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# Air Force Special Projects Production Facility History

## Volume I
## Overview

DIRECTORATE OF SPECIAL PROJECTS
OFFICE OF THE SECRETARY OF THE AIR FORCE

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**HQ AIR FORCE SPECIAL PROJECTS PRODUCTION FACILITY**

# AIR FORCE SPECIAL PROJECTS PRODUCTION FACILITY HISTORY

## VOLUME I

## OVERVIEW

1 September 1976

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This volume consists of 291 pages.



Volume I of III Volumes

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AFSPPF HISTORY
Volume I

PUBLICATION REVIEW

This report has been reviewed and is approved.

RICHARD E. McLAUGHLIN
Lt Colonel, USAF
Commander

AFSPPF HISTORY
Volume I

## FOREWORD

Throughout the past decade and a half, earth satellite reconnaissance has provided strategic intelligence at each key juncture in international affairs which involved our national security. This period started in the late 1950s with the Government's investigation into our apparent "missile lag" and runs through the current verification of the Strategic Arms Limitation Treaty (SALT) agreements. Without this reconnaissance satellite capability and the reliability of the acquired and exploited intelligence, the history of this country would likely have been quite different.

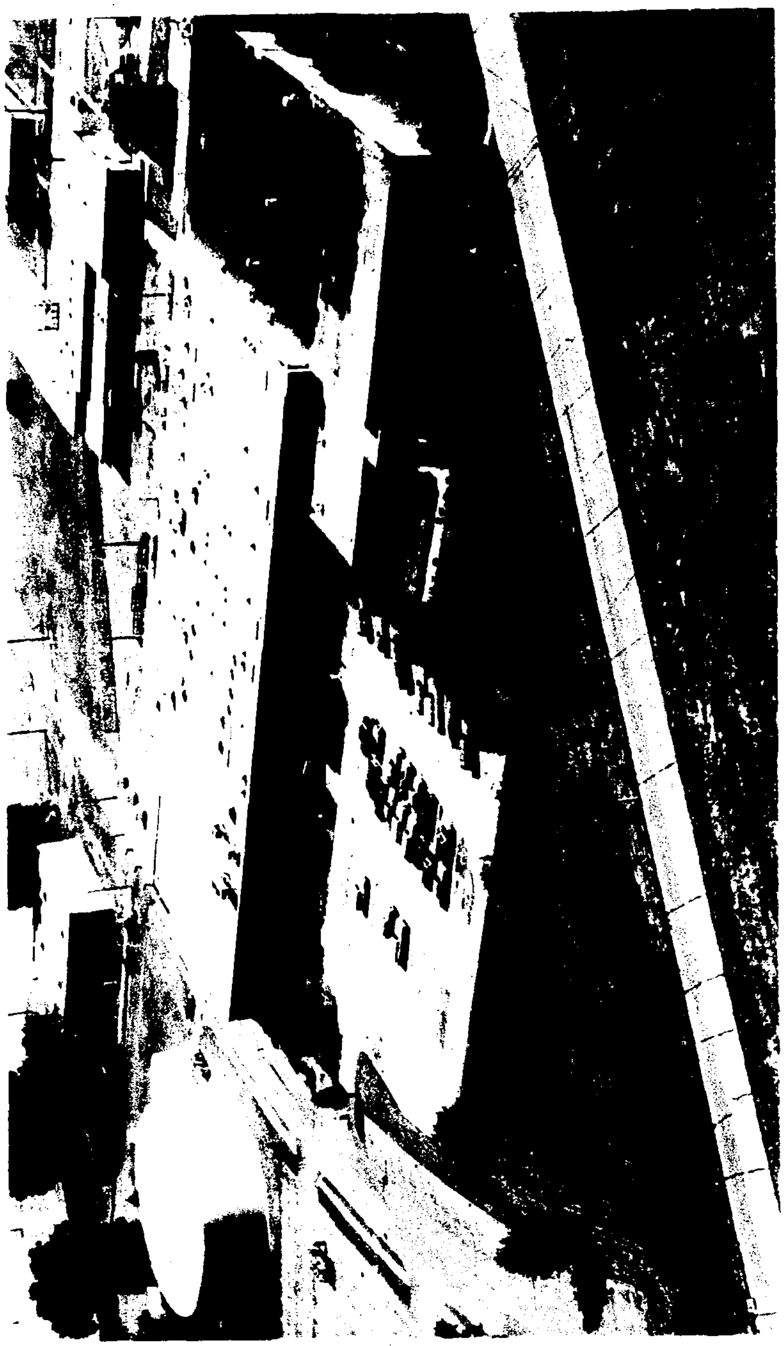
The history of the Air Force Special Projects Production Facility (AFSPPF) is closely related with the evolution of earth satellite reconnaissance. The Facility was established to support the SAMOS Program, which was a project derived from studies in earth surveillance from space that began as early as 1946, and which achieved minimal success in 1960. The Facility expanded in mission, technical ability, and production capability as earth satellite reconnaissance systems were improved through development of the CORONA, GAMBIT, and HEXAGON Programs. History has already shown that AFSPPF was a key element and contributor in the overall success of these vital national programs.

This history consists of three volumes. Volume I provides an overview of the Facility's organizational history to include: (1) a background summary on the establishment of AFSPPF, (2) the evolution of this organization and its mission, (3) a resume of the security aspects involved in the operation of this Facility and, (4) a summarization of significant accomplishments over these past 16 years. Volume II centers around the various priorities and resources of AFSPPF. Specifically, Volume II discusses: (1) the growth in number and technical types of personnel, (2) the associated contractors and their relationships to this organization, (3) the equipment items assigned to each functional area, and (4) the evolutionary acquisition of the plant and its annexes. Volume III outlines: (1) the phasedown decisions, (2) the planning factors involved in the phasedown and transfer of the Evaluation, Production, and Research and Development functions, and (3) the details surrounding the final closure and deactivation of AFSPPF. Appendices have been provided which consist of significant historical references to present a more complete documentation.

The story has been written not only to preserve the significant role this organization has played in the National Reconnaissance Program (NRP) but also as a dedication to all of the men and women who created the history of AFSPPF through their individual and collective accomplishments.

Although many credits and acknowledgements are due for the writing, organizing, compiling, and reproduction of this history, the following are deserving of special recognition for their significant contributions. These individuals are: Lt Colonel Herbert J. Duval, Jr. who worked in several positions in the Analysis/Evaluation area for 11 years prior to his retirement in November 1975 and was largely

responsible for the creation of this history; Major Thomas S. Moorman, Jr. who served in the Analysis Division and as Executive Officer from 12 November 1970 thru 15 July 1974; Colonel Verl R. Stanley who served as Director of Evaluation and Vice Commander from March 1970 to July 1974; Captain Michael J. Riley who was assigned as an RD Development Engineer in 1969, later became Chief of the Special Activities Section, and finally was Executive Officer from July 1974 thru July 1976; Mr. George J. Myers who was hired as the Chief Scientist to the RD Director in July 1966 and was elevated to the position of Technical Director to the Commander in November 1969, where he remained until his retirement on 30 September 1976; and Miss Catherine M. Walsh who was the clerk-stenographer to the Director of Evaluation from July 1967 thru July 1975 and then assigned to the Administrative Office of AFSPPF from July 1975 thru December 1976.



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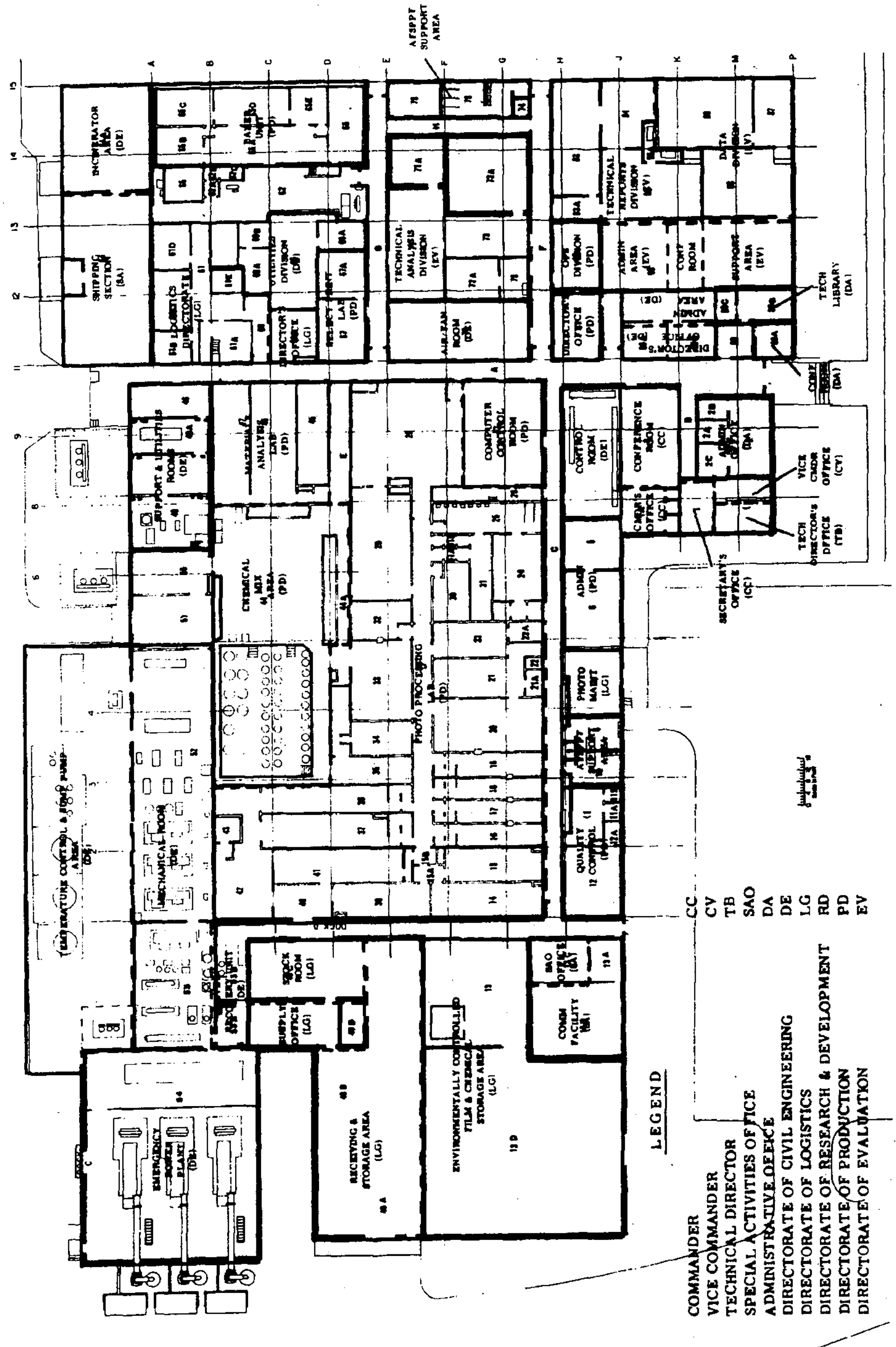


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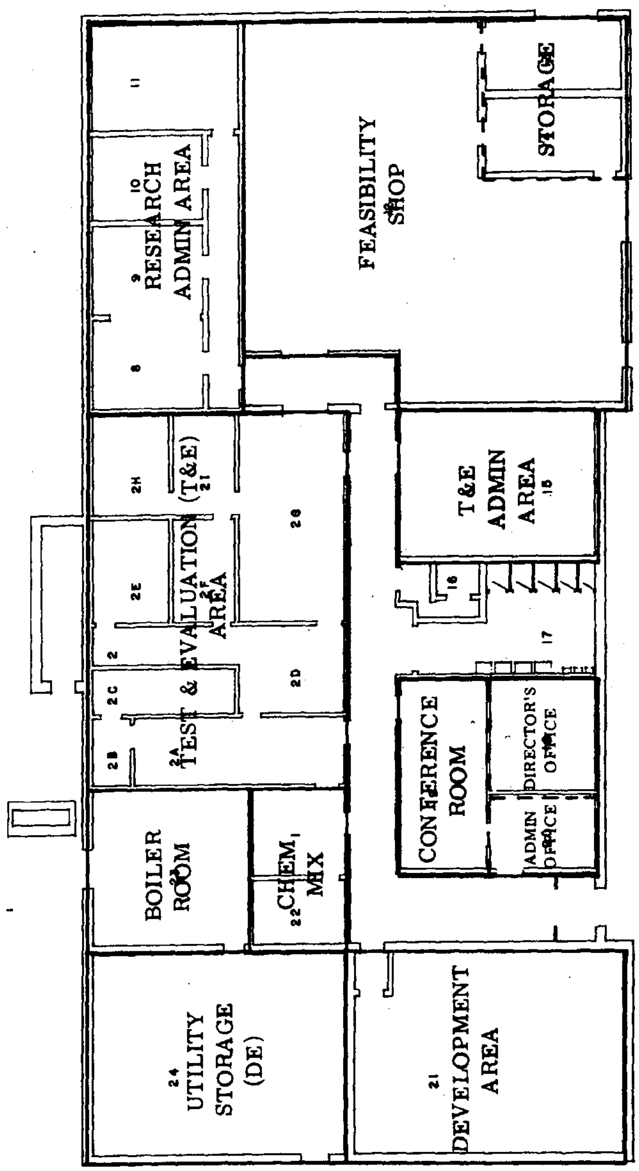


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# SECTION I

## INTRODUCTION

The Air Force Special Projects Production Facility (AFSPPF) was a unique organization created to meet requirements for the processing and duplication of earth satellite reconnaissance imagery and for research and development to originate and improve related photographic techniques and equipment. The organization was established on 15 December 1960 by Secretary of the Air Force Order Number 116.2 as the Air Force Satellite Photographic Processing Laboratory (AFSPPL) at Westover Air Force Base, Massachusetts.[1] The following message from the Office of the Secretary of the Air Force announced the establishment of AFSPPL, stated its mission, identified initial resources, and gave guidance to information officers for response to inquiry:

> "Confidential from SAFMS 70285 For: SAC, ARDC, AFBMD, 8 AF, AFBMD (SAFSP), and AFCCDD. Attn: Commander and Information Officer. This is a joint SAFMS and SAFOI message. Subject is establishment of the Air Force Satellite Photographic Processing Laboratory. This message in 2 parts. Part 1. The first steps toward establishment of an Air Force Satellite Photographic Processing Laboratory were taken on 15 Dec by an order of the Secretary of the Air Force specifically establishing this organization, defining its command and support structure, mission, and giving specific guidance to be followed in implementation. The laboratory will be an integral part of the SAMOS project and will be under the direct command of the Director of the SAMOS project, 2400 East El Segundo Boulevard, El Segundo, California. It will be largely created from the 8 Reconnaissance Technical Squadron at Westover Air Force Base, Massachusetts, and will be located at Westover Air Force Base. It will be attached to the Air Force Command and Control Development Division, Air Research and Development Command, L G Hanscom Field, Massachusetts, for administrative, logistic, and some contractual support. The mission of the laboratory embraces both research and development and processing and production of photographic materials. Specifically, its mission will be to conduct the research and development necessary to provide the best possible equipment, techniques, and knowledge applicable to satellite photography, to insure that the processing and duplication of photography obtained from satellite vehicles is of the highest possible quality, and to process, duplicate, and distribute this photography to designated users. Physical space and some resources and manning for the laboratory will be taken from the 8 Reconnaissance Technical Squadron. The 8 Reconnaissance Technical Squadron will remain as a separate unit with the Satellite Photo Processing Laboratory having priority over all resources. Some personnel will be drawn from other Air Force organizations. Actual transfer of spaces, manpower, and other resources will follow approval of a detailed plan to be submitted to the Secretary of the Air Force by the Director of the SAMOS project. This plan is based upon early work accomplished by ARDC, SAC, and the Air Staff, and is expected to be finally approved at an early date. The organization Commander of the new laboratory is expected to be named within a day or so and will immediately assume the duties as representative of the Director of the SAMOS project. Further implementation instructions will follow final approval of the plan mentioned above. Part 2. For Information Officer. No press information will be initiated on this subject by any Air Force organization or contractor. This also applies to internal media. The following may be used, in answer

1 SAF Order 116.2, 15 Dec 1960, Organization and Functions of the Air Force Satellite Photographic Processing Laboratory (Appendix, Item 1). (C)

to specific inquiry: 'The Air Force has established a Research and Development Satellite Photographic Processing Laboratory at Westover Air Force Base, Massachusetts. The laboratory will be attached to the Air Force Command and Control Development Division, ARDC. Its primary mission will be to conduct research and development necessary to develop techniques to be employed in future satellite photographic processing. The research laboratory will share the building occupied by the 8 Reconnaissance Technical Squadron of the 8 Air Force since it possesses one of the most modern laboratories of its kind in the country.' This answer to query will be used only if absolutely necessary and no further elaboration will be made. Objective is low key press treatment, if any." (C)

Very significant in this message, in light of subsequent security actions, is the admission of the earth satellite photographic mission. The changing policy with regard to security is discussed in Section III of this Volume. Also discussed in this Volume is the continuing concern with Base relations that began with the disruption of the 8th Reconnaissance Technical Squadron (RTS) mission in support of the 8th Air Force at Westover Air Force Base.

The organization continued as specified by SAF Order 116.2 until 25 August 1964 when SAF Order 116.3 changed the designation significantly to the Air Force Special Projects Production Laboratory, omitting reference to satellite photography.[2] From 26 January 1961 until 10 November 1965, the organization also was designated the 6594th Test Squadron, normally with AFSPPL appended in parentheses. The designation was further refined to the Air Force Special Projects Production Facility (AFSPPF) by a revised SAF Order 116.3.[3] The special order which organized the AFSPPF also discontinued the use of the organizational name, 6594th Test Squadron (AFSPPL).[4]

[redacted] in January 1962, this organization hereafter will be referred to as the Facility or AFSPPF. The Facility was supported administratively and logistically in turn by the Air Force Command and Control Division, [redacted] the Space Systems Division, Air Force Systems Command (AFSC), Los Angeles Air Force Station, California;[8] and the Space and Missile Systems Organization, Los Angeles Air Force Station, California.[9]

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2 SAF Order 116.3, 25 Aug 1964, Organization and Function of the Air Force Special Projects Production Laboratory (Appendix, Item 2). (FOUO)

3 SAF Order 116.3, 10 Nov 1965, Organization and Function of the Air Force Special Projects Production Facility (Appendix, Item 3). (FOUO)

[redacted]

9 SAF Order 116.3, 28 Sep 1971, Organization and Function of the Air Force Special Projects Production Facility (Appendix, Item 7). (U)

While many organizational realignments and nomenclature changes occurred during the life of the Facility, the primary mission of processing and duplication of earth satellite reconnaissance imagery and conducting related research and development remained. The mission of assessing the performance of camera systems was added in early 1963. Thus the Facility came to have an operational mission consisting of these three broad tasks. The relationship of the performance of these tasks was synergetic, as each individual function in many ways stimulated and nourished the other. The Facility also developed full logistic and civil engineering support capabilities over the years. Details on the evolution of the mission and organizational structure are presented in Section II of this Volume.

The earth satellite reconnaissance projects which the Facility was tasked to support were SAMOS, CORONA, GAMBIT, and HEXAGON. A history including a description of each of these reconnaissance systems, its development and antecedents, was prepared for the National Reconnaissance Office (NRO) by Mr. Robert Perry and published by the Facility in June 1974.[10]

The Facility was established and configured to support the SAMOS Project; however, this project was fraught with technical problems and emphasis was redirected to support the CORONA Program. The CORONA camera system was designed to acquire large area coverage for the purpose of search and surveillance. CORONA was followed in the development cycle by the GAMBIT Program. The GAMBIT camera was a high resolution pointing system used for specific target coverage. The CORONA Program was replaced by the HEXAGON Program. The HEXAGON camera is a search and surveillance system designed to provide high resolution with large area coverage.

Support of SAMOS was a primary mission of the Facility until the fall of 1962. By this time, the Facility's laboratory had developed into the most highly technical and precision production unit in the DoD. Therefore, it was not surprising that this Facility was selected to process and duplicate reconnaissance material during the Cuban crisis and that period shortly thereafter (October 1962 - April 1963). It was through these efforts during this period of immediate threat to our national security and the earlier support of the SAMOS Program that the Facility was presented the Air Force Outstanding Unit Award.[11] The citation for this award stated:

> "The 6594TH TEST SQUADRON (AFSPPL) (AFSC) distinguished itself by outstanding service from 1 May 1962 through 31 December 1963. During this period the 6594TH TEST SQUADRON, through exceptional achievement in the field of photographic science, rendered significant support to military operations which materially aided in the detection of and alleviation of a threat to the security of the United States of America. This outstanding contribution, effort, and devotion to duty brought highest credit on all assigned personnel of the 6594TH TEST SQUADRON, the Air Force Systems Command, and the United States Air Force."

10 A History of Satellite Reconnaissance Report, Volumes I, IIA, IIB, IIIA, and IIIB, Robert Perry, Oct 73 to Jan 74, BYE 17017-74. (TS)

11 AFOU Award, SO-GB-252, Hq USAF, May 62 - Dec 63, 15 Sep 64 (Appendix, Item 8). (U)

From the early days of the Facility, research and development was a dynamic part of the mission. It was essential in maintaining and developing techniques and equipment to ensure the most current expertise, quality, and production unit capability to accomplish this unique mission in imagery processing and duplication. It was also recognized that an interest in basic research was also essential since available technology was clearly insufficient at the time. A Research and Development Evaluation Team was established in April 1961 and chaired by the Facility with participation from personnel of recognized competence in the field. Representatives included scientists and photography experts from the Rochester Institute of Technology (RIT), Rome Air Development Center (RADC), and Aeronautical Systems Division (ASD). The team evaluated all equipment and technique development proposals gathered from the community by the Facility and recommended those that should be pursued.[12] Through the foresight of the Facility research and development people, many developments were identified in this early period which resulted in short range improvements, while others involving more basic research required eight to ten years before their full significance was realized. An example of this latter type of effort was in the research done on non-conventional films (Free-Radical, Dry Silver, Silver-Color, Amorphous, etc.). As early as October 1961, there is evidence of Facility recognition of the significance of the Horizons' effort to the National Reconnaissance Program.[13]

In 1962, the Configuration Control Board (CCB) was established for the management of research and development in support of CORONA film processing and duplication. Subsequently as the CCB mission expanded to also include support for GAMBIT and HEXAGON, the Facility provided technical evaluations of research and development proposals (PARs) presented by the primary contractor, Eastman Kodak (EK). The Facility was instrumental, through its own research and development efforts, in stimulating the development of alternate sources within the photographic industry. Frequently, these sources were selected by the CCB to pursue a development through the Facility in lieu of Eastman Kodak. This tended to encourage competition with its attendant rewards in creativity and cost savings, but more importantly the development of improved capability proceeded with greater vigor than would likely have occurred had it remained solely with one organization/contractor.

Although not clearly stated until early 1965, it was evident that the Facility mission would have to include an imagery analysis section tasked to evaluate the camera and duplication systems. Two study groups were convened which reviewed available knowledge and techniques of imagery analysis and

12 Letter, 6594th Test Squadron (AFSPPL), 25 Apr 1961, Summary of Activities. (C)
13 Letter, 6594th Test Squadron (AFSPPL), 24 Oct 1961, Summary of Activities. (S)

recommended courses of action which would lead to the development of a capability to evaluate camera system performance. These groups were the Drell Committee, chaired by Dr. Sidney Drell from Stanford University, and the Swing Committee with [redacted] as Chairman. This work was closely monitored and in many cases pursued within the Facility's research and development staff headed by Lt Col Leroy A. Williams. The magnitude of this work ultimately led to the establishment of the Directorate of Evaluation. The Evaluation Directorate became a key center for imagery analysis within the national reconnaissance structure and made significant contributions to the success of the CORONA, GAMBIT, and HEXAGON Programs.

In October 1963, the Controlled Range Network (CORN) was established as a program designed to support the imagery analysis task by providing a series of permanently "fixed" ground truth resolution targets of varying sizes and types throughout the United States and Canada. In addition to these fixed sites, there were nine mobile target field units formed which moved by truck or air to operationally selected locations. These mobile units were tasked to display canvas resolution targets to be photographed by aircraft and satellite reconnaissance cameras. The use of deterministic targets photographed operationally prompted major advances in imagery analysis. The Facility assumed the responsibility for directing CORN operations and for establishing and managing the contracts under which targets were fabricated, maintained, and deployed to meet evaluation requirements. As camera performance assessment through imagery analysis became more complex, CORN requirements became more specific and incorporated a variety of different size and types of targets in addition to the resolution targets.

Beginning with CORONA Mission 1001 in August 1963, the Facility was tasked as the primary alternate to the processing and duplication capability of the Eastman Kodak Company at Rochester, New York. EK had been contractually processing reconnaissance imagery for the Central Intelligence Agency (CIA) since the first clandestine flight of the U-2 and from the first success of the CORONA Program in August 1960. Exactly what was originally intended by this term "alternate" (sometimes referred to as "Viable Backup") relationship was never totally clear. In the beginning, CORONA tasking consisted of producing duplicate imagery for selected customers. This customer list increased over the years and original negative processing requirements were added on several missions. By the end of the CORONA Program (Mission 1117), all the original negative processing and duplicate imagery production were accomplished at the Facility. This was due largely to EK's involvement with the replacement program, HEXAGON. After the products from Mission 1117-2 were received by the intelligence community, Major General Lew Allen, Director of Special Projects (SAFSP) specifically cited the Facility in stating:

> "It is fitting that the original negative processing of final CORONA imagery be done by the SPPF, which has consistently contributed in a major way to the success of the national reconnaissance program. On the occasion of this significant processing

milestone, please extend my congratulations and gratitude to all of your certified people for a job well done. As we go forward with new tasks and increased capabilities, I know that the SPPF will continue to justify my confidence and that of the NRO." [14]

Other Facility commendations were received at the termination of the CORONA Program from the Director of the CIA, Mr. Richard Helms,[15] and the Director of the National Reconnaissance Office, Dr. John L. McLucas.[16]

AFSPPF produced duplicate imagery from the GAMBIT Program beginning with the first mission, 4001. The Facility demonstrated the capability, through both in-house training and Operational Readiness Tests (ORTs), to successfully process the 9.5 inch GAMBIT original negative. After processing the original negative and producing all duplicates on GAMBIT Mission 4337-1, in January 1973, the Facility received the following commendation from Dr. McLucas:

"I would like to extend my congratulations on the outstanding processing task recently completed at AFSPPF. The results were directly indicative of the fine professionalism which is consistently displayed at the Facility and also readily visible every time I visit there. Please express my gratitude to all involved personnel for a first rate job." [17]

A message was also received from SAFSP which stated:

"The success of GAMBIT Mission 4337 surpasses all expectations. Subject to PET confirmation, this flight resulted in the acquisition of the best GAMBIT resolution to date. To say the least, Dr. McLucas and members of the intelligence community were delighted with the results of this outstanding mission. They were specifically impressed with the sample enlargements from 4337-1 which reflected the processing quality of your Facility. Congratulations to you and your people for a job which demonstrated a high degree of technical competence and professionalism - extremely well done." [18]

The evaluation of camera system performance on-orbit was formally included in the Facility mission in support of GAMBIT. A Performance Evaluation Team (PET) was established with participation by governmental and contractor agencies involved in all phases of the camera system development and operation. The Facility supported the team with evaluated data collected through imagery analysis, provided a meeting place where imagery could be reviewed together with the collected data, performed final evaluation tasking and automated/scientific analysis, produced selected imagery for documentation, and published all PET reports.

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14 Message, Charge 3037, 2 Jun 1972, Commending AFSPPF for Support of CORONA Program (Appendix, Item 9). (TS)

15 Message, Pilot 4057, 26 May 1972, Commending AFSPPF for Support of CORONA Program (Appendix, Item 10). (TS)

16 Message, Whig 0761, 2 Jun 1972, Commending AFSPPF for Support of CORONA Program (Appendix, Item 11). (TS)

17 Message, Whig 0068, 19 Jan 1973, Commending AFSPPF for 4337-1 (Appendix, Item 12). (TS)

18 Message, Charge 0864, 7 Feb 1973, Commending AFSPPF for 4337-1 (Appendix, Item 13). (TS)

As experience was gained in evaluation of system performance and as the scientific/engineering capability of the Facility was upgraded, it became evident that performance assessment should begin during the preflight testing phase. This allowed a firsthand insight into the characteristics of that system which were paramount to the planning phase of operations, as well as postflight evaluation. This concept of "closed-loop" evaluation was pursued in 1969-1970 and led to an expanded role for the Facility in the performance evaluation of the HEXAGON system. This was timely in that the HEXAGON Program provided for a much more extensive system of ground testing camera components and vehicle integration than any of the previous programs.

The HEXAGON Project included a comprehensive preflight testing program employing large test chambers at the Sensor Subsystem Contractor's (Perkin Elmer, Inc.) plant, Danbury, Connecticut, and another at the Satellite Vehicle Integration Contractor (Lockheed Space and Missile Center), Sunnyvale, California. These test chambers were designed to simulate orbital conditions. Thousands of feet of film were exposed in testing each camera system in each of these chambers. The original negative film from the test chamber was processed and thoroughly evaluated at the Facility to determine the acceptability of each camera assembly and its readiness for flight. These tests were designed to determine the best exposure setting and to predict system performance on-orbit. Facility personnel were closely involved in mission planning for postflight analysis of performance, particularly with regards to the deployment of Controlled Range Network targets. This tasking was in addition to the extraction and data analysis during postflight performance evaluation and imagery duplication requirements of approximately two million feet per mission.

On 1 June 1973, management responsibility for the HEXAGON Sensor Subsystem was reassigned from the Office of Special Projects, CIA to SAFSP (SP-7). A period of transition involving detailed planning, letters of agreement, and new policies followed wherein the responsibilities were shifted over to the Air Force. Near the end of 1973, Mr. Robert J. Kohler, who as Deputy Program Director had in fact been the key manager in the development and operation of HEXAGON for the CIA, forwarded the following letter commending the support provided by the Directorate of Evaluation:

> "As my involvement in the HEXAGON Program draws to a close, I cannot let the moment pass without taking note of the long-standing association of our two organizations in this effort. Most importantly, I want to salute the outstanding and significant contributions of the Directorate of Evaluation as a body and the people as individuals.
>
> I can say without question that the Directorate of Evaluation has been the single most cooperative, dedicated group on this program with which it has been my pleasure to be associated.
>
> More important, however, is what we achieved. In our early acceptance efforts, we accomplished something the contractor was incapable of doing. Throughout the acceptance process, data collected by AFSPPF allowed us to isolate out-of-spec

> conditions and insure that the acceptance was based on all the facts, not simply those the contractor chose to present. In retrospect, however, the single most important activities we undertook were the Readiness Reports. Not only was this activity unprecedented in the NRP, but it was, in a major way, responsible for the outstanding performance achieved by the systems on orbit. The ability to run the A-2 tests, quickly evaluate the data and readjust system parameters pre-flight was essential. I say this in full recognition of the fact that the past efforts were without question, of the highest caliber and greatest meaning of any such effort conducted to date. In my view, getting the system set right pre-flight is much to be preferred to finding out about it post-flight." [19]

The Facility, as it operated in support of the GAMBIT and HEXAGON Programs in the period after 1970, bore little resemblance to the Facility that was established in December 1960. The tasking and the capabilities of the Facility had significantly grown to include: self-sufficiency to assure that the critical mission could be carried out under emergency conditions, which resulted in the addition of a 3000KW auxiliary power generation plant and a two million gallon water storage and pumping station; a fully capable civil engineering and logistics function; a high capacity EPA approved incinerator/silver recovery capability; and an industrial waste treatment plant to transform effluents to solids to reduce the effects of effluents, exhaust fumes, and smoke on the environment.

Contractual methods became sophisticated compared to the early years as a result of a stimulus to the industry provided by the Facility's research and development efforts. To avoid continual reliance on the same two or three contractors, other industrial sources had been encouraged to develop into the precision photographic by-products field. This resulted in a more healthy and competitive procurement and was a significant change as initially sole-source procurement had been the rule. Many significant developments were directly contributed by the Facility research and development programs or were prompted because of the pressure of competition. Entirely new concepts were developed in processing black and white and color films, photographic printing technology, film titling, quality assurance on the production line, and imagery analysis. The use of imagery analysis expanded to determine product quality, evaluate performance of the acquisition system, and identify and quantify anomalous performance.

The Facility became a storage center for films, chemicals, and photo-technical equipment in support of the nation's Overseas Processing and Interpretation Centers (OPICs). In 1965 for example, there was over $1 million provided to support Air Force and Navy reconnaissance technical units world-wide. On 30 June 1969, the Facility was tasked to manage and operate the National Emergency Reserve (NER). Photo processing and image viewing equipment was stored and inventoried through in-house data software. This

[19] Letter, Central Intelligence Agency, 27 Nov 1973, Commending AFSPPF for Support of HEXAGON Program (Appendix, Item 14). (U)

system could be activated immediately to forward any item by Logistics Air anywhere in the world within days after requirement request/approval. The unique capabilities and exceptional performance of this Facility were recognized through the presentation of the Air Force Organizational Excellence Award on 11 June 1973.[20] The citation which accompanied the award stated:

> "The Air Force Special Projects Production Facility has distinguished itself by outstanding achievement in support of activities extremely significant to the security of the United States and the free world from 1 July 1971 to 30 June 1972. During this period, the Air Force Special Projects Production Facility conducted necessary research and development in production and evaluation techniques in support of special projects for the Air Force. Through the dedication of personnel assigned this Facility, important advancements have been made in the overall Air Force research and development program. Displaying the highest professionalism and effectiveness, the Air Force Special Projects Production Facility contributed immeasurably toward the successful accomplishments of their mission. The distinctive accomplishments of the members of the Air Force Special Projects Production Facility reflect credit upon themselves and the United States Air Force."

The history of this Facility would not be complete without mentioning some of the key people responsible for the growth of this $50 million organization. Although all commanders were instrumental in the development of AFSPPF, two were in command during its most notable eras. Colonel Harold Z. Ohlmeyer was the first commander and held that position for eight years. It was during his tenure that this organization had to carve itself from HQ 8th Air Force (SAC) in human, plant, and equipment resources; establish rapid production response; develop close coordination for Base support; and expand in technical capability, equipment, personnel, and space to meet increased mission requirements. This was accomplished in the face of varied and in some cases intense opposition from the Base because of the struggle of priorities and the fact that this Facility was under a different parent command.

In his three years, Colonel Ralph J. Swofford did more in actually promoting and expanding the capabilities of this organization than any other individual. He fought for and got approval to process original negative material from the CORONA, HEXAGON, and GAMBIT Programs; initiated a program to build up our technical expertise by getting more scientific related personnel assigned; strongly supported an organizational restructuring to become less dependent on contractor assistance; and campaigned for and gained approval to have the governmental pre and postflight evaluation of each HEXAGON camera system performed at AFSPPF. As the result of his efforts the Facility improved its production capability through automation control, new equipment, and increased manning.

Lt Colonel Leroy A. Williams is considered to be the architect of research and development at AFSPPF. As a member of both the Drell and Swing Committees, he was able to remain current on the problems and efforts to develop new methods in assessing reconnaissance satellite systems and processing their

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20 AFOE Award, SO-GB-409, Dept of AF, Jul 1971-Jun 1972, 11 Jun 1973 (Appendix, Item 15). (U)

products. He then channeled funding and scientists into the development of new equipment and techniques to improve the processing and analysis capabilities of this Facility. He monitored other research programs in the photo-science community and coordinated closely with industrial organizations involved in this type of hardware, software, and evaluation and photographic reproduction methodologies for application to our mission requirements. Specifically in February 1961, he established an RD Evaluation Team comprised of Professor Shoemaker (RIT), Mr. Silkman (RADC), Mr. Berry of Wright Air Development Division, and his staff to review all efforts being pursued in this field. He was the first to require that each piece of equipment being developed be tested and evaluated in its breadboard stage.

Colonel Verl R. Stanley was originally assigned as Director of Evaluation on 1 March 1970. He then became Vice Commander on 15 May 1973 and served in that capacity until his reassignment on 19 July 1974. Colonel Stanley was the individual who coordinated each detail with the HEXAGON Program Chairman on the evaluation tasks of the preflight and postflight analyses phases performed on each camera system. Due to the significant increase in workload to support the HEXAGON Program, Colonel Stanley initiated action and received approval to increase his scientific and data processing staff, upgrade the precision data collection and data processing equipment, and enlarge the physical space to be used for these types of evaluation. He fostered a feasibility study to see what costs and factors were involved in managing and operating the Controlled Range Network Program with Air Force resources. He also forced the CORN contract into competitive versus sole-source bidding. Using cost comparison data from his feasibility study, he was able to more closely evaluate future CORN contract bids which at the time had risen to over [redacted] As a result, this competitive bidding saved the Air Force approximately $600,000 in the first year alone. Colonel Stanley was also tasked to plan for the Facility phasedown. He accomplished this through a carefully timed programming plan which outlined manpower reductions; equipment, personnel, and document movements; transfer of Facility functions to new operating locations; and preparations for closing the physical plant.

More on the personnel of this organization who provided significant contributions to its history is presented in Section I of Volume II.

A decision was reached to convert Westover Air Force Base from an active duty base of the Strategic Air Command to an Air Force Reserve (AFRES) Base effective 1 May 1974. It was decided further that many of the support functions would be deleted and/or reduced in scope. This caused the Commander (Col William E. Callanan), the Director of Special Projects (Brig Gen David G. Bradburn), and the Director of the National Reconnaissance Office (Dr. John L. McLucas) deep concern over the future of AFSPPF. The factors in question were adequacy of Base support; the actual need to retain a backup capability for processing in the face of stringent economy reductions; ever increasing operational costs;

security and cover of the Facility's mission; feasibility of alternate operational procedures in lieu of reduction or loss of Base support; and the DoD directive which required percentage reductions in military manning. At the direction of Dr. McLucas and Brigadier General Bradburn, the Facility accomplished a study of ten available options for continuing to perform AFSPPF's assigned mission at Westover AFB. The course of action recommended by the Facility is stated in a message[21] to Brigadier General Bradburn and Brigadier General John Kulpa who, at that time, was Chief of Staff of the NRO. As a result, Colonel Callanan was immediately directed to cancel construction and procurement of real property related equipment pending the final decision of the future of the Facility.

The staff of the Facility, led by Colonel Stanley, Major Moorman, and newly assigned Commander, Colonel Clark E. Davison, continued to study and assess the availability of Base support from AFRES, identify other sources of support, and negotiate host-tenant agreements in the best interests of the welfare of assigned Facility personnel and mission accomplishment. This work was severely hampered by the fact that the Facility was directed by the NRO Security Office not to make any statement concerning phaseout or closure of AFSPPF at Westover AFB.

On 24 October 1973, Dr. McLucas, who had recently been named Secretary of the Air Force, announced his decision by message[22] to phase down and ultimately close the Facility over a period from April 1974 through December 1976. It was necessary to program this lengthy transitional period to allow for the operational preparation of the production, research and development, and evaluation functions at new geographic locations.

It was not until 8 November 1973 that a limited release[23] to the DoD photo-science community was approved which discussed the future reduction/phasedown of the Facility. On 13 June 1974, a selective release[24] of the intention to close the Facility was approved, but again no public release was authorized.

The staff at AFSPPF designed and coordinated a detailed programming plan[25] which addressed the action items and milestone events required to complete the orderly transition of the operational functions during the phasedown and ultimate closure of AFSPPF.

The closure of the Facility marks the end of 16 years of development and achievement by the hundreds of men and women assigned to this organization. Their vital contributions to our national security through dedicated efforts in producing responsive, quality intelligence materials greatly assisted the United States Government in successfully meeting challenges such as the Cuban crisis in 1962, Vietnam in the mid-1960s, etc.

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21 Message Waddy 0668, 5 Jul 1973, Future of AFSPPF (Appendix, Item 16). (S)
22 Message Whig 1324, 24 Oct 1973, AFSPPF Realignment (Appendix, Item 17). (TS)
23 Message Whig 1400, 8 Nov 1973, AFSPPF Phasedown (Appendix, Item 18). (S)
24 Message Whig 0780, 13 Jun 1974, AFSPPF Phaseout (Appendix, Item 19). (S)
25 AFSPPF Report, 15 Apr 1974 (Revised 1 May 1975), Programming Plan PFP-1 (Realignment). (TS)

AFSPPF HISTORY
Volume I

## SECTION II

## MISSION AND ORGANIZATIONAL EVOLUTION

### BACKGROUND

The operational mission/tasking of the Facility, while changing in scope and complexity, has continued to be the processing and duplication of earth satellite reconnaissance imagery, imagery analysis for the performance evaluation of earth satellite systems, and photo-related research and development. Many other operational functions were added over the years; for example, the contractual and operational management of the Controlled Range Network (CORN), logistics support to other photo squadrons around the world by supplying film and chemistry in emergency situations, administratively managing and maintaining the National Emergency Reserve (NER) which provided a source of production/analysis equipment for all NRO facilities, etc. Each part of this organization's mission evolved as knowledge and experience were gained in the pioneering of reconnaissance from space. This Facility was established to support the SAMOS Project, and then successively adapted its resources and efforts to assist in the development and testing of each new program (CORONA, GAMBIT, HEXAGON [redacted].

The Facility was born into what now would be considered a relatively simple organizational structure. An office within the Air Force Ballistic Missile Division (AFBMD) of the Air Research and Development Command (later to become the Air Force Systems Command) was tasked with the responsibility of pursuing earth satellite programs. Some of these programs were conceived as early as 1946 and referred to by several various names/nomenclatures. The most significant of these was Weapons System 117L (WS-117L) from which the SAMOS Program was developed. The man in charge of this office was designated the Director of Special Projects (SAFSP) and was assigned to the Office of the Secretary of the Air Force (OSAF). SAFSP was one echelon under the OSAF, and AFSPPF at Westover AFB was but one echelon removed from SAFSP.

As the SAMOS Program faltered because of technological deficiencies associated with acquiring and electronically transmitting imagery from space, another satellite reconnaissance system was well into the development and test stages. This program was named CORONA and was a "spin-off" from much of the work done by AFBMD on WS-117L. The plan was to develop a search and surveillance satellite camera system and then perfect a re-entry and recovery procedure to physically recover the original exposed imagery. CORONA was covert and originally a joint effort of AFBMD and the CIA. The CIA had the responsibility for the payload system and contracted with the Eastman Kodak Company (EK) for the processing and duplication of the imagery. Two histories have been published on the CORONA Program, one based on the views of CIA[26], and the other on the interactions of the NRO.[27]

When the SAMOS Program was cancelled, the capability of the Facility was applied to CORONA in a supporting or alternate role to EK, who was the primary processing/duplicating contractor. This role relationship, tasked by OSAF/NRO, continued throughout the CORONA, GAMBIT, and HEXAGON Programs. The growth of research and development efforts to further improve photo processing equipment and techniques, the expansion of the Facility's evaluation mission, and the increased tasking to provide logistics support opened avenues to other technology laboratories and outlets in the government and civilian community. While this organization continued to be directly responsible to SAFSP and its mission, direction and tasking also came from another element of OSAF, the Office of Space Systems (SAFSS). Indirect tasking, in the sense that it had to be approved by SAFSP, was also received from the HEXAGON Program Office (CIA), subcommittees of the United States Intelligence Board (COMIREX, EXRAND), the Configuration Control Board (CCB), and the Defense Intelligence Agency (DIA). Operational work, as well as research and development studies, increased to a point in the late 1960s/early 1970s where it was necessary to coordinate/prioritize all projects at AFSPPF with activities at several different Government and industrial agencies. The complexities of tasking during this period are outlined in Table 2-1.

TABLE 2-1

AFSPPF'S TASKING INTERACTIONS

| Tasking/Coordination Interaction | Agency/Committee |
|---|---|
| Direct | SAFSP |
| | SAFSS |
| Indirect | HEXAGON Program Office (CIA) |
| | NRO Committees (CCB, Color Committee) |
| | USIB Committees (COMIREX, EXRAND) |
| | DIA |
| Coordination of Efforts | National Photographic Interpretation Center (NPIC) |
| | DIA |
| | Hq USAF (IN, AFSSO, AFRDR, MPC, ACIC) |
| | Hq AFSC (ASD, AFAL, RADC, CRL, FTD) |
| | Hq TAC/Hq SAC/Hq MAC/Hq PACAF |
| | NISC |
| | Defense Mapping Agency (DMA) |

26 CORONA Program History, Volumes I-V, CIA, 19 May 1976, BYE 15274-74. (TS)
27 IBID Footnote 10, page 1-3.

TABLE 2-1 (CONT'D)

| Tasking/Coordination Interaction | Agency/Committee |
|---|---|
| | Contractors (Eastman Kodak, Perkin Elmer, Itek, TRW, Aerospace, Data/Mead Corporation) |
| | Consultants (NBS, RIT, Eikonix, Technical Operations) |

As the technical capabilities of AFSPPF improved and expanded so did the mission; this was evidenced by the ever increasing demand to support more and different types of reconnaissance systems requirements. AFSPPF was given added responsibilities not only because of its expertise and technology but recognized for its continual efforts to develop/refine and manage resources which included personnel assignment and training, plant facilities, equipment, and other support areas. The success in every phase of the state-of-the-art resulted in elevating AFSPPF to the most advanced imagery production facility in the Armed Forces of the United States; the center for government evaluation of camera system performance both in the preflight and postflight phases; a primary source of innovative development of aerial reconnaissance photographic processing-related equipment, films, and techniques; and a source of competitive development which prompted EK to conduct a dynamic research and development program in response to National Reconnaissance Program requirements.

The command and control structure of the Facility was as follows: (1) Operations, AFSPPF was under the operational control of the SAFSP; (2) Administration, AFSPPF received budgetary and administrative management direction from Space and Missile Systems Organization (SAMSO) and the personnel offices at Westover AFB; and (3) Research and Development Support, AFSPPF was provided program contractual support from Rome Air Development Center (RADC), Griffiss AFB, the Air Force Avionics Laboratory (AFAL), Wright Patterson AFB, and procurement/contractual Air Force units at Westover AFB. The following is an historical summary of the development of the different organizational elements within the Air Force Special Projects Production Facility.

## THE PRODUCTION DIRECTORATE (PD)

Prior to the establishment of the Facility (as AFSPPL), Building P-1900 housed the 8th Reconnaissance Technical Squadron (8RTS). One of the primary tasks of 8RTS was the photographic processing and duplication of Air Force U-2 mission imagery. It was because of: (1) the modern photographic laboratory capability, (2) the proximity to Rochester, NY and Washington, DC, and (3) the fact that it was part of a large and active base that Building P-1900, Westover AFB was the site selected for this organization.

In 1961, the Operations Division, as it was known then, made several lab modifications in parallel with the development of production techniques to print and reproduce the product from the first 35mm photo-electronic satellite system. Three high speed 35mm spray processors (Houston Fearless SP-120) were installed for processing this new material. This relatively small format reconnaissance photography made it necessary to acquire interim printing equipment to reassemble 35mm frames from the SAMOS E-1 System onto a 9.5 inch format. This interim printing system led to the purchase, installation, and testing of two printers manufactured by EK. The Reassembly Printer was a prototype automated, high resolution projection instrument which utilized a strobe light source and was capable of printing 35mm strips onto 9.5 inch duplication film. The Cadillac instrument was the first continuous contact printer to use a mercury vapor lamp light source. It was purchased in early 1962 and used as the primary duplication printer. The Cadillac Printer was capable of printing black and white duplicate material up to 9.5 inches at a rate of 86 feet/minute. The lab personnel were trained, equipment made operational, communications teletype readied, and the Shipping Section placed on alert for SAMOS. Unfortunately because of the lack of success of this project, only one mission was processed and four duplicates produced. The acquisition quality of the film from this initial attempt at obtaining satellite reconnaissance was so poor that the other programmed launches of this project were cancelled.

During 1961 through 1963, the production capability of the Facility was mainly utilized to duplicate large volumes of tactical reconnaissance film in support of the Southeast Asia conflict. In October 1962, the Cuban crisis brought with it the requirement for immediate original negative processing, duplicate reproduction, and reporting on ten U-2 flights of Cuba each week for a six week period. AFSPPL was selected to be the primary processing/duplicating facility for U-2 mission operations flown during this crisis. Production footage from this coverage exceeded 500,000 feet. As a result of this and related photo reconnaissance operations, the importance of imagery reconnaissance was publicly recognized and the vital role of precision processing to the national intelligence effort was fully demonstrated.

The increasing demand for better quality photography generated the need for more sophisticated equipment and processing standards. This led to the development of programmable processors and improved printers, sensitometry, and quality control. The following were technological outgrowths based on operational mission experiences: (1) the concepts of infrared density scanning of partially developed images; (2) spray versus immersion processing, which contributed to the development of the Yardley and Trenton advanced processors; (3) development of a tri-gradient tone reproduction system; and (4) a Data Monitor System which provided a means for real time accumulation, evaluation, and control of essential film processing parameters. The Facility's technicians also made contributions in other areas, for example: major authors of Air Force Manual 95-13,[28] assistance in developing the Precision Photo Processing Course (AFSC 234X0) for Air Training Command instruction, etc.

[28] AFM 95-13, Dept of AF, Volumes I & II, Jun 66/Jul 67, Principles and Practices for Precision Photographic Processing Laboratories. (U)

Beginning with Mission 1001 in August 1963, the Facility began duplication of photo reconnaissance imagery from the CORONA satellite system. This consisted of producing approximately 375,000 feet of 70mm film monthly for as many as 25 customers. To prepare for original negative processing of CORONA materials, an Operational Readiness Test (ORT) was conducted in 1966 at AFSPPF. This ORT was requested by SAFSS and included the following participants: EK, NPIC, NRO, and CIA. As the result, the Facility established/refined operational procedures, was certified by the OSAF, and subsequently processed the original negative and produced all duplicates from Mission Segments 1047-1, 1115-2, 1116-2, and both 1117-1 and 1117-2.

Table 2-2 summarizes CORONA production at AFSPPF from August 1963 until the end of the program.

TABLE 2-2

CORONA PROGRAM PRODUCTION PER MISSION SEGMENT

| Year | Originals | Duplicates | Footage |
|---|---|---|---|
| 1963 | - | 5 | 1,375,000 |
| 1964 | - | 23 | 4,100,000 |
| 1965 | - | 25 | 4,500,000 |
| 1966 | - | 16 | 5,522,106 |
| 1967 | - | 18 | 6,479,434 |
| 1968 | 1 | 16 | 5,584,910 |
| 1969 | - | 12 | 9,499,101 |
| 1970 | - | 8 | 2,795,838 |
| 1971 | 1 | 4 | 1,417,022 |
| 1972 | 3 | 4 | 1,725,039 |

The increase and subsequent decrease in requirements reflected in Table 2-2 were functions of CORONA scheduling. After August 1963, the Facility was involved with some type of photo production requirement from every CORONA mission and was assigned the total production of the last CORONA system flight, Mission 1117, in May 1972.

When the GAMBIT Program flights began in July 1963, the Facility was again tasked to produce duplicates for each mission. Up until September 1966, the newly renamed, Directorate of Operations, was required to reproduce four duplicates, five in 1968, and in 1969 tasking was increased to all Priority 3 and Priority 4 production, a total of nine duplicates. Starting in mid 1971, the Directorate of Production conducted a series of ORTs to gain certification approval to process original negatives from GAMBIT missions. The final test conducted by the NRO, augmented by Eastman Kodak, NPIC, and GAMBIT Program Office personnel, in September 1972 was successful and approval granted by OSAF.[29] In January 1973, the Facility processed all requirements for GAMBIT Mission 4337-1, with great success.[30,31]

Table 2-3 summarizes the GAMBIT imagery originally processed and that duplicated by the Production Directorate (renamed from the Operations Directorate in January 1971).

TABLE 2-3

GAMBIT PROGRAM PRODUCTION PER MISSION SEGMENT

| Year | Originals | Duplicates | Footage |
|---|---|---|---|
| 1964 | - | 4 | 436,500 |
| 1965 | - | 4 | 466,800 |
| 1966 | - | 5 | 548,085 |
| 1967 | - | 5 | 898,899 |
| 1968 | | None (All production done at EK) | |
| 1969 | - | 9 | 498,318 |
| 1970 | - | 9 | 1,071,900 |
| 1971 | - | 9 | 1,155,856 |
| 1972 | - | 9 | 571,409 |
| 1973 | 1 | 9 | 1,117,703 |
| 1974 | - | 4 | 481,230 |
| 1975 | - | 4 | 147,112 |

In 1971, the HEXAGON Program brought to this organization a new challenge in mass production of high quality reconnaissance imagery. New distribution concepts implemented for this program, which specifically identified the required imagery for each customer (selected target complexes versus all receiving selected area coverage) reduced requirements from what they could have been under the old concept. Priority 1 and Priority 2 Target Complex Coverage and Priority 3 and Priority 4 Area Coverage were duplicated by the Facility. The amount of duplication varied from 11 to 30 copies depending upon the priority area being reproduced. The annual total production at the Facility increased from 8 to 9 million feet in 1970 to approximately 16.3 million feet in 1972 largely as the direct effect of HEXAGON requirements. This increase in volume greatly compounded production, shipping, and management problems.

29 Message, Whig 1176, 8 Sep 72, GAMBIT ORE at Westover (Appendix, Item 20). (TS)
30 IBID Footnote 17, page 1-6.
31 IBID Footnote 18, page 1-6.

The HEXAGON Acceptance/Readiness procedures included comprehensive tests of each camera in large test chambers equipped to simulate orbital operation. Between 15 and 30 thousand feet of original film were exposed through each sensor subsystem under nominal conditions in each of two chambers: Chamber A at Danbury, Connecticut, and Chamber A-2 at Sunnyvale, California. Frequently, the Chamber A-2 Readiness tests had to be repeated in part as many as three or four times to assure proper camera adjustment on-orbit. This resulted in another significant increase in the film volume. In June 1971, the Facility started processing HEXAGON test chamber original film. Although the volume per mission varied, it involved approximately 125,000 - 150,000 feet annually for an average of eight to nine camera systems.

Table 2-4 summarizes the production figures in support of the HEXAGON Program.

TABLE 2-4

HEXAGON PROGRAM PRODUCTION PER MISSION SEGMENT

| Year | Test Originals | Duplicates | Footage |
|---|---|---|---|
| 1971 | 3 | 11 | 1,323,011 |
| 1972 | 6 | 30 | 5,801,151 |
| 1973 | 10 | 30 | 6,305,232 |
| 1974 | 6 | 15 | 2,030,857 |
| 1975 | 4 | 4 | 986,658 |
| 1976 (thru May) | 0 | 4 | 514,369 |

Various additional tasks were assigned to the Production Directorate over the years. An example of these was the daily processing of U-2 reconnaissance coverage of Cuba during the crisis; after the crisis, the Facility was reassigned as the alternate photo production unit to the Naval Intelligence Support Center (NISC). As alternate, two missions were processed and duplicated at this organization, each mission resulted in approximately 60,000 feet of film. Another task was the processing of imagery from 1964 thru 1968 in support of the Terrestrial Sciences Division of the Massachusetts Institute of Technology and the Cambridge Research Laboratory's cloud physics studies. This involved the processing of approximately 18,000 feet of original film annually in 1964 thru 1966 and about half that amount in 1967 and 1968. Figure 2-1 lists a summary of the imagery footage produced by AFSPPF from 1961 thru 1975. Figures 2-2 thru 2-4 present work flow charts during different periods of the 1970s. Figure 2-2 charts the duplicate production flow during the peak period of 1972 and 1973 under the automated control of the IBM 1130/1800 System on-line; off-line in April 1974 with production control from the IBM 360/40 (Figure 2-3); and back on-line in June 1975 with control by the PDP-11/40 (Figure 2-4). This method of control and a detailed work order form filled out by the Production Directorate's Operations Division were the means utilized to monitor all assigned mission projects. Other automated programs were used to control such tasks as

SUMMARY OF AFSPPF'S PRODUCTION

(millions of feet)

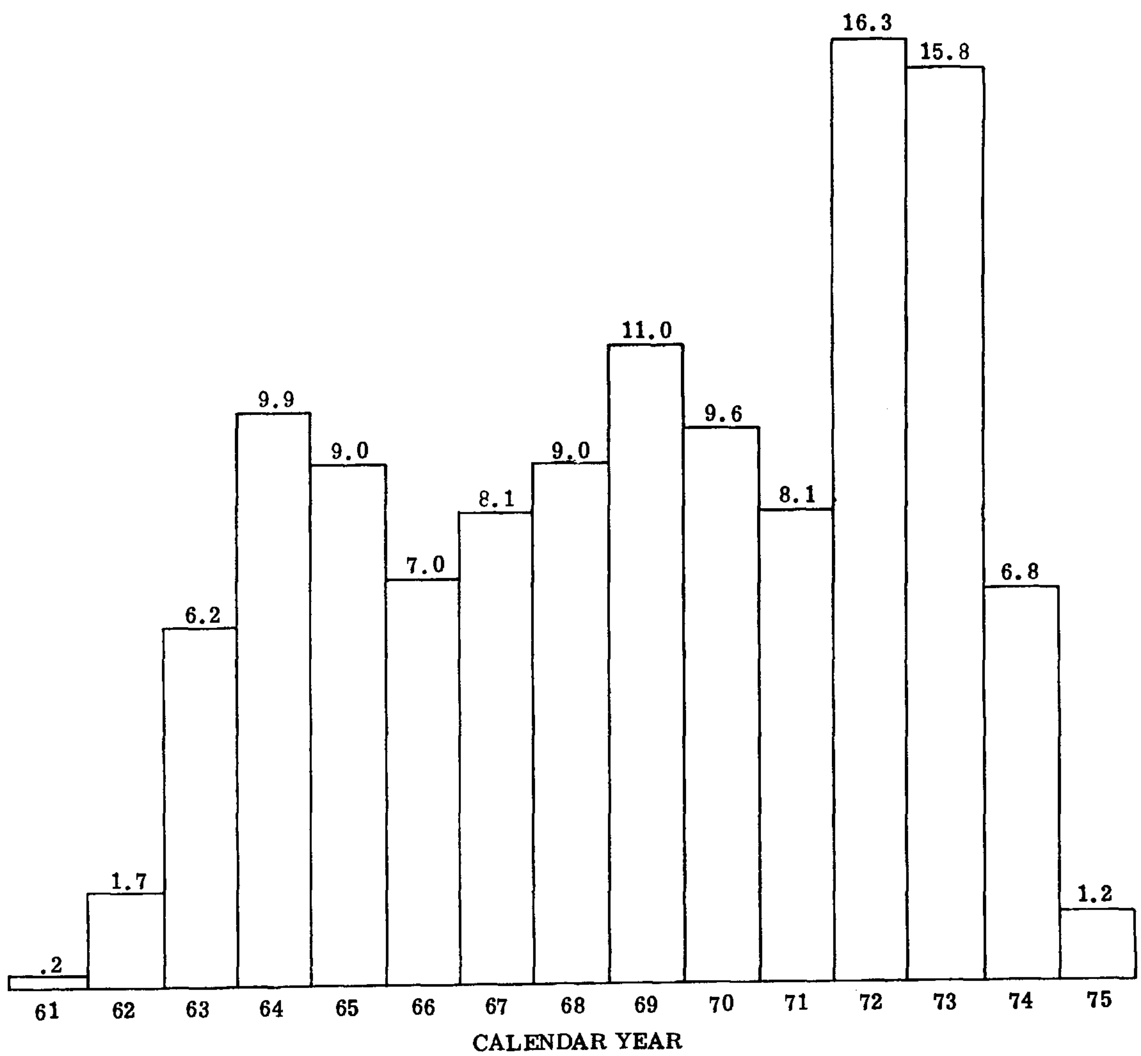



FIGURE 2-1

DUPLICATE PRODUCTION WORKFLOW AS MONITORED BY THE 1800/1130 COMPUTER

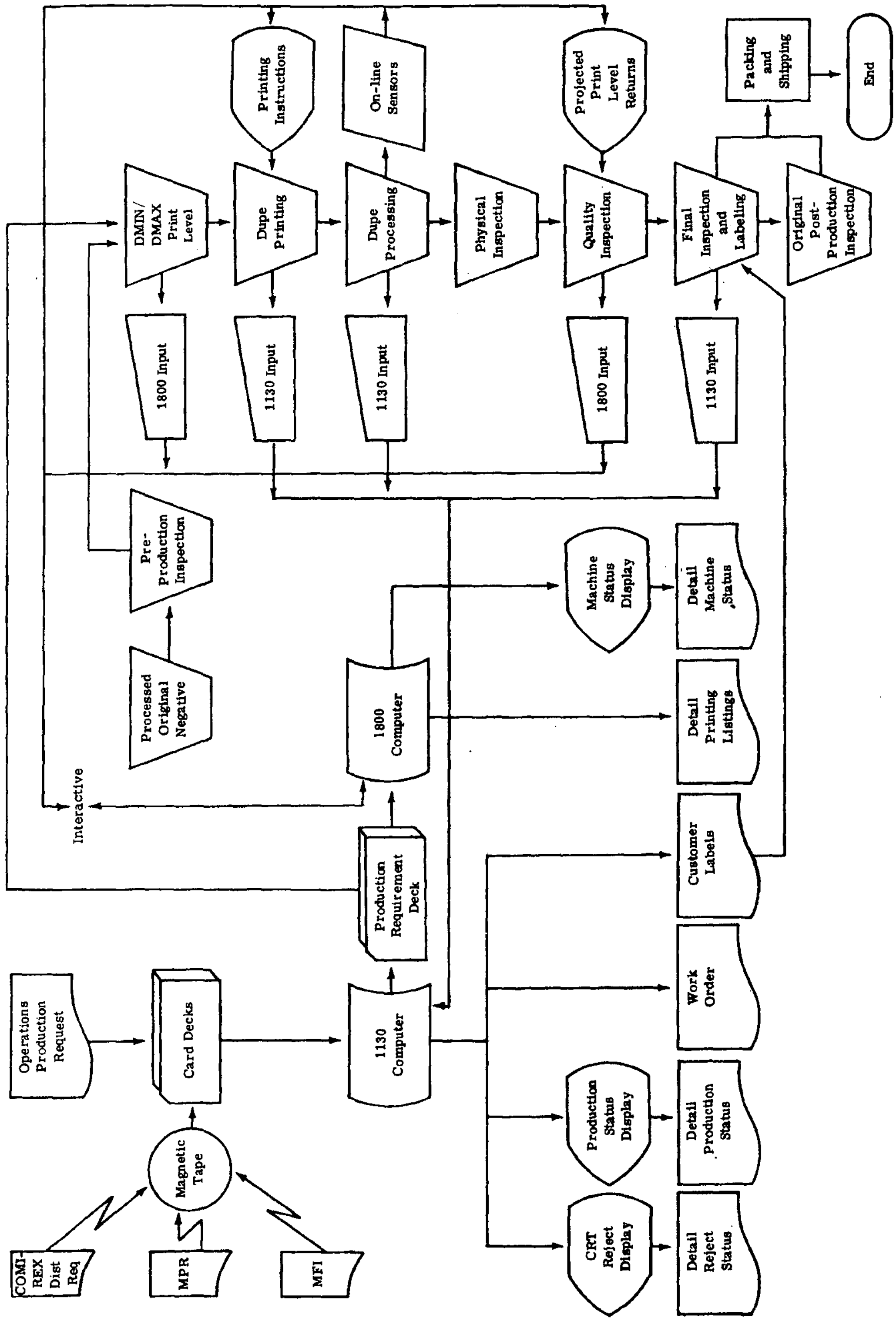



FIGURE 2-2

DUPLICATE PRODUCTION WORKFLOW AS MONITORED BY THE 360/40 COMPUTER

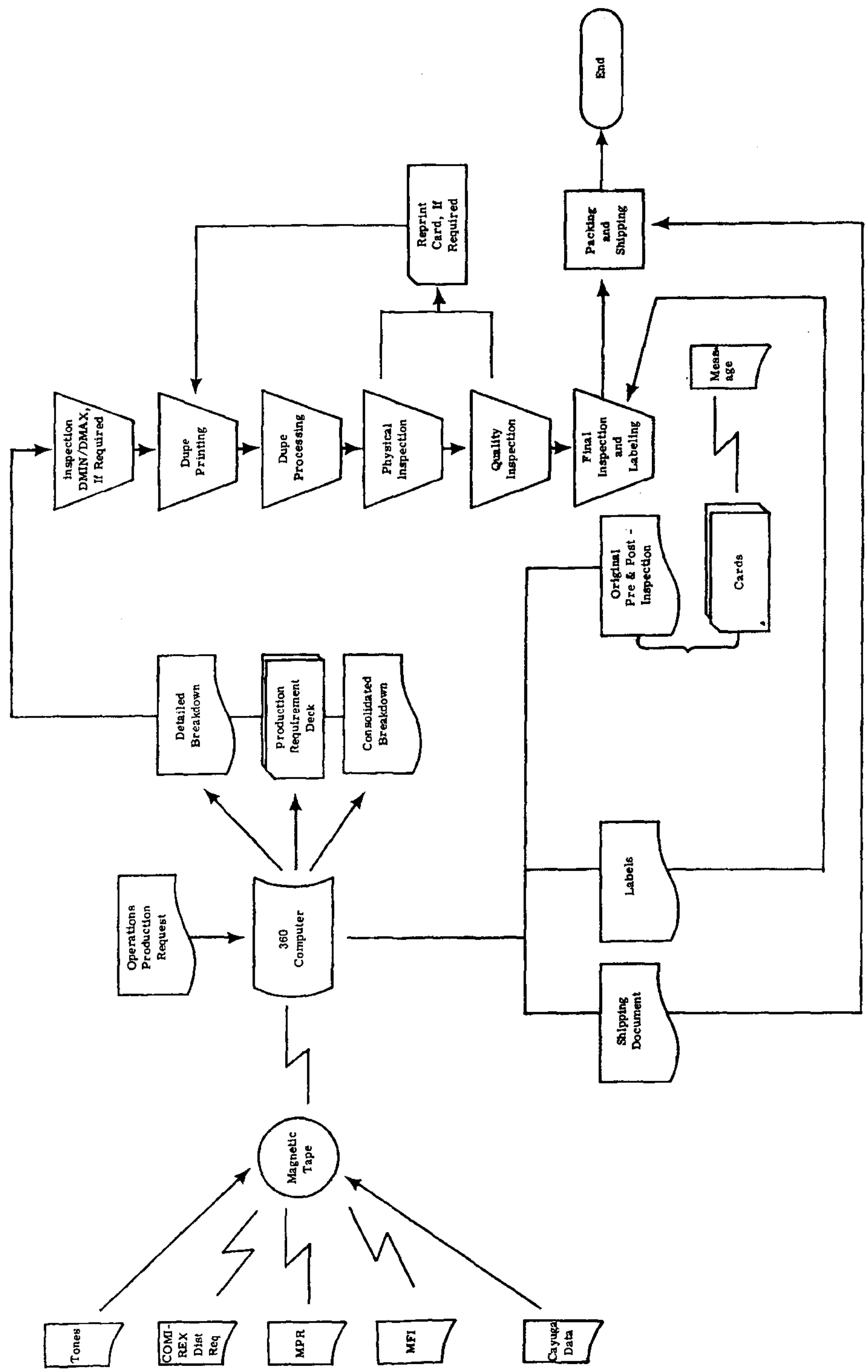



FIGURE 2-3

DUPLICATE PRODUCTION FLOW AS MONITORED BY THE PDP-11/40 COMPUTER

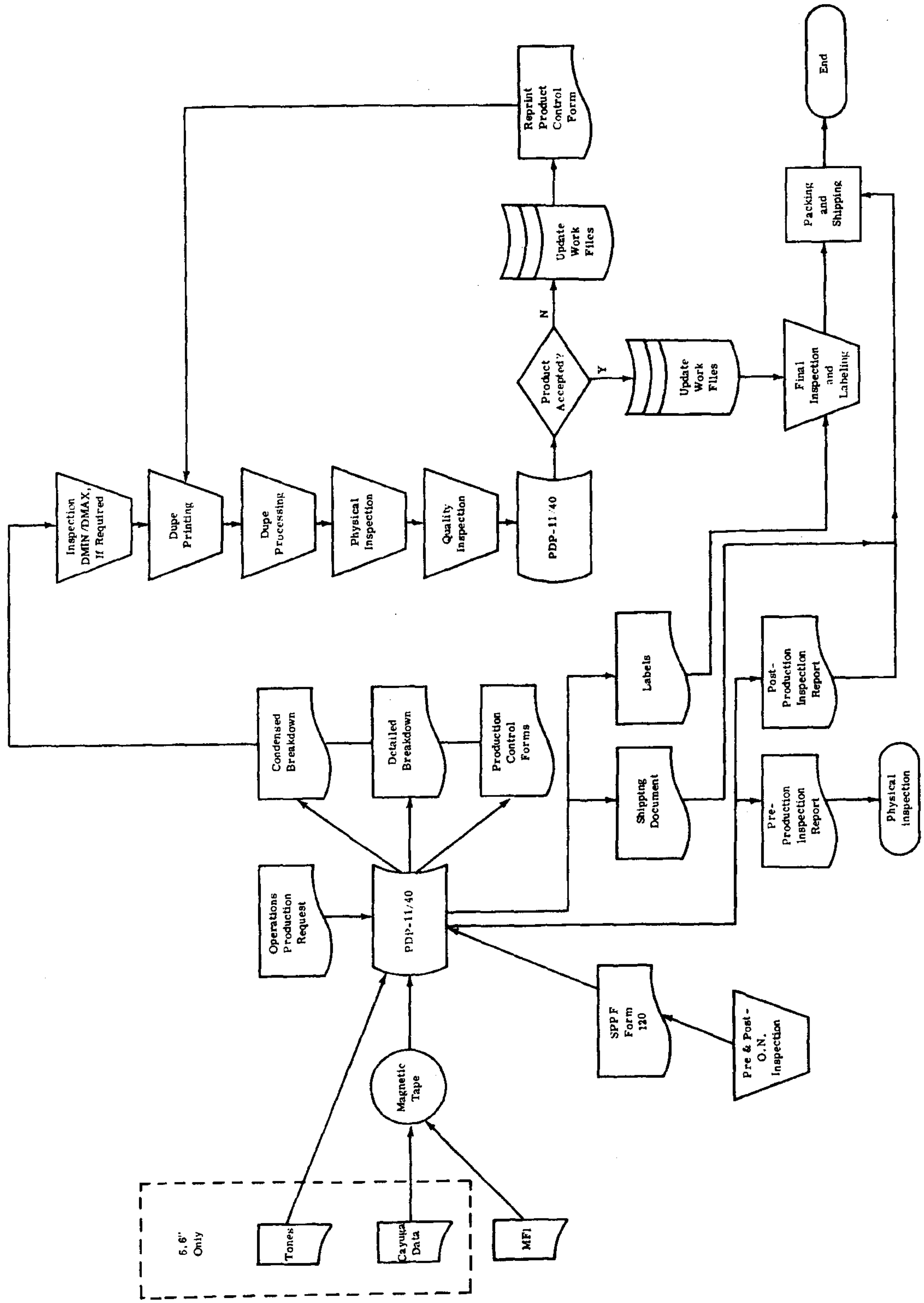



FIGURE 2-4

quantitative/qualitative chemical analysis, granularity, image quality/resolution, tone generation/reproduction, processing standards, etc.

Throughout the history of the Facility a dynamic effort was made to upgrade the production capabilities, satisfy all current and projected requirements, assure the highest quality product possible, meet all suspenses, and to operate in as cost effective a manner as possible. In order to fulfill these goals, personnel were selected by name, the use of photo technology consultants and contractors expanded, the physical space of the laboratory enlarged, and production equipment improved. Of primary significance was upgrading the process control system with the following improvements: (1) advanced processors, (2) process sensor instrumentation, (3) automation of process monitoring functions, and (4) establishment of high precision, automated chemical mixing, analysis, and control capabilities. Other refinements were made in the establishment and maintenance of a Class 100 Cleanroom, automation of the production control function, and significantly improved materials analysis and sensitometry capabilities. Some specific improvements are summarized below:

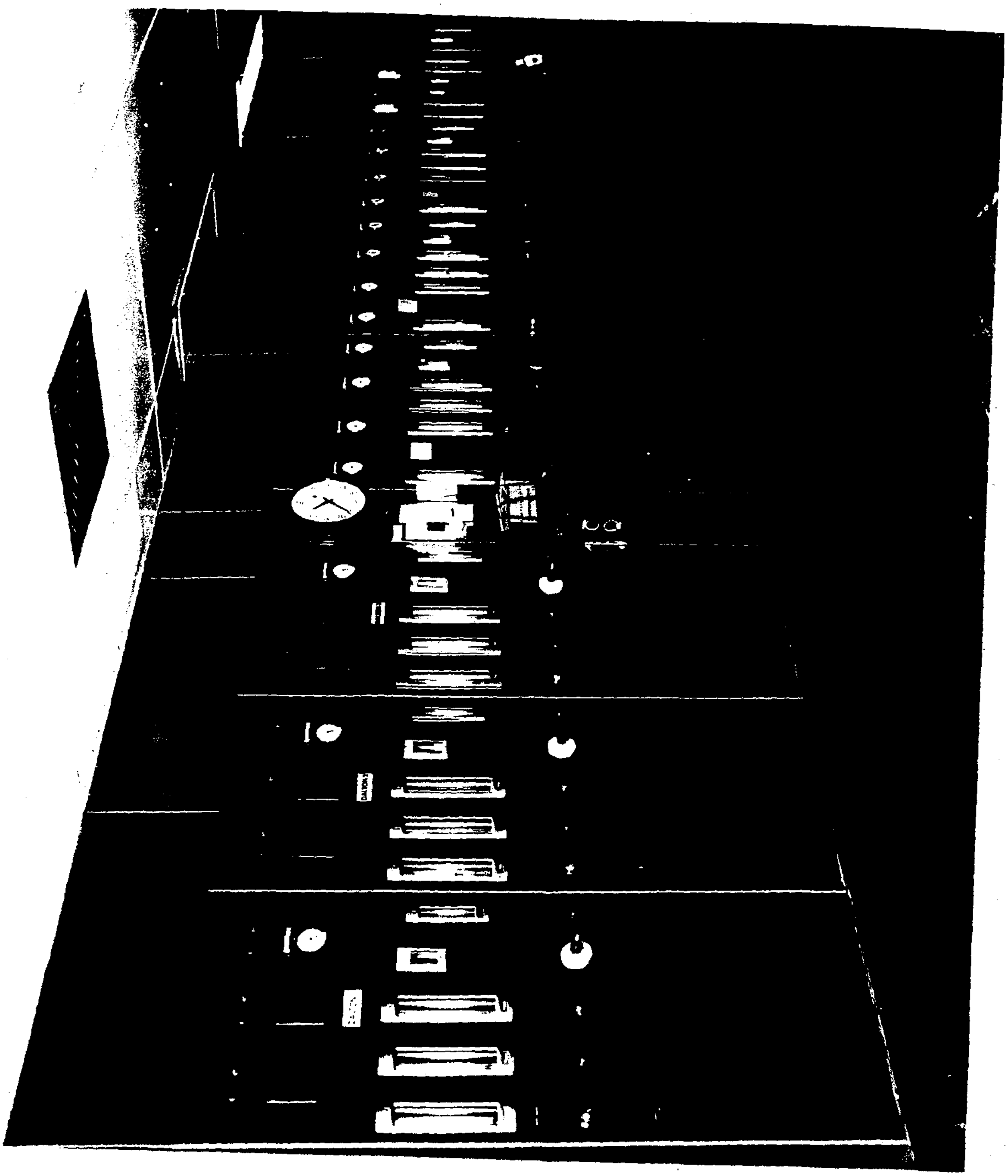
A. A bulk chemical batching system was installed in 1969 to automatically weigh and precisely mix predetermined developers and fix constituents. This, together with the expanding chemical analysis capability, enabled the Facility to develop a special developer formula for normally high contrast SO-192 Film in spray processors. This modified formula allowed for low contrast processing of SO-192 Film in regular production, without performing costly modifications to the processors for viscous operation. The automated batching system resulted in a significant savings in time, manpower, and materials. Figure 2-5 shows a picture of the chemical mix area with the batching system's control panel in the background.

B. The installation of an electronic monitoring/control system also known as the "Taylor Package" was made on a Dalton Processor in 1972. This system allowed all critical parameters of the processor to be remotely monitored with three options for effecting any process correction: (1) machine operator, (2) human intervention at the process control monitoring console, or (3) automatically by the IBM 1800 Computer. After an exhaustive but successful testing period, the other Dalton and Trentons were also modified with this system. Figure 2-6 shows the enormous size and complexity of the monitoring/control panel.

C. A chemical analysis study was conducted by the Stanford Research Institute in the 1969-1971 period and the tests performed by Facility technicians. This study resulted in analytical methodologies which greatly enhanced the development of the chemical analysis procedures used by this organization. This work was also the prime impetus for increased technical personnel, equipment, and materials specialization which led to the expansion of the Chemical Analysis Laboratory. Figure 2-7 presents a picture of the chemical analysis area.

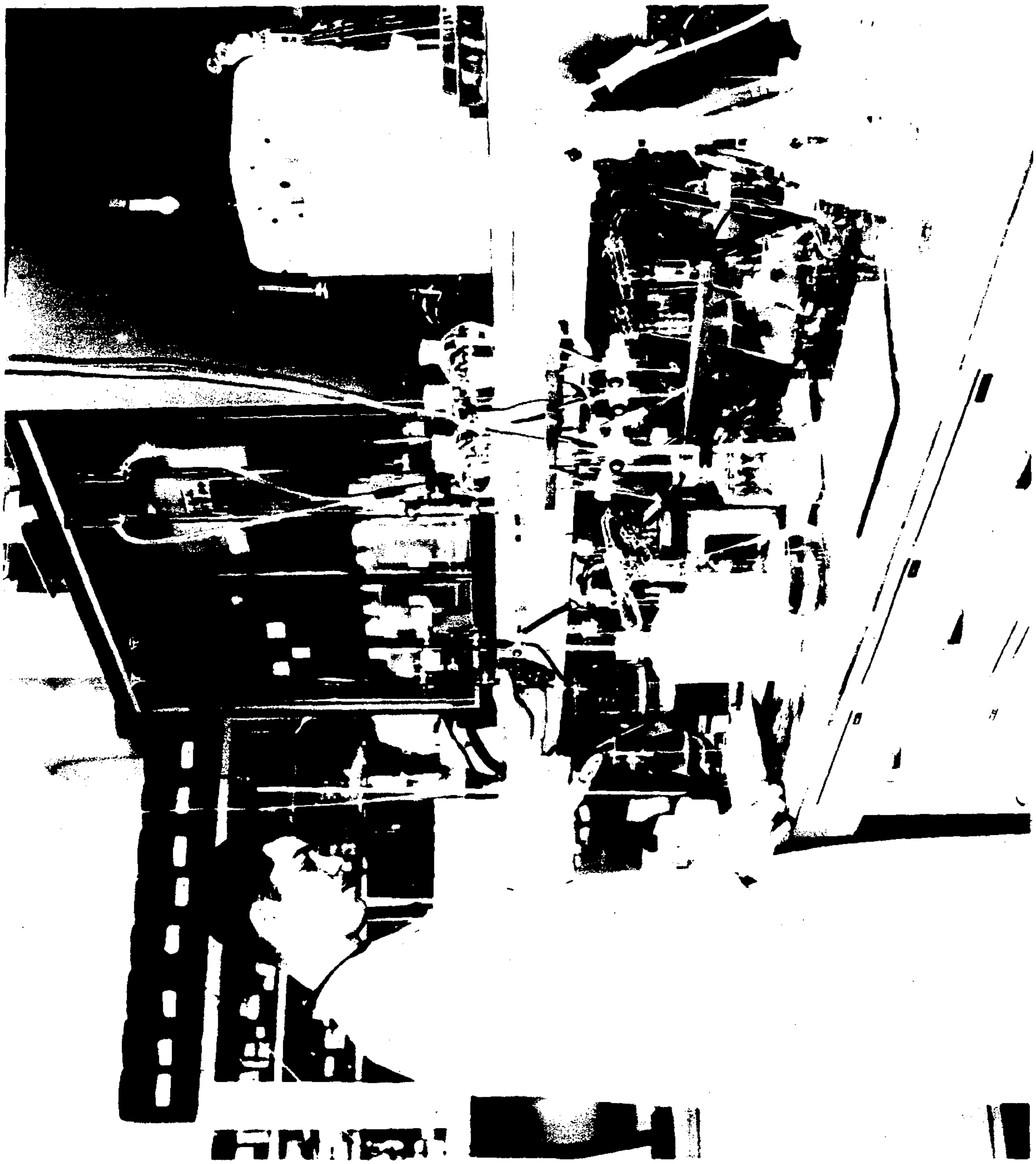
AUTOMATED CHEMICAL MIXING AREA

FIGURE 2-5



ELECTRONIC MONITORING/CONTROL SYSTEM

FIGURE 2-6



CHEMICAL ANALYSIS AREA

FIGURE 2-7

Support areas that made vital contributions are:

A. The Materials Analysis Laboratory (MAL)

In April 1970, this lab was established as a "spin-off" from the Research and Development Directorate. It was equipped to test and establish sensitometric and densitometric standards; accomplish initial testing of new films and processes; evaluate products through microanalysis, macroanalysis, sensitometric, spectrophotometric, photometric, and radiometric means; and perform standardization of materials and machine calibrations. Some of this laboratory's major achievements include: (1) discovered the negative effects of film base pelloids in both original and duplicate materials. This study produced a report submitted to the NRO[32] which ultimately led to the development of nonpelloid duplication films by EK; (2) categorized different film types by their sensitivity wavelengths and photometric transmission signatures to determine the best combination of original negative to duplication material for optimum quality production; (3) represented the Government in interferometrically measuring the optics produced by a contractor to determine if they met required specifications prior to their being assembled into the optical bar HEXAGON cameras; (4) performed numerous tilt measurements on the chamber produced Sync-Flash Targets to determine whether optics were properly aligned in the HEXAGON Camera System; (5) saved the Government approximately $60,000 a year by developing a formula to replace the previously purchased developer (Dupe 1:1), this new formula was named SPPL 1 and has been refined throughout the years to meet the changes in film types, equipment, and processes; and (6) most recently in 1976, saved the Government $70,000 in solving the focus problem in the Advanced Microcamera System. The solution was the development of nylon collars which allowed an even distribution of air flow onto the film being sensed by the focusing platen.

Figure 2-8 shows a view of one of the laboratories within the materials analysis area.

Although there have been several outstanding technicians assigned to this laboratory operation, it has been Mr. M. Worwood (1962-1976) who through his initiative, experience, and expertise has been responsible for the development of this photo science mensuration and standards laboratory. The laboratory has provided service not only to this Facility but also to many associated laboratories within the photo science community.

B. The Select Print Laboratory (SPL)

The Still Photographic Laboratory was established in 1962 under the Research and Development Division; transferred to the Technical Reports Division, Evaluation Directorate where it was renamed the Technical Reports Photographic Laboratory Branch during the major Facility reorganization in June 1966; and was reassigned under PD as the Select Print Laboratory in late 1970 when a reorganization took place

32 Film Base Study, AFSPPF, Aug 1966. (U)

CALIBRATION/VIEWING/MICROGRAPH/DENSITOMETER EQUIPMENT

IN MATERIALS ANALYSIS AREA

FIGURE 2-8

to put all photo laboratory personnel under the same directorate. Originally this lab was confined to an approximate 890 square foot area to accomplish general purpose black and white photographic camera, process, and printing support. Most of this support work was processed manually. In 1964, a giant step was taken toward speed and consistent quality in line and half tone work with the purchase of a LogEflo LD-24 Automatic Film Processor. By late 1970, the requirement to produce briefing aids and select prints for technical reports had significantly increased. This production increase was in support of the existing GAMBIT and CORONA Programs and the projected volume from the new HEXAGON system. To expand this area, the Baker Unit, a self contained portable cleanroom, with its 2,200 square feet of working space was transferred from RD to the SPL. This resulted in a better productional flow by allowing more than one task to be worked on at a given time. Figure 2-9 shows the printing/enlargement area within the Baker Unit. Figure 2-10 shows the original SPL area which was now used as a studio, copy camera, and microfilming/processing area. The capability of SPL expanded to include one-to-one or enlarged quality prints and 35mm and overhead vuegraph briefing slides in either black and white or color. Four men stand out in the development of this unit considered by many the finest still photography laboratory in the DoD. These men are: Mr. C. Rauscher, Technical Reports Division Chief (1962-1976), who with Sergeant R. Wagner built the framework and established the early black and white production procedures; Captain D. Sykes who doggedly pursued establishment of a color production capability; and Sergeant P. Schoen, Chief of the SPL (1970-1976) who refined and improved techniques, training, and equipment to meet the stringent suspenses posed by the GAMBIT and HEXAGON Program Offices and the NRO in support of special reproduction requirements. SPL significantly distinguished itself and the Facility through its quality reproduction of color and black and white illustrations and mission imagery photographs for high level documents, for example: two Color Task Force Reports for the NRO;[33,34] the five-volume CORONA History;[35] the five volumes of a history of satellite reconnaissance,[36] etc.

C. Computer Division

Before this division was established in 1966, there were a few successful systems developed toward automatically controlling the production process. The first was in the 1961-1963 period when the Macbeth Quantiscan was installed to read a step wedge to determine if the processing machine were in control. As the mission requirements increased in the mid 1960s, it was decided that the most practical

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33 Use of Color Photography in the NRO, Color Task Force, May 1971, TCS 354012-71. (TS)

34 Technology, Status, and Future of Satellite Color Photography, Color Task Force, Dec 1974, TCS 363509-74. (TSRN)

35 IBID Footnote 26, page 2-2.

36 IBID Footnote 10, page 1-3.

SELECT PRINT LAB PRECISION PRINTING AREA WITHIN THE BAKER UNIT

FIGURE 2-9

SELECT PRINT LAB STUDIO/MICROFILMING AREA

FIGURE 2-10

way to maintain uniformity and quality was to computerize the product control function. The IBM 1130 was purchased in February 1967 and supported production control up until it was discontinued in November 1974 due to the pending closure of the Facility. Although it took approximately a year to develop operational software for this system, it was invaluable in revising a time-consuming manual operation into an automated product control/management tool. Approximately a year later, a proposal was made for the rental of an IBM 1800 Computer System to interface with the 1130 to further refine product control. This action was approved and the 1800 arrived on 7 November 1968. This system allowed direct on-line support, centralized process control, processor parameter monitoring and control through the Taylor instruments, and technical data collection/analysis/distribution within the PD lab area. The 1800 was also discontinued (April 1974) because of the closure. Once the decision was made to discontinue the 1130/1800, a study was made to find the elements within the production cycle which justifiably required automated support. These elements were defined and action taken to purchase a PDP-11/40 which was felt to be totally capable of providing production/quality control for this Facility's scaled down mission (10% of NRO duplication requirements). The system was installed in December 1974 and was declared operational after an ORT in June 1975. This system's software capability has been and will continue to be expanded to meet the ever improving technology of photographic processing. This PDP-11/40 will transfer with the Production function to Offutt AFB. Prior to the full operational control of the PDP-11/40, there was the interim use of a PDP-8E (on loan from the Evaluation Directorate) by the quality control personnel for density acquisition feedback and densitometer calibration. This system was never fully exploited as a support tool because it was designated for transfer with the Evaluation function. Off-line support (labels, breakdown listings, production control cards, etc.) was provided through the IBM 360/40 Computer assigned to the Data Division, Evaluation Directorate.

Figure 2-11 is a view of the Computer Control Room from which the equipment monitored data/status of the entire production cycle.

In the early years of the 1130 and 1800, much of the software was developed through the assistance of contractors (AIL, CSC, Data Corp, etc.) as the majority of personnel were photo processing technicians assigned from the PD lab to be computer operators. However, it was basically the in-house computer programmers who wrote and tested the operational software for the PDP-8E and PDP-11/40. The most significant figure during this time was Captain J. Hill, Computer Systems Analyst, who supervised, designed, and scheduled the rewrite and revision of all programs. Also, the work of Mr. G. D'Amours on the initial documentation of the PDP-8E and Sergeant M. Strausbaugh on the transitional and future development of the PDP-11/40 deserves special recognition.

THE COMPUTER MONITOR/CONTROL ROOM

FIGURE 2-11

D. Despooling/Downloading Complex

In 1970, a proposal was made to install a despooling/downloading area in AFSPPF to give the GAMBIT and HEXAGON Program Offices a complete reproduction system alternative to EK. This proposal was approved and the complex installed by EK personnel in May-June 1971 at a cost of [redacted] This gave the Facility the capability of despooling, splicing, and inspecting 70mm to 9.5 inch film from the Take-up spool of a test or operational camera system. Figure 2-12 shows equipment in this area.

The dynamics of trying to improve the photo production operation continued throughout the history of AFSPPF through the use of the most current printer/processor/titler/analyzer equipment; contractor and in-house modifications due to new applications and/or techniques; and the development of new instruments to satisfy new, changing, and increased requirements. This improvement goal started with the Houston Fearless A-8 Immersion Dupe Processor right up to the Trenton and from the Morse A-11 Manual Control Printer to the Cayuga. Figure 2-13 shows the printing area as it was configured with five Redondos (modified Niagaras) prior to the transfer of the Production function. Figure 2-14 is a picture of the densitometer/final inspection/quality control area.

As part of the phasedown, the Facility's mission was reduced to approximately 10% of the National Reconnaissance Office requirement for black and white mission imagery duplication. This was specifically defined as the requirement to produce all Priority 4 products for HEXAGON and GAMBIT missions. The new tasking became effective with Mission 1208 on 7 May 1974. In parallel with the reduction in mission came a decrease in personnel, processing equipment, and automated support systems. As the result of the manning reductions, there were only enough personnel to man two shifts (18 hours) versus three shifts (24 hours) during mission operations; thus PD was given a more relaxed delivery suspense (stated as, "on a timely basis").

The successful mission performance by the Production Directorate was totally a team effort. However, it was men like: Captains F. Battey and W. Neyman with their strong leadership and planning; the parochial and knowledgeable concern and guidance of Lt Col W. Kunde; the superior administrative and clerical support of Sergeants K. Bernhard and G. Fraley; and the firm photographic processing foundation, dedication, and expertise provided by the top noncommissioned officers in the field, for example: Sergeants L. Miller, L. Lee, L. Coulter, W. Ray, T. Schacklett, R. Webb, J. Laurendi, J. Moore, B. Vestal, W. Smith, T. Haga, and R. Poelman who were responsible for establishing this organization's reputation for quality and time-responsive production. Many of these men spent two or more tours at the Facility.

The Production function; photo processing, computer, maintenance, and administrative technicians; and the production and computer equipment will be transferred to the 544th Aerospace Reconnaissance Technical Wing (ARTW), Offutt AFB Nebraska. This unit is scheduled to be fully operational by November 1976.

DESPOOLING/DOWNLOADING AREA

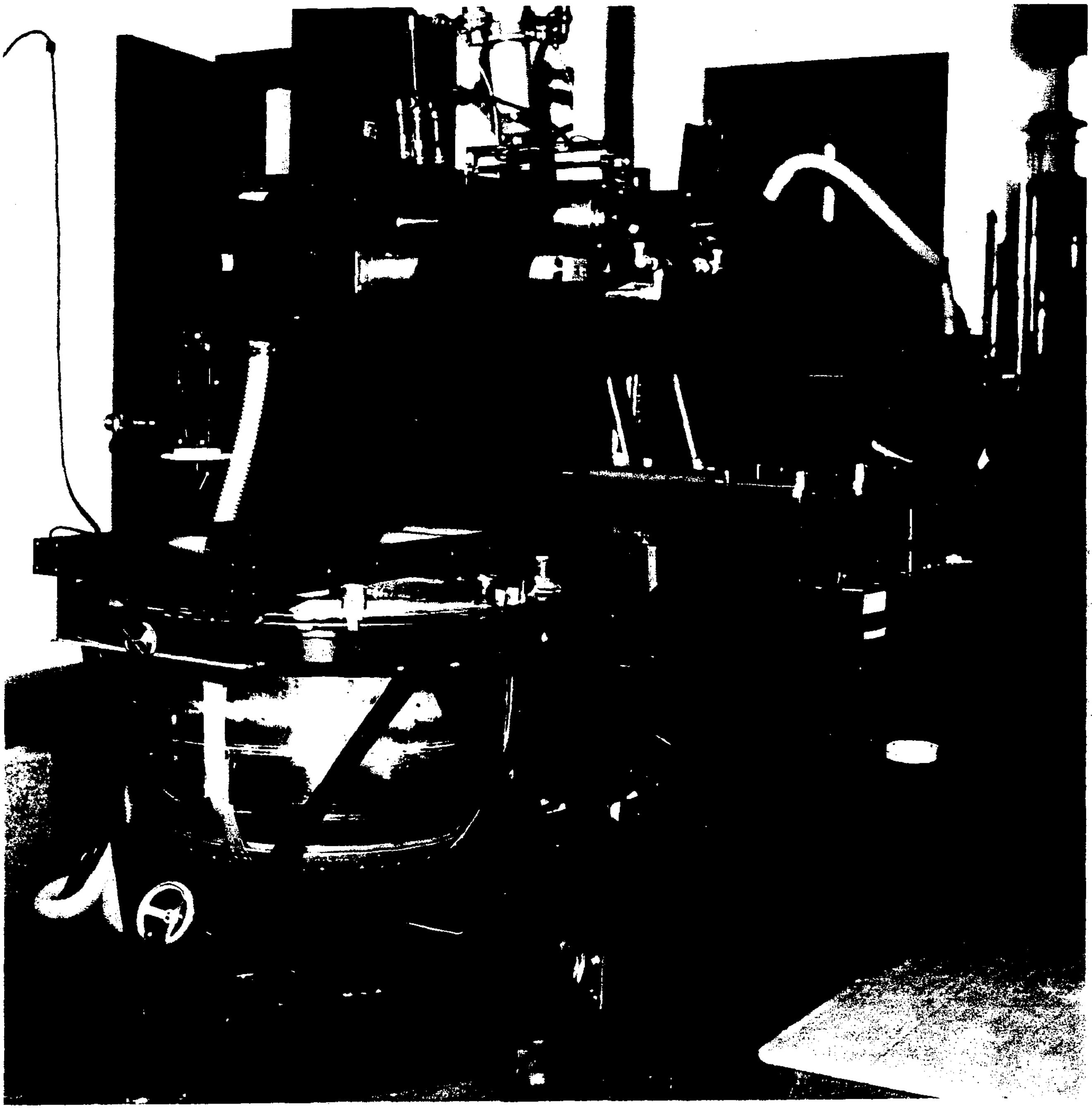


FIGURE 2-12

PRODUCTION PRINTING AREA

FIGURE 2-13

PRODUCTION QUALITY CONTROL AREA

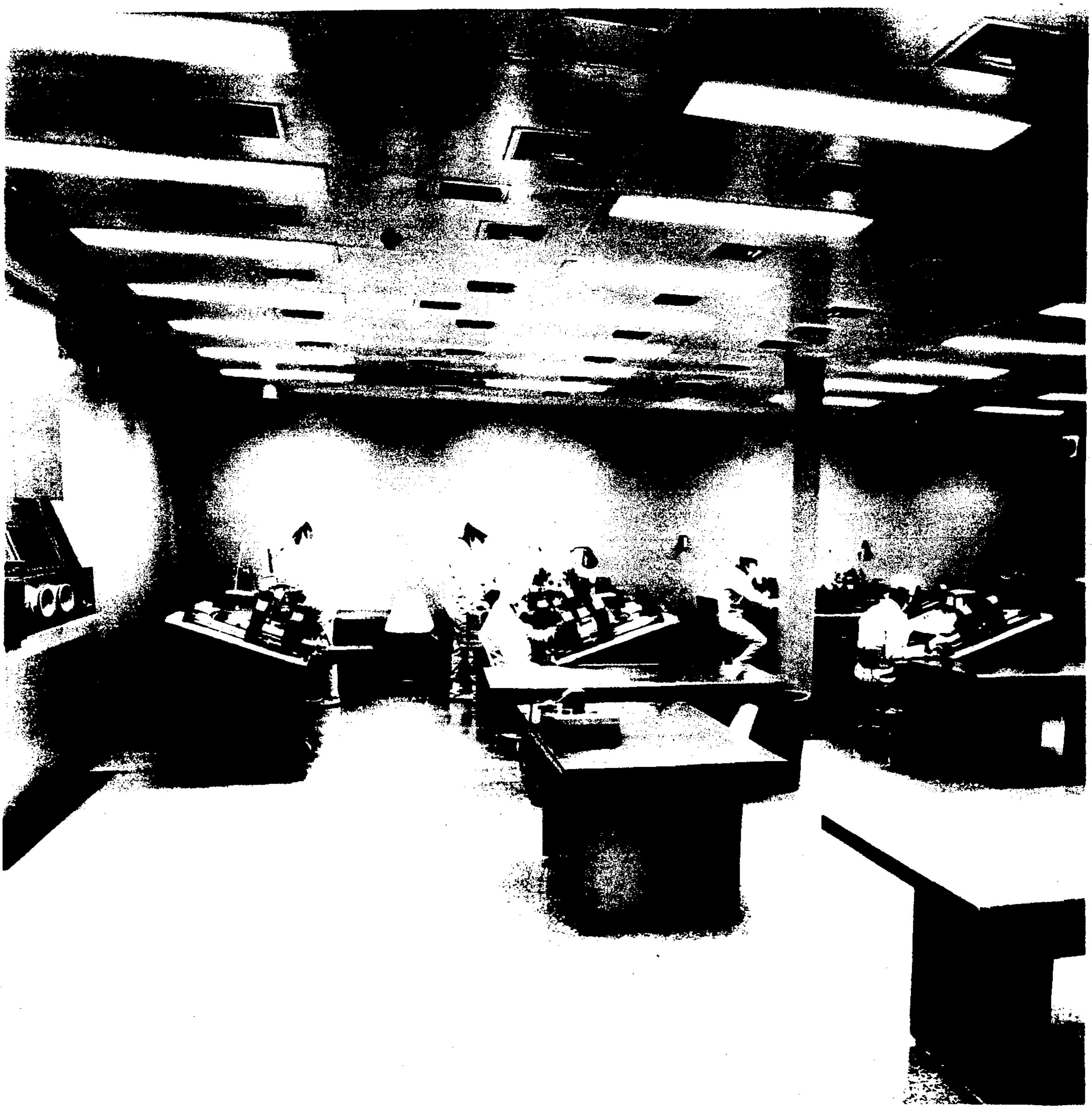


FIGURE 2-14

THE RESEARCH AND DEVELOPMENT DIRECTORATE (RD)

Right from the start, when plans were being formulated by the Office of the Secretary of the Air Force (OSAF) to establish a Government precision photo laboratory to support the duplication requirements of SAMOS, it was realized that this organization would also need a research and development capability. This decision was based on the fact that this operation would require new and unique pieces of equipment to handle the transmitted imagery from SAMOS and produce duplicates from a reformation of 35mm strips of original negatives. This method had never been used to reproduce any operational material. Lt Colonel H. Ohlmeyer, Commander of the 6594 Test Squadron (AFSPPL), was given a substantial budget and virtually a free hand in pursuing the development of this laboratory and the assignment of personnel. He was very fortunate to secure the assignment of a photo scientist from the Rome Air Development Center (RADC) by the name of Leroy A. Williams. Lt Colonel Williams reported in January 1961 and immediately embarked on building a research and development program geared to the improvement of photographic printing/processing equipment and techniques. This man turned out to be the most productive and dynamic personality ever assigned to RD.

In the early 1960s photographic processing and duplication were more a matter of art than science, with the resultant product being primarily dependent upon the dedication and experience of the technicians rather than the type of equipment and process control. The basic plan developed by offices directly attached to the OSAF (specifically SAFSS and SAFSP, the acronyms by which they are presently known) and the Command Staff from the Facility was to build a mass production, clean room, precision controlled photographic laboratory. In February 1961, Colonel Williams established an RD Evaluation Team to visit various contractors and review/assess the expertise and equipment available to meet these goals. This group consisted of Colonel Williams, Chairman; Major Clarence Schmidt, Chief of AFSPPL's Photo Laboratory; Professor William Shoemaker, Director of Photographic Arts and Sciences at Rochester Institute of Technology (RIT); Mr. William Benz, contract engineer at the Wright Air Development Division (WADD), Wright-Patterson AFB, and Mr. Howard Silkman, a development engineering supervisor at RADC, Griffiss AFB. Based on this research, RD initiated many programs in an effort to improve the Facility's production capability, i.e., development of a Reassembly Printer with Eastman Kodak (EK); 2X/4X Enlarging Printers with EK and the Morse Company; an improved LogEtronic SP-10/70 Printer, etc. RD also made a complete investigation into developing faster and continuous control processors to replace the existing EH-18 and the HTA-2 Processors. During this period, RD indirectly exerted influence on EK to develop large scale processors employing spray instead of deep tank immersion processing in an effort to gain speed and control.

In the spring of 1961, RD in consultation with Professor Shoemaker formulated the specification standards for an "ultra-clean laboratory." A contract was awarded to Anderson-Nichols & Company from Boston, Massachusetts to architecturally draft the modification design to Building P-1900. Because it was estimated that these extensive modifications would not be completed before the fall of 1964, RD negotiated with the Baker Company of Biddeford, Maine for two of their off-the-shelf "Baker Units." The Baker Unit is a portable, self contained, environmentally controlled facility. These units were installed in P-1900. The larger of the two was used as an interim clean laboratory area while the other housed the newly procured Mann-Data Microanalyzer. RD's early charter was to improve the state-of-the-art in photographic reproduction. As there were only three officers and one secretary assigned during the early 60s, it was obvious that this task could not be handled in-house. This is when the relationships between contractors and the Facility started. The assigned officers did much toward encouraging industry to develop specialized processing and handling equipment for the support of the SAMOS photo-electronic system. The first relationships were with Houston Fearless in the production equipment area; Data Corp of Dayton, Ohio in developing mensuration instruments and photo science equipment; and Fairchild Hiller Corp, Germantown, Maryland which was enlisted to study areas such as cleanroom operation, quality control, and incineration and waste disposal.

In the 1964 - 1966 period, a training program was established wherein military personnel with a background in photography were given a series of indoctrination lectures on advanced photo production techniques. A Photographic Science Seminar was organized by Lt Colonel Williams and ran from July 1965 to June 1966. This seminar consisted of lectures from experts throughout the community who spoke on many technical aspects[37] of photography, film, optics, camera systems, image analysis, etc. Consultants also studied the operational plans of the Facility and made recommendations on the laboratory configuration and procedures. Consultants, such as RIT Professor W. Shoemaker, also influenced the photo training programs at Lowry AFB Colorado by the cross-fertilization of ideas and training needs. In addition, they helped to improve the photo science curricula at RIT and worked with AFIT in establishing a Master's Degree Program for selected Air Force and CIA personnel. Subsequently, the majority of photo science and laboratory officers and civilian scientists/technicians assigned to AFSPPF received some type of photo-related training at RIT.

Military and civilian scientists from all areas of the photo science community who were involved in developing reconnaissance satellite systems discussed their requirements for engineering data with RD personnel. This was particularly true in the relatively unknown field of techniques to measure system performance. Data Corporation personnel, namely [redacted] suggested possible application of electronic engineering signal transfer analysis techniques and procurement of microdensitometers for image analysis. RD received approval to purchase two microdensitometers, one from Ansco Corporation, Washington, DC and the other from the Joyce-Loebel Company. Data Corp also began the development of an advanced microdensitometer with the D. W. Mann Company, Burlington,

[37] Agenda, 6594th Test Sq, 16 July 1965, Photographic Science Seminar (Appendix, Item 21). (U)

Massachusetts, which was to be the standard for analysis for many years. During this era, RD was manned by two officers, one enlisted technician, two civilian scientists, and one secretary.

In 1962, Lt Colonel Williams established the Optics and Materials Standards Laboratory (later to be renamed the Materials Analysis Laboratory) to provide an in-house standards laboratory capability for support of the photographic production and image analysis missions of the Facility.

In late 1963, the Sidney Drell Committee made a study of the evaluation technology of satellite systems and recommended an intensive effort to apply techniques such as Modulation Transfer Function (MTF) and Graded Estimated Measuring Samples (GEMS). Lt Colonel Williams, Captain S. McCulloch from RD and the following consultants: [redacted], Data Corporation; [redacted], Itek Corporation; Dr. G. Parrent, Technical Operations; [redacted], Perkin-Elmer Corporation; and Dr. James Eyer, University of Rochester, served on the Drell Committee and its outgrowth, the Swing Committee (July 1964). The major subject addressed by these committees was the Image Quality Evaluation Program. The objective of this program was to develop and validate an analysis system for determining the quality of satellite photography. As a result of the committee's action, a study called "Crossover" was implemented for the inter-laboratory comparison of microdensitometric and data processing procedures from five facilities: Eastman Kodak/BRIDGEHEAD, Itek, Perkin-Elmer, Data Corporation, and AFSPPL. This was the first scientific evaluation program undertaken by this Air Force organization. Although the results of this experiment were discouraging due to the many variables (different microdensitometers, procedures, calibration, environment, etc.), it did give this Facility its first community exposure in the field of image analysis. AFSPPL also started development of new resolution targets with Wright-Patterson AFB scientists which were to become the standards for the community. In 1963, AFSPPL contracted for the deployment of the Mil Std 150, Tribar, and Gray Scale targets to provide ground truth data for assessment of on-orbit performance of satellite camera systems. This was the beginning of the Controlled Range Network (CORN) Program which lasted from October 1963 until the managerial responsibility was transferred to SAFSP in the summer of 1974 after confirmation that this Facility was to be phased out. CORN was used to support the CORONA, GAMBIT, HEXAGON, Red Dot, and [redacted] Programs. A more detailed discussion of the CORN Program can be found on pages 4-55 thru 4-70. RD also began the sponsorship of a formal research effort with Data Corporation on target design, construction, and analysis.

In 1962, RD developed the capability to produce very high quality prints and enlargements of operational photography. The best studio type printing and processing equipment was procured and assembled into what became the Select Print Laboratory (SPL). This SPL grew from a small still photographic laboratory encompassing approximately 890 square feet to an entire Baker Unit (2,200 square feet) and a two room studio (Rooms 67 and 67A). This highly sophisticated laboratory was regularly tasked to supply the NRP community with large numbers of special order black and white and/or color prints and positive transparencies.

Due to the increase in activities, RD was enlarged to six officers, six enlisted technicians, three civilian physical scientists, and two secretaries in 1964. This staffing included more diversification as two of the officers were technical managers while the other four were photo trained. One of the enlisted men was a procurement specialist and the other five were photo technicians. One of the civilian positions was made that of Technical Director of Research and Development (GS-15). This position was transferred to the Facility command level in November 1969.

The research and development program expanded continuously and, with it the funding level, to a point where the amount reached approximately [redacted] in 1965. The funding program had been formalized into the following categories: research and development (P-3600), off-the-shelf hardware (P-3020), and services (P-3080). The funding was transmitted to SAF [redacted] by means of a monthly automatic data report called the Program Financial Status. Formal reporting on the progress of individual programs was written in a quarterly report prepared for SAFSP and was also included in the Quarterly Program Report to the NRO. The first quarterly reports were almost entirely of the RD efforts; whereas in later years, these reports included data on operational mission production, evaluation efforts, logistical support, and personnel.

In late 1966, RD categorized this program into ten areas to better improve management control and budgeting. These major areas were:

A. Image Analysis

This included all research into imagery evaluation and the CORN Program.

B. Processors

This included processor development, film dryers, and color processing.

C. Photographic Environmental Standards

This included all materials handling, clean photo laboratory standards, and quality control methods.

D. Materials Research

This basically involved research and development of the non-conventional film systems.

E. Printers

This included development and modification of all printers.

F. Quality Control

This included automation, sensitometric instrumentation, etc.

G. Laboratory Auxiliary and Support Equipment

This included bench test and other types of T&E equipment.

H. Photochemistry

This included film developers, controlled development, etc.

I. Film Inspection and Viewing

This included light tables, microscopes, etc.

J. Conservation

This included film salvage, chemical reclamation, and pollution control.

In later years, these categories varied to some degree as new areas of investigation or a major shift in emphasis occurred. Notably among these were the following special projects: Digital Reconstruction System (BIKINI Printer), CORN Services, and Advanced Technology.

Generally, the funding operation was to budget for RD programs in the 10 major areas referenced above. The Director of RD had the primary responsibility for the preparation, coordination with the other directorates and staff within AFSPPF, and presentation of the budget request to the CCB and the Director of Special Projects (SAF/SP-1). The budget for the following fiscal year was prepared during the third quarter of the present fiscal year. The budget was broken down into three categories (P-3600, P-3020, and P-3080). A summary of expenditures by funding areas from FY 69 thru FY 76 is shown in Table 2-5.

TABLE 2-5

SUMMARY OF RD EXPENDITURES FROM FY 69 THRU FY 76

| Fiscal Year | P-3600 | P-3020 | P-3080 | Total |
|---|---|---|---|---|
| 1976 | [redacted] | | | |
| 1975 | | | | |
| 1974 | | | | |
| 1973 | | | | |
| 1972 | | | | |
| 1971 | | | | |
| 1970 | | | | |
| 1969 | | | | |
| TOTALS | [redacted] | | | |

* Includes funding of CORN operations

NOTE: The decline in expenditures for FY 75 & FY 76 is largely because of the transfer of the CORN Program to SAF/SP-6 and to the reduced number of new RD Programs due to pending closure of AFSPPF.

The budget was administered by RD to include: (1) receipt of the approved budget from SAF[redacted] (2) transfer of funds to the procurement agency, (3) coordination in obligations and expenditures, and (4) the reprogramming within a specified category to fund additional expenses. The RD funding was actually provided by the NRO through a representative in SAFSS. Consequently, program approvals originated at that level using the CCB for technical review. For the annual budget submission the proposed budget was presented to SAF/SP-1 for his concurrence after CCB recommendations had been made. An agreed upon rank order of program priorities was then finalized approximately two to three months prior to the beginning of the new fiscal year. When funding approvals were sent by the NRO representative, individual programs and, in some cases, groups of programs were named. In cases where a desired program could not be funded, it was placed in one of two categories: "protected" or "deferred." If protected, the program might be funded later in the fiscal year; if deferred, the program could not be considered until the following year unless funds were transferred to it from an approved or protected program. Once the formal, annual budget request/approval cycle was complete, adjustments continued to occur throughout the year. Significant program approval changes were made a matter of discussion at the Executive Session of the quarterly CCB. In emergency cases, decisions were arrived at through telephone, teletype, or personal coordination. Beginning in 1973, a more informal coordination procedure was implemented. This procedure consisted of telephone coordination between the Commander of AFSPPF and SAFSS (NRO) for program approvals/changes and then AFSPPF relaying this information to SAF[redacted]and AFAL to record any of those approvals or changes. One of the nicest features of the budget method was its flexibility. Approved funds could be transferred and utilized on any program within the specific category for which they were approved, i.e., P-3600 funds may be used on any approved RD program within the P-3600 Category.

Procurement of RD programs was accomplished by procurement agencies at AFAL, RADC, SAMSO, ARDC, and Westover AFB. RD and LG procurement efforts include acquisition of supplies and materials to support research programs. A typical RD program would go through the following procurement sequence:

A. Concept generation.

B. Technical definition.

C. CCB Program approval request.

D. NRO Program funding.

E. RD generation of Statement of Work (SOW).

F. Forward SOW and letter of instruction to a central procurement office, i.e., AFAL/RWF-4.

G. AFAL/RWF-4 project engineer would be assigned to prepare purchase request (PR).

H. PR forwarded to Aeronautical Systems Division (ASD) procurement.

I. Procurement prepared and mailed a Request for Proposal (RFP) to the firms on the bidders' list or if sole source, to the selected source.

J. Proposals received and evaluated by the AFSPPF Proposal Review Board and then the AFAL project engineer.

K. Contract awarded.

L. Contractor advised of AFSPPF participation in technical monitoring.

M. RD and contractor cooperation during contract performance.

N. RD participation in acceptance testing and performance of the test and evaluation phase.

O. RD recommendation for program application, follow-on effort, or termination.

The image evaluation effort had grown considerably by 1964 with AFSPPL performing major services in measuring the performance achieved by each CORONA and GAMBIT system. In the development of an image evaluation capability, RD established the Data Analysis Section. This Section was formed to reduce the massive amount of data being collected. An IBM 1710/1620 Computer System was rented and RD personnel assigned to develop the software and methodology required to automate the image analytical process. The volume of requirements continually increased, especially in support of the GAMBIT camera system development. Because of this significant increase in work load, it was essential to augment the RD group assigned this task. However, in a meeting with the NRO and SAFSP, it was learned that additional tasking of research and development programs and operational requirements were projected for the Facility. As a result, in mid 1966, AFSPPL was reorganized into five directorates and was upgraded to a Wing level organization. The Evaluation Directorate (EV) was created out of RD resources to handle the system performance evaluation function. The Select Print Laboratory was moved to EV and renamed the Technical Reports Photographic Laboratory Branch. The computer facilities and personnel were also transferred to EV as the Technical Data Division to support the analysis of CORONA and GAMBIT systems.

In 1966, at the suggestion of Captain Robert Koch (USN) who was assigned to the SAFSS, RD upgraded their Materials Analysis Laboratory to provide a calibration center for NRO activities. Funding was provided for the procurement and/or development of the best state-of-the-art sensitometric and densitometric instrumentation for the Facility. As a result the capabilities of this laboratory exceeded the original expectations. This was due to the purchase/acquisition/development of primary density, resolution, and color standards equipment. The existence of this standards facility led to direct tasking in support of the HEXAGON Program and organizations such as NPIC, TOPOCOM, and DIA.

Until mid 1967, RD's manning remained at the same level (17 personnel) as it was prior to the reorganization. RD continued to conduct research in image analysis and microdensitometry in support of the EV mission, and the financial/contractual management control of the CORN Program and CORN target research. PD was assigned operational control of mission CORN requirements.

In July 1967, the manning level of RD was increased to allow for more in-house hardware development work. The philosophy was that breadboard or experimental models of processing hardware ought to be fabricated and tested at AFSPPF before large scale contracts with industry were negotiated. Part of the problem of supporting contractor developed hardware was that the length of procurement cycles ran 6 to 9 months during this period. Three experimental machine shop technician slots and an engineering draftsman position were established to enable the start of what eventually became known as the Feasibility Section. Also, three enlisted military photo technician positions were added to enable in-house test and evaluation of developmental systems. This resulted in a manning structure of five officers, nine enlisted personnel, seven civilians, and two secretaries.

In 1966 - 1968, RD concentrated many of their efforts on improving photo production operations by solving equipment problems and increasing automation. Programs were started on contact printing research, use of laser light sources, automatic printing analyzers, and improved exposure control devices. A large scale effort was begun to develop high speed production, 70 millimeter and 9.5 inch machines which could process at speeds of 200 feet per minute. Improved quality control and more efficiency were attempted by means of the development of an automated processing control system utilizing an IBM 1800 Computer. A consulting effort was begun with the Airborne Instruments Laboratory, Deer Park, New York for the design, software, and installation of the 1800 Process Control System with customized peripherals.

Developmental engineering continued during the 1968 - 1969 period as the major emphasis was placed on improving photographic production operations with new processors, vacuum film dryers, microwave dryers, and cleanroom area conditions. The chemical mixing facilities were highly automated with automatic batching machinery and the film shipping area was upgraded to handle more volume. The Laboratory Standards Contract by Data Corporation continued while a new consulting firm, Information Technology Corporation (renamed EIKONIX in 1971), Burlington, Massachusetts, founded by Mr. Jack Finley formerly of Data Corporation, was funded to continue the image analysis services he was providing to EV.

By 1968 - 1970, under the leadership of the Commander, Colonel Ralph Swofford, AFSPPF had attained a major role in the RD efforts of the NRO. RD was undertaking efforts in all facets of photo reproduction, system performance evaluation, and equipment test and evaluation. Two community-wide image analysis conferences were hosted at AFSPPF. RD was fulfilling a more active role in support of the Configuration Control Board (CCB), where heretofore AFSPPF had acted only as an observer at its quarterly meetings. In 1969, NRO assigned RD to review the work of EK/BRIDGEHEAD and to provide engineering consulting services to the CCB on all of their proposals. In many instances from this point in time, programs for RD resulted from tasking developed at CCB meetings, i.e., development of an RS Material Printer by Itek, the Total Object Contrast (TOC) Process at Technical Operations, a study of atmospheric contrast attenuation, etc. As a result of this growth in activity, RD's manning was increased to 23.

In 1969, RD became involved in an investigation of selective area printing in an effort to reduce the volume of duplicates in the reproduction of HEXAGON requirements. A printer was fabricated by Perkin-Elmer Corporation to demonstrate rapid reproduction of selected areas in chip, strip, or roll form from one machine. Another printer development was started with Baird-Atomic, Incorporated, Bedford, Massachusetts, to demonstrate how a high quality step and repeat printer could be used for chips or strips. These programs proved to be successful but the selective area printing concept was never fully adopted for operational use.

AFSPPF was also one of the first organizations involved in the study to determine the feasibility of color satellite photography. RD approached this subject from many directions as there was virtually no mass production color capability in existence. A process was devised which could develop color film at 50 feet per minute using the available EH-75 High Speed Processor built by Houston Fearless. Higher quality color originals and duplicates were demonstrated using a "Silver-Color Process" which involved the addition of silver to the green layer of color film after development. The science of color sensitometry within the community was inadequate, so RD initiated a program with the MacBeth Division of Kollmorgen Corporation, Newburgh, New York for research in this area. As a result, a colorimeter (KCS-18) and a color precision densitometer (TDA 1000) were developed for transparent roll film. Research was conducted by MacBeth on the control of color in a mass production environment and the techniques to measure small color differences. There was also very little known or practiced in color microdensitometry. Therefore, RD administered research into this area with Mead Technology Laboratories and EIKONIX Corporation. RD also contracted with Technical Operations to study and propose a color performance evaluation system.

During this period, the CCB became acutely aware of the loss of image quality transfer in duplication due to the rapidly improving camera systems. Because of the proven scientific evaluation capabilities of AFSPPF, RD was tasked to analyze the potential of all conventional and non-conventional duplication materials. This program required major efforts not only by RD but the other analytical resources of AFSPPF as well. The results of this conventional versus non-conventional evaluation were reported at CCB meetings and in a report published by AFSPPF in the latter part of 1971. The results of this six film study showed that the Itek RS Film had the potential for almost zero loss at 200 lines/millimeter; the Free-Radical material reached comparable resolution transfer only when grossly overexposed; and 3M Dry Silver had less potential than the standard duplication Type 2430. The latter result was important in itself because the NRP community was expending vast sums of money developing Dry Silver hardware systems. However, the final selection was based on the image analysis and photointerpretability studies performed by AFSPPF and NPIC which both showed a preference for the new conventional duplication material from EK, SO-192.

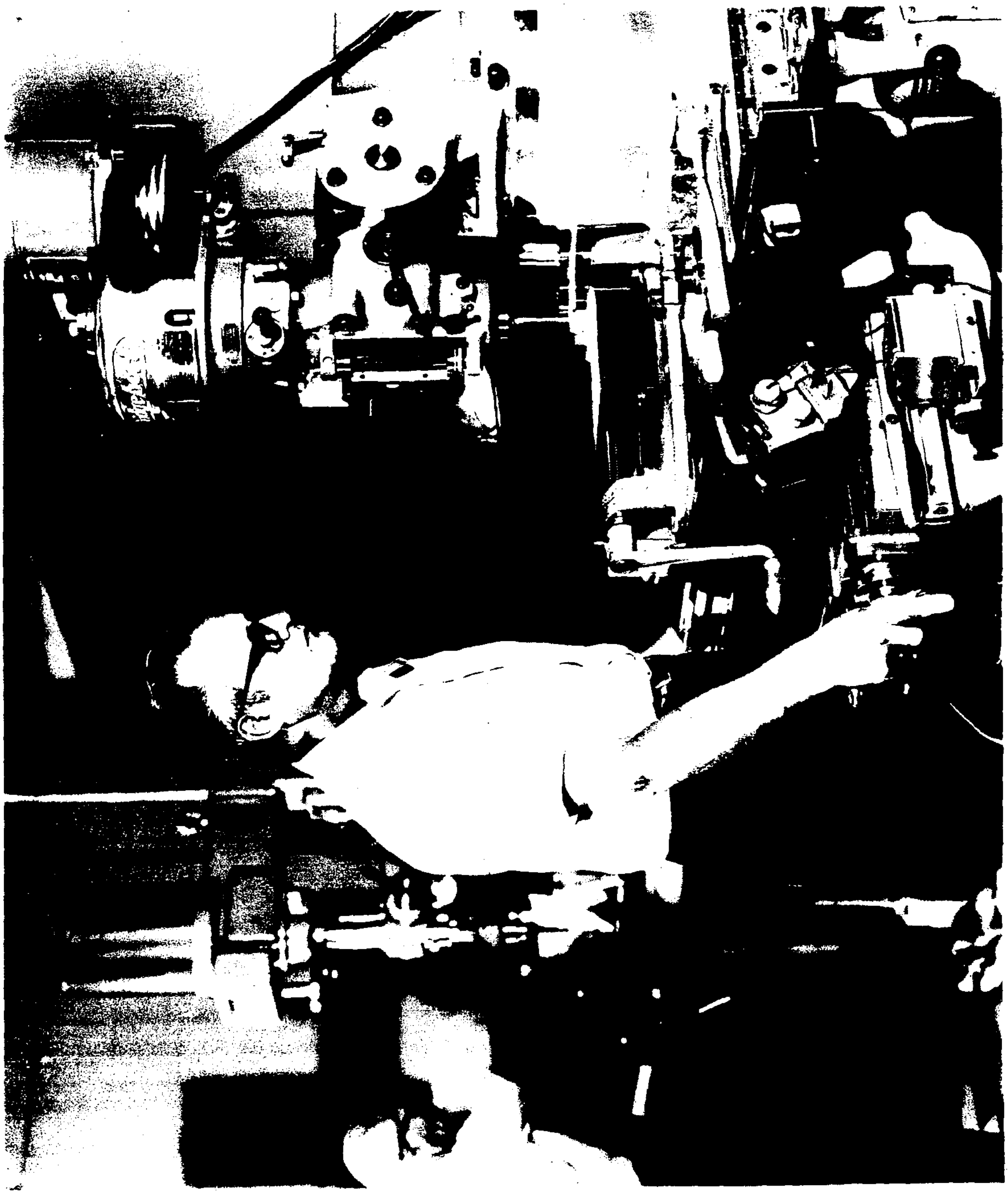
Up until 1970, RD had operated a special photographic facility in the Baker Unit for the test and evaluation of development processing equipment. Chief Master Sergeant Takeda and three enlisted photo technicians were assigned and handled all photographic reproduction from selected target exposures to roll-to-roll duplication. These personnel also produced the photo enlargements from mission material required for the PET and TERO reports produced by EV. During this era, the enlisted photo personnel of RD regularly augmented PD's photo laboratory force to assure that all production schedules were met. During 1970, the Baker Unit was transferred to the Production Directorate along with three enlisted photo technicians where it was renamed the Select Print Laboratory. The Materials Analysis Laboratory function, the civilian in charge (Mr. M. Worwood), and three enlisted personnel were also transferred to PD.

In May 1970, RD was relocated from Building P-1900 to P-1875 which had been modified extensively to provide sufficient room, power, and environmental control for test and evaluation of large printers, processors, and other developmental equipment. A picture of P-1875 can be seen in Figure 4-2, page 4-11 of Volume II. An area was established for a machine shop, named the Feasibility Section. The best available machine tools and sheet metal equipment were assembled to enable in-house preparation of breadboards and models to support the RD engineers. This shop also provided emergency repair service to the Production, Evaluation, and Civil Engineering Directorates. Figure 2-15 shows personnel from the Feasibility Section working at the Bridgeport Milling Machine and on the drill press in support of specialized fabrication requirements. Several "wet" rooms were constructed to support the research in color film processing. A color sensitometric spray processor which enabled precise control over each step in a process was designed and fabricated by Mead Technology Laboratories, Dayton, Ohio. In addition, an EK 1411 and an EK 1811 color processors were procured and integrated into one system to allow study of the multi staged Silver-Color Process. This combined system was called the 3211, see Figure 2-16.

With these new facilities, RD implemented a policy which had been originally suggested by the AFSPPF System Analysis Team in a September 1971 report.[38] The policy was to do as much advance study and testing in-house before embarking on a formal contract for a piece of equipment, and to do all test and evaluation under the direction of and by Government personnel. Support for the in-house color research and development efforts, such as development of a production model spray type color processor, development of the Silver-Color Process, etc., was obtained by contract for the services of Dr. R. Goldberg. The first contract in August 1970 was with Dymat, Incorporated, and later with Richard J. Goldberg, Incorporated which was formed by Dr. Goldberg so that he could concentrate on specific areas of color research.

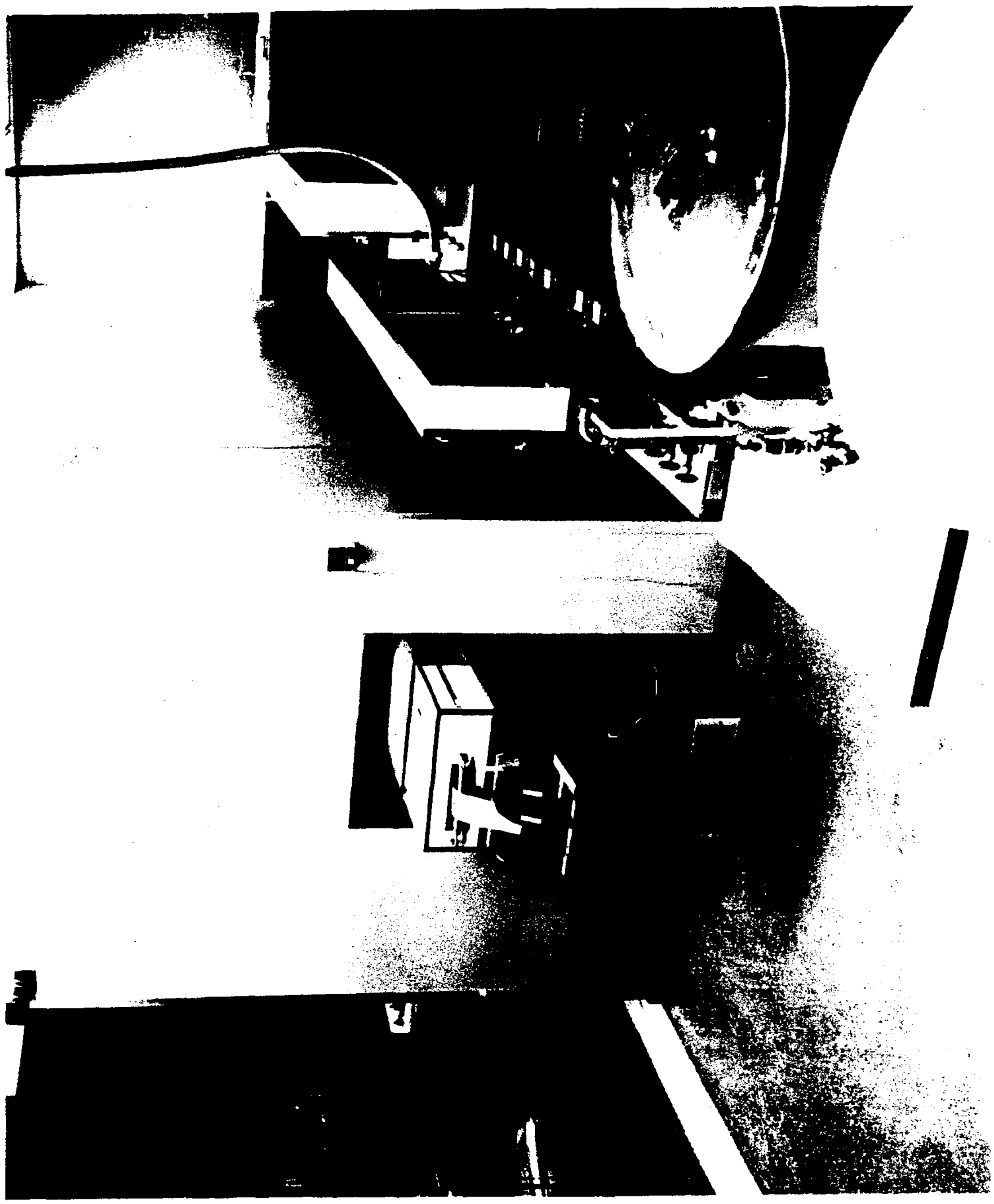
Starting in late 1968, Mr. George Hunter of RD directed a study into the problem of pollution control and reduction of water consumption at AFSPPF. Considerable interest in the subject was appearing nationally and local newspapers were criticizing Westover AFB for polluting the Chicopee River. The

[38] Facility Systems Analysis Report, AFSPPF, 10 September 1971, Recommendations, BYE 15268-71. (TS)



FEASIBILITY SHOP ACTIVITY

FIGURE 2-15



THE INTEGRATED 3211 COLOR PROCESSOR

FIGURE 2-16

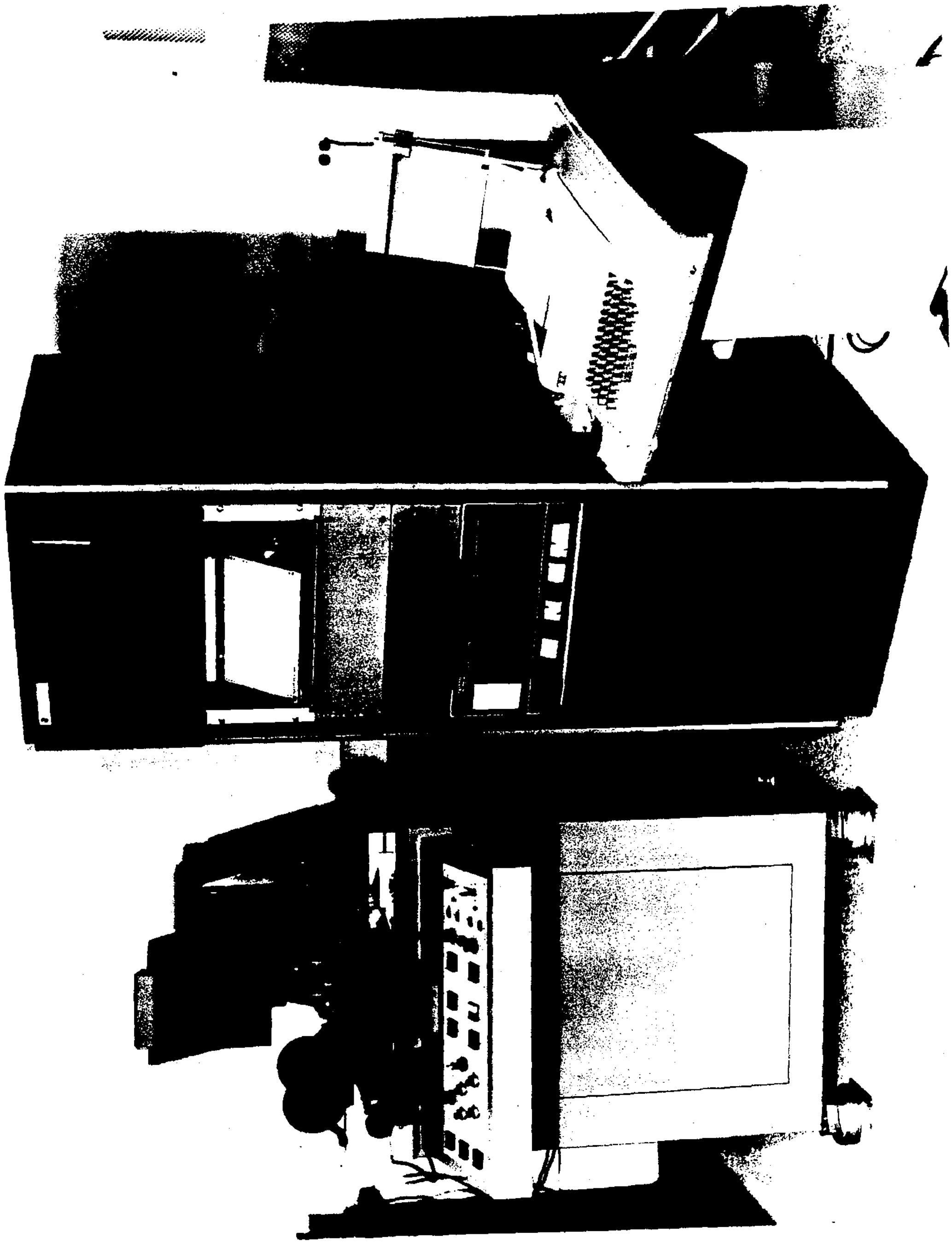
study resulted in a recommendation to build a plant to process the water, concentrate the waste, and recover the silver. RD, in close coordination with the Facility Civil Engineering Directorate, conducted a crash program with Food Machinery Corporation, Santa Clara, California to eliminate all effluents from the Facility. Several research programs were also started to determine methods for disposal or regeneration of solid wastes removed from the effluents. This work resulted in the design by FMC of the Industrial Waste Treatment Plant. The plant was completed in August 1974 and marked the successful completion of one of the nation's first photographic pollution control efforts.

After 1971, RD entered a period where the emphasis was placed more on applied research and development than on the upgrading of production hardware. A program of large volume color satellite reconnaissance missions was never adopted by the NRO, therefore, a hold was placed on the major color development efforts. The conventional/non-conventional evaluation study resulted in the selection of SO-192 as the standard duplication material for HEXAGON; thus reducing emphasis on Free-Radical, RS, and Dry Silver as candidate production systems.

RD was tasked to investigate advanced technologies for possible applications to photography. Programs were conducted on charge-coupled-devices (CCD) for microdensitometry, imaging photographic printing, and a non-linear model of the photographic process. A method for transmission of imagery by means of light beams, called "Pandora's Box," was also investigated, but not implemented. A new piece of printing equipment, called the "BIKINI Printer," using high speed ink-jets was funded and built for AFSPPF by Mead Technology Laboratories. However, Headquarters USAF/IN requested it be given to Foreign Technology Division (FTD), Wright-Patterson AFB Ohio. This instrument arrived at FTD in 1971 and another like-instrument was delivered to the Naval Intelligence Support Center (NISC). Both BIKINI Printers are presently being used in an image reconstruction program.

RD attempted to solve production problems immediately after they occurred and were identified. Examples of this type of effort were investigations into new concepts of titling. The Ink-Jet Titler was built by the Fairchild Space Defense Systems (FSDS) in November 1971, and units installed at AFSPPF and Eastman Kodak for evaluation. These Titlers were not operationally acceptable due to their inconsistent performance. FSDS also made a study of color ink-jet printing; however, with the problems experienced with the black and white Ink-Jet Titler, no color hardware was fabricated.

A major effort was expended on improving the state-of-the-art in microdensitometry. A new commercial microdensitometer made by Photometric Data Systems (PDS), Webster, New York was modified extensively and became the "workhorse" of EV during the 1970 - 1974 evaluation of the HEXAGON camera system performance. Figure 2-17 shows a picture of the PDS, Model 1050, and its operational components (a PDP-8I Minicomputer with magnetic tape and chart recorder and a teletypewriter). Research into



THE PDS, MODEL 1050 MICRODENSITOMETER

FIGURE 2-17

microdensitometry resulted in the design and fabrication of a "New Generation Microdensitometer" embodying all the latest advances in optics and electronics. Units were installed at BRIDGEHEAD and NPIC and were still undergoing an operational evaluation at the time of the Facility phaseout. This system is unique in its use of three lasers for light sources, linear performance at high resolution, and use of laser interferometry for micrometer precision in platen movement. A more detailed discussion on the evolution of microdensitometry can be found on pages 4-47 thru 4-55.

In 1971, RD was tasked by the CCB to design production hardware for Free-Radical materials, as it was optimistically felt that this film would be successful. Full-scale engineering models of both printers and processors were developed and used in evaluation of non-conventional materials. Failure of the Free-Radical material to achieve a camera speed finally caused cancellation of this program.

Test and evaluation activities continued as a major effort for RD up until the transfer of their function in September 1976. Equipment such as a printer and a heat processor for Free-Radical materials and a processor for Dry Silver reproduction were installed and evaluated. Figure 2-18 is a picture of the Dry Silver Processor which was evaluated by the T&E personnel assigned to RD. Automatic roll film scanning densitometers such as the AIL Densitometric Control System, the ITT Dynamic Color Scanner, etc. went through several testing cycles after being developed on contract. Figure 2-19 presents a picture of the ITT Scanner undergoing T&E in October 1973.

The in-house research efforts became concentrated on improvements in color materials and processes. A major program was started on developing a single layer, full color film system called Isocolor. Dr. R. Goldberg formed a group of as many as six local photo technicians to work in RD on this color research project. An off-base laboratory was rented in South Hadley, Massachusetts, to provide work space for some of his people who did not have a security access to the Facility. This program was still operational at the time of the phasedown of AFSPPF.

Development of advanced printing concepts using lasers, the Airgate principle, and the Baird-Atomic idea continued for several years. In 1974, AFSPPF was able to embark on its most notable printing hardware achievement. This requirement came from the [redacted] which was experiencing much difficulty in resolving the problem of reassembling the system's four original negative parts into a single composite roll of duplicates. RD felt the best approach would be to modify the Baird-Atomic (BA) Step and Repeat Printer developed in 1969 - 1970. Therefore, in September 1974, RD let a contract with Baird-Atomic to modify the old Step and Repeat High Resolution Printer to meet the [redacted] requirements. This new development machine was named the Automatic Composite Step and Repeat (ACSAR) Printer. The success of this effort resulted in the purchase of three additional ACSAR Printers to be used in the baseline compositing of all [redacted] production. More information on the BA Step and Repeat Printers can be found on

DRY SILVER PROCESSOR

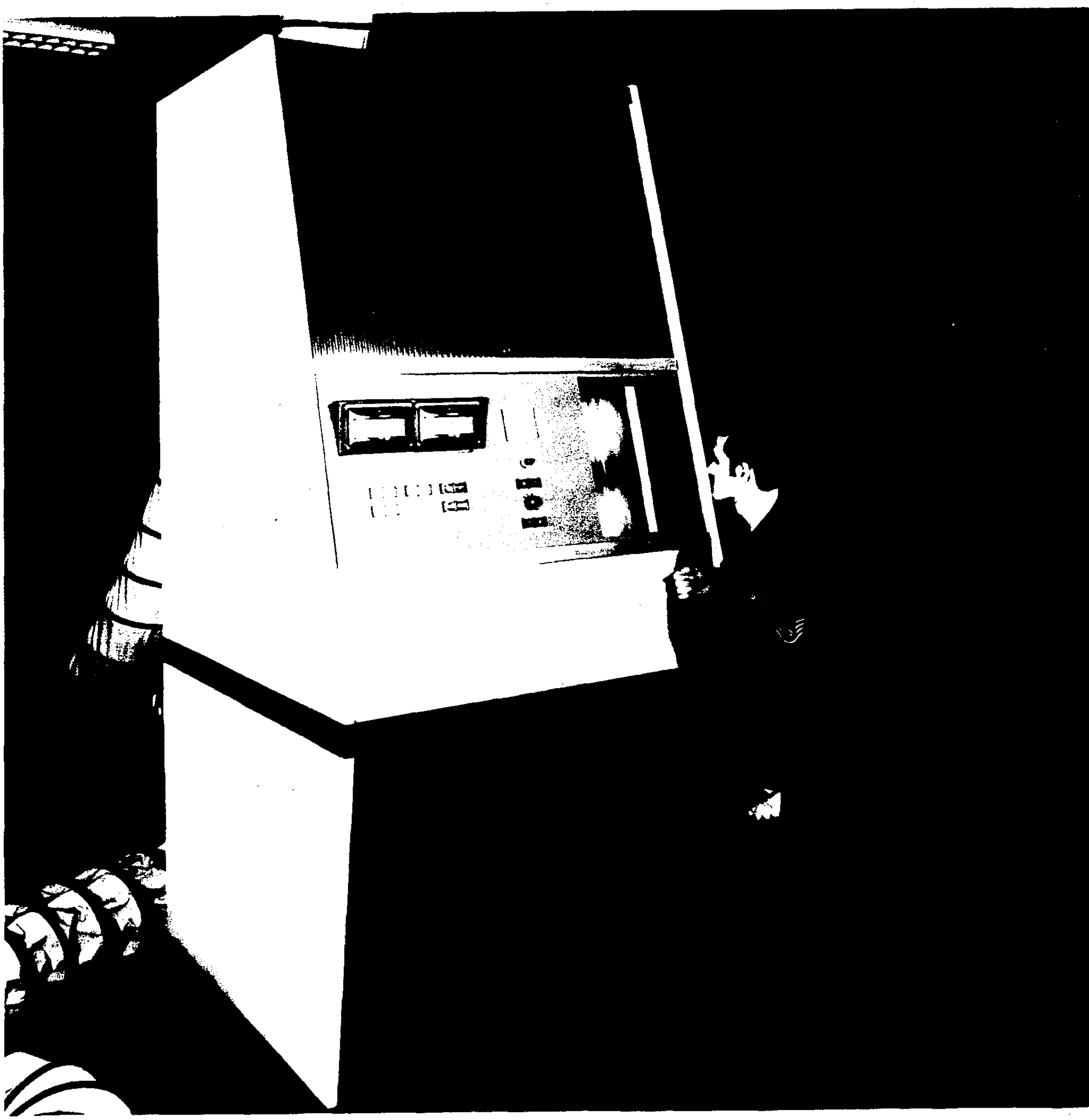
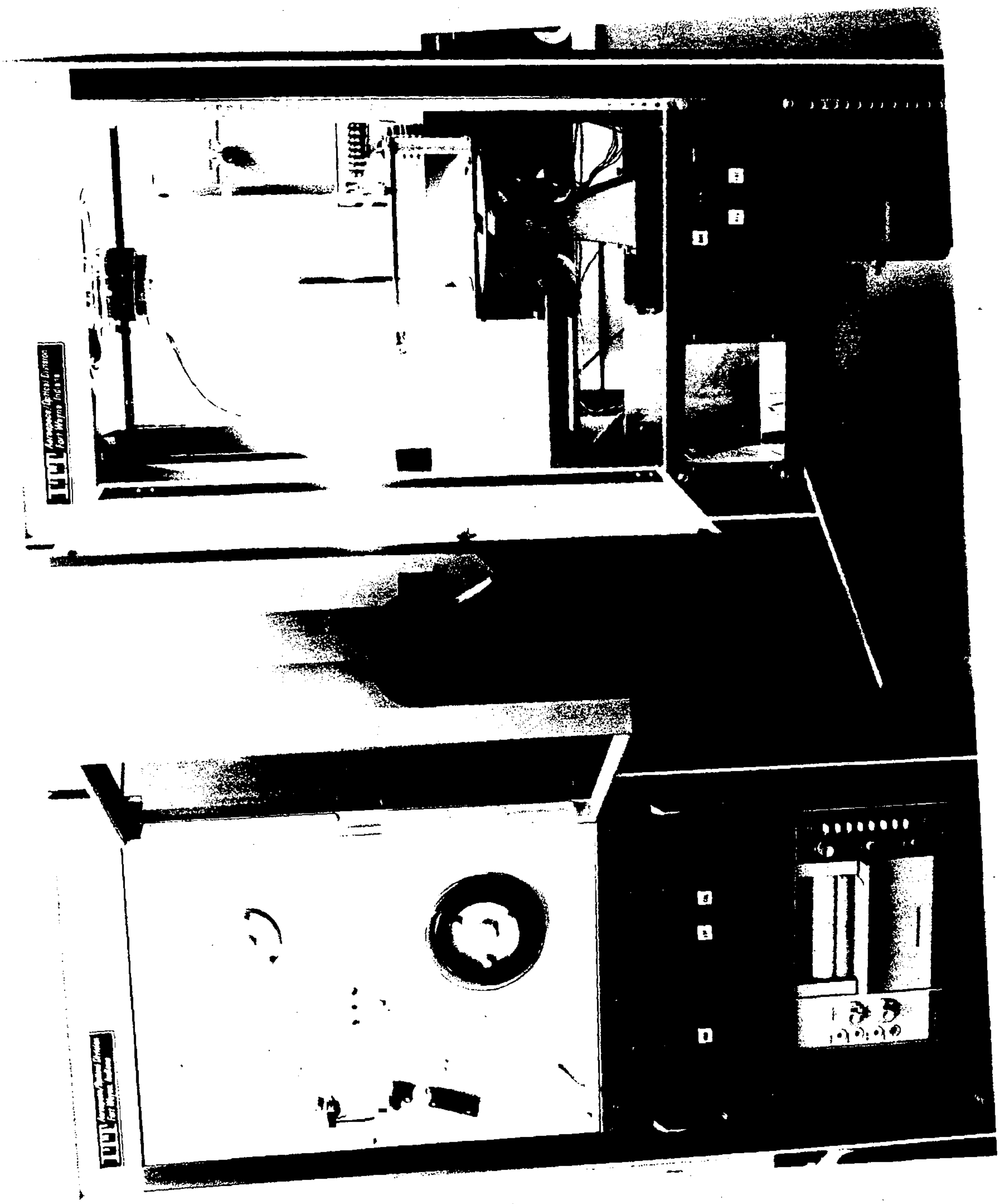


FIGURE 2-18



ITT DYNAMIC COLOR SCANNER

FIGURE 2-19

pages 4-39 thru 4-42.

The RD organizational structure was divided into the following sections: the Research Division which planned and conducted research into specialized photographic processing, evaluation techniques, and equipment to advance the accomplishment of the mission; the Development Engineering Division which initiated, monitored, coordinated, and documented the engineering efforts contracted with industry; and the Test and Evaluation (T&E) Division which performed the T&E of research and development materials and equipment developed in-house and on contract.

The following support areas within the organizational structure of RD provided valuable contributions to AFSPPF's operational mission:

A. The Feasibility Section

In July 1967, the Feasibility Section was established in the RD Directorate to enable more in-house developmental efforts. A model shop was equipped and staffed to prepare breadboards of photographic processing hardware prior to seeking formal contracts. In the late 1960s, this shop assisted in the production of several successful developments, i.e., a high speed automatic splicer which operated at the tandem speed of a processor capable of performing at 200 feet per minute. This made the EH-67 (70 millimeter) and the EH-75 (9.5 inch) Processors feasible for mission support operations for, in the past, operators could not splice at those high speeds. The Feasibility shop developed high speed "takeoffs" for the processors to eliminate the need for the operators to cut and switch film "takeoffs." Another development was a successful lid popper to enable the rapid removal of lids from plastic film cans which had become a "roadblock" in PD's mass production cycle. The lid popper was made in three sizes to handle film formats from the CORONA (70mm), HEXAGON (6.6 inches) and GAMBIT (9.5 inches) Programs. This development was so successful that units were fabricated for BRIDGEHEAD, NPIC, and DIA. Another major effort was the fabrication of the AFSPPF named Model 3211 Color Processor. This processor was used for in-house research into the Silver-Color Process. This was essentially a mating of the EK Model 1411 and EK Model 1811 Color Processor with the addition of peripheral equipment (frame, rollers, fast exposure system, etc.) to handle the multi-step Silver-Color Process. After the announcement of the Facility phaseout, the Feasibility Section became more involved in parts fabrication and machinery modification versus total hardware development. The men assigned to this shop were Mr. R. Meunier, an experimental sheet metal worker; Mr. E. Cwieka and Mr. E. Molloy, who were machinists; and Mr. R. Lucas, an RD laboratory technician. The Section was operated and directed by Mr. G. Hunter, Chief of Research.

B. The Test and Evaluation (T&E) Section

The T&E Section was formed to provide an in-house capability for evaluating developmental hardware after Government acceptance. In the past, the Air Force employed contractors to run such tests. This method of operation proved expensive, slow, and frequently non-conclusive. In late 1971, as a result of a proposal by the Facility's System Analysis Team, the decision was made by SAFSS and SAF/SP-1 to allow the Facility engineers to direct the T&E on their assigned projects. The T&E technicians had the responsibility of determining and assuring that the power, water, space, and environmental support were readied prior to the arrival of the hardware. In addition, they would assist in designing the T&E plans and procuring the test materials (films, precision targets, special instrumentation, etc.). The people assigned were, in most cases, senior NCOs with experience and expertise in the state-of-the-art of the photographic processing equipment and procedures used at AFSPPF. Their backgrounds varied, but most of the personnel also had a working knowledge of photointerpretation, system performance analysis, electronics, and/or computers. These talents were critical as many of the systems going through T&E involved control systems or automatic data reduction.

The T&E Section could handle any size piece of equipment from small densitometers to a 40 foot folded high speed processor. When large equipment, such as the Cayuga printer, was delivered it had to be installed in its permanent operating position in the mission production laboratory. The T&E people would then perform acceptance and evaluation tests on the equipment after permanent installation.

The capabilities of this Section were greatly complemented by the Photo Laboratory, the Standards Laboratory, the Photo Maintenance Branch and the other support service areas of AFSPPF.

The major pieces of equipment which went through T&E at AFSPPF were the: FSDS Free-Radical Heat Processor, PE Free-Radical Printer, 3M High Capacity Dry Silver Processors, ITT Dynamic Color Scanner, AIL Semi-Automatic Densitometric Control System, BA Step and Repeat Printer, HF Micro-Wave Dryer, AIL Airgate Printer, and the EK High Intensity Precision Sensitometer.

An important requirement of the RD Directorate was the coordination, preparation, and publication of the Five Year Plan. This plan was broken down into the following six sections: Mission Statement, Assumptions, Objectives, Areas of Concentration, Manning, Plant Modifications and Expansion. The contents of this report were derived through a meeting of the Facility Proposal Review Board (PRB). The PRB was comprised of all Directors, key staff members, and was chaired by the Vice Commander. In this meeting each Director would submit a proposal to include the justification and estimated cost of all support programs his directorate required during the next five year fiscal period. Upon completion of a review of all requirements, each program was discussed and rated. The PRB would then arrange these projects in priority order by specific year. The draft of this plan was then submitted to the Facility Commander for his approval. Once approval was gained, the report was published and sent to SAFSS, SAF[redacted] and SAF[redacted] The last Five Year Plan[39] was produced in April 1971.

[39] AFSPPF Report, 30 April 1971, Five Year Plan (1971 - 1975), TCS 354010-71. (TS)

Another vital yearly administrative task was the production of a detailed justification for the next fiscal year's financial program. This report was divided into the three funding categories and an estimate of the costs for film and chemical supplies. This data was determined by the same procedure as that used to prepare the Five Year Plan. The format of each category listed the RD line number, title, estimated cost, and textually summarized the problem and proposed solution of each program. Each fiscal year Financial Program Report was produced in two versions: one was system classified and the other prepared as a SECRET document. This was done for wider dissemination of the work being performed and controlled by the RD Directorate at AFSPPF. The last report in this series[40] was produced for FY 75.

When the decision was made in October 1973 to phase out AFSPPF, the future of the Research and Development function was not settled. The programs under way at the time continued while the future of the Air Force involvement in the ground handling of satellite photography was reviewed and discussed. The RD Director at that time, Lt Colonel Butt, convincingly briefed higher headquarters and the CCB that an Air Force research and development group had a vital role to play in the development of processing equipment, photographic materials research, support of the [redacted] support to the CCB, and continued scientific assistance to the NRO's evaluation mission at NPIC. The decision was made by SAFSS to continue the RD effort at the same level until mid 1976 when the function and four military engineering officers would be transferred to CIA/Image Technology Division (ITD) in the Washington, DC area. Program plans were made to continue all major study efforts in areas such as electrostatic laser recording materials, amorphous duplication materials, Isocolor, and microdensitometry. The ITD was tasked to combine all exploitation and production/processing research and development in support of NRO programs, other than that being performed at BRIDGEHEAD. The test and evaluation of developed equipment, i.e., AIL Semi-Automatic Densitometric Control Systems, EK High Intensity Precision Sensitometer (HIPS), AIL Airgate Printer, PE Free-Radical Printer, etc. would be continued by the new group using laboratory areas established for that purpose at the [redacted]

These plans were implemented and by September 1976 all personnel and records and most of the equipment were in place at the new operating location.

The successful evolution of RD at AFSPPF can be attributed to its dedicated engineers, scientists, and photo technicians. Some of the personnel who provided major contributions and program continuity include the following directors: Lt Colonel Leroy Williams (1961 - 1966), the "Architect of RD"; the organizational and managerial abilities of Major Francis Bernier (1966 - 1969); and the determination of

40 AFSPPF Report, 31 March 1974, AFSPPF FY 75 Financial Program. (S)

Lt Colonel George Hansen (1971 - 1974). Other outstanding contributors were: Chief Master Sergeant V. Altenhein as Chief of the T&E Section; Chief Master Sergeant Leroy Miller in color equipment and processing research; Staff Sergeant Allen Scott in the evaluation of non-conventional materials; Lt John Hilten who developed the first computer system analysis program using the IBM 1620/1710; Captain Barry Britton for work in image analysis and the Advanced Microcamera System; Major Jay Johnson for his dynamic perseverance in the development of the New Generation Microdensitometer; Captain Michael Riley as the project engineer of the CORN Program; Sergeants Benjamin Williams and Joseph Brassard, procurement technicians who monitored and prepared the funding; and Mr. George Hunter, the most productive civilian engineer ever assigned to RD, who worked both in research (Isocolor, Silver-Color, etc.) and hardware and system development (3211 Color Processor, EH-67, EH-75, Pollution Control, Incineration, Chemical Mix System, etc.).

## THE CIVIL ENGINEERING DIRECTORATE (DE)

Building P-1900 was designed and constructed in the middle 1950s as a reconnaissance technical facility. AFSPPL was activated on 15 December 1960 and shared P-1900 with its original tenant, the 8RTS, until 1963 when the expanding mission necessitated that AFSPPL utilize the entire building. The building, originally 54,000 square feet, was expanded to 106,960 square feet and modified through a series of construction projects costing over [redacted] to provide the best and most current state-of-the-art photo processing plant in the DoD. These changes were required to meet the demands of increased processor capability, high level security, computer sophistication, and other advancing technologies.

As a tenant unit, the Facility received maintenance and utility support from the 814th Civil Engineering Squadron on a "priority" service call basis during the period from 1960-1963. "Priority" treatment was rendered based on the high level interest/coordination between the OSAF and SAC in establishing/developing this organization to meet its vital mission. There was no formally assigned civil engineering capability within this organization at that time. The photo processing effluents were introduced into the Westover AFB storm sewer system which flowed directly into the Chicopee River. There was no formal pollution abatement program. A small Electrolytic Silver Recovery System was in use to reclaim silver from the spent hypo solution. The building air conditioning and other environmental control were provided by two Chrysler Refrigeration units totaling 200 tons.

The first Military Construction Project (MCP) was awarded to the Franchi Construction Company, Inc. in 1962. This project was called "Modification to P-1900" and was valued at [redacted] dollars. Specifically, this project was concerned with providing an environmental control capability for the new processors scheduled for the Facility. Three refrigeration machines totaling 660 tons, cooling towers, air handling equipment, a plenum area above much of the existing Facility, an electronic control/monitoring system to hold temperatures with ± 1/4 degree, and a 750 KVA electrical substation were built/installed. Capability to control humidity within 5% of a set point and systems to provide heating and cooling needed for the processors throughout the year made it necessary to include boilers because the central base system at Westover was shut down during the summer. Other systems included in this project were: a wet-dry central vacuum, oil free compressed air, and instrument compressed air. The total area added to the building under this contract was 2,600 square feet in addition to the second story plenum area of 27,350 square feet. Figures 2-20 thru 2-22 present pictures showing the immense scope of work involved in this project.

Soon after the completion of the "Modification to P-1900" Project, it was realized that this control system could not be properly operated and maintained by transitory personnel. Therefore in late 1963, the Base Civil Engineers permanently assigned a 15-man air conditioning and refrigeration section to provide a three-shift, 24-hours per day, 7-days per week operation and maintenance capability in support of this organization. This work force was also supplemented by the Base Refrigeration Shop. During the first few years of operation, the system worked well because of its design and the quality of equipment; but, by 1966, lack of dedicated and specialized maintenance caused degradation to the capability of the existing control system. Additional equipment, including another 274 ton refrigeration machine and a 300 ton cooling tower, was added under another MCP named "Augmentation to the Modification of P-1900" in 1963. By late 1968, the increase in equipment, coupled with SAC going to an austere "breakdown maintenance" system, made the maintenance program untenable. Therefore, a manpower package[41] was formulated in January 1969 to establish an in-house civil engineering capability to support the existing plant and the programmed power production and water plants.

The original Electrolytic Silver Recovery System became saturated by the speed of the processors. Attempts at recovering silver were abandoned during the summer of 1964 when the Facility was being configured for the Trenton and Dalton processors. In late 1966, an ion exchange system of steel wool was installed. During this period, pressure was exerted at all levels of the Government to establish environmental control and in particular to stop the pollution of waterways. The problem of treating photo wastes to prevent contamination was extremely complex. Several contractors were involved in the research along with AFAL, Wright-Patterson AFB Ohio. In 1968, a classified materials destruction system was contracted through Fairchild Hiller. A mulcher-incinerator system was installed in 1968 and accepted in December 1969 for a contract cost of [redacted] Silver was recovered as a process by-product from the ash produced by this system.

41 Manpower Package, AFSPPF, Jan 1969, Justification for Increased Manpower Requirements (Appendix, Item 22). (U)

AERIAL VIEW OF THE CONSTRUCTION OF THE PLENUM AREA IN P-1900

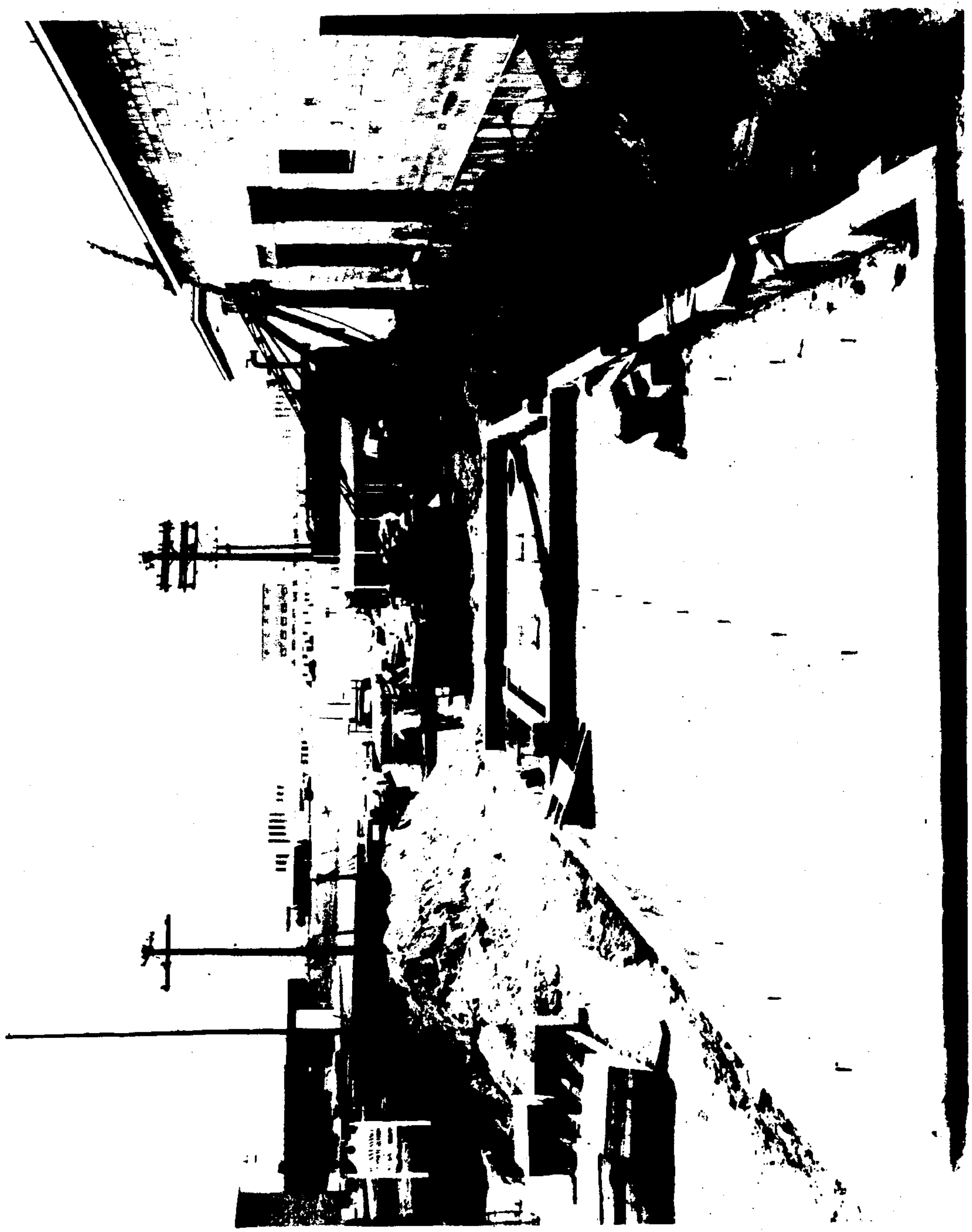
(August 1962)

FIGURE 2-20

CONSTRUCTION OF MECHANICAL ROOM WHICH HOUSES P-1900 REFRIGERATION UNITS

(August 1962)

FIGURE 2-21



FOUNDATION FOR THE TEMPERATURE CONTROL AND SUMP PUMP AREA

(October 1962)

FIGURE 2-22

A history of periodic power failures/fluctuations occurred during the early and mid 1960s. As the production requirements increased the need for consistent stable power became critical. In 1967, an MCP Project was programmed for FY 1968 to provide three 1000 KW generators and associated switch gear to give the Facility its own dedicated power source capability. The work on this Emergency Power Plant started in June 1969 and was accepted in January 1972 at the cost of [redacted][42] Figure 2-23 is a view of the construction of forms and the erecting of steel reinforcement for the foundation. Figure 2-24 shows the outside of the completed plant, while Figure 2-25 presents a picture of the power equipment.

Because of the unreliability of the base water system, especially in 1967 and early 1968, AFSPPF decided to sink several deep water wells with the idea of severing dependency on the base system. The Facility contracted with R. E. Chapman of Oakdale, MA to drill five wells during the summer of 1968. After the quality of water from these wells was determined and an engineering economy analysis made, it was decided to abandon this project in favor of constructing a storage tank and booster pump station.

There were several other major construction projects during the mid to late 1960s. The first was the "Augmentation to the Modification of Building P-1900" which was completed in August 1964 at a cost of approximately [redacted] The items included in this project were: (1) a new 3,840 square foot Chemical Mix area; (2) rehabilitation of the old Chemical Mix area to provide rooms for three new Dalton Processors; (3) a Pneumatic Tube Carrier System connecting the Dalton Processor area with the Quality Control/Chemical Analysis Laboratory/Chemical Mix areas; and (4) four new air handling systems (AC-6 thru AC-9). In 1966, the south corner of Building P-1900 was modified to create a vaulted area to house the Data Division's 360 Computer System. This project included special wiring, air conditioning, and structural changes which cost [redacted] Also in 1966, the project, "Phase III modifications to P-1900," was started. This included the installation of the Ion Exchange Silver Recovery System, and a series of interior modifications throughout the building to upgrade the Photo Laboratory area and to provide additional vaulted work areas. Phase III was a 1967 MCP item completed in December 1967 at a cost of [redacted] In 1968, a small project was completed to raise the floor in the Production Directorate's control room to accommodate the 1130 Computer. After completion of the Phase III modifications, a contract was let to install the mulcher-incinerator Classified Waste Destruction System. Although this project had problems, particularly the development/design of the mulcher, the installation preparation and accomplishment of the final system were sound and exact. A P-341 Emergency Construction Project (ECP) was started in 1968 at the contract quote of [redacted] to provide a communications facility and an environmentally controlled film storage area. This expansion to Building P-1900 resulted in an additional 7,700 square feet of space. Figure 2-26 shows construction of the steel framework and roofing of the communications/film storage addition. Figure 2-27 is a

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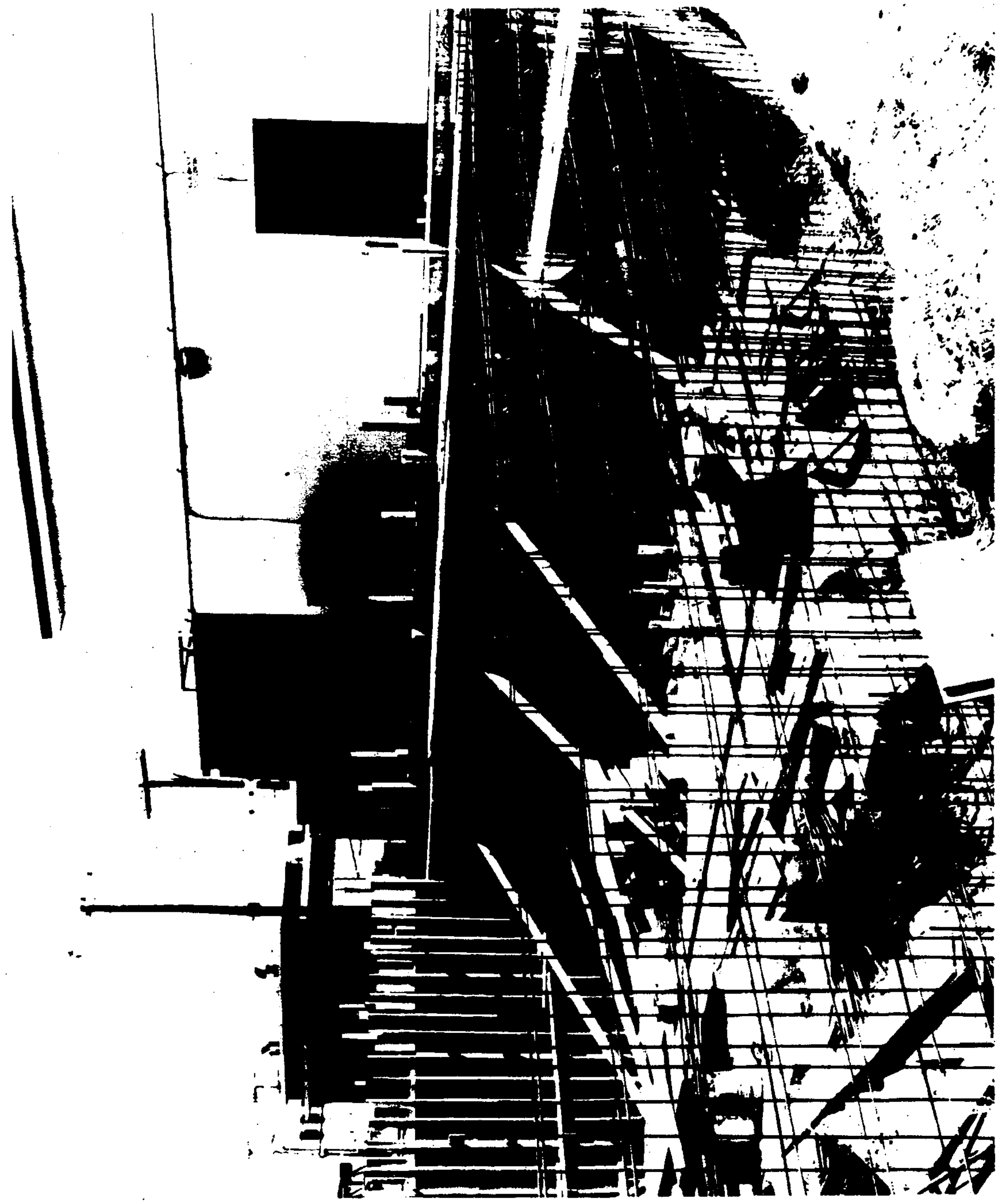
42 DD Form 1354, Dept of Army Engineers, 18 Jan 72, Acceptance of EEP Addition. (U)



CONSTRUCTION OF FOUNDATION FOR EMERGENCY POWER PLANT

(September 1969)

FIGURE 2-23

COMPLETED EMERGENCY POWER PLANT ADDITION TO P-1900

(June 1972)

FIGURE 2-24

EMERGENCY POWER PLANT EQUIPMENT

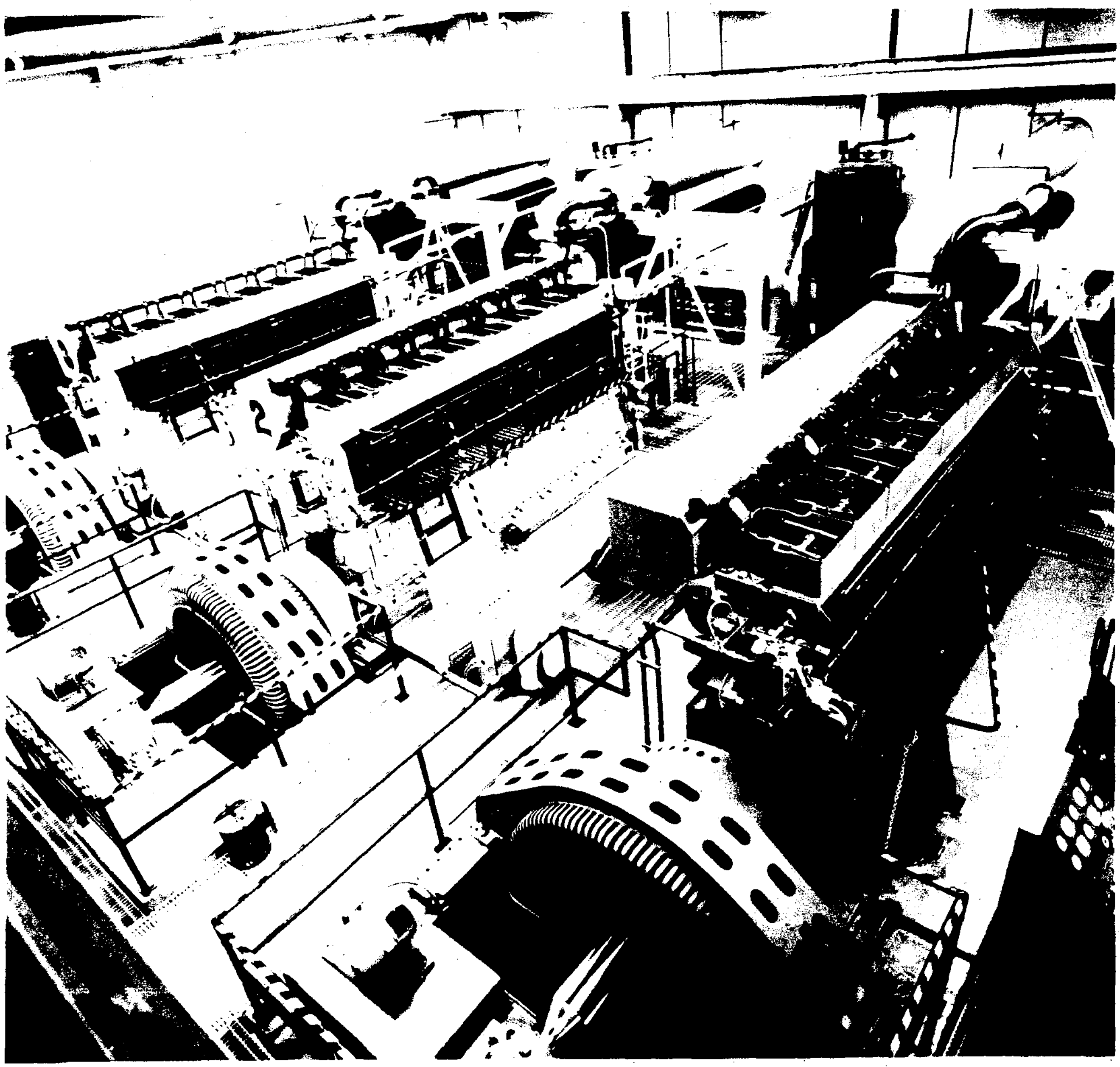
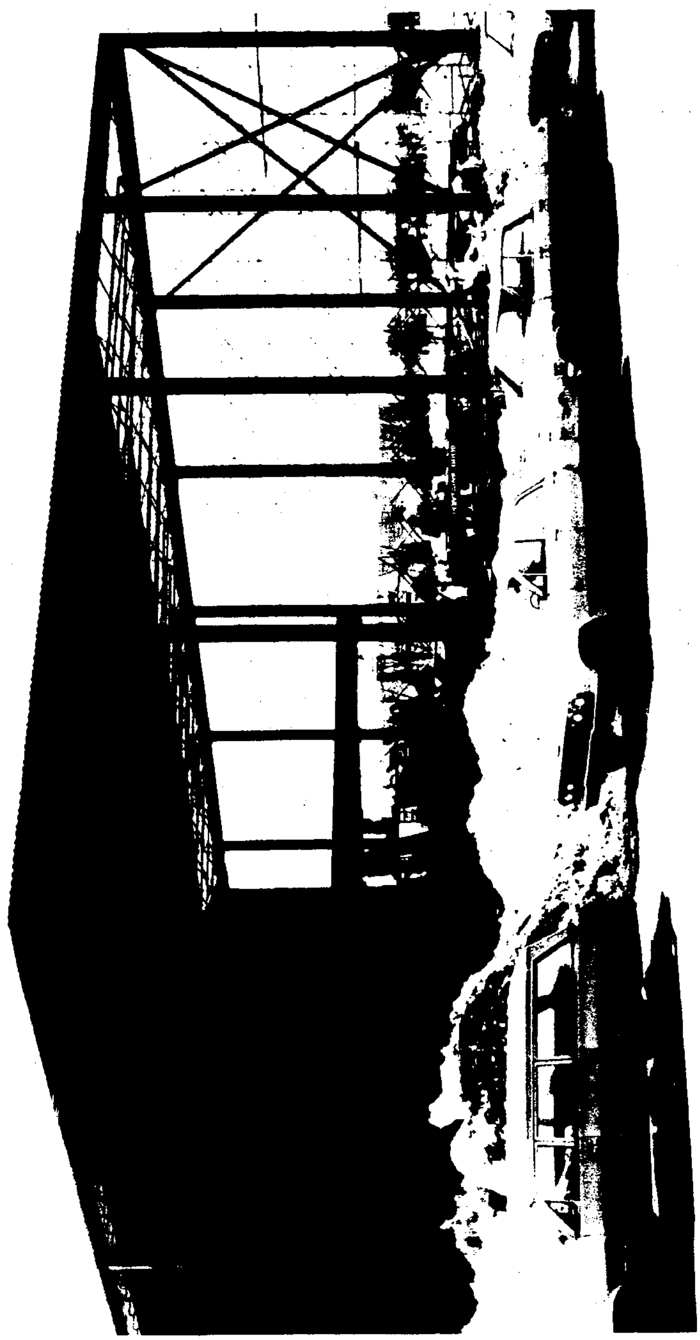


FIGURE 2-25



CONSTRUCTION OF FOUNDATION FOR COMMUNICATIONS/FILM ENVIRONMENTAL FACILITY

(February 1969)

FIGURE 2-26

picture of the completed addition with the exception of the transshipment door. Specifically, this project provided 1,300 square feet for a new secure vaulted communications area and 6,400 square feet of environmentally controlled space for the handling/storage of film. Due to cost considerations and the fact that the existing chilled water system was nearing capacity, the air conditioning installed for these new areas was a series of three roof mounted, direct expansion, independent package units rather than an extension of the existing system.

It was in January 1970 that the Directorate of Civil Engineering was formally established. Up until this time the planning, programming, maintenance, and operations functions in support of this Facility had been handled by the Westover AFB civil engineers in close coordination with AFSPPF managers who performed this job on an additional duty basis. Two men who served in that capacity were [redacted] and Major W. McCabe who were both officially assigned to RD. Based on the inadequacies of the existing support/ maintenance arrangement, the Command Section drew up a manpower package to propose the formulation of a Civil Engineering Directorate. This complicated package involving host-tenant agreements, additional manning, and the transfer of slots was indorsed by General R. A. Berg, Director of SAFSS, on 6 January 1969[43] and forwarded to Air Force Office of Manpower and Organization (AFOMO) where it received final approval. Major W. Clark was the first official civil engineering officer assigned. During his tour from January 1969 to August 1973, he supervised the growth of this Directorate from 1 officer and 1 senior NCO to 1 officer, 1 senior NCO, and a draftsman in the Directorate office staff, and 17 Refrigeration, 13 Power Production, and 5 Water and Waste spaces. In 1972, the Utilities Section consisting of 8 slots was transferred from the Maintenance Division of the Logistics Directorate to Civil Engineering bringing the total authorized manning to 46. The organization of this new directorate was divided into the office staff and the following functional elements:

A. Refrigeration and Air Conditioning Division

This element was responsible for installing, operating, modifying, and maintaining all refrigeration and air conditioning, dehumidifying, and atmospheric control equipment, machinery, and related systems.

B. Electrical Power Production Division

This element was responsible for installing, operating, and maintaining all generators and support power equipment under the jurisdiction of AFSPPF.

C. Water and Waste Division

This element was responsible for installing, operating, modifying, and maintaining all equipment which supplies, processes, and discharges water/waste at AFSPPF.

43 Memo to AFOMO, SAFSS, 6 Jan 69, AFSPPF Civil Engineering Manpower Increase. (FOUO)

AFSPPF's emphasis on water pollution abatement, spurred on by the Water Quality Act of 1965, continued to research ways to stop the pollution of local streams. The FY 71 MCP item, Industrial Waste Treatment Facility, valued at [redacted] was started in July 1972 and completed in August 1974.[44] It was designed to recycle all water used in photo processing and separate the chemical waste. This plant was a pilot operation which had great potential to explore various process treatments. In order to allow for recycling of used hypo and to provide for more complete silver recovery, the Ion Exchange Silver Recovery System was replaced with an Advanced Electrolytic System capable of recovering 98% of the silver from the used hypo. This new electrolytic system was completed in 1972. The addition of this plant enabled all effluents from the building to be treated either by the waste treatment plant or the base sanitary system, thus terminating the long term pollution caused by this Facility to the Chicopee River. Figure 2-28 shows the Industrial Waste Treatment Plant under construction; Figure 2-29 an outside view of the completed plant; and Figure 2-30 the treatment processing equipment.

In April 1973, the requirement for more secure working space due to the deep involvement of all phases of production and evaluation of the HEXAGON Program led to the design of more vaulted areas in the Facility. Also, in June 1973 with the added mission responsibilities, the Commander/SAO requested that the security alarm system be upgraded. These projects were both cancelled in June 1973 upon announcement of the phasedown of the Facility.

The Utilities Division was transferred to the Directorate of Civil Engineering in 1972. The military plumbers, carpenters, electricians, and civilian maintenance mechanics provided greater resources and flexibility to respond to minor modification and equipment installations. Thus with this addition the Directorate controlled the total civil engineering's operation and maintenance capability within AFSPPF. Administrative support was provided by the Facility's administrative office and by the clerk-typists assigned to the Production Directorate.

An elaborate system of sprinkler and fire detection systems was installed as part of the safety modification and rehabilitation project completed in April 1972.[45]

In terms of a self sufficient utility capability, the 3,000 KW Emergency Power Generation Plant became operational in January 1972. This plant provided a stable emergency source capable of supplying full operational power to the entire Facility. To alleviate the pressure problems from the base water system, a 2,000,000 gallon water storage tank and booster pump station were constructed at a cost of

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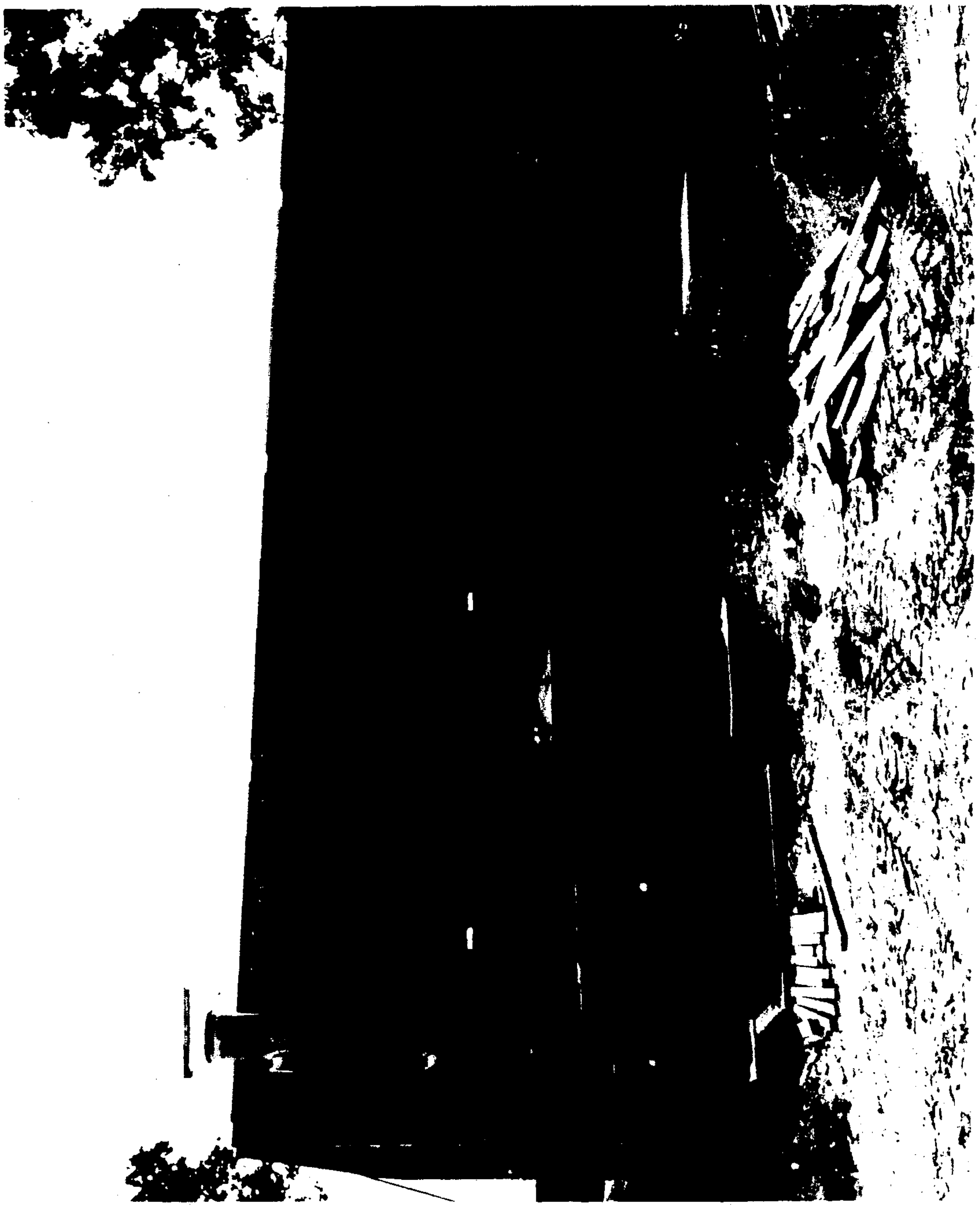
44 DD Form 1354, Dept of Army Engineers, 14 Aug 74, Acceptance of Industrial Waste Treatment Facility. (U)

45 DD Form 1354, Dept of Army Engineers, 13 Apr 72, Acceptance of Sprinkler and Fire Detection Systems. (U)



INDUSTRIAL WASTE TREATMENT PLANT UNDER CONSTRUCTION

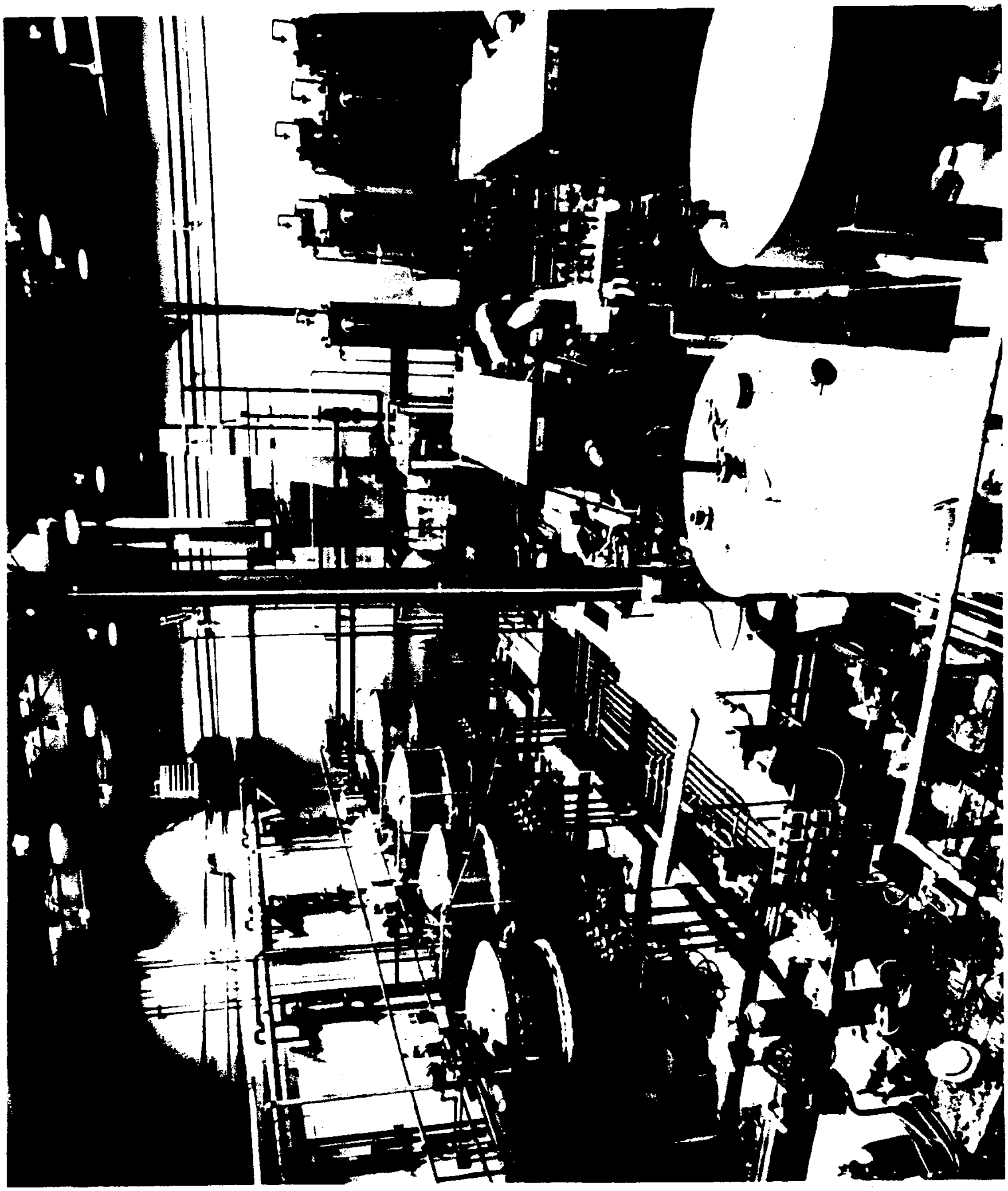
(June 1973)

FIGURE 2-28

COMPLETED INDUSTRIAL WASTE TREATMENT PLANT

(August 1974)

FIGURE 2-29



INDUSTRIAL WASTE TREATMENT PLANT EQUIPMENT

FIGURE 2-30

[redacted] They were accepted in June 1973.[46] Figure 2-31 shows a picture of this Water Storage and Pumping Facility.

Other construction projects during the 1970s included the modifications and rehabilitation of the photo laboratory areas and the installation of fire protection systems throughout the building which totaled approximately [redacted] Building P-1875, which is directly adjacent to the back of P-1900, was acquired to house the expanded research and development function in 1970. Approximately [redacted] was spent to modify the building and to install a new fire alarm system. An addition to P-1900 was constructed for the Feasibility Section and accepted in May 1974.[47] Feasibility was assigned to RD and consisted of mechanics tasked with testing, evaluating, and modifying equipment. This project, plus the initial collection tanks for the Industrial Waste Treatment Plant, was completed in March 1974 at a cost of [redacted]

The Directorate of Civil Engineering met, and in many cases surpassed, its mission of providing support to the photo production, research and development, imagery analysis, data processing, report reproduction, and logistic functions of AFSPPF. The area responsibilities grew from the original 54,000 square feet in P-1900 to the following in 1976:

| Building Identifier | Function | Size (square feet) |
|---|---|---|
| P-1900 | Operations | 106,960 |
| P-1875 | RD | 10,245 |
| P-3101 | Pump Station | 806 |
| P-3102 | Industrial Waste Treatment | 5,800 |
| T-2404 | Warehouse | 9,600 |
| P-3100 | Water Storage | (2,000,000 Gallon Water Tank) |

NOTE: In 1972, this organization also had two additional storage warehouses (Buildings 7502 and 7504), each consisting of 30,400 square feet.

The sophistication of DE's tasks covered a spectrum from operating and maintaining 21,504 square feet of Class 100 Category Cleanroom area requiring exact temperature, relative humidity, and static pressure control to a centralized control room which had the capability to monitor equipment status and the environmental conditions within each room/laboratory of the Cleanroom area. Figure 2-32 shows the control panel which monitored these lab areas. An idea of the scope of responsibility in the refrigeration area alone is provided by the equipment which included 2,025 pieces of air moving systems (air showers, fans, filters, etc.), 7,865 indicating and control panels (controllers, valves, electrical wiring,

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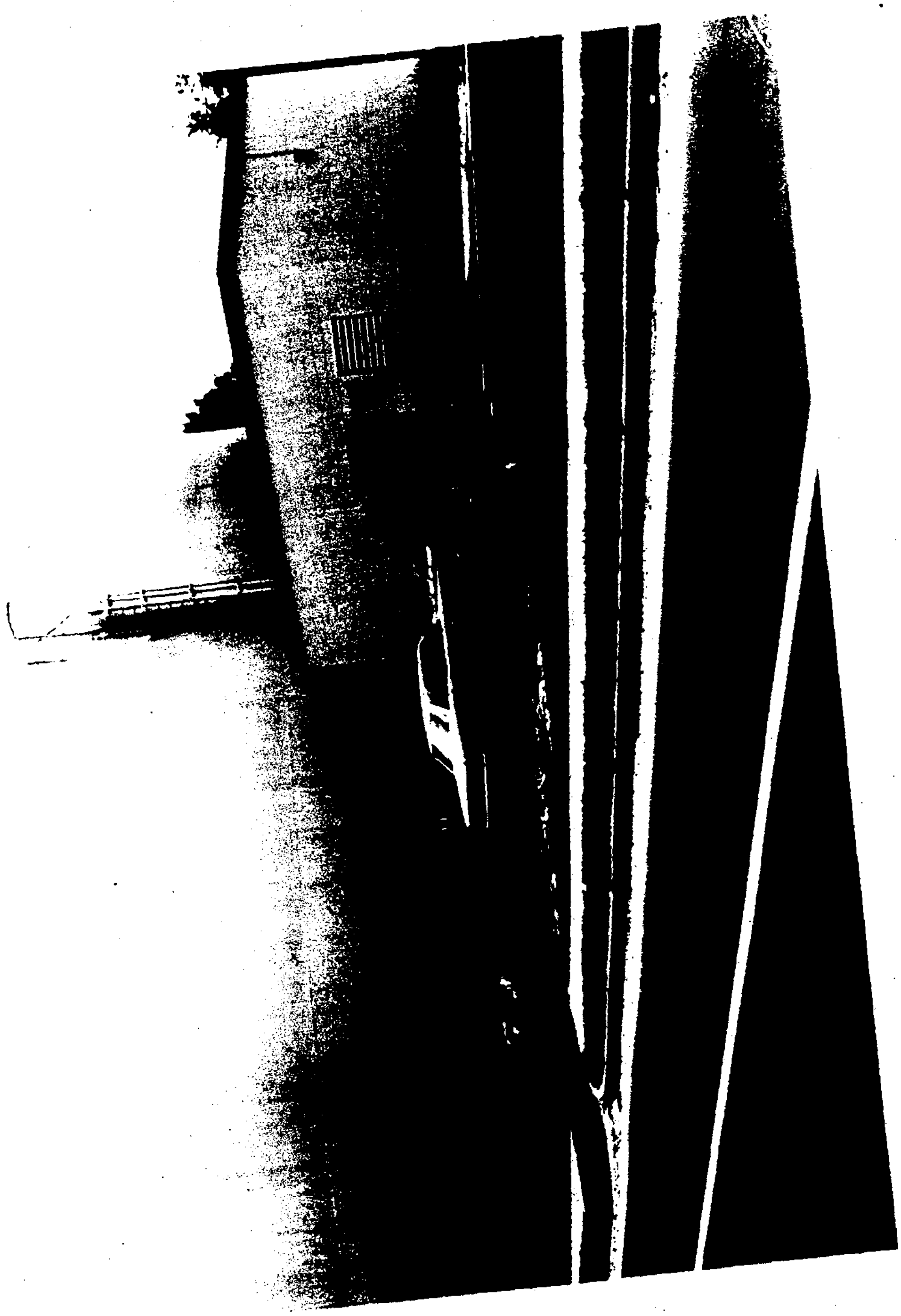
46 DD Form 1354, Dept of Army Engineers, 25 Jun 73, Acceptance of Water Tank and Pumping Station. (U)

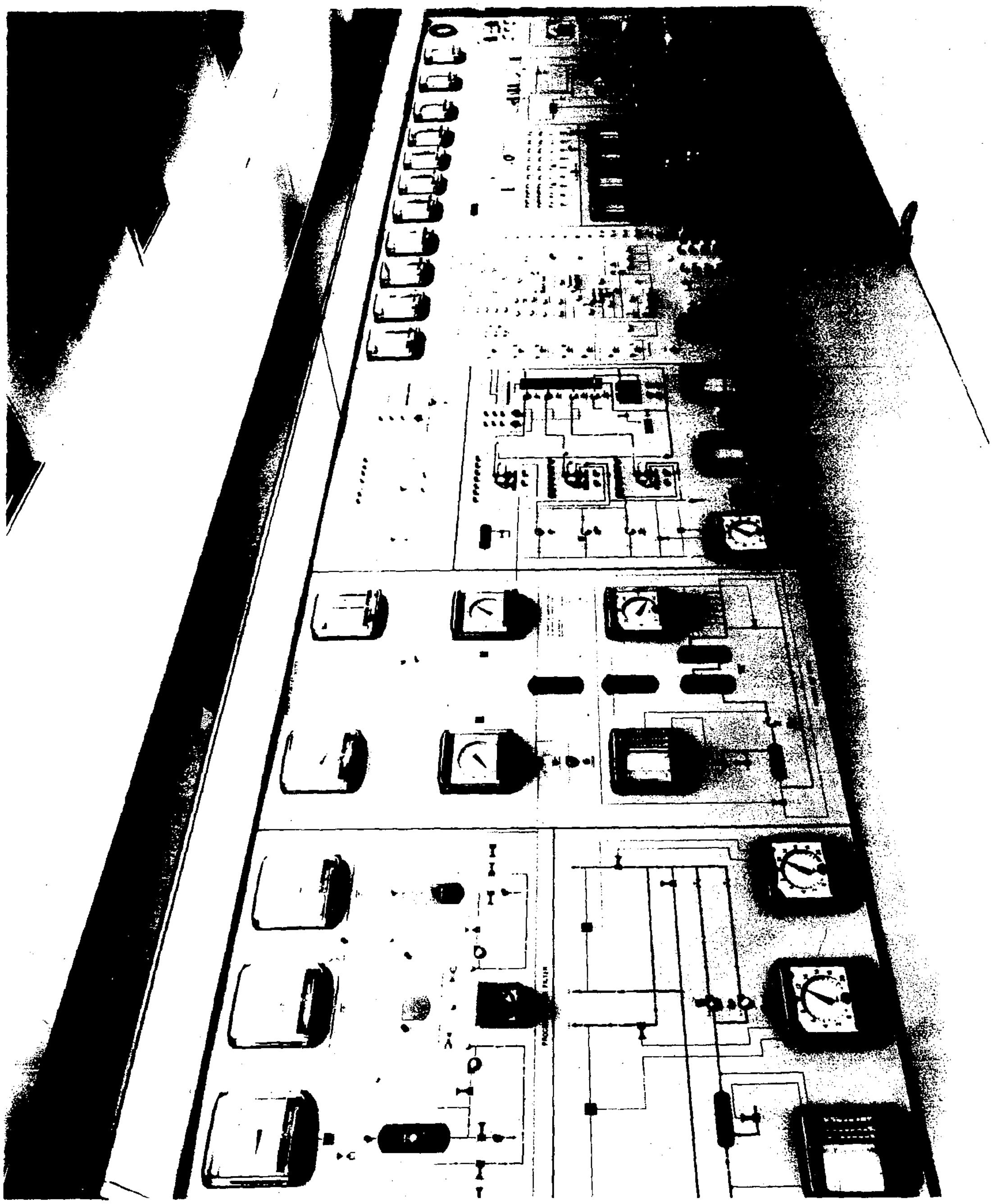
47 DD Form 1354, Dept of Army Engineers, 22 May 74, Acceptance of Addition and Alterations to Building P-1900, SPPF (Appendix, Item 23). (U)



COMPLETED WATER TANK AND PUMP STATION

(June 1973)

FIGURE 2-31



CENTRALIZED CONTROL ROOM SHOWING EQUIPMENT AND ENVIRONMENTAL MONITORING PANEL

FIGURE 2-32

indicators, etc.), 13 water systems, 10 refrigeration units (approximately 1,000 tons), and 20 miles of pipe varying from 1/8 inch to 12 inches in diameter.

One thing that has remained abundantly clear throughout the existence of this service-oriented Directorate is that it could not have successfully accomplished its mission without the extreme dedication, technical expertise, and ingenuity of those military and civilian personnel assigned. Men like Sergeant R. Buckelew who spent 11 years at this organization, the first tour in structuring the Refrigeration Section and the second (1971-1976) as the Directorate NCOIC and the man most responsible for making the Industrial Waste Treatment plant operational; Sergeant R. Travers (1962-1969, 1970-1975) who was instrumental in the design, development, and utility construction of much of P-1900; Sergeant J. Anderson who established the operating procedures for the Emergency Power Plant; Sergeant B. McCord who took over the Refrigeration Division in the peak years from 1969-1973 and developed a complete in-house maintenance capability and the manning for that Division; the two foremen who both have been part of the organization from 1965, Mr. B. White (Maintenance) and Mr. G. Wilcox (Operations); and the guidance, management, and planning of Lt Col R. McLaughlin who, as the last DE Director and the last Facility Commander, provided vital assistance in the relocation of the Production, Research & Development, and Evaluation functions, and was the man responsible for managing the physical closure of AFSPPF.

The collection of precision equipment, physical facilities, quality control/monitoring techniques, maintenance practices, and technically talented and dedicated personnel will never again be equal to that assembled under the Directorate of Civil Engineering. It is unfortunate that this carefully maintained and sophisticated equipment will remain as real property to Buildings P-1900 and P-1875 and be turned over to Westover AFB as excess to Air Force needs at the phaseout of this Facility. The only exceptions were the Silver Recovery System which was relocated with PD at Offutt AFB, and 21 various sized chemical mixing tanks which were transferred to the NER.

## THE LOGISTICS DIRECTORATE (LG)

A firm requirement existed for a logistics section to support the development of the newly established Air Force Satellite Photographic Processing Laboratory (AFSPPL) upon its activation on 15 December 1960. In January 1961, the Commander, Colonel H. Ohlmeyer, assigned two Supply and three Maintenance Technicians to provide this support. The name of this unit was the Division of Material. In mid 1965, this Division was upgraded to the Directorate of Material, and in August 1971, was renamed the Directorate of Logistics.

During 1961, the supply account consisted of approximately 300 line items. The Supply Branch stored the supplies in two buildings with a total floor space of 4,300 square feet. One of these warehouse buildings (T-1831) was shared with the 8RTS. This supply account used two methods for procuring materials. All

"Federally Stock-Numbered" items were requisitioned from the Sacramento Air Material Area (SAMA). All other items were purchased through the Westover AFB Procurement Office. Items purchased through Base procurement included films and chemistry purchased from Eastman Kodak. In the 1962 - 1963 period, AFSPPL received permission to brief a purchasing agent supervisor at Westover AFB. The rationale was to have someone with the basic knowledge of the importance of the Facility's procurement requirements and also one who could, if necessary, expedite purchase requests.

During 1961, the three Maintenance Technicians shared shop space in Building P-1900 with 8RTS Maintenance personnel. A close personal relationship developed within this group, and it was not unusual for them to lend assistance on one another's projects.

The Division of Material was augmented by two civilians (Mr. Amen and Mr. Schick) in early 1962. The operational requirements remained relatively stable. However, some supply difficulties were encountered with both SAMA and Base procurement. The difficulties with SAMA were not because of a lack of cooperation but because of the geographic separation involved. The problem with Base procurement centered around the amount of time required to process a purchase request. As a result of these difficulties, the following steps were taken to improve the Base Supply support:

A. An Impress Fund of $500 was established to allow procurement of routine requirements up to $150 and emergency requirements up to $250 directly from the vendor.

B. A classified miscellaneous supply account (non-reporting) was assigned by the direction of SAFSP.[48]

C. A DoD Urgency Category of BRICK-BAT, an Industrial Priority of DX-01, and a USAF FAD-1 were authorized by SAF[49] for use by this Facility. The BRICK-BAT Urgency Category means Presidential approval; the DX-01 Priority can be defined as receiving the first "copy" of the requested item which comes off the assembly/manufacturing line of the contracted vendor, regardless of whom it was scheduled for; and the USAF FAD-1 (Force Activity Designator) allowed this organization the highest DoD requisition priority.

D. The SAMA personnel on-loan to this organization were replaced with permanent party military and civilian personnel.

In July 1963, the authorized manning for the Division of Material was increased by two personnel, a Budget Technician and an Administrative Clerk. This increased the total to 32 personnel. The organizational structure and alignment were as follows: the Chief and his Staff (a Clerk and a Budget Technician); the Supply Branch (9 military and 1 civilian); and the Maintenance Branch which consisted of a Photo Section

[48] SAFSP Letter, 10 June 1963, AFK Account Number K0997. (C)
[49] SAF Message, 6 March 1968, reconfirming request of 17 May 1965 for: "Support for the AFSPPF." (C)

(10 military photo maintenance personnel), an Electronics Section (6 military electronics technicians), and a Utilities Shop (1 military carpenter, 1 electrician, and 1 plumber). So as of that date, the Materials Division had evolved from a fragmented group, staffed by individuals on loan or TDY from other military units, to a well organized support section comprised of permanently assigned specialists. The primary reason for this personnel buildup was to support the newly assigned Facility mission of producing duplicates of imagery taken from the CORONA satellite reconnaissance system.

During this period (December 1961 - July 1963), the supply account grew from 300 to over 700 line items. This growth surfaced a problem that was never satisfactorily resolved. The problem was the availability of adequate warehouse space. The total warehouse area expanded from 4,300 square feet in 1961 to approximately 20,000 square feet in mid 1963. This storage space included: two Bomb Storage Igloos (3,750 square feet each), two Butler Buildings (1,650 square feet each), six refrigerated vans (320 square feet each), and Building 1831 (7,500 square feet).

With mission expansion came the parallel requirement to increase the supply of film and chemicals. The main facilities used for this bulk storage of film and chemicals were two concrete bunkers located in a bomb storage area approximately three miles from AFSPPF. Additionally, the Facility required refrigerated storage for their more sensitive mission materials. This was accomplished by using six environmentally controlled vans which were located in a parking lot approximately two blocks from the Facility. This forward supply point precluded the logistics personnel from having to drive six miles round trip every time they had to issue film.

The maintenance work load also increased significantly. The 8RTS equipment was removed and, in many cases, was replaced by prototype/"one-of-a-kind" pieces of equipment. This caused many maintenance problems, primarily because of the lack of knowledge/experience in the new mechanical and electronic systems. As a result of this increased work load, it became necessary for the Maintenance Branches to man a 24-hour shift operation during missions and a rotating stand-by schedule during non-mission periods. The Supply Branch worked a rotating stand-by schedule during mission operations.

During 1963 and 1964, new state-of-the-art equipment continued to be received by the Facility, i.e., two Houston Fearless (EH-67) High Speed Processors, and one Trenton and two Dalton Processors from Eastman Kodak. None of these processors was a standard Air Force equipment item and, therefore they required specialized/advanced maintenance training. Generally this training was only available from the manufacturer. The Maintenance Branch was also responsible for the alarm system in P-1900; the Taylor Environmental Controls System used to regulate the air conditioning in P-1900; the closed-circuit Security TV System; the two Mann-Data Microdensitometers; and numerous light tables and evaluation equipment assigned to the Technical Analysis function of RD. Because of this increased responsibility, the Branch was manned with a Maintenance Officer and augmented from 19 to 26 personnel.

In 1964, this Division was tasked with the "World-Wide Logistical Support" of the Overseas Processing and Interpretation Centers (OPICs) under the responsibility of the NRO. This program had a two-fold purpose: (1) to provide a single point of control for the supplies and equipment required to support these overseas centers, and (2) to provide a cover story for the working relationship between EK and the OPICs. Figure 2-33 presents a picture of the locations that AFSPPF supported during this program. This method of overseas support continued from 1964 until 1968. Since 1968, this requirement significantly decreased because of the phaseout of the OPIC concept. This overseas support program was very beneficial to AFSPPF for it acted as a forerunner to the National Emergency Reserve (NER) Program assigned to this Facility in 1969.

During the reorganization of the Facility in mid 1966, this Division became the Directorate of Material. Lt Robert Beaver, the Director, instituted a plan to formalize the control/operational procedures governing this function. His first action was to assign additional duties to the Supply Division. The Imprest Fund Officer (Mr. E. Kruzel) was tasked with establishing and maintaining a supply/equipment research library. An Inventory Management Specialist (Staff Sergeant E. Nelson) was appointed as the Facility Equipment Manager; and Technical Sergeant R. Priest, a Materials Facilities Specialist, was assigned as the Film and Chemical Monitor. Because the supply account had now reached 1,200 line items, the next step was writing, publishing, and implementing a set of formal operating procedures[50] for processing requests for supplies, equipment, and services. This procedure not only put a tighter control on purchasing, but enabled the Supply Division to maintain a status on each request and, in most cases, expedite delivery. As mission tasking increased, competition developed between the various operational functions of AFSPPF for funding to meet operational requirements. Therefore, it was proposed that an Equipment Review Board[51] be established to review all requests for equipment which exceeded $1,000. The Equipment Review Board was the forerunner to the formulation of the Financial Management Board,[52] and consisted of all directors and was chaired by the Commander or Vice Commander. The purpose of the Financial Management Board was to keep the Commander and his Staff advised of the Facility Operations & Maintenance (O&M) expenditures.

Control of the funding for O&M at AFSPPF began in 1961. O&M funding was originally received from Air Force Appropriation 3600, RDT&E under Budget Program Activity Code (BPAC) 690, Program Wide

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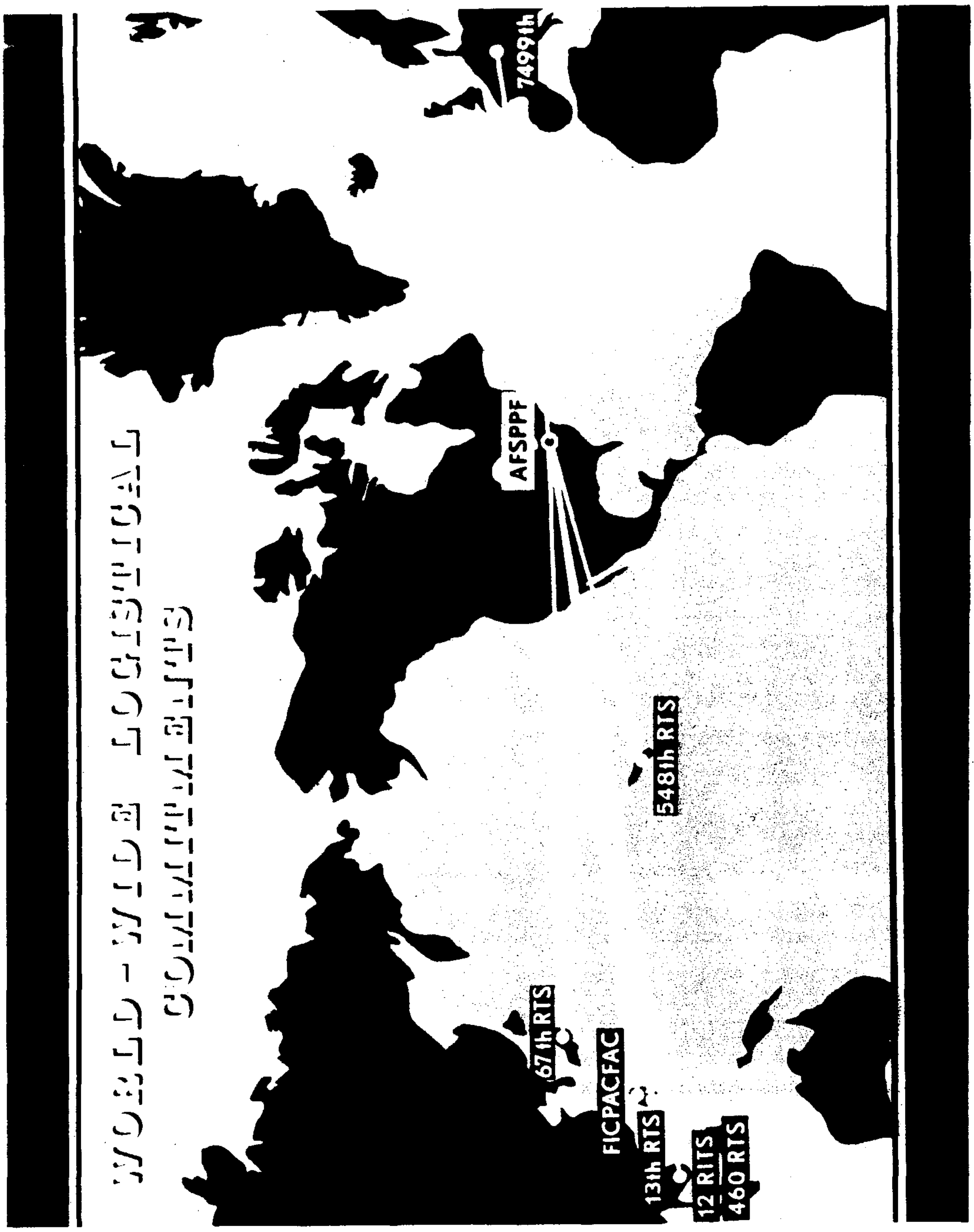
50 Logistics Operating Instruction 67-2, AFSPPF, updated 26 February 1973, Processing Requests for Supplies, Equipment, and Services. (U)
51 Logistics Operating Instruction 67-18, AFSPPF, updated 11 June 1973, Responsibilities of the Equipment Review Board. (U)
52 Logistics Operating Instruction 172-1, AFSPPF, updated 11 June 1973, Financial Management Board (Appendix, Item 26). (U)




THE OVERSEAS LOGISTICAL SUPPORT PROGRAM

FIGURE 2-33

Management and Support. This fund category, which was consistent with AFSPPF's so-called "cover story," provided for those Air Force organizations whose primary mission was research and development oriented. Annual budget submissions as well as fund status reporting were made to the Space and Missile Systems Organization (SAMSO) because, as an intermediate command, that office had administrative control of all Operating Budget Account Numbers (OBAN) and allotments issued from Headquarters, Air Force Systems Command. However, AFSPPF's annual funding requirements have historically been forwarded for an initial review and justification to SAF[redacted]prior to being forwarded to SAMSO for approval. Up until 1964, AFSPPF's financial plans were prepared at SAF[redacted]by Facility personnel in TDY status. From 1965 until 1976, this budget was compiled at AFSPPF.

The start of the normal budget submission cycle began in September when a "Budget Call" was received in letter form from SAMSO. This call detailed the criteria to be used for formulating the next fiscal year's budget input. The call also included any assumptions that should be taken into account in preparing the budget, i.e., a budget ceiling, civilian pay raises, etc. The Director of Material then forwarded budget preparation packages (instructions, pertinent information, forms, and suspense date) to the other AFSPPF directors. After these packages were returned, the Budget Technician and Director compiled and consolidated the various inputs into a single document called the "FY_ _ Initial Budget Submission." The Director then briefed the Financial Management Board on the proposed submission and at that time, it was modified/approved. Upon final approval by the Commander, the document was reproduced in 20 copies. This unclassified submission was hand carried by the Director in late November to Los Angeles Air Force Station (LAAFS) to brief the Director of SAF[redacted] Adjustments/modifications, if any, were made manually, and the Director then took the report to SAMSO/Accounts Control Budget Management (ACBM) for review by the Budget Programs Officer. Once the submission was formally accepted at this level, it was ready for consolidation into the AF Systems Command Budget.

Beginning in FY 73, the AFSPPF's O&M funding was placed under Air Force Appropriation 3400, Base Operations and Maintenance. During this period, AFSPPF was directed to segregate their Civil Engineering costs by expense element and report this data separately. Annual financial plans continued to be forwarded to SAMSO/ACBM through SAF[redacted]for review/approval. During this time period, a new internal reporting procedure was instituted within AFSPPF which provided cost data as utilized by the various directorate functions. This information proved to be a valuable management tool for the AFSPPF Staff.

Table 2-6 presents a summary of the approved Operations & Maintenance Budget for AFSPPF by expense element indicator code (EEIC) from FY 70 thru FY 76.

TABLE 2-6

SUMMARY OF AFSPPF O&M BUDGET FROM FY 70 THRU FY 76
(dollars in thousands)

| EEIC | FY 70 | FY 71 | FY 72 | FY 73 | FY 74 | FY 75 | FY 76 |
|---|---|---|---|---|---|---|---|
| 39X Civilian Pay | ← Budgeted by SAF [redacted] → | | | | | [redacted] | |
| 40X Travel | [redacted] | | | | | | |
| 49X Communications | | | | | | | |
| 53X CE Svcs | | | | | | | |
| 56X Contract Maintenance | | | | | | | |
| 59X Misc Svcs | | | | | | | |
| 61X/60X Supplies | | | | | | | |
| 63X/62X Equipment | | | | | | | |
| TOTAL | | | | | | | |

Additionally, the Director was responsible for submitting a budget input for: (1) mission film and chemicals from the classified portion or "black" P-3080 Category to fund the Eastman Kodak contract; (2) off-the-shelf equipment from the unclassified portion or "white" P-3020 Category; and (3) two "white" P-3080 Category line items (computer support and film and chemicals). The inputs were closely coordinated with the directorates involved with these functions, i.e., film and chemistry with PD and RD, computer support with PD and EV, etc. Once the requirements were stated and justified, they were incorporated into the RD Budget submission and forwarded to SAF [redacted] for review/approval.

The manning authorization remained the same up to 1966, but as the mission tasking continued to increase personnel shortages were experienced in critical areas. The area encountering the greatest hardship was the Electronics Maintenance Branch. In September 1965, this shop's manning was down to two staff sergeants (William Topper and Richard Wagner). These men were working 12 hours a day, 7 days a week, plus alternating nights on stand-by. The work order backlog for this shop increased to over 900 man-hours. As a result an emergency manpower requisition was forwarded to the Military Personnel Center for four electronics maintenance technicians. These slots were filled by July 1966 and the operational and preventive maintenance programs were fully reinstated and the backlog of work orders completed by December 1966.

The supply account had continued to increase and by mid 1969 contained 2,600 line items. This growth in volume had virtually exceeded the capacity of all available warehouse space. In the summer of 1969, the construction of the new 6,400 square foot cold storage addition to P-1900 was completed. This environmentally controlled warehouse was large enough to store all mission film stock from the six vans. AFSPPF turned in three of the refrigerated vans to Base Supply and used the other three for miscellaneous storage.

On 25 June 1969, the National Emergency Reserve (NER) was formally established by an NRO Directive entitled, "Establishment of NRO Photographic Materials and Equipment Responsibilities." The NER was an extension of the world-wide logistical concept which the Facility had supported since 1964. The publication of this directive was one of the primary factors in the success of this program, as it clearly defined the responsibilities of all NRO agencies.

The NER was an equipment pool stored at Westover AFB. The Directorate of Material was charged with the custodial and maintenance responsibility for this equipment. The primary purpose of the NER was to provide the NRO community with a reserve of state-of-the-art photographic processing equipment which would allow the augmentation of any processing facility in the world on short notice. A secondary purpose of the NER was to provide storage and maintenance facilities for any equipment that became excess to the current requirements of the NRO.

The three primary agencies involved with the NER were the NRO, AFSPPF, and Eastman Kodak. The NRO had the overall responsibility for the NER items and approved/directed all equipment transfers. The NRO also made all budgetary projections for equipment acquisitions and modifications. AFSPPF was directed to perform the management control and in-house maintenance for the equipment in the NER. This responsibility included receipt, storage, operational inspection, and accounting for all stored and loaned NER assets. Eastman Kodak had the responsibility for major maintenance and modification. This was a very practical contract for the majority of the NER equipment was manufactured by EK.

The NER was not difficult to manage, but it did require a lot of warehouse space. AFSPPF negotiated with the Westover AFB Commander and received one of the bays (Bay 8) of a 99th Bomb Wing hangar to store NER equipment. A more detailed summary of the NER Program can be found on pages 4-1 thru 4-11.

By 1971, the authorized manning for the Directorate had increased to 48 personnel. This expansion was mainly due to the enormous amount of support this Facility gave the newly developed HEXAGON satellite system. In August 1971, the name of this group was changed to the Directorate of Logistics (LG). In addition to the advent of the HEXAGON Program, other factors significantly affected LG during this time period. The OPICs were phased out resulting in a large turn-in of equipment to the NER. This additional equipment, plus the increase in supplies to support the HEXAGON Program, again made warehouse space a critical situation. Once more, AFSPPF with the support of the Secretary of the Air Force negotiated with the Base. The Facility was given two aircraft nosedocks (Buildings 7502 and 7504). This provided LG with an additional 60,800 square feet of warehouse area. Both nosedock buildings were used to store NER, PD, and RD equipment and supplies. Another subtask assigned to AFSPPF by the NRO was that the Facility would act as the alternate original negative processing plant to EK/BRIDGEHEAD. This required that LG order and store over [redacted] worth of film and chemicals. This volume of material overfilled the cold storage area in P-1900. So the decision was made by the Commander and Director of Logistics to consolidate the lesser used film and chemistry in the uncontrolled environment of Nosedock 5 (Building 7504). This was not an optimum situation because the temperatures within this structure ranged from 20 degrees Fahrenheit in the winter to over 120 degrees Fahrenheit in the summer. These conditions caused the following problems over the years: (1) film degradation (loss of sensitivity and fogging), and (2) chemical deterioration, i.e., the acetic acid froze and could not be used for several weeks; the EA-5 chemicals completely decomposed, etc. At times, these types of discoveries resulted in reordering the material through emergency requisition to avoid mission delays in production. The Facility Systems Analysis study also had a great impact on LG in 1971. This study was conducted to ... "allow management to optimize resource allocation, production and process control, and information flow through organizational efficiencies and automation of tasks, where feasible and desirable." This quote was taken from the Introduction of Part I, Facility Systems Analysis Report.[53] As a result of this investigation, the Utilities Maintenance Branch with its six assigned specialists was transferred to the Directorate of Engineering. This action reduced LG manning to 42 personnel. This number of personnel and organizational structure remained the same until July 1974.

The announced realignment of Westover AFB in April 1973, and the subsequent transfer of the host command from SAC to AFRES further compounded the warehouse space problem. This was mainly because Nosedocks 5 and 7 were located on a portion of Westover AFB which was projected to be turned over to the civilian community by June of 1974. Several different on-base facilities, i.e., Buildings 1850, 5375, etc. were examined, but were found to be unsuitable for various reasons. With the decision by the SAF in October 1973 to phase down and ultimately close AFSPPF, LG proposed that another NER equipment excess review conference (an unsuccessful review was held in 1971) be convened at this Facility. LG also suggested that the organizations present for this review be expanded to include both NRO and non-NRO photographic-related agencies. These proposals were accepted and a meeting was scheduled for 19 November 1973. The

[53] Facility Systems Analysis Report, 12 July 1971, Part I, Description of Present System, BYE 15268-71. (TS)

following organizations attended this review: EK, DIA, NISC, USAF/Intelligence, EPA, and CIA. Many pieces of equipment were claimed and approval was given by NRO to ship those machines. As a result of this conference, the NER was reduced from 120 to 42 line items. In November 1976, the remaining equipment in the NER will be shipped and officially transferred to [redacted]

Other major LG support areas affected by the announced realignment of Westover AFB included: Transportation, Accounting and Finance, and Base Supply. In the fall of 1973, Logistics Air Service was discontinued at Westover AFB. Up until that time, this service had been transshipping material from EK to the 497th RTG at Wiesbaden, Germany. This service was actually cancelled in May 1974 when Westover AFB officially became an AFRES Base because of security and the lack of flight control/maintenance support. The supplies and equipment stored in Nosedock Buildings 7502 and 7504 were transferred to Building T-2404 (12,000 square feet), the Feasibility Addition of Building P-1900 (5,202 square feet), and in a 2,000 square foot, outside storage area adjacent to Building P-1900. Immediate action was taken by LG to reduce line items and stock levels so that these three areas would only have to store the materials required to produce AFSPPF's reduced mission tasking (10% of the total NRO duplication requirements). With the October 1973 decision to close this organization by 1 January 1977 and transfer of the Evaluation function to NPIC, the Production function to Offutt AFB, and the RD function to an unspecified location, a phasedown/phaseout plan was written.[54] The major actions involving LG were: (1) to identify disposition of the supplies and equipment located at AFSPPF, and (2) to arrange for the shipment of these materials. A new, automated management program (Equipment Shipment) was designed by the Director, Captain T. Wilkinson, to control and list all available equipment by ultimate disposition. This program was written for the Digital Equipment Corporation , PDP-11/40 Minicomputer System, by Master Sergeant M. Strausbaugh. Initially the listing had six parts but was increased to 14 in mid 1974 to cover additional disposition to other organizations. This list provided a valuable managerial tool for AFSPPF/LG, EV, PD, RD and the SAFSS/NRO in the control of each individual piece of equipment being shipped from this Facility.

By 1 July 1974, a reduction in authorized manning from 42 to 21 personnel had been completed. Although this reduction was accomplished through normal attrition (assignments, separations, retirement, etc.), it still had a profound effect on the support to the Production and Evaluation operational missions. It was at this time that an even closer and more cooperative relationship surfaced between the machine operators from PD and EV and the maintenance technicians from LG.

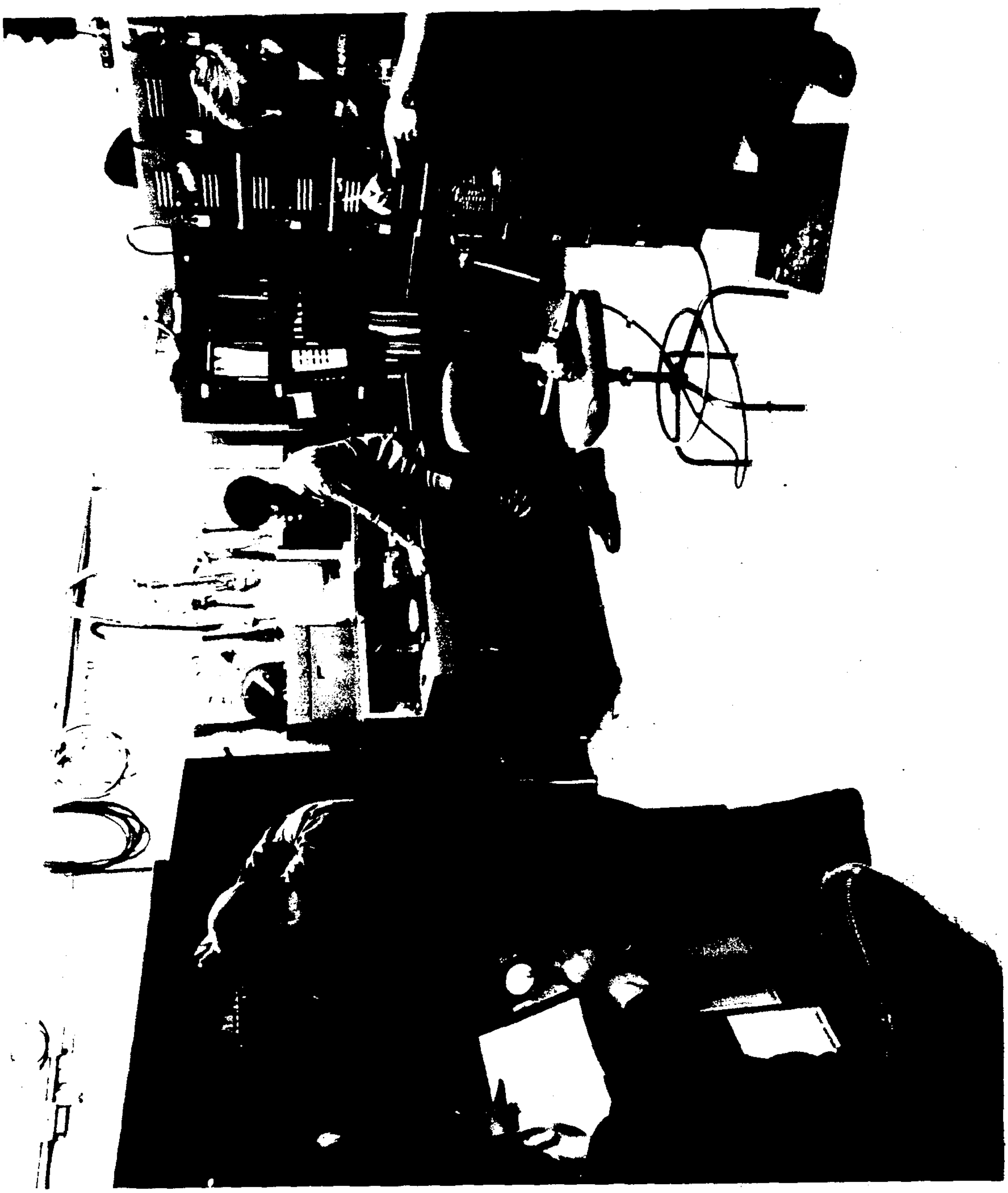
The first major shipments of equipment took place in June and August 1975 when the Evaluation function was transferred to NPIC, Washington, DC. There were five truckloads of equipment (64 items) valued at

[54] AFSPPF Programming Plan PFP-1, revised 1 May 1975, Realignment, TCS 363501-75. (TS)

[redacted] in support of this move. The next shipments of equipment took place in the summer/fall of 1976 in conjunction with the transfer of the RD function to CIA's Image Technology Division. Some RD equipment and the historical contract records were moved to the [redacted] Building, Washington, DC where the RD staff offices are located; however, most of the equipment was shipped to the [redacted] where test and evaluation areas were allocated. Four truckloads of RD equipment (72 items) valued at [redacted] were shipped during this transfer. Since May 1976, 27 truckloads of PD equipment (1,234 items) valued at [redacted] have been shipped to the 544th ARTW, Offutt AFB Nebraska to support the transfer of the Production function. The last function to be transferred is the Materials Analysis Laboratory. The majority of this equipment will be shipped to DIA/Technology Division (DC-6) in the November/December 1976 time period.

Through the years there have been many personnel who have contributed to the success of the Directorate of Logistics. For it could have been the individual from Supply who drove to Boston to pick up special color printing paper; the Supply sergeant who locally purchased ink for the multilith presses; the Electronics Maintenance man who was able to keep the microdensitometers in 24 hour operation; the Photo Maintenance technician who fixed the Niagara Printer; or the Budget Technician who was able to get funding approved for a new piece of computer peripheral equipment that was responsible for AFSPPF meeting their mission requirements within the critically defined suspense periods. The following is a summary of some of the more significant contributions. Of special note is the caliber of Director/Chief of this service-oriented area. No other Directorate was as consistently fortunate in having the leadership, dedication, and expertise of the men who directed this function. These officers met every challenge, i.e., organization, automation, operating procedures, logistical coordination, documentation, storage crisis, etc. In chronological order the Directors were: Captain Frank Curtis, Lieutenant Robert Beaver, Captain Billie Caskey, Captain Anthony Ashe, Captain William Gaeth, and Captain Thomas Wilkinson. Other key men were NCOIC, Senior Master Sergeant J. Byrd, who devised the work order control system; Master Sergeant William Topper who, in his 12 years of electronics maintenance service to AFSPPF, contributed significantly in many areas (maintained the Facility Alarm System, modified PDS Microdensitometers; altered EK Ident Printer, etc.) Master Sergeant Donald Blair who, in two tours as Chief of the Photo Maintenance Branch, was the man responsible for keeping all photo production equipment operational; and Master Sergeant Joseph Harris who, as Chief of Supply and later as Directorate NCOIC, was responsible for organizing the many warehouse movements in the 1970s, assisted in the Facility Budget preparation, and documented/coordinated the movement of equipment/supplies during the phasedown period. Other technicians who stand out were:

A. Master Sergeant C. Gault, Technical Sergeants D. Dunn and B. Webster, and Staff Sergeants R. Aird and W. Gavin from the Photo Maintenance Branch; Figure 2-34 shows personnel from this Branch working on the Redondo Printer.



PRECISION PHOTO MAINTENANCE TECHNICIANS WORKING ON THE REDONDO PRINTER

FIGURE 2-34

B. Technical Sergeants C. Boulware and J. Smith, and Staff Sergeants K. Shultz, J. Barnes, and R. Wagner from the Electronics Maintenance Branch; Figure 2-35 shows Airman Charles Braun checking the voltage on a Quantiscan Automatic Recording Densitometer.

C. Technical Sergeant G. Lachcik, and Staff Sergeants H. Ellis and T. Lyons from the Supply Division; Figures 2-36 (P-1900 Cold Storage) and 2-37 (Nosedock 5) show examples of the types and volume of storage maintained by this Division.

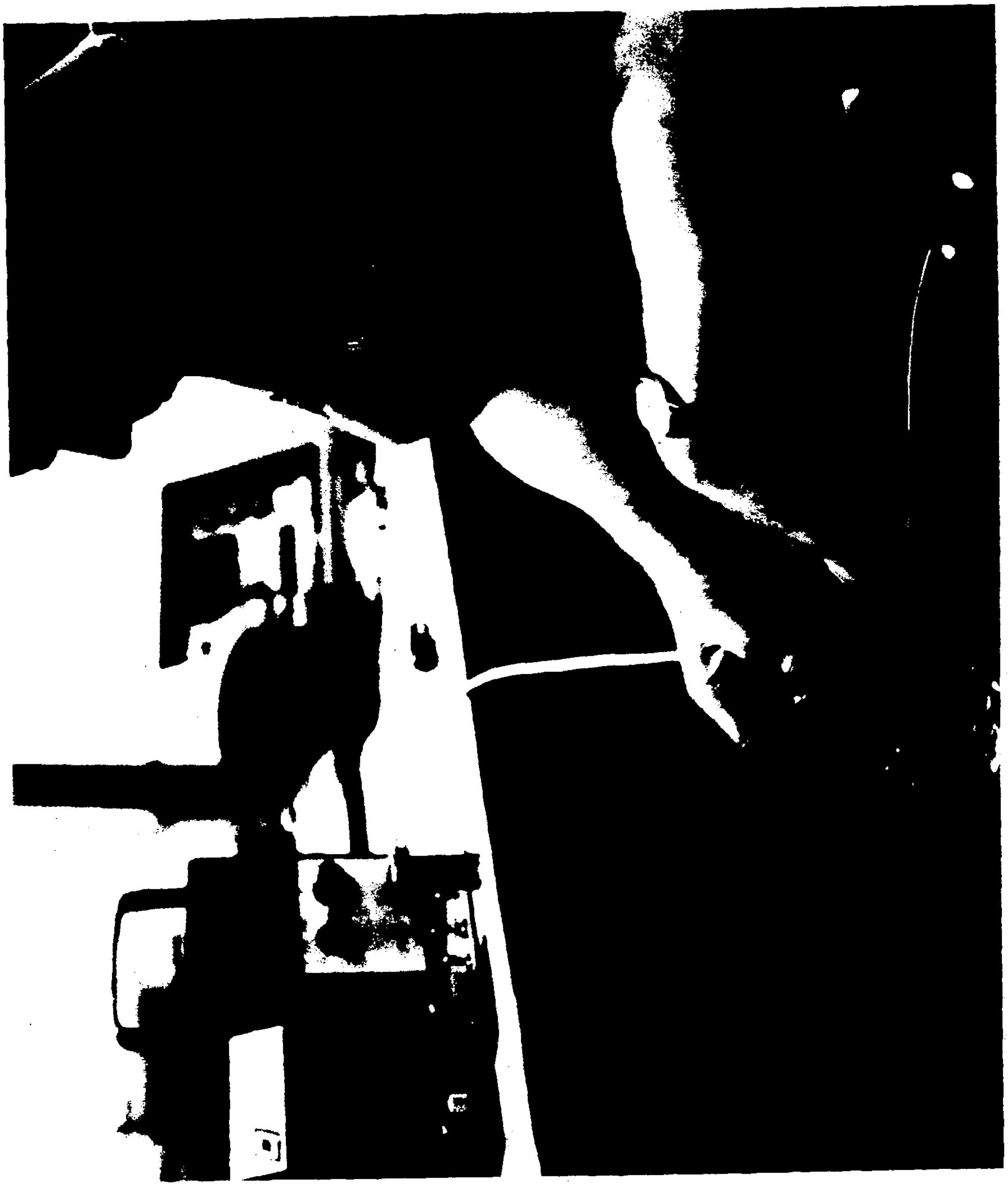
A small contingent of Logistics personnel will remain at the Facility until the closure of AFSPPF in December 1976. These personnel will be engaged in coordinating the final equipment shipments, assisting in preparing P-1900, P-1875, and the Industrial Waste Treatment Plant, etc. for transfer to AFRES, and closing out the Logistics Directorate. The majority of these talented personnel will be reassigned into other Air Force organizations. One Supply and six Electronic and Photo Maintenance personnel were selected for transfer to Offutt AFB to support the PD function in their new operating location.

## THE EVALUATION DIRECTORATE (EV)

Originating as a "spin-off" activity from the RD Directorate in June 1966, EV grew from a small force of one officer, two civilians, and approximately five enlisted personnel to a peak Directorate strength of 45 which included a Director, Deputy Director, two secretaries, three Division Chiefs and a dedicated group of engineers, analysts, technicians, and specialists. This growth in manning and resulting diversity of skills reflected the dynamic requirements faced by both EV managers and working level personnel. The Technical Analysis, Data, and Technical Reports Divisions were distinct, specialized units, each having a separate function; however, the general flow of work from data extraction to data analysis to final documentation integrated the total Directorate into a unique activity which rapidly and accurately responded to all mission demands.

The history of the Directorate of Evaluation is essentially a combination of the evolution of three units which were transferred from the Research & Development Directorate. The RD Directorate's main charter was "...to conduct the research and development necessary to provide the best possible equipment, techniques, and knowledge applicable to satellite photography..."[55] The major portion of these efforts in the 1961 - 1962 period was centered around the goal of insuring"...that the processing and duplication of photography obtained from satellite vehicles is of the highest possible quality..."[56] In 1962 - 1964, RD activities increased and the mission expanded, e.g., upgrading the Standards Laboratory (August 1962); establishment of the Select Print Laboratory (late 1962); performance characteristics evaluations on each GAMBIT (July 1963) and CORONA (August 1963) mission; development of the Controlled Range Network (October 1963);

[55, 56] IBID Footnote 1, page 1-1.

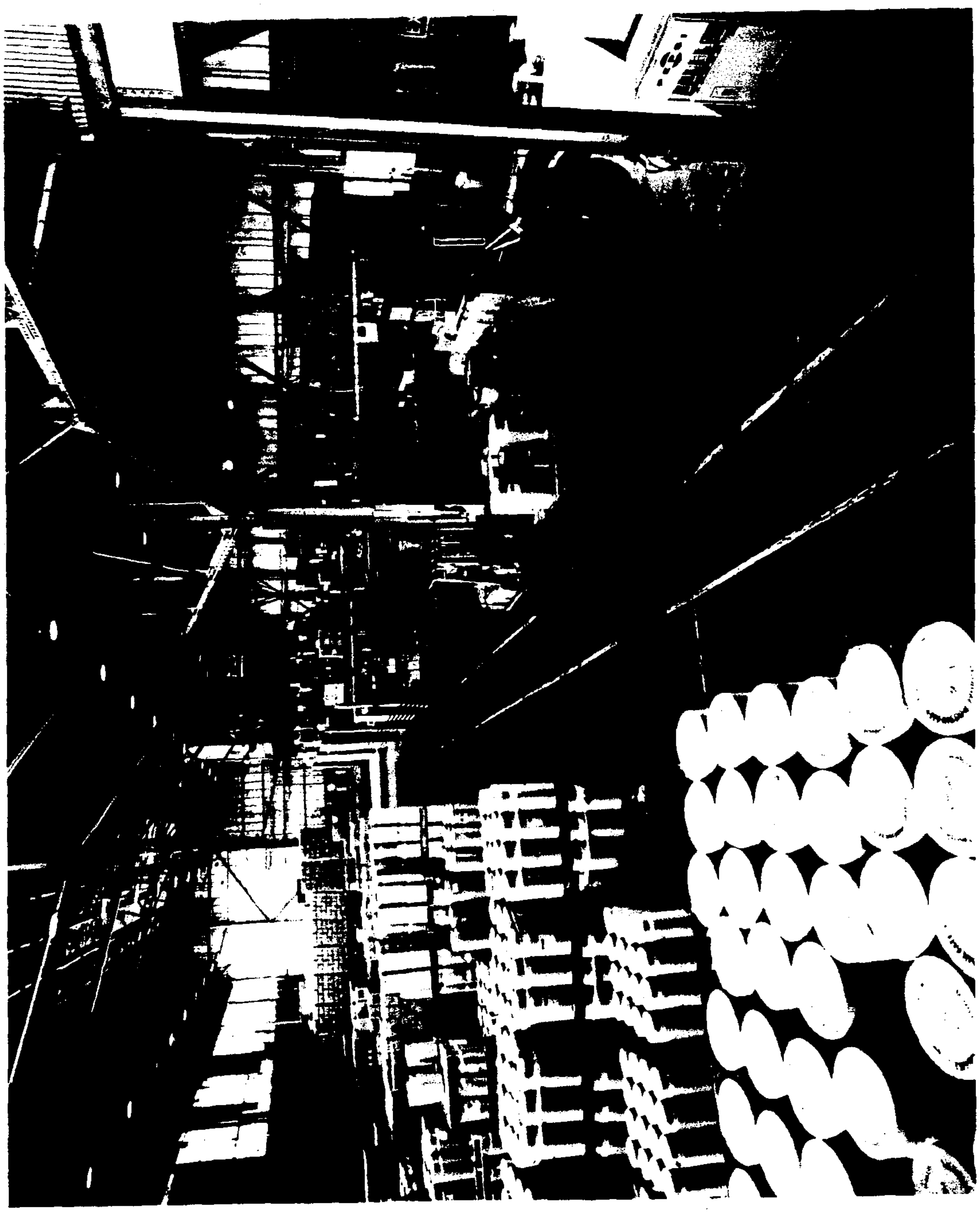


AN ELECTRONIC DIGITAL REPAIRMAN WORKING ON THE QUANTISCAN DENSITOMETER

FIGURE 2-35

FILM BEING STOCKED IN P-1900 COLD STORAGE WAREHOUSE

FIGURE 2-36



CHEMICAL SUPPLIES FROM NOSEDOCK 5 WAREHOUSE BEING READIED FOR TRANSPORTATION TO AFSPPF

FIGURE 2-37

Project Eye Que, performing objective/subjective analyses for photointerpreter standards in image analysis (November 1963); support of the Image Quality Evaluation Program (January 1964); etc. Therefore, Colonel Ohlmeyer decided that a separate section had to be created to develop an image assessment capability and to perform camera system performance analysis. In late 1963/early 1964, two study groups (the Drell and [redacted] Committees) were formed in the community to research the current state-of-the-art in the field of imagery analysis. The Facility representative in these groups was Lt Colonel L. Williams, Director of RD. These committees included some of the best known photo-optical and scientific authorities in the country. In July 1964, the committee chaired by [redacted] sought to improve analysis techniques in evaluation of reconnaissance photography, including transfer function analysis. This led to better methods of determining the camera system performance by microdensitometrically measuring the modulation transfer function (MTF) from an imaged edge. It was the establishment of feasibility of this basic technique that resulted in the Facility Commander's final decision to establish a separate section devoted to the analysis of satellite sensor subsystems. As a result, plans were made in November 1965 to transfer the Technical Analysis Branch (became the Technical Analysis Division), the Technical Reports Branch (became the Technical Reports Division), and the data processing segment of the Statistical Analysis Branch (became the Technical Processing Division) to the newly established Directorate of Evaluation in June 1966. Thus, the organizational structure of EV was established and the development of these three units continued to evolve.

The following is a capsuled chronological summary of the events and efforts of the function of the Directorate of Evaluation from its inception in RD to its closure on 1 August 1975.

Since 1963, support had been given to the GAMBIT and CORONA Program Office Evaluation Teams in performing density extraction, imaged and superficial film degradations, subjective CORN tribar resolutions, and objective Mann-Data Microdensitometer measurements for determining MTF/AIM system resolution performance. This support also included a convenient centralized location for members of the Performance Evaluation Team, consisting of both Government and contractor scientists, to review the measured data and imagery to evaluate overall system performance.

In the mid 1960s, emphasis was placed on: (1) upgrading the imagery evaluation system, mainly through contract development with Data Corporation; (2) improving the methods used to prepare and publish technical evaluation reports; and (3) increasing the data processing capability with the replacement of the IBM 1620/1710 by an IBM 360/30 Computer System.

In conjunction with the establishment of EV, a Military Construction Project was approved to establish vaulted work areas for all divisions. Vault doors were added outside the entrance to Technical

Reports (Room 83A) and the Data Division (Room 88), and the southern corner (Rooms 86 to 88) of P-1900 was modified to a Class A vaulted area. By December 1967, all divisions were within security approved working/storage areas. In July 1968, Technical Processing Division was renamed the Data Division.

The year 1969 was the most pivotal for the Evaluation Directorate. The biggest impact was the decision to hold preflight Acceptance and Readiness tasking and Postflight Analysis meetings at AFSPPF. This resulted in EV becoming more deeply involved in the support of HEXAGON than ever experienced with the CORONA and GAMBIT Programs. The Commander, Colonel Swofford, made the decision to upgrade the technical expertise by assigning more scientifically-oriented personnel to EV and by so doing significantly reduce dependency on contractual consultants. This resulted in changing the AFSCs of the officers in the Technical Analysis Division from Photo-Radar Intelligence Officers (AFSCs 8044 and 8016) to Reconnaissance Research Development Engineers (AFSC 2895A). Also in 1969, EV performed an evaluation[57] comparing the informational retention of three duplication methods. A plan was devised in 1969 to set up an active training program within the Directorate. Up to this time, EV personnel had been limited to General Military Training (GMT), Career Development Courses (CDCs), and On-the-Job-Training (OJT). This program was designed to have the Data Division personnel train with industry (International Business Machines Corporation, Digital Equipment Corporation, etc.) to learn the new equipment, software, and programming techniques. It also included visits by the Reconnaissance Research Development Engineers from Technical Analysis to companies (Photo Data Systems, EIKONIX, Technical Operations, etc.) working on the development of equipment which was planned for use in EV's production cycle. The Reports Division sent their lithographic pressmen to courses on the operation and maintenance of new offset presses, and the Division Chief to periodic Audio-Visual Conferences. In 1972, EV held internal briefing sessions for all its members to better acquaint them with how their contributions fitted into the evaluation phases of the HEXAGON and GAMBIT systems. Later in 1974, Captains Noland (EV) and Britton (RD) attended a seminar on image assessment and specifications sponsored by the Society for Photographic Instrumentation Engineers (SPIE) to observe the current state-of-the-art in image evaluation and new applicational developments in industry.

In 1970, preparations were made for establishing the evaluation procedures and work flow for test film analysis of future HEXAGON systems. The prototype test was outlined in a report,[58] dated 28 May 1970. The Dual Gamma Viscous Process was evaluated for determining adjacency effects on image analysis. Line Targets were introduced into the CORN Program and analytical software prepared. The non-linear methods of system performance assessment were being developed and tested to linearize the effects of Dual Gamma. Applications of microdensitometric mensuration for color analysis on the CORN Edge Target

[57] Report, AFSPPF, 15 July 1969, Special Evaluation Report Comparison of Film Duplicating Methods, TCS 354022-69. (S)

[58] Report, Acceptance Team, 28 May 1970, HEXAGON Sensor Subsystem Development Model Acceptance Team Report, BYE 107339-70. (TS)

from the color film segment were tested on GAMBIT Mission 4326. The IBM 360/30 was replaced by a 360/40 third generation 256K Core System. There was a marked increase in the request for color prints in technical reports. The Directorate completed a report[59] documenting the methods, procedures, and equipment used in the evaluation of original negative and duplicate photographic products. In this period the first minicomputer controlled, high speed, production-oriented microdensitometer was received from Photometric Data Systems (PDS), Incorporated, Webster, New York. A manpower study was performed resulting in the request for additional personnel to support operational HEXAGON requirements and indicating that all internal actions and feasible mission reductions had taken place. An automated calibration procedure was developed for the Mann-Data and PDS Microdensitometers. The CCB directed a study into atmospheric contrast reduction methods in an effort to reduce the uncertain properties that the atmosphere induces on CORN ground truth data. The Photographic Branch of the Technical Reports Division was transferred to the Production Directorate. EV assisted in performing an investigation into the methods used by the camera contractor in assessing focus from the Edge Target in the chamber target reticle. This led to the new 33-line Focus Target. The initial work on the Optimal Image Evaluation Program[60] developed by Mr. Jack Finley of Information Technology Corporation (later renamed EIKONIX) was received. The requirement to publish the CORONA Program TEROs terminated with the completion of the Mission 1110 report, 28 August 1970.

In 1971, EV prepared the first complete publication cycle of an operational HEXAGON camera system. This included the following: Interferograms, Acceptance, Readiness, Postflight Analysis, and Performance Evaluation Team reports. A second vastly improved PDS Microdensitometer was received which had a new stage design and optical stage position encoders. A subjective/objective evaluation, processing analysis, and characterization study[61] of non-conventional versus conventional duplicate materials was completed. Extensive software developments were written to support analysis of HEXAGON system, e.g., focus/motion/ target contrast from PFA Line Targets, analysis of Gray Scale Targets, image motion analysis, etc. Editorial and duplication support was provided for the first NRO Color Task Force report,[62] which discussed the feasibility of using color photography in the NRP. The Technical Analysis Division was upgraded with the arrival of two photo scientist staff officers and the Data Division received a Computer Systems Analyst (AFSC 5135A) position. The Reversible Line Target (RLT) which varied from 3, 8, 12, to 18 inches

[59] Report, AFSPPF, 15 April 1970, Photographic Evaluation Methods, Procedures and Equipment, TCS 354007-70. (TS)
[60] Appendices 1 and 2, Information Technology Corporation, January 1970, Optimal Image Evaluation ITC/2100501-FR-1. (FOUO)
[61] Report, AFSPPF, 15 December 1971, Evaluation of Conventional/Non-Conventional Files. (C)
[62] IBID Footnote 33, page 2-18.

in width and the Two-Step Gray Scale Target became the primary targets utilized in determining the performance of the HEXAGON camera system. Mission 1201, which was launched on 15 June 1971, was EV's first operational experience utilizing the Visual Edge Matching (VEM) technique. The development of this technique was pursued by the HEXAGON Program Chairman with Itek Corporation so that analysts could microscopically examine cultural detail and characterize the scene's edge sharpness in terms of equivalent standard tribar resolution. This technique was chosen to complement the CORN Program because it allowed analysis of denied area coverage. Also in 1971, the Director of Evaluation (Lt Colonel V. Stanley) chaired, and the Deputy Director (Captain T. Moorman) was the officer of prime responsibility (OPR) on a seven month study[63] made of this organization and its procedures. The analysis was conducted in the following phases: (1) determination of management objectives; (2) study of the present organization; (3) analysis of the findings; and (4) conclusions and recommendations. This revealing effort resulted in personnel adjustments, organizational structure changes, and additional automation of operational tasks.

By early 1972, the goals of establishing a military scientific and technical staff to perform image evaluation and develop in-house computer systems analysis, primarily independent of contractor assistance, had been achieved. In 1972, NRO interest in the feasibility of large color film payload(s) prompted a test program to calibrate the PDS and Mann-Data Microdensitometers to determine color responses and possible correction formulas. EV also modified the first PDS Microdensitometer to be compatible with the improved model received in August 1971. A report[64] was compiled and published summarizing the test and analysis procedures used throughout the manufacturing flow, assembly, and orbital operation evaluation phases of the HEXAGON Sensor Subsystem. In April 1972, the Optical Power Spectrum Analyzer, purchased by the CIA, was delivered to AFSPPF to have EV and RD assist in an effort to develop a program which could measure the performance of the HEXAGON camera system through spectral analysis of the film product. The Technical Reports Division completed 38 publications in support of the HEXAGON and GAMBIT Programs during 1972. The Technical Analysis Division started the four segment TDY support of each HEXAGON mission with two enlisted technicians, used primarily as VEM readers, and one Reconnaissance Research Engineering Officer, who worked on the operational analysis staff. In November 1972, three additional tape and disk drives (total of six each) for the IBM 360/40 were acquired to expedite data reduction and processing for HEXAGON evaluation.

In January 1973, the first of the PFA Technical Report series[65] was completed to assist the Air Force

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[63] IBID Footnote 53, page 2-74.
[64] Report, Sensor Subsystem Evaluation Group, September 1972, Sensor Subsystem Test and Analysis Procedures, BYE 15301-72. (TS)
[65] Report, HEXAGON Tracking Task Force, January 1973, Coarse Path Tracking in the HEXAGON Camera System, BYE 15327-72. (TS)

(SAF/SP-7) by historically documenting some of the problems, factors, and investigations which occurred during the first three operational years of the HEXAGON Program. Eleven of these reports were published from January 1973 to July 1975. Both PDS Microdensitometers were modified with the Pneumatic Focus Servo which aided in machine repeatability by removing the manual task of focusing from the operator. The Automated Resolution Data Terminal (RDT) System, which was devised in EV and designed by Captain Noland, Technical Analysis Division, to record and edit resolution data via a dedicated terminal, was built through the coordinated efforts of LG, RD, and EV. The RDT became operational in August 1973 to support GAMBIT and HEXAGON resolution collection and analysis. Captain D. Watson, Chief of the Data Division, completed a redocumentation and upgrading of all mission support software. With the pending transfer of the HEXAGON Program responsibility from the Office of Special Projects, CIA, to the Air Force (SAF/SP-7) on 1 June 1973, EV produced a detailed document[66] on the HEXAGON system performance evaluation functions being accomplished at AFSPPF. This study greatly assisted SAF/SP-7 in planning for the management of operations and testing upon assuming this responsibility. Two members of EV were assigned to the Imagery Resolution Assessment and Reporting Standard (IRARS) Task Force sponsored by the NRO to prepare standards for determining resolution of imagery within the NRP. A study and report[67] on the feasibility of using the Visual Edge Matching Technique in assessing GAMBIT system performance were completed. The Technical Reports Division reproduced the first version of a report[68] on a new subjective technique used by the photointerpreter to judge the interpretability of an acquired image. This development is called the National Imagery Interpretability Rating Scale (NIIRS). With the SAF 24 October 1973 announcement that AFSPPF would be phased out by the end of December 1976, Evaluation (Lt Colonels H. Duval and L. Martucci) began its role in the NRO AFSPPF Closure Study Group. The first decisions at a meeting in November 1973 were: (1) the function would be assumed by the NPIC/Applied Photo Science Division (APSD); (2) 30 personnel positions and required analytical equipment would be transferred; and (3) a full operational capability would be achieved at NPIC by 1 September 1975.

In 1974, EV performed several transfer studies to: (1) identify and coordinate equipment for transfer; (2) select the different specialty codes required at NPIC and filling those slots with available/experienced technicians from EV; (3) propose the most efficient and cost effective means of automated data reduction at

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[66] Document, AFSPPF, early 1973. HEXAGON System Performance Evaluation Functions, BYE 15257-72. (TS)

[67] Report, AFSPPF, March 1973, Application of Visual Edge Matching (VEM) to Mission 4336, BYE 15269-73. (TS)

[68] Report, NPIC, 15 November 1973, National Imagery Interpretability Rating Scale, TCS 36127-73. (TS)

NPIC; (4) reduce the capability of the present IBM 360/40 System; (5) identify existing personnel slots to be deleted within EV during the first increment of manpower reduction at AFSPPF; and (6) develop a plan for the orderly transition of relocating the EV function to NPIC. Lt Colonel Louis Martucci organized and chaired an Analysis Team to review the computer support required by PD upon the discontinuance of their IBM 1800/1130 production control system in April 1974. As a result of this computer support study, a recommendation was forwarded to SAFSS, and approval granted, to acquire a PDP-11/40 Minicomputer. The conversion of the software was organized/scheduled and, in many cases, written by Captain J. Hill who had recently been assigned to the Data Division. In the interim, EV loaned their PDP-8E Minicomputer to the Production Directorate for use in the return density acquisition/densitometer calibration functions performed during mission processing. EV also assigned Captain J. Hill and Mr. H. D'Amours to rewrite the software from the discontinued IBM 1800/1130 System programs to be compatible with the PDP-8E. In October/November 1974, the two-dimensional Non-Linear Model software was loaded in the IBM 360/40 and used in support of EV's image assessment program. Largely due to the analysis and programming achievements of Master Sergeant R. Swetavage, NCOIC of the Data Division, AFSPPF was able to save the Government approximately [redacted] in annual equipment rental. These actions included: (1) recommended discontinuance of PD's IBM 1130, IBM 1800, and IBM System 7; (2) located and received approval to replace five leased components of the existing IBM 360/40 with Government-owned parts being excessed at Headquarters, Pacific Air Command; and (3) reduced present 360/40 capability by eliminating two tape drives, three disk drives, and a paper tape recorder and controller. Lt Colonel L. Martucci, Executive Committee member, and Lieutenant D. Turbide, Training Chairman of the Standing Committee of IRARS, were the major contributors in authoring, compiling, editing, and publishing a document[69] for standardizing the technique of reading image tribar resolution. In June 1974, the decision was made that the dedicated IBM 360/40 System used for data reduction and analysis would not be transferred to NPIC. However, two experienced Computer Systems Analysts from the Data Division were selected for assignment to the new EV location. Lt Colonel Martucci wrote the format used as the pilot for the other directorates and functions for inclusion in the Realignment Plan.[70] The NRO management responsibility of the CORN Program was transferred to SAF/SP-6 (Contract) and SAF/[redacted] in June 1974. EV provided edit and publication support for the second Color Task Force report.[71] By the end of 1974, there were 29 personnel assigned to EV.

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[69] Report, IRARS TF, June 1974, Imagery Resolution Assessment and Reporting Standard (IRARS) for Tribar Resolution, BYE 15313-73. (TS)

[70] IBID Footnote 54, page 2-75.

[71] Report, Color Task Force, December 1974, Technology, Status, and Future of Satellite Color Photography, TCS 363509-74. (TS)

In the final year of the Evaluation Directorate, a joint effort between RD and EV was started on the test and evaluation of the New Generation Microdensitometer (NGM). The NGM, delivered to AFSPPF in March 1975, was designed to be a rugged, reliable production instrument capable of measuring both black and white and color micro-imagery. In June 1975, Lt Colonels Duval and Martucci and Mr. D. Durand of NPIC/APSD visited SAF/SP-7 and SAF [redacted] at Los Angeles Air Force Station, and the HEXAGON West Coast Field Office and SAF [redacted] at Sunnyvale AF Station. The purpose of this visit was to: (1) give a detailed briefing of the plans to support both the HEXAGON and GAMBIT Programs; (2) outline the organizational structure of the newly combined APSD/EV function at NPIC; and (3) answer any questions that the Program Offices had concerning the operation at this new location. Close coordination between EV and NPIC in the preparation to relocate was continued up to the transfer of the function and closure of the Directorate on 1 August 1975. The first shipment of equipment to NPIC was in June 1975. This consisted mainly of supplementary and support items (one PDP-8E Minicomputer, Laminar Flow Baker Hoods, two EK automatic light tables, equipment documents, etc.) which allowed EV to continue mission operations through July. The last shipment containing mission support equipment (PDS Microdensitometers, VEM Stations, operational procedures documents, etc.) was sent in mid August. Fifteen military personnel transferred to NPIC, one civilian and three military retired, two civilians and three military were reassigned to other Government positions, one military separated from active duty, and one civilian and three military spaces were reassigned to the AFSPPF Administrative Section.

The following presents a more detailed resume of the three divisions:

A. Technical Analysis Division (EVA)

The first Division within the Evaluation Directorate to be discussed is Technical Analysis, as it was the starting point for the majority of support projects assigned to EV. In the early years of 1962 - 1963, as was the case with the other two divisions which originated from RD, Technical Analysis was involved with the test, application, and development of new techniques and methods to: (1) measure the characteristics of photographic film; (2) assess sensor subsystem performance through the evaluation of the imaged product; and (3) support the research and development program at AFSPPL. During this period, this unit was known as the Technical Analysis Branch of the Research and Development Division. The Branch's main efforts were centered on developing an image quality evaluation program based on existing technology, recommendations from the Drell and [redacted] Committees, and the theoretical work done in this field by Mr. Jack Finley of Data Corporation, Dayton, Ohio. Various phases of this program were applied to the early reconnaissance satellite Discoverer Series in 1962, the first GAMBIT Mission in July 1963, and the first CORONA 1000 Series in August 1963.

The initial methods used in the performance characteristics evaluation of these satellite systems were:

Visual Reciprocal Edge Spread (VRES)

The VRES System was developed and tested in late 1962 for the purpose of providing a means of measuring image quality. This technique was based on the measurement of the apparent width (in millimeters) of random imaged edges. The reciprocal of this measurement produced a number roughly equivalent to resolution. Thus, a 10 micrometer edge (0.01 millimeter) would produce a VRES value of 100. The measurement was performed by a trained photointerpreter utilizing a microscope equipped with filar eyepiece optics for measuring distance. This technique was utilized prior to the development of linear systems analysis methods and therefore many problems such as non-optimum optics, vibration, etc. were never resolved. Also, although this method appeared sound as a relative measuring tool, it was extremely operator dependent due to the demanding nature of the measurements. It should be noted that this procedure is analogous to the present day Visual Edge Matching (VEM) Technique where edge width (sharpness) is measured by comparison to a matrix of referenced edges of differing contrast and sharpness. This technique was discontinued in early 1965.

Machine Reciprocal Edge Spread (MRES)

In 1963, a brief investigation was undertaken to see whether VRES could be replaced by an objective microdensitometric equivalent measurement of the edge spread. This technique was called Machine Reciprocal Edge Spread (MRES). However, this procedure had the same basic problems as the subjective VRES measurement and that was the fact that the photographic process is non-linear. Because of this non-linearity the measured quality would vary under different exposure conditions. This technique was discontinued in late 1965.

50% Amplitude

The technique known as 50% Amplitude was an attempt to microdensitometrically measure quality by the spread function half-width. It became very apparent and was stated in an evaluation paper written by Dr. George Parrent, Technical Ops, in late 1965 that this method although applicable to communications theory was not suitable for determining the quality of the photographic process. This method was discontinued in 1965.

Tribar Resolution

This is the only technique that survived the early system characteristics evaluation performance methods. Not only did it survive this period, but developments in ground truth tribar targets continued to evolve in support of reconnaissance camera system evaluations up through the early 1970s. Basically this technique consisted of photointerpreters microscopically resolving the smallest tribar group in both the in-track and cross-track flight directions. This group of known dimensions was then converted to a resolution value in ground resolved distance. In the early 1950s, the tribar target was adopted as the test standard for photographic systems. Although it has always been considered a "last resort" measure, because of its subjectivity, it is still being used today to supplement the more sophisticated image assessment techniques. As more understanding of this type of testing developed throughout the 1950s and early 1960s, particularly with respect to reader variability and effect of contrast, interest rose on establishing some sort of field target program. In 1962 - 1963, a national survey was taken to locate and evaluate all photographic target "fixed" sites for testing. The fixed sites consisted of ground resolution target arrays painted on a flat permanent base (asphalt, cement, etc.). A surprisingly large number of these sites were found both in the United States and Canada; however, practically all fixed targets were in poor condition due to a lack of maintenance. The two options facing the community were: (1) to repair and maintain the fixed sites, and/or (2) develop a new system of displaying tribar resolution targets. Data Corporation suggested that the community implement a field deployable mobile target system. This was approved and on 15 October 1963 the Controlled Range Network (CORN) was born. By April 1974, resolution targets painted on canvas were part of available mobile field units which had the capability of displaying target arrays near any given location. Both the fixed and mobile ground truth targets were part of the CORN Program. Figure 2-38 shows a picture of a typical mobile target array in the 1964 - 1965 period. See pages 4-55 thru 4-70 for a more detailed discussion of the CORN Program.

It was apparent that a requirement existed for new diagnostic/objective methods for evaluating system performance based on information transfer theories. Therefore, research was begun on the application of linear system analysis using microdensitometric traces of known edges on the photography.

Other activities during this period included the developmental/applicational work being performed on the Model 1032, Mann-Data Microdensitometer (Machine "A") received in August 1962. This microdensitometer was used in the Crossover Study recommended by the Drell Committee to perform an inter-laboratory comparison of the microdensitometers and data processing procedures used in image assessment performance by five facilities directly or indirectly supporting the reconnaissance satellite program. These companies/organizations included the BRIDGEHEAD Facility of Eastman Kodak, Itek Corporation, Perkin-Elmer Corporation, Data Corporation, and the Air Force Special Projects Production Laboratory (AFSPPL). Unfortunately, due to the variables (different microdensitometers, analysis software, environment, etc.) and the design of the experiment itself, no standards were established for microdensitometry as it related to image evaluation. In September 1963, the first microdensitometer measured edges from operational material (Mission 4001) were analyzed in support of the GAMBIT Performance Evaluation Team (PET). Commencing with this mission, Technical Analysis continued actively supporting the PET Team on all GAMBIT missions up through 1 August 1975 (Mission 4344). The PET Chairman forwarded the mission mensuration requirements by message via the secure communications network and the work was performed by the

TYPICAL MOBILE TARGET ARRAY IN 1964 - 1965
(Variable Aspect Ratio Tribar, 51/51 Tribar, Bullseye, 200 Foot Edge, and Tri-Color Targets)

FIGURE 2-38

Division prior to the PET Team arrival at AFSPPF, approximately four to six weeks after payload recovery. Technical Analysis was directed by Captain Samuel McCulloch and consisted of four enlisted photointerpretation technicians and one civilian secretary. Figure 2-39 presents a picture of a Staff Meeting being held by Captain McCulloch with two RD scientists (G. Hunter and P. Johnson), the Chief of the Technical Reports Branch (C. Rauscher), the officer in charge of the computer operation (Lieutenant J. Hilten), and Mrs. L. Dostal, the Branch secretary.

From 1964 thru 1968, Technical Analysis was characterized by the development of the Edge Gradient Analysis Program, new analytical software, standardization of equipment and operating procedures, performing support for the GAMBIT and CORONA Program Offices, and improvement in microdensitometers and their application to systems performance analysis. In 1964, attention focused on the use of edges and effective exposure to derive the optical transfer function. During this period photographic films were being processed by the spray method. Program development centered around noise reduction and estimating methods to produce the required transfer functions. The methods employed were mainly acceptance of techniques already established in communications, e.g., optimum noise filtering for photographic data and optimum targets (Pseudo-Sync Target) for transfer function analysis. Basically, the Edge Gradient Analysis technique was an attempt to evaluate the capability of the photographic reconnaissance system to store and retain image quality. The Optimal Filter technique characterized the edge response measurement by providing meaningful MTF/AIM resolution data from the microdensitometric traces of cultural (man-made edges) and manufactured CORN Edge Targets. In the evolution of edge data collection and analysis parameters, this Branch established criteria for the selection of scene edges, edit procedures for microdensitometric traces, statistical sampling, and data preparation. Also to achieve a better representation of the edge response, a new method called the Multiple Trace technique was implemented which increased the number of non-overlapping measurements of an edge to more than one "cut" (depending upon the length of the edge). The first operational application of the MTF/AIM technique was on GAMBIT Mission 4007. MTF/AIM was used in determining specific camera system resolution as a predictor of tribar resolution and was the basic technique used in the evolution of many software analysis programs from 1964 to 1 August 1975.

With the major goals of: (1) obtaining correlatable objective with subjective resolution and (2) eliminating as much subjective (human) assessment in system performance as possible, attention centered around improving the microdensitometry capability, establishing valid measuring techniques, and developing objective analysis software. In September 1965, two Model 1140 Mann-Data 70mm Microdensitometers ("B" and "C" Machines) were delivered. These improved machines were equipped with a Digital Data Acquisition System with paper tape output and a modified viewing/light source system for better focus.

TECHNICAL ANALYSIS BRANCH STAFF MEETING IN 1964

FIGURE 2-39

In March 1965, the Technical Analysis Branch developed the first set of computer calibration standards for the Mann-Data Microdensitometer. In April 1965, Technical Sergeant Jack Strobel devised a density/exposure analysis method which categorized the imaged minimum density values (DMIN) and the imaged maximum density values (DMAX) of the terrain image of each frame and determined whether these values fell within the accepted exposure limits. The amount of exposure error was expressed in 1/3 f/stops; if the error were computed to be less than a 1/3 f/stop, then the exposure was considered as correct. In October 1965, the Facility established a cross reference of microdensitometric standards with the National Bureau of Standards. This included standards in machine operations, data gathering, and quality assurance. Late in 1965, the Technical Analysis Branch had basically standardized their capability for the photographic evaluation of original negative products. These evaluations performed for CORONA and GAMBIT included: (1) the inspection of film for imaged, superficial, and film format degradations, (2) the extraction and analysis of density/exposure data, and (3) the system performance assessment of imaged quality through objective (microdensitometry) and subjective (visual tribar) means.

With the expanding mission of the research and development efforts and the increased support required of the Technical Analysis Branch to satisfy CORONA and the new GAMBIT-Cubed two payload bucket system, Colonel Ohlmeyer directed the reorganization of AFSPPF into a five-directorate organizational structure. In June 1966, the Evaluation Directorate (EV) was established and the Technical Analysis Branch of RD was transferred to EV. During this same period, the CORN Program continued to expand with new targets evolving to meet the improved modifications of each satellite reconnaissance system, and the nine mobile units attained the following site instrumentation capability: (1) the Model 500 EL Hasselblad Camera to measure inherent contrast of the displayed targets. This inherent contrast was then compared to the apparent satellite system contrast acquired photography of the same targets. Therefore, any loss in contrast could be attributed to the atmosphere, camera system, and/or processing system; (2) the reflectance values of the CORN targets were measured by a Beckman DK-2 Spectral Photometer; (3) spectral radiance was measured by a radiometer; and (4) cloud distribution and type were recorded on color film by a Nikon Sky Camera equipped with a 180 degrees fish-eye lens. The 51/51 Tribar Target (5T) was developed in 1966. The 5T proved to be the most effective CORN target designed for the purpose of measuring tribar resolution. This target consisted of two 381 foot legs, each with nine panels, which could be displayed in various configurations, dependent upon the acquisition system's capability, to ground resolutions from [redacted]. During the middle 1960s, this Division also concentrated in establishing machine and operational standards. These included standards on macrodensitometry and sensitometry, and the mensuration procedures on various tribar, edge, line, and density targets. These methods were the first in what became a long series of photographic quality measurements by objective means. As the equipment and calibration procedures improved, environmental working conditions were also being advanced. In August 1966, portable Edgegard Hood, laminar flow work stations were installed for each densitometer and microscope table which provided a cleanroom environment at each of these working areas. Then in late 1966, Logistics (LG) maintenance personnel regulated the power lines running into the Technical Analysis Division work area to ensure that constant stabilized power would be provided. This alleviated the problems caused by fluctuating power when operating the precision microdensitometers.

In 1967 - 1968, a small, select group from EV and the Technical Analysis Branch was chosen to perform a special characteristic evaluation on a new type of drone aircraft. This program was called "Captain Hook." This special analysis group took total initiative in analyzing the product from three test flights. The evaluation consisted of plotting the mission, scanning the film for physical and imaged degradations, measuring the densities, and determining the resolution from specially deployed CORN tribar targets. The use of the microdensitometric MTF/AIM Intercept technique to derive resolution was limited because of the lack of suitable edges. Upon completion of the data extraction process, an analysis was performed, conclusions drawn, and recommendations made for future Captain Hook system flights. This data was then compiled into technical performance evaluation reports for the Program Office.

In May 1968, a special study was done by Mr. Jack Finley and Mr. Saul Kurlat of Information Technology (later renamed EIKONIX) which centered on AFSPPF's involvement in supporting the activities of the GAMBIT Performance Evaluation Team (PET). Several interesting conclusions were drawn: (1) neither the GAMBIT PET nor TERO reports had any positive impact on immediate contractor efforts; (2) there was no apparent "feedback" from contractors or other Government agencies on the methods being used or contents of the evaluation reports; and (3) the duplication process should be immediately reviewed/ modified to handle the improved GAMBIT system (an analysis performed by this Division showed that the duplicate product read an average of one tribar less than that read from the original negative). This study paralleled the same feelings formed by the Directorate of Evaluation in concluding that the GAMBIT PET and TERO reports were being used primarily for historical purposes. As a result, Captain Holliman, Chief of the Technical Analysis Division, devised a new format incorporating these two separate GAMBIT publications into a one report. This saved numerous man-hours and expense in the preparation and edit of publication and analysis support. As of December 1968, there were three Photo-Radar Intelligence Officers, six Photointerpretation Technicians, and eight Precision Photographic Processing Specialists assigned to this Division.

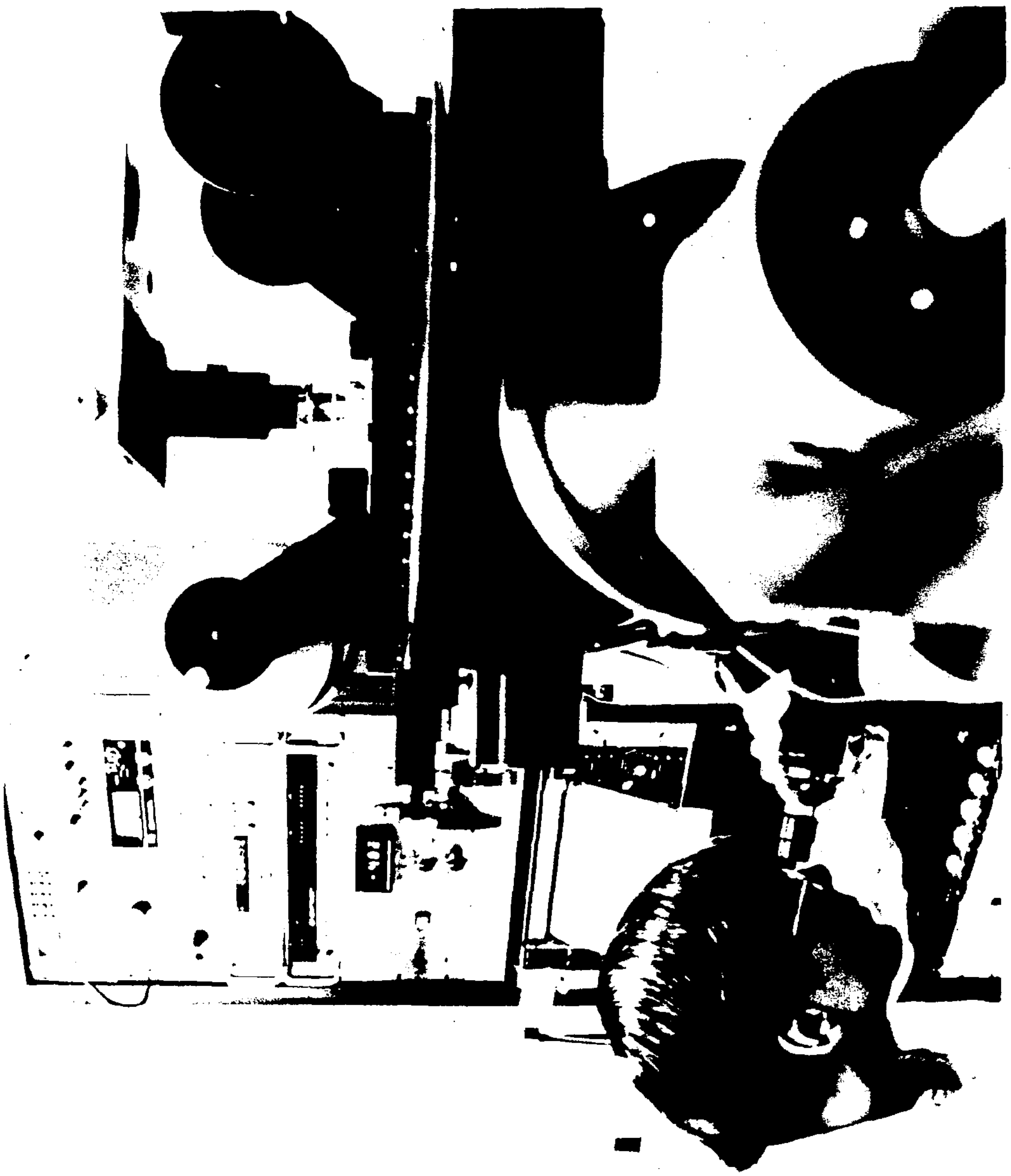
In response to the recommendation to review the current photographic duplication process, a series of investigations were started. The concern over the current duplication method was based on an evaluation made by the Technical Analysis Division in late 1968, which compared three different film duplicating methods. This study revealed that approximately 20 to 25% of the resolution measured on the original negative was being lost during duplication. Extensive experimentation was conducted to determine the loss in propagating tribar targets to one or more duplication generations. These tests showed that an appreciable loss was encountered. This prompted another series of investigations with regard to the overall duplication policy and evaluation procedures. In March 1969, a major experiment was performed by the Technical Analysis Division to evaluate the effectiveness of the existing three-gamma method. This study showed that the three-gamma procedure was susceptible to many more opportunities for error. As a result a single-gamma method was adopted. Throughout this series of experiments many evaluation techniques were applied. A review was made of these techniques and an organized duplicate evaluation system was developed and documented for future duplicate analysis projects. This system included such approaches as a method for using density probability distributions of original negative and duplicate materials to create tonal curves without requiring a technician to match density points. Also in early 1969, the Density Automatic Recording Equipment (DARE) designed by technicians from this Division and the Airborne Instruments Laboratory (AIL) of Long Island, New York was delivered. This device allowed the automatic collection of density data from the original negative which heretofore had to be recorded manually. This data was used in the statistical analysis of exposure and atmospheric conditions of the GAMBIT and CORONA reconnaissance satellite systems. Basically, the DARE consisted of a panel by which the operator recorded the density data which in turn was coded onto paper tape and then forwarded to the Data Division for reduction and analysis by the IBM 360 Computer. Figure 2-40 shows two operational work stations utilizing the DARE equipment. In September 1969, Captain Holliman prepared and staffed a manpower change request to increase the scientific staff within this Division. The basic justification centered around the decision by the HEXAGON Program Office to use AFSPPF as the Government center for evaluating all HEXAGON sensor subsystems. This action was also in response to Colonel Swofford's desire to upgrade the technical expertise of AFSPPF, therefore becoming less dependent upon contracted consultant assistance. This resulted in changing three Intelligence Officers' slots to three Development Reconnaissance Research Engineering positions. The first individual selected through this process was Captain Stephen Noland, a recent graduate of the Rochester Institute of Technology's two-year Training with Industry Program. By August 1971, the other two positions were also filled by graduates of this same program. In November 1969, the first (Machine "D") of two Model 1050 Photometric Data Systems (PDS) Microdensitometers was delivered. This basic, commercially available machine was selected because it fulfilled most of the production requirements (higher speed, greater reliability, faster data collection, greater operator comfort, etc.) needed to meet the increased production demands of image analysis. After considerable modification, the PDS became the microdensitometry "workhorse" of the community. The second PDS (Machine "E") was delivered in August 1971. Improvements continued to be made to the PDS machines, which included: (1) improved objectives for greater linearity, (2) linear optical shaft encoders, (3) the capability of sampling

USE OF THE DENSITY AUTOMATIC RECORDING SYSTEM ON MISSION 1051

FIGURE 2-40

at .5 micrometers, (4) dynamic feedback focus sensing and control, (5) optimized photometry for color work, etc. Figure 2-41 shows a picture of Staff Sergeant A. Hill checking the focus of the PDS "D" Machine. A more detailed description of the evolution of microdensitometry can be found on pages 4-47 thru 4-55. In July 1969, the first task was assigned in support of the HEXAGON Program. It consisted of the interferometric analysis of each optical bar (OB) camera which was scheduled for a sensor subsystem. This work was done in close cooperation and coordination with the Materials Analysis Laboratory and the results published in a separate report for each optical bar set (first report was completed on 17 November 1969). The latter part of 1969 was spent in preparing to support a full scale HEXAGON Acceptance operation.

In February 1970, the Line Target performance analysis work under contract to EIKONIX was introduced. Experimentation and analysis showed that the response from an imaged line offered a better representation of performance assessment because it provided a better signal-to-noise ratio than an edge. Line Target experimentation was a history in itself covering widths from [redacted]. The cost was minimal since the experimental lines were made from strips of old CORN targets, were deployed on existing CORN operations, and all data analysis was performed at the computer facility within the Data Division. The Line Target yielded valuable insight into optical problems which were not observable from other standard CORN targets. It also produced confirmation of a simplification of the sensitometric properties of Dual Gamma processing for small scale objects and thus provided a means of evaluating the nature of the linear film MTF. During this period, a greater use was made of the CORN target array. This included: (1) new analysis software to achieve tonal rendition data from Gray Scale Targets; (2) total revision of the target reflectance monitoring procedure; (3) Line Targets were added to the standard arrays; and (4) edge reflectance and density data were used to calculate the parameters required to determine system contrast. Also, Captain H. Gordon and Sergeant J. Strobel accomplished vastly improved operating procedures with the CORN contractor and NRO Program Offices. In April 1970, the first Government Acceptance Team arrived at AFSPPF to test and discuss the preliminary results of the analyses conducted on the Development/Qualification Model (D/Q). This was the first total involvement of this organization at this level of evaluation. In the past, assignments would be forwarded by message, completed, and the data made available to the Program Office, thus fulfilling strictly a support role. However, with the HEXAGON Program, Captain Noland was assigned to the Engineering Evaluation Team and specialists from the Technical Analysis Division worked alongside the Program engineers. Mr. R. Kohler, Acceptance Chairman, scheduled the first operational (SN-003) Acceptance meeting at AFSPPF in November 1970. Also, during this session, the analysis procedures were established for all future Acceptance/Chamber A evaluations. These procedures included: (1) Resolution Analysis which involved subjective resolution readings of tribars of each camera at different temperatures and Vx/h ratios at all scan angles and under different focus and smear conditions; (2) Focus Analysis based on analysis of the chamber Tribar, Seven-Edge, 100-Cycle, and Line Targets

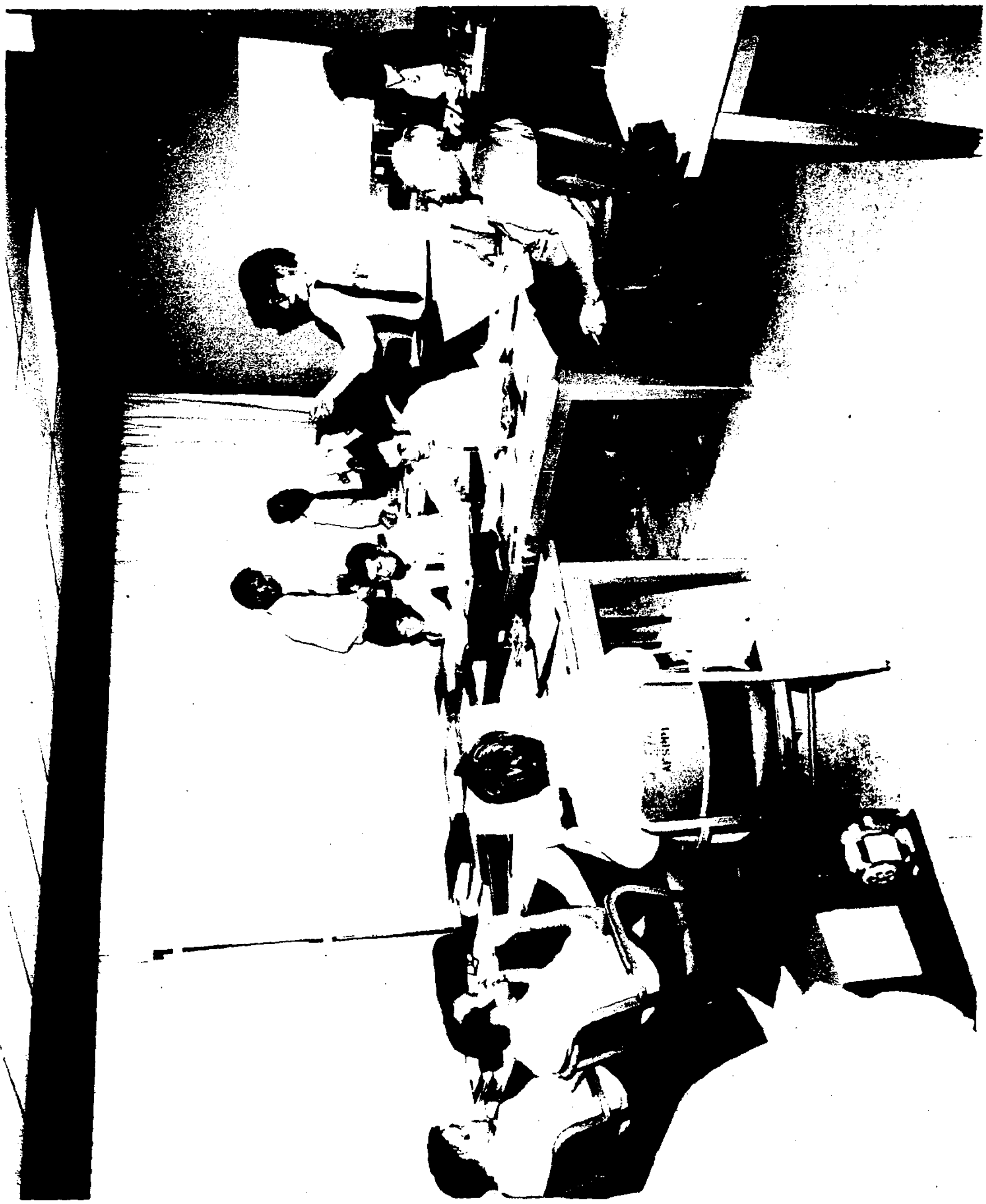


A TECHNICIAN OPERATING THE MODEL 1050 PDS MICRODENSITOMETER

FIGURE 2-41

acquired in both continuous and flash modes; (3) Film Synchronization which was the measurement and analysis of the Sync-Flash Target to derive the smear introduced into the imagery by the transport system and/or platen; (4) Film Marking Evaluation to determine the condition of the film after it had completely passed through the camera system; (5) Performance Predictions which were used to estimate on-orbit system performance as determined by the outputs of the three model (Orbital, Atmospheric, and Camera Performance) program known as CRYSPER; and (6) Electromechanical Evaluation which was made using telemetry data to ensure that the system met the design specification requirements. Figure 2-42 shows a picture of Mr. Kohler "leading" a discussion at this meeting.

Image analysis procedural and software development reached a pinnacle in 1971 for this was the first year in which the Technical Analysis Division participated in all evaluation phases (preflight and postflight) of the HEXAGON system. In preparation, a large variety of mission extraction and operational image analysis software was developed to support the design engineers, performance evaluation teams, and image exploiters. Examples of these efforts were optimum focus assessment using special test targets; statistical analyses of VEM data for system evaluation; Line Target scan analyses for determining system focus, smear, and MTF measurements. A summary of image quality analysis techniques and software can be found on pages 4-70 thru 4-74. Early in 1971, Mr. Kohler directed the trial of a new subjective technique called Visual Edge Matching (VEM) to evaluate HEXAGON. After a lengthy experimental period in establishing a method to produce a master edge matrix, this procedure was adopted. The VEM technique proved extremely beneficial economically as it allowed a means of assessing system performance without total reliance on the costly CORN Program. A team of five resolution readers from the Technical Analysis Division, headed by Staff Sergeants F. Penny and R. Capps, became experts in this technique. Up through 1975, this group was assigned to support many VEM projects at AFSPPF and other evaluation locations (NPIC, BRIDGEHEAD, and Perkin-Elmer). The data was primarily used to establish image quality profiles across the format web for focus optimization, platen tilt verification, and the examination of field curvature and field dependent smear. This technique was continually refined with the development of better master matrices, and was used in the evaluation of all HEXAGON missions, commencing with 1201 which was launched on 15 June 1971. Also, in mid 1971, this Division participated in the second phase preflight evaluation of each HEXAGON system. This phase was called the Readiness or Chamber A-2 Test and was conducted at the camera contractors' West Coast Facility at Sunnyvale Air Force Station, California. Mr. Roy Burks from the West Coast Program Office was the HEXAGON Readiness Chairman. The purpose of this test was to evaluate photographic performance prior to flight and to determine if there had been significant changes in resolution, plane of best focus, film synchronization, or electromechanical behavior since completion of the Acceptance testing. The resolution, focus, and smear tests conducted



ACCEPTANCE TEAM MEETING ON SERIAL NUMBER 3 (SN-003)

FIGURE 2-42

during this phase followed the same basic procedures as those performed during Acceptance. However, unique to the Readiness exercise was the VEM Calibration Target. This target was used to derive a calibration curve which related edge numbers to resolution for the master matrix. In general, Readiness was considered an abbreviated Acceptance test. However, while Acceptance testing usually required this Division to perform over 20,000 individual tribar readings and 2,000 single microdensitometric measurements, the support work for Readiness would vary widely (5,000 to 15,000 tribar readings) because of the necessity in many cases to do retests. By 1 September 1971, the Technical Analysis Division had: (1) achieved close coordination and open communication lines between SAFSS, SAFSP, CIA, and the various industrial contractors involved in the HEXAGON Program; and (2) been realigned along a more functional structure, e.g., an engineer (Captain Noland) was assigned as HEXAGON Project Scientist and another engineer (Captain Lopez) as the GAMBIT Project Scientist. These two officers became directly involved with all engineering requirements, modifications, and evaluation pertaining to their systems. The Division was further restructured with the additions of the Data Collection, Density Analysis, and Resolution Analysis Branches. The number of personnel assigned to this Division was increased from 17 to 20 and all mission requirements in support of the GAMBIT and HEXAGON Programs were flow-charted by task (microdensitometry, resolution, slit chronology, etc.). By the end of 1971, detailed planning was being performed for the extensive use of the new Multiple Line Display configurations to be used in the systems performance evaluation of Mission 1201.

The most extensive use of the CORN Program was in the year 1972. These activities required close coordination with the Contract Manager from RD (Captain Riley) and the Operational Control Manager from the Technical Analysis Division (Captain Gordon). The following are two of the major events/actions during this period: (1) new fabricated targets included 18 Reversible Lines, the six panel Color, Two and Three-Step Gray Scales, the Log Periodic, and a variable dynamic Point Source; and (2) CORN display operations in support of Mission 1202 required unprecedented logistical considerations with regard to both targets and field deployment crews. Target complements varied from 5 to 20 and employed the use of crews numbering from 5 to 28 personnel. Captain Gordon's operations group was required to maintain a 24 hour a day Control Center to ensure that the complex Multiple Line Displays were properly deployed in time. Pre-mission planning included a survey of possible sites ranging in length from 2 - 40 nautical miles. Once the sites had been selected they were cleared/prepared to accommodate different target arrays designed to address specific engineering tests on designated orbits. This was also the year of the "Blue Suit" CORN study. Because of the huge costs involved in operating the CORN Program, in particular in the support of the HEXAGON Program, it was decided to look into other ways of providing the HEXAGON, GAMBIT, and RED DOT Program Offices with a ground control target system. One of the options explored was to determine the feasibility of physically operating the CORN Program using USAF resources (Blue Suit).

Although it was determined that this approach had potential, it was not feasible because of the time it would take to get authorization, manning, and develop operating procedures. However, this study did provide a good cost comparison for evaluating future contract bids. Another positive action from this study was going from Sole to Select Source bidding. As a result of this effort an approximate [redacted] was saved from the original 1973 CORN contract proposal submitted to AFSPPF. With the programmed use of color in HEXAGON Mission 1204 and the operational experimentation of color material in GAMBIT, a color CORN target research program was started to design and fabricate targets for determining the performance of systems utilizing color material. As a result of the extensive and complex CORN operations in 1972, a detailed classified directive outlining the CORN operational procedures for support of all NRP controlled programs was written by the Technical Analysis Division. In an effort to establish another objective means of assessing system performance, [redacted] to build an Optical Power Spectrum Analyzer (OPSA) for delivery to AFSPPF. The concept was to measure image quality by spectral analysis. The OPSA was delivered to the Technical Analysis Division in May 1972. Although some promising results were achieved, the developmental program was stalled due to heavy mission commitments. Unfortunately, the original contract only covered the delivery of the hardware so provisions had to be made to continue development of the software to analyze the image quality output. Figure 2-43 shows a picture of the Optical Power Spectrum Analyzer. In 1974, the OPSA was shipped to NPIC for further study and application to system performance analysis. In August 1972, it was determined that a feature to automate the control of the focus of the New Generation Microdensitometer (NGM) developed by Technical Operations could also be applied to the existing PDS machines which were providing microdensitometric measurement support to the GAMBIT and HEXAGON Programs. Captains Noland (EV) and Britton (RD) made several trips to Technical Operations while assisting in the design of the Pneumatic Focus Control Servo System modification, which when retrofitted on the PDS Microdensitometers enabled the automatic setting and maintaining of focus to ±.5 micrometers.

The majority of the Technical Analysis Division's efforts in 1973 was spent in collection, measurement, and analysis of data from several GAMBIT and HEXAGON systems. The technicians viewed over 8,000,000 feet of film in the support of three GAMBIT and eleven separate HEXAGON evaluations (3 Readiness, 2 Acceptance, 2 Black and White and 2 Color Postflight, and 2 PET). In 1973, a contract was given to EIKONIX to develop a color image analysis capability similar to that which was used to evaluate black and white material. The results were the formulation of a complete analysis system called COLORC which included the entire process from Status "A" calibration of the microdensitometers to the production of transfer functions in effective exposure. As a result of developing this color image analysis capability, extensive testing was conducted on the PDS Microdensitometers and several improvements made on the machines (new photo multiplier tubes, etc.). However, it was found that the general design of these PDS

OPTICAL POWER SPECTRUM ANALYZER (OPSA)

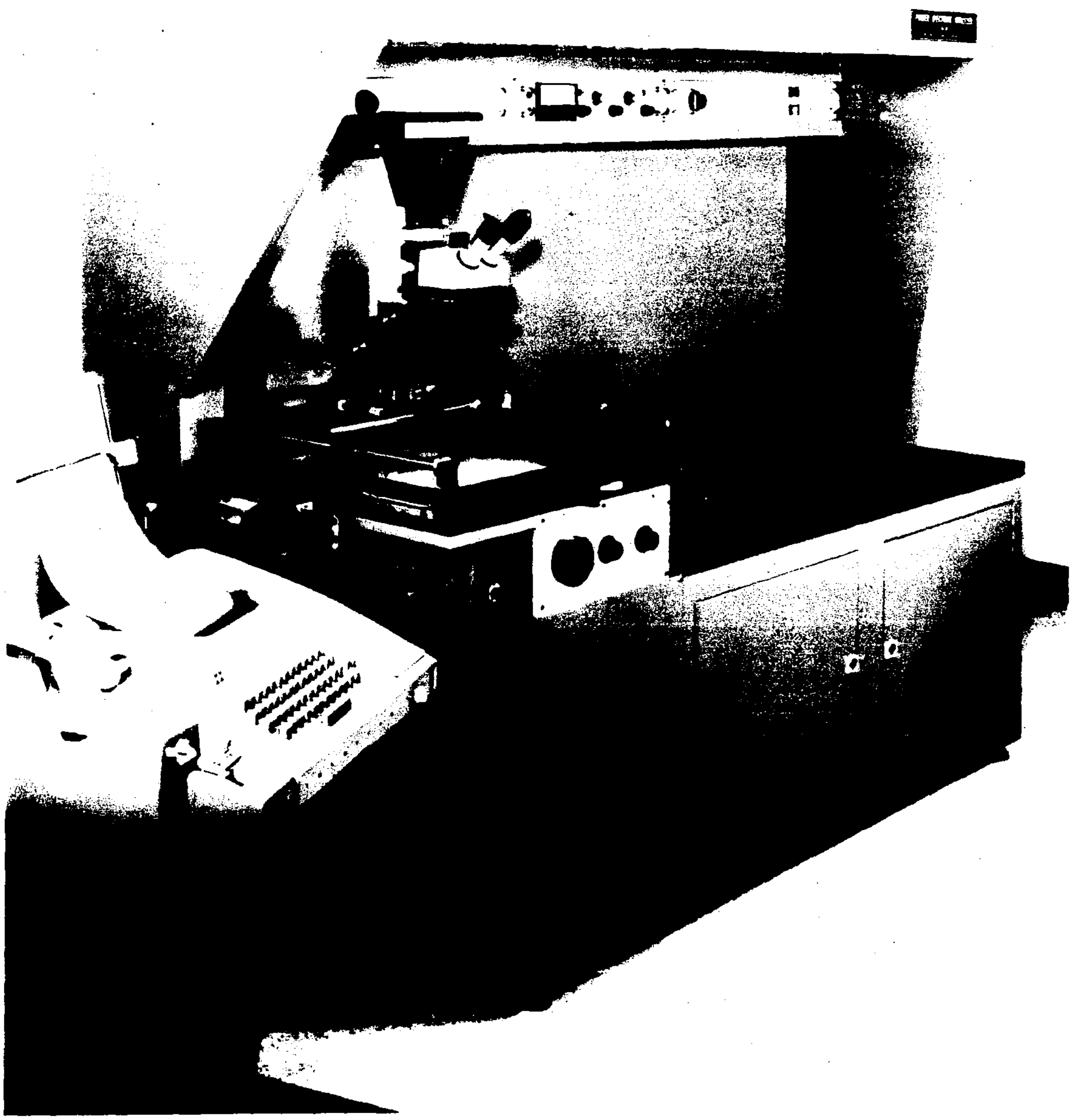


FIGURE 2-43

machines was not adequate to handle the requirements for tri-layer color mensuration. This deficiency gave support to the existing need for a new state-of-the-art microdensitometer. Two of the reconnaissance research engineers assigned to Technical Analysis (Major Pollard and Captain Noland) joined engineers from RD in establishing the specifications for the development of a new linear microdensitometer. The design included: three laser light sources to measure both black and white and color material, a new light collection system to ensure linear performance, laser interferometric velocity measurement and control, etc. This new instrument was called the New Generation Microdensitometer (NGM) or the Linear Microdensitometer (LMD). Because of the success in utilizing the Visual Edge Matching (VEM) technique in performing engineering and performance analysis of the HEXAGON system, the Technical Analysis Division completed a special VEM evaluation in March 1973 on GAMBIT Mission 4336. This study was performed to give the GAMBIT Program Office data for assessment of applications of this technique in the areas of focus determination, off-axis performance, and the effects of extended periods of Door Open Light (DOL) time on image quality. In mid 1973, Lieutenant D. Turbide was assigned as the Training Chairman for the newly formed Imagery Resolution Assessment and Reporting Standards (IRARS) Task Force. The first accomplishment of this Task Force was the establishment of a tribar resolution reading standard. Next, the Task Force developed a 4-phase reading and certification program. Lt Turbide had the responsibility for administering this test to all resolution readers involved in supporting the National Reconnaissance Program. In February 1973, research was done to find a replacement for the Digital Automatic Recording Equipment (DARE) which due to constant production use and the fact that it utilized an outmoded paper tape punch system had become unreliable. An option called the Digital Data Acquisition System, utilizing a PDP-8E Minicomputer, was proposed and accepted. This system was implemented in April and had the capability of: (1) collecting data from both densitometers simultaneously, (2) total data format flexibility, and (3) recording data on the IBM 360 compatible magnetic tape. With the phaseout message announcement on 24 October 1973, the Technical Analysis Division first learned of its fate. Although referred to as the Evaluation function, it was the mission of the Technical Analysis Division which was scheduled for transfer to NPIC/APSD. Shortly after this announcement it was also decided to transfer the management of the Controlled Range Network Program to SAFSP. In November 1973, a prototype of the automated Resolution Data Terminal System was operationally tested on Mission 4340. This system was designed by Captain Noland for the purpose of rapidly collecting resolution data from the time-critical HEXAGON Acceptance and Readiness preflight tests. It was estimated that a 50% savings in man-hours resulted from the implementation of this device. A more detailed discussion of this in-house achievement can be found on pages 4-74 thru 4-76.

Although the Technical Analysis Division was again fully employed in the support of GAMBIT and HEXAGON Programs in 1974, there was a noticeable decrease in Facility involvement and few requests for special research or image analyses studies were received. This was also the first year that the Acceptance reports were written and published at the camera contractors' East Coast plant in Danbury, Connecticut. There were 19 various preflight and postflight evaluation exercises accomplished, many of which were performed simultaneously. The complete cycle from extraction/mensuration/edit to processing/ edit to analysis/documentation took approximately three and one-half weeks (dependent upon the requirements for that specific phase of evaluation). The other major effort during this period was the detailed planning and coordinating with NPIC/APSD in preparation for the functional transfer. Ten of the fifteen men (1 Reconnaissance Research Engineering Officer, 1 Photo Scientist Officer, 3 Photointerpretation Supervisors, and 5 Precision Photo Processing Technicians) were selected to relocate with this mission to NPIC. In June 1974, three different classified versions of the IRARS standard for reading tribar resolution were written, compiled, and published by Lt Colonel Martucci (EV) and Lt Turbide. Also in June, the transfer of the CORN management was completed. SAF [redacted] assumed the primary responsibility for CORN operations, effective with GAMBIT Mission 4341. In the October - November period of 1974, AFSPPF realized the work accomplished by EIKONIX starting back in 1969 on the use of a model to remove non-linear effects of the film in recording the image. This work was prompted by the implementation of the Dual Gamma Viscous Process introduced by Eastman Kodak in the processing of GAMBIT, CORONA, and, in 1971, on HEXAGON materials. The process resulted in producing a high adjacency/non-linear (Eberhard) effect on the photographed image. This program required extensive experimental work in quantifying the non-linearities and developing mathematical constants to compensate for the apparent distortions of the intensity image resulting from the Dual Gamma Process. The initial model applied only to one-dimensional objects, and was soon followed by the two-dimensional ("one-shot") diffusion model. The models, based upon the actual physical and chemical processes which took place in the film, were written into the systems performance evaluation software for the purpose of converting density to effective exposure. Improved versions of the Diffusion/Non-Linear Model are presently employed in many analysis programs being utilized by several NRO organizations. For a more detailed discussion of this work, see pages 4-37 thru 4-39.

In January 1975, a report entitled Description and Operation of Macrodensity Acquisition System Interface was written to document the electronic interface which permitted the direct entry of macro-densitometer data by the MacBeth TD-201 Densitometer to the PDP-8E Minicomputer. This Digital Data Acquisition System replaced the DARE equipment in 1973. In March 1975, the New Generation

Microdensitometer was delivered to the Technical Analysis Division for operational T&E. This state-of-the-art instrument employs laser illumination, photodiode detection, and uses interferometric velocity control for determining stage position. The NGM also had many other unique electronic, optical, and data processing features. The NGM was shipped with other Evaluation equipment to NPIC in August 1975 where it will continue to be tested and evaluated. The mission support for HEXAGON ceased with the completion of the Readiness Test on SV-10 in May and the Postflight Analysis of Mission 1209 in August, and for GAMBIT with the publication of the Performance Evaluation Team Report on Mission 4344 in August. It was a tribute to the technicians of Technical Analysis and other members of the Evaluation Directorate that they were able to maintain continuity in the performance and completion of numerous projects from May until the transfer of this mission. A list of work done during this period is shown on page 3-4 in Volume III of this History. In June 1975, the first of two shipments of equipment and materials was forwarded to NPIC. This included six densitometer and microscope Laminar Flow Baker Hood Work Stations, two Viewing Tables with Zoom 70 Microscopes, etc.; the second shipment was in mid August and included two PDS Microdensitometers, four Richards MIM II Light Tables, two VEM Comparator Stations, 16 boxes of operational documentations, etc. By the third week in July, the ten personnel assigned to remain with the function were enroute to NPIC and the others were reassigned to different Air Force organizations. The Technical Analysis Division's evaluation capability was fully operational at NPIC/APSD on the programmed date of 1 September 1975.

The men who immediately come to mind when speaking of the accomplishments of the Technical Analysis Division are Captain Stephen Noland whose technological expertise and ingenuity resulted in the development of improved system performance data collection and analysis, e.g., modifications to the PDS Microdensitometers, designing and monitoring the completion of the Digital Data Acquisition System and the Resolution Data Terminal System, numerous applications of minicomputers to mission analysis operations, etc. Captain Harold Gordon provided dynamic leadership, management, and dedication during the peak operational periods of the 1970s by taking the initiative and responsibility for ensuring that the production requirements were accurately completed on time. Also, Master Sergeant James Weinert who through personal perseverance and thoroughness in scientific approach became the most knowledgable noncommissioned officer in microdensitometry within the Air Force; Technical Sergeant Jack Strobel for his innovative, determined, and positive contributions in developing and performing image analysis in the infant years of system performance assessment; and Master Sergeant Dale Voller, NCOIC of this Division, who through the self-learned knowledge of automation via minicomputers developed several resolution collection and edit routines for preflight and postflight analysis, acted as the primary CORN Program Monitor in 1973 - 1974, and designed and implemented a reader training program for the technicians assigned to the Resolution Analysis Branch.

B. Data Division (EVD)

This Division evolved from a small segment of the Statistical Analysis Branch of the Research and Development Division responsible for performing data processing on 1620/1710 Computer System. This system was leased from IBM in June 1964 and included a keypunch, card sorter, and paper tape Input/Output (I/O) system (later converted to card I/O). The basic mission of this unit was to support the test, evaluation, and analysis of projects assigned to the RD Division. Initial operating and programming were handled through existing manpower sources. Lieutenant J. Hilten, an RD mathematician/engineer, and two enlisted programmers with the close association of a consultant contractor (Mr. Jack Finley) were assigned to develop the first analytical software for CORONA and GAMBIT mission requirements.

Three major events occurred in 1966: (1) this element of RD was reassigned as the Technical Processing Division under the newly formed Evaluation Directorate, in June; (2) also in June, the 1620/1710 System was replaced by a medium scale IBM 360/30; and (3) the projected data processing manning started to report with the arrival of the first Data Automation Officer (AFSC 6855) and Computer Systems Superintendent (AFSC 68790). The 360/30 System consisted of the following components: 2030 Processing Unit, 2311 Disk Storage Drives, 2403 Magnetic Tape Unit and Controller, 2520 Card Punch, 1443 Printer, and other features such as External Interrupt Unit, Internal Timer, Storage Protection Unit, etc. Figure 2-44 presents a picture of some of the major components of this system as configured in this Division.

The period from 1966 to 1967 centered mainly around: (1) the generation and improvement of programs like: edge analysis, density distribution, exposure analysis, Modulation Transfer Function (MTF)/Aerial Image Modulation in support of the CORONA and GAMBIT Programs; (2) conversion of existing programs from the 1620/1710 to the 360/30; and (3) the support of AFSPPF management information requirements. In 1967, the number of personnel assigned had increased to six (one officer system analyst, a civilian programmer, two enlisted programmers, and two enlisted computer operators). Also during this period, the close association had continued with Mr. Finley (Data Corporation from 1962 to 1968, and later with his own company, EIKONIX, from 1968 to August 1975), who initiated much of the analytical software being used and tested to evaluate operational satellite reconnaissance systems performance, e.g., optimum filtering and other grain noise rejection methods, automatic data edit, conversion to effective exposure, analysis of atmospheric contrast reduction, automatic adaption to CORN target and mission parameters, and other features necessary for a production image evaluation system.

In 1968, two enlisted technicians (programmer and machine operator) and one civilian scientist programmer were detailed and subsequently assigned to the Production Directorate to assist contractor programmers in developing software for PD's new integrated 1130/1800 Production Control System. Also in 1968, the name of this Division was changed from Technical Processing to the Data Division; the first image

IBM 360/30 COMPUTER SYSTEM

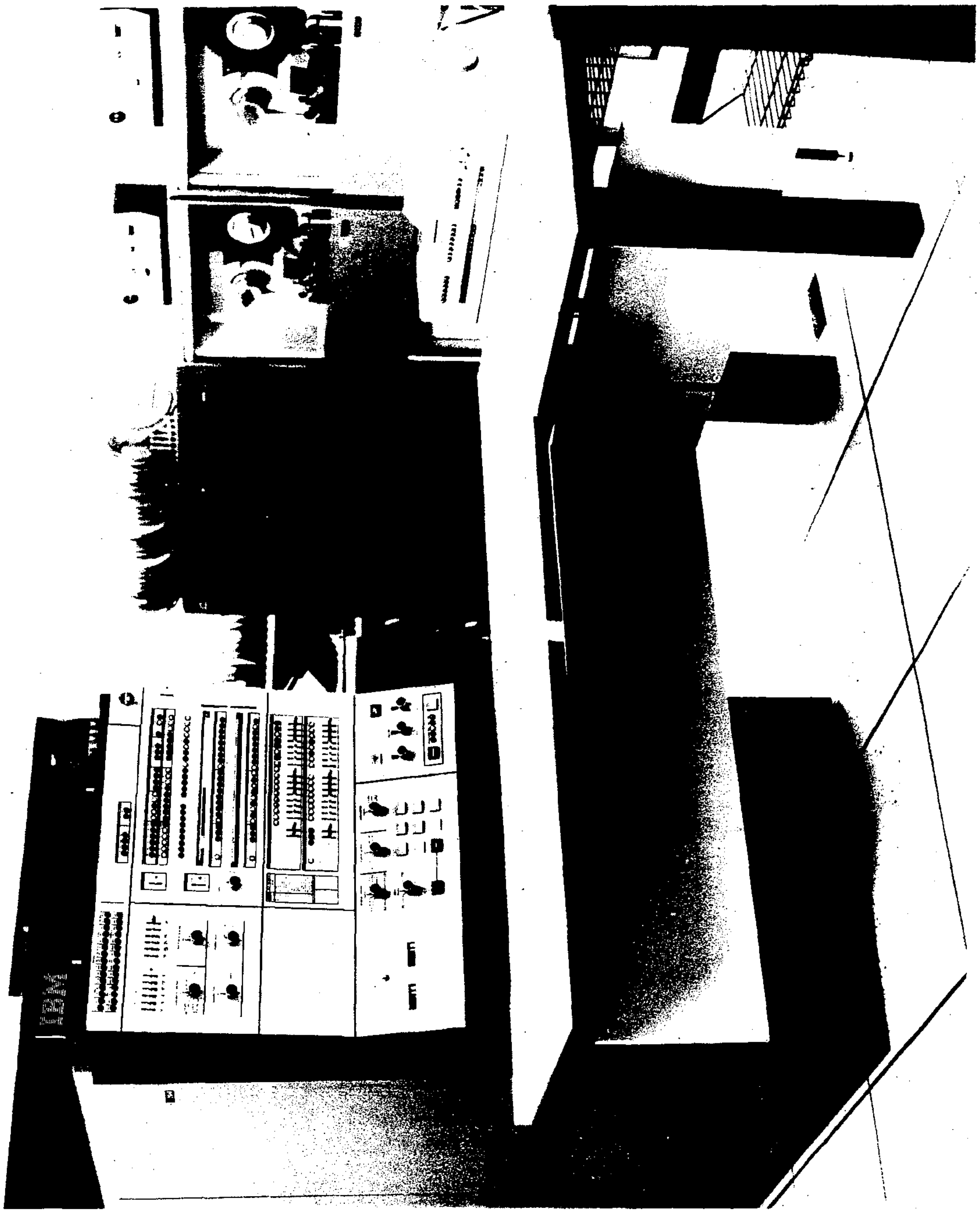
FIGURE 2-44

analysis and computer support program library was established; and analytical historical data was no longer filed on cards but built into disk files.

In 1969, the organization and operation of the Data Division changed under the leadership of Captain D. Watson. He was responsible in the ensuing period for: (1) redesigning internal programming methods to take advantage of the 360/40 System and multiprogramming capabilities of its software, (2) establishing documentation specifications for use by the Division programmers and for all contracted software; (3) rewriting programs to achieve a savings in computer execution time; (4) standardizing the file structure for all mission data; and (5) completely reorienting the data processing system toward a volume production status. The Data Division also felt the first impact of the HEXAGON system in converting/developing a program to calculate optical path differences and lens optical transfer functions for interferogram evaluations of each optical bar camera. EV's input to the AFSPPF's manpower study requested one additional authorization for a Computer Systems Analyst based on: (1) the Commander's desire to build a self sufficient data processing staff, and (2) the estimated increase in complexity and volume of the computer requirements to support HEXAGON (subsequently, this request was approved).

In 1970, the two major actions affecting this Division were: (1) approval was granted to replace the 360/30 Computer with an IBM 360/40 with the Disk Operating System (DOS), and (2) the beginning of the total involvement with the preflight and postflight analytical software of the HEXAGON system. On 24 September 1970, the 360/40 was delivered to AFSPPF. This system included the following major units: a 2040 Processing Unit with 256K Memory, 2401 Magnetic Tape Units, 2803 Tape Controllers, 2821 Control Unit, 2314 Disk Storage Control, 2318 Disk Storage Drive, 2312 Disk Storage, 2540 Card Reader/Punch, and a 1403 High Speed Printer. Figure 2-45 presents a picture showing the 360/40 in the Data Division Computer Operations Room. The upgraded system was required because of the extensive software utilized to process and analyze the Acceptance (preflight) data from the three simulation chambers ("A," "C," and "D") at the camera contractor's plant in Danbury, Connecticut. During the entire period from 1970 up until 1 August 1975, the Data Division relied heavily on several versions of the IBM POWER Spooling System which operated under DOS. The primary advantage of this new operating technique was an increased efficiency in both manpower and machine utilization and scheduling. Programs could be prioritized and loaded in an arbitrary order for unattended execution, and the output then directed to disk file for later printing. This was especially significant in the 1970 - 1971 period when the Data Division was only 60% manned.

In 1971, there was a significant increase in HEXAGON related activities, starting with the requirement to assist in developing an analysis program for focus and sync-flash data. Also, in early 1971, techniques were developed for computer calibration of the Technical Analysis Division's microdensitometers to



IBM 360/40 COMPUTER SYSTEM

FIGURE 2-45

eliminate errors due to the Callier phenomenon. This resulted in the development of software and file structures which characterized specific microdensitometers, apertures, and film data. This data could be quickly recalled at any time during the mission processing cycle. In February 1971, procedures were developed for utilizing the much faster and superior quality 360/40 System, Model 1403 Printer and 1627 Calcom Plotter to create press quality output which would go directly to the Technical Reports Division for publication without requiring the illustrators to recopy the content. In July, the manning authorization was increased from six to ten personnel. This augmentation included a military Computer Systems Analyst, a civilian Computer Programmer, an enlisted military Programmer, and an enlisted Computer Operator. In late 1971, the Data Division coordinated with the Facility Communications Section in developing a procedure to transmit processed analytical data from operational Line Targets to the Postflight Analysis (PFA) Review Meetings held after each HEXAGON payload was recovered. This gave the HEXAGON PFA Team more data to better optimize the on-orbit performance of the next mission segment. Mission control data was stored on disk files and programs were written to produce printer image tapes which could be transmitted by data link to the users (Program Offices, both the East Coast and West Coast camera contractor's Field Offices, SAF/SP-7, NPIC, etc.) via AFSPPF's secure communications facility. Also in 1971, there were modifications to many of the analysis programs to accommodate the newly developed Non-Linear Model designed to invert adjacency influenced data to effective exposure.

In 1972, the Data Division was involved in 6 Interferogram, 3 Image Motion, 4 Focus, 5 Line Analysis, 1 Visual Edge Matching, and 2 Gray Scale programs. These programs were written in FORTRAN and ASSEMBLER languages and required a total of 1,091,000 bytes of core. Approximately 55% of these programs required source data from other organizations. The main efforts during this year were centered on development of focus and motion (smear) analysis. Due to this significant increase in computer operation, three additional tape and three disk drives were leased from IBM to expedite data processing.

By 1973, the pendulum had swung from evaluating system performance by measuring edges to using Line Target data. Therefore, efforts were expanded to develop system-specific programs for the postflight analysis of Lines acquired from HEXAGON (PFALINES) and GAMBIT (PETLINES). These Line Analysis Programs were designed to use files of system data (thru focus optical transfer function data, etc.) and to perform analyses directed at problems unique to that photographic reconnaissance system. Preflight (Acceptance and Readiness) test support continued for HEXAGON at a high level. Based on the real possibility that AFSPPF would be phased out, a letter was sent on 18 May 1973 to AFSCF/DBVC. This letter provided the status of the three computer systems installed at the Facility and presented a discussion regarding the discontinuance of each system. At that time, the discontinuance date for the 360/40 was estimated to be 30 June 1975 (later extended until 1 August 1975). This letter was sent to the Air Force

Systems Command's Computer Controlling Office for their planning purposes in FY 75 and FY 76. Prior to 1973, some of the sophisticated equipment at AFSPPF had minicomputers as an integral part of the system. Each Directorate which had this type of equipment, also was responsible for the maintenance of the minicomputer. In late 1973, EV volunteered to assume the custodian role for all minicomputers in or on loan from AFSPPF. The Data Division NCOIC was assigned the task of maintaining the status, location, and contract maintenance requirements. Table 2-7 presents a summary of this information in addition to the ultimate disposition of all minicomputers allocated to this organization.

TABLE 2-7

SUMMARY OF MINICOMPUTERS AT AFSPPF

| Equipment | Computer (Manufacturer) | Contract Maintenance | Computer Received | Computer Shipped/Destination |
|---|---|---|---|---|
| PDS "E" Micro-D | PDP-8/I (DEC) | Yes | Oct 71 | Aug 75/NPIC |
| PDS "D" Micro-D | PDP-8/I (DEC) | Yes | Jul 69 | Aug 75/[redacted] |
| Mann-Data "C" Micro-D | PDP-8/I (DEC) | Yes | Apr 72 | Jul 75/EK |
| Reso Data Terminal | PDP-8 (DEC) | Yes | Jul 70 | Aug 75/NPIC |
| AIL Auto-Densitometer | PDP-8/L(DEC) | Yes | Jul 70 | Apr 76/[redacted] |
| BA Printer | PDP-11/05 (DEC) | No | Jan 75 | Mar 77/[redacted] |
| Ident Printer | H-316 (Honeywell) | No | Jul 70 | Sep 74/EK |
| Ident Printer | H-316 (Honeywell) | No | Jul 70 | Sep 76/544th |
| Ink-Jet Titler | H-316 (Honeywell) | No | Apr 73 | Salvaged |
| Power Spectrum Analyzer | 1200 (NOVA) | No | Oct 72 | Mar 74/NPIC |
| Cayuga Printer | 1210 (NOVA) | No | Mar 75 | Sep 76/544th |
| Cayuga Printer | 820 (NOVA) | No | Mar 75 | Sep 76/544th |
| NGM (SN-1) Micro-D | 1230 (NOVA) | Yes | Mar 75 | Aug 75/NPIC |

Although the majority of 1974 was again spent in the development and modification of programs to assess the ever improving HEXAGON and GAMBIT systems, much time was consumed in planning for the transfer of the EV function and closure of the Evaluation Directorate at AFSPPF. In January 1974, a time utilization study revealed that the Data Division could reduce their system capability; and thus lower the funding allocated for equipment rental. Therefore, two tape drives, three disk drives, and a paper tape reader and controller used as components of the 360/40 Computer System were discontinued. As part of the requirement to reduce AFSPPF's total manning to 160 by 1 July 1974, three personnel (one Computer Systems Analyst Officer, one enlisted Computer Operator, and an enlisted Programmer) from the Data Division were released for reassignment. As a result, the personnel work schedule during mission operations was revised from 3 nine hour (overlapping) shifts to 2 twelve hour shifts. Although the decision had been made to transfer the function of EV and to close AFSPPF, some optimism remained that this decision would be reversed and that the Facility would go back into full mission support operations. This optimism was based on the desire to maintain a full Evaluation, Photo Processing, Research and Development, and Data Processing capability at one location. It was for this reason, when Master Sergeant Swetavage identified five Government-owned 360/40 components being excessed at Headquarters PACAF, that AFSPPF requested these units to replace the same components being leased from IBM for their system. The transfer of this equipment was approved and the components (central processing unit, control unit, card reader/punch, select channel, and printer) arrived in March 1974. This action resulted in a monthly rental savings of $17,000. In April 1974, Captain Massarini was selected as a member of the newly formed HEXAGON System Software Compatibility Team tasked to document all image assessment programs utilized in HEXAGON performance evaluations. Also in April, Lt Colonel Martucci, Deputy Director of Evaluation, Captains Hill and Johnson, and Sergeants Swetavage, Strausbaugh, and Singleton performed an in-depth study to identify the requirements for photographic production computer support based on the loss of PD's IBM/1800/1130 Production Control System. Their study resulted in five feasible options to handle the Production Directorate's automated control requirements at AFSPPF and later at their new operational site at the 544th ARTW. The decisions resulting from this study were: (1) to purchase a PDP-11/40 and do the program conversion in-house; (2) in the interim, to obtain the density return acquisition and densitometer calibration functions from an existing PDP-8E on loan from EV; and (3) to supplement the production mission with miscellaneous data processing support from the IBM 360/40 in the Data Division. The Data Division provided the programmers, managed by Captain Hill, to rewrite the software from the 1130/1800 for operation on the PDP-8E. This task was completed in October 1974 and an operational procedures document written entitled PDP-8E Computer Operations. The supplementary programs also required a conversion modification to be compatible with the IBM 360/40. In total, 38 programs were rewritten in this phase and declared operational in August 1974. Up to now all planning for the transfer had included the shipment of the dedicated IBM 360/40 System. Unfortunately, in late June, a decision was made not to relocate the 360/40 to NPIC. However, to ease the transition, two systems analysts (Captains Massarini and Jackson) were selected to fill two of the 30 Air Force slots allotted for this movement. In December 1974, AFSPPF sent out a Data Processing Program Report which presented the following information: program name and nomenclature, documentation status, programmer, language, purpose, and input/output information on the entire inventory of programs utilized by the Data Division.

The last eight months of operation in the Data Division were involved mainly with: (1) the conversion/modification of the Production Control System programs used in the photo processing mission at AFSPPF, and (2) the design and monitoring of the HETRA Remote Job Entry (RJE) System at NPIC which was to be utilized for processing the system performance evaluation data at APSD. Captain Massarini and

Captain Noland, Technical Analysis Division, suggested and received approval to use an existing Government-owned PDP-8E Minicomputer to preprocess the raw resolution, microdensitometric, and macrodensitometric data which would minimize the utilization of the RJE, thus expediting receipt of the final processed data from computer central at CIA Headquarters. The schedule, established for converting the analytical programs ("Reso 4," "Reso Original and Backup," "VEM Collection," etc.) written for the IBM 360/40 to be compatible with the combined system of minicomputers and the RJE which was linked by data line to the 370/195 System at computer central, was completed as planned. In total, 90 programs were converted and available for the Operational Readiness Test performed at NPIC/APSD in August 1975. By April 1975, the major Facility management information systems programs had been converted from the 360/40 format to the PDP-11/40 System. A report was written in April 1975 entitled Program Documentation for TWINSCAN, for the purpose of documenting the software used at AFSPPF in the simultaneous or independent automated operation of the two Mann-Data Microdensitometers (Machines "B" & "C"). This work was done to give the two recipients (NBS and EK) information on the configuration and use of the these microdensitometers. On 1 August 1975, the IBM 360/40 Computer System was phased out; the rental equipment returned to IBM; and the Government-owned equipment was distributed to various locations (Langley AFB, Scott AFB, etc.).

The highest tribute was paid to this highly dedicated, professional, and motivated unit of system analysts, programmers, and machine operators by five separate companies/agencies. First the Field Representatives from the Digital Equipment Corporation (DEC) and International Business Machines (IBM) Corporation who have praised the technicians by stating that because of the thorough use and manipulation of their computers by the Data Division that both corporations have improved their equipment. Acknowledgment was received from EIKONIX and Mead Technology Laboratories for the "around-the-clock" cooperative assistance provided these two corporations, in support of their development and testing of image assessment programs. The Data Division was also cited by the HEXAGON Program Chairman for their significant contributions to the development of on-orbit analysis techniques, software, and 24-hour a day response to all mission processing requirements.

Three men, although mentioned later in the acknowledgments, are deserving of special recognition. The first is Captain Dale Watson who was Chief of the Data Division for four years and the man responsible for organizing the management and operational procedures for this Division. Another member is Technical Sergeant William Sanson, a Data Processing Supervisor, who had the ability to detect and isolate errors during data processing and as a result saved valuable analytical and programming time. Sergeant Sanson always provided total dedication to accomplishing the mission regardless of whether it was system performance assessment, contractor support, research and development, or management information system tasks. The third man was Master Sergeant Robert Swetavage whose innovative, thorough, economical, and timely management recommendations/actions were major factors in the outstanding and effective mission support operation performed by the Data Division from 1970 thru 1 August 1975.

C. Technical Reports Division (EVT)

Another Branch transferring from RD to incorporate under the Evaluation Directorate was the Technical Reports Branch. This Branch was established with the hiring of Mr. Charles Rauscher in October 1962. The initial mission was to photographically document Building P-1900 modifications; new photo processing equipment installations; and produce 8" x 10" vue-graphs, 35mm slide briefings, and static displays. At this period of time, this Branch was known primarily as the Still Photo Lab and had very little graphic equipment. In January 1963, this Still Photo Lab unit was assigned to reproduce reports on RD equipment evaluations, and a limited duplicating capability was added. The reports produced by this small print shop were well received and resulted in the requirement in early 1964 to reproduce GAMBIT Performance Evaluation Reports (PETs) and Technical Evaluation Reports (TEROs) on the new 1000 Series CORONA missions. At this time, the Still Photo Lab was renamed the Technical Reports Branch.

Mr. Rauscher's group of five enlisted technicians (a Draftsman, Illustrator, Still Photographer, Printing and Binding Specialist, and Printing Technician) was responsible for designing the basic format for these publications. The first reports were all typed on duplicating paper master plates at a 1:1 scale. This was a very slow and cumbersome method because the majority of information consisted of columns of figures and statistical data. Mr. Rauscher conducted an immediate search for a faster and better quality reproduction system. He drew up a staff study of his findings and proposed implementation of a Photo Direct Master Duplicating System, designed by the Addressograph & Multigraph (A&M) Corporation, Mount Prospect, Illinois/Cleveland, Ohio. This system was the forerunner of the publication method used until the closure of the Facility. This first system included an Offset Multilith Duplicating Press, Model 1250 and a Loader Processor Platemaker, Model 1425. The advantages of this system were:

A. Typists could use any type of paper.

B. Corrections could be easily overlaid (stripped-up) rather than the previous method of retyping the whole page.

C. Illustrations and/or typed draft could be reduced or enlarged for process copy.

D. The 1250 Duplicator could reproduce a vastly improved printing quality.

In December 1964, the Branch's photo laboratory was tasked with projection printing of reconnaissance satellite imagery for inclusion in the technical evaluation reports. This required an enlarging capability up to 40 times (40X) the original image. It also entailed precise registration in placing the imagery within the classification frisket. Both the GAMBIT and CORONA Program Offices were highly impressed with the prints produced by the Technical Reports Branch. Both program offices felt strongly that one of the best means of displaying, as well as characterizing, systems was to do it through actual photographic examples. This resulted in a marked increase in work load and led to the purchase of the following photo equipment:

A. LogEflo LD-24 Automatic Film Processor

B. EK 10 - 20 - 40X Enlarger

C. Chromega Projection Printer

D. Miller Holzworth Printer

This enabled the Technical Reports Branch photo laboratory to perform the following tasks: (1) documentary photography; (2) black and white and color prints and slides; and (3) technical report projection printing support.

Another innovation in the report publication product was the utilization of plastic binding and different styles and sizes of typeset for the cover and divider pages. To accomplish this, a 316 EP Punching Machine, a 316 EP Binding Machine, and a Model 880 Composing Varityper Machine with six fonts were purchased from General Binding Corporation (GBC), Northbrook, Illinois.

It was at this point in June 1966 that AFSPPF was upgraded to a Wing level Facility. As part of that reorganization, the Technical Reports Branch of RD was transferred to the newly established Directorate of Evaluation where it became the Technical Reports Division. The organizational structure included the Division level and the Photographic, Layout, and Lithographic Branches. Ten personnel manned these three branches. The mission remained essentially the same; however, the work load significantly increased. Equipment improvements during this period included the 705 Photo Direct Plate Processor which automatically combined the camera and platemaking phases. This produced a plate which could be placed directly on the press for reproduction. The GBC Model 12 LD Laminator was purchased and used to preserve report covers, divider pages, security badges, photo processing machine operating instructions, etc.

From 1966 - 1970, the Technical Reports Division remained relatively static with the mission requirements gradually increasing but the general type of production remaining the same. Figure 2-46 presents a display representing the capabilities, functions, and major pieces of equipment of each branch within the Division.

The next significant event affecting this Division was the reorganization by AFSPPF in 1970 which aligned all functional AFSCs under the same Directorate. This concept resulted in the transfer of the personnel and functions from the Photographic Branch to the Production Directorate where this unit was renamed the Select Print Laboratory (SPL). Although the concept of aligning all AFSCs under one Directorate was sound, this particular action was unfortunate for the Still Photographers assigned to the Select Print Laboratory. The SPL received 90% of their entire work load from the Directorate of Evaluation. Despite

TECHNICAL REPORTS DIVISION MISSION DISPLAY BOARD

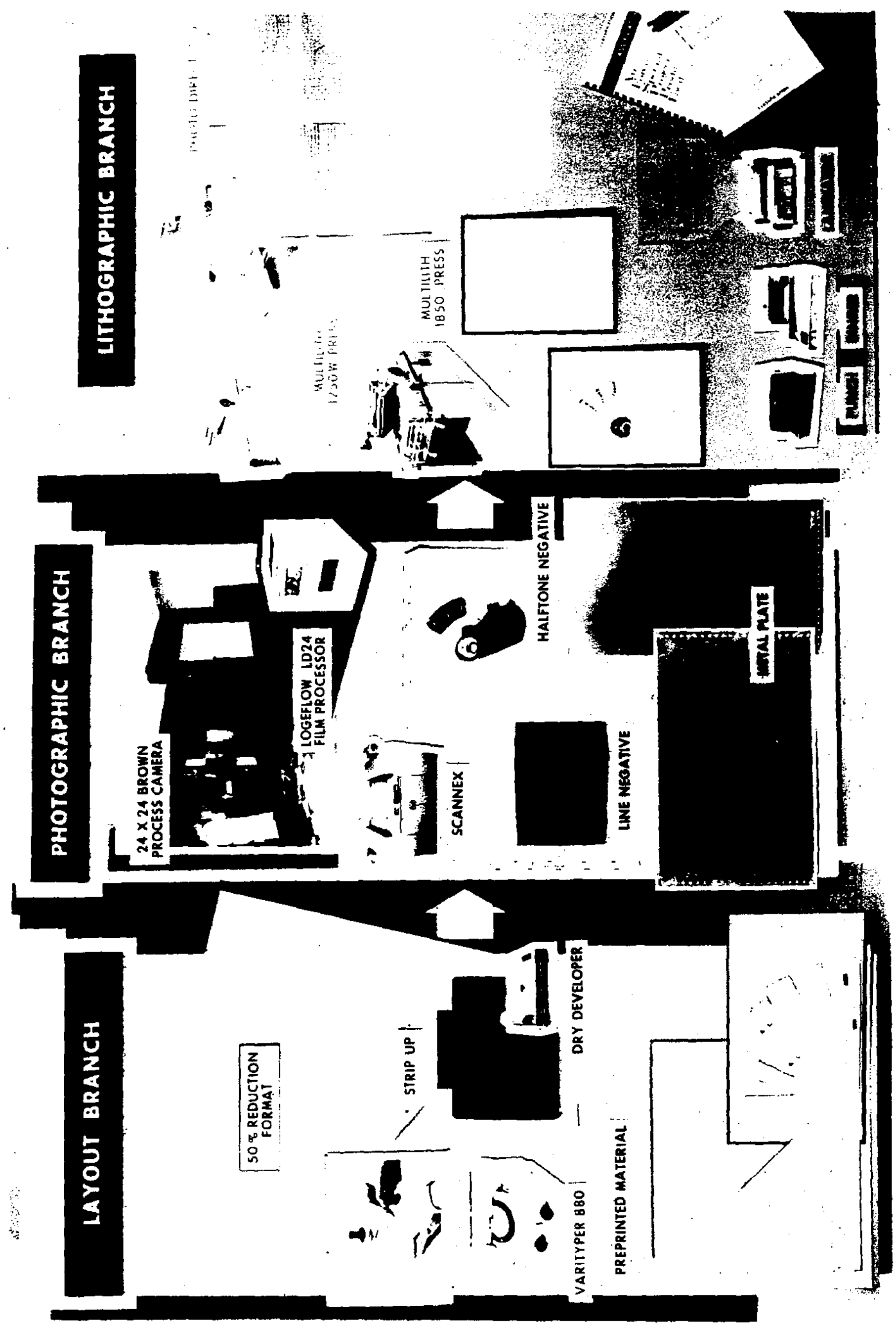



FIGURE 2-46

this administrative policy, good cooperation and coordination were retained between EV and PD in receiving SPL support.

The last major piece of equipment purchased for the Technical Reports Division was the A&M 805 Electrostatic Master Imager which replaced the A&M 705 Photo Direct Plate Processor. This was a revolutionary development in printing technology because it was the first to incorporate a dry processing technique versus wet chemistry which had caused many operational problems. Figure 2-47 shows a picture of the A&M 805 platemaker. Another innovation was the close coordination between the Technical Reports and Data Divisions in devising data processing programs to computerize graphic presentations with the IBM 360/40 for inclusion in the technical reports. This saved many man-hours of graphics work in drawing, "laying out," "stripping up," and typing formats. Examples of these automated printouts and plots were: CORN target summary data by each mobile display, mission command information by rev and frame, density summaries by slit number, exposure data based on peak resolution, smear rate distributions, etc. In this same time period, AFSPPF proposed that EV was capable of supporting all required HEXAGON publications. The HEXAGON Program Chairman approved this proposal. By 1971, the Technical Reports Division was operationally prepared for what turned out to be the longest and toughest mission challenge of their existence.

Since March 1970, this Division had been reproducing Interferogram Reports which presented data on interferometrically determined modulation transfer functions of each optical bar tested in a preflight simulated chamber (Chamber D) at Perkin-Elmer, Danbury, Connecticut. These were relatively small publications and could be handled easily along with the GAMBIT PET and CORONA TERO requirements. However, with the advent of Acceptance, Readiness, Postflight Analysis, and PET Reports for each HEXAGON mission, personnel schedules had to be devised which covered 18 hours a day, 7 days a week during report preparation, compilation, editing, and publication periods.

During the peak production period from 17 March 1971 thru August 1975, this Division was continually involved in some phase of report preparation. With the announcement of the pending closure of AFSPPF and the transfer of EV to NPIC/APSD, the decision had to be made whether to include this dedicated reports group with the transfer. Based on the fact that NPIC had their own printing plant, it was decided that a force of four technicians (Draftsman, Illustrator, Multilith Offset Pressman, and a Visual Information Specialist) would remain and be assigned to the AFSPPF Administrative Section to support the reproduction function of the Facility until the phaseout. Although the personnel from EV who were transferring to NPIC were gone by early August, several reports, e.g., CORONA History, two additional Image Resolution Assessment and Reporting Standards (IRARS), the Financial Plan, the Facility History, etc. remained to be completed. The last man officially assigned to the Technical Reports Division left for his new assignment on 30 September 1976,

THE A&M 805 ELECTROSTATIC MASTER IMAGER

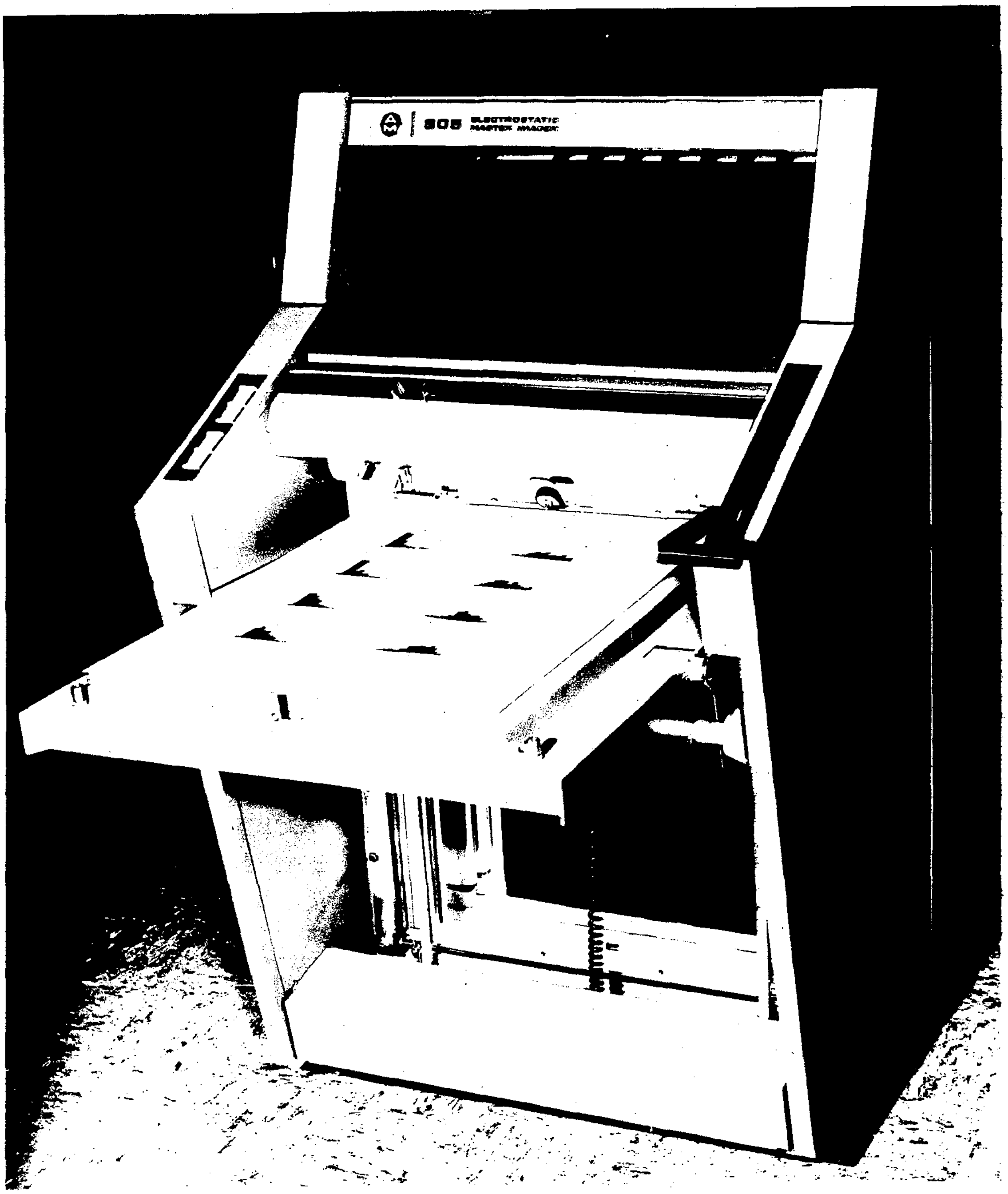



FIGURE 2-47

thus bringing to an end one of the most responsive, innovative, and dedicated small printing plants in the DoD.

Although certain personnel are acknowledged later in this section, two are singled out for special mention. First and foremost, Mr. Charles Rauscher, who through planning, training, and managerial abilities was able to meet the many and various challenges assigned him throughout his 14 years of service as head of this group. The second, Technical Sergeant Richard Barrus, who upon assignment in October 1966 as a Draftsman Supervisor, developed production techniques which significantly reduced the man-hours required to complete these lengthy and exacting technical reports. His interest was so deep that he became involved not only in the mechanics of his graphics work but also the contents of the text. As such, he provided valuable assistance not only as a graphics technician but in the editing/quality phases of each report.

The following personnel are but a small percentage of the outstanding engineers, technicians, specialists, and administrators assigned to the Directorate of Evaluation from June 1966 to August 1975.

A. Technical Analysis Division

Personnel from this Division, such as Captains S. Noland, G. Holliman, and C. Bush, were the prime initiators and coordinators of the mission projects in EV. They understood the complexities of the satellite reconnaissance systems and were expert analysts of sensor subsystem performance and image quality evaluation. However, without the precise operation of the mensuration equipment provided by Staff Sergeants R. Arnold, F. Penny, H. Loewen, R. Capps, S. Boston, R. Prunoske, and A. Craley; and the supervisory abilities and multi-talents of dedicated contributors like Master Sergeants J. Weinert, D. Voller, A. Whitmore, and Technical Sergeant J. Strobel, the data would not have met mission requirements. There was also the achievement of Captain H. Gordon, OIC of Data Collection, whose knowledge and operational management of the Controlled Range Network were unparalleled in the history of this program.

B. Data Division

Computer services of this Division were developed into the essential means of solving engineering problems, test evaluations, and special studies. EV's outstanding computer programmers/analysts were: Captains W. Jackson, R. Massarini, and D. Watson. These men were seemingly on call day and night to innovate software changes to operational programs and/or provide instant consultation to prevent mission data processing stoppages. The Data Division was consistently manned by individuals of the highest professional caliber. Some of these dedicated technicians were Technical Sergeants W. Sanson and J. Bradley (machine operators); Master Sergeant M. Strausbaugh and Mr. H. D'Amours (programmers); and the best NCOIC ever to serve in this Directorate, Master Sergeant Robert Swetavage.

C. Technical Reports Division

This Division's graphics people, i.e., Master Sergeant J. Dollar and Technical Sergeant R. Barrus, and Illustration Specialists Technical Sergeants J. Francavilla and E. Ward consistently responded to all mission challenges in preparing formats for the several types of technical reports. Similarly, the Lithographic expertise of pressmen like Master Sergeant L. Nelson and Technical Sergeant R. Dixon exceeded the quality criteria and met all reproduction deadlines for these large volume publications. However, the person who stands out above all others was Mr. Charles Rauscher, the Division Chief, for it was his creative talent and determination which won the recognition of his group and product throughout the NRO community.

D. The Evaluation Directorate's Office

Expert leadership and dedication from the Evaluation Directorate were received from officers like Colonel V. Stanley, Lt Colonels H. Duval, Jr. and L. Martucci; from the noncommissioned officers who drove mission operations such as Chief Master Sergeant J. Badgett and Technical Sergeant R. Jewell; and from that long line of outstanding secretaries, the backbone of EV's administrative and report preparation functions, which included: Mrs. Nancy Doyle, Mrs. Janice Lawrence, Miss Cathy Walsh, and Mrs. Stevie Chaisson.

The men and women of EV share equally in the success of the Directorate of Evaluation as a unit of dedicated, responsive, quality performers.

## SECTION III

## COVER, SECURITY, & COMMUNICATION

BACKGROUND

The Air Force Special Projects Production Facility (AFSPPF) was established with the primary task of supporting the processing and duplication of the SAMOS Earth Satellite Reconnaissance Program. The following is an excerpt from a Headquarters USAF message which states the mission of the Air Force Satellite Photographic Processing Laboratory (AFSPPL), the name by which this organization was first known.

> "From HED USAF, Wash DC. To SAC Offutt AFB Nebr. Info 844RTS Offutt AFB Nebr, 8AF RTS Westover AFB Mass, ADC Andrews AFB MD. Secret Cite AFCIN-1B2-90296. Subject is Project SAMOS. This msg in 4 parts. Part 1. Recent direction to the management of the satellite reconnaissance program has emphasized that the processing, duplication and distribution of photographic materials resulting therefrom is a responsibility which the Air Force must be able to discharge in a nationally acceptable manner. The 8RTS, Westover AFB, has been selected to perform these tasks. Part 2. The Secretary of the Air Force has requested that a detailed plan be prepared for conversion of the 8RTS, Westover AFB, to a Department of Defense Satellite Reconnaissance Processing Facility........Part 4. Request plan be forwarded to HQS USAF, Attention AFCIN-1B2, not later than 14 Oct 60. This msg has been coordinated with the Director of Missile and Satellite Systems."

As this mission expanded to include the research and development of photo production related hardware and software and the photographic characteristics evaluation of satellite imagery, the prime concern to the National Reconnaissance Office (NRO) became one of insuring that this unit maintained a policy of limited access on a strictly need-to-know basis and tight physical, administration, and communications security.

The problems of obtaining adequate intelligence over denied areas through photo reconnaissance were greatly amplified by the Gary Powers U-2 incident in May 1960. Consequently, Government direction to the management of the Satellite Reconnaissance Program emphasized the importance of the control and handling of SAMOS photographic products.

On 15 December 1960 Confidential SAF Order 116.2 [72] established the AFSPPL at Westover Air Force Base, Massachusetts. The order placed this new organization under the command of the Director of the SAMOS Project and attached AFSPPL to the Air Force Command and Control Development Division, L. G. Hanscom Field, Massachusetts, for administrative, logistic, and contractual support. The actual

[72] IBID Footnote 1, page 1-1.

transfer of spaces, manpower, and other resources was scheduled to take place upon approval of a plan submitted by the Director of the SAMOS Project to SAF.

Copies of the original mission statements for this organization can be found in the Appendix. The three organization and function mission statements were incorporated into Secretary of the Air Force Orders dated 15 December 1960[73]; a revision, dated 25 August 1964[74]; and the current mission directive which was effective on 10 November 1965.[75]

Although the specific reference to satellite photography was eliminated for security reasons from the official mission statement on 25 August 1964, this organization has continued to provide technical, analytical, and research support to satellite reconnaissance programs from SAMOS to CORONA, GAMBIT, HEXAGON right through to the current [redacted] The first SAF order concerning this organization states that the mission provides support for a satellite photographic reconnaissance program; however, this information was never released publicly as the required clearances for all personnel were under the TALENT-KEYHOLE (TK) Control System which would not allow any reference to that type of reconnaissance.

Although several attempts were made to establish a cover story for this organization, one was never approved. In the beginning, members of AFSPPL and their former co-workers from the 8RTS worked in different areas of the same building. AFSPPL personnel were constantly instructed not to discuss their specific duties. This was an extremely sensitive matter as their former co-workers knew what specialty fields they were assigned to. Therefore, AFSPPL personnel could never effectively hide the fact that they were involved in some kind of photographic project. These personnel were also briefed not to freely volunteer the name of their organization to anyone on base or in the local community. They were also told that there should be no "open" social association with contractors and government personnel on or off base.

There were no public information announcements of the establishment of AFSPPL. However the scope of the mission grew to the point where on 30 June 1963 8RTS had to relocate into other buildings on Westover AFB. As long as the 8RTS was co-located in Bldg P-1900, public attention was not drawn to the existence of this organization. In fact, the 8RTS sign remained on the building until approximately the summer of 1965 when it was replaced by a sign bearing the short-lived name of the 6594th Test Squadron. Even when the name of this organization was changed to the Air Force Special Projects Production Facility in November 1965, the "test squadron" connotation remained popular and was used by most base personnel. Slowly as 8RTS and other long-tour base personnel were transferred, the fact that AFSPPF was involved in photographic projects became less and less conspicuous.

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73 IBID Footnote 1, page 1-1.
74 IBID Footnote 2, page 1-2.
75 IBID Footnote 3, page 1-2.

With the change in the mission statement in August 1964 to reflect the support of "special projects," the lack of an official cover story again complicated the security function because it deleted all reference to a photographic mission. The mission was stated as "research and development in support of special projects directed by the SAF." Variations of this statement have been used since 1964 as the reply to any question concerning the organization's mission. The most common response was simply "research and development in support of special projects." However, as written in the April 1972 staff study conducted by this organization into the options/requirements for a cover story, a simplified statement "usually arouses curiosity and leads to more probing and often unanswerable questions." The AFSPPF staff went on to point out that, "There is a great deal of unclassified information/documentation that reveals, to some extent, the mission of this organization. The information is most readily available at our host base, Westover AFB. However, there is considerable information available to Hq AFSC, Hq SAMSO, and various procurement activities in addition to numerous industrial agencies with whom we are contractually involved." For example:

A. Large purchases of photo equipment through normal procurement channels at Westover AFB.

B. Assignment of Precision Photo Processing and Photo Interpretation enlisted personnel and officers with reconnaissance engineering AFSCs.

C. Officer Effectiveness Reports (OERs) endorsed by the "Deputy Commander for Satellite Programs" and a required statement in the OER duty section specifying that, "These duties are performed in support of the mission of the Space and Missile Systems Organization."

D. The use of a Determination and Finding statement for support of satellites and related items to authorize contractual efforts to procure photographic equipment, materials, and services.

Other examples that generally revealed AFSPPF's mission were transmitted in a message to SAFSP.[76] The study was concluded with the proposal of an organizational name change and a new mission statement. A copy of the staff report can be found in the Appendix.[77]

After numerous meetings with security and policy representatives at SAFSP and SAFSS, the decision was made not to change the name and mission statement. This was summarized in an SAFSP message on 9 March 1973.[78] This message also provided specific directions dealing with personnel, contracting, civil engineering, awards, refuse, communications, finance, and additional BYEMAN billets for non-AFSPPF Westover personnel. Those directives reinforced existing BYEMAN security policies, but did not alleviate the problem of having no official cover story, which existed until Facility closure.

From the beginning of this organization, security has been the overriding factor in all major operational

76 Message, WADDY, 24 Aug 1970, Unclassified Documents Revealing Mission. (S)
77 Staff Study, AFSPPF, 11 Apr 72, Cover Story (Appendix, Item 27). (S)
78 Message, CHARGE 1466, 9 Mar 73, Security Guidelines for WADDY (Appendix, Item 28). (S)

and administrative decisions. Originally, the security support was provided by the 8RTS staff. This became another extremely sensitive situation as AFSPPL had priority over all 8RTS resources. The first personnel permanently assigned were the Commander, Lt Col Harold Z. Ohlmeyer, and his secretary, Renata H. Grochal. On 4 January 1961 there were 6 officers, 1 warrant officer, and 58 enlisted personnel assigned to the AFSPPL unit for 45 days special duty (TDY).[79] This procedure allowed these people to continue to work and support both AFSPPL and 8RTS while awaiting special clearances required to work on the SAMOS Program. This presented Security with the problem of keeping the non-TALENT-KEYHOLE (TK) AFSPPL and 8RTS personnel out of areas where TK materials were being stored/worked on.

The initial TK photographic laboratory consisted of the old 8RTS Continuous Processing Laboratory (approximately 4,500 square feet). Admission was by personal recognition at a checkpoint at the entrance to the laboratory. No special badges were involved. However, in April 1961, at the urging of the Commander, SAF authorized the use of Air Police (AP) to control access to the work areas. In an agreement with SAC, AFSPPF was assigned use of 10 Air Policemen from the 1814th AP Squadron to man two guard posts on a 24 hour basis, seven days a week. These 10 APs were assigned on a rotating basis, but were also still given base duty tours. By that time AFSPPF security had established a badge/picture system which the APs used to identify authorized personnel. This procedure was referred to as the "Two-badge System" and was utilized until 1968. It consisted of a permanent picture-type badge for all personnel assigned and also included badges for the frequent visitors (contractor and government). These badges were stored at Checkpoint 1 located in the building vestibule. The actual procedure was to give name and badge number, and upon positive identification the AP would issue a badge. This badge would admit the individual to most areas of Building P-1900; however, for access to the AFSPPL laboratory, the individual would have to turn in his first badge at Checkpoint 2, and the AP would give him a second badge allowing entrance into the laboratory only. Visitors could gain access to P-1900 by having their clearances forwarded over the communication network to the Special Activities Office (SAO)/Security Section who would prepare a temporary badge covering the visit period. The Security Section would then turn this temporary badge over to the Air Policeman at Checkpoint 1. Upon arrival the visitor would identify himself, sign in on the roster maintained at Checkpoint 1, be verified in writing by the person he was visiting, assigned an escort, and then issued the badge. After 1968 the Facility established an alpha-numeric one badge system. The badge was coded to include program clearances and authorized unescorted areas to which that person could gain access. This procedure continued until the closure of the Facility.

The following is the official evolution of names used for the security function at AFSPPF: (1) Security Section, (2) Special Projects Office (SPO), and (3) the Special Activities Office (SAO). Variations of these names were used interchangeably throughout the existence of this organization.

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[79] Special Order 2, 4 Jan 61, TDY Assignment of 8RTS Personnel to AFSPPL. (U)

PHYSICAL SECURITY

[redacted]

As much of the mission equipment (computers, copy machines, printing presses, etc.) was maintained by uncleared contractor personnel, it became necessary to sanitize work areas and to make certain that all Facility personnel were alerted to the presence/location of these uncleared maintenance personnel. Besides the use of controlled area badges and personal escort, two other methods were designed by this organization to alert Facility personnel. One was a system of red blinking lights installed in key hallways which could be activated when uncleared personnel were in the area. The second was that each outer door to an operational area had a holder in which a sign, identically color coded to our badge system, could be placed.

For additional protection the Facility had a ten zone intrusion alarm system installed in the early 1960s by American District Telegraph Company. Originally, this alarm system was controlled from three points. Primary control was handled at Checkpoint 1 through an Annunciator Panel by Security Policemen on duty. Switches on this panel were utilized to reset the zones, thereby terminating alarms from sounding at the Security Police station. Secondary control was at the Master Alarm Control Panel located in SAO. From this alarm control panel Facility security personnel could "lock out" any given zone to open the area for access by contractors or maintenance personnel without having an alarm sound at Base Security Police. These first two panels allowed security personnel to determine which zone was in an "alarm" condition and to immediately respond to that zone. The third monitor was at Base Security Police. The panel located at Air Police headquarters could identify an alarm condition within Building P-1900, but could not indicate which zone the alarm was coming from, a fact which was kept from all personnel assigned to the organization with the exception of SAO and the Commander. The alarm system consisted of:

A. Magnetic operated door switches.

B. Microswitches mounted inside the vault doors which were activated by the door handle.

C. Kidde ultrasonic motion detection devices both above and below ceilings.

D. Mosler capacitance alarm controls in all air conditioning ducts leading into or out of a vault. These alarms were also used in the basement.

E. Lead tape on the windows.

F. Key shunts on zones which are not strictly above the ceiling. The shunts were put in an access position during duty hours, thus preventing an alarm condition.

The configuration of the zones changed from time-to-time, due to either a rearrangement or addition to one of the classified working areas, but generally speaking, it remained the same as its original design.

After installation, initial maintenance was provided by Springfield Audio, Inc. However, in 1964, the decision was made to transfer the maintenance of this system to the Facility's electronic maintenance personnel. This decision was based on cost, quality of workmanship, and access difficulties. The system was declared obsolete in 1973, and a contract was negotiated with American District Telegraph for a complete new alarm system; however, with the verdict to deactivate the Facility, this $50,000 contract was cancelled. Consequently, with many of the components no longer being manufactured, it was to the credit of personnel like Sergeants W. Topper, C. Boulware, J. Smith, and K. Shultz that the system was kept operational to meet mission/security requirements.

As the Air Force started its reduction in manpower, the 99th Air Police Squadron was one of the first organizations affected. Therefore, in March 1969, an agreement was made between SAC and AFSPPF to relieve the APs from manning the guard posts within P-1900 as long as this organization could be assured that it would receive a response with a force sufficient to surround the building within minutes of an alarm alert. During this period a new procedure was established to have the Base Police also control access to the building during nonduty hours. This procedure included: (1) SAO forwarded an access roster of authorized AFSPPF personnel to Base Security Police; (2) the individual requesting access would call the police desk from a phone immediately outside the front entrance and give his name and serial number, and then hang up; (3) the desk Security Policeman would then call back and ask for the code word; (4) upon giving the code word, the individual would open the front door cipher lock and gain access to the building. With the exception of the code word, this procedure was repeated for access to any of the zone vaulted areas within P-1900.

In 1973 as the Base Security Police force was further reduced, AFSPPF assigned personnel as duty officers to control access to Bldg P-1900 on a 24 hour a day, 7 day a week basis to provide additional security protection. This procedure remained in effect until Facility closure.

ADMINISTRATIVE SECURITY

Until approximately 1970 most assigned personnel had only the TK access. There were also a few persons who required the BYEMAN project access; these included the Commander, Directors, Security, selected Research & Development, and Evaluation personnel. However, with the Facility's increased involvement in the processing and evaluation of preflight test material and postflight mission film from HEXAGON, all personnel were given a minimum of a Phase III BYECOM access.

Documents and messages were controlled manually from 1960 to 1968. All documents and other classified items, with the exception of messages, were recorded on a Top Secret Register, AFSC Form 53 (Sep 1964). Messages were logged on a Message Delivery Register, AF Form 1014 (Oct 1953).

This method proved inadequate for controlling documents as the volume of classified increased. Therefore, in 1968 a new system was formulated by Lt Col Thomas Taylor which consisted of recording each document on the following: SAC Log Form 210, IBM ADP General Purpose Card, and a DIA Form 592 (Apr 1966), Correspondence Control Register card. These cards were prepared by either typing or in handwriting but were not key punched. Whenever that document was shipped a DIA Form 591-A (Apr 1966), SAO Document Receipt card, was prepared and sent with the shipment. The DIA Form 591-A was returned to AFSPPF/SAO where it was filed with that document's corresponding Form 592.

In 1970, Major Rolland Smiley, the new Security Officer, designed a computerized control system which not only provided better control but also reduced the man-hour requirements involved in maintaining/researching this library of data and documents. The data programming, further development, and testing were accomplished by Master Sergeant Robert Swetavage and Staff Sergeant James Henion. This control system operated as follows. When a document was received, it was assigned a Facility control number, e.g., SPB-76-001 or SPT-76-001. The "SP" meant special projects; "T" and "B" referred to the control system; the next two digits were the year; and the last three digits represented the number of the document received that year. After assignment of the local control number, an entry was made on the register form which included the local control number, copy number, in-house account code (separate code for each Directorate), classification, disposition, originator, receipt number, addressee, system control number, subject/title, document date, received date, destroyed or shipped date, number of attachments, and a transaction code. Once the initial work of coding and key punching cards for every document was finished, the cards were punched/updated once a week. A computer printout was run every six months. The computer printout was generally over 500 pages and provided seven major listings:

A. Active documents by local control number.

B. Inactive documents by local control number.

C. Destroyed documents by local control number.

D. Shipped documents by local control number.

E. Active documents by subject/title.

F. Active documents by in-house account.

G. Cross-reference between local control number and system control number.

From December 1960 through May 1972 all messages were accounted for by a manual control system. In June 1972, a new in-house automated system was developed. This program consisted of logging the incoming message on an AFSPPF designed "Message Control" form. This form was keyed to an 80 column punch card format. Information blocks were identified for the local check number, subject/title, message cite number, code which indicated whether the Facility was an action or info addressee, and the date received. The cards were punched weekly and a printout, sorted by message cite number, was made monthly. Since the cite number included a slug and the ascending number of the message sent by that organization, the computer sort was by organization and arranged chronologically. Once every six months a composite listing was run and the corresponding monthly listings were destroyed.

All personnel assigned to the Facility had to meet the Special Security Investigation Requirements (SSIR) of USAFINTEL 201-4. SSIR included an Expanded Background Investigation (EBI) and adjudication of each individual's EBI by the Air Force Intelligence Personnel Security Division (AFINSB) to ensure that all personnel fully met the requirements to be indoctrinated and given access to compartmented information.

Two problems existed which gravely affected personnel assignment to AFSPPF. The first was long standing and centered around the length of time involved to clear newly assigned personnel. The second surfaced with the expansion of the Southeast Asian conflict and involved getting enough qualified photo technical personnel to fill the authorized billets.

Up until February 1967 when General Horace M. Wade, Deputy Chief of Staff, Personnel, Hq USAF, directed AFMPC to establish this outfit as a selectively manned organization, AFSPPF had a limited voice over who would be assigned. Under this new directive, personnel were evaluated from both an SSIR and technical qualifications standpoint. The personnel who were deemed acceptable on the basis of SSIR were then required to submit a DD Form 398, Statement of Personal History; DD Form 1584, National Agency Check Request; and a fingerprint card as part of their assignment nomination package. This procedure allowed the SAO to forward an EBI for processing weeks and sometimes months before the individual physically arrived at Westover. Even with the initiation of this practice a person had to wait from one to three months upon arrival at Westover before SAO received the authorization to indoctrinate. During the waiting period, officers were assigned to administrative duties by the Executive Officer and enlisted men were turned over to the Facility Sergeant Major for detail duty.

In 1969 a new procedure was started in an effort to expedite the clearance process. The SAO made a special trip to the Lowry Technical Training Center, School of Photographic Science, and recruited members from several classes of students. This resulted in the following advantages to AFSPPF: (1) received first choice of the best qualified students; (2) established a staggered replacement system; (3) processed initial security papers well in advance, thus reducing waiting period; and (4) developed communications on personnel requirements, thus instituting a pseudo "pipeline" system.

In the early 1970s, procedural changes were continually being made to better manage personnel replacement and indoctrination. The following are a few examples: (1) a small information type management program was developed for use on the Univac 9300 to track the status of the clearance process on each individual; (2) under the direction of Major Moorman, Executive Officer, vacancies for NCOs were forecast to AFMPC earlier, therefore providing more time between selection and arrival at Westover; (3)

Major Smiley interviewed prospective candidates in basic training at Lackland AFB, Texas, instead of during Technical School, thus providing more lead time; and (4) the actual time for an EBI was reduced when the Defense Investigative Service was formed. Unfortunately, although all these actions resulted in a significant improvement in the personnel selection/clearance process, the closure decision was made thus eliminating the requirement for new personnel.

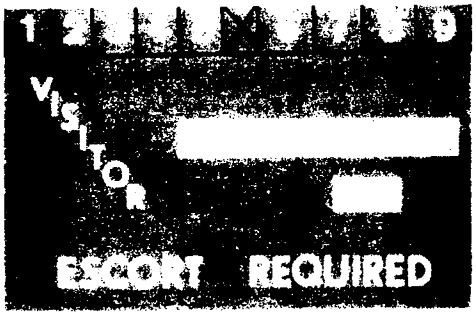
The Facility utilized one other personnel source to great advantage and that was those who had been previously indoctrinated or assigned to AFSPPF were reassigned. This not only greatly aided in maintaining technical proficiency but significantly eased the re-indoctrination process.

Until 1970, the Facility utilized the standard SAC Controlled Area Access Badge (SAC Form 1036) for control of personnel and visitors. Although different colored tape was used on all assigned personnel badges to indicate TK, B, or both system accesses, there was no coding put on a visitor's badge. This system worked well up to the time in 1970 when the number of visitors significantly increased. The cause of this influx was centered around AFSPPF's support of the HEXAGON Program. It soon became very obvious from the security aspect that the Facility needed a new badge system that indicated not only the individual's access to the control systems but also their project indoctrination.

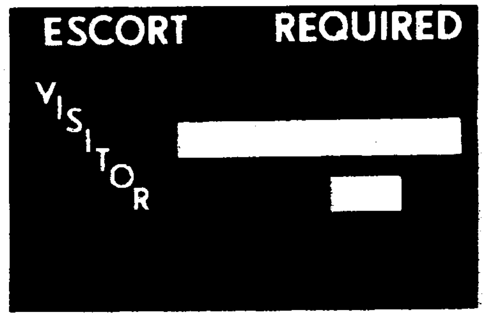
In September 1970, Major Smiley, and Staff Sergeants Phillip Cavanaugh and Richard Barrus designed and implemented AFSPPF's current four badge system. The four badges covered the following clearance situations: (1) all red indicated just TK, (2) all green meant just B, (3) a combination of red and green conveyed both TK and B, and (4) a striped badge connoted no authorized clearances. An area at the top of the red/green and green badges was numbered in nine blocks. These nine block areas referred to the different projects within the B system. If the area was not marked that meant the individual had access authorization to that particular project. The office symbols at the bottom of the badges were used to indicate the areas of the building in which that individual had access without the requirement for an escort. The black and white striped or "zebra" badge indicated that the visitor had no authorized access to any compartmental information. Figure 3-1 presents examples of the color and format of these four badges. All work areas where compartmented materials were exposed had signs posted on the exterior of their entrance doors to indicate the status of that area (TK, B, or TK/B).

The SAO was faced with the problem of establishing a procedure for destroying classified materials, particularly film. From 1960 to 1969, the SAO performed classified destruction as follows: (1) coordinated with Westover AFB Civil Engineering for isolated use of the base incinerator; (2) assigned one officer and a minimum of a three-man crew to load, transport, ensure security, and personally burn all designated material; (3) upon completion of burning, station one crew member to rake through all ashes to ensure complete destruction. Once it had been verified that all materials had been destroyed and the

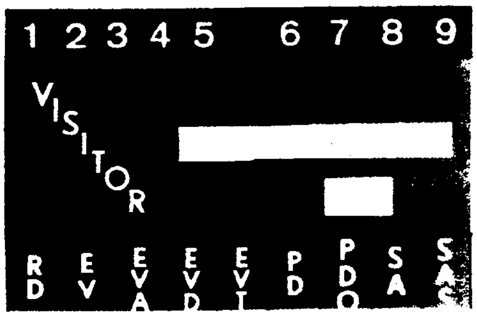
CONTROL BADGE SYSTEM




"B" Access

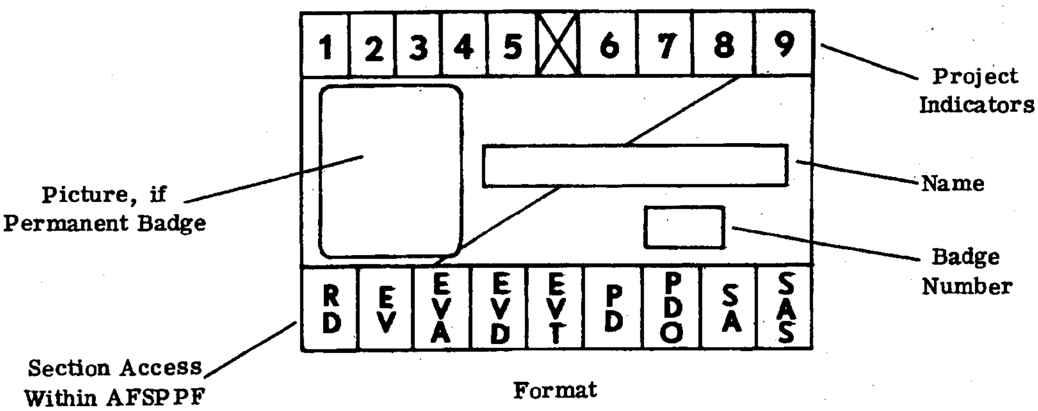



"TK" Access




"TK"/"B" Access


Escort Required




Format

FIGURE 3-1

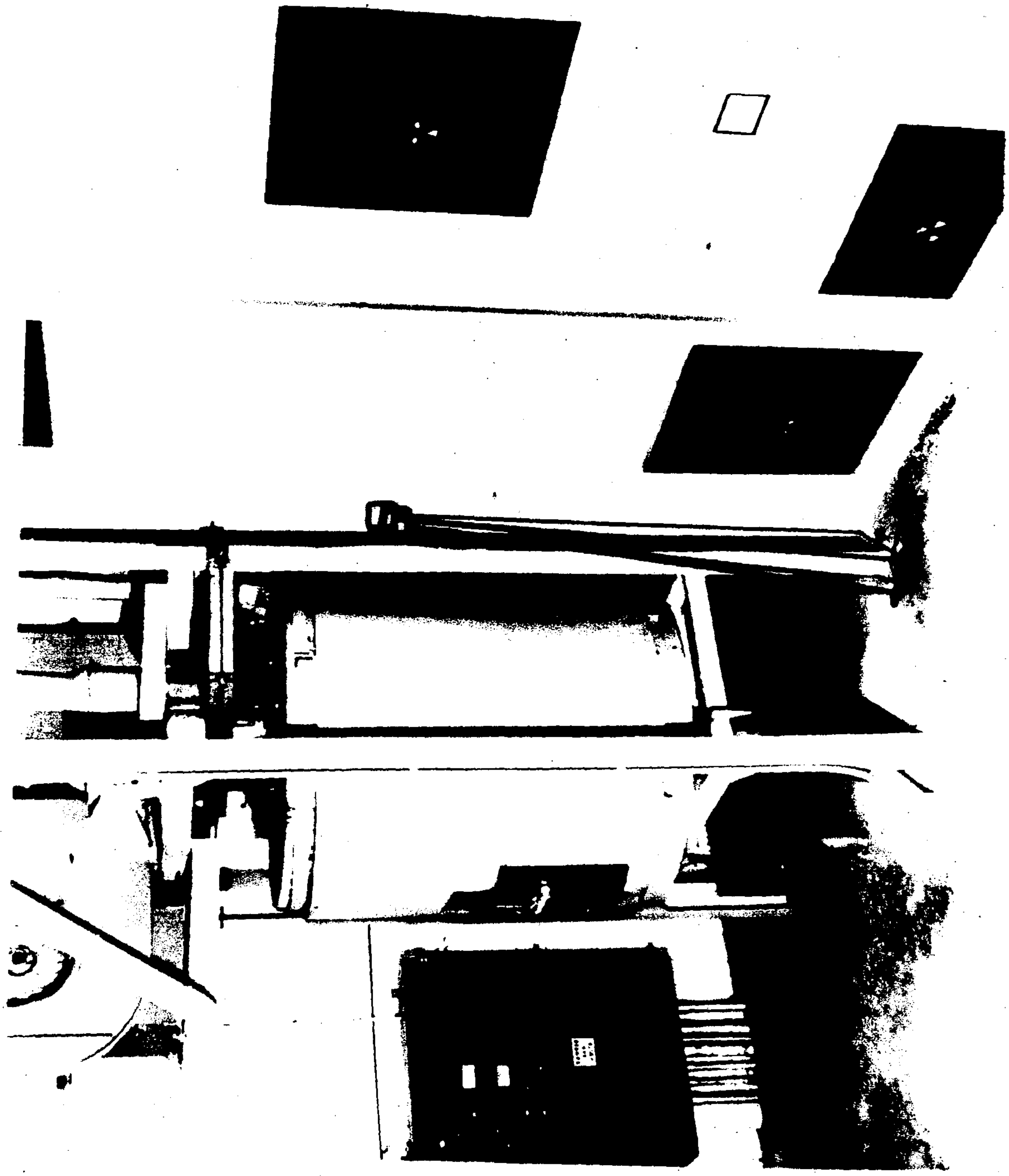
incinerator pit cleaned, the SAO would then notify the Civil Engineers that the detail was complete and all AFSPPF personnel were out of the area. Since this was a totally inadequate method in terms of the man-hours involved and the verification of destruction, the RD Directorate initiated a program in August 1968 to design, build, and install within Building P-1900, a new classified materials destruction system. This unit was designed as a mulcher-incinerator-silver recovery system and was contracted to Fairchild Hiller. After several early problems in the design of the mulcher, the system became conditionally acceptable/operational in the fall of 1969, and was given final acceptance in December 1970. The system was capable of destruction at the rate of 250 pounds per hour. This unit not only solved the problem of classified destruction but also earned thousands of dollars worth of credit from the recovery of silver. Figure 3-2 presents the facing of the incinerator, while Figure 3-3 shows the incinerator in use.

COMMUNICATIONS SECURITY

Classified communications within AFSPPF originally consisted of a dial teletypewriter (TWX) with a One-Time-Tape (OTT) cryptographic capability, which was directly connected to the Pentagon. The TWX was installed in the former 8RTS Security Office and operated by an administrative specialist. In early 1962, the TWX machine was relocated in what is currently the Shipping Activities Section (Room 64) and an additional circuit was opened to SAFSP at Los Angeles Air Force Station. This new communications area was approximately 15 by 25 feet and was manned by two Communications Center technicians. In 1965, both circuits were changed from OTT to KW-26 cryptographic equipment. In 1967 a KG-13 Cryptographic unit and a Model V terminal were installed to provide AFSPPF with its first compatible computerized receiving/sending data capability (punched cards). At this time a Communications Center Supervisor's slot was assigned.

During 1968, construction was started on an addition to Building P-1900 which was designed for the new Facility Communications (Comm) Center. In September 1969, the Communications Center (Room 13B) was operational and included the following equipment: two Univac 9300 Computer Systems with a punched card capability (read 600/punch 200 cards per minute), magnetic tape (1,000,000 characters per hour), and had a high speed printer (960,000 characters per hour) capability, one on-line TWX (100 words per minute), and one off-line TWX. The KG-13 remained as the cryptographic unit. These circuits terminated directly into the Andrews AFB switch for the BYEMAN SOCOMM Network. In addition, an unclassified Dial TWX circuit to Aeronautical Systems Division, Wright-Patterson AFB, Ohio, and Data Corporation, Dayton, Ohio, was installed to support the Controlled Range Network (CORN) operation.

In July 1970, a Cryptographic Maintenance Technician was authorized to perform maintenance and ensure a 24-hour operational readiness of all cryptographic equipment. It was mainly due to the efficient performance of Sergeant B. Wrest in maintaining this equipment that AFSPPF was able to meet its immediate response requirements to support on-orbit HEXAGON missions.



INCINERATOR WITH THE SCRUBBER UNIT AND CONTROL PANEL

FIGURE 3-2

THE INCINERATOR IN OPERATION

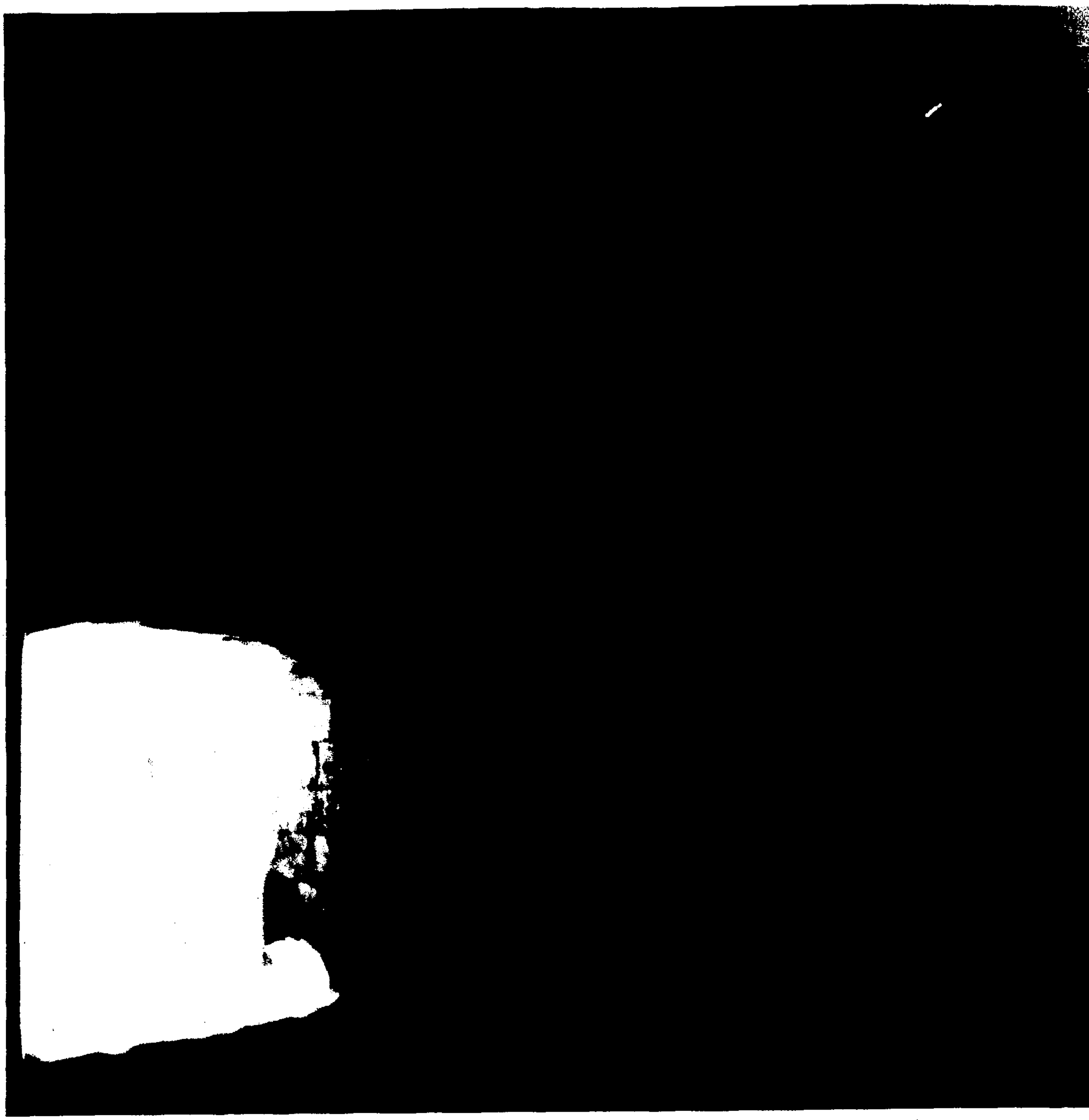


FIGURE 3-3

In January 1971, an AUTOSEVOCOMM (Narrow-Band Subscriber Terminal) unit was installed to provide secure telephone communications.

The first of two Bell Telephone System Foreign Exchange (FEX) lines was installed in the Evaluation Directorate in April 1971. The phone had three extensions and had a Washington, DC number. In September 1971, a second FEX line was installed with extensions in both the Commander's office and the Evaluation Directorate. Approval of these two lines was based on the significant increase in support that this organization was providing the HEXAGON Program.

During July 1971, an additional full-time data/TWX line was added, thus increasing our data sending/receiving capability by 100 percent. There was no increase in TWX capability at this time, however, since the actual TWX unit was not installed until March 1972. In December 1971, new DS 4800 Data Modems were installed which again increased the sending/receiving data capability by approximately 33 percent.

The unclassified Dial CORN TWX unit was removed in approximately March 1972, and a new Western Union unclassified TWX was installed. This unit was located in the Evaluation Directorate's Operations Center (Room 73A) and was used for direct CORN communications with the contractor, Data Corporation. This new CORN TWX was operated by personnel from the Evaluation Directorate.

The last increase in manning occurred in March 1973 resulting in a peak force of four comm center and two cryptographic maintenance enlisted personnel. All Communications Center personnel were officially assigned to the 1814 Communications Squadron at the Pentagon and were then unofficially given "attached duty" at AFSPPF. This action was taken to protect the fact that this organization had any dedicated communications capability.

With the announcement in October 1973 of the planned deactivation of AFSPPF, a workload survey was performed by Master Sergeant Henry Leighow, NCOIC of the Communications Center, to program for the release of equipment no longer required to complete the mission. Based on his study, one of the Univac 9300 Computers was scheduled for removal in May 1974 to reduce the expense both in manpower and monies of the communications support provided. Next the AUTOSEVOCOMM was removed in June 1975. A Dial TWX circuit directly connected to the Pentagon and secured by a KW-7 Cryptographic Unit was installed in July 1975. This installation allowed for removal of the second Univac 9300 in August 1975 since a data capability was not absolutely essential once the Evaluation function was transferred to Washington, DC. This new Dial TWX provided sufficient TWX capability. Again, because of the relocation of the Evaluation function and its correlated reduction effect in communications, one of the FEX telephone lines was removed in August 1975.

The Communications Center was closed in the late fall of 1976. All cryptographic equipment was returned to Det 1, Washington, DC and the contracted telecommunication equipment turned back to their respective companies. Figure 3-4 shows the Communications Center equipment as it was in 1970.

SHIPPING ACTIVITIES SECURITY

The task of receiving and disseminating system classified materials pertaining to the various National Reconnaissance Programs (NRP) was the responsibility of the TALENT Control Officer (TCO)/ BYEMAN Control Officer (BCO), also referred to as the SAO Officer, the Security Officer, or the Special Projects Officer. Authorized access plus a strict "need to know" concept have always been the governing factors for the handling of these NRP products. Specific instructions on the preparation and distribution of the NRP materials are detailed in separate manuals for the B[84] and TK[85] Control Systems. Since the early 1960s, all NRP products have been triple wrapped with the outer wrapping marked so that there was no way one could discern the contents or classification of the package. There are also many other directives used in the operation of packaging, addressing, controlling, and the transportation of classified materials; i.e., an address roster for all worldwide facilities that have authorization to receive TK and B materials;[86] use of a customer/color code format when ordering, sorting, and shipping materials;[87] specific instructions on the preparation of materials to be shipped to foreign customers through the trans-shipment point at NPIC;[88] guide on how to use the Armed Forces Courier Service (ARFCOS);[89] etc.

From 1960 thru 1963, there was no heavy volume demand on the Security Section and the function of receipt, control, and dissemination of compartmented materials was handled by the three men assigned to the Special Projects Office (SPO). The actual receipt, wrapping, and storage of outgoing products were performed in the original security area (Rooms 71 and 71A), which later became the mission extraction section of the Evaluation Directorate. For the first several SAMOS missions the original material was delivered to Westover AFB by military aircraft and, after completion of the reproduction, the duplicates were transported to the customer again by military aircraft. Whenever a requirement existed to transport material between AFSPPL and Eastman Kodak at Rochester, NY, a team of two couriers would be dispatched in a private automobile from this organization to deliver or pick up the material.

With the Facility's involvement in the duplication and evaluation of the CORONA Program, increased demands were placed on the SPO. As a result, a special shipping section under the TCO/BCO was established in 1964 to handle all receipt and shipment of compartmented materials. A new vaulted area (Room 64) was completed in July 1964 to house the new Shipping Activities Section. This function was

84 DoD Instruction S-5210.51(MI), Aug 66, BYEMAN Control System Manual. (S)
85 USAFINTEL Manual 201-4, 12 Nov 73, The USAF Implementation of the DoD TALENT Control System. (TS)
86 DIA Document DS-6C2, June 74, TCO/BCO Address Roster. (S)
87 EXSUBCOM Memo, 22 April 1975, Customer/Color Code Revision. (S)
88 Message, SPECTRE 4579, 22 Mar 73, Specific Instructions on Shipping TK Material to NPIC. (TS)
89 Memo and Guide, 18 April 75, General Information Concerning ARFCOS. (U)

EQUIPMENT WITHIN THE COMMUNICATIONS CENTER

(January 1970)


FIGURE 3-4

co-located in the same area as the Security Section. Eight personnel, four lieutenants and four enlisted members were assigned to the section. The officers handled the administrative aspects and performed all courier duties, while the enlisted were responsible for all packing and wrapping.

From 1964 to 1971, the original material was picked up at Eastman Kodak by two lieutenants in a commercial truck which was supplied to the Facility by Data Corporation, Dayton, Ohio, through an existing contract. The officers who were specifically assigned to this organization as designated couriers were not replaced upon completion of their tours. Instead, some were reassigned in vacant operational positions in accordance with their background and knowledge of the Facility mission. To fill the requirement for couriers, all assigned officers below the rank of Major were put on a detail to act as the senior courier, and all E-7s and above were detailed as assistant couriers.

Upon completion of the reproduction by the laboratory, the Shipping personnel would package, control, and transport the material to the flightline for loading on a special designated military aircraft known as [redacted]

In August 1970, the specially configured truck being contracted through Data Corporation was replaced by a truck supplied to AFSPPF under a black contract which SAFSS had with Eastman Kodak. The mission of this truck remained to transport materials (film and equipment) between AFSPPF and EK. In 1971, with the voluminous increase in workload and corresponding longer production time associated with the HEXAGON reproduction requirements, it was felt that AFSPPF could not respond within the required time if they were forced to lose a day waiting for the original materials to be trucked from Eastman Kodak.

[redacted]

[redacted]

FIGURE 3-5

[redacted]

Controlling/receipting has always been the most tedious and time consuming task in the shipping function. Days could be added to the production schedule just to ensure proper receipting. With the advent of the HEXAGON Program production, it was obvious that the method of controlling/receipting had to be improved. The immediate "fix" was to increase the number of personnel (from four to nine); however, this did not solve all the problems. Under the present manual method of receipting for the material, NPIC had to totally repackage and recontrol all material upon receiving it in Washington, DC. To resolve these problems Major Smiley developed an idea of producing a computerized shipping manifest for each customer which would eliminate the manual receipting at AFSPPF and the need for repackaging and controlling by NPIC. AFSPPF took the initiative by assigning Computer Systems Analyst (Captain James Hill), a computer programmer, and the NCOIC of Shipping to develop, test, and implement this automated shipping document system. The success of this new procedure resulted in the saving of as much as two days in the packing of a HEXAGON mission, and in several instances the final packing was completed two or three hours after the laboratory accepted its last duplicate reproduction. This new system also allowed NPIC to merely add the new address to each package.

With the reduction of the AFSPPF mission and the success of the computerized shipping document procedure, the Shipping Activities Section was reduced to one NCO in August 1974. In March 1975 with the shipping/receiving tasks being essentially routine, the volume of requirements at a minimum, and the effects of programmed reduction in AFSPPF manning due to the phasedown being felt, a decision was made by the Commander to turn the responsibility of Shipping over to the Production Directorate.

There also existed the requirement to receive and ship classified technical evaluation reports, special analysis studies, briefing materials, letters, and documents. Up until 1970, the ARFCOS was the primary means of transporting this material [redacted] was also used if a special priority requirement was approved by SAFSS. However, with AFSPPF's involvement in the vast system of HEXAGON preflight testing, there was an urgent requirement for a time responsive transportation system to carry B materials from Westover AFB to Washington, DC. Mr. Robert Kohler, HEXAGON Acceptance and Post Flight Analysis (PFA) Chairman, made arrangements to have AFSPPF included in the courier system run by the CIA [redacted]

AFSPPF did not have those dedicated options in the movement of TALENT-KEYHOLE documents, as only [redacted] and ARFCOS were used. In several cases there were situations where a project could not be delivered or was delayed at AFSPPF because the necessary documents were enroute somewhere in these systems. Up until 1974 this was a minor problem; however, the decision by DoD to reduce ARFCOS expenditures had a severe impact. Service was provided once a week, but the delivery schedule between the Boston ARFCOS Station and Washington, DC in many instances took up to two weeks to get a package to/from Washington. In 1975 the situation became worse as the delivery schedule was changed to twice-monthly. This change resulted in some packages taking three and four weeks to reach their destination. However, the impact was not as significant as it was in 1974 because of the lesser role played by the Facility at this point in the phasedown cycle.

Other refinements aided in the secure operation of the Shipping function. A conveyor belt system within a concrete tunnel, which was constructed in 1964, modified in 1966, and further refined in 1968, ran from the Quality Control Section (Figure 3-6) to Shipping (Figure 3-7). This system provided the following advantages: (1) allowed Photo Laboratory personnel to forward the completed material in cans directly to the Shipping Section, rather than putting them on a mobile cart and physically transporting them; (2) enabled the Shipping personnel to receive staggered delivery from the lab rather than getting all the material in one batch; and (3) provided the laboratory with a 24-hour a day access to a vaulted storage area.

The Shipping Activities Section was governed by numerous messages, memoranda, letters, manuals, and directives which set the policy for the proper methods of handling the huge amount of classified film and documents received and shipped by AFSPPF. However, without the innovations, perseverance, and

CONVEYOR SYSTEM ENTRANCE FROM PHOTO LABORATORY QUALITY CONTROL SECTION

FIGURE 3-6

CONVEYOR SYSTEM RECEIPT AREA IN SHIPPING ACTIVITIES SECTION

FIGURE 3-7

the long hours of dedicated service of men like Lt Col T. Taylor, Maj C. Smiley, Lt A. Ostdiek, and Sergeants R. Darby, W. Hall, and D. Hoar, the Shipping Activity mission would not have been successful. Figure 3-8 is a picture of the Shipping crew led by Sergeant D. Hoar in the process of controlling and packing the reproduced materials from a CORONA mission in March 1969.

PACKING AND CONTROLLING MATERIAL FOR SHIPMENT

FIGURE 3-8

## SECTION IV

## MAJOR ACHIEVEMENTS

### BACKGROUND

Over the 16 year history of this Facility, a great many projects were undertaken to solve production problems, enhance data extraction and analysis, or to meet unique mission requirements. Certainly one of the most significant features of the organization was its broad range of endeavors and the freedom of action and high level support to pursue the accomplishment of all major mission responsibilities. Established to perform the processing and duplication of satellite photography and related research and development, and cloaked in utmost secrecy, the Facility immediately initiated action to design, modify, and build the equipment, facilities, and expertise necessary to support the strategic interests and mission of the National Reconnaissance Office (NRO) in the area of high resolution photography. Under these general directions and aided by superb financial management and support, AFSPPF conscientiously investigated every facet of high volume, high quality processing and reproduction of photography; the measurement and evaluation of camera system performance; and the applications of advanced developments in materials, equipment, and automation to photographic reconnaissance. Although not all of these efforts resulted in success, there was the knowledge that the particular idea/concept had been carefully reviewed and assessed, providing evidence rather than conjecture as to whether the method or piece of equipment could be used to better enhance the completion of the Facility's assigned mission. It is safe to say that valuable information, whether positive or negative, was gained from every project/program entered into by this organization.

Section IV presents a detailed summary of the major achievements accomplished by AFSPPF. Some of these had immediate impact on the operational mission of the community while others are still on-going and may find application in future systems. These achievements will be written up under the function directorate of this organization which derived the major operational impact of the effort. It should be stated that management/monitoring by the Commander and the Technical Director; engineering supervision from Research and Development; financial, maintenance, and supply support from Logistics; and the installation and utility expertise from Civil Engineering were involved in one or more facets of each and every project.

### DIRECTORATE OF LOGISTICS (LG)

The primary mission performed by the Logistics Directorate was to provide maintenance, supply, and budget support to all Facility activities. Under these responsibilities came the management of the National Emergency Reserve (NER), a classified TALENT-KEYHOLE (TK), Secret Equipment Account. This task was given to AFSPPF in July 1967, although not officially established and assigned until June 1969. The basic requirement was to provide a single point for storage and accountability of unique photographic processing and interpretation equipment in support of NRO activities on a world-wide basis.

The purpose of establishing the NER was twofold: (1) the primary reason was to have vital pieces of photographic processing equipment available to supplement other processing sites under emergency conditions, and (2) to provide storage for specialized, excess processing and evaluation equipment uniquely related to the NER efforts.

This equipment account and the procedures for administering it were outlined and approved in a document[86] signed by Dr. John L. McLucas, Director of the National Reconnaissance Office (DNRO) on 25 June 1969. This directive formalized a procedure that had been in effect in some form as early as July 1967. Historical shipping documentation has shown the importance of this early support, for example, a letter[87] forwarded from Hq AFFTC/FTTSF, Edwards AFB CA showing that AFSPPF was active in supporting the Flight Test Evaluation Program for the SR-71. Although this letter identifies the project or program being supported, most of the documentation does not list the specific purposes for which the equipment was to be utilized. The impact of the support provided to other photographic processing organizations by this Facility during the early years can best be demonstrated by the information provided in Figures 4-1 thru 4-3. These figures represent the support to various organizations from FY 65 thru FY 67. It is evident from these figures that AFSPPF played a key role in supporting the reconnaissance effort in Southeast Asia during the buildup in Vietnam.

It should also be noted that other types of logistics support were performed by AFSPPF during the 1967 - 1969 period. NER equipment as well as chemicals and film were being shipped to contractors (FMC, Data Corp, HF Corp, Technical Operations, Inc., etc.) for joint project development.

In 1969, it was decided by the NRO Staff that a single point of control for NRO equipment items was necessary to provide efficient support to all world-wide NRO facilities. The 25 June 1969 Directive referenced earlier defined the requirement for the NER as follows: "The NRO Staff is responsible for maintaining the reserve of equipments outlined in "Annex C" of the OPIC agreements dated 26 February 1965. Quantitative requirements for the types of equipment outlined will be as mutually agreed upon by the NRO Staff, the CIA, and the DIA." This document defines the types of equipment to be stored in the NER in the following broad terms: "the equipment maintained in the NER should represent the latest current state-of-the-art equipment as used (or planned for production use) at the NRO fixed processing facilities."

86 Directive, DNRO, June 1969, Establishment of NRO Photographic Materials and Equipment Responsibilities, BYE 12285-69. (TS)

87 Letter, HQ AFFTC, 25 Sep 1967, Updating of Custody Receipts, (Appendix, Item 29). (U)

FY 65 LOGISTICAL SUPPORT
(dollars)

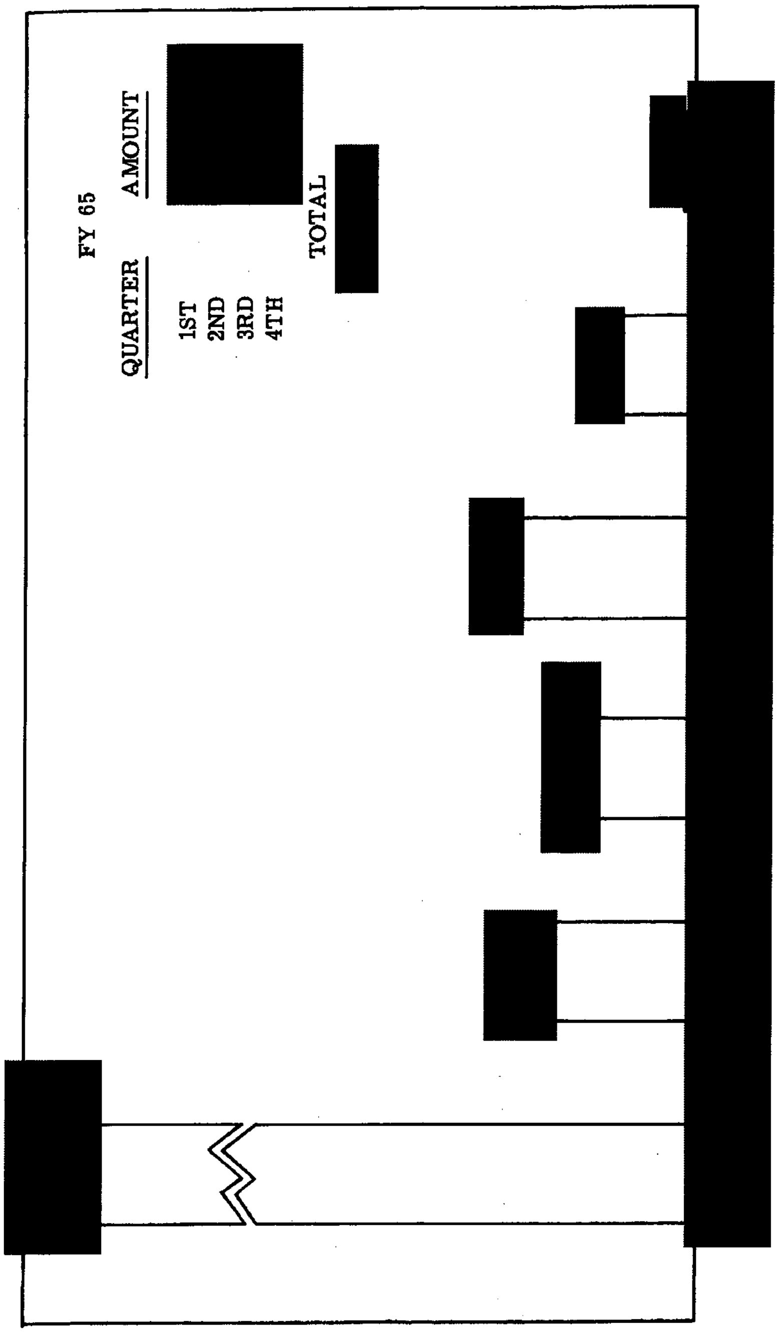
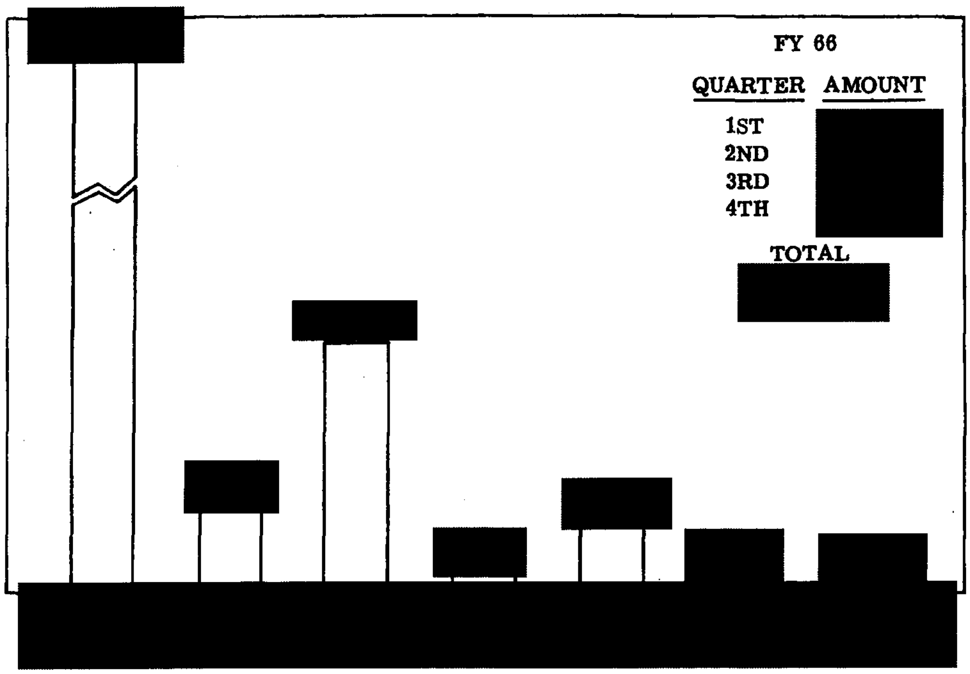



FIGURE 4-1

FY 66 LOGISTICAL SUPPORT

- Dollars -




- Pounds -

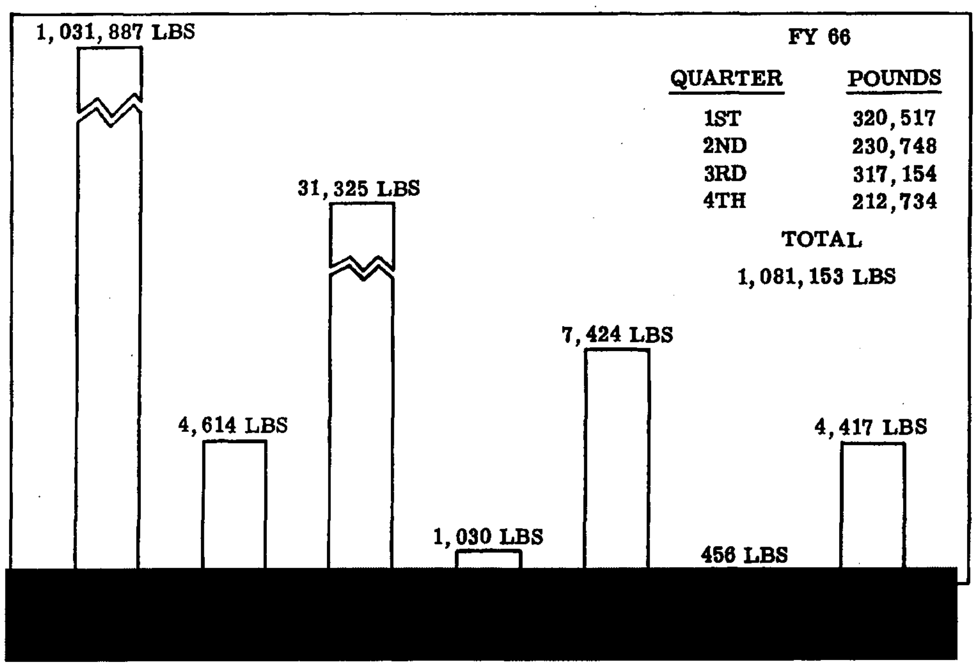
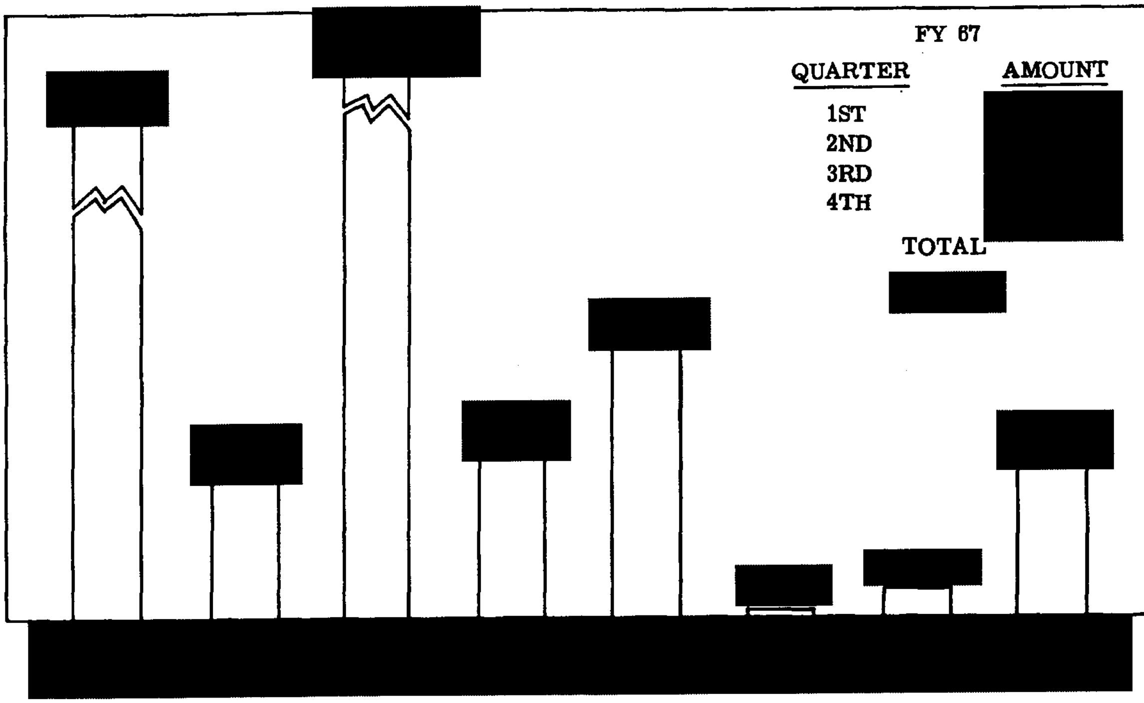



FIGURE 4-2

FY 67 LOGISTICAL SUPPORT

- Dollars -




- Pounds -

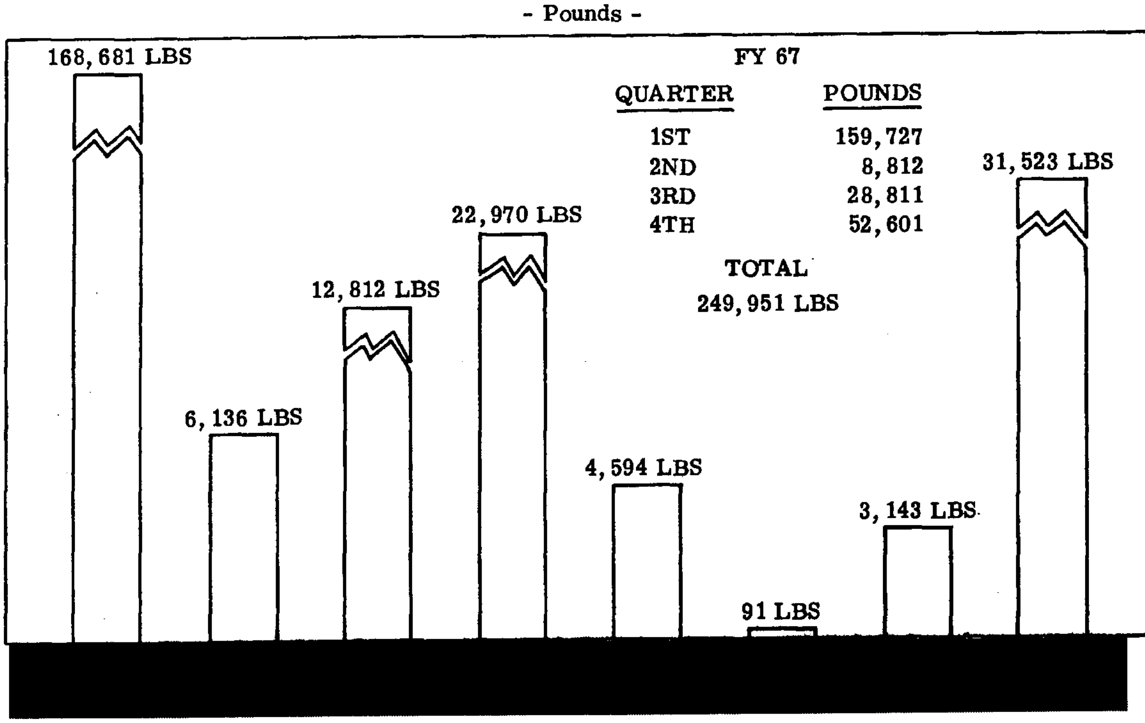



FIGURE 4-3

The management responsibilities were as follows: "the AFSPPF at Westover is designated NER Inventory Manager. All equipment assigned to the NER will be maintained on a computer inventory at the AFSPPF. Equipment assigned to the NER will be warehoused at EK, Rochester or temporarily held elsewhere. These later items will be arranged for by mutual agreement between AFSPPF and EK or the organization involved, but will be carried on the AFSPPF inventory." The directive also states that all excess NRP equipment items will be shipped to the NER at AFSPPF. Once the equipment is received it will either be stored in the NER or disposed of as excess to the NRP. Regarding excess items the directive states: "AFSPPF will be responsible for inventory control of excess items, rehabilitation (if required), warehousing, and shipping of items as required." The responsibilities for maintaining the equipment in the NER were assigned as follows: "repair will normally be accomplished by the user. Requirements beyond the user's capability will be reported to AFSPPF for resolution. Overhaul of NER equipment will be accomplished under the direction of AFSPPF. The AFSPPF will establish inspection and reporting procedures for overhaul funding and scheduling. If possible, replacement/spare parts for NER equipment will be obtained through normal supply channels. In an emergency situation, spares may be requested from AFSPPF." Budgetary responsibilities for the NER are defined: "as new equipments are developed and phased into production use at the NRO fixed facilities, a determination of their applicability to the OPICs and/or the NER will be made by the NRO Staff. Those new items deemed applicable will be budgeted, funded for, and identified separately as NER equipment reserve."

Procedures for withdrawal of equipment from the NER are: "items assigned to the NER are under the control of the DNRO and will only be released at his direction and to those organizations within/or outside the NRO as he may direct."

The document also stated that: "equipments identified as NER may be used by AFSPPF and EK in the accomplishment of their assigned missions so long as these equipments are available for emergency packing and shipment as required."

The term "excess" meant: "items may be released when needed to support any program of the NRO or to supplement or expand the capability of an OPIC." The procedure for obtaining these items was to have the program directors request release of the item from the NRO.

With the signing of this DNRO Directive, the responsibilities of all parties possessing NER equipment were defined for the first time. More specifically, procedures were outlined for the release, receipt, and use of this equipment. The release of NER equipment had not actually been at the direction of the DNRO, but his designated representative (Col Hoy succeeded by Col Owens) since 1970.

The special equipment account has been used to support the following organizations since 1970:

[redacted]

The most significant contribution the NER has made to the NRO mission has been the release of equipment to EK and AFSPPF for support of GAMBIT and HEXAGON photographic production. An example of this was the delivery of a Fultron Film Processor to EK for modification from spray to viscous developer. After modification this processor was sent back to AFSPPF for installation. This modification proved so successful that the Trenton Film Processor also installed at AFSPPF was modified to viscous. Another example of normal mission support provided by the NER took place in August 1973 when AFSPPF sent two HEXAGON Presplice Dollies to EK for use on Mission Segments 1206-2, 3, & 4.

The NER also provided support to the IDEALIST Program. In 1970 and 1971, a Versamat Film Processor (SN 8142) used for black and white materials and a two strand viewing table with microscope was shipped to the Goodyear Aerospace Corporation, Litchfield Park, Arizona marked for Project Senior

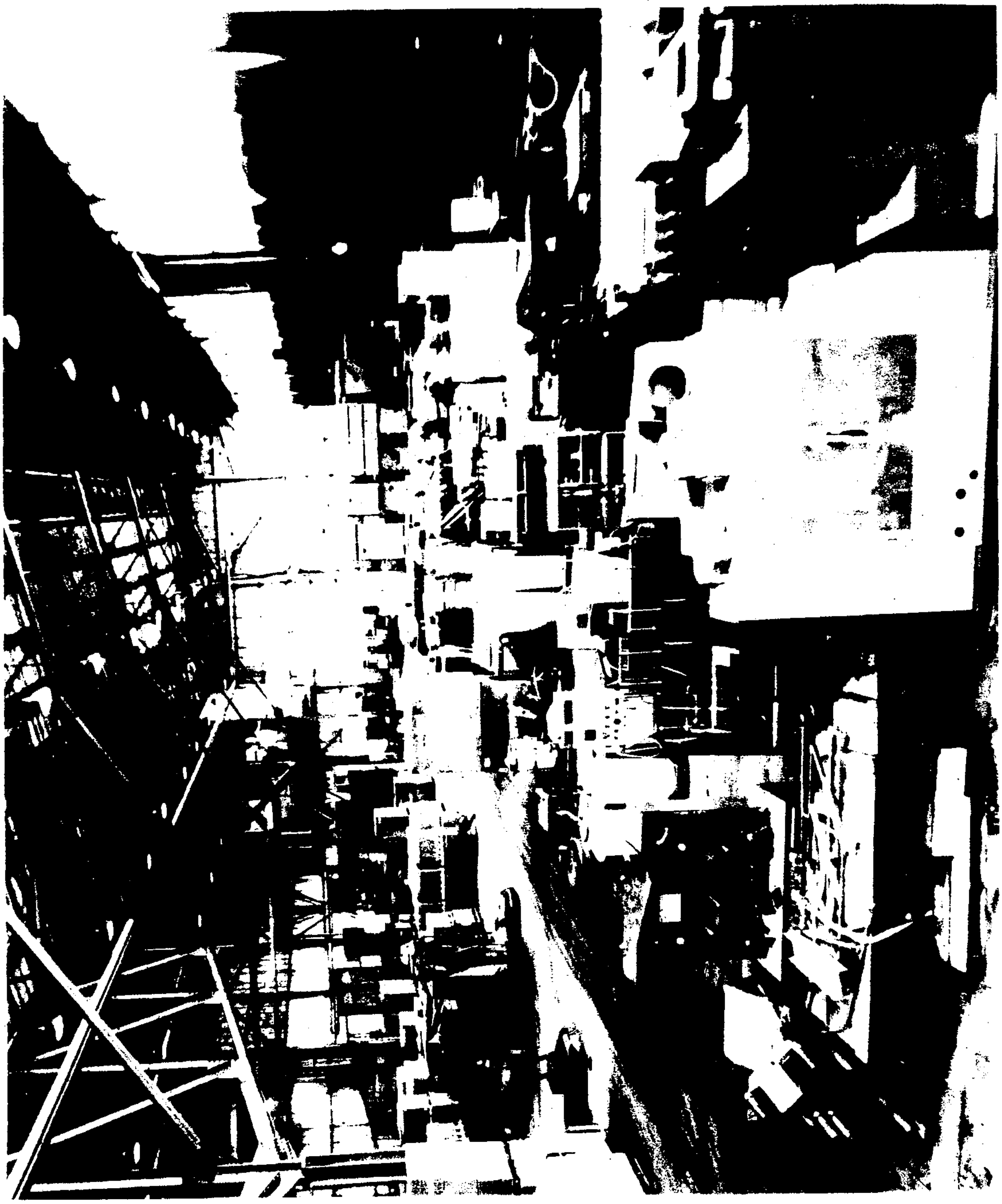
Lance. In January 1971, a Fullflo Filter Unit P/N WYFTSS was shipped to Edwards AFB CA to support a photo processing facility. In August 1971, a viewing table with an electric drive (FSN 6750-181-0991 PK) was shipped to Warner Robins AFB (FX2399) GA marked for Project Senior Year. In October 1971, a Film Titler (FSN 6740-941-8808) was also shipped to Warner Robins AFB.

AFSPPF also supported a Certification ORI at the 548th RTG in Hawaii in the spring of 1971 by forwarding the following NER equipment: Clinton Cleaner Waxer, Versamat Model 11-2 Kit, 12 Dexter Film Spools, and a Calumet Sink.

Another type of support provided from the NER was the ability to provide Government Furnished Equipment (GFE) to numerous contractors working on NRO research and development contracts. The two companies that received the majority of this GFE support were EK and Photo Horizons. One program for which EK received support from NER was the Cayuga Printer Contract. In April 1972 two Niagara Printers were shipped to EK to be used as the chassis for two of the newly developed Cayuga Printers. The Cayuga is now the production printer for all GAMBIT mission production at both AFSPPF and EK. Photo Horizons Corporation received many pieces of equipment from NER over the years to support the Free Radical Film Program. When this program was cancelled these items were returned to the Government and placed back into NER or redistributed to other NRO organizations and/or contractors.

From 1969 until 1971, the NER grew until there were over 100 units of equipment stored at AFSPPF. It became so large that storage space became critical. In September 1971, an effort was made to reduce the size of NER by declaring certain equipment items excess and shipping them to other NRO organizations that could utilize them. Although the review was conducted and some items redistributed, this action achieved only minimal success. In 1972 and 1973, the size of the NER remained at approximately 120 units. Storage space continued to be a major problem, as AFSPPF never had an adequate facility to store a large volume of precision photo production equipment. From 1971 thru 1973, the NER equipment was stored in Nosedock 7 (Building 7504) on the flight line at Westover AFB, see Figure 4-4. This building was designed as an aircraft maintenance facility for B-52 and KC-135 aircraft. It was constructed of sheet metal with extremely limited environmental control. In the winter time it could be heated to keep the temperature at a desired level (approximately 50 degrees), but in the summer there was no air conditioning/humidity control and the temperature would frequently exceed 100 degrees F. As the Overseas Processing and Interpretation Centers (OPICs) were phased out, the NER received less and less requests for equipment movement. This along with other factors led to the decision to conduct another review for determining excess equipment. These factors were:

A. Limited storage space at Westover was compounded by the changeover of the Base from SAC to AFRES. As a result of this action, storage facilities presently being utilized by AFSPPF were declared



NER STORAGE IN NOSEDOCK 7, BUILDING 7504

FIGURE 4-4

excess in areas which were being turned over to the surrounding civilian communities. Because of the loss of these buildings, the FX Supply Account was lessened and NER storage space available was reduced from 60,000 to just over 20,000 square feet.

B. Possibility of valuable photo equipment stored for a long period of time in a non-environmentally controlled building becoming damaged by deterioration.

C. Reduction in requirement for a large NER because of the phaseout of many operating locations. These phaseouts were due to the lesser involvement of the NRO in the "air breather" programs (U-2 & SR-71).

This review took place on 19 November 1973 and was different from the 1971 review in that organizations other than those directly under the NRO were involved. As a result of this review, NER was reduced to 42 line items. The excess equipment was disposed of as follows:

A. Those items which were not selected were sent to Redistribution and Marketing (R&M), now called the Defense Property Disposal Agency. The major items in this category included two Houston Fearless EH-67 Processors, a D. W. Mann Microdensitometer Console, and a Micro-Wave Film Dryer.

B. Customers requesting and receiving equipment as a result of this review included DIA, Environmental Protection Agency (EPA), Air Force OOAMA Depot at Hill AFB, EK, and NISC.

C. Some items were reclassified and issued directly to AFSPPF (Directorates of Production and Research and Development).

D. Other NER items were converted to warehouse assets.

From mid 1975 the NER has been maintained primarily to support NRO contractors and is projected to carry that mission in the future. The last item issued from NER was the Visual Edge Match (VEM) machine and table sent to EIKONIX Corporation as GFE in support of an R&D contract to automate the VEM edge selection process.

In the early years the NER was small enough to be managed by a manual stock record control system. However, it began to expand at such a rapid rate in the late 1960s that Captain A. Ashe, Director of Logistics, coordinated with Captain D. Watson of the Evaluation Directorate in designing a computerized program listing. The features of this flexible program were that IBM cards were key punched on each line item which enabled complete nomenclature, description, and physical locational data for each piece of equipment. The program was written to provide a two-part listing. Part I reflected each individual item in the account and indicated whether it was at AFSPPF or on loan while Part II listed the specific location (Eastman Kodak, Houston Fearless, EIKONIX, Westover AFB, etc.) of each piece of equipment.

The program was written in COBOL Language and made compatible with the UNIVAC 9300 Communications transmittal equipment. This provided a quick and easy means of sending information on any specific piece of equipment or the total inventory of the NER to the designated users. The source cards were posted daily and therefore the deck was available for printout at any required time. As a minimum it was produced quarterly with copies being transmitted to the NRO (Colonel Owens) and Eastman Kodak (R. Koch).

Although the Logistics personnel assigned as NER monitors (Staff Sergeants Bishop, Williams, and Martin) updated the listing after each change/negotiation, a complete inventory was required semiannually by personnel detailed from other directorates within AFSPPF. The listings themselves provided the following categorical information: the major noun descriptor, the complete nomenclature, the manufacturer, the stock number, the local warehouse storage area or the name of the on-loan organization, and the total number of units for each line item.

Many personnel throughout the years were responsible for developing and successfully managing the National Emergency Reserve, but it was Captain William Gaeth and Senior Master Sergeant Joseph Harris who bore the bulk of the responsibilities. For it was under their tenure in the 1970s as Director and NCOIC of Logistics that the inventory grew to 145 individual items with a total worth of over [redacted] They coordinated the two NER equipment reviews at Westover AFB, arranged for the receipt of incoming and the packing and transportation of outgoing equipment, and maintained control over this valuable asset as AFSPPF representative to the NRO Chairman.

A meeting took place on 10 and 11 August 1976, the outcome of which had impact on some of the items programmed for the NER. This meeting was scheduled as a result of a HQ USAF decision to retain Building P-1875 for the establishment of an Air Force Reserve (AFRES) reconnaissance technical facility. The overall plan is to develop a peace time mission which will involve photographic processing and imagery exploitation to better train the Reserves for field operations.

To give assistance and support to this effort, Colonel L. Butt, the NRO representative at this meeting, approved the transfer of 12 items from the NER to this new AFRES organization. These items included: two B&L Zoom 70 Microscopes, an EK 10X - 20X - 40 Enlarger, an 11CM Black and White Versamat Processor, two Richards 940 Light Tables, and different types of processor adapters and mixing tanks. This equipment is valued at [redacted]

Captain T. Wilkinson, Director of Logistics since April 1973, will be responsible for coordinating the transfer of the remaining NER equipment to [redacted] in the fall of 1976. It is anticipated that the NER will be managed under the same guidelines as it was under the control of AFSPPF.

DIRECTORATE OF CIVIL ENGINEERING (DE)

The primary mission of the Directorate of Civil Engineering was to plan, control, and record all civil engineering programs and construction projects; maintain and operate all real property equipment assigned/affixed to this Facility; and supervise the operation of the water and waste, refrigeration and air conditioning, and power production functions. Three specific achievements stand above the many others accomplished by this Directorate. These were: (1) the Silver Recovery Program, (2) Industrial Waste Treatment Plant, and (3) attaining a self sufficient utilities operation.

- Silver Recovery Program -

Although the economy of recovering silver from the photographic process had been recognized for many years, it was not until the middle 1960s that the Air Force in conjunction with three contractors started a major silver recovery program. In 1966, AFSPPF, in cooperation with Eastman Kodak (EK), Fairchild Hiller, and Food Machinery Corporation (FMC) developed a sophisticated, efficient system to reclaim silver from both hypo and used film. The silver was reclaimed through an arrangement with EK who received the raw silver wastes from AFSPPF, processed them, and then credited the value of the silver to the NRO Film Purchase Account.

In the early 1960s, AFSPPF dumped all photographic wastes, which at that time were untreated, into the storm drainage system which emptied into the Chicopee River. In 1966, a major program was started to clean up the water pollution caused by the Facility. The program continued to 1974. The incentives for developing this program were:

A. The monetary value of reclaiming the silver and keeping it available for reuse.

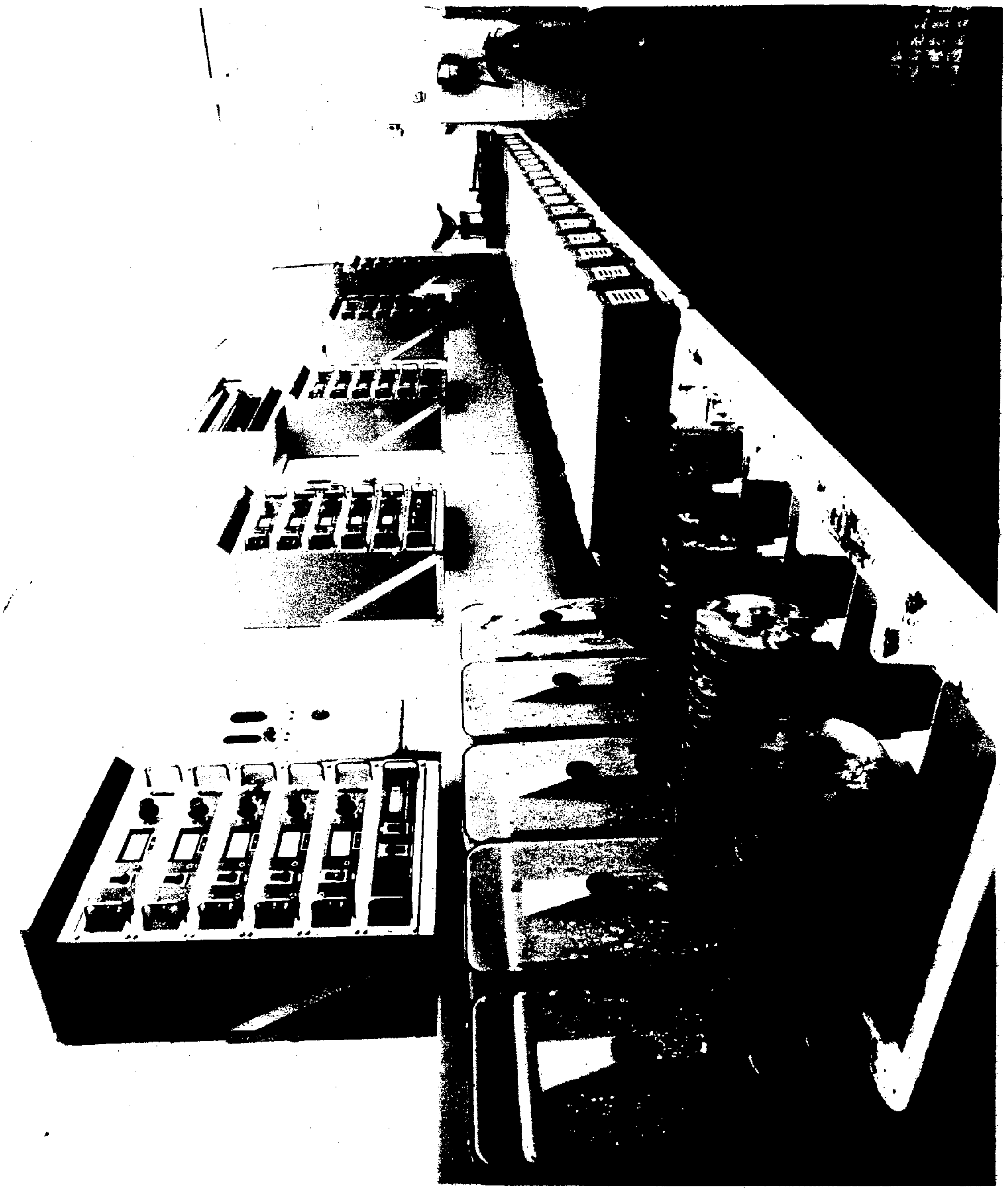
B. The cost savings achieved by extending the life of the hypo through a means of controlling the silver level.

C. The elimination of the water pollution problem caused by discharging contaminated wastes into the surrounding streams.

D. Protecting the photo production mission of the Facility, as the amount of water pollution indicated that there could have been a large scale photo processing plant in P-1900.

E. The need for a classified destruction capability to dispose of used film, again to protect the security of the Facility mission.

The first significant step in the Silver Recovery Program was taken in 1966 when Anderson-Nichols & Company, the designers of the Facility, and EK installed the steel wool Ion Exchange Silver Recovery System, see Figure 4-5. The spent hypo flowed through a series of four stainless steel drums packed with steel wool in removable containers. The silver replaced the steel wool by an ion exchange action and the desilvered hypo was discharged into the storm drainage system. While reclaiming silver, this system



ION EXCHANGE SILVER RECOVERY SYSTEM

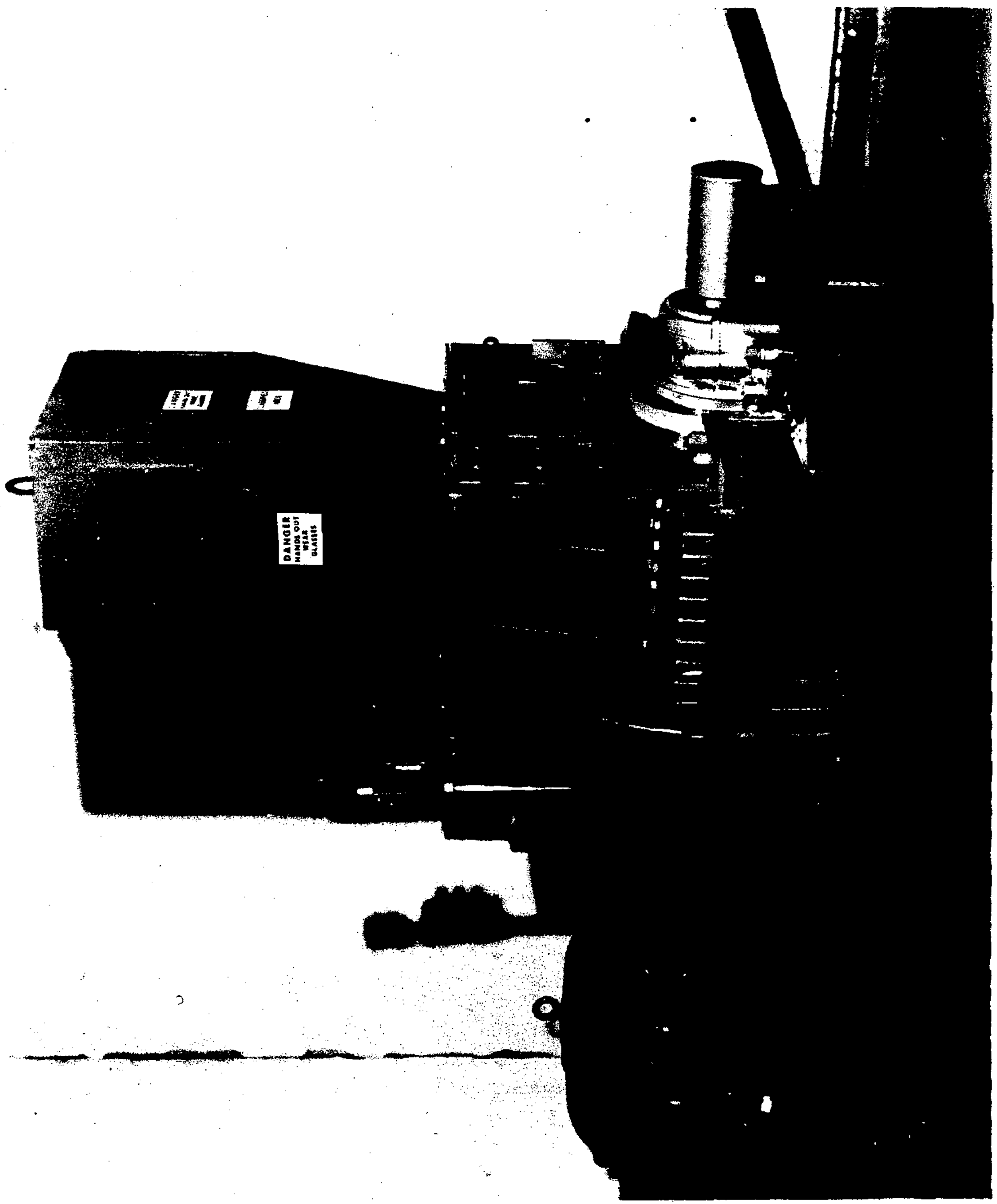
FIGURE 4-5

was far from optimal because of the remaining problems of water pollution and the fact that it was a labor concentrated and very messy process. The Ion Exchange System was salvaged in 1970.

The next step was the development of a Mulcher-Incinerator System under contract with Fairchild-Hiller. This served as a classified waste destruction system for disposing of used film and other classified material. The system became operational in 1970. The recovery of silver from the incinerator ash was really a process by-product. After several attempts at building a mulcher capable of taking a despooled roll of film and chopping it into pieces fine enough to completely burn, the present Blo-Hog Mulcher was developed, see Figure 4-6. This mulcher was joined to a standard three-chamber incinerator equipped with gas burners and pollution control devices. A picture of the incinerator with the scrubber unit and control panel can be seen on page 3-13. The capacity of this Mulcher-Incinerator System was 250 pounds/hour. In fact, the capacity was limited by the incinerator. It was estimated that approximately $74,000 worth of credit was gained in the NRO Film Purchase Contract with EK from the silver recovered from the incinerator ash during the period of FY 72 to FY 76. This system will be left as real property to the building when it is turned over to the Base on 1 January 1977.

The next major step in the program was the installation of the Electrolytic Silver Recovery and Hypo Conservation System designed and installed by FMC. A final report[88] on this upgraded system was written by FMC in July 1973. This system was the first big step toward the elimination of water pollution from the Facility. The system utilized a series of Rotex Units to deposit silver on rotating stainless steel disks for later removal. The hypo was piped from the processors through the electrically controlled Rotex Units where the amount of silver removed from the hypo was carefully controlled and monitored. The Chemical Mix area added fresh hypo to the circulating supply of refined hypo. This allowed the processors to operate under the critical specifications for hypo solutions. In the original installation, part of the Ion Exchange System was utilized to strip the remaining silver from the small amount of hypo that was bled off to allow the proper chemical ratio. After this stripping operation, the hypo was discharged into the storm drain. In addition to the high quality silver plate recovered, great economy was achieved by this process since it greatly reduced the amount of new hypo that had to be mixed and utilized during mission operations. The final modification to this system consisted of using one of the Rotex machines as a "Tailing Unit" to replace the Ion Exchange Stripping Unit. The system worked well and remained in that configuration until the Industrial Waste Treatment Plant was completed in 1974 when the refined (desilvered) hypo from the "Tailing Unit" was diverted to the plant for disposal. Approximately $105,000 worth of silver plate was credited to the NRO Film Account by EK between FY 72 to FY 76. Figure 4-7 is a picture of the Electrolytic Silver Recovery and Hypo Conservation System. This silver recovery system was dismantled and

[88] Final Report, FMC, July 1973, Upgrading of Silver Recovery System. (U)



BLO HOG MULCHER

FIGURE 4-6

ELECTROLYTIC SILVER RECOVERY AND HYPO CONSERVATION SYSTEM

FIGURE 4-7

reinstalled at the 544 TMS in the fall of 1976 by EK representatives.

- Industrial Waste Treatment Plant (IWTP) -

From the beginning of large volume photographic processing operations in P-1900, the same water pollution problems common to all photo processing plants were present. The Water Quality Act of 1965 was the beginning of serious pressure to clean up the water pollution problems. The increased awareness and possible investigation of the previously undetected sources of water pollution were the impetus for action to clean up and/or disguise the effluents to protect the fact that this building had the capability of performing large scale photo processing. USAF programs for silver recovery from photo waste and efforts to generally clean up the water discharged from bases also helped move this organization toward an industrial waste treatment program. In 1968, an in-house research project was begun to develop methods for effective treatment of liquid photographic waste and to substantially reduce water consumption in the Facility's photo laboratories. The project, directed by Mr. George Hunter, Chief of AFSPPF's Research & Development Division, was accomplished by the Food Machinery Corporation, Santa Clara, California with Mr. Erik Thuse and Mr. Donald Watson as the principal contacts. Phase I of this project provided the conclusion that the most reasonable approaches to the problem would be: a type of electrolytic silver recovery to minimize both hypo usage and toxicity of the waste; (2) a wash water recovery by Reverse Osmosis Units to reduce the volume of waste (by 50%); and (3) to develop a method of concentrating the remaining waste to solid form for disposal. Phase I was completed in 1969. The next step was to have AFSPPF prepare performance specifications, select appropriate equipment, design the configuration for a pilot plant, and calculate an itemized cost estimate. This information was presented to SAMSO who then directed AFSPPF to proceed with a 1972 MCP project entitled Industrial Waste Treatment Facility, Westover AFB. Using the Phase I FMC study as basis for the design, S&T Western, Incorporated was selected to design the plant and to provide the operation and maintenance manuals for this prototype plant. The design was completed in March of 1972 and construction started in July 1972. The project, estimated to to cost approximately [redacted] included the construction of a 5,800 square plant facility, two intermediate transfer stations, and an underground piping system which interconnected all three. The intricate corrosion resistant piping system and pumps were prime factors in the high estimated cost provided by the construction contractor (Hart Engineering Company). In the interim while the plant was being built, an effluent collection system was installed in P-1900 to provide gravity feed of the processing waste to the intermediate transfer station located in P-1900. This collection system was designed by EK and installed by the Valley Electric and Heating Company.

The Industrial Waste Treatment Plant was accepted and put into operation in August 1974. The original design concept envisioned an around-the-clock operation, separate treatment of color and black and white processing waste, and the reuse of the water. The phasedown of the AFSPPF mission radically altered those concepts. Although the plant was designed to process up to 50,000 gallons per day (gpd), waste flow was being processed at a rate of 10,000 gpd during photo plant operations. This forced the IWTP into an intermittent operation with resulting inefficiencies and maintenance problems, particularly in the Reverse Osmosis Units. There was virtually no color processing being done; therefore, the waste was combined with the black and white waste and processed through the same major pieces of equipment. The idea of reusing the water from the plant was abandoned because of possible color contamination of the recycled water. In addition, the cost of repiping the Facility to allow reuse was excessive when compared to the cost of the high quality water which was available to AFSPPF. To preclude possible stream contamination, provisions were made locally to dump the processed water into a sanitary sewer system for subsequent treatment.

The following information was learned during the development phases of this program:

A. Viscous Developer

This waste is extremely difficult to deal with. Although it is thick and hard to pump, it has very few solids. It is incompatible with Vapor Compression Evaporator (VCE) processing. If the viscous developer is boiled off separately in steam kettles, it must be handled very carefully. If it is dumped into the concentrate from the VCE, it dilutes the mix and increases the energy requirements for boiling off the concentrate.

B. Reverse Osmosis Units

These units must be treated with formaldehyde if they are shut down for any length of time. Failure to do this during early operation of the plant caused clogging of the permeators. All efforts to clean the units failed. In February 1976 a destructive test was performed by Polymetrics, Incorporated of Santa Clara, California on one of the clogged permeators. They recommended replacement of the 10 permeators; however, the wash water carried so little chemical waste that it was decided to stop treating the wash water and divert it into the sanitary sewer. This resulted in a savings of $15,000, the cost to replace the permeators.

C. Kettle Condensate System

The original condensers were equipped with copper tubes. They failed and were replaced with stainless steel condensers which worked well during all plant operations.

D. Vapor Compression Evaporator (VCE)

Initially, AFSPPF experienced many problems with both compressors ranging from a leaking steam seal to a broken main shaft. The compressor manufacturer, MD Pneumatics out of Springfield, Missouri, was always able to repair the unit. Fortunately both units were never down for an extended period at the same time; however, the threat was still present. Finally on 20 March 1975, a decision was made by the Command Staff to purchase another compressor to be used solely as a backup. Periodic cleaning of the tube bundle and heat exchanger with a nitric acid flush improved the performance and reliability of these units. In November 1974, a test study was run to investigate the possibility of processing photo waste containing viscous developer. The results were that the tube bundle acted as a collector for the thickener and became totally clogged, see Figure 4-8. The only solution was taking the unit out of the machine and manually scraping the tubes. After all the viscous developer was flushed from the VCEs, the units operated successfully up until the last mission supported by the IWTP. However this test did virtually eliminate the proposed relocation and utilization of the VCEs to the [redacted] which was scheduled to use viscous developer in their photographic processing.

E. Heat Tape

It was found that the electric heat tape provided to keep the fume scrubber piping from freezing was inadequate. After the first winter, an AFSPPF civil engineer strung a low pressure steam line parallel to those pipes in the outside enclosure to keep them open.

F. Disposal of Residue

Although a small RD effort was started to find whether there was any use for the solid chemical waste generated by the plant, none was found. Since this waste was water soluble, care had to be taken in disposal. A local firm was given a small contract to bury the residue in an EPA approved site. Due to the relatively small amounts generated during the life of the plant and the imminent closure of the Facility, further action to find a use for the residue was abandoned.

This pilot plant was successful in demonstrating that water-borne photo waste could be concentrated into solid waste to eliminate water pollution. While the system was expensive from an energy standpoint, it was effective and met all design objectives. If the plant had operated at the designed scale, it probably would have been advantageous to find a commercial use for the residue. In an area where water quality was poor or expensive, reuse of the water would have been practical. Pictures of the IWTP can be seen on pages 2-61 and 2-62.

The Industrial Waste Treatment Plant will be turned over to the AFRES at Westover AFB upon closure of the Facility operation approximately 1 January 1977.

- Utility Self Sufficiency -

AFSPPF created a self sufficient equipment and personnel utility operation capability for the processing of photographic film. This development included specialized civilian and military manning and the construction of a 2,000,000 gallon water storage tank and pumping station, an industrial waste treatment plant, and a 3,000 KW emergency power production facility. The following discusses the evolution of self sufficiency in the areas of electrical power and water supply.

RESULTS OF TESTING FEASIBILITY OF PROCESSING

VISCOUS DEVELOPER WASTE THROUGH A VAPOR COMPRESSION EVAPORATOR

(19 November 1974)

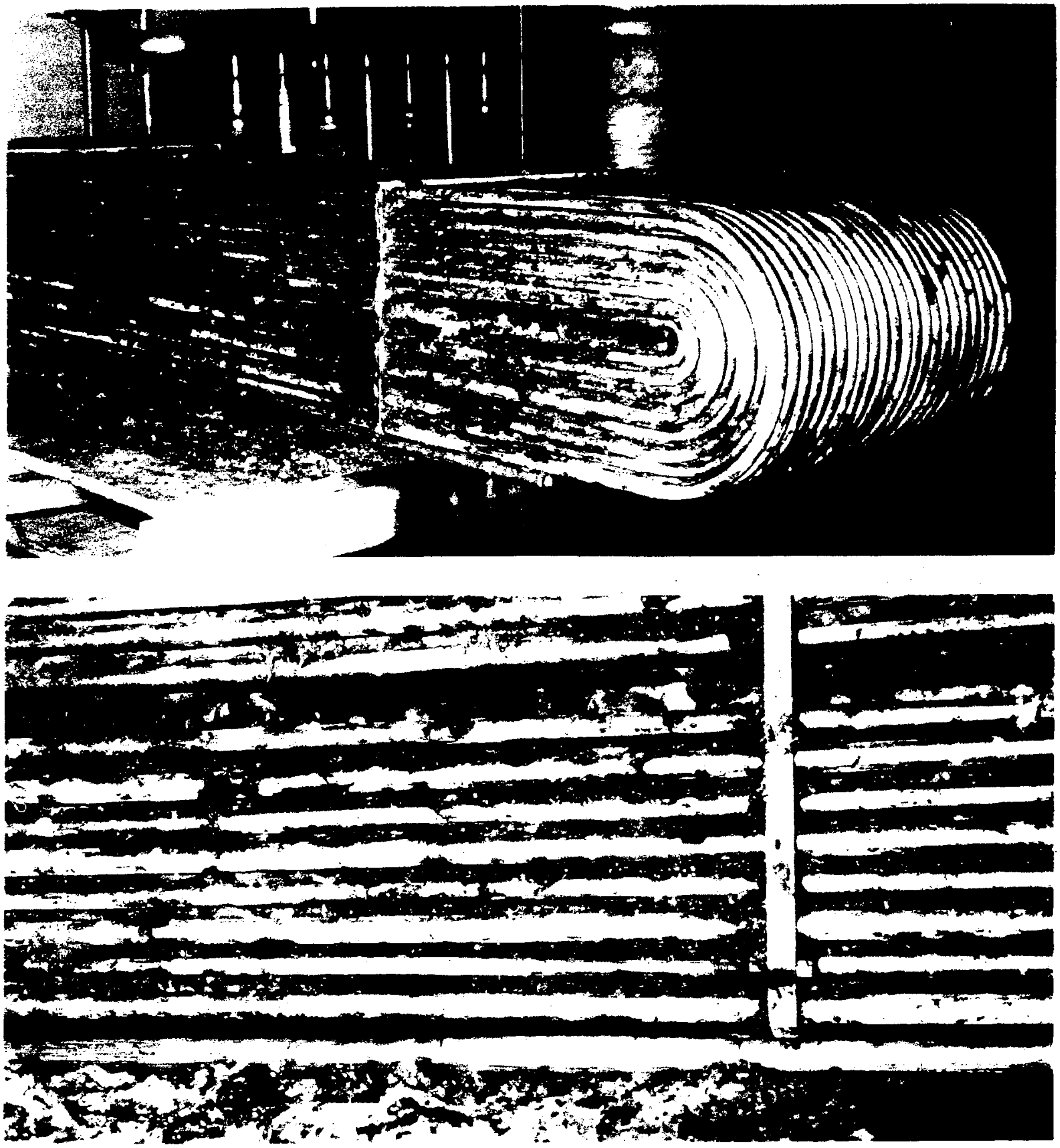


FIGURE 4-8

A. Water System

As the Facility expanded in the mid 1960s, the water requirements became too taxing for the Base system to handle. The Base water supply proved inadequate several times during 1966 with the pressure dropping as low as 10 pounds/square inch against the required 50 pounds/square inch. Since the major problem was the insufficient supply of water, the Command Staff decided to drill a series of deep rock wells to provide a supplemental source to the Base water system. The R. E. Chapman Company of Oakdale, Massachusetts was engaged to drill the wells in a close proximity to Building P-1900. During the summer and fall of 1967, five wells were drilled. Each well was approximately 600 feet deep and capable of delivering 100 gallons/minute. The water found was potable but high in sulphates which made it poor quality for photo processing. After considerable testing and review of the options to refine this water, it was decided that all alternatives were too costly and the wells were capped and abandoned. The next step taken to provide sufficient high quality water to the Facility was the construction of a 2,000,000 gallon, above ground storage tank and a pump station with water treatment equipment and pumps. In order to economize and specialize, the tank and pump house construction was offered to bidders separately. The R. H. White Construction Company built the tank at an estimated cost of [redacted] nd the Hundreds Corporation won the bid to construct the booster pump house at a cost o[redacted] The actual combined total cost was [redacted] Construction began in December 1971, was completed in December 1972, and accepted in June 1973. The project was successful in providing an independent water supply capable of supporting all current and projected mission processing requirements. A picture of this Water Storage and Pump House Facility can be seen in Figure 2-31, page 2-64.

B. Electrical Power

As the processing mission of AFSPPF increased with additional support requirements for GAMBIT and CORONA, it became apparent that there was a need for the Facility to become basically self sufficient in the area of electrical power. The original configuration of the Facility included a 500 KW diesel generator for backup power. This capability was totally inadequate to meet the electrical load which reached a 2,000 KW load range at the height of mission operations. While the commercial electrical system had proved reliable, variations (surges/"brown-outs") did occur which affected the operation of the data computers and microanalyzers, but more importantly the photo processing equipment which could have meant destruction of portions of irretrievable, original imagery. For these reasons, programming action was started in June 1966 to provide adequate and stable backup power for the Facility. The decision was to build an emergency power plant addition onto P-1900. Anderson-Nichols & Company was chosen to design the power plant. The result of thei[redacted] work was the design of a 4,420 square foot area which would house three reconditioned Worthington 1,000 KW Model SDR-8 Diesel Generators and associated switch gear. The design of this plant would allow either independent or parallel operation with commercial power. A FY 68 MCP Project was developed, presented, and approved. Bids were opened in May 1969 and resulted in the award of the construction contract to the Hart Engineering Company of East Providence, Rhode Island. The bid (not including the Government furnished generators) was for the amount of [redacted] Construction began in July 1969 and although scheduled for completion in October 1970, it was not finished until June 1972 because of delays due to poor generator performance.

The three generators were received from the Schoonmaker Company of Sausalito, California in June 1968 and were stored on Base awaiting completion of the power plant addition to P-1900. The engines were moved into the new building in June 1970. The military personnel needed to operate the plant had been assigned by MPC and were in place at the Facility. These technicians accomplished the repairs and got the engines operating. It was estimated that $135,000 and approximately three months time were saved by the outstanding work directed by Master Sergeant Jack Anderson. After numerous delays in shipment of test equipment and various parts, the plant was finally completed in February 1972 and accepted by the Air Force in June 1972. The final cost of the plant was [redacted]

After activation, the plant and the nine enlisted technicians assigned provided dependable backup power. This included many cases where the generators were operated around-the-clock to support key, time responsive mission photo processing and image evaluation requirements. During phasedown planning, it was decided that no attempt would be made to relocate the generators due to their age and the difficulty in obtaining spare parts. This auxiliary plant will be left in place when Building P-1900 is turned over to the Base in January 1977. Pictures of the Emergency Power Plant and its equipment can be seen on pages 2-54 and 2-55.

PRODUCTION DIRECTORATE (PD)

The primary mission of the Directorate of Production was to operate a high quality, high volume photographic production facility in support of the National Reconnaissance Program (NRP). To better accomplish this high level mission, PD established the following operational and quality assurance sections: the Operations Division for planning, scheduling, and monitoring all production requirements; the Production Division for performing the mission production printing and processing and all still photographic reproduction requirements; the Computer Division for automating production control and monitoring the quality of all mission products; and the Quality Assurance and Materials Analysis Divisions for setting production standards, establishing operating procedures, and assuring quality control. The success of the Production Directorate in achieving these goals resulted in the establishment of a photographic laboratory which gained the reputation as the finest film duplicating facility in the DoD. As their major tasking was the continual reproduction support of the CORONA, GAMBIT, and HEXAGON Programs, PD's major achievement basically centered around gaining the capability for producing the best product possible from these satellite systems. In those endeavors two areas of significance highlighted the evolution of the Production Directorate. These were: (1) the automation of the precision photographic processing operation, and (2) the establishment of the Materials Analysis Laboratory (MAL) which performed analytical testing and evaluation of photographic materials.

- Photographic Production Automation -

The beginning of the automation of the precision laboratory began in 1962 with the complete renovation of the old 8RTS photographic laboratory into a Class 100 Cleanroom with environmental controls capable of maintaining temperatures to ± 1/4 degree Fahrenheit and humidity to within ± 5% of the set point. This was the first large scale cleanroom precision photographic laboratory in the U. S. Air Force.

Automation of the production cycle began during this same 1962 construction period. Houston Fearless designed and installed a Data Monitor System (DMS) to provide a process control capability and record the principal processing and environmental parameters. For better communication links between the personnel operating the DMS and the operators of the processors and other equipment, two-way intercoms and a pneumatic message delivery tube system for sending step tablets from the processor to the Quality Control Section were also installed. TV cameras were used to monitor the pre and post inspection phases. Also, as a part of the laboratory modification was the expansion of the chemical mixing area and the centralization of the control of the chemical parameters (flow rates, temperatures, etc.). This was accomplished by a large Taylor Instruments control panel installed in the newly renovated Chemical Mix Section. During this period, chemical analysis/certification was accomplished by a combination of a dip test and the standard chemical titrations. The procedure of manually reading the density step tablets and continuous wedges was automated in 1963 when AFSPPF, working with MacBeth Corporation, developed the Quantascan which would read the step tablets to determine whether the processors were within control specifications.

In the early 1960s, advances were made in process control but essentially no automation occurred in production control. Consequently, in February 1967, an IBM 1130 Computer was purchased to automate the following direct support for production control:

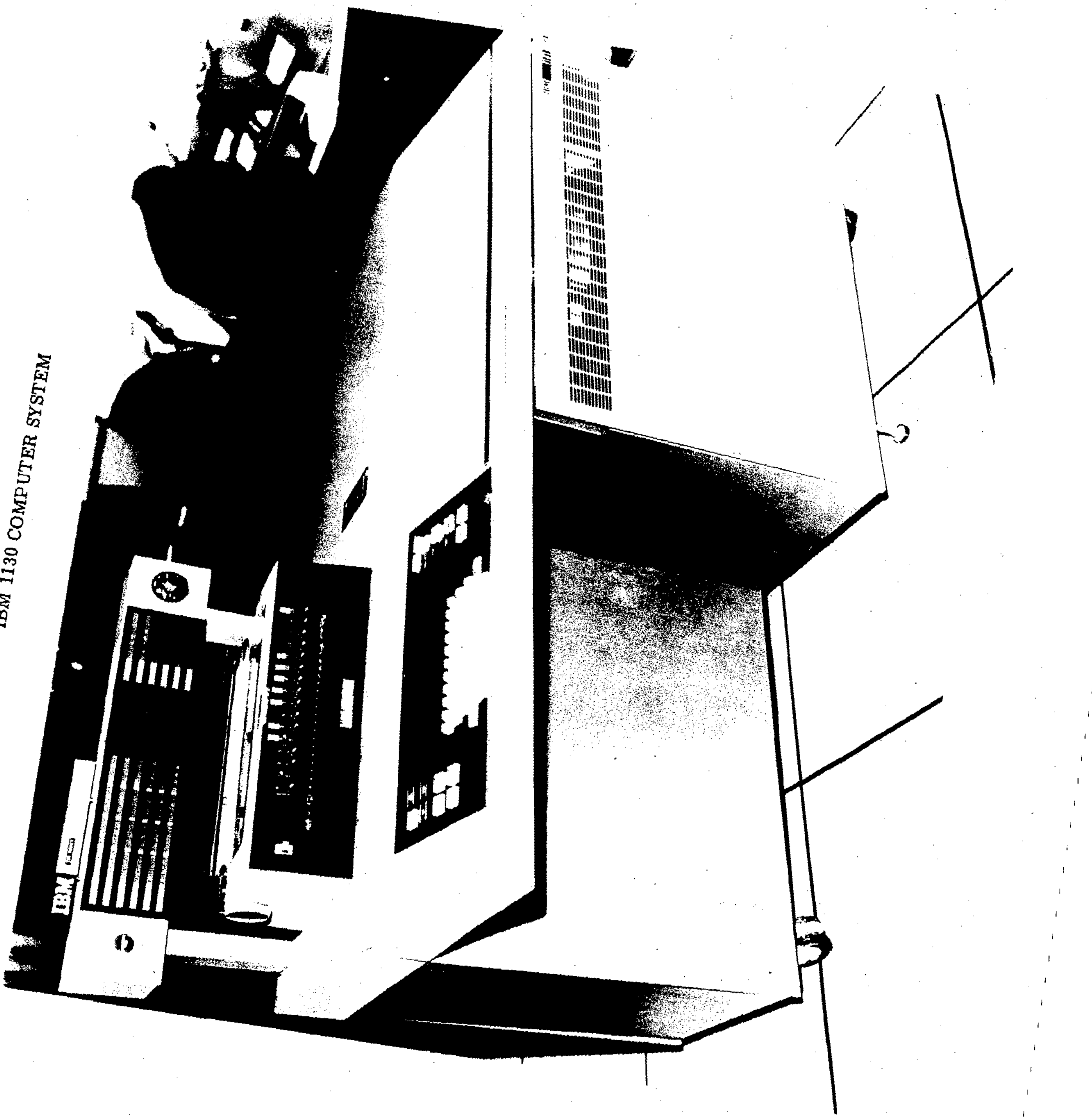
A. Produce current production status reports by analyzing input to the computer from six data entry terminals in the Printing, Processing, and Quality Control Divisions and displaying this information on a huge tote board in the Production Control Room.

B. Produce shipping directions, labels, and receipts.

C. Perform a cost analysis on each production project.

D. Provide product control information on a TV screen.

The 1130 System consisted of 16K core memory, central processing unit/console, disk capability, line printer, paper tape unit, plotter, and six data stations. Figure 4-9 presents a picture of the IBM



IBM 1130 COMPUTER SYSTEM

[FI]GURE 4-9

1130 Computer. Although it took approximately a year to develop operational software, the 1130 proved invaluable as a production control monitoring system. The IBM 1130 Computer was discontinued in November 1974 due to the reduction in mission tasking and pending closure of the Facility.

With the significant increase in requirements to support the new blocks of GAMBIT and CORONA systems, it was felt that the DMS and IBM 1130 were inadequate to handle production control. After evaluating various alternatives and makes of computer, a decision was made to lease an IBM 1800 Process Control Computer to upgrade production control. The IBM 1800 was installed on 7 November 1968. The IBM 1800 was selected to provide: (1) real time support to the process control function, (2) monitor processor parameters, (3) calculate printer instructions, (4) analyze step tablets, and (5) supply product acceptance instructions to the final inspection team. Extensive software development and hardware design and fabrication were required before the 1800 could furnish this type of support. The software and hardware were initially performed by AIL Corporation. This hardware consisted of remote entry stations in the Printing, Quality Control (QC), and Initial/Final Inspection Sections which were connected to the 1800. In the QC Section, the AIL terminal ("Q" Station) had a Quantiscan wired into it so the density reading could go directly to the 1800. In the Inspection Section, the densitometers were attached directly to the terminal ("D" Station). During initial inspection, the operator would make several density readings which would be automatically recorded by the 1800. The operator also entered the location of the readings he took by roll, frame, and grid number. The 1800 would utilize this density data to generate printing instructions for that roll of material. When the roll of film reached the Printing Section, the operator would enter the roll number into the terminal ("P" Station) and the 1800 would respond by relaying the printer setting back to the operator. When the roll was ready for final inspection, the densitometer operator would query the "D" Station for location and the desired density return for that specific roll. This query was made by entering the roll number. The 1800 would then forward the desired information back to the "D" Station for the operator to use in his final inspection.

AIL, which was not a company that totally specialized in computer programming and analysis, was joined by Computer Sciences Corporation (CSC) in the task of upgrading the 1800 System. AIL's work was completed in March 1971 while CSC provided support from January 1970 until September 1973. All during this period the IBM 1800 Processing Control System was being refined to meet the changes in processing parameters and the advances in multiprogramming. The 1800 System consisted of 64K core memory, central processing unit/console, central controller plus various digital and analog control units, line printers, magnetic tape unit, disk drive, and an operator control unit. AFSPPF was the first organization that ever customized a computer for this type of production monitoring and control. Figure 4-10 presents a picture of the IBM 1800 Data Acquisition and Control System. The 1800 was returned to IBM in April 1974 for the same reasons the IBM 1130 was discontinued.

IBM 1800 DATA ACQUISITION AND CONTROL SYSTEM

FIGURE 4-10

Next attention was given to improving the method of precisely mixing chemicals for without the accurate processing/fixing of chemicals other efforts to improve the end product have little effect. Because of the importance of this function and the pending impact of HEXAGON requirements, it was decided to automate the chemical mixing process as much as possible. FMC was contracted to design and fabricate an automatic Batch System. The system allowed large batches of correctly mixed chemistry to be prepared at any time during the mission which resulted in a significant savings in chemicals previously lost by human error. This system was successfully used from 1970 until October 1976.

In this same time period an effort was initiated to completely automate the analysis/verification of photographic chemistry as all batches were mixed ready for use. Dr. Dale Coulson of Stanford Research Institute, California began an in-depth study to determine the best method(s) for developing a program to accomplish this entire evaluation process. His study revealed that there was not any one single, timely method to automate the analysis of the photo chemistry used at AFSPPF; however, it did indicate that certain portions could be automated.

Dr. Coulson continued his study centering on developing techniques for use on gas chromatographs (GC) and atomic absorption (AA) units to determine the amount of the critical components in the developer. Two GC and one AA were procured for his work. One GC was configured to determine the grams/liter content of phenidone in the developer while the second was configured to hydroquinone and metol in the developer. If a particular developer contained an improper amount of the phenidone, hydroquinone, and/or metol, it could be adjusted. The use of the GC units greatly reduced the man-hour requirements of the chemical analyst as it took approximately 15 minutes compared to over an hour by the previous method to perform this analysis. It also decreased chemical consumption because badly mixed chemistry could be corrected by adding the missing properties. The AA unit was utilized to determine the silver content of the hypo being recycled from the silver recovery units. This task took 10 minutes on the AA unit while the previous manual method would take approximately two and a half hours to complete.

In 1971, a contract was awarded to Sybron Corporation, Taylor Instrument Division, Rochester, New York, for the design and fabrication of an electronic processor control system for the Dalton Processor. The prototype system was installed and connected to the 1800 in 1972. The system monitored 13 functions of the Dalton. Of the 13 functions, 11 were commanded by Taylor controllers to the established set point for that mission material. Four controllers were used to monitor the developer temperature, developer flow rate, machine speed, and fix temperature functions, while the IBM 1800 Computer had the capability to change set points. The remaining nine controllers were utilized for the less critical functions and had the set points changed by the photo technician running the Dalton Processor.

This first "Taylor Package" was debugged and resulted in a significant advance in the control and operation of the Dalton. As a result improved "Taylor Packages" were procured for the remaining two Daltons and two Trentons. At that time the prototype was also upgraded. The packages for the Trentons were designed to monitor 23 functions with 19 of the functions being controlled by the operator and 4 by the 1800. These "Taylor Packages" were unique in a Government photographic processing facility. They greatly reduced man-hours and materials for initial processor certification and helped to assure the best possible product for the NRO community.

As the production requirement significantly increased with the advent of HEXAGON, it became obvious that the titling function had to be improved. The present method of using a Unimac Titler with its manual stamping heads was too slow for the production cycle which had recently had most of its functions upgraded by automation. In November 1971, AFSPPF undertook a contractual effort with FSDS to automate this step. The basic concept was to utilize the principle of applying a series of ink dots known as "Video Jet" ink printing. This titler was controlled by a minicomputer which detected framemarks and automatically titled at speeds of 25 - 40 feet per minute. Although the system achieved most of its design goals, it was difficult to maintain. The Video Jet Ink Titler was never used operationally because the CCB decided to implement the Optical Titling System developed by EK in 1973.

Printer automation was not realized until 1975, when the highly sophisticated EK Cayuga Printer was installed at AFSPPF. This automated system was the culmination of several development efforts by both AFSPPF and EK. The system was controlled by two minicomputers and was capable of reading the density on the original and optimizing the duplicate reproduction. Its features included a modulated light source and a fixed array of photodiodes for density scanning. The Cayuga Printer was shipped back to EK for minor modifications in August 1976 and then will be forwarded to the 544th ARTW to be used in the Production function at Offutt AFB. At present only EK and AFSPPF have utilized this automated printing system.

Shortly after the phasedown/closure announcement in October 1973, AFSPPF decided to discontinue use of the IBM 1130/1800 Systems and replace them with a PDP-11/40 minicomputer. The decision was based on economy (computer rental) and the reduction in mission requirements. While awaiting the arrival of the PDP-11/40, PD utilized a PDP-8E on loan from the Evaluation Directorate for density acquisition and densitometer calibration and the IBM 360/40 for such off-line support as the production of labels, breakdown listings, and production control cards.

The PDP-11/40 was delivered to AFSPPF in December 1974 and the programming plan developed by Captain J. Hill and Master Sergeant R. Swetavage started. The system consisted of 80K core memory, three disk drives, magnetic tape unit, control processing unit, two VT-5 CRT Terminals, line printer, universal digital controller, 11 RT-1 Data Entry Terminals, VT-55 Graphic Display Terminal, and a high speed paper tape reader/punch. Figure 4-11 shows a picture of the PDP-11/40 Computer System at AFSPPF. Although this system has been used since its ORT Certification in June 1975 to monitor photographic mission production, additional programming will be required before full utilization of this system's capability will be realized. The PDP-11/40 will be transferred with the Production function to Offutt AFB on 15 September 1976.

By 1975, AFSPPF's Photo Laboratory had become the most highly sophisticated, automated production facility in the DoD.

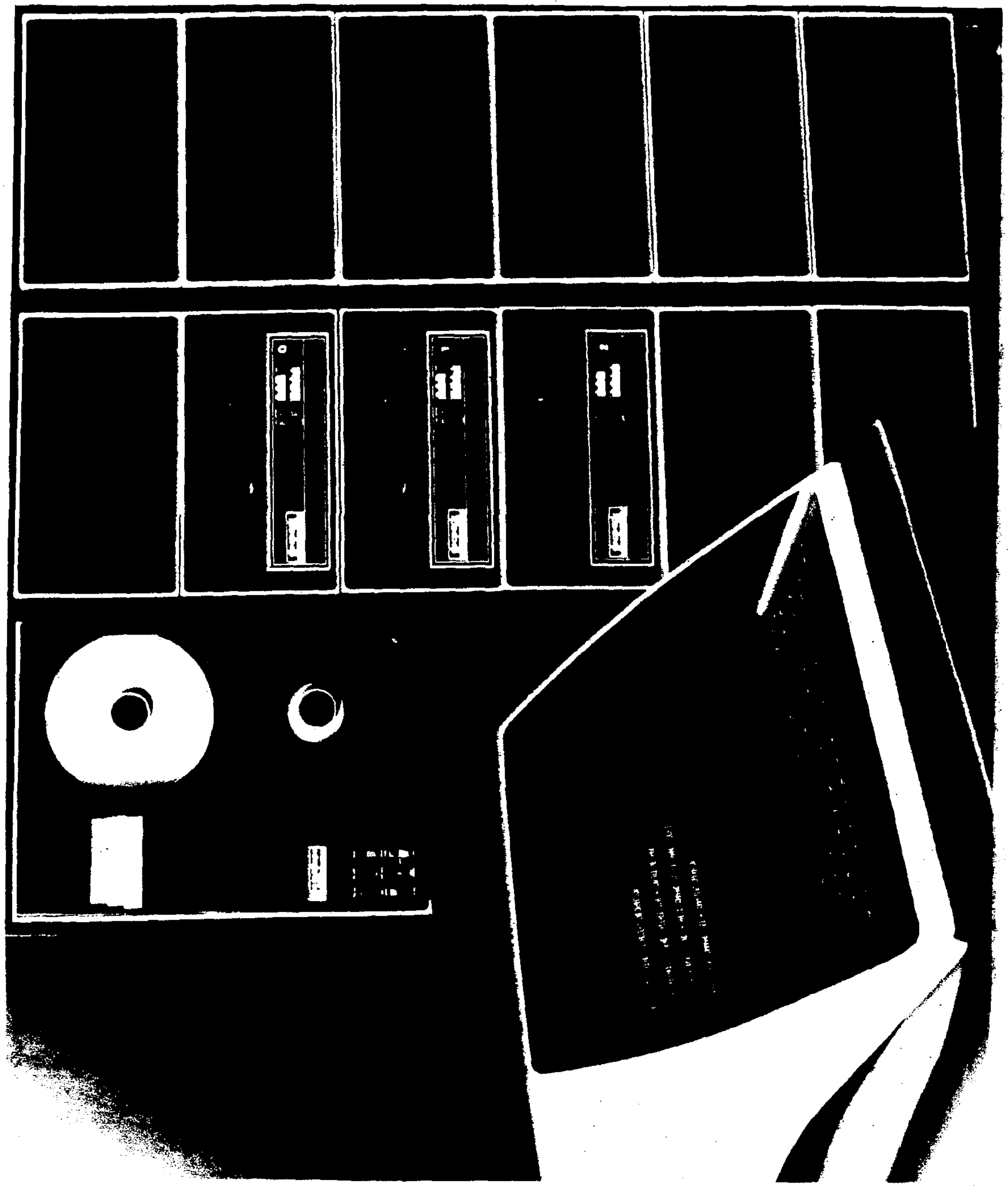
- Materials Analysis Laboratory (MAL) -

The Materials Analysis Laboratory was a unique, highly sophisticated photographic testing facility established to provide production standards and a quantitative analysis capability to support the mission of AFSPPF.

MAL, originally called the Optics and Material Standards Laboratory (OMSL), was conceived and established by Lieutenant Colonel L. Williams in 1962 as a standards laboratory for the Research and Development Directorate. Mr. M. Worwood was hired as the Chief, OMSL and occupied that position until the equipment was transferred to DIA's Technology Division (DC-6) in the fall of 1976.

From the outset until the mid 1960s, this laboratory was limited in space and resources. However, as the scope of the assigned mission increased, the facilities and space grew from one room (224 square feet) to a three room laboratory covering 1,600 square feet. The present day mission became established in April 1970, the same period that MAL was reassigned from RD to the Production Directorate. This change was made because the primary mission of the Materials Analysis Laboratory was to establish and maintain standards for the Production Photo Lab. The other mission tasks included the implementation, analysis, and refinement of all standards and analysis techniques dealing with the production and evaluation of photographic materials and systems; analyzing conventional and non-conventional photographic materials; producing and certifying materials for standardization; calibrating analytical equipment; and providing technical support to the NRO. A picture of one of the areas within MAL is shown in Figure 2-8, page 2-17.

Over the years, this analysis laboratory was equipped with many pieces of one-of-a-kind state-of-the-art analytical/mensuration equipment. It has been this broad variety of equipment and the dedicated technical personnel that have been responsible for developing the capability and building the reputation of MAL. Some examples of this equipment are: the MacBeth Research Laboratories Model KCS-18 Transparent Film Colorimeter which is capable of measuring light transmission of color film in 20 nanometer increments with a one millimeter aperture; the MacBeth Model MRL-001 Color Densitometer which is capable of reading black and white and color densities using a half millimeter aperture; the Houston Fearless Equal Energy Scanning Spectrosensitometer which is capable of analyzing the spectral sensitivity of films,



PDP-11/40 PRODUCTION CONTROL SYSTEM

FIGURE 4-11

photo multiplier tubes, and photodiodes; the Aeroflex Precision Densitometer which is capable of determining the density characteristics of film to five significant figures; the Data Corporation Sensitometric Spray Processors which are capable of duplicating processing conditions of large volume processors on a small scale thus reducing both resources and man-hours when establishing standards or analyzing materials; and the Perkin-Elmer Corporation Advanced Microcamera System which is capable of an automated production of target belts and an ultra high resolution evaluation of conventional and non-conventional film materials. A complete listing of all the equipment assigned to the MAL (as of 30 May 1975) can be seen in Volume II, Figure 3-13, pages 3-32 thru 3-34.

Although establishment of the MAL with its many and diverse capabilities was a major achievement in itself, the Materials Analysis Laboratory also made several significant contributions in the test and evaluation phase of new/modified equipment and the development of new techniques and processes. The following are examples of these efforts and services:

A. Assisted in the procurement and developed the operating procedures of AFSPPF's first production microdensitometer (Mann-Data, "A" Machine).

B. Determined the problems caused by base pelloids on duplicating and original film materials. As a result a new film without the pelloid backing (Type 2430) was introduced by Eastman Kodak.

C. Discovered minute dirt particles in duplicating films supplied by EK which resulted in EK improving their quality control procedures, especially in the handling of films used in the NRP.

D. Produced a wide selection of target belts for use in the evaluation of printers and film studies for AFSPPF and contractors. Target belts were also supplied to other Air Force organizations as well as to the Army, Navy, and CIA.

E. Assisted in the development of edge scanning techniques on the Facility Mann-Data Microdensitometer.

F. Trained two NPIC technicians on the capabilities, operation, and use of the Mann-Data Microdensitometer at AFSPPF.

G. Analyzed the R-2 original negative sample strips from each GAMBIT and HEXAGON mission prior to calibrating the microdensitometers used in postflight evaluation.

H. Provided special photometric evaluation of the first satellite photographic coverage of a Red Chinese missile engine test site.

I. Performed spectral (log) sensitometric and photometric signature evaluation of acquired USSR films to determine their use as either acquisition or duplicating material. This was done in support of the Avionics Laboratory at Wright Patterson AFB Ohio.

J. Supported the Acceptance testing of each HEXAGON vehicle by making microcomparator measurements of Sync-Flash Targets to determine whether the optical bar cameras were in synchronization.

K. Developed and perfected the formula (SPPL 1) for a bulk mixed chemistry to process duplicating films for use at AFSPPF, thus reducing the requirement for buying EK premixed chemistry.

L. Developed a low gamma chemistry which allowed AFSPPF to spray process EK Type 3414 Film and produce improved imagery quality. This accomplishment also resulted in eliminating the requirement to use two other film types in production, thereby reducing film and chemistry supplies.

M. Performed a thorough comparative analysis in 1970 of EK and non-conventional films which included image structure, mensuration, resolution, AIM curve and MTF determinations, reciprocity failure, spectral sensitivity, granularity, dimensional stability, physical and structural characteristics, and sensitometric properties. The results showed that non-conventional materials at that time were not manufactured for production use like the conventional EK film types were in terms of structure and quality.

N. Devised a solution to a focusing problem on the Advanced Microcamera System, thus saving the Air Force over $70,000 by eliminating the need for an engineering change by the contractor.

As evidenced by these efforts, MAL provided significant contributions in addition to their daily duties of establishing and maintaining photographic processing and evaluation standards with the National Bureau of Standards (NBS) and other laboratories within the photo science community. Mr. Worwood and his staff, which varied from one to nine technicians, performed direct mission support to the Production and Evaluation Directorates and research and development test and evaluation to the RD Directorate. Mr. Worwood became an authority in this field and held many two-week classroom sessions of up to 30 people to teach the photo technicians this scientific art. The significant accomplishments achieved by the Materials Analysis Laboratory in support of this Facility and other associated organizations made it imperative to continue this type of function within the community upon closure of AFSPPF. A decision was made by the NRO to transfer the majority of the equipment to DIA (DC-6) where they will establish a similar standards laboratory.

## DIRECTORATE OF RESEARCH & DEVELOPMENT (RD)

The primary mission of the Research & Development Directorate was to maintain an Air Force capability to perform research, development, test, and evaluation in the photographic sciences; to manage coordinated contractor research and development programs in support of the Facility's mission; to prepare a five year programming plan and budget for future efforts; to monitor all financial matters involving RD contracts and prepare the annual operational budget; and to operate a feasibility group who could perform the fabrication of in-house hardware development and modification.

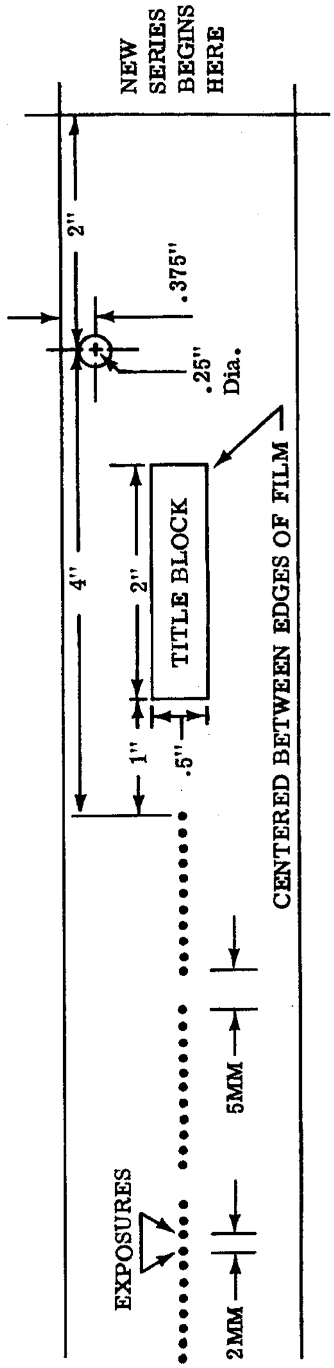
The scientists and technicians from RD were involved in some facet of every major achievement attained by this organization. Their roles varied depending upon the program, i.e., acted strictly as a budgetary monitor (CORN Program); consulted/advised other directorates within the Facility on the purchase of the best type of laboratory and film processing equipment (Black and White and Color Versamat Processors, Niagara Printers, MacBeth Densitometers, etc.); assisted in the design and performed the modification of existing equipment (Trenton and Dalton Processors, EH-75 Processors, 3M Dry Silver Processors, etc.); conducted several research materials programs (Free-Radical, Diazo, Amorphous, Transparent Electrophotographic, etc.); performed in-house developmental programs (Color Film Titling, Phase Image Duplication System, Color Film Record, the Isocolor Program, etc.); coordinated closely with the contractor in adapting, designing, developing, testing, and implementing new systems evaluation techniques (Tone Reproduction Program, Performance Analysis Program, etc.) and advanced equipment (Photowaste Disposal System and Silver Recovery, New Generation Microdensitometer, etc.) These are but a few of the programs that RD was involved in. It is difficult to single out RD's major achievements from those credited to the other directorates because RD played an integral part in every new effort/project conducted by/within AFSPPF.

The following paragraphs will discuss four achievements in which RD was the major contributor: (1) the Advanced Microcamera System; (2) the capability developed and work performed in evaluating non-conventional photographic materials; (3) the development of the mathematical non-linear model used in the analytical software to evaluate satellite reconnaissance camera system performance; and (4) the evolution of printing concepts to improve image quality transfer.

- Advanced Microcamera Systems (AMS) -

In late 1972, AFSPPF became more deeply involved in the evaluation of non-conventional versus conventional photographic films and the research into types of printing systems required to reproduce production volume non-conventional materials. From this effort it became obvious that the existing microcamera system used to support these types of evaluations was inadequate. Consequently, an in-house study of the problem was performed and the resultant recommendation was to support the development of an improved microcamera system. AFSPPF requested through the NRO's Configuration Control Board (CCB) the sum of [redacted] for this effort. It was planned that should this proposal be approved that the project be funded for in the FY 74 Financial Plan. The approval was given, a select source procurement initiated, and proposals from a number of companies were received and evaluated. The CCB was briefed on the results of the evaluation performed by AFSPPF's Proposal Review Board. At this meeting, the Eastman Kodak representative voiced his company's requirements for a microcamera. As a result, AFSPPF was directed to resolicit proposals using a new set of specifications which incorporated EK's requirements. The most significant changes to the original specifications were the tighter tolerance on focus (± .1 micron) and provisions for a step and repeat automatic (triplet) mode of operation. A triplet consists of eleven exposures varying in intensity repeated three times. Figure 4-12 shows the relationship of exposures

PROFILE OF AN AUTOMATED TRIPLET VARIABLE EXPOSURE OPERATION




NOTE: A triplet is three replicate sets consisting of eleven exposures varying in .2 ND increments of any type of target image.

FIGURE 4-12

and other operations which make up a triplet. A new statement of work was prepared, proposals resolicited, and each new proposal evaluated. The outcome was the awarding of a contract to Perkin-Elmer Corporation in May 1974 for two instruments.

Although Perkin-Elmer had difficulties with the extremely tight specifications of the contract, two Advanced Microcamera Systems were designed, manufactured, and delivered in August 1975 to AFSPPF and EK at a cost of approximately [redacted]

These systems have made significant advances in the state-of-the-art of producing ultrahigh resolution micro-imagery on film. The AMS has an Electro-pneumatic Focus Servo System which maintains focus within plus or minus 0.1 micron of the focus setting. The focus range is from 15 microns above the emulsion to 25 microns into the emulsion. This focus subsystem is the most significant factor in these new micro-cameras since it provides an extremely precise focus capability which was nonexistent prior to the AMS. As a result accurate studies of the effects of focus position on resolution could be made for the first time. Also, replicate exposures could be repeatedly made at the same focus position.

Other features included: (1) the ultraviolet exposure capability (previously nonexistent) for the study of non-conventional film material; (2) the ability to precisely rotate the target to provide specific angular orientation of targets on the film; (3) a variable contrast target illuminator to enable continuous adjustment of target contrast without changing targets; (4) precise film positioning so that accurate target belt geometrics could be obtained; (5) an optical titling capability; (6) a film punch, and (7) a radiometer for exposure calibration purposes.

During the AFSPPF test and evaluation of the AMS, Mr. M. Worwood solved a recurring focus problem by modifying the system with nylon collars to allow for an even distribution of air flow onto the film being sensed by the focusing platen. This saved the Government approximately $70,000 in renegotiation and an engineering change by the contractor. Figure 4-13 presents a picture of the Advanced Microcamera System.

Using the AMS, Eastman Kodak and AFSPPF technicians have been able to obtain resolution values, primarily at low contrast, which exceeded the published characteristics specifications for that film type. EK has used the AMS extensively in film materials research and tests each batch of original negative and duplication film prior to use.

The two men who were the most closely involved with this achievement were Captain Barry Britton, the RD Project Officer, who prepared the specifications, Work Statement, and monitored the component and system assembly test and evaluation (T&E) at Perkin-Elmer, and Mr. M. Worwood who performed the acceptance T&E at AFSPPF.

THE ADVANCED MICROCAMERA SYSTEM

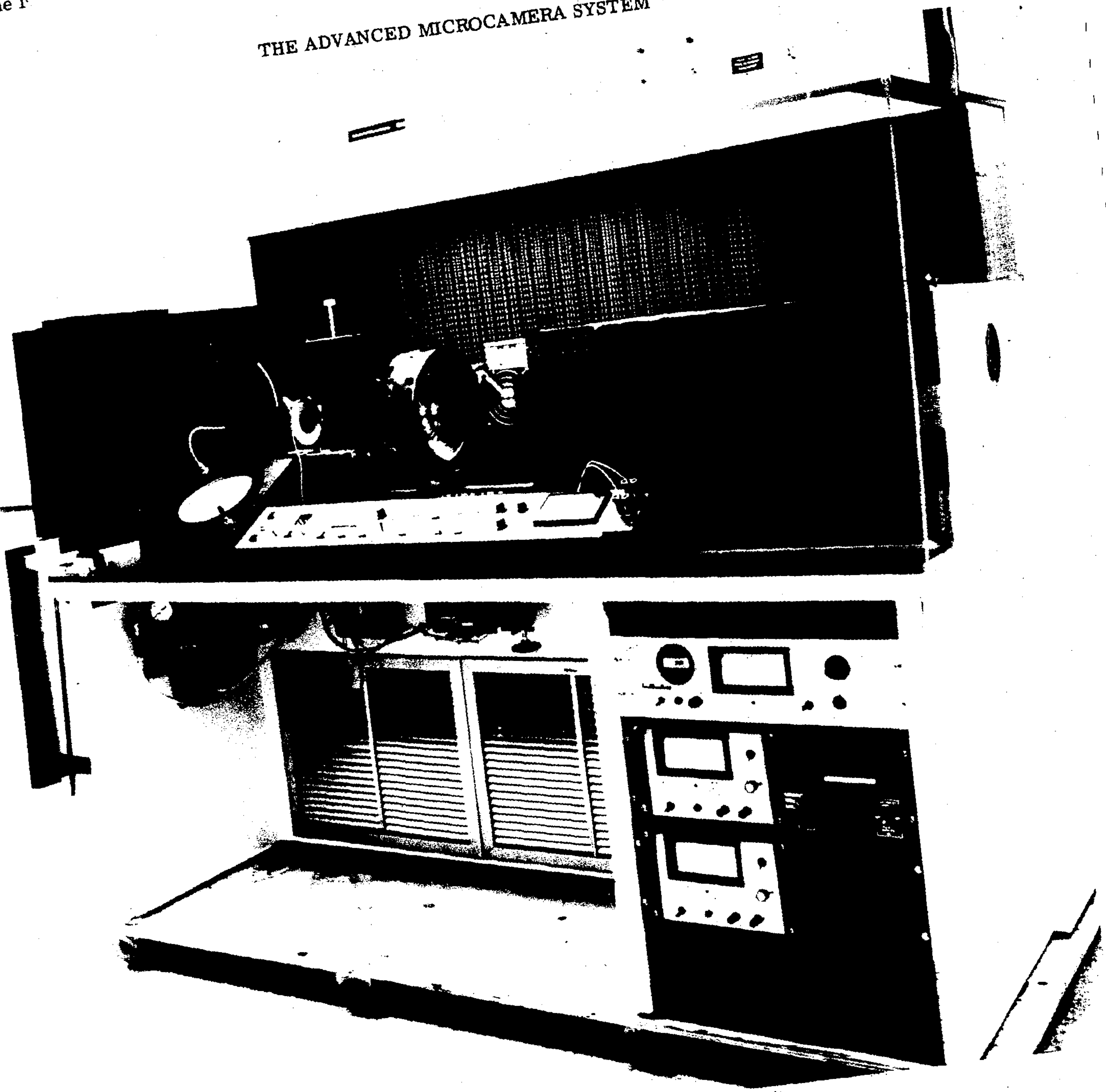








FIGURE 4-13

It is presently planned that the microcamera from AFSPPF will be transferred to the [redacted] when the Facility closes. There it will be used to support NRO and other DoD requirements.

- Non-Linear Model -

Beginning in the late 1960s, considerable research and experimental efforts were directed toward the implementation of classical linear systems performance analysis for photo-optical systems. Image evaluation experts were much enamored with the apparent simplicity of cascading the transfer functions of subsystem elements. Although many advancements were made along this theory, it was discovered that the assumption that all subsystems performed linearly was not true. This was detected when analysts encountered the highly non-linear behavior of the edge enhanced photographic step caused by the new, radically different viscous process.

AFSPPF had an on-going contractual effort with EIKONIX Corporation, Burlington, Massachusetts for technical assistance in the area of systems performance analysis. In 1969, scientists from EIKONIX suggested that a mathematical model could be developed to linearize the effects of the viscous process. Initially this concept was not received enthusiastically by the various satellite reconnaissance program offices. Without program sponsorship, AFSPPF proceeded at a limited pace. Captain Edward Wallace, the RD Program Manager during this 1969 to 1971 period, monitored EIKONIX's experimental work on quantifying non-linearities. However, in late 1971, with the realization of the magnitude of the problems caused by the adjacency effects, a concentrated effort to develop a non-linear model was initiated by AFSPPF and EIKONIX.

In 1972, Lt Barry Britton replaced Captain Wallace as Program Manager. The EIKONIX personnel, under the technical direction of Dr. A. Silvestri and Dr. D. Ehn, produced a working one-dimensional (1D) model in 1973. However, the viscous process was significantly modified during the testing of the 1D model causing a need for a re-establishment of the mathematical constants. Experimental work on a more advanced mathematical model indicated that a two-dimensional (2D) model was possible and would provide a much improved program. Consequently, work was redirected toward the 2D model under Dr. A. Devaney.

In the fall of 1974, the 2D ("one-shot") model software was installed on the AFSPPF IBM 360/40 Computer for use in support of the Evaluation Directorate's systems performance evaluation function. The specific parameters of the Non-Linear Model can be found in the users handbook[89] published by EIKONIX.

Since viscous processing chemistry and methods change periodically, which require new mathematical constants within the model, work was continued to develop a method for determining these constants each time Eastman Kodak changed their processing formulas. A sophisticated method of determining these

[89] Report, EIKONIX, 3 June 1975, A Users Manual for Determining EIKONIX's Diffusion Model Parameters. (U)

constants was implemented in late 1974/early 1975. The Non-Linear Model, in various forms, has been and is being utilized by several NRO organizations. The following is a listing of those organizations and a brief explanation of their utilization of the model:

A. CIA/Office of Development and Engineering (OD&E)

The 2D model is used in conjunction with OD&E (formerly the Office of Research & Development) image enhancement tasks on the Interactive Digital Image Manipulation System for "backing out" process anomalies (process-induced enhancement). This information is extremely valuable when studying digital enhancement schemes. OD&E is also using the Non-Linear Model in their studies of the effects of process non-linearities on the shape of objects.

B. NPIC/Applied Photographic Sciences Division (APSD)

The former Evaluation function at AFSPPF is now being accomplished by the same Air Force technicians assigned to APSD. They use this model extensively in their operational tasks of HEXAGON Acceptance and Readiness testing and in community microdensitometer support of the GAMBIT, HEXAGON, [redacted] Programs. The model has also been employed in NPIC mensuration studies to assess the distortions induced by process non-linearities. NPIC was responsible for the requirement levied on EK to routinely generate process-specific constants for each original negative production run. This is a tremendous asset to users of the Non-Linear Model since even slight changes in processing parameters affect the accuracy of the model.

C. [redacted]

The Non-Linear Model was used as a diagnostic tool to aid in the characterization/solution of rastering problems in scanning laser printers. However, the ultimate utility of the model in this role has yet to be established. Thus far, indications are that some adaptation of the model may be required to accommodate these types of unconventional systems.

D. SAF/Special Projects 6 (SP-6)

Efforts by this office are continuing in an attempt to derive two-dimensional system transfer functions from operational photography via analysis of the Double Annulus Target. This effort is being aided significantly by use of the Non-Linear Model. It is the goal of this work to establish a technique that will provide accurate estimates of in-flight optical aberrations of the GAMBIT and HEXAGON cameras.

E. AFSPPF/Evaluation Directorate (EV)

The Non-Linear Model was successfully employed in the evaluation of HEXAGON preflight chamber Line Targets at various focus positions. The results of this evaluation were most significant because they showed that transfer function estimation via image evaluation is a valid and reliable approach.

F. EK/BRIDGEHEAD

The model was successfully employed for analysis of the Five-Step Gray Scale Target anomalies in GAMBIT and HEXAGON CORN photography. The use of the model resulted in significant corrections to the density data. As a result of the value of this model, EK now places special edge targets at each end of the roll being processed to determine the consistency of constants within the processing operation.

The Non-Linear Model will continue to be modified to meet the changes in processing (presently being modified for the 391 Viscous Method), and new applications will be found for the evaluation of each new photographic system.

- Advancement Efforts in Printing -

Throughout the history of the organization, RD has investigated many printing concepts in an effort to improve the image quality transfer and/or fulfill a formating requirement which could not be accomplished by existing equipment.

In the early 1960s, it was thought that improved image quality transfer could be achieved by enlarging the original negative image. Consequently two contracts, one with the Morse Instrument Company and the other with Eastman Kodak were negotiated for the design and manufacture of two 2.6X Continuous Enlargers. However, these machines did not prove successful and the effort to improve printing quality was redirected to investigate various light sources and better methods of exposing the duplicate film. Several studies and experiments were entered into utilizing various laser light sources, but they proved to be impractical. A failure due to the lack of exposure uniformity was the Houston Fearless High Resolution Printer, Model 100 (HRP-100) which utilized a high energy plasma arc light source inside a quartz glass drum. The duplicate would then be placed on the original and exposed around the rotating drum.

Another attempt involved a modified Niagara that used a hard wired computer-type logic connected to an optical fourier transform frequency sensing device for on-line control of the Niagara's printing light source. The film passed the sensor and the logic measured selected fourier transform frequency contents to determine the printer light setting. Although this effort by Technical Operations Incorporated was an approach similar to the Eastman Kodak density sensing technique used in the later developed Cayuga, it was not as successful, mainly due to the presence of pelloids in original films.

In 1968, as the decision was being made to support the reproduction requirements of the new, larger payload HEXAGON System, emphasis was transferred from ways to improve the image transfer to efforts that would maintain the present transfer quality but produce multiple duplicates in new formats, i.e., 5 inch by 6 inch chips, short strips, etc.

Two efforts were made under this new goal. The first by Perkin-Elmer Corporation consisted of modifying a Niagara Printer with three printing stations. These stations would provide the following: Station 1 would produce a contact 4 inch by 6 inch chip; Station 2 would produce a two-times enlarged 4 inch by 6 inch chip; and Station 3 would produce contact strips from 1 to 12 feet in length. The second effort by Baird-Atomic (BA) Incorporated was the development of a high speed chip printer which had the capability to produce multiple copies of individual 5 inch by 6 inch chips at the rate of 120 feet per minute or produce a strip by printing chips adjacent to each other.

Both the Perkin-Elmer modified Niagara and the BA Step and Repeat Printer performed according to specification but because the NRO community could not agree on the format (chip or strip), they were not used operationally for neither instrument had significant advantages over the standard Niagara Printer. This BA Printer was shipped to Eastman Kodak for study of its unique method of exposing chips and the Perkin-Elmer machine was stored in the warehouse where it was later "cannibalized" for repair parts for the Niagara/Redondo Printers.

This next effort was the investigation of a new Airgate Printing concept developed by Airborne Instruments Laboratories (AIL) Information Systems (formerly FMA, Incorporated), Los Angeles, California. This study was performed to determine if image quality transfer could be improved over that produced from the Niagara. The Airgate concept consisted of two flat, porous, ceramic "rocks" through which clean air was forced. The "rocks" were separated by approximately an inch and the original and duplicate films were pulled through the gate formed by the "rocks." As the material passed through the gate the air pressure forced the films together so the exposure could be made under high pressure. The lamp house was situated in the middle of the upper gate. Working breadboards were fabricated and evaluated but the resolution transfer never proved significantly better than the existing Redondo or Niagara Printers.

It was not until 1974, when the [redacted] informed AFSPPF of a major formating problem [redacted] that AFSPPF got started on a totally successful effort in the printing area.

Upon a thorough review, RD began to evaluate possible methods of solving this problem. Two previous programs, the BA Step and Repeat Printer and the AIL Information Systems Airgate Printing concept were revaluated. As a result, the BA Printer was recalled from Eastman Kodak and a program undertaken with Baird Atomic, Incorporated to modify this machine to meet the requirements of the [redacted]

Mr. N. Julian from RD was assigned as the Program Manager of the new Automatic Compositing Step and Repeat (ACSAR) Printer. A contract for [redacted] was signed in September 1974 between AFAL and BA. The AFAL Project Engineer was Mr. William Benz and the BA Project Manager was Mr. Rocky Gulla.

The original BA Printer had the following significant features:

A. Drive systems which could precisely feed and position the original and raw stock materials within five-thousandths of an inch.

B. A flash tube light source which was synchronized to the optimum film-to-film air bladder pressures at the platen to allow near-static exposure conditions.

C. Manual control of step and repeat roll-to-roll printing or multiple copy select frame printing.

D. Resolution transfer potential better than the Redondo Printers.

To accomplish the compositing printer objectives required by the [redacted] the following additional subsystems were added to the basic printer:

A. Frame Mark/Code Reader System

This subsystem detected frame marks and read the frame Binary Coded Decimal (BCD) numbers on the original negative subframes at a position just ahead of the printing station; monitored the progression of these subframes; stored frame length information; and precisely positioned the subframes in the compositing process.

B. Frame Length Servo System

Once the length was determined for a subframe to be printed, a servo controlled shutter located above the platen gate automatically set to the required aperture.

C. Flash Detection System

Although the flash lamp light source in the printer was extensively pretested for reliability, a flash detector was included in the ACSAR Printer as an error precaution to ensure against any possibility of missed exposures. In the event of a lamp misfire, a series of additional flashes would be initiated for the given frame; if an exposure flash were still not detected, the printer would shut down and a diagnostic signal would sound.

D. Automatic Operation System

An automatic instruction inputting and printer control system were added to permit the printer to operate at its maximum speed rate. The heart of this automatic system was a PDP-11/05 Minicomputer. This computer would receive initial and continuous instructions during all printer operations. Specifically, it received inputs from the frame mark and code reader systems, the precise feed capstans, the flash detector, and other print cycle interlocks. Based on these inputs, the computer outputs instructions to the printer. The input/output time of the computer is always shorter than the printer cycle of one exposure per second. In addition to the computer, this automatic system included a high speed paper tape reader, a teletypewriter, interface electronics, and a situation control panel.

Each of the above subsystems was designed, bench tested, and implemented into the basic printer system. Special attention was taken by properly shielding, decoupling, and filtering to avoid undesirable interactions.

The versatility of the printer is basically limited only by the storage capacity of the computer. Inputs to the system can be quickly modified via the high speed tape reader programs or through the teletypewriter.

System output formats can be varied from multiple copies of complete subspool composites to multiple copies of selected single frame composites, or to any combination of both. The composites are outputted in continuous roll form with teletypewriter copy confirmation of frame numbers and numbers of copies printed. This continuous roll output with its frame marks and BCD code frame numbers, and after completion of duplicate recompositing processing, can be the basis for extracting chips or flats if desired.

This Automatic Compositing Step and Repeat Printer successfully met all developmental requirements on or ahead of schedule and was accepted as the prototype for the baseline compositing component in the [redacted] production cycle. The ultimate impact of this ACSAR was the significant increase in speed of compositing and the elimination of the requirement to cut and splice the original negative numerous times to produce the desired composite. Figure 4-14 is a photograph of the Automatic Compositing Step and Repeat Printer.

This prototype ACSAR Printer will be shipped to the [redacted] upon closure of AFSPPF. As a result of this work three production models have been ordered by CIA to support [redacted] These ACSAR Printers will be installed and operationally activated into [redacted] in the spring of 1977.

- Non-Conventional Photographic Materials Evaluation Capability -

In 1963, AFSPPF began its involvement in the development, test, and evaluation of non-conventional photographic duplicating materials to replace the conventional silver halide films. During this early period, there was only limited knowledge in this field and a very small number of instruments to process these types of films. However by 1968, AFSPPF had developed and continued to expand its capability to test and evaluate non-conventional materials. The Facility built this function into the first and most unique test and evaluation (T&E) capability unit within the United States Government.

This development program began as an effort to find duplicating films which would: (1) eliminate the need of a water supply for processing and (2) reduce the requirement for silver, which had become in scarce supply. However, as both the GAMBIT and HEXAGON systems performance improved, the major goal of the non-conventional duplicating film program centered on finding a duplicate film capable of retaining as much of the original's information as possible.

In October 1964, AFSPPF began an evaluation of a material called Free-Radical. This film was produced by Horizons, Incorporated (HI) and was a dye-molecular material which contained no silver and had a high resolution transfer capability. The film was processed/fixed by immersion in a solvent. Although this Free-Radical system appeared to have great potential, it was unacceptable in a volume production environment because of the toxicity of the solvent. In November 1966, AFSPPF began the second of five contractual efforts with HRI for an improved Free-Radical duplicating film which was to be

AUTOMATIC COMPOSITING STEP AND REPEAT (ACSAR) PRINTER

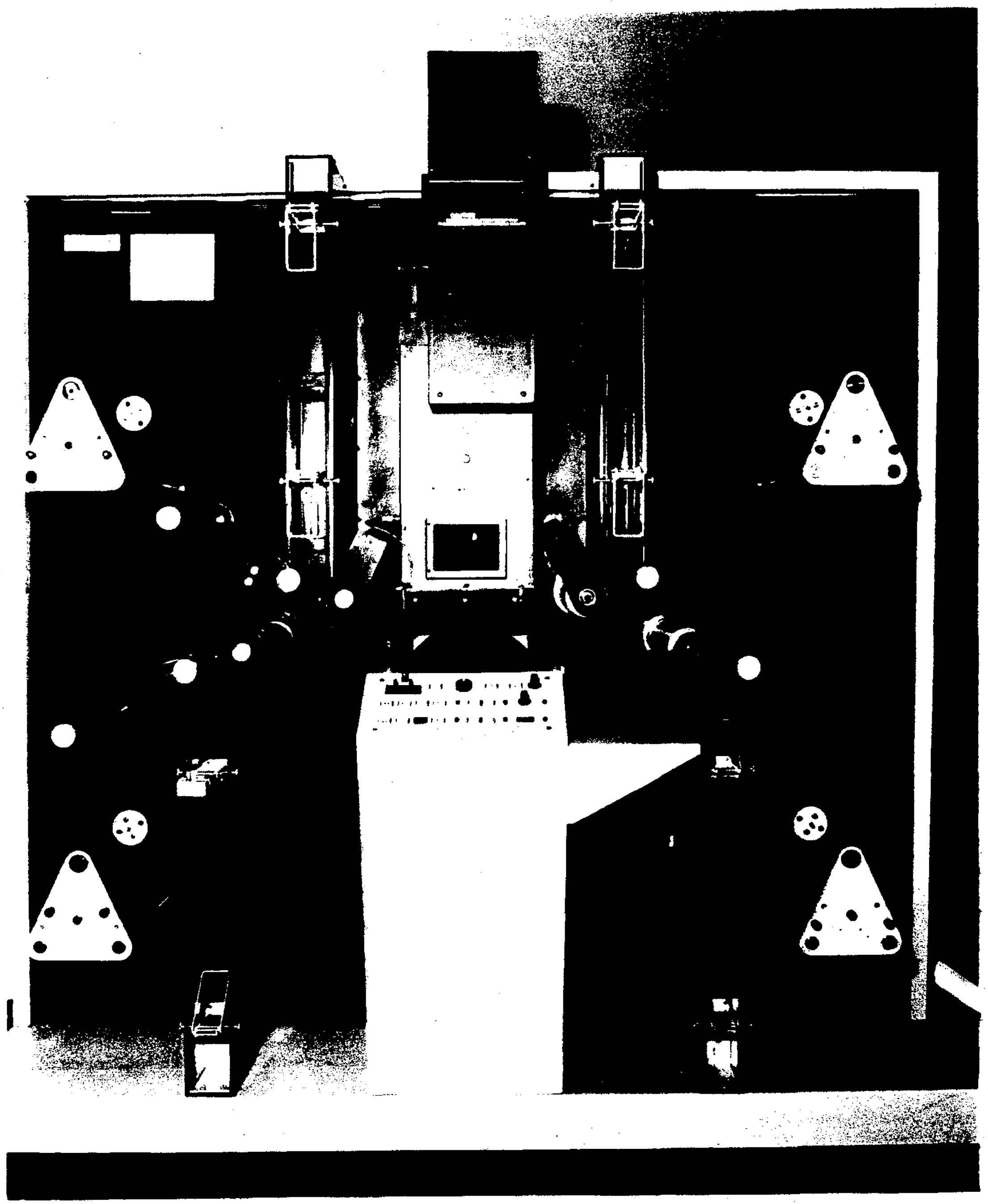


FIGURE 4-14

a completely dry neutral system. The system proposed using hot air at 120 to 160 degrees Celsius to process the film. This, as with each of the succeeding efforts, provided improved Free-Radical films under laboratory conditions, but HRI could never succeed in making a duplicating film which would meet operational production requirements. In total the Facility spent 10 years pursuing this concept at a cost of [redacted] only to find that more research was required into the processing mechanism of this material. This program was discontinued in December 1974.

Other AFSPPF efforts in studying/researching non-conventional materials and processing techniques during this period included:

A. Reviewed the work done by Kalvar, Incorporated, New Orleans, Louisiana, on a vesicular light refracting film but it did not meet the resolution requirements.

B. Invested over [redacted] in research by Tecnifax, Incorporated, Holyoke, Massachusetts on a molecular dry processed film called Diazo. This associated research started back in 1963. Two printer/processors were developed by Tecnifax for [redacted] to handle Diazo and other dry chemistry films. This effort was not successful because no duplication system could be found to transfer the high resolution capabilities of the Diazo original. This was because of Diazo's low sensitivity which required a very long printing gate. The length of processing time ("creep") apparently destroyed the resolution transfer.

In 1968, AFSPPF's Evaluation Directorate performed an important study[90] during evaluation of GAMBIT missions which revealed that 20 - 25% of the resolution measured on the original negative was being lost in the duplication process. This was traced to the poor modulation transfer function (MTF) of the standard duplication material (Film Type 2430) furnished to the community. AFSPPF further showed that expected improvements in GAMBIT performance, on which millions of dollars were invested, would increase the resolution loss to 40 - 50%. This exposé led to other major programs in an effort to develop better duplication films, processes, and printers.

Also in 1968, AFSPPF learned of another promising film system called Reduced Silver (RS), a viscous processed film developed by Itek Corporation. Itek was given approximately [redacted] in funding to perform RS material research and build a full scale printer/processor to test the feasibility of using Reduced Silver on an operational mission production basis. The major factor in terminating this effort was that RS had a very rapid latent image decay factor. The film had to be processed immediately after exposure. A printer/processor was developed, delivered, and used in RD for work on other programs.

The Minnesota Mining and Manufacturing Company (3M) developed a dry processed photographic film called Dry Silver (Type 784). The research of this material was co-sponsored by NPIC and AFSPPF. This

[90] IBID, Footnote 57, page 2-83.

film had its processing chemistry built into the coating of the film. Processing was activated by a tempered air heat process. AFSPPF conducted evaluations on 3M films and two generations of heat processors from 1970 to 1975. The Dry Silver material did not perform consistently at fixed processing temperatures and the processors had cyclical variations in uniformity during heat processing. This effort was discontinued in March 1975.

AFSPPF continued to brief the CCB on all studies and efforts being pursued by RD to develop a non-conventional substitute for the silver halide duplicating films. By the end of six years of work in printing, processing, and analyzing, AFSPPF had become recognized for its technical capability in evaluating non-conventional systems. Additions to the RD T&E Laboratory included equipment to measure densitometry, sensitometry, and a microcamera to test the resolution and noise characteristics of these new films. As the CCB was aware of AFSPPF's proficiency, in July 1970 they directed that this organization conduct a comprehensive test and evaluation program of the most promising non-conventional and conventional duplication systems. A portion of this program was designed to be performed as near to high speed production conditions as possible. Consequently in February 1971, a piece of mission original negative film was taken to Itek and Perkin-Elmer for exposure and processing on their production equipment. Itek used its printer/processor and Perkin-Elmer utilized the modified Niagara they developed for Free-Radical film processing. The study was concluded in late 1971 and a report written on the results of both conventional and non-conventional film systems. The conclusions showed that the RS had the most promise for reaching 100% resolution transfer at 200 lines per millimeter (the goal of the HEXAGON Program). However, it was Eastman Kodak's new silver halide duplication stock (SO-192) that demonstrated the best resolution (it reached a 90% transfer level). This report was distributed in a TK classified version,[91] and in a Confidential edition.[92] The CCB weighed the results of this study and a similar evaluation performed by NPIC and decided that the conversion of all production to the RS film system was too costly compared to the adoption of SO-192. Therefore, SO-192 became the standard duplication film for GAMBIT and HEXAGON mission production.

During the 1970s, other series of equipment were developed to improve the evaluation of non-conventional films, i.e., the High Intensity Precision Sensitometer, the Free-Radical Printer, the Free-Radical Processor, the ultra-violet exposure capability of the Advanced Microcamera Systems, etc. The NRO community continued the research and development of Free-Radical, including the support of acquisition films. In this effort, AFSPPF was tasked to provide T&E support to Photo Horizons (a subdivision of HI),

[91] Report, AFSPPF, 23 November 1971, Evaluation of Conventional/Non-Conventional Films, TCS 354007-71. (TS)
[92] IBID Footnote 61, page 2-84.

NPIC, and the CIA.

In February 1975, the Facility funded for the research and application of an innovative, non-conventional duplicate material called Amorphous which was developed by Energy Conversion Devices, Troy, Michigan. This new technology offers both latent and developed image stability and is processed thermally. Another effort being pursued by AFSPPF at the time of the Facility phasedown was an electrostatic film called Transparent Electrostatic Photographic (TEP) material made by Scott Graphics, South Hadley, Massachusetts. This effort was undertaken as it showed great potential as a recording film for the [redacted] To assist in this evaluation the RD engineers became part of a team that developed a [redacted] sensitometer which could be attached to an optical table for the evaluation of the TEP System. These last two efforts will be carried on by the RD function now assigned to CIA.

The test and evaluation facilities, equipment, and expertise accrued by AFSPPF over approximately 12 years became an important asset to the NRO community. The capabilities of this organization were unique in that production, system evaluation, photoscience, and T&E specialists were available at one location and dedicated to the improvement of photographic reconnaissance equipment and techniques. The major contributors in the contractual, research, test, and evaluation of non-conventional materials at AFSPPF were: Mr. Nelson Julian (an RD Research Engineer), Mr. Milton Worwood (Chief of the PD Materials Analysis Laboratory), Mr. George Myers (the Facility's Technical Director), and Technical Sergeant Allan Scott (an RD Research Technician). Every effort was made to ensure that unbiased, scientifically sound analyses were provided to all users of the T&E facilities at AFSPPF. Many of the CCB decisions, which impacted on choices of films, processes, and directives to contractors, were based on results achieved by AFSPPF.

DIRECTORATE OF EVALUATION (EV)

The primary mission of the Evaluation Directorate was to maintain and operate an independent and unbiased Government evaluation unit for performing the analysis of operational and proposed reconnaissance imagery and duplicating systems; to provide data processing technical assistance, programming, and computer support to the image evaluation mission and the Facility's management information requirements; and to operate a printing plant for publishing classified technical reports, briefings, and visual graphics.

EV was similar to the Production Directorate in that it was primarily operated as a mission-oriented services directorate. The majority of accomplishments were in support of the CORONA, GAMBIT, and HEXAGON Programs. EV's major achievements must be attributed to the innovative and dedicated nature of the physical scientists, data programming analysts, the Chief of the Technical Reports Division, and the knowledge and foresight of some of the Directors. These people worked closely with the engineers from

RD in accomplishing these operational improvements. The achievements were associated with expanding the scope, improving the techniques, and/or increasing the processing/mensuration speed. The most significant of these were: (1) the evolution of microdensitometry; (2) the management of the Controlled Range Network (CORN); (3) the establishment of image quality analysis techniques and software, and (4) the design and implementation of the Automated Resolution Data Terminal (RDT) System.

- Evolution of Microdensitometry -

The Drell Committee, which later became the [redacted] Committee, was assembled in 1963 to debate the state-of-the-art of image analysis and provide guidance for the future. One of the major results of these deliberations was the recommendation that the analysis of edges and lines on satellite photography could provide reliable objective measures of on-orbit camera system performance. Theoretically, the spread function of the optical system can be obtained from the derivative of an edge trace. The Fourier transformed spread function then provides a Modulation Transfer Function (MTF) for the system. This is true if the dimensions of the input forcing function (ground target) are known and the system is reasonably linear. However, the critical factors in implementing this technique were the development of a precision machine capable of measuring microdensities on film and the development of a method for obtaining the MTF of the actual film material used.

The scientific firm called Data Corporation, Dayton, Ohio, was originally formed to pursue contract research and development in the aerial reconnaissance field. Data Corp was one of the organizations that worked very closely with AFSPPF management during the physical building and development of the Facility and was very instrumental in equipping it for photographic film duplication. Data Corp had for some years been experimenting with microdensity measurement systems and, because of this knowledge, was awarded a contract to develop the first precision microdensitometer.

The design of the first microdensitometer was based upon a precision microcomparator stage available from the David W. Mann Company. Data Corporation was the prime contractor and performed the system design and specification. The final product was built by D. W. Mann Company except for portions of the photometric and electronic system which were built by Data Corporation. The first machine delivered to the Facility was the Model 1032 ("A" Machine), see Figure 4-15. This machine was completed in August 1962. Up to this time, little use had been made anywhere of microdensitometric data other than as a qualitative descriptor of image structure. However, it became apparent that the quality of the new film materials now being used would require better means of collecting and processing data. In December 1963, the Facility accepted delivery from Data Corporation of the first Digital Data Acquisition System designed for microdensitometry. This system produced a paper tape compatible to the IBM 1620/1710 Computer paper tape readers at this Facility and provided the capability necessary for automated data analysis. The

THE FIRST MANN-DATA MICRODENSITOMETER, MODEL 1032

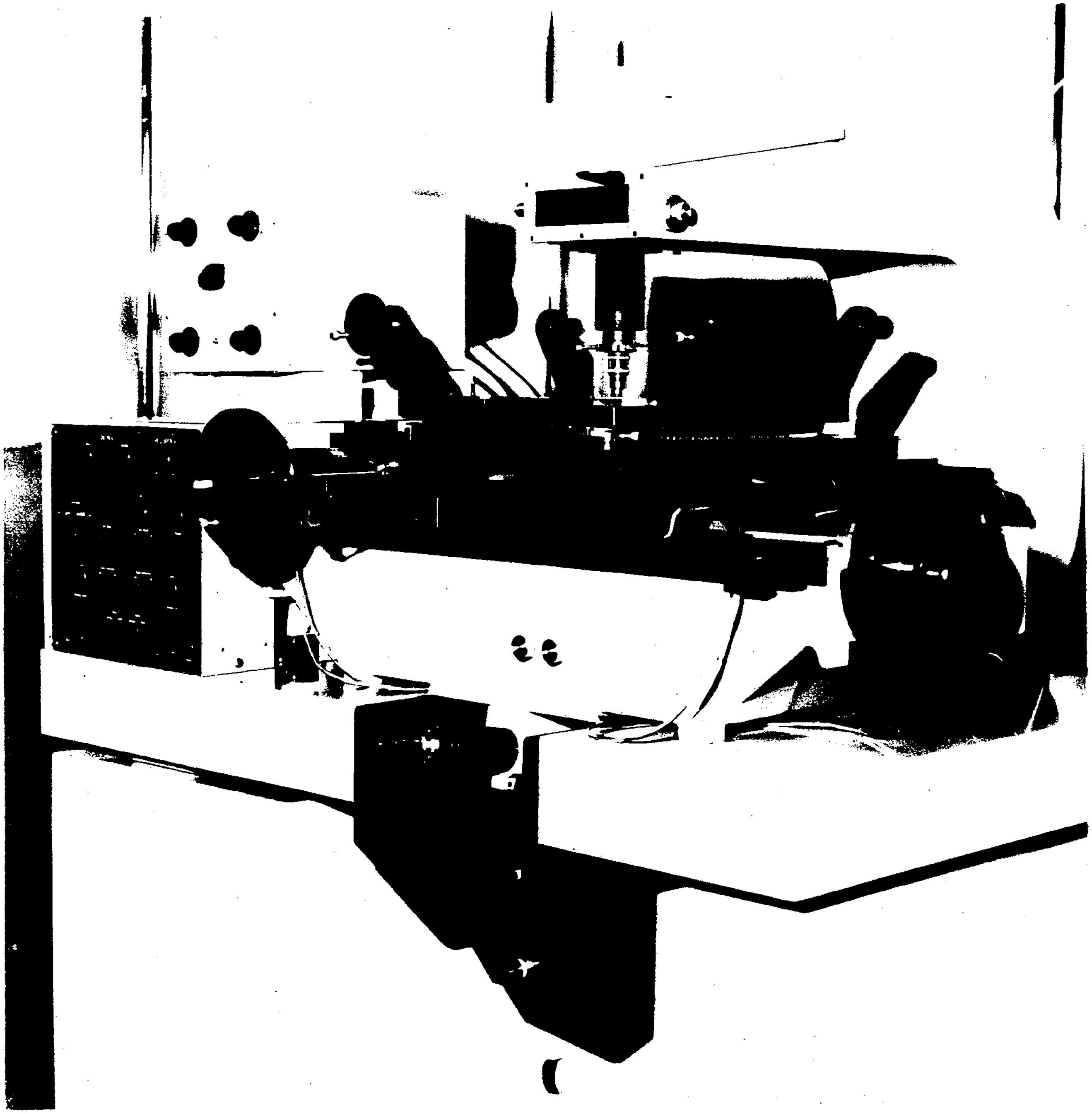


FIGURE 4-15

Digital Data Acquisition System was interfaced onto the Mann-Data Microdensitometer "A" Machine. In February 1964, the "A" Machine with its automatic data collection capability was used to collect data on CORN targets from CORONA Mission Segment 1004-1.

With the improvements of the CORONA and GAMBIT camera systems, acquisition films, and processing, it was soon realized that an additional analytical and machine capability was required. In September 1965, two of the Model 1140 ("B" and "C" Machines) Mann-Data Microdensitometers were delivered, complete with paper tape data recording equipment, see Figure 4-16. These improved capability machines were smaller and lighter than the Model 1032. In late 1966, these machines were modified to incorporate force-feed oiled nuts for driving the stage, which allowed higher speed scanning. In May 1967, a Magnetic Tape Recording System was developed for the "A" Machine, along with a solid state logarithmic amplifier of improved stability and range. The paper tape recording equipment was used continuously until late 1969, and the "A," "B," and "C" Machines were in operating condition until transferred to other standards laboratories.

Ironically, the means of expediting the development of an operational measuring system by having Data Corp perform the work led to the main system deficiency. The customized circuitry of the mid 1960 electronic era proved to be erratic and difficult to align and maintain. The microdensitometers were in demand because more technical analysis was being made as the satellite systems were improved and more knowledge learned about image analysis. After four years of operational experience with the three instruments, representing over [redacted] in investments, AFSPPF decided improvements had to be made. The down time on the equipment had become so excessive that it was no longer possible to meet EV's stringent suspense deadlines and, therefore, provide data in time to affect the next system's launch parameters.

The first decision made was to have some local contractor or AFSPPF maintain the instruments. A crash program was initiated to redesign and convert the electronic measuring and data collection systems to commercially available, high quality electronic units which could be aligned and maintained by AFSPPF military electronic personnel. The best available regulated power supplies, logrithmic amplifiers, and analog-to-digital converters were procured. The photomultiplier light sensor was redesigned using the best PMT available to optimize noise, range, and stability. Approximately [redacted] of miscellaneous electronic equipment was purchased to modify the three systems at AFSPPF. In addition to the upgrading of the Photometric System, improvements were made to the Position Measuring System and the Data Collection System. Optical shaft encoders were added to the "X" & "Y" drives for position sensing. A minicomputer (Digital Equipment Corporation, Model PDP-8) was configured with magnetic tape decks to provide high speed data collection from two microdensitometers simultaneously. Another feature added was a means for automatic insertion of header information (operation, rev, date, operator, etc.). The

MANN-DATA MICRODENSITOMETER, MODEL 1140

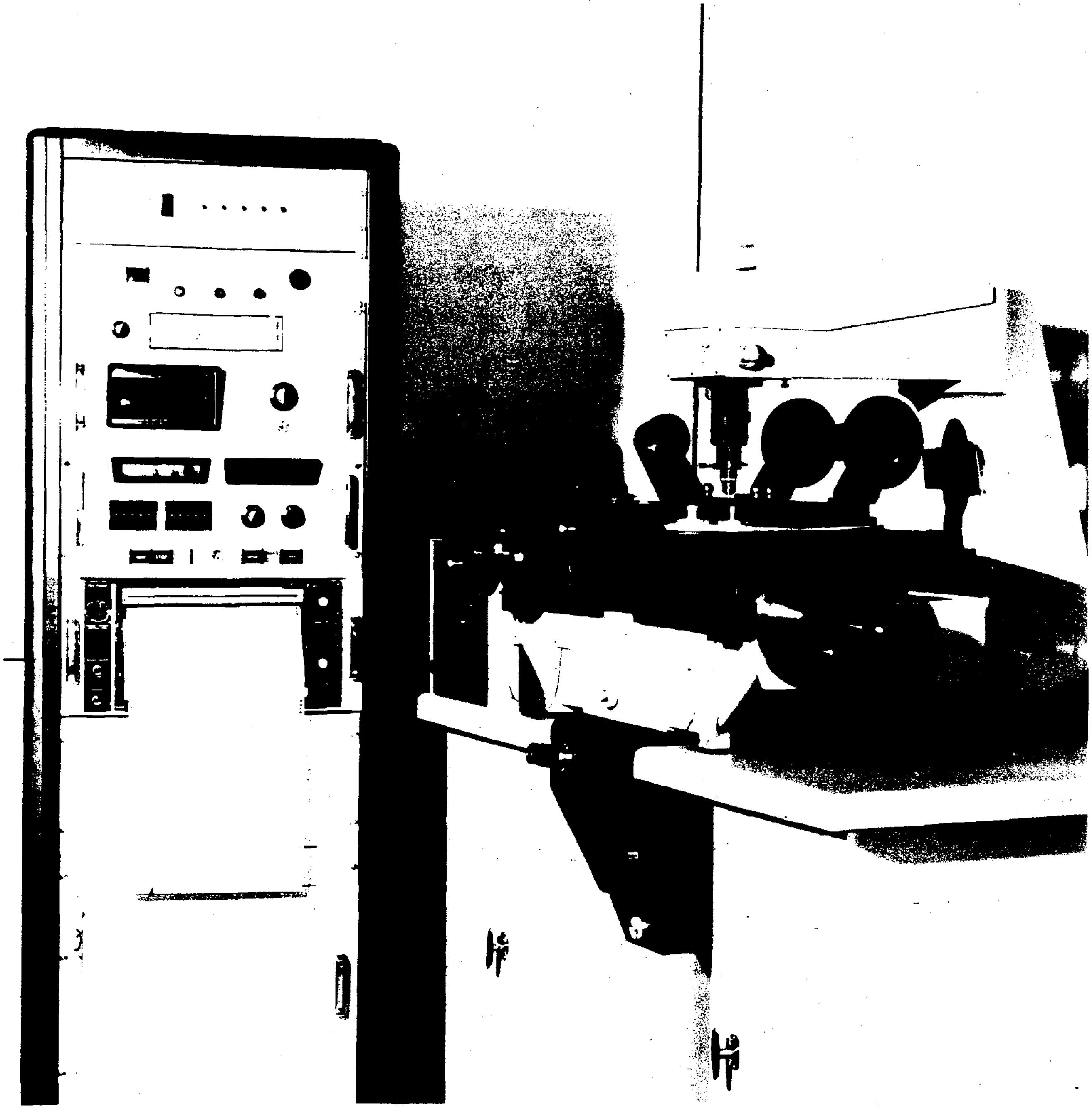


FIGURE 4-16

data reduction and analysis were reduced considerably by this automation. The "B" and "C" Machines were used to support the mission until the phasedown occurred. The "A" Machine was used for in-house film studies and will be shipped to DIA/DC-6 upon closure of AFSPPF. The men most responsible for the development of these machines at AFSPPF were Mr. M. Worwood and Sergeant J. Weinert.

During the period when the Mann-Data machines were causing so many maintenance problems, the RD engineers and EV scientists kept researching for a more production oriented machine. In the spring of 1969, AFSPPF gained knowledge and was briefed on a new microdensitometer developed by Photometric Data Systems (PDS) Incorporated, Webster, New York. Although the design did not include roll film handling, there were the following interesting features: (1) fast scanning, (2) direct viewing of the scanned area, and (3) minicomputer control (PDP-8) of the scanning and data collection. AFSPPF requested the PDS Company to present a proposal on building a machine with modifications to meet the mission requirements of the Evaluation Directorate. Negotiations were successful and two systems were purchased at a total cost of approximately [redacted] The machines as manufactured by PDS would not meet the requirements of AFSPPF, which made close coordination essential during design and development. Even after delivery, information supplied by EV to PDS was responsible for continued improvement in the microdensitometer system and in the system control software. These two machines, backed by the Mann-Data systems, enabled the Evaluation Directorate to meet the new mission challenge of analyzing each HEXAGON camera system. Full loads of original film were run during chamber tests at Perkin-Elmer's (the camera contractor) East Coast Acceptance Plant and their West Coast Preflight (Readiness) Facility. Thousands of test targets had to be analyzed from this chamber film before the HEXAGON camera could be certified for launch. Even the mission postflight payload analysis was a much greater workload than expected, as many more target acquisitions were made during the early stages of this program in order to fully characterize the HEXAGON System. The PDS machines, with their automated data collection and reduction capability, proved to be invaluable assets when additional mensuration requirements, such as repeated scanning of a large list of targets on each mission, were requested in order to optimize exposure settings on-orbit.

However, as more experience was accrued with the exceptionally high resolution (on the order of 200 lines per millimeter) of the HEXAGON products, severe technical limitations began to appear with the microdensitometers at AFSPPF. Foremost was the optical phenomenon called partial coherence which causes measurements to become object-dependent when the resolution level reaches the coherence interval of the optical system's illuminating source. The effects of this problem are the widely variable results from traces of imagery from the same camera system as if the MTF of the microdensitometer were constantly changing. The problem is difficult to isolate because it is compounded by any other machine variation such as retrace errors, focus variation, noise fluctuations, etc. AFSPPF had been researching this phenomenon and suggested a solution to develop an optical system completely different from the classical microdensitometer. This system would be designed with a laser light source to scan the image with an intense spot of light, thus allowing all the transmitted light to be collected in a manner similar to that of an integrating sphere. This idea was first proposed by Drs. Thomas Skinner and George Parent of Technical Operations, Incorporated, Burlington, Massachusetts in consultation with AFSPPF. The theoretical soundness of the idea was researched and evaluated by Mr. Richard Swing and Ms. Diana N. Grimes of the National Bureau of Standards.

A contract was sought in 1969 to build a laser scanning microdensitometer to evaluate these theories. The Columbia Broadcasting System (CBS) Laboratories, Incorporated, Stamford, Connecticut submitted a proposal to build the instrument applying their expertise gained in laser scanning on the [redacted] Unfortunately, another company formed by dissident engineers from CBS, called Image Systems, Incorporated, located in Stamford, also submitted a proposal. AFSPPF was ready to award the contract to CBS when the two companies got into litigation and rather than getting into the legalities of the situation, the decision was made to cancel the program. As a result, two years were lost before any further development work would be undertaken.

Operational experience with the PDS Microdensitometers began to indicate that reliability and repeatability were no better than with the Mann-Data systems. Even when operational, the data produced was suspect due to the failure to maintain absolute focus control and positive positional accuracy. Although these problems had been or were being attacked individually (e.g., development by Technical Operations of the pneumatic focus control servo in August 1972), it was apparent that stopgap measures would not suffice and that a new generation instrument was required. After much review and debate about advanced scientific instruments versus rugged, reliable production instruments, a decision was made to let a contract for the research and development of a "New Generation Microdensitometer" (NGM). The requirements for this instrument encompassed the ideas of the leading Government and industrial scientists in this field. AFSPPF received 40 responses in answer to their advertisement placed in the Commerce Daily. Of these, eight firms submitted proposals and three were deemed satisfactory. A unique approach was taken when two of these firms were funded to perform parallel research studies for one year. These two companies were Technical Operations (Tech Ops), Burlington, Massachusetts, and Cornell Aeronautical Laboratories (CAL), Buffalo, New York. It was felt that the long range interests of the Government would be best served by this competitive study. Key personnel in this effort were: Mr. G. Reynolds and Mr. J. Fallon at Tech Ops; Mr. R. Kinzly at CAL; Mr. G. Myers, Major J. Johnson (Project Engineer), and Major M. Pollard at AFSPPF; and Mr. R. Swing and Ms. D. Grimes at NBS.

In October 1972, the contractors submitted reports of their research, detailed design plans, and a breadboard mock-up for the NGM. A large team of experts from NPIC, AFSPPF, EK, NBS, RADC, and AFAL conducted an in-depth study and recommended award of the fabrication contract to Tech Ops. The CCB felt the design was so promising that two instruments were contracted for at a total cost of [redacted] one for EK/BRIDGEHEAD and the other for AFSPPF.

It should be noted that the Pneumatic Focus Servo Control designed by Tech Ops for the NGM worked so well in the laboratory that a decision was made to retrofit the PDS machines with that system. Three machines were modified and as a result were able to gain focus control to ± 0.5 micrometer over the full focus range of the optics for the normal scanning distances.

Tech Ops did an excellent job building the New Generation Microdensitometer (NGM), also known as the Linear Microdensitometer (LMD). Technically, the system exceeded some of the specifications. The first NGM (SN-001) was delivered to AFSPPF for operational T&E in March 1975. This machine was then shipped with other equipment from the Evaluation Directorate to NPIC in August 1975, where it has been available for operational mensuration and continued T&E. Figure 4-17 shows a picture of the New Generation Microdensitometer (SN-001). The second instrument (SN-002) was installed at Eastman Kodak in April 1976. This unit was funded for EK to support research programs and systems evaluations tasked by the CCB. Thus far, some problems (laser reliability, maintaining precise optical alignment, and a defect in the stage servo) have surfaced during the test and evaluation of both machines. The operational evaluation was not completed by the end of 1976, but the following major features had been successfully demonstrated:

A. Repeatable measurements in density and position on both color and black and white films.

B. Measurement latitude of 4.0 optical density with a daily precision of ± 0.01 density.

C. Positional precision of ± 0.5 micrometer for scans up to 100,000 micrometers.

D. Apparent linearity to over 400 lines per millimeter, the limit of the testing.

E. Scan velocities up to 8 millimeters per second and data rates of 8 kilohertz.

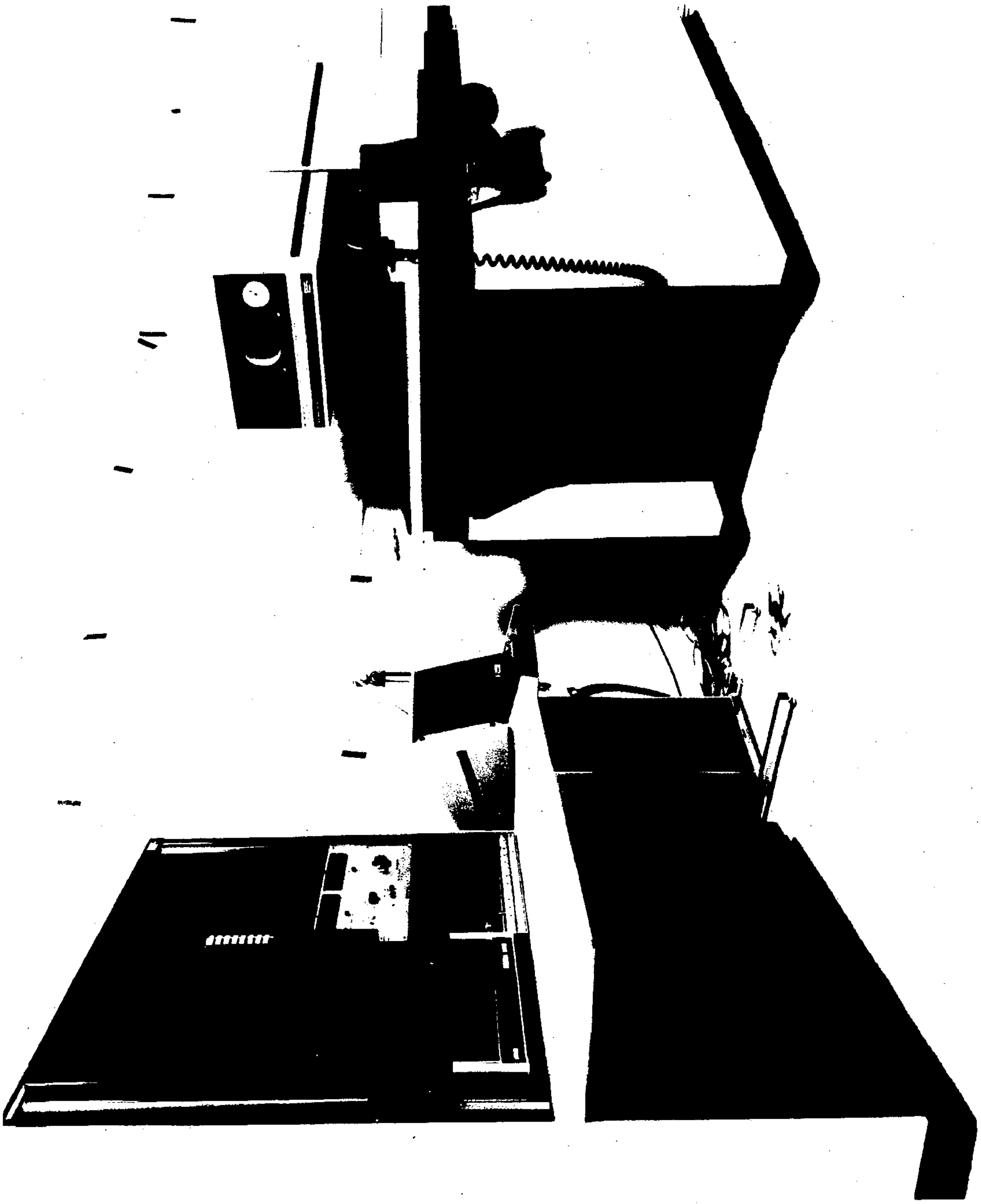
F. Focus control within ± 0.5 of a micrometer.

G. Solid state detectors with low noise due to the energy of the laser sources.

H. Complete computerized scan control, data collection, scan display, and readout; also, computer monitoring of instrument status, error notification, and maintenance diagnostics.

I. Maximized operator convenience and comfort.

The major problem, which delayed acceptance and delivery of the second unit, was a serious defect in the Positional Servo System. Repeated scans showed the ± 0.5 micrometer precision was not being obtained. Compounding this problem was the fact that the Advanced Technology Division of Tech Ops made the decision to go out of business on 30 September 1975. This greatly hampered efforts to resolve the servo problem. Part of the technical staff from Tech Ops who worked on building the NGM remained



THE NEW GENERATION MICRODENSITOMETER (NGM)

FIGURE 4-17

together and joined Aerodyne Research, Incorporated (ARI), Bedford, Massachusetts. Although ARI spent a great deal of time trying to solve this problem, it was to no avail. Finally, at the suggestion of AFSPPF, ARI consulted with the Draper Laboratory of MIT on the problem. Dr. Shaoul Ezekiel was assigned to the system. Under the guidance of Dr. Ezekiel, the ARI engineers isolated the problem as a design error in the servo itself. Modifications to both machines were effected and some improvement was observed. Erratic scan behavior still exists and is presently being evaluated by NPIC/APSD.

Although these two machines were well constructed by Tech Ops, the estimated cost was grossly underestimated. This program, including the parallel study phase, cost [redacted] However, the management (NRO, CCB, and AFSPPF) kept faith in this development and was able to secure the additional funding support. Although the final characterizations of performance have not been completed, it is certain that an advance in the state-of-the-art of microdensitometry has been achieved. Special credit must be given to the following people who have conducted their respective T&E programs: Captain Stephen Noland (EV Scientist who now is assigned to NPIC), Mr. David Richards (a Research and Development Scientist at Eastman Kodak), and the man who has continued to monitor the acceptance of this entire program, Major Jay Johnson (RD Engineer who now is assigned to the NRO Staff at SAFSS).

- The Controlled Range Network (CORN) -

One of the most successful and the longest running contractual efforts in which AFSPPF was involved was the Controlled Range Network (CORN) Program. AFSPPF was responsible for the operational, contractual, and financial management of this program from its implementation on 15 October 1963 until the NRO managerial responsibility was transferred to SAFSP in the summer of 1974 due to the pending closure of the Facility.

CORN is a system of Government owned mobile and fixed site reconnaissance targets within the continental United States, which is utilized by various Federal agencies and their contractors to test and evaluate photographic, radar, and infrared reconnaissance systems. The primary use of CORN has been to support the following NRP Programs: CORONA, GAMBIT, HEXAGON, IDEALIST, and during its experimental era [redacted] DoD winged reconnaissance aircraft including the RF-4C, RF-111, SR-71, and RA-5 as well as the NASA winged and satellite programs have also been supported. Additionally some experimental CORN Five-Step Gray Scale (5GS) and tribar resolution targets made out of paper were utilized at [redacted] for the operational evaluation of RF-4C Camera performance. The CORN Program has made a significant contribution of providing otherwise unobtainable data to the various program offices for their engineering and design studies and, in the case of HEXAGON, for the determination of fees on an incentive based contract.

The management, technical services, and materials necessary to operate the CORN Program have been provided by a single contractor, Mead Technology Laboratories (formerly named Data Corporation), Dayton, Ohio, under yearly Air Force contracts with AFSPPF from 15 October 1963. CORN evolved from a need to provide objective ground truth data on reconnaissance systems performance for NRO Programs. The original concepts for operational resolution targets and the evaluation of the recorded imagery were developed by the Drell Committee. The services of the Mead Technology Laboratories (MTL) for target development and deployment were procured because of their involvement with systems performance analysis. The original CORN Statement of Work authorized the establishment, management, and support of photographic reconnaissance sites which included a teletype communications network. Provisions were also made for the development, test, and fabrication of advanced target types and the establishment of mobile field station engineering and technical services. The contractor was directed to formulate "operations plans" which would include the selection and effective use of geographic target locations and outline the procedural details for target display/instrumentation operations, site alerting, site reporting, personnel training, and target maintenance.

The majority of users were informed about the capability and services of this program through a reference book called the CORN Manual,[93] which was published by MTL. The CORN Manual described the unclassified operation of the program, each fixed site, each type of mobile target, the mobile multi-sensor targets, and the different target ranges (photogrammetric, radar, and infrared). This manual was distributed to all probable Government users. On several occasions CORN symposiums were held in order to bring interested parties together to be briefed on the current operational procedures, capabilities, and funding. In July 1965, a large symposium was held at Wright-Patterson AFB, Dayton, Ohio which in reality was held to establish a cover for the national satellite reconnaissance aspect of the CORN operation. Over 250 people from the different military services; Government agencies; photometric, infrared, and radar equipment manufacturers; as well as the operational users attended. The group was briefed that the CORN network was going to be used to test equipment on fixed wing and helicopter aircraft systems. A Manual[94] was handed out to all attendees fully describing the CORN Program. Another symposium was held at AFSPPF in August 1968 for security indoctrinated users only. This meeting was called to establish priorities and schedules, and to resolve problems in the targeting encountered within the NRO community.

When CORN started in 1963, only fixed resolution target arrays were available. These were located at: [redacted]

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[93] Manual, Data Corporation, 15 September 1973, Controlled Range Network. (U)

[94] Manual, Reconnaissance Division, Reconnaissance Applications Branch, AFAL, July 1965, Controlled Range Network. (U)

However, the need to increase the number and location of target arrays to facilitate systems evaluation resulted in the expansion of this network to a mobile target display system.

By April 1964, the first ground mobile units were established. They were located at [redacted] Each unit consisted of a rental 5 ton truck (the prime target vehicle), and a pickup truck with a small trailer for temporary housing for the personnel in the field. The 24 hour operating range for a two-man field crew was 200 nautical miles. This meant that from assignment of the target area, the crew could travel a maximum of 200 nautical miles with their equipment.

The ground mobile units were supplemented by an air mobile target unit in May 1964. This unit utilized a chartered C-47 Aircraft to transport targets and crew to remote locations, providing quick response to display requirements that could not be met by ground mobile units because of time and distance. Air mobile target display operations were discontinued in early 1966 as an economy measure. The targets from that unit were transferred to a supplemental ground mobile unit designated [redacted] Table 4-1 provides a summary of the number of mobile crews and primary fixed sites utilized by CORN over the 1963 - 1974 time period.

TABLE 4-1

SUMMARY OF THE NUMBER OF MOBILE UNITS AND FIXED SITES

| Year | Mobile Units | Fixed Sites |
|---|---|---|
| 1963 | 1 | 4 |
| 1964 | 5 | 3 |
| 1965 | 6 | 2 |
| 1966 | 12 | 2 |
| 1967 | 9 | 1 |
| 1968 | 9 | 0 |
| 1969 | 9 | 0 |
| 1970 | 9 | 0 |
| 1971 | 9 | 0 |
| 1972 | 9 | 1 |
| 1973 | 9 | 1 |
| 1974 | 9 | 1 |

Since 1963, concepts for using the targets as well as target designs have continually evolved to meet each new requirement of the various program offices. The original mobile target complement was comprised of the Military Standard 150A (Mil Std 150A) Resolution, 74 foot diameter Bullseye, and Gray Scale Targets. The targets consisted of portable sections which could be assembled in a two hour time period. Other targets developed during the early period of this program were the High Contrast Tribar ("T"), the Tri-Color, and the Point Source. The High Contrast "T" Bar Target had uniform bar lengths and decreasing bar widths, in a sixth-root of two progression, and was designed to measure ground resolutions from 17 to 8 feet. Design reflectances were 88% for the bars and 4% for the background. The Tri-Color Target consisted of three (red, white, and blue) 20 x 20 foot patches, and the Point Source was a 19 inch diameter, highly polished spherical reflection target.

The remainder of 1964 witnessed additions and modifications to the mobile target inventory and formal management control of many fixed target sites. The High Contrast "T" Bar was redesigned with the bar length-to-width reduced to a 5:1 aspect ratio. Medium Contrast (9:1) and Low Contrast (5:1) "T" Bar Targets were fabricated from resulting salvage materials. Additional Mil Std 150A, designed to measure ground resolutions from [redacted] were added. Bullseye Targets were deleted from the inventory in September 1964. The materials from the Bullseye Targets were later used to fabricate the Eight-Step Gray Scale Targets which were put into the inventory in April 1965. A new mobile target for the microdensitometric evaluation of edge gradients was conceived in April 1964 and added to the inventory in September of that year. Originally designated the Controlled Scene Brightness Target and nicknamed "Acres and Acres," it was later renamed the Edge Analysis Target (Edge Target). This target included one hundred and two 40 x 20 foot panels of vinyl coated canvas. When fully deployed, the target presented both 200 foot cross-track and a 200 foot in-track edge of 37% (gray) and 3% (black) reflectances. The deployment of this target could be varied to display edges of 160, 120, 100, 80, or 40 feet in length.

In 1966, the 51/51 Tribar Target (5T) was developed. This proved to be the most significant target designed for measuring tribar resolution ever used in this program. This 5T had bars with a 5:1 aspect ratio and a bar to background contrast ratio of 5:1. The bar widths decreased in a sixth-root of two progression and provided ground resolution of [redacted]. Design reflectances were 33% for the bars and 7% for the background. The target consisted of two 381 foot legs, each with 9 panels, which were displayed with one leg parallel to the line-of-flight and the other perpendicular to it. Figure 4-18 illustrates a typical target array displayed after development of the 51/51 Tribar Target.

It was not until 1970 when CORN started to provide data to support the engineers of the HEXAGON Program that a need for vastly different target designs was evident. As an outgrowth of a HEXAGON engineering meeting at AFSPPF, two targets were developed. These were the Reversible Line Target (RLT) and the

TYPICAL MOBILE TARGET ARRAY IN 1966

(Edge, Gray Scale, Tri-Color, Point Source, and 51/51 Tribar Targets)

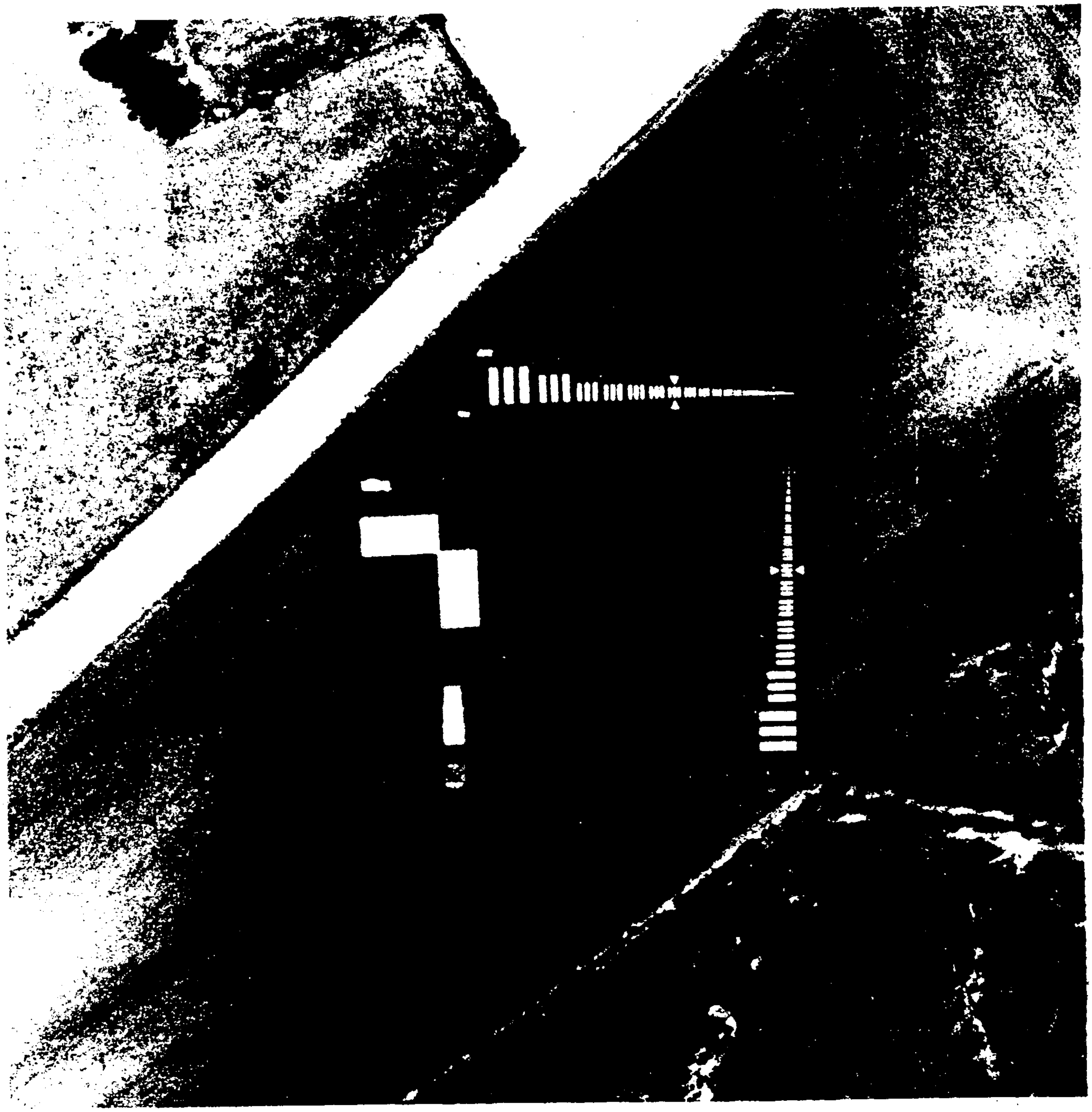


FIGURE 4-18

Two-Step Gray Scale (2GS) Target. The RLT consists of two legs of 84% reflectance material, which varied from [redacted] in width depending upon the requirement. These lines were deployed on 150 x 75 foot, 4% reflectance background panels. The RLT was used to evaluate the line spread function and the modulation transfer function of the camera system. The 2GS consisted of two 50 foot square panels, one with a 7% reflectance value and the other 21%. These targets were used to augment the RLT analysis by providing a means of determining image contrast.

Other targets were developed in the 1971 - 1973 time frame to provide data not obtainable with existing CORN targets. The following targets were designed by Eastman Kodak: Log Periodic, Six-Color, and Twelve-Color; while the Double Annulus and the Two Dimensional Dirac Comb Targets were originated by MTL. Although these last five targets provided the engineers with some valuable data, they did not have the impact on the CORN Program or program offices that targets like the 5T or RLT had. The specific dimensions, contrast ratio, reflectance, and descriptions of the majority (not the EK designs) of targets can be found in the current CORN Manual.

As important to accurate data acquisition as the target design and fabrication are, of equal importance is the geographic location and the precise method of displaying the target. Therefore, each field crew was highly trained to ensure the proper deployment of targets, to operate the site instrumentation (scene brightness meter and photometer), to record weather, and to describe any unusual environmental situation in the target display area. By the time AFSPPF transferred the management responsibility of CORN to SAFSP, the field operations for HEXAGON, which in the early 1970s required constant communication between AFSPPF, MTL, the Program Office, the SAFSP Operations Center, the Satellite Control Facility, and the Contractor's Field Units, had become routine. AFSPPF never had a single manager who was responsible for all functions of the CORN Program. The contractual and financial aspects were always assigned to an R&D Engineering Officer. The operational control was for a short time a PD responsibility; it was officially transferred to the Evaluation Directorate in the late 1960s. This move was made because of the projected close involvement in engineering requirements which would be coordinated between EV and HEXAGON Program scientists.

Basically the Facility's contractual and financial management changed little until the HEXAGON Program Office (HPO) began to utilize CORN resources at an unprecedented high level. Until that time AFSPPF budgeted annually for an estimated usage as forecast by the various program offices. These forecasts were usually accurate to within 10 - 15%. However, as there was no data base to forecast the requirements for HEXAGON, it was difficult to fund for support. As the HEXAGON engineers realized the potential of the CORN Program for characterizing their camera system, their use of CORN doubled from the original estimate forwarded to AFSPPF for budgeting. The impact of the HEXAGON Program on CORN was not merely one of an increased number of displays but also included the rapid fabrication of new target designs, site preparation procedures, and deployment configurations. The magnitude of the effect of HEXAGON on funding showed as this program increased in operational and management costs from approximately [redacted] in 1964 to over [redacted] in 1972.

Under PD, the operational control function consisted primarily of receiving requirements from the CORONA and GAMBIT Program Offices, declassifying the information, and retransmitting this CORN display tasking to MTL. However when EV assumed this responsibility, the requirements increased significantly. EV had a representative in the premission engineering group. This group had as one of their main responsibilities the planning of all CORN target designs and display configurations. This representative was Captain Harold Gordon who became so thoroughly familiar with the field operations of CORN and the GAMBIT and HEXAGON camera systems that he was able to guide/suggest options to the program offices which resulted in the maximum technical benefit with a minimum of expenditure in resources.

Since the Satellite Control Facility did not know the locations of the CORN crews or the weather in the display area, there were times when CORN crews were dispatched but displays could not be made or, if made, they were not acquired because of adverse weather conditions. Because of the heavy use of CORN resources, many of which were in photographic series for HEXAGON requirements, the Program Office could not afford to waste valuable engineering film on poor acquisition percentage targets. Therefore, a meeting was requested by AFSPPF with the HEXAGON Program Office CORN Manager, and operations personnel from the Satellite Control Facility and MTL to devise a better method of forecasting and cancelling CORN requirements. The new operations plan included: (1) providing the Satellite Control Facility with the programmed display locations on a daily basis, and (2) establishing a minimum cancellation notification time to prevent the field crew from incurring display costs for a deployment that could not be acquired. This method ensured maximum successful utilization of CORN financial and material resources.

The following is a summary of the contributions of CORN, while under the management of AFSPPF, to each NRP program:

A. CORONA

Initially, CORN was the only performance measure used for this program. As this was the first program to use CORN, no experience existed for this resource to support a satellite reconnaissance system, thus operating procedures, targets, and analysis methods had to be developed and tested. CORN provided system performance data for CORONA, which consisted primarily of tribar resolution readings.

B. GAMBIT

Support of this program again was primarily for system performance evaluation although the methods for collecting the data were improved by refining the tribar resolution targets and introducing the

Edge, Line, and Point Source Targets. CORN also was used for engineering tests such as focus (Defocus, Best Photograph Focus, and Best Electrical Focus), lens astigmatism experiments, factory-to-orbit resolution comparison, system resolution statistics, color versus black and white film studies, stereo mirror settling analysis, etc. Figure 4-19 shows a GAMBIT CORN display on Film Type SO-255 from Mission 4337, 11 January 1973.

C. HEXAGON

This program made the most extensive use of CORN for engineering analysis, and was the only program to use CORN resolution data for evaluation of on-orbit performance to determine the camera contractor's fee. Besides the use of the standard CORN display which included the 5T, Edge, and 5GS Targets for resolution and contrast studies, the Program Office needed a means to provide data to answer questions on focus, field curvature, platen tilt, cross-track/in-track smear at different scan angles, in-track skew, lens MTF, optical bar "dither," and film synchronization. For these reasons, the Reversible Line Target was developed. However, the target itself, as displayed under existing procedures, would not provide the desired data. To resolve this, a new field deployment procedure was devised. The procedure was called Multiple Line Displays (MLD) and was implemented on Mission 1202. This procedure was further refined with each successive mission. Figure 4-20 shows a sketch of a Multiple Line Display used on Mission 1202. The top drawing depicts an in-track array which consisted of 18 standard RLTs displayed parallel along the flight azimuth, one nautical mile apart, near the nadir of the camera system. This enabled the engineers to map the focal plane as a function of field angle in the in-track direction and also to measure smear at/or near nadir. The bottom drawing illustrates the type of array configured to measure smear at high scan angles. It consisted of nine 12 inch wide Line Targets, each 300 feet long on a 300 x 75 foot 4% reflectance background, spaced two nautical miles apart. This is an excellent example of the planning and innovative flexibility of the CORN Program capability. These MLDs required that a number of RLT legs be displayed over an area up to 40 miles at precise one or two mile increments. Consequently, the contractor reviewed maps of the Southwest United States and proposed site locations. Once the sites were tentatively selected by the Program Office, they were surveyed and, if acceptable, cleared and leveled. Figure 4-21 shows the locations of the cleared MDL sites. Figure 4-22 shows examples of MLD Arrays. Figure 4-23 shows a picture of an MLD acquired on Operation 306, Frame 005 of Mission 1202. CORN provided the HEXAGON Program Office with data which helped to solve many problems which could only be addressed with the vehicle on-orbit. Without CORN, particularly the flexibility of the MLD, it is highly unlikely that HEXAGON would have been as successful as it is today.

D. IDEALIST (Red Dot)

The Red Dot Program, managed by Eastman Kodak, used the U-2 Aircraft to serve as a high altitude test bed for acquisition film product research and development. As a direct result of the data

CORN DISPLAY ON MISSION 4337

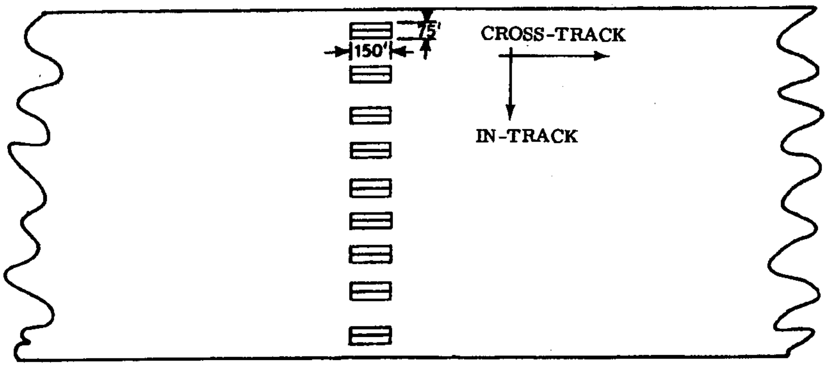
(Tri-Color, Point Source, Five-Step Gray Scale, 51/51 Tribar, Vernier Tribar, 80 Foot Edge, and 3 Inch Reversible Line Targets)

[redacted]

FIGURE 4-19

EXAMPLES OF SPECIFIC MULTIPLE LINE DISPLAY DEPLOYMENTS USED ON MISSION 1202

IN-TRACK LINE TARGET ARRAY




IN-TRACK LINE TARGET ARRAY - HIGH SCAN ANGLE

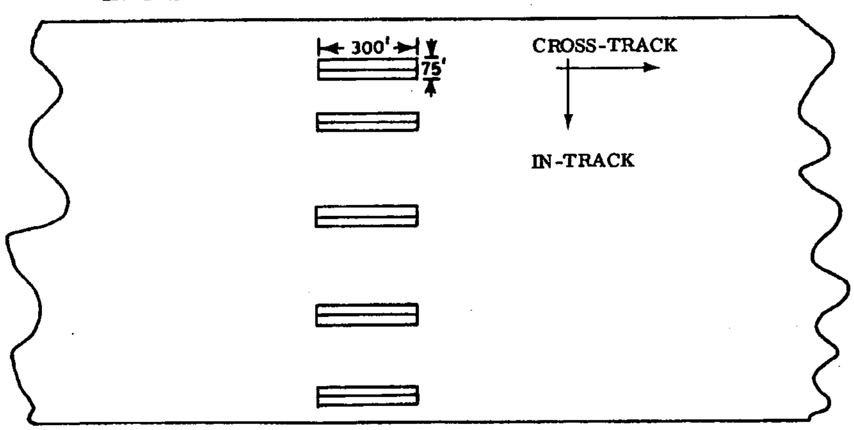


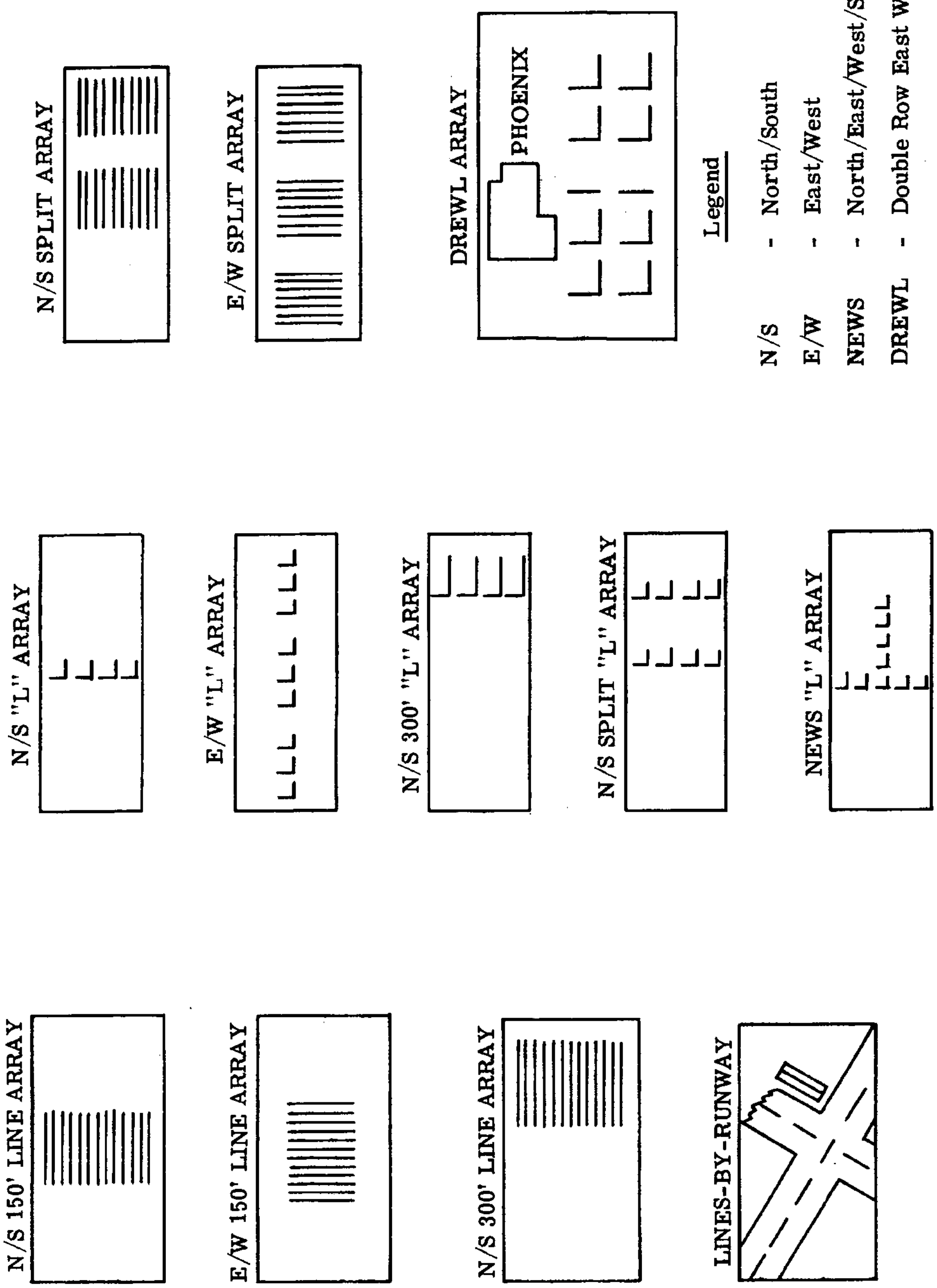

FIGURE 4-20

MULTIPLE LINE DISPLAY SITE LOCATIONS

[redacted]

FIGURE 4-21

EXAMPLES OF TYPES OF MULTIPLY LINE DISPLAY ARRAYS




Legend

N/S - North/South
E/W - East/West
NEWS - North/East/West/South
DREWL - Double Row East West "L"

NOTE: In order to make a 300 foot line or leg of an "L" array, two legs of an RLT were put together.

FIGURE 4-22

CROSS-TRACK LINE ARRAY FROM MISSION 1202

[redacted]

NOTE: There were 17 RLTs displayed 2,000 feet apart. A Gray Scale and 51/51 Tribar Target were also deployed for ground truth and contrast data. This experiment was for determining cross-track film velocity errors at various scan angles.

FIGURE 4-23

provided by CORN displays new black and white and color films were developed for use in the GAMBIT and HEXAGON Programs. Red Dot utilized a very small percentage (less than 10%) of the yearly number of CORN displays. These displays were deployed in the Southwest United States and consisted of a standard configuration of the Five-Step Gray Scale, Tri-Color, 51/51 Tribar, and Edge Targets. All Red Dot requirements were fulfilled on a non-interference basis with displays for the satellite programs. Figure 4-24 is a Red Dot Program picture taken of Frame 384 on Mission GT 73-031.

E. [redacted]

In a move to reduce the amount of funding to operate the CORN Program, AFSPPF took the initiative of looking into various options to economize spending, which in late 1971, was projected to exceed [redacted] The Evaluation Directorate did a study on the operational details and costs that would be required should the Air Force assume the full management and operation of the CORN Program. This study showed that although it was feasible, there was not enough time to coordinate, fund, establish, and train an Air Force unit in time to support the on-going GAMBIT and HEXAGON Programs. A parallel phase of this study was to open up the bidding to a preselected group of reconnaissance-oriented contractors. This step was taken and proposals were received from six contractors. Although Mead Technology Laboratories (Data Corp) was again eventually selected, this competitive bidding resulted in an approximate [redacted] savings to the Government for the FY 72 CORN Contract.

Through the miles of nylon and canvas materials, vinyl and painted coatings, quality control, communications, operations and deployment procedures, and required reports, the management and cooperation between MTL and AFSPPF were excellent. This was true from 1963 with the first team of key individuals consisting of Captain G. Woods/TSgt J. Strobel (RD) and Mr. E. Ricci (MTL) up to the peak years in the early 1970s with Captain M. Riley (RD), Captain H. Gordon/TSgt D. Voller/Colonel V. Stanley (EV), and Mr. R. Zimmerman (MTL). However, when speaking of the CORN Program at AFSPPF, one immediately thinks of the dedicated and innovative role of Captain Harold Gordon for it was he with Mr. R. Zimmerman who was responsible for implementing the highly complex Multiple Line Displays in support of the then fledgling HEXAGON camera system.

It should be noted that although the original inventory of the Controlled Range Network included mobile, fixed, and multi-sensor targets, AFSPPF's use in support of CORONA, HEXAGON, and GAMBIT was primarily with mobile target arrays. The Fixed Sites never reached their potential because the military

CORN DISPLAY FOR RED DOT PROGRAM

(51/51 Tribar, Six-Step Color, Five-Step Gray Scale, Point Source, and Log Periodic Targets)

FIGURE 4-24

organizations responsible for the maintenance of these locations allowed the surface of the Fixed Targets to deteriorate. The mobile multi-sensor targets (passive and active infrared and coherent and noncoherent radar targets) were discontinued as part of this program in 1970, and added to the responsibilities of the Directorate of Reconnaissance Engineering at Aeronautical Systems Division, Wright-Patterson AFB Ohio. The mobile targets from the CORN Program have continued to support the NRO Programs since the transfer of the contractual management to SAF/SP-6 and the operational management to SAF [redacted] in June 1974.

- Image Quality Analysis Techniques and Software -

In the early 1960s, several papers were published on the application of linear system analysis to photographic systems. However, the practical problems (accurate linearization to intensity, treatment of grain noise, automatic data collection and production, etc.) were being ignored. It was at this time that AFSPPF entered into contract with Mead Technology Laboratories (renamed from Data Corporation in 1968) and later EIKONIX Corporation (renamed from Information Technology Corporation in 1971) to study, review, and then formulate a practical inventory of techniques, software, and hardware designed to perform meaningful analysis on a production basis.

Photography is unique in its noise properties, and operational photography imposes severe constraints on target energy. It was therefore necessary, over the years, to develop targets and analysis methods which made best use of the imagery and its extraction potential. In the early 1960s, analysis was carried out by largely manual means, i.e., the Visual Reciprocal Edge Spread (VRES) Technique, visual sharpness from microdensitometric chart records, PI readings of tribar targets, 50% Amplitude Technique, etc. with very mixed results. However, by 1975, automated analytical techniques and precise mensuration/hardware had been developed to handle large volumes of system data on a production basis.

In the period from 1964 to 1975, new types of microdensitometers were developed. Procedures and software were prepared for computer calibration of these machines on a routine basis, using a standardized machine setup procedure. Analytical software was built into disk file storage and methods existed for collection, pre-processing, editing, processing, reporting, and transmission of data to the program offices and system contractors. Techniques were derived for the extraction and annotation of targets of opportunity from operational film as well as for utilization of the expanded CORN target inventory. An atmospheric contrast reduction program from Line Target areas and observed edges (called 2:1 Program) was written and incorporated into the image quality programs. The quality and reflectance characteristics of the mobile CORN targets were monitored at monthly intervals by photometric mensuration of the properties of each operational target. This information was then stored in computer files for ready access during mission data processing.

During the 1968 - 1975 period, the image analysis and computer support program library expanded to several hundred programs, covering the field from preflight Acceptance (HEXAGON) to the postflight analysis and duplication of the CORONA, GAMBIT, and HEXAGON. This sophisticated software incorporated the analysis of both color and black and white films.

In the 1970s, a concerted effort was undertaken to totally standardize program input and documentation. Existing programs were internally documented and operating instructions were prepared in detail. All data programming contractors were given specifications for program documentation which required narrative description, models, flow charts, and operating instructions on all work being performed for AFSPPF. An internal work order system was instituted which allowed orderly transition of complex mission phases through the EV cycle of system performance analysis. Mission data was transmitted to AFSPPF from the primary contractors (Eastman Kodak and Perkin-Elmer) and the GAMBIT and HEXAGON Program Offices for reduction, analysis, and file storage. Similar procedures were in existence for the collection of test and basic data during HEXAGON Acceptance and Readiness preflight testing. By 1975, a complete and efficient production system existed in the Evaluation Directorate.

This same production system lent itself well to efforts to improve evaluation methods. For example, in the early days of image evaluation technology, interest focused on edges as target sources. Edges were used primarily because of their relative abundance in municipal complexes. Man-made Edge Targets were designed and manufactured by Mead Technology Laboratories and put into the CORN inventory. The edge target has a unique place in Modulation Transfer Function (MTF) measurement in that it presents a discontinuous input to an imagery system. If the system can be linearized, then the edge response can be mathematically treated to yield an MTF. No information about the target is required other than the fact that it represents a discontinuity in intensity space. Unfortunately, the photographic process is noisy due to the graininess of the recording medium, and much effort was expended over the years in developing statistical methods (derived from communications theory) which could be used for the treatment of such noise. However, the results tended to be unreliable at high spatial frequencies. The joint capabilities of AFSPPF and EIKONIX were used to solve this problem. Analysis showed that lines were a better source for deterministic targetry than edges. Field experiments were undertaken using temporary "throw-away" paper lines of varying width deployed on standard CORN edges as background. Data was collected and processed by AFSPPF and analyzed by EIKONIX. An interim solution to the adjacency problem was developed and line widths were varied over several GAMBIT missions. Acceptable results were found down to a 2 inch line width. The 3 inch line was finally adopted as a good compromise because it offered freedom from distortion and high signal-to-noise ratio. By 1970, computer programs and measuring techniques had matured to the point where reliable MTF data was being collected and processed routinely from Line Targets.

In 1970, AFSPPF became involved in collecting data from HEXAGON preflight testing, primarily for the purpose of determining why contractor results were not meeting specifications. At that time, focus testing was being performed by means of edge targets on a tilted object plane. After extensive testing of the targets at AFSPPF, it was proved conclusively that this method of testing being performed by the camera contractor was based on a weak hypothesis. Drawing from past experience, the AFSPPF-EIKONIX Team recommended the design of a target which led to the 33-line tilted reticle Focus Target. Each line of this target was analyzed during test data reduction by methods drawn from the existing operational line analysis programs at AFSPPF.

Such efforts fell into a pattern which repeated itself many times during the history of this Facility. The Materials Analysis Laboratory, Production Directorate photographic processing, data collection, and data processing capabilities of AFSPPF were used to support many analytical and conceptual efforts from outside agencies and contractors. During these efforts technological fall-out from the operational and developmental work done in EV was common. Figure 4-25 is a graphical description of a summary of the image evaluation analysis system as it was in 1972. This graph shows how various parts of the on-going activities contributed to each other and to the improvement of the final product.

In addition to performing mission mensuration and analysis support for the CORONA, GAMBIT, and HEXAGON satellite reconnaissance systems, the Evaluation Directorate also supplied microdensitometric, computational, analysis, and publication support to a continuous stream of special investigative projects. These included duplication materials tests, image collection system analysis, image motion experiments, atmospheric contrast reduction, NRO Color Task Force support, Free-Radical Non-Conventional Study, documentation of NPIC's National Imagery Interpretability Rating Scale (NIIRS), development of the Visual Edge Matching (VEM) technique, and many others. With relation to the solution of these types of study projects, many of which were adopted operationally, software was written, documented, and inventoried on such subjects as granularity, power spectrum, film MTF, etc. This work pioneered many of the analytical programs and techniques used in evaluating the new operational requirements.

When the Dual Gamma Viscous Process was implemented by Eastman Kodak in the late 1960s, previous methods of linearization failed as this type of processing introduced an appreciable amount of Eberhard (adjacency) effect. Since Line Targets were of prime importance, an interim small object sensitometric approximation was developed and tested by EIKONIX and EV in order to allow production to proceed during the diffusion model development. The joint investigative, data collection, and analysis capability of these two organizations were often used in a cost-effective and productive manner for the pursuit of short and long range image analysis problems.

OVERVIEW OF THE IMAGE EVALUATION ANALYSIS SYSTEM

AS OF 1971/1972

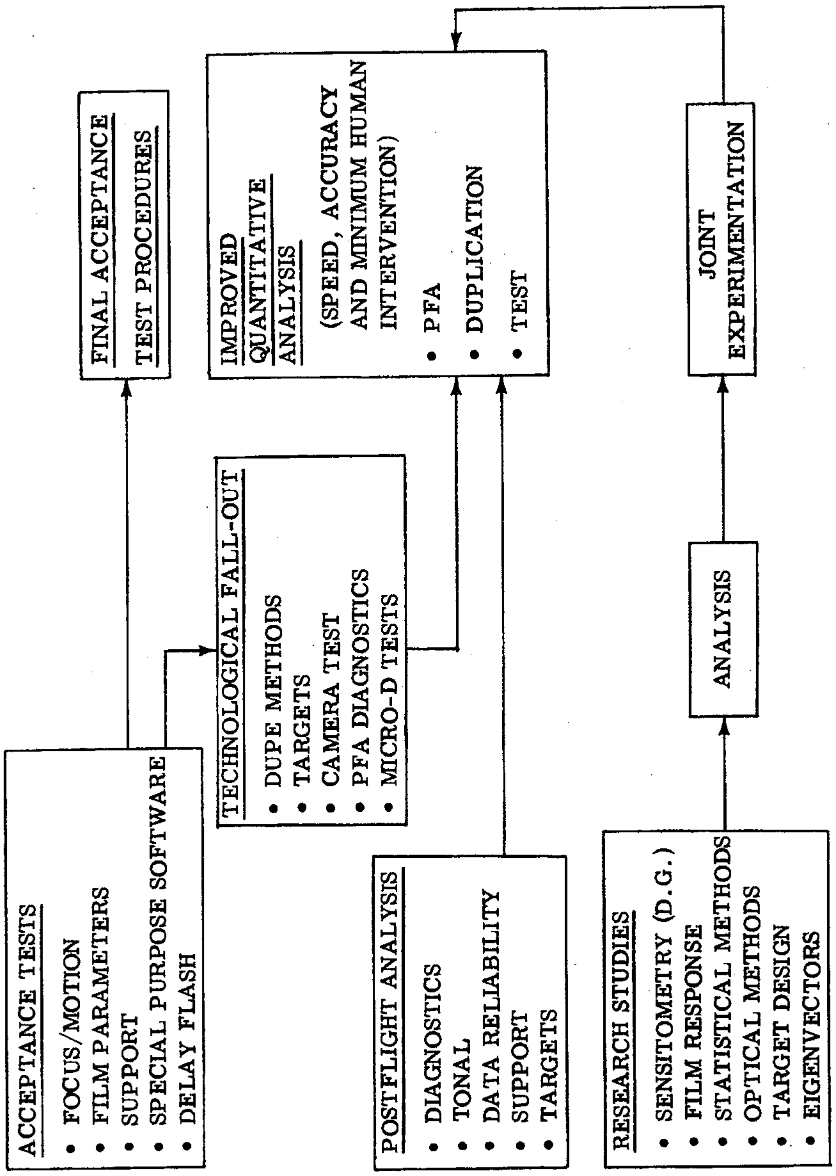



FIGURE 4-25

The bulk of this work can be attributed to the long association AFSPPF has had with Mr. Jack Finley, the foremost expert in photographic image system performance analyses. This contractual consultant (1962 - 1976) has been the individual most instrumental in the development of the image quality analysis capability at this organization. Other principal contributors were: Captains C. Bush, G. Holliman, H. Gordon, and S. Noland, all of whom served a tour in some staff position in the Technical Analysis Division during a period from 1963 to 1975; Captains R. Massarini, W. Jackson, and Master Sergeant R. Swetavage all assigned to the Data Division Staff in the 1970s; and Colonel V. Stanley, Director of Evaluation from March 1970 to May 1973, who was a strong proponent of automation during the preparation for and operation of the many new tasks required to support HEXAGON. Another influential figure within AFSPPF in building this capability was Captain Dale Watson who served as Chief of the Data Division from September 1968 to July 1973. His long and dedicated efforts resulted in the complete reorganization and documentation of AFSPPF's mission data processing facility.

- The Automated Resolution Data Terminal (RDT) System -

In the early 1970s, as AFSPPF became more deeply involved in the HEXAGON Acceptance and Readiness testing, it was realized that the method for collecting resolution data had to be upgraded. Up to that time, collection was performed by a laborious, manual method. Each resolution reading station required two personnel, one to measure or read the targets, and the other to record the data on an 80 column AF Form 1530, Punch Card Transcript. After this step, at least two individuals were employed in key punching the recorded data and editing the results for accuracy and reasonableness.

In the spring of 1971, Major V. Stanley initiated the concept of an automated system of recording the resolution readings which would employ a dedicated terminal at each reader station. This would allow the reader to record his own data, and perform some simple edit routines to reduce the repetitive correction steps. Captain Stephen Noland, a reconnaissance development engineer assigned to the Technical Analysis Division, Directorate of Evaluation, offered to design a system which could be fabricated in-house, thereby saving significantly on development, contract fees, labor costs, and time of delivery.

The final design and operating concepts of this resolution data collection system consisted of the following major parts:

A. Four Reader terminals with displays, keyboards, and associated power supplies.

B. A PDP-8 Minicomputer with associated disk storage and 9 channel magnetic tape drive. This component was the data recording unit.

C. Terminal interface unit, which provided the necessary control signals and line interfacing between the terminals and the PDP-8 Minicomputer.

D. Medium speed line printer which operated at 120 characters per second. This unit allowed the operators to have a listing of their data buffer at any time for edit and correction.

E. Control program software.

Captain Noland's design of the terminal included two basic parts: (1) the memory/display module and (2) the operator's keyboard. The memory/display module was mounted where the operator could look at the numbers currently in the terminal buffer without losing his infinity adaptation in the microscope. The keyboard, which contains all the operating controls for the terminal, was located at the operator's side so that he could enter data without taking his eyes from the microscope.

The terminal data was formatted specifically for the arrangement of data used in the Acceptance/ Readiness analysis programs. The operator entered the data one frame at a time, and had the capability to perform simple editing while the data was still residing in the terminal. This allowed him to perform a reasonableness check on the data merely by glancing at the numerical display. If the data were acceptable, he would then transmit the data to the PDP-8 by pushing a button on the keyboard. During the transmission process, the terminal frame counter is incremented, so that the terminal was automatically ready for the next frame.

Once the data is in the computer, the operator could request a printout of his data buffer for edit purposes. This appears on the line printer, whereupon the operator could examine the data for sequence accuracy. If errors were detected, he could return to the terminal and enter corrections. Access to the data buffer was keyed by frame number, so the operator need only manipulate one frame at a time. When he was satisfied with the information stored in the buffer, the operator then commanded the computer to write the data on magnetic tape. At this point, the buffer was cleared, and the terminal reset for the next sequence.

After approval of the initial design concepts, Captain Noland proceeded with the design and fabrication of a prototype terminal. In July 1970, AFSPPF acquired a surplus PDP-8 Minicomputer from a CIA program which was terminated. Approximately [redacted] was required to purchase the peripherals to update this minicomputer system. These components included a 4K memory extension board, an external interface, a TTY interface, a paper tape reader/punch, and four terminal interfaces. The first prototype was placed into operation in December 1971. After a period of debugging and operational testing, approval was granted for the fabrication of four "production" versions of the terminal. Mr. Robert Kohler, the HEXAGON Program Operations Chairman, was briefed on the RDT and highly endorsed the implementation of this system. Drawing upon the experience learned with the prototype, Captain Noland proceeded with the repackaging of the prototype into the final configuration.

The original concept was to fabricate the production terminals in-house, but due to EV's increasing requirements to support HEXAGON, it was decided to have the circuit cards wire wrapped by a local contractor, Springfield Audio & Electronics, Incorporated. However, the remaining fabrication was performed by the RD Feasibility Shop (Mr. R. Meunier) and the Logistics Electronics Maintenance personnel (Sergeants Monroe and Boulware). The final production configuration was complete and operating in August 1973 for support of GAMBIT and HEXAGON resolution data collection and analysis.

The total cost for each of these customized terminals, including parts and contractor labor, was approximately $2,500. In addition, the cost for the PDP-8 Minicomputer System and accessories was approximately [redacted] The estimated savings in man-hours for the function of collecting resolution data was about 50%. This savings resulted from: (1) the elimination of the requirement to have two people at the reading stations, (2) greatly reduced human errors in the recorded data due to the terminal edit capabilities, and (3) increased efficiency in entering and recording the data. The RDT was shipped in June 1975 to be used in the evaluation function at NPIC/APSD.

This accomplishment is an excellent example of demonstrating the inner workings of AFSPPF and points out the advantages of having multi capabilities (human and support services) assigned to one organization. Specifically, the talent and expertise of the designer and project manager, Captain Noland; the electronics technician, who wired and interfaced the terminals and computer, Sergeant Boulware; the Logistic Manager, Captain Wilkinson, who was able to secure the funding for the terminals and the modifications to the PDP-8; and the Feasibility specialist, Mr. R. Meunier, who was able to build the frame and hardware for the terminals.

CONFIDENTIAL

NO: 116.2
DATE: December 15, 1960

## SECRETARY OF THE AIR FORCE
## ORDER

SUBJECT: Organization and Functions of the Air Force Satellite Photographic Processing Laboratory

1. There is hereby established the Air Force Satellite Photographic Processing Laboratory (AFSPPL) at Westover Air Force Base, Massachusetts.

2. The Laboratory will be under the command of the Director of the SAMOS Project, 2400 East El Segundo Boulevard, El Segundo, California. It will be attached to the Air Force Command and Control Development Division, Air Research and Development Command, L. G. Hanscom Field, Massachusetts, for administrative, logistic, and contractual support.

3. The mission of the AFSPPL will be to conduct the research and development necessary to provide the best possible equipment, techniques, and knowledge applicable to satellite photography, to insure that the processing and duplication of photography obtained from satellite vehicles is of the highest possible quality, and to process, duplicate, and distribute this photography to designated users.

4. Physical space and some resources and manning for the AFSPPL will be taken from the 8th Reconnaissance Technical Squadron. The 8th Reconnaissance Technical Squadron will

AFHQ FORM 0-869, 17 JUN 52

CONFIDENTIAL

CONFIDENTIAL

NO: 116.2
DATE: December 15, 1960

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remain as a separate unit, with the AFSPPL having priority over all resources. Actual transfer of spaces, manpower, and other resources will follow approval of a detailed plan to be submitted to the Secretary of the Air Force by the Director of the SAMOS Project.

Dudley C. Sharp

2

CONFIDENTIAL

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**NO:** 116.3
**DATE:** August 25, 1964

## SECRETARY OF THE AIR FORCE
## ORDER

**SUBJECT:** Organization and Function of the Air Force Special Projects Production Laboratory

1. There is hereby established the Air Force Special Projects Production Laboratory (AFSPPL) (U) at Westover Air Force Base, Massachusetts.

2. The Laboratory will be under the command of the Director of Special Projects, OSAF, 2400 East El Segundo Boulevard, El Segundo, California. It will be assigned organizationally to the 6594th Aerospace Test Wing (AFSC), Sunnyvale, California. Host base will provide support in accordance with AFR 11-4.

3. The mission of the AFSPPL will be to conduct the research and development necessary to provide the best possible production equipment and techniques in support of special projects specified by the Secretary of the Air Force.

EUGENE M. ZUCKERT
Secretary of the Air Force

AFHQ FORM 0-582, 17 JUN 53

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**NO:** 116.3
**DATE:** November 10, 1965

## SECRETARY OF THE AIR FORCE
# ORDER

**SUBJECT:** Organization and Function of the Air Force Special Projects Production Facility

1. There is hereby established the Air Force Special Projects Production Facility (AFSPPF) (U) at Westover Air Force Base, Massachusetts.

2. The Facility will be a named unit under the command of the Director of Special Projects, OSAF, 2400 East El Segundo Boulevard, El Segundo, California. It will be assigned organizationally to the Space Systems Division (AFSC), Los Angeles Air Force Station, California. Host base will provide support in accordance with AFR 11-4.

3. The mission of the AFSPPF will be to provide production services and conduct necessary research and development in production and evaluation techniques in support of special projects specified by the Secretary of the Air Force.

4. Secretary of the Air Force Order No. 116.3, dated August 25, 1964, is hereby superseded.

HAROLD BROWN
Secretary of the Air Force

AFHO FORM 0-882, 17 JUN 63

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**DEPARTMENT OF THE AIR FORCE**
**HEADQUARTERS AIR FORCE SYSTEMS COMMAND**
**ANDREWS AIR FORCE BASE, WASHINGTON, D.C. 20331**

24 January 1966

SPECIAL ORDER
G-6

1. The Headquarters, Air Force Special Projects Production Facility (AFSPPF), having been constituted and activated by the Department of the Air Force and assigned to the Air Force Systems Command, with further assignment to the Space Systems Division, is organized at Westover Air Force Base, Massachusetts, effective 10 November 1965.

a. Personnel Accounting Symbol LKHKL3 sub command code W will be utilized for personnel reporting and MAF identification and control purposes.

b. Personnel will be furnished by Headquarters, Space Systems Division and as directed by Hq AFSC.

c. Equipment is authorized under EAID 0000 9379 0000.

d. Authority: Secretary of the Air Force Order No. 116.3, dated 10 November 1965; DAF AFOMO Letter No. 508n, Subject: Organization and Function of the Air Force Special Projects Production Facility, 12 January 1966; and AFM 26-2. (SCOO)

2. The 6594 Test Squadron (AFSPPL), (Air Force Satellite Control Facility) located at Westover Air Force Base, Massachusetts, is discontinued effective 10 November 1965.

a. Personnel Accounting Symbol LKHB8D is voided as of date of discontinuance.

b. Personnel will be reassigned in accordance with instructions provided by Headquarters AFSC.

c. Organization records and funds will be disposed of in accordance with the instructions of the Commander, SSD.

d. EAID Code 6594 5665 0000 is voided as of date of discontinuance. All supplies and equipment transferred to Headquarters, Air Force Special Projects Production Facility, EAID Code 0000 9379 0000. (SCOO)

FOR THE COMMANDER

UNITED STATES AIR FORCE
OFFICIAL
HQ AIR FORCE SYSTEMS COMMAND

JOHN F. RASH, Colonel, USAF
Director of Administrative Services

DISTRIBUTION: "A, B & C"

FORGING MILITARY SPACEPOWER

CONFIDENTIAL

**NO:** 116.2
**DATE:** January 26, 1962

## SECRETARY OF THE AIR FORCE
## ORDER

**SUBJECT:** Organization and Functions of the Air Force Satellite Photographic Processing Laboratory

1. There is hereby established the Air Force Satellite Photographic Processing Laboratory (AFSPPL) at Westover Air Force Base, Massachusetts.

2. The Laboratory will be established as a named activity under the command of the Director of Special Projects, 2400 East El Segundo Boulevard, El Segundo, California. It will be assigned organizationally to the 6594th Aerospace Test Wing (AFSC), Sunnyvale, California. Host base will provide support in accordance with AFR 11-4.

3. The mission of the AFSPPL will be to conduct the research and development necessary to provide the best possible equipment, techniques, and knowledge applicable to satellite photography, to insure that the processing and duplication of photography obtained from satellite vehicles is of the highest possible quality, and to process, duplicate, and distribute this photography to designated users.

4. Physical space and some resources and manning for the AFSPPL will be taken from the 8th Reconnaissance Technical Squadron. The 8th Reconnaissance Technical Squadron will remain as a separate unit, with the AFSPPL having priority over all resources.

5. Secretary of the Air Force Order No. 116.2, dated January 26, 1961, is hereby superseded.

57-62-767

EUGENE M. ZUCKERT
Secretary of the Air Force

SPPL 4763

AFHQ FORM 0-862, 17 JUN 58 COPY NO. 4 CONFIDENTIAL SAFMS 620133

CONFIDENTIAL

**NO:** 116.2
**DATE:** January 26, 1961

## SECRETARY OF THE AIR FORCE
## ORDER

**SUBJECT:** Organization and Functions of the Air Force Satellite Photographic Processing Laboratory

1. There is hereby established the Air Force Satellite Photographic Processing Laboratory (AFSPPL) at Westover Air Force Base, Massachusetts.

2. The Laboratory will be established as a named activity under the command of the Director of the SAMOS Project, 2400 East El Segundo Boulevard, El Segundo, California. It will be assigned organizationally to the 6594th Test Wing (Satellite) (ARDC), Sunnyvale, California. Host base will provide support in accordance with AFR 11-4.

3. The mission of the AFSPPL will be to conduct the research and development necessary to provide the best possible equipment, techniques, and knowledge applicable to satellite photography, to insure that the processing and duplication of photography obtained from satellite vehicles is of the highest possible quality, and to process, duplicate, and distribute this photography to designated users.

4. Physical space and some resources and manning for the AFSPPL will be taken from the 8th Reconnaissance Technical Squadron. The 8th Reconnaissance Technical Squadron will

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Page # 1 of 2 pages.
Series # ________

AFHQ FORM 0-888, 17 JUN 58

CONFIDENTIAL SPPL-00103

CONFIDENTIAL

NO: 116.2
DATE: January 26, 1961

remain as a separate unit, with the AFSPPL having priority over all resources. Actual transfer of spaces, manpower, and other resources will follow approval of a detailed plan to be submitted to the Secretary of the Air Force by the Director of the SAMOS Project.

5. Secretary of the Air Force Order No. 116.2 dated December 15, 1960, is hereby superseded.

EUGENE M. ZUCKERT
SECRETARY OF THE AIR FORCE



Copy # 5 of 20 copys.
Page # 2 of 2 pages.
Series # ________

CONFIDENTIAL

SPPL 00103

NO: 116.3
DATE: SEP 28 1971

## SECRETARY OF THE AIR FORCE
## ORDER

SUBJECT: Organization and Function of the Air Force Special Projects Production Facility

1. The Air Force Special Projects Production Facility (AFSPPF) at Westover Air Force Base, Massachusetts, is under the Command of the Director of Special Projects, OSAF, 2400 East El Segundo Boulevard, El Segundo, California. It is assigned organizationally to the Space and Missile Systems Organization (AFSC), Los Angeles Air Force Station, California. Host base provides support in accordance with AFR 11-4.

2. The mission of the AFSPPF is to provide production services and conduct necessary research and development in production and evaluation techniques in support of special projects specified by the Secretary of the Air Force.

3. Secretary of the Air Force Order No. 116.3, dated November 10, 1965, is hereby superseded.

4. This Order is issued in accordance with AFR 11-18, dated July 18, 1963, subject: "Delegating or Assigning Statutory Authority."

Robert C. Seamans Jr.
SECRETARY OF THE AIR FORCE

AFHQ FORM 0-882, 17 JUN 53

**DEPARTMENT OF THE AIR FORCE**
**WASHINGTON**

SPECIAL ORDER
GB-252

15 September 1964

1. DP, CAPT RICHARD D GOSS, A03039058, is awarded the Distinguished Flying Cross for heroism while participating in aerial flight on 12 Jul 64 (POSTHUMOUS).

2. The 6594th Aerospace Test Wing is awarded the Air Force Outstanding Unit Award for exceptionally meritorious service in support of military operations from 1 May 62 to 31 Dec 63. The units listed below also share in the award:

6594th Recovery Control Gp
6593d Test Sq (Special)
6593d Instrumentation Sq
6594th Test Sq (AFSPPL)
6596th Instrumentation Sq
6594th Instrumentation Sq

BY ORDER OF THE SECRETARY OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE · OFFICIAL · HEADQUARTERS U.S. AIR FORCE

CURTIS E LeMAY
Chief of Staff

R J PUGH
Colonel, USAF
Director of Administrative Services

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~~T O P S E C R E T~~ 021818Z JUN 72 CITE CHARGE 3037.

IMMEDIATE WADDY

CORONA

FOR COL CALLANAN FM MAJ GEN ALLEN

1. CAL, YOU AND YOUR ORGANIZATION HAVE NOW COMPLETED PROCESSING THE FINAL PORTIDN OF THE FILM LOAD FROM THE LAST CORONA FLIGHT. IN MY JUDGMENT, THIS HISTORIC OCCASION IS WORTHY OF NOTE. THE CORONA PROGRAM MARKED THE BEGINNING OF SPACE RECONNAISSANCE AND HAS BEEN A MAINSTAY OF NATIONAL INTELLIGENCE FOR WELL DVER A DECADE. THE TECHNICAL SKILLS CREATED DURING THE TIME SPAN OF THIS PROGRAM HAVE CONTRIBUTED DIRECTLY TO THE SECURITY OF OUR NATION AND TO WORLD PEACE. THE STRATEGIC ARMS LIMITATION TREATY JUST SIGNED REFLECTS GREAT CONFIDENCE IN SATELLITE RECONNAISSANCE.

2. IT IS FITTING THAT THE ORIGINAL NEGATIVE PROCESSING OF FINAL CORONA IMAGERY BE DONE BY THE SPPF, WHICH HAS CONSISTENTLY CONTRIBUTED IN A MAJOR WAY TO THE SUCCESS OF THE NATIONAL RECONNAISSANCE PROGRAM.
ON THE OCCASION OF THIS SIGNIFICANT PROCESSING MILESTONE, PLEASE EXTEND MY CONGRATULATIONS AND GRATITUDE TO ALL OF YOUR CERTIFIED PEOPLE FDR A JOB WELL DONE.

3. AS WE GO FORWARD WITH NEW TASKS AND INCREASED CAPABILITIES, I KNOW THAT THE SPPF WILL CONTINUE TO JUSTIFY MY CONFIDENCE AND THAT OF THE NRO.

SIGNED LEW ALLEN.

~~T O P S E C R E T~~

BT

~~T O P S E C R E T~~ 262307Z MAY 72 CITE PILOT 40[redacted]
[redacted] ADIC [redacted] CHARGE [redacted] SPECTRE, WADD[redacted]
[redacted] WHIG, [redacted]
CORONA
FROM: THE DIRECTOR

1. WITH THE LAUNCH OF THE LAST CORONA SYSTEM, AN ERA COMES TO AN END. AS YOU ARE AWARE, THIS SYSTEM IS THE PROGENITOR OF SATELLITE PHOTORECONNAISSANCE SYSTEMS. THE PROGRAM PIONEERED THE DEVELOPMENT OF PANORAMIC, STEREOSCOPIC CAMERAS FOR USE IN SPACE AND THE CAPABILITY TO RECOVER OBJECTS FROM EITHER OBRIT. DESPITE INITIAL DISCOURAGING FAILURES, PERSISTENCE AND DEDICATION BROUGHT ABOUT SUCCESS. SINCE 1960, MORE THAN ONE HUNDRED MISSIONS HAVE BEEN FLOWN SIGNALING CORONA AS THE WORKHORSE OF PHOTORECONNAISSANCE SYSTEMS. DURING THIS PERIOD, THE SYSTEM INCREASED IN MISSION DURATION FROM A DNE DAY, SEVENTEEN REVOLUTION ORBIT TO CURRENT EIGHTEEN/NINETEEN DAY COVERAGE. THE RESDLUTION PROVIDED BY THE CORONA SYSTEM IMPROVED FROM GREATER THAN TWENTY-FIVE FEET TO LESS THAN SEVEN FEET. FURTHER, ITS DEVELOPMENT AND OPERATION PROVIDED THE BASIS AND CONFIDENCE FOR THE DEVELOPMENT OF INCREASINGLY SOPHISTICATED SYSTEMS. IT IS INTERESTING TO RECALL SOME OF THE PROGRAMS'S "FIRSTS," AMONG WHICH WERE:

A. FIRST SATELLITE RECONNAISSANCE SYSTEM PUT INTO ORBIT.
B. FIRST OBJECT RECOVERED FROM SPACE.
C. FIRST USE OF PANORAMIC AND STEREOSCOPIC CAMERAS IN SPACE FLIGHT.
D. FIRST DUAL BUCKET RECONNAISSANCE SYSTEM.
E. FIRST SATELLITE SYSTEM TO EMPLOY STELLAR, INDEX, AND PANORAMIC CAMERAS IN COMBINATION.

2. THE ABOVE TESTIFIES TO THE TECHNICAL ACHIEVEMENTS MADE DURING MORE THAN A DECADE, AND ALL OF YOU MAY BE JUSTLY PROUD OF THE PART YOU PLAYED IN THESE ACCOMPLISHMENTS. ALTHOUGH ONE CAN CALCULATE THE MANHOURS AND DOLLARS DEVOTED TO DEVELOPING AND OPERATING THE SYSTEM, IT IS NOT POSSIBLE TO DERIVE IN FINITE TERMS THE VITAL IMPACT THE SYSTEM HAS HAD ON OUR NATIONAL SECURITY. IT IS CLEAR, HOWEVER, THAT CRUCIAL INTELLIGENCE HAS BEEN COLLECTED THROUGHOUT THE YEARS AGAINST TARGETS OF THE HIGHEST NATIONAL INTEREST WHICH, UNTIL VERY RECENTLY, COULD NOT HAVE BEEN COLLECTED BY OTHER MEANS. I WANT TO EXTEND TO ALL OF YOU MY DEEP APPRECIATION FOR THE PART YOU PLAYED IN THE SUCCESS OF THIS TRULY HISTORIC INTELLIGENCE COLLECTION PROGRAM.

~~T O P S E C R E T~~
BT

~~T O P S E C R E T~~ 022120Z JUN 72 CITE WHIG 0761.

PRIORITY [redacted] ADIC [redacted] CHARGE, [redacted] PILOT, [redacted]

SPECTRE, WADDY, [redacted]

CORONA

FROM DR. MCLUCAS

WITH THE SUCCESSFUL RECOVERY OF THE FINAL BUCKET OF THE CORONA PROGRAM ON 31 MAY 1972, I ADD MY CONGRATULATIONS TO THOSE OF THE DIRECTOR OF CENTRAL INTELLIGENCE. THE PROUD RECORD OF THE CORONA SYSTEM COULD ONLY HAVE BEEN ACHIEVED THROUGH THE UNIQUE COOPERATION AND SUPPORT OF ALL YOUR ORGANIZATIONS. WELL DONE.

~~T O P S E C R E T~~

Item 11

~~T O P S E C R E T~~ 191510Z JAN 73 CITE WHIG 0068.

PRIORITY CHARGE, WADDY

GAMBIT

FOR GEN ALLEN AND COL CALLANAN FROM DR. MCLUCAS

1. I WOULD LIKE TO EXTEND MY CONGRATULATIONS ON THE OUTSTANDING PROCESSING TASK RECENTLY COMPLETED AT AFSPPF. THE RESULTS WERE DIRECTLY INDICATIVE OF THE FINE PROFESSIONALISM WHICH IS CONSISTENTLY DISPLAYED AT THE FACILITY AND ALSO READILY VISIBLE EVERY TIME I VISIT THERE.

2. PLEASE EXPRESS MY GRATITUDE TO ALL INVOLVED PERSONNEL FOR A FIRST RATE JOB. E-2 IMPDET.

CHARGE 0864 7 FEB 73 # 386

WADDY FOR CALLANAN

FROM L. ROBERTS/L. NEUNER

SUBJ: GAMBIT MISSION 4337

THE SUCCESS OF GAMBIT MISSION 4337 SURPASSES ALL EXPECTATIONS. SUBJECT TO PET CONFIRMATION, THIS FLIGHT RESULTED IN THE ACQUISITION OF THE BEST GAMBIT RESOLUTION TO DATE. TO SAY THE LEAST, DR. MCLUCAS AND MEMBERS OF THE INTELLIGENCE COMMUNITY WERE DELIGHTED WITH THE RESULTS OF THIS OUTSTANDING MISSION. THEY WERE SPECIFICALLY IMPRESSED WITH THE SAMPLE ENLARGEMENTS FROM 4337-1 WHICH REFLECTED THE PROCESSING QUALITY OF YOUR FACILITY. CONGRATULATIONS TO YOU AND YOUR PEOPLE FOR A JOB WHICH DEMONSTRATED A HIGH DEGREE OF TECHNICAL COMPETENCE AND PROFESSIONALISM -- "EXTREMELY WELL DONE".

27 November 1973

Lt Col H. J. Duval, Jr
Director of Evaluation
Air Force Special Projects Production Facility
Westover Air Force Base, Massachusetts

TO: All Directorate of Evaluation Personnel

As my program with AFSPPF involvement draws to a close, I cannot let the moment pass without taking note of our long standing association in this effort. Most importantly, I want to salute the outstanding and significant contributions of the Directorate of Evaluation as a body and the people as individuals.

Our direct association goes back to 1968, when it became clear to Roy Burks and myself that the Project Office needed a way to conduct independent evaluations of the performance of certain subsystems. After much discussion, we decided to employ the AFSPPF for this acceptance work. Not many realize that that decision was a tough one. Many of us were worried that the support we would get from AFSPPF would be less than adequate and, in the end, take a back seat to your other work. At the time, concentrating all our evaluation efforts at SPPF was a gamble. The gamble certainly paid off, and all of our early suspicions and concerns were totally unfounded to say the least. I can say without question that the Directorate of Evaluation has been the single most cooperative, dedicated group on this program with which it has been my pleasure to be associated.

More important, however, is what we achieved. In our early acceptance efforts, we accomplished something the contractor was incapable of doing. Throughout the acceptance process, data collected by AFSPPF allowed us to isolate out-of-spec conditions and insure that the acceptances were based on all facts, not simply those the contractor chose to present. In retrospect, however, the single most important activities we undertook were the Readiness Reports. Not only was this activity unprecedented, but it was, in a major way, responsible for the outstanding performance achieved by the systems. The ability to run the A-2 tests, quickly evaluate the data, and readjust system parameters before hand was essential. I say this in full recognition of the fact that the past efforts were, without question, of the highest caliber and greatest meaning of any such effort conducted to date.

It is not often that I feel insufficient, but this is one of those times: for words are cheap, but I have nothing else to offer. I wish I could get every man in Evaluation a medal or a promotion, for they certainly deserve it. The people of Evaluation are highly professional, and it has been my pleasure to work with them over the last five years. We all can take pride in the job that has been done, and you can be well assured that the contributions of SPPF/EV have been made known and are recognized at the highest levels. More important, however, is that each man and woman in EV can take personal satisfaction in the job he has done and the contributions he has made to the success of this critically important program.

Please express to each member of the Evaluation Directorate staff my personal appreciation for his support and my best wishes for his future endeavors.

Very sincerely yours,

R. J. Kohler

ROBERT J. KOHLER
Project Office

**DEPARTMENT OF THE AIR FORCE**
**WASHINGTON**

**SPECIAL ORDER**
**GB-** 409

11 June 1973

The Air Force Special Projects Production Facility (AFSC) is awarded the Air Force Organizational Excellence Award for exceptionally meritorious achievement in support of military operations from 1 July 1971 to 30 June 1972.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

JOHN D. RYAN, General, USAF
Chief of Staff

DEPARTMENT OF THE AIR FORCE · OFFICIAL · HEADQUARTERS U.S. AIR FORCE

DWIGHT W. COVELL, Colonel, USAF
Director of Administration

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GB-409

S E C R E T EYES ONLY 051714Z JUL 73. CITE WADDY 0668.

IMMEDIATE: CHARGE

INFO IMMEDIATE: WHIG

BYEMAN/POLICY

EYES ONLY TO GEN BRADBURN (CHARGE) FOR ACTION.

EYES ONLY TO GEN KULPA (WHIG) FOR INFORMATION.

SUBJECT: FUTURE OF AFSPPF.

1. AT YOUR DIRECTION AND THAT OF SAFSS WE HAVE INPUT CONSIDERABLE DATA TO FACILITATE A DECISION ON THIS SUBJECT. AT THIS POINT IN THE SITUATION AND IN MY CAREER, I'D LIKE TO OFFER FOR YOUR CONSIDERATION A COURSE OF ACTION THAT I STRONGLY RECOMMEND.

2. A FEW POINTS AS BACKGROUND SEEM NECESSARY.

A. TO BE ACCEPTABLE IT APPEARS AN OPTION TO RETAIN AFSPPF IN ANY FORM MUST PROVIDE FOR SUBSTANTIAL REDUCTION OF MILITARY SPACES AND AN OPERATION INDEPENDENT OF NORMAL BASE SUPPORT.

B. OUR SURVEY OF RELATED INSTALLATIONS, AS REPORTED TO YOU, SHOWS CLEARLY THAT THE PLANT AT AFSPPF IS SUPERIOR FOR ITS PURPOSE TO ANY IN THE UNITED STATES INCLUDING BRIDGEHEAD.

C. I UNDERSTAND THAT A SUBSTANTIAL EFFORT IS AGAIN UNDERWAY TO GAIN APPROVAL FOR BREAKING SATELLITE IMAGERY OUT OF THE TK SYSTEM AND/OR EVEN DECLASSIFYING PORTIONS OF ZI COVERAGE. IF THIS SHOULD EVER HAPPEN, A SUBSTANTIAL TK DUPLICATING CAPABILITY WOULD BE A MUST.

D. MILITARY IMAGERY PROCESSING CAPABILITIES HAVE BEEN SUBSTANTIALLY REDUCED AND EVEN SHARPER REDUCTIONS INCLUDING CONSOLIDATIONS, ARE BEING STUDIED, THUS DECREASING AVAILABLE ALTERNATIVES.

E. THE USAF OPERATES MANY ACTIVITIES WITH A MIX OF MILITARY, GOVERNMENT CIVILIAN AND CONTRACT CIVILIAN MANNING. YOUR AEROSPACE DATA FACILITY AT BUCKLEY AND THE DEFENSE MAPPING AGENCY, AEROSPACE CENTER AT ST LOUIS ARE EXAMPLES.

3. I STRONGLY RECOMMEND THAT AFSPPF BE KEPT INTACT WITH SUBSTANTIALLY THE SAME MISSION AS AT PRESENT; BUT THAT THE MANNING BE RESTRUCTURED OVER THE NEXT 12 TO 24 MONTHS TO REPLACE MILITARY WITH GOVERNMENT CIVILIANS AND CONTRACTOR SUPPORT TO OPTIMIZE THE MIX AT A MILITARY LEVEL OF APPROXIMATELY 15-20 PERCENT (50-60 PERSONNEL). I SEE NO NEED FOR ANY MILITARY MAN ASSIGNED TO BE BELOW E-6, AND EVEN E-6 GRADES WOULD BE FEW.

4. THERE ARE SEVERAL POINTS IN FAVOR OF THIS OPTION:

A. WE SATISFY THE NEED TO REDUCE MILITARY SPACES.

B. WE PRESERVE A UNIQUE CAPABILITY WHEREIN PHOTO PROCESSING AND DUPLICATION; IMAGERY ANALYSIS; AND THE R AND D FUNCTIONS ARE CO-LOCATED, CLOSELY INTEGRATED AND MUTUALLY BENEFICIAL. THIS IS A SYMBIOTIC RELATIONSHIP WHEREIN EACH ENABLES THE OTHER TWO TO FUNCTION MORE EFFECTIVELY.

C. WE CONTINUE TO MAKE USE OF A SUPERIOR PLANT INSTEAD OF ATTEMPTING TO REPLACE IT SOMEWHERE ELSE ON A PIECE MEAL BASIS.

D. WE HAVE A CAPABILITY FOR PROCESSING AND DUPLICATING IMAGERY WHICH WILL ALWAYS BE RESPONSIVE TO NRO REQUIREMENTS. IT WOULD BE RELATIVELY EASILY ADJUSTED IN STRENGTH DEPENDING UPON THE MISSION BECAUSE OF INCLUSION OF THE FLEXIBILITY OFFERED BY CONTRACTUAL SUPPORT IN KEY AREAS.

E. THE FACILITY COULD BE MAINTAINED INDEFINITELY UNDER THESE TERMS REGARDLESS OF WHAT DISPOSITION WAS MADE OF WESTOVER AIR FORCE BASE. AS NOTED IN OUR PREVIOUS STUDY ON THIS SUBJECT, (OPTION TEN)

SUPPORT WE NOW RECEIVE FROM WAFB COULD BE OBTAINED ELSEWHERE AND MUCH MORE EASILY, WITH A SMALL MILITARY COMPONENT WITH NO ONE UNDER E-6. IN FACT, WITH SUCH A SMALL MILITARY COMPLIMENT AND THE RANK STRUCTURE ENVISIONED WE COULD FUNCTION WITHOUT HOUSING, COMMISSARY ETC.

5. I URGE YOU TO SERIOUSLY CONSIDER THIS OPTION ALTHOUGH IT IS PRESENTED HERE VERY BRIEFLY. AT YOUR DIRECTION I WILL FLESH IT OUT WITH SUPPORTING DATA. WE ARE ALSO READY TO DISCUSS IT AT ANY TIME AND PLACE YOU DIRECT.

E-2 IMPDET

S E C R E T

BT

| DRAFTER | RELEASER |
|---|---|
| VERL R. STANLEY, COL, USAF<br>VICE COMMANDER | VERL R. STANLEY, COL, USAF<br>VICE COMMANDER |

~~T O P S E C R E T~~ 241403Z OCT 73 CITE WHIG 1324.
CHARGE INFO WADDY
FOR GENERAL BRADBURN AND COL DAVISON FROM DR. MCLUCAS
SUBJECT: AFSPPF REALIGNMENT

FOR DECISION TO CLOSE WESTOVER AIR FORCE BASE, AS YOU KNOW, CAUSED US TO LOOK AT ALTERNATIVES TO THE CONTINUATION OF THE AIR FORCE SPECIAL PROJECTS PRODUCTION FACILITY. HAVING CONSIDERED THE VARIOUS OPTIONS, I HAVE SELECTED A PLAN WHICH WILL RESULT IN THE CLOSURE OF THE FACILITY AT WESTOVER AIR FORCE BASE BY ABOUT DECEMBER 1976.

WE WILL PROCEED AT THIS TIME TO CONTRACTUALLY AUGMENT THE PROCESSING CAPABILITY AT EASTMAN KODAK SO THAT THEY WILL HAVE A CAPABILITY TO PROCESS THE BULK OF THE TOTAL NRO PHOTOGRAPHIC WORK LOAD. BASED UPON MY DISCUSSION WITH THE CINCSAC, WE WILL PROCEED TO AUGMENT THE CAPABILITY OF THE 544TH ARTW AT OFFUTT AIR FORCE BASE TO HANDLE THE REMAINING NRO PHOTOGRAPHIC PRODUCTION WORKLOAD.

THE PLAN ADOPTED CALLS FOR THE TRANSFER OF THE EVALUATION FUNCTION TO NPIC. IT ALSO REQUIRES CONTINUATION OF PHOTOGRAPHIC R&D.

AS WE DISCUSSED ON OCTOBER 19, I ANTICIPATE A REALLOCATION OF SOME SPACES WITHIN THE NRO, AND A DRAW DOWN OF PERSONNEL TO PERMIT RELEASING SOME MILITARY SPACES BY EARLY FY 1975. SUBSEQUENTLY MANPOWER SPACES WILL BE TRANSFERRED FOR THE EVALUATION FUNCTION WHEN IT IS RELOCATED AT NPIC. AUGMENTATION OF THE 544TH ARTW TO PERFORM THE NRO PROCESSING FUNCTION WILL REQUIRE TRANSFERRING MORE MILITARY MANPOWER SPACES. AT THE TIME THE AFSPPF AT WESTOVER AIR FORCE BASE IS CLOSED, THE REMAINING MILITARY AND CIVILIAN SPACES WILL BE RELEASED.

GENERAL BROWN AND GENERAL MEYER HAVE BEEN INFORMED OF THIS PLAN. PLEASE WORK CLOSELY WITH GENERAL KULPA IN PLANNING AND CARRYING OUT THIS REALIGNMENT.

E-2 IMPDET
~~T O P S E C R E T~~
BT

S E C R E T 08220Z NOV 73 CITE WHIG 1400
PRIORITY CHARGE INFO PRIORITY WADDY
SECUR
SUBJECT: AFSPPF PHASE DOWN

IN ORDER TO PERMIT PERSONNEL ACTIONS AT THE AFSPPF TO PROCEED NORMALLY, IT IS NECESSARY TO PERMIT ACKNOWLEDGEMENT OF THE PHASE DOWN AT THIS TIME. WE HAVE BEEN WORKING WITH THE OFFICE OF INFORMATION TO ARRIVE AT A SUITABLE APPROACH; WE ARE PRESENTLY COORDINATING AN UNCLASSIFIED MESSAGE WHICH READS AS FOLLOWS. REQUEST YOUR COMMENTS AS SOON AS POSSIBLE.

QUOTE:
FROM: OSAF
TO AFSC
INFO: SAMSO LOS ANGELES CA
SAC OFFUTT AFB NEBR
WESTOVER AFB MAS
UNCL SAFOI
FOR INFORMATION OFFICER
SUBJ: AFSPPF PHASE DOWN

THE AIR FORCE SPECIAL PROJECTS PRODUCTION FACILITY (AFSPPF) WAS EXEMPTED FROM THE WESTOVER AFB CLOSURE ACTION ANNOUNCED BY THE SEC DEF ON 17 APR 73. SUBSEQUENT REVIEW, HOWEVER, HAS DETERMINED THAT THE MANPOWER STRENGTH AT THE AIR FORCE SPECIAL PROJECTS PRODUCTION FACILITY WILL BE REDUCED OVER A PERIOD OF TIME. THERE WILL BE NO FORMAL ANNOUNCEMENT OF THIS REDUCTION, BUT THE FOLLOWING ANSWERS ARE APPROVED FOR USE IN RESPONSE TO QUERY. QUESTIONS NOT COVERED SHOULD BE REFERRED TO SAFIOPA. ACTION OFFICER IS MAJ J. W. DUEMMEL, AV 227-5175.

Q. WHAT IS THE MISSION OF THE AFSPPF?
A. "THE MISSION OF THE AFSPPF IS TO PROVIDE SERVICES AND CONDUCT NECESSARY RESEARCH AND DEVELOPMENT IN PRODUCTION AND EVALUATION TECHNIQUES IN SUPPORT OF SPECIAL PROJECTS."
Q. WHAT ARE THESE SPECIAL PROJECTS?
A. I'M SORRY, THAT INFORMATION IS CLASSIFIED.
Q. WHY WAS IT DECIDED TO REDUCE THE MANPOWER AT THIS FACILITY?
A. PRESSURES TO REDUCE EXPENDITURES AND THE DIFFICULTIES OF OBTAINING SUPPORT WHEN NORMAL BASE FUNCTIONS PHASE OUT WERE CONTRIBUTING REASONS.
Q. IS IT INTENDED TO CLOSE THIS FACILITY AT SOME FUTURE DATE, OR IS IT POSSIBLE THAT IT WILL BE CLOSED?
A. ALL AIR FORCE PROGRAMS ARE CONTINUALLY UNDER REVIEW. THESE REVIEWS DETERMINE SUBSEQUENT CLOSURE ACTIONS. THUS, IT IS POSSIBLE THE FACILITY MAY CLOSE AT SOME FUTURE DATE.
Q. HOW MANY PEOPLE ARE ASSIGNED THERE?
A. ABOUT 300.
Q. HOW MANY PEOPLE WILL REMAIN AFTER THE PHASE DOWN?
A. ABOUT HALF.
Q. WHERE DO THE FUNCTIONS GO?
A. FUNCTIONS WHICH ARE NOT RETAINED OR DISCONTINUED WILL BE ABSORBED BY VARIOUS AIR FORCE ORGANIZATIONS AND AIR FORCE CONTRACTORS.
Q. WHAT OTHER ORGANIZATIONS?
A. I AM SORRY; THAT INFORMATION IS CLASSIFIED.
FROM WILLIAM T. COLEMAN, SAFOI.
UNQUOTE.
E-2 IMPDET
S E C R E T
BT

S E C R E T 131806Z JUN 74 CITE WHIG 0780.
CHARGE INFO WADDY.
HANDLE VIA TALENT/KEYHOLE CONTROL CHANNEL.
SECUR
FOR GENERAL BRADBURN AND COLONEL DAVISON FROM
MR. PLUMMER.
SUBJECT: SPPF PHASE OUT

I HAVE DECIDED THAT IT IS APPROPRIATE TO DECOMPARTMENT AND DECLASSIFY THE ULTIMATE PHASE OUT OF THE SPPF. THE PHASE OUT WILL BE COMPLETE BY THE THIRD QUARTER OF FISCAL YEAR 1977. BETWEEN NOW AND THAT TIME THERE WILL BE A STEADY DRAW DOWN OF PERSONNEL AT THE SPPF. I DESIRE THAT THIS ACTION NOT BE MADE A SUBJECT OF PUBLIC RELEASE EXCEPT IN THE CASE OF A RESPONSE TO QUERY. CURRENTLY RELEASED INFORMATION STATES THAT A PHASE DOWN IS OCCURRING; HOWEVER, A PHASE OUT HAS NEVER BEEN MADE A MATTER OF PUBLIC DOMAIN. YOU ARE AUTHORIZED TO INFORM YOUR PEOPLE THAT THEY MAY DISCUSS THE TIMING OF THE PHASE OUT BUT THAT SPECIFICS BEYOND THIS AS TO FUNCTIONS AND PURPOSES OF THE PHASE OUT STILL REMAIN WITHIN THE TALENT-KEYHOLE CONTROL SYSTEM. THIS MESSAGE HAS BEEN COORDINATED WITH SAFOI, SAFLL, AND AFPR. AFSC IS AWARE OF THIS ACTION. E-2 IMPDET
S E C R E T
BT

~~TOP SECRET~~ 081919Z SEP 72 CITE [redacted]
WADDY INFO PILOT CHARGE SPECTRE [redacted]
BYEMAN GAMBIT
WADDY FOR CALLANAN, PILOT FOR KOHLER, CHARGE FOR NEUNER,
SPECTRE FOR KRIVJANSKI/SHAFER/SUCKOW [redacted] FOR MURPHY,
[redacted] FOR KOCH FROM OWENS
SUBJ: GAMBIT ORE AT WESTOVER

CONGRATULATIONS ON YOUR SUCCESSFUL ACCOMPLISHMENT OF THE GAMBIT ORE CONDUCTED 29-31 AUG. ALL PHASES OBSERVED BY THE NRO REP WERE CONDUCTED IN A MOST PROFESSIONAL MANNER. ALSO WISH TO THANK TIGER TEAM FOR THEIR EXCELLENT SUPPORT AND HELP DURING THIS EXERCISE. A VIABLE BACK-UP CAPABILITY HAS NOW BEEN ESTABLISHED FOR PROCESSING ORIGINAL GAMBIT MISSIONS FOR THE NRP.

~~TOP SECRET~~
BT

## 6594TH TEST SQUADRON PHOTOGRAPHIC SCIENCE SEMINAR

| LECTURE | DATE | SUBJECT | LECTURER |
|---|---|---|---|
| 1 | 24 Jul 65 | Variation in Photographic System and Geometric Optics | [redacted] |
| 2 | 21 Aug 65 | Emulsions and Non-Silver Systems | |
| 3 | 18 Sep 65 | Processing Theory | |
| 4 | 16 Oct 65 | Photographic Progress | |
| | | Tone Reproduction | |
| 5 | 20 Nov 65 | Photographic Standards | |
| | | Physical Optics | |
| 6 | 18 Dec 65 | Physical Optics | |
| | | Physical Optics | |
| 7 | 15 Jan 66 | Physical Optics | |
| | | Contamination Control and Standards | Capt W. McCabe (SPPF) |
| 8 | 19 Feb 66 | Image Evaluation; Data Analysis | [redacted] |
| 9 | 19 Mar 66 | Camera Systems Consideration | |
| 10 | 16 Apr 66 | Summary: Application of Course Elements to Unified Approach to Problem Solving | |
| 11 | 21 May 66 | Air Force Research and Development Progress | Col. T. Byington (Wright-Patterson AFB) [redacted] |
| | | SPPF Research and Development Progress | Mr. W. Forrester (SPPF) |
| 12 | 18 Jun 66 | Air Force Procurement Procedures and Problems | [redacted] (Wright-Patterson AFB) |
| | | Classified and to be Determined as Result of Other Lectures | Lt Col. L. Williams (SPPF) |

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DEPARTMENT OF THE AIR FORCE

WASHINGTON 20330

OFFICE OF THE SECRETARY January 6, 1969

MEMORANDUM FOR MAJOR GENERAL BERG, AFOMO

SUBJECT: AFSPPF Civil Engineering Manpower Increase

Hq AFSC is processing a request for 19 additional civil engineering spaces for the Air Force Special Projects Production Facility (AFSPPF) at Westover AFB, Massachusetts. These additional spaces are needed to maintain the new power generation plant and water well which are under construction. The total requirement is for 34 spaces; however, 15 will be provided by transfer from Westover AFB, Hq 8AF and SAC. Attached is a listing of the remaining 19 by rank, AFSC and the date required.

For your information, AFSPPF has returned ten air police spaces to the SAC MET at Westover AFB which will in turn return them to you in FY 3/69. Applying these ten spaces to our requirement results in a net increase of nine--four civilians and five military--for the total AFSPPF manning.

As you may know, the Directorate of Special Projects (SAFSP) and AFSPPF are located in AFSC for administrative and personnel support only. These two units are, in fact, an extension of OSAF. AFSPPF should be given a separate Program Element Code (PEC) different from the Air Force Satellite Control Facility (PEC 3PR) in which it is now identified as has been done recently for SAFSP by assigning it PEC 6QP. In this way the OSAF manning within AFSC can be readily identified for control and accountability.

When the AFSC request is received, I would greatly appreciate your favorably considering their proposal for the 19 additional spaces and your establishing a separate PEC for the AFSPPF.

Atch
list

/s/ RUSSELL A. BERG
RUSSELL A. BERG
Brigadier General, USAF
Director
Office of Space Systems

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Atch 1
TAB A

## TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

PAGE ___ OF ___ PAGES

| 1. FROM: (Installation/Activity/Service) and Zip code) | 2. OPERATING UNIT | 3. DISTRICT CODE | 4. OPERATING AGENCY | 5. DATE | 6. JOB NUMBER | 7. SERIAL NUMBER | 8. CONTRACT NUMBER |
|---|---|---|---|---|---|---|---|
| D/A, US Army Engineer District, NY<br>26 Federal Plaza<br>New York, New York 10007 | - | New York | - | 21 February 74 | Westover-72-MCAF | 74-2-1-F | DACA 51-72-C-0140 |

| 9. TO: (Installation/Activity/Service) and Zip code) | 10. OPERATING UNIT | 11. DISTRICT CODE | 12. OPERATING AGENCY | 13. ACCOUNTING NUMBER | 14. ACCOUNTABLE OFFICE NUMBER | 15. TYPE OF TRANSACTION | 16. PROJECT NUMBER |
|---|---|---|---|---|---|---|---|
| Commanding Officer<br>ATTN: Base Civil Engineer<br>Westover AFB, Chicopee Falls, Mass | — | — | — | — | — | A: [X] NEW CONSTR. [X] EXISTING FAC. [ ] CAPITAL IMP. [ ] OTHER (Specify)<br>B: [ ] BENF/O [X] PHYSICAL COM. [ ] FINAN. COM. [ ] OTHER (Specify) | |

| ITEM NO. 17 | CATEGORY CODE 18 | FACILITY (Category description) 19 | NO. OF UNITS 20 | TYPE 21 | UNIT OF MEAS. 22 | TOTAL QUANTITY 23 | COST 24 | DRAWING NUMBERS 25 | REMARKS 26 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 740-617 | Addition and Alterations to Bldg. P-1900 SPPF | 1 | P | S.F. | 5,500 | [redacted] | ile No. 695-501 to 695-520 | One story addition with masonry walls, steel frame, concrete floor slab, and footings, built-up roofing, related interior utilities, and Air Conditioning. |
| 2 | | Parking Areas, Vehicle | 1 | P | S.Y. | 3,800 | | 65-501 | 2" Bit. concrete Related site work and improvements. |
| 3 | | Alterations to existing laboratory | | | | | | 65-515 516 | Modifications to existing room, static pressure control systems, and to supply air fan control of existing air handling units. |

This Form 1354 covers 100% of Budget Line Item No. 7272-001, and 7.5% of Budget Line Item No. 2-04. Estimated Cost of [redacted] does not include design costs. The costs of construction furnished on this form represent the best estimates available at this time. Upon financial completion, revised final amounts will be furnished on updated DD Form 1354.

27. STATEMENT OF COMPLETION: The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

TRANSFERRED BY (Signature): Stanley C. Kudzma
DATE: 2/26/74
TITLE (Area Engr/Base Engr./DBWO): STANLEY C. KUDZMA, Area Engineer

28. ACCEPTED BY (Signature): x Daniel M Wheatley
DATE: 22 May 74
TITLE (Post Engr./Base Civ. Engr./Navy Rep.): DANIEL M. WHEATLEY, Major, USAF
Squadron Civil Engineer

29. PROPERTY VOUCHER NUMBER

DD FORM 1 NOV 61 1354

CONFIDENTIAL

**DEPARTMENT OF THE AIR FORCE**
**SAFSP**
Air Force Unit Post Office, Los Angeles 45, California

REPLY TO ATTN OF: [redacted] Lt Col Davis/3196 [redacted] 10 June 1963

SUBJECT: AFK Account Number K0997

TO: Hq SSD
Attn: SSSP (Captain Ware)

1. A classified AFK account, No. K0997, has been assigned to the 6594 Test Squadron (AFSPPL), Westover AFB, Mass. which will replace the AFW 2047 account currently being utilized by the Squadron.

2. The account is not subject to Major Air Command jurisdiction and is exempt from stock balance and consumption reporting.

3. Request you take action as is necessary, pursuant to AFM 67-1 and AFR 67-10 to appoint Captain Frank W. Curtis, 66426A, 6594 Test Squadron (AFSPPL), as the accountable officer and further that direct communication between the 6594 Test Squadron (AFSPPL) and SMAMA be authorized to effect transfer of property from the AFW 2047 account to the AFK account.

4. This communication is unclassified when disassociated from SAFSP.

SIGNED

JAMES S. SEAY
Colonel, USAF
Deputy Director, [redacted]

Copies to:
6594 Test Squadron (AFSPPL)
Hq SMAMA (SMNC)

CONFIDENTIAL

DOWNGRADED AT 12 YEAR INTERVALS; NOT AUTOMATICALLY DECLASSIFIED. DOD DIR 5200.10

CONFIDENTIAL

QUNOTE:
DTG 062155Z MAR 68
FM SAF
TO AFSC/SCSR/LTCOL HESTER
ASD WPAFB OHIO
RADC GRIFFISS AFB NY
GPJIUQ/WESTOVER AFB MASS/LTCOL TAYLOR
SECRET AFRDRG
SUBJ: SUPPORT FOR THE AFSPPF, WESTOVER. REFERNCE MSG AFRDRE 73038, 17 MAY 65. THE PUSPOSE OF THIS MESSAGE IS TO RECONFIRM THE REQUEST FOR CONTINUED ASSISTANCE FOR AFSPPF SUPPORT OUTLINED IN REFERENCED MSG. ALL AFSPPF R&D EFFORTS WILL CONTINUE TO BE FUNDED UNDER PROJECT 698-AJ (P.E. 34111-F ADVANCED SPACE TECHNOLOGY/COMP) THIS PROJECT IS ASSIGNED A PRIORITY OF FAD-1, IMPORTANCE CATEGORY I - BRICKBAT 0-1, AND ALL SUPPORT WILL CONTINUE TO BE HANDLED ACCORDINGLY. LETTERS HAVE BEEN FORWARDED TO RADC AND ASD BY THE AFSPPF OUTLINING THE MAN YEARS OF SUPPORT REQUIRED. SCSR IS REQUESTED TO INSURE THAT APPROPRIATE PRIORITY IS ASSIGNED AS REQUIRED WITHIN AFSC. UNQUOTE.
GP-1 UNQUOTE
C O N F I D E N T I A L
BT

NNN

N

CONFIDENTIAL

DEPARTMENT OF THE AIR FORCE
Headquarters AF Sp Proj Pdn Fclty (AFSC)
Westover AFB, Massachusetts 01022

LOI 172-1

11 June 1973

Budget

FINANCIAL MANAGEMENT BOARD

This LOI establishes Logistics Directorate responsibilities pertaining to the monthly Financial Management Board meeting. It applies to the Director/Deputy Director of Logistics and the Budget Technician and it is their responsibility to become familiar with the directives contained herein.

---

1. Procedures.

a. LG will schedule a Financial Management Board to be held during the first week of each month. The Directorate of Research and Development will be consulted for possible R&D fund posture input at the time the meeting is scheduled.

b. Board members will be briefed on the status of Facility D&M Funds. Presentation format will be that deemed necessary by LG to maintain adequate surveillance of the approved financial program pertaining to each member's area of responsibility. Copies or extracts of applicable monthly and quarterly operating and management reports will be provided as available to the members of the Board for their review and analysis.

c. Should it become apparent to the Budget Technician that re-allocation of funds within the approved program is necessary, LG will so advise the Board. Recommended adjustments to the various Elements of Expense/Investment Accounts (EEIC's) will be provided for the Board's approval/concurrence.

d. Should it be deemed necessary to assume a "DEFERRED" funding posture during the month, LG is authorized to do so with CV approval. LG will, however, provide subsequent explanation for such action during monthly board meetings.

e. LG will brief the Board on the annual Operations & Maintenance Budget Estimate prepared in accordance with AFR 172-1, prior to its submission to higher headquarters. Requirements being carried forward in the unfunded section of the Budget will be identified for the Board Members. To the extent possible, the financial implications of the Budget estimate as pertaining to the various directorates will be outlined.

2. Meetings: The Facility Financial Management Board will meet at least once a month at the call of the Director of Logistics.

3. Minutes: Minutes of the meetings will be maintained by the Director of Logistics. Minutes should be complete and contain a record of the members attending, items discussed, and actions taken. Copies will be signed by the chairman and distributed to the Board members.

William D. Gaeth

WILLIAM D. GAETH, Capt, USAF
Director of Logistics

OPR: LG
DISTRIBUTION: X

[redacted]

Item 27

[redacted]

[redacted]

[redacted]

[redacted]

RECOMMENDATION:

[redacted]

S E C R E T 090044Z MAR 73 CITE CHARGE 1466.

PRIORITY WADDY INFO PRIORITY WHIG

SECTION ONE OF TWO

SECUR

SUBJECT: SECURITY GUIDELINES FOR WADDY

1. REFERENCE: A. AFSPPF STAFF STUDY, 11 APR 72

B. WHIG 0236, 27 FEB 1973

2. THE QUESTION OF WADDY SECURITY AND COVER STORY HAS BEEN AN OPEN ACTION ITEM FOR THE PAST YEAR. THE SITUATION HAS BEEN BRIEFED TO GENERAL BRADBURN IN DEPTH AND HE HAS DIRECTED THAT SP-3 BECOME MORE INVOLVED IN PROVIDING SECURITY DIRECTION AND GUIDANCE TO WADDY.

3. FOR THE PAST THREE DAYS A REPRESENTATIVE FROM WADDY, CAPT MOORMAN, AND SP-3 [redacted] REPRESENTATIVES HAVE BEEN REVIEWING ALL ASPECTS OF THE WADDY INTERACTION WITH THE WHITE WORLD. THE PURPOSE OF THESE DISCUSSIONS WAS TWOFOLD. FIRST, TO INSURE A MUTUAL UNDERSTANDING OF THE DEPTH OF THE PROBLEM AND SECONDLY, TO DRAFT POLICY GUIDELINES TO BE USED BY WADDY IN THEIR DAY TO DAY WHITE INTERACTION.

4. THE FOLLOWING IS A FUNCTIONAL BREAKDOWN OF THE RESULTS OF THESE DELIBERATIONS. WHERE APPROPRIATE, RATIONALE HAS BEEN PROVIDED. THE BASIC POLICY ON THE MAJORITY OF THESE AREAS HAS BEEN COORDINATED WITH WHIG DURING THE FEB 1973 MEETINGS.

A. ORGANIZATIONAL DESIGNATION

IN THE ORIGINAL STAFF STUDY (REF A) PROVIDED BY WADDY, IT WAS SUGGESTED TO CHANGE THE NAME TO A XXXX TEST WING DESIGNATION TO ELIMINATE THE "SPECIAL PROJECTS" AND "PRODUCTION" CONNOTATIONS. WITH THE AUSTERE TIMES AND REALIZING THAT UNIQUE DOD

ORGANIZATIONS ARE UNDER SCRUTINY FROM BUDGET AND MANPOWER PERSONNEL IT IS FELT THAT A NAME CHANGE WOULD DRAW UNNECESSARY ATTENTION TO THE ORGANIZATION.

B. MISSION STATEMENT

WADDY HAS PROPOSED THAT A MISSION STATEMENT OF THE ORGANIZATION BE REVISED TO READ "...PERFORM RESEARCH AND DEVELOPMENT, TEST AND EVALUATION IN THE AREA OF PHOTOGRAPHIC EQUIPMENT AND MATERIALS." THE USE OF THE WORD PHOTO AND THE IMPLICATIONS IN AN UNCLASSIFIED MISSION STATEMENT OF AN ORGANIZATION ASSIGNED TO SAMSO/SAFSP IS UNACCEPTABLE. THE LINKING OF SPACE AND PHOTO TENDS TO LEND CREDANCE TO THE EXISTENCE OF A SATELLITE RECONNAISSANCE PROGRAM, AND EVINCES AN SAFSP ASSOCIATION WITH SUCH A PROGRAM.

C. PERSONNEL

[redacted]

D. MANPOWER

THE SAMSO MANAGEMENT ENGINEERING TEAM (MET) SUPPORTS WADDY IN COORDINATION WITH SP-5. THIS HAS NOT BEEN A MAJOR PROBLEM; HOWEVER, THE MET ISSUES THE WADDY UDL AND STAFFED A SIGNIFICANT MANPOWER CHANGE REQUEST LAST YEAR. BECAUSE OF

THESE INTERACTIONS, AND HIS DIRECT OBSERVATION OF THE PHOTO-INTELLIGENCE-ORIENTATION OF THE ORGANIZATION AND THE ASSOCIATION TO SAFSP, WE INTEND TO BRIEF THE CHIEF OF THE MET DET FOR BOTH FORMAL CONSTRAINING AND CUT-OUT PURPOSES.

E. CONTRACTING

IT IS RECOMMENDED THAT AN APPROPRIATE NUMBER OF CONTRACTING OFFICERS AND BUYERS AT AFAL AND RADC BE BRIEFED TO INSURE A FORMAL CONSTRAINT, AND A MORE EFFECTIVE CUT-OUT. REQUEST YOU IDENTIFY THOSE INDIVIDUALS AT THESE PROCUREMENT ACTIVITIES WHO SHOULD BE BRIEFED. IN ADDITION, DD 254 ON WHITE CONTRACTS WILL BE DEVOID OF INTELLIGENCE AND SI/SAO TERMINOLOGY. GUIDANCE ON DD 254 PREPARATION WILL BE PROVIDED SEPARATELY.

F. CIVIL ENGINEERING.

THE MAJOR PROBLEM IN THIS FUNCTIONAL AREA IS THE REQUIREMENT FOR WADDY ENGINEERING OFFICERS TO BRIEF CONSTRUCTION PROJECTS TO SAMSO AND AFSC BOARDS. APPROVAL OF CONSTRUCTION PROJECTS WILL HERLAFTER BE ACCOMPLISHED IN NRO CHANNELS. IF A BOARD IS NECESSARY, IT WILL CONSIST OF SAFSP STAFF PERSONNEL AND A BRIEFED ADVISOR. THE ASSISTANCE WHICH THE SAMSO D.E. STAFF PROVIDES IN ARCHITECTURAL AND ENGINEERING SELECTION/REVIEW IS NOT VIEWED TO BE A SIGNIFICANT SECURITY PROBLEM. AS THIS STAFF SUPPORT IS A NECESSITY AND THE CAPABILITY IS NOT DUPLICATED AT SAFSP, IT IS FELT THAT WADDY SHOULD CONTINUE TO BE SUPPORTED BY SAMSO.

G. AWARDS

WADDY PARTICIPATION IN THE SAMSO AIRMAN/ NCO OF THE YEAR AWARDS WITH THE REQUISITE JUSTIFICA-

TION TENDS TO AGAIN UNDERSCORE THE PHOTO/SPACE RELATIONSHIP. THIS POLICY SHOULD BE DISCONTINUED. ALL DECORATIONS SHOULD CONTINUE TO BE SUBMITTED IN A CLASSIFIED FORM THROUGH SP-5.

H. REFUSE

IT IS UNDERSTOOD THAT WADDY HAS DEVELOPED A TECHNIQUE TO RE-USE THE LARGE VOLUME OF PLASTIC FILM CANS USED IN THE PRODUCTION FUNCTION. THE FEASIBILITY OF RE-USING THE METAL CANS AND SPOOLS SHOULD BE EXPLORED. AS A POLICY, EVERY EFFORT SHOULD BE MADE TO ELIMINATE/RE-USE EXPENDABLES WHICH CLEARLY IDENTIFY WADDY AS A LARGE SCALE PHOTO PRODUCTION FACILITY.

I. COMMUNICATIONS

CHARGE IS VFRY CONCERNED OVER THE USE OF WORDS SUCH AS PHOTOGRAPHIC, IMAGRY, INTELLI-GENCE, ETC., IN WRITTEN AND TELEPHONIC COMMUNICA-

FINAL SECTION OF TWO

TIONS.

(1) WRITTEN COMMUNICATIONS

IT IS RECOMMENDED THAT IN THE FUTURE ALL CORRESPONDENCE REPEAT ALL CORRESPONDENCE TO CHARGE BE SENT THROUGH BLACK CHANNELS. THIS CAN BE ACCOMPLISHED EITHER BY MESSAGE OR BY PUTTING A BYEMAN COVER LETTER ON THE DOCUMENT.

(2) TELEPHONIC

IT IS REALIZED THAT THE TOTAL ELIMINA-TION OF THE ABOVE OBJECTIONABLE WORDS IS EXTREMELY DIFFICULT. WE ARE EXPLORING THE POSSIBILITY OF INSTALLING A MINIMUM OF THREE SECURE VOICE, KY-3

INSTRUMENTS AT WADDY. THESE SHOULD BE USED WHERE THE CONTENT OF CONVERSATIONS MIGHT REVEAL YOUR PHOTO-ORIENTED NUSSION. IN NO INSTANCE WILL EXPRESSIONS BE USED IN CONVERSTION WITH CHARGE OR WHIG PERSONNEL.

J. FINANCE

THE PRESENT INTERACTION BETWEEN YOUR LOGISTICS FUNCTION AND BASE FINANCE IS AN EVERY DAY OCCURRENCE AND QUITE INVOLVED. AS IN THE SITUATION WITH BASE PERSONNEL THERE EXISTS A LARGE AMOUNT OF INDIVIDUAL INFORMATION ON WADDY ACTIVITIES AT BASE FINANCE. IT IS FELT, HOWEVER, THAT BECAUSE OF THE EXTENT AND COMPLEXITY OF THE DEALINGS, IT WOULD BE UNWISE TO ATTEMPT TO CHANGE YOUR PRESENT OPERATION. CONCEIVABLY A MAJOR CHANGE COULD WELL SERVE TO FOCUS ATTENTION ON THE ORGANIZATION RATHER THAN REDUCING THE VISIBILITY.

K. STAFF VISITS

I AS MENTIONED, CHARGE HAS NOT BEEN SUFFICIENTLY INVOLVED IN PROVIDING GUIDANCE ON SECURITY MATTERS. CONSEQUENTLY, WE INTEND TO VISIT WADDY AT LEAST TWICE A YEAR TO PROVIDE STAFF ASSISTANCE AND BRIEF ON CURRENT SECURITY POLICY.

L. NEED FOR OTHER BYEMAN BILLETS ON WESTOVER.

THIS MESSAGE ADDRESSES THE MAJORITY OF THE INTERACTIONS WHICH WERE COVERED IN REF. A AND B. THERE MAY BE, HOWEVER, A REQUIREMENT TO BRIEF OTHER PERSONNEL ON WESTOVER TO ENSURE SECURITY, I.E., BASE COMMANDER, PROCUREMENT OFFICER, OR COMPTROLLER. REQUEST COMMENTS ON

THE DESIRABILITY OF ADDITIONAL CLEARANCES.

M. CONTINGENCIES

POTENTIAL CONTINGENCIES ARE SO VARIED THAT ANY ATTEMPT TO ESTABLISH PROCEDURES AT THIS TIME FOR ALL POSSIBILITIES WOULD BE FRUITLESS. A MORE REALISTIC APPROACH IS TO PROVIDE WADDY WITH UP-TO-DATE NAMES OF CHARGE AND WHIG PERSONNEL THAT CAN PROVIDE DECISIONS WHEN CONTINGENCY SITUATIONS THREATEN SECURITY.

5. REQUEST YOUR COMMENTS AND RECOMMENDATIONS AS EARLY AS POSSIBLE AFTER WHICH WE SHALL CODIFY SECURITY RULES THAT REFLECT THE ABOVE POLICY ACTIONS AND PROVIDE YOU WITH HARD COPY OF SAME.

E-2 IMPDET

S E C R E T

BT

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, AIR FORCE FLIGHT TEST CENTER (AFSC)
EDWARDS AIR FORCE BASE, CALIF. 93523

25 SEP 1967

REPLY TO ATTN OF: FTTSP (Mr Furnish/73026)

SUBJECT: Updating of Custody Receipts (Ltr, PFM, dtd 29 Jun 67)

TO: Hq AFSPPF (PFMM /Capt Beaver)
Westover AFB, Mass 01022

Attached are the requested hand receipts covering the two Versamat processing machines and associated support equipment that are presently in use at the AFFTC Photography Branch in support of the SR-71 Flight Test Evaluation Program.

FOR THE COMMANDER

CLYDE S. CHERRY, Colonel, USAF
Director, Systems Test

2 Atch
AF Form 1297