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Report No. FAA-NA-80-168

LEVEL II

NAFEC TECHNICAL REPORT

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PROJECT PLAN
OPERATIONAL EVALUATION OF TERMINAL ATC WITH DABS

The MITRE Corporation

MARCH 1980

Prepared for

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Aviation Facilities Experimental Center
Atlantic City, New Jersey 08405

NOTICE

PROJECT PLAN

NPD NO. 03-110

SUBPROGRAM 142-176

PROJECT NO. 142-176-530

This project plan has been established as a technical and operational document outlining the effort to be applied in the accomplishment of this project. The project plan was prepared on the basis of the best information available. It is emphasized that this is a research and development effort and that changes in this plan may be necessary as the work progresses. Any such changes will be accomplished by coordination with the Engineering Management Staff and other affected NAFEC elements. Other involved personnel will be advised.

Reviewed by:

NAFEC Associate Program Manager

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Concurred by:

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16. Abstract

This report describes a two-phase effort intended to complement the on-going DABS technical tests by assessing the operational implications and man-machine interactions when DABS is integrated with the ARTS III system. The effort includes simulated and live runs with the participation of ATC controllers, and an analytical evaluation of the effect of DABS on aircraft separation requirements, ATC procedures, and controller workload.

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METRIC CONVERSION FACTORS

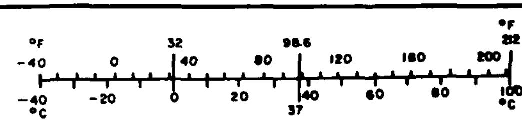
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



FOREWORD

This document was prepared under a close working relationship between Mr. Verne Tallio of NAFEC and the author. In addition to providing many suggestions and comments, Mr. Tallio was instrumental in developing the test scenarios and organizing the evaluation effort.

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1. OBJECTIVES OF DABS/ATC OPERATIONAL EVALUATION

The general objective of the DABS/ATC operational evaluation is to complement the on-going technical tests of DABS and related ATC system changes by assessing the operational and man-machine interaction aspects of DABS/ATC. Thus, this evaluation is primarily concerned with assessing and demonstrating the controller's ability to perform his job effectively and efficiently using the new DABS/ATC system. Specifically, the following aspects of the system are to be evaluated:

(1) Effects on Separation Requirements

With DABS, and the associated subsystems (e.g., Video Reconstitutor), some of the display characteristics of aircraft radar and beacon data are different from today's ARTS III displays. Some display factors (e.g., position accuracy, target resolution, and processing delays) are directly related to separation assurance. The evaluation effort will seek to verify that the controller can satisfactorily insure adequate aircraft separation using the new DABS/ATC display characteristics.

(2) Quality of Displayed Surveillance Data

There is a need to collect and analyze controllers' opinions regarding the DABS surveillance quality and to confirm that no unsatisfactory aspects of an operational nature exist in the new surveillance displays. Examples of some areas that need to be evaluated are: The characteristics of full-digital and video-reconstituted displays, radar clutter, and display of weather data.

(3) Impact on ATC Procedures

It is expected that the field-implementation of DABS will necessitate changes in today's ATC operational procedures. The nature and the extent of these changes need to be determined.

(4) Impact on Controller Workload

This aspect of operational evaluation will be concerned with verifying that DABS does not impose extra demands on the controller, particularly with regard to the frequency of keyboard entries, flight strip handling, and voice communications. In addition, there is a need to insure that the new system does not include any characteristics which may contribute to increased controller stress, workload, or affect his ability to comprehend the "ATC picture" in any way.

(5) Acceptability of New Display Characteristics

DABS introduces many new features in the contents and format of the information displayed on the controller's scope. This activity will include the gathering and analysis of controllers' opinions as to the suitability of the displayed data. Each of the new display characteristics will be examined in order to identify and correct any potential problems or weaknesses, and to explore areas where future improvements can be implemented.

(6) Acceptability of New Keyboard Entries

Several new controller keyboard entries are provided in the ARTS III version which will interface with DABS. In addition, some changes were made to the existing ARTS III keyboard entries. This activity will include the gathering and analysis of controllers' opinions, to insure the operational acceptability of the new features of the keyboard entries.

2. BACKGROUND

2.1 General

DABS, currently being developed by the FAA, is intended to provide improved aircraft surveillance through the following: use of a unique address for each aircraft; monopulse direction finding; reduced synchronous garbling; reduced false, split, and lost targets; and other technical advantages. In addition, DABS will provide extensive data-link communications supporting various ATC automation services, such as automated traffic advisory messages. DABS is designed to be fully compatible with the present ATCRBS capability, so as to permit an extended and economic evolution of the ATC system.

The three DABS engineering models have been undergoing extensive technical testing, primarily at NAFEC and its adjacent facilities (i.e., Elwood and Clementon, NJ). As part of these activities, the NAS en route and ARTS III systems are being modified in order to accommodate the new interfaces required with DABS.

The results of these testing activities will support the Technical Data Package (TDP) which is due to be issued by the FAA in April 1980. The TDP will serve as a basis for procuring the production version of DABS. In addition to complementing the technical testing effort, it is expected that the operational evaluation tests, described in this report, will result in additional meaningful data on issues which specifically relate to the operational viability of the DABS/ATC system (see Section 1).

2.2 Scope

The operational evaluation effort will be limited by the following aspects:

(1) DABS/ARTS III

Only the DABS/ARTS III interface, as developed and tested at NAFEC, will be used for evaluation. This refers to the modified single beacon ARTS III system with the TABG tracker. The DABS/ARTCC interface will not be used in this effort.

(2) Surveillance Functions

The operational evaluation will be primarily concerned with the surveillance features of the DABS/ARTS III system. The DABS data-link capability will not be included in the evaluation, except for the following two messages which are surveillance-related:

(i) ATCRBS ID REQUEST
(ii) ATCRBS ID CODE

(3) NAFEC Tests

All tests will be conducted at NAFEC. DABS or other equipment not located at NAFEC will not be used.

(4) Normal Operations

The tests are designed to evaluate DABS/ARTS under normal operating conditions. No failure modes will be intentionally introduced in the test scripts.

(5) Philadelphia Environment

Tests will be configured to simulate the Philadelphia International Airport operations. This includes the airport adaptation, traffic mixes, flight patterns, and ATC procedures.

(6) Frozen System

Since this evaluation will require the participation of several controllers and observers during the test missions, it is necessary that the tests be run smoothly and efficiently. Therefore, an essential prerequisite for the operational evaluation effort is that all systems being used will have been adequately tested technically, and found to be reasonably ready for operational evaluation. Also, it is expected that, at the time of testing, all system parameters will be set at their nominal, or most reasonable, values, and no known hardware or software problems or malfunctions will exist.

2.3 Evaluation Phases

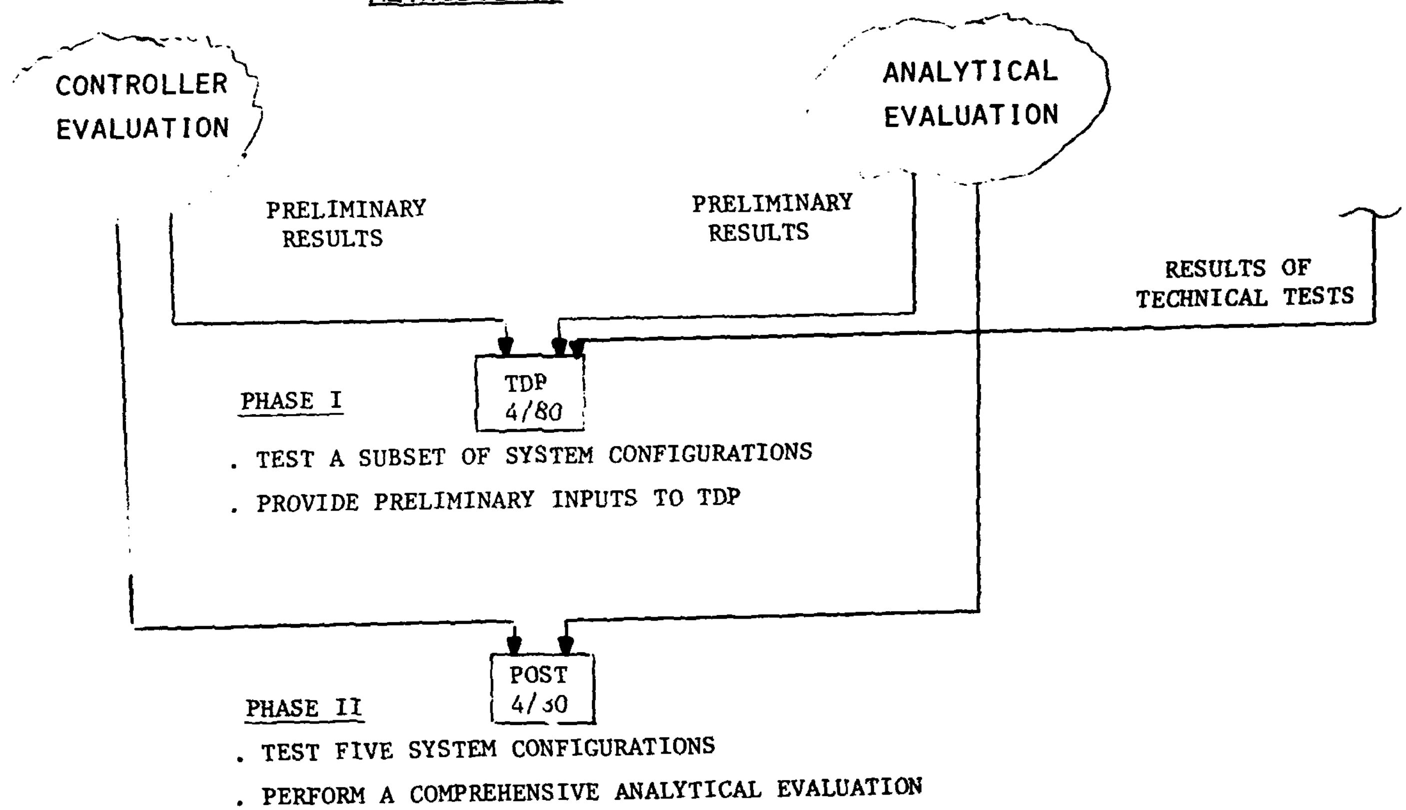
The operational evaluation effort is envisioned to consist of two major phases:

Phase I: Preliminary Controller Evaluation (pre-TDP)
Phase II: Operational Impact Analysis (post-TDP)

As depicted in Figure 2-1, Phase I will provide preliminary results prior to publication of the TDP, scheduled for April 1980. If some of the system configurations (see Section 4.3) are not available for testing prior to the issuance of the TDP, these configurations will be tested as part of the Phase II effort. In addition, Phase II will include a comprehensive analytical evaluation of the major operational aspects of the DABS/ATC system (see Section 5.2.2.2). The controller evaluation effort under Phase I will be accomplished with controllers from the NAFEC staff. These controllers may also take part initially in tests conducted under Phase II. Subsequently, controllers from operational ARTS III sites will be invited to NAFEC for a final evaluation of the various configurations.

FIGURE 2-1

METHODOLOGY



3. RELATED DOCUMENTATION

1. ATC-10309, Sperry UNIVAC, "DABS Computer Program Functional Specifications", Draft Report, December 1979.

2. ATC-10300, Sperry UNIVAC, "DABS/SRAP II/ARTS III Design Data".

3. Project 1431B, FAA, "Test Plan: DABS/ATC System Technical Tests for Terminal Surveillance", June 1979.

4. PHL 7110.23B, Philadelphia Tower, Standard Operating Procedures Handbook.

4. SYSTEM/EQUIPMENT DESCRIPTION

4.1 General

The DABS/ARTS III system can operate with Full-Digital (F/D) displays or with the present Time-Share (T/S) displays. These two basic concepts are illustrated in Figures 4-1 and 4-2, respectively. Beacon inputs are processed through the DABS sensor. Search data are processed through a digitizer, i.e., MTD or RDAS, or directly displayed on a T/S scope through the Video Delay Generator without any DABS processing. The Video Reconstitutor provides reconstituted beacon or primary raw video data on the ARTS T/S PPI display. Two simulation vehicles, ARIES and ATCSF, can be used with the basic configurations to generate input signals based on prescripted traffic scenarios.

4.2 Overview of Subsystems

A brief overview of each of the major subsystems used in the evaluation is provided below:

(1) DABS

The engineering model of DABS installed in building 269A at NAFEC will be used. This system includes the DABS antenna and sensor equipment, surveillance and communications processing computers, and off-line software support capabilities. A detailed description of DABS can be found in FAA-RD-74-189, "DABS: A System Description".

(2) ARTS III

The system used in the performance evaluation effort will be a version of the ARTS III system modified to interface with DABS. In addition to processing the DABS surveillance and communications messages, the modified system includes major differences from today's ARTS III, primarily: Tracking of all beacon as well as search-only targets, whether associated or non-associated; an improved tracker--the Thresholded Alpha Beta Gamma Tracker (TABG); new display characteristics, notably, an all digital display capability; and new keyboard entries. This system is described in ATC-10300, Sperry UNIVAC, "DABS/SRAP II/ARTS III Design Data". The Computer Program Functional Specifications are documented in ATC-10309.

FIGURE 4-1

BASIC CONFIGURATION (I)
WITH F/D DISPLAYS

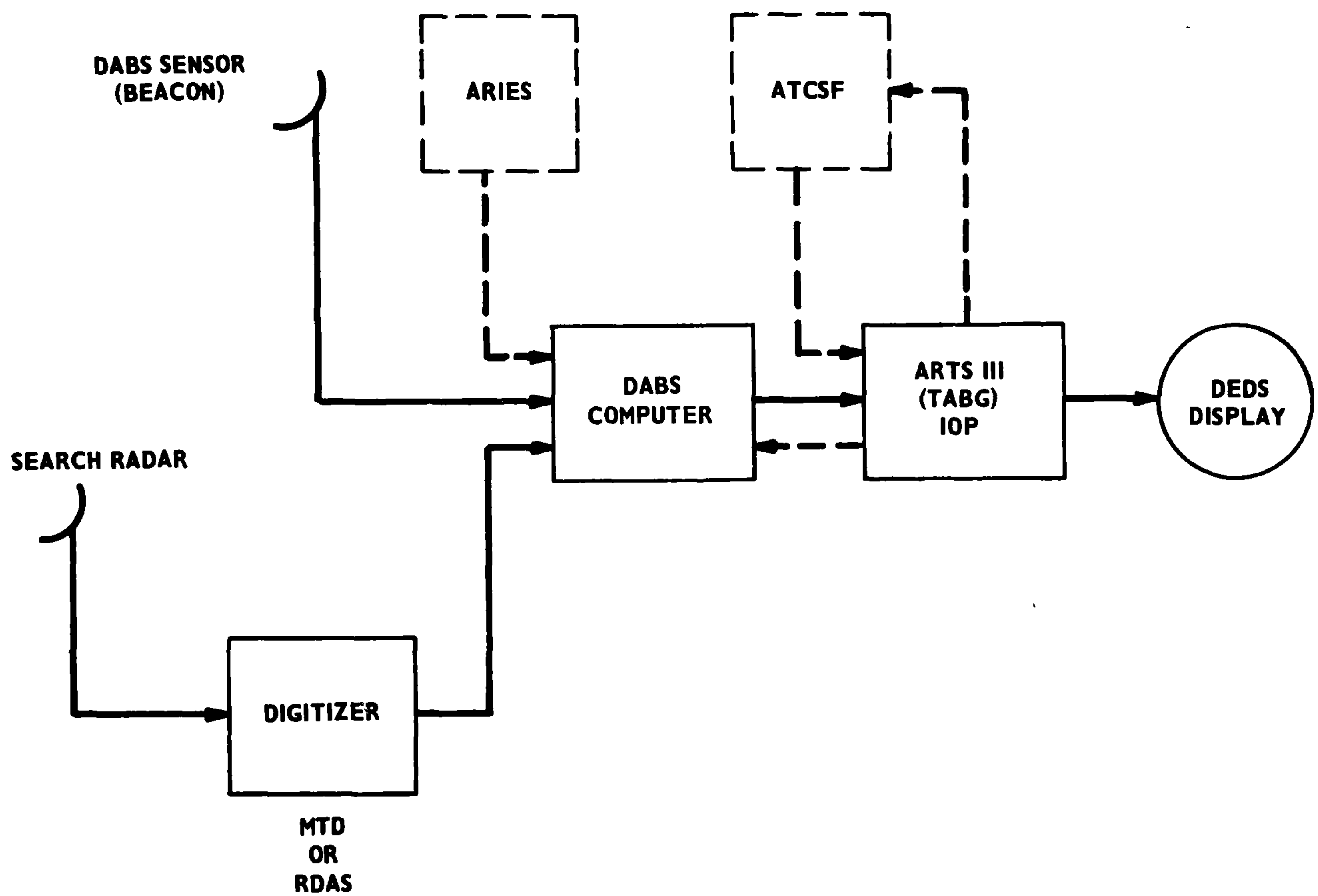
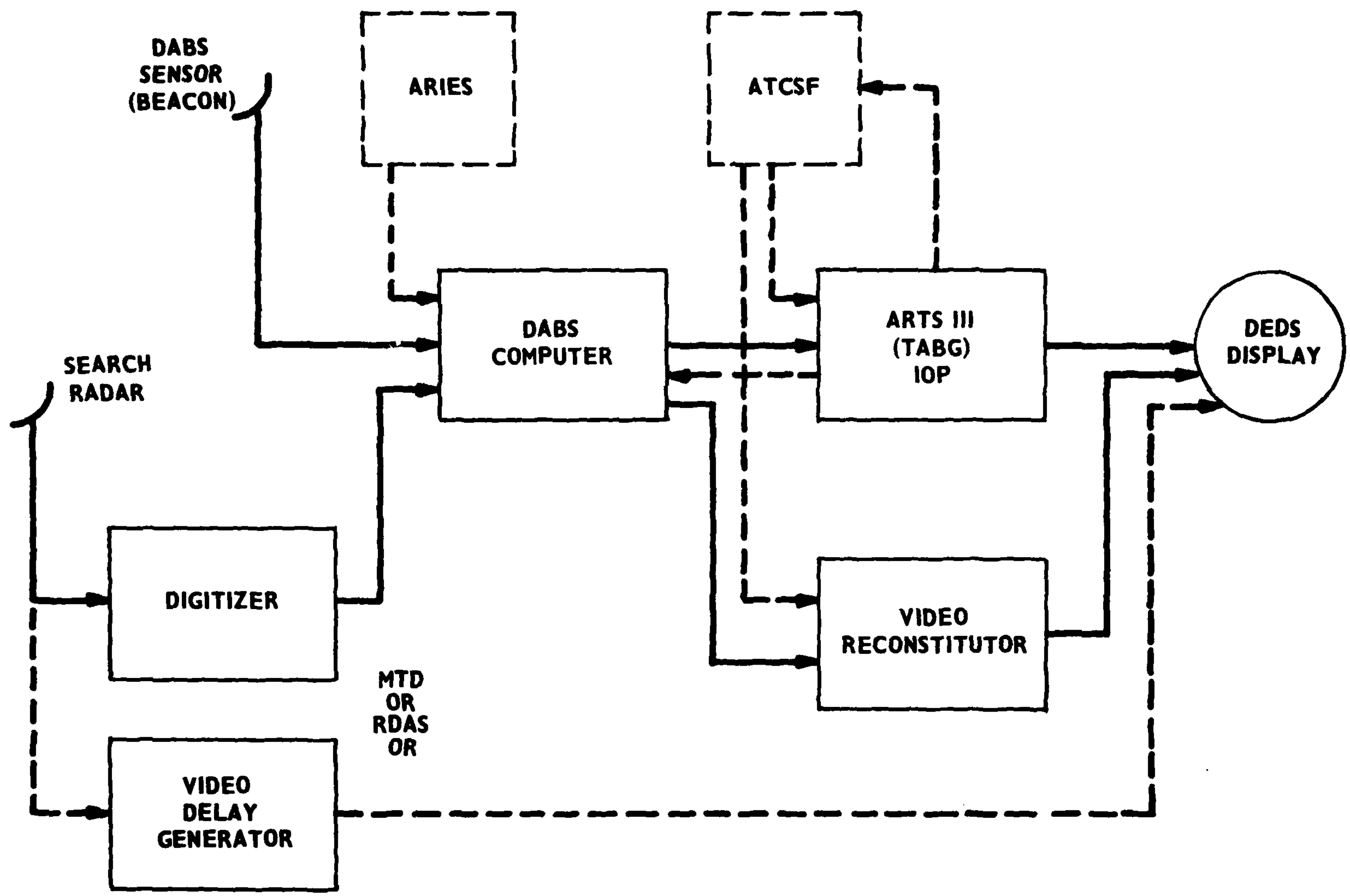


FIGURE 4-2

BASIC CONFIGURATION (2)
WITH T/S DISPLAYS



(3) Video Delay Generator

The Video Delay Generator is a unit that provides delay of primary radar video signals. This is done to provide registration of these signals with the DABS reconstituted video output. The primary radar video is provided to an ATC facility served by a DABS sensor that does not have digitized primary radar inputs. The unit is combined in the same physical package as the Video Reconstitutor, but it is functionally independent.

(4) Video Reconstitutor

The purpose of the Video Reconstitutor is to provide reconstituted beacon and reconstituted radar video to an ARTS facility for display on the PPI. The Video Reconstitutor converts the digital DABS output surveillance messages to rho-theta ATCRBS beacon, radar, and weather video formats for use on ARTS III time-shared display. All DABS messages are input to the Video Reconstitutor in the format of ATCRBS messages.

(5) MTD

The Moving Target Detection subsystem was developed by the FAA for the purpose of improving primary radar target detection in the presence of clutter, e.g., ground clutter, precipitation clutter or angle clutter. The MTD was tested in the ARTS II site at Burlington, VT. The MTD provides digital weather messages and radar target reports for processing by DABS. A detailed description of the MTD is provided in FAA-E-2704, "Airport Surveillance Radar, ASR-9", November 1979.

(6) RDAS

The Radar Digital Acquisition System processes primary radar data and outputs digital weather data and target report messages for use by DABS. RDAS data is in the same general format as the MTD data. RDAS and MTD are two alternatives for processing and digitizing of primary radar data. A detailed description of RDAS is provided in PX-12106, Sperry UNIVAC, "Technical Manual for Sensor Receiver and Processor," September 1978.

(7) ATCSF

The ATC Simulation Facility at NAFEC has been programmed to generate simulated DABS output messages, thus driving the ARTS III system in a simulated DABS/ARTS III interface. The controllers manning the ARTS III displays in the TATF are in telephone contact with simulated pilots in the ATCSF building. The simulated pilots affect the flight pattern of the simulated aircraft by making keyboard entries according to the instructions issued by the controllers. The ATCSF is described in "Digital Simulation Facility, User's Guide", Simulation and Analysis Division, NAFEC.

(8) ARIES

The Aircraft Reply and Interference Environment Simulator generates simulated aircraft replies, feeding them to the DABS sensor at Intermediate Frequency (IF), according to a pre-scripted traffic scenario on tape. ARIES can simulate any mix of ATCRBS and DABS transponders. In addition to the beacon data, ARIES provides simulated digitized radar data in the output format of the Common Digitizer (CD) corresponding to the simulated beacon targets. A detailed description of ARIES can be found in FAA-RD-78-96, "The Aircraft Reply and Interference Environment Simulator", Volumes 1, 2, 3.

(9) Airborne TACAN

The airborne Tactical-Air-Navigation aid system--to be used in the live-flight tests (see Section 5.1.3.3)--was designed to display and record air-to-air distance and bearing measurements. The system used at NAFEC is designated Hoffman AN/ARN-84(V). The air-to-air TACAN does not involve any of the ground TACAN frequencies, nor is the TACAN ground station involved in the air-to-air link. The airborne digital TACAN outputs are recorded on magnetic tape for subsequent processing and data reduction. Based on flight tests performed at NAFEC, it was concluded that the air-to-air ranging measurements exhibited zero bias, with a standard deviation error of less than 100 feet. A good description of this equipment can be found in FAA-RD-77-59, "Accuracy Test of an Air-to-Air Ranging and Bearing System", and in FAA-NA-79-32, "NAFEC Range Instrumentation Systems".

4.3 Test Configurations

The combined DABS/ARTS system can be structured in one of five basic system configuratons. Each of these configurations has unique characteristics primarily with respect to the features of the surveillance data being displayed on the controller's scope. An explicit objective of the effort described in this plan is to provide a comparative evaluation of the advantages and disadvantages of each of the five configurations. These configurations are as follows:

(1) Configuration #1: F/D Display & MTD (Figure 4-3)

In this configuration the MTD processes and digitizes raw search data, which is then processed by DABS together with the DABS and ATCRBS beacon data obtained through the DABS sensor. The DABS output is processed by the ARTS III system, which includes the TABG tracker. The displayed data on the controller's scope is exclusively digital. Unlike today's ARTS III, no raw video data is displayed in this configuration.

(2) Configuration #2: F/D Display & RDAS (Figure 4-4)

This configuration is the same as (1) above except that the search radar data is processed and digitized by the RDAS equipment instead of the MTD.

(3) Configuration #3: T/S Display & MTD & Video Reconstitutor (Figure 4-5)

In this configuration the T/S displays are used instead of the F/D displays in configurations #1 and #2. Reconstituted primary and beacon video is produced by the Video Reconstitutor unit to simulate the kind of raw video displayed on today's ARTS III PPI.

(4) Configuration #4: T/S Display & RDAS & Video Reconstitutor (Figure 4-6)

This configuration is the same as (3) above except that the RDAS is used to process and digitize search data instead of the MTD.

FIGURE 4-3

CONFIGURATION #1: F/D DISPLAY & MTD

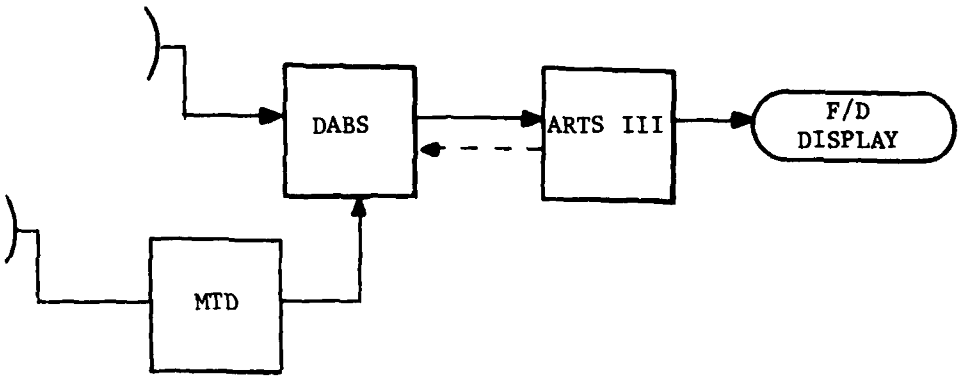


FIGURE 4-4

CONFIGURATION #2: F/D DISPLAY & RDAS

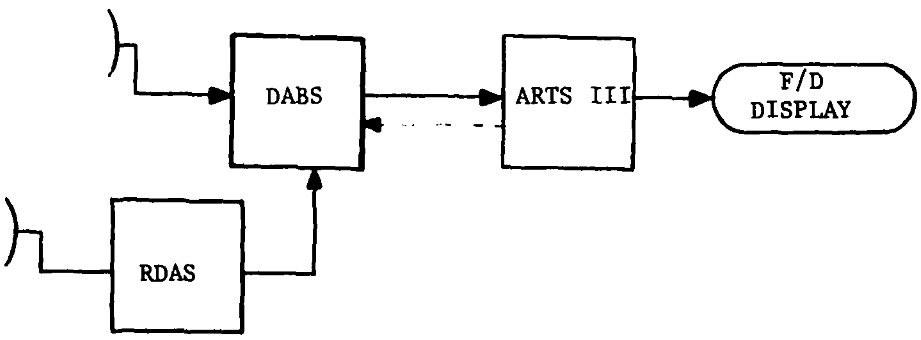


FIGURE 4-5

CONFIGURATION #3: T/S DISPLAY & MTD & VIDEO RECONSTITUTOR

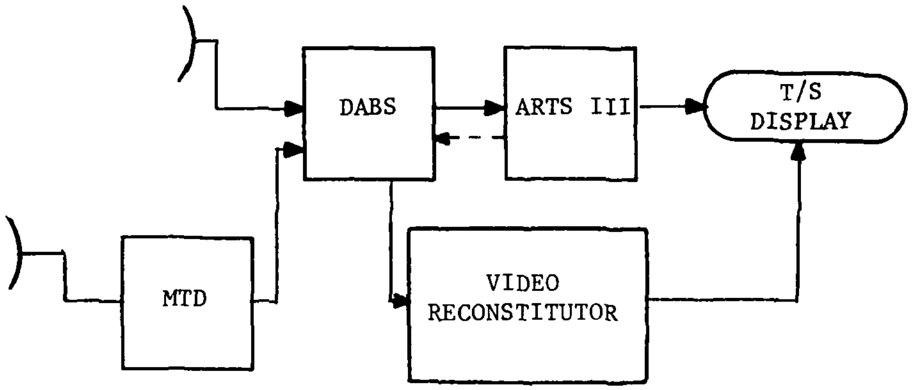
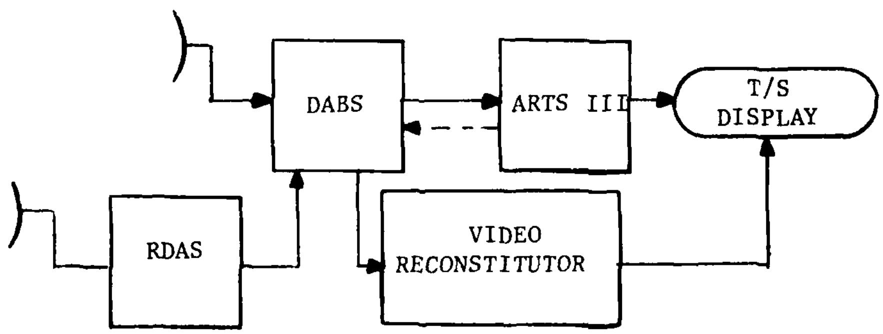


FIGURE 4-6

CONFIGURATION #4: T/S DISPLAY & RDAS & VIDEO RECONSTITUTOR

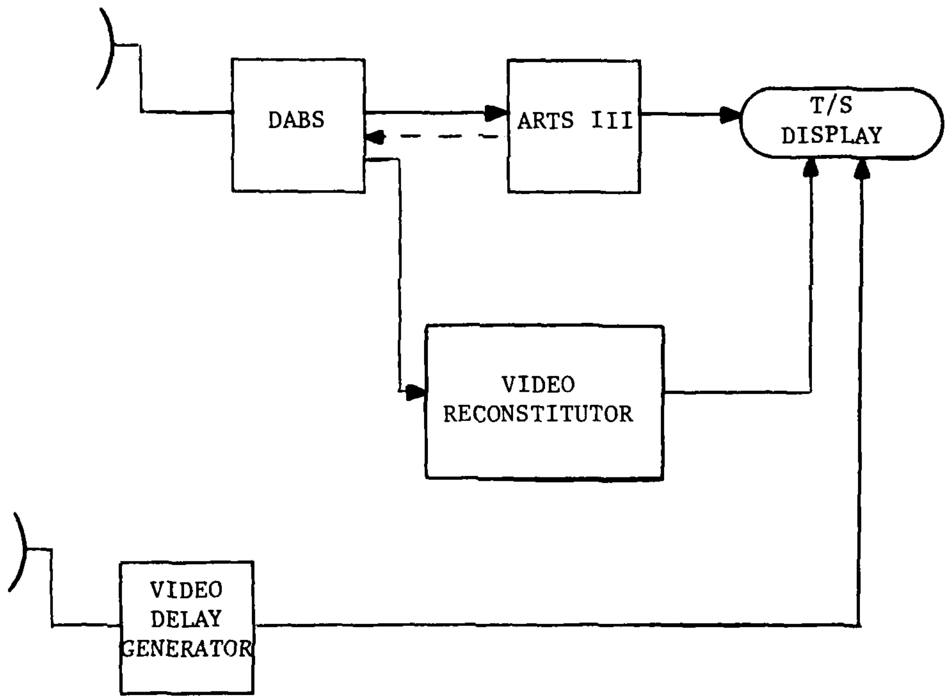


(5) Configuration #5: T/S Display & Video Delay Generator & Video Reconstitutor (Figure 4-7)

In this configuration neither the MTD nor the RDAS is used to digitize the radar data. Instead, the primary data is directly displayed on the controller's scope after a delay sufficient to insure the registration of the primary data with the reconstituted beacon video produced by the Video Reconstitutor.

FIGURE 4-7

CONFIGURATION #5: T/S DISPLAY & VIDEO DELAY GENERATOR & VIDEO RECONSTITUTOR



5. DATA COLLECTION

As previously discussed (see Section 2.3), the overall operational evaluation will be carried out in two sequential phases. Subsection 5.1 below describes the activities to be performed under Phase I; subsection 5.2 describes the Phase II effort.

5.1 Phase I: Preliminary Controller Evaluation (Pre-TDP)

5.1.1 General

The major outcome from Phase I will be a compilation of controllers' opinions on the suitability of the DABS/ARTS III system from an operational point-of-view. In addition to such subjective assessment of the system, any objective results obtained in the course of testing will also be provided in the final report. These may include such items as quantitative measures of surveillance accuracy, identification of suggested changes to future ATC procedures in facilities with DABS coverage or adjacent facilities, and uncovering any operationally-related areas which may have been overlooked during previous test efforts or analyses.

The intended purpose of the Phase I effort is to generate data relevant to the TDP, scheduled for 4/80. Due to the tight schedule, and the possible non-availability of some of the test configurations (see Section 4.3), Phase I should not be considered to be a comprehensive operational evaluation of DABS/ARTS III; rather, Phase I is envisioned as a preliminary activity, with final results to be provided at the completion of Phase II.

5.1.2 Methodology

Under Phase I, a number of test missions will be run using the various configurations of the DABS/ARTS III system. In the event that some of the five test configurations are not available before 4/80, the tests will use only those configurations whose technical tests will have been completed successfully. There will be several simulated as well as live-flight sessions, using the actual DABS/ARTS III equipment. The simulated runs will be made using the ARIES unit, and the ATCSF, as alternative test vehicles. The live tests will be run using two DABS-equipped aircraft, carrying onboard instrumentation (i.e., Hoffman TACAN AN/ARN-84(V)) for measuring and recording the exact separation between the test aircraft.

All radar displays used in the tests will be manned by controllers and observers selected from NAFEC personnel with prior operational experience. Field controllers will not be required for the Phase I tests. The test participants will be requested to fill out detailed questionnaires which will specifically address all the relevant items subject to evaluation. In addition, a debriefing questionnaire will be filled out, supplemented by a general discussion of test results and controllers' observations and comments. Various data will be automatically collected during the tests for subsequent reduction and analysis (see Section 5.1.5.4).

5.1.3 Test Modes

Three test modes will be used: ARIES, ATCSF, and live-flight. These are described below.

5.1.3.1 ARIES*

Description (Figure 5-1)

In the ARIES mode, simulated beacon (DABS and ATCRBS) targets will be used based on the traffic scenario, and in addition, targets of opportunity will be processed. At least one test will be run for each of the available test configurations (see Section 4.3). The ARIES will simulate realistic radar noise (i.e., jitter and blip/scan) and fruit. The tests will be run in both VFR and IFR weather conditions.

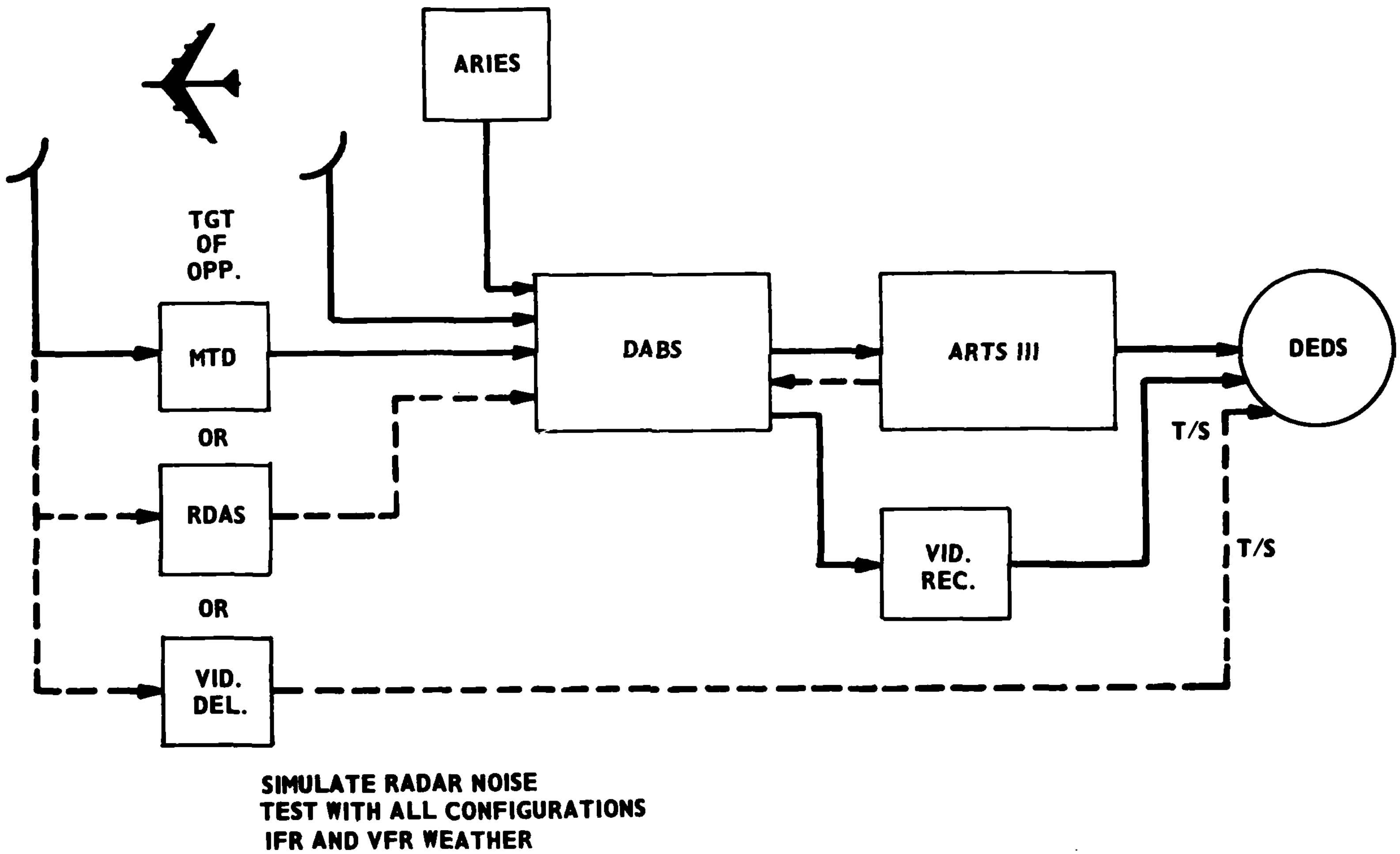
Purpose

The ARIES mode will be used to familiarize the test participants (i.e., controllers and observers) with the basic characteristics of the DABS/ARTS III system. Since ARIES does not readily permit on-line entries of aircraft maneuvers (other than those specified in the pre-scripted scenario), this test mode will be "passive" in the sense that the controllers will not control or communicate with the test aircraft. Rather, they will observe and evaluate the display characteristics and other operationally-significant implications of DABS.

* ARIES mode also implies the surveillance and evaluation of targets-of-opportunity.

FIGURE 5-1

TEST MODE I – ARIES



Scenarios

The ARIES test scenario is described in Appendix A. In general, the scenario has the following characteristics:

(1) Realistic Philadelphia environment and traffic pattern (runways 27R for arrival, 27L for departures)

(2) 50% DABS aircraft
50% ATCRBS aircraft

(3) 60 arrivals, 20 holds
60 departures
20 over-flights

(4) 90% controlled
10% uncontrolled

(5) Reply Probability:

Primary: 85%
Beacon: 95%

(6) Fruit rate:

4K per second

(7) Test Duration:

2 hours

Prerequisites

The following items must be accomplished prior to the actual tests:

(1) Scenario preparation and verification

(2) Testing and verification of the total system as shown in Figure 5-1.

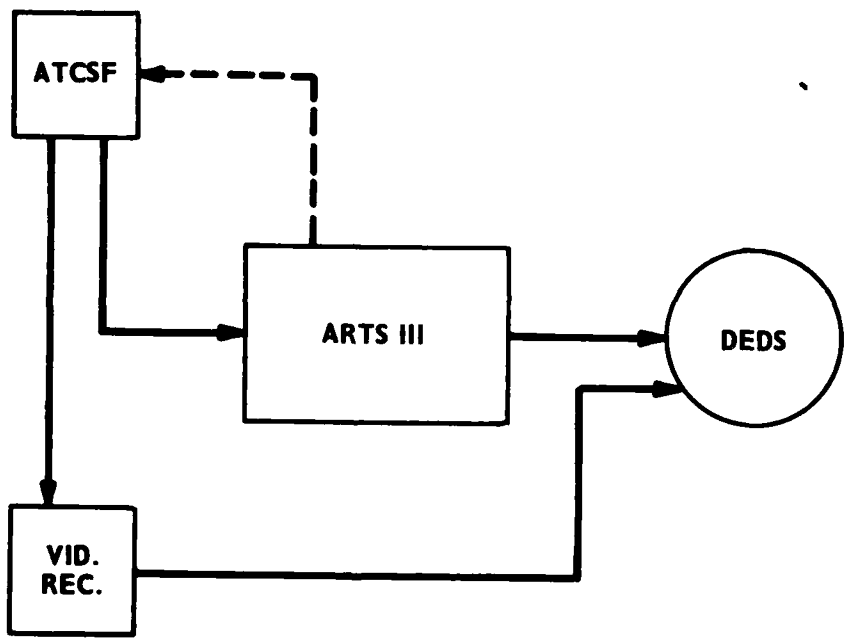
5.1.3.2 ATCSF

Description (Figure 5-2)

The ATCSF simulates the DABS computer in that DABS-formatted target reports are generated and shipped to the ARTS III system for processing. In addition, the ATCSF is presently being modified to generate input signals for the Video Reconstitutor. This will make it possible to display simulated beacon and primary video in addition to the alphanumeric information produced by ARTS III.

FIGURE 5-2

TEST MODE 2 – ATCSF



SIMULATE DABS COMPUTER
2 SCENARIOS (MEDIUM/HEAVY)
SIMULATE RADAR NOISE
REALISTIC PHIL SCENARIO (ARR/DEP/HOLDS/OVERS)

Purpose

The ATCSF provides the capability to simulate the interactions between controllers and pilots. Thus, the ATCSF is suitable for an "active" simulation, meaning that the controller assumes an active role in controlling the actual maneuvers undertaken by the simulated aircraft.

The major areas which will be evaluated in the ATCSF mode will be:

(1) The acceptability of the new and modified keyboard entries

(2) The effect of DABS on controller workload

(3) The effect of DABS on ATC procedures.

Scenarios

Two traffic scenarios will be developed for the ATCSF test mode (see Appendix B). Scenario #1 will represent medium load, and scenario #2 will be heavy load traffic. The scenarios will have the following characteristics:

(1) Realistic Philadelphia Airport environment and traffic pattern

(2) 30% DABS aircraft
50% ATCRBS aircraft
20% search-only aircraft

(3) 90% controlled aircraft
10% uncontrolled

(4) Radar Noise:

Range jitter: 50 feet rms
Azimuth jitter: 0.10° rms
Blip-scan: 95%

(5) Test Duration:

2 hours

Prerequisites

The following items must be accomplished prior to the actual tests:

(1) Completion and verification of the ATCSF software changes, primarily the newly developed interface with the Video Reconstitutor

(2) Completion and check-out of the test scenarios

(3) Testing and verification of the total system as shown in Figure 5-2.

5.1.3.3 Live-Flight

Description (Figure 5-3)

In the live-flight mode, two DABS-equipped aircraft will fly a prescribed flight course around NAFEC. Hoffman AN/ARN-84(V) airborne TACAN equipment will be used to obtain the proper laterla separation. The separation, as measured by this equipment, will be compared against the separation as visually observed on the controller's display, and subsequently will be analyzed to obtain a quantitative measure of the deviations between the true separation and the displayed separation (see Section 6).

Two ARTS III systems (i.e., systems #1 and #3) at the TATF will be used simultaneously to facilitate a "side-by-side" comparative evaluation of the ARTS III system with and without DABS. The ASR facility used for the ARTS III display will be configured and calibrated to represent a realistic ARTS III radar capability.

In addition to the two test aircraft, all targets of opportunity will be displayed on the two systems for comparative evaluation. Weather permitting, tests will be run in both IFR and VFR conditions.

Purpose

The live-flight tests will be used to demonstrate the differences in the displayed video and alphanumeric data before-and-after DABS. Also, for the DABS/ATC system, the accuracy of the displayed aircraft position and relative separation will be evaluated subjectively as well as quantitatively. The resolution of two targets in proximity will also be subject to assessment.

Scenarios

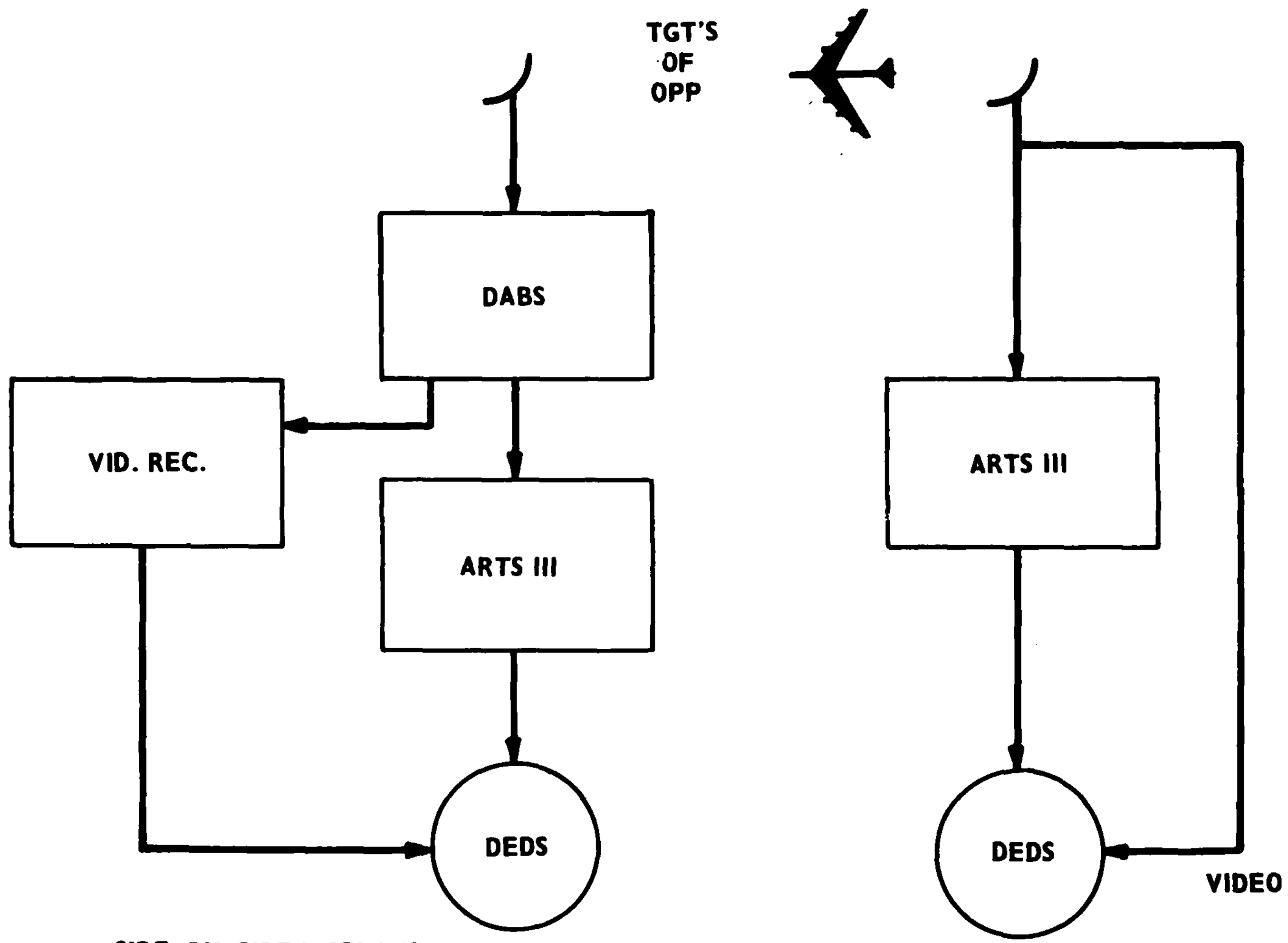
The flight plans of the two test aircraft are illustrated in Appendix C. The flight paths were designed to achieve the following flight patterns:

(1) Parallel flights, tangential and radial to the radar antenna, with varying fixed lateral separations:

4 nm
3 nm
2 nm

FIGURE 5-3

TEST MODE 3 – LIVE FLIGHT



SIDE-BY-SIDE DISPLAYS
ON-BOARD INSTRUMENTATION
TEST WITH ALL CONFIGURATIONS
IFR AND VFR WEATHER
SPECIALLY-DESIGNED FLIGHT SCRIPT

(2) Overtakes

(3) Head-ons

(4) 30° crossovers

These patterns will be accomplished at various distances from the radar antenna, namely: 5, 20, and 40 nm. The flight tests will be repeated at two altitudes: 5,000 and 12,000 feet.

The tests will include periods in which the aircraft represent (selectively) different transponder equipment: DABS-equipped, ATCRBS-equipped, or no beacon (i.e., search only).

Prerequisites

The following items must be accomplished prior to the actual tests:

(1) Completion and check-out of the flight plans

(2) Coordination with the Eastern Region

(3) Scheduling of pilots and test aircraft

(4) Preparation of pilot test procedures

(5) Preparation of controller test procedures

(6) Testing and verification of the total system as shown in Figure 5-3. Also, testing and verification of the airborne instrumentation equipment.

5.1.4 Test Missions

The number of test missions depends on the readiness of the equipment required for each of the five system configurations described previously (Section 4.3). Since a firm statement stipulating which configurations will be available is not possible at this time, three contingency plans were identified depending on the test equipment readiness. Eventually, all five configurations will be tested by both NAFEC and field controllers. However, the sequence of the tests depends on equipment availability. Whatever results are obtained by 4/80 will be applied to support the TDP, but the test effort will continue past the TDP publication.

Contingency I: All Systems Ready

If all five system configurations are available for operational evaluation according to this plan, sixteen test missions will be needed as listed in Figure 5-4.

FIGURE 5-4 TEST MISSIONS: CONTINGENCY PLAN I

ASSUMPTION: ALL SUBSYSTEMS WILL BE READY BEFORE 3/80

MISSION	MODE	PURPOSE
1	ARIES*	EVALUATE F/D WITH MTD
	F/D - MTD	
2	ARIES	EVALUATE F/D WITH RDAS
	F/D - RDAS	
3	ARIES	EVALUATE T/S WITH MTD
	T/S-MTD-VID. REC.	
4	ARIES	EVALUATE T/S WITH RDAS
	T/S-RDAS-VID. REC.	
5	ARIES	EVALUATE T/S WITH VID. DEL.
	T/S-VID. DEL.-VID. REC.	
6 -8	ATCSF	REALISTIC SCENARIOS
9 -11	ATCSF WITH VID. REC.	REALISTIC SCENARIOS
12 -16	LIVE*	SAME AS 1-5 BUT WITH LIVE TEST AIRCRAFT
		SIDE-BY-SIDE EVALUATION

* "ARIES" AND "LIVE" IMPLY ALSO TARGETS OF OPPORTUNITY

Contingency II: Only Video Delay Generator and Video Reconstitutor

This contingency represents the most basic configuration which must be available in order to run the operational evaluation. Eight test missions will be required as listed in Figure 5-5.

Contingency III: Contingency II Equipment Plus MTD

This contingency will require twelve tests as listed in Figure 5-6.

5.1.5 Test Conduct

5.1.5.1 Controller Procedures

As guidance to the participating test controllers, a set of controller procedures will be developed for each mission. The procedures will identify: (1) general control guidelines, e.g., handoffs, keyboard entries, airport geometry rules, and (2) special actions required in a test, e.g., "request change to ATCRBS", "record observed separation", "note whether pilot's reported position at fix XXX corresponds with observed position".

5.1.5.2 Pre-Briefing

Each mission will be preceded by a pre-briefing session in which a general description of the test will be presented, as well as test objectives, procedures, and assignments.

5.1.5.3 Controller and Observer Functions

Each radar scope (or a pair of scopes in the side-by-side test) will be manned by at least two people: a controller and an observer. The controller is responsible for executing the test procedures, filling out the entries on the questionnaire form, and, in general, observing the scope and noting on the form or verbally any peculiarities or display characteristics which are different from today's ARTS III system.

The observer function during the tests is to record on the observer log the controller comments as well as his own observations of the display characteristics or controller actions.

5.1.5.4 Data Gathering

The collected data, which will be subsequently used for analysis, include both manually and automatically collected data, as follows:

FIGURE 5-5 TEST MISSIONS: CONTINGENCY PLAN II

ASSUMPTION: ONLY VID. DEL. GEN. AND VID. REC. WILL BE READY BEFORE 3/80.

TEST MISSIONS:

MISSION	MODE
5	ARIES T/S & VID. DEL. & VID. REC.
6-8	ATCSF
9-11	ATCSF WITH VID. REC.
16	LIVE

FIGURE 5-6 TEST MISSIONS: CONTINGENCY PLAN III

ASSUMPTION: ONLY MTD AND VID. DEL. GEN. AND VID. REC. WILL BE READY BEFORE 3/80

TEST MISSIONS:

MISSION	MODE
1	ARIES F/D & MTD
3	ARIES T/S & MTD & VID. REC.
5	ARIES T/S & VID. DEL. & VID. REC.
6-8	ATCSF
9-11	ATCSF WITH VID. REC.
12,14,16	LIVE

(1) Manual Data

These consist of the following records:

- Controller questionnaires (Appendix D)
- Observer logs
- Debriefing notes and comments

(2) Automatic Data

These consist of the following:

- ARTS III extraction, including as a minimum: target reports, tracking messages, and keyboard entries

- DABS sensor recordings, including as a minimum:

  DABS to ATC surveillance messages
  Uplink and downlink messages

- ARIES data recordings indicating which ATCRBS and DABS targets replied to interrogations.

- ATCSF data recordings including: messages sent to the IOP and the Video Reconstitutor; true aircraft position, speed, heading and altitude; and "pilot" keyboard entries.

- Airborne instrumentation digital tape recordings of ranging data.

(3) Photographic Data

Pictures of the controller scope will be taken during the tests, for subsequent viewing and analysis. The pictures will show the whole display or sections thereof, as determined by the test manager. Various display features, especially those which are considerably different from the ARTS III displays, will be photographed.

(4) Playback Capability

A playback capability would enable the rerunning of individual tests under the same surveillance inputs as received and recorded in the original test. The FR-1800 video recording system can be used to record DABS surveillance output for subsequent replay into the ARTS III system. Although a playback capability is a desirable feature, it is not considered an absolute necessity for the operational evaluation effort. As such, while the test plan does not include any requirements for playback use, the capability, if available, could be a useful test tool. The playback feature is a desirable evaluation tool in that it would make it possible to evaluate the system's repeatability, verify changes and corrections, and determine the effect of changing parameters and/or software logic.

5.1.5.5 Debriefing

At the completion of each test mission, a debriefing session will be held for the purpose of summarizing the test results. A debriefing form (Appendix E) will be completed by each of the participating controllers and observers. In addition, the participants will be encouraged to discuss any comments, suggestions, or problems relative to the specific mission, or, in general, the operational aspects of the combined DABS/ATC system.

5.1.5.6 Mission Report

A mission report will be prepared for each completed mission. This report will include a test description, significant findings, a list of the types of data collected, a summary of the controllers' evaluation, and a summary of the debriefing session.

5.2 Phase II: Operational Impact Analysis (Post-TDP)

5.2.1 General

Phase II of the operational evaluation effort will be much broader and more comprehensive than the Phase I effort. Under Phase II, all the five system configurations will be evaluated, as these systems are expected to be completed and checked out prior to commencement of Phase II testing. Phase II includes two major aspects:

(1) Testing with field controllers. Controllers from various ATC facilities will be invited to NAFEC to participate in the operational evaluation of the integrated DABS/ATC system.

(2) Analytic evaluation of the operational implications of DABS/ATC. This includes the collection and analysis of quantitative data (e.g., surveillance accuracy), as well as studies aimed at determining the impact on operational issues such as separation requirements, ATC procedures, and controller workload.

The specific areas which are to be evaluated in Phase II are:

- Effect on current separation requirements
- Potential for reducing the current separation standards without compromising safety
- Effect on ATC procedures
- Surveillance quality (i.e., accuracy of position, accuracy of relative separation, resolution, jitter, blip-scan, false targets, clutter problems, weather accuracy)
- Controller workload
- Adequacy of new and changed keyboard entries
- Quality of new display characteristics
- Effect on ATC functions (e.g., CA, MSAW)

5.2.2 Methodology

Two types of activities will be conducted: (1) Tests with field controllers, and (2) Analytic evaluation. These are described below.

5.2.2.1 Tests With Field Controllers

Essentially, these tests will be performed in a similar fashion to the controllers' tests described for Phase I. Before the start of the tests, a one-day orientation session will be conducted (see the agenda in Appendix F) in order to introduce the field controllers to the NAFEC test facilities, the concepts of DABS, and the intricacies of the operational evaluation activities.

A minimum of sixteen simulated and live test missions will be conducted, as shown in Figure 5-4, using the five system configurations. Controllers' evaluation data will be collected through inflight and post-flight questionnaires, and comments made in the debriefing sessions, in much the same manner as described above for the Phase I testing.

5.2.2.2 Analytic Evaluation

The analytic evaluation will include the following analyses:

(1) Results of other related test efforts will be reviewed with the objective of compiling those results which pertain to the operational aspects of the DABS/ATC system. These test efforts will include, in addition to the technical tests conducted at NAFEC, the MTD tests in Burlington Vt., the Tampa/Sarasota system tests, and any other tests which may be found to be relevant.

(2) Quantitative measurements will be made of the accuracy of the surveillance information as displayed on the controller's scope. This includes measurements of the true vs. displayed aircraft position, the true vs. displayed relative separation between aircraft in close proximity, and other aspects of surveillance quality as it appears to the controller, such as: false targets, jitter, missing targets, and target resolution (i.e., overlapping targets, and targets in clutter).

(3) Based on the surveillance accuracy results, an analysis will be performed to determine whether the surveillance accuracy of DABS/ATC is consistent with the required ATC separation standards, and, moreover, whether the standards can be reduced without compromising safety.

(4) An analysis will be made of potential procedural problems and possible improvements to ATC procedures as a result of introducing the DABS/ATC concept. Also, an identification will be made of what revisions will be necessary to the current procedures, and what new procedures may be needed, if any.

(5) The effect of DABS/ATC on the CA (Conflict Alert) and MSAW (Minimum Safe Altitude Warning) functions will be analyzed from an operational point-of-view, to insure that DABS/ATC does not introduce some features which may adversely affect the performance of these functions.

(6) An analysis will be made of the increase and/or decrease to the controllers' workload as a result of the changes introduced by the DABS/ATC system.

6. DATA REDUCTION AND ANALYSIS (DR&A)

Each mission will yield a large amount of data that must be edited, reduced, analyzed, and reported. This section describes the data processing techniques which will be applied to the various types of collected data, namely: qualitative, quantitative, and photographic data.

6.1 Qualitative

The subjective information supplied by the controllers and observers during and after the missions will be compiled and classified for each operationally-significant factor as shown in Table 6-1. In addition, potential problems as well as any specific required improvements as identified by the controllers, will be compiled and presented in the final results.

In addition, the analysis of the inflight live tests will be concerned with comparing the true aircraft relative separation against the displayed separation. This analysis will be accomplished by comparing the true separation as measured and recorded by the Airborne TACAN instrumentation with the separation as observed and estimated by the test controllers. The estimated separation will be recorded manually by the test observer during the test at one-minute time intervals. Subsequently, the deviations between the estimated and TACAN-recorded separation (at matching time instants) will be calculated and plotted.

6.2 Quantitative

Quantitative data reduction will be accomplished as part of the Phase II evaluation effort. The purpose of this data reduction will be to obtain quantifiable measures of the surveillance accuracy of the radar data displayed on the controller's scope. The emphasis will be on evaluating the accuracy of the displayed vs. true data, as effected by the aggregate of all subsystem errors including the errors introduced by the radar digitizer, DABS, ARTS III, the display subsystem, and other components such as the Video Reconstitutor and the Video Delay Generator. The following measures will be obtained:

- True vs. displayed position deviation
- True vs. displayed relative separation of two aircraft in proximity
- Blip/scan ratio
- False targets
- Target jitter

TABLE 6-1

REDUCED QUALITATIVE DATA

	Adequacy			Comparison With ARTS III BTL			
	Good	Acceptable	Needs Improvement	Better	Same	Worse	Comments
1. ACCEPTABILITY OF DISPLAYED INFORMATION							
Target Symbols (D/A/S)*							
Data Block Information							
Tabular Lists							
Automatic Offset							
Jitter							
History Trail							
Map Quality							
Range Marks							
Weather Display							
General F/D Display Quality							
Video Display (D/A/S)							
2. KEYBOARD ENTRIES							
Changes to ARTS III Entries							
Usefulness of New Entries							
Frequency of Use							
Response Time							
Effect on Controller Workload							
3. PROCEDURES							
Handling of Handoffs							
Beacon Code Changes							
Flight Plan DABS Address Entry							
Ident							
4. SEPARATION							
Ability to Distinguish Targets (Resolution)							
Ability to Identify Targets							
Ability to Maintain Separation Standards							
Potential for Reducing Separation Standards							

* DABS/ATCRBS/Search

TABLE 6-1 (Continued)

	Adequacy			Comparison With ARTS III BTL			
	Good	Acceptable	Needs Improvement	Better	Same	Worse	Comments
5. SURVEILLANCE QUALITY							
TARGETS							
Split Targets							
False Targets							
Lost Targets							
ACCURACY							
True vs. Displayed Position Accuracy							
True vs. Displayed Separation Accuracy							
Beacon/Radar Registration							
TRACKING							
Coasts							
Drops							
Initiations							
WEATHER							
Displayed vs. True							

The above measures will be grouped by the following classifications:

- DABS, ATCRBS, and search-only targets
- Tangential and radial flights
- Small and large aircraft
- Various ranges from the radar antenna, i.e., 0-10, 10-25, 25-50 nm
- Presence and lack of ground clutter and precipitation

The reduced data on position and separation accuracy will be expressed in statistical terms of mean and standard deviation, and, in addition, scan-by-scan plots of the true vs. displayed deviations will be provided.

It is likely that some of the measures above will be derived as part of the technical surveillance tests to be conducted at NAFEC. In particular, the blip/scan ratio, false target rate, and target jitter statistics will probably be available from the technical tests. If that is the case, such results will be used, and no additional data reduction will be required. On the other hand, the evaluation of the true vs. displayed position, and the relative separation, are not included in the technical tests, and will have to be accomplished as a separate effort. Basically, such evaluation requires the recording of the true aircraft position, the position as shown on the display and special data reduction to measure the deviations between the two. The required instrumentation is available at NAFEC and has been used in several studies concerned with determining surveillance accuracy (See FAA-RD-73-62; volume I, II, III; Measurement and Analyses of ASR-4 System Error. Also, FAA-RD-76-178, Airspace Configuration and Separation Evaluation Configuration and Procedures, Terminal ATC Digital Display System Errors, ARTS III.)

The NIKE-Hercules radar system at NAFEC may be used as an optional supplement to the operational evaluation effort, provided the availability of the equipment and resources required for data reduction and analysis. The NIKE-Hercules precision X-band tracking radar tracks targets in either a reflected mode (i.e., "skin paint") or a beacon transponder mode. Aircraft position reports are processed in a minicomputer and subsequently recorded on a magnetic tape. This system has been used in several DABS technical tests at NAFEC for evaluating the aircraft positional accuracy under DABS surveillance. A Description of the NIKE-Hercules system can be found in WP-79N00003, "Test Plan for DABS Accuracy Tests", and in FAA-NA-79-32, "NAFEC Range Instrumentation Systems".

7. INSTRUMENTATION AND FACILITIES

The following facilities will be required for the operational evaluation effort.

(1) TATF

The TATF will be used in all the test missions. Normally, one ARTS III system will be used, except that during the inflight live tests, two systems will be used simultaneously to facilitate the "side-by-side" evaluation (see Section 5.1.3.3).

(2) DABS

The DABS sensor will be used in all the tests, except those missions where DABS is simulated by the ATCSF.

(3) ATCSF

The ATCSF will be used to simulate DABS, ATCRBS, and search inputs to ARTS III. At least six ATCSF tests will be run--three with F/D displays, and three with T/S displays using the Video Reconstitutor. Simulated pilots will participate in the tests to execute the controllers' ATC instructions. At the present time, the ATCSF software is being modified to provide the required inputs to drive the Video Reconstitutor.

(4) ARIES

The ARIES will be used to simulate DABS and ATCRBS beacon inputs to the DABS sensor. At least one test requiring the ARIES will be run for each of the five system configurations.

(5) Test Aircraft

Two NAFEC test aircraft will be used for the inflight live tests. Onboard equipment will include the Hoffman TACAN instrumentation for measuring and recording the relative separation (see Section 4.2, item (9).

8. COORDINATION AND AREAS OF RESPONSIBILITY

The operational evaluation effort will require the participation of a number of different NAFEC and outside organizations. The varied activities that will be undertaken make it imperative that close and continuous coordination be maintained throughout the test effort. The following is an outline of the test participants and support personnel, including their respective areas of responsibility. The organizational assignments are shown in Table 8-1.

(1) Test Manager

The test manager is responsible for the overall execution of the test effort; scheduling the various activities as described herein; assigning specific tasks to the test participants; scheduling NAFEC resources; and maintaining the proper coordination between the test personnel as well as any other NAFEC and outside organizations (e.g., the Eastern Region for coordinating the live flight tests).

(2) Test Analysts

Three test analysts will be required to perform the following functions:

- Develop, update and checkout test scenarios
- Develop and update test procedures
- Develop and checkout data reduction tools
- Prepare questionnaires and log forms
- Verify that the total system and the various components are ready prior to the actual tests with controllers
- Develop and present agenda and information items for the controller orientation sessions, pre-test briefings, and debriefing sessions
- Perform data analyses of the test results
- Write mission reports and overall test reports

In Phase II, the analysts' job will include--in addition to the above--an analytical evaluation of the effect of DABS/ATC on separation minima and ATC procedures, and a compilation of operationally-relevant data derived from previous technical tests, as discussed in Section 5.2.2.2.

TABLE 8-1

ORGANIZATIONAL ASSIGNMENTS

	ANA 100A	ANA 210	ANA 520	ANA 240	ANA 640	ANA 750	MITRE	UNIVAC	TEXAS INST.
1. Test Manager	●								
2. Test Analysts	●						●		
3. Test Controllers		●							
4. Test Observers	●	●							
5. Pilots					●				
6. ATCSF Support				●					
7. Technical Support								●	●
8. Photographic Support			●						
9. Display Error Measurements						●			

(3) Test Controllers

The test controllers will provide an evaluation of the radar display characteristics from an operational point-of-view. In addition to filling out the questionnaires and debriefing forms, the controllers will be encouraged to offer any comments, opinions and observations with regard to the merits and demerits of the new DABS/ATC system in general and the five basic system configurations in particular.

During the ATCSF tests, the controllers will assume a more active role--albeit in a simulation exercise--in actually controlling aircraft in simulated Philadelphia Airport environment.

(4) Test Observers

The test observers will assist the controllers by recording any pertinent information observed during the test on the observer log sheet. The observers will also participate in the debriefing sessions and provide their evaluations of the system.

(5) Pilots

The pilots will fly the aircraft in the live-flight tests according to prescribed flight paths. The pilots will be in radio contact with a controller in the TATF to coordinate any deviations from the flight plans or special actions needed for the test (e.g., transponder turn off, ident, etc.)

(6) ATCSF Resources

Support from ATCSF personnel will be needed before and during the tests. Before the tests, the ATCSF software needs to be developed and checked out to insure that the ARTS III and Video Reconstitutor systems receive the proper signals from the ATCSF, and that the full system (i.e., ARTS III/ATCSF/Video Reconstitutor) and the various interfaces operate reliably. During the tests, ATCSF support will be needed in providing the simulated pilots to communicate with the controllers and effect the maneuvers of the simulated aircraft.

(7) Technical Support

To insure the smooth execution of the tests, the ARTS III and DABS contractors (i.e., UNIVAC and Texas Instruments) will be requested to provide technical support as necessary. This support may include monitoring the equipment during the tests, performing data collection and reduction, and verifying that the system is ready for testing in preparation for each mission.

(8) Photographic Support

Coordination with NAFEC's photographic section will be required for allocating the necessary personnel and equipment.

(9) Display Error Measurements

In phase II of the operational evaluation effort, special test instrumentation and data reduction resources will be required to accomplish the measurement of the display errors (i.e., true vs. displayed information) as described in Section 6.2.

This activity will involve the use of specialized test equipment (e.g., Telereadex) and some data reduction packages associated with this equipment. Coordination will be required with the appropriate NAFEC organization in charge of such facilities.

Optionally, depending on the available resources, NAFEC's NIKE-Hercules equipment may be used to provide the positional accuracy of the DABS/ATC system (see Section 6.2).

9. SCHEDULES

This section provides tentative schedules for accomplishing the Phase I and II test activities. The major planning consideration governing the schedules is the need to obtain meaningful results prior to the issuance of the DABS TDP, scheduled for April 1980. Since some questions exist relative to the readiness of the various subsystems required to test the five DABS/ATC system configurations, three contingency plans were developed to account for different levels of subsystem availability prior to 4/80. Another major consideration is the need to insure the completion of all technical tests and shakedowns before the system is ready to be presented and used by controllers for operational evaluation. Finally, the schedule for Phase I overlaps the time period allotted for the relocation of NAFEC's technical facilities to the new technical and administrative complex, with a possible impact on the desired schedule.

9.1 Phase I

As discussed in Section 5.1.4, the Phase I activities are dependent on the availability of five system configurations. Three contingencies exist:

Contingency I: All subsystems ready before March 1980. A minimum of 16 missions will be required.

Contingency II: Only the Video Delay Generator and the Video Reconstitutor are ready before March 1980. A minimum of 8 missions will be required.

Contingency III: The MTD, the Video Delay Generator, and the Video Reconstitutor are ready before March 1980. A minimum of 12 missions will be required.

The schedules are shown in Figures 9-1, 9-2 and 9-3, respectively.

9.2 Phase II

The schedule for Phase II of the DABS/ATC operational evaluation effort is illustrated in Figure 9-4. Phase II is divided into two parts: (1) Tests with field controllers, and (2) Analytic evaluation. The tests with field controllers can start as soon as the five system configurations are ready for operational testing. A minimum of 16 missions will be run, extending over a period of two weeks. As an option, a second controller team will be invited, in order to provide more evaluation data. Subsequently, an analysis of the test results will be conducted.

The operational evaluation effort will be accomplished in parallel with the field-controllers tests. A final report will be issued summarizing the findings of both parts of the activity.

FIGURE 9-1
CONTINGENCY PLAN I

ASSUMPTION : ALL SUBSYSTEMS READY BEFORE MARCH 1980

1. PRE-TEST ACTIVITIES
   - Write Test Procedures
   - Testbed Shakedown
   - Develop DR&A Tools
   - Develop/Test ATCSF and ARIES Scenarios
   - Prepare Questionnaires
   - Develop New SW

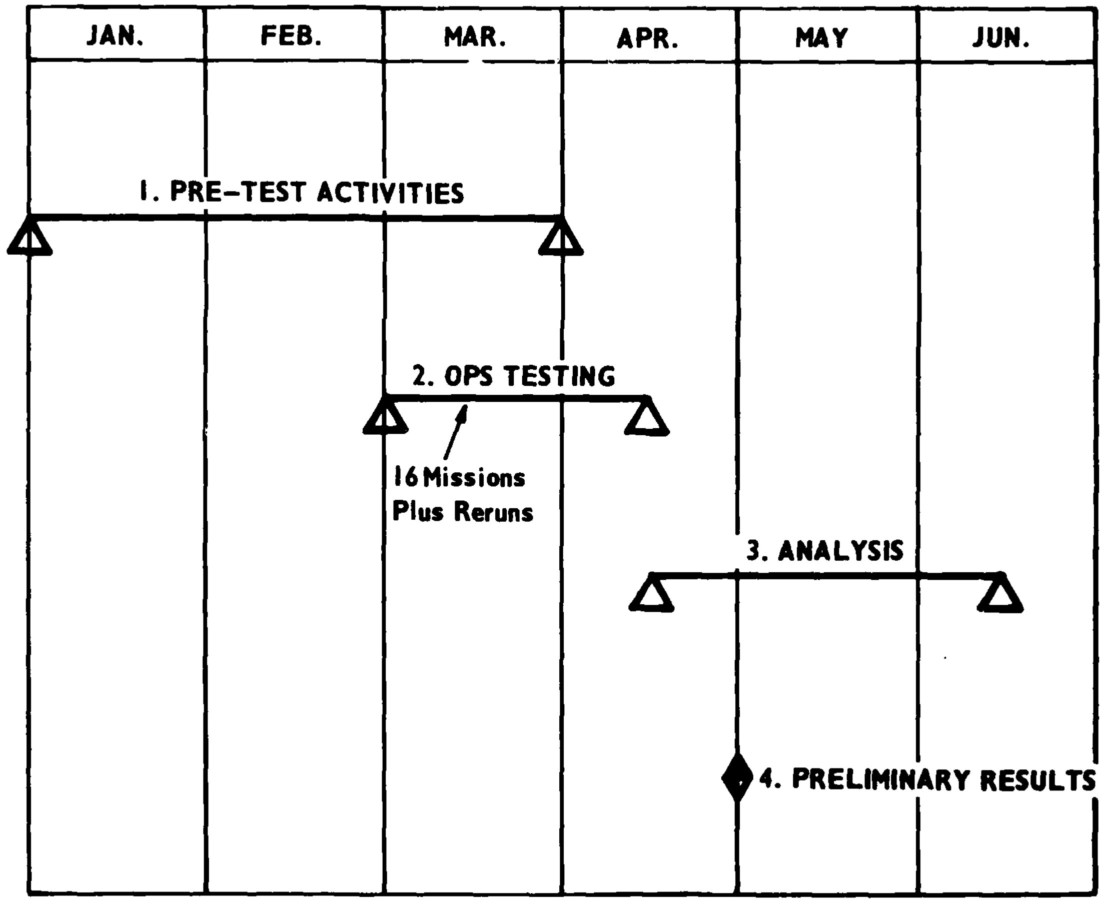


FIGURE 9-2

CONTINGENCY PLAN II

ASSUMPTION: ONLY THE VIDEO DELAY GENERATOR AND THE VIDEO RECONSTITUTOR ARE READY BEFORE MARCH 1980

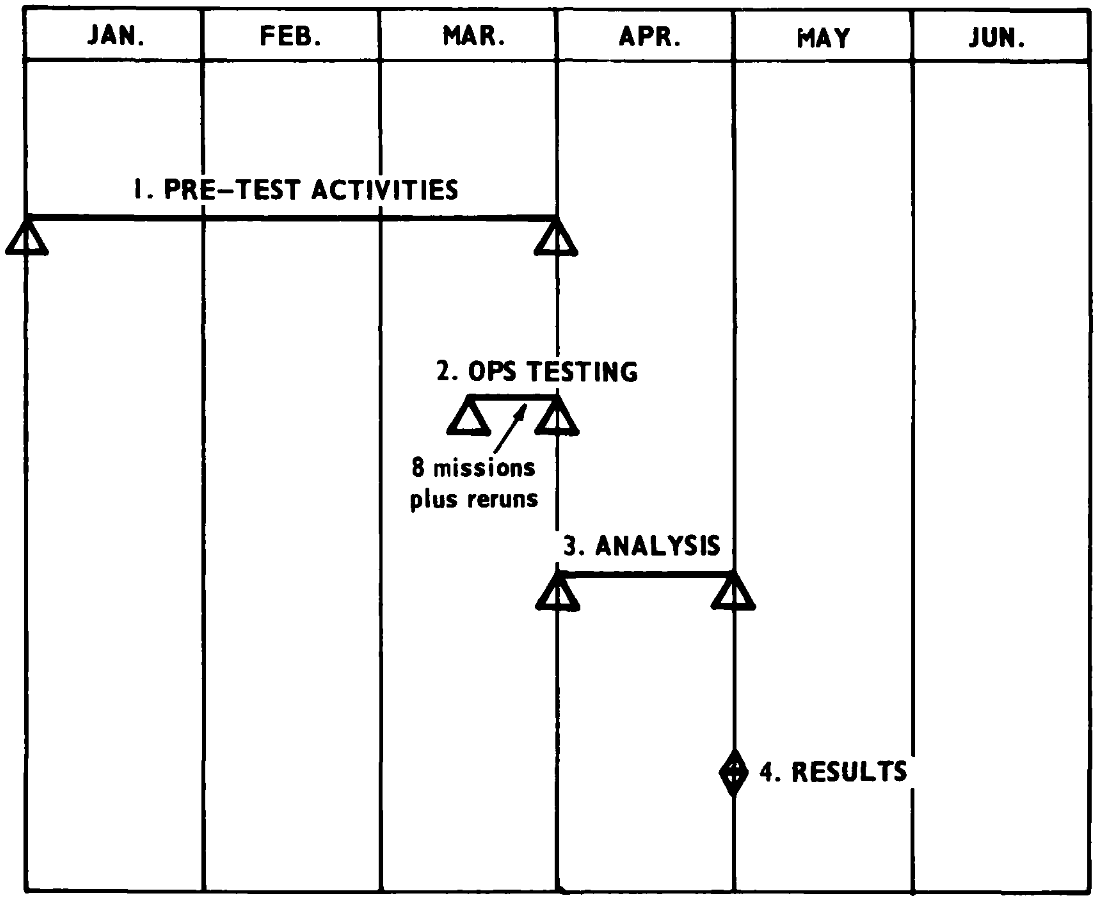


FIGURE 9-3

CONTINGENCY PLAN III

ASSUMPTION : THE MTD, VIDEO DELAY GENERATOR, AND VIDEO RECONSTITUTOR ARE READY BEFORE MARCH 1980

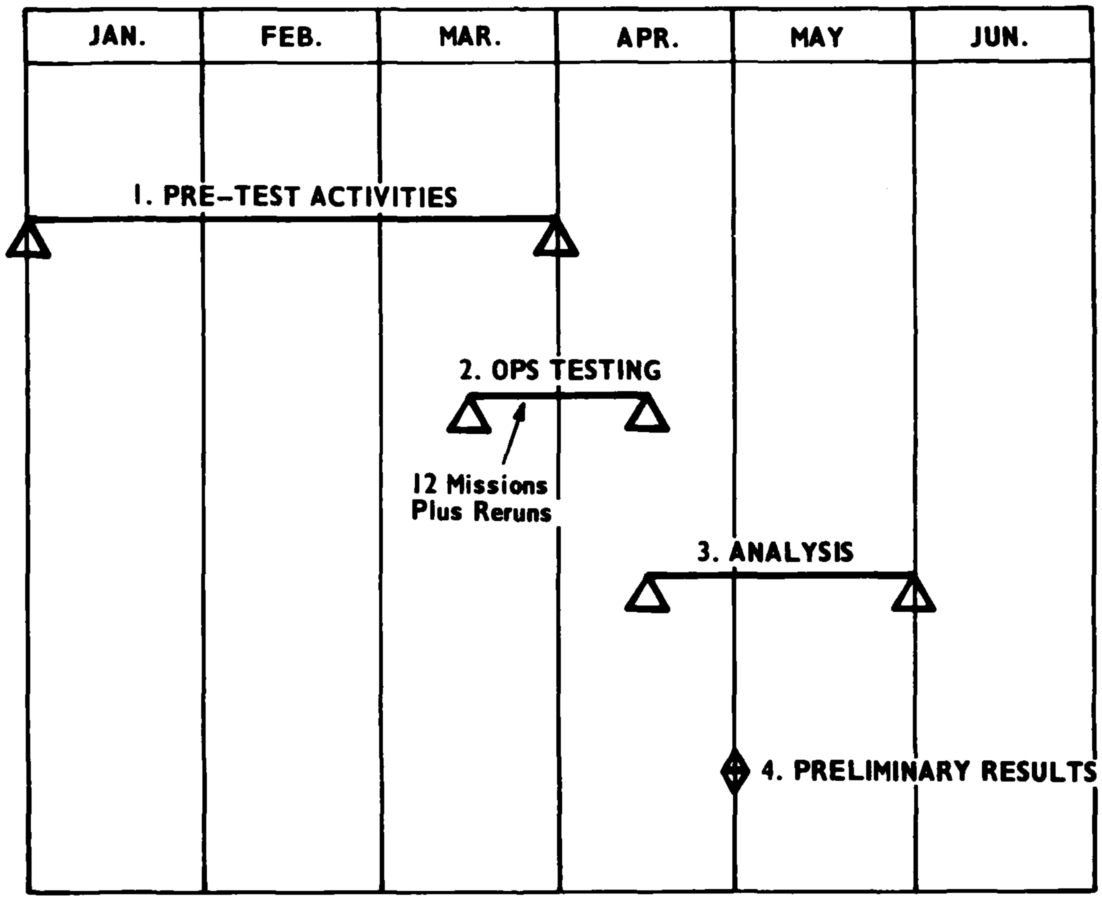
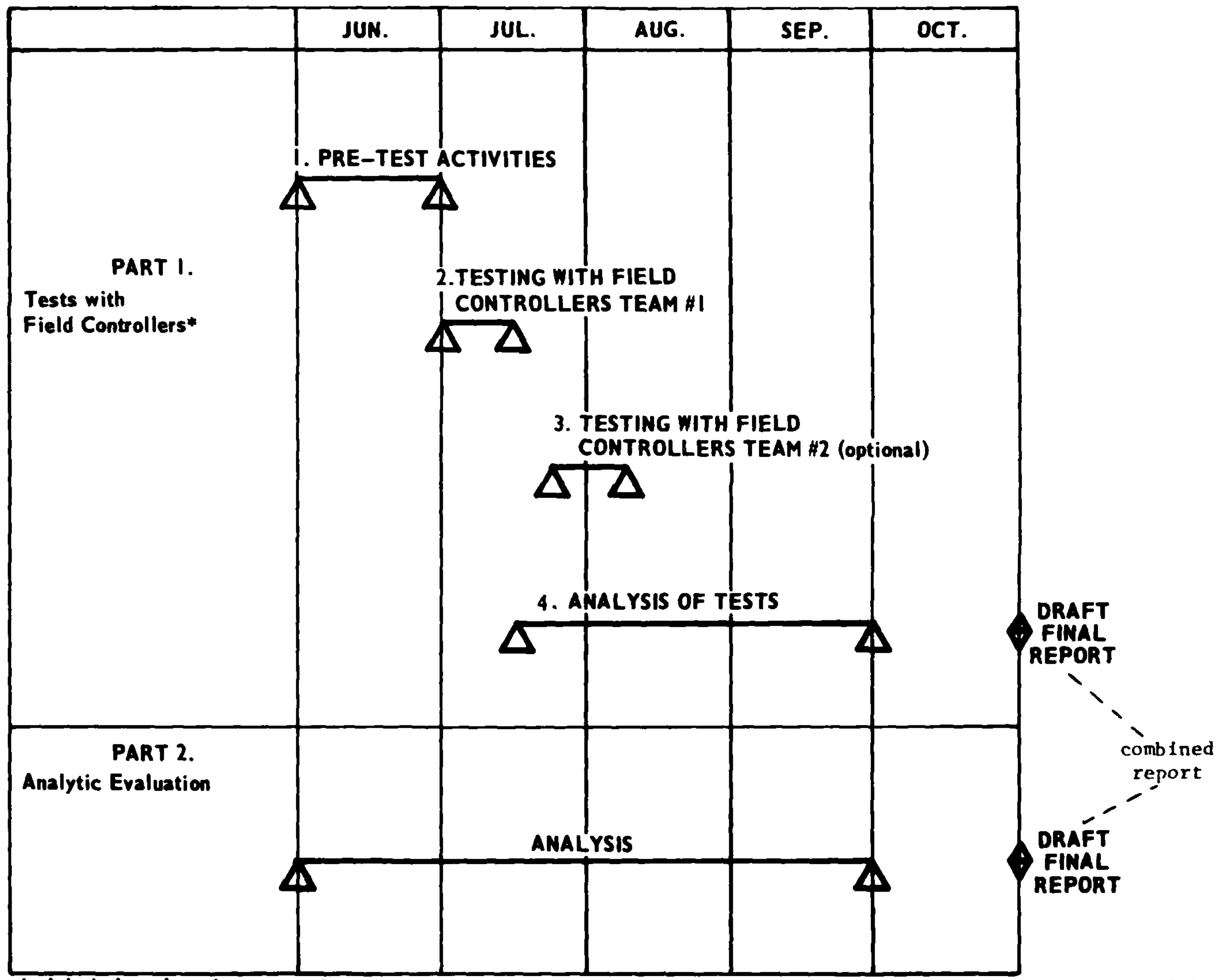


FIGURE 9-4

SCHEDULE FOR PHASE II



*This schedule is based on the assumption that the five system configurations are available for operational testing before July 1980. If this is not the case, the schedule will be modified accordingly.

APPENDIX A
ARIES TEST SCENARIO

AIRCRAFT ID	DEPARTURES	ENROUTE	ARRIVALS		SPEED	ALTITUDE	BEACON EQUIP.	TIME			ATCRBS CODE	A/C TYPE	DABS CODE	AUTO START
UA123			3	2	250	45K	10	00	00	00	0411	B707	000411	1
N180RM		1			180	50U	6	00	02	00	3370	PA31	000206	1
NW681			1	1	250	45K	10	00	03	00	0501	B727	010581	1
UA124	1				250	60K	10	00	03	00	2010	B727	020204	1
AL22	4				200	60U	10	00	05	00	2011	B727	020210	1
N323EC		2			160	60K	6	00	06	00	1754	N265	000212	1
AA704			3	2	250	45U	10	00	06	00	1013	DC8	001013	1
N400NA	9				160	40K	6	00	07	00	2012	BE18	020214	1
ACM746	3				180	40U	6	00	08	00	2013	DHC6	020220	1
EA573			1	1	250	45U	10	00	09	00	0711	DC10	0107F1	1
TW235	1				250	60K	10	00	10	00	2014	B707	020224	1
N22WS		13			180	50U	6	00	11	00	3077	BE36	000216	1
RAN997	6				180	40U	6	00	12	00	2015	ND26	020230	1
RC411			3	2	250	45K	10	00	12	00	0406	DC9	000406	1
N330CC		19			180	60K	6	00	13	00	4350	C500	000222	1
TW17	2				250	60K	10	00	14	00	2016	B707	020234	1
N2274			1	1	250	45K	10	00	15	00	0322	LR24	00BBBB	1
EA596	1				250	60K	10	00	17	00	2017	B727	020240	1
N37221		3			180	60U	6	00	18	00	4266	C310	000226	1
TW247			3	2	250	45U	10	00	18	00	0405	B727	000405	1
N27AC	4				250	60U	10	00	20	00	2020	FFJ	020244	1
N9AT		1			240	50K	10	00	21	00	2755	LR25	000232	1
UA643			1	1	250	45K	10	00	21	00	0502	DC9	00CCCC	1
PL324	3				250	60K	10	00	23	00	2021	B727	020250	1
NR647K		13			200	50U	8	00	24	00	2742	C340	000236	1
EA579			3	2	250	45K	10	00	24	00	1130	DC9	001130	1
N710TK		19			160	60K	6	00	27	00	3354	BE90	000242	1
AA703			1	1	250	45U	10	00	27	00	0712	B707	01071F	1
NW780	1				250	80U	10	00	27	00	2022	B727	020205	1
N4466X		2			120	40U	4	00	30	00	4303	PA28	000246	1
NW785			3	2	250	45U	10	00	30	00	0402	B727	000402	1
AL131	1				250	60K	10	00	30	00	2023	DC9	020211	1
N4025W		3			120	60K	4	00	32	00	4362	PA28	000252	1
PC24			1	1	250	45K	10	00	33	00	0323	DC9	000000	1
UA7208	3				250	60K	10	00	34	00	2024	B727	020215	1
UA702			3	2	250	45U	10	00	36	00	1007	DC10	001007	1
N37223		13			180	50U	6	00	37	00	0306	C310	000323	1
NW536	4				250	40K	10	00	37	00	2025	B727	020221	1
EA560			1	1	250	45U	10	00	39	00	0503	B727	010503	1
N766WC		14			160	50K	6	00	40	00	0522	AC50	000327	1
N81RT	3				190	40U	6	00	40	00	2026	C310	020225	1
RC405			3	2	250	45K	10	00	42	00	1123	DC9	001123	1
N3AD		3			190	60U	6	00	43	00	4366	BE58	000333	1
BN344	1				230	60K	10	00	43	00	2027	B727	020231	1
NW75			1	1	250	45K	10	00	45	00	0713	DC8	00FFFE	1
N82210		1			180	50K	6	00	46	00	4305	PAYE	000337	1
AA351	3				250	40K	10	00	47	00	2030	B727	020235	1
AA707			3	2	250	45K	10	00	48	00	1016	B727	001016	1
N7383F		19			180	60U	6	00	50	00	4344	C402	000343	1
EA611	9				250	60U	10	00	50	00	2031	B727	020241	1
UA142			1	1	250	45K	10	00	51	00	0324	DC10	00FFFF	1
TW843			3	2	250	45U	10	00	54	00	1001	DC8	001001	1

DABS OPERATIONAL TEST

ARIES SAMPLE

DL827	1				250	60K	10	00	54	00	2032	DC9	020245	1
N161SA		2			180	40K	6	00	55	00	3464	PA31	000347	1
RC600			1	1	250	45U	10	00	57	00	0504	DC9	010504	1
AL258	8				250	60U	10	00	57	00	2033	DC9	020251	1
N8153R		13			160	50U	6	00	58	00	5564	BE55	000353	1
N722W		3			180	60K	8	01	00	00	7354	C310	000357	1
NW15			3	2	250	45K	10	01	00	00	1012	B707	001012	1
N50X	4				170	40U	6	01	00	00	2034	BE23	020255	1
N481T			1	1	250	45K	10	01	03	00	0714	LR24	00AAAA	1
N6526B		1			160	50U	6	01	04	00	3430	C210	000365	1
N1575	1				140	60K	4	01	04	00	2035	C130	020261	1
N333X			3	2	250	45K	10	01	06	00	0420	LR24	000420	1
AL395	4				210	60K	8	01	06	00	2036	PA11	020265	1
N235		19			160	60K	6	01	09	00	5325	PA23	000367	1
UA501			1	1	250	45U	10	01	09	00	0324	B727	010324	1
AA237	1				250	80U	10	01	10	00	2037	B727	020271	1
EA722			3	2	250	45U	10	01	12	00	1144	DC9	001144	1
N2761M		14			180	50U	8	01	13	00	5373	C310	000373	1
EA847	3				250	60K	10	01	13	00	2040	B727	020275	1
TW11			1	1	250	45K	10	01	15	00	0505	DC10	00FPCD	1
N90F		2			160	60K	6	01	17	00	2766	PASE	000377	1
EA123	9				250	60U	10	01	17	00	2041	B727	020301	1
UA711			3	2	250	45K	10	01	18	00	1134	DC10	001134	1
N26S	8				250	80U	9	01	20	00	2042	L329	020305	1
N732HF		13			160	50U	6	01	21	00	5362	C210	000403	1
NW62			1	1	250	45U	10	01	21	00	0715	B707	010715	1
AA342			3	2	250	45U	10	01	24	00	0410	B727	000410	1
RAN970	3				200	60K	8	01	24	00	2043	NM26	020311	1
N2093A		3			140	60K	4	01	25	00	4263	PA28	000407	1
EA647			1	1	250	45K	10	01	27	00	0325	DC8	00BCFD	1
N972TF	1				250	60K	10	01	27	00	2044	AC21	020315	1
N55ES		1			180	50U	8	01	29	00	1654	C310	000413	1
RC471			3	2	250	45K	10	01	30	00	0441	DC9	000441	1
UA91	9				250	80U	10	01	31	00	2045	B727	020321	1
N115K		19			180	60K	6	01	33	00	4022	C500	000417	1
AA12			1	1	250	45K	10	01	33	00	0506	DC10	0012BC	1
N759WW	4				160	80U	6	01	35	00	2046	C182	020325	1
TW68			3	2	250	45U	10	01	36	00	0431	B727	000431	1
N743UG		14			180	50U	8	01	37	00	6662	G159	000423	1
NW782	3				250	120K	10	01	38	00	2047	B727	020331	1
UA144			1	1	250	45U	10	01	39	00	0716	DC8	0007AD	1
N7144N		2			160	60U	6	01	40	00	2734	BE35	000427	1
N77PPW			3	2	250	45K	10	01	42	00	0436	LR24	000436	1
AL416	5				230	80U	9	01	42	00	2050	BA11	020335	1
NR6AT		13			180	50U	6	01	43	00	2003	BE90	000433	1
N47			1	1	250	45K	10	01	45	00	0326	LR24	000326	1
N1841D		3			160	60K	6	01	46	00	4262	G2	000437	1
AL114	6				250	80K	10	01	46	00	2051	DC9	020341	1
N37KC		1			160	50U	6	01	49	00	0310	C337	000324	1
EA963	9				250	100K	10	01	50	00	2052	L101	020345	1
N333KD		19			180	60K	8	01	52	00	4217	AC6T	000330	1
N27272		14			140	50U	4	01	55	00	3125	PA31	000334	1

APPENDIX B

ATCSF TEST SCENARIOS

SCENARIO #1 - HEAVY LOAD

See Pages B-2 to B-4

SCENARIO #2 - MEDIUM LOAD

This scenario will be a subset of Scenario #1.

AIRCRAFT ID	DEPARTURES	ENROUTE	ARRIVALS	SPEED	ALTITUDE	BEACON EQUIP.	TIME			ATCRBS CODE	A/C TYPE	DABS CODE	DABS VFR	AUTO START
UA123			3 2	250	100K	10	01	00	00	0411	B707	000411		1
N180RM		1		180	50U	6	01	02	00	3370	PA31			1
N1		1		180	45U	4	01	03	00	1200	PA28			1
NW681			1 1	250	100K	10	01	03	00	0501	B727	010561		1
UA124	1			250	20K	10	01	03	00	2010	B727	020204		1
N2761M		13		160	50	6	01	03	00		PA23			1
AL22	4			200	20U	10	01	05	00	2011	B727			1
N323EC		2		160	60K	6	01	05	00	1754	N265	000212		1
AA704			3 2	250	100U	10	01	06	00	1013	DC8			1
N4244C		1		180	45K	6	01	06	00	1200	C182	000440	1	1
N400NA	9			160	20K	5	01	07	00	2012	BE18	020214		1
N469		26		160	60	6	01	07	00		PA23			1
ACM746	3			180	20U	6	01	08	00	2013	DHC6			1
N854MA		13		180	35K	6	01	08	00	1200	C182	000434	1	1
EA573			1 1	250	100U	10	01	09	00	0711	DC10			1
N20A		29		160	60	5	01	10	00		PA23			1
TW235	1			250	20K	10	01	10	00	2014	B707	020224		1
N572		13		160	45U	6	01	10	00	1200	C182			1
N22WS		13		180	50U	6	01	11	00	3077	BE36			1
RA4997	6			180	20U	6	01	12	00	2015	ND26			1
RC411			3 2	250	100K	10	01	12	00	0406	DC9	000406		1
N330CC		19		180	60K	6	01	13	00	4350	C500	000222		1
TW17	2			250	20K	10	01	14	00	2016	B707	020234		1
N93A		19		160	50	6	01	14	00		PA23			1
N2274			1 1	250	100K	10	01	15	00	0322	LR24	008888		1
N573		1		160	55U	6	01	15	00	1200	C182			1
EA596	1			250	20K	10	01	17	00	2017	B727	020240		1
N37221		3		180	60U	6	01	18	00	4266	C310	000226		1
TW247			3 2	250	100U	10	01	18	00	0405	B727			1
N31926		27		160	60	5	01	18	00		PA23			1
N27AC	4			250	20U	10	01	20	00	2020	FFJ			1
N9AT		1		240	50K	10	01	21	00	2755	LR25	000232		1
UA643			1 1	250	100K	10	01	21	00	0502	DC9	00CCCC		1
N2605R		14		160	50	6	01	21	00		PA23			1
N574		26		160	65U	6	01	22	00	1200	C182			1
DL324	3			250	20K	10	01	23	00	2021	B727	020250		1
N8647K		13		200	50U	8	01	24	00	2742	C340			1
EA579			3 2	250	100K	10	01	24	00	1130	DC9	001130		1
N115K		26		180	45K	6	01	25	00	1200	C182	000430	1	1
N710TK		19		160	60K	6	01	27	00	3354	BE90	000242		1
AA703			1 1	250	100U	10	01	27	00	0712	B707			1
NW780	1			250	20U	10	01	27	00	2022	B727			1
N575		29		160	75U	6	01	29	00	1200	C182			1
N4466X		2		120	40U	4	01	30	00	4303	PA28			1
AL131	1			250	20K	10	01	30	00	2023	DC9	020211		1
NW785			3 2	250	100U	10	01	30	00	0402	B727			1
N389		13		160	50	6	01	30	00		PA23			1
N4025W		3		120	60K	4	01	32	00	4362	PA28	000252		1
RC24			1 1	250	100K	10	01	33	00	0323	DC9	000000		1
UA7208	3			250	20K	10	01	34	00	2024	B727	020215		1
N759WW		28		160	60	6	01	35	00		PA23			1
UA702			3 2	250	100U	10	01	36	00	1007	DC10			1
N37223		13		180	50U	6	01	37	00	0306	C310			1

DABS OPERATIONAL

TEST

ATCSF

HEAVY SAMPLE

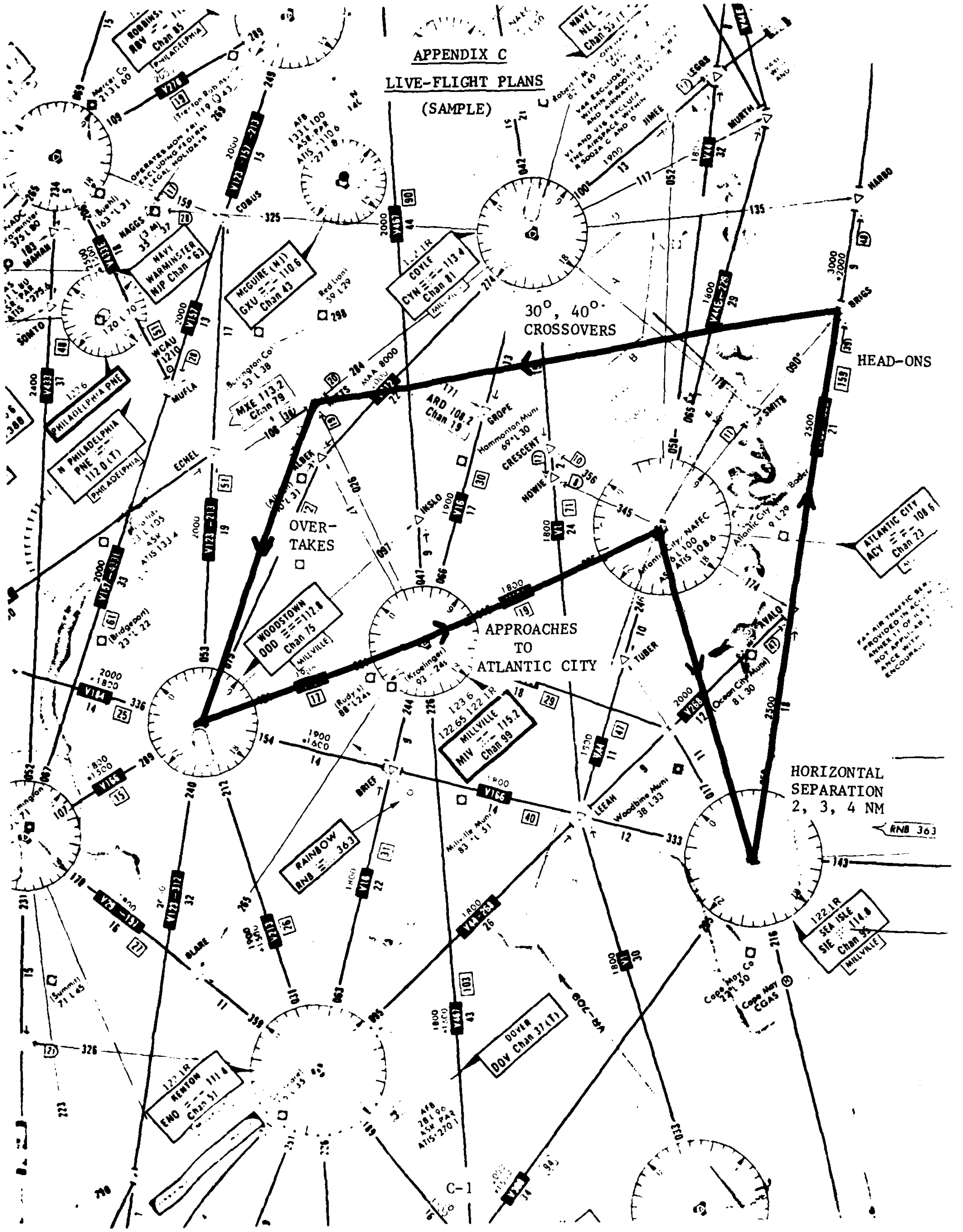
NW536	4				250	20K	10	01	37	00	2025	B727	020221		1
N576		28			160	45U	6	01	38	00	1200	C182			1
EA560			1	1	250	100U	10	01	39	00	0503	B727			1
N766WC		14			160	50K	6	01	40	00	0522	AC50	000327		1
N81RT	3				190	20U	6	01	40	00	2026	C310			1
N9044V		13			160	50	6	01	40	00		PA23			1
N20S3K		29			180	55K	6	01	40	00	1200	BE58	000414	1	1
RC405			3	2	250	100K	10	01	42	00	1123	DC9	001123		1
N3AD		3			190	60U	6	01	43	00	4366	BE58			1
RN344	1				230	20K	10	01	43	00	2027	B727	020231		
NW75			1	1	250	100K	10	01	45	00	0713	DC8	00EEEE		1
N46A		26			160	60	6	01	45	00		PA23			1
N577		19			160	65U	6	01	45	00	1200	C182			1
N82210		1			180	50K	6	01	46	00	4305	PAYE	000337		1
AA351	3				250	20K	10	01	47	00	2030	B727	020235		1
AA707			3	2	250	100K	10	01	48	00	1016	B727	001016		1
N7R83F		19			180	60U	6	01	50	00	4344	C402			1
EA611	9				250	20U	10	01	50	00	2031	B727			1
UA142			1	1	250	100K	10	01	51	00	0324	DC10	00FFFF		1
TW843			3	2	250	100U	10	01	54	00	1001	DC8			1
DL827	1				250	20K	10	01	54	00	2032	DC9	020245		1
N161SA		2			180	40K	6	01	55	00	3464	PA31	000347		1
N427		19			160	50	6	01	56	00		PA23			1
N364		2			160	45K	6	01	56	00	1200	PA28	000433	1	1
N578		2			160	55U	6	01	56	00	1200	C182			1
AL258	8				250	20U	10	01	57	00	2033	DC9			1
RC600			1	1	250	100U	10	01	57	00	0504	DC9			1
N8153R		13			160	50U	6	01	58	00	5564	BE55			1
N722W		3			180	60K	8	02	00	00	7354	C310	000357		1
N50X	4				170	20U	6	02	00	00	2034	BE23			1
NW15			3	2	250	100K	10	02	00	00	1012	B707	001012		1
N978		29			160	60	6	02	02	00		PA23			1
N481T			1	1	250	100K	10	02	03	00	0714	LR24	00AAAA		1
N6526P		1			160	50U	6	02	04	00	3430	C210			1
N1575	1				140	20K	4	02	04	00	2035	C130	020261		1
AL395	4				210	20K	8	02	06	00	2036	BA11	020265		1
N333X			3	2	250	100K	10	02	06	00	0420	LR24	000420		1
N235		19			160	60K	6	02	09	00	5325	PA23	000367		1
UA501			1	1	250	100U	10	02	09	00	0324	B727			1
N411		19			180	50	6	02	10	00		PA23			1
AA237	1				250	20U	10	02	10	00	2037	B727			1
N579		1			160	35U	6	02	10	00	1200	C182			1
EA722			3	2	250	100U	10	02	12	00	1144	DC9			1
N2761M		14			180	50U	8	02	13	00	5373	C310			1
EA847	3				250	20K	10	02	13	00	2040	B727	020275		1
TW11			1	1	250	100K	10	02	15	00	0505	DC10	00FBCD		1
N412		13			180	50	6	02	16	00		PA23			1
N90F		2			160	60K	6	02	17	00	2766	PASF	000377		1
EA123	9				250	20U	10	02	17	00	2041	B727			1
UA711			3	2	250	100K	10	02	18	00	1134	DC10	001134		1
N265	8				250	20U	9	02	20	00	2042	L329			1
N413		28			180	50	6	02	20	00		PA23			1
N34E		1			180	55K	6	02	20	00	1200	C182	000410	1	1

N732NF		13			160	50U	6	02	21	00	3362	C210			1
NW62			1	1	250	100U	10	02	21	00	0715	B707			1
N580		28			160	45U	6	02	22	00	1200	C182			1
AA342			3	2	250	100U	10	02	24	00	0410	B727			1
RAN970	3				200	20K	9	02	24	00	2043	ND26	020311		1
N2093A		3			140	60K	4	02	25	00	4263	PA28	000407		1
N972TF	1				250	20K	10	02	27	00	2044	AC21	020315		1
EA647			1	1	250	100K	10	02	27	00	0325	DC8	00BCFD		1
N414		2			180	50	6	02	28	00		PA23			1
N581		19			160	35U	6	02	28	00	1200	C182			1
N55ES		1			180	50U	8	02	29	00	1654	C310			1
RC471			3	2	250	100K	10	02	30	00	0441	DC9	000441		1
UA91	9				250	20U	10	02	31	00	2045	B727			1
N898SR		28			180	45K	6	02	31	00	1200	C182	000427	1	1
N115K		19			180	60K	6	02	33	00	4022	C500	000417		1
AA12			1	1	250	100K	10	02	33	00	0506	DC10	00128C		1
N415		1			180	50	6	02	33	00		PA23			1
N582		14			160	45U	6	02	33	00	1200	C182			1
N759WW	4				160	20U	6	02	35	00	2046	C182			1
TW68			3	2	250	100U	10	02	36	00	0431	B727			1
N743UG		14			180	50U	8	02	37	00	6662	G159			1
NW782	3				250	20K	10	02	38	00	2047	B727	020331		1
UA144			1	1	250	100U	10	02	39	00	0716	DC8			1
N416		14			180	50	6	02	39	00		PA23			1
N7144N		2			160	60U	6	02	40	00	2734	BE35			1
N31WR		29			180	35K	6	02	40	00	1200	BE58	000423	1	1
N583		13			160	65U	6	02	40	00	1200	C182			1
AL416	5				230	20U	9	02	42	00	2050	PA11			1
N778PW			3	2	250	100K	10	02	42	00	0436	LR24	000436		1
N86AT		13			180	50U	6	02	43	00	2003	BE90			1
N584		2			160	45U	6	02	43	00	1200	C182			1
N47			1	1	250	100K	10	02	45	00	0326	LR24	000326		1
N417		27			180	50	6	02	45	00		PA23			1
N585		26			160	55U	6	02	45	00	1200	C182			1
N18410		3			160	60K	6	02	46	00	4262	G2	000437		1
AL114	6				250	20K	10	02	46	00	2051	DC9	020341		1
N37KC		1			160	50U	6	02	49	00	0310	C337			1
EA963	9				250	20K	10	02	50	00	2052	L101	020345		1
N418		28			180	50	6	02	50	00		PA23			1
N586		28			160	65U	6	02	50	00	1200	C182			1
N333KD		19			180	60K	8	02	52	00	4217	AC6T	000330		1
N419		26			180	50	6	02	53	00		PA23			1
N27272		14			140	50U	4	02	55	00	3125	PA31			1
N420		14			180	50	6	02	55	00		PA23			1

APPENDIX C

LIVE-FLIGHT PLANS

(SAMPLE)



APPENDIX D

CONTROLLER QUESTIONNAIRE FORM

DATE:

MISSION START TIME: END TIME:

MISSION DESCRIPTION:

WEATHER:

CONTROLLER:

OBSERVER:

DISPLAY POSITION:

CONTROLLER EVALUATION OF TARGET SYMBOL

		ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS(*)
		GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
ASSOCIATED TRACKS								
DABS								
ATCRBS								
SEARCH								
UNASSOCIATED TRACKS								
DABS	○							
MODE C NON-SELECTED	*							
NON-MODE C NON-SELECTED	+							
MODE C SELECTED	□							
NON-MODE C SELECTED	△							
SEARCH	/							
UNTRACKED TARGETS								
F/D ONLY	.							

GENERAL

OVERALL QUALITY OF TARGET SYMBOL DISPLAY

SHOULD ANY SYMBOLS BE CHANGED?

ARE SYMBOLS EASILY DISTINGUISHABLE?

REMARKS:(*)

(*) Attach additional sheets if more space is needed.

CONTROLLER EVALUATION OF DISPLAYED DATA BLOCK

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
FULL DATA BLOCK (Associated Tracks)							
DABS							
ATCRBS							
SEARCH							
LIMITED DATA BLOCK (Unassociated Tracks)							
DABS							
ATCRBS							
SEARCH							
PARTIAL DATA BLOCK (Associated Tracks Within Filter Limits)							
DABS							
ATCRBS							
SEARCH							

GENERAL

OVERALL QUALITY OF DATA BLOCK INFORMATION

SHOULD ANY FIELD BE CHANGED?

SHOULD ANY FIELD BE DELETED?

SHOULD ANY FIELD BE ADDED?

REMARKS:

CONTROLLER EVALUATION OF TABULAR LISTS

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
COAST STATUS							
DABS							
ATCRBS							
SEARCH							
SUSPEND STATUS							
DABS							
ATCRBS							
SEARCH							
ARRIVAL STATUS							
DABS							
ATCRBS							
SEARCH							
DEPARTURE STATUS							
DABS							
ATCRBS							
SEARCH							

GENERAL

OVERALL QUALITY OF TABULAR LISTS

SHOULD ANY LIST INFORMATION BE CHANGED?

REMARKS:

CONTROLLER EVALUATION OF AUTOMATIC OFFSET AND JITTER

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

AUTOMATIC OFFSET

ASSESS GENERAL QUALITY OF AUTO OFFSET

NOTE ANY INSTANCES OF AUTO OFFSET PROBLEMS

JITTER

NOTE IF ANY NOTICEABLE OR DISTRACTING DISPLAY JITTER (I.E., TARGET POSITION OR OTHER) HAS OCCURRED

REMARKS:

CONTROLLER EVALUATION OF HISTORY TRAIL AND PREDICTED POSITION

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
HISTORY TRAIL							
DABS							
ATCRBS							
SEARCH							
PREDICTED POSITION							
DABS							
ATCRBS							
SEARCH							

GENERAL

OVERALL QUALITY OF HISTORY TRAILS?

SHOULD THE HISTORY TRAIL BE CHANGED IN ANY WAY?

OVERALL QUALITY OF THE PREDICTED POSITION DISPLAY?

USEFULNESS OF THE PREDICTED POSITION?

REMARKS:

CONTROLLER EVALUATION OF MAP, RANGE MARKS, AND WEATHER DISPLAY

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
MAP DISPLAY							
RANGE MARKS							
WEATHER DISPLAY							

REMARKS:

CONTROLLER EVALUATION OF GENERAL F/D DISPLAY QUALITY

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
GENERAL F/D DISPLAY QUALITY:							
CLARITY							
BRIGHTNESS							
RESOLUTION							
LACK OF RADAR SWEEP							
RADAR CLUTTER							
SPI							

OTHER (ADD):

REMARKS:

CONTROLLER EVALUATION OF VIDEO DISPLAY (RAW AND RECONSTITUTED)

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
VIDEO DISPLAY							
SIZE							
DABS							
ATCRBS							
SEARCH							
STRENGTH							
DABS							
ATCRBS							
SEARCH							
CLUTTER							

GENERAL

OVERALL QUALITY OF VIDEO DISPLAY

SHOULD ANY VIDEO DISPLAY CHARACTERISTIC BE CHANGED?

ADDED?

ELIMINATED?

REMARKS:

CONTROLLER EVALUATION OF KEYBOARD ENTRIES

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
KEYBOARD ENTRIES:							
METHOD OF IDENTIFYING DABS TRACKS							
RESPONSE TIME							
FREQUENCY OF USE							
EFFECT ON CONTROLLER WORKLOAD							

GENERAL

OVERALL QUALITY OF KEYBOARD ENTRIES

SHOULD ANY ENTRIES BE CHANGED?

ADDED?

DELETED?

REMARKS:

CONTROLLER EVALUATION OF THE EFFECT ON ATC PROCEDURES

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
PROCEDURES							
HANDLING OF HANDOFFS							
BEACON CODE CHANGES							
ENTRY OF DABS ADDRESS IN FLIGHT PLAN							
IDENT REQUESTS							

GENERAL

ASSESS THE EFFECT OF DABS/ ATC ON TERMINAL PROCEDURES

REMARKS:

CONTROLLER EVALUATION OF EFFECT ON SEPARATION REQUIREMENTS

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
SEPARATION:							
ABILITY TO DISTINGUISH TARGETS (RESOLUTION)							
ABILITY TO IDENTIFY TARGETS							
ABILITY TO MAINTAIN SEPARATION STANDARDS							

GENERAL:

OVERALL SEPARATION ABILITY WITH DABS

ANY FACTORS WHICH MAY REQUIRE EXTRA SEPARATION?

WHAT IS THE POTENTIAL FOR REDUCING THE SEPARATION STANDARDS?

REMARKS:

CONTROLLER EVALUATION OF SURVEILLANCE QUALITY

	ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
	GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	
SURVEILLANCE QUALITY							
FREQUENCY OF SPLIT TARGETS							
FREQUENCY OF FALSE TARGETS							
FREQUENCY OF LOST TARGETS							
BEACON/RADAR REGISTRATION							
FREQUENCY OF TRACK COASTS							
FREQUENCY OF TRACK DROPS							
TRACK INITIATION							

GENERAL:

GIVE AN OVERALL ASSESSMENT OF THE SURVEILLANCE QUALITY

LIST ANY SURVEILLANCE PROBLEMS YOU OBSERVED

REMARKS:

APPENDIX E

DEBRIEFING FORM

DATE:

MISSION START TIME: END TIME:

MISSION DESCRIPTION:

WEATHER:

EVALUATOR:

FUNCTION (Controller, Observer, or Other):

DISPLAY POSITION:

On a scale of 1 to 5, rate DABS/ATC performance as compared with today's ARTS III system:

5	4	3	2	1
Much improved over ARTS III		Similar to ARTS III		Worse than ARTS III

EVALUATION AREA	RATE	Describe(*) Improvements (if any) Over ARTS III	Describe (*) Deficiencies If Any as Compared with ARTS III	Comments(*)
DISPLAYS				
TARGET POSITION				
DATA BLOCKS				
WEATHER				
MAP				
TABULAR LISTS				
GENERAL DISPLAY QUALITY				
OTHER				

(*) Attach additional sheets if more space is needed.

EVALUATION AREA	Rate	Describe Improvements (if any) Over ARTS III	Describe Deficiencies If Any as Compared with ARTS III	Comments
SURVEILLANCE				
DETECTION				
TARGET DETECTION				
FALSE TARGETS				
MISSING TARGETS				
OTHER				
ACCURACY				
POSITION ACCURACY (if noted)				
SEPARATION ACCURACY (if noted)				
WEATHER ACCURACY (if noted)				
OTHER				
TRACKING				
COASTS				
TRACK DROPS				
TRACK INITIATION				
CONTROLLER WORKLOAD				
(1) VOICE COMMUNICATIONS				
(2) KEYBOARD ENTRIES				
(3) OTHERS				

QUESTIONS

1. Was the mission suitable for evaluating the operational implications of DABS/ATC?

   Please explain:

2. In your opinion, can today's separation standards be maintained with DABS/ATC?

   Please explain:

3. Do you think that with the improved surveillance of DABS, a potential exists for reducing today's separation standards?

   Please explain:

4. Please state the improvements which DABS/ATC provides relative to today's ARTS III system?

5. Please state any problems or potential problems which exist, in your opinion, in the DABS/ATC system.

6. Do you foresee any potentially serious ATC problems and/or disadvantages which may develop should DABS/ATC (as configured in today's mission) be implemented in the field?

Please explain:

7. Does the DABS/ATC system increase, decrease, or make no difference relative to the workload of the ATC controller?

Please explain:

8. What new ATC procedures, if any, will be needed if DABS/ATC were implemented in the field?

9. To what degree do you feel would replacement of today's ARTS III system with DABS/ATC, as configured in today's mission, enhance the terminal ATC operations?

Please explain:

10. Do you have any additional comments on the adequacy of the DABS/ATC system?

11. Do you have any suggestions on what improvements should or could be made to DABS/ATC?

APPENDIX F

FIELD-CONTROLLER ORIENTATION AGENDA

1. Objectives of the operational evaluation
2. General description of DABS
3. Major differences between DABS and ARTS III
4. New display characteristics
5. New keyboard entries
6. Test vehicles: ARIES and ATCSF
7. Description of the operational evaluation missions
8. Philadelphia Airport environment and procedures
9. Review of questionnaires, debriefing forms, and log sheets
10. Major areas that are subject to operational evaluation
11. Demonstration of DABS/ATC equipment