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NORTHEAST CORRIDOR USER EVALUATION,(U)
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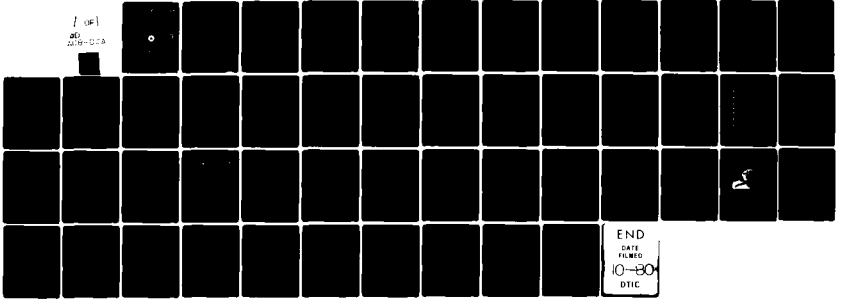

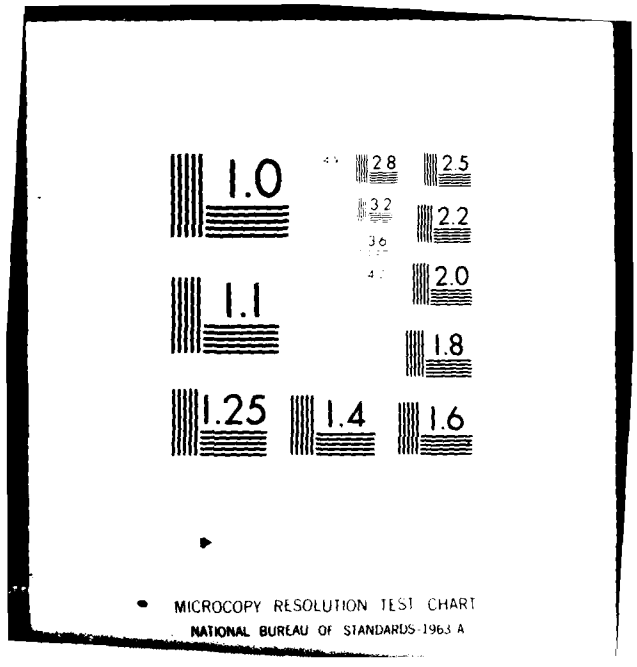
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Report No. FAA-RD-80-17

LEVEL II

NORTHEAST CORRIDOR USER EVALUATION

Joseph Harrigan

INTERIM REPORT

April 1980

Prepared for

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D. C. 20590

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16. Abstract

This report describes an evaluation of the Northeast Helicopter Corridor Routes (NEC). The Northeast Corridor is an experimental route between Boston and Washington, D.C., consisting of two, one-way, reduced width airways designed expressly for helicopter operations. The evaluation is a joint effort of the Federal Aviation Administration (FAA) and the Helicopter Association of America (HAA). The data being gathered is in the form of data extraction tapes from Automated Radar Terminal Service (ARTS) equipped air traffic control (ATC) facilities along the routes and flight logs submitted by the helicopter pilots after each corridor test flight. The test flights are being made as cooperating corporate helicopter operators fly the corridor in the course of their normal operations.

The data collection phase of this evaluation began July 15, 1979, and will continue until July 15, 1980.

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METRIC CONVERSION FACTORS

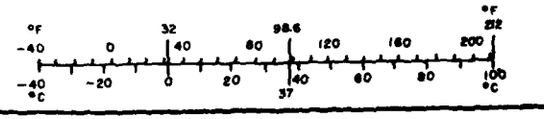
Approximate Conversions to Metric Measures

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

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

Approximate Conversions from Metric Measures

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



PREFACE

This evaluation could not have been accomplished without the wholehearted cooperation and support of the New England and Eastern Region Air Traffic Control and Data Systems personnel in the regional offices and the tracking facilities. The effort put forth by these Federal Aviation Administration employees, in addition to their already taxing duties, has earned them the sincere thanks of the members of the project team.

The Northeast Corridor Helicopter Operators Council, the corporate members, and the pilots participating in this project deserve recognition and thanks for their invaluable assistance in making this evaluation work. The users are the prime data source and have devoted much time and effort to furthering the aims of this project, often at great personal cost and effort. Our sincere thanks to them.

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INTRODUCTION

PURPOSE.

The primary objective of this test is to determine the feasibility of discrete, low altitude, reduced width, Area Navigation (RNAV) airways, and associated spurs and approaches for helicopter operations between Boston and Washington, D.C. Although, at present, these routes are classified experimental, this test will provide data to enable a decision to be made to reclassify these routes as operational in their present configuration and to acquire data to support development of national standards.

Additional benefits available from this evaluation will be data on:

1. Interfacing helicopter routes with fixed wing routes.
2. Navigation signal, RADAR, and communications coverage along the routes.
3. Airway route width requirements for rotorcraft.
4. Updating terminal instrument procedures (TERPS) for helicopters.
5. Development of intercity helicopter routes in other areas of the National Airspace System (NAS).

BACKGROUND.

The increasing use of helicopters in corporate transportation and on-site field support, the projected sales figures for new generation helicopters, and the increase seen now and expected for the future of Instrument Flight Rules (IFR) equipped helicopters, make it imperative that the Federal Aviation Administration (FAA) be responsive to and cooperate with the helicopter industry and operators, to provide a viable means for these vehicles to operate at their full potential. One step in that direction was the establishment of the Northeast Helicopter Corridor (NEC). The corridor consists of two, one-way routes between Boston, Massachusetts, and Washington, D.C., with a spur route to the Allentown, Pennsylvania, area and point-in-space approaches to locations adjacent to city center destination points. The corridor is shown in figures 1 through 4 and a typical point-in-space approach in figure 5.

By virtue of its design characteristics, the helicopter does not readily lend itself to operating in conjunction with fixed-wing air traffic. The characteristics that set the helicopter apart from fixed-wing aircraft enable it to operate very efficiently in its designed area of operations, which is low-altitude, short point-to-point route segments, and arrivals and departures away from major air terminals. The Northeast Corridor (NEC) was designed to accommodate these special characteristics of the modern IFR-capable commercial helicopter.

The NEC was designed strictly for helicopter operations. It is an RNAV route based on very high frequency omnidirectional radio range/distance measuring equipment (VOR/DME) situated below the Victor Airway system. It is half the route width of the normal fixed-wing airway and it is, for the most part, noninterfering with fixed-wing operations. Helicopters operating in the area served by this route should find the NEC a safe, efficient, and expedient route to travel in all weather conditions with a minimum influence on or from fixed-wing air traffic.

This evaluation will provide data that will enable a decision to be made on designating this route a public use airway. The NEC, at present, is an experimental route open only to participants in this evaluation.

In-depth information about the establishment of the NEC and authorization to fly the corridor will be found in the FAA Advisory Circular AC73-2 (appendix C).

The following helicopter operators have agreed to take part in this evaluation:

Atlantic Aviation/DuPont	Greater Wilmington Airport
RCA Corporation	Trenton-Mercer County Airport
Mack Trucks	Allentown-Queen City Airport
Tyco Labs	Manchester-Grenier Field
United Technologies Corporation	E. Hartford-Rentschler Field
View Top Corporation	White Plains-Westchester County Airport
Wheelabrator-Frye Corporation	Saugus-Beverly Airport
N.Y. State Department of Environmental Conservation	New York, New York

Corridor usage by these operators as of November 15, 1979, is shown in figure 6.

DISCUSSION

DATA SOURCES.

There are two main sources of data for this evaluation: (1) The analysis of Automated Radar Terminal System (ARTS) III/I data, tapes made as operators fly the corridor, and (2) A study of operator flight logs submitted by participating pilots after each corridor flight.

The track analysis data is recovered from ARTS system data extraction tapes sent to National Aviation Facilities Experimental Center (NAFEC) from tracking facilities located along the NEC. The facilities are six terminal approach control facilities (appendix A) equipped with ARTS data extraction systems.

Prior to test startup, the Eastern and New England Regions were briefed on the aims and conduct of the test and through them, the cooperation of the tracking facilities was authorized.

Each facility was visited, and operations and data systems personnel were briefed on the program and their part in it. Each facility was supplied with fresh data tapes to facilitate data extraction, and written guidelines were provided for data extraction and data forwarding.

The participating operators are limited to eight, since the test was designed for all weather operations and the eight listed operators were the only IFR certificated operators likely to utilize the corridor. With the advent of Special Federal Aviation Regulation (SFAR) 29-2, which provides (for helicopter, single pilot) IFR, if the aircraft meets certain instrumentation and stabilization requirements, we may expect additional helicopter operators to join the test as their aircraft become certificated. The operators are members of the Northeast Helicopter

Operators Council (NEHOC) and the Helicopter Association of America (HAA). All written materials on the evaluation are distributed by HAA and flight data logs are sent to HAA prior to being forwarded to NAFEC. Test briefings and progress reports are presented at NEHOC meetings.

DATA COLLECTION.

Prior to a flight along the corridor by a participating operator, certain actions must be taken to assure that tracking is accomplished. The operator must alert the facility in whose area the flight originates or initially penetrates, that the flight requires tracking. This is normally done by a telephone call to the facility in time for the Data Systems Officer or Data Systems Specialist to place a tape on a recorder capable of making an extraction tape of the flight. An IFR flight plan (figure 7) is then filed showing the route of flight, requested altitude, and approach desired; in remarks, the key phrase "NEC Test" is inserted. This flight plan will generate flight progress strips (figure 8) at the control sectors that the flight will transit and the phrase "NEC Test" will alert the controller to the flight's status as an NEC test flight. The controller will assign the flight a discrete beacon code as determined by the appropriate Air Route Traffic Control Center (ARTCC) computer and assure that the recording tape is running while the flight is in radar contact.

The test flight will not receive any special handling and will be treated as a normal IFR flight. If the flight penetrates more than one approach control facility, the controller will advise the receiving facility of the flight's status in time for that facility to ready a tape for recording. In order to obtain maximum tracking coverage, facilities are requested to continue track recording as long as the flight is in radar contact, even though the flight may have been handed-off to an adjacent facility. Receiving facilities are requested to initiate track recording as soon as the flight is identified and prior to receiving handoff, if possible. This method of overlap is desirable to avoid possible gaps in tracking coverage. When the flight has passed out of a facility's radar coverage, the tape is removed and sent to NAFEC for data reduction and analysis. Tape identification and mailing labels are provided to the facilities. As each tape is received, a fresh tape is sent to the facility.

At the completion of the flight, the pilot fills out a flight data log (figure 9) and sends it to HAA. From there it is sent to NAFEC to be mated with the appropriate data tape. These flight data logs contain pertinent information on the route, altitude, times, weather, holding, approaches, etc., and a remarks section to document any course excursions. The Remarks Section is vital to explain any course deviations seen on the tape data reduction plot and categorize them according to cause. For example, if a helicopter was vectored off course to avoid weather or traffic, it must be known in order to differentiate the excursion from one caused by a navigational failure. The Remarks Section also contains any air traffic control (ATC) problems the flight encounters. These are followed up and hopefully resolved in a timely fashion. Each operator was issued a set of instructions for filling out the flight log properly (appendix B).

The taping procedure outlined here is used at all the tracking facilities except the New York Common IFR Room (CIFRR). New York has an ARTS I system while the other trackers have ARTS III systems. New York records continuously and stores tapes normally for 15 days. In the case of traffic transiting the New York CIFRR area, we must wait until the flight logs are received, and then forward New York a

list showing dates, times, and aircraft identification. The New York data systems specialist then pulls the tapes covering the times and sends them to NAFEC.

All logs and tapes are logged-in upon receipt and are cross-referenced. Setting up this system of tracking involved the cooperation of the New England and Eastern Regions, the tracking facilities, and operators. Procedures were written and distributed and briefings were held with FAA and industry. Follow-up meetings are held periodically and procedural amendments are sent out as the need arises.

TYPICAL OPERATIONAL CORRIDOR FLIGHT.

In this section we will list and explain the procedures followed by both the operator and the ATC personnel during a typical tracked flight. Helicopter 2461L proposes to fly from North Philadelphia Airport to Washington, D.C.:

1. The pilot will call Philadelphia Approach Control (PHL) by telephone to alert the facility that he desires to have his flight tracked. (All operators are supplied with a list of contacts at each tracking facility.) The pilot, as specified in a procedural letter sent to the operators, will supply the facility contact with the following information:

a. Tracking requested.
b. Aircraft identification.
c. Time entering facility's airspace.
d. Route of flight.
e. Requested altitude.

This notification does not relieve the operator of the responsibility of filing a flight plan.

2. Upon receipt of this telephone notification, the approach control PHL operations officer or his deputy will advise both the data systems specialist and control personnel of the impending flight and assure that a tape is readied for recording.

3. The pilot will then file and IFR flight plan, through the Philadelphia Flight Service Station (FSS) (figure 7).

The flight plan items by box numbers are:

Box No. 1--Type of flight plan--IFR checked in this box indicates that the flight intends to operate under instrument flight rules.

Box No. 2--Aircraft identification--N2461L is the aircraft registration number.

Box No. 3--Aircraft type/special equipment--SA 341G/A shows that the aircraft is an Aerospatiale Gazelle. /A indicates that the aircraft is equipped with DME and a 4096 code beacon transponder.

Box No. 4--True airspeed knots--110 is the proposed true airspeed the aircraft intends to maintain.

Box No. 5--Point of departure--PNE is the three letter identifier for North Philadelphia Airport.

Box No. 6—Departure time, proposed, actual--1400 in the proposed box is the time the aircraft (A/C) intends to depart the North Philadelphia Airport (PNE). The actual time box is for the pilots use for record keeping. These times are in Greenwich Mean Time (Z).

Box No. 7—Initial cruising altitude--3,000 is the altitude the pilot requests for this flight.

Box No. 8--Route of flight--D BEKEL V314R TAYLO V 317R RINTY. This is the route requested by the pilot broken down as follows:

a. D BEKEL--The pilot requests to fly from PNE direct to the nearest waypoint on the southbound corridor. BEKEL is the five letter identifier assigned to this RNAV waypoint, which is a point 19.5 nautical miles (MNI) out on the YARDLEY VORTAC 255.5° radial, latitude 40-07-03.8 N longitude 75-17-36.5 W. All waypoints along the corridor are so designated and are located by the VORTAC radial and DME, and latitude and longitude.

b. V314R--This is the route designator for the southbound corridor. It stands for Victor (for very high frequency (VHF) airway number 314R, for RNAV or Area Navigation Route).

c. TAYLO--This is the identifier for the waypoint on V314R, where a transition is made to V317R. It indicates to the controller the limit of flight on V314R and the beginning of flight along V317R.

d. V317R--The route designator for the second segment of this RNAV route.

e. RINTY--The waypoint identifier of the last in route waypoint along this RNAV route.

Box No. 9--Destination--Union Station Heliport, Washington, D.C. A proposed helicopter landing facility on the roof of Union Station in Washington, D.C.

Box No. 10--Remarks.

a. Req Copter RNAV 184--This indicates that after passing RINTY the pilot requests to execute the area navigation helicopter point-in-space approach (figure 10) in the Washington, D.C. area: the approach track is 184° magnetic. If the pilot is VFR by the missed approach point, he will continue to his destination under visual conditions along the Washington Area Helicopter Routes (figure 11).

b. "NEC TEST"--This box alerts the controllers along the route that this is a NECC test participant and should be tracked and recorded.

Box No. 11--Estimated time en route--1:10 indicates that the pilot estimates that the route as filed will take 1 hour and 10 minutes to fly.

Box No. 12--Fuel on board--2:00 indicates that with the fuel load planned to be carried for this flight the helicopter could remain aloft for 2 hours.

Box No. 13--Alternate aiport--Baltimore/Washington International is the airport that the flight will proceed to if the pilot is unable to make his original approach to VFR conditions.

Box No. 14 through 17--Self explanatory.

Box No. 18--Flight watch stations--For VFR flights only--to indicate which FSS the flight will contact.

4. After the flight plan is filed, it is sent by FSS teletype to the nearest ARTCC computer which verifies the routing as correct and routes messages to facilities along the path of flight of the helicopter, which cause flight progress strips (figure 8) to be printed at those facilities. The flight progress strips include the basic flight plan information and estimated times at fixes in each facility's area. The strips are printed 30 minutes prior to the flight entering the area. The first set of strips to appear will be at North Philadelphia Control Tower. Since the pilot requested 3,000 feet, the entire flight will be in terminal airspace.

5. Upon receipt of the departure strip, North Philadelphia Control Tower will coordinate a release and clearance with PHL, which will have received strips on the flight at approximately the same time as PNE. As planned, the flight will proceed from the PNE control zone into the PHL approach control airspace.

6. At his proposed departure time, the pilot of N2461L will call North Philadelphia Tower and request his IFR clearance. The tower will deliver the clearance as filed, plus a discrete beacon code, unless circumstances dictate otherwise. The helicopter will read the clearance back as a check and then request departure clearance. The flight will be cleared for takeoff by the tower and PHL Approach Control will be notified of its departure. PHL should start a data extraction tape running at this time. Shortly after takeoff, the flight will be advised to contact PHL Departure Control.

7. The Philadelphia departure controller, having been notified of N2461L's departure, will acquire radar contact on the flight as it appears on the scope departing the PNE helipad. The controller, alerted by the phrase "NEC Test" on his strip, will assure that the flight is being taped. The controller will reaffirm the route and altitude of the flight at this time and verify that it is on the assigned beacon code. The controller will monitor the flight's progress on its direct course from PNE to BEKEL and its intercept and navigation on V314R.

8. Prior to departure, the pilot of this helicopter will have set all the waypoints of his route into his area navigation set (or as many as possible, depending upon the equipment complexity). Upon receiving clearance to depart, he will takeoff and proceed directly to BEKEL using RNAV guidance and climb to his requested altitude of 3,000 feet.

9. When advised by the tower, the pilot will contact PHL departure control and confirm that he is in radar contact. It is recommended that at this time the pilot check that the flight is being recorded.

10. The flight will navigate direct to BEKEL, using area navigation and, once there, will intercept V314R and continue on course.

11. As the flight passes WAGGS, the PHL controller will point it out to the Baltimore controller via landline. (The PHL/BAL Approach Control boundry lies approximately over WINGO.) Having received flight progress strips prior to this

time, the Baltimore controller should know that this is a tracked flight due to the phrase "NEC Test" in the strip's Remarks Section. Baltimore should have a tape running at this time. Baltimore will establish radar contact and take over control as the flight passes WINGO. The PHL controller should advise the BAL controller at this time of the flight's tracked status as a double check.

12. Since at 3,000 feet the PHL controller can still see the flight on his radar until approximately over EGNER, track recording at PHL should continue to this point. When the helicopter is no longer in radar contact, the DSS will be advised to secure recording; he will remove the tape, label it with date, time, aircraft identification, beacon codes, route of flight, and any other pertinent information and mail it to NAFEC. Tapes, tape data labels, and mailing labels have been supplied to the tracking facilities and are replenished as they are used.

13. Approaching WINGO, the pilot will be advised to contact Baltimore Approach Control.

14. The Baltimore Controller will monitor the flight along this portion of the route. He will observe the transition to V317R and issue a clearance for the point-in-space approach to the Washington area (the copter RNAV-184°). At the controller's discretion, the flight will be cleared to descend to 2,500 feet approaching RINTY to facilitate commencing approach.

15. The Baltimore controller will advise the Washington controller of the approach in progress, but coordination is not required because the approach is in Baltimore airspace.

16. Passing RINTY, the pilot will commence his approach via CLORY, OLNEE, and the missed approach point (MAP) observing altitude restrictions depicted on the approach plate (figure 10). The flight may descend no lower than 940 feet to the MAP.

17. If the flight enters visual conditions prior to the MAP and no lower than 940 feet, the pilot will so advise Baltimore Approach, cancel his instrument flight plan, and proceed VFR to his destination via the published Washington area VFR helicopter routes (figure 11). If the pilot proceeds to the MAP at 940 feet and is still in IFR conditions, a missed approach will be executed back to CLORY. Baltimore will be advised and an alternate approach will be made.

18. Assuming the helicopter RNAV approach was successful, Baltimore will continue recording radar data until the flight is no longer in radar contact. The tape will then be handled as was done by Philadelphia.

19. At the completion of the flight, the pilot of N2451L will accomplish the NEC in-flight/post-flight data log (figure 9) and forward it to HAA. HAA will then send the log to NAFEC for comparison with the facility tapes.

20. Exceptions to this scenario are flights entering into, departing from, or operating within the New York CIFRR Approach Control Area. These flights are not required to alert the New York facility prior to a test flight. The New York CIFRR is equipped with an ARTS I Terminal Radar System (all other tracking facilities have ARTS III systems). The New York facility constantly records all traffic movements and the required track tapes are requested after receipt of the flight data logs. A list is sent to the New York Data Systems Officer (DSO) containing

dates, times, and aircraft identifications of flights in the New York area. The DSO then has the tapes for the corresponding dates and times located and sent to NAFEC for analysis.

DATA REDUCTION AND ANALYSIS.

Upon receipt of a facility data extraction tape at NAFEC, it is logged in and assigned a local control number. All information on the tape label is recorded. This includes: facility of origin, date of recording, aircraft identification, beacon code, tape start and end times, and route of flight. Spaces are provided for the number of the corresponding flight data logs, the pilots name, the data systems specialist's initials if available, and remarks. This information is filled in upon receipt of the flight data log. The flight data logs are normally received after the tapes and are recorded on a separate log and assigned a control number. This log contains the following information: date of flight, aircraft identification, pilots name, departure point and time, point and time at which corridor is joined, route of flight and altitude point of corridor exit and time, facilities whose airspace was penetrated, a space for the corresponding tape number, and remarks.

With both logs, it is possible to correlate all received tapes with their corresponding flight data logs.

After a tape is processed for identification and correlation, it is then searched by the computer for the beacon code of the flight on the tape. This code is obtained from either the tape label or the flight data log of the flight. This beacon code is stripped from the tape and entered into a data file. The data file (tape) contains the flight's discrete beacon code, time, rho-theta (ARTS III) or X-Y (ARTS I) from the RADAR site, and altitude. The position information is converted to latitude and longitude and a plot of the helicopter's track is generated. The plot shows all waypoints and VORTAC's along the route. The corridor lateral boundaries are also plotted on the track to allow a gross evaluation of the flight's ability to stay within the corridor. Altitude and time are obtained from the associated computer printout. All flight data logs are studied to gain a knowledge of corridor usage patterns and recurrent navigation or ATC problem areas. Additional software will be developed to compute the total system crosstrack error based on the ARTS radar data and the desired track. Statistics will be generated on a segment-by-segment basis. To date, 55 tracks have been plotted. Problems encountered in this area include: designing software to read the facility tapes, generate maps, and plot the track in relation to known waypoints with as little error as possible. This job has been made more difficult by the nonstandard tape format used on recordings furnished us by the CIFRR facility. This facility is equipped with an ARTS I system, unlike the other trackers which are ARTS III. The software package for reduction of ARTS I tapes has been developed and is undergoing testing at this time.

TECHNICAL APPROACH.

Each plot will have the route centerline and boundaries added after the helicopter flight track has been drawn in by the computer. These tracks will be analyzed to determine adherence to the course. Any tracks that approach or exceed the established corridor boundaries of 2 miles either side of course will be investigated. This will be done by referring to the flight data log submitted for that flight. If the deviation can be shown to have been caused by a known diversion, such as a

radar vector around weather or traffic, or by the elimination of a waypoint or other explainable cause, the course excursion will be disregarded. If no explainable cause can be found, other flights over the same track or route segment will be studied to determine if this is a recurring situation. If this course displacement has occurred more than once or has been experienced by more than one aircraft, an investigation will be undertaken to determine the cause.

Statistical data is printed out as each tape is processed. This data includes aircraft position, altitude, time, beacon code, tracker, and track number and is updated with each antenna scan. This statistical data will be analyzed to show quantitatively how well the tracked flights were able to maintain the course and to remain within the reduced route width boundaries.

TEST RESULTS

DATA BASE TO DATE.

The data base of this evaluation to date, December 15, 1979, is made up of 103 ARTS data extraction tapes and 157 flight data logs (see figure 12 for tape breakdown by facility). Data collection commenced on July 15, 1979 and is scheduled to run until July 15, 1980. The discrepancy between numbers of tapes and logs can be accounted for by scheduled and unscheduled outages of recording machines, flights that proceed VFR due to clearance delays, improper flight plan filing, coordination breakdowns, and the recording of more than one flight per tape. Flight data logs that cannot be matched to a tape are still a valuable source of data. The data received thus far are a representative sample of corridor usage. As can be seen in the charts of corridor segments (figures 13-17), the most heavily utilized are in the New York area.

CORRIDOR USAGE.

The primary users of the corridor, of the designated test participants, have been the RCA Company based in Trenton, New Jersey, and the Mack Truck Corporation based in Allentown, Pennsylvania. Both of these operators make frequent round trips to New York City. Use by other operators has been very sporadic. The corridor has shown its utility in this type of operation, and the New York CIFRR has responded to the frequent corridor departures from Manhattan Heliports with a system of preplanned or "canned" departure clearances called Card-A-Clearance. This allows frequent users to depart and join the corridor with a minimum of delay and coordination. Perhaps with the advent of (SFAR) 29-2, which permits a single pilot to fly IFR, traffic on the northern and southern portions of the route will increase.

ROUTE WIDTH OBSERVATIONS.

The track plots generated to date show aircraft track, waypoints, and VORTACs. The route centerline and route width boundaries are added later. Preliminary studies, when these features have been added to representative plots, show that the flights tend to remain well within the designated 2 nmi either side of course. Sample track plots are shown in figures 18, 19, and 20.

PROBLEM AREAS.

CONTROLLER UNFAMILIARITY WITH NEC AND NEC EVALUATION. This was expected, and although it caused problems in the initial stages of the evaluation, as the volume of use increased and more ATC personnel were exposed to the NEC evaluation, a definite lessening of this type comment was found. This still appears on occasion and is treated on a per case basis when possible. The time lag between the occurrence and when the flight logs are received at NAFEC increases the difficulty of finding a general solution to this problem.

CORRIDOR CLEARANCES UNOBTAINABLE. To a great extent this can be attributed to the problem mentioned previously, and also to flight plan filing problems. In some cases, a simple misspelling of a waypoint (and some of them lend themselves to misspelling) would cause a flight plan to be rejected. In other cases, the route was not in the ARTCC computer in the right form. This would not be discovered until the route was filed. An error of this sort would give an erroneous indication of flight plan validity and yet no strips would be printed. This type fault required extensive investigation to rectify. It was treated by supplying all users with sample flight plans and detailed information on filing. There have been cases of a flight plan being filed properly and still causing problems. These have been traced to FSS personnel changing the format slightly to conform with prior practices. This required contacting the FSS's, outlining the evaluation procedures to them, and supplying them with flight plan samples and explanations of the need for a standard filing format. Unless a flight plan is accepted by the ARTCC computer, strips will not be printed at the control positions involved, and unless strips are available, it is very difficult for a controller to issue a clearance for a route with which he is not familiar. The follow-up actions on the comments in this area appear to be effective in that the incidence of these complaints is diminishing.

HOLDS AT DEPARTURE POINT. Departure holds are generally attributable to traffic at the destination airport or inbound on a requested outbound route, and are mostly New York inbounds and departures. The main reason for this is the complexity of the traffic in the New York metropolitan area. This is a difficult situation to track down and resolve to everyone's satisfaction. By the time the log arrives and the problem is noted, it is almost impossible to determine the exact reason for the delay. This type of delay is normally based on the individual controller's assessment of the local situation at the time the clearance was requested. This is difficult to duplicate after any time has elapsed. Another instance of a departure hold, which will be treated later, is when certain specific approaches are in progress. Delays of this sort cannot be completely eliminated, but as controller familiarity with the system and helicopter capabilities grow, it should diminish in frequency.

ISSUANCE OF CONVENTIONAL ROUTE RATHER THAN RNAV ROUTE. This was more common in the very early days of the test and is not seen at the present time. The main reason for this was that the controller was unfamiliar with the test aims and really did not see the difference. In some cases, it was shown that the conventional routing was, in fact, faster at that particular time.

HANDOFF DELAYS COORDINATION DELAYS. The primary area where this problem is encountered is between Philadelphia Approach Control (PHL), McGuire RAPCON (WRI), and the New York Common IFR Room (EWR-JFK). WRI is located between PHL and JFK on the NEC and all north and southbound corridor traffic impacts on their area

to some extent. A flight northbound on V313R would not be accepted from PHL if the flight was at 2,000 feet or below unless the WRI controller got prior approval from JFK. This was an accepted practice and, to some extent, still is. However, in actual practice as corridor experience builds, the problem is lessening, primarily due to the fact that the accepting JFK controller is becoming more certain of what to expect from the helicopter and accepts the flight more readily. This in turn allows the WRI controller to accept the flight without undue delay.

A solution to this problem is that whenever possible, northbound flights transiting the WRI approach control airspace do so at an altitude of 3,000 feet or higher. Flights at these altitudes only cut through a very small portion of WRI airspace and do not require a handoff to WRI, only a point-out, and can be handed off directly from PHL to JFK, thus eliminating possible delays. Southbound flights out of New York on V314R can avoid the McGuire area if they are routed SPATE direct TOLAN, bypassing BALDE. This keeps the flight clear of WRI airspace and permits a direct handoff to PHL from Newark (EWR) with only a point-out to WRI. This routing cannot be approved at all times due to local traffic flows in the EWR sector area.

EXCESSIVE WAYPOINTS. Along the southern portions of V314R and V313R are waypoints as close as 4.7 nmi to each other, with an average distance of 10.5 nmi between waypoints in this area. This amount of waypoints greatly increases pilot workload, and it is felt that some of these waypoints could be eliminated. A study must be made of the original corridor layout rationale to determine if these waypoints were designated to keep the corridor out of controlled airspace. If this is so, an airspace action must be initiated to realign the route.

LATE DESCENT CLEARANCES. There have been instances of flights being held at cruising altitude past the requested descent point. This has caused some inconvenience to the operators. This was brought about, in one case, by the controller not realizing that he could issue the approach clearance (it was an approach into DCA and he did not realize that the entire Point-in-Space Approach (PISA) was accomplished in BAL airspace). This case was isolated and controllers involved were made aware of the proper procedure.

This also occurred on an approach into New York from the north, and as far as can be determined, was caused by a combination of coordination breakdown and the New York traffic situation at the time.

DENIAL OF APPROACH CLEARANCE. At times, the Copter RNAV 026 approach into the New York metropolitan area cannot be used to JFK Runway 13L/13R VOR approaches in progress, commonly referred to as the Canarsie approach. This approach is only used when the wind at JFK is out of the southeast and IFR arrivals are being made to runways 13L and 13R (figure 21). The approach airspace to be protected infringes on the R026 approach and since they are IFR arrivals, all must be treated equally. The JFK approaches cannot be stopped to accommodate an arriving IFR helicopter. This would create chaos in the New York terminal area. The only solution now available to this problem is for the controller to create a gap in the fixed wing flow and fit the helicopter into it or to have the helicopter hold until a gap occurs. Both of these approaches create problems, but as the controllers become more familiar with the helicopter approach and can more readily visualize the time a helicopter takes to complete the approach and free the airspace, the helicopters will be more readily accepted and cleared for the approach along with the fixed wing traffic. Controllers are gradually becoming more aware of the limitations of helicopter holding capability and this should reduce some of the

proposed delays and excessive "expected approach clearance" ti[illegible] This approach conflict does not occur regularly, and hopefully by next summ[illegible] we can expect to see this situation developing again, we will have wor[illegible]out an equitable solution.

POOR RADAR COVERAGE. The actual NEC radar coverage will be determined from the track plots when all data has been recovered and position and altitude factors can be considered.

EN ROUTE HOLDING. In the test thus far, two instances of actual holds have been encountered. Both of these were less than 2 minutes and both were nonstandard, e.g., 360° turns. One hold for practice was also reported.

PROBLEM SUMMARY.

There have been other problems reported in addition to the ones listed but they have been scattered and not classifiable. Reported problems have been followed up and attempts have been made to resolve them. It appears obvious that the most general cause of problems along the route has been a lack of knowledge of the route and the NEC evaluation by the on-duty ATC specialist. This preliminary portion of the test has served as a training period for both the operators and ATC, and the results of this use of the corridor are beginning to show. Problems are becoming less frequent and logs are generally showing more satisfaction with handling. The greatest improvement has been along the corridor segments receiving the most use.

FUTURE DEVELOPMENTS.

Procedures have been agreed upon by FAA and the operators to permit VFR helicopters to operate along the corridor if they meet certain minimum standards as set forth in Advisory Circular AC-73-2, "IFR Helicopter Operations in the Northeast Corridor." These VFR operators require a corridor approval from the Office of Flight Operations prior to using the corridor. The VFR operators will not be tracked. This is to maintain the sample integrity. These operators are requested to submit flight logs after each flight. Allowing VFR operations on the corridor will benefit in three ways: (1) it will provide additional experience for control personnel; (2) it will give operational corridor experience to those operators planning to become IFR certificated and join the evaluation in the future; and (3) the flight logs will provide an additional source of data on corridor problem areas. VFR operators will be treated similarly to IFR operators but will not be provided IFR separation, they will be handled on a traffic and workload permitting basis.

CONCLUSIONS

Based on data received and processed during the period covered by this report, the concept of the Northeast Helicopter Corridor is a viable and feasible method of routing helicopters between the East Coast cities of Washington, D.C.; Philadelphia, Pennsylvania; New York, New York; and Boston, Massachusetts. Using information gathered during this test, the implementation of similar helicopter-only routes in other areas of the National Airspace System (NAS) would be greatly facilitated.

System problems were encountered, as was expected, but these were primarily due to the relative newness of the concept. The problems listed below have decreased in direct proportion to route segment usage.

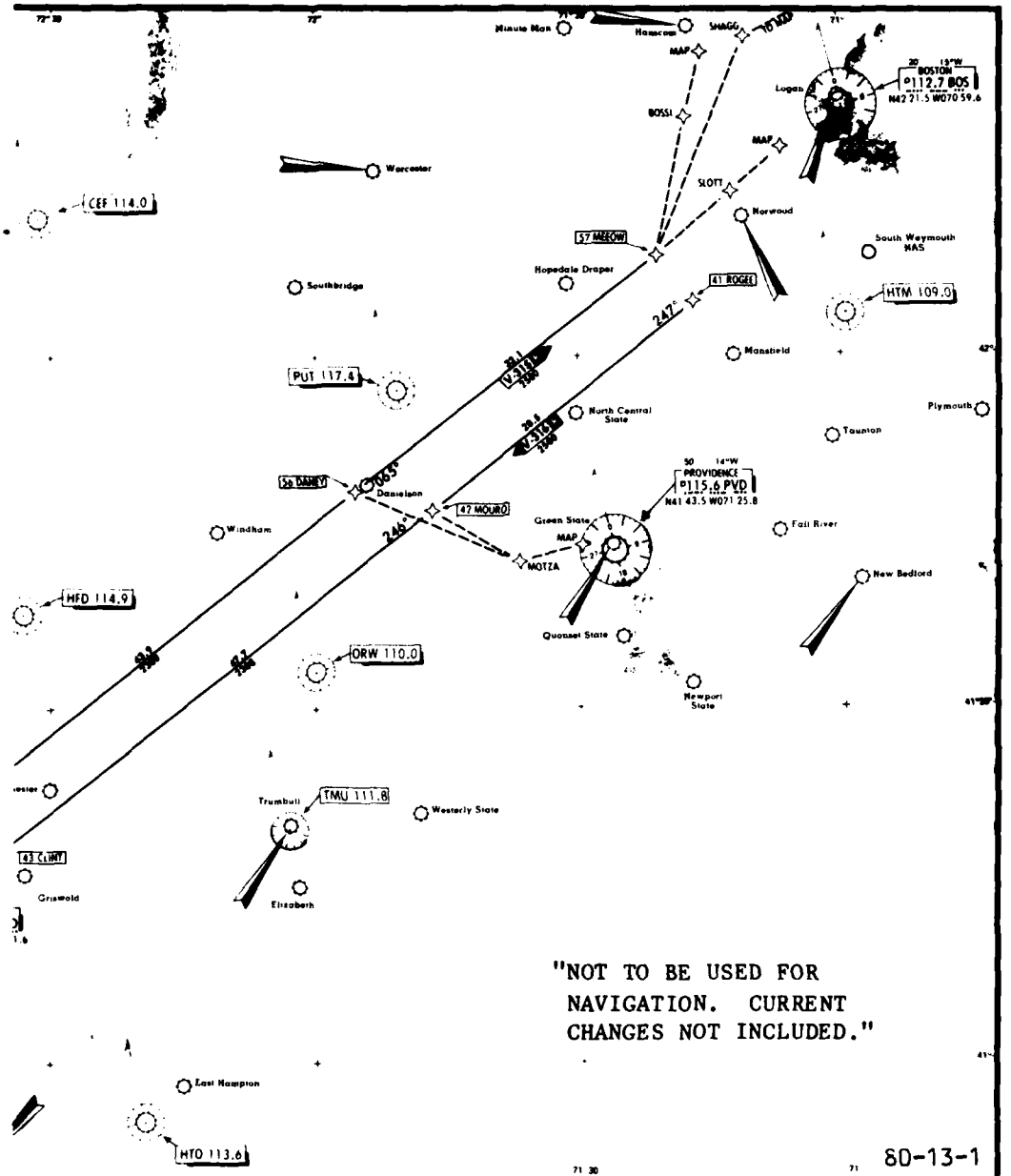
1. No tracks plotted thus far have shown any flights exceeding the ±2 nmi route width.

2. Pilot comments have been generally favorable and have not reflected any technical problems bearing on the actual flying of the route.

3. Controller reaction to the route has been favorable, once experience and knowledge of the route and its aims became known.

4. Although the New York area has been the most heavily utilized portion of the route, knowledge gained from these operations will be applicable to the whole route.

5. The hardest part of the evaluation, the learning or break-in period, is now behind us and the remaining months should afford much valuable data on the entire route.



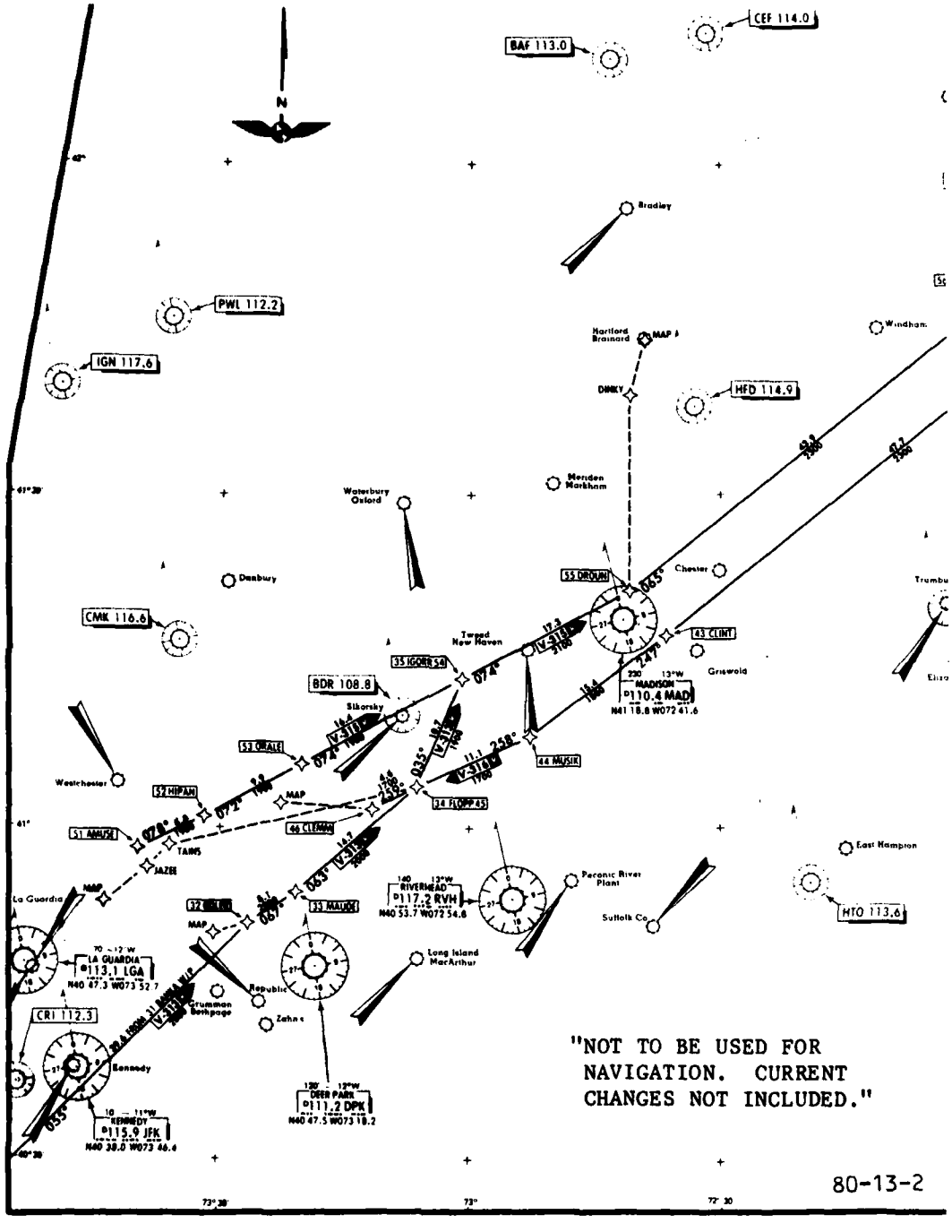
(This airway continued from Northeast Helicopter Corridor Routes, Washington, D.C. - New York Chart)

NO	NAME	IDENT	FREQ	ELEV	BEARING DME DIST	VAR	LAT LONG
32	ROLER	JFK	115.9	00	061.0 20.0	13W	N405104.8 W732631.1
33	MAUDE	RVH	117.2	01	284.0 19.6	13W	N405401.4 W732052.1
34	FLOPP	RVH	117.2	01	331.8 13.0	13W	N410330.3 W730604.8
35	IGORR	RVH	117.2	01	054.8 20.2	13W	N411324.1 W730052.5

Victor airway 419R New York - Boston

NO	NAME	IDENT	FREQ	ELEV	BEARING DME DIST	VAR	LAT LONG
51	AMUSE	DPK	111.2	01	415.0 19.5	12W	N405805.7 W733950.1
52	HIPAN	DPK	111.2		335.0 16.8	12W	N410054.9 W733136.2
53	ORALE	DPK	111.2		4[illegible] 18.3	12W	N410545.4 W732008.2
54	IGORR	RVH	117.2	01	054.8 20.2	13W	N411324.1 W730052.5
55	DROUN	MAL	109.4	02	024.4 22.9	13W	N412139.9 W726045.9
56	DANEY	PVD	115.6	01	247.0 21.9	14W	N414819.5 W715420.4
57	MEEOW	BOS	112.7	00	245.4 20.4	15W	N420825.3 W712045.9

FIGURE 1. NORTHEAST CORRIDOR, NORTHEAST PORTION



CHANGES New chart

FIGURE 2. NORTHEAST CORRIDOR, NORTH CENTRAL PORTION

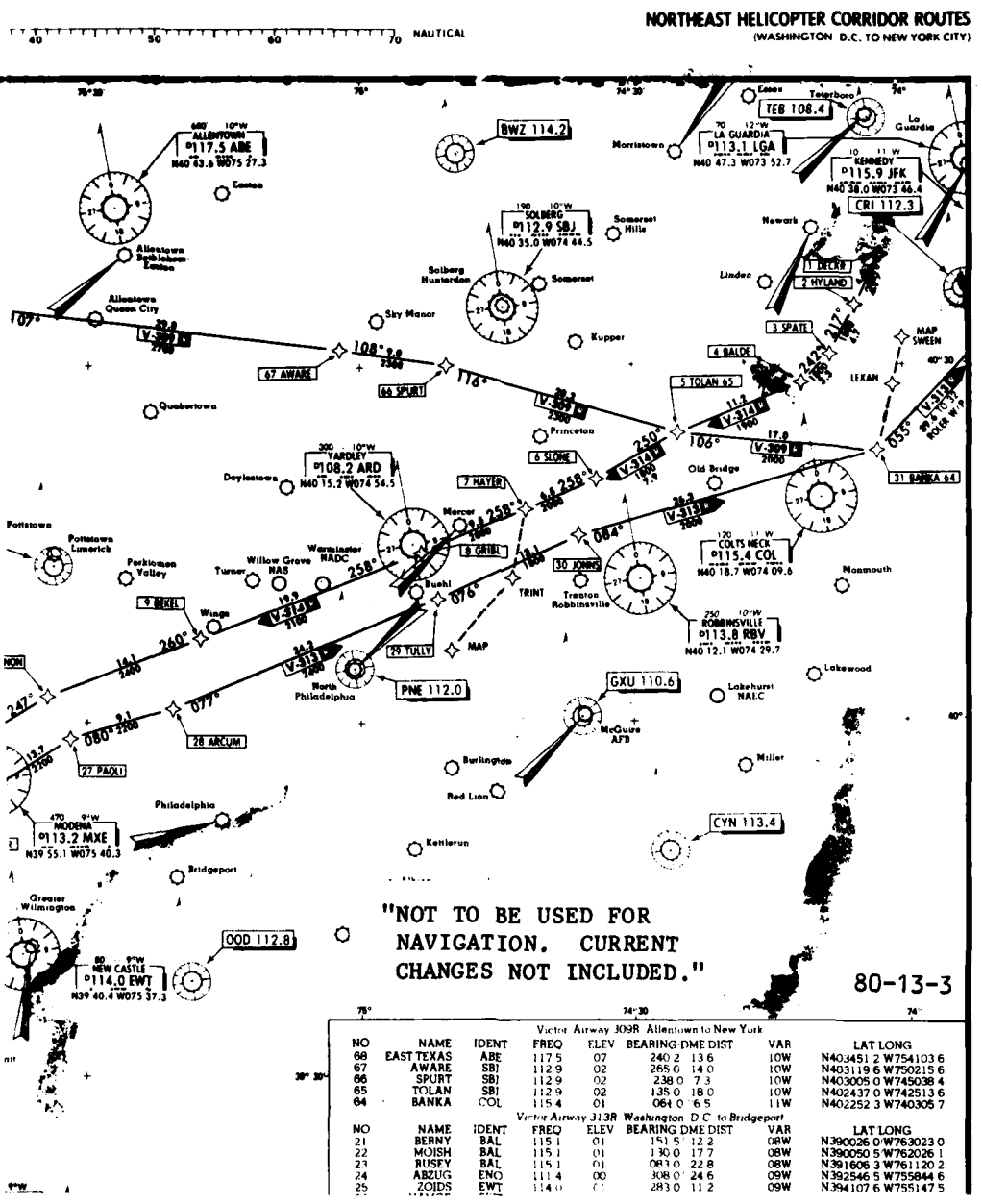


FIGURE 3. NORTHEAST CORRIDOR, SOUTH CENTRAL PORTION

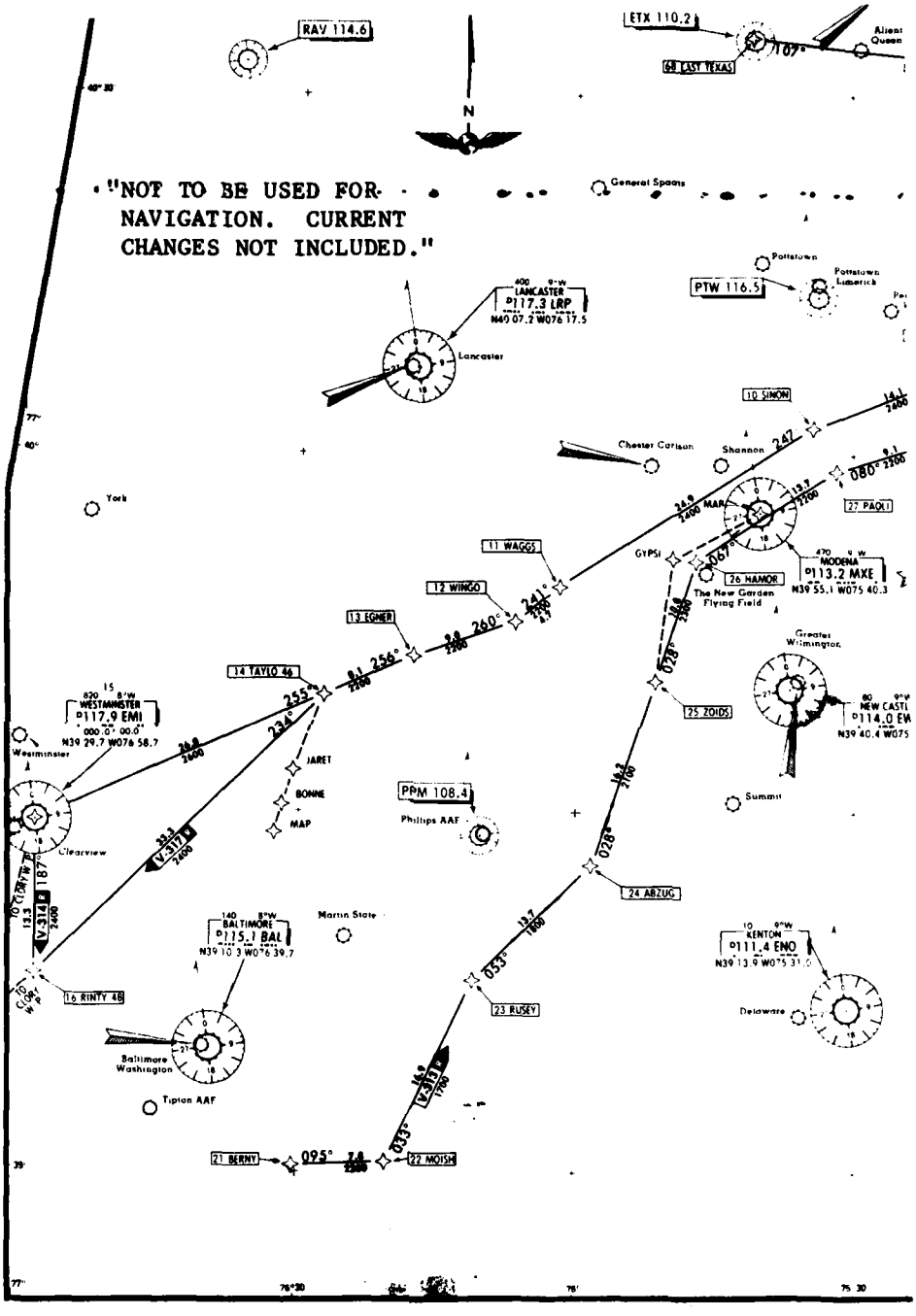


FIGURE 4. NORTHEAST CORRIDOR, SOUTHWEST PORTION

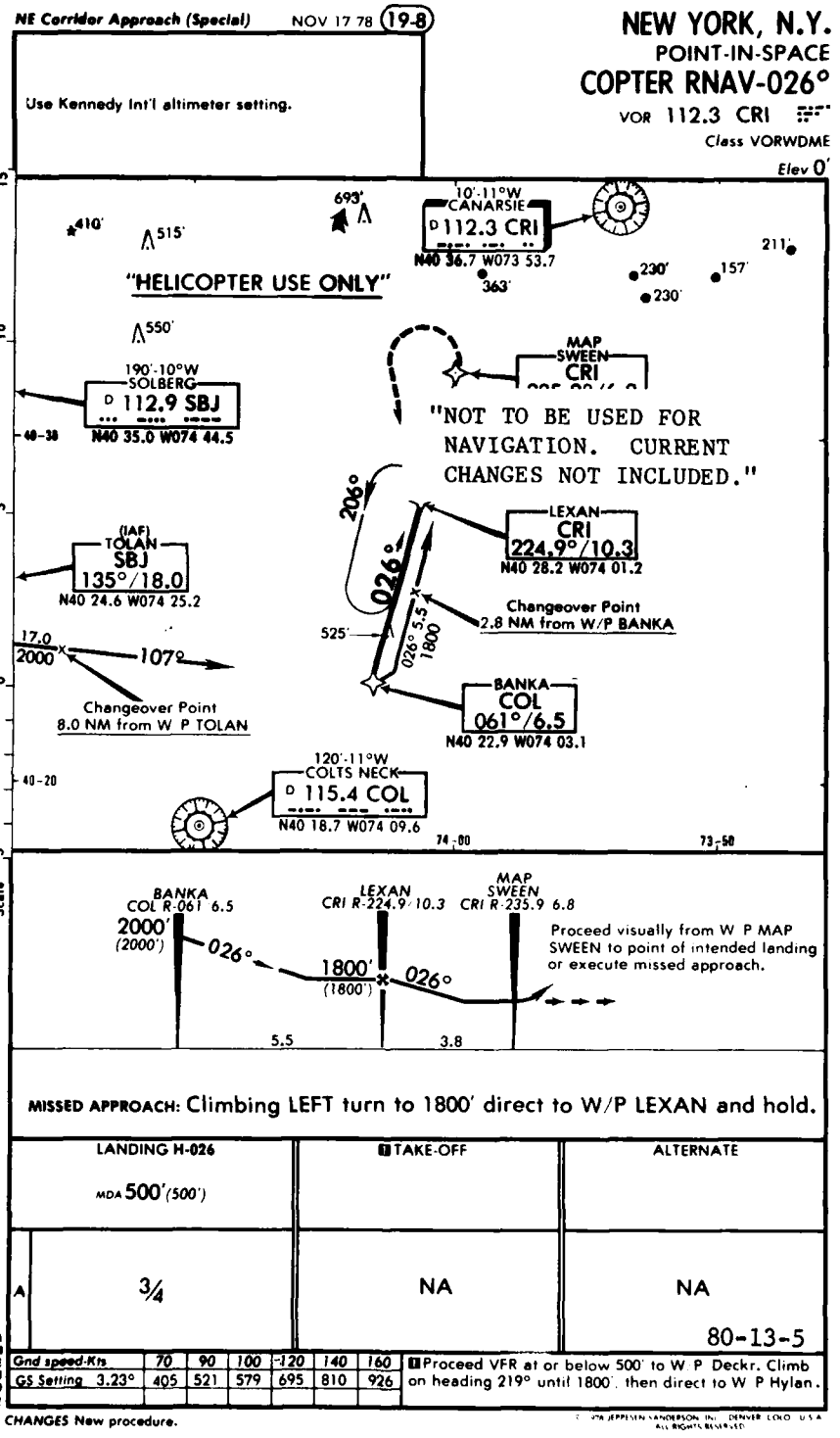


FIGURE 5. APPROACH PLATE, COPTER RNAV 026

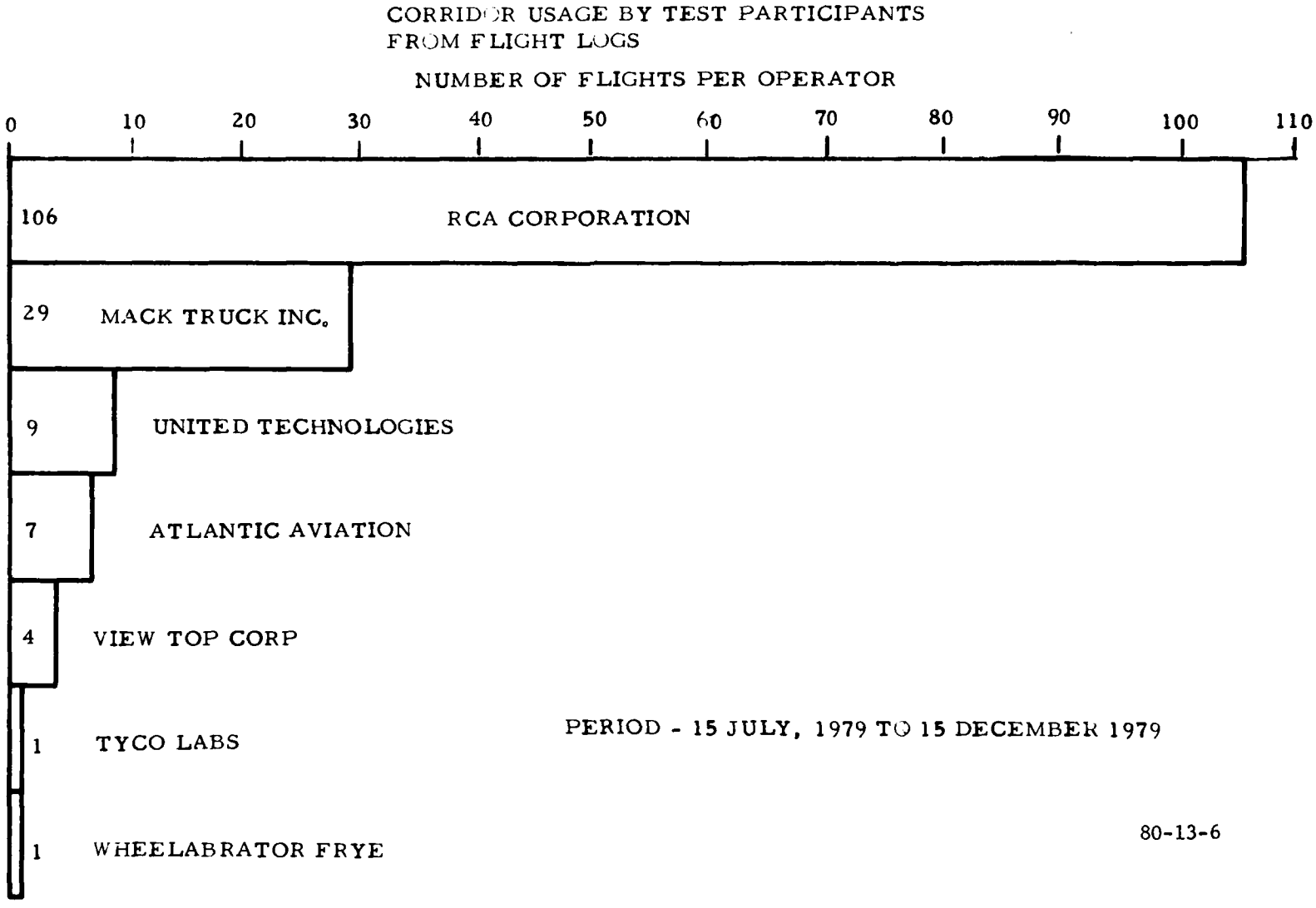


FIGURE 6. CORRIDOR USAGE BY PARTICIPANTS

FEDERAL AVIATION AGENCY

FLIGHT PLAN

Form Approved
Budget Bureau No. 04-R072.3

1. TYPE OF FLIGHT PLAN: ✓ IFR; VFR; DVFR; FVFR

2. AIRCRAFT IDENTIFICATION: N 2461 L

3. AIRCRAFT TYPE/SPECIAL EQUIPMENT ✓: SA 341G/A

4. TRUE AIRSPEED: 110 KNOTS

5. POINT OF DEPARTURE: PNE

6. DEPARTURE TIME: PROPOSED (Z): 1400; ACTUAL (Z):

7. INITIAL CRUISING ALTITUDE: 3000

8. ROUTE OF FLIGHT: D⁰ BEKEL V314R TAYLO V317R RINTY

9. DESTINATION (Name of airport and city): UNION STATION HELIPORT WASHINGTON D.C.

10. REMARKS: REQ. COPTER RNAV 184 "NEC TEST"

11. ESTIMATED TIME EN ROUTE: HOURS 1; MINUTES 10

12. FUEL ON BOARD: HOURS 2; MINUTES 00

13. ALTERNATE AIRPORT(S): BALTIMORE/WASHINGTON INTERNATIONAL(BWI)

14. PILOT'S NAME: JONES

15. PILOT'S ADDRESS AND TELEPHONE NO. OR AIRCRAFT HOME BASE: ON FILE PNE

16. NO. OF PERSONS ABOARD: 3

17. COLOR OF AIRCRAFT: RED/WHITE

18. FLIGHT WATCH STATIONS:

CLOSE FLIGHT PLAN UPON ARRIVAL

✓ SPECIAL EQUIPMENT SUFFIX
A — DME & 4096 Code transponder
B — DME & 64 Code transponder
D — DME
L — DME & transponder—no code
T — 64 Code transponder
U — 4096 Code transponder
X — Transponder—no code

FAA Form 7233—1 (4-66) FORMERLY FAA 398

80-13-7 0052 027 8000

FIGURE 7. SAMPLE FLIGHT PLAN

N2461L SA41/A ACYO 440	3035 P1400 30	PNE	PNE BEKEL V314R TAYLO V317R RINTY DCA O RNAV 184 NEC TEST	80-13-8

FIGURE 8. SAMPLE FLIGHT DATA STRIP

NORTHEAST CORRIDOR EVALUATION PROJECT

IN-FLIGHT/POST-FLIGHT DATA LOG

DATE 10/15/79 ACID N2161L PILOT JONES

DEPARTURE PT PNE TIME 1400 Z

JOIN NEC @ BEKEL W/P TIME 1410 Z

RTE OF FLT V314R TAYLO V317R RINTY

INIT ATC CTC PHL (APCH) TIME 1405 Z

INIT ALT 3000 MSL ASSG'D BCN CODE 4517

FLT COND IFR 20 Ø 2 25 ◆

EXIT NEC @ RINTY W/P TIME 1505 Z

APCH? YES ✓ NO ___ TO MAP DCA W/P, ARPT

TYPE PIS NO. (DESIG) COPTER RWAY 18 4

MAP WX 10 Ø 5

RTE DEV-ATC ___ WX ___ NAV X OTHER ___

EXPLAIN FLEW-WAGGS ⇒ TAYLO

DUE LRP VTAC OUTAGE

HOLD? NO ___ YES ✓ @ TAYLO W/P. ~~FIX~~

TIME 1446 Z 4 MINS

PATTERN 1 MIN RT TURNS NE

REMARKS ___

80-13-9

FIGURE 9. SAMPLE FLIGHT DATA LOG

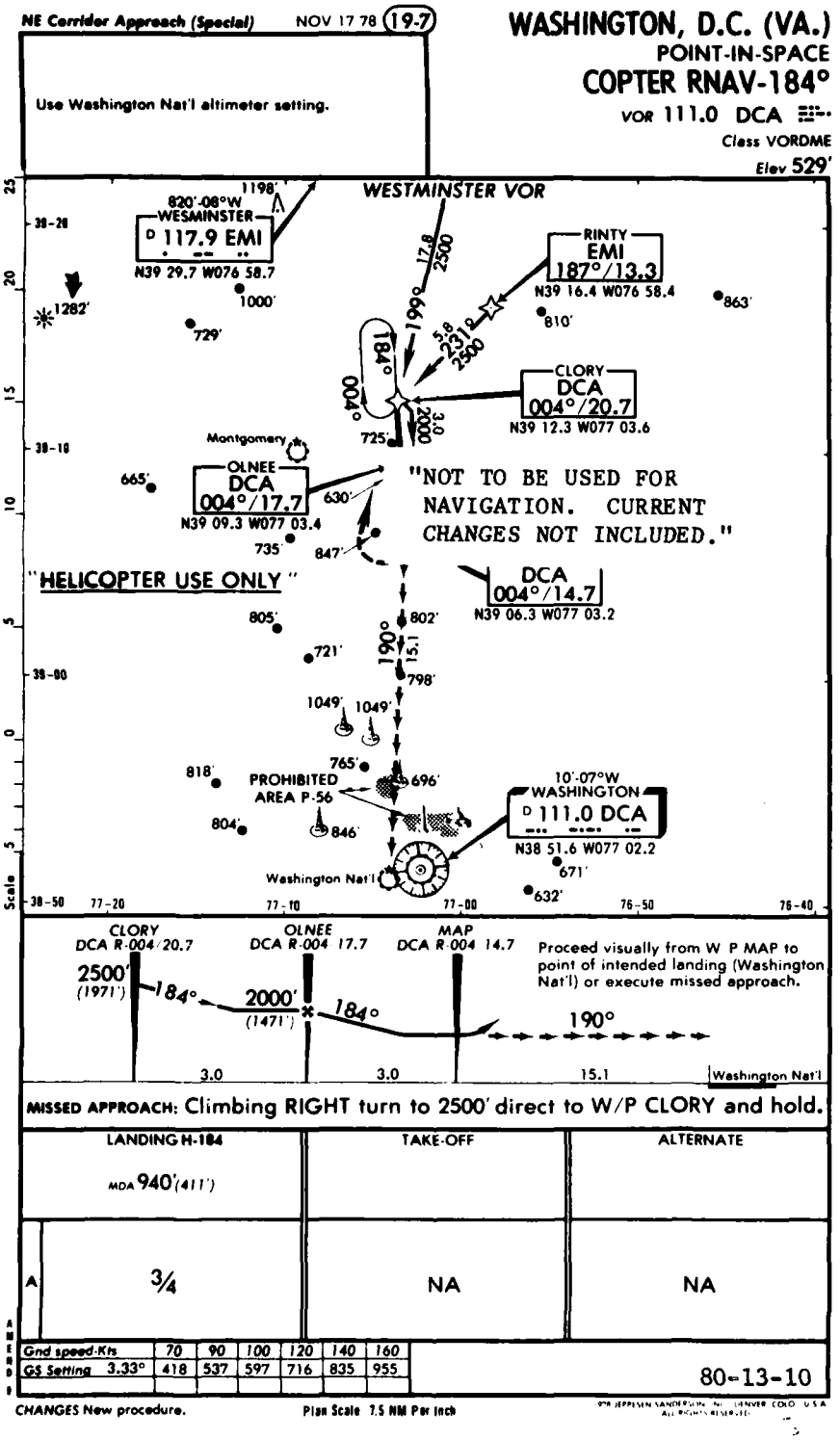


FIGURE 10. APPROACH PLATE, COPTER RNAV 184

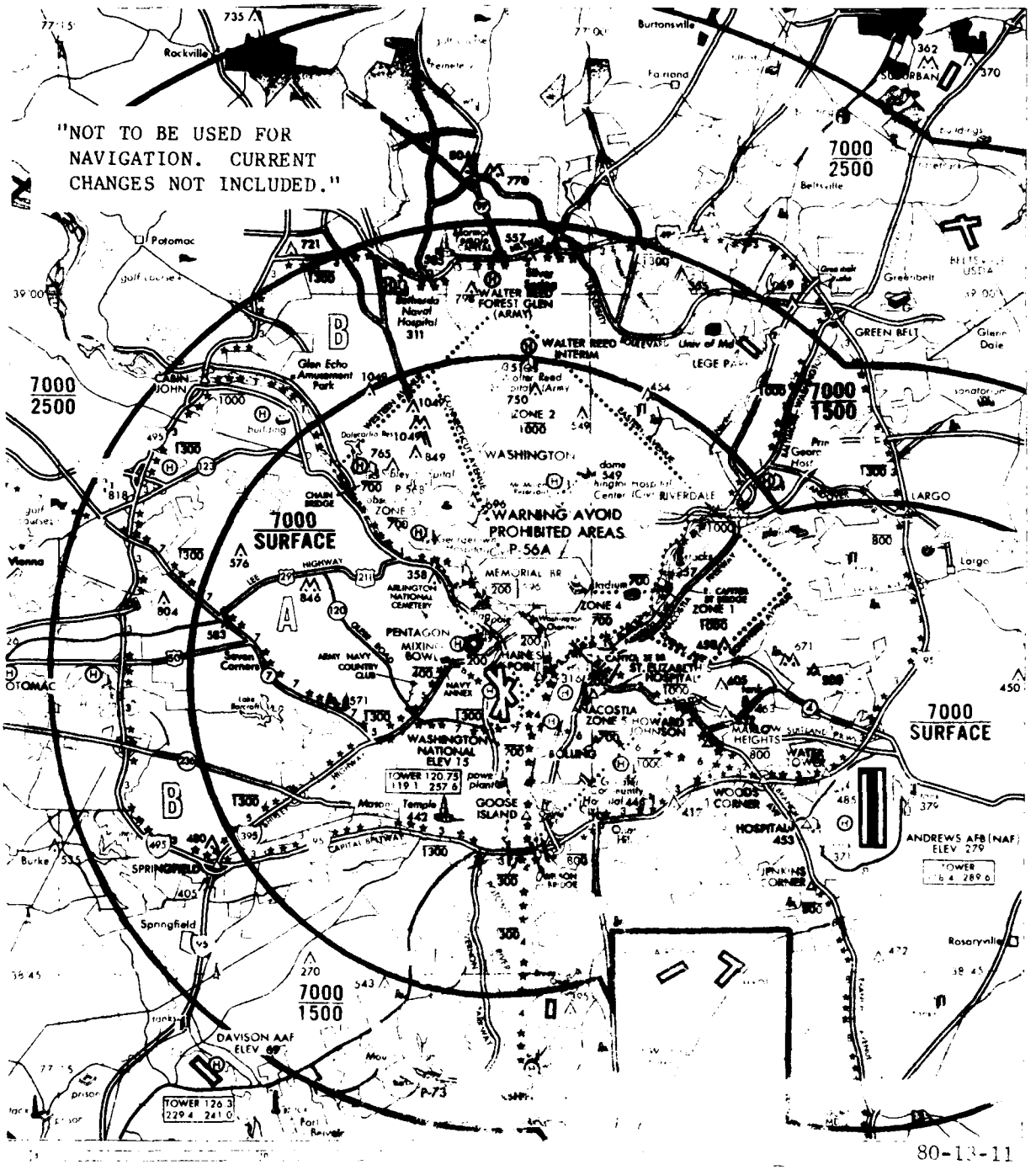


FIGURE 11. WASHINGTON D.C. VFR TERMINAL ROUTES

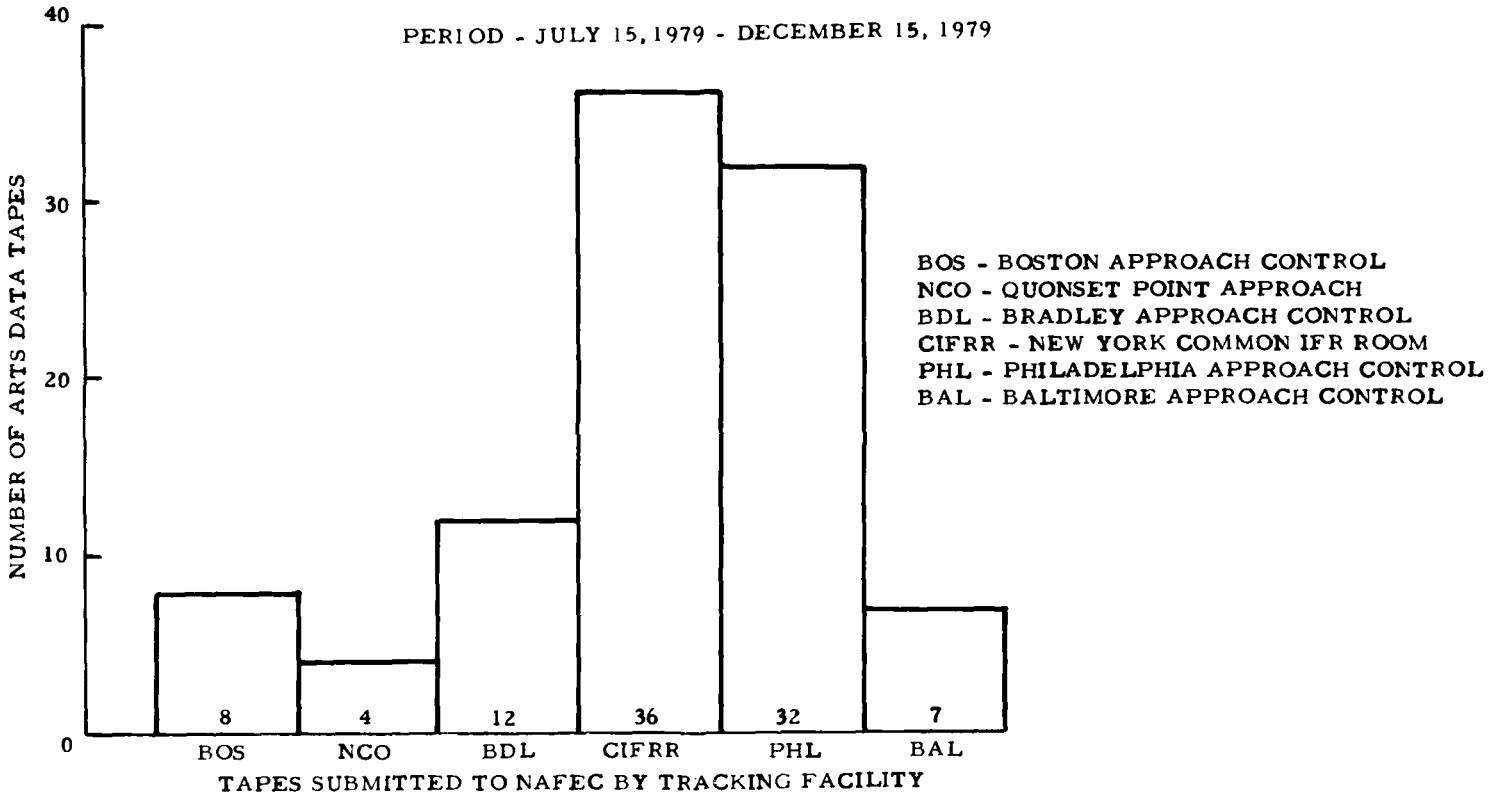


FIGURE 12. TAPES RECEIVED, BY FACILITY

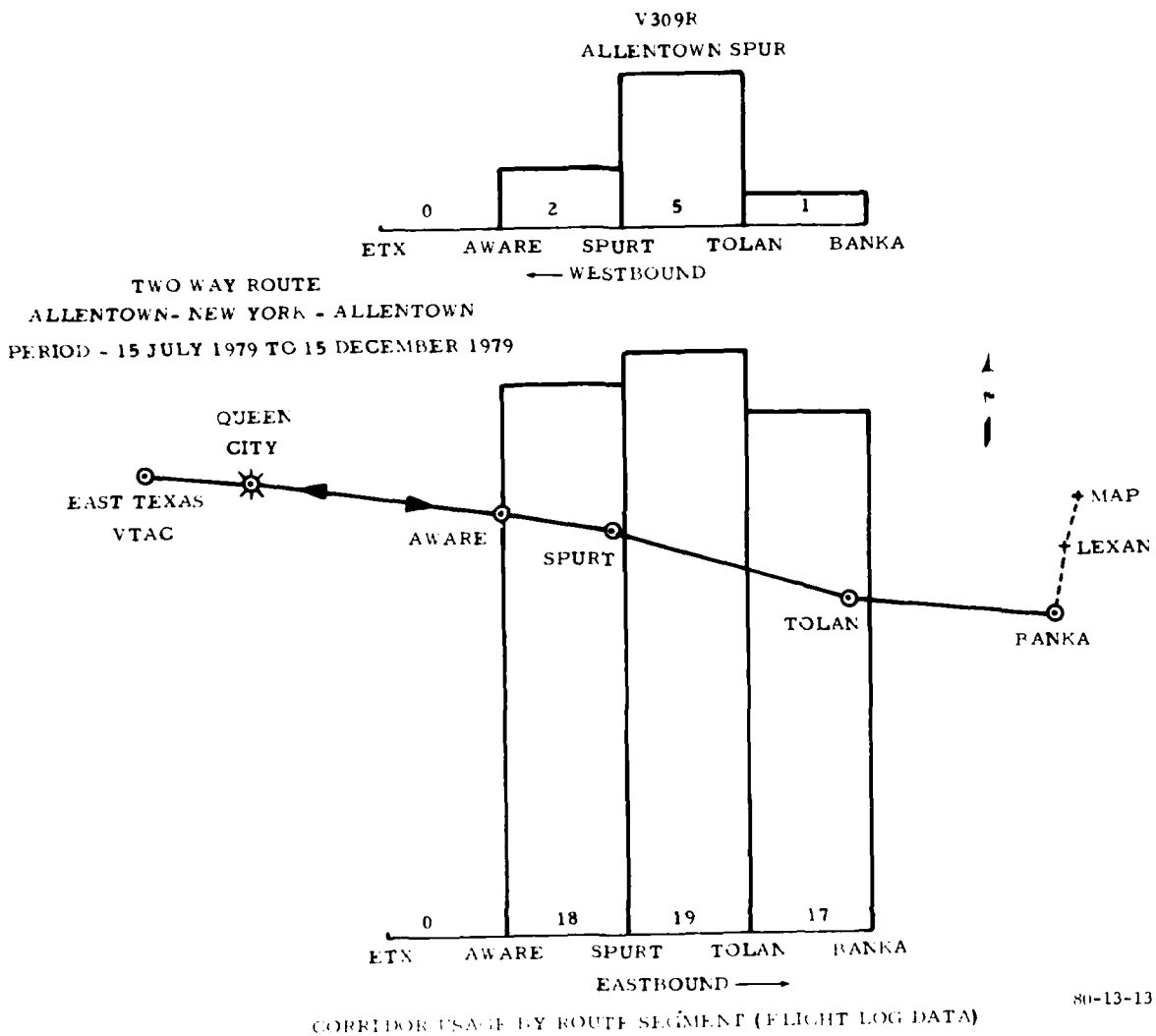


FIGURE 13. CORRIDOR USAGE, V309R

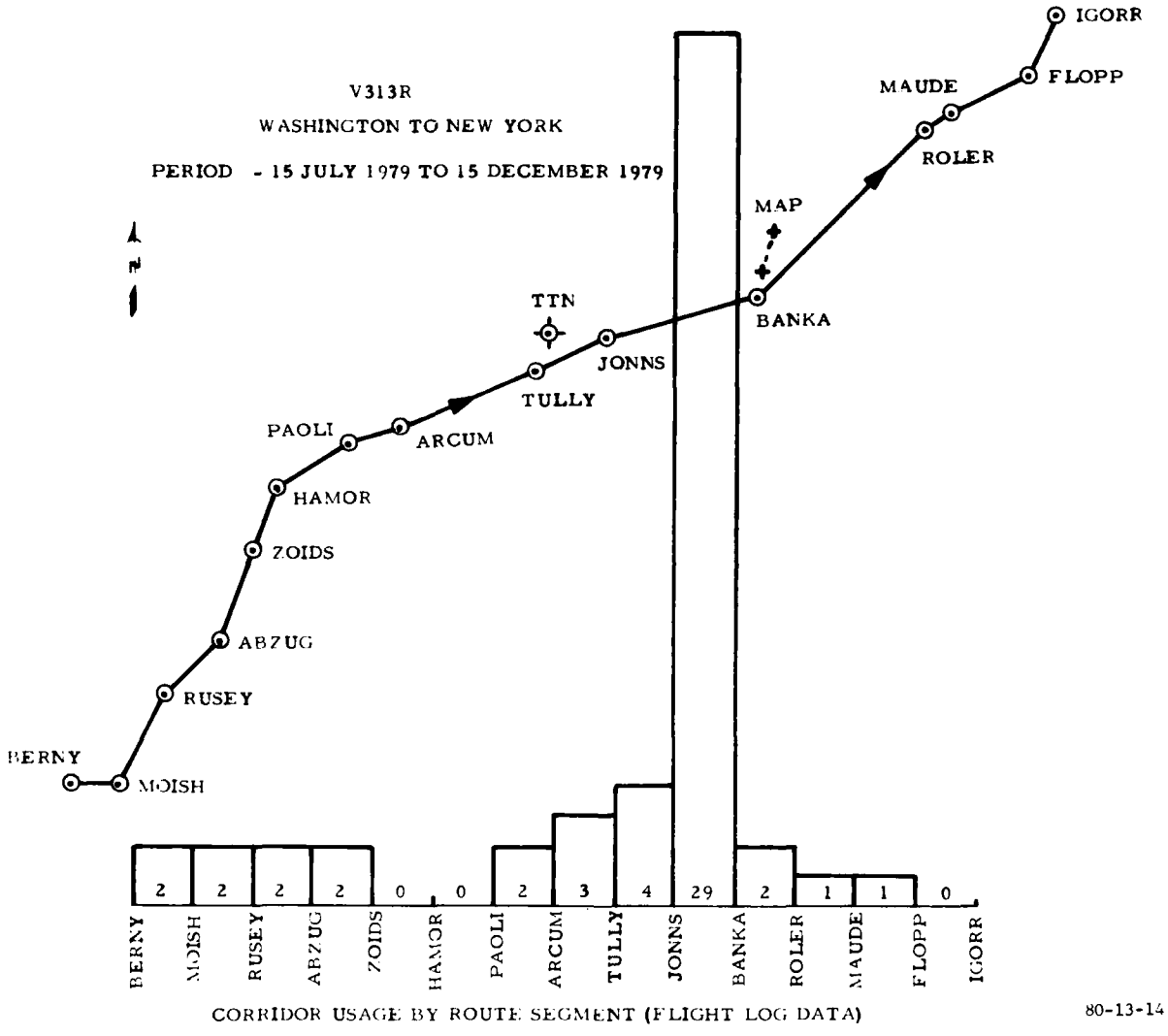


FIGURE 14. CORRIDOR USAGE, V313R

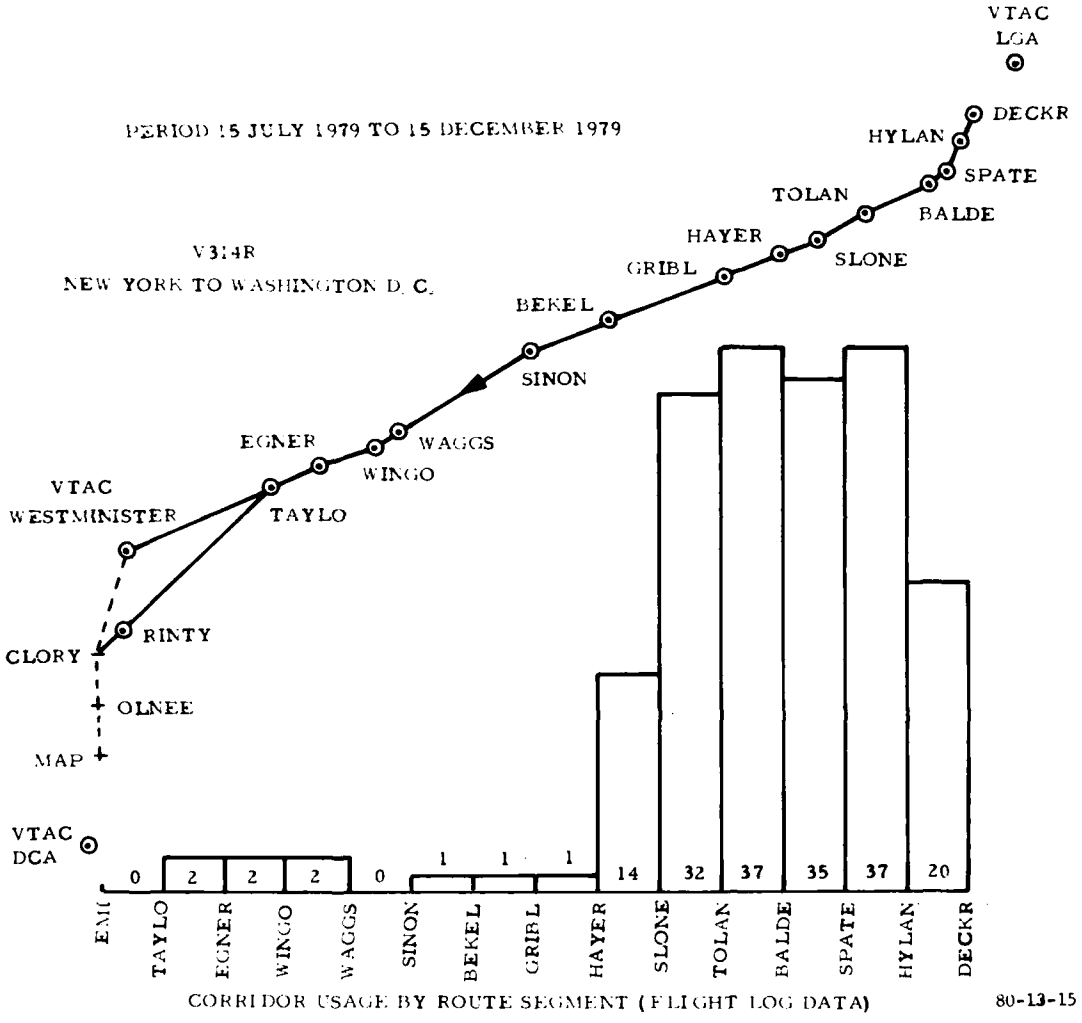


FIGURE 15. CORRIDOR USAGE, V314R

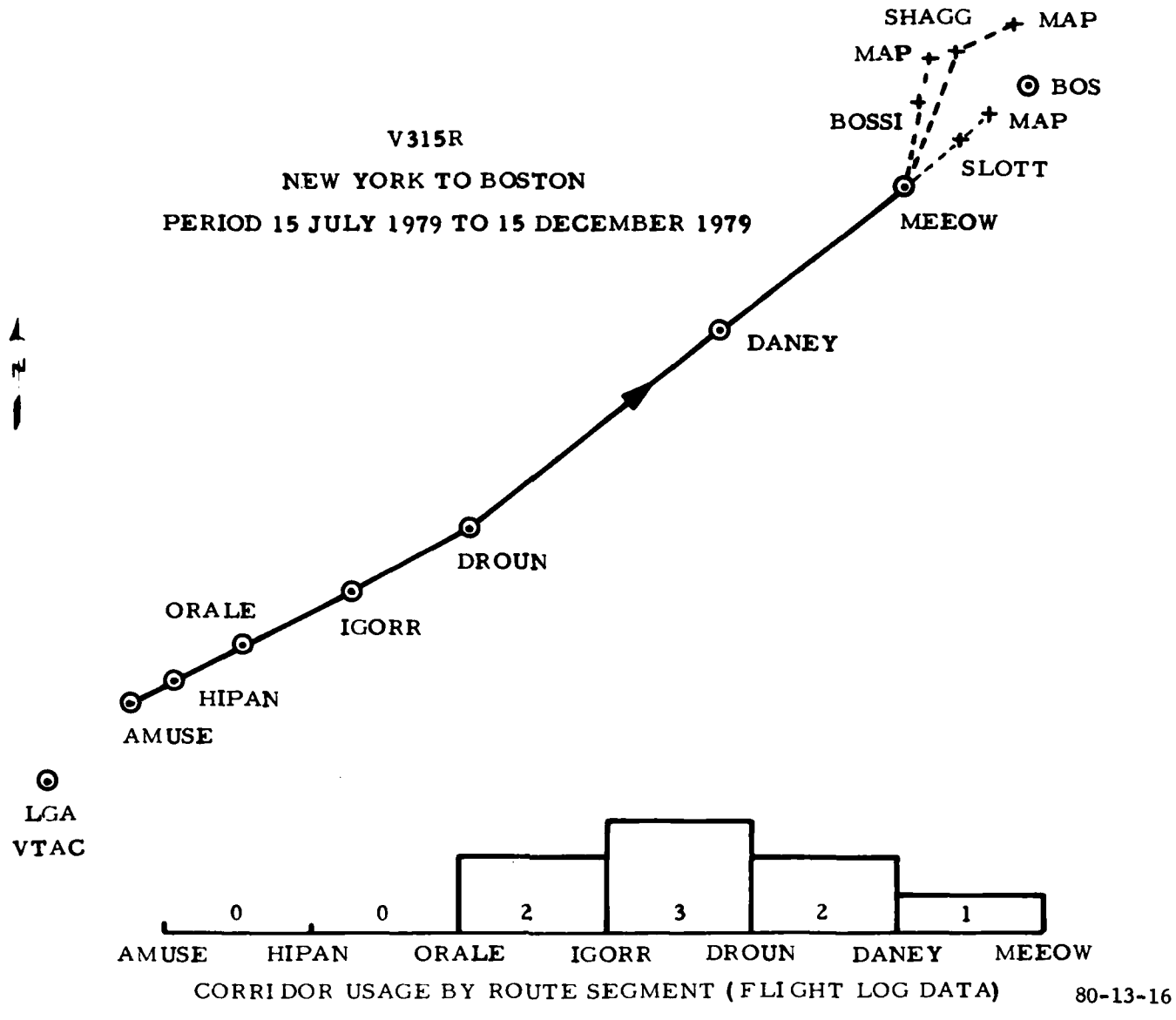


FIGURE 16. CORRIDOR USAGE, V315R

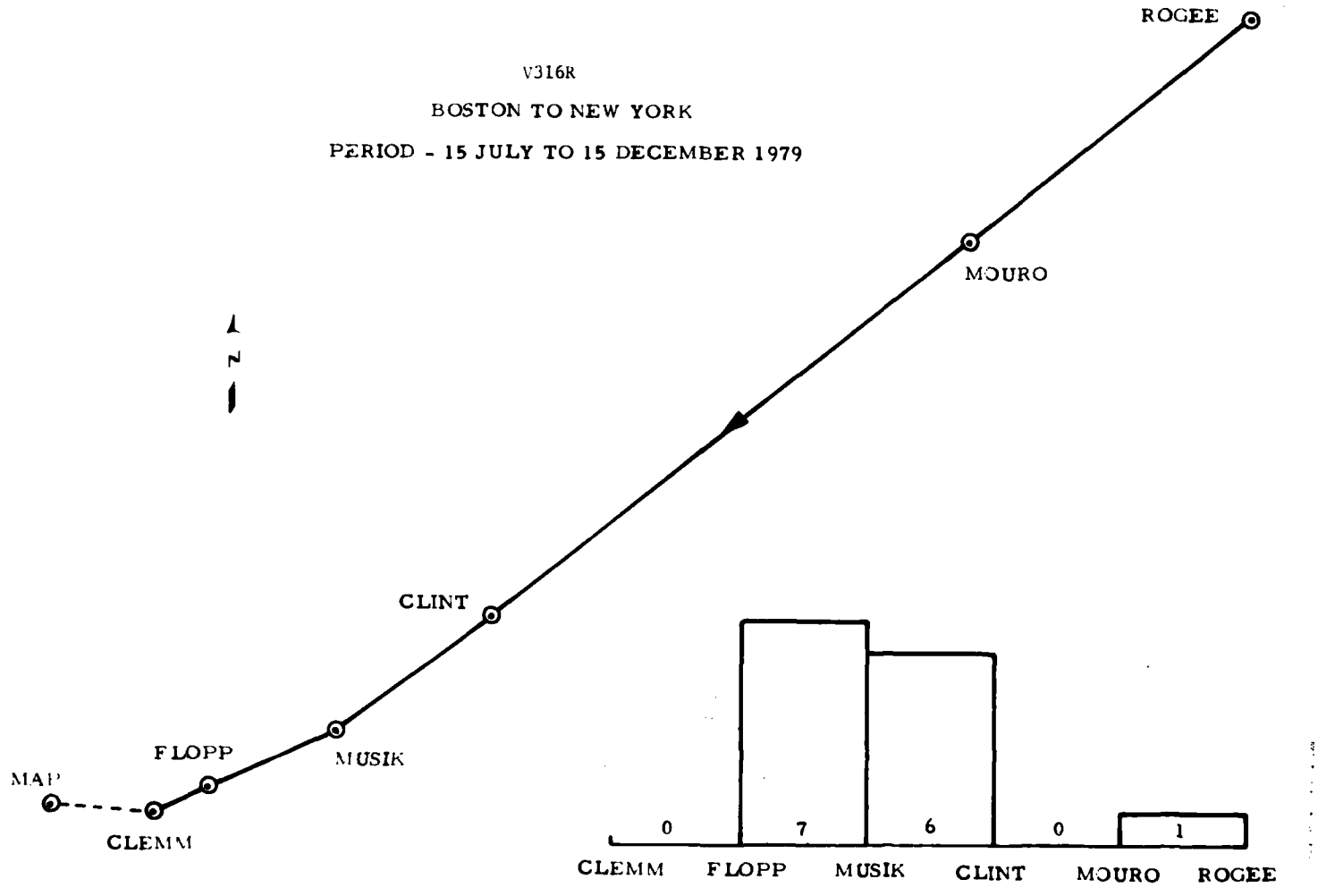


FIGURE 17. CORRIDOR USAGE, V316R

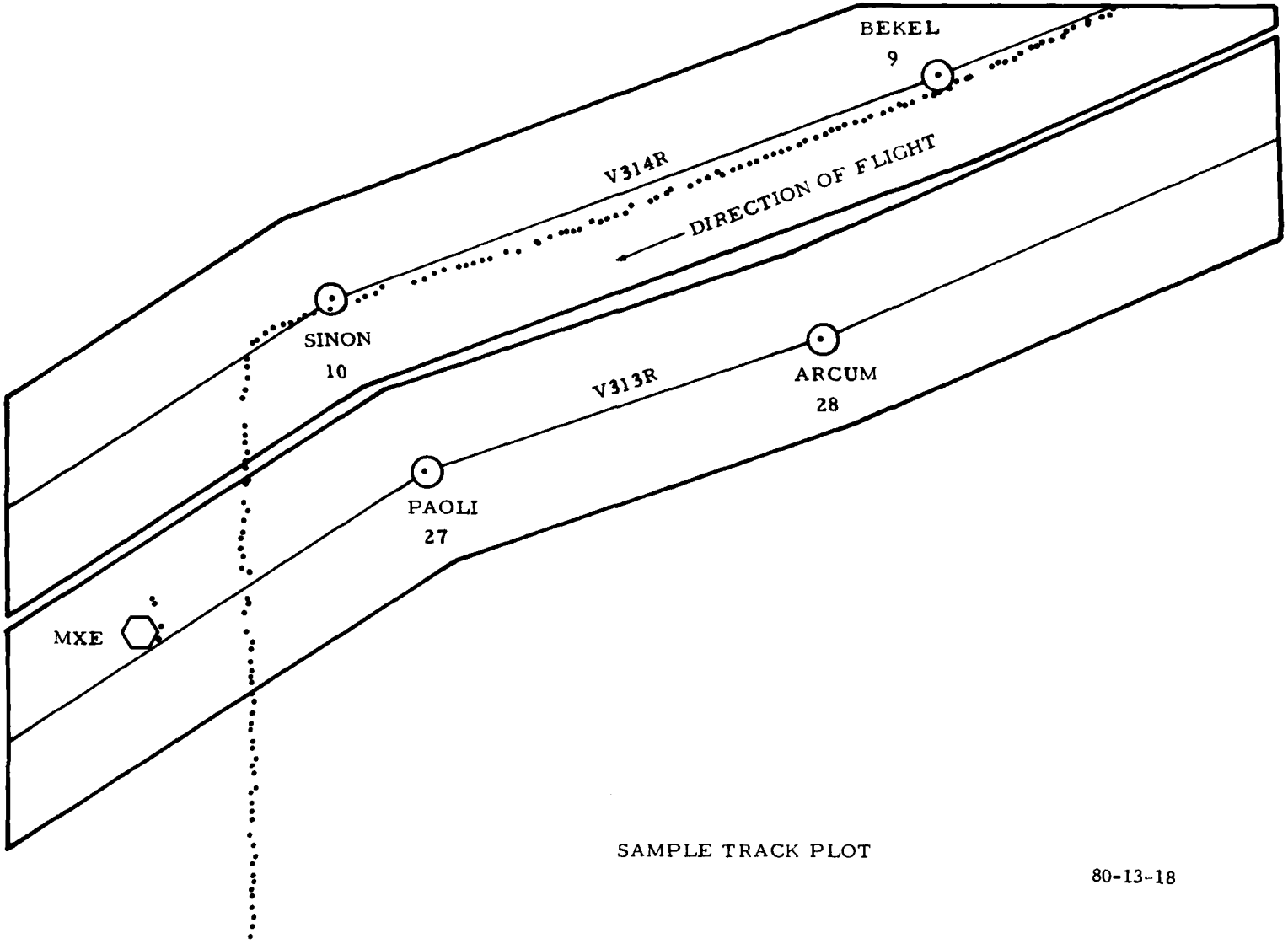


FIGURE 18. SAMPLE TRACK PLOT, V314R

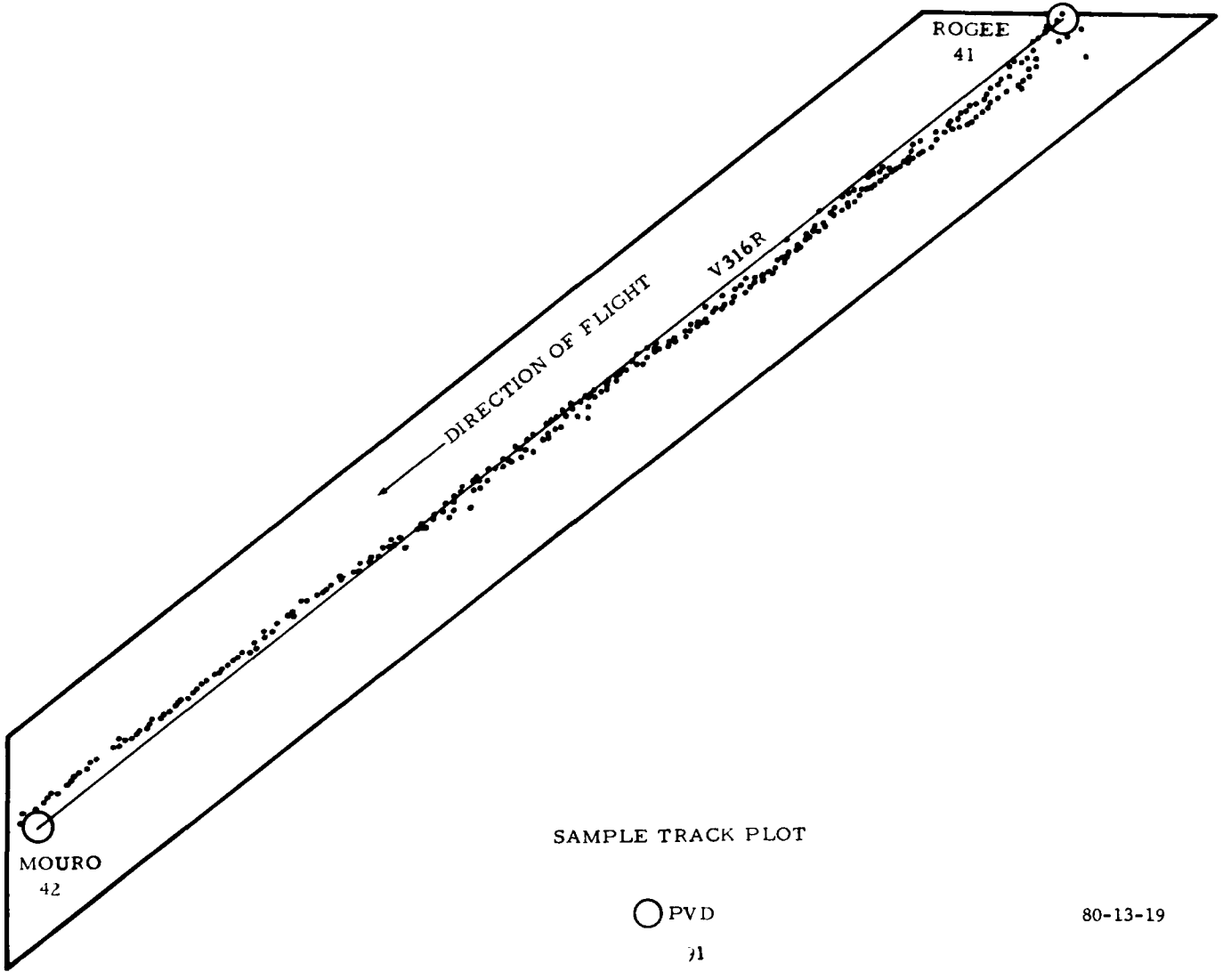


FIGURE 19. SAMPLE TRACK PLOT, V316R

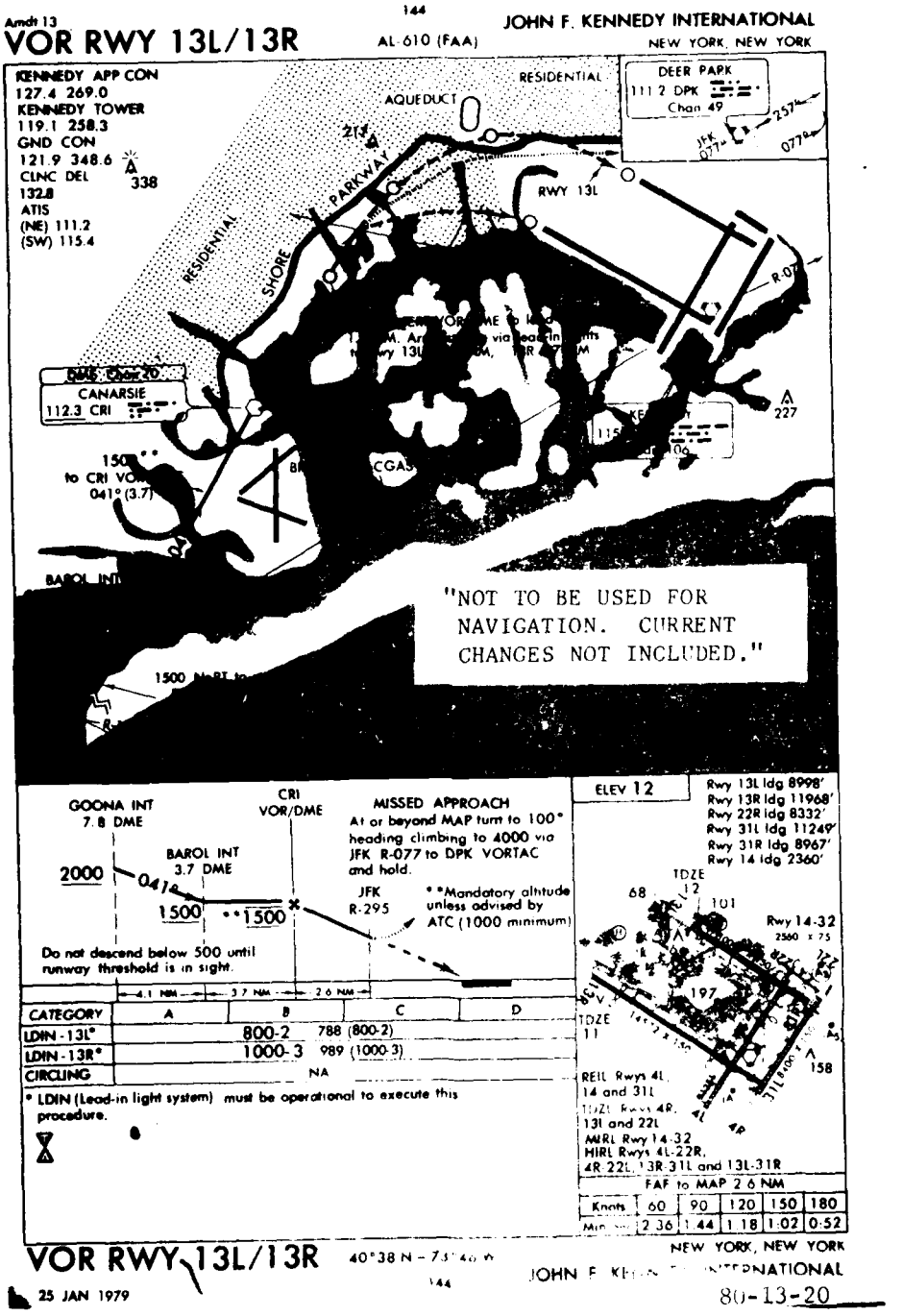


FIGURE 20. APPROACH PLATE, JFK RUNWAYS 13L/13R, CANARSIE APPROACH

APPENDIX A

INSTRUCTIONS FOR FILLING OUT FLIGHT DATA LOG

IN-FLIGHT/POST-FLIGHT DATA LOG COCKPIT

ITEM NO.	LABEL	CONTENTS
1	DATE	Enter day, month, and year test flight takes place.
2	ACID	Aircraft identification--enter tail number of helicopter.
3	PILOT	Enter name of pilot in command.
4	DEPARTURE PT	Enter point of initial departure, airport, heliport, factory site etc., if possible, identify in relation to a known site if not readily identifiable.
5	TIME	Enter time of actual departure. All times hereafter mentioned to be expressed in Greenwich Mean Time (Civil Universal Time) in the 24-hour clock.
6	JOIN NEC @	Enter location where NEC is intercepted. Either at a waypoint or in relation to a waypoint e.g., 5 S. zoids.
7	TIME	Enter time NEC is intercepted.
8	RTE OF FLT	Enter filed route of flight as per flight plan. If route flown does not correspond with route shown here, please note and explain in remarks.
9	INIT ATC CTC	Enter initial contact with the approach control which will first track the flight e.g., if flight originates in McGuire approach control area it will be initially tracked by Philadelphia approach control. Contact Philadelphia and so note in this space.
10	TIME	Enter time of contact with initial tracking facility.
11	INIT ALT	Enter first assigned altitude. If altitude changes are required en route, please note in remarks. If VFR, enter actual altitudes flown.
12	ASSG'D BCN CODE	Enter discrete beacon (transponder) code assigned by ATC. Note any beacon code changes en route in remarks.

13	FLT COND	Enter actual weather conditions encountered at your flight altitude during the flight. This may be shown in segments, e.g., ABZUG-HAMOR, clear; PAOLI-TULLY, sctd clds at altitude; TULLY-BANKA, in cloud.
14	EXIT NEC @	Enter location where flight departs NEC. Either at waypoint or in relation to a waypoint. If starting point in space, approach that will be shown in item 16.
15	TIME	Enter time of departure from NEC.
16	APCH?	Indicate yes or no if any kind of approach was made after departing the NEC.
17	TO	Enter waypoint or airport to which approach was made if answer to item 16 is yes. If point in space approach is made, enter last waypoint prior to missed approach waypoint. If airport approach is made enter airport name.
18	TYPE	Enter type of approach made, e.g., P.I.S., ILS, VOR, ETC.
19	NO. (DESIG)	Identify approach made, e.g., Copter RNAV-022.
20	MAP WX	If approach accomplished, enter actual weather encountered at missed approach waypoint or missed approach point.
21	RTE DEV	Enter any deviations or diversions from filed route of flight. Categorize them, if possible, as to cause; ATC, NAV, weather, other.
22	EXPLAIN	Enter reason for deviation from route, e.g., ATC would refer to a deviation caused by an approach control vector to avoid traffic. Wx would refer to a vector initiated either by ATC or pilot request to avoid an area of precipitation. A deviation might be required due to a VORTAC outage along the route. Any reason that takes the test helicopter off the filed route must be logged for proper data interpretation.
23	HOLD?	Complete this section if holding has been accomplished during this flight. Check yes or no. If yes continue to 24.
24	@	If answer to item 23 is yes, enter point at which holding was accomplished. If held on NEC, enter waypoint or other identifiable point, if held off NEC, enter fix.
25	TIME	If held, enter time of entry into holding pattern.

26	MINS	If held, enter time in minutes spent in holding pattern.
27	PATTERN	If held, describe holding pattern assigned, e.g., right turns, 1-minute legs.
28	REMARKS	Use this section to note any out of the ordinary occurrence not covered in the categories above, e.g., flight not completed as filed due to inflight change of plans, New York common IFR room unable to track due to recorder outrage, etc.

Upon completion of flight or day's flights send completed forms to the address shown. That address is:

Federal Aviation Administration
Helicopter Association of America
1156 15th St. N.W., Suite 610
Washington, D.C. 20005

Any questions on the form or these instructions should be directed to

Joseph D. Harrigan
At the above address or
Tel 609-641-8200 Ext 3905/3906

APPENDIX B

TEST TRACKING FACILITIES DATA

Boston Approach Control

Ant. loc. 42-20-55.7 N 071-00-22.8 W Elev. 15
Fac. loc. Logan International Airport, Boston, Massachusetts.
Type ASR-7 ARTS III

Quonset Point Tracon

Ant. loc. 41-36-07.9 N 071-24-41.9 W Elev. 10
Fac. loc. Providence, Rhode Island.
Type ASR-5 ARTS III

Bradley Tracon

Ant. loc. 41-56-19.6 N 072-41-01.0 W Elev. 170
Fac. loc. Bradley International Airport, Windsor Locks, Connecticut.
Type ASR-8 ARTS III

New York Common IFR Room

Ant. loc. 40-38-10.2 N 073-46-02.4 W Elev. 10 (JFK)
Ant. loc. 40-41-24.6 N 074-09-47.5 W Elev. 10 (EWR)
Fac. loc. JFK International Airport, Jamaica, New York.
Type ASR-7 ARTS I

Philadelphia Approach Control

Ant. loc. 39-51-34.1 N 075-16-02.3 W Elev. 9
Fac. loc. Philadelphia International Airport, Philadelphia, Pennsylvania.
Type ASR-7 ARTS III

Baltimore Approach Control

Ant. loc. 39-10-44.1 N 076-41-01.8 W Elev. -
Fac. loc. Baltimore-Washington International Airport, Baltimore, Maryland.
Type ASR-8 ARTS III

APPENDIX C

ADVISORY CIRCULAR AC 73-2

AC 73-2

DATE 6/11/79

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: IFR HELICOPTER OPERATIONS IN THE NORTHEAST CORRIDOR

1. PURPOSE. This circular advises interested users of special Area Navigation (RNAV) helicopter routes between Washington, D.C., and Boston, Massachusetts, (known as the "Northeast Corridor") and provides guidelines to operators for the safe use of these routes. The use of these routes is voluntary.

2. BACKGROUND. The Federal Aviation Administration (FAA), in conjunction with the Helicopter Association of America (HAA), established a pilot project in mid-1974, in the Northeast Corridor, which was designed to demonstrate the feasibility of instrument flight rules (IFR) helicopter operations in high density traffic areas with minimum impact on or from fixed wing traffic, or with the air traffic control system. The route selected was from Washington, D.C. to Boston, Massachusetts, via Philadelphia, Pennsylvania, and New York, New York, with numerous feeders, spurs and RNAV instrument approach procedures, including both onshore and offshore environments. The Northeast Corridor is considered a dynamic route structure with additions or changes to be made as required. Experience gained will serve as the basis for national application.

a. The Northeast Corridor routes have a minimum altitude as low as 1700 feet above ground level (AGL) with a maximum authorized altitude of 5000 feet mean sea level (MSL). This eliminates coordination with Air Route Traffic Control Centers, and uses approach control services throughout the entire route. The corridor is predicated on the use of RNAV which, at the present time, is described with reference to VOR/DME facilities, although other systems such as Loran C, Omega, or VLF may be used as outlined in FAA Advisory Circular 90-45A, "Approval of Area Navigation Systems for Use in the U.S. National Airspace System." Two one-way routes have been established which will assure safety for opposite direction traffic at the same altitudes, when the guidance in this advisory circular is followed.

Initiated by: ATF-4

b. RNAV instrument approaches to a landing area or to a point-in-space are part of the Northeast Corridor concept. RNAV routes will terminate in a helicopter RNAV or conventional instrument approach procedure. Conventional instrument approaches may also be used at a destination airport. The RNAV point-in-space approach permits a descent to a designated point, and upon reaching visual contact at or above the minimum descent altitude, will permit proceeding under visual flight rules (VFR) or special VFR (SVFR) to the desired landing point. The point-in-space approach will only be utilized under weather conditions that permit air traffic control to accommodate it.

c. In establishing the Northeast Corridor concept, many facets were considered and examined such as: noninterference with airways; navigation coverage along routes and for approaches; radar and communications coverage; minimum en route altitudes (MEA); facility performance at low operational altitudes; video map accuracy for radar surveillance; adequacy of holding pattern airspace areas; route widths; impact on air traffic control services, instrument approaches, missed approaches, and departure approaches.

d. One of the major considerations in this project is the route width of the discrete helicopter RNAV airway structure. In order to effectively construct the Northeast Corridor concept, a ± 2 mile route width was necessary in order to fit this structure into the airspace without affecting established airways. In so doing, an important factor in conventional airway structuring had to be minimized. This factor is known as Flight Technical Error (FTE), and is a measure of the accuracy with which the pilot/autopilot can adhere to the prescribed track. In permitting this factor to be minimized, this advisory circular provides acceptable means of ensuring that users of this structure can safely use the Northeast Corridor system. A pilot operating IFR on this structure with improper equipment or inadequate pilotage technique could disrupt air traffic operations along the conventional airway system and possibly necessitate cancellation of the helicopter route. In addition to the route width reduction, the RNAV holding pattern airspace on this route is smaller than holding pattern airspace required for conventional aircraft.

e. It was considered desirable to develop special routes consistent with conventional traffic flow that could be used by helicopters under IFR conditions. As a result, the FAA has designed a route which would closely parallel conventional routes and has the potential for improving service for IFR helicopter operations. Subsequently, flight checks of sections of the proposed corridor were accomplished by conventional aircraft and finally by helicopter. Procedures for en route and approach capability were proposed and verified by flight check. The entire route was completed for area navigation rho-theta authorization in January 1978, although some segments were approved as early as 1975.

f. A preliminary environmental review (FAA Facility Management Handbook, 7210.3D, paragraph 11) has been completed on the Northeast Corridor

routes and procedures. This review does not indicate a requirement for further consideration of environmental impacts of this program.

3. KEY ITEMS.

a. Sections 91.116; 91.119; and 91.123, Part 91, of the Federal Aviation Regulations contain requirements concerning takeoff and landing, minimum altitudes, and course to be flown that must be complied with under IFR "unless otherwise authorized by the Administrator." In the interest of the safe and efficient expansion of helicopter operations, the Administrator hereby authorizes deviation from the cited regulations to the extent needed to permit helicopter operation on the Northeast Corridor routes, for operators who show that they meet the acceptable safety criteria in paragraph 4 of this advisory circular.

b. To insure that only authorized operators will utilize this corridor, public use en route or approach charts will not be issued until the route has been designated for public use. In the meantime, the FAA will issue written descriptions of the en route and approach procedures, and the operator can arrange for his own charts as desired. Such charts, however, should be made available to the respective FAA region for review. (Note: Several operators have joined forces to print charts. For further information on availability of these charts, contact the Helicopter Association of America.)

c. Routes will be designated with the letter "R" as is done for all other RNAV routes, e.g., V315R.

d. IFR helicopter operations on the Northeast Corridor will not necessarily receive radar vectoring. It is, therefore, assumed that authorized IFR helicopter operations on Northeast Corridor routes will follow the prescribed discrete routing with precision and without radar vectoring. It should be noted, however, that due to the complexities of the New York area, operations in this segment will be monitored by air traffic control.

e. In establishing the initial structure, it was deemed necessary to establish a considerable number of waypoints due to the complexity of the corridor and to minimize flight technical error. Frequent bearing changes are necessary to minimize corridor interrelation with established routes and airways. As experience dictates, it is expected that the corridor can be redesigned in some areas, thereby reducing the number of waypoints. During this initial period, however, it is considered undesirable to make changes in the prescribed route due to necessary follow-on requirements such as changing approach control video maps, special notification to users, and resultant changes in their operating charts; and the need for special flight checks to assess obstacle clearance, signal coverage and establishment of precise coordinates.

f. Waypoints are identified by name, reference facility with rho-theta information as well as latitude and longitude. Minimum and maximum en route altitudes between waypoints are provided as well as distances and changeover point information.

g. Area Navigation approaches in addition describe the minimum descent altitude, missed approach instructions, and holding patterns. Point-in-space approaches are not limited by distance from the point-in-space to the point of intended landing; however, they will normally be in close proximity to a landing area. Point-in-space approach procedures will identify the available landing area or areas in the vicinity by course and distance from the missed approach point.

h. Each of the major cities along this route has been assigned a point-in-space for both the northbound and southbound segment. It is expected that operators will utilize this point for operations within the local area. It will be the operator's responsibility for complying with Federal Aviation Regulations for VFR flights beyond the point-in-space, and to obtain a Special Visual Flight Rule from the appropriate air traffic control facility when weather so requires before operating in a control zone. The route of flight from the point-in-space to the intended point of landing should also be provided to air traffic control.

i. Helicopter point-in-space or direct airport approach procedures have been established for the following locations: Boston, Providence, Hartford, New York, Philadelphia, Bedford, Beverly, Baltimore, and Washington.

4. ISSUANCE OF AUTHORIZATION.

a. The sensitivity of the Northeast Corridor structure during the early phases, and recognition that authorization is required to assure that the Northeast Corridor routes are properly used, precludes advertising the Area Navigation waypoints and approach/departure procedures for general use.

b. Upon request to the appropriate FAA authorities identified below in paragraph 5, an operator who meets the necessary criteria may be granted authorization to utilize this corridor. Applicants should show that the following criteria have been met:

(1) The helicopter(s) to be used are certificated for IFR.

(2) The helicopter(s) are equipped with RNAV equipment approved for en route, terminal area, and approaches in accordance with AC 90-45A.

(3) Pilots operating within this corridor are IFR helicopter rated, and pilot technique is adequate to fly RNAV under IFR conditions within the confines of the corridor. This condition can be satisfied by having an operator designate one pilot

who will be checked by the local General Aviation District Office (GADO) (if they consider this to be necessary) as to competency in RNAV IFR flight. This should be a short simulated IFR RNAV flight on a conveniently selected portion of the Northeast Corridor route structure, and an Area Navigation approach procedure. Thereafter, it will be the responsibility of the operator's FAA approved and designated pilot to check-out the operator's other pilots who will fly the Northeast Corridor.

c. When the regional Flight Standards Division is satisfied that the operator meets all criteria, they will issue a letter of authorization which will be given in the name of the company and will list authorized aircraft registration numbers and authorized check pilot's name. All pertinent information on the route, waypoints, approach procedures, holding patterns, etc., as provided by the Air Traffic Division will be included. This will provide the basis for the operator to prepare or have prepared the necessary en route and approach charts (see paragraph 3.a.). These charts will be reviewed by the FAA.

d. Authorized operators are encouraged to file IFR flight plans on all Northeast Corridor operations, regardless of weather, in order to promote crew competency and familiarity by the air traffic controllers with their operations, and provide an effective data bank for route analysis and evaluation.

5. HOW TO INITIATE AUTHORIZATION.

a. Interested operators initially should contact the appropriate regional Air Traffic Division and request consideration for authorization. Such request should contain the area in which they wish to operate and confirmation of data outlined under paragraph 4 of this advisory circular.

b. The regional Air Traffic Division will coordinate the request with the Air Traffic Service and also with the regional Flight Standards Division, in order that Flight Standards may perform any equipment or flight check they deem necessary.

c. The Air Traffic Division will advise all authorized users of any changes or modifications on this route. Contacts are:

(1) Eastern Region - Washington to Hartford, Connecticut, contact

Federal Aviation Administration
JFK International Airport
Jamaica, New York 11430
(Telephone: 212-995-3392)

(2) New England Region - Hartford, Connecticut, to Boston, Mass. contact:

Federal Aviation Administration
12 New England Park
Burlington, Massachusetts 01830
(Telephone: 617-273-7286)

6. FUTURE PLANS.

a. Monitoring of corridor operations will be accomplished by the FAA for a one year period to obtain technical data on aviation system accuracy, under typical IFR helicopter operating conditions. Systems Research and Development Service, National Aviation Facilities Experimental Center, and the regional facilities in support of the Air Traffic and Flight Standards needs will collect data using the Automated Radar Terminal System (ARTS-III) terminal radar tracking and data collection. National Aviation Facilities Experimental Center will conduct data reduction and analysis in order to report the results of system performance by the Northeast Corridor users.

b. FAA is evaluating the Northeast Corridor structure utilizing Loran C, Omega, VLF, and airborne radar equipment for compatibility, performance and accuracy within this system. If these systems are found to be suitable during this evaluation, expanded use of this equipment will be considered for use along the corridor as appropriate for en route, terminal, or approach operations.

c. Results from this project are expected to be of material help in the future development of all weather helicopter operations in the national airspace system.

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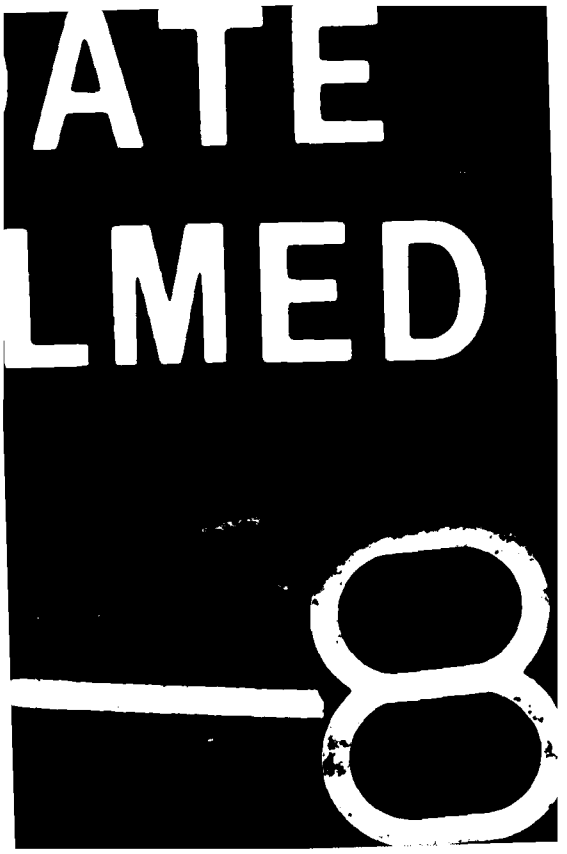
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