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PRELIMINARY AIRSPACE AND TRAFFIC ADVISORY SERVICE (ATAS) FLIGHT TEST PLAN

by

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PRELIMINARY AIRSPACE AND TRAFFIC ADVISORY SERVICE (ATAS) FLIGHT TEST PLAN

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1. INTRODUCTION.

The Airspace and Traffic Advisory Service (ATAS) is a ground based system that receives surveillance data from the Mode S sensor and automatically develops and disseminates traffic advisories and advisories on violations of restricted airspace. The traffic advisory service (TAS) portion of ATAS uses the Mode S data link to send to an ATAS-equipped aircraft two types of advisories: proximity advisories on near-by aircraft and priority advisories on aircraft that are in potential conflict. The restricted airspace advisory (RAS) function of ATAS uses the data link to inform the pilot that he has violated a specific restricted use airspace (e.g., Terminal Control Area or Military Operation Area).

The preliminary ATAS (P-ATAS) has been developed to investigate and assess the TAS and RAS functions before the final ATAS system can be implemented. The P-ATAS acceptance tests being performed and reported on by the IOCS, Inc. and the P-ATAS performance tests (Reference 1) serve to validate the P-ATAS logic implementation through the use of various real-time simulations. The purpose of the flight tests is to complete the validation of the P-ATAS as a fully operational system.

2. TEST OBJECTIVES.

The objective of these tests is to demonstrate, through flight testing, that the P-ATAS was implemented according to the design (Reference 2). The specific objectives are to demonstrate that the P-ATAS properly develops and disseminates: (1) traffic advisories; and (2) restricted airspace advisories. These are explained as follows:

2.1 VALIDATION OF P-ATAS TRAFFIC ADVISORIES.

Flight patterns involving two or three aircraft will be used to validate the development and dissemination of traffic advisories. The emphasis is on the demonstration of proximity and priority advisories as well as proper transitions from one type of advisory to another. The P-ATAS system will be examined under the following four different intruder aircraft conditions: (The subject aircraft is always ATAS-equipped.)

a. The intruder has a Mode S transponder with altitude encoder (Mode S and Mode C).

b. The intruder has an ATCRBS transponder with altitude encoder (Mode 3/A and Mode C).

c. The intruder has an ATCRBS transponder without altitude encoder (Mode 3/A and non-Mode C). For this encounter only horizontal traffic situations will be examined.

d. Two or more intruders are involved at the same time.

2.2 VALIDATION OF RESTRICTED AIRSPACE ADVISORIES.

Two ATAS features related to restricted airspace advisories will be validated:

a. The development and dissemination of restricted airspace advisories will be demonstrated by flying an ATAS-equipped aircraft into and out of a designated restricted airspace.

b. The simultaneous development and dissemination of restricted airspace advisories and traffic advisories will be demonstrated by flying two or more aircraft in a proximity or priority advisory generating pattern inside a designated restricted airspace.

3. DATA COLLECTION AND ANALYSIS.

This section describes the data collection and analysis to be performed. The first subsection provides a summary of data collection procedures including data collection logs, flight logs, and equipment requirements. The second subsection explains the analysis to be performed. The third subsection includes the test matrix.

3.1 DATA COLLECTION.

The data to be analyzed and interpreted for these tests will entirely be collected by test flights. The data consists of data extraction tapes and test log sheets. The data extraction tapes are recorded at the Mode S site. The data of the test log sheets are collected both aboard the aircraft and at the Mode S site.

For these tests the Mode S load tape labeled "P-ATAS Demonstration" will be used. This tape differs from the "P-ATAS" load tapes only in the restricted airspace message contents. This message has been changed to be the data link text message "DELMR MOA." (Reference 3, page 6). This change was made because the airborne intelligent display (AID) will display data link text messages but has not been programmed to display RAS advisories. The display of this text message will make it possible to observe and confirm that RAS advisories are being disseminated.

The operation procedures of the Mode S sensor are as follows:

1. Load the tape "P-ATAS Demonstration" with the single-site option.

2. Read the proper data collection cassette for the desired data records.

3. Mount the 9-track magnetic tapes to record the test data.

4. Enter special instructions at the Mode S console:

   a. WS,2 (Enable ATAS data collection.)

   b. A2,888,1 (Extract time records.)

   c. WG,7,4000,2 (Change system parameter to make all Mode S aircraft ATAS-equipped.)

During a test run the test director and the flight engineer will keep records of operation. These records will include date, time, aircraft identification, data extraction tape number, and special conditions of the test. In addition the flight engineer will record the time and content of all special events (e.g., TAS or RAS advisory display). These data will be used to document the operation of the P-ATAS system and to confirm proper dissemination of advisories.

The development of TAS and RAS advisories is confirmed by examination of the data extraction tapes recorded during the tests. The following record types will be recorded on the data extraction tapes:

E017 - Proximity detect recording buffer.
E019 - RAS violation recording buffer.
E103, E105, E107 - Central track store.
E351 - Comm-A uplink message.
E427 - Surveillance report.

3.2 DATA ANALYSIS.

The data extraction tapes will be processed by the existing ATAS data reduction and analysis software (Reference 4) to produce encounter summaries and RAS text message records. These results will be examined with the flight logs to validate TAS and RAS of the P-ATAS.

3.3 TEST MATRIX.

The test matrix (Figure 1) describes all the planned test flight runs which can be completed in one flight.

Six test issues as described in Section 2 are to be investigated. Throughout the flight the subject aircraft is ATAS-equipped with Mode S transponder, but the equipage of the intruder aircraft varies with the test issues. Each single daisy flight pattern (Figure 2) with the intruder below or above the subject aircraft permits a maximum of six horizontal encounters. The vertical separation between the aircraft will be 1,500 ft. for demonstrating proximity advisories, and 400 ft. for priority advisories. The vertical flight pattern (Figures 3, 4, and 5) will be used to demonstrate the transition from proximity advisories to priority advisories. The test data as specified in Section 3.1 will all be collected during the flight, but the options of data reduction and analysis vary according to different test issues.

Test Run Number	Issue Number	Objective	Intruder Equipage	Flight Patterns	Data Reduction and Analysis Options	Data Interpretation
1	Section 2.1, A.	Traffic adv., Mode S and Mode C intruder.	Mode S, altitude encoder	Single daisy, intruder below, 1,500 ft., 2 encounters (Figure 2)	Encounter summaries	Correlate the proximity and priority adv. of data extraction tapes with those of flight log sheets.
2	Section 2.1, B.	Traffic adv., Mode 3/A and Mode C intruder.	ATCRBS, altitude encoder.	(Same as above)	(Same as above)	(Same as above)
3	Section 2.1, C.	Traffic adv., Mode 3/A only intruder.	ATCRBS without altitude encoder.	(Same as above)	(Same as above)	(Same as above)
4	Section 2.1, A	Traffic adv., Mode S and Mode C intruder.	Mode S, altitude encoder.	Vertical encounter, tail chase, intruder below, 2 encounters (Figure 3)	(Same as above)	(Same as above)
5	Section 2.1, B.	Traffic adv., Mode 3/A and Mode C intruder.	ATCRBS altitude encoder.	Vertical encounter, head on, intruder below, 2 encounters (Figure 4)	(Same as above)	(Same as above)

FIGURE 1. TEST MATRIX

Test Run Number	Issue Number	Objective	Intruder Equipage	Flight Patterns	Data Reduction and Analysis Options	Data Interpretation
6	Section 2.1, A.	Traffic adv., Mode S and Mode C intruder.	Mode S, altitude encoder.	Single daisy, intruder below, 400 ft., 2 encounters (Figure 2)	(Same as above)	(Same as above)
7	Section 2.1, B.	Traffic adv., Mode 3/A and Mode C intruder.	ATCRBS, altitude encoder.	(Same as above)	(Same as above)	(Same as above)
8	Section 2.1, C.	Traffic adv., Mode 3/A only intruder.	ATCRBS without altitude encoder.	(Same as above)	(Same as above)	(Same as above)
9	Section 2.1, A.	Traffic adv., Mode S and Mode C intruder.	Mode S, altitude encoder.	Single daisy, intruder above, 400 ft., 2 encounters (Figure 2)	(Same as above)	(Same as above)
10	Section 2.1, B.	Traffic adv., Mode 3/A and Mode C intruder.	ATCRBS, altitude encoder.	(same as above)	(Same as above)	(Same as above)

FIGURE 1. TEST MATRIX (Continued)

Test Run Number	Issue Number	Objective	Intruder Equipage	Flight Patterns	Data Reduction and Analysis Options	Data Interpretation
11	Section 2.1, D.	Traffic adv., two intruders	Intruder 1: Mode S, altitude encoder; Intruder 2: ATCRBS, altitude encoder.	Single daisy, one intruder above, the other below, all 400 ft., 4 multiple encounters (Figure 2)	(Same as above)	(Same as above)
12	Section 2.2, A.	Airspace adv.	(No intruder)	Fly into restricted airspace, 10 airspace advisories.	Printout of uplink text messages.	Correlate the airspace adv. of data extraction tapes with those of flight log sheets.
13	Section 2.2, B.	Simultaneous traffic and airspace adv.	Mode S, altitude encoder.	Vertical encounter in restricted airspace, intruder below, both aircraft climbing, 2 encounters (Figure 5)	Encounter summaries, printout of uplink text messages.	Correlate all uplink messages of data extraction tapes with those of flight log sheets.

FIGURE 1. TEST MATRIX (Continued)

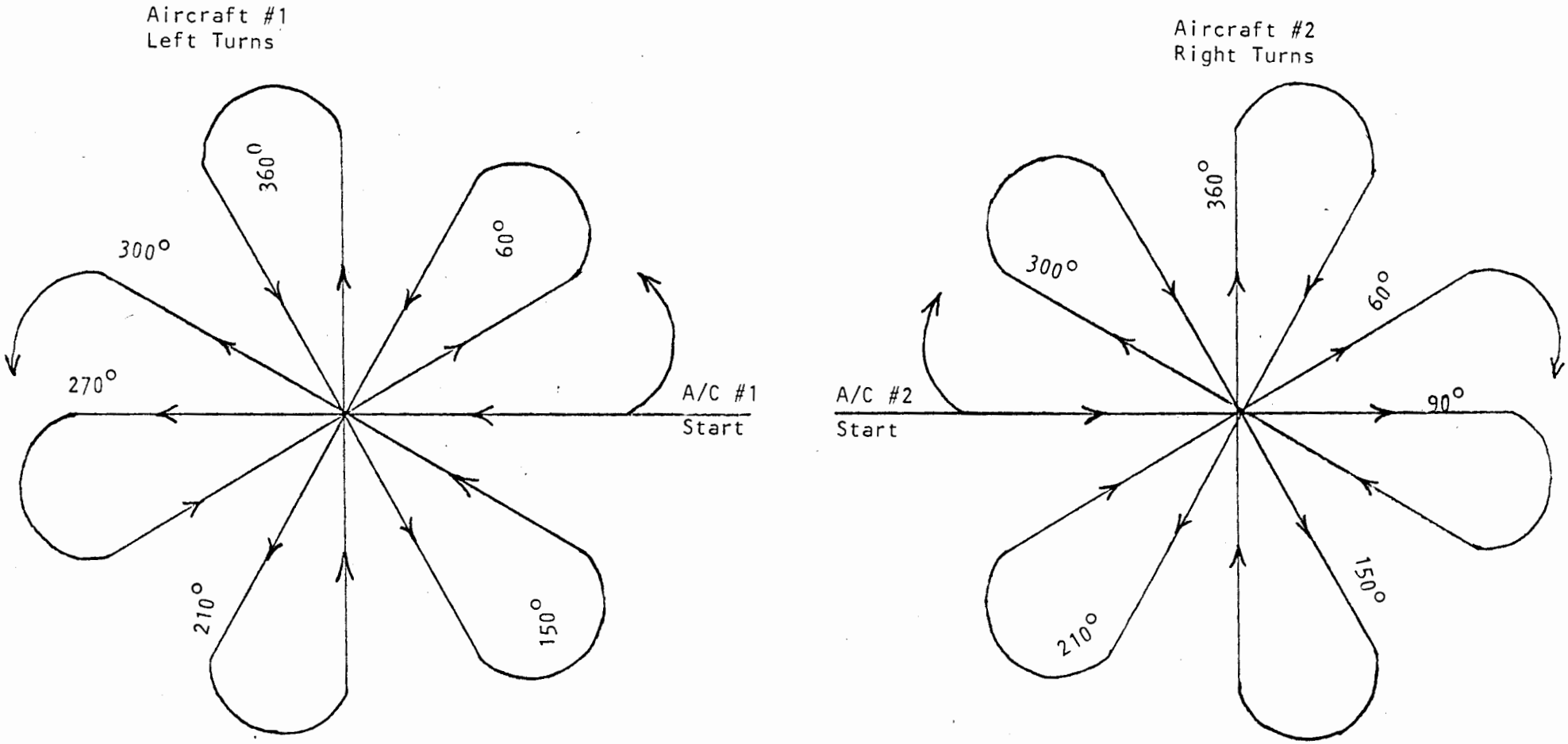

FIGURE 2. SINGLE DAISY FLIGHT PATTERN

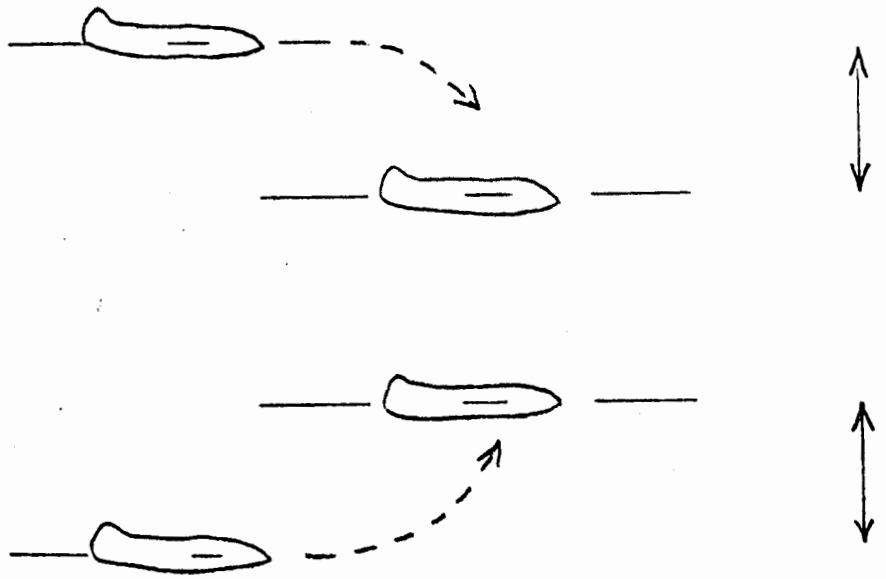

FIGURE 3. VERTICAL TAIL CHASE ENCOUNTER WITH A LEVEL FLYING AIRCRAFT

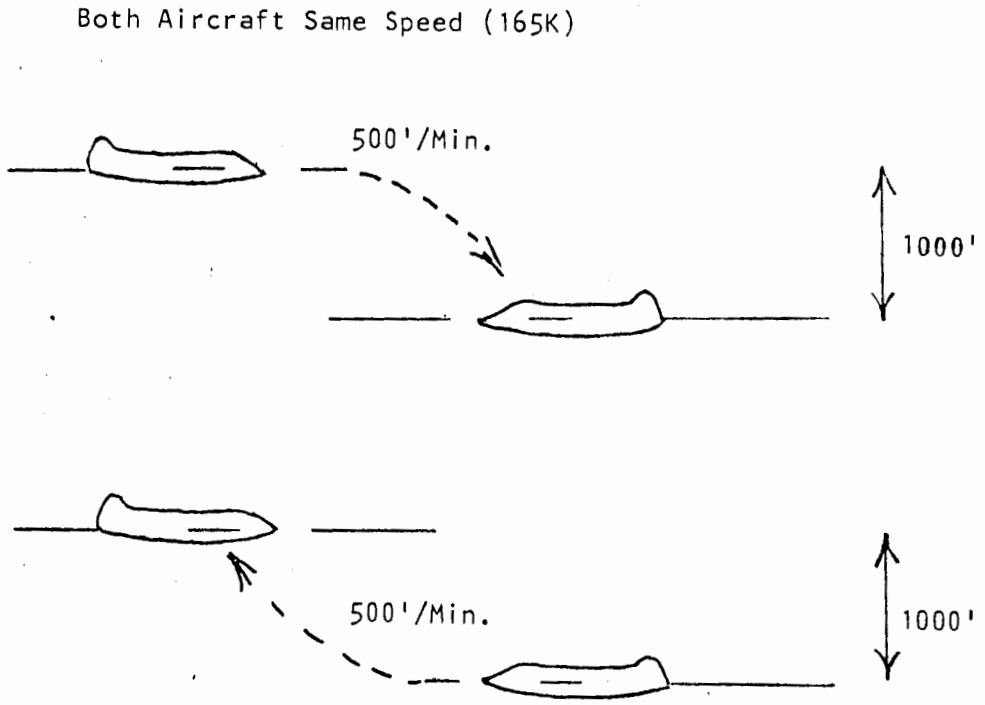

FIGURE 4. VERTICAL HEAD ON ENCOUNTER WITH A LEVEL FLYING AIRCRAFT

Start 800' Apart - Same Speed

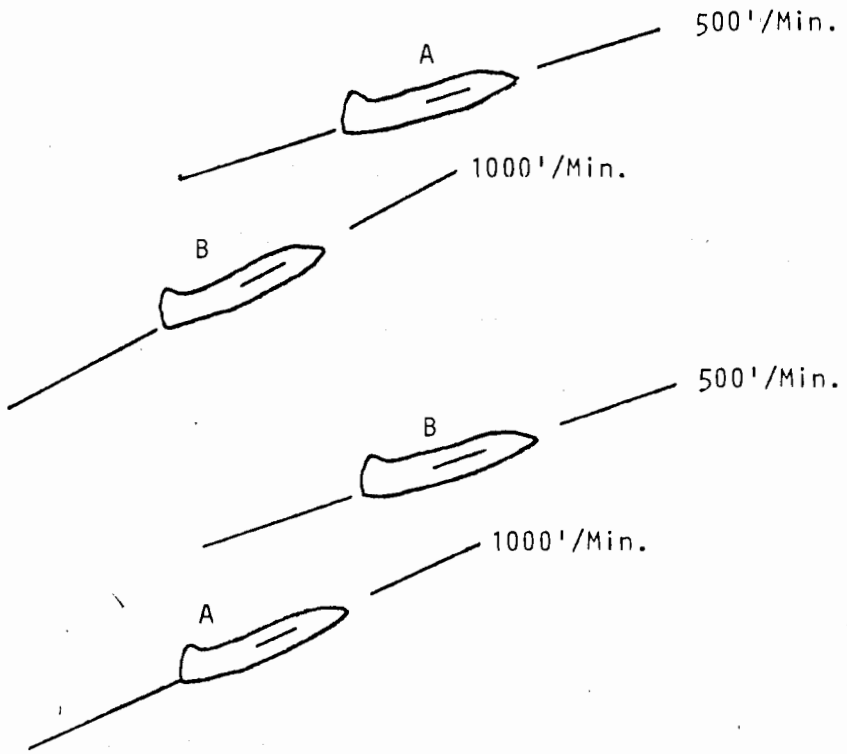

FIGURE 5. VERTICAL TAIL CHASE

4. PROGRAM COORDINATION.

The various areas of responsibility and coordination requirements are explained individually.

a. FAA System Research and Development Service (SRDS).

ARD-240: Develops SRDS program milestones, provides funding for contractor support, coordinates requirements for special support, and provides overall program guidance.

b. FAA Technical Center

ACT-100: The management of the ATAS test and evaluation program is the responsibility of ACT-100A.2. The Mode S sensor support is provided by ACT-100A.3.

ACT-600: All requirements for the Technical Center aircraft, rental aircraft, aircraft modifications and special installation, and aircraft pilots will be supported by ACT-600.

ACT-700: The general purpose computer (Honeywell 66/60) for test data reduction and analysis is operated by ACT-700. Special requirements and schedules will be provided by ACT-100A.2.

c. New York Air Route Traffic Control Center (ARTCC)

All test flights which are above 5,000 ft. will be coordinated with the New York ARTCC.

d. Approach Control

The test flights are planned to be in the vicinity of the Technical Center. Tests will require coordination with some or all of the following approach controls: Philadelphia, Dover, McGuire, and Atlantic City.

5. REFERENCES.

1. Resnick, Julius L.: "Preliminary ATAS Performance Test Plan," DOT/FAA Technical Center Report No. CT-82-100-57LR, May 1982.

2. ARCON, Inc.: "Software Design Description for Preliminary ATAS," prepared under the IOCS, Inc. Contract No. DOT-FA79NA-6054, May 1982.

3. Leeper, J.L. and Kennedy, R.S.: "Formats for DABS Data Link Applications," Report No. FAA-RD-80-81 (ATC-96), July 1980.

4. IOCS, Inc.: "IOCS Multisite System (IMS) (ATARS Data Reduction and Analysis Software) Documentation," (Phase A, Release 9), three volumes, Contract No. DOT-FA79NA-6054, January 1982.