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1 December 1969

IMAGERY INTERPRETATION PROCESS RESEARCH

A. OBJECTIVES:

1. FY 69-76. Establish and maintain a data base of the skills of the Center's imagery exploitation personnel.

Rationale: Apply this data, as well as related research findings available in the literature and in the ~~Human Factors~~ ~~Community~~, to determine and implement necessary improvements in the exploitation process of present (conventional) imagery, and to plan for the effective exploitation of future imagery systems.

2. FY 71-76. Identify potential applications of automated and semi-automated exploitation systems.

Rationale: A thorough understanding of the human exploitation processes will provide information which can be applied to the development of machine capabilities to augment productivity in the face of increasingly greater demands for services.

3. FY 69-76. Develop psychophysical procedures for assessing image quality.

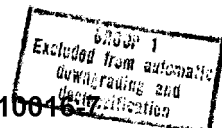
Rationale: There is a continuing need to establish the psychophysical relations between current and future imaging systems in order to optimize the design of acquisition and display systems.

4. FY 69-76. Develop and promote application of human factors state-of-the-art principles to the design of photoexploitation equipments.

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Rationale: The limitations and capabilities of the Center's human resources must be considered in the design specifications of exploitation hardware in order to effect maximum system performance.

B. PROGRESS--FY 1969-1970:

1. OBJECTIVE #1.

a. Results:

(1) A series of photo interpretation and photogrammetry performance measures were developed and/or administered during FY 1969.

(2) A statistically significant improvement in general target search was shown to have occurred from 1967 to 1969.

(3) Twelve weeks of training for novice photo interpreters in the Offutt Defense Sensor Interpretation and Applications Training Program were found to be roughly equivalent to 2½ years of on-the-job experience for photo interpretation reasoning ability.

(4) Mensuration accuracy statements were refined by means of an intensive statistical analysis of operational research data.

b. Expected Results:

(1) A preliminary validation of an Agency administered PI selection battery will be completed prior to 1 Dec.

(2) A PI target knowledge inventory will be made available *about* prior to 1 Dec. A cross section of targets typically read out by area specialists were selected as test items in an evaluation of identification performance. Results will indicate which type

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targets are to be included in a pilot training program to be developed during FY 1970.

2. OBJECTIVE #2.

a. Results:

A five year projection of the possible role of Automated collateral storage and retrieval systems for use by photo-interpreters and collateral support personnel was developed.

b. Expected results:

A preliminary evaluation of a new semi-automated text and graphics display system will be conducted in terms of its potential application to photointerpretation, collateral support, graphics and text display and manipulation.

3. OBJECTIVE #3.

a. Results:

Preliminary psychophysical relations between photography and line-scan imagery resolution requirements were established by comparing the exploitation of photographs and line-scan images of the same ground-order-of-battle target models.

b. Expected results:

The above study will be replicated utilizing real G-O-B targets for validation purposes.

4. OBJECTIVE #4.

a. Results:

(1) A comprehensive literature review of line-scan interpretation research was conducted.

(2) The Human Engineering Design Guide, a document summarizing basic physiological and engineering information applicable to

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inclusion of sections specific acoustics and comparators.

(3) Approximately 250 articles on imagery exploitation research were reviewed and included in the Imagery Interpretation Bibliography. These relevant to NPIC were abstracted and included in the State-of-the-Art Review.

(4) A number of industrial and government research facilities were contacted in search of relevant state-of-the-art information.

(5) Several European studies indicated that the convergence angle of microscope eyepieces might influence visual performance. Since the CENTER employs a variety of optical instruments, many of which were designed with high convergence angles, preliminary research was conducted on the effect of convergence angle upon photointerpretation performance. The results were far from conclusive, but there were sufficient indications of excessive ocular accommodative activity to warrant continuation of the research.

b. Expected results:

(1) The Human Engineering Design Guide will be further updated and republished during FY 1970.

(2) The literature review and site visits discussed above will continue. Unaided stereo projection display possibilities and unconventional imagery exploitation state-of-the-art will be emphasized.

(3) Research shall continue on microscope convergence angle, and an investigation of the effects of microscope field-of-view on PI performance will be designed.

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## C. PROGRAM PLANS:

1. Alternatives:
2. Approaches Selected:

## a. Objective # 1

(1) Target knowledge training:

FY 70-73. Broaden the scope of the current development of PI target knowledge training programs. The approach(es) to be followed will be established during the current contract.

(2) Critical Skills:

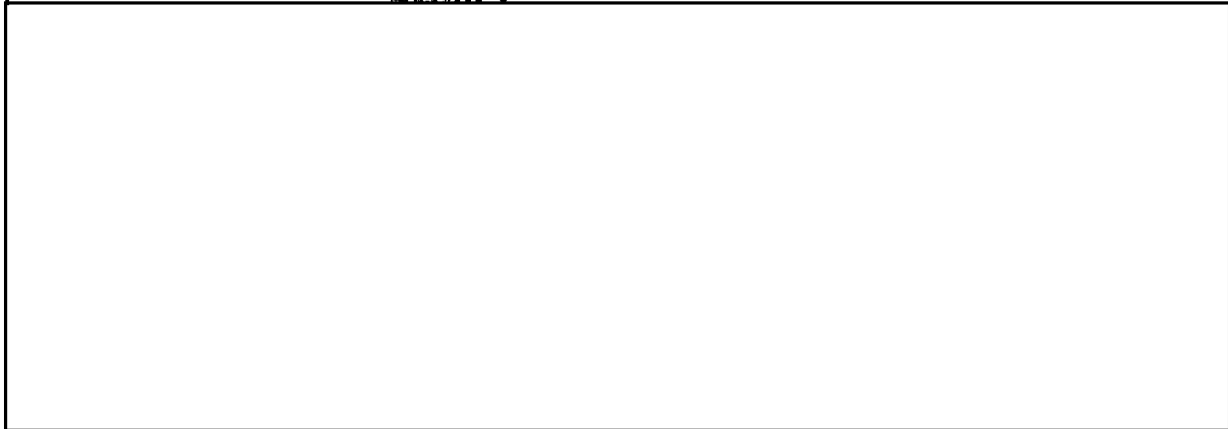
FY 70-76. The long-range research objectives of the Imagery Interpretation Research Program are to remain responsive to the priority needs of the operational components of the CENTER. It is intended that future exploitation oriented research topics evolve as they have in the past --- the production groups take stock of their critical skills on their critical skills on an annual basis, and in coordination with the HUMAN FACTORS SECTION, select those skills which appear to require immediate improvement or which should be developed in preparation for advanced hardware or procedural changes. If the request is compatible with HFS resources, a research plan is developed and implemented to evaluate current skill level; where applicable, performance under simulated conditions of advanced technology are also evaluated. On the basis of the research findings, a decision is then made by the operational group initiating the request to maintain the

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c. OBJECTIVE #3.

(1) Acquisition System Parameters:

FY 70-76. Collection of exploitation data on intelligence information extraction as a function of image quality will continue. Such data gathering must be target, requirement, and sensor specific, and must produce results which will enable future acquisition system planners to devise objective design specifications, based upon known user image quality needs.

Line-scan and  parameters will be emphasized earliest in the program, with  to follow as each becomes appropriate.

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(2) Display System Parameters:

FY 70-76. Research efforts will be concerned with an objective determination of quality requirements of imagery in anticipation of new acquisition system products for display and exploitation. As in collecting the data for C.3.a., interpreter information needs will be the primary criterion. Consideration of line-scan and  displays will occur earliest in the program, with succeeding studies to be dependent upon subsequent acquisition system developments.

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(3) Image Manipulation:

FY 70-76. Continuing support shall be lent to ITS/ATB efforts to define optimum image processing procedures. Image quality tradeoffs based upon user needs must be objectively designated, and where feasible, artificial manipulations of image rendition may be found appropriate if exploitation efficiency is demonstrated to be enhanced.

d. OBJECTIVE #4.

(1) Relevant R&D Advances:

FY 70-76. Efforts will be made to maintain cognizance of human factors research results and their potential application to CENTER requirements. Emphasis will be on research and information assemblage in support of decisionmakers anticipating CENTER environment alternatives. Techniques for upgrading the performance of CENTER human resources will also be priority targets for consideration.

(2) Human Engineering Design Guide:

FY 70-76. This document will be updated with revised human engineering design data as available, and with new bodies of information as required to support new system developments. The Guide will be maintained for the Intelligence Community as a central source of human engineering design specifications for image exploitation hardware development.

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## 1. Alternatives

Several alternative contractual approaches to accomplish the objectives cited herein are available. A single contractor could be selected to conduct all R&D activities to improve the human interpretation process, thereby focusing all research activities at a single point, but limiting the program quality to contractor capabilities. Separate commercial sources for each research question would provide maximum research quality, but would prove to be administratively cumbersome. The recommended solution is a compromise -- employ several major contractors, each demonstrating broad technical & management resources in image interpretation research, and introduce several human factors contractor specialists for limited research areas.

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