AD-A076 104 SYNECTICS CORP ROME N Y F/G 5/2

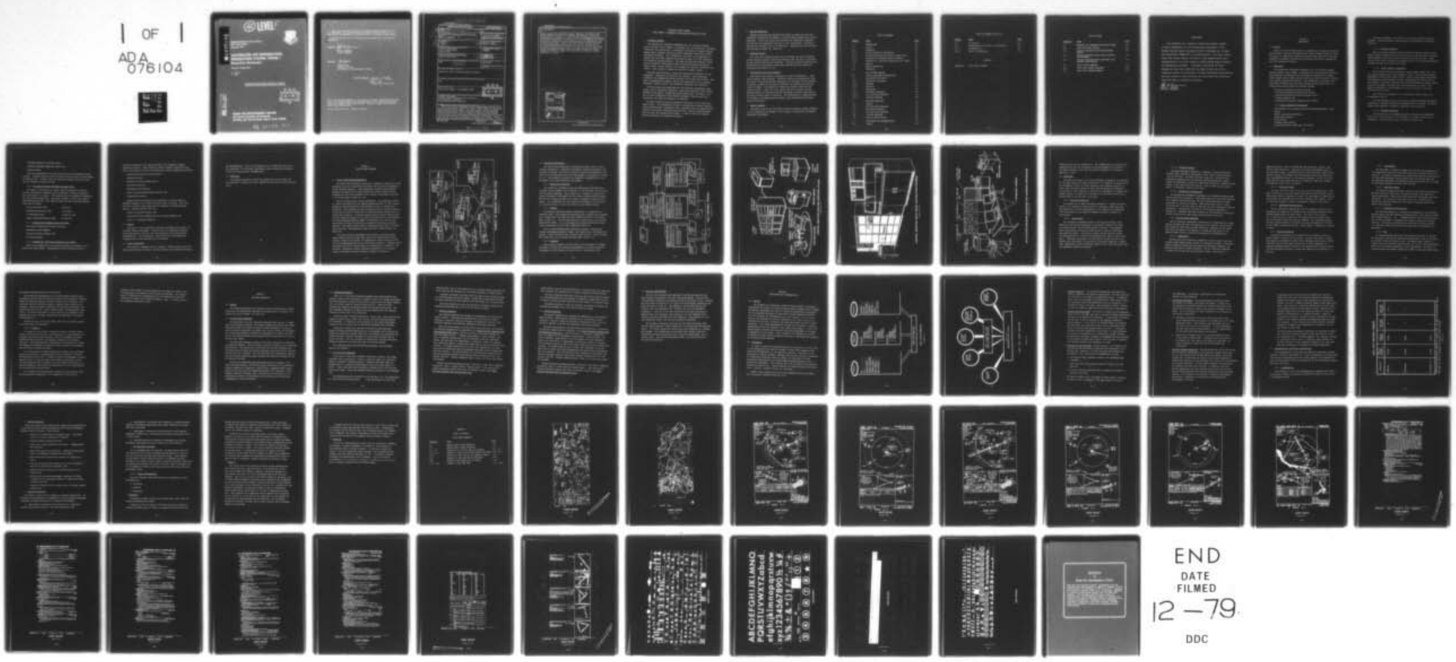
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM. PHASE I. VOLUME I.--ETC(U)

SEP 79 N BOTTINI , P NASH F30602-77-C-0065

UNCLASSIFIED RADC-TR-79-179-VOL-1 NL

1 OF 1

ADA 076104



END

DATE FILMED

12-79

DDC

RADC-TR-79-179, Vol I (of five)
Final Technical Report
September 1979

AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE I
Executive Summary

Synectics Corporation

N. Bottini
P. Nash

ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, New York 13441

This report has been reviewed by the RADC Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

RADC-TR-79-179, Vol I (of five) has been reviewed and is approved for publication.

APPROVED:

JOHN R. BAUMANN
Project Engineer

APPROVED:

HOWARD DAVIS
Technical Director
Intelligence & Reconnaissance Division

FOR THE COMMANDER:

JOHN P. HUSS
Acting Chief, Plans Office

If your address has changed or if you wish to be removed from the RADC mailing list, or if the addressee is no longer employed by your organization, please notify RADC (IRRP), Griffiss AFB NY 13441. This will assist us in maintaining a current mailing list.

Do not return this copy. Retain or destroy.

(19) TR-79-179-VOL-1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RADC-TR-79-179, Vol I (of five) (18)	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE I. Volume I. Executive Summary. (6)		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report, 26 Apr 77 — 26 Jul 78 (9)
		6. PERFORMING ORG. REPORT NUMBER N/A
7. AUTHOR(s) N./Bottini P./Nash (10)		8. CONTRACT OR GRANT NUMBER(s) (15) F30602-77-C-0065 New
9. PERFORMING ORGANIZATION NAME AND ADDRESS Synectics Corporation 310 E. Chestnut Street Rome NY 13440		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 91370307
11. CONTROLLING OFFICE NAME AND ADDRESS Rome Air Development Center (IRRP) Griffiss AFB NY 13441		12. REPORT DATE (11) September 1979
		13. NUMBER OF PAGES 64
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Same (12) 63		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same

18. SUPPLEMENTARY NOTES

RADC Project Engineer: John Baumann (IRRP)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Automated Cartography
Automated Flight Information Product Production
Text Composition and Editing
Electron Beam Recorder Film Output

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report details developmental efforts in providing the initial phase of a fully automated Air Information Production System (AAIPS) for the Defense Mapping Agency Aerospace Center. The system is used to produce DOD Flight Information Publications (FLIPS); Navigation/Planning and Special Purpose Charts; Special Products; and the Automated Air Facility Information File. The requirements, functional design and operational considerations of the AAIPS Charting, Air Facilities, and Publishing Subsystems are presented. The principal purpose of the three subsystems is the reduction of the labor (Cont'd) over

DD FORM 1 JAN 73 1473

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

407 633 LB

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Item 20 (Cont'd)

(manual) required for the revision and publication of information critical to flight operations and logistical planning. Improvement of response time between receipt of changes to air navigation/air facilities data and the dissemination of new data to all users, is also provided. The Publishing Subsystem permits publications to be produced on electronic equipment and extends the power and flexibility of digital manipulation to the updating and reformatting of publications. The Air Facilities Subsystem provides maintenance of the AAFIF data bases, selective data base retrieval, special report generation and generation of formatted tape files for film negative output. The Charting Subsystem provides capture, revision and output of graphic data appearing throughout the DMAAC Flight Information Publications, through preservation of data in digital form and providing techniques to simplify alteration of the data.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

TECHNICAL REPORT SUMMARY
FINAL REPORT - AUTOMATED AIR INFORMATION PRODUCTION SYSTEM

1. Technical Problem

The Aeronautical Information Department (AD) of the Defense Mapping Agency Aerospace Center (DMAAC) is responsible for the acquisition, maintenance evaluation, and exploitation of aeronautical information to support Defense Mapping Agency Aerospace Charts and Flight Information Publications (FLIPS) distributed worldwide. This information is provided to the Department of Defense (DoD) and other agencies and authorized users for flight operations and logistical planning purposes. The major AD production programs are DoD Flight Information Publications (FLIPS), Navigation/Planning and Special Purpose Charts, Special Products, and Automated Air Facility Information File (AAFIF). Each production program also results in several outputs.

The AAIPS system involves a functional configuration comprised of three subsystems: Publishing; Air Facility; and Charting. These subsystems accomplish the automated production workload of all FLIPS and the AAFIF. This effort encompassed the analysis, design, and specification of all hardware components, software and all user procedures comprising each subsystem.

The FLIP products are associated with the following geographical areas: Alaska, Pacific Australasia Anaractica, Canada North Atlantic, United States, Caribbean South America, Europe North Africa Middle East, and Africa. For each of these geographical areas Planning documents, Enroute Charts and Supplements, and Terminal Procedures are produced.

The AAFIF contains evaluated information pertaining to all foreign free world airways. The informational content is categorized as General Identification and Description, Operational Users, Navigation Aids and Communications, Airfield Descriptions, Maintenance and Servicing, Special Purpose Equipment Base Services, and Transportation Weather. A total of about 90 different products constitute the scheduled production.

2. General Methodology

Methods used during the course of the project included the review and assessment of production environments, current hardware systems, and software technology. Product data bases were developed and independent subsystems were designed and implemented according to user requirements. Interactive software and procedures were also established. Subsystem test and evaluation were performed at DMAAC, St. Louis, MO.

3. Technical Results

The AAIPS pilot system concluded that the concept was valid, efficient on-line revision existed, operational procedures were the key to integration, and the selected hardware was responsive. The major technical result was the production of quality graphics and products meeting all FLIP production specifications currently in use.

4. Implications for Further Research

Three major areas should be addressed as future considerations: interfaces; products; and technology. Regarding interfaces, consideration could be given to the possible digital transmission of the AAFIF and FLIP products or possibly a subset of the product by-passing the recording and printing process at DMAAC. The products area should be seriously considered for further research. Under this area, format size and of special interest, symbology should be reveiwed to provide streamling of product specification and thus providing greater flexibility. The technologies of computer/peripheral hardware, telecommunications hardware, and printer/plotter/recorders should be monitored.

5. Special Comments

The AAIPS is one of the first major multiple-technology systems implemented in the production environment for the purpose of supporting cartographic production requirements.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

APPENDIX

LIST OF FIGURES

EVALUATION

The Automated Air Information Production System (AAIPS) is being integrated into the production environment of the Defense Mapping Agency Aerospace Center's Aeronautical Information Department (DMAAC/AD) in a phased manner. The first phase, which this report covers, involved a total system design with implementation of a pilot system to prove system design concepts and operational software. Successful testing of the pilot system has shown that AAIPS will be able to meet the strict schedules imposed on production of Flight Information Publications and will provide a more efficient and up-to-date Air Facilities data base than is presently available.

John R. Baumann
JOHN R. BAUMANN
Project Engineer

SECTION I

INTRODUCTION

1.0 General

This is the final Technical Report, Automated Air Information Production System (AAIPS), Rome Air Development Center Contract Number F30602-77-C-0065. This report is submitted as required by Contract CDRL Item A012 and has been prepared in accordance with Data Item Description DI-S-3591/A, MIL-STD-847A and other pertinent directives.

1.1 Background

The Aeronautical Information Department (AD) of the Defense Mapping Agency Aerospace Center (DMAAC) is responsible for the acquisition, maintenance evaluation and exploitation of aeronautical information to support Defense Mapping Agency (DMA) Aerospace Charts and Flight Information Publications (FLIPS) distributed worldwide. This information is provided to the Department of Defense (DoD) and other agencies and authorized users for flight operations and logistical planning purposes.

The major AD production programs include:

- √ DoD Flight Information Publications (FLIPS);
- √ Navigation/Planning and Special Purpose Charts;
- √ Special Products; and
- √ Automated Air Facility Information File (AAFIF).

1.1.1 Flight Information Publications

FLIP products are associated with the following geographical areas:

Alaska,
Pacific Australalasia Anaractica,
Canada North Atlantic,
United States,
Caribbean South America,
Europe North Africa Middle East, and Africa.

For each geographical area AFLIPs of the following general types are produced: Planning documents, Enroute Charts and Supplements, and Terminal Procedures.

1.1.1.1 Planning Documents

Each of the eight separate planning documents primarily consist of pre-flight planning information such as special use air space and pilot procedures. These documents collectively consist of about 50,000 lines of text. There are about 3600 update transactions performed annually to the planning documents representing about 38,500 text line changes.

1.1.1.2 Enroute Charts & Supplements

The 89 Enroute Charts are produced in large graphic format (20" X 45") and typically require over 30,000 changes per year. The six textual Enroute Supplements contain 140,000 lines of text. Nearly 45,000 update transactions are performed on these documents annually representing over 62,000 lines of text changes. Information contained within these documents are airway system/special use airspace, aerodrome data, and navigational facilities. The Enroute Supplements for foreign areas also contain sketches of selected aerodromes and heliports.

The IFR Enroute Supplement U.S. is essentially textual content with no aerodrome sketches.

The VFR Supplement for the United States contains aerodrome information consisting of aerodrome sketches with supporting text of military and general aviation VFR aerodromes (landplanes, seaplanes, and helicopters).

1.1.1.3 Terminal Procedures

The publications are standardized graphics illustrating predetermined maneuvers for runway approaches and landings and instrument meterological conditions. The three basic types of Terminal Procedures are:

Instrument Approach Procedures (IAPs);

Standard Instrument Departures (SIDs); and

Terminal Charts

There are approximately 3000 IAPs for which over 17000 changes are made annually. Similarly there are over 1350 SIDs for which as many as 2400 changes are made per year. Finally, there are nearly 550 terminal charts for which over 1600 updates are made each year.

1.1.2 Navigation/Planning and Special Purpose Charts

The charts in this series all require special overprints containing selected aeronautical information such as airfields, electronic navigation aids, and special use airspace. The overprint data is portrayed by symbolization with textual description. The annual workload is nearly 1000 compilations/revisions per year. The types of charts and their associated product scales are as follows:

Tactical Pilotage Chart	1:500,000;
Operational Navigation Chart	1:1,000,000;
Jet Navigation Chart	1:2,000,000; and
Global Navigation/Planning Chart	1:5,000,000.

1.1.3 Aeronautical Information Special Products

The special products are of three varieties:

Aeronautical Video Mapping;

Tactical Situation Displays; and

Air Field Diagrams.

1.1.4 Automated Air Facilities Information File (AAFIF)

AAFIF is an automated file of evaluated information pertaining to all foreign free world airways. Approximately 44,000 airfield records are currently maintained on the AAFIF with about 2700 information updates received by AD daily. AAFIF resides on reels of magnetic tape and a disk file on the UNIVAC 1108 with the informational content categorized as follows:

General Identification and Description;

Operational Users;

Navigation Aids and Communications;

Airfield Description;

Maintenance and Servicing;

Special Purpose Equipment Base Services; and

Transporation Weather.

Outputs derived from AAFIF source information, totaling about 90 different products, are recorded on magnetic tape or printed. About one-third are in digital tape format with the remainder as hardcopy printed reports. Scheduled product users are:

Defense Intelligence Agency (DIA);

World Wide Military Command and Control System (WWMCCS); and

Other U. S. Government Agencies.

1.2 Purpose

This report is the culmination of the work performed during Phase I of the AAIPS program development. Included herein is information regarding the System Overview, Training, Test and Evaluation, and Conclusions and Recommendations. The requirements, functional design, and operational considerations of each subsystem will be presented.

1.3 Report Organization

This report is organized into five volumes. Volume One deals with the AAIPS System Overview, Training, Test and Evaluation and presents Conclusions and Recommendations. Each of the remaining four volumes deal with one of the subsystems, its functional requirements, design, operational considerations, and conclusions and recommendations.

1.4 References

The numerous references used for the completion of this project and the production of reports are either required or fall under the SOW specifications.

SECTION 2

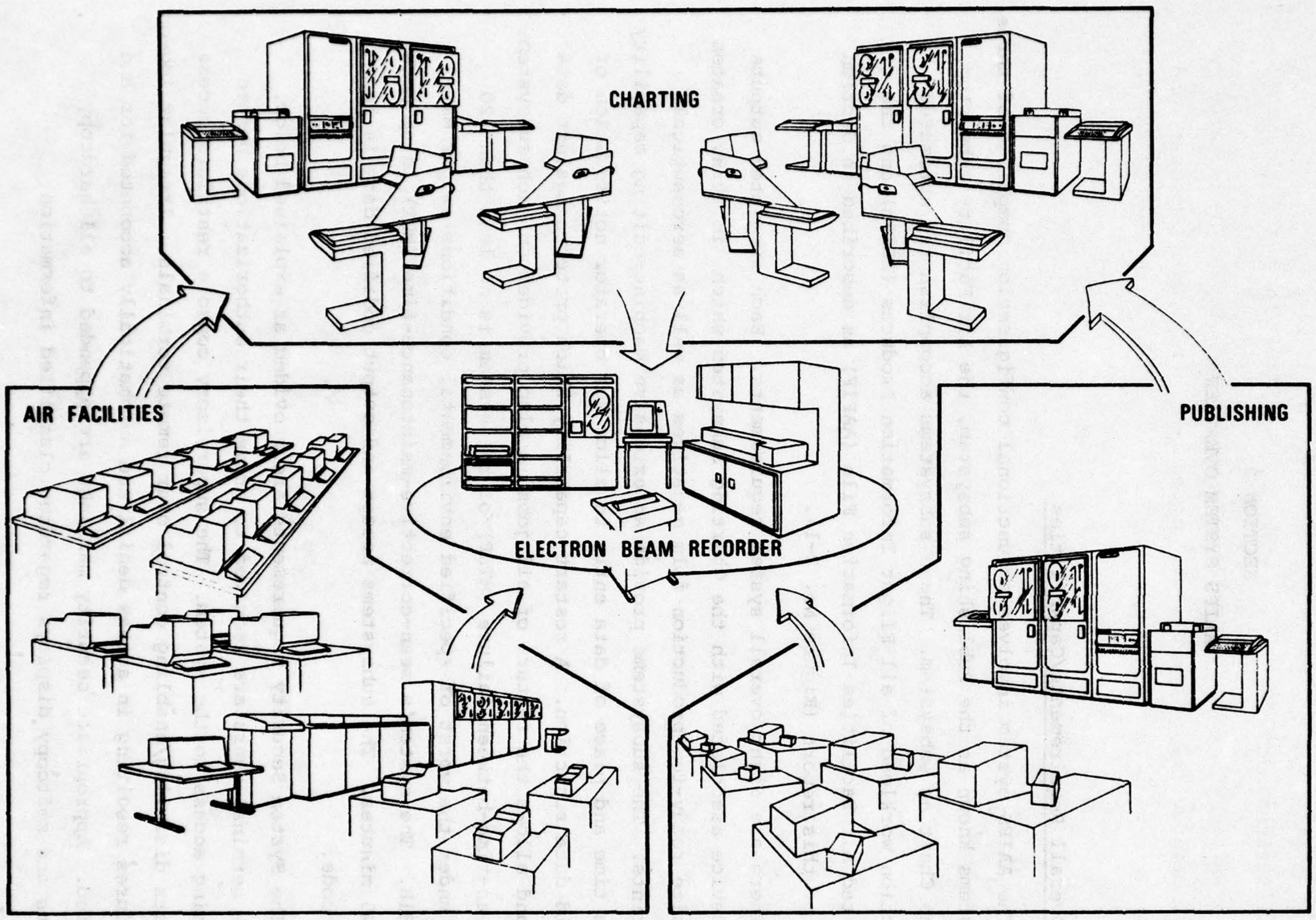
AAIPS SYSTEM OVERVIEW

2.0 Overall Requirements/Capabilities

The AAIPS system involves a functional configuration comprised of three subsystems known as the Publishing subsystem, the Air Facility subsystem, and the Charting subsystem. These subsystems accomplish the automated production workload of all Flight Information Products (FLIPs) and the Automated Air Facilities Information File (AAFIF) as described in Section 1.1.1 of this report (Figure No. 2-1).

There are eight overall system requirements. Each subsystem outputs to a device associated with the Charting Subsystem which, in turn, creates composite ready-for-production film negatives as well as aeronautical overprints. The subsystems provide an extensive machine-editing capability at the time and place of data entry to allow for operator notification of invalid data rejection. A restart capability which protects against data loss and allows the restart of all jobs is also provided on each subsystem. The mean-time-between failure (MTBF) of the system is no less than 120 hours under the worst of specified environmental conditions as per MIL-STD-781B. The system's mean-corrective-maintenance-time (MCT) is no more than 45 minutes. The subsystems accept and output codified data is in ASCII code.

The System Security requirements are provided as explained below. Remote terminal users are required to prove their authorizations before obtaining access to the system. The supervisory console restricts access with its disabling/enabling control over remote terminals. Irregular log-on procedures resulting in access denial are automatically accounted for and recorded. Appropriate security markings are appended to all hardcopy reports and softcopy displays regarding classified information.



AUTOMATED AIR INFORMATION PRODUCTION SYSTEM

Figure No. 2-1

2.1 Operational Environment

The AAIPS system operational environment manifests itself in three tangible perspectives: operational procedures; hardware environment; and personnel functions. The overall functional framework implemented for the AAIPS will be integrated within the AD environment as illustrated in Figure No. 2-2. The Automation Division will assume the responsibility for the management of the AAIPS production environment.

2.1.1 Operational Procedures

The operational procedures within the Aeronautical Department have undergone several changes with the addition of the Charting, Air Facilities, and Publishing subsystems. These changes are necessary to provide for a smooth integration of the AAIPS into the current organizational structure. The details of these procedures are listed in subsequent volumes of this report. It is projected that the operational procedures will be refined, on a continual basis, at some point where they are deemed optimum.

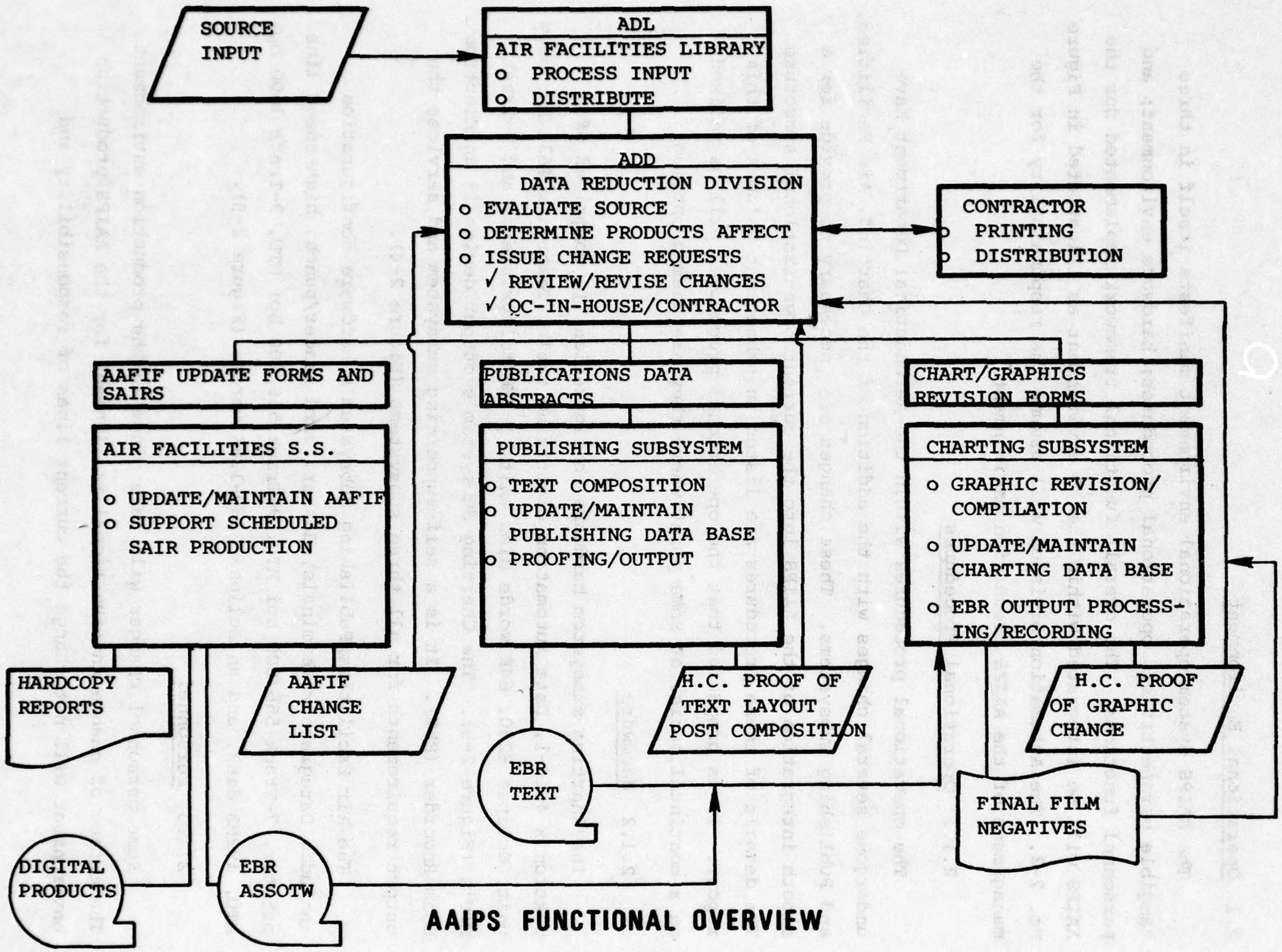
2.1.2 Hardware

The Charting subsystem hardware configuration is comprised of a Tektronix 4014-1, Data Automation digitizing table, Tektronix 4631 hardcopy unit, Eclipse S230, 64K words disk unit, 192MB teleprinters, and 9-Track MTU's (Figure 2-3). The Charting Subsystem's output device is an Electron Beam Recorder (EBR). It is a self-supporting subsystem and services the output requirements for all three subsystems (Figure 2-4).

The Air Facilities/Publishing Subsystem's hardware configuration includes Datagraphix terminals, dasher, card reader/punch, high-speed line printer, 7-Track 556/800 bpi MTU, 9-Track 556/800 bpi MTU, 9-Track 1600 bpi MTU, 192MB disk, and an Eclipse C330-128K words. (Figure 2-5).

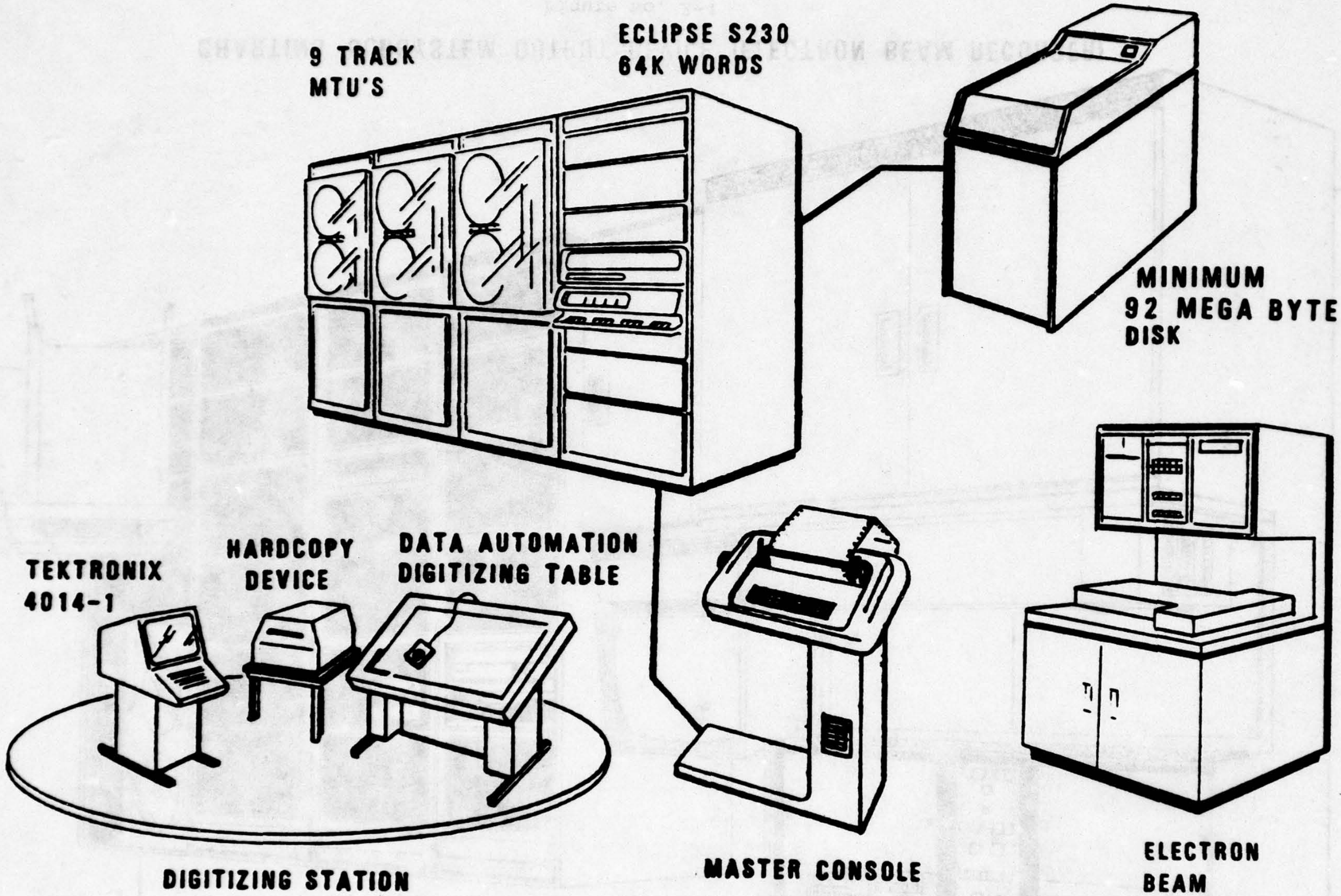
2.1.3 Personnel

Some personnel changes will take place in the production environment. The extent of change and functional realignment for the AAIPS production environment will not change the current lines of responsibility and



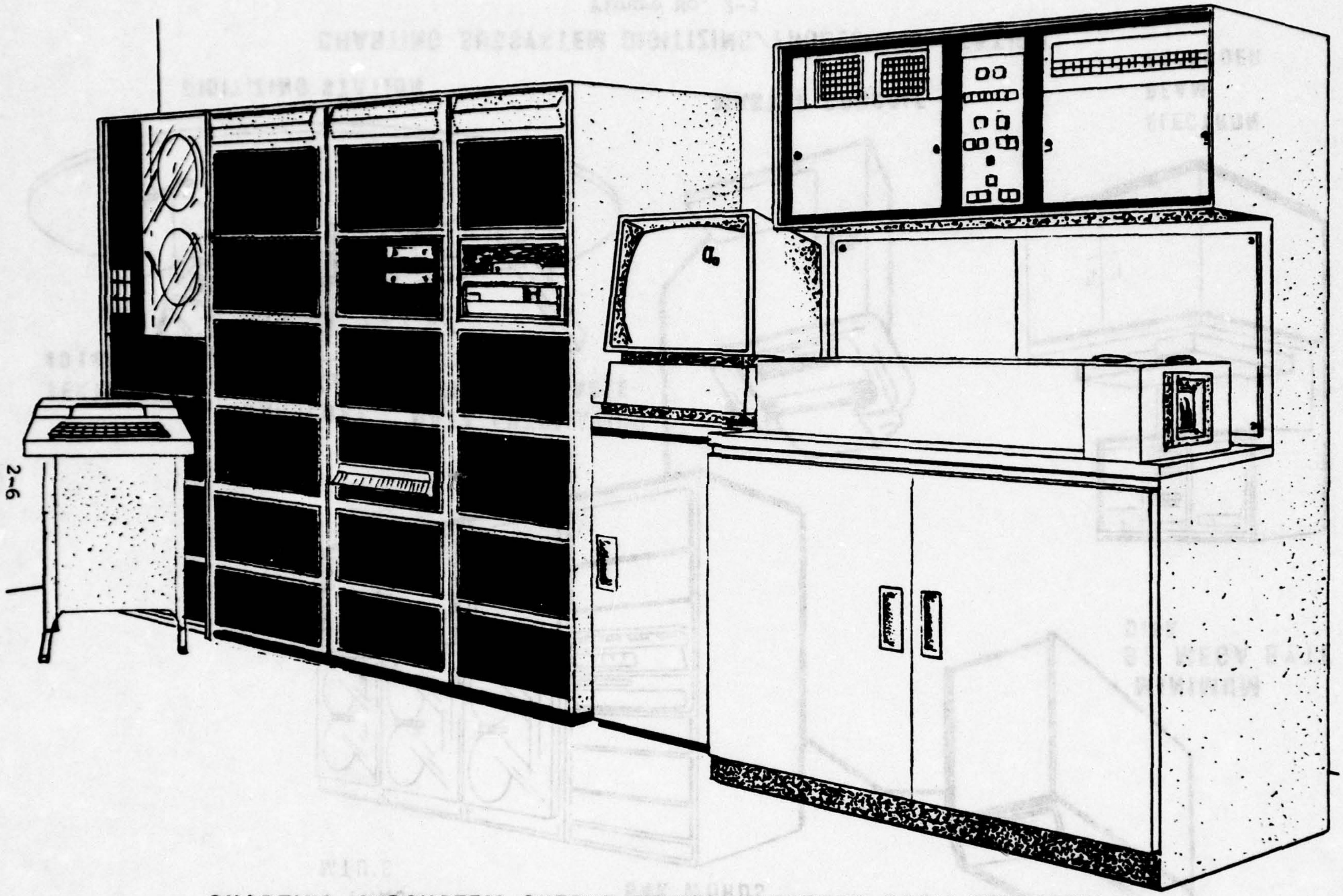
AAIPS FUNCTIONAL OVERVIEW

Figure No. 2-2



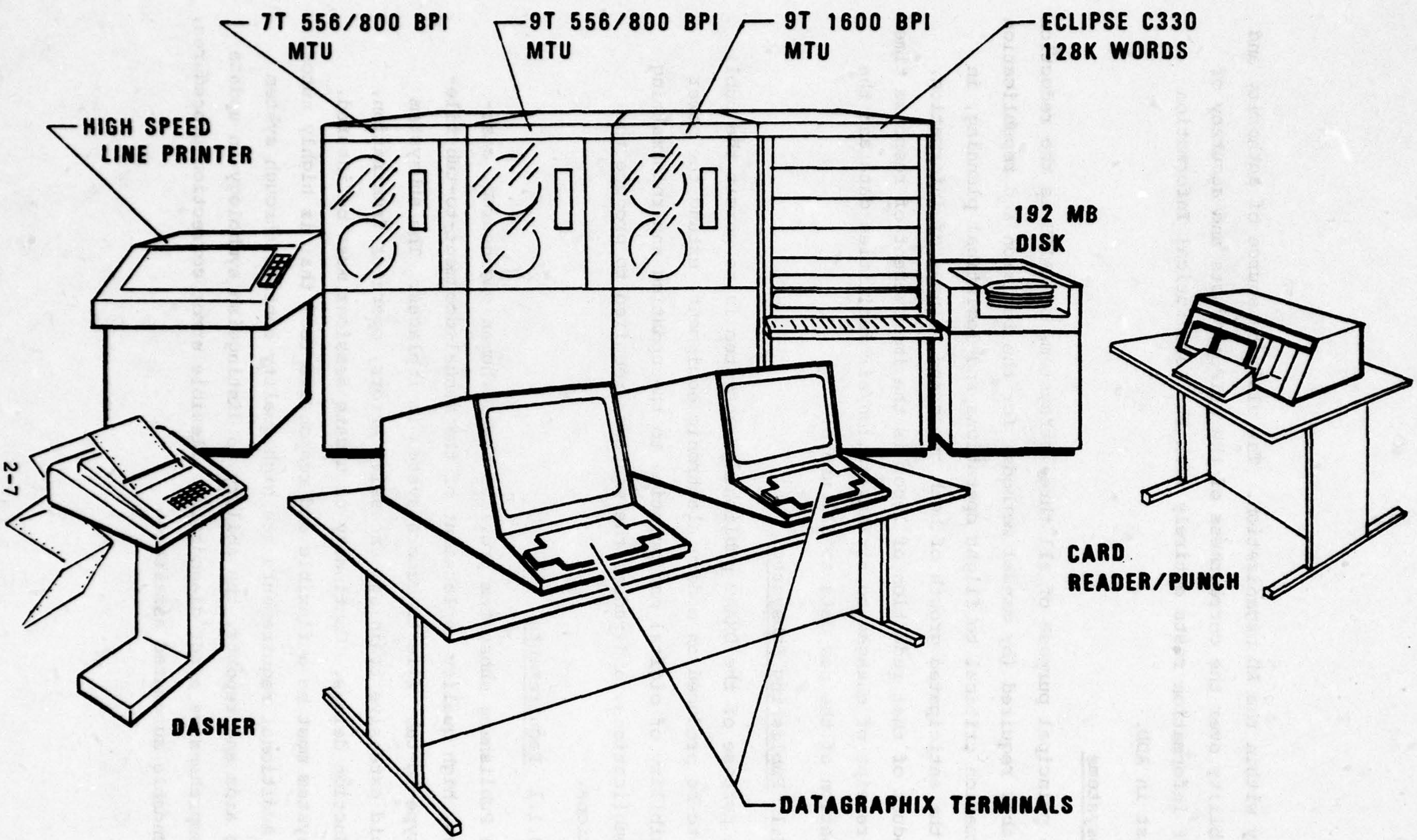
CHARTING SUBSYSTEM DIGITIZING/PROCESSING STATION

Figure No. 2-3



CHARTING SUBSYSTEM OUTPUT DEVICE (ELECTRON BEAM RECORDER)

Figure No. 2-4



AIR FACILITIES/PUBLISHING SUBSYSTEMS PILOT HARDWARE CONFIGURATION

Figure No. 2-5

authority within the AD organization. The ultimate source of authority and responsibility over the correctness of the FLIP products and accuracy of the AAFIF information rests entirely with the Aeronautical Information Specialist in ADD.

2.2 Subsystems

The principal purpose of all three subsystems of AAIPS is the reduction of the labor required (by manual methods) for the revision and republication of information critical to flight operations and logistical planning, in view of the anticipated growth of both types and volumes of information. A by-product of that reduction of labor is the improvement of response time between receipt of changes to air navigation/air facilities data and the dissemination of the new data to all users.

2.2.1 Publishing Subsystem

The purpose of the DMAAC publishing subsystem is to permit the publications to be produced on modern electronic equipment, extend the power and flexibility of digital manipulation to the updating and reformatting of the publications, and reduce the manpower required to produce the publications.

2.2.1.1 Requirements

The Publishing subsystem provides a well human engineered, cost-effective, high quality replacement of the manual document-to-tub file-to-varitype-to-tub file-to-camera system it replaces. The subsystem must avoid extensive training, excessive errors, operator frustration, and production delays. Continuity of update sessions must be insured. The subsystem must be a flexible and responsive tool that is highly automatic. Additional requirements are high quality control through system proofing aids and reports, the ability to distinguish symbology in update mode, comprehensive error diagnostics, flexible error correction procedures, and dependable automated assistance.

2.2.1.2 Functional Design

The DMAAC Publishing subsystem is designed to create and maintain complex flight information publications (FLIPs) used by military pilots all over the world. The major functional areas are: log-on/log-off; publication identification and creation; display manipulation; update pages; file management; publication reports and statistics; repagination and output to CBR; and publication proofing. Each of these are described in detail in subsequent volumes of this report.

2.2.1.3 Operational Considerations

The Aeronautical Information Department (AD) of DMAAC publishes flight and air facilities information. These publications are used by DoD agencies, U.S. Commands, military services, and other authorized users for flight operations and logistical planning. These publications result in about 140 issues and 1.5 million lines of text per year with a 50% annual character change rate. The data base structure of the Publishing subsystem is designed to accommodate that data necessary for the production of the publications as well as the ready access and maintenance of the data.

2.2.2 Air Facilities Subsystem

The Air Facilities subsystem is tasked with the responsibility of maintaining the AAFIF data base and supporting on-line queries, selective data base retrieval, AAFIF special report generation, scheduled tape and hard-copy report generation, and generation of formatted tape files for the Charting output device to record film negatives of the ASSOTW report.

2.2.2.1 Requirements

The Air Facilities subsystem is required to receive input in the form of AAFIF update request forms, special air information requests, interactive analyst's queries and data entry through local and remote terminals, and auxiliary tape input for AAFIF conversion. The Air Facilities subsystem is required to provide data base processing, update, and retrieval, hardcopy printout, output and ASSOTW EBR tape processing, security, and special report generation. Compliance with these requirements result in the following outputs: extracted subsets of AAFIF data base, AAFIF special reports, special and scheduled tape and hardcopy products from AAFIF data base, and ASSOTW EBR tapes for the Charting subsystem. The Air Facilities subsystem must also provide the means for displaying AAFIF file contents for analyst's review (local and remote).

2.2.2.2 Functional Design

The major functional areas of the Air Facilities subsystem are: data base initialization, data base update, data base retrieval, product output. These areas allow the subsystem to fulfill its requirements to AAIPS as well as utilizing the Automated Air Facilities Information File (AAFIF). Each of these are discussed in detail in subsequent volumes of this report.

2.2.2.3 Operational Considerations

The Air Facilities subsystem data base is designed to assist in the maintenance and production of ASSOTWs, SAIRs, and update functions by the Defense Mapping Agency Aerospace Center. The effort's main purpose is to create an on-line retrieval and update system that permits interactive dialogues between users and the computer. This subsystem contains the 2300 airfield records of the AAFIF data base and completes an average of 135* update transactions per day. *(This number is expected to increase to 2000).

2.2.3 Charting Subsystem

The Charting subsystem of the Automated Air Information Production System (AAIPS) is tasked with the capture, revision, and output of graphic data appearing throughout the DMAAC Flight Information Publications (FLIPs). Consistent with the time-saving purpose of all three subsystems, the Charting subsystem achieves its goal by the preservation of data in digital form and providing techniques to effect the simplicity of alteration of the data.

2.2.3.1 Requirements

The subsystem is required to support the creation and maintenance of a FLIP graphic data base which is further exploited to generate other FLIP products. The Charting subsystem also accepts data from the Publishing and Air Facilities subsystems, merges charting data with textual data from the Publishing subsystem, and generates final film negatives that are ready for production through the Electron Beam Recorder.

2.2.3.2 Functional Design

The Charting subsystem provides interactive data acquisition/revision, EBR data processing, EBR control processing/recording, EBR symbol/text library maintenance, charting data base maintenance, EBR graphic data base maintenance. The four major functional areas are: Interactive Data Acquisition, EBR Data Preparation, EBR Control Processing, Master Font/Symbol File Processing.

2.2.3.3 Operational Considerations

The Charting subsystem is designed and implemented in a functionally modular fashion with each operation performed having a very discrete result. Well defined functions are implemented which, under operator control, can be linked together to accomplish very complex digitizing or editing functions. The system is menu-driven with the menu containing thirteen (13) functional capabilities which are devided into 162 subfunctions or operations.

2.2.3.4 EBR

All three subsystems make use of the advanced technology of the EBR for high speed, high quality output plotting/recording. Data is converted into images on electron sensitive film. The EBR provides a method of creating the final separation negatives with line, point, and area symbology which go to the printer subsequent to field distribution. The result is a more efficient and complete capability of DMAAC to maintain airfield data and prepare hardcopy products for distribution.

The minimum key characteristics of the EBR computer-controller and peripherals are CPU (with options such as 32K-16 bit word memory, automatic power fail detection/restart, and direct memory access interface), disk controller and drive (2M words capacity), magnetic tape controller and transport, console teletype or equivalent dot-matrix type terminals, and display processor monitor, vector, discrete point, and alphanumeric capability. The overall EBR system is also required to be equipped for the suppression of radio frequency interference and radiation in accordance with MIL-STD-461.

The EBR also has its own tape format, data file, and symbol library to be used within the subsystems.

2.2.3.5 <u>Training</u>

For reasons of practicality, manpower allocation, training, supervision, and functional security, the potential for a clear separation of personnel functions has been provided. The strict separation of major software functions enables a corresponding separation of personnel functions: ADA system personnel, responsible for maintaining the system and changing its behavior if necessary, operator personnel for updating and maintaining the AAFIF data base.

It is obvious that a software design which follows clear functional objectives facilitates a corresponding division of personnel functions and responsibilities as well. It makes it easier for management to define specific rules, to train for them, and to maintain supervisory control over both personnel and the system. The fine tuning of functions is an inherent capability which allows for some duties to be the responsibility of a few specially trained persons.

It is apparent that some personnel changes will be necessary; some have already been accomplished. It is important to note that the personnel roles created to operate AAIPS will not change the current lines of responsibility and authority within the AD organization. The ultimate source of authority and responsibility over the correctness of the FLIP products and accuracy of the AAFIF information rests entirely with the Air Information Specialist in ADD.

SECTION 3

TEST AND EVALUATION

3.0 General

The subsystems acceptance and evaluation tests were performed to demonstrate that the capabilities required by the SOW were met or exceeded. All testing took place at DMAAC, St. Louis, MO.

3.1 Air Facilities Subsystem

The objectives of the Air Facilities subsystem tests were to (1) demonstrate that hardware, software, and firmware capabilities supplied by vendors performed and met the criteria as stated in SOW requirements (2) that Air Facility functions performed in a manner such that the results and procedures of its functions matched or exceeded the requirements as stated in the SOW and (3) that these functions could properly execute and perform over the Air Facility data volume.

The tests were designed to achieve three major objectives in evaluating the Charting Subsystem. The first series covered all aspects of the subsystems functionality. The second was to verify that the Charting Subsystem Pilot data base could be stored and recalled repeatedly from disks without jeopardizing the data files' contents. The last objective was to demonstrate acquisition and revision procedures against typical chart products including the IAP, SID, Enroute, and AP/2.

Tests for the Publishing Subsystem demonstrated the adequacy of the vendor hardware/software, verified the proper functioning of the Publishing software capabilities (hypenation, justification, repagination/EBR output, global file editing, and auto indexing/retrieval), full repertoire of edit commands, measured throughput times, and measured the performance of the subsystem with regard to incorporating actual changes into the data base corresponding to FLIP publications.

3.2 Publishing Subsystem

Tests 1-37 of the AAIPS Publishing Subsystem Test and Evaluation Procedures, Volume 3 were designated as inspection tests and included operational and non-operational hardware characteristics, general edit and update capabilities, and vendor supplied software characteristics. These tests were successfully conducted and approved during the specified test period. The test regarding sufficiency of memory size was approved after all required software had been shown to be operational.

Functional tests regarding hyphenation; center, left, right justification; repagination/EBR output; global file editing; and auto indexing/retrieval were performed. In addition, tests pertaining to the merged text/graphic capability and the volume test for publishing throughput were performed.

Volume Test Timings were conducted utilizing the Test data base. Change throughput exceeded expectations by a considerable 50% of prediction. Timings are expected to improve based upon the findings that publication and system familiarity affected throughput to a much greater extent than did volume of change. The test succeeded in demonstrating prototype Publishing Subsystem capability to process more than 1/15 of FLIP changes.

All inspection tests were performed satisfactorily and government approval was obtained.

3.3 Air Facilities Subsystem

Three types of tests were conducted; inspection, function, and volume. Inspection Tests presented in a visual or practical manner of a particular hardware, software or firmware function. Function tests dealt with the demonstration of a required system capability such as an add, update, or delete. Volume tests dealt with performing a function over 1/15 of the Air Facility data base. Tests were conducted during the period of 15-30 September 1978.

The methodology used in constructing the test was: (1) the construction of a Test Result Certification Matrix; (2) the construction of a test procedures matrix; and (3) the construction of a function/volume test sheet for tests requiring the demonstration of complex functions or volume testing.

The major conclusion from these tests was that the Air Facility system, in a two-week period using one analyst, successfully accomplished the work of several analysts who would generate the same volume in a two-week period.

The prime conclusion is that the functions as proposed, designed, and implemented performed over 1/15 of the Air Facility volume.

3.4 Charting Subsystem

The Charting subsystem was designed and implemented in a functionally modular fashion. Each operation performed has a very discrete result. Therefore, a series of tests was necessary to demonstrate that all of the functions required in the SOW were implemented and working properly.

The tests were designed to achieve three major objectives in evaluating the Charting subsystem and are specified in the AAIPS Charting Subsystem Test and Evaluation Plan, Vol 2. The first series of tests were conducted to cover all aspects of the subsystem;s functionality. These included: all station hardware; demonstration of how font/symbol files were generated, edited, and verified as to completeness of character, widths, and spacing; and a digitizing session in which every major function has been utilized from the menu. The second objective was to verify that subsystem's pilot data base could be stored and recalled repeatedly from disks without jeopardizing data file contents. The third objective was to demonstrate acquisition and revision procedures against typical chart products including the IAP, SID, Enroute, and AP/2. Products generated were to total 1/15 of the total Charting workload.

System testing was performed between 3 June and 13 June 1978 at DMAAC/AD, Building #3, Area 27, AAIPS Facility, Charting Room 2. The charting subsystem successfully passed every area of evaluation found in the AAIPS Charting Subsystem Test and Evaluation Plan.

cedures matrix; and (3) the construction of a function/volume test sheet for tests requiring the demonstration of complex functions or volume testing.

The major conclusion from these tests was that the Air Facility system, in a two-week period using one analyst, successfully accomplished the work of several analysts who would generate the same volume in a two-week period.

The prime conclusion is that the functions as proposed, designed, and implemented performed over 1/15 of the Air Facility volume.

3.4 Charting Subsystem

The Charting subsystem was designed and implemented in a functionally modular fashion. Each operation performed has a very discrete result. Therefore, a series of tests was necessary to demonstrate that all of the functions required in the SOW were implemented and working properly.

The tests were designed to achieve three major objectives in evaluating the Charting subsystem and are specified in the AAIPS Charting Subsystem Test and Evaluation Plan, Vol 2. The first series of tests were conducted to cover all aspects of the subsystem;s functionality. These included: all station hardware; demonstration of how font/symbol files were generated, edited, and verified as to completeness of character, widths, and spacing; and a digitizing session in which every major function has been utilized from the menu. The second objective was to verify that subsystem's pilot data base could be stored and recalled repeatedly from disks without jeopardizing data file contents. The third objective was to demonstrate acquisition and revision procedures against typical chart products including the IAP, SID, Enroute, and AP/2. Products generated were to total 1/15 of the total Charting workload.

System testing was performed between 3 June and 13 June 1978 at DMAAC/AD, Building #3, Area 27, AAIPS Facility, Charting Room 2. The charting subsystem successfully passed every area of evaluation found in the AAIPS Charting Subsystem Test and Evaluation Plan.

3.5 Electron Beam Recorder

The test and evaluation and acceptance of the EBR by Synectics from Image Graphics Incorporated (IGI) was a two phase process. Phase one was the preliminary acceptance and training period at the vendor's site. Training was given during the period of 3-17 April 78 and preliminary acceptance took place the week of 22 May 78. (See Appendix A of the AAIPS EBR Test and Scenario, Test and Evaluation Plan - Volume V for test and acceptance procedures). Phase two of the Test and Evaluation process took place at DMAAC/AD where the acceptance test performed at IGI was repeated and an 80-hour production environment test was conducted. (See Appendix B of the above-mentioned Volume V for Test and Acceptance procedures).

The Acceptance Inspection and Tests for the AAIPS Cartographic EBR Recorder System combined "Visual Inspection" with "Operational and Recording Tests". The "Visual Inspection" section dealt with documentation, software, and hardware. The "Operational and Recording Tests handled conditions, operational and human engineering tests, electrical measurements, and recording tests. (See the above-mentioned Volume V for specifications of the Test and Evaluation.)

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

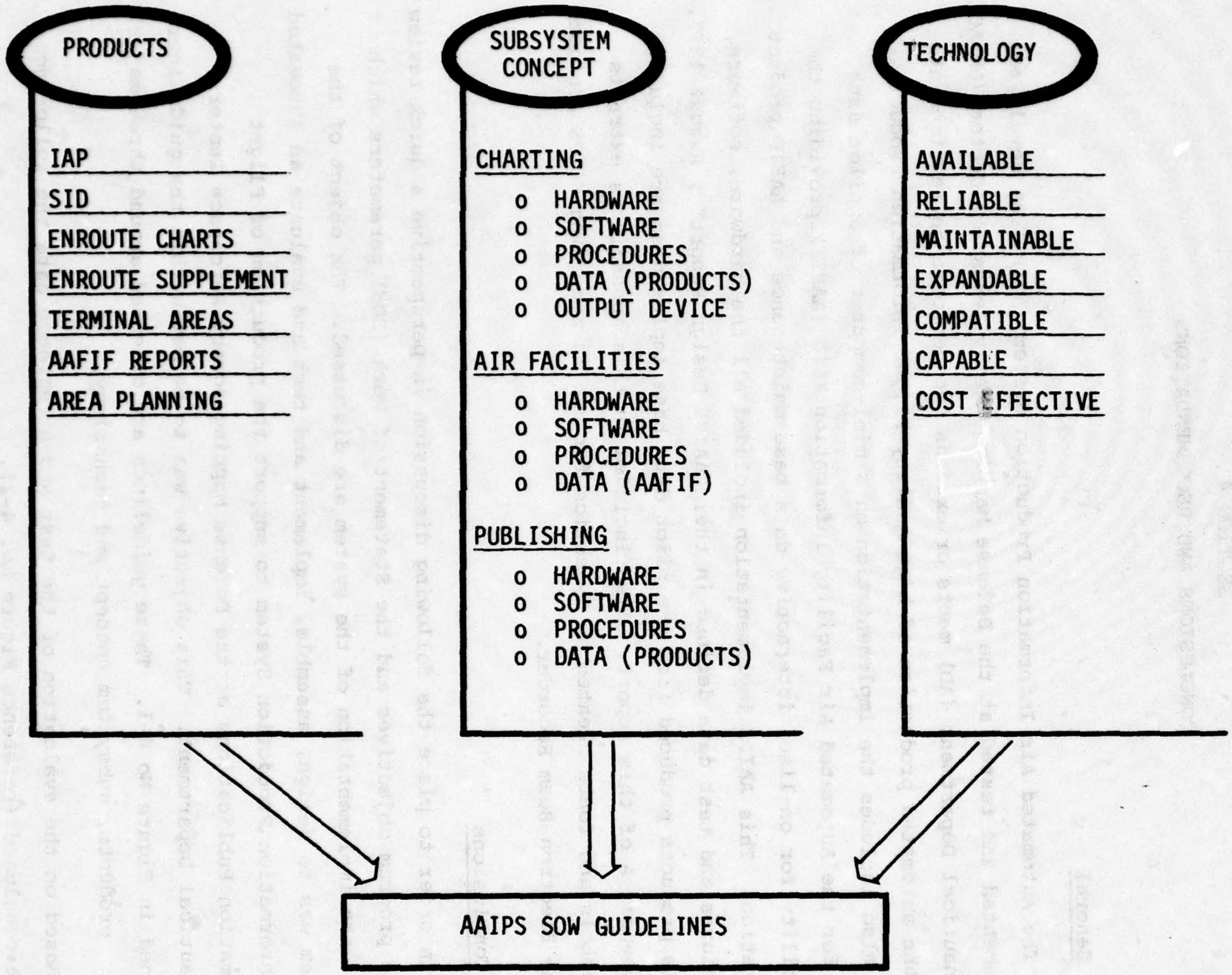
4.0 General

The Automated Air Information Production System (AAIPS) as developed, implemented and tested at the Defense Mapping Agency Aerospace Center (DMAAC) Aeronautical Department (AD) meets or exceeds the performance requirements for the automated production of high quality Flight Information Products. This also includes the implementation on a mini-computer of a pilot data base for the Automated Air Facility Information File (AAFIF) providing the capability for on-line, interactive data base maintenance and AAFIF product generation. This AAIPS implementation included all the hardware, software, procedures and test data defined in the; "AAIPS Design Report" , August 1977. Sample products produced from the pilot data base implemented are included in Appendix A of this report. Also included in this Appendix is extracts of symbols and fonts created by Synectics for use in recording FLIPS products on the Electron Beam Recorder.

4.1 Conclusions

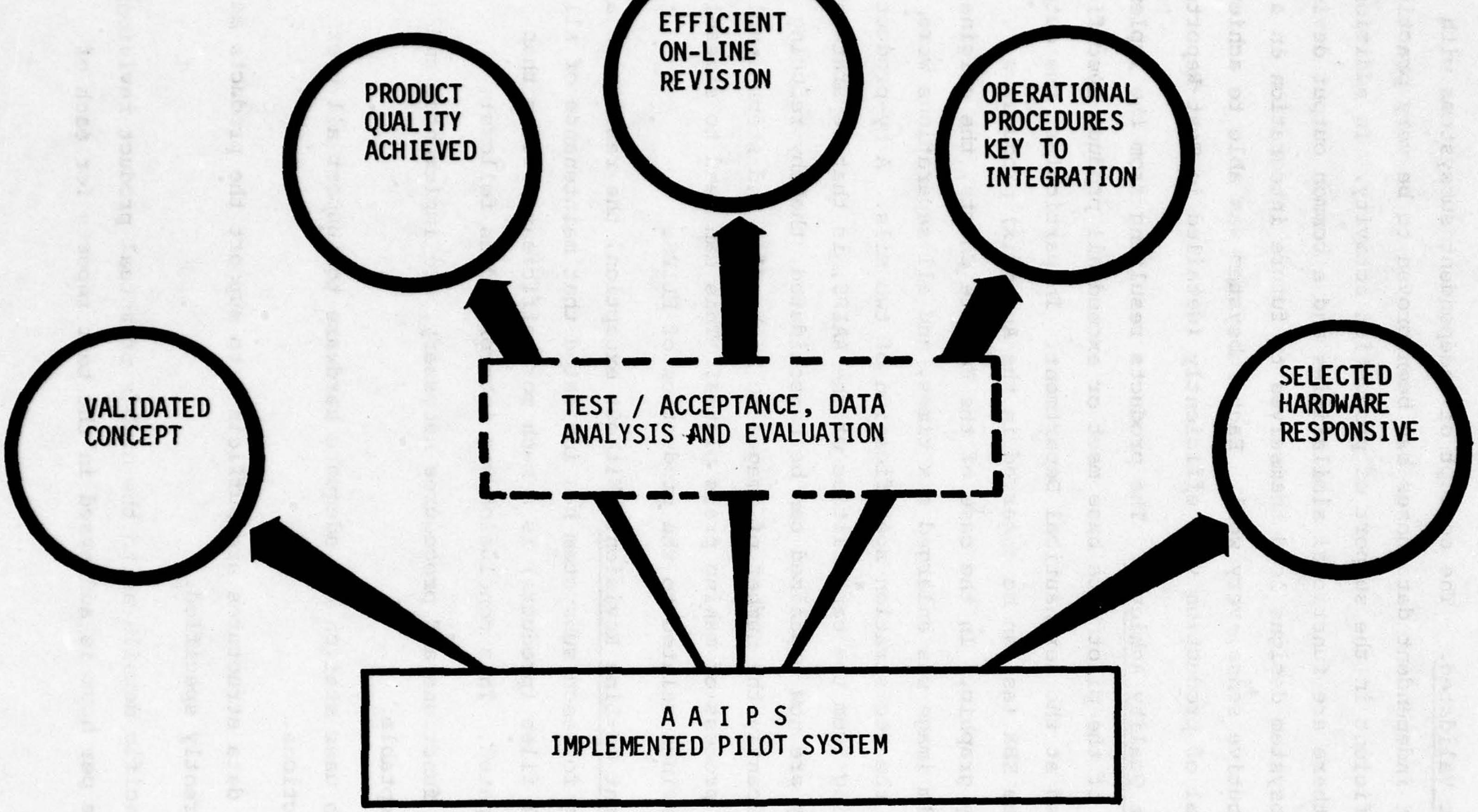
In order to place the following discussion in perspective a quick review of the program objectives and the Statement of Work (SOW) parameters which guided the implementation of the system are discussed. The object of the program was to design, assemble, implement and test and evaluate an Automated Air Information Proudction System to support the production of Flight Information Publications at the Defense Mapping Agency Aerospace Center, Aeronautical Department. This objective was to be met within the guidelines outlined in Figure No 4-1. These guidelines are oriented around three major areas: products, subsystem concept and technology.

Based on the evaluation of the test and acceptance data the following can be concluded (reference Figure No. 4-2).



AAIPS SYSTEM PARAMETERS

Figure 4-1



AAIPS PILOT SYSTEM CONCLUSIONS

Figure 4-2

✓ Concept Validated. The concept of independent subsystems with product independent data bases has been proven to be very practical and efficient in the support of production activity. In addition, since there are functional similarities and a common output device, the subsystem designs lend themselves to future integration in a distributive sense, very well. Each subsystem was able to achieve its goal of production very efficiently (detailed in Test Reports).

✓ Product Quality Achieved. The products resulting from the implementation of the pilot data base meet or exceed all product specification utilized at the Aeronautical Department. In particular, the output from the EBR (as can be observed in the Appendix) produces a quality graphic. In the case of the Enroute Charts, the original EBR film image was enlarged six times, and all separations were within the registration specification of two mils. A by-product resulting from the capabilities of the AAIPS, is that separations as they are now organized can be consolidated, thereby reducing significantly the number of images to be handled and steps involved in the process of making press plates. This can lead to sizeable cost savings related to the production of FLIPS.

✓ Efficient On-Line Revision. Without exception, the results of all testing for each subsystem has indicated that maintenance of all digital files (products) is a much more efficient process than anticipated. This conclusion was interpreted as follows:

- o All functions and procedures necessary, are implemented and acceptable.
- o Each user station has adequate hardware to suuport all user functions.
- o All data structures are sufficient to support the products as currently specified.

The specific details as to the number of actual product revisions by type per hour is addressed in the test reports for each of the subsystems. In addition, a description of revisions by category is also addressed.

✓ Operational Procedures. How does operational procedures affect the measure of success in the AAIPS environment? To begin with, the operational procedures defined and redefined during the pilot system proved adequate to support the necessary throughput of the AAIPS. But, an evaluation of these procedures in use, pointed to two definite conclusions:

1) Procedures currently in use at the end of the pilot system can be improved within the Design of the AAIPS with no or little additional effort. This indicates that throughput can only get better with very little investment. It also demonstrates that the AAIPS Design was predicated on a solid understanding of FLIP production requirements and processes.

2) Operational procedures will be an even more important aspect of the Phase II AAIPS effort. Procedures not only related to the operation of user stations but equally as important, the total integration of AAIPS into the AD environment and organization.

✓ Selected Hardware Responsive. The best method for determining whether the user station configurations and supporting hardware was responsive to FLIP production was by observation and hands-on experience. A great deal of experience was gained in this respect because the actual pilot data base and all acceptance tests were run by AD personnel, not Synectics personnel. All SOW required hardware characteristics and response times have been satisfied. In addition, user supporting capabilities are also available such as the special cursor for the charting stations and a special keyboard for the publishing stations. All hardware is off-the-shelf, completely maintainable and meeting or exceeding all reliability and maintainability requirements in the SOW.

In assessing all of the results of the AAIPS pilot system it became very clear that the technology required to successfully complete the program covers a wide spectrum within the DMA R&D program, in fact it includes technology common to many application areas. This system is a successful demonstration of how a carefully managed Research and Development program, coupled with outstanding support from the user agency can result in a very cost effective implementation of a production system. Figure 4-3 illustrates the industry standard in terms of man-years of effort related to the software required and implemented under the AAIPS pilot program. It also indicates the actual Synectics man-years expended to accomplish the implementation; in affect, a two to one savings in labor cost.

The AAIPS system was designed, developed, and installed at DMAAC/AD by Synectics personnel located in Rome, New York, St. Louis, Mo., Washington, D.C., and Image Graphics, Inc., personnel located in Connecticut and St. Louis. In addition, RADC personnel at Griffiss AFB and St. Louis, DMAAC/AD personnel at St. Louis and RADC were instrumental in supporting the AAIPS development.

4.2 Recommendations and Future Considerations

The recommendations listed below are basically short-term in nature, primarily related to AAIPS Phase II. Future considerations are those areas that should be addressed now so that proper planning can be addressed to take the AAIPS beyond Phase II in preparation for new and changing requirements and technology.

4.2.1 Recommendation

The following is a list of recommendations by subsystem for items to be included in Phase II as should be considered in Phase II with a plan for implementing them

AAIPS PILOT SOFTWARE SUMMARY

SUBSYSTEM	**NO. OF FORTRAN STATEMENTS	*INDUSTRY STANDARD	MAN YEARS /STANDARD	MAN YEARS EXPENDED
CHARTING	25,000	10/DAY	10	3.5-4
PUBLISHING	20,000	10/DAY	8	4
AIR FACILITIES	15,000	10/DAY	6	5

*BASED ON THE ADAMS REPORT PREPARED BY DIEBOLD CORP. FOR ROME AIR DEVELOPMENT CENTER

**INCLUDES ALL UTILITY SOFTWARE BUT EXCLUDES SYSTEM SOFTWARE

Figure 4-3

✓ Charting Subsystem

During the course of both original data capture and testing/revision, it was discovered that certain enhancements to the Charting Subsystem software would be desirable. These include:

- o Function for orthogonality of straight lines. (Line would result to be either horizontal or vertical)
- o Variable leading of multi-line text.
- o Limited set of text manipulation functions. (Change/Delete/Add characters)
- o Morse Code Input via text function. (Operator enters Alpha-numeric and subsystem translates to Morse Code).
- o Mask editing which would allow "cutting" of sections of a chart.
- o Maintain the Feature Type currently set such that function need not be selected each subsequent time.
- o Method by which a feature can be cancelled while in the graphic mode.
- o Charting Data Post-processing(EBRDC) capability to select a single file for processing instead of a complete set from a product directory.
- o Generate rectangles from two corner points at variable angular orientations.

✓ Publishing Subsystem

The system as delivered will produce the required publications. The following software/hardware is recommended to further optimize performance throughput and human engineering in a production environment:

a. Specification, acquisition and interface to a viewer model terminal incorporating extra function keys; Datagraphix 132B.

b. Specification, acquisition and interface to a proofing printer capable of reproducing upper/lower case special characters in several font styles and sizes.

c. Improvement or provision of such software as would improve hyphenation, AGEAR entry, block deletion and right justification within a field of data.

d. Continued analysis of production requirements and possible throughput enhancements that may be found to be cost effective.

✓ Air Facilities Subsystem

It is recommended that the functions, as demonstrated during the Air Facilities Pilot system be extended and implemented to cover the full Air Facilities data base and processing volume. Major emphasis in this Phase II effort should be placed on an extended data base structure with automatic loading support, improved processing capabilities for application programs that product (off-line) reports and tapes, and a full expansion to remote, multi-user access for the on-line data base maintenance system.

4.2.2. Future Considerations

There are basically three major areas to be addressed as future considerations:

- Interfaces
- Products
- Technology

✓ Interfaces

Interfaces to AAIPS can occur on the input side, output side and between subsystems within AAIPS.

Currently all of the inputs to the AAIPS system are received in hardcopy or analog form, go through an assessment and data extraction process and then used to revise the digital files. Areas or sources of digital data should be identified and evaluated as to their ability to streamline and reduce the time to input and update data bases. Programs such as the "TERPS" system are candidates.

Currently the output of the AAIPS system is hardcopy reports, magnetic tape files for the AFFIF and FLIP products in hardcopy form. Since all of the data comprising these reports are in digital data bases, consideration could be given to the possible digital transmission of these products or possibly a subset of the product by-passing the recording and printing process at DMAAC. This could be done for selected products or selected users. A consideration might be to transmit this data directly to aircraft which would be equipped to handle this information. But selected users equipped with appropriate printer/plotters could reduce the time to distribute, thereby increasing the currency of data.

✓ Products

The current set of FLIP products and their related specifications have evolved over many, many years and as is characteristic of this type of environment the formats, symbology, and general appearance of the products have taken the form of the method under which they were compiled. This is not to critize the AD FLIP products in any manner, but the AAIPS employs automated technology and new procedures for accomplishing this production which provides a greater flexibility in many respects. But to take advantage of this flexibility with an eye to reducing cost and improving throughput, consideration should be given to streamlining product specification particularly in the area of symbology and format size. Many examples of how symbology could be amended can be discussed here but suffice it to say that one mil differences in line weights can not generally be distinguished with the human eye. But developing hardware and software to handle data at this resolution can be extremely expensive and limiting.

A second area which deserves some analysis is what future products may be required by FLIP users and what form they will take. If experience is a teacher in this area the user, once he becomes aware of the flexibility at DMAAC/AD, will develop requirements for many new products both recurring and one-time with the emphasis being on digital products.

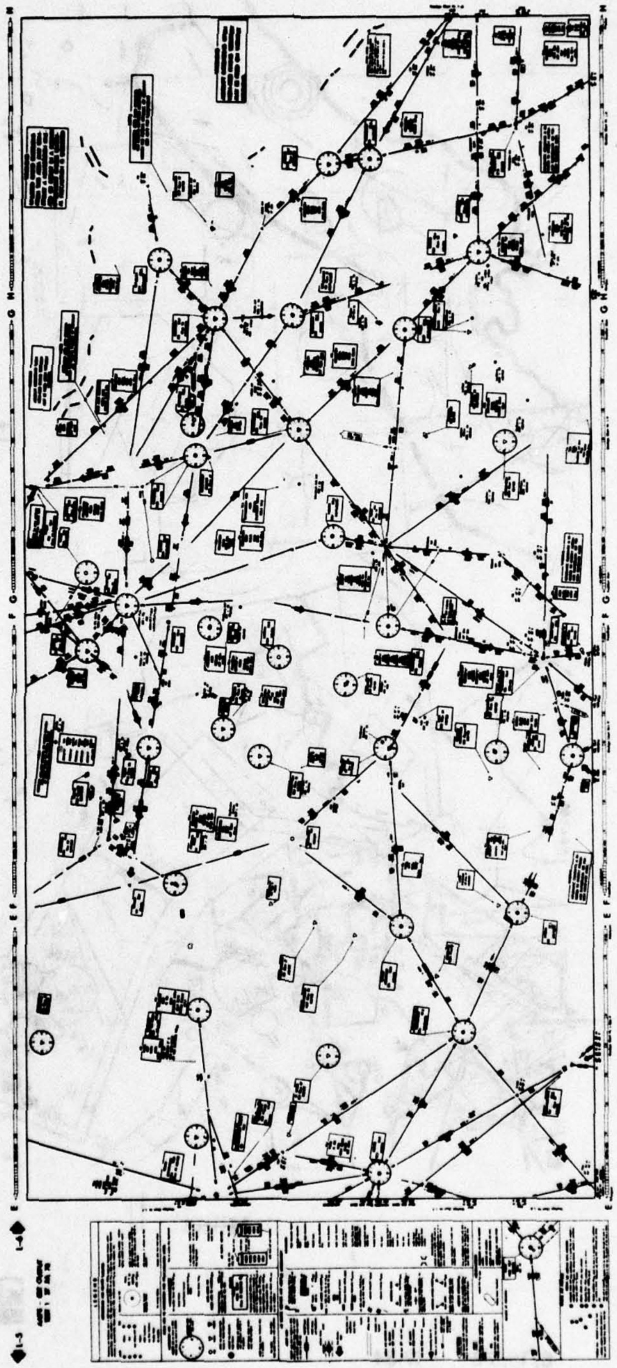
✓ Technology

As with any system employing state of the art technology in hardware and software a constant assessment is necessary to take advantage of new technology when it becomes available. In the case of AAIPS this refers to not only computer/peripheral hardware, but telecommunications hardware and printer/plotter/recorders as well. In addition, software techniques and methodologies will be changing. All of this should be reviewed as to its relevancy to AAIPS on a schedule which would allow for its' smoothe integration into the AAIPS system.

APPENDIX A

TABLE OF CONTENTS

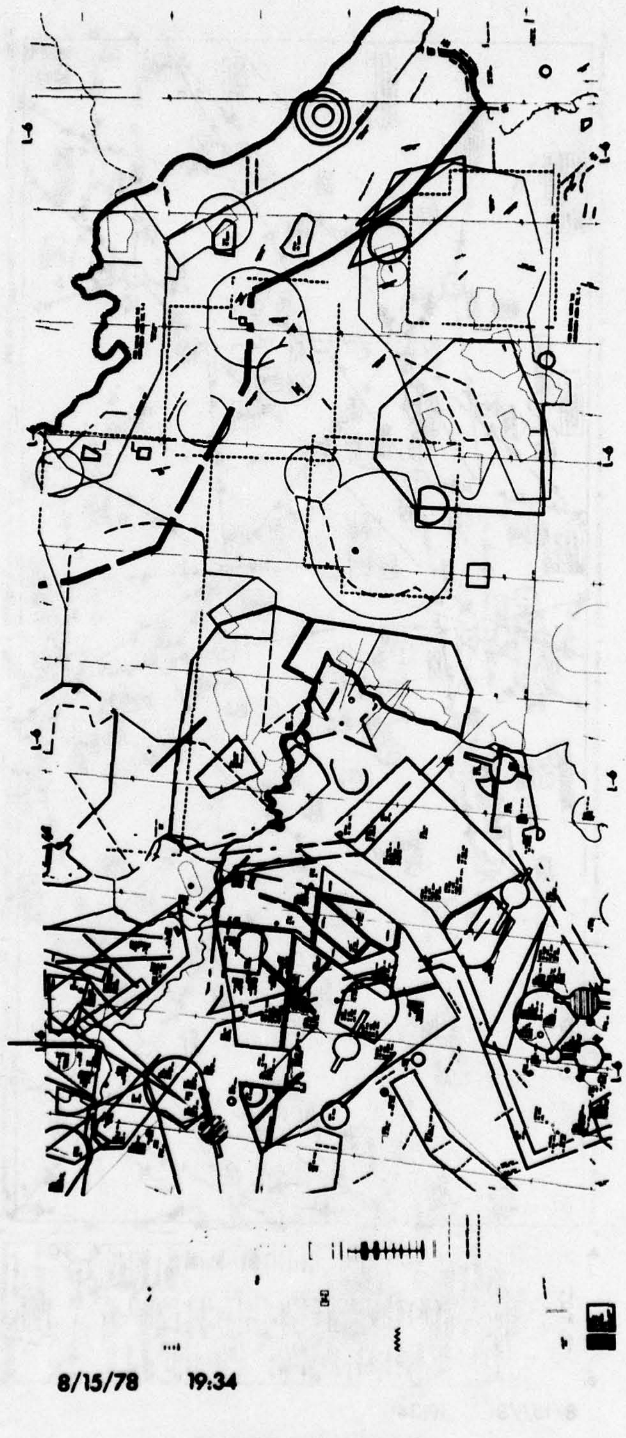
AAIPS OUTPUT EXAMPLES



1 8/15/78 19:34

AAIPS OUTPUT

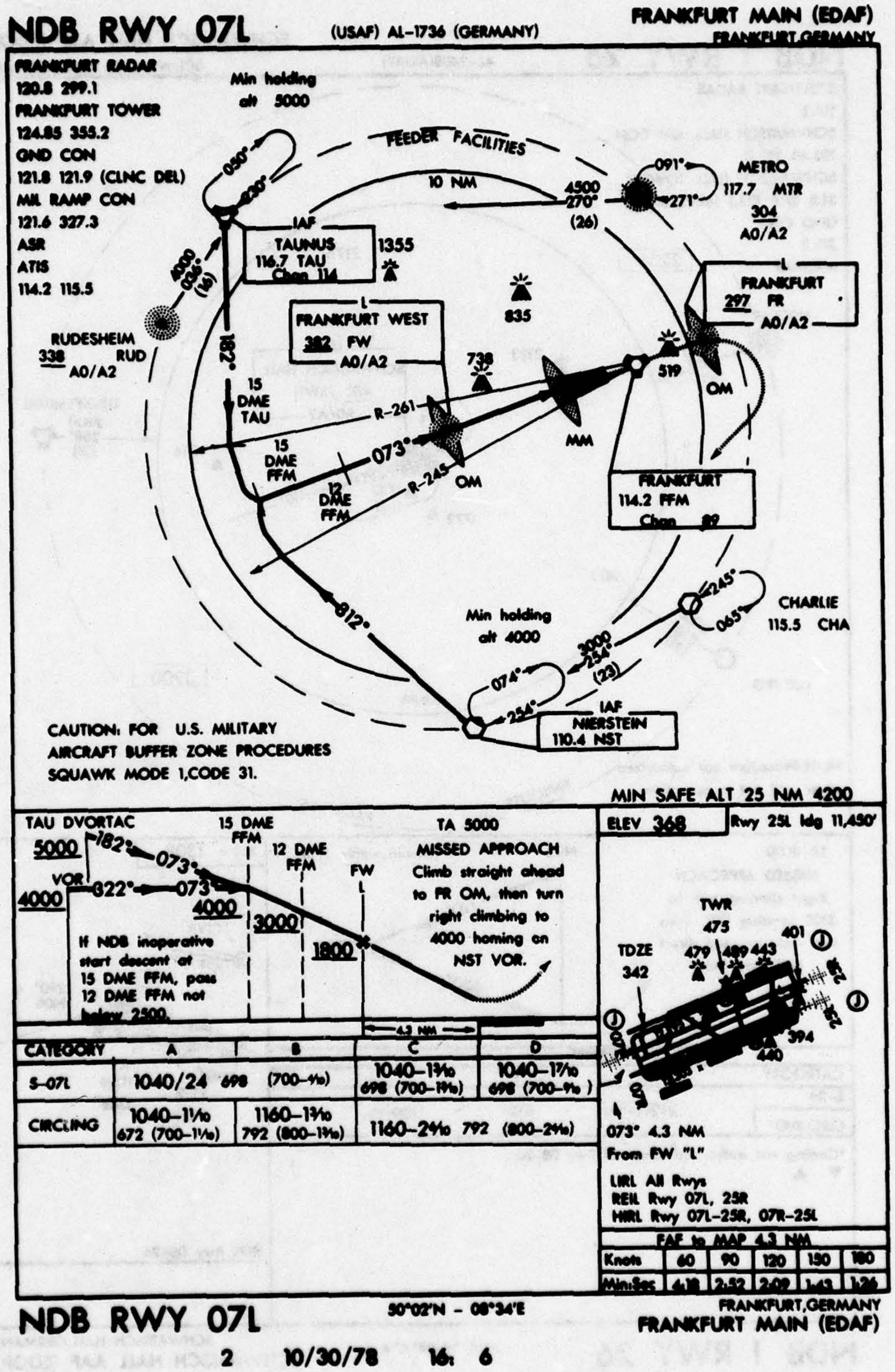
Figure A-1



2 8/15/78 19:34

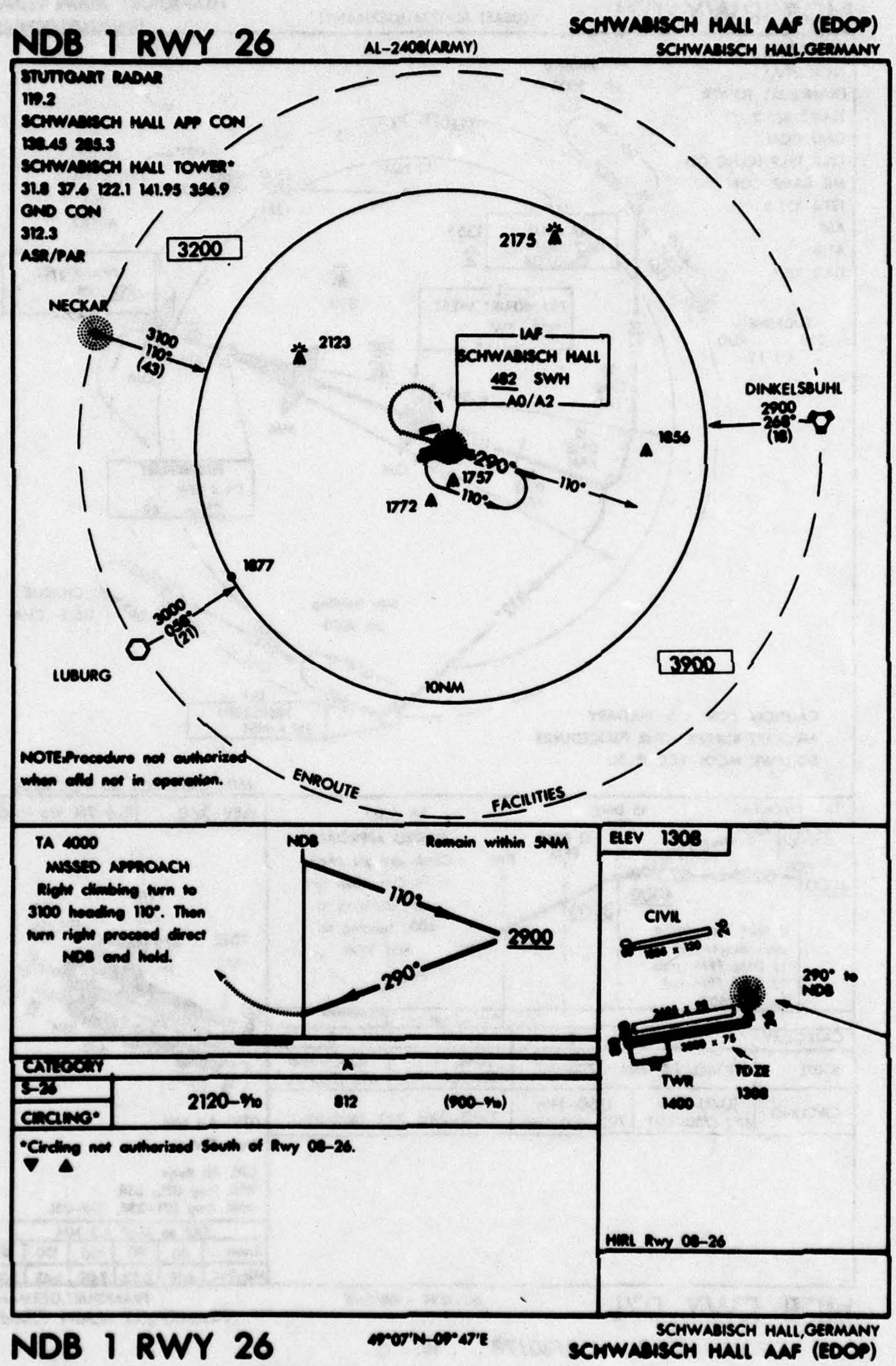
AAIPS OUTPUT

Figure A-2



AAIPS OUTPUT

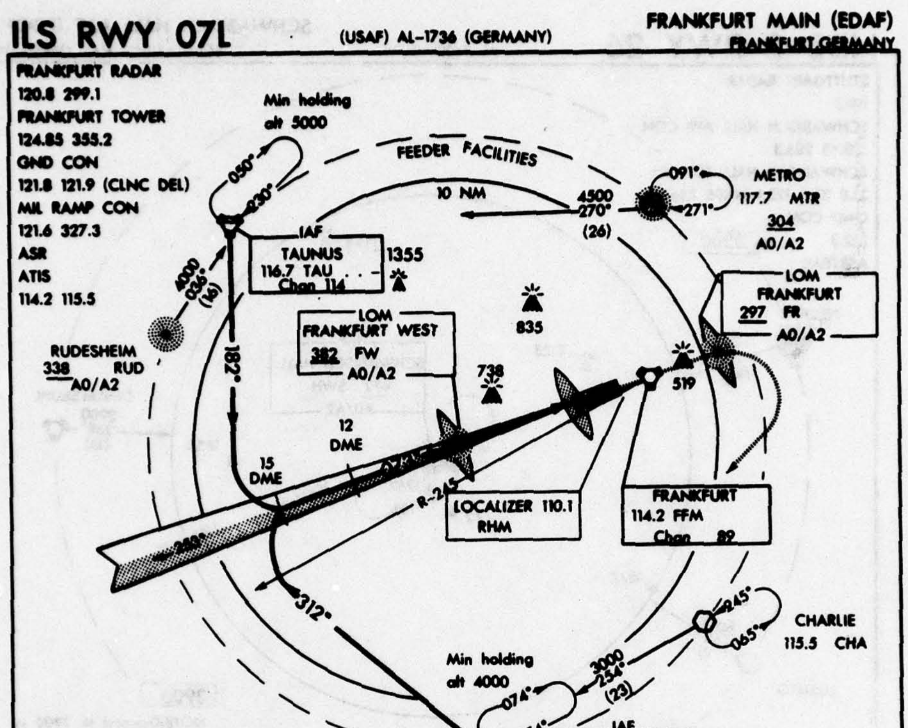
Figure A-3



10 10/30/78 16: 6

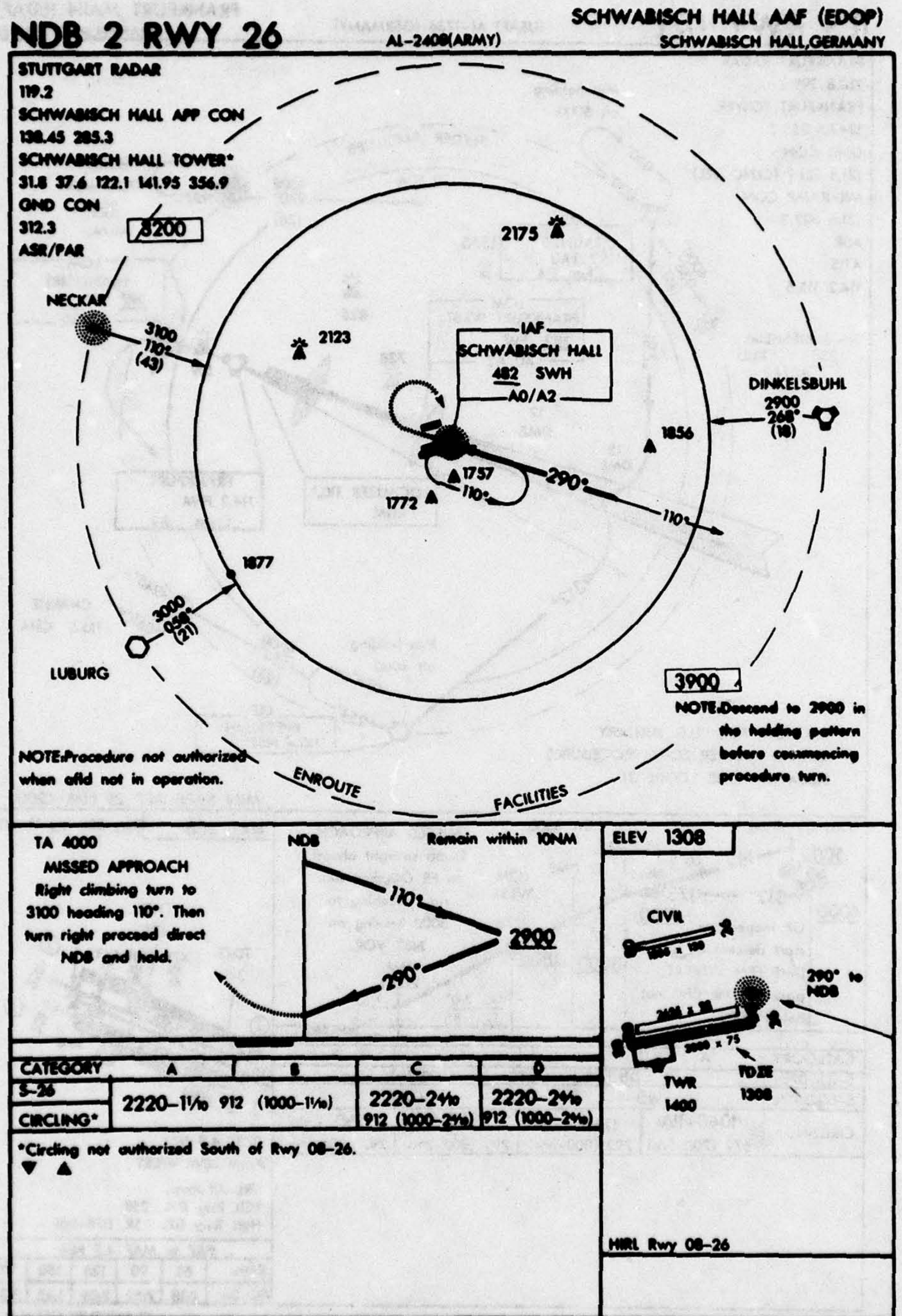
AAIPS OUTPUT

Figure A-4



AAIPS OUTPUT

Figure A-5



CATEGORY	A	B	C	D
S-26	2220-1¼₀ 912 (1000-1¼₀)		2220-2⅘₀ 912 (1000-2⅘₀)	2220-2⅘₀ 912 (1000-2⅘₀)
CIRCLING*				

*Circling not authorized South of Rwy 08-26.

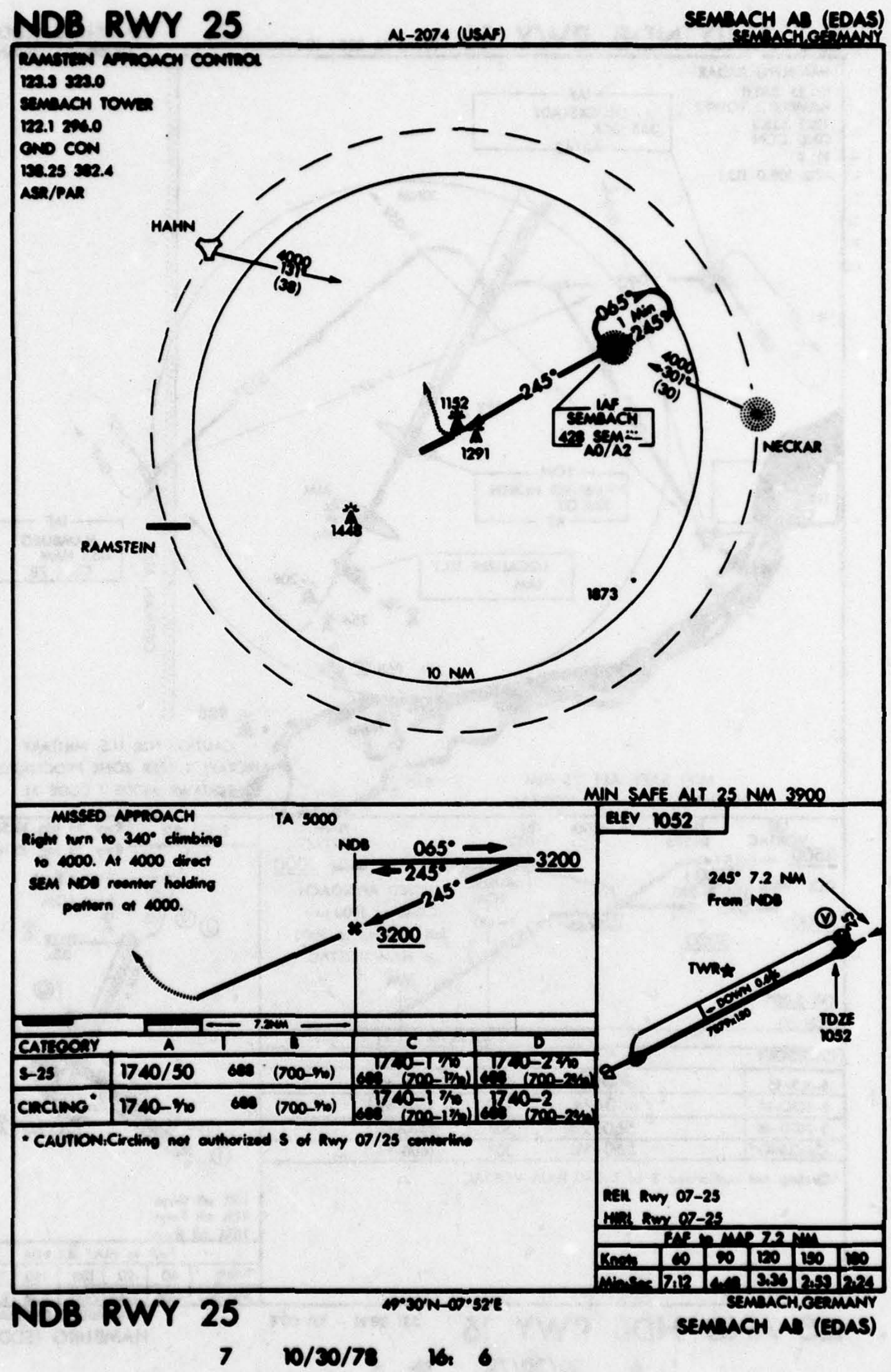
HIRL Rwy 08-26

NDB 2 RWY 26 49°07'N-09°47'E SCHWABISCH HALL,GERMANY SCHWABISCH HALL AAF (EDOP)

9 10/30/78 16: 6

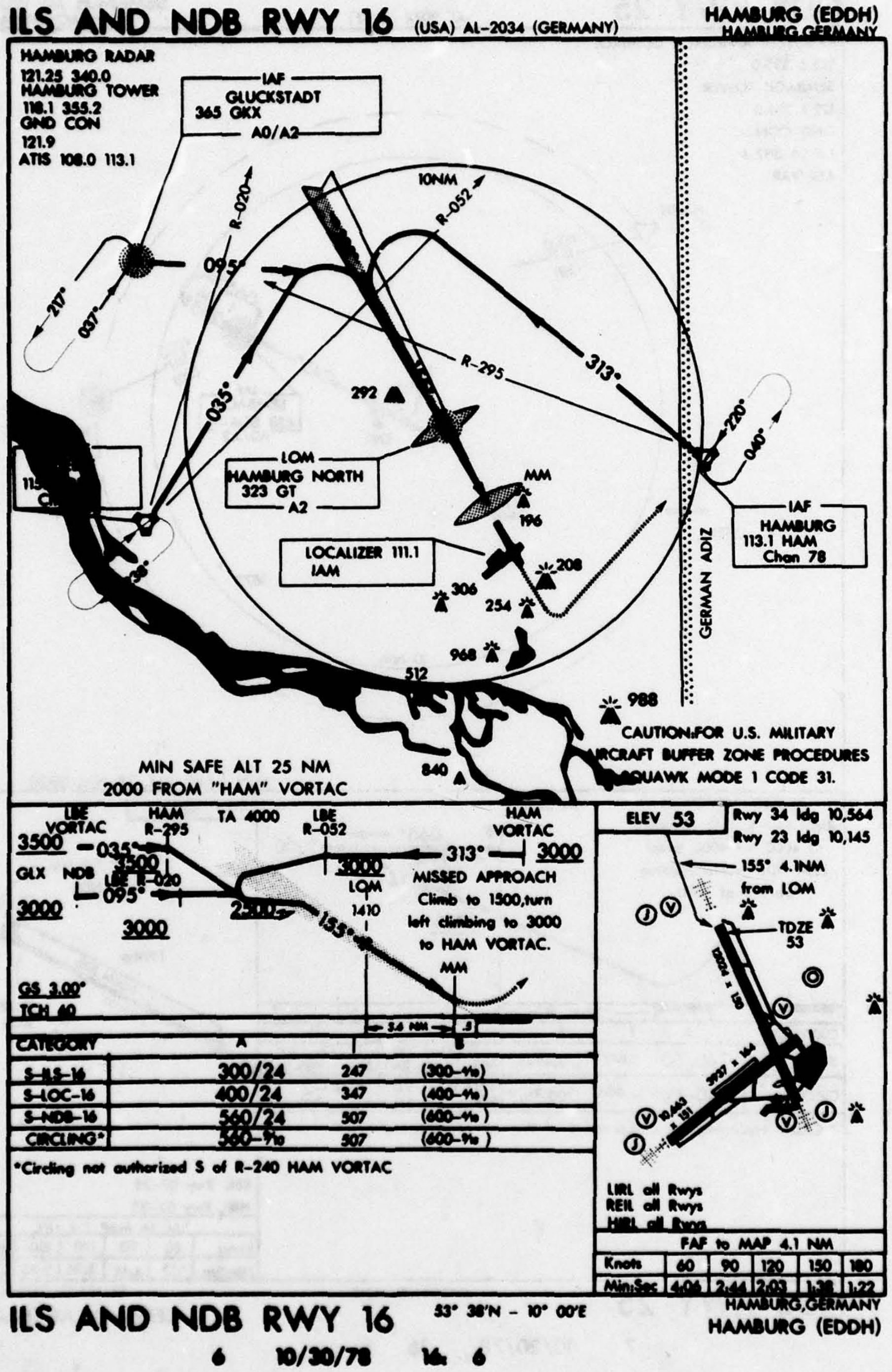
AAIPS OUTPUT

Figure A-6



AAIPS OUTPUT

Figure A-7



AAIPS OUTPUT

Figure A-8

BITBURG AB,GERMANY 49°57'N 06°34'E (AOE) GMT+1 **H-3C-6G, L-6F, T-2G**

AF 1228 BL5, 6, 7, 8 (Rwy 06-24), 9, 10 HS2 (ASP)① (S70, T200, ST175, TT300, TDT800) **(EDAB)**

JASU-(MC-1 Modif) (MD-3) (M32A-60)

FUEL-J4, SP, De-ice 0-148 SOAP PRESAIR HPOX LOX LPOX

A-GEAR

RWY 6 MA-1A MOD② BAK-9(B)③ BAK-13(B)④⑤ ——————
(74' OVRN) (959') (1959')

—————— BAK-13(B)④⑤ BAK-9(B)③ MA-1A MOD② RWY 24
(2060') (790') (273' OVRN)

EXPLOSIVES CAPABILITY-A/1/2/2/20-B/2/2/100 PPR 7323

AERODROME REMARKS-Mandatory NS ABTMT program-quiet hr 0700-1200Z Sun & German hol. No eng starts or tkof, essential full stop ldg only & no low apch dur this period. Tran alert svc 0700-1600Z Mon-Fri, 1600-2300Z Mon-Fri exp svc delay of 3 hr or longer. 2300-0700Z Mon--Fri emerg svc only. 0700-1600Z Sat & Sun exp up to 3 hr delay. 1600-0700Z Sat & Sun emerg svc only. Ltd F-4 tran main capability due to phase out of F-4 opr. Enter VFR initial no further than 3 NM fr apch end of rwy. Portions of VFR overhead pat not vis fr twr. BAK-9 cable hsg extn to within 3' of rwy edge. Reduced rwy separation std of 4000' in use btn: Ftr type acft, T-39's, similar performance acft, convl acft (exc hvy) flw turbo jet acft. Spangdahlem AB, rwy 5 NM E. Wx fcst same as PMSV METRO. Acft executing a lo apch or go around dur VFR cond shall maint 2200' or blw until passing the dep end of the rwy. ①Rwy sfc is porous friction, first 750' both ends of rwy is concrete, exp ntc difference in BA at trns fr concrete to porous asphalt, 180° turns permitted only on concrete portion of rwy ends. ②O/R 15 min. Non--std runout ltd to 855' on dep end Rwy 06. ③Apch end BAK-9 not inplace unless BAK-13 O/S. ④Rigged for no-ntc engagement. ⑤Unlgtd for night use.

COMMUNICATIONS-(PTD 369.7) (ATIS 283.0)

● **EIFEL CON**-384.7 313.7ⓐ 279.8ⓑ 277.2T 141.1 (E)

TOWER-277.2T 257.8x 244.3 122.1 (E) **GND CON**-399.2

COMMAND POST-352.5

STAGE 1 RADAR SVC-Ctc Eifel Control 25 NM out on 394.0 141.1 0700-1700Z Mon-Fri.

PMSV: METRO-344.6 Full svc 0300-1600Z Mon-Fri, hr variable in accordance with ld flying. Ltd svc OT.

RADIO AIDS TO NAVIGATION

TACAN BIT CHAN 56 (40/25) 49°56'25"N 06°33'23"E At Fld. MP 0500-0700Z Mon & Thu.

RADAR-SEE TERMINAL FLIP FOR RADAR MINIMA.

RADIO/NAV REMARKS-ⓐArr. ⓑDep.

BORDEAUX ACC/FIC,FRANCE (Civ) GMT+1(+2DT) **L-7-8-11, T-3**

RADAR-See Control freq **(LFBB)**

CONTROLⓐ-366.4ⓑ 293.0ⓒ 129.4 128.75ⓓ 125.1 124.2 124.15 (V)

Limoges Sector-129.4

North Sector-314.3 125.1

South Sector-124.2

Toulouse East Sector-124.15

MARINA BLUE-See Bordeaux TCC for mil operational tfc arr.

INFOⓘ-125.3

VOLMET-**Bordeaux Radio**-126.4 QNH and trend.

REMARKS-Blw FL 235 lo airspace freq will be used, however, for FL 200-210-220-230 CS is France Con only. ⓐ Also for UTA use btn FL 195-FL 235 with CS France Con. ⓑMandatory IFR tkof freq for mil opr tfc within TCA for N dep. ⓒMandatory IFR tkof freq for mil opr tfc within TCA for S dep. ⓓAlso ctl freq for Toulouse TCA and Tarbes PAU TCA. ⓘ0630-1900.

BORDEQUX ATCC,FRANCE (FAF)

MARINA BLUE RADAR-(See FRANCE ATCC FAF)

AERO/FAC DIR ; PAGE: 21 1978 SEP. 9 7:11:40 1.2 REDUCTION

AAIPS OUTPUT

Figure A-9

22 AERODROME/FACILITY DIRECTORY

Δ ◇ **BORDEAUX/MERIGNAC**,FRANCE 44°50'N 00°43'W (AOE)
GMT+1(+2DT) **H-4F-7A, L-8E, T-3A**
CIV 161 B①L4, 6, 7, 9, 10, 11 H102② (ASP) (S110, T145, ST175, TT308) **(LFBD)**
FUEL-(NC-LA+1TA2TB)
A-GEAR③
RWY 05 BARRIER———————————————BARRIER RWY 23
(361' OVRN) (272' OVRN)
RWY 11 BARRIER———————————————BARRIER RWY 29
(312' OVRN) (312' OVRN)
AERODROME REMARKS-Ldg fees rqr. Wx. ①O/R. ②Rwy 05-23 clsd UFN. ③On pilots req only.

COMMUNICATIONS
● **MERIGNAC APP CON/RADAR**-265.2 362.3X 121.2ⓒ 118.6 (E)ⓑ
MERIGNAC ARPT Tower-360.2 257.8 119.7 118.3 (E)ⓑ
MERIGNAC GND CON-290.4 257.8 121.9
VOLMET-See BORDEAUX ACC/FIC; MADRID ACC; PARIS ACC/FIC, HF only.

RADIO AIDS TO NAVIGATION
VORTACW BDX 114.4 CHAN 91 (100/50) (150/50 to the W) 44°49'39"N 00°43'16"W At Fld.
NDB (10 NM-W) (A1) BD 350 44°51'N 00°41' At Fld.
NDB (30 NM-W) (A1) BDM 393 44°55'55"N 00°33'53"W 232° 8.1 NM to Fld.
NDB (HW) (A1) BE 318 44°52'N 00°24'W 266° 13.7 NM to Fld.
NDB (10 NM-W) (A1) NB 361 45°09'N 00°33'W 207° 20.4 NM to Fld.
ILS-
■ **RADAR**ⓒⓓ-PAR 385.4ⓓ 344.0ⓓd 335.5ⓓ 236.1ⓓ 123.3ⓓ 118.1 (E)ⓓ
●**ADIO/NAV REMARKS**-ⓐTo FL 200. ⓑO/R to ACC. ⓒNot permanently monitored, use on pilots initiative when ILS unusable or under exceptional circumstances, pro in kFrench language only. ⓓ O/R to APP CON.

BORDEAUX/SOUGE, FRANCE 44°51'N 00°48'W GMT+1(+2DT)
FA/CIV 138 26 (ASP) (S11) **(LFDO)**
FUEL①-(NC-C1)
AERODROME REMARKS-Opr 0700-1100Z, 1230-1600Z Mon-Fri, 0700-1100Z Sat. Reserved for acft with rdo and cleared by Bordeaux Twr. ①SR-30 to SS+30.

BORDER RADAR, (BOULMER) ENGLAND (RAF) 52°24'N 01°37'W GMT(+1DT) **H-2-3-5**
RADARⓐ-267.2ⓑ 134.85ⓒ 134.3x 132.9ⓓⓔ (E1)ⓕ **(EGQM)**
RMREMARKS-ⓐMil fac-Joint ATC radar unit. Provides Upper Airspace Ctl Svc, Middle Airspace Ctl-/Advisory Svc. ⓑIntial ctc freq. ⓒ0800-2000Z. ⓓAdvisory Svc 0830-1730Z Mon-Fri. ⓔ Northern England Radar adv svc. ⓕO/R to ATCC.

BORDJ EL AMRI, (MASSICAULT) TUNISIA (Massicault) 36°43'N 09°57'E GMT+1(+2DT) **L-14F**
CIV 112 H35 (ASP) (AUW 6) **(DTTI)**
AERODROME REMARKS-Opr HX. Pilot trng.
TOWER-123.0 0700-1500Z.

BORDJ OMAR DRISS, (FORT FLATTERS) ALGERIA **H-9D-11D, L-19C**
28°08'N 06°50'E GMT **(DAAW)**
CIV 1207 59 (SAND)
AERODROME REMARKS- Opr HX. Ldg fees rqr.
VORW BOD 114.3 (200/FL400) (90/FL50) 28°08'10"N 06°50'07"W At Fld. On test.

BORFINK HELIPAD, GERMANY 49°42'N 07°06'E (LA631078) GMT+1 1.8 NM S of Erbeskopf Radome
AF/GAF 1854
HELIPORT REMARKS- OFFL BUS ONLY. Unattended. Opr SR-SS. Tfc pat and alt at pilots discretion. Hwy 50' NW. Tree line 160' SE. 6' hi structure 50'S. Crash eqpt O/R. Fone Birkenfeld Mil 540, Civ 06782-5434.

BOULOGNE SUR MER, FRANCE 50°37'29"N 01°54'28"E **H-3B-6F, L-4H**
VORW BNE 113.8 (70/FL 500) 242°14 NM to Le Touquet/Paris Plage.

◇ **BOURGES**, FRANCE 47°04'N 02°22'E (AOE) GMT+1(+2DT) **H-3B-8B, L-8G**
CIV 528 L4 H56 (ASP) (S70, T83, ST104, TT140) **(LFLD)**
FUEL①- (NC-1A1TA2)
AERODROME REMARKS- Opr 0700-1700Z Mon-Fri exc hol; OT O/R prior 1700Z. CSTMS O/R 24 hr Mon-Fri, O/R prior 1700Z last work day for Sat, Sun and hol. ①0700-1700Z Mon-Sat, O/R prior 1700Z for Sun and hol.
ARPT Tower- 118.3

AERO/FAC DIR ; PAGE: 22 1978 SEP. 9 7:11:42 1.2 REDUCTION

AAIPS OUTPUT

Figure A-10

BROYE LES PRESMES, FRANCE 47°20'N 05°31'E GMT+1(+2DT)
FAF 602 L4, 5, 9 H77 (ASP) (S39) **H-3C-7B, L-6E-6H-6A**
FUEL-(NC-A1TA2) **(LFYH)**
A-GEAR
RWY 18 BARRIER ——————————————— BARRIER RWY 36
(246' OVRN) (246' OVRN)
AERODROME REMARKS-Emerg only, after ctc with Dijon APP CON. Opr 0800-1130Z, 1230-1545Z Mon, Tue, Wed & Fri; 1100-1545Z Thu. ①HX.
COMMUNICATIONS
DIJON APP CONⓐ-395.3 362.3 140.4 122.1 (E)
BROYE ARPT Tower-263.7 257.8 122.10 119.7 (E)
RADIO AIDS TO NAVIGATION
NDB (50 NM-W) (A1) BRP 427 47°20'06"N 05°31'50"E At Fld.
UHF/DF BROYE HOMER-399.2 362.3 354.7 325.5 324.2 289.4 257.8 226.6 (U)
RADARⓑ-Broye GCA 399.2 314.0 226.6 123.3
RADIO/NAV REMARKS-ⓐOpr Dijon Longvic A/D hr. ⓑRwy 18.

BRUCK, AUSTRIA **H-3D, L-10F**
VOR-DME BRK 111.2 Chan 49 (60/50) 48°00'02"N 16°54'01"E 298° 15.3 NM to Wien/Schwechat. VOR MP 0800-1000Z 1st Thr, DME MP 0800-1000Z 3rd Thr.
NDB (40 NM-W) (AO/A2) BRK 408 48°03'48"N 16°43'04"E 296° 6.0 NM to Wien/Schwechat. MP 0800-0930Z 2nd Fri.

Δ ◇ **BRUGGEN,** GERMANY 51°12'N 06°08'E (AOE) GMT+1 **H-3C-6G, L-5A**
RAF 241 BL1, 6, 7, 9, 12 H81 (ASP) (S60, T175, ST175, TT205, TDT550) **(EDUR)**
JASU-1(A4) 1(C5) 1(C6) 1(E1) 1(E5) 1(E6) 1(E11) 1(E12)
FUEL-(NC-AJ4, 0-156) LHOX LOX
A-GEAR
RWY 09 RAF MK-12A BAK-13① ——————————— BAK-13① RAF MK-12A RWY 27
(THLD) (1450') (1400) (THLD)
AERODROME REMARKS-PPR. Opr 0700-1600Z Mon-Fri. Glider flying Sat, & hol. QFE Altimeter Settings will provided-See Pro section. When freezing cond are fcst both barriersmay be in raised posn outside A/D times. Taxi clnc criteria reduced in dispersal areas. Only specified acft or acft under close marshaller ctl permitted access. ①Apch end cable down, ovrn cable up.
COMMUNICATIONS
CLUTCH RADAR-388.6 362.3X 130.8X 119.7
APP CON-362.3x 354.2 244.9 119.7x 130.8x 122.1x (E)
TOWER-284.8 257.8x 122.1x 130.8x 119.7x
VOLMET-Wx rpt avbl at H+35 fr West Drayton, U.K. on 11200 and 4722 kHz.
RADIO AIDS TO NAVIGATION
TACAN BGG Chan 126 (40/25) 51°11'59"N 06°08'04"E At. Fld. MP dly 0500-0600Z, wkly 0630-0830Z Mon, mthly 0630-1130Z 1st Mon.
NDBⓐ (40 NM-W) (AO/A2) BG 329 51°11'49"N 06°07'36"E At Fld.
UHF/DFⓑ-362.3x 354.4 354.2 (Ux)
ILS-Lczr crs offset 3° N rwy cntrline. No BC. MP dly 0500-0600Z, 2 wkly 0700-1100Z Wed.
• RADAR-ASRⓒ: Call Radar-344.0x 283.2x 119.7x 122.1x (E) PARⓓ: Call Talkdown 385.4x 371.5x 371.0x 130.5x 123.3x (E)
RADIO/NAV REMARKS-CTLZ ctl by Wildenrath ZONE CON. Obtain clnc on 354.4 prior to entering unless under ctl of CLUTCH RADAR. ⓐMP dly 0600-0700Z, mthly 0700-0900Z 1st Fri. ⓑMP dly 0600-0700Z, wkly 0700-0900Z Mon, mthly 0700-1100Z 1st Mon. ⓒSvc provided by Wilderath Radar. MP dly 0500-0530Z, wkly 0700-0930Z Sun, mthly 0700-1300Z 1st Sun. ⓓMP dly 0430-0600Z, wkly 1300-1600Z Fri, mthly 1300-1700Z 4th Fri.

BRUNKENDOR, GERMANY **H-5D, L-5C**
VORTACW BKD 117.7 Chan 124 (100/FL 250) 53°02'09"N 11°32'51"E

VOR unuse		255°-288° all alt
VOR unrel		301°-311° blw 3500"
TACAN unuse	283° byd 25 NM	
TACAN unrel	301°-311° blw 3500"	

NDB (35 NM-W) (A2) BKD 378 53°04'06"N 11°24'11"E

BRUNO, BELGIUM **H-6F, L-5A, T-1A**
VORW BUN 110.6 (40/25) 51°04'22"N 04°46'30"E 232° 14.9 NM to Brussels Natl.
NDB (50 NM-W) (A2) BUN 254 51°04'37"N 04°46'46"E 232° 15.1 NM to Brussels Natl.

AERO/FAC DIR ; PAGE: 25 1978 SEP. 9 7:11:52 1.2 REDUCTION

AAIPS OUTPUT

Figure A-11

30 AERODROME/FACILITY DIRECTORY

△ ◇ CELLE, GERMANY 52°36'N 10°02'E (AOE) GMT+1 **H-3C-5D, L-5C, T-2E**
GAR 129 BL6, 7 H60 (ASP (EDCL)
JASU-2(G-40) FUEL-(NC-A+LJ4, 0-133)
AERODROME REMARKS-Opr 0700-1600Z Mon-Fri, OT PPR, clsd hol. Practice apch blw 1500' MSL proh 1200-1330Z and 2200-0600Z Mon-Fri. Wx.
COMMUNICATIONS
HANNOVER RADAR-App Con-370.9 362.3⊙ 119.7⊙ 118.05 (E) H24
Dep Con-118.15 (E) H24
TOWER-282.8x 263.7 257.8 139.95x 123.1x 122.1x 40.0 (E)
RADIO AIDS TO NAVIGATION
NDB (25 NM-W) (AO/A2) CL 311 52°36'07"N 10°07'05"E 263° 3.0 NM to Fld.
UHF/DF HOMER-317.5 366.5x 257.8x (U)
ILS-No BC.
RADAR-SEE TERMINAL FLIP FOR RADAR MINIMA.
RADIO/NAV REMARKS-⊙Grd freq.

CENTOCELLE HELIPORT, ITALY See ROMA/CIAMPINO

◇ CERVIA, (SAN GIORGI DI CESENA) ITALY 44°14'N 12°19'E GMT+1(+2DT)
HAF 16 BL4 H92 (ASP) (SWL 30) **H-4H-7D-8E, L-12E**
FUEL①-LJ4, 0-117-128-133-148 (LIPC)
A-GEAR
RWY 12 SAFE-BAR/BAK-12
SAFE-BAR/BAK-12 RWY 30
(984')
(984')
AERODROME REMARKS-CAUTION-WIP rwy and twy. Opr SR-30 to SS+30. ①Refuel avbl Sat-Sun if PN rcv by 1200Z Sat.
COMMUNICATIONS
ROMAGNA APP CON-227.9 123.5 122.1 118.15
TOWER-289.4 257.8 243.4x 227.9 122.1 (E)
RADIO AIDS TO NAVIGATION
TACAN CEV Chan 102 (40/25) 44°12'22"N 12°21'25"E 296° 1.6 NM ro Dls. 136° 15.0 NM to Rimini. MP 0700-0800Z 1st Sat, 1300-1400Z 3rd Sat.
NDB⊙ (50 NM-W) (A1) CEV 387 44°16'03"N 12°10'55"E 116° 5.2 NM to Fld.
UHF/DF HOMER-289.4 257.8 243.4x 227.9 (U)
• RADAR-Call GCA 385.4 346.9 243.4x 123.3 122.1 (E)
RADIO/NAV REMARKS-⊙A/D times.

CHAH BAHAR, IRAN 25°17'N 60°38'E GMT+3:30(+4:30DT)
MIL 20 57 (SAND) (OIZC)

CHAH BAHAR AB, IRAN 25°26'N 60°23'E GMT+3:30(+4:30DT) **H-13D, L-18H**
HAF 50 H128 (ASP)
AERODROME REMARKS-Extv const of fac in progress.

△CHATEAUDUN, FRANCE 48°04'N 01°23'E GMT+1(+2DT) **H-3B-7A, L-7C**
FAF 440 B① L4 H73② (CON) (S22, T30, TT52) (LFOC)
FUEL③-(NC-A1TA2) OX
AERODROME REMARKS-Opr 0700-1630Z Mon-Fri. ①O/R 30 min prior SS. ②6824' avbl ldg Rwy 10-28 ngt only. ③0630-1030Z, 1200-1630Z Mon-Thr, Fri. Refuel not assured Sat, Sun & hol.
COMMUNICATIONS
APP CON-362.3 225.1 142.1 140.4 122.1 (U)
ARPT Tower-257.8 376.4 140.9 122.1 (U, Vx)
RADIO AIDS TO NAVIGATION
NDB (50 NM-W) (A1) CDN 360 48°03'47"N 01°21'49"E At Fld.
UHF/DF HOMER-362.3 298.1 (U)
• RADAR-ASR/PAR-385.4 344.0 286.0 285.5 138.4 123.3x (U)

△CHATEAUROUX/DEOLS, FRANCE 46°52'N 01°44'E GMT+1(+2DT) **H-3B-7B, L-6G**
CIV 528 L①6, 7, 9, H83 (CON) (S154, T176, ST175, TT325) (LFLX)
FUEL②-(NC-LTA2)
AERODROME REMARKS-PPR 24 hr. Opr 0700-1700Z Mon-Fri OT O/R prior 1500Z, Sat, Sun & hol O/R prior 1500Z last work day. ①O/R prior 1700Z. ②O/R 30 min 0700-1700Z Mon-Fri.
COMMUNICATIONS
ARPT Tower-230.1 120.2 129.9x
RADIO AIDS TO NAVIGATION
VHF/DF HOMER-120.2 129.9x
♦ ILS-BRG 218° LCZR CX 110.3/335 Glide Slope 3°. LOM CTX 466.

CHATILLON/SUR MARNE, FRANCE **H-3C-8F, L-8E-7D**
VORW-DME CLL 117.2 Chan 119 49°08'24"N 03°34'43"E 065° 21.5 NM to Reims/Champagne.
VORW-DME CTL 117.6 Chan 123 (100/50) (70/50 to the N, NE) 49°08'16"N 03°34'41"E 065° 21.9 NM to Reims/Champagne. O/S UFN.
NDB (60 NM-W) (A1) CTL 399 49°08'16"N 03°34'44"E 065° 21.0 NM to Reims/Champagne.

AERO/FAC DIR ; PAGE: 30 1978 AUG. 21 16:40:37 1.2 REDUCTION

AAIPS OUTPUT

Figure A-12

AERODROME/FACILITY DIRECTORY 55

RHINE, SWITZERLAND 47°33'55"N 08°28'39"E **H-6H-7C, L-6F-6B**

NDB (25 NM-W) (AO/A2) RHI 332 157° 5.8 NM to Zurich.

RODEZ/MARCILLAC, FRANCE 44°24'N 02°29'E GMT+1(+2DT) **H-4G-7B, L-6G-11C**

CIV 1906 L2, 4 H62① (ASP) (S88) **(LFCR)**

FUEL-(NC-C1A1TA2)

AERODROME REMARKS-Opr 0500-1100Z, 1300-2100Z Mon-Fri; 0500-1100Z, 1300-1800Z Sat; 0900-1100Z, 1400-2100Z Sun. OT 48 hr PPR. CSTMS SR-30 to SS+30, 12 hr PN; SS+30 to SR-30, 24 hr PN. ①6070' avbl ldg Rwy 31.

COMMUNICATIONS

BORDEAUX CONTROL-125.1

TOULOUSE INFO-119.7

RODEZ OPS-119.1 A/D times

RADIO AIDS TO NAVIGATION

NDB (10 NM-W) (A1) RZ 387 44°26'N 02°26'E 130° 2.4 NM to Fld.

● ILS-BRG 313° LCZR RZ 110.1/334.4 Glide Slopt 3.2°. 0500-1100Z 1300-2100Z Mon-Fri; 0500-1100Z, 1300-SS+30 Sat; 0800-1100Z, 1300-SS+30 and O/R 1 hr prior closing Sun.

ST. BRIEUC, FRANCE 48°31'N 02°48'W (AOE) GMT+1(+2DT) **H-3B, L-7B**

CIV 420 L4 H46① (ASP) (S39) **(LFRT)**

FUEL②-(NC-C1A1)

AERODROME REMARKS-CAUTION-UFN WIP. Trench on W side and edge rwy 10-28. Men and machinery present. Opr 0430-1800Z, 2000-2200Z Mon-Fri, 0700-1800Z Sat, 0700-1100Z, 1300-1800Z Sun and hol, OT O/R before 1500Z. Ldg fees rqr. ①4936' avbl ldg day, 4298' avbl ldg ngt for Rwy 10. 4019' avbl ldg Rwy 28. ②0700-1100Z, 1230-1800Z, sked acft O/R prior 1600Z.

ARPT Tower-119.4 119.7x

NDB (35 NM-W) (A1) SB 354 48°32'37"N 02°49'06"W 171° 1.7 NM to Fld.

VHF/DF **HOMER**-119.7 119.4

△ ◇ **ST. TRUIDEN,** BELGIUM 50°48'N 05°12'E GMT+1(+2DT) **H-3C-6F, L-5A**

BAF 246 L4, 6, 7 H98① (ASP) (C-130) **(EBST)**

JASU②-(A3) (G-10) **FUEL**-(NC-CJ4, 0-133-148) PRESAIR HPOX

A-GEAR

RWY 06 SAFE-BAR BAK-9(B) ———————— SAFE-BAR RWY 24
(820') (1499') (725')

AERODROME REMARKS-Opr 0700-1900Z Mon-Fri, clsd Sat, Sun, hol. Glider flying 0800Z-SS Sat, Sun, hol. Wx. ①8677' avbl ldg Rwy 06, 8821' avbl ldg Rwy 24. ②Nr avbl unk.

COMMUNICATIONS

BELGA RADAR-276.9

BEVINGEN APP CON-240.2 362.3 243.4 122.5 (E)

BEVINGEN TOWER-226.2 257.8 243.4 122.1 (E)

RADIO AIDS TO NAVIGATION

TACAN BVG Chan 33 (40/25) 50°47'33"N 05°11'41"E At Fld.

NDB (W) (A1) ST 510 50°46'51"N 05°11'16"E 068° 1.4 Nm to Fld.

UHF/VHF/DF **HOMER**-362.3 254.0Ⓐ 243.4x 122.5 (Ux, V)

● **RADAR**-Call BEVINGEN GCA: 385.4 344.0 281.0 243.4 227.5Ⓑ 142.92 140.22 123.3 (E)

RADIO/NAV REMARKS-ⒶApch. ⒷGCA talkdown.

SALON, (SALON DE PROVENCE) FRANCE 43°36'N 05°07'E GMT+1(+2DT)

FAF 194 L4, 9 H65 (CON) (S88) **H-4G-7B, L-11D, T-3D**

FUEL-(NC-A1①A+1②TA2①TB②) OX **(LFMY)**

A-GEAR

RWY 16 BARRIER ———————— BARRIER RWY 34
(OVRN) (OVRN)

AERODROME REMARKS-CAUTION-E part of afld reserved for coptor tfc, glider flts and pilot trng. Opr 0630-1700Z Mon-Fri exc hol. A/D reserved for mil rdo eqpt acft. A/D reserved for trng of French air combat patrol activity 0650-0745Z, 1100-1130Z, all other tfc proh. ①0630-1700Z mon-Fri, OT exp 3 or 5 hr delay or O/R 24 hr in advance. ②O/R 48 hr.

COMMUNICATIONS

● **APP CON**-375.6 362.3 360.2 344.0 140.4 138.7 122.1 119.7Ⓐ E(U)

ARPT Tower-395.1 257.8 138.5 122.1 119.7Ⓐ (U)

RADIO AIDS TO NAVIGATION

NDB (80 Nm-W) (A1) SAL 334 43°36'38"N 05°06'09"E At Fld.

UHFⒷ/VHFⒸ/DF **HOMER**ⒹⒺ-375.6 138.7 (E)

● **RADAR**Ⓖ-ADRⒺⒻRadar: 286.6 280.4 140.9 119.7Ⓐ 122.1 PARⒺ GCA: 286.6 280.4 140.9

RADIO/NAV REMARKS-ⒶPrin Civ. ⒷAll APP CON freq also avbl. Ⓒ121.5 O/S UFN. ⒹCtc APP CON. ⒺA/D times. ⒻMP Sat and 1st Mon fo month. ⒼCiv, usable to 30,000'.

AERO/FAC DIR ; PAGE: 55 1978 AUG. 21 17:19:54 1.2 REDUCTION

AAIPS OUTPUT

Figure A-13

2 SPECIAL USE AIRSPACE LEGEND–FRANCE

ICAO LOCATION IDENTIFIERS FOR COUNTRIES

COUNTRY	IDENTIFIER	COUNTRY	IDENTIFIER	COUNTRY	IDENTIFIER
Afghanistan	OA	Guinea-Bissau	GP	Pakistan	OP
Algeria	DA	Iceland	BI	Poland	EP
Angola	FN	Iran	OI	Portugal	LP
Austria	LO	Iraq	OR	Rhodesia	FR
Bahrain	OB	Ireland	EI	Rwanda	FE
Belgium	EB	Israel	LL	Saudi Arabia	OE
Benin	DD	Italy, Sardinia & Sicily	LI	Senegal	GO
Botswana	FB	Ivory Coast	DI	Sierra Leone	GF
Burundi	FU	Jordan	OJ	Somalia	HC
Cameroon	FK	Kenya	HK	S. Africa	FA
Canary Islands	GC	Kuwait	OK	Spain	LE
Central African Empire	FF	Lebanon	OL	Sudan	HS
Chad	FT	Liberia	GL	Swaziland	FD
Congo	FC	Libya	HL	Sweden	ES
Cyprus	LC	Luxembourg	EL	Switzerland	LS
Denmark	EK	Madagascar	FM	Syria	OS
Egypt	HE	Madeira Island	LP	Tanzania	HT
Ethiopia	HA	Malawi	FW	Togo	DX
Finland	EF	Mali	GA	Tunisia	DT
France	LF	Malta	LM	Turkey	LT
French Afars & Issas HF	HF	Mauritania	GQ	Uganda	HU
Gabon	FO	Morocco	GM	United Kingdom	EG
Germany	ED	Mozambique	FQ	Yemen (Aden)	OD
Ghana	DG	Namibia	FA	Yemen (Sanaa)	OY
Gibraltar	LX	Netherlands	EH	Yugoslavia	LY
Greece and Crete	LG	Nigeria	DN	Zaire	FZ
Guinea	GU	Norway	EN	Zambia	FL

Special Use Airspace areas in FLIPs are assigned designators (identifiers) which include ICAO Location Identifiers, airspace prefix and airspace number.

Example: EDD14–ED (ICAO Location Identifiers) D (Airspace prefix) 14 (Airspace Number).

Where a country has not assigned a complete airspace designator the lacking elements have added by DMAAC enclosed in parenthesis. Example (ED)D14

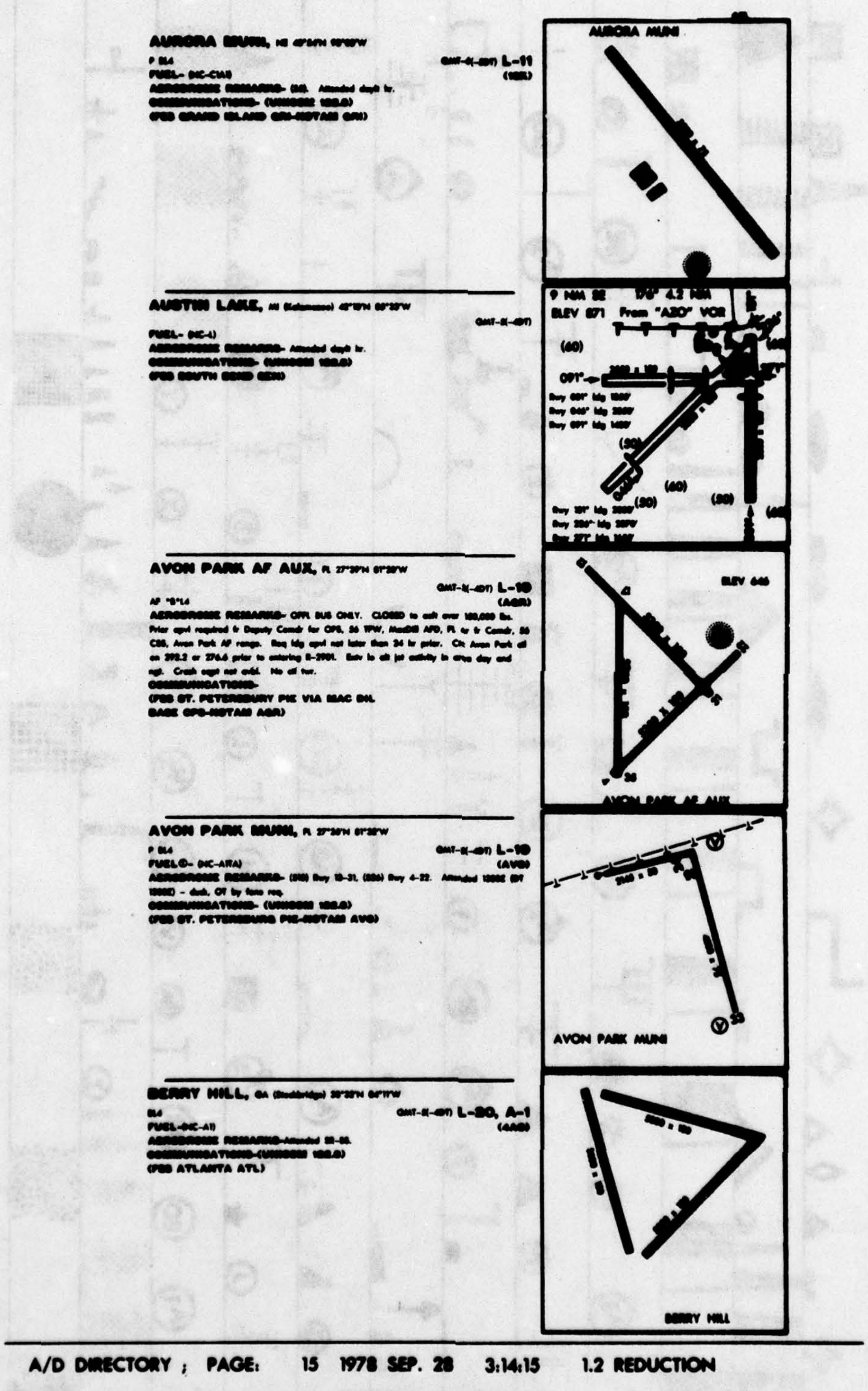
The portion of a designator enclosed in parenthesis will not be used in voice communications.

NUMBER	AREA NAME	EFFECTIVE ALTITUDE	TIME USED: DAYS OF WEEK	TIME USED: HOURS OF DAY	WEATHER	CONTROLLING AUTHORITY
			AFGHANISTAN			
See Area Planning AP/3A for information on Afghanistan.						
			ALGERIA			
DAD32	Arzew Firing Sector brg 358°/085° radius 11.0 NM centered on 35°54'N 00°20'W.	To 4000'	By NOTAM	By NOTAM	VMC-IMC	No A/G
DAD46	La Macta Firing Sea & Land Beginning at 35°55'N 00°04'W to 35°42'N 00°04'W to 35°42'N 00°09'W to 35°55'N 00°09'W to point of beginning.	By NOTAM	By NOTAM	By NOTAM	VMC-IMC	No A/G
			FRANCE			
(LFP)A32	Limeil Brevannes Test Center Circle radius 0.5 NM centered on 48°44'N 02°29'E. (23 MAY 74)	To 3300' AGL	Cont	Cont	VMC-IMC	No A/G
LFD32	Hourtin Firing Sector brg 256°/296° radius 2.7 NM centered on 45°14'N 01°10'W. (11 AUG 77)	To 800'	By NOTAM	By NOTAM	VMC-IMC	No A/g
LFD32	Hourtin Jet Activity Beginningat 45°17'N 01°07'W to 45°17'N 01°08'W to 45°14'N 01°08'W to 45°11'N 01°07'W to 45°12'N 01°10'W to point of beginning. (8 SEP 77) ①0700-2200Z (DT 0600-2100Z) Mon-Fri, 0700-1200Z (DT 0600-1100Z) Sat as hol.	To FL 95	①	①	VMC	No A/G
(LFP)A33	Vaujours Test Center Circle radius 0.5 NM centered on 48°56'N 02°36'E. ①1800' AGL for conventional and 3300' AGL for aircraft.	①	Cont	Cont	VMC-IMC	No A/G

INTRO–SPEC A/S–L; PAGE: 2 1978 SEP. 13 1:04:17 HALF SCALE

AAIPS OUTPUT

Figure A-14



AAIPS OUTPUT

Figure A-15

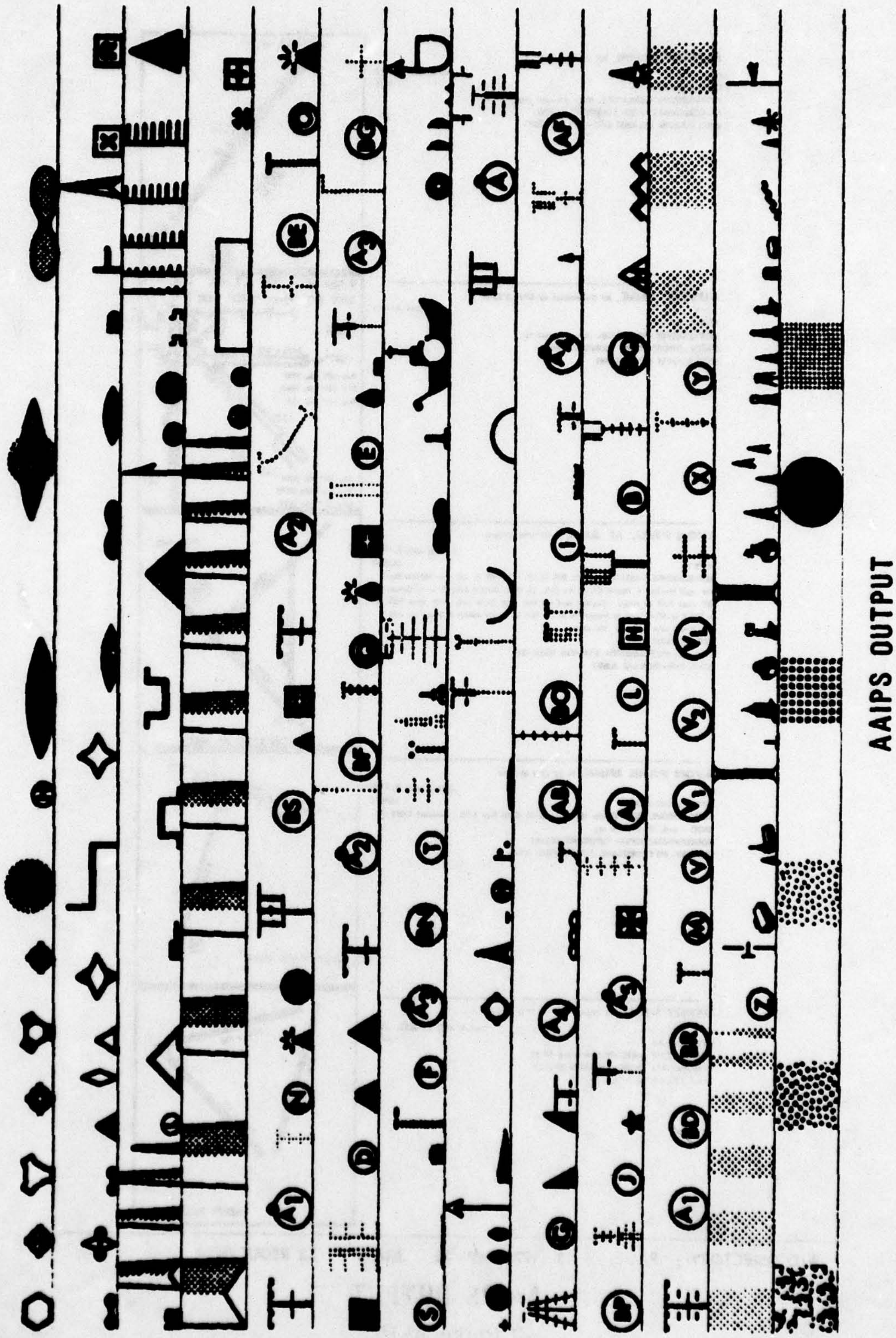


Figure A-16

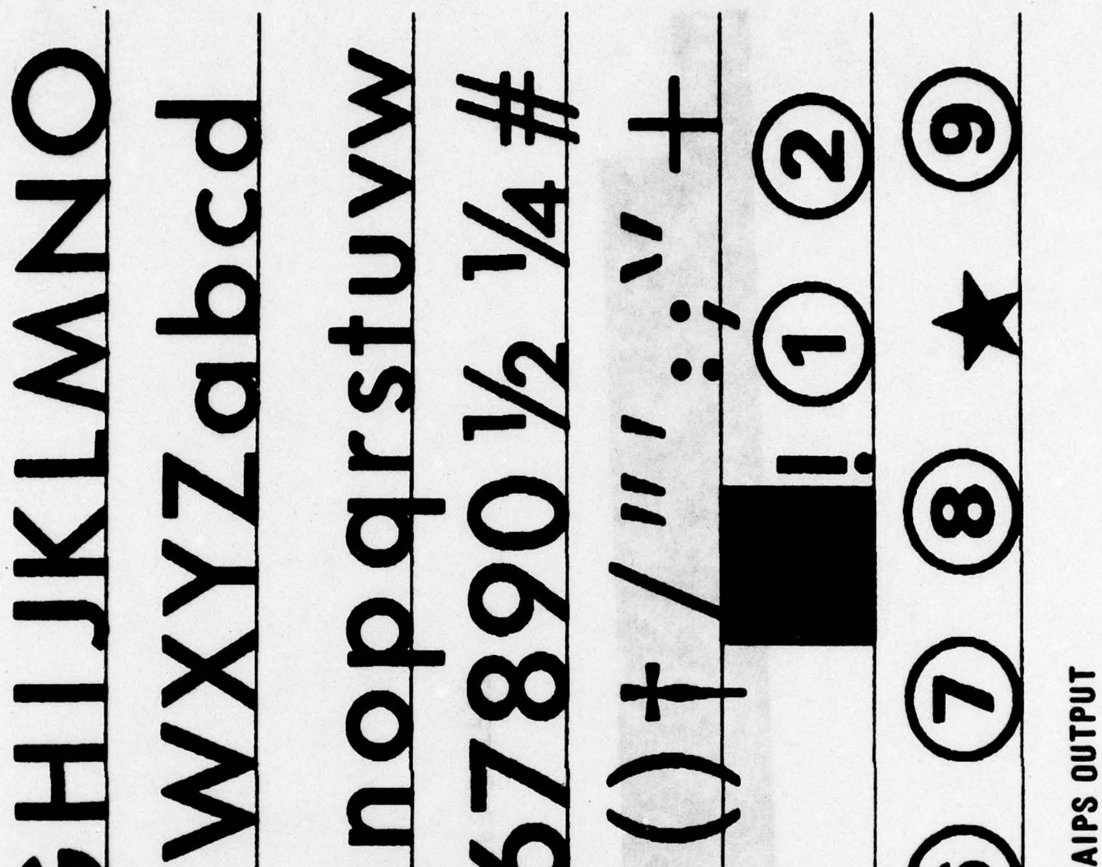

ABCDEFGHIJKLMNO
PQRSTUVWXYZabcd
efghijklmnopqrstuvw
xyz1234567890½¼#
¾%±&*()†/"':;" +
; = — ° -- ! ① ②
③ ④ ⑤ ⑥ ⑦ ⑧ ★ ⑨
AAIPS OUTPUT

Figure A-17

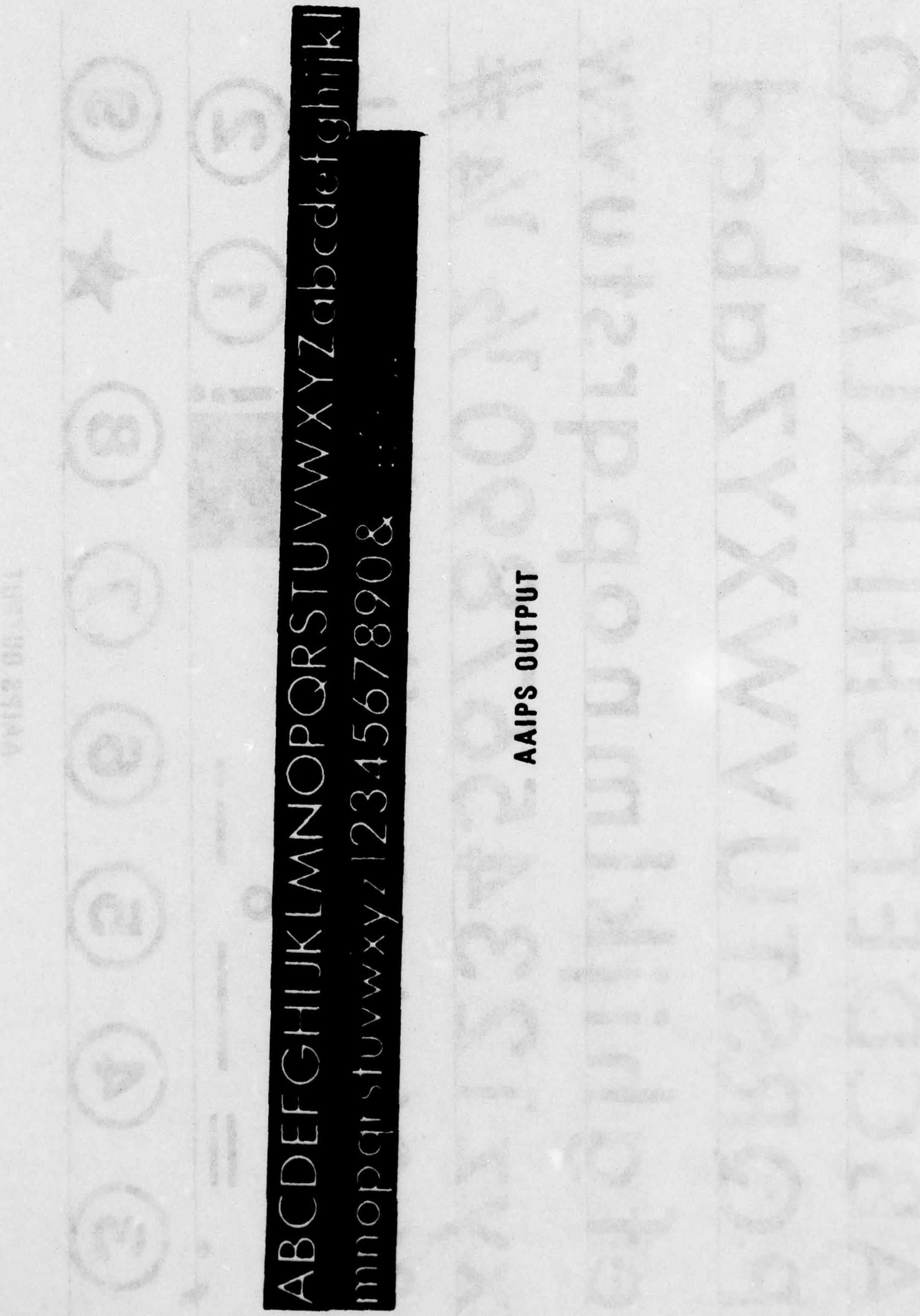
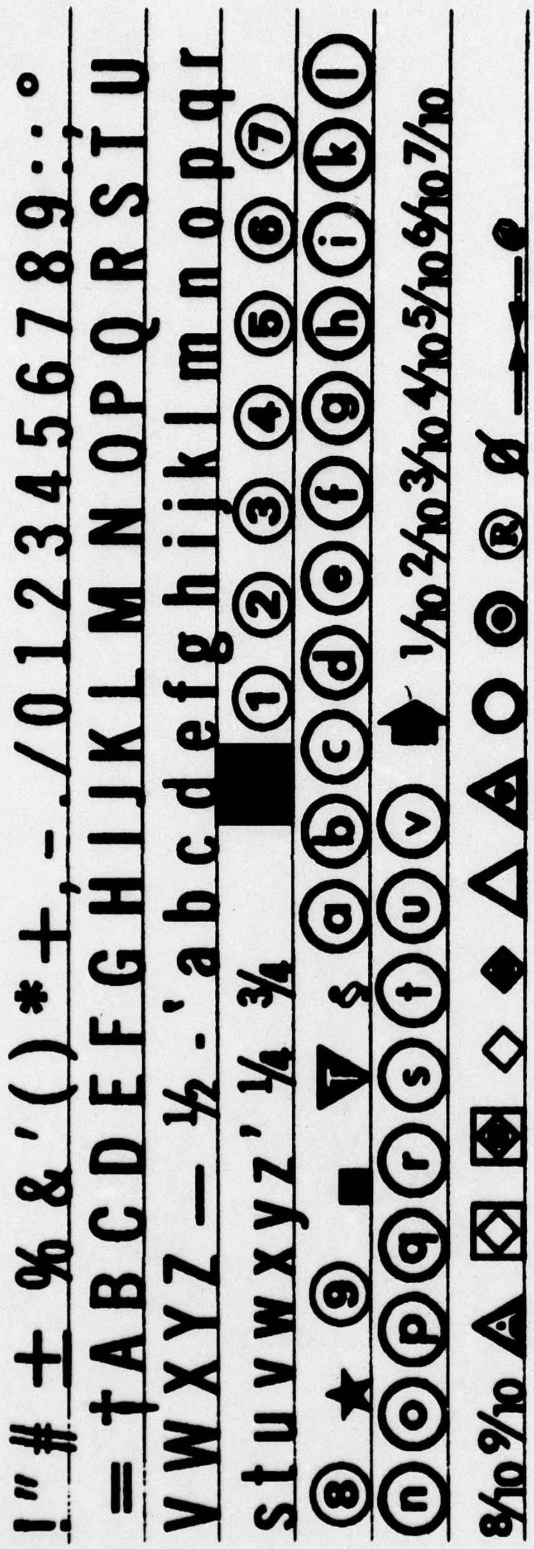

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijkl
mnopqrstuvwxyz1234567890&
AAIPS OUTPUT

Figure A-18



AAIPS OUTPUT

Figure A-19

MISSION
of
Rome Air Development Center

RADC plans and executes research, development, test and selected acquisition programs in support of Command, Control Communications and Intelligence (C^3I) activities. Technical and engineering support within areas of technical competence is provided to ESD Program Offices (POs) and other ESD elements. The principal technical mission areas are communications, electromagnetic guidance and control, surveillance of ground and aerospace objects, intelligence data collection and handling, information system technology, ionospheric propagation, solid state sciences, microwave physics and electronic reliability, maintainability and compatibility.