~~TOP SECRET~~

25X1

WORKING PAPER

25X1

16 September 1969

Copy 2

MEMORANDUM FOR: Chief, Technical Services & Support Group, NPIC

SUBJECT: NPIC Image Enhancement Potential

1. Attached is an analysis of a problem that has assumed a great deal of importance and concern over the past year. Basic facts indicate that a starting solution is well within our grasp, provided that management recognizes the need for implementing such a procedure and feels assured that whatever added costs are incurred justify the potential improvement of target quality.

2. It is recommended by APSD that you carefully review this paper with the realization that this is the first step in obtaining a goal which is on the horizon and readily within reach. APSD would be happy to answer any questions which you may have.

25X1

Deputy Chief
Applied Photo Science Division/TSSG/NPIC

Attachment: a/s

Distribution:
Cy 1 - NPIC/TSSG, w/a
2 - NPIC/TSSG/APSD, w/a chrono 9/69
3 - NPIC/TSSG/RED, w/a
NPIC/TSSG/APSD/ (16 Sep69)

25X1

25X1

GROUP 1
Excl. from automatic downgrading and declassification

~~WORKING PAPER~~ ~~TOP SECRET~~

[redacted] 25X1

TOP SECRET

WORKING PAPER

ATTACHMENT to [redacted] 25X1

I. PROBLEM: NPIC has no timely in-depth target oriented image enhancement capability

II. FACTS:

1. NPIC Management has become increasingly aware of the need for specialized printing (i.e. the Dupe Specs Study).

2. The Applied Photo Science Division (APSD) has the responsibility under its missions and functions to investigate, develop and implement advanced techniques for analyzing and interpreting degraded imagery.

3. The APSD has in-depth knowledge of present reproduction techniques and criteria.

4. The APSD is at the processing site for the initial phase handling of all satellite missions.

5. NPIC has information available to them (from the ephemeris) to get pass/frame numbers and coordinates of specific targets prior to film arrival at the processing site.

6. The APSD has photo scientists available to provide production-oriented image enhancement products to the Center.

7. The APSD presently has microdensitometric techniques for enhancing some images and the potential for production-oriented digital image enhancement.

[redacted] 25X1

ATTACHMENT to [redacted] 25X1

8. The TSSG/Research Engineering Division/Advanced Technology Branch/Exploratory Laboratory (TSSG/RED/ATB/EL) has the continuing potential for providing techniques for use in production of digital and analogue image enhancement products.

9. The ATB/EL has the chemical lab and dark room facilities necessary to provide tailor-made enhanced image products to customers.

10. The ATB/EL has an excellent photomicrographic capability.

11. The Production Services Group/Reprographics Division/ Photographic Services Branch (PSG/RD/PSB) has printers and processors capable of being used to enhance images.

12. PSG/RD/PSB has a quantity of different reproduction stocks.

13. The Eastman Kodak Film Evaluation and Testing Facility Laboratory at "Bridgehead" (EK FEAT Lab) is physically located at the processing site and near the original negative breakdown area.

14. The EK FEAT Lab has in-depth knowledge of the physical aspects of all Eastman Kodak emulsions.

15. The EK FEAT Lab has access to all EK R&D on new emulsions.

16. The EK processing facility has many special order (SO) EK emulsions available to it.

17. The EK FEAT Lab is funded by the NRO to serve the Community.

III. DISCUSSION:

1. History shows that for the past three to four years, NPIC PIs

[redacted] 25X1

have sporadically indicated a need for various types of image enhancement techniques to assist them in their readout of degraded targets.

APSD, the RED Exploratory Lab and PSG/RD/PSB have attempted to provide such assistance through the use of isodensitracing, density cuts, photomicrography, and a limited amount of chemical enhancement procedures. Informal assistance has also been requested from the major processing site (EK) to occasionally reproduce specific targets on different emulsions or to make special density cuts and enlargements.

2. All these attempts have been conducted on an ad hoc basis with a minimum of scientific investigation.

3. Some means must be generated to coordinate those procedures that can be implemented to provide optimum quality material to the PIs on a production basis. Based on the facts stated in the initial portion of this report, the APSD is in the unique position of being able to immediately assist the interpreter in acquiring some image enhancement assistance in all phases of his readout.

4. In order to provide the interpreter with optimum quality material on a finite number of selected targets during his first and second phase readout, the APSD could implement the following procedures:

a. Devise small computer programs to search out from predicted mission ephemerides, pass and frame numbers of those targets notorious for their poor quality reproductions, those which demand

immediate in-depth one time readouts and other very high priority targets. The results from such programs would be available to the APSD team leader at the processing site prior to the arrival of the film.

b. During the initial phase handling of the mission negatives, the APSD team would critically assess those frames indicated by the program readouts and judge whether image enhancement for each specific target is justified. He can also use his own wisdom and experience to determine whether certain image enhancement techniques would alleviate the results of poor quality products due to malfunctioning systems.

c. Once he determines that a target can be improved through image enhancement, he can enlist the aid of either the FEAT Lab or the production processing personnel at EK to provide an optimum quality reproduction for their customers. If the number of such "tailor-made" targets are restricted to manageable amounts, the enhanced products could be made available to the Center simultaneous with the arrival of the other reproductions.

5. During all phases of the PI readout of the reproductions at NPIC, APSD personnel could be on hand to point out for the PI those areas where image enhancement can benefit him. Judgement could then be made as to whether enhancement should be accomplished using the original negative still at EK (and their expertise), or to use the

NPIC facilities and work from 2nd or 3rd generation duplicate negatives. The type of enhancement techniques to be used would determine where it would be accomplished and by whom.

6. The NPIC has the potential for providing a great variety of image enhancement products. It is presently equipped to provide microdensitometric and isodensitometric products to the PI and has a potential to eventually provide a sophisticated digital image restoration facility. Techniques presently being investigated by the TSSG/RED/ATB/EL and EK concerning analogue/chemical enhancement show promise of providing production methods to assist the PI. The Center has an excellent photomicrographic capability, some good dark room equipment and fine production oriented processing and printing equipment. The chemical and physical characteristics of the present reproduction materials is also well known.

7. What appears to be lacking is the coordination and cooperation necessary to consistently provide the photointerpreter with a scientifically designed, production oriented image enhancement capability. The problem of how to enlist the aid of the EK processing personnel, the FEAT Lab, the EL, PSB and APSD to provide this capability should not be an insurmountable task.

8. The facts point out that the APSD utilizing the techniques investigated by the EL and EK could effectively implement a Center

wide image enhancement program which would encompass providing such resources for all phases of PI readout. They can initiate action immediately by establishing a small informal cadre of presently available photo scientists within the APSD to coordinate current ad hoc studies being conducted throughout the Center and at EK.

9. The division needs, however, the authority and backing of management in order to effectively cut across division and group lines to establish this unique capability. Without the total cooperation of the EL and PSB (and incidently the PIs) any attempt to provide such services will be seriously curtailed. In the interim, the NPIC CCB observer can sound out his chairman to determine whether the FEAT Lab could be tasked on a continuing basis to assist in this endeavor, whether such projected services would be covered under the CCB PARs presently investigating reproduction quality or whether a new PAR could be suggested to deal with this specific task. should also be contacted and 25X1 briefed on this suggestion to determine whether the NRO will be amenable toward establishing such a potential at the processing site(s).

10. In order to provide the PI with the knowledge of how image enhancement techniques can be an assist to him, the APSD plans to publish a handbook depicting the different enhancement methods that are presently available. The illustrations will provide the PI with

information on how different types of image degradations can be overcome and will be a guide to indicate how the specific image of interest to him may be enhanced. Once the handbooks are available, briefings can be conducted for the different groups and the services of APSD technologists will be made available to the PIs during each mission readout.

IV. RECOMMENDATIONS:

It is recommended that:

a. Management authorize the TSSG/APSD to be the focal point for producing a production oriented image enhancement capability within the Center.

b. Management have TSSG/APSD brief the NRO [redacted] on the projected plan for having a Center image enhancement capability. 25X1

c. The CCB observer discuss with the other CCB members, the possibility of using existing or suggested PARs as vehicles for providing an image enhancement capability at the processing site.

d. That the TSSG/RED/ATB/EL emphasize programs to investigate new and unique image enhancement techniques that could be used in the Center. (This is particularly applicable in the realm of images depicted on exotic films such as color, bicolor, etc. and for products provided from real time systems.)

e. Some access be provided to APSD technologists to use present EL dark room and chemical lab facilities on a non-interfering basis.

[redacted]

WORKING PAPER

ATTACHMENT to [redacted]

25X1

25X1

f. The PSG/RD/PSB provide APSD technologists access to some printing equipment on a non-interfering basis.

WORKING PAPER

[redacted]

25X1