative, at least not in the time frame indicated. It is essential

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