REPORT NO. DOT-TSC-FAA-73-3

FLIGHT PLANS:
STOL AVIONICS FLIGHT-TEST PROGRAM

PGS STOL Program Office

MAY 1973

PRELIMINARY MEMORANDUM

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-73-3		

4. Title and Subtitle	5. Report Date
FLIGHT PLANS: STOL AVIONICS FLIGHT-TEST PROGRAM	May 1973
	6. Performing Organization Code
7. Author(s) PGS STOL Program Office	8. Performing Organization Report No. DOT-TSC-FAA-73-3
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142	10. Work Unit No. FA318/R3105
	11. Contract or Grant No. DOT-TSC-379
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Systems Research and Develop. Service Washington, D.C. 20591	13. Type of Report and Period Covered May 1972-Nov. 1972 Preliminary Memorandum
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This document presents the flight-test plans for the U.S. DOT/Transportation Systems Center STOL Avionics Flight-Test Program. Tests described include:

a. Shakedown Test, Hanscom Field,
b. NAFEC Checkout Tests,
c. Area Navigation Tests,
d. Approach Flight Tests,
e. VOR Filter Tests,
f. Land/Sea Interface Tests,
g. Maneuver Flight Tests,
h. Philadelphia Noise Tests,
i. Northeast Corridor Tests,
j. Mountain Region Tests, and
k. New York City Tests.

17. Key Words	18. Distribution Statement
STOL Area Nav - VOR/DME, DME/DME LORAN C MODILS	THIS DOCUMENT CONTAINS PRELIMINARY INFORMATION SUBJECT TO CHANGE. IT IS CONSIDERED AN INTERNAL TSC WORKING PAPER WITH A SELECT DISTRIBUTION. IT IS NOT A FORMAL REFERABLE REPORT. DISTRIBUTION IS EFFECTED BY AND RESPONSIBILITY OF THE AUTHOR.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	288	

FOREWORD

This document presents the Flight Plans for the U.S. Department of Transportation, Transportation Systems Center, STOL Avionics Flight-Test Program.

TABLE OF CONTENTS

CONTENTS (CONCLUDED)

1. INTRODUCTION

The majority of the flight plans contained herein were prepared by the Transportation Systems Center prior to participation by the Contractor (Lockheed-Georgia).

The Contractor prepared the Series S Shakedown Tests and the Series D VOR Filter Tests in addition to correcting the remaining flight plans after receiving comments from various Federal Aviation Administration offices.

Since copies of the flight plans had been distributed prior to initiation of flight tests, the same format has been retained for this report by including the flight plan series as attachments where each attachment is complete within itself and may be referred to by holders of previous copies.

The Contractor also prepared the Table A-1 and Table A-4 attachments to each flight plan for ground/airborne equipment and data requirements. Since the tables were prepared in a matrix for all flight plans the same tables have been attached to each plan.

The estimated number of personnel required for each test and recommendations for alternative missions and mission combinations are included in Section 2.0, Flight Plans.

Special formatting and quick-look data requirements are not presented; however, they, along with other specifics, will be included in the Operations Manual for each flight plan.

The attached flight plans are not necessarily in the sequence in which they were flown once the airplace had completed shakedown and checkout flights. Emphasis was placed on concurrent testing and the efficient utilization of the available flight time.

The initial plans were modified during the program as conditions and requirements warranted and this report reflects the final plans as they were flown during the flight tests.

2. FLIGHT PLANS

The STOLNAV flight plans are included as attachments herein. Additional information is included on the cover sheet for each plan to provide data on the number of personnel required as well as alternate missions.

The FAA/NAFEC support, including manpower requirements, is defined in NAFEC Report, "Test Plan, SRDS/TSC/NAFEC/V-STOL Area Navigation, Project No. 043-326-05X," dated February 1972.

2.1 ATTACHMENT A

SERIES S

SHAKEDOWN TEST

STOL AVIONICS FLIGHT TEST PROGRAM

SHAKEDOWN TEST, HANSCOM FIELD - SERIES S

A. OBJECTIVE

After ground test verification of airborne and ground equipment at L. G. Hanscom Field, a series of shakedown flights will be made to ensure that all functions are ready for the NAFEC tests and will include the following objectives:

1. Check total system operation including qualitative antenna pattern coverage
2. Pilot and contractor familiarization
3. Collect a broad spectrum of data on all available navaids to verify the STOLNAV system and the data acquisition/reduction hardware and software
4. Verify, and modify as necessary, the preflight, flight test, and post flight procedures for typical operations
5. Correct any deficiencies as a result of the tests in 1 and 3 above

B. TEST RATIONALE

The shakedown flight plans will include the following tests:

1. Antenna Pattern/System Shakedown Tests
2. Area Nav Evaluation
3. Approach Tests

Each test plan will be similar to the NAFEC tests including procedures, data requirements (except EAIR quantities), and the overall performance evaluation. However, the primary purpose will be to determine the

performance of the airborne and ground equipment and software, make changes and corrections as necessary, and retest until the configuration is considered ready for the test program.

C. FLIGHT PLANS

1. Antenna Coverage/System Shakedown - Antenna pattern effects will be investigated by flying outbound from Hanscom Field to a suitable VORTAC at 5,000 feet altitude. Provided the outbound performance is satisfactory, a 360° turn at 3° per second will be flown around the VORTAC while tuned to other VORTAC's in the area. Loran C will be locked on Nantucket/Dana slaves and selected as primary navigation. The primary purpose of the turn will be to investigate antenna shading effects both from the navaid standpoint and from the airplane to the telemetry van at Hanscom Field. The turn will be repeated as required to determine the approximate coverage. Antenna null/ directivity effects will be determined by flying an 8-heading cloverleaf pattern over the VORTAC with zero relative heading oriented toward Hanscom Field. Turns to each heading will be at a high rate to qualitatively assess the Loran C tracking capability although precise position data will not be available. On each heading, when stabilized over the VORTAC, the pilot will announce the heading and a hack at which time the signals and displays will be evaluated. Discrepancies will be annotated in the airborne and ground stations and repeat headings may be necessary for trouble-shooting and analysis purposes.

2. Area Nav/Approach Tests - The area navigation hardware, software and data parameters will be evaluated by flying a triangular circuit between VORTAC stations defined by waypoints. Simulated STOL approaches using a programmed 6^{o} glide angle will be flown for software checks and familiarization.

Basically, the flight paths, waypoints and navaid geometry will be similar to the NAFEC Series A and B flight plans. VOR/DME, DME/DME, and Loran C will be selectively exercised for primary navigation along predetermined flight paths. All data quantities will be recorded on board and transmitted via telemetry.

The telemetry van will monitor selected quick-look data and advise the airplane of any discrepancies such as drop-outs, poor reception, or improper quantities.

The program flight software will be checked for input/output, proper calculations, displays, and navaid swapping functions. Rho-Theta information and Loran C time differences will be checked at waypoints for proper indications. The profiles will be flown at altitudes from 2,000 to 5,000 feet and airspeeds from 140 to 180 knots. Throughout the system tests, the pilot will evaluate his displays, flyability, and control capabilities. The C/M console operator will monitor system performance and select the primary and throughput navaids.

During the flights, procedures and checklists will be utilized and modified as required for later program usage. After flight the results will be discussed by utilizing quick-look data, notes, and observations. The onboard and T/M tapes will be formatted for evaluation of the data parameters, as necessary, and for evaluation of the data reduction techniques and software.

The total estimated flight time for the shakedown test is 10 hours. A description of the waypoints is shown in Table S-1.

D. EQUIPMENT

Airborne and ground equipment to be used during the test is shown in Table A-1.

E. DATA TO BE COLLECTED

Data to be collected from the airborne system is shown in Table A-4.

F COORDINATION REQUIRED

Coordination will be handled by the DOT/TSC Program Manager and details will be supplied at a later date.

G. DESCRIPTION OF FLIGHT

Flight Path 1 (Figure S-1)

Initiate FP1 WP1

Takeoff from Hanscom R/W 29, 3° climb to SP1, 2000 feet (5.9 NM)

At WP1 level 2000 feet, 180 KTS, 292° track to WP2 (2.2 NM)

At WP2 execute right 79° turn at 3° per second to WP3

At WP3 proceed to WP4, 2000 feet, 180 KTS, 011° track (10.3 NM)

At WP4 execute 3° climb to WP5 at 5000 feet (9.4 NM)

At WP5 level 5000 feet and continue on track to Concord VORTAC (CON), WP6, 5000 feet (22.8 NM)

At WP6 terminate area nav and begin antenna pattern tests below

Antenna Pattern Tests (5000 Feet)

At Concord VORTAC (CON), fly a 360° turn to left, 3° per second, then a 360° right turn at 3° per second (figure 8 pattern) repeat turns as necessary to define shading problems, if any.

Upon completion of circle turns, fly an 8-heading cloverleaf (see Figure S-2) beginning on a convenient heading. On each heading, pilot announce "hack" when approximately over VORTAC and state heading, e.g. "Hack 045°". C/M operator record time for each hack and note general system operation while stabilized. Repeat various headings as necessary to define antenna pattern effects, if any.

AREA NAV TESTS

Flight Paths 2 and 3 (Figure S-3)

In CON vicinity, initiate FP2 WP1 (on 246° Concord to Keene track) (15 NM)

At WP1 establish track to WP2, 5000 feet, 180 KTS (22.5 NM)

At WP2 execute left 146° turn at 3° per second to WP3, 5000 feet

Continue on 099° track to WP4, 5000 feet (13 NM)

At WP4, descend on 3° path to WP5, 3000 feet, 180 KTS (6.3 NM)

At WP5, level at 3000 feet, proceed on track to WP6, 3000 feet (17.2 NM)

At WP6 execute left 107° turn at 3° per second to WP7, 3000 feet

At WP7 proceed to WP8, 3000 feet, 180 KTS (2 NM)

At WP8 climb on 3° path to WP9, 5000 feet (6.3 NM)

At WP9 initiate FP3 WP1 (12.1 NM)

At FP3 WP1 execute left 106° turn to FP3 WP2 at 3° per second, 5000 feet

At FP3 WP2 initiate FP2 WP1 (13.7 NM) and repeat patterns for each PR1 Nav Mode as shown below:

First Circuit: LORAN C#1 Dana, Nantucket

Second Circuit: VOR #1/DME #1 GDM

Third Circuit: DME #1/DME #2 GDM/LEB, GDM VOR

Thruput Navaids

First Circuit: Loran C #2

Second Circuit: VOR #2/DME #2 CON

Loran C #1

Third Circuit: VOR #1 - EEN, VOR #2 - GDM

Loran C #1

Loran C #2

DME #1/DME #2

APPROACH TEST (Figure S-4)

After third circuit initiate FP2 WP1 and proceed to WP2, Keene (EEN), 5000 feet, 180 KTS. At WP2 initiate FP4 WP1, execute 86° left turn to intercept EEN 159° radial to Gardner (GDM).

Descend enroute to 3700 feet, 180 KTS . (PRI NAV MODE-LORAN)

At FP4 WP1 execute 48° left turn and establish 111° track to WP2, 3700 feet (22.6 NM).

At WP2 start 3° descent to WP3, 1600 feet, airspeed as required (6.6 NM)

At WP3, slow to approach speed and continue to WP4, 1600 feet (3.0 NM)

At WP4 start 6° descent on simulated approach to L. G. Hanscom R/W (1.7 NM)

Upon reaching WP5 at 500 feet, Hanscom threshold, breakoff and make a normal landing.

Estimated Flight Time:	Time
Flight Path 1 -	0:20
Circle Turns -	0:08
Clover Leaf -	0:23
Flight Paths 2, 3 -	1:45
Flight Path 4 -	0:40
Total Flight Time -	3:16

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∠ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp ∠ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp ∠ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32 VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

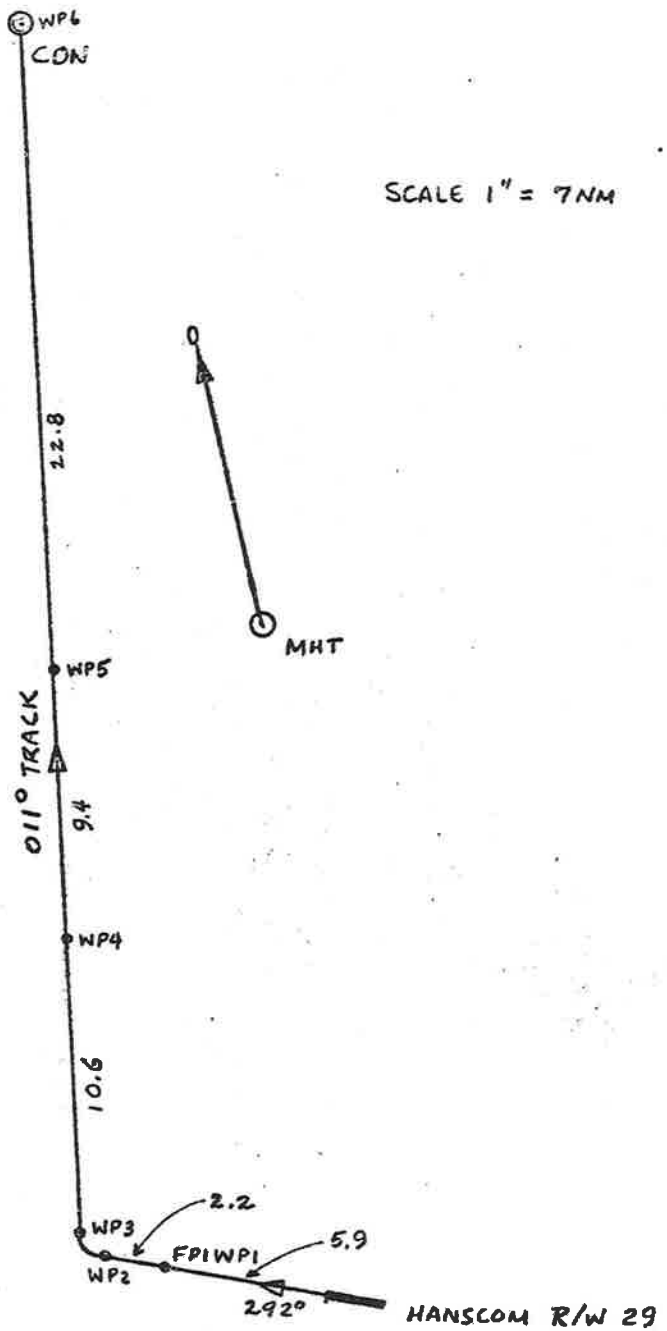
DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE S-1

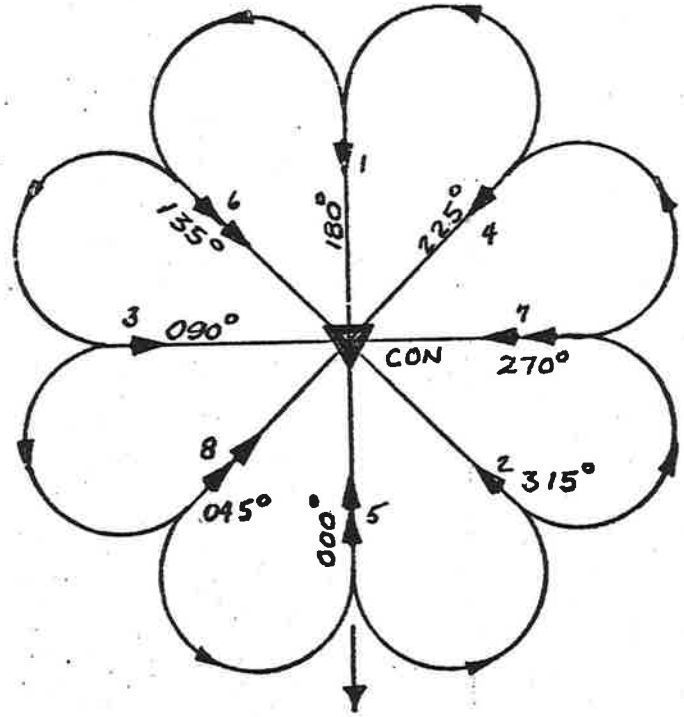
DESCRIPTION OF WAYPOINTS

FLT PATH	WP	THETA/RHO	LAT.	LONG.	ALT.
1	1	292°/10.9 BED	42° 29' 03"N	71° 26' 00"W	2000'
1	2	111°/25.8 GDM	42° 29' 35"N	71° 28' 44"W	2000'
1	3	210°/22.5 MHT	42° 30' 22"N	71° 29' 57"W	2000'
1	4	191°/32.2 CON	42° 41' 00"N	71° 31' 00"W	2000'
1	5	191°/22.8 CON	42° 50' 20"N	71° 32' 00"W	5000'
1	6	CON	43° 13' 11"N	71° 34' 33"W	5000'
2	1	246°/15 CON	43° 03' 34"N	71° 50' 18"W	5000'
2	2	065°/3 EEN	42° 49' 35"N	72° 14' 24"W	5000'
2	3	099°/3 EEN	42° 47' 58"N	72° 13' 28"W	5000'
2	4	099°/16 EEN	42° 49' 19"N	71° 55' 56"W	5000'
2	5	099°/22.3 EEN	42° 49' 59"N	71° 47' 20"W	3000'
2	6	279°/1.3 MHT	42° 51' 47"N	71° 24' 02"W	3000'
2	7	352°/1.3 MHT	42° 53' 17"N	71° 22' 54"W	3000'
2	8	352°/3.3 MHT	42° 55' 08"N	71° 23' 58"W	3000'
2	9	352°/9.6 MHT	43° 00' 55"N	71° 27' 21"W	5000'
3	1	172°/1.3 CON	43° 12' 03"N	71° 33' 51"W	5000'
3	2	246°/1.3 CON	43° 12' 21"N	71° 35' 55"W	5000'
4	1	GDM	42° 32' 45"N	72° 03' 32"W	3700'
4	2	292°/16.3 BED	42° 29' 41"N	71° 33' 09"W	3700'
4	3	292°/9.7 BED	42° 28' 53"N	71° 24' 17"W	1600'
4	4	292°/6.7 BED	42° 28' 31"N	71° 20' 16"W	1600'
4	5	292°/5 BED	42° 28' 18"N	71° 17' 58"W	500'



SHAKEDOWN FLIGHT
OUTBOUND FLIGHT PATH
FIGURE S-1

AVG. SPEED = 180 KTS
EACH LEG = 4.8 NM
EACH TURN 225° LEFT AT
3°/SECOND = 3.75 NM
TOTAL DISTANCE = 68.4 NM
FLT. TIME = 23 MINUTES



TO L.G. HANSCOM FIELD

SCALE 1" = 2 NM

ALTITUDE : 5000' MSL

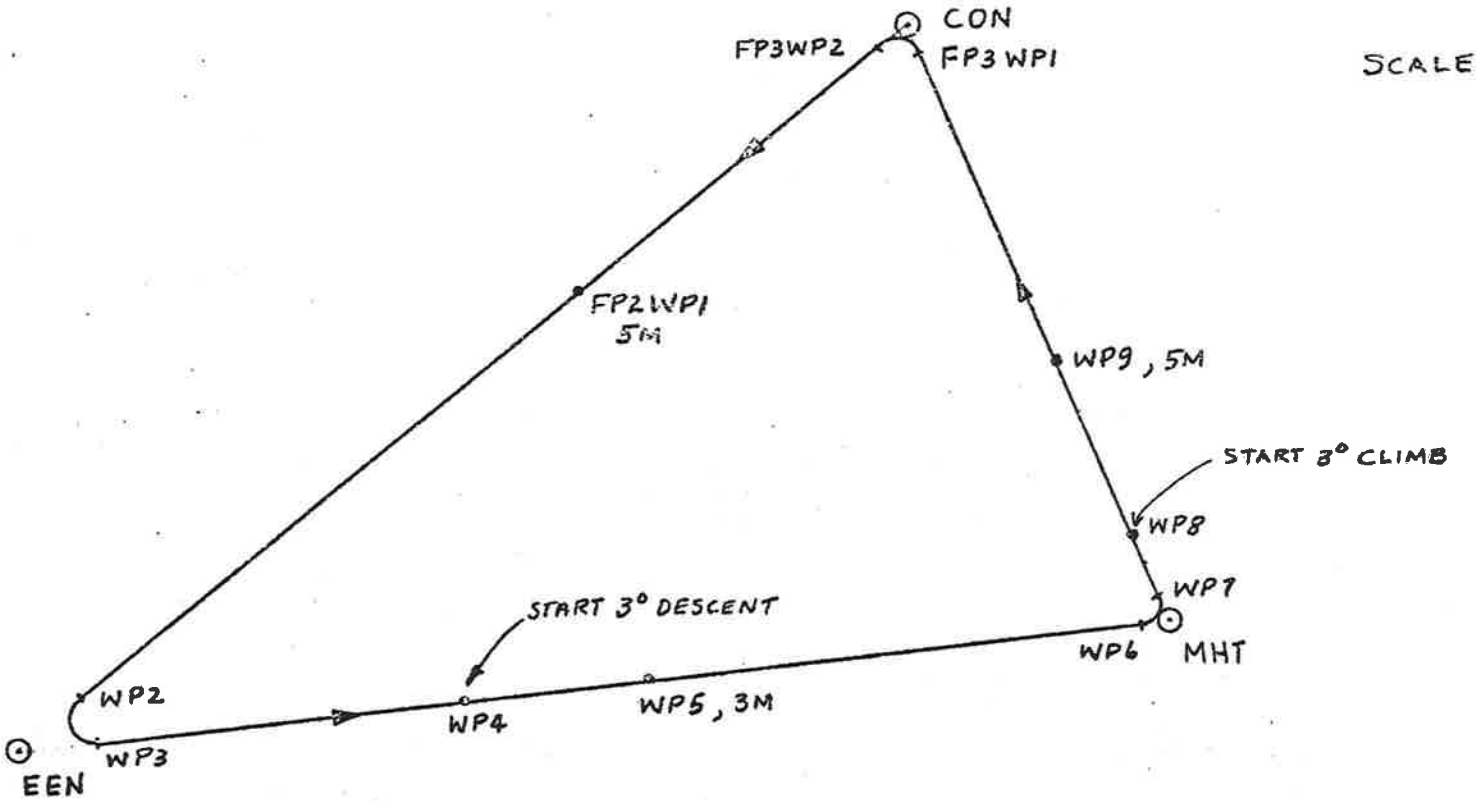
TIME FROM CON TO TURN
IS 48 SECONDS

TURNING TIME = 75 SECONDS

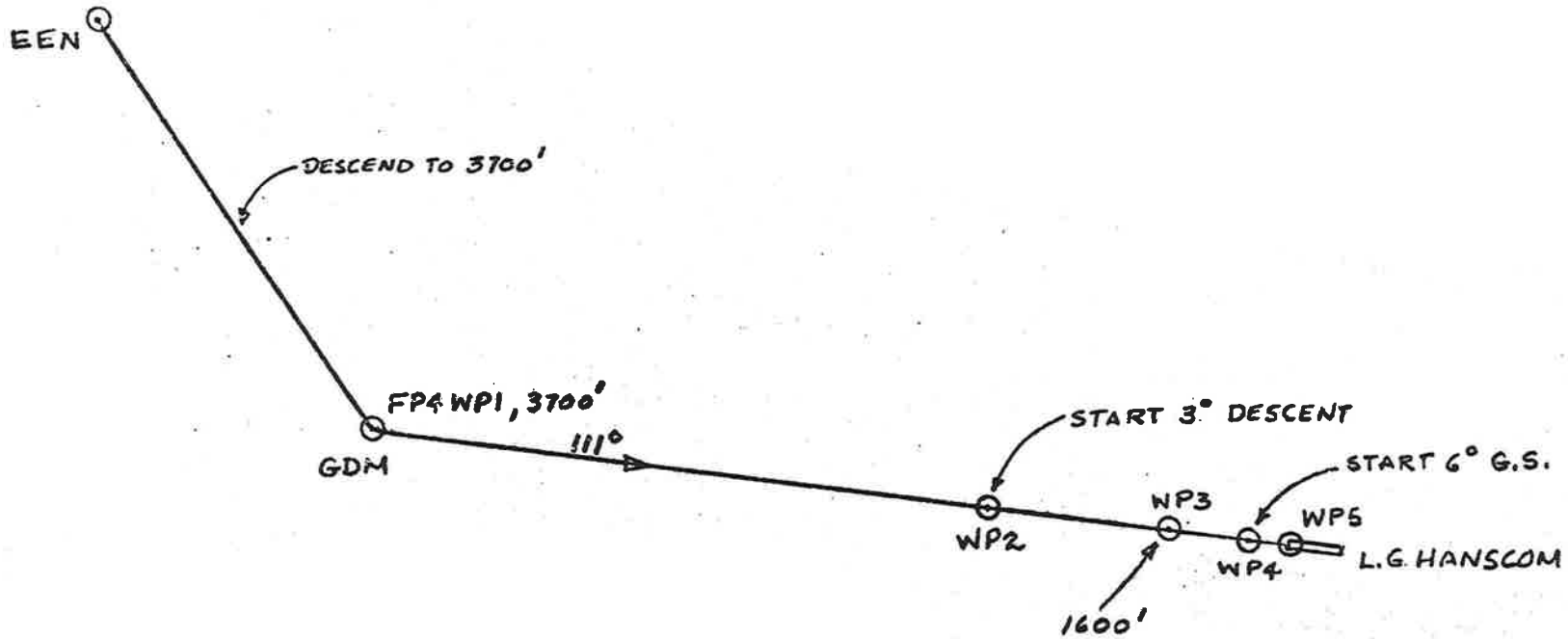
TIME FROM ROLLOUT TO CON
IS 48 SECONDS.

SHAKEDOWN FLIGHT - 8 HEADING CLOVERLEAF

FIGURE 5-2



SHAKEDOWN FLIGHT
AREA NAV TRIANGULAR PATTERN
FIGURE 5-3



SHAKEDOWN FLIGHT
APPROACH TEST
FIGURE S-4

2.2 ATTACHMENT B

SERIES A

CHECKOUT FLIGHT TESTS

ATTACHMENT B - CHECKOUT FLIGHT TESTS, SERIES A

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technician.

Recommended Alternate Missions and Combinations:

No alternate missions are recommended. Checkout of the MODILS including crew familiarization will be performed at the end of selected flights.

STOL AVIONICS FLIGHT TEST PROGRAM

CHECKOUT FLIGHT TESTS - SERIES A

A. OBJECTIVE

The objectives of the check-out flights (Series A) at NAFEC will be:

1. Check total system operation
2. Pilot familiarization
3. Contractor familiarization
4. Collect a broad spectrum of navaid data on all available navaids
5. Collect navigation data provided by the TSC navigation system using the navaid data in 4
6. Collect EAIR data correlated with the data of 4 and 5

B. TEST RATIONALE

The checkout flight tests will be used to exercise and determine the proper operation of all airborne systems, the telemetry link and the telemetry van, timing system (airborne and ground), data formatting, data processing and reduction, and the data analysis support. An assessment will be made of the quality of the navaid data recorded at positions determined by the EAIR radar and compare them to simulated navaid measurements computed for the same positions. This will establish the validity of the measured data or the simulated data dependent on which has the higher confidence or reasonability. In addition an assessment will be made of the TSC Area Navigation System performance. This will be accomplished by comparing the EAIR position and the TSC navigation position, using the navaid data evaluation as a guidance. The

waypoint guidance and switchover techniques will also be evaluated by a qualitative assessment by the pilot and by assessing his ability to follow the nominal flight path.

C. FLIGHT PLAN

Three circuits of a triangular flight path will be flown on the system checkout flight. The primary nav mode for each of the circuits will be:

1. Basic VOR/DME Mode* - Fly the triangular flight path using ACY, SIE, and OOD VOR/DME's. All legs of the triangle may be flown as radials of these VORTACS.

2. DME/DME Mode - DME/DME information will be used to compute position and fly the sequence of waypoints. Use ACY and MIV VORTACS. Throughput Loran C's for coverage and comparison.

3. Loran C Mode - Use Loran C signals to estimate position and fly the sequency of waypoints. Throughput other navaids for coverage, geometric effects, and comparison.

*Basic aircraft front-end equipment may be used in some flights to fly the radials while recording VOR/DME and DME/DME combinations for coverage and geometric effects. One or more of the flight paths may be reflown to fine tune the system. Tables A2 and A3 and Figure A-1, define the flight.

D. FLIGHT TEST DURATION

The three circuits outlined in C. above will each require 45 minutes based on standard approach airspeeds for the test aircraft. Therefore, 2.3 hours will be required to exercise all basic modes one time. Ten hours total is planned in checkout to allow for changes to the system.

E. EQUIPMENT

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with the attached telemetry list, Table A-4.

G. NAFEC SUPPORT REQUIRED

NAFEC support will be required in the following areas:

1. EAIR tracking with serial output data to the TSC telemetry van and real time plots.
2. Aircraft operation, servicing, and maintenance.
3. MODILS operation.

The use of the phototheodolite facilities is optional and will be determined at a later date.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

As indicated in Paragraph C above, the flight test will be run over a triangular flight path starting at NAFEC, proceeding to Sea Isle, direct to Millville with a low approach to Millville Airport, direct to Woodstown, direct to a point approximately 10 miles from NAFEC on a bearing 220 degrees, and finally an approach in to NAFEC using the area navigation display. The three modes will be used on separate flight paths. A separate checkout flight for the MODILS will be used during the Series C Approach Path A flight tests. Two flight paths will be programmed into the computer for this test.

Flight Path 1

Takeoff ACY rwy 22, climb on course to 1000', heading 216°.
Initiate flight path #1.

Proceed to WP1-1 via 216° course. (6.0 nm).

Initiate 3° angle of climb out of 1000' at WP1-1. Proceed direct to WP1-2, via 216° course, reaching WP1-2, at 4000'. (9.4 nm).

Maintain level at 4000' upon reaching WP1-2. Proceed to WP1-3 via 216° course, normal cruise. (7.1 nm).

Upon reaching WP1-3, execute standard rate right turn to track to WP1-4. Heading on rolling out at WP1-4 will be approx. 330°. (2.0 nm).

Track direct WP1-5 via 330° course. Adjust airspeed as necessary to prepare for 3° descent at WP1-5. (5.8 nm).

Start 3° descent out of 4000' at WP1-5, course 330°, airspeed as required, tracking direct to WP1-6. (6.3 nm).

Level off upon reaching WP1-6. Altitude 2000'. Reduce airspeed in preparation for low approach to MIV runway 32. Track direct to WP1-7 via 330° course, maintain 2000'. (4.0 nm). Simulated low approach to Millville apt: Start 6° descent out of 2000' upon reaching WP1-7. Descend to 500' at WP1-8. WP1-8 is threshold of MIV runway 32. Airspeed, gear, flaps as necessary. (2.3 nm).

Upon reaching 500' altitude MDA at WP1-8, pull up, proceed direct to WP1-9 while climbing to 1000' on course 336°. Maintain 1000' until crossing WP1-9. (5.0 nm).

Flight Path 2

After crossing WP1-9, enter flight path #2 into computer via PICOM initiate 3° climb, proceed direct WP2-1, reaching WP2-1 at 4000'. (9.4 nm) course 336°.

Level off at WP2-1 upon reaching 4000'. Resume normal cruise, proceed direct WP2-2 via 336° course. Maintain 4000' (3.5 nm).

Enter standard rate right turn at WP2-2, to track to WP2-3. Heading on rolling out at WP2-3 will be approx. 099°. (2.0 nm).

Proceed direct to WP2-4 and then to WP2-5. Course 099° (18.0 nm and 17.1 nm).

Execute standard rate right-turn at WP2-5, to track to WP2-6. Heading on rolling out at WP2-6 will be approx. 218°. (2.0 nm).

Proceed to WP2-7 via 218° course. Reduce airspeed as necessary in preparation for low approach to ACY runway 22. maintain 4000' until WP2-7.

Upon reaching WP2-7, start 6° descent out of 4000'. Proceed to WP2-8, descending to 500' at WP2-8, which is the threshold of ACY runway 22. Airspeed, gear, flaps as needed (6.0 nm).

Approximately 116 nm/circuit
Approximate avg. airspeed = 160 kts.
Flight time approx. 0:44/circuit.
Estimated Total Flight Time = 10 Hours

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-2

WAYPOINT DESCRIPTIONS - SERIES A, CHECKOUT FLIGHT

WP	LATITUDE	LONGITUDE	VOR	RHO/THETA	TD/DANA	TD/NANTUCKET
1-1	39°22'20"	74°38'00"	ACY	261°/5.5	70025	51840
			MIV	132"/8.5		
			SIE	035°/18.7		
			ENO	087°42.3		
			OOD	125°/35.1		
			CYN	209°28.1		
1-2	39°13'50"	74°43'05"	ACY	216°/14.9	70090	51945
			MIV	157°/21.6		
			SIE	035°/9.3		
			ENO	098°/37.3		
			OOD	140°/36.5		
			CYN	211°/37.5		
1-3	39°07'25"	74°47'00"	ACY	216°/22.0	70120	52025
			MIV	171°/26.0		
			SIE	035°/2.2		
			ENO	109°/34,8		
			OOD	153°/40.0		
			CYN	211°/46.6		
1-4	39°06'50"	74°48'35"	ACY	219°/23.5	70118	52045
			MIV	175°/26.0		
			SIE	330°/1.7		
			ENO	110°/33.0		
			OOD	154°/38.3		
			CYN	204°/45.9		

TABLE A-2 (Cont'd)

WAYPOINT DESCRIPTIONS - SERIES A, CASCADE FLIGHT

WP	LATITUDE	LONGITUDE	VOR	THETA/RHO	TD/DANA	TD/[illegible]
1-5	39°11'58.0"	74°53'52.8"	ACY	234°/21.6	70088	52030
			MIV	181°/20.7		
			SIE	333°/7.8		
			ENO	103°/28.8		
			OOD	153°/30.2		
			CYN	220°/43.0		
1-6	39°16'53.5"	74°58'56.3"	ACY	251°/20.8	70055.5	52012
			MIV	193°/15.1		
			SIE	351°/9.2		
			ENO	091°/21.7		
			OOD	153°/26.0		
			CYN	228°/41.2		
1-7	39°20'01.1"	75°02'09.5"	ACY	261°/22.6	70004.7	52012
			MIV	204°/12.2		
			SIE	332°/18.1		
			ENO	083°/23.7		
			OOD	153°/22.0		
			CYN	234°/40.0		
1-8	39°21'49.0"	75°04'00.5"	ACY	266°/23.8	69994	52012
			MIV	215°/11.3		
			SIE	331°/20.3		
			ENO	078°/22.4		
			OOD	154°/19.6		
			CYN	237°/40.2		

TABLE A-2 (Cont'd)

WAYPOINT DESCRIPTIONS - SERIES A, CHECKOUT FLIGHT

WP	LATITUDE	LONGITUDE	VOR	RHO/THETA	TD/DANA	TD/NANTUCKET
1-9	39°25'30"	75°07'50"	ACY	276°/26.0	69948	52000
			MIV	239°/10.0		
			SIE	332°/25.2		
			ENO	065°/21.6		
			OOD	156°/14.7		
			CYN	245°/40.1		
2-1	39°33'30"	75°14'35"	ACY	292°/31.7	69878	51975
			MIV	287°/12.9		
			SIE	333°/34.8		
			ENO	042°/23.7		
			OOD	156°/5.3		
			CYN	258°/40.8		
2-2	39°36'20"	75°17'00"	ACY	296°/34.2	69855	51965
			MIV	297°/15.3		
			SIE	333°/38.2		
			ENO	035°/25.3		
			OOD	156°/1.8		
			CYN	263°/41.5		
2-3	39°37'55"	75°16'00"	ACY	299°/34.0	69845	51950
			MIV	303°/16.9		
			SIE	335°/39.0		
			ENO	035°/26.9		
			OOD	099°/1.8		
			CYN	265°/40.3		

TABLE A-2 (Cont'd)

WAYPOINT DESCRIPTIONS - SERIES A, CHECKOUT FLIGHT

WP	LATITUDE	LONGITUDE	VOR	RHO/THETA	TD/DANA	TD/NANTUCKET
2-4	39°37'55"	74°53'00"	ACY	316°/18.0	69912	51808
			MIV	044°/7.2		
			SIE	002°/31.2		
			ENO	060°/38.3		
			OOD	099°/19.8		
			CYN	252°/23.7		
2-5	39°37'55"	74°29'50"	ACY	029°/11.3	69948	51656
			MIV	084°/22.8		
			SIE	033°/34.8		
			ENO	072°/56.6		
			OOD	099°/36.9		
			CYN	260°/11.3		
2-6	39°36'20"	74°28'45"	ACY	036°/10.1	69988	51664
			MIV	089°/23.2		
			SIE	035°/34.4		
			ENO	074°/53.6		
			OOD	101°/38.6		
			CYN	200°/12.7		
2-7	39°32'40"	74°31'15"	ACY	036°/6.0	70005	51710
			MIV	098°/20.8		
			SIE	035°/30.2		
			ENO	077°/50.2		
			OOD	107°/37.0		
2-8	39°27'50"	74°34'30"	ACY	027°/0.5	70050	51770
			MIV	114°/18.8		
			SIE	036°/24.7		
			ENO	081°/46.2		
			OOD	116°/35.6		
			CYN	207°/22.2		

TABLE A-3

VHF RADIO NAV FACILITIES

VORTAC	IDENT.	LATITUDE	LONGITUDE	ELEV.	DECLINATION	FREQUENCY
Atlantic City	ACY	39°27'20.7"	74°34'36.2"	70 ft	-10.0°	108.6
Coyle	CYN	39 49 02	74 25 55		-10.0°	113.4
Kenton	ENO	39 13 53.6	75 30 58.6	10 ft	-9.0°	111.4
Millville	MIV	39 32 15.2	74 58 03.1	120 ft	-10.0°	115.2
Sea Isle	SIE	39 05 43.4	74 48 02.6	10 ft	-9.0°	114.8
Woodstown	OOD	39 38 09.2	75 18 12.2	140 ft	-9.0°	112.8

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∆ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp∆ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp∆ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

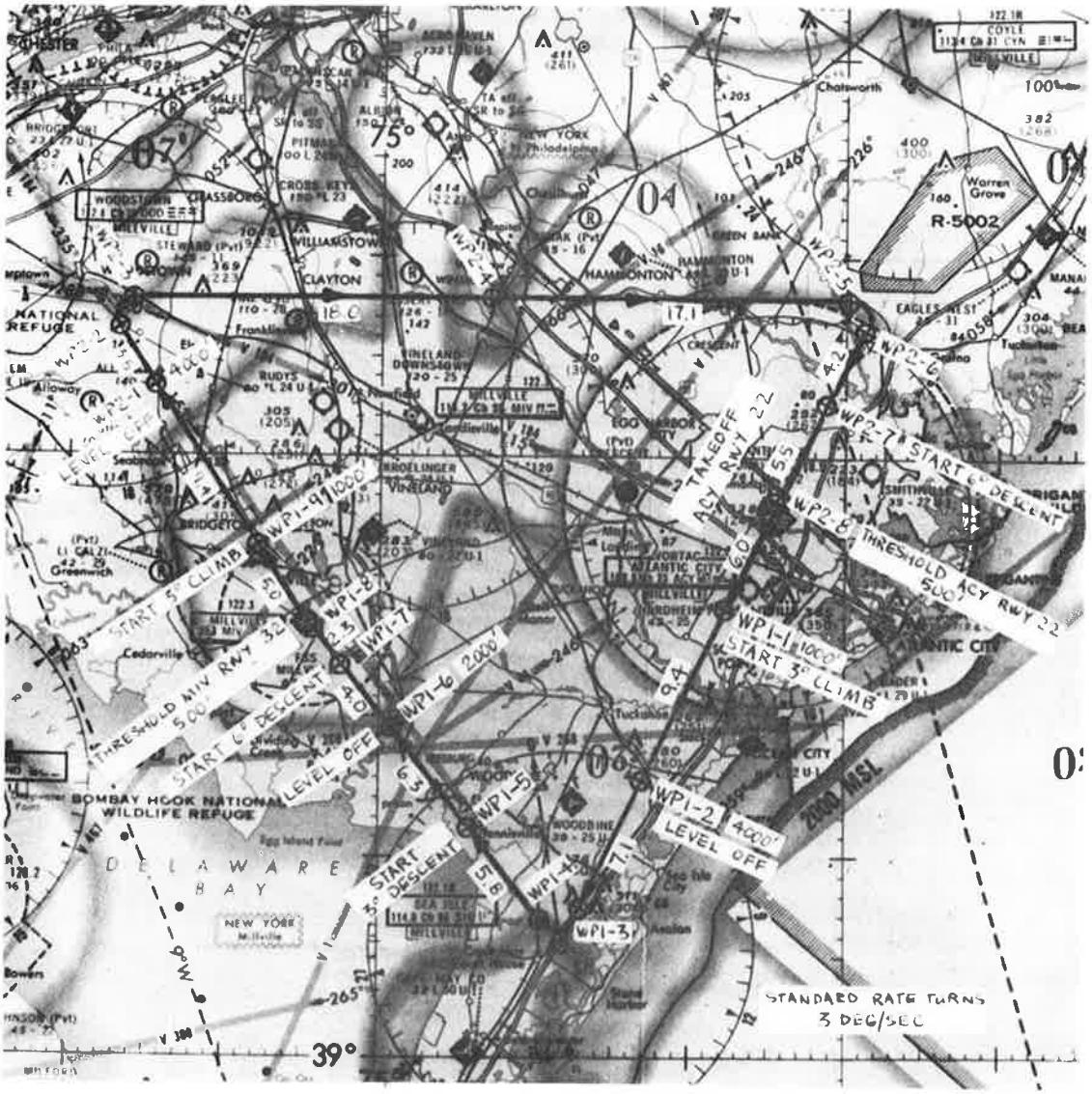

R-5002
Warren Grove
Chatsworth
CLAYTON
WILLIAMSTOWN
HAMMONTON
NATIONAL REFUGE
BRIDGETON
VINELAND
MILLVILLE
Cedarville
ATLANTIC CITY
BOMBAY HOOK NATIONAL WILDLIFE REFUGE
DELAWARE BAY
NEW YORK
WP1-1
WP1-2
WP1-3
WP1-4
WP1-5
WP1-6
WP1-7
WP1-8
WP1-9
WP2-6
WP2-7
WP2-8
START 3° CLIMB
START 5° CLIMB
START 6° DESCENT
LEVEL OFF
2000'
4000'
5000'
2000' MSL
THRESHOLD ACY RWY 22
THRESHOLD MIV RWY 32
ACY TAKEOFF RWY 22
STANDARD RATE TURNS
3 DEG/SEC
39°
75°

FIGURE A-1

2.3 ATTACHMENT C

SERIES B

AREA NAVIGATION TESTS

ATTACHMENT C - AREA NAVIGATION TESTS, SERIES B

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technician

Recommended Alternate Missions and Combinations:

It is recommended that the Series D VOR Filter Tests be considered a prerequisite to the Area Navigation Tests in order to permit testing with the optimum VOR Filter/DME area nav mode. If EAIR data are not available for these tests, it is recommended that Approach Tests using the NAFEC Phototheodolite facilities be conducted as an alternate mission.

STOL AVIONICS FLIGHT TEST PROGRAM

AREA NAVIGATION TESTS - SERIES B

A. OBJECTIVE

The objective of the Area Navigation tests is to refine and validate the Area Nav capability of the STOLNAV System. Each Area Nav Mode (VOR/DME, DME/DME, LORAN) will be exercised using various navigation aid geometries and receivers. To fully exercise the system the flights will be flown at varying altitudes with remote approaches.

B. TEST RATIONALE

The test will be conducted to provide the following:

- Provide an extensive test of each of the TSC Area Nav Modes;
- Provide a massive library of real time navaid data under various flight regimes for simulation and analysis purposes;
- Provide data for an evaluation of coverage and system performance in non-optimal navaid reception regions;
- Provide data for an evaluation of altitude effects on the navaid source data;
- Provide data for an evaluation of altitude effects in the navigation capabilities;
- Provide data for the determination of the repeatibility of navaid measurements.

C. FLIGHT PLANS

The Area Navigation test flights will be flown around the same triangular flight path as the system checkout test. On some RNAV flights, the

vertical profile will be unchanged (low approaches included at MIV and ACY). Other flights for Loran C will be performed at constant altitudes of 1,000, 2,000 and 4,000 feet.

During these circuits, various primary Nav Data sources will be used and evaluated. The flights to be conducted will be as follows:

1. VOR/DME Primary Nav Mode using Millville VORTAC
   a. Varying altitude flight - 3 circuits
   b. Approaches at Millville (MIV) and Atlantic City (ACY) - (Concurrent)
2. DME/DME Primary Nav Mode using ACY and MIV
   a. Varying Altitude Flight - 3 circuits (Note: WP2-2 and WP2-8 are close to ACY-MIV Baseline)
   b. Approaches at MIV and ACY - Concurrent (Note: This flight is to evaluate effect of intersection angle on approach accuracy. ACY crossing angle = 80°. MIV crossing angle = 50°. ACY approach is very close to ACY-MIV baseline.)
3. DME/DME Primary Nav Mode using Sea Isle (SIE) and ACY VORTAC
   a. Varying Altitude Flights - 3 circuits (Note: This flight is to evaluate DME/DME navigation accuracy along a baseline. Leg #1 (Waypoints 2-5 through 1-4) is along the SIE/ACY baseline.)
   b. Approaches to ACY and MIV - (Concurrent) (Note: This flight is to evaluate VORTAC reception during low approaches at NAFEC and Millville. ACY approach is performed directly on the SIE-ACY baseline (crossing angle = 0°). This is a low-accuracy geometry. MIV approach corssing angle = 65°.)

4. VOR/DME Primary Nav. Mode using Coyle (CYN) VORTAC - Three circuits. This flight is to evaluate reception and dropout at low altitude/ long distance. Reception problems anticipated at low altitudes near Waypoints 1-3 and 2-2.

5. DME/DME Primary Nav. Mode using CYN and SIE VORTAC - Three circuits. This flight is to evaluate DME/DME on a long baseline (47 nm). There is a large crossing angle along Leg #1 and a possible low altitude reception problem.

6. LORAN C Primary Nav. Mode using Dana and Nantucket LORAN C.

   a. Level Flights - 9 circuits (3 at 1000', 3 at 2000', and 3 at 4000'.)

   b. Approaches at MIV and ACY during the 1000' altitude circuits.

D. FLIGHT TEST DURATION

The total flight time required is as follows:

Series B-1	2.3
Series B-2	2.3
Series B-3	2.3
Series B-4	2.3
Series B-5	2.3
Series B-6	7.0
Total	18.5 Hours

The above figures are based on standard flight and approach speeds for the aircraft.

E. EQUIPMENT

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with the list in Table A-4. Radar data from the EAIR will be collected and formatted in the telemetry van.

G. NAFEC SUPPORT REQUIRED

NAFEC support will be required in the following areas:

1. EAIR tracking with serial output data to the TSC telemetry van and real time plots.
2. Aircraft operation, servicing, and maintenance.
3. MODILS operation.

The use of the photo theodolite facilities is optional and will be determined at a later date.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

(See Series A).

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X	X	X	X	X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X				X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp & Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp & SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp & SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

2.4 ATTACHMENT D

SERIES C

APPROACH FLIGHT TESTS

ATTACHMENT D - APPROACH FLIGHT TESTS - SERIES C

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technicians

Recommended Alternate Missions and Combinations:

Selected portions of the approach tests (flight paths) may be combined with any of the tests except the Series A checkout tests and the Series H, I and J tests which are offsite from NAFEC and of long duration. If EAIR data are unavailable, the tests may be flown using the NAFEC Phototheodolite facilities.

STOL AVIONICS FLIGHT TEST PROGRAM

APPROACH FLIGHT TESTS, SERIES C

A. OBJECTIVE

The objective of this test is to evaluate the MODILS guidance and the ability of the pilot to transition to MODILS guidance from an area navigation mode. The area navigation that will be used for the pilot display will be the LORAN navigation mode. During this test the other navigation aids will be telemetered for later evaluation.

B. TEST RATIONALE

Scanning beam landing guidance systems offer via their high accuracy potential and wide sector coverage the possibility of reducing separation criteria and allowing curved flight approaches to the runway. These phenomena, when coupled with area navigation in a STOL vehicle, may relieve congestion at the terminal. A central problem in this coupling is the transition from the area navigation mode to the final approach fix point. The errors involved in the area navigation quite obviously contribute to the complexity of transition.

The complexity of transition will affect the area navigation paths in terminal area. The nature of the approach paths may affect the specifications of both systems; the scanning beam landing system and the area navigation system. These tests will investigate both non line-of-sight and line-of-sight devices during this critical transition. This test responds to Navigation Data Requirements 1, 4, 5, 6, and 7, of the FAA V/STOL Data Requirements.

C. FLIGHT PLANS

Using the airborne system's area navigation capability, five approach paths to NAFEC will be flown. These paths will consist of up to nine 3 dimensional waypoints. The primary navigation system input to the area navigation system will be Loran C. Fifteen approaches will be flown on each of the five approach paths. The geometry of MODILS intercept will be varied to allow variable final approach leg length and angle of MODILS intercept.

D. FLIGHT TEST DURATION

There are five approach paths (7 flight paths) in Series C. The times for these flight paths are shown in Table 1 below:

Approach Path Number	Flight Path Number	Time for Single Flight (Minutes)	Time for Total Flights (Hours)
A	1	12.4	3.1
B	2	10.6	2.7
C	3, 4	13.5	3.4
D	5, 6	11.9	3.0
E	7	9.2	2.3

Table C.1

The total flight time duration for series C is 14.5 hours based on an average speed of 140 knots, a 3 °/sec turning rate and flying each path fifteen (15) times.

E. EQUIPMENT

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with the list in Table A-4.

G. NAFEC SUPPORT REQUIRED

NAFEC support will be required in the following areas:

1. EAIR tracking with serial output data to the TSC telemetry van and real time plots.
2. Aircraft operation, servicing, and maintenance.
3. MODILS operation.

The use of the photo theodolite facilities is optional and will be determined at a later date.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

Seven flight paths will be flown over five approach paths in Series C. Two Approach Paths (C&D) will require 2 flight paths due to the 9 way-point limitation of the software. Each ground track will vary the intercept angle with respect to the MODILS localizer. The intercept

angle is defined by the heading of the aircraft when it initiates a standard rate turn that terminates at an 'outer' marker for the MODILS capture known as the nominal capture point. The five intercept angles are 0°, 135°, 45°, 90°, and 180° (Figure C-1). A profile view of the flights is shown in Figure C-2. The MODILS location is shown in Figure C-3. All flights will be flown parallel to runway centerline over the MODILS antenna.

The waypoint definitions are given in Table C-2. The definitions of the facilities to be used are given in Table C-3. The navigation sources available for each waypoint are given in Table C-4. The primary navigation sources to be exercised initially will be as follows:

LORAN - Nantucket, Dana, and Cape Fear

VOR/DME - Atlantic City, Sea Isle, and Millville

DME/DME - Millville and Sea Isle

Approach Path A

Approach Path 1 realizes a 0° intercept by performing a standard rate turn that intercepts the extension of the localizer centerline 3.35 miles from the localizer (Figure C-4). Thus at the nominal capture point the plane is on a straight and level flight.

Take off from runway to WP1 at altitude of 200 ft. Climb at 3° to 1500 ft. and 140 kts. at WP2 (approx 704 FPM). Turn right 180° to WP3.

Proceed at 1500 ft., 140 kts. to WP4. Turn right 180° to WP5.

Proceed at 1500 ft., 140 kts. to WP6 the nominal capture point. Under MODILS guidance start 6° descent at WP7.

Descend to WP8 to 200 ft. Overfly runway at 200 ft. to WP1. Climb at 4° to 1500 ft. and 140 kts. to WP2.

Repeat procedure for 15 passes.

Approach Path B - 135° Intercept

Take off from runway to WP1 at 200' altitude, 140 kts. (Figure C-5). Climb at 3° to 1500 ft. and 140 kts. at WP2 (approx 740 FPM). Turn left 135° to WP3.

Proceed at 1500 ft., 140 kts. to WP4. Turn left 90° to WP5.

Proceed at 1500 ft., 140 kts. to WP6. Turn left 135° to WP7 the nominal capture point. Under MODILS guidance start 6° descent at WP8.

Descend to WP9 to 200 ft. Overfly runway at 200 ft. to WP1.

Repeat procedure from WP1 to WP9 for 15 passes.

Approach Path C (Flight Path 3 and 4 - 45° Intercept)

Take off from runway to FP3WP1 at 200 ft. altitude, 140 kts. (Figure C-6). Climb at 3° to 1500 ft. and 140 kts. at FP3 WP2. Turn left 135° to FP3 WP3.

Proceed at 1500 ft., 140 kts. to FP3 WP4. Turn left 90° to FP3 WP5.

Proceed at 1500 ft., 140 kts. to FP3 WP6. Turn left 90° to FP3 WP7. Upon passing FP3 WP7 enter FP4 WP1 in via PICOM entry.

Proceed at 1500 ft., 140 kts. to FP4 WP1. Turn left 45° to FP4 WP2 the nominal capture point. Under MODILS guidance start 6° descent at FP4 WP3.

Descend to FP4 WP4 at 200 ft. Overfly runway to 200 ft. Upon passing FP4 WP4 enter FP4 WP1 in via PICOM entry and proceed to FP3 WP1 at 200 ft.

Repeat procedure for 15 passes.

Approach Path D (Flight Paths 5 and 6) - 90° Intercept

Take off from runway to FP5 WP1 at 200 ft. altitude, 140 kts. (Figure C-7). Climb at 3° to 1500 ft., 140 kts. at FP5 WP2. Turn right 90° to FP5 WP3.

Proceed to FP5 WP4 at 1500 ft., 140 kts. Turn right 90° to FP5 WP5.

Proceed to FP5 at 1500 ft., 140 kts. Turn right 90° to FP5 WP7. Upon passing FP5 WP7 enter FP6 WP1 in via PICOM entry.

Proceed to FP6 WP1 at 1500 ft., 140 kts. Turn right 90° to FP6 WP2 the nominal capture point. Under MODILS guidance start 6° descent at FP6 WP3.

Descend to FP6 WP4 to at 200 ft. Overfly runway at 200 ft. Upon passing FP6 WP4 enter FP5 WP1 in via PICOM entry.

Repeat procedure for 15 passes.

Approach Path E - (Flight Path 7) - 180° Intercept

Take off from runway to WP1 (Figure C-8) at 200 ft. altitude, 140 kts. Climb at 3° to 1500 ft., 140 kts. at WP2. Turn right 180° to WP3.

Proceed at 1500 ft., 140 kts. to WP4. Turn right 180° to WP5 the nominal capture point. Under MODILS guidance start 6° descent at WP6.

Descend to WP7 at 200 ft. Overfly runway at 200 ft. to WP1.

Repeat procedure for 15 passes.

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∆ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp ∆ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp ∆ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

WAYPOINT DEFINITIONS

TABLE C-2

APPROACH PATH	FLIGHT PATH	WAYPOINT	BEARING/DISTANCE FROM PRECEEDING WP	ALTITUDE	LAT/LON
A	1	1	353°/0.6 NM		
	1	2	353°/4.7 NM	1500	
	1	3	83°/1.49 NM	1500	
	1	4	173°/12.45NM	1500	
	1	5	263°/1.49 NM	1500	
	1	6	353°/3.8NM	1500	
	1	7	353°/1.0NM	1500	
	1	8	353°/2.35NM	200	
B	2	1	353°/0.6 NM	200	
	2	2	353°/4.7	1500	
	2	3	285.5°/1.38	1500	
	2	4	218°/6.2	1500	
	2	5	173°/1.15	1500	
	2	6	128°/6.2	1500	
	2	7	060.5/1.38	1500	
	2	8	353°/3.0	1500	
	2	9	353°/2.35	200	
C	3	1	353°/0.6 NM	200	
	3	2	353°/4.7	1500	
	3	3	285.5°/1.38	1500	
	3	4	218°/10.8	1500	
	3	5	173°/1.15	1500	
	3	6	128°/7.3	1500	
	3	7	83°/1.15	1500	
	4	1	38°/3.4 NM	1500	

WAYPOINT DEFINITIONS

TABLE C-2 (Cont'd)

APPROACH PATH	FLIGHT PATH	WAYPOINT	FROM PRECEEDING WP	ALTITUDE	LAT/LON
	4	2	015.5°/0.57	1500	
	4	3	353°/3.0	1500	
	4	4	353°/2.35	200	
D	5	1	353°/0.6 NM	200	
	5	2	353°/4.7	1500	
	5	3	38°/1.15	1500	
	5	4	83°/3.2	1500	
	5	5	128°/1.15	1500	
	5	6	173°/10.65	1500	
	5	7	218°/1.15	1500	
	6	1	263°/3.2 NM	1500	
	6	2	308°/1.15	1500	
	6	3	353°/3.0	1500	
	6	4	353°/2.35	200	
E	7	1	353°/0.6 NM	200	
	7	2	353°/4.7	1500	
	7	3	083°/1.49	1500	
	7	4	173°/1065	1500	
	7	5	263°/1.49	1500	
	7	6	353°/3.0	1500	
	7	7	353°/2.35	200	

FACILITIES USED DURING FLIGHT

TABLE C-3

Facility	Elevation, ft	Lat.	Long.	Mag. Var.
Vortac				
ACY	70	39° 27' 20.7"	74° 34' 36.2"	-10
MIV	120	39 32 15.2	74 58 3.1	-10
SIE	10	39 5 43.4	74 48 2.6	- 9
Loran				
DANA	625	39 51 7.7	87 29 11.19	
NANTUCKET	625	41 15 11.93	69 58 38.76	
CAPE FEAR	TIP	34 3 46.36	77 54 46.19	
Modils	77	39 27 20.2	74 34 48.5	-10

NAVIGATION DATA SOURCES AVAILABLE FOR EACH WAYPOINT

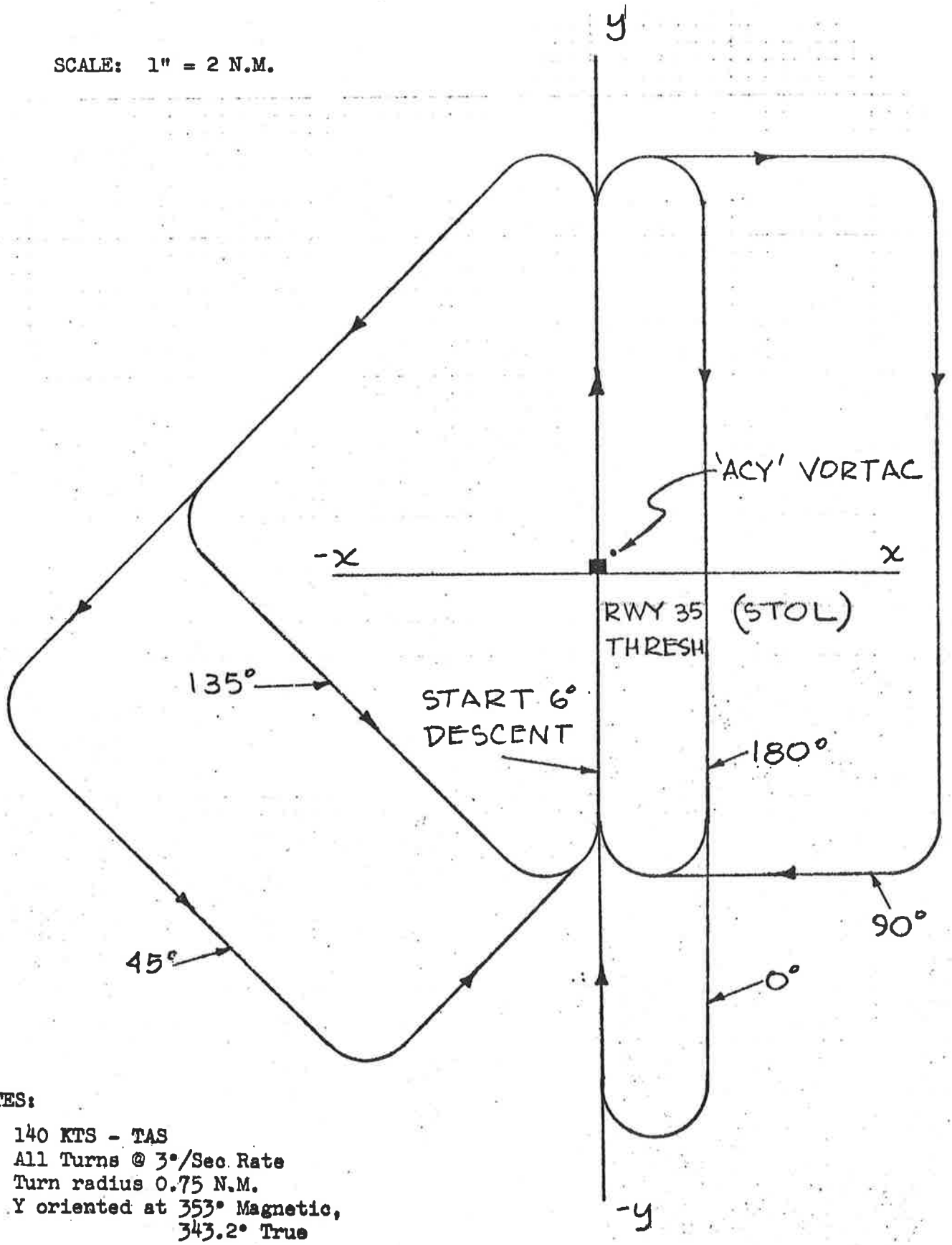
Table C-4

N-NANTUCKET A-ACY MO-MODILS
D-DANA S-SIE
F-FEAR M-MIV

Flight Path No.	Waypoint	Navigation Data Sources
1	1	NDFAM
1	2	NDFAMS
1	3	NDFAMS
1	4	NDFAMS
1	5	NDFAMS
1	6	MO NDFAMS
1	7	MO NDFAMS
1	8	MO NDFAMS
2	1	NDFAMS
2	2	NDFAMS
2	3	NDFAMS
2	4	NDFAMS
2	5	NDFAMS
2	6	NDFAMS
2	7	MO NDFAMS
2	8	MO NDFAMS
2	9	MO NDFAMS
3	1	NDFAM
3	2	NDFAMS
3	3	NDFAMS
3	4	NDFAMS
3	5	NDFAMS

TABLE C-4 (Cont'd)

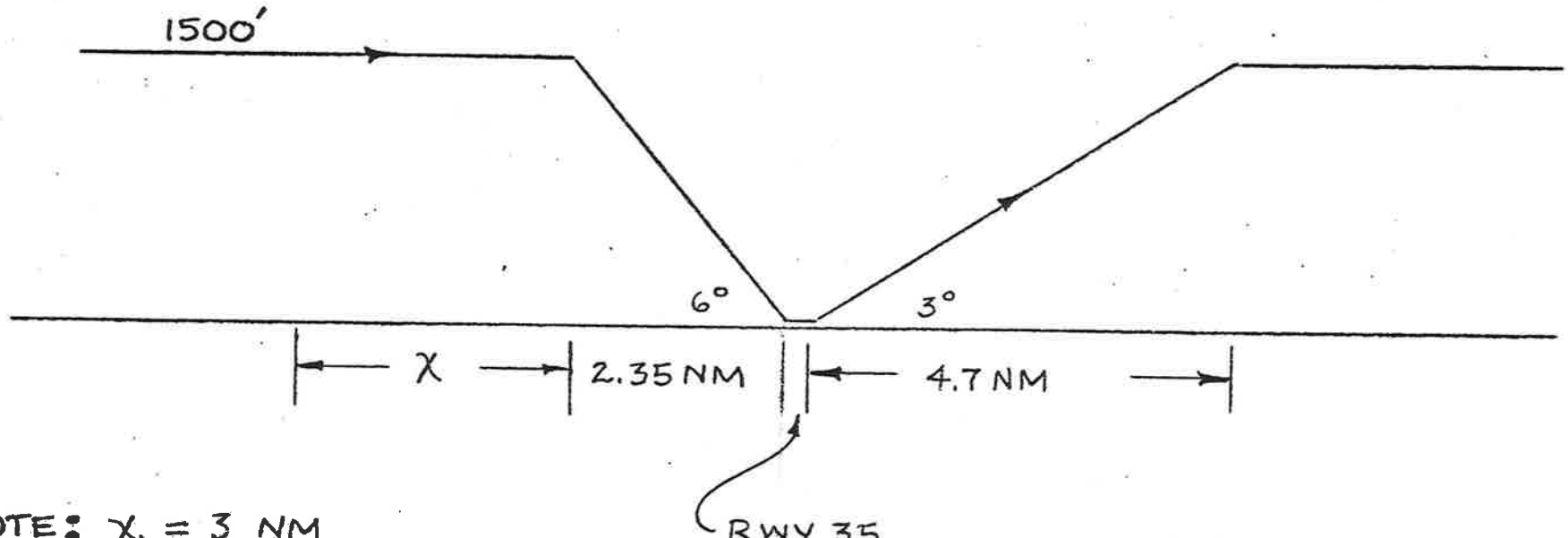
Flight Path No.	Waypoint	Navigation Data Sources
3	6	NDFAMS
3	7	NDFAMS
4	1	NDFAMS
4	2	MO NDFAMS
4	3	MO NDFAMS
4	4	MO NDFAMS
5	1	NDFAM
5	2	NDFAMS
5	3	NDFAMS
5	4	NDFAM
5	5	NDFAMS
5	6	NDFAMS
5	7	NDFAMS
6	1	NDFAMS
6	2	MO NDFAMS
6	3	MO NDFAMS
6	4	MO NDFAMS
7	1	NDFAM
7	2	NDFAMS
7	3	NDFAMS
7	4	NDFAMS
7	5	MO NDFAMS
7	6	MO NDFAMS
7	7	MO NDFAM



NOTES:

1. 140 KTS - TAS
2. All Turns @ 3°/Sec Rate
3. Turn radius 0.75 N.M.
4. Y oriented at 353° Magnetic, 343.2° True

FIGURE C-1



NOTE: X = 3 NM
DISTANCE FROM
APPROACH GATE
TO LETDOWN
POINT

FIGURE C-2

MODILS
POSITION

X = 100'
y = 14'

RUNWAY THRESHOLD
39° 27' 05.9 " N
74° 34 44.4 " W

RUNWAY HEADING
353° MAGNETIC
343.2° TRUE

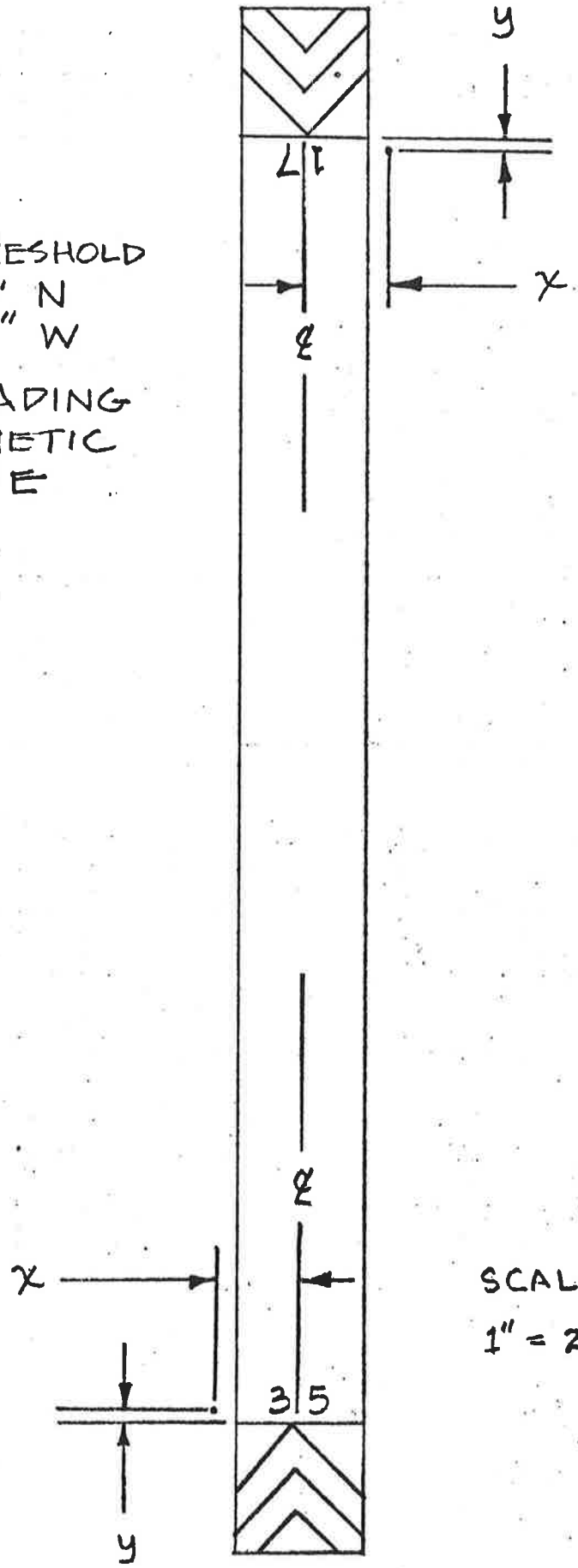
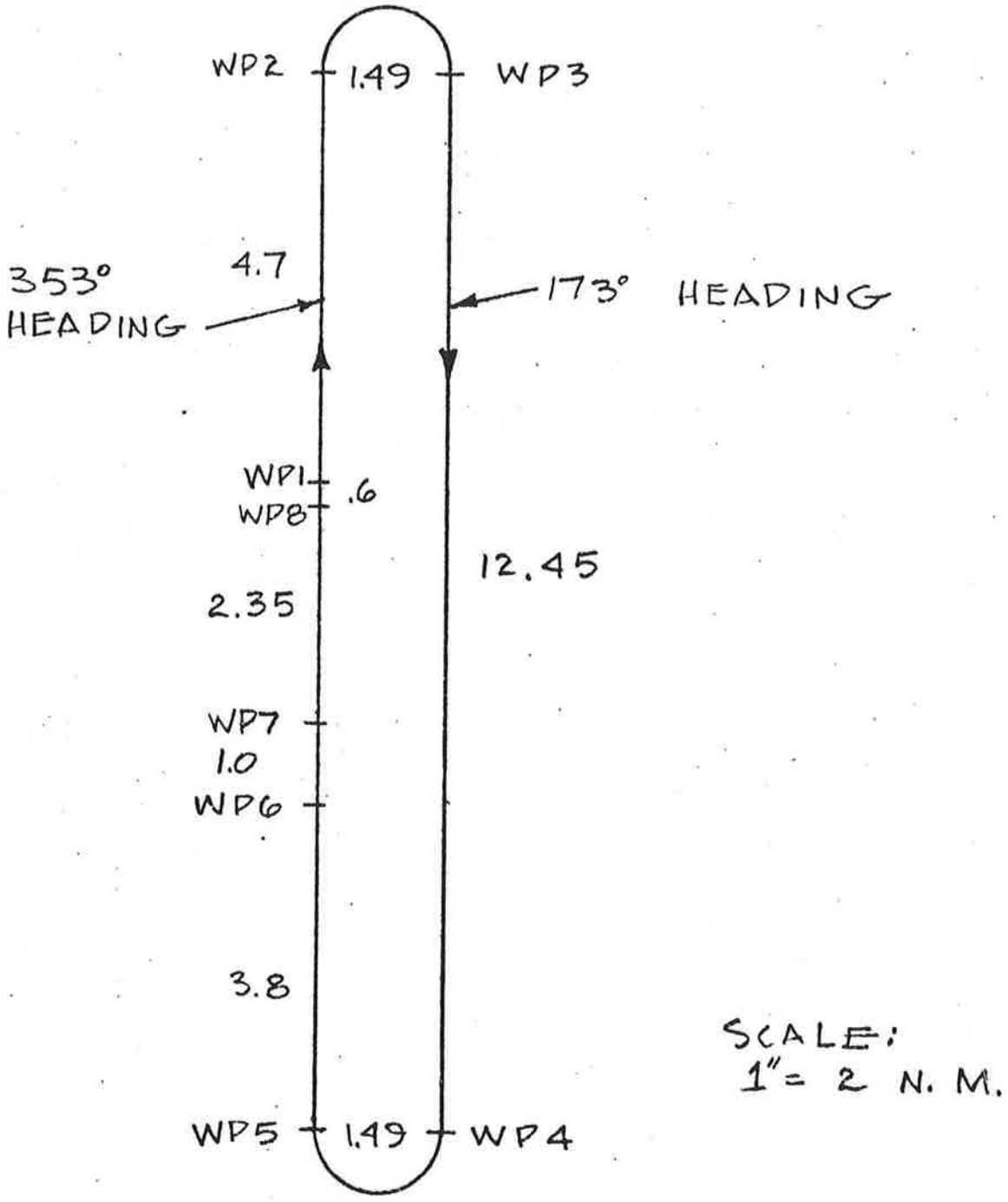
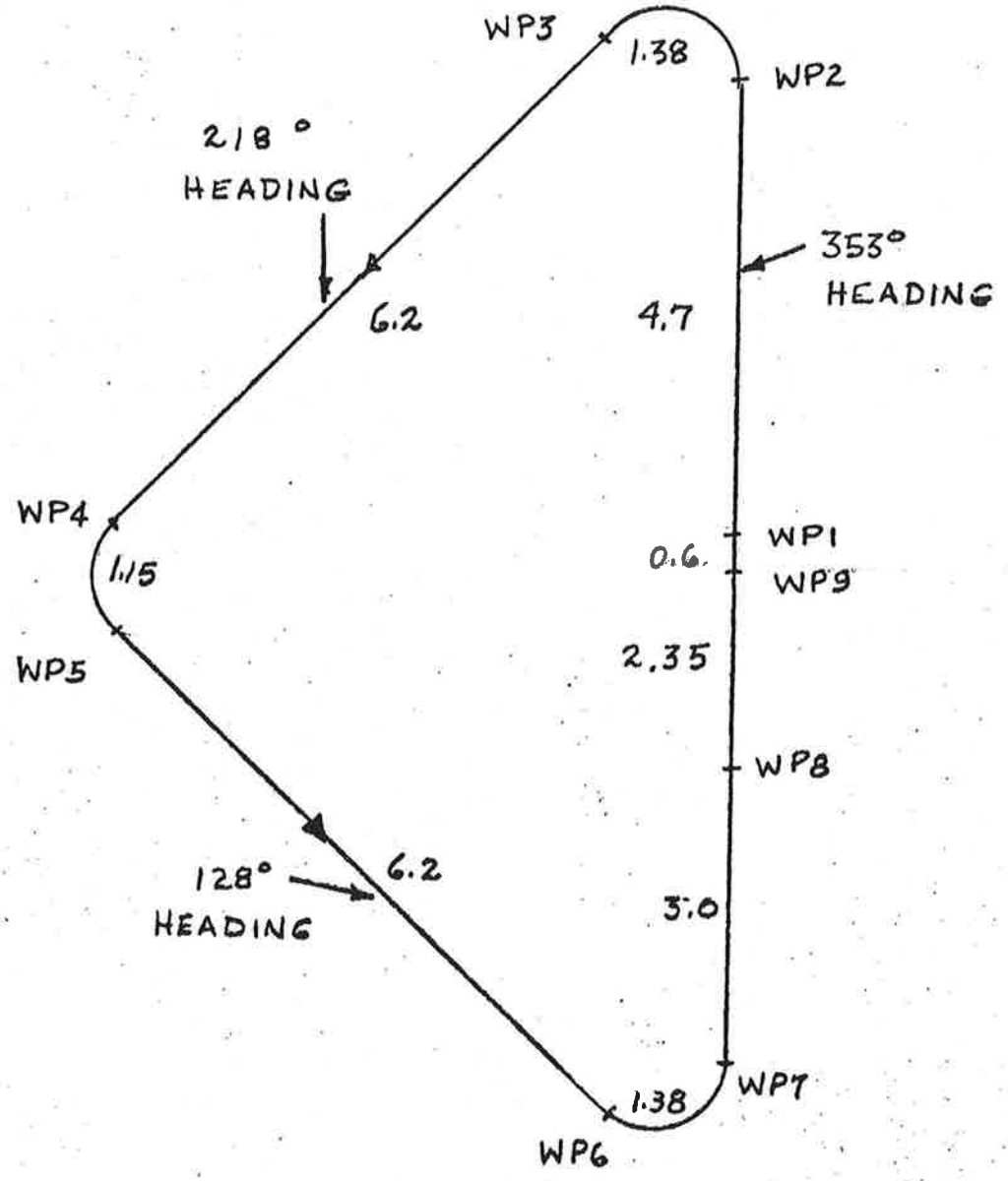


FIGURE C-3



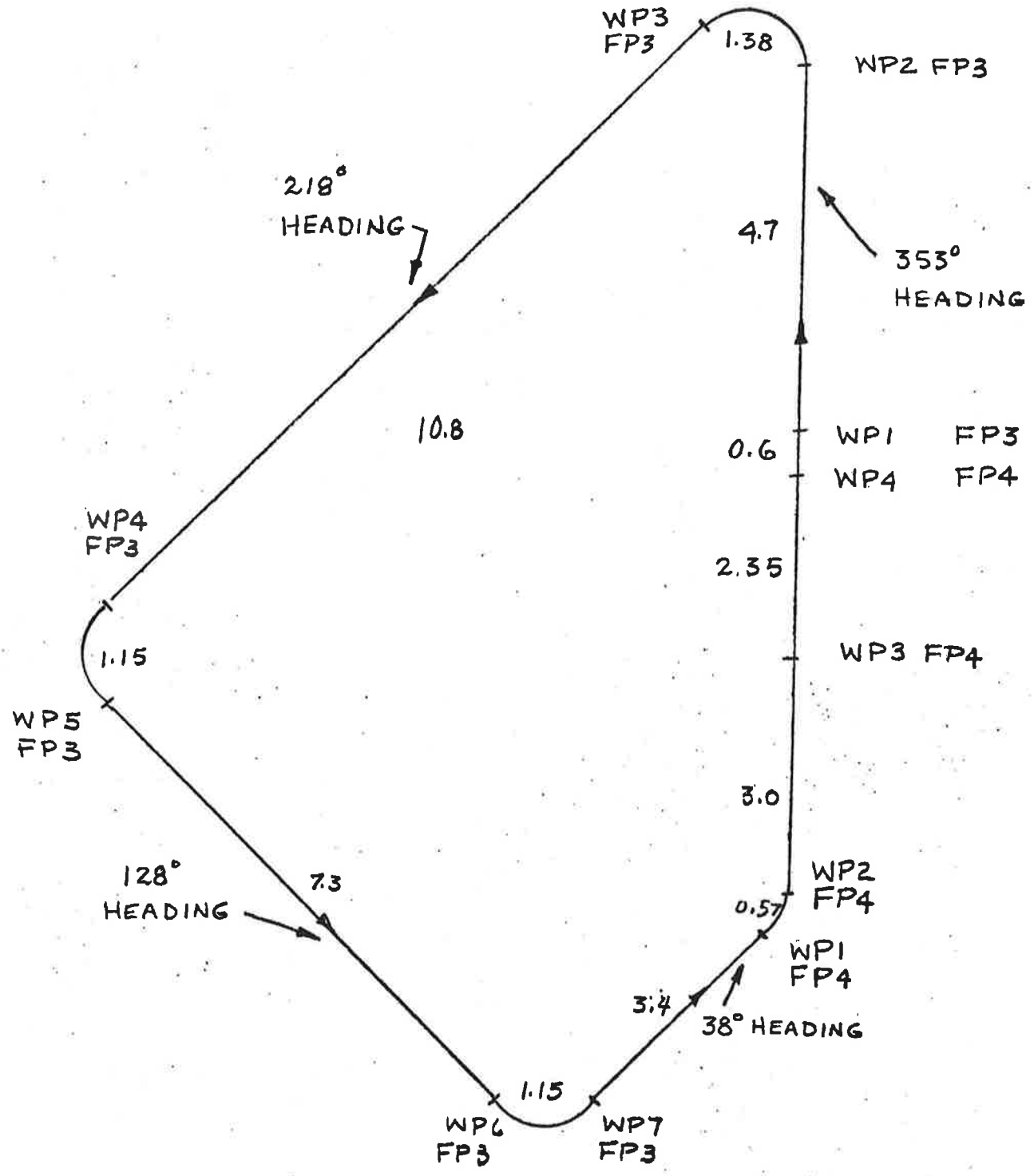
SERIES C APPROACH PATH A (FP-1)

FIGURE C-4

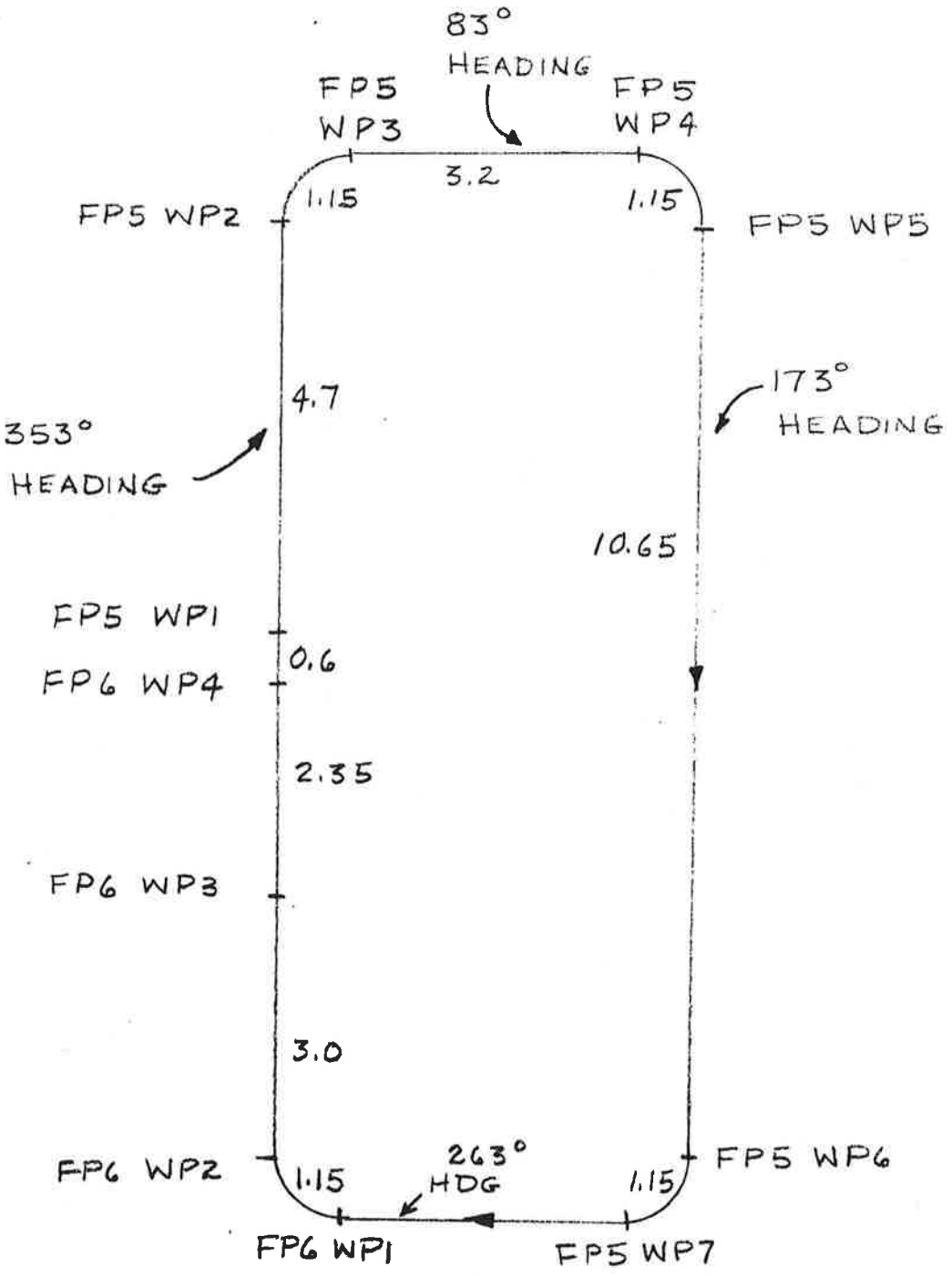


SERIES C APPROACH PATH B (FP-2)

FIGURE C-5

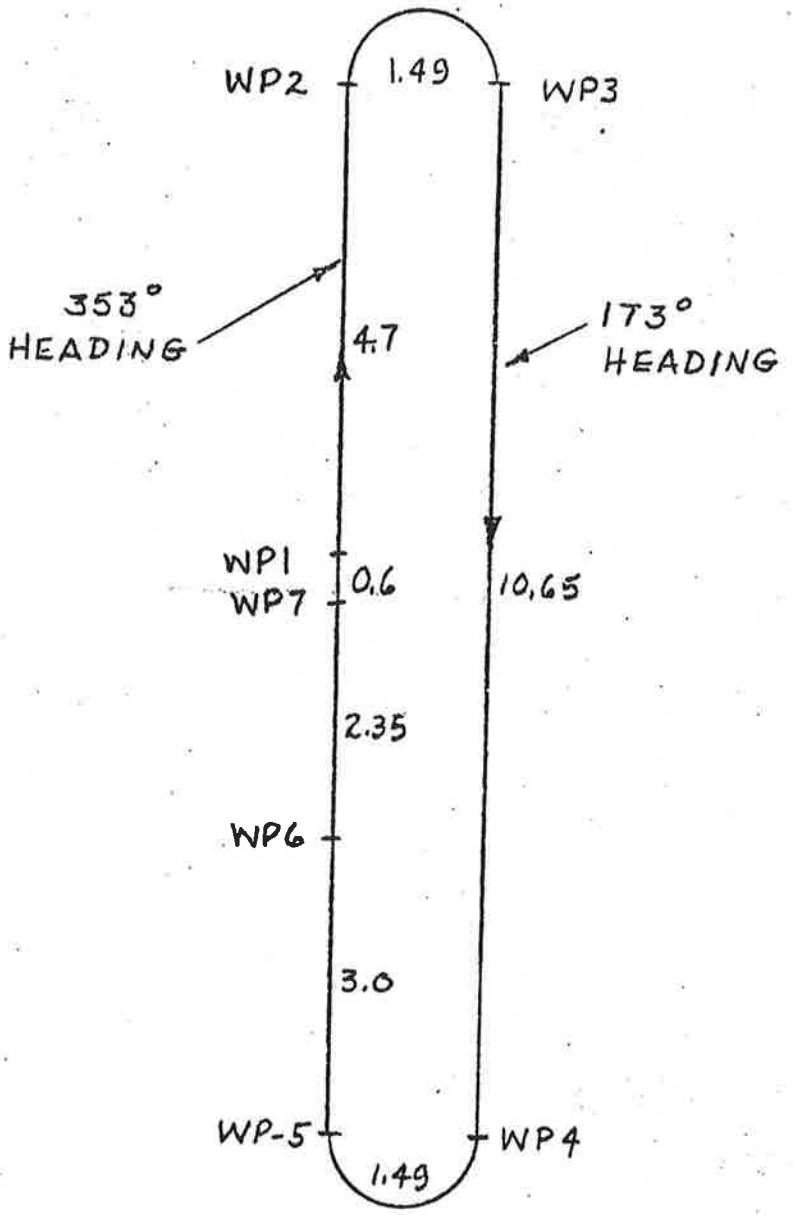


SERIES C APPROACH PATH C (FP-3,4)
FIGURE C-6



SERIES C APPROACH PATH D (FP5,6)

FIGURE C-7



SERIES C APPROACH PATH E (FP7)
FIGURE C-8

2.5 ATTACHMENT E

SERIES D

VOR FILTER FLIGHT TESTS

ATTACHMENT E - VOR FILTER TESTS, SERIES D

Number of Personnel Required:

DOT/TSC	(1) Technical Monitor
Contractor	(2) Avionics Flight Test Engineers
	(1) Telemetry Engineer
	(2) Avionics Technicians
	(1) Instrumentation Technicians

Recommended Alternate Missions and Combinations:

It is recommended that these tests be flown prior to the Area Navigation and Approach Tests, Series B and C. Alternate missions would be the Loran Land/Sea Interface tests, Maneuver Tests, and Philadelphia Noise Tests, Series E, F, and G. The tests could be combined with preliminary Approach tests, Maneuver tests and/or Area Nav tests wherein the VOR/DME mode could be evaluated or deleted as the conditions warrant.

STOL AVIONICS FLIGHT TEST PROGRAM

VOR FILTER FLIGHT TESTS, SERIES D

A. Objective:

The objectives of the VOR Filter test flight (Series D) are:

1. Collect VOR data along and across known poor radials
2. Area Navigate with TSC system in poor VOR regions with and without the filters.

B. Test Rationale:

The VOR transmitted radials at STOL altitudes and approach altitudes exhibit reduced quality. The noise on a VOR radial has been grouped into three qualitative categories - bends (low frequency), scallops (intermediate frequency), roughness (high frequency and noise). Through appropriate filters each of these effects could be compensated; however, at the expense of increasing filter time constants and system lags. As currently configured, the CTOL airway structure is based on flying along established radials which are constantly being checked. The introduction of area navigation which permits flight anywhere in the coverage of a VOR must consider flights which cross radials at STOL altitudes in the NAFEC area. The filters will simulate (1) the Butler Vac distance proportional filter, a distance/heading proportional filter and the same filters each with an added smoothing filter.

Filter tests will be run to accomplish the following:

1. Provide a data base for future simulation and filter development.
2. Evaluate the performance of the Area Nav System both with and without the filters. This will allow us to assess each of the filters and their respective gains.

C. Flight Plans

The aircraft will be flown along VOR radials and perpendicular to the VOR radials. One FAA recommended altitude will be flown for all flight paths.

There are four different flight paths - where a flight path is defined as a given set of waypoints. One flight path is along three radials and three flight paths are perpendicular to the radials.

D. Flight Test Duration

There are four flight paths in Series D. The times for these flight paths are shown in the table below.

Flight Path Number	Time for Single Flight (hrs.)
1	1.1
2, 3, 4	0.9
Total	2.0

The total hours shown above is for a single flight. It is anticipated that flight paths 1, 2, 3, and 4 test will be combined

for two flights and flight path 1 will be repeated an additional eight (8) times for a total flight time of approximately 13 hours.

E. Equipment

Airborne, Ground, and Tracking equipment to be used during the test is listed in Table A-1.

F. Data to be Collected

Airborne data will be received and collected in accordance with Table A-4.

G. NAFEC Support Required

NAFEC will supply the following support:

1. EAIR operation. The output will be in serial form to the telemetry van and real time X-Y plots of range, aximuth, and elevation in a serial position.
2. Aircraft maintenance and servicing.

H. Coordination Required

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. Flight Plans

In a NAFEC area the flight patterns will purposely traverse VOR signal areas recognized as relatively poor. In each instance the quality of the processed VOR signal will be determined prior

to filtering and after filtering. Paths will be flown along and perpendicular to the radials to test the efficacy of the filters.

A definition of each waypoint (Theta/Rho from ACY) is given in Table D-1. The navigation facilities to be used during the tests are given in Table D-2.

While all navigation facilities listed in Table D-2 can be used during the tests, the primary facility will be Atlantic City VORTAC

J. Description of Flight

Initiate Flight Path 1 WP1

Takeoff from Atlantic City runway and climb at 3° angle to WP1 on 290° heading, 1500' (6 NM).

Proceed to WP2 on 290° track, 1500', 180 kts (24 NM)

At WP2 execute a 185° left turn at 2°/second to WP3.

At WP3 proceed to WP4 on 105° track, 1500', 180 kts (30 NM)

At WP4 execute 90° right/260° left turn at 3°/second to 295° track to WP5, 1500' 180 kts (30 NM)

At WP5 execute a 185° left turn at 2°/second to WP6, 1500', 180 kts

AT WP6 proceed to WP7 on 110° track, 1500', 180 kts (30 NM)

At WP7 execute 90° right/275° left turn at 3°/second to 285° track to WP8, 1500', 180 kts (30 NM).

At WP8 execute a 190° right turn at 1°/second to WP9, 1500', 180 kts.

At WP9 initiate Flight Path 2 WP1, 1500', 180 knots (30 NM)

Proceed to FP2 WP1 on 115° track.

At WP1 execute 90° right/225° left turn to WP2 on 310° track (9.3 NM)

At WP2 execute 110° left turn at 3° per second to WP3.

Proceed to WP4 on 200° track, 1500', 180 knots (5.3 NM)

At WP4 execute 70° right turn at 3° per second to WP5.

At WP5 proceed on 270° track to WP6, 1500', 180 kts (8.6 NM)

At WP6 execute a 110° right turn at 3° per second to WP7.

At WP7 proceed on 020° track to WP8, 1500', 180 knots (12.5 NM)

At WP8 execute a 70° left turn at 3° per second to WP9.

At WP9 initiate Flight Path 3 WP1, 1500', 180 kts (8.6 NM)

Proceed to FP3 WP1 on 310° track

At WP1 execute 110° left turn at 3° per second to WP2

At WP2 proceed on 200° track to WP3, 1500', 180 knots (20.5 NM).

At WP3 execute 90° right/270° left turn at 3° per second to WP4.

At WP4 execute 110° right turn at 3° per second to WP5.

At WP5 proceed on 130° track to WP6, 1500', 180 kts (8.6 NM)

At WP6 execute 70° right turn at 3° per second to WP7.

At WP7 proceed on 200° track to WP8, 1500', 180 kts (12.5 NM).

At WP8 execute 110° left turn at 3° per second to WP9.

At WP9 initiate Flight Path 4 WP1.

Proceed on 090° track to FP4 WP1, 1500' 180 kts (8.6 NM).

At WP1 execute 70° left turn at 3° per second to WP2.

At WP2 proceed on 020° track to WP3, 1500, 180 kts (5.3 NM).

At WP3 execute 110° right turn at 3° per second to WP4.

At WP4 proceed on 130° track to WP5 (ACY) 1500', 180 kts (9.3 NM)

At WP5 breakoff area navigation and follow normal landing procedures.

Total Distance:	362 NM
Average Speed:	180 kts
Total Flight Time:	2:00

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp Δ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp Δ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp Δ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32 VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE D-1

DESCRIPTION OF WAYPOINTS

Flight Path	Waypoint	Theta/Rho From ACY	Latitude	Longitude	Altitude
1	1	290°/6 NM			1500'
1	2	290°/30 NM			
1	3	285°/30 NM			
1	4	ACY			
1	5	295° 30 NM			
1	6	290°/30 NM			
1	7	ACY			
1	8	285°/30 NM			
1	9	295°/30 NM			
2	1	ACY			
2	2	310°/9.3 NM			
2	3	302.9°/10.3 NM			
2	4	273.4°/10.4 NM			
2	5	270°/11.3 NM			
2	6	270°/19.9 NM			
2	7	273.5°/20.9 NM			
2	8	308.3°/21.1 NM			
2	9	310°/21.9 NM			
3	1	310°/30.5 NM			
3	2	307.7°/31.5 NM			
3	3	270°/31.9 NM			
3	4	307.7°/31.5 NM			
3	5	310°/30.5 NM			
3	6	310°/21.9 NM			
3	7	308.3°21.1 NM			
3	8	273.5°/20.9 NM			
	9	270°/19.9 NM			1500'

Table D-1 (Cont'd)

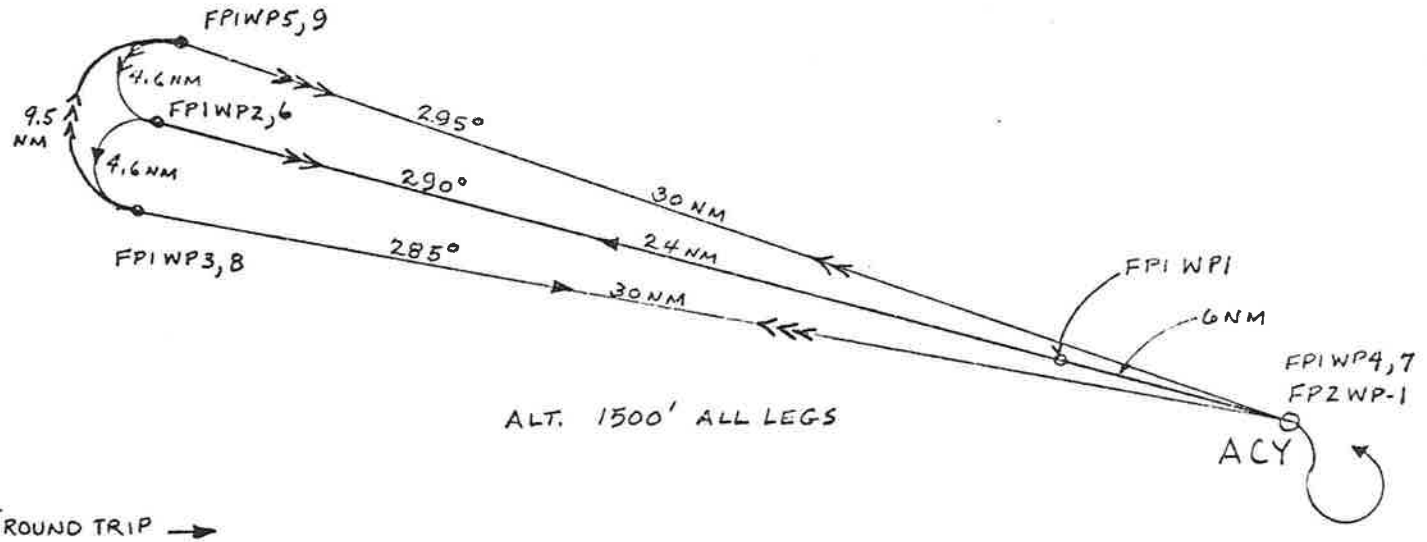
Flight Path	Waypoint	Theta/Rho From ACY	Latitude	Longitude	Altitude
4	1	270°/11.3 NM			1500'
4	2	273.4°/10.4 NM			
4	3	302.9°/10.3 NM			
4	4	310°/9.3 NM			
4	5	ACY			1500'

TABLE D-2

DESCRIPTION OF FACILITIES

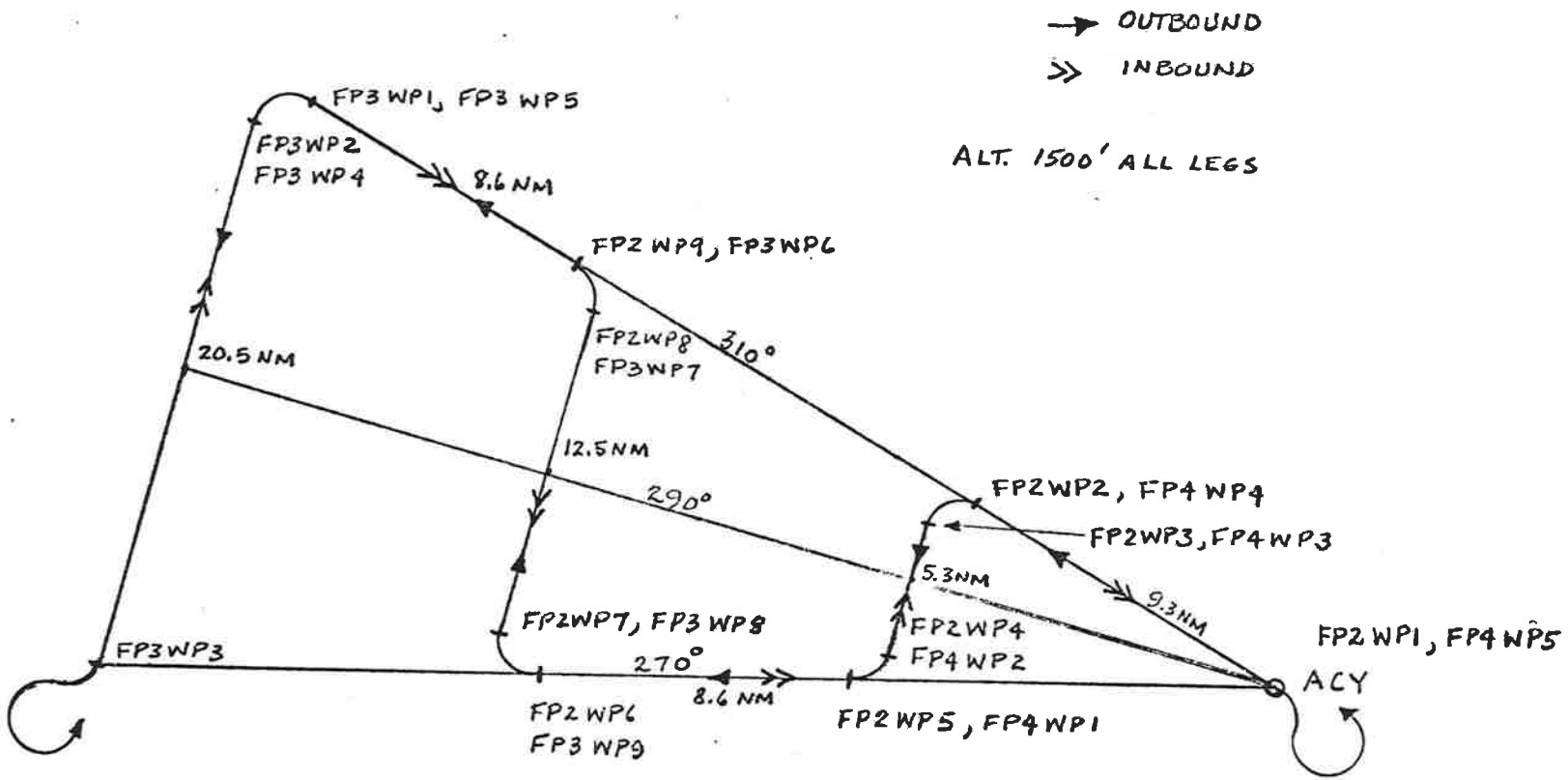
	Facility	Elevation	Latitude	Longitude	Mag. Var.
VORTAC					
	ACY	70	39 27 20.7	74 34 36.2	-10.0
	MIV	120	39 32 15.2	74 58 3.1	-10.0
	OOD	140	39 38 9.2	75 18 12.2	-9.0
LORAN					
	DANA		39 51 7.7	87 29 11.9	
	NANTUCKET		41 15 11.93	69 58 38.76	
	CAPE FEAR		34 3 46.36	77 54 46.19	

SCALE 1" = 5 NM



SERIES D — FLIGHT PATH 1
ALONG RADIAL TESTS
FIGURE D-1

SCALE 1" = 5NM



SERIES D – FLIGHT PATHS 2, 3, 4
CROSS-RADIAL TESTS
FIGURE D-2

2.6 ATTACHMENT F

SERIES E

LAND/SEA INTERFACE TEST

ATTACHMENT F - LAND/SEA INTERFACE TEST, SERIES E

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technician

Recommended Alternate Missions and Combinations:

Depending on conditions, any test may be used as an alternate mission. The Series E tests should be flown after the Area Nav tests, Series B, to provide baseline accuracy data in the Loran Mode prior to the Land/Sea tests. The tests may be combined with portions of the Maneuver tests and alternate missions could be any tests other than Series A and B.

STOL AVIONICS FLIGHT TEST PROGRAM

LAND/SEA INTERFACE TEST - SERIES E

A. Objective

The objective of the Land/Sea Interface test (Series E) is to maneuver along the coast line crossing land/sea boundaries and flying such that the path from transmitter to receiver has large land/sea effects along the path.

B. Test Rationale

The Land/Sea interface flight test (Series E) is keyed to investigate propagation anomalies in Loran C which effect the measured time difference as a result of land/sea interfaces along the propagation path from the transmitter to the receiver. The flight test has been designed to investigate the short distance effects by repeatedly flying over land/sea boundaries and to investigate the long distance phenomenon by adjusting the path from the transmitter to the receiver such that transitions occur from almost all land to a land/sea/land path.

C. Flight Plan

The flights in the NAFEC area will consist of patterns that weave through the land/water interfaces along the coast south of Atlantic City. In addition the plan provides for flights crossing Delaware Bay. An attempt has been made to conduct the flights over various types of terrain (marshy, sandy, heavy foliage) and along the

shores. The flights are constructed such that the ground track is on a near-direct bearing to one Loran station and near perpendicular to another.

D. Flight Test Duration

The flight test will consist of three programmed flight paths, which will cover the ground tracks in both the outbound and the inbound directions. The total time for each is as follows:

Outbound Ground Track	1.5	hours
Inbound Ground Track	1.4	hours
Total Time per Circuit	2.9	hours

It is anticipated that a total of 6 circuits will be made for an approximate total flying time of 18 hours.

E. Equipment

Airborne, Ground, and Tracking equipment to be used durin the test is shown in Table A-1.

F. Data to be Collected

Data will be collected from the airborne equipment in accordance with Table A-4.

G. NAFEC Support Required

NAFEC support will be required in the following areas:

1. EAIR tracking with serial output data to the TSC telemetry van and real time plots.
2. Aircraft operation, servicing, and maintenance.

H. Coordination Required

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. Flight Description

The flight test for Land/Sea Interface will consist of three flight paths linked together to provide one circuit of the ground track over the region of interest. The flight, as described below, will consist of an outbound and inbound track. The inbound track will exactly retrace the outbound track. Each circuit will be flown two times at each altitude and three altitudes (2000', 4000' and 8000') will be flown, starting at the highest altitude and working down within the limits of EAIR coverage at the maximum range. The circuit described below is designed for a 2000 foot altitude; however, the only changes required for the 4000 and 8000 foot altitudes will be the position of the initial and final waypoints. Figure E-1 is a graphic representation of the flight path with Table E-1 being a detailed description of each waypoint.

Outbound Track - Flight Paths 1 and 2

Takeoff and turn to southeast. Track direct to WP1-1 (10.0 NM). Cross WP1-1 at 2000', 130 kts.

At WP1-1 level off at 2,000', proceed to WP1-2, track 213°, 12.8 NM, 200 kts.

At WO1-2, standard rate right turn to WP1-3, heading 315°, 200 kts. Proceed to WP1-4 on 315° track, 40 NM, 200 kts.

At WP-4, enter ½ standard rate left 180° turn to proceed to WP1-5, 200 kts.

At WP1-5, proceed to WP1-6 on 135° track, 40 NM, 200 kts.

At WP1-6, right ½ standard rate 180° turn to proceed to WP1-7, 200 kts.

After crossing WP1-7, proceed to WP1-8 on 315° track, 40 NM, 200 kts.

At WP1-8, enter ½ standard rate left 180° turn to proceed to WP1-9, 200 kts.

At WP1-9, enter Flight Path 2 WP1 via the PICOM. Proceed to FP2 WP1 on 135° track, 40 NM, 200 kts.

At WP2-1, enter standard rate right 180° turn to proceed to WP2-5, 200 kts.

At WP2-2, proceed to WP2-3 on 315° track, 31.7 NM, 200 kts.

At WP2-3, enter ½ standard rate left 180° turn to proceed to WP2-4.

At WP2-4, proceed to WP2-5 on 135° track, 317 NM, 200 kts.

At WP2-5, perform 90° right/270° left turn to reverse heading to WP2-6 on 315° track, 31.7 NM, 200 kts.

Continue in reverse direction through WP2-6, -7, -8 and -9.

After crossing WP2-9, enter FP3 in the computer via PICOM. Continue flying sequence of waypoints in opposite (inbound) direction.

At WP3-9 flight path is completed. Visual approach and landing at ACY (10 NM).

Outbound			
Distance	293.5 NM	Time	1:28
Inbound			
Distance (to ACY)	287 NM	Time	1:26
Total			
Distance	580.5	Time	2:54

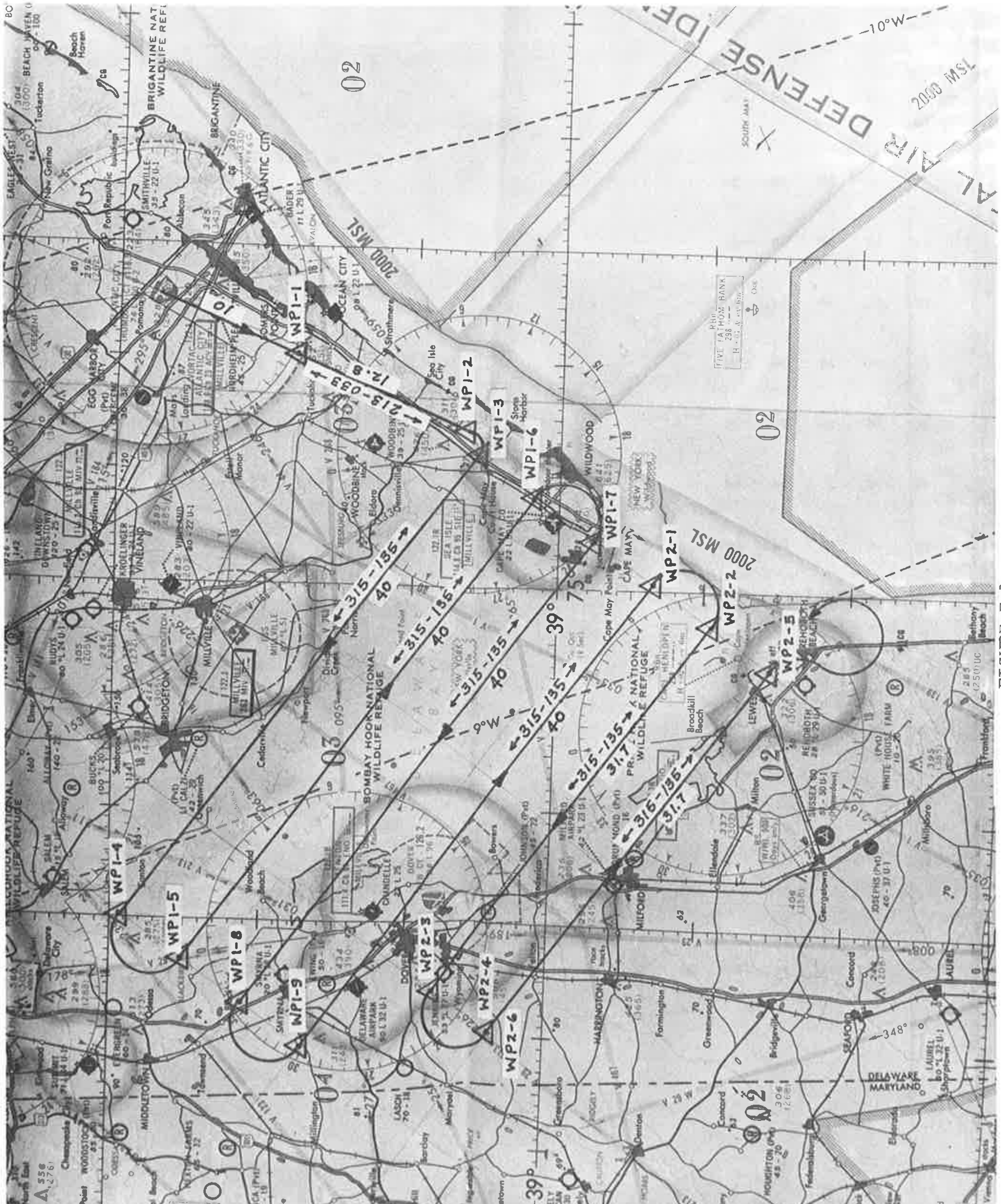

WP1-1
WP1-2
WP1-3
WP1-4
WP1-5
WP1-6
WP1-7
WP1-8
WP1-9
WP2-1
WP2-2
WP2-3
WP2-4
WP2-5
WP2-6
213-033
12.8
10
←315-135→
40
31.7
←316-135→
9°W
39°
75°
10°W
2000 MSL
DEFENSE
AIR
ATLANTIC CITY
OCEAN CITY
WILDWOOD
CAPE MAY
BRIGANTINE
MILLVILLE
VINELAND
BRIDGETOWN
SALEM
DOVER
MILFORD
HARRINGTON
GEORGETOWN
LEWES
BOMBAY HOOK NATIONAL WILDLIFE REFUGE
DELAWARE
MARYLAND

FIGURE E-1

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp Δ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp Δ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp Δ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32 VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

WAYPOINT DESCRIPTION

TABLE E-1

WAYPOINT		FACILITY	THETA/RHO	LATITUDE	LONGITUDE
1-1	3-9	ACY	213°/10.0	39°18'09"	74°39'40"
1-2	3-8	ACY	213°/22.8	39°06'18"	74°46'16"
1-3	3-7	SIE	SIE	39°05'43"	74°48'03"
1-4	3-6	SIE	315°/40.0	39°29'14"	75°29'45"
1-5	3-5	ENO	359°/11.7	39°25'25"	75°33'36"
1-6	3-4	SIE	225°/5.0	39°01'40"	74°51'50"
1-7	3-3	SIE	225°/10.0	38°57'38"	74°55'37"
1-8	3-2	ENO	334°/8.8	39°21'07"	75°37'30"
1-9	3-1	ENO	303°/8.6	39°17'24"	75°41'08"
2-1	2-9	SIE	225°/15.0	38°53'35"	74°59'24"
2-2	2-8	SIE	225°/20.0	38°49'32"	75°03'11"
2-3	2-7	ENO	225°/7.0	39°08'14"	75°36'17"
2-4	2-6	ENO	225°/12.0	39°04'12"	75°40'04"
2-5	↑	SIE	225°/25.0	39°45'29"	75°06'57"

2.7 ATTACHMENT G

SERIES F

MANEUVER FLIGHT TESTS

ATTACHMENT G - MANEUVER FLIGHT TESTS, SERIES F

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technician

Recommended Alternate Missions and Combinations:

The Maneuver tests can be combined with Approach tests or Land/Sea Interface tests. Any other test may be used an an alternate depending on the conditions. If EAIR data are unavailable, the mission could be flown within the tracking range of the NAFEC Phototheodolites.

STOL AVIONICS FLIGHT TEST PROGRAM

MANEUVER FLIGHT TESTS, SERIES F

A. Objective

The objective of this test is to measure and evaluate the errors induced in the Loran navigation system when the aircraft is under acceleration. These accelerations will be imposed upon the system when the aircraft performs a turning maneuver.

B. Test Rationale

In achieving the high accuracy potential of the Loran C navigation system it is necessary to filter the noise within the Loran bandwidth. This filter, usually inherent in the phase lock loop, imposes a time lag upon the time difference output of the Loran navigation mode. Thus a compromise is made in filter time constant selection to accommodate steady flight accuracy requirements and accuracy requirements under maneuver.

This phenomenon would affect the approach paths in the terminal area. In essence the ability of line-of-sight navigation techniques to permit transition to final approach along curved paths is in question. Depending on the magnitude of the effect, the tightness of the turn may have to be altered to permit proper positioning at the final approach fix. All enroute maneuvers and holding patterns would have to be examined in light of this

effect. The examination of this phenomenon in the flight tests will respond to Navigation Data Requirements 1, 3 and 7, of the FAA V/STOL Data Requirements.

C. Flight Plans

The maneuver phenomenon for Loran C is dependent upon the orientation of the flight path to the Loran transmitters. Three different ground tracks will be flown with each of the ground tracks intersecting at a common point. The ground tracks will be displaced 45° apart. Since the phenomenon is essentially altitude independent only one altitude will be flown.

Each flight leg will be on the order of 10 miles. At the end of each leg a controlled turn will be made. The length of the flight leg will permit observation of settling times of the receiver. Because of sensitivity of position deviation to velocity, each ground track will be traversed three times, each flight, to obtain sufficient data for evaluation. The pattern will be repeated for three different aircraft velocities of which the minimum will be 150 knots. At an average speed of 160 knots the flight tests require about 7.0 hours.

D. Performance Measure

The measurement of system performance will be determined from comparison of position indicated in the Loran navigation mode

against the position indicated by the NAFEC EAIR facility. The flights will be flown in the NAFEC area where the EAIR accuracy is known to be excellent. Since changes in position indication in the maneuver mode are being measured, we anticipate that an accuracy ratio on the order of 7-8:1 will be available.

E. Flight Test Duration

There are five flight paths in Series F. Three flight paths will be used to gather data and the remaining two paths will be transition type paths to proceed from/to NAFEC to the test area.

Flight Path Number	Time For Flight (hrs)
1	0.2 (transition)
2	0.6
3	0.6
4	0.6
5	0.2 (transition
	2.2 Hours

Time for each flight test is based on an average speed of 160 knots and a turning rate of 7.0°/sec or 0.37 NM radius of turn. The flight test will be run at airspeeds of 150, 160 and 170 knots.

F. Equipment

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

G. Data to be Collected

Data will be collected from the airborne equipment in accordance with Table A-4.

H. NAFEC Support Required

NAFEC support will be required in the following areas:

1. EAIR tracing with serial output data to the TSC telemetry van and real time plots of the radar position of the aircraft.
2. Aircraft operation, servicing, and maintenance.

I. Coordination Required

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

J. Flight Test Descriptions

Five flight paths will be used in this series with flight paths 1 and 5 being used to transition the aircraft to/from NAFEC and the test area. Figures F-1, F-2 and F-3 are plan views of flight paths 2, 3 and 4. Each flight test will consist of flying the following flight paths.

Flight Path No.	No. of Times Flown
1	1
2	2
3	2
4	2
5	1

The above flight tests will be flown at 150 knots, 160 knots and 170 knots. The waypoint description of each flight path is given in Table F-1.

The facilities to be utilized will be as follows:

Facility	Elevation	Latitude	Longitude	Mag. Var.
ACY	70	39 27 20.7	74 34 36.2	-10
LORAN				
DANA		39 51 7.7	89 29 11.9	
NANTUCKET		51 15 11.93	69 58 38.76	
CAPE FEAR		34 3 46.36	77 54 46.19	

The primary navigation data are the signals transmitted for Loran stations. The ACY facility is available for alternate navigation mode.

Flight Path 1

Takeoff from runway Climb at a 3° angle and a bearing of 157.5 degrees from NAFEC airport to 4000 feet at WP1. Proceed to WP2 at 4000 feet. Prior to reaching WP2 (approx. 6 miles between WP1 and WP2) enter FP2 WP1 in the computer via the PICOM.

Flight Path 2

At WP1 turn left for 53° to WP2. Proceed at 150 knots at altitude of 4000 feet to WP3.

At WP3 perform left turn for 180° at bank angle of 45° at 150 knots to WP4. From WP4 proceed in level flight at 4000 feet and 150 knots to WP5.

At WP5 perform left turn for 180° at bank angle of 45° at 150 knots to WP6. From WP6 proceed in level flight at 4000 feet altitude, 150 knots to WP7.

At WP7 perform left turn for 180° at bank angle of 45° at 150 knots to WP8. After passing WP8 enter FP2, WP1 in via the PICOM and repeat FP2. After passing FP2 WP8 the second time enter FP3 WP1 in via the PICOM.

Flight Path 3

Flight path 3 is initiated after crossing WP8 of FP2 (see above).

Proceed to WP1 at 4000 feet altitude and 150 knots. At WP1 perform left turn for 225° at bank angle of 45° at 150 knots to WP2. From WP2 proceed to WP3 in level flight at 4000 feet altitude and 150 knots.

At WP3 perform left turn for 180° at bank angle of 45° and 150 knots to WP4. From WP4 proceed to WP5 in level flight at 4000 feet altitude and 150 knots.

At WP5 perform left turn for 180° at bank angle of 45° at 150 knots to WP6. From WP6 proceed to WP7 in level flight at 4000 feet altitude and 150 knots.

At WP7 perform left turn for 180° at bank angle of 45° and 150 knots to WP8.

Upon passing WP8 enter FP3 WP1 via the PICOM entry system and repeat FP3. After passing FP3 WP8 the second time enter FP4 WP1 via the PICOM.

Flight Path 4

Flight path 4 is initiated after crossing WP8 of FP3. (see above)

Proceed to WP1 at 4000 feet altitude and 150 knots. At WP1 perform left turn for 90° at bank angle of 45° at 150 knots to WP2. From WP2 proceed to WP3 in level flight at 4000 feet altitude and and 150 knots.

At WP3 perform left turn for 180° at bank angle of 45° and 150 knots to WP4. From WP4 proceed to WP5 in level flight at 4000 feet altitude and 150 knots.

At WP5 perform left turn for 180° at bank angle of 45° at 150 knots to WP6. From WP6 proceed to WP7 in level flight at 4000 feet altitude and 150 knots.

At WP7 perform left turn for 180° at bank angle of 45° and 150 knots to WP8. After passing WP8 enter FP4 WP1 and repeat FP4. After passing FP4 WP8, the second time enter FP5 WP1 via the PICOM.

Flight Path 5

Flight path 5 is initiated after passing FP4 WP8 (see above).

Proceed to WP1 at 4000 feet at WP1 begin 3° descent to arrive at WP2 at 1500 feet. Proceed to WP3 at 1500 feet. At WP3 begin a 6° descent under MODILS or Area Nav guidance to WP4. WP4 is the MODILS site and the approach should be broken off at 200 feet and a normal landing made.

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∠ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp ∠ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp ∠ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

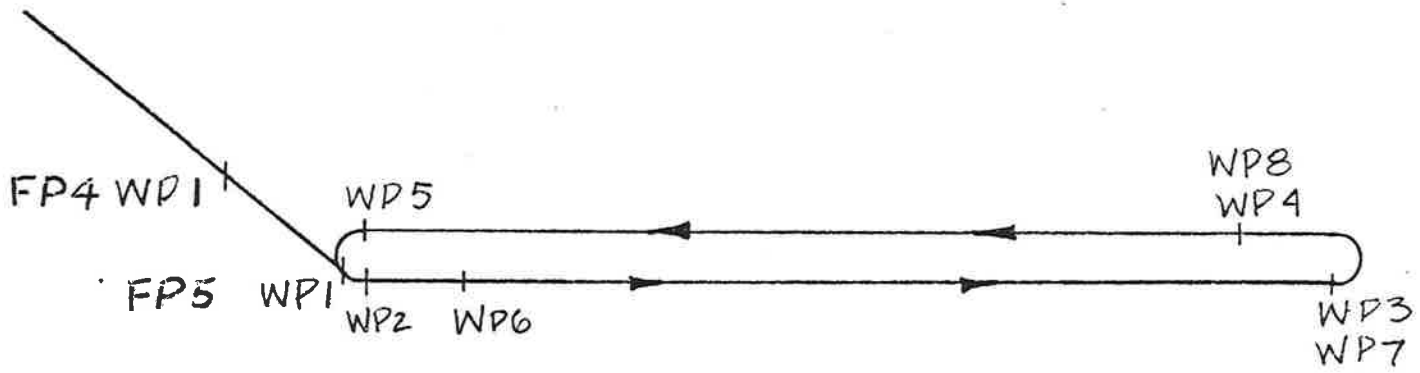
DETAILED DEFINITION OF WAYPOINTS

TABLE F1

Flight Path	Waypoint	Latitude	Longitude
1	1	39° 16.5'	74° 25.4'
1	2	39° 12.2'	74° 21.7'
2	1	39° 12.2'	74° 21.7'
2	2	39° 12.'	74° 20.7'
2	3	39° 12.'	74° 8'
2	4	39° 12.57'	74° 9.2'
2	5	39° 12.57	74° 20.7'
2	6	39° 12'	74° 19.5'
2	7	39° 12.'	74° 8'
2	8	39° 12.5'	74° 9.2'
3	1	39° 12.55'	74° 20.7'
3	2	39° 12.77'	74° 20.4'
3	3	39° 19.57'	74°11.7'
3	4	39° 19.17'	74° 13.2'
3	5	39° 12.57'	74° 20.7'
3	6	39° 12.77'	74° 19.5'
3	7	39° 19.57'	74° 11.7'
3	8	39° 19.17'	74° 13.2'

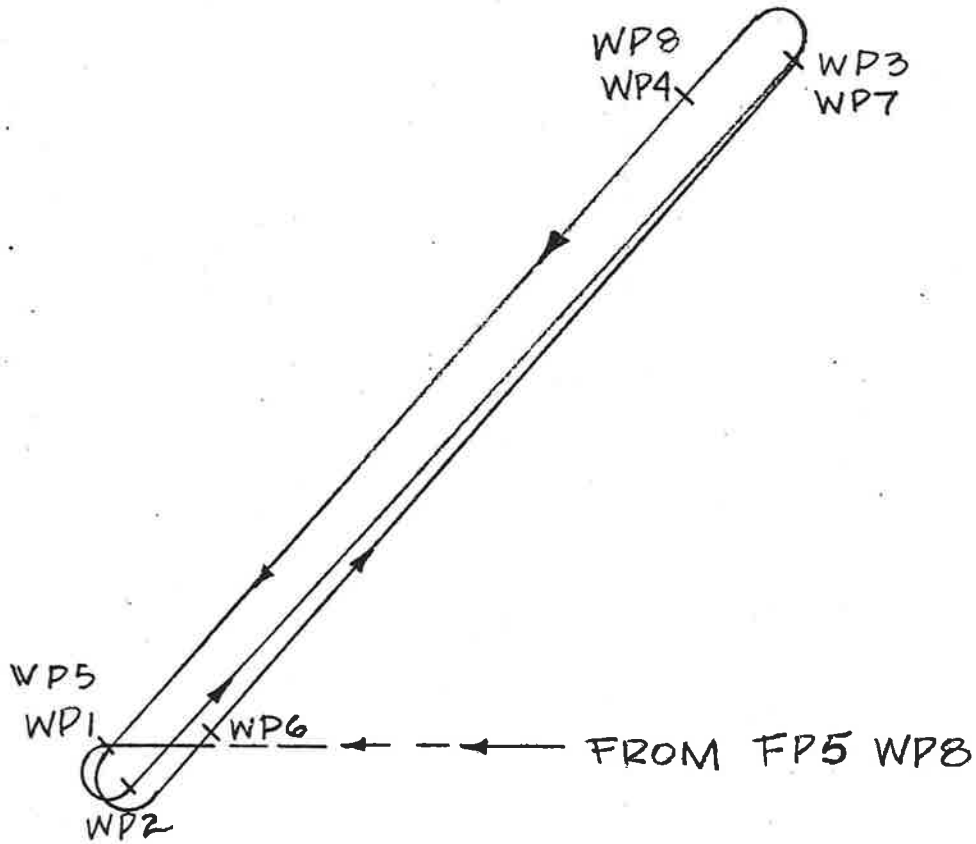
TABLE F1 (con't)

Flight Path	Waypoint	Latitude	Longitude
4	1	39 12.57	74 20.7
4	2	39 12.07	74 20.7
4	3	39 5.17	74 11.5
4	4	39 6.37	74 12.0
4	5	39.12.57	74 20.7
4	6	39 11.47	74 20.4
4	7	39 5.17	74 11.5
4	8	39 6.37	74 12.0
5	1	39 16.2	74 30.6
5	2	39 25.9	74 34.4
5	3	39 26.9	74 34.7
5	4	39 29.325	74 35.62



SCALE: 1" = 2 N.M.

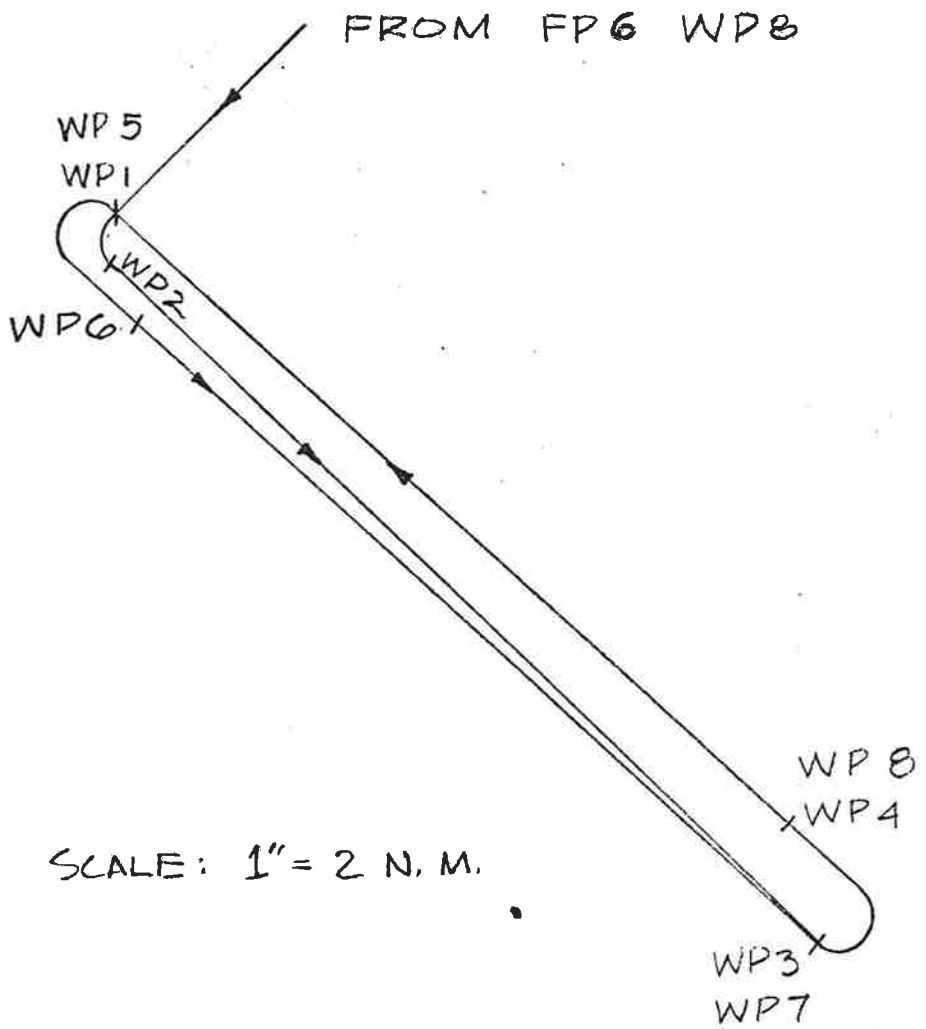
SERIES F FLIGHT PATH 2
FIGURE F-1



SCALE: 1" = 2 N. M.

SERIES F FLIGHT PATH 3

FIGURE F-2



SERIES F FLIGHT PATH 4
FIGURE F-3

2.8 ATTACHMENT H

SERIES G

PHILADELPHIA NOISE TESTS

ATTACHMENT H - PHILADELPHIA NOISE TESTS, SERIES G

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(2)	Avionics Flight Test Engineers
	(1)	Telemetry Engineer
	(2)	Avionics Technicians
	(1)	Instrumentation Technician

Recommended Alternate Missions and Combinations:

These tests should be flown after the Area Navigation and VOR Filter tests to permit evaluation of the noise effects on navigation and effectiveness of the VOR filter(s). The mission can be combined with portions of the Approach tests. Alternate missions will be planned based on prevailing conditions.

STOL AVIONICS FLIGHT TEST PROGRAM

PHILADELPHIA NOISE TESTS SERIES G

A. OBJECTIVE

The objective of the Philadelphia Noise Test (Series G) is to fly a grid pattern over Philadelphia at various altitudes, at day and night, and at peak electrical noise conditions. The tests will collect data on LORAN, VOR and DME in an urban environment, to evaluate the quality of the LORAN, VOR, and DME signals, to evaluate the coverage of VOR and DME over Philadelphia at STOL altitudes and to evaluate the Area Nav capability of LORAN in the noisy environment.

B. TEST RATIONALE

It has been proposed in the STOL system to provide inner city or near city STOLPORTS. The city or urban area contributes significantly to the radio noise in each of the radio navaid frequency bandwidths. Philadelphia is characteristic of such an environment and is also sufficiently close to NAFEC to be under EAIR surveillance at STOL altitudes. The Philadelphia noise test is designed primarily as a data gathering mission to collect data on LORAN noise over a city at several altitudes, at day/night, and at peak electrical noise conditions.

At the same time, data will be collected on VOR and DME to evaluate noise on these signals and to assess coverage.

C. FLIGHT PLANS

The effects of the noise and city environment phenomena are distributed unevenly over the areas of interest. Grids will be flown over these areas and patterns of error distribution will be determined from examination of the distortions over these grids.

In the regions where the NAFEC EAIR radar is effective, it will be used to measure the position of the aircraft. This measurement will be compared to the position indicated in the Loran mode. In other regions a combination of surveillance radar measurement and/or other airborne navigation modes will be used to assess the performance of the system.

D. FLIGHT TEST DURATION

The flight test will consist of seven flight paths which include transition to/from NAFEC. Each complete circuit of the seven flight paths will require approximately 2.7 hours at an average airspeed of 180 kts. It is anticipated that these flights will be repeated at least 8 times for a total flight time of approximately 20 hours.

E. EQUIPMENT

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with Table A-4.

G. NAFEC SUPPORT REQUIRED

NAFEC support will be required in the following areas:

1. EAIR tracking with serial output data to the TSC telemetry van and real time plots.
2. Aircraft operation, servicing, and maintenance.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

A constant altitude grid consisting of 7 rectangular circuits will be flown over the Philadelphia area to take Loran-C data and evaluate the effect of city noise on navigational accuracy. Loran-C signals from Nantucket, Dana and Cape Fear will supply the primary nav information. The grid may also be flown using the Woodstown (OOD), Yardley (ARD) or Pottstown (PTW) VORTACS in the RNAV mode.

Each circuit consists of a 20 nm by 10 nm rectangle. Seven circuits (420 nm) plus the distance to and from NAFEC (approx. 60 nm) will require 3:00 flying time at an average speed of 180 kts.

Each of the circuits will be flown eight times at varying altitudes depending on radar coverage and Air Traffic Control clearances.

Figures G-1 and G-2 represent the layout of the Philadelphia grid flight paths. Table G-1 represents the detailed description of each waypoint.

Flight Path 1

After takeoff from ACY, proceed direct to WPØ-1 via ACY 351° radial, level off. Proceed direct to WPØ-2 via ACY 351° radial (24.1 nm).

Initiate flight path 1 just prior (2 nm) to crossing WPØ-2, and proceed via the entry leg direct to WP1-1, heading 279° (3.8 nm).

The plane will now be in position to begin circuit 1 (see Figure 1). Circuit 1 is indicated by a solid line. Cross WP1-3, proceed direct WP1-4 via heading 279°. (12.0 nm) after obtaining positive indication of waypoint passage at WP1-4, enter right standard rate turn to intercept the northbound leg, proceed to WP1-5 heading 009°. (20.0 nm) intercept angle to the northbound leg will be at pilot's discretion.

After crossing WP1-5, enter standard rate right turn to intercept eastbound leg, proceed to WP1-6 heading 099° (10.0 nm) intercept angle to eastbound leg is at pilot's discretion.

After crossing WP1-4, enter standard rate right turn to intercept southbound leg, proceed to WP1-7 heading 189° (13.0 nm). Intercept angle to southbound leg is at pilot's discretion.

Flight Path 2

After crossing WP1-7, initiate flight path 2, proceed direct to WP2-1 heading 189° (7.0 nm) after crossing WP2-1, standard rate right turn to intercept westbound leg of circuit 2, and proceed to WP2-2. (12.0 nm) circuit 2 is indicated by dashed line.

Circuit 2, and subsequent circuits are flown in a similar manner to circuit 1. Each circuit lies 2 nm west of the preceeding one, and each is designated as an individual flight path in the computer. Upon reaching the fifth waypoint of each circuit except flight path 1 the next flight path is initiated in the computer.

Upon reaching WP7-5, grid is complete and proceed direct WP7-6 ACY.

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1 (Cont'd)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5 Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∠ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp ∠ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp ∠ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32 VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE G-1

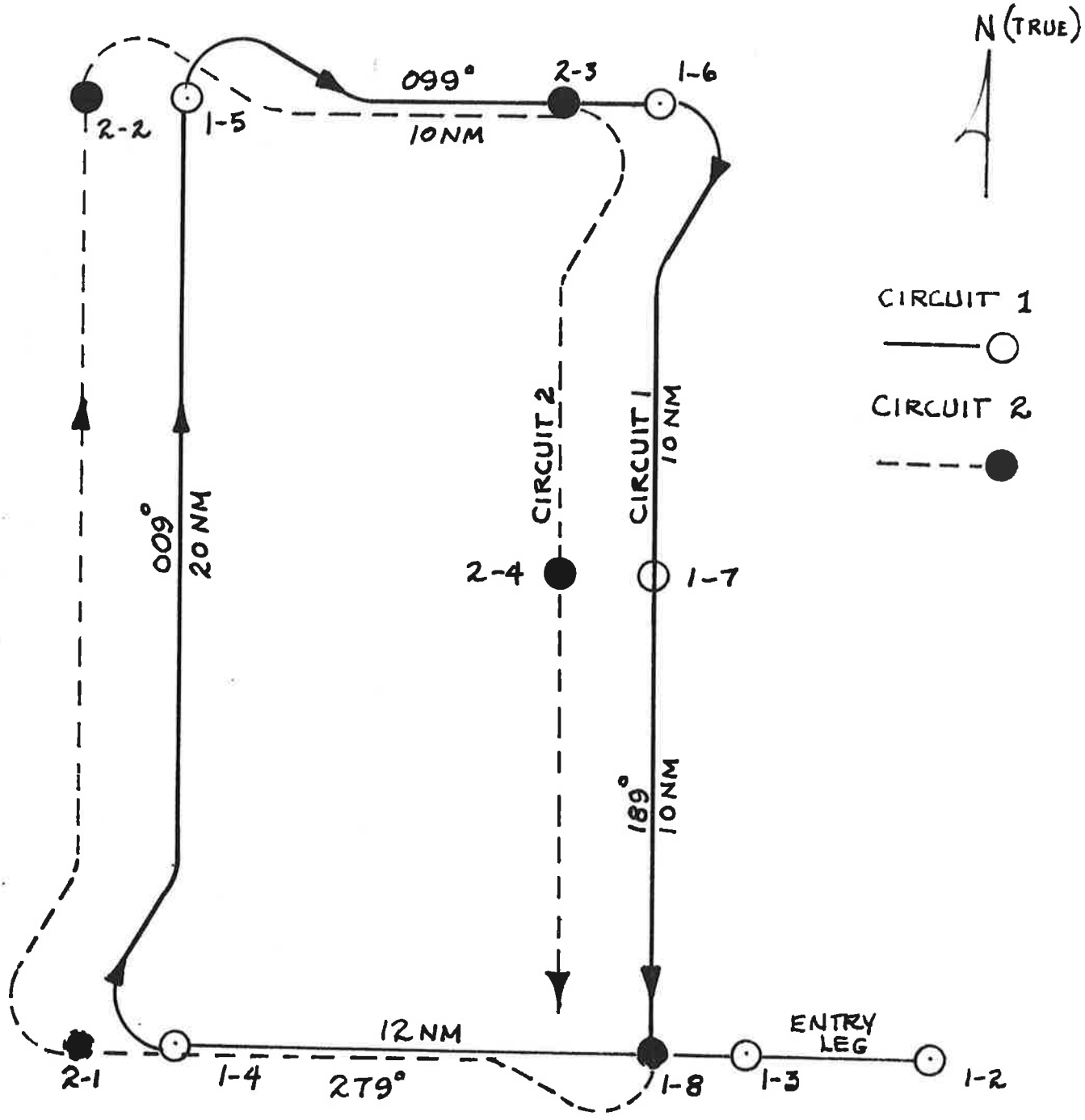
PHILADELPHIA GRID (NORTH-SOUTH LEGS)

WAYPOINT	LAT.	LONG.	TD DANA	TD NANTUCKET
1-1	(Depends on	Altitude)		
1-2	39° 50'	74° 45'		
1-3	39° 50'	74° 49' 54.9"		
1-4	39° 50'	75° 05' 26.1"		
1-5	40° 10'	75° 05' 26.1"		
1-6	40° 10'	74° 52' 30.1"		
1-7	40° 00'	74° 52' 30.1"		
1-8	39° 50'	74° 52' 30.1"		
2-1	39° 50'	75° 08' 01.3"		
2-2	40° 10'	75° 08' 01.3"		
2-3	40° 10'	74° 55' 05.3"		
2-4	40° 00'	74° 55' 05.3"		
2-5	39° 50'	74° 55' 05.3"		
2-6	39° 50'	75° 10' 36.5"		
2-7	40° 10'	75° 10' 36.5"		
2-8	40° 10'	74° 57' 40.5"		
3-1	40° 00'	74° 57' 40.5"		

TABLE G-1 (Continued)

PHILADELPHIA GRID (NORTH-SOUTH LEGS)

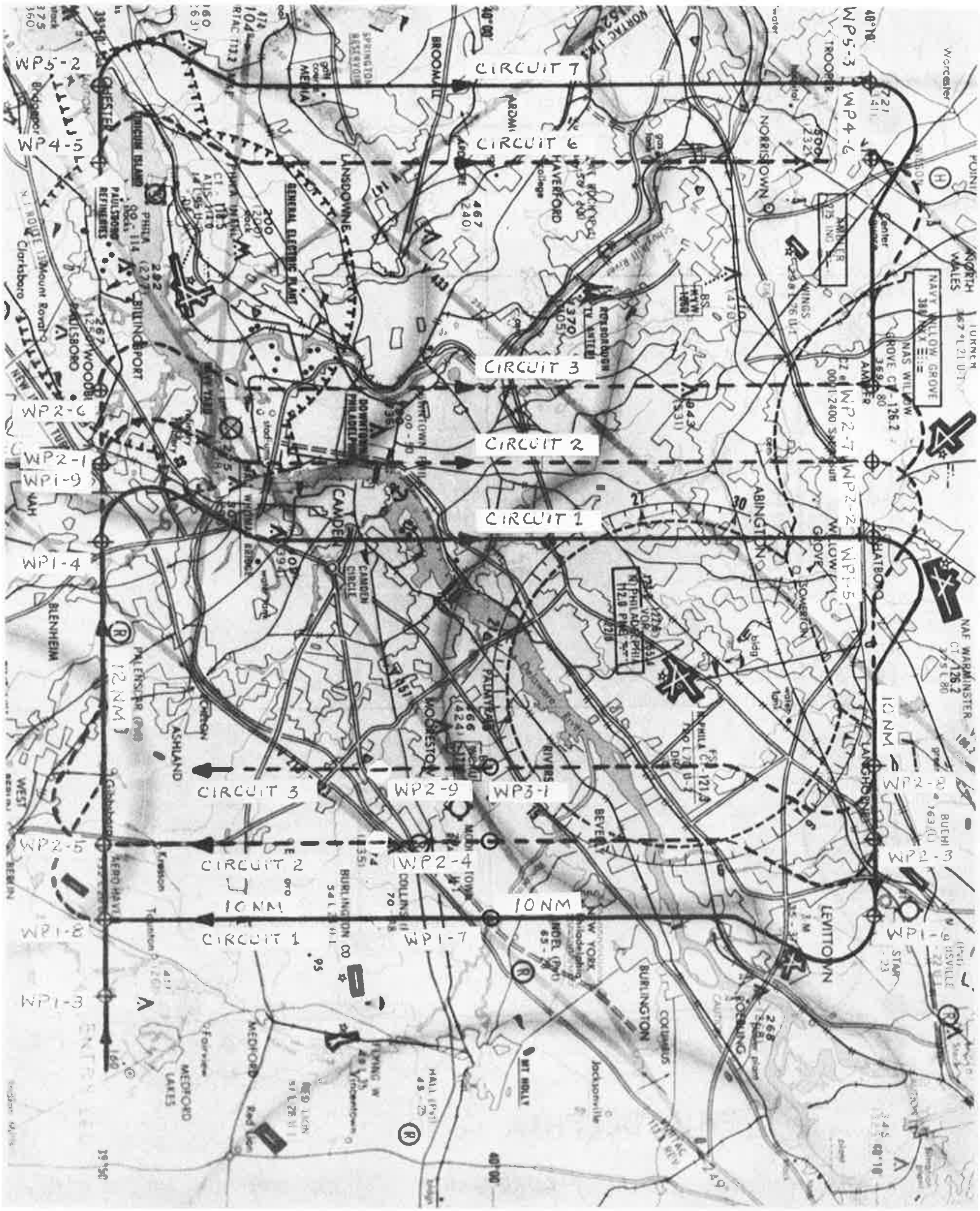
WAYPOINT	LAT.	LONG.	TD DANA	TD NANTUCKET
3-2	39° 50'	74° 57' 40.5"		
3-3	39° 50'	75° 13' 11.7"		
3-4	40° 10'	75° 13' 11.7"		
3-5	40° 10'	75° 00' 15.7"		
3-6	40° 00'	75° 00' 15.7"		
3-7	39° 50'	75° 00' 15.7"		
3-8	39° 50'	75° 15' 46.9"		
4-1	40° 10'	75° 15' 46.9"		
4-2	40° 10'	75° 02' 50.9"		
4-3	40° 00'	75° 02' 50.9"		
4-4	39° 50'	75° 02' 50.9"		
4-5	39° 50'	75° 18' 22.1"		
4-6	40° 10'	75° 18' 22.1"		
4-7	40° 10'	75° 05' 26.1"		
4-8	40° 00'	75° 05' 26.1"		
5-1	39° 50'	75° 05' 26.1"		
5-2	39° 50'	75° 20' 57.3"		
5-3	40° 10'	75° 20' 57.3"		
5-4	40° 10'	75° 08' 01.3"		
5-5	40° 00'	75° 08' 01.3"		
5-6	39° 27' 21"	74° 34' 36"		



PHILADELPHIA GRID

FIGURE G-1

FIGURE G-2


CIRCUIT 7
CIRCUIT 6
CIRCUIT 3
CIRCUIT 2
CIRCUIT 1
CIRCUIT 3
CIRCUIT 2
CIRCUIT 1
WP5-2
WP4-5
WP5-3
WP4-6
WP2-6
WP2-1
WP1-9
WP1-4
WP2-7
WP2-2
WP1-5
WP2-9
WP3-1
WP2-5
WP2-4
WP2-3
WP1-8
WP1-7
WP1-3
12 NM
10 NM
10 NM
10 NM

2.9 ATTACHMENT I

SERIES H

NORTHEAST CORRIDOR FLIGHT TEST

ATTACHMENT I - NORTHEAST CORRIDOR FLIGHT TEST, SERIES H

Number of Personnel Required:

DOT/TSC	(1) Technical Monitor
Contractor	(1) Avionics Flight Test Engineer
	(1) Telemetry Engineer (tape formatting)
	(1) Avionics Technician
	(1) Instrumentation Engineer

Recommended Alternate Missions and Combinations:

Because of the duration and detailed planning required for these tests, no combinations are possible. Alternate missions will be dependent on prevailing conditions and available facilities.

STOL AVIONICS FLIGHT TEST PROGRAM

NORTHEAST CORRIDOR FLIGHT TEST - SERIES H

A. OBJECTIVE

The objective of the Northeast Corridor test is to fly the TSC system in the Northeast Corridor using Area Navigation at assumed STOL altitudes. This test will be used to:

Demonstrate the Area Nav capability of the TSC system,

Collect data in the Northeast Corridor on LORAN, VOR, and DME navaids,

Evaluate LORAN performance and VOR and DME coverage at STOL altitudes, and

Evaluate the relative performance of each of the Area Nav modes in the absence of a reference position.

B. TEST RATIONALE

The Northeast Corridor Test (Series H) will serve a two-fold purpose. In the Northeast Corridor (Boston - New York - Washington) precision tracking radars will not be available to provide a reference position. These tests will therefore serve as a demonstration of the Area Nav capabilities of the TSC system in a pseudo STOL Environment. It is proposed to fly the Eastern Airlines Area Nav routes at low altitude (2500, 3000, 6000 ft). Simultaneously, data will be collected on LORAN, VOR, and DME navaids and the coverage and performance of these systems along these routes. In post flight analysis and simulation either an estimated position using all the navaids will be developed as reference or a position envelope which determines the position of the aircraft assuming each of the Area Nav Modes had been used. The latter approach

is more significant in the enroute phase since it presents a qualitative picture of the relative navigation accuracies of each of the Nav Modes.

C. FLIGHT PLANS

Six round trip flights will be made from NAFEC to Boston to Washington National Airport to NAFEC to represent a typical Northeast corridor test flight. Four trips will be made at altitudes of 3000 feet northeast bound and 2500 feet southwest bound. Two trips will be made at a constant altitude of 6000 feet. The actual VOR/DME and DME/DME coverage will be compared with predictions of coverage made before the flights.

D. FLIGHT TEST DURATION

The flight test time will be as follows:

North-bound flight (no wind)	1:32
South-bound flight (no wind)	2:45
Total Round Trip	4:18

It is estimated that a total of six round trips will be made depending on the aircraft time available. This will require approximately 25 flight hours.

E. EQUIPMENT

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with Table A-4. In addition, data will be collected using the ARTS facilities at various locations throughout the routes.

G. NAFEC SUPPORT REQUIRED

NAFEC support will be required in the following areas:

1. Aircraft operation, servicing, and maintenance.
2. ATC personnel to operate equipment in centers through which we are passing.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

The flights are divided into northbound and southbound flights. Basically the flights are designed from Eastern Airline flight paths from Boston to LaGuardia and LaGuardia to Washington National. A straight line flight path connects the arrival and approach fixes in the New York area.

The layout of the flight path is depicted in Figure H-1 with a detailed description of each waypoint given in Table H-1.

A typical flight over EAL RNAV routes is outlined below. All flights will be over this route, the only difference being the enroute altitudes.

Because of air traffic clearances, it is anticipated that most of the flights will be made during the hours when traffic is lighter over the terminal areas, i.e., at night or on weekends.

The flight originates at NAFEC and terminates at NAFEC with a refueling stop at Boston Logan International Airport.

Northbound Flight - Flight Paths 1 and 2

Takeoff from NAFEC climbing to 3000 feet enroute to Jersey Waypoint, 1-1, 180 knots. 353°/38.5 NM

At Jersey Waypoint execute a 65° right turn to intercept EAL V304R to Branch Waypoint, 1-2, 3000 feet, 180 knots. 058°/19.7 NM.

At Branch Waypoint, proceed to Goat WP, 1-3, 3000 feet, 180 knots. 058°/ 56.8 NM.

At Goat WP proceed to Moosup WP, 1-4, at 3000 feet, 180 knots, along EAL V300R. 071°/98.2 NM.

At Moosup WP proceed to Norfolk WP, 1-5, at 3000 feet, 180 knots. 063°/26.9 NM.

Prior to reaching Norfolk WP, contact Boston Tower and request active runway.

Note: A primary, Runway 27, and a secondary, Runway 4R, Logan RNAV approach pattern will have been previously coordinated for the STOLNAV program.

If Runway 27 is assigned, proceed to Norfolk, Lightship, Rawson, G. S. Intercept and Runway 27 Threshold Waypoints 1-5, 1-6, 1-7, 1-8 and 1-9, respectively.

Distance: 275 NM Estimated Flight Time: 1.5 hrs.

If Runway 4R is assigned, initiate FP2WP1 prior to arrival at Norfolk Waypoint, then proceed to Norfolk, Milton, and Runway 4R Threshold Waypoints 2-1, 2-2, and 2-3, respectively.

Southbound Flight - Flight Paths 3, 4, 5, 6 and 7

Note: Either of two previously approved Logan departures may be used. The primary departure is Upton Two from Runway 22R. The secondary is Upton Two from Runway 4R.

If the departure is from Runway 22, initiate FP3WP1 and proceed to Initial Point, 3-2, WP climbing to 650 feet altitude. At 3-2 turn right to track to Neponset WP, 3-3, climbing to 2000 feet. At Neponset proceed to Upton WP climbing to 2500 feet enroute. Before reaching Upton initiate FP4WP1.

If the departure is from Runway 4R, initiate FP3 WP5 and proceed to the Initial Point Waypoint, 3-6, climbing to 1000 feet. At 3-6 execute left turn to track to Newton WP climbing to 2500 feet enroute. At Newton WP proceed to Upton WP at 2500 feet, 180 knots. Prior to reaching Upton. initiate FP4WP1.

At Upton WP proceed to Wilton WP, 4-2, at 2500 feet, 180 knots. 252°/95.8 NM.

At Wilton WP proceed to Lambertville WP, 4-3 at 2500 feet, 180 knots. 248°/82.5NM.

At Lambertville WP proceed to Columbia WP, 4-4, at 2500 feet, 180 knots. 236°/117.7 NM.

At Columbia WP proceed to Beltsville WP, 4-5. Prior to reaching Beltsville call Washington National Tower and request the active runway.

Note: Two approaches to Washington National will have been previously coordinated for STOLNAV use. The primary approach will be to Runway 18 and is designated Watergate One. The secondary is a Wilbur Two approach to Runway 36.

If Runway 18 is assigned, proceed to Beltsville, Watergate, Little Falls, and Runway 18 Threshold Waypoints 4-5, 4-6, 4-7 and 4-8, respectively.

If Runway 36 is assigned, initiate FP5WP1 prior to reaching Beltsville then proceed to Beltsville, Anacost, Wilbur, Ritchie, Wilson Bridge and Runway 36 Threshold Waypoints 5-1, 5-2, 5-3, 5-4, 5-5 and 5-6, respectively.

If Runway 18 is assigned the departure will be a Suitland One route. After crossing the Runway 18 Threshold; initiate FP6WP1 and proceed to Initial Point, Suitland and Sparrows Waypoints 6-2, 6-3 and 6-4.

If Runway 36 is assigned, initiate FP6WP5 after crossing the Threshold and proceed on a Sparrows One Departure to the Initial Point and Sparrows Waypoints 6-6 and 6-7.

In either departure case initiate FP7WP1 prior to reaching Sparrows WP and proceed to Chester WP at 2500 feet, 180 knots. 090°/24.2 NM.

At Chester WP, 7-2, proceed to Woodstown WP, 7-3, at 2500 feet, 180 knots 055°/40.2 NM.

At Woodstown WP turn right to track to Atlantic City WP, 7-4, 2500 feet, 180 knots. 117.5°/38.9 NM.

Distance: 497 NM **Estimated Flight Time:** 2.76 hrs.

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-1. (Con't)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR #1			X	X	X	X	X	X	X	X	X	X	X
VOR #2			X	X	X	X	X	X	X	X	X	X	X
DME #1			X	X	X	X	X	X	X	X	X	X	X
DME #2			X	X	X	X	X	X	X	X	X	X	X
Loran - C (T)			X	X	X	X	X	X	X	X	X	X	X
Loran - C (C)			X	X	X	X	X	X	X	X	X	X	X
CP-2			X	X	X	X	X	X	X	X	X	X	X
Data Adapter			X	X	X	X	X	X	X	X	X	X	X
T/M Prog.			X	X	X	X	X	X	X				X
T/M TMTR			X	X	X	X	X	X	X				X
Tape Recorder			X	X	X	X	X	X	X	X	X	X	X
Time Code Generator			X	X	X	X	X	X	X	X	X	X	X
WWV Receiver			X	X	X	X	X	X	X	X	X	X	X
Tape Reader			X	X	X	X	X	X	X	X	X	X	X
VHF Comm.			X	X	X	X	X	X	X	X	X	X	X

TABLE A-1. (Con't)

AIRBORNE EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Pilot's Sta. (STOLNAV)			X	X	X	X	X	X	X	X	X	X	X
MODILS			X		X								
*DMS									X	X	X	X	X
*INE									X	X	X	X	X

*If Feasible

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp ∠ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp ∠ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp ∠ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE H-1

DESCRIPTION OF WAYPOINTS

NORTHEAST BOUND ENROUTE

FPWP	NAME	LATITUDE	LONGITUDE	ALT	O/P FROM PRECEDING WAYPOINT	VOR/DME NO. 1	VOR/DME NO. 2
1-1	Jersey	400417.6"	744859.6"	3000		OOD 112.8	CYN 113.4
1-2	Branch	401748.9	743018.9	3000	58°/19.7	ARD 108.2	RBV 113.8
1-3	Goat	405636.5	733541.7	3000	58°/56.8	COL 115.4	JFK 115.9
1-4	Moosup	414759.6	714409.7	3000	71°/98.2	HFD 114.9	ORW 109.8
1-5	Norfolk	420609.1	711724.9	3000	63°/26.9	PUT 117.4	PVD 115.6

LOGAN APPROACHES

(A) Runway 27 (Primary)

1-5	Norfolk	420609.1	711724.9	3000	63°/26.9	BOS 112.7	MHT 114.2
1-6	Light Ship	4220-09.7	704907.7	3000	56°/25.2	"	"
1-7	Start Turn At Rawson	422230.1	704951.5	2000	02°/2.4	"	"
1-8	3° GS Intercept	422301.5	705059.6	2000	317°/1.0	"	"

TABLE H-1

DESCRIPTION OF WAYPOINTS

LOGAN APPROACHES (Cont'd)

(A) Runway 27 (Primary) (Cont'd)

FPWP	NAME	LATITUDE	LONGITUDE	ALT	O/P FROM PRECEDING WAYPOINT	VOR/DME NO. 1	VOR/DME NO. 2
1-9	Rwy 27 Threshold	422136.5	705917.6	16'	272°/6.3	BOS 112.7	MHT 114.2

(B) Runway 4R (Secondary)

2-1	Norfolk	420609.1	711724.9	3000	63°/26.9	BOS 112.7	MHT 114.2
2-2	Milton	421623.3	710248.1	1800	62°/14.9	"	"
2-3	Rwy 4R Threshold	422103.6	710044.4	16'	33°/4.9	"	"

LOGAN DEPARTURES

(A) Upton Two From 22R (Primary)

3-1	Far End RW22R	422123.6	710044.4		215°/2	BOS 112.7	MHT 114.2
3-2	Initial Point	421922.1	710022.7	650	187.5°/2.0	"	"
3-3	Neponset	421551.8	710713.7	2000	239.5°/6.2	"	"
3-4	Upton	420824.6	713510.2	2500	265°/22.0	"	"

TABLE H-1

DESCRIPTION OF WAYPOINTS

LOGAN DEPARTURES (Cont'd)

(B) Upton Two From 4R (Secondary)

FPWP	NAME	LATITUDE	LONGITUDE	ALT	O/P FROM PRECEDING WAYPOINT	VOR/DME NO. 1	VOR/DME NO. 2	
3-5	Far End RW 4R	422236.4	705959.4		035°/2	BOS 112.7	MHT 114.2	
3-6	Inital Point	422525.7	705836.5	1000	035°/3.0	"	"	
3-7	Newton	421927.5	710954.9	2500	249°/10.3	"	"	
3-8	Upton	420824.6	713510.2	2500	254°/21.7	"	"	
SOUTHWEST BOUND ENROUTE								
4-1	Upton	420825.0	713512.0	2500	See Departure	"	"	
4-2	Wilton	411836.4	732449.6	2500	252°/95.8	HFD 114.9	MAD 110.4	
4-3	Lambertville	402915.0	745225.0	2500	248°/82.5	JFK 115.9	CMK 116.6	SBJ 112.9
4-4	Columbia	39° 12 15.1	76° 48 22.7	2500	236°/117.7	EWT 114.6	BAL 115.1	
WASHINGTON NATIONAL APPROACHES								
(A) Runway 18 (Watergate One)								
4-5	Beltsville	390539.8	765804.4	2500	236°/10.0	DCA 110.0	OTT 113.7	
4-6	Watergate	385803.4	770920.5	2500	236°/11.6	"	"	

TABLE H-1

DESCRIPTION OF WAYPOINTS

WASHINGTON NATIONAL APPROACHES (Cont'd)

(A) Runway 18 (Watergate One) (Cont'd)

FPWP	NAME	LATITUDE	LONGITUDE	ALT	O/P FROM PRECEDING WAYPOINT	VOR/DME NO. 1	VOR/DME NO. 2
4-7	Little Falls	385550.2	770656.9	2300	147°/2.9	DCA 110.0	OTT 113.7
4-8	Rwy. 15 Threshold	385141.7	770238.7	500	148°/5.3	"	"

(B) Runway 36 (Wilbur Two)

4-5/ 5-1	Beltsville	390539.8	765804.4	2500	236°/10.0	DCA 110.0	OTT 113.7
5-2	Anacost	385332.9	765803.0	2500	186°/12.2	"	"
5-3	Wilbur	384420.9	765749.4	2000	186°/9.2	"	"
5-4	Ritchie	384420.9	770140.0	1600	277°/3.0	"	"
5-5	Wilson Bridge	384726.4	770156.6	800	003°/3.1	"	"
5-6	Rwy. 36 Threshold	385032.0	770213.3	500	002°/3.1	"	"

TABLE H-1

DESCRIPTION OF WAYPOINTS

FPWP	NAME	LATITUDE	LONGITUDE	ALT	O/P FROM PRECEDING WAYPOINT	VOR/DME NO. 1	VOR/DME NO. 1	
WASHINGTON DEPARTURES								
(A)	Suitland One (Runway 18)							
6-1	Far End Rwy 18	385032.0	770213.3		183°/2	DCA 111.0	OTT 113.7	
6-2	Initial Point	384735.7	770126.9	1000	176°/3.0	"	"	
6-3	Suitland	385152.2	765636.6	2500	49°/5.7	"	"	
6-4	Sparrows	390733.8	763118.8	2500	59°/25.2	"	"	
(B)	Sparrows One (Runway 36)							
6-5	Far End Rwy 36	385139.6	770220.1		003°/ 2	DCA 110.0	OTT 113.7	
6-6	Initial Point	385735.7	770858.0	2500	326°/7.9	"	"	
6-7	Sparrows	390733.8	763118.8	2500	78°/30.9	"	"	
RETURN TO ACY								
7-1	Sparrows	390733.8	763118.8	2500	See Departure	OTT 113.7	BAL 115.1	OOD 112.8
7-2	Chester	391103.4	760026.1	2500	90°/24.2	EWT 114.0	BAL 115.1	OOD 112.8
7-3	Woodstown	393900.0	752300.0	2500	55°/40.2	"	OOD 112.8	
7-4	ACY	392700.0	743500.0	1500	117.5°/38.9	ACY 108.6	OOD 112.8	

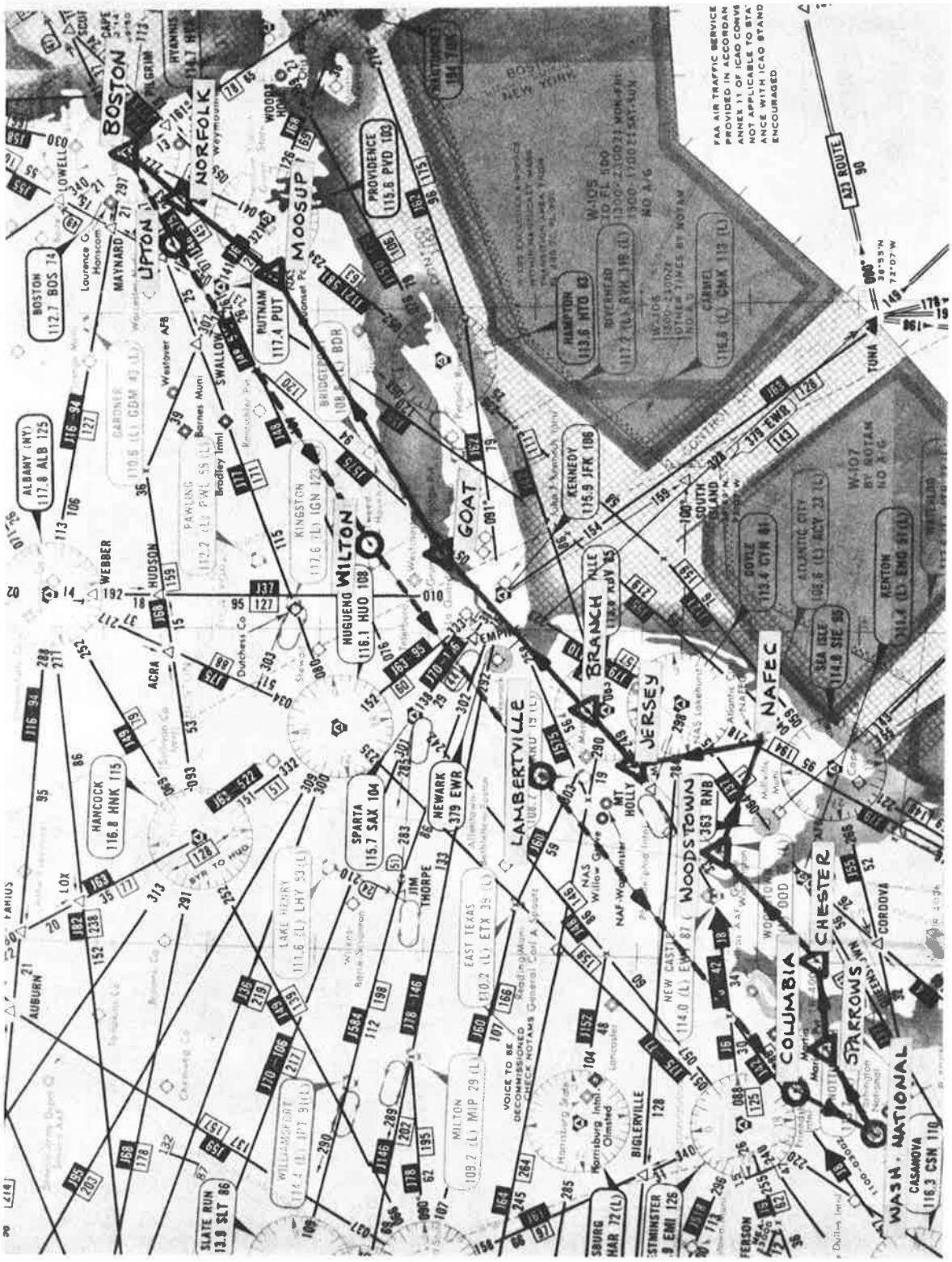

BOSTON
NORFOLK
PROVIDENCE
PVD 103
MOOSUP
UPTON
WILTON
GOAT
HUGUENO
HUO 108
KENNEDY
JFK 106
BRANCH
JERSEY
NAFEC
LAMBERTVILLE
NEWARK
EWR 379
SPARTA
SAX 104
HANCOCK
HNK 115
ACRA
WOODSTOWN
RNB 363
COLUMBIA
CHESTER
SPARROWS
WASH. NATIONAL
CASANOVA
CSN 110
A23 ROUTE
W-105
W-106
W-107
FAA AIR TRAFFIC SERVICE
PROVIDED IN ACCORDAN
ANNEX 11 OF ICAO CONV
NOT APPLICABLE TO STA
ANCE WITH ICAO STAND
ENCOURAGED

FIGURE H-1

2.10 ATTACHMENT J

SERIES I

MOUNTAIN REGION TESTS

ATTACHMENT J - MOUNTAIN REGION TESTS, SERIES I

Number of Personnel Required:

DOT/TSC	(1)	Technical Monitor
Contractor	(1)	Avionics Flight Test Engineer
	(1)	Telemetry Engineer (tape formatting)
	(1)	Avionics Technician
	(1)	Instrumentation Technician

Recommended Alternate Missions and Combinations:

No combinations or alternate missions are recommended.

STOL AVIONICS FLIGHT TEST PROGRAM

MOUNTAIN REGION TESTS, SERIES I

A. Objective

The objective of this series of tests is to evaluate Loran C and VOR/DME coverage and performance in a mountain area.

B. Test Rationale

Many of the potential operational areas for STOL aircraft are in areas of mountain terrain (e.g., recreational areas, regional development). The VOR/DME system encounters line of sight and reflection problems in the context of area navigation and Loran is subject to local propagation anomalies. The flight tests in the mountainous regions are primarily for data gathering and coverage evaluation to determine the feasibility of using these radio navigation aids with currently existing facilities. This flight test is highly regionally dependent but may provide the guidelines for future development in a mountainous region.

C. Flight Plans

The flight paths will be such to evaluate the effects of the mountainous terrain in conjunction with the location of VOR sites. The paths will be flown, where feasible, parallel, perpendicular, and oblique to the mountain range. The flight paths will originate and terminate at L. G. Hanscom Field, Bedford, Mass.

D. Duration of Flight Tests

There are two flight plans in Series I. The times for these flight paths are shown in Table I-1 below:

Flight Path No.	Time for Single Flight (Hours)
3, 4, 5	3.0
6, 7, 8	3.0
	6.0 Total Hours

FLIGHT PATH DURATION

TABLE I-1

Time is based on coverage of 180 knots and a turning rate of 3°/sec. Therefore flying each track twice will require a total of 12 hours.

E. Equipment

Airborne, Ground, and Tracking equipment to be used during the test is shown in Table A-1. Tracking the aircraft in the regions of Massachusetts and New Hampshire will be accomplished by scope approximations from the enroute radars and by using the DMS/Inertial system on the test aircraft, if feasible.

F. Data to be Collected

Data will be collected from the airborne equipment in accordance with the attached Table A-4 list. In addition position data will be derived from the DME/Inertial system and from scope approximations if available.

G. NAFEC Support Required

NAFEC support will be required in the following areas:

1. Coordination of the flights in the test area
2. Aircraft operation, servicing and maintenance in the L. G. Hanscom Field area
3. Providing equipment and personnel to collect scope photographs
4. Assistance in the coordination of the positioning of the DME transponders.

H. Coordination Required

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. Flight Description

The tests will consist of two plans from Hanscom Field to the Mt. Washington area and return. Plan "A" (see Figure I-1) will be flown at 3000 and 5000 feet altitudes enroute with one leg over Mt. Washington at 7400 feet altitude. Plan "B" (see Figure I-2) will be flown at 5000 and 7000 feet enroute with one leg over Mt. Lafayette. Each plan is approximately 540 miles round trip.

Tables I-2, I-3 and I-4 define the waypoints and navaid facilities.

A description of each plan is given below.

Flight Path 3, 4, and 5 (Plan "A")

The aircraft will take off from Hanscom Field and climb at 3° climb angle to 3000 ft. at WP1. Proceed to WP2 at 3000 ft. altitude and 180 knots.

At WP2 execute 59° right turn at 3°/sec and proceed to WP3. 014.5°/62.1NM.

At WP3 execute 90° right turn at 3°/sec to WP4.

From WP4 proceed to WP5 at 3000 ft. altitude and 180 knots. 105.5°/37.2 NM.

At WP5 initiate 3° climb to altitude of 5000 feet to WP6. 106°/6.4 NM.

Proceed to WP7 at 5000 ft. altitude and 180 knots. 106.5°/22.9 NM.

At WP7 execute 90° left turn to WP8 at 3°/sec.

After passing WP8 enter FP4 WP1 via PICOM. Proceed to FP4 WP1 at 5000 ft., 180 knots. 017°/23.3 NM.

At FP4 WP1 execute 90° left turn at 3°/sec to FP4 WP2. Proceed to FP4 WP3 at 5000 feet, 180 knots.

At FP4 WP3 execute 90° left turn at 3°/sec to FP4 WP4. Proceed to FP4 WP5 at 5000 feet, 180 knots. 196°/13.4 NM.

At FP4 WP5 execute 3° climb to 7400 feet at FP4 WP6. At FP4 WP6 execute left turn at 3°/sec to FP4 WP7. Proceed to FP4 WP8 at 7400 feet, 180 knots. 077°/45.1 NM.

At FP4 WP8 execute 90°/270° procedure turn to FP4 WP9. After stabilizing on track to FP4 WP9 enter FP5 WP1 in via PICOM. Proceed to FP5 WP1 at 7400 feet, 180 knots.

At FP5 WP1 begin 3° descent to FP5 WP2. Proceed to FP5 WP3 at 4000 feet, 180 knots. 285.5°/24.6 NM.

At FP5 WP3 execute 90° left turn at 3°/sec to FP5WP4.

At FP5WP4 proceed to FP5 WP5 at 4000 feet. 194.5°/62.1 NM.

At FP5 WP5 execute left turn to FP5 WP6 at 4000 feet.

At FP5 WP6 begin 3° descent to Hanscom Runway 11.

Flight Path 6, 7 and 8 (Plan "B")

The aircraft will take off from Hanscom Field and climb at 3° climb angle to 3000 feet to WP1. Proceed to WP2 at 3000 feet altitude and 180 knots.

At WP2 execute 59° right turn at 3°/sec. Proceed to WP3 climbing to 5000 feet enroute.

At WP3 execute 90° right turn at 3°/sec to WP4.

At WP4 proceed to WP5 at 5000 feet, 180 knots. 105.5°/37.2 NM.

At WP5 begin 3° climb to WP6 at 7000 feet altitude. 106°/6.4 NM.

At WP6 proceed to WP7 at 7000 feet, 180 knots. 106.5°/22.9 NM.

At WP7 execute 90° left turn to WP8 at 3°/sec. After passing WP8 enter FP7 WP1 in via PICOM. Proceed to FP7 WP1 at 7000 feet, 180 knots. 017°/23.3 NM.

At FP7 WP1 execute 90° left turn at 3°/sec to FP7 WP2. Proceed to FP7 WP3 at 7000 feet, 180 knots. 287°/38.6 NM.

At FP7 WP3 execute 153° left turn at 3°/sec to FP7 WP4.

At FP7 WP4 begin 3° descent to 6000 feet at FP7WP5.

At FP7 WP5 proceed to FP7 WP6 at 6000 feet.

At FP7 WP6 execute 90°/270° procedure turn and proceed to FP7 WP7 at 6000 feet, 180 knots. 318°/44.9 NM.

At FP7 WP7 execute 122° left turn to FP7 WP8. Upon passing FP7 WP8 enter FP8 WP1 in via PICOM. Proceed to FP8 WP1 climbing to 7000 feet, 180 knots.

At FP8 WP1 execute 90° right turn at 3°/sec to FP8 WP2. Proceed to FP8 WP3 at 7000 feet, 180 knots. 285.5°/25.6 NM.

At FP8WP3 execute 90° left turn to FP8 WP4.

At FP8 WP4 proceed to FP8 WP5 at 7000 feet, 180 knots. 194.5/62.1 NM.

At FP8 WP5 execute left 59° turn to FP8 WP6. Descend enroute to arrive at FP8 WP6 at 4000 feet.

At FP8 WP6 begin 3° descent to Hanscom Runway 11.

TABLE A-1

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
VOR Test Set	X		X	X	X	X	X	X	X	X	X	X	X
DME Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Loran Test Set	X		X	X	X	X	X	X	X	X	X	X	X
Leak Checker	X		X	X	X	X	X	X	X	X	X	X	X
FOU	X												
DVM	X												
Oscilloscope	X												
T/M Van Equipment													
PCM System	X	X	X	X	X	X	X	X	X				X
Osc. Rec.	X	X	X	X	X	X	X	X	X				X
Printer	X	X	X	X	X	X	X	X	X				X
Displays	X	X	X	X	X	X	X	X	X				X
Time Code Gen	X	X	X	X	X	X	X	X	X				X
WWV Receiver	X	X	X	X	X	X	X	X	X				X
Intercom/Comm	X	X	X	X	X	X	X	X	X				X
TFS	POST FLIGHT FORMATTING - ALL FLIGHTS												
Misc. Test Equip.	X	X	X	X	X	X	X	X	X				X

TABLE A-1 (Cont'd)

GROUND EQUIPMENT REQUIRED BY FLIGHT PLAN

EQUIPMENT	PRE-FLIGHT	FLIGHT	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
Tracking Facilities													
EAIR		X	X	X	X	X	X	X	X	As Possible			
Real Time Plot		X	X	X	X	X	X	X	X	"			
MODILS	X	X	X		X								
ARTCC Radar		X							X	X	X	X	

TABLE A-4

DATA LIST BY FLIGHT PLAN

X - Air & T/M Recording
XO - Onboard Recording only
XG - Gnd T/M Recording only

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. MODILS Loc Dev.	X		X								
3. MODILS G.S. Dev.	X		X								
4. MODILS DME Dist.	X		X								
5. Status WD1 (Flags)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD2 (CP-2 ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD3 (ERR)	X	X	X	X	X	X	X	XO	XO	XO	X
8. A/C Heading	X	X	X	X	X	X	X	XO	XO	XO	X
9. ADC Alt (Uncorr.)	X	X	X	X	X	X	X	XO	XO	XO	X
10. ADC Alt (Corr.)	X	X	X	X	X	X	X	XO	XO	XO	X
11. ADC TAS	X	X	X	X	X	X	X	XO	XO	XO	X
12. ADC IAS	X	X	X	X	X	X	X	XO	XO	XO	X
13. ADC Alt. Rate	X	X	X	X	X	X	X	XO	XO	XO	X
14. LORAN T - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
15. LORAN T - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN C - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
17. LORAN C - TDB	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
18. LORAN Source - TDA	X	X	X	X	X	X	X	XO	XO	XO	X
19. LORAN Source - TDB	X	X	X	X	X	X	X	XO	XO	XO	X
20. LORAN Comp. Status WD	X	X	X	X	X	X	X	XO	XO	XO	X
21. LORAN Comp Δ Mast.	X	X	X	X	X	X	X	XO	XO	XO	X
22. LORAN Comp Δ SA	X	X	X	X	X	X	X	XO	XO	XO	X
23. LORAN Comp Δ SB	X	X	X	X	X	X	X	XO	XO	XO	X
24. LORAN Comp Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
25. LORAN Comp Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
26. Comp. Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. Comp Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. VOR #1 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
29. VOR #2 Bearing	X	X	X	X	X	X	X	XO	XO	XO	X
30. DME #1 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
31. DME #2 Dist.	X	X	X	X	X	X	X	XO	XO	XO	X
32. VOR #1/DME #1	X	X	X	X	X	X	X	XO	XO	XO	X
33. VOR #2/DME #2	X	X	X	X	X	X	X	XO	XO	XO	X
34. VOR Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X

* - If Feasible

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

TEN SAMPLES PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
35. DME Pri Source	X	X	X	X	X	X	X	XO	XO	XO	X
36. DME Sec. Source	X	X	X	X	X	X	X	XO	XO	XO	X
37. TWP/FWP Bearing 1	X	X	X	X	X	X	X	XO	XO	XO	X
38. TWP/FWP Bearing 2	X	X	X	X	X	X	X	XO	XO	XO	X
39. Unfiltered VOR Angle				X			X	XO	XO	XO	X
40. Filtered VOR Angle				X			X	XO	XO	XO	X
41. Filter "DT"				X			X	XO	XO	XO	X
42. Cross Track Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
43. Glideslope Dev.	X	X	X	X	X	X	X	XO	XO	XO	X
44. TWP Range	X	X	X	X	X	X	X	XO	XO	XO	X
45. WP Switch Flag	X	X	X	X	X	X	X	XO	XO	XO	X
46. EAIR Status (Qual)	XG	XG	XG	XG	XG	XG	XG				
47. EAIR Synch	XG	XG	XG	XG	XG	X	XG				
48. EAIR Range	XG	XG	XG	XG	XG	XG	XG				
49. EAIR Azimuth	XG	XG	XG	XG	XG	XG	XG				
50. EAIR Elevation	XG	XG	XG	XG	XG	XG	XG				
*51. INE Latitude							XO	XO	XO	XO	
*52. INE Longitude							XO	XO	XO	XO	

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	L	SHAKE-DOWN
1. Time	X	X	X	X	X	X	X	XO	XO	XO	X
2. Status WD4 (VOR#)	X	X	X	X	X	X	X	XO	XO	XO	X
3. Status WD5 (DME #)	X	X	X	X	X	X	X	XO	XO	XO	X
4. Status WD6 (LOR #)	X	X	X	X	X	X	X	XO	XO	XO	X
5. Status WD7 (Prog. #)	X	X	X	X	X	X	X	XO	XO	XO	X
6. Status WD8 (Nav Mode)	X	X	X	X	X	X	X	XO	XO	XO	X
7. Status WD 9 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
8. Status WD 10 (ERR. Type)	X	X	X	X	X	X	X	XO	XO	XO	X
9. Nav Mode Sel	X	X	X	X	X	X	X	XO	XO	XO	X
10. Thru-Put Mode	X	X	X	X	X	X	X	XO	XO	XO	X
11. VOR #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
12. VOR #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
13. DME #1 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
14. DME #2 Freq.	X	X	X	X	X	X	X	XO	XO	XO	X
15. Baro. Alt Corr.	X	X	X	X	X	X	X	XO	XO	XO	X
16. LORAN Slave ID	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
17. VOR Filt. Type Flag				X			X	XO	XO	XO	X
18. Last WP Flag	X	X	X	X	X	X	X	XO	XO	XO	X
19. Local Mag Decl.	X	X	X	X	X	X	X	XO	XO	XO	X
20. Local Earth Radius	X	X	X	X	X	X	X	XO	XO	XO	X
21. Status WD11 (ERR Tab)	X	X	X	X	X	X	X	XO	XO	XO	X
22. TWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
23. TWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
24. TWP Alt.	X	X	X	X	X	X	X	XO	XO	XO	X
25. FWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
26. FWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
27. FWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
28. PWP Latitude	X	X	X	X	X	X	X	XO	XO	XO	X
29. PWP Longitude	X	X	X	X	X	X	X	XO	XO	XO	X
30. PWP Altitude	X	X	X	X	X	X	X	XO	XO	XO	X
31. No. VOR Filter Samples				X			X	XO	XO	XO	X
32. Desired Heading	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
33. Selected Course	X	X	X	X	X	X	X	XO	XO	XO	X
34. Loran T Status	X	X	X	X	X	X	X	XO	XO	XO	X
35. Loran T Δ TMM	X	X	X	X	X	X	X	XO	XO	XO	X
36. Loran T S/N A	X	X	X	X	X	X	X	XO	XO	XO	X
37. Loran T S/N B	X	X	X	X	X	X	X	XO	XO	XO	X
38. Loran T S/N M	X	X	X	X	X	X	X	XO	XO	XO	X
39. Loran T TDA (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
40. Loran T TDB (MSW)	X	X	X	X	X	X	X	XO	XO	XO	X
41. Loran C TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
42. Loran C TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
43. Loran C Pred. TDA	X	X	X	X	X	X	X	XO	XO	XO	X
44. Loran C Pred. TDB	X	X	X	X	X	X	X	XO	XO	XO	X
45. Loran Source TDA	X	X	X	X	X	X	X	XO	XO	XO	X
46. Loran Source TDB	X	X	X	X	X	X	X	XO	XO	XO	X
47. RD350 Scale (X Trk)	X	X	X	X	X	X	X	XO	XO	XO	X
48. RD350 Scale (G.S.)	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE SAMPLE PER SECOND	A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
49. PICOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
50. PICOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
51. PICOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
52. SYSCOM WD 1	X	X	X	X	X	X	X	XO	XO	XO	X
53. SYSCOM WD 2	X	X	X	X	X	X	X	XO	XO	XO	X
54. SYSCOM WD 3	X	X	X	X	X	X	X	XO	XO	XO	X
55. FP/WP WD	X	X	X	X	X	X	X	XO	XO	XO	X
56. Loran T TDA (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
57. Loran T TDB (Tracker)	X	X	X	X	X	X	X	XO	XO	XO	X
58. Pri DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
59. Pri DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X
60. Sec. DME Sta. Lat.	X	X	X	X	X	X	X	XO	XO	XO	X
61. Sec. DME Sta. Long.	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE A-4 - Cont'd

DATA LIST BY FLIGHT PLAN

ONE HUNDRED SAMPLES PER SECOND - ANALOG	SERIES A	B	C	D	E	F	G	H	I	J	SHAKE-DOWN
1. + 5VDC	X	X	X	X	X	X	X	XO	XO	XO	X
2. Tape Remaining	X	X	X	X	X	X	X	XO	XO	XO	X
3. Data Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
4. Phase A	X	X	X	X	X	X	X	XO	XO	XO	X
5. Phase B	X	X	X	X	X	X	X	XO	XO	XO	X
6. Phase C	X	X	X	X	X	X	X	XO	XO	XO	X
7. DA Monitor	X	X	X	X	X	X	X	XO	XO	XO	X
8. 28 VDC	X	X	X	X	X	X	X	XO	XO	XO	X
9. 26 VAC	X	X	X	X	X	X	X	XO	XO	XO	X
10. DA Power Discrete	X	X	X	X	X	X	X	XO	XO	XO	X
11. DA Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
12. CP2 Over Temp	X	X	X	X	X	X	X	XO	XO	XO	X
13. CP2 Go - No Go	X	X	X	X	X	X	X	XO	XO	XO	X
14. Tape Rec. Ready	X	X	X	X	X	X	X	XO	XO	XO	X
15. T.R. Broken Tape	X	X	X	X	X	X	X	XO	XO	XO	X
16. 3 Phase Alarm	X	X	X	X	X	X	X	XO	XO	XO	X
17. DA 115V Alarm	X	X	X	X	X	X	X	XO	XO	XO	X

TABLE I-2

DESCRIPTION OF WAYPOINTS

PLAN "A"

FPWP	LATITUDE	LONGITUDE	ALTITUDE
3-1	42° 32' 30.0"	71° 29' 00.0"	3000
3-2	42 55 30.0	72 36 48.0	3000
3-3	43 57 36.0	72 36 48.0	3000
3-4	43 58 42.0	72 35 24.0	3000
3-5	43 58 42.0	71 43 42.0	3000
3-6	43 58 42.0	71 34 48.0	5000
3-7	43 58 42.0	71 03 00.0	5000
3-8	43 59 42.0	71 01 36.0	5000
3-9, 4-1	44 23 00.0	71 01 36.0	5000
4-2	44 24 00.0	71 03 00.0	5000
4-3	44 24 00.0	71 57 00.0	5000
4-4	44 23 00.0	71 58 24.0	5000
4-5	44 09 36.0	71 58 24.0	5000
4-6	44 01 36.0	71 58 24.0	7400
4-7	44 00 42.0	71 56 24.0	7400
4-8	44 23 00.0	71 01 36.0	7400
4-9, 5-1	44 04 00.0	71 48 12.0	7400
5-2	43 58 42.0	72 01 12.0	4000
5-3	43 58 42.0	72 35 24.0	4000
5-4	43 57 36.0	72 36 48.0	4000
5-5	42 55 30.0	72 36 48.0	4000
5-6	42 30 12.0	71 35 00.0	4000

TABLE I-2 (Cont'd)

DESCRIPTION OF WAYPOINTS

PLAN "A"

FPWP	LATITUDE	LONGITUDE	ALTITUDE
5-7	42° 28' 18.0"	71° 18' 00.0"	100

PLAN "B"

6-1	42° 32' 30.0"	71° 29' 00.0"	3000
6-2	42 55 30.0	72 36 48.0	3000
6-3	43 57 36.0	72 36 48.0	5000
6-4	43 58 42.0	72 35 24.0	5000
6-5	43 58 42.0	71 43 42.0	5000
6-6	43 58 42.0	71 34 48.0	7000
6-7	43 58 42.0	71 03 00.0	7000
6-8	43 59 42.0	71 01 36.0	7000
6-9, 7-1	44 23 00.0	71 01 36.0	7000
7-2	44 24 00.0	71 03 00.0	7000
7-3	44 24 00.0	71 56 48.0	7000
7-4	44 22 18.0	71 57 18.0	7000
7-5	44 20 42.0	71 53 12.0	6000
7-6	43 58 42.0	71 03 00.0	6000
7-7	44 22 06.0	71 56 30.0	6000
7-8	44 21 12.0	71 58 24.0	6000
7-9, 8-1	43 59 42.0	71 58 24.0	7000
8-2	43 58 42.0	71 59 48.0	7000
8-3	43 58 42.0	72 35 24.0	7000
8-4	43 57 36.0	72 36 48.0	7000

TABLE I-2 (Cont'd)

DESCRIPTION OF WAYPOINTS

PLAN "B"

FPWP	LATITUDE	LONGITUDE	ALTITUDE
8-5	42° 55' 30.0"	72° 36' 48.0"	7000
8-6	42 30 12.0	71 35 00.0	4000
8-7	42 28 18.0	71 18 00.0	100

TABLE I-3

DESCRIPTION OF FACILITIES

Facility	Elevation (ft.)	Latitude	Longitude	Mag. Var.
VORTAC				
BOS	20	42° 21.4'	71° 0'	-15°
GDM	1280	42 32.7	72 3.2	-15°
MHT	470	42 52.2	71 22.5	-15°
CON	710	43 13.4	71 34.2	-15°
LEB	1460	43 40.6	72 12.5	-14°
MPV	1110	44 12.4	72 33.6	-15°
ENE	190	43 25.3	70 36.6	-17°
CAM	1490	43 0	73 7.2	-15°
LORAN				
DANA		39°51' 7.7"	87°29'11.9"	
NANTUCKET		41 15 11.93	69 58 38.76	
CAPE FEAR		34 3 46.36	77 54 46.19	
CAPE RACE		46 46 31.96	53 10 28.51	
JUPITOR		27 1 59.09	80 6 52.92	

MHT - Manchester

CON - Concord

LEB - Lebanon

D - Dana

N - Nantucket

F - Cape Fear

R - Cape Race

J - Jupiter

CAM - Cambridge

BOS - Boston

MPV - Montpelier

ENE - Kennebunk

GDM - Gardner

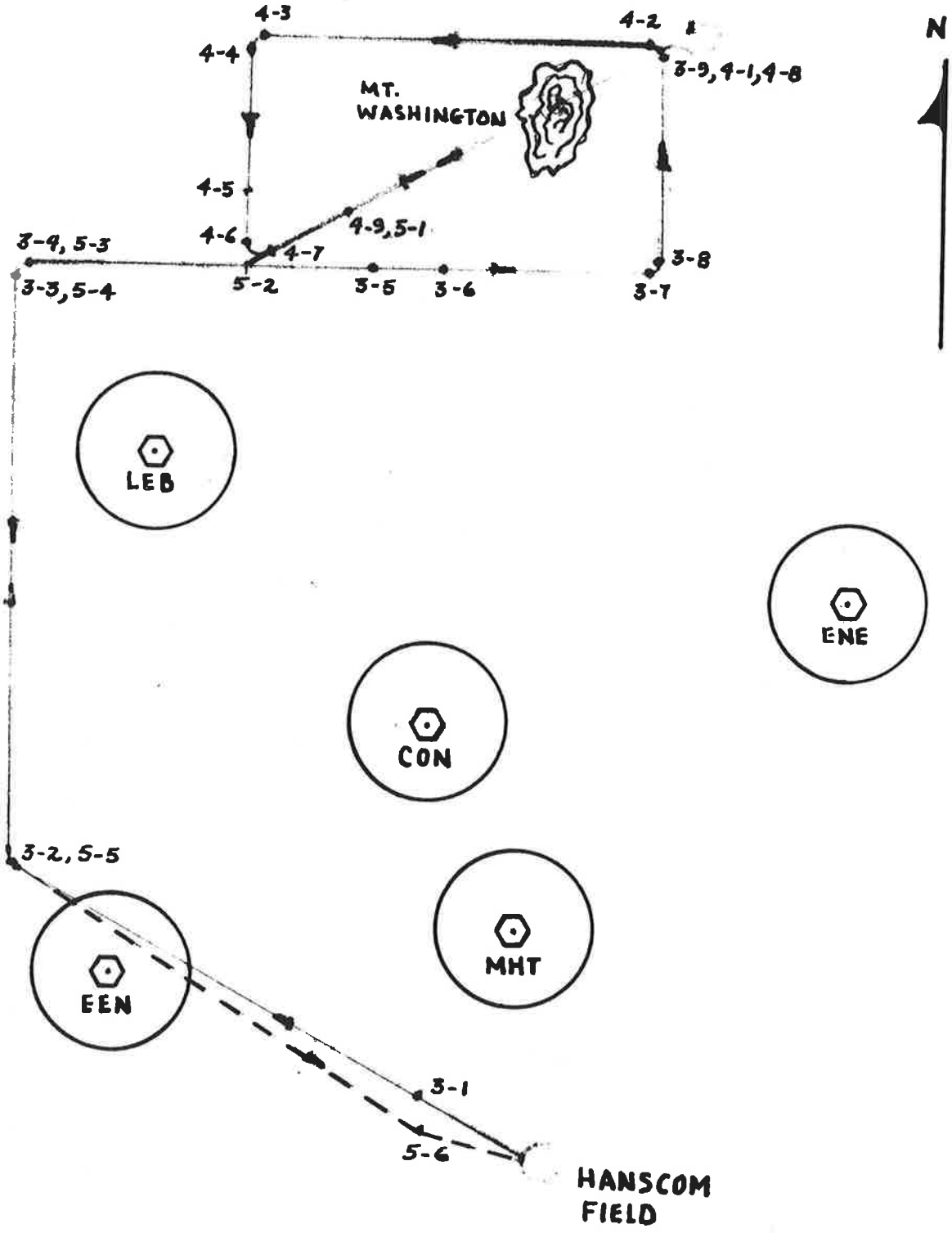
BOS - Boston

TABLE I-4

PRIMARY NAV. DATA USED DURING FLIGHT

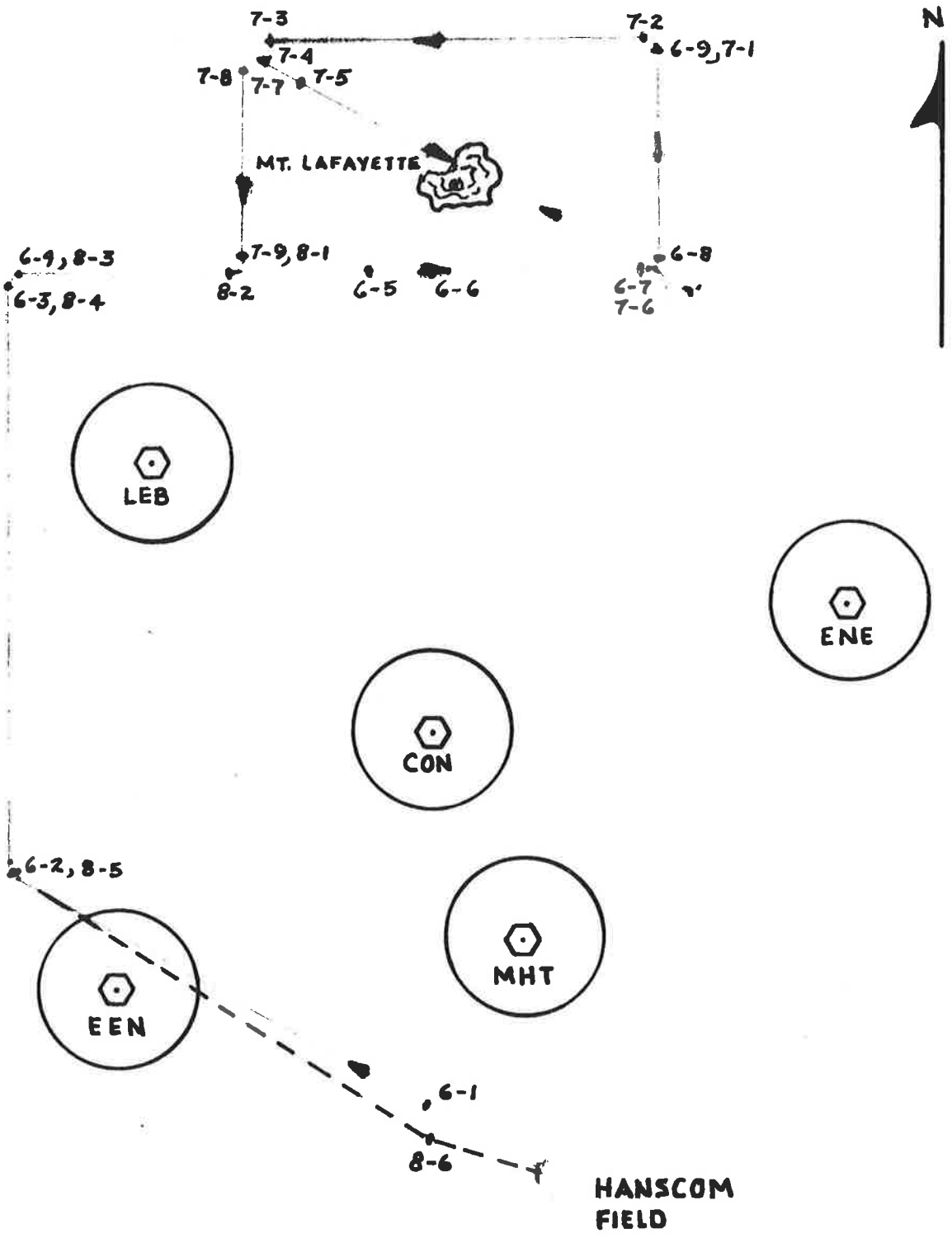
Flight Path	Leg	Primary Nav. Facility Use	Mode	Alternate Nav. Mode Facility Use
3, 6	1	L	FNR	CON, EEN, MHT
3, 6	2	L	FNR	CON, EEN, LEB
3, 6	3	L	FNR	EEN, LEB, ENE
3, 6	4	L	FNR	LEB, ENE, AUG
4, 7	1	L	ENR	ENE, AUG
4, 7	2	L	FNR	ENE, AUG, LEB
4, 7	3	L	FNR	ENE, AUG, LEB
4, 7	4	L	FNR	ENE, AUG, LEB
5, 8	1	L	FNR	LEB, ENE, AUG
5, 8	2	L	FNR	LEB, EEN, CON
5, 8	3	L	FNR	EEN, CON, MHT

L denotes Loran signals from Dana, Cape Fear, Nantucket.



PLAN "A"

FIGURE I-1



PLAN "B"

FIGURE I-2

2.11 ATTACHMENT K

SERIES J

NEW YORK CITY TESTS

ATTACHMENT K - NEW YORK CITY TESTS, SERIES J

Number of Personnel Required:

DOT/TSC	(1) Technical Monitor
Contractor	(1) Avionics Flight Test Engineer
	(1) Avionics Technician
NAFEC	(1) Coordinator

Recommended Alternate Missions and Combinations:

No combinations or alternate missions are recommended.

STOL AVIONICS FLIGHT TEST PROGRAM
NEW YORK CITY TESTS, SERIES J

A. OBJECTIVE

The primary objective of this series of tests is to evaluate the LORAN C and VOR/DME coverage in the New York City area under low altitude STOL environments. A secondary objective is to evaluate the STOLNAV system under inter- and intra-city STOL operational environments.

B. TEST RATIONALE

The flight tests are designed to provide data on navaid coverage and human factors in inter-and intra-city STOL operations. Since EAIR data will not be available, the ARTS I radar facilities of the NYCIFRR will be requested for tracking data where possible.

It is proposed that the existing helicopter IFR routes in addition to departure and closure routes be utilized. All enroute altitudes will be 1100 feet while approaches at Newark, Teterboro, LaGuardia, Westchester County and the proposed STOLport location will be to 500 feet minimum altitude. Escape routes and holding patterns are included in the event that traffic momentarily delays an approach.

The tests will be run during hours of light traffic in the New York Metroplex area.

The DME/DME mode will be first utilized to determine adequacy of coverage using JFK and LGA facilities. LORAN 1 will be monitored for tracking performance and used as a backup navigation mode.

C. FLIGHT PLAN

Three circuits of the Metroplex profile will be flown. The profile is defined as follows:

1. Entry - Colts Neck VORTAC to "Brooklyn" Waypoint

2. "Brooklyn" WP to "Turnpike" WP to approach at Newark

3. Newark departure to "STOL 1" WP, "STOL 2" WP and approach at Teterboro

4. Teterboro departure to "Hudson" WP to "STOL 3" WP, "STOL 4" WP to approach at Hudson River STOLport.

5. STOLport departure to "Empire" WP, "STOL 5," "STOL 6," "Turnpike" WP and approach at Newark

6. Newark departure to "STOL 1," "STOL 2" and Teterboro approach

7. Teterboro departure to "Hudson" WP and approach at LaGuardia

8. LaGuardia departure to "STOL 7," "Fort Totten" WP, "Dale" WP, "Cove" WP and approach at Westchester County

9. Westchester departure to "STOL 8" and approach at Teterboro

10. Teterboro departure to "Hudson" WP and approach at LaGuardia

11. LaGuardia departure to "Diamond," "STOL 9" and "STOL 10" Waypoints

Further circuits will be flown by re-selecting Waypoint 1-2 ("Turnpike") and repeating the above sequence.

D. FLIGHT TEST DURATION

The three circuits outlined in C above will require approximately 50 minutes each based on an average airspeed of 160 knots. Therefore, the total flight time including transit to and from NAFEC is estimated at 3.8 hours. Only one flight will be made because of scheduling complexities and the adequacy of data possible for the one flight.

E. EQUIPMENT

Airborne, ground, and tracking equipment to be used during the test is shown in Table A-1.

F. DATA TO BE COLLECTED

Data will be collected from the airborne equipment in accordance with the Table A-4 schedule.

G. NAFEC SUPPORT REQUIRED

No NAFEC support, other than aircraft operation, servicing and maintenance, will be required.

H. COORDINATION REQUIRED

Coordination will be handled by the NAFEC Test Manager and the details will be supplied at a later date.

I. FLIGHT DESCRIPTION

The Metroplex profile is shown in Figure J-1. Six sequential flight paths will be programmed into the computer as follows:

Flight Path 1

After passing over Colts Neck VORTAC initiate flight path 1 (WP1-1)

Descend from enroute altitude to arrive at WP1-1 at 1100 feet.
033°/19.9NM

At WP1-1 execute left standard rate turn and proceed to WP1-2 (Turnpike) at 1100' (160 to 180 knots) 320°/4.1 NM

At WP1-2 proceed to WP1-3 (Newark Glideslope intercept) 1100', airspeed as necessary for approach. 314°/3.8 NM

At WP1-3 begin 6° descent to Newark Runway 29 (WP1-4 at 500 feet).
314°/0.95 NM

At WP1-4 execute left turn down the runway climbing to 1100 feet enroute WP1-5 (STOL 1). 288°/3.8 NM

At WP1-5 execute right standard rate turn to WP 1-6 (STOL 2)

At WP1-6 proceed to WP 1-7 at 1100 feet, approach speed as required.
060°/9.7 NM

At WP 1-7 begin 6° descent to Teterboro Runway 6 (WP 1-8 at 500 feet).
.059°/0.95 NM

At WP 1-8 execute right standard rate turn and climb to 1100 feet enroute to WP 1-9 (Hudson). 144°/3.8 NM

Enroute to WP 1-9 initiate FP2 WP1.

Flight Path 2

At WP 2-1 proceed to WP 2-2 at 1100 feet. 144°/0.6 NM

At WP 2-2 execute right standard rate turn to WP 2-3, 1100 feet approach speed as necessary

At WP2-3 proceed to WP 2-4 (STOLport G.S. intercept), 1100 feet. 216°/0.6 NM

At WP 2-4 begin 6° descent to Hudson River STOLport (proposed), WP 2-5 at 500 feet. 216°/0.95 NM

AT WP 2-5 execute right climbing turn to WP 2-6 (Empire) at 1100 feet

At WP 2-6 proceed to WP 2-7 (STOL 5) at 1100 feet. 214°/4.8 NM

At WP 2-7 execute right standard rate turn to WP 2-8 (STOL 6) at 1100 feet

At WP 2-8 proceed to WP 2-9 at 1100 feet. Enroute to WP 2-9 initiate FP3 WP1 and slow to approach speed. 314°/2.8 NM

Flight Path 3

At WP 3-1 begin 6° descent to WP 3-2 (Newark Runway 29 at 500 feet) 314°/0.95 NM

At WP 3-2 execute left turn down the runway climbing enroute to WP 3-3 at 1100 feet. 288°/3.8 NM

At WP 3-3 (STOL 1) execute right standard rate turn to WP 3-4 (STOL 2) at 1100 feet.

At WP 3-4 proceed to WP 3-5 at 1100 feet. Slow to approach speed as required. 060°/9.7 NM

At WP 3-5 begin 6° descent to WP 3-6 (Teterboro Runway 6 at 500 feet) 059°/0.95 NM

At WP 3-6 execute right standard rate turn climbing enroute to Hudson WP 3-7 at 1100 feet. 144°/3.8 NM

At WP 3-7 proceed to WP 3-8 (LaGuardia Glideslope Intercept), 1100 feet. Enroute initiate FP4WP1. 113°/5.0 NM.

Slow to approach speed as necessary.

Flight Path 4

At WP 4-1 begin 6° descent to WP 4-2 (LaGuardia Runway 13) at 500 feet. 113°/0.95 NM

At WP 4-2 proceed down the runway to WP 4-3 at 500 feet. 135°/1.2 NM

At WP 4-3 (STOL 7) proceed to WP 4-4 climbing enroute to 1100 feet 103°/3.7 NM

At WP 4-4 proceed to WP 4-5 (Dale) at 1100 feet. 106°/2.9 NM

At WP 4-5 left standard rate turn to track to WP 4-6 (Cove), 1100 feet. 040°/10.0 NM

At WP 4-6 left standard rate turn to track to Westchester County Glideslope Intercept, WP 4-7 at 1100 feet. 345°/8.9 NM

At WP 4-7 begin 6° descent to Westchester County Runway 34, WP 4-8 at 500 feet. 345°/0.95 NM

At WP 4-8 execute left climbing turn to WP 4-9 (STOL 8) at 1100 feet. Enroute to WP 4-9 initiate FP5WP1

Flight Path 5

At WP5-1 proceed to WP5-2 (Teterboro Runway 24 Glideslope Intercept) at 1100 feet. 240°/17.0 NM

At WP 5-2 begin 6° descent to Teterboro Runway 24, WP 5-3 at 500 feet. 240°/0.95 NM

At WP 5-3 execute left climbing turn to WP 5-4 (Hudson) at 1100 feet. 157°/3.8 NM

At WP 5-4 execute left turn to track to WP 5-5. 113°/5.0 NM

At WP 5-5 begin 6° descent to LaGuardia Runway 13, WP 5-6 at 500 feet. 113°/0.95 NM

At WP 5-6 execute right turn to track to WP 5-7 (Diamond), climbing enroute to 1100 feet. 220°/4.8 NM

At WP 5-7 proceed to WP 5-8 (STOL 9) at 1100 feet. Enroute to WP 5-8 initiate FP6WP1. 220°/5.5 NM

Flight Path 6

At WP 6-1 execute right standard rate turn to WP 6-2 (STOL 10) at 1100 feet.

At WP 6-2 proceed to WP 6-3 (Turnpike) at 1100 feet. Enroute initiate FP1WP2 and repeat circuits as required. 320°/3.1 NM.

TABLE J-1

DESCRIPTION OF WAYPOINTS

WP	NAME	LATITUDE	LONGITUDE	ALTITUDE (FT.)
1-1	Brooklyn	40°37'12.0"	73°59'48.0"	1100
1-2	Turnpike	403942.0	740412.0	1100
1-3	G.S. Int.	404142.0	740824.0	1100
1-4	EWR R/W 29	404204.2	740927.6	500
1-5	STOL 1	404242.0	741424.0	1100
1-6	STOL 2	404354.0	741454.0	1100
1-7	G.S. Int.	405015.0	740500.0	1100
1-8	TEB R/W 6	405048.0	740414.4	500
1-9, 2-1	Hudson	404818.0	740036.0	1100
2-2	STOL 3	404748.0	735954.0	1100
2-3	STOL 4	404651.0	735942.0	1100
2-4	G.S. Int.	404618.0	740000.0	1100
2-5	STOLPORT	404534.9	740028.0	500
2-6	Empire	404504.0	740118.0	1100
2-7	STOL 5	404033.0	740348.0	1100
2-8	STOL 6	404009.0	740512.0	1100
2-9, 3-1	G.S. Int.	404142.0	740824.0	1100
3-2	EWR R/W 29	404204.2	740927.6	500
3-3	STOL 1	404242.0	741424.0	1100
3-4	STOL 2	404354.0	741454.0	1100
3-5	G.S. Int.	405015.0	740500.0	1100
3-6	TEB R/W 6	405048.0	740414.4	500

TABLE J-1

DESCRIPTION OF WAYPOINTS

WP	NAME	LATITUDE	LONGITUDE	ALTITUDE (FT.)
		° ' "	° ' "	
3-7	Hudson	404818.0	740036.0	1100
3-8, 4-1	G.S. Int.	404712.0	735400.0	1100
4-2	LGA R/W 13	404655.9	735244.3	500
4-3	STOL 7	404618.0	735124.0	500
4-4	Fort Totten	404609.0	734630.0	1100
4-5	Dale	404548.0	734245.0	1100
4-6	Cove	405442.0	733612.0	1100
4-7	G.S. Int.	410248.0	734130.0	1100
4-8	West R/W 34	410335.9	734206.7	500
4-9, 5-1	STOL 8	410309.0	734500.0	1100
5-2	G.S. Int	405209.0	740212.0	1100
5-3	TEB R/W 24	405127.4	740316.4	500
5-4	Hudson	404818.0	740036.0	1100
5-5	G.S. Int	404712.0	735400.0	1100
5-6	LGA R/W 13	404655.9	735244.3	500
5-7	Diamond	404245.0	735545.0	1100
5-8, 6-1	STOL 9	403754.0	735918.0	1100
6-2	STOL 10	403742.0	740054.0	1100
6-3	Turnpike	403942.0	740412.0	1100

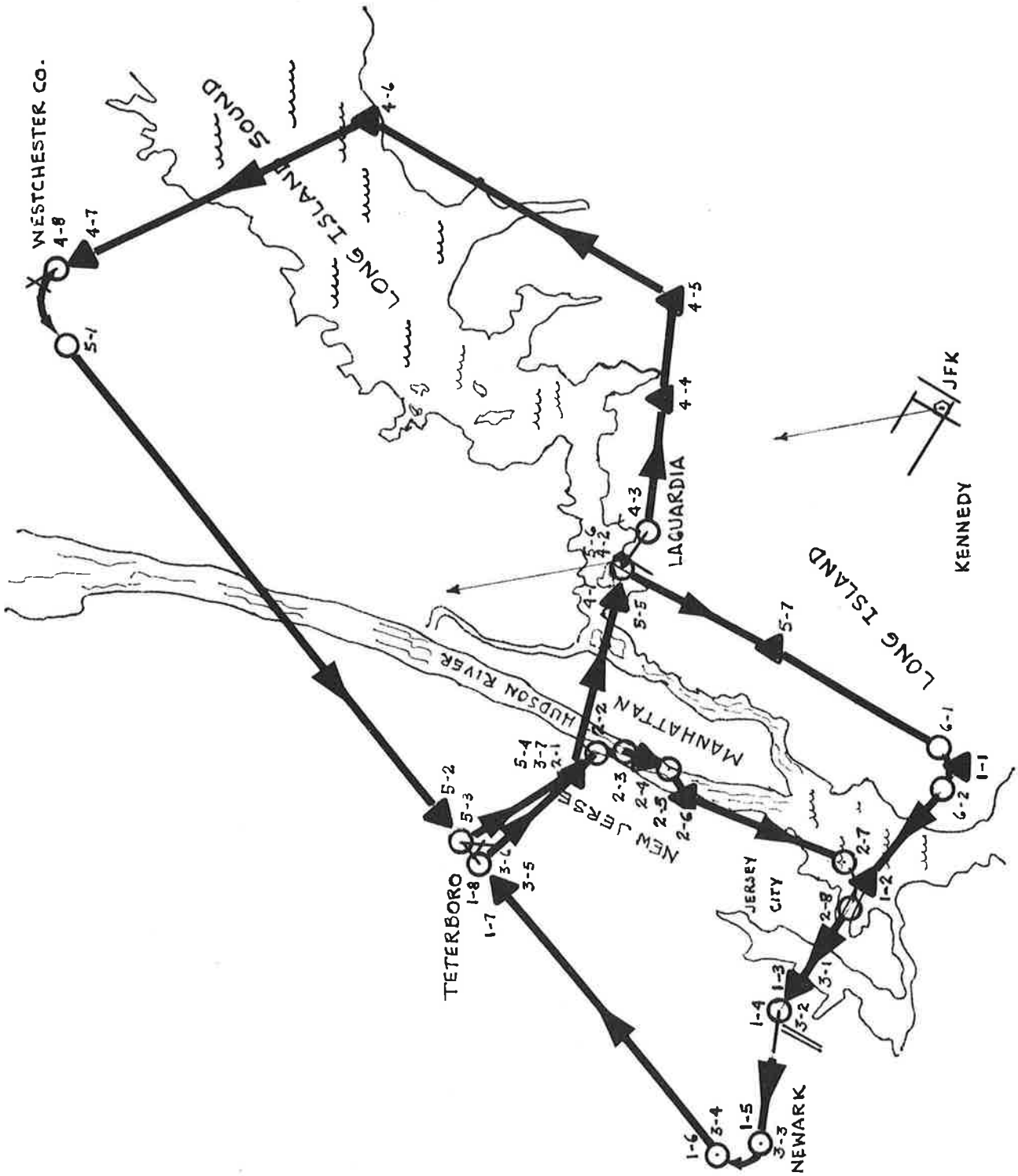

WESTCHESTER CO.
4-8
4-7
5-1
SOUND
LONG ISLAND
4-6
4-5
4-4
4-3
LAGUARDIA
JFK
KENNEDY
LONG ISLAND
5-6
4-2
4-1
5-5
5-7
6-1
1-1
6-2
HUDSON RIVER
MANHATTAN
5-4
3-7
2-1
2-2
2-3
2-4
2-5
2-6
NEW JERSEY
5-2
5-3
3-6
3-5
TETERBORO
1-8
1-7
2-7
1-2
JERSEY CITY
2-8
1-3
3-1
1-4
3-2
1-5
3-3
NEWARK
1-6
3-4

FIGURE J-1