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HEXAGON Sensor Subsystem
Post-Flight Analysis Working Group

Minutes for Meeting #1
Date : 20 August 1968
Location : Headquarters
Attendees:

MEMBERS

Mr. R. Kohler, Chairman (Hqs)
Mr. R. Burks (Hqs)

Capt. D. Berganini (AF/SP-7)

Lt. Col. W. Williamson (SAFSS)
Mr. J. Ames (TRW)
Mr. P. Convertito (P.E.)
Mr. W. Cottrell (P.E.)
Mr. S. Duffield (E.K.)

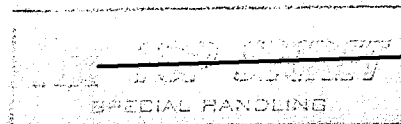
OBSERVERS

Mr. D. Schoessler (E.K.)

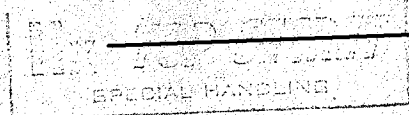
* Part-time

I. PURPOSE AND CHARTER OF THE WORKING GROUP

The Chairman opened the meeting by introducing all the participants. The purpose of this meeting was to outline the problems that should be considered by the Subsystem Post-Flight Analysis (PFA) Working Group at this stage of the HEXAGON Program development. The PFA associated with the HEXAGON Program will necessarily be different from that of the C or G³ Programs, because we now have four recovery vehicles and the capability of changing focus in flight. The timeliness of PFA will be critical if we are to learn information from the first bucket and use it to influence vehicle commanding during successive buckets. It is important that any new equipment necessary be identified as early as possible so that a routine procurement cycle will be adequate. In view of the above, the following questions were posed for consideration at subsequent PFA meetings.



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A. What should be the flow of the PFA? This will, of course, be driven by the flow of the original negative, where most of the analysis must take place.

B. Traditionally, original negatives have not been released to contractors. If this tradition continues, analysis off of the ON must be done at Government facilities. Therefore, what equipment is available at Westover, NPIC, or E.K. (Bridgehead)?

C. What kind of PFA is needed for timely feedback to the HEXAGON Command Post?

D. Does the performance analysis team need dupes for immediate assessment?

E. Is the appropriate equipment available for this magnitude of PFA?

F. What are the major analysis techniques to be employed in evaluating system performance?

G. How do we determine exposure adequacy -- SUNNY type?

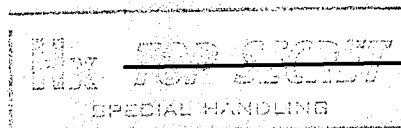
H. What reports should be generated, by whom and with what distribution?

II. CURRENT PFA PROCEDURES

The current PFA procedures followed by the C and G³ Programs were reviewed. In general, the G³ Program Office has elected to run their PET meetings with Government participants only. Questions are usually twx'd to the appropriate party and discussions regarding these questions take place at the PET meetings. Contractors are available only when called upon. The C Program operates under the philosophy that equipment and film contractors are active participants in the PET meetings and have maintained informal tasking to study problem areas of a specific mission. For both C and G³, the following sequence of reporting is usually followed:

A. NPIC performs an immediate on-site analysis and reports their findings to the community by twx.

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B. Preliminary mission assessments are written by various requirements offices within Government organizations.

C. A PET meeting is held two to three weeks following bucket recovery (recovery of the second bucket for C). The C PET team issues a twx report. The G³ PET team issues a final hardbound report.

D. Eastman Kodak, in the past, has produced a report for each mission in three sections; namely, I - dealing with processing parameters, standard curves and sensitivity levels of processing; II - density/luminance, image quality evaluation and edge tracing; III - densitometric measurements. II and III have recently been discontinued. Report I now reports sensitometric readings and physical evaluation of performance.

E. Westover prepares a TERO that includes a detailed analysis of system performance and serves as a follow-on to the Eastman Kodak report. Some redundancy to the E.K. report is noted.

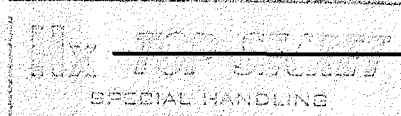
F. Itek performs a systems analysis study of the J-3 systems and prepares a report.

G. Photographic Evaluation Report by NPIC.

H. A final LMSC system report that in the past has incorporated data from several of the above reports. This serves primarily as a historical record of mission performance.

In general, it was agreed that the data contained in the above reports is necessary for various elements of the committee at various times. However, not all of the data is needed by all elements of the group at any given time. It was suggested that for HEXAGON, we should outline a systematic approach for creating data similar to that listed above for C and G³ and that the individual data reports should be incorporated into an overall historical notebook by one responsible organization. The various organizations represented at the meeting will consider the needs of their components prior to the next PFA meeting.

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III. EQUIPMENT AVAILABLE AT WESTOVER FOR PTA

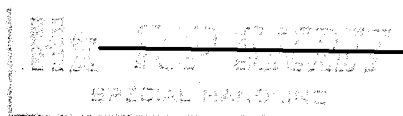
The Air Force Special Projects Production Facility, located at Westover AFB, Massachusetts, was established by SAF Order 116.3 on 25 August 1964. The prime missions were to provide military facilities for photographic production and system evaluations for the SAFSS. A secondary mission was to provide an interface between the civilian and government agencies engaged in scientific and technical development of photographic systems.

Certain tasks were evolved under the mission of the Facility. Full production capabilities equaling those at the contractor facility were desired for emergency backup and to meet growing production requirements. It was evident that a center for the scientific evaluation of system and mission performance was needed that would reflect the interests of the national agencies in an unbiased manner. A continuing effort was needed to insure improvement in the quality of photographic products for intelligence use. Application of the results of research and development programs to improve photographic production and evaluation techniques for system improvement was an obvious task. Integration of the efforts of intelligence exploiters and system developers was required to insure the accomplishment of national goals. The CORN system for the calibration and evaluation of satellite and aircraft reconnaissance systems was established which required continuous management and control by a military agency and, finally, considerable technical and materiel support of world-wide reconnaissance installations by a stateside national agency was found to be an essential requirement.

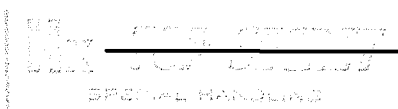
The production of mission material has grown rapidly as reconnaissance systems have increased in numbers and complexities. Current delivered products amount to about nine million feet of film annually.

The accomplishment of the tasks assigned and the production requirements of the Facility have been aided materially by the command and control structure that was evolved. Operationally, AFSPPF functions under the Director of Special Projects who reports directly to the Secretary of the Air Force (SAFSP). Administrative, some budgetary, and management directions are provided by SAMSO. Support in the conduct of research and development programs, materiel procurement, and operation of the CORN system is provided by Air Force organizations at Westover, Rome, and Wright-Patterson Bases.

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Internally, AFSPPF has five directorates under the commander. These are Operations, Research and Development, Evaluation, Materiel, and Administrative Services. Attachment I reveals a description of these departments including pictures of available equipment.

The Operations Directorate includes two divisions, Laboratory and Shipping, manned by military personnel. The objectives of this directorate are mainly concerned with the production and distribution of high quality photographic products in high volume. Every effort is made to insure the production capacities and quality level exist to handle the full national requirement should the need arise. A part of each mission requirement is processed to insure that training and equipment standards are maintained at the required levels. Currently, provisions are being made for the production of color materials in volume for the eventuality that color film will be required for intelligence needs. A major effort is under way to automate film inspection and printing to meet the problems of increased mission operations and shortened production cycles.

A computerized process control system is being installed to improve quality control and production efficiencies. The directorate is continuously developing and updating methods and standards for the clean-room operations required for handling the high quality photographic products being generated. Information on clean-room standards, evaluation of new materials, chemicals, and equipment is disseminated to all organizations in the community. All classified film products other than Priority One are handled, controlled, and distributed by the directorate. Recipients include national organizations such as NPIC and DIA, the Navy, the Army, SAC, and overseas commands. Distribution is made by MAC aircraft and the courier system.

The Research and Development Directorate includes the Science and Methods Divisions and Management Operations. Civilian and military scientists and engineers augmented by photo technicians and data processing personnel are included in the manning. This directorate provides support to the national effort in many areas. Sponsored research is continuously under way to advance the techniques of image analysis required in the evaluation of system performance. Precision processing equipment is developed, built, and tested to meet future production requirements of the Facility. Automated film inspection and printing equipment is being developed

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to improve quality and reduce production problems. Computer system design and software development are provided to support production and system evaluation functions of the Facility. Continuous research into improved photographic materials is conducted to insure compatibility between improved camera systems and duplicating film materials. The duplication process is under continuous study to improve the transfer of intelligence information from the original to the product. Advanced color processing systems are under development to provide high-volume color production in the future. Research is conducted into the reclamation of silver and film materials and the problems of chemical pollution and waste disposal. Programs are conducted to develop improved auxiliary equipment for production and evaluation such as film inspection, titling, and viewing equipments.

The Directorate of Evaluation includes the Analysis, Processing, and Reports Divisions. The directorate is manned with system analysts, photo interpreters, data processing personnel, photographers, and publications personnel.

This directorate has the vital objective of analysis of operational system performance from the taking system through the products provided the intelligence exploiters. Using the original and duplicate film materials, evaluation is made of the operation of the camera hardware; the operational conditions encountered; the attainment of coverage desired; the resolution and image quality attained; and the degree of overall effectiveness achieved as compared to previous missions. Assistance is provided by system personnel and photo interpreters, but every effort is made to provide an unbiased, objective, statistically sound evaluation of performance. Facilities have been developed to provide for the complete cycle of original negative inspection, image quality assessment, data reduction, and report generation in a single, secure, and well-equipped area. Techniques have been evolved for objective measures of system performance both by research contract with recognized authorities and by in-house analysis programs. Diagnostic procedures are used wherein a field experiment is run during an operational mission and the results used in parametric analyses to enable optimization of variables or further system improvement.

The problems of photometric measurements are under continual study. New devices and techniques are evaluated for

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Improvement in accuracies and degree of precision. Studies are made of data correlations and statistics to provide answers or indications for the systems designers. The results of studies and the reduced data are published in the form of technical reports to higher authorities. One new objective is the analysis of the quality and fidelity of the duplicate products provided to the intelligence community. Techniques are being developed to enable objective measurements of true photographic qualities and intelligence utilities of duplicates that should lead to further improvements in mission effectiveness.

The Directorate of Materiel is comprised of the Maintenance and Supply Divisions. Manning includes electronic technicians, plumbers, processor technicians, machinists, and supply personnel. The directorate provides the supply support for the equipment and operation of the production laboratory. Support operations such as installation, maintenance, and repair of a wide variety of photographic equipment is provided. All real property is controlled and maintained by the directorate. Emergency logistical support is provided to other photographic activities world-wide.

The Controlled Range Network (CORN) is managed by a team within the regular organization of the Facility. Control of the target deployments and the actual displays to meet operational requirements is provided by Operations personnel. Evaluation personnel monitor photometric accuracies, ground-truth data collection, and deployment performance. Research and Development personnel are responsible for target research, target procurement, and budgetary problems.

The CORN system is comprised of a network of instrumented ground displays including both fixed and mobile units. Targets are provided for testing the responses of photographic, radar, and infrared reconnaissance systems. Targets have been developed for each system to test resolution, sensitivity, and accuracy of the sensors. Deployments are provided anywhere within the ZI with a high degree of accuracy in location and orientation.

The outputs of the CORN Program include both subjective and objective measures of performance. Standard military "T" bar-targets are used for visual resolution and color patches are used for spectral fidelity tests. Objective measures include resolution from controlled edge targets, sensitometric response from calibrated gray-scale patterns, and mensuration accuracies from precision dimensioned objects.

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The capabilities of the AFSPPF can be illustrated by a summary of present and projected workload. Film production averages nine million feet per year, but the equipment capacity would allow up to 24 million feet if desired. Approximately 20 TERO and 10 PET reports are generated yearly. A 50 percent increase to 30 TERO and 15 PET reports is practicable. The Directorate of Research and Development handles approximately 21 new projects under an annual budget of 2.4 million dollars. This could be increased to 30 projects under a budget of 5 million dollars without a major increase in personnel. Suballotment workload is approximately 13 equipment procurements under a budget of 1.4 million dollars, and this could easily be increased to 20 procurements with a budget of 2.0 million dollars annually.

IV. PRESENT NPIC PFA TEST AND ANALYSIS AND AVAILABLE EQUIPMENT

The Chief, Image Evaluation Branch, NPIC, presented the current NPIC organization with emphasis on the Technical Services and Support Group whose primary function is to insure optimum photographic products for exploitation from both a photographic and photogrammetric standpoint. The Division provides information to various contractors during system development which not only influences the format of data that will be analyzed by NPIC, but also allows NPIC analysts to become familiar with various collection systems as they become operational. The current NPIC participation in PFA for C and G³ is roughly divided into three categories:

- A. NPIC team preliminary evaluation at the processing site.
- B. PET analysis.
- C. Detailed studies and photographic reports.

A listing of equipment available at NPIC was reviewed. Details relating to the above are included in Attachment II.

V. IN-FLIGHT CONTROLLABLE SENSOR SUBSYSTEM PARAMETERS

P.E. presented a brief description of the major components of the HEXAGON Sensor Subsystem. Of primary interest to the

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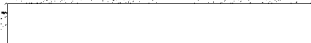
IN-FLIGHT CONTROLLABLE
SENSOR SUBSYSTEM

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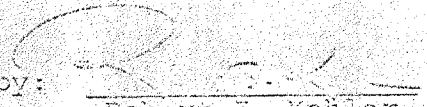
PFA Working Group are those parameters that can be changed on-orbit. These include focus, exposure slit, V/H and total scan.

It is assumed that recipients of the minutes are familiar with the MMAGOW Sensor System; therefore, further verbiage will not be included. Attachment III contains details regarding the parameters discussed.

Prepared by:


Recorder

Approved by:


Robert J. Kohler
Chairman

Attachments:

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- II - A/S
- III - A/S

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