TECHNICAL REPORT

POLICE AIR MOBILITY: STOL EVALUATION, PHASE I

By: Allen R. Kidder, Sigmund P. Zobel

CAL No. VY-2901-G-2

Final Report Prepared for:

National Institute of Law Enforcement
and Criminal Justice
Law Enforcement Assistance Administration
U.S. Department of Justice
Grant Award Nos. NI-70-006 and NI-71-038

September 30, 1970

CORNELL AERONAUTICAL LABORATORY, INC.
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PART I

PROJECT SUMMARY

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PART I PROJECT SUMMARY

CHAPTER I INTRODUCTION

1. Purposes of the Study

While police jurisdictions have used aircraft for as long as forty years (New York City's police aviation unit was organized in October, 1929), it is only in the last decade that strong interest in aircraft, particularly helicopters, as police vehicles has become apparent. In consonance with this interest, the National Institute of Law Enforcement and Criminal Justice (NILECJ) has undertaken a comprehensive study of many aspects of police air mobility. This report is concerned with Phase I of the study program.

The first phase has had three main purposes. One was to survey the current use of helicopters for police air mobility. Factors which were investigated included the types of law enforcement-related missions performed by various agencies, types and numbers of helicopters employed, types of special equipment installed in the helicopters, annual utilization, and measures of effectiveness. Also surveyed were helicopter performance characteristics, procurement costs, and operating costs. Personnel and organization factors examined include pilot selection criteria, pilot training programs, and flight crew costs. Results of this survey have been previously reported.[1]

A second purpose was to evaluate the short take-off and landing fixed wing aircraft (STOL) as a vehicle for police air mobility. Since the helicopter was used as a "control" vehicle to assist in the evaluation of the STOL, an ancillary result during fulfillment of the second purpose was further evaluation of the helicopter for police air mobility. The survey referred to above, and various documents cited therein, provided at best a heterogeneous set of data not specifically oriented towards development of guidelines.

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[1] The findings are being published as THE UTILIZATION OF HELICOPTERS FOR POLICE AIR MOBILITY by the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice, and will be available from the Government Printing Office.

However, the field data collected directly for NILECJ served not only to partially validate reported findings and provide further data for evaluation of the helicopter in the police context, but also to indicate practical limitations.

The third main purpose was, by gathering pertinent data for NILECJ, to help the Institute develop preliminary guidelines for the use of STOLs and helicopters as police air mobility vehicles. An increasing number of police jurisdictions are applying to the Federal Government for financial assistance in obtaining aircraft, particularly helicopters. This assistance should be allocated so as to achieve maximum positive overall effects. Consequently, to assist the grantors in their decision making process, and to discourage local jurisdictions from making unjustifiable applications for grants, the a priori guidelines may be used as a filter.

2. Approach Taken

The approach taken in Phase I of the investigation was to get as close to the "real world" as was feasible. A Helio Super-Courier STOL was provided to a metropolitan area police agency (Metropolitan Dade County Public Safety Department, DCPSD) which had long term experience with a helicopter (Bell 47G-2). Although the DCPSD grant is to partially fund one year's operation of the STOL, it was considered advisable to get a feeling for the utility of a STOL in the police context within an earlier time frame than one year.

As a result, a short term, closely controlled, intensive period of flight operations, involving both the STOL and the helicopter, was used to collect data and make observations directed toward the establishment of preliminary guidelines for use of both classes of aircraft by police jurisdictions. A schedule was devised to provide 220 hours of patrol flights (110 hours for each aircraft), with ten different patrol missions, over a four-week period. "Demand" missions, i.e., unscheduled as part of the test,

requested of the DCPSD Aviation Section or as a result of an in-progress incident, but occurring within the period of the intensive testing, were treated as part of the input. The Phase I investigators were present during the entire four weeks, and actively participated in the operations, to the extent of flying many hours as observers in both aircraft.

As a result of the Phase I program, a considerable amount of "first-hand" data was collected and observations were made directly by the study team. Thus, the preliminary guidelines are based upon operational experience.

CHAPTER II SUMMARY AND CONCLUSIONS

1. Highlights of the Study and its Findings

a. Test Implementation

Four weeks of intensive flight testing of the STOL and helicopter in regular police service were used to collect the basic operations data. Each aircraft was scheduled to fly two hours on the first day and four hours on each day thereafter, seven days a week, for a total of 110 scheduled patrol hours in 55 scheduled flights for each airplane. Due to the unavailability of one helicopter pilot during the second, third, and fourth weeks of test operations, the schedule was modified. As a result, the STOL was flown for 63 patrols and missions for a total of 125 hours 50 minutes, while the helicopter was flown for 50 patrols and other missions for a total of 70 hours 40 minutes. Ten patrols were used in the original flight schedule: fire detection, general surveillance, illegal dumping, lighted patrol, recreation areas, rooftop surveillance, rural area, stolen vehicles search, traffic, and water patrol. A small number of flight assignments was changed to include water pollution patrols, narcotics patrols, and maintenance checkout missions. Further discussion of the test implementation may be found in Chapter IV and Appendix A, below.

b. Air Mobility Effectiveness

The flight schedule was largely suspended during the first week of planned patrols while the STOL and helicopter flew in support of efforts to contain and suppress a civil disturbance which erupted within the DCPSD jurisdiction. While the occurrence of disorders over a four day period was unfortunate and distressing to the citizens and officials, it proved to be highly serendipitous to the study team. Working at times as a team, and at other times alone, both aircraft demonstrated high levels of effectiveness (for which the Aviation Section was commended by the Director of Public Safety). Their most notable successes were in providing illumination where and when needed, maintaining surveillance over crowd movements and curfew

violators, pursuing fugitives, detecting firebombings and lootings in progress, assisting in the command and control functions, and leading directly to several apprehensions. A complete log of the air support provided is included in this report as Appendix B, with some discussion in Chapter V.

During the routine part of the testing period, both aircraft produced positive effects, with the helicopter appearing to be generally more effective, as may be seen from examination of Tables 5-2 and 5-3, below, in Chapter V. In fairness to the STOL and its performance, however, it should be pointed out that the STOL is constrained to a minimum altitude of 1,000 feet over congested areas, while the helicopter was not. Additionally, while all the STOL pilots were experienced police officers, none had previous experience as airborne police officers, while the helicopter pilots each had been serving as airborne policemen for ten years. Needless to say, this experience in aerial observation and tactics, combined with their familiarity with the vehicle they had operated for that length of time, compared with only a few weeks' experience in the STOL by its pilots, placed the helicopter at a considerable advantage.

Chapter V contains the in-depth discussion of the mission effectiveness of both aircraft.

c. Additional Findings and Conclusions

1. Regarding costs and cost/effectiveness -

For June and July, 1970, the STOL cost $16.99/flight hour in fixed and direct expenses; during January - July, 1970, the helicopter cost $28.94/flight hour for the same expenses. Not only was the total cost/hour less for the STOL than the helicopter, but so were the direct operating costs. However, since more discoveries and apprehensions were made by the helicopter, during fewer flight hours, its costs (total or direct) were less per discovery and apprehension than for the STOL. Thus, in the present case, the helicopter appears to be more cost/effective. Further, on an annual basis, the STOL costs more than the helicopter for both direct and total costs.

But this finding has not been adjusted for the fact that the annual flight hours for the STOL were three times as many as for the helicopter. Another comparison of interest is the cost of providing 24 hour patrol coverage with one vehicle for one year. To do this with a two-man patrol car would cost about $100,000, compared to about $373,000 for STOLs and $445,000 for helicopters. It should be noted, however, that the impact of the cost difference between a ground unit and an aerial unit is less severe when the patrol is related to the comparative area covered.

These data are discussed in Chapter VII.

2. Regarding Effectiveness -

It is evident to the study team that the appropriate police aircraft is at least as effective as ground units, and in some cases more effective, in the performance of certain police tasks. In traffic observation and control, obtaining assistance for stranded motorists or accident victims, etc. most requirements can be fulfilled more effectively by an aircraft than by a few ground units, and probably at a lower cost as well. Surveillance patrol is in the same category. Large areas can be monitored by one aircraft, whose pilot and observer can report large gatherings, unusual activity, peculiar vehicular activity, and so on, to the dispatcher for investigation. This can result in permitting more intensive deployment of patrol cars in areas with high crime rates and high density of structures, where some pertinent activity is difficult or impossible to observe from the air. Providing illumination at the scenes of accidents, disasters, or other events requiring high level (of intensity) illumination or such that ground source illumination is not readily and quickly available, is an outstanding and unique capability of an aerial platform.

Chapter VIII discusses these considerations in greater detail.

2. Implications of the Findings

a. Towards Guidelines for LEAA

The investigation has culminated in preliminary data and

conclusions that imply two basic guideline sets which are recommended to LEAA for its use in evaluating applications for funding assistance in the procurement and operation of aircraft by police departments. In essence, the general guidelines are:

1) The grant application should be supported by a completed planning study, with a report furnished as a supplement to the application. As a minimum, the planning study should have

- considered police mission requirements
- assembled the environmental parameters of the area of jurisdiction
- made a comparative analysis of candidate aircraft and either decided on specific models or prepared a set of specifications
- drawn up a sound budget for aircraft acquisition, personnel training, and operations for at least a two year period.

2) The aircraft selected by the applicant agency should be the most appropriate for its needs. While the planning study should establish the appropriateness of the aircraft, certain criteria can be used to judge the soundness of the applicant's discussion. These criteria are related to the size of the department or agency, its area of jurisdiction, and the current status of any air operations. Furthermore, the choice of aircraft class (helicopter or STOL) should be supported by documented requirements which can best or uniquely be served by the designated airplane. As a minimum, a case must be made showing the need for an air vehicle as

a) An aerial platform for
   - quick response capability
   - directed search
   - surveillance
   - command and control (including traffic)

b) A delivery vehicle for

- illumination
- specialists (i.e., crime laboratory personnel)
- riot control devices
- logistic support to ground based actions

In addition, the applicant should have indicated an awareness of appropriate minimum equipment needs, such as communicators, siren, public address, and high intensity controllable-direction spotlights.

Further discussion of the guidelines may be found in Chapter VIII, below.

b. Evaluation Procedures

While the helicopter survey cited in Chapter I found a number of police departments using helicopters (and fixed wing aircraft) for a broad spectrum of missions, it failed to find more than isolated examples of departments which attempted to evaluate the use of their aircraft. Consequently, it was necessary to develop additional measures for application to the DCPSD data, such as may be found in Chapters V - VII, below. However, another group of analysts may well use a different set of procedures. The point being made is that to provide a uniform basis for evaluation of police air operations so that local level results may be compared with each other and possibly integrated, standardized evaluation procedures should be developed. This is further discussed in Chapters III and IX.

c. Data Requirements

The analysis was somewhat weakened by the lack of detailed DCPSD operations data required to do other than a coarse evaluation. While some of the desired data were stored, the retrieval process was so time consuming and costly as to preclude their use for the present purpose. This was largely due to the circumstances that the data had been collected, analyzed, and stored for other purposes than evaluation of air operations.

Consequently, there is a clear need for an intensive examination of the data requirements for evaluation of police air mobility applications, to be followed by development of procedures for providing the data. This is discussed further in Chapter V.

CHAPTER III RECOMMENDATIONS FOR FURTHER POLICE AIR MOBILITY INVESTIGATION

1. In Furtherance of the Phase I Effort

The Dade County STOL project is part of the Phase I effort, along with the study being reported in this document. It appears evident to the CAL investigators that the DCPSD project director and NILECJ can benefit from additional technical assistance during the remainder of the grant performance period. Specifically, a more meaningful evaluation of the STOL (and the helicopter) can be made in two directions. One is related to performance in specific missions or incidents. The other is concerned with the generation of more reliable and meaningful elements of cost/effectiveness data. A scenario approach, in which the incidents, service missions, and flight profiles would be specified, would be used to provide the desired conditions. Additionally, certain real missions, which have not yet been flown or flown in an insufficient number of sorties, would be flown to gather cost and effectiveness data.

2. Phase II Study Needs

a. As part of the Phase I investigation, some evaluation procedures have been developed by CAL and by DCPSD, under their respective grants. For a similar study by other personnel and in a different locale, the evaluation procedures used would probably be at best a partially intersecting set. This, of course, would make it difficult to have meaningful comparisons or achieve integration of results. Since a continually increasing number of police departments are utilizing aircraft in their operations, the need for standardized evaluation procedures, to be used by all, will become increasingly acute if consolidated reporting and valid comparisons are to be feasible. Development of standard evaluation procedures, which implies specification of data requirements and development of data sources, should be a high priority task.

b. An air operations evaluation manual should be developed for use by police departments. The manual would include the standard evaluation

procedures, the data requirements, reporting forms, etc.

c. An air mobility planning handbook should also be developed. This manual would be the official document providing guidance for the consideration, acquisition, and operation of aircraft as regular police service vehicles.

The above recommendations have been given in condensed form. Further discussion may be found in Chapter IX.

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PROJECT DISCUSSION

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CHAPTER IV TEST IMPLEMENTATION

The implementation of the test design, with the exception of schedule revisions necessitated by the civil disturbance which occurred during the first week, and the presence of only one helicopter pilot during the last three weeks, followed the test plan rather closely. Details of this plan are set forth in the test manual, (cf. Appendix A), and consequently are not repeated here. However, it is appropriate in this chapter to comment on various aspects of the test implementation for the benefits that may be obtained for similar operations in the future. Accordingly, the organization of this chapter is by the various elements of the test program.

1. The Manual

Use of a test manual proved to be beneficial in two ways. First, preparation of the manual was quite helpful to the CAL program team, as the test designers. Not only did it facilitate effective orientation toward a feasible operational program, but it also provided a "blueprint" for the test, such that the program was implementable in a smooth and effective manner by close adherence to the plan as set forth in the manual.

Second, the manual benefited the DCPSD personnel in several ways. Participation in the review of its first draft provided the Dade County STOL project supervision with an opportunity to review the full program with which they would be expected to comply. Review of the draft also permitted them to provide their inputs to making the plan operationally feasible and consistent with the DCPSD grant program. Additionally, all aviation unit personnel were provided copies of the manual, and several of them made frequent reference to it. This facilitated rapport between the flight crews and CAL, not only during the test period itself but also in the pre-test briefing which was held prior to the start of flight operations.

The benefits derived from the preparation of the manual and its circulation to all personnel participating in the test program were sufficient to recommend this be a standing procedure for operations of this nature.

2. The Pre-test Briefing

Before test operations were begun, a briefing was held for the pilots and supervisors of the Aviation Section, Research and Planning Bureau, and the Chief of the Administrative Division. As a result of the direct presentations and subsequent discussions, the flight operations were begun with good rapport between CAL and DCPSD personnel, and a minimum of unresolved questions.

The briefing was in essence a verbal presentation of the Test Manual, with some supplemental discussion. Topics included the following items.

(1) Purposes of the respective grants to DCPSD by the Law Enforcement Assistance Administration (LEAA) and to CAL by NILECJ were discussed so all personnel involved had a clear understanding of the intent of the program, and the roles of the various participants.

(2) Objectives of the project were stated and explained. For example, it was pointed out that the data collection was necessary for at least three reasons. One was to provide data for analysis of police air operations; a second was to provide guidance toward the development of better data systems; a third was to provide inputs toward the development of more generally applicable system evaluation procedures to be developed. It was also brought out that it was desired to learn something about operational constraints on aircraft in police use, as a second objective. Finally, the principal objective of CAL's assignment was given - to define preliminary guidelines for use by LEAA in evaluating grant applications for STOLs or helicopters for police use.

(3) So there would be clear understanding of "who was to do what" during the intensive flight test operations, the program responsibilities of DCPSD and of CAL, respectively, were pointed out.

Responsibilities of Dade County were given as including, but not restricted to, seven elements:

(a) provide advice and assistance in developing the patrols to be flown and the procedures to be followed;

(b) adhere to the agreed upon procedures and activities;

(c) when an aircraft is operational, advise the appropriate dispatcher (of three) that the aircraft is over her area of responsibility;

(d) maintain the aircraft in "up status" during the intensive test period;

(e) make available to CAL any pertinent records;

(f) review and provide a critique of the preliminary guidelines to be developed by CAL,

(g) subsequent to the intensive test period, conduct its aerial operations and analysis so as to validate, reinforce, supplement, or amend the findings as reported by CAL.

Responsibilities of CAL were given as including six elements:

(a) select the basic patrols to be flown by the aircraft;

(b) select the patrol-area-time configurations;

(c) organize and conduct the pre-test briefing;

(d) conduct the pre-flight briefing and post-flight debriefing accompanying each patrol flight or other mission flown during the test periods;

(e) provide continual assessment of and recommend changes in procedures as they may be indicated by experience during the test operations;

(f) prepare the report on the intensive test operations and the resultant findings.

(4) Next, the procedures to be followed, as Standing Operating Procedures (SOP), during the test operations, were discussed. Specifically, this included orientation regarding the pre-flight briefing procedure, the mission report form to be completed for each flight, the post-flight debriefing procedure and preparation for the next flight. The forms to be used were explained, and an opportunity provided for the flight crews to raise questions regarding the data to be provided by themselves, and the questions to be put to them and the kinds of responses expected.

Opportunity was also given the flight personnel, at this time, to raise questions of interpretation and scope of the various routine patrol flights that were used to comprise the flight test design.

(5) Finally, the pre-test briefing was concluded by a discussion

of the importance of the project to LEAA and NILECJ. Consequently, it was pointed out, the prescribed procedures should be followed closely, to the extent feasible. Any deviations were to be mutually agreed upon, and every effort was to be taken to assure the validity of the data.

3. The Patrol Flights

A basic set of ten patrols was selected. Each was chosen only if it satisfied two conditions - it had been flown with some measure of success by one or more other police agencies, and it was applicable to the Dade County police environment. Candidate patrols were drawn from the data obtained in the helicopter survey referred to previously (see page 5). By so doing, the first condition was automatically satisfied. Consideration of the physical features of the DCPSD area of jurisdiction, and reference to the County's criminal statistics, supported by consultation with DCPSD officials, facilitated satisfaction of the second condition.

The ten patrol assignments decided upon for use in the program were:

(1) Fire Detection
(2) General Surveillance
(3) Illegal Dumping Detection
(4) Lighted Surveillance
(5) Parks and Other Recreational Area Surveillance
(6) Rooftop Surveillance
(7) Rural and Vacant Area Surveillance
(8) Search for Stolen Vehicles
(9) Traffic Surveillance
(10) Waterfront Surveillance

Definitions and intents of the patrols are given below, in Appendix A pp. 112-113, and need not be further discussed at this point.

4. Test Flight Design

The ten patrols provided assignments for the flight operations during the intensive test period. The STOL and helicopter were each assigned four

hours of flight time (with the exception of the first day, when the pre-test briefing accounted for half of the day), during each day of the four week intensive test period. Each flight was scheduled for two hours in duration, with some split into two patrols of one hour each. Both aircraft were assigned all patrols, for a minimum total of three hours in one instance, and a maximum of thirty-two hours, in another. Scheduled times during the day, area patrolled and total time spent on any one of the ten patrols were varied in an effort to obtain the most useful combinations of place - time - patrol for evaluation purposes.

The original intent was to fly the designed schedule for one week, take a week to review the results and make any modifications that appeared to be indicated by the first week's operations, and then continue the design operations for three consecutive weeks. These details are also spelled out in the Test Manual, Appendix A, below. However, two events precluded strict adherence to the planned program. The first was an unexpected civil disturbance, lasting several days, during the first week scheduled for operations; the other was a loss of one of the two helicopter pilots, due to annual leave, during the three week period. However, the effect of the former was to provide invaluable data pertaining to aircraft effectiveness during civil disturbances accompanied by violence. This is discussed elsewhere in this report (see Appendix B , pp. 141-143). The effect of the latter was to curtail the planned helicopter activity, reducing its scheduled flight time by 24 hours. Partial recovery of patrol flight time was effected by adding 12 hours to the STOL schedule. The schedule as shown in Appendix A, pp.115-122, is the revised schedule, and also indicates which scheduled patrols were lost due to the civil disturbance.

Details of the flights that were actually made and included in this evaluation program are given in Chapter V. Needless to say, the exact a priori design could not be implemented. In fact, it had been anticipated that uncontrollable factors such as incidents in progress, special mission requests, weather, equipment failure, etc., would require planned or impromptu modifications in the patrol programs. Nonetheless, it should be noted that a carefully planned design and program, with operating rules for coping with

unscheduled events so as to turn them to advantage to the program, is a necessary condition for successful implementation of any test and evaluation project.

As previously noted, the three design factors were place, time, and patrol. Each factor was varied, or applied, as a function of the DCPSD data on when and where the "action" generally occurred, the relative frequency of occurrence of a specific type of crime,[1] and the effective range of the aircraft for a two hour patrol flight. The time distribution (in planned hours) by patrol was roughly determined by the comparative importance of each of the ten patrols. The hour of the day and the location were largely determined by the occurrence pattern of various crimes.

To facilitate patrol scheduling on this basis, the jurisdiction, which had been partitioned into five ground unit stations or districts, each serviced by one of three broadcast frequencies for communications and dispatching purposes, was divided into 9 aerial patrol zones, subdivided into 35 subzones. These subzones differ in area, but each covers a similar land or water area in terms of land use and criminal or other police-related activities. The flight zones are shown in Figure 4-1, while the zone areas are listed in Table 4-1.

[1] i.e., those crimes against which it was believed an aircraft could be effective.

Table 4-1

Dade County Public Safety Department
Flight Zone Areas
(square miles)

Zone	Subzone	Area	Total	Zone	Subzone	Area	Total
1	A	15		2	A	15	
	B	22			B	15	
	C	15	52		C	12	
					D	15	57
3	A	31		4	A	152	
	B	6			B	23	
	C	10			C	180	
	D	13	60		D	76	431
5	A	28		6	A	132	
	B	15			B	51	
	C	42			C	240	
	D	31	116		D	36	459
7	A	38		8	A	113	
	B	37			B	31	
	C	36			C	263	
	D	38	149		D	89	496
9	A	48					
	B	66					
	C	83					
	D	71	268				

Total Flight Area 2,088 square miles

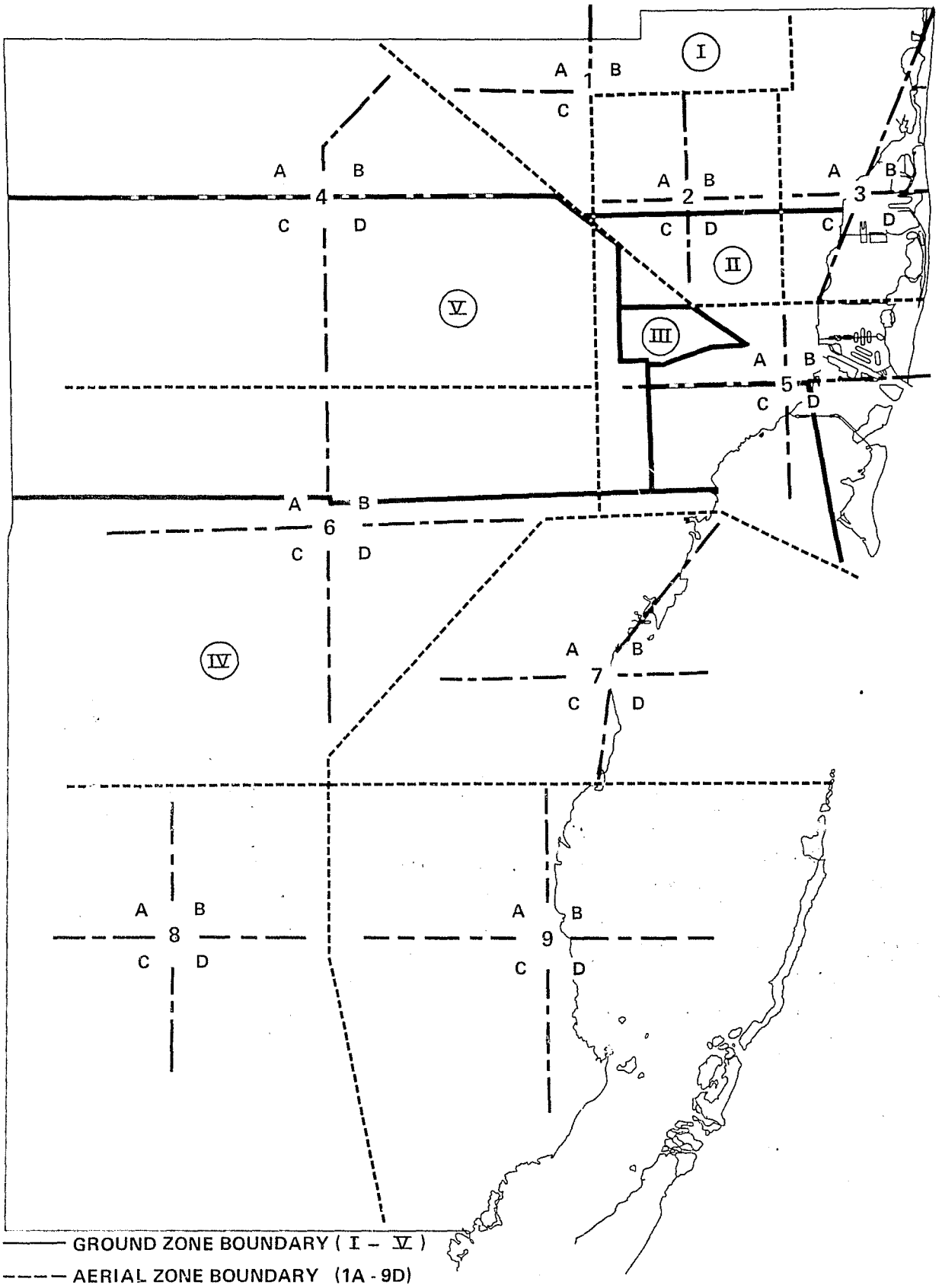

Figure 4-1 GROUND AND AERIAL PATROL ZONES, DADE COUNTY, FLORIDA
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As one example of the discretionary aspects of the scheduling, Traffic Surveillance was limited to the times during which traffic densities are the highest, and to the zones which included principal arteries. The hours were 7-9 am and 5-7 pm, during weekdays; the areas were 2ABC, 3AC, 4D, 5ACD, and 7AC. This typifies the process used to select the areas and times for the specific patrols. The DCPSD Research and Planning Bureau made a study of selected Part I Crimes, such as burglary and robbery, and Part II offenses, such as vandalism, in which the more critical areas, days, and hours were identified. Results from the study, together with the obvious data and experience concerning recreation area patrol needs, traffic, etc., provided the "demand" pattern. Scheduling was then effected so as to provide the patrols when and where they would have the greater likelihoods of effectiveness. The only exceptions to this approach were necessitated by the limited range of the helicopter used, precluding some of the potentially worthwhile patrols by that vehicle in the more remote areas.

While each scheduled flight was for a preassigned patrol, the crew was expected to

(a) participate in any surface unit action if the pilot and observer thought they could be of service, without a specific request,

(b) initiate action when appropriate,

(c) advise appropriate dispatcher of their presence by indicating their unit number and their status of being on the specific radio channel. Essentially, this placed the aerial unit on the same duty status as a surface unit while on patrol.

5. Patrol Briefing and Debriefing Procedures

Before each assigned patrol flight, the crew was briefed on the purpose of the patrol and the zones to be covered. A flight plan was selected so as to achieve maximum in-service coverage during the two hours in the air. Immediately upon landing and completion of the post-flight routine for the aircraft, a mission report form, as shown in Appendix A, was completed. With the assistance of the completed mission report, the crew was interviewed to amplify points of interest and to provide inputs for recording on the post-flight evaluation form, also shown in Appendix A, by CAL personnel. The mission report and post-flight debriefing procedures were followed even during the civil disturbance period, referred to above.

6. Data Sources

Data for the analysis and evaluation were obtained in several ways. Considerable data and information were collected through the use of the mission reports and the post-flight evaluation forms. These provided the data on patrols and other missions flown, durations, effects, limitations, potentials, direct operating costs, etc. Much of the subjective evaluation material also originated with these documents and procedures. The daily time history sheet, shown on page 137, provided a log of the status of each aircraft throughout the intensive test period.

Data pertaining to complaints, surface unit response times, and summary statistics have been provided by the Data Processing unit of the DCPSD. Additional data were compiled directly by personnel in the DCPSD Research and Planning Bureau, the Aviation Section, and the CAL investigators.

First-hand subjective evaluations were obtained not only from the crew members, through the post-flight debriefings and informal discussions, but also by the CAL personnel from the 32.5 hours they flew as observers, in both aircraft. The experiences of participating in the patrols, personally observing capabilities and limitations, and being present during actions leading to apprehensions are of inestimable value in providing background for meaningful evaluation and guidelines.

CHAPTER V MISSION EFFECTIVENESS

This chapter contains the data collected which may be used to compare the relative effectiveness of a helicopter and STOL while performing both scheduled and unscheduled law enforcement related missions. Parameters examined include: hours and missions flown by mission type; mission effects (numbers of arrests assisted, vehicles recovered, fires discovered, etc); comparative effectiveness of helicopter and STOL as perceived by the flight crews; off-airport landings by mission type and type of incident; aircraft utilization and availability; aircraft performance (airspeed and endurance capabilities and their significance); and breakdown of the frequency with which specialized equipment was used or could have been used to enhance mission effectiveness.

1. Mission Analysis

During the period from June 15 through July 19, 1970, the STOL flew 125 hours, 50 minutes while performing 63 missions. Of these missions, 55 were scheduled (i.e. part of the test design) two-hour missions, while the remaining eight unscheduled missions were flown on an "as needed" basis in response to special situations which included an armed robbery, four nights of civil disturbances and an area of suspected marijuana plants.

The helicopter flew 50 missions which accounted for 74 hours, 40 minutes of flying during this same period. Thirty-one scheduled two-hour missions and 19 unscheduled missions were flown. These unscheduled missions were primarily for the civil disturbances and crime laboratory photographs, but also included administrative, airport survey, training, drowning, narcotics detection and traffic planning activities. A breakdown of the number of missions flown by type is given in Table 5-1.

2. Mission Effects

Although the total impact of the introduction of the STOL into service with DCPSD could not be measured, the STOL has demonstrated that it is a useful and effective supplement to Dade County's helicopter operation. While any

Table 5-1

MISSION ANALYSIS

June 15 - July 19, 1970

	Helicopter	STOL
Total Number of Hours Flown:	74 Hrs. 40 Min.	125 Hrs. 50 Min.
Total Missions Flown:	50	63
Unscheduled Missions Flown:	20	8
Administrative	1	0
Airport Survey	1	0
Armed Robbery	0	1
Civil Disturbance	8	6
Demonstration for Police Academy	1	0
Drowning	1	0
Narcotics	1	1
Photographic	6	0
Traffic Planning	1	0
Scheduled Missions*Flown:	30	55
Fire Detection	1-1/2	1
General Surveillance	8	19-1/2
Illegal Dumping	1	2
Lighted Patrol	2	6-1/2
Maintenance	1	1
Narcotics	1	0
Recreational Area	2	2
Rooftop Surveillance	3	2-1/2
Rural Area	1	3-1/2
Stolen Vehicles	1-1/2	3-1/2
Traffic	4-1/2	4-1/2
Water Patrol	2-1/2	8
Water Pollution	1	1

*Scheduled missions are of two hour duration. Where a mission covers two types of patrols, each type of patrol activity is treated as 1/2 of a mission.

deterrence created by the STOL would be difficult to measure, demonstrate and prove, other effectiveness measures such as numbers of arrests assisted, stolen vehicles recovered, and accidents and fires discovered are easily shown. Summaries of the accomplishments of the STOL and helicopter are presented in Tables 5-2 and 5-3.

The most critical test of the STOL's capabilities was during the civil disturbances which occurred in the first four evenings of the test.

During the first evening, the STOL became airborne after the disturbance activity had subsided. However, the STOL observations were used to determine that the disturbance had stopped, and this information was the basis for the cancellation of "Control Plan I" and the withdrawal of police surrounding the disturbance area.

During the following two nights, the helicopter and the STOL, working as a team, were used to provide illumination, surveillance and command and control in the civil disturbance area. Both the helicopter and the STOL were used to report to ground units the locations of fires, firebombers, snipers, looters and crowd gatherings. The STOL assisted in the arrest of at least three firebombing suspects, while the helicopter assisted in the arrests of at least 10 firebombers, looters and snipers.

Illumination provided by the STOL and the helicopter was effective in spite of the 1,000 foot altitude restriction on the STOL and the fact that the helicopter's illumination systems was "homemade" and consisted of three aircraft-type landing lights. Although the STOL's light output was much higher (3.8 million candlepower) that the helicopter's, the helicopter was able to compensate by flying much lower (at 300-600 ft.) than the STOL. This altitude also provided vertical separation between the two aircraft to minimize the risk of collision when both are in operation on the same mission.

Both the STOL and the helicopter were able to illuminate trouble spots upon request of the ground units. The number of requests for illumination grew noticeably each night as ground units became increasingly aware of the availability and effectiveness of airborne observation and illumination. On one occasion, the helicopter was used at the scene of an accidental shooting to provide illumination so that the victims could be lowered on stretchers from the roof of a building.

The helicopter dropped many tear gas canisters in attempts to disband crowds and flush fugitives from areas of dense vegetation. This was not attempted with the STOL because of its altitude restriction and/or its minimum speed which was too great to effect an accurate delivery.

Both the helicopter and the STOL used their illumination systems for lighted patrols and rooftop surveillance over residential, commercial and industrial areas on a scheduled basis. Although the deterrence effect actually achieved is unknown, significant assists to ground units were made by both the helicopter and the STOL. These assists were possible because the aircraft were already airborne and could quickly respond to incidents as they occurred.

The helicopter provided three noteworthy instances of illumination. One was at the scene of a fire, a second was at the scene of a bad accident in which a car had plunged into a canal following a high speed chase in a rural area. The third involved both the lights and the public address system to assist in the arrests of five unauthorized persons on the roof of a school.

The STOL provided three assists while on patrol after dark. The STOL's high intensity searchlight was helpful in dispersing a large crowd gathered at the scene of a major fire. On another occasion, the STOL assisted ground units in the night pursuit of four subjects involved in an armed robbery. When the subjects abandoned their car and fled into an open field, the STOL illuminated the field and one of the subjects was then apprehended. The other incident involved the arrest of a man with a rifle threatening to commit suicide while barricaded in his home. The STOL was aided in locating the house by the use of highway flares placed in the street. Then, after it was ascertained that the subject was alone in the house, ground units called for illumination by the STOL. As soon as the house was illuminated, police fired four tear gas cannisters at the windows, successfully putting three of them into the house. Then the STOL was asked to turn off the light so the police could move about undetected. Shortly, thereafter, the subject came out of the house and was arrested.

Other arrests were made as a result of the aircraft flying on scheduled patrol during daylight hours. The STOL assisted in the arrest of

Table 5-2

STOL DATA

MISSION EFFECTS *

Missions Flown:	63
Calls Responded To:	47 or more
Accomplishments:	
Accidents Discovered	2
Arrests Assisted by STOL	8 or more
Firebombing	3
Burglary	3
Armed Robbery	1
Attempted Suicide	1
Fires Discovered	11 or more
Motorist Assists	2
Stolen and/or Abandoned Vehicles Discovered †	8

In addition, the STOL

- provided illumination, surveillance, and command and control during four nights of civil disturbances. The STOL's P.A. system was used to announce the curfew. During the first night of the disturbance, observations by the STOL crew were the basis of cancellation of "Control Plan 1" and the withdrawal of police from the area

- was used to photograph 6 violations of the pollution code, for which warrants will be subsequently issued

- dispersed a crowd at the scene of a fire using the high intensity searchlight.

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* NOTE: Numbers of arrests, fires discovered and calls responded to are approximate, since many of these incidents occurred during the civil disturbance, for which records are not completely specific.

† Does not include a possible abandoned car as indicated by an oil slick in a canal.

Table 5-3

HELICOPTER DATA

MISSION EFFECTS*

Missions Flown:	50
Calls Responded to:	24 or more
Accomplishments:	
Accidents Discovered	10
Arrests Assisted by Helicopter	24 or more
Looting, Firebombing (possible) and Sniping (civil dist.)	several
Firebombing (known - civil disturbance)	8
Unauthorized Persons on Roof of School	5
Public Intoxication (sniffing lacquer thinner)	1
Subject with Rifle	1
Youths Shooting at Houses From a Boat	4
Assists at Scenes of Drownings (First vehicle on scene at one; directed recovery and transported the body of the other)	2
Discoveries of Areas Where Narcotic Plants were Growing	2
Discoveries of Narcotics and Instruments	1
Fires Discovered	15-19
Stolen and/or Abandoned Vehicles Discovered †	9
Warnings Issued	3

In addition, the helicopter

- provided illumination at the scenes of a bad accident, a fire and an accidental shooting
- provided illumination, surveillance, command and control and tear gas drops during three nights of civil disturbances
- photographed violations of pollution ordinances
- photographed three crime scenes, the scene of an accidental shooting, and the scenes of the civil disturbances
- responded to a call regarding an overturned boat at the request of the Coast Guard, which had no helicopter available at the time.

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* NOTE: Number of arrests, fires discovered, and calls responded to are approximate, since many of these incidents occurred during the civil disturbance, for which records are not completely specific.

† Does not include two possible abandoned cars as indicated by oil slicks in canals.

three burglary suspects. The helicopter assisted in the arrest of four youths shooting at houses from a boat by directing the boat to a dock where police were helplessly watching the youths. The helicopter also assisted in the arrest of a subject with a rifle and on two occasions gave verbal warnings to people shooting near residential areas. The most unusual arrest made by the helicopter crew was made when they discovered a parked car with a lone occupant in an isolated area. They landed to investigate and discovered that the subject was sniffing lacquer thinner and was so intoxicated that he had not heard the helicopter circle above or land 50 feet from his car. He was arrested for public intoxication by the helicopter crew and taken away by a ground unit.

Searches for areas where narcotics plants were alleged or likely to be growing were made by both aircraft. The results of the STOL flight were inconclusive. The helicopter, however, discovered two areas where marijuana plants were growing and discovered a tent containing narcotics and associated instruments. An arrest was subsequently made at the tent after a stake-out was set up.

Both the helicopter and STOL were effective in discovering stolen and/or abandoned vehicles. During the test period, the helicopter discovered nine vehicles and the STOL discovered eight. More man hours were required of air and/or ground personnel in the discoveries made by the STOL, since the discoveries had to be checked by either a ground unit or the helicopter to make sure that the car was stolen before the tow truck was called.

Other law enforcement activities performed by the helicopter included photography of three crime scenes, the scene of an accidental shooting, and the scenes of the civil disturbances.

Pollution control flights were made by both aircraft. Photographs of pollution violations were made and will be used as the basis for more than a half dozen warrants which will be issued. The pollution control official stated that in the four hours of flying in the two aircraft, he accomplished what otherwise takes an entire month to perform.

Public safety activities were performed by both aircraft. The helicopter was the first police vehicle at the scene of one drowning, and

directed the recovery and transported the body of the victim of a second drowning. The helicopter discovered 10 automobile accidents, while the STOL discovered two. The STOL also summoned aid on two occasions for stranded motorists in remote areas.

3. Comparative Effectiveness of STOL and Helicopter as Perceived by Flight Crews

The relative capabilities of the helicopter and STOL to perform law enforcement missions in specific instances were assessed by interviewing the observer after each flight. The STOL observer was asked whether or not the helicopter could or could not have handled the particular mission as effectively as the STOL. Likewise, when the helicopter flew, the observer was asked whether or not the STOL could have handled the mission as effectively as the helicopter. When either aircraft flew, the observer was also asked whether the mission could have been handled only by the STOL or only by the helicopter. This data is shown in Tables 5-4 and 5-5. Of 53 missions flown by the STOL, the STOL crews felt that 12 of these could not have been handled as effectively by the helicopter. Nine of these could only have been handled effectively by the STOL. Two missions could only have been handled by the helicopter, and the effectiveness of four missions was compromised by having the STOL instead of the helicopter. Of 39 missions flown by the helicopter, 18 could not have been handled as effectively by the STOL and 15 of these could only have been effectively handled by the helicopter. The helicopter crews cited no missions which could only have been handled by the STOL. Related to this, the helicopter made off-airport landings while performing 23 of its missions. Only on one of these missions would it have been possible, in the opinion of the helicopter crew, for the STOL to have landed. The STOL made no off-airport landings during the test period.

Tables 5-6 and 5-7 show relative aircraft effectiveness by mission type as judged by the flight crews. Based upon these tables and the interviews with the flight crews, the STOL is best suited for activities where:

a. off-airport landings are not required or are infrequently required;

Table 5-4

STOL MISSION DATA

Effectiveness and Off-Airport Landing Data

Total number of missions	
which helicopter could handle as effectively:	41
which helicopter could not handle as effectively:	12
which could be handled effectively only by the helicopter:	2
which could be handled effectively only by the STOL:	9
in which it would have been advantageous to land at the scene:	7
in which it would not have been advantageous to land at the scene:	45
in which helicopter could have landed:	42
in which helicopter could not have landed:	7
in which STOL could land:	17
in which STOL could not land:	32
in which STOL made an off-airport landing:	0
where it was advantageous to land; the helicopter could land, but the STOL could not:	2
where it was advantageous to land and neither the helicopter nor the STOL could land:	1
where the effectiveness was compromised by having the STOL:	4
where the effectiveness was not compromised by having the STOL:	45
Total number of missions flown	53

Table 5-5

HELICOPTER MISSION DATA

Effectiveness and Off-Airport Landing Data

Total number of missions	
which STOL could handle as effectively:	21
which STOL could not handle as effectively:	18
which could be handled effectively only by the helicopter:	15
which could be handled effectively only by the STOL:	0
where it would have been advantageous to land at the scene:	24
where it would not have been advantageous to land at the scene:	15
where helicopter could have landed:	36
where helicopter could not have landed:	3
where helicopter did land:	23
where helicopter did not land:	16
where STOL could land:	1
where STOL could not land:	38
where helicopter landed and STOL could have landed:	1
where helicopter landed and STOL could not have landed:	22
where it was advantageous to land but neither helicopter nor STOL could have landed:	0
Total number of missions flown	39

Table 5-6

STOL Effectiveness By Mission Type

Mission Type	Approximate No. of Hours Flown By The STOL By Mission Type	Percentage of Hrs. Where Helicopter Would Have Been As Effective As The STOL	Percentage of Hrs. Flown Where Helicopter Would Not Have Been As Effective As The STOL	Percentage of Hrs. Flown Where Mission Could Only Have Been Handled By The Helicopter	Percentage of Hrs. Flown Where Mission Could Only Have Been Handled By The STOL
Unscheduled Missions:					
Armed Robbery	0.5	100%	0%	0%	0%
Civil Disturbance	13.5	75%	25%	0%	25%
Scheduled Missions:					
Fire Detection	2.0	100%	0%	0%	0%
General Surveillance	25.0	80	20	4	12
Illegal Dumping	4.0	100	0	0	0
Lighted Patrol	13.0	38	62	0	46
Recreational Area	5.0	80	20	40	20
Rooftop Surveillance	5.0	20	80	0	40
Rural and Vacant Area	4.0	50	50	0	0
Search for Stolen Vehicles	7.0	100	0	0	0
Traffic Patrol	9.0	100	0	0	0
Water Patrol	8.0	81	19	0	19
Water Pollution	2.0	100	0	0	0

Table 5-7

Helicopter Effectiveness By Mission Type

Mission Type	Approximate No. of Hours Flown By The Helicopter By Mission Type	Percentage of Hours Flown Where STOL Would Have Been As Effective As The Helicopter	Percentage of Hours Flown Where STOL Would Not Have Been As Effective As The Helicopter	Percentage of Hours Flown Where Mission Could Only Have Been Handled By The Helicopter	Percentage of Hours Flown Where Mission Could Only Have Been Handled By The STOL
Unscheduled Missions:					
Civil Disturbance	13.583	74%	27%	27%	0%
Drowning	0.583	0	100	0%	0%
Photographic	2.917	37%	63	63%	0%
Scheduled Missions:					
Fire Detection	3.000	33%	67%	67%	0%
General Surveillance	15.000	47	53	40	
Illegal Dumping	2.000	0	100	100	
Lighted Patrol	3.000	100	0	0	
Narcotics	2.000	0	100	100	
Recreational Area	4.000	50	50	50	
Rooftop Surveillance	5.000	100	0	0	
Rural and Vacant Area	2.000	0	100	100	
Search for Stolen Vehicles	2.000	50	50	0	
Traffic Patrol	9.000	67	33	22	
Water Patrol	5.000	60	40	40	
Water Pollution	2.000	100	0	0	

b. flight at less than 1,000 feet over densely populated areas is not required;

c. aerial illumination is desired;

d. a capability for attaining a high-speed is advantageous;

e. an extended endurance capability is useful.

Mission types for which the STOL appears to be best suited are civil disturbance, lighted patrol, recreational area patrols, rooftop surveillance, search for stolen vehicles, traffic, water patrol, and pollution control. The suitability of the STOL for these missions is discussed below:

a. Civil Disturbance - Most of the civil disturbance activity during the test period occurred at night. Although the helicopter did land at the command post to obtain information and replenish fuel and tear gas supplies, there was no advantage to be gained from landing in the areas of actual operations. Additionally, because of the danger of striking unseen objects such as wires, even the helicopter would not make off-airport night landings unless the pilot was very familiar with the obstructions surrounding the landing areas. Although the STOL could not legally fly below 1,000 feet, illumination provided by the STOL was at least as effective as that provided by the helicopter at 300-500 feet (due to the difference in the illumination equipment). The additional endurance of the STOL was used to advantage since the STOL remained airborne while the helicopter returned to refuel. During the joint operations, the STOL exceeded the helicopter endurance capability (normally 2 hours) and flew one civil disturbance mission for 3 hours, 20 minutes. The primary limitation of the STOL was that it was not considered to be a suitable platform for dropping tear gas canisters.

b. Lighted Patrol - The STOL is as effective as the helicopter since the helicopter usually does not make off-airport night landings, and since the illumination provided proved to be adequate even from 1,000 feet. Patrol speeds used for the two aircraft were comparable, although the STOL has a greater speed capability.

c. Rooftop Surveillance - Since most of the rooftop surveillances (checks of industrial, commercial and educational facilities) were conducted at night, neither aircraft attempted to land during these patrols. As in the lighted patrols, the illumination provided by the STOL was adequate.

d. Search for Stolen Vehicles - The STOL demonstrated its capability to successfully perform this activity by assisting in the recovery of 8 stolen and/or abandoned cars as compared to 9 for the helicopter. However, the helicopter is more efficient in terms of manpower in that it could usually land, check the vehicle and call in a wrecker without having to call a ground unit. The helicopter crew did in fact land during the recovery of 8 vehicles. The STOL, however, cannot always ascertain whether or not the car is worth recovering or has been abandoned by the owner, and sensibly will not risk damaging the aircraft by landing at the scene. Therefore, it must call in a ground unit to check out the discovery, thereby tying up both the aircraft and the ground unit.

e. Traffic Patrol - This activity consisted of looking for accidents, traffic backups and disabled autos and reporting them. Neither the helicopter nor the STOL had occasion to land for traffic related incidents,[1] which indicates that the helicopter's ability to land may be of limited significance for this type of activity. The STOL can cover more roadway during rush hours due to its higher speed.

f. Water Patrol, Recreational Area Patrol, and Patrol of Rural and Vacant Areas - For these types of activities, the STOL suffers in effectiveness from its inability to land (without significant risk) to perform routine checks of suspicious appearing activities on the ground. Since the incidents usually do not warrant the risk of damaging the aircraft, a ground unit or the helicopter must be called in if a check is to be made. The STOL does, however, have an advantage relative to the helicopter due to its greater speed and endurance. The round trip from the Opa Locka Airport to certain parts of Dade County, e.g. the Everglades National Park, virtually exhausts the helicopter's fuel supply and necessitates refueling at other airports if more than a brief patrol of the remote area is contemplated. The STOL, on the other hand, can fly at high speed to the remote area, patrol the area for a few hours and return home without refueling. The STOL can spend less time flying to and from the patrol area, spend less time on the ground refueling and can patrol more area while on station by patrolling at a higher speed.

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[1] However, the helicopter did land on two occasions while on traffic patrol, to handle other types of incidents as they occurred.

g. Water Pollution Control - The STOL appears to be as effective as the helicopter for taking photographs of pollution violations. Landing at the site is of little significance, since the citations are not issued at the time of the incident. The greater speed of the STOL permits a greater number of sites to be visited during a given amount of time.

The types of activities for which the STOL does not appear to be well suited are drownings, illegal dumping, and narcotics patrol.

a. Drownings - Although only the helicopter has attended drowning incidents and therefore comparative data are not available, the ability of the STOL to locate a body and direct a boat crew to effect recovery has been questioned by the helicopter crew. Additionally, the STOL, unless equipped with floats, would usually be unable to land at the scene to transport the body.

b. Illegal Dumping - The helicopter is a much better vehicle for this type of enforcement operation than the STOL because of its ability to land in rural areas to investigate and to issue citations without significant risk to the aircraft. Off-airport landings in the STOL are hazardous and, as one of the STOL pilots indicated, it is not worth the risk to the aircraft for a petty offense. If the STOL pilot chooses not to land, then he must call in the helicopter or the ground unit and wait for their arrivals and thereby ties up men and equipment for a substantial period of time for the minor offense.

c. Narcotics Patrol - The helicopter appears to be superior to the STOL for narcotics detection because of its ability to land in small areas in order to check suspicious plant growths, and isolated tents or buildings. The STOL was used to investigate an area for narcotic plants, but attempts at plant identification from the air yielded inconclusive results. However, the helicopter crew discovered three areas where marijuana was growing and was able to land at or near these locations. The helicopter pilot and a narcotics officer also checked a tent where there were narcotic substances and instruments used for administering narcotics.

The usefulness of the STOL for criminal photography is unknown because no comparative evaluations were attempted. However, the STOL may not be as well suited as the helicopter because of the 1,000 ft. altitude restriction over populated areas.

With respect to fire detection missions, there is insufficient data to assess either the relative aircraft effectiveness or the importance of the mission type.

For general surveillance, it appears that the STOL is a suitable vehicle, although the helicopter may be somewhat more effective. Assessments by the helicopter and STOL flight crews regarding the suitability of the STOL (relative to the helicopter) for general surveillance are contradictory and inconclusive.

4. Helicopter Landing Data

Since the STOL made no off-airport landings during the test period, data concerning the types of missions and the types of incidents in which the helicopter landed yield indications of the types of capabilities which are lost or compromised when the STOL is used instead of the helicopter. Table 5-8 shows the types of missions which the helicopter was flying when the landing was made. Note that no landings were made during lighted patrol or rooftop surveillance missions. Of much greater significance is Table 5-9 which presents the type of incidents for which the landings were actually made. The primary types of incidents for which the helicopter landed were for the recovery of stolen vehicles, civil disturbances (landing at the command post only), narcotics investigations, checks of persons in remote areas, issuing warnings, making arrests, and assisting with the recovery of bodies of drowning victims.

5. Aircraft Availability

Availability of the aircraft is an important measure of effectiveness, since an aircraft which is frequently grounded because of weather or maintenance provides little deterrent or law enforcement capability. Aircraft availability was compared for the two aircraft types by recording those scheduled flying hours and missions which were lost or shortened due to weather or maintenance. This data is summarized in Table 5-10. As can be seen from this table, the helicopter demonstrated that it is less affected by weather (at least with

Table 5-8

Helicopter Landings

by

Mission Type

	Approximate No. of Hrs. Flown by the Helicopter by Mission Type	Number of Incidents where the Helicopter Landed	Total No. of Off-Airport Landings Made While Handling Incidents
Unscheduled Missions			
Civil Disturbance	13 Hrs. 35 Min.	4	4
Drowning	35 Min.	1	2
Photographic	3 Hrs. 55 Min.	1	1
Scheduled Missions			
Fire Detection	3 Hrs.	2	2
General Surveillance	15	6	7
Illegal Dumping	2	2	3
Lighted Patrol	3	-	-
Narcotics	2	3	3
Recreational Area	4	3	3
Rooftop Surveillance	5	-	-
Rural and Vacant Area	2	2	2
Search for Stolen Vehicles	2	2	3
Traffic Patrol	9	2	2
Water Patrol	5	3	3
Water Pollution	2	1	1

Table 5-9

Helicopter Landings

by

Type of Incidents

Type of Incident	No. of Incidents For Which the Helicopter Landed
Aircraft Accident	1
Arrests:	2
One male arrested for public intoxication (sniffing lacquer thinner)	
Four males arrested for shooting at houses from boat	
Car Stripping Investigation	1
Checks of persons in remote areas	3
Civil Disturbance	4
Landed at command post for fuel, information, and tear gas replenishment	
Demonstration of Helicopter	1
Drownings	2
Information	1
Narcotics Investigations	5
Photography at Crime Scene	1
Recovery of Stolen and/or Abandoned Vehicles	8
Warnings:	3
One incident of illegal dumping	
Two incidents of people discharging firearms	

Table 5-10

AIRCRAFT AVAILABILITY

	HELICOPTER		STOL	
	No. of Missions	No. of Hours	No. of Missions	No. of Hours
Total Activity	50	74.67	63	125.83
Scheduled Missions Cancelled due to Weather	1	2.00	7	14.00
Scheduled Missions Aborted due to Weather	4	3.25	5	3.58
Scheduled Mission Hours Lost to Weather	--	5.25	--	17.58
Scheduled Missions Cancelled due to Maintenance	4	8.00	0	0.00
Scheduled Mission Aborted due to Maintenance	0	0.00	1	0.92
Scheduled Mission Hours Lost to Maintenance	--	8.00	--	0.92
Scheduled Mission Hours Lost to Weather or Maintenance	--	13.25	--	18.50

respect to rain, low ceilings and poor visibilities) than is the STOL. The helicopter lost 5 hours 15 minutes of scheduled flying due to weather whereas the STOL lost 17 hours 35 minutes. This was primarily a result of the concern of the STOL crew with being able to fly to the nearest airport while remaining in VFR conditions[2], since the STOL was marginally equipped for instrument flying. The helicopter, however, can operate legally with very low ceilings and visibilities and can, with little jeopardy, land in an open area and wait for the weather to improve.

The helicopter lost 8 hours due to a VHF aircraft transmitter failure. The STOL, on the other hand, lost only 55 minutes in maintenance. Scheduled inspections for both aircraft were performed during the week when no tests were run, in order not to conflict with the tests. These inspections required one working day for each aircraft.

If scheduled hours lost are added to hours actually flown, the sum is an indication of the total hours that would have been flown under ideal conditions. Actual hours divided by total hours give availability ratios, which are 85% for the helicopter and 87% for the STOL. Six percent of the helicopter hours were lost to weather and 9% were lost to maintenance. Twelve percent of the STOL hours were lost to weather and less than 1% of the hours were lost to maintenance.

6. Aircraft Performance

The STOL and helicopter operated by Dade County differ considerably in terms of their airspeed and endurance capabilities. In order to determine the significance of these capabilities, the amount of time each aircraft spent in performance regimes unattainable by the other aircraft was ascertained.

Table 5-11 shows the percentages of missions in which various speed ranges were employed. Although the STOL used speeds higher than the helicopter was capable of an a large percentage of missions and the helicopter sometimes flew at speeds slower than the STOL could fly, the majority of the missions

[2] I.e., Visual Flight Rules, with ceilings at least 1,000 feet and visibility at least three miles.

Table 5-11

Airspeeds Used By The Helicopter And STOL While Performing Missions

Airspeed (MPH)	Percent of Helicopter Missions in which This Speed was Used	Percent of STOL Missions in which This Speed was Used
0-10	7.9%	*
11-20	7.9	*
21-30	18.4	*
31-40	21.1	0.0%
41-50	26.3	19.2
51-60	44.7	46.2
61-70	76.3	92.3
71-80	7.9	55.8
81-90	*	36.5
91-100	*	38.5
101-110	*	36.5
111-120	*	38.5
121-130	*	7.7
131-140	*	1.9

* - Not within the performance capability of the aircraft in present configuration.

Table 5-12

Helicopter and STOL Flight* Duration Distributions

Flight Duration	Helicopter			STOL		
	No. of Flights	Percent of Total Flights	Cumulative Percentage	No. of Flights	Percent of Total Flights	Cumulative Percentage
0 - .50 Hrs.	4	7.5	7.5	3	4.8	4.8
.51 - 1.00 Hrs.	13	24.5	32.0	3	4.8	9.6
1.01 - 1.50 Hrs.	11	20.8	52.8	6	9.5	19.1
1.51 - 2.00 Hrs.	24	45.3	98.1	26	41.3	60.4
2.01 - 2.50 Hrs.	1	1.9	100.0	16	25.4	85.8
2.51 - 3.00 Hrs.	-	-	100.0	4	6.3	92.1
3.01 - 3.50 Hrs.	-	-	100.0	3	4.8	96.9
3.51 - 4.00 Hrs.	-	-	100.0	2†	3.2	100.0

*On missions H-70-222 and 235, the helicopter refueled a total of three times while away from its base. These two missions are treated as 5 flights for purposes of this tabulation.

†The longest STOL flight was 3 Hrs. 50 Min. as compared with 2 Hrs. 10 Min. for the helicopter.

were flown at speeds achievable by both aircraft. In fact, speeds from 51 to 60 miles per hour were used in 76.3% of the helicopter missions and 92.3% of the STOL missions. For Lighted Patrol missions with either the helicopter or the STOL, it was felt that speeds of 65 MPH or less were preferable, because the slower speeds provide sufficient time to scrutinize the area illuminated. Higher speeds do not provide enough time to identify and comprehend activities being illuminated. The higher speeds were used by the STOL to fly to and from patrol areas, to respond to calls, and to patrol uninhabited or sparsely populated areas.

Another performance parameter in which the capabilities of the two aircraft differed significantly was endurance. The helicopter could fly for two hours with a reserve fuel allowance of about 20 minutes. Maximum flight time experienced was 2 hours 10 minutes. The STOL, however, has the capability to fly unrefueled for 8 to 10 hours if necessary, although the longest flight during the test was 3 hours 50 minutes. Endurance distributions are shown in Table 5-12.

The limited endurance of the helicopter was a significant handicap on one mission where the helicopter was providing illumination at the scene of a bad rural accident in which a car had gone into a canal. The helicopter provided valuable assistance to the ground units during rescue operations but had to leave the scene to refuel. By the time refueling was completed, the helicopter was no longer needed.

The STOL exceeded the maximum helicopter mission length on 15 occasions. This represents 24% of the STOL missions. The longest STOL flight exceeded the longest helicopter flight by 1 hour 40 minutes.[3]

Although some of the longer STOL flights were planned to exceed two hours, the ability to continue the mission beyond two hours on an unplanned

[3]It should be pointed out that the longest STOL mission falls within the capabilities of many of the more modern piston or turbine engined helicopters commonly used by law enforcement agencies, although the STOL's maximum endurance is at least twice that of the modern helicopters.

basis greatly enhanced the STOL's effectiveness on several occasions. During the civil disturbances, four of the STOL missions exceeded two hours, with two of these greater than three hours. This capability permitted aerial coverage to be maintained while the helicopter returned for fuel. On another occasion, as the STOL was nearing the end of its scheduled two hour lighted patrol mission, the STOL was requested at the scene of the potential suicide noted above (cf. p.33). The STOL illumination equipment was the only feasible means of providing the desired lighting on a demand basis and for the desired area. By the time the STOL was released and returned to the airport, it had been airborne continuously for 3 hours and 40 minutes. If the helicopter had been used, it would have had to refuel and therefore would not have continuously had a capability to provide illumination upon request.

7. Equipment Used

The ability of the helicopter and STOL to provide assistance to ground units was at least in part made possible by the special equipment (e.g. high intensity searchlights, public address systems, etc.) installed in or carried by each aircraft. Tables 5-13 and 5-14 show the number of missions during which each type of specialized equipment was used by the aircraft. Equipment used by the helicopter included lights, public address system, siren, tear gas canisters, still and movie cameras, floats and the litters. Special equipment was used on one half of the missions. Similarly, the STOL used the searchlight, public address system, siren and a camera. This equipment was used on 43 percent of the missions.

Flights during the test period also served to indicate what additional equipment would have been useful if it had been available. According to the helicopter pilots, the helicopter could have used improved high intensity lights,[4] liquid tear gas for the tear gas dispenser installed in the helicopter, a movie camera for gathering evidence, and a live TV system to provide information to the command officers on the ground during civil disturbances. The

[4]The current system is ineffective above 500 feet.

Table 5-13

HELICOPTER DATA

Equipment Used

Number of missions where special equipment was used:	25
Lights:	9
Lighted patrol only	2
Lighted patrol and illumination by request	7
Illumination by request only	0
Number of incidents where illumination was used to assist ground units	11
Public Address	10
Siren	3
Tear gas cannisters	2
Still camera	5
Movie camera	1
Floats	1
Litter	1
Number of missions where no special equipment was used:	25
Number of missions in which additional specialized equipment could have been used:	9
Improved hi-intensity lights	6
Liquid tear gas for dispenser	1
Movie camera	1
Live T.V.	1

Table 5-14

STOL DATA

Equipment Used

Number of missions where special equipment was used	22
Lights:	15
Lighted patrol only	6
Lighted patrol and illumination by request	7
Illumination by request only	2
Number of incidents where illumination was used to assist ground units	10 or more
Public address	7
Siren	2
Still camera	1
Number of missions where no special equipment was used:	31
Number of missions in which additional specialized equipment could have been used:*	16
Permanent police radio installation+	4
Stabilized prism monoculars	4
Binoculars‡	3
Additional VHF navigation-communication radio	2
Floats	2
Air and water sampling equipment	1
Weather radar	1

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* In addition, on 5 missions, the pilot or observer stated that an FAA waiver permitting flight below 1,000 feet over densely populated areas would have been helpful.

\+ A portable hand held radio transceiver (Dumont HH-300) was used with a permanent antenna mounted on the aircraft pending delivery of a permanent police radio installation.

‡ Three types of binoculars were subsequently evaluated and found to be unsatisfactory.

STOL crew felt that they could have used the following equipment: a permanent police radio installation to make communications less cumbersome and more reliable; stabilized prism monoculars or binoculars to read license plates; a second VHF navigation-communication radio for additional safety during marginal weather operations; floats for water patrol and patrol of recreational areas; air and water sampling equipment for pollution control; and perhaps weather radar for avoidance of the thunderstorms which occur nearly daily in the summer in Southern Florida.

8. The Aircraft and the Department

Consideration of mission effectiveness should not be limited to the accomplishments or lack of accomplishments of the aircraft per se. An aircraft in police service should be regarded as one component in the patrol and response system. Accordingly, the set of missions flown during a particular time frame, uniquely and collectively, should be regarded in the context of the analysis and evaluation of the entire department's patrol operations.

An attempt was made to do this in the present study. The intent was to examine several data sets and relationships, for the aircraft alone, and for the aircraft in relation to the entire department's field operations. Earlier portions of this Chapter have contained analysis of the aircraft and their direct effects. This portion is concerned with their relation to the department, or the indirect effects of the aircraft, as well as comparisons with the performance of ground units.

The indirect effects are those favorable changes in certain crime rates or frequencies which may be at least partially attributable to the use of the police aircraft on a regular basis. Within the context of the signals and terminology used for calls by DCPSD, burglary, vandalism, and holdup are probably the crimes most likely to be reduced by regular strategic and tactical use of police aircraft. Gross measures for analysis of the effects are the trend in the number of calls per unit time, and comparisons of equivalent periods over time. Table 5-15 shows the monthly totals of such calls, for the period February, 1968 through July, 1970. It may be noted that burglaries

Table 5-15

Dade County Public Safety Department

Number of Dispatched Calls

Burglary, Vandalism, and Hold Up

February 1968 - July 1970 inclusive*

	Call								
	Burglary			Vandalism			Hold Up		
Month/Year	1968	1969	1970	1968	1969	1970	1968	1969	1970
Jan.	----	742	890	----	423	476	----	99	167
Feb.	553	754	886	541	441	469	78	100	126
March	707	754	972	574	441	525	95	100	138
April	655	813	939	517	480	417	90	95	129
May	661	672	941	519	489	428	89	99	112
June	713	623	1066	534	448	447	98	86	149
July	606	851	1131	492	531	434	111	90	142
Aug.	655	800		359	563		119	122	
Sept.	592	768		444	461		118	118	
Oct.	564	826		448	488		124	137	
Nov.	639	733		476	566		118	131	
Dec.	725	920		470	445		109	151	

*Source: DCPSD - Patrol Units Operational Time Analysis, All Dispatched Calls. Note: February 1969 and March 1969 are machine tabulated with identical numbers in two different reports; it is assumed that one is in error.

and holdups are increasing during the period, while vandalism is decreasing. The comparisons between June and July, 1970 and June and July, 1969 (since regular patrols have been flown only since mid-June, 1970) indicate only the trend effects in the data. Thus, these particular data are not helpful for the present purpose. A longer time frame, among other things, may be required for the effects on crime statistics to be measurable.

It was hoped to apply a finer-grain analysis to crime frequencies in relation to the aerial operations. For example, one meaningful comparison would be to compare the crime rate(s) in the zones covered by the aircraft, during the times of patrol, with the rates in the same zones during the rest of the time. Unfortunately, the form in which the data are kept and are retrievable is such that the effort to retrieve the frequency of specific crimes in specific zones, during particular times, would be greater than permitted by the time and budgetary constraints of the program.

Another useful analysis would relate response times to in-progress crimes by the aircraft to response times by patrol cars, for the same incidents. Once again, while the data exist for patrol cars, their retrieval is not feasible. However, average response times for all calls dispatched, emergency calls only, and calls when a patrol unit was not in service or did not respond, are available for each of the signal codes, in the monthly operational time analysis (OTA) reports. The time measurement of greatest interest, average response time when a vehicle is in service, can be obtained by inference from the other data reported in the OTA's. For the first seven months of 1970, there were 2959 burglary calls resulting in the dispatch of vehicles in service. Their average response time (reported as travel time) was 7.4 minutes. The comparable statistics for vandalism are 1,738 calls with an average response time of 8.0 minutes, and for holdups, 801 calls with an average response time of 5.2 minutes.

During the intensive test flight operations there were very few of these three signals to which the aircraft responded, with only one for which there is a firm datum on response time. This was a potential vandalism with

several persons on a school roof. The helicopter was on lighted patrol over the area served by the radio frequency of that ground district, and, upon hearing the dispatch of ground units, changed course to vector in to the location. It took one minute to arrive at the scene, at about 80 MPH, and provide rooftop illumination which flushed out suspects, forcing them to leave and be apprehended, before anyone on the ground could get to the roof.

A more general comparison in response times can be made by assuming the helicopter or STOL is in service, on a given frequency, when the dispatch is made. For example, suppose there is a burglary-in-progress call in the Central (ground patrol) district, and the STOL is in the eastern end, with the incident location being in the western end. The STOL would be over the location in 4-5 minutes. Average travel time for a ground unit is 7.4 minutes. The difference in time is even more meaningful if one recalls that ground unit patrols are scheduled on the basis of grid groupings, so a vehicle in service is ordinarily within a comparatively small, localized area of the district, rather than possibly being at the opposite end. The savings in time to arrive at the location has the potential for greater success in detection of suspects fleeing from the scene of a crime.

9. Impact of the Test on Dade County

In discussing mission effectiveness of the test flight operations, it is relevant to include comments on the impact the program had on the aerial operations of DCPSD. During 1964-1969, its helicopter flew an average of 29.3 hours per month. Most of the time it was on the ground, in standby status, and flew mainly on request for assistance or administrative assistance. Less than 41% of the flight hours were on routine patrol. Its capabilities for police service were not utilized beyond a small degree, and neither the Department nor the public regarded it as another routine patrol, pursuit, or surveillance vehicle.

However, this viewpoint was rather dramatically changed by the achievements of the STOL and the helicopter during the four weeks of the intensive test period and since. The assistance provided during the four days

of civil disturbance, the discoveries, apprehension assists, and other accomplishments made while in service on routine patrol, in most cases leading to involvement with ground unit officers, and in several cases, leading to favorable coverage by news media, literally put the DCPSD air operations "on the map". Furthermore, it was seen that each aircraft could and did fly several hours daily on a scheduled basis. With the present complement in the Aviation Section, routine patrol time of 160-200 hours per month, using both aircraft, should be feasible.

CHAPTER VI COST CONSIDERATIONS

1. Introduction

One of the major reasons for evaluating STOL aircraft for use as police vehicles is that certain STOLs are considerably cheaper to operate than most helicopters now used by police agencies. Cost data supplied by STOL manufacturers indicate that the direct operating cost[1] of the Helio H-295 "Super Courier" STOL is $11.68 per hour and the cost of the Fairchild-Hiller "Porter" is $26.85 per hour. Similarly, the direct operating costs for two to three seat reciprocating engined helicopters range from $13.26 to $20.87 per hour, and 5-7 seat turbine helicopters range from $25.25 to $62.51 per hour. Total operating costs (direct operating costs plus depreciation and insurance) based upon 1,000 hours of flying annually are quoted as $19.88 for the "Super Courier" and $47.17 for the "Porter". Total operating costs per hour for the reciprocating and turbine helicopters vary from $23.01 to $37.06 and $52.50 to $119.64, respectively.

2. Dade County Experience

Since the Dade County Public Safety Department has only been operating its "Super Courier" since May 25, 1970, operating cost data was available only for June and July 1970. Because the data sample is so small, the cost data accumulated thus far serve to verify certain components of estimated operating costs rather than to accurately indicate operating costs which will be valid in the long run.

Actual and predicted operating costs for the STOL are presented in Table 6-1. Based upon 196.3 flying hours, the direct operating cost is $10.20 per hour and, the fixed cost (hull, liability and pilot and observer life insurance) is $6.97 per hour and the total operating cost is $17.17 per hour at a utilization rate of 98 hours per month or 1.61 hours per day. This

[1] Direct operating costs consist of fuel, oil, maintenance, parts and labor, and reserves for overhauls and life limited components. Cost data is based on quotes from manufacturers as of January, 1970.

Table 6-1

STOL Operating Costs

June and July 1970

(196.3 Flying Hrs.)

		Quantity	Unit Cost	Total Cost	Total Cost/Hr.	Budgeted Cost/Hr.
Direct Operating Cost:						
Fuel:	June	980 gal.	$.261/Gal.	$255.93		
	July	1,153 gal.	$.27/Gal.	311.31		
	Total			$567.24	$2.89	$3.00
Oil:	June	24 qts.	$7.20/case	7.20		
	July	-	-	-		
	Total			$ 7.20	$ .04	$0.16
Maintenance:	June	100 Hrs. Inspection		$243.20		
	July	100 Hrs. Inspection & Antenna Installation		282.95		
	Total			$526.15	$2.68	$2.69
Budgeted Reserve for Engine Overhaul:			$4.59/Hr.	$901.02	$4.59	$4.59
Total Direct Operating Cost				$2,001.61	$10.20	$10.44
Fixed Costs:						
Hull, Liability,,and Pilot and Observer Life Insurance			$8,000/Yr.	$1,333.33	$6.97	$5.71
Total Fixed and Direct Operating Costs				$3,334.94	$ 17.17	$16.15

*Source: Dade County Public Safety Department

compares with budgeted direct, fixed and total operating costs of $10.44, $5.71 and $16.15 per hour, respectively. Thus, actual costs incurred so far are within approximately 5% of budgeted costs.

DCPSD has been operating a Bell 47G-2 helicopter since 1959. Operating cost data are summarized in Table 6-2. Total operating cost for the period from January 1964 through July 1970 has averaged $25.34 per hour at a utilization rate of 31 hours per month or 1.02 hours per day.[2] These costs do not include aircraft depreciation. Since no hull insurance is carried for the helicopter, accident repair costs have been included in the maintenance costs.

Dade County data gives a preliminary indication that the total operating cost (excluding pilot and observer salaries) of the "Super Courier" STOL is approximately two thirds that of the Bell 47G-2. However, it must be remembered that the initial utilization rate of the STOL was more than three times that of the long term average utilization rate for the helicopter. If the helicopter had been flown at a utilization rate comparable to the STOL, the total cost per hour might have decreased to as little as $19.30 per hour.[3] If this had occurred, then the STOL costs would have been about 88% of the 47G-2 total operating costs per hour.

It is not possible to compare the 47G-2 costs incurred by DCPSD with operating costs furnished by the manufacturer, because this model is no longer produced. However, the 47G-2 has been superseded by the 47G-3B, 47G-4A, and 47G-5 which are all structurally similar to the 47G-2 but have larger engines and higher performance. Direct operating costs for these helicopters are quoted as $20.87, $19.02 and $16.72 per hour respectively. For comparison, the DCPSD 47G-2 direct operating costs (excluding accident repair costs) are $18.84 per hour.

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[2] During June and July 1970, the months of the intensive test period, the helicopter averaged 53 hours per month (2.03 hours per day). Helicopter availability was limited during July because only one pilot was available.

[3] Assuming no additional accidents and an unchanged direct operating cost with additional utilization, total cost per hour would decrease because the accident repair costs ($16,000) would be spread over additional hours.

Table 6-2

Helicopter Operating Costs*

Bell 47G-2

January 1964 - July 1970

Time Period †	Flying Hrs.	Total Cost	Average Cost/Hr.
1964	389	$ 2,267.87	$ 5.83
1965	370	11,359.00	30.70
1966	149	1,230.74	8.26
1967	395	23,676.30‡	59.94‡
1968	440	8,188.40	18.61
1969	364	5,389.30	14.81
1970 (Jan-July)	355	10,275.59	28.94§
Total (Jan 1, 1964 through July 31, 1970)	2,462	$62,387.20	$25.34

*Includes Fuel, Oil, Maintenance Labor and Parts. Aircraft hull insurance is not carried on the helicopter; however, accident repair costs have been included in the total cost. Pilot and observer costs are excluded. Source: Dade County Public Safety Department.

†January through December except where noted.

‡Repair Costs of $16,000 were incurred for an accident on April 29, 1966 and were charged to 1967 operations.

§This is broken down as follows:

Fuel (15.5 gal./Hr.)	$ 4.36
Oil	.20
Maintenance	24.38
Total Cost/Hr.	$28.94

Thus, Dade County's cost of operating the Bell 47G-2 does not appear to be grossly inconsistent with the costs of operating more modern reciprocating engined helicopters. Therefore, it is reasonable to use the "Super Courier" and 47G-2 data for at least "order of magnitude" comparisons between STOL and helicopter operating costs in a police environment.

CHAPTER VII COST/EFFECTIVENESS CONSIDERATIONS

1. Conceptual Discussion

In performing a comparative cost/effectiveness analysis of police patrol vehicles, the objective is to choose the combination of patrol vehicles which will maximize the utility (i.e. the deterrent effect, enforcement capabilities, or other performance measures) of the patrol fleet for various levels of expenditures. In other words, cost effectiveness analysis can be used to choose a mix of vehicles so that a law enforcement agency "gets the most for its money".

Comparison of alternative candidate police vehicles is difficult because not only do the costs of owning and operating the vehicles vary widely, but also so do the capabilities of these vehicles. Ground vehicles and various aircraft types vary both with respect to the types of activities which they can perform and their relative effectiveness in performing those capabilities which they hold in common.

A. Cost and Performance Differences of Police Vehicles

Law enforcement aircraft are much more expensive to operate than ground patrol cars. The cost of having one patrol car with a two man crew on the street 24 hrs. per day, 365 days per year is roughly $100,000. To provide identical coverage with a helicopter costs more than $414,000 with the least expensive piston engined helicopter, from $659,000 to $770,000 with a five seat gas turbine helicopter and as much as $1,225,000 with a seven seat gas turbine helicopter. It is relatively easy to ascertain that the helicopter coverage costs four to eight times as much as the squad car to own and operate; to determine whether the helicopter is four to eight times as effective as extremely difficult because the two vehicles do different things and complement each other. It is nearly always the ground unit, for instance, which makes the actual arrests even if the suspect was located by the helicopter, because often the air vehicle can't land at the scene. On the other hand, the helicopter performs rescues where the ground units can't go and makes

observations of areas which the ground units can't see from the road (e.g. rooftops, backyards, fenced-in areas, etc.).

Cost/effectiveness comparisons between classes of aircraft (i.e. conventional fixed wing, STOL, piston-engined helicopters, and turbine engined helicopters), are not as difficult as comparisons between aircraft and ground vehicles, and are generally categorized with increasing costs for increasing capabilities between classes.

A conventional fixed wing aircraft (e.g. Cessna 182) represents the least expensive class of police aircraft. This type serves as an aerial platform for various patrol activities, but it is predominantly used for traffic patrols. Its limitations are that it usually must land at an airport, and begins to compromise safety at speeds much below 80 MPH at low altitudes.[1]

The various STOL (Short Take-Off and Landing) aircraft, as typified by the Helio "Super Courier" are considerably more expensive to buy and somewhat more expensive to operate than conventional fixed wing aircraft, due to their more complex designs and greater horsepower. The advantages of the STOL over conventional light aircraft are the ability to fly safely at speeds as low as 40 MPH and to operate from unimproved areas as short as 600 feet in length.

Piston engined helicopters have acquisition costs comparable to certain STOLs. However, the direct operating cost of the helicopters are from 14 to 78% greater than those of the STOL. While the STOL has much more speed and endurance than piston engined helicopters, the helicopter can legally operate at lower altitudes, can hover, and can land, without undue risk, in areas whose dimensions are only slightly larger than the rotor diameter.[2]

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[1]There are at least two companies, however, that make STOL modifications to fixed wing aircraft.

[2]Rotor diameters of light helicopters rarely exceed 40 feet.

Turbine powered helicopters are the most expensive and perhaps the most effective police air vehicles. Their initial acquisition and direct operating costs are roughly double those of the piston engined helicopters. The top speeds of these helicopters are comparable to those of the STOL, although their maximum endurances are less than half of the "Super Courier". Turbine helicopter endurances are generally more than those of piston engined helicopters. Payloads of the turbine engined helicopters are greater than the piston engined rotorcraft, but this capability is degraded much more rapidly by the effects of temperature and altitude.

B. Trade-off Considerations

Since the resources of any law enforcement agency are limited, trade-off considerations within the constraint of a fixed budget must be made. That is to say, given $X for patrol operations, many factors must be considered to arrive at and choose from alternative mixes of vehicles. One of the most important set of parameters is the existing budget and the existing vehicle fleet and associated personnel. The relevant questions are: (1) what are the present capabilities? (2) what are the voids to be filled and the capabilities to be extended? and (3) what are the alternatives within the funds obtainable? Some vehicle types may be included or excluded on consideration of the following variables:

1. type of jurisdiction (state, county, local)
2. geographical area of jurisdiction
3. population size and density
4. topography
5. predominant weather patterns
6. predominant types of patrol activities (highway, urban, rural, etc.)
7. temperature and altitudes encountered
8. types of services provided (e.g. medical evacuation, search and rescue, pollution control, etc.)

A few examples may help to illustrate the unique applicabilities of some vehicles. If a state police organization emphasizes speed checks on limited access highways where the clocking is done by aircraft and the arrests are made by ground units, then conventional fixed wing aircraft are adequate for the patrol function. A municipality with a high population density and a limited jurisdictional area may only be able to justify a piston engined helicopter, whereas a county sheriff's office with a large geographic area of responsibility may require the additional speed of a turbine helicopter to quickly reach outlying areas. Agencies which wish to have a medical evacuation capability will probably choose a turbine helicopter so that the patient and attendant can ride inside the helicopter, rather than having the patient ride on an external litter, as is necessary with most piston engined helicopters. Police agencies in locations which have high altitude and temperature combinations may choose supercharged reciprocating engined helicopters over turbines because of their superior high altitude performance characteristics. Police departments in locales which experience low ceilings and poor visibility a great proportion of the time may choose helicopters over fixed wing aircraft due to the lower sensitivity of helicopters to these conditions.

C. Marginal or Incremental Analysis

In using marginal or incremental analysis, the investigation considers the relationships of marginal cost and marginal utility when adding alternative candidate vehicles to the existing fleet. The question may take the following form: given the present fleet of ground vehicles and budgetary constraints, would the total effectiveness be best enhanced by adding eight patrol cars, two piston engined helicopters, one helicopter and one STOL, two STOL's, or one turbine powered helicopter?

In the ideal case, the utility of the fleet is maximized, at any given budget level, when the composition of an additional equal expenditure for any type of vehicle would produce an increase in effectiveness which is the same no matter which vehicle was chosen. This is difficult to achieve in reality because:

(1) the vehicles are "lumpy" in the economic sense, i.e. the vehicles are indivisible and represent large incremental annual expenditures for each additional vehicle.

(2) effectiveness is difficult to measure and nearly impossible to express in the same terms because the vehicles perform different tasks.

(3) the increase in effectiveness decreases with each additional vehicle of the same type (i.e. the number of apprehensions attributable to each helicopter will eventually decrease as the number of helicopters increase beyond some point.

(4) increases in one type of vehicle will change the utility (effectiveness) of the other vehicles because alternative vehicle types are often complementary. One additional helicopter will mean that the existing ground units will make more apprehensions, since the helicopter can direct them to activities which they do not or cannot otherwise see. This type of comparative effort can be so effective as to lead to frustration, as has been experienced by the Illinois State Toll Highway Authority. Since using aircraft to perform speed checks, the violators discovered number about twice as many as can be apprehended by the available ground units.

The relevance of marginal or incremental analysis will be discussed by examining the relationships of marginal cost to marginal utility in four situations:

1) for the first vehicle of a given class; e.g. the first helicopter.

The first (and predominant) vehicles in a law enforcement agency must be patrol cars, since the <u>first</u> patrol cars represent both the smallest incremental cost for adding a police vehicle and at the same time the greatest increases in effectiveness. The first vehicle cannot be a helicopter (or other aircraft type) because the helicopter depends on the ground units to make the actual arrests. As more and more ground units are added, eventually

the incremental effectiveness of each added unit becomes less and less until at some point more effectiveness could be obtained, for equal expenditures, with an air vehicle. Usually, the most cost/effective initial air vehicle will be a helicopter because it is much more versatile than other air vehicles and therefore represents the greatest additional capabilities. For activities of a limited scope, where the ability to land during patrol missions is unimportant (e.g. patrol of highways), fixed wing aircraft would be a more cost effective vehicle than a helicopter.

2) adding the nth vehicle of a given class, e.g. adding a helicopter to a fleet of n-1 helicopters.

As in the case of ground vehicles, as more and more vehicles are added, at first the added effectiveness per vehicle may increase as a deterrent force level is reached, but eventually the benefits derived from each additional vehicle become smaller and smaller. In the meantime, the addition of helicopters may increase the effectiveness of the patrol cars such that after a certain number of helicopters have been introduced, more effectiveness can be obtained by adding either more cars or other specialized aircraft types.

3) the first vehicle of an additional class, e.g. a STOL added to a helicopter fleet.

Helicopters, particularly the turbine powered ones, are expensive aerial platforms, but are often justifiable because of their unique capabilities. Usually the first vehicles of a law enforcement aviation unit are helicopters in order that those contingencies which require hovering, slow flight and vertical flight (rescues, air evacuation, ground checks of inaccessible areas) may be adequately covered. As more and more helicopters are added to provide a wide variety of services and patrol activities, an increasing number of patrol hours will be those in which off airport landings will rarely be required (e.g. lighted patrols, traffic surveillance, rooftop surveillance, etc.). At some level of these activities, a fixed wing aircraft (conventional or STOL) could be justified for full time use, at a cost less than that of an additional helicopter, thus enabling both types of aircraft to specialize in missions for which they are uniquely or best suited.

4) for the nth vehicle of an additional class, e.g. a second STOL added to a fleet of one STOL and helicopter.

Except for special situations, it is likely that the marginal utility derived from each additional STOL added to a helicopter fleet would diminish rapidly. Probably there is an optimal range of ratios between fixed and rotary wing aircraft for each jurisdiction. These conditions arise because the types of activities for which the STOL is best suited are limited in number and because any increases in discoveries by STOL aircraft mean that additional hours must be spent by either the helicopter or a ground unit in order to investigate the situation on the ground.

2. Application of Cost/Effectiveness Concepts to Dade County Data

A. Cost/Effectiveness Measures to be Used

Certain cost and cost/effectiveness measures may be used to compare alternative vehicles with respect to the cost per time unit of providing patrol coverage, the cost per capita of the coverage, the average cost incurred for various types of achievements (apprehensions or significant discoveries) and the ratios of costs of alternative vehicles. Specifically, those measures which may be extracted from existing data include the following:

1. Direct operating cost/hour of flight
2. Total cost/hour of flight
3. Direct operating cost/discovery
4. Direct operating cost/apprehension
5. Direct and total operating costs per capita
6. Total annual cost of aircraft/total annual cost of ground unit
7. Comparable number of ground units to equal the cost of one aircraft.

Although these measures are admittedly gross indicators, they can be used to indicate relative costs for providing services with various vehicles.

B. Determination of the Values of the Cost/Effectiveness Measures for Dade County

1. Direct Operating Cost/Hour of Flight

As was derived in Chapter 6, the direct operating costs for the helicopter and STOL were $18.84 and $10.20 per hour respectively. This included gas, oil, maintenance parts and labor and reserves for life-limited components.

2. Total Cost/Hour of Flight

The total cost per hour of flight, as derived in Chapter 6, was $25.34 per hour for the helicopter and $17.17 per hour for the STOL. These costs consisted of direct operating costs plus accident repair costs for the helicopter and insurance for the STOL. These figures do not include depreciation (insufficient data is available) nor do they include pilot salaries. During the test period, there were two helicopter pilots and three STOL pilots. The two helicopter pilots and one of the STOL pilots earn $11,000 annually while the remaining two STOL pilots earn $9,000. Added to these salaries are 21 percent in fringe benefits, bringing total salaries to $13,310 and $10,890 respectively. The pilot salaries, therefore, represented costs of $2,556 for the helicopter and $3,369 for the STOL during the five week period, or $34.23 and $26.77 per hour. Adding the pilot's salaries to the direct operating costs and fixed costs yield total costs incurred of $4,448 for the helicopter and $5,507 for the STOL, or $59.57 per hour and $43.76 per hour, respectively. Observer salaries are excluded for this purpose since they were volunteers on station duty or off duty at the time, or an on duty pilot.

3. Operating Cost per Discovery

Direct and total operating costs (including pilot salaries) per significant discovery were derived for each aircraft. If significant discoveries are defined to exclude those events in which the aircraft were called for, the helicopter made approximately 48 significant discoveries and the STOL made 32. Direct operating costs per discovery were $29.31 for the helicopter

and $40.11 for the STOL. Total costs per discovery were $92.67 and $172.09 respectively. Direct and total costs per vehicle recovered amounted to $156.30 and $494.23 for the helicopter and $160.44 and $688.36 for the STOL.

4. Operating Cost per Apprehension

If the numbers of apprehensions assisted or made by the aircraft are used as measures of effectiveness, then comparisons of relative efficiencies can be made by dividing the operating costs by the number of arrests to obtain an average cost per arrest. Based on 24 arrests assisted by the helicopter and 8 assisted by the STOL, the direct operating costs per arrest were $58.61 for the helicopter and $160.44 for the STOL, while the total costs per arrest assist were $185.34 and $688.36 respectively.

5. Direct and Total Annual Operating Costs per Capita

The total population for Dade County, according to the 1970 Census Bureau figures, is 1,259,184. Subtracting the three major incorporated areas of Miami, Hialeah and Coral Gables leaves 783,733 in unincorporated Dade County, which is the jurisdiction of the DCPSD.

Based upon 374 hours per year annual utilization, the annual direct operating cost of the helicopter (excluding accident repair costs) was $7,046. Total cost, including pilots was $36,097 per year.

During the first two months of operation, the STOL averaged 98 hours per month, which extrapolates to 1,176 hours per year. Based on this utilization rate, the annual direct operating cost is approximately $12,000. The total annual operating cost (direct operating cost plus insurance plus pilot's salaries) is projected to be about $55,400. Note that although the total STOL cost is 50 percent greater than that of the helicopter, the number of flying hours for the STOL is more than three times as great.

6. Total Annual Cost of Aircraft/Total Annual Cost of Ground Unit

Total cost of the helicopter operation, at an annual utilization of 374 hours per year is approximately $36,100 per year, while total STOL cost of

flying 1,176 hours is projected to be about $55,400 per year. The cost for a two man ground unit to provide patrol coverage 24 hours a day, 365 days a year is estimated to be about $100,000, as stated above.

Annual costs of the helicopter, STOL and ground unit are not comparable in the above forms, because the annual utilizations are all different. To remedy this, helicopter and STOL costs will be extrapolated to patrols covering 24 hours per day, 365 days per year. The assumptions which are used are:

a. Maximum annual aircraft utilization is 1,200 hours
b. Flight crews consist of two pilots
c. Pilots fly 4 hours per 8 hour shift and fly no more than 20 hours per week
d. Pilots work an average of 220 days per year considering vacation, sick leave, holidays, etc.
e. Additional pilots are hired at an average salary of $10,890 per annum.

Based on these assumptions, 8 aircraft and 20 pilots are required to provide 8,760 flying hours. To achieve these levels, either 18 additional helicopter pilots or 17 additional STOL pilots would be needed.

The total cost of providing aerial patrols for 8,760 flying hours per year would be $444,600 with helicopters and $372,600 with a fleet of STOLs as compared with $100,000 annually for continuous coverage with a two man patrol car. A breakdown of the aircraft cost estimates is shown in Table 7-1. These cost estimates must be treated as minimum values because no hull insurance is carried on the helicopter and depreciation expense is not considered for either aircraft (the helicopter is over 10 years old and is completely depreciated, while accurate depreciation data is not available for the "Super Courier"). It should also be noted that no attempt has been made to consider differences in area covered by air and ground units, in this gross analysis.

7. Comparable Numbers of Ground Units to Equal the Cost of One Aircraft

Based on the data presented in Section 6 above, helicopter patrol

Table 7-1

Total Aircraft Fleet Costs at 8,760 Hours/Year

	Helicopter	STOL
Direct Operating Costs 8,760 Hours	*	$ 89,352
Fixed Annual Costs 8 Aircraft	*	64,000
Total Annual Aircraft Operating Costs	$221,978*	$153,352
Current Expenditures for Pilots	26,620	$ 35,090
Annual Cost of Additional Pilots at $10,890 each	196,020	185,130
Total Aircraft Fleet Costs (annual basis)	$444,618	$372,572

* The average total helicopter operating cost (excluding crew) of $25.34/Hr., which was experienced between January 1964 and July 1970, is used to derive the total annual aircraft operating expense.

coverage costs at least as much as 4.4 patrol cars and STOL coverage costs more than 3.7 patrol cars. Total cost of the STOL coverage is approximately 84% as expensive as helicopter coverage for equal times aloft.

C. Discussion of Results

During the test period, the STOL demonstrated that it was a useful and effective addition to the Dade County's law enforcement capability, particularly during the civil disturbances. Enthusiasm of DCPSD administrators, the officer in charge of the Aviation Section and the pilots, as well as the public, indicates that the STOL has been regarded favorably.

According to Dade County experience, the direct operating cost per hour of the STOL is about 54% of the helicopter, while total cost per hour of the STOL including crew costs, is about 78 percent that of the helicopter. These figures are based upon the realized utilization rates of 374 and 1,176 hours per year for the helicopter and STOL, respectively. Based on equal utilization rates, the STOL may cost 84 percent as much as the helicopter.

For comparative purposes during the test, the helicopter was operated on a scheduled patrol basis more extensively than ever before in its 10 year history. Although the helicopter flew only 59% as many hours as the STOL during the tests, due to a crew shortage, the accomplishments of the helicopters exceeded those of the STOL in terms of significant discoveries, number of arrests assisted, and number of stolen and/or abandoned vehicles recovered. In spite of the higher cost per hour of the helicopter, the average cost for each of these achievements was less for the helicopter because of an apparent greater productivity per hour. The ratios of helicopter to STOL total cost per arrest, significant discovery or vehicle recovery, were 54 percent, 23 percent, and 72 percent respectively.

Thus, the implication is that the STOL is a less expensive aerial platform in terms of the hourly cost, but, in terms of actual accomplishments, the helicopter appears to provide more results per dollar spent. However,

in spite of these indications, these must not be considered to be conclusive results for three reasons:

1) The very short test period (5 weeks) provides an insufficient sample size, particularly in view of the fact that the overall evaluation program is 12 months long;

2) There may in fact be a bias in the program in that the areas patrolled by the STOL tended to be more in rural and wilderness areas than the helicopter because the STOL could more efficiently reach and patrol these areas; and

3) A further bias may be built into the program because of crew experience. All pilots were both experienced policemen and well qualified pilots. However, the two helicopter pilots have each been flying the helicopter for DCPSD for the past ten years. The STOL pilots, although all were experienced patrolmen and qualified pilots, have only flown as police pilots (and have only flown this particular type of aircraft) since the beginning of the STOL program.

Because the STOL has achieved positive results but its cost/effectiveness relative to the helicopter is questionable and has not been sufficiently verified, it is suggested that STOL law enforcement aircraft be evaluated over a longer period of time and in several jurisdictions to provide a larger data base. Tests with many flight crews and with varying terrain, climate, demographic characteristics and with several types of law enforcement agencies would help prevent errors due to unintentional biases and an insufficient sample size.

CHAPTER VIII CONSIDERATIONS FOR POLICE AIRCRAFT UTILIZATION

1. Introduction

We will first discuss how the effectiveness of a police department can be enhanced by appropriate use of aerial platforms, then discuss factors to be considered in choosing the aircraft, and finally, define guidelines for evaluating the merits of applications for assistance in the procurement of aircraft by police departments. The guidelines will follow from the effectiveness and selection discussions, referred to above.

2. Aerial Platforms and Police Effectiveness

A basic question which must be given a positive answer if a police department is to be provided with aircraft, is, "Can the police department be made more effective by the addition of appropriate aircraft?" Accordingly, this question is now addressed.

An aircraft may be used by a police department in essentially two operating modes - as an observation platform or as a delivery vehicle. All activities, other than training, may be subsumed under one or the other. The observation platform functions are discussed first.

Included within the scope of the observation platform mode are several tasks which an aircraft can perform with equal or greater effectiveness than one or perhaps several ground units.

Traffic observation is one such task. One slow-flying aircraft at low altitude has considerably greater capability than several patrol cars in noting conditions on freeways or other arterials. Accidents, stranded motorists, critical densities, speeders and reckless drivers, and traffic jams are examples of events which the aircraft can note, and cause appropriate ground unit action to be taken. In any police jurisdiction which has high density rush hour traffic conditions, aerial observation may well be the most effective and economical way of minimizing risks of accidents and maximizing the level of assistance to motorists or accident victims in need of assistance.

An aircraft can also be effective and economical in several of the circumstances best served by surveillance patrol. For example, when there are fairly extensive recreation areas such as parks, beaches, or boating areas, aerial patrol again appears to be the best way to perform this necessary police service. Another type of surveillance patrol which a low-flying, slow speed aircraft is well suited to is over industrial, commercial, and school buildings, and residential areas. In particular, rooftops and ground facilities prone to illegal entry require surveillance during times when they are unoccupied. During "prime" night-time hours, the use of lights to illuminate such areas, or dark residential areas which are frequented by prowlers and intruders, not only may serve as a deterrent to such activities, but also have been found to provide greater assurance to the commercial interests and the homeowners.

If there are large gatherings, either outdoor or indoor, a police aircraft can serve most effectively as a command and control platform to coordinate the activities of the police ground force. A jurisdiction in which there are events which draw large crowds would benefit by the use of an aircraft not only for command and control, but also to maintain surveillance over parking areas and the general vicinity after the event, until the area has been cleared of non-residents. The command and control function of an aircraft is also very effective during a civil disturbance, as the Dade County experience in the summer of 1970 proved.

Another example of the use of an aircraft as an observation platform, in a way that ground units could not even approach an aircraft in effectiveness, is in the detection of water pollution and large scale air pollution. Effectiveness of aircraft for this purpose was underscored by the enthusiasm of a pollution control agent, as noted above (cf. p.36).

As a final example of the police aircraft's utility as an observation platform, the search and/or pursuit function may be used. The coverage of large areas in short time frames for lost persons, vehicles suspected of being involved in crimes, or the pursuit of fugitive persons or vehicles can all be effectively handled by an aircraft. Once a subject is located, the

vectoring in of ground personnel, to intercept or recover, can frequently best be done from the air.

Much of the effectiveness of a police aircraft is in its observation platform capabilities, as discussed to some extent above. However, the police aircraft may also have important, though less frequent, need as a delivery platform. One example is the dissemination of tear gas to disperse crowds that cannot otherwise be controlled. Another is to "deliver" illumination at the scene of an accident, fire, night-time search, or of a particular location for any of a number of police and public safety purposes. Yet another would be to transport specialists (i.e. crime laboratory personnel) to remote or relatively inaccessible locations. Transportation of prisoners may also be more cost/effective by police aircraft than by ground vehicles.

The foregoing discussion is intended to provide a framework within which a police department may attempt to determine if its effectiveness level can be improved by the introduction of aircraft into its patrol operations, or by the addition of aircraft to an existing air arm. Each example given illustrates how a police aircraft can be used effectively, in response to a particular need. If it can be shown that these needs are present within the jurisdiction, so that on an aggregate basis or a sufficiently recurrent basis, intensive use of an aircraft would be made for routine and special assignments, then a case can be made for leasing, sharing, or procuring aircraft. While it would also be desirable to show that an aircraft would be cost/effective as well, this is of lesser importance than improved effectiveness of the police department.

3. Choice of Aircraft

The choice of appropriate aircraft for the particular department's needs is an important decision which should be well founded. One department may accomplish its objectives with helicopters only; another may require a mix of rotor and fixed wing aircraft; or, fixed wing only may meet the requirements.

One may consider the decision process as consisting of a three dimensional problem. Three data factors are to be evaluated. Once this has been accomplished, the documentation exists to support the aircraft choice. One factor is concerned with mission requirements; a second consists of parameters of the environment; the third is comprised of the operational characteristics of aircraft. These aspects of the decision process are now explained further.

The mission requirements must be clearly understood and stated. In order to make the most current decisions regarding the makeup of the patrol fleet of a police department, the policies, objectives, and missions to be performed are considered. Only by knowing what has to be done by way of patrol and response is it possible to determine how best to make up the patrol fleet. That is, the needs of a given department may be best served by an all automobile fleet, or an aircraft in addition to cars, or several aircraft of one or different classes as well as cars, etc. Putting it another way, the appropriate patrol and response vehicle fleet composition is closely related to the force structure required to satisfy the policies-objectives-mission configuration. Thus, the evaluation of the first factor will lead to an indication as to how many aircraft, if any, are required, and what appears to be the best combination of helicopters, STOLs or other fixed wing craft.

As indicated above, the second decision factor is comprised of the data on the parameters of the environment. These include the terrain features, altitude and temperature ranges, annual weather profile, and any other physical aspects of the jurisdiction's locale which may serve as constraints or demands upon the performance of an aircraft in police use. In essence, these parameters, together with the performance capabilities necessary to meet the mission requirements, comprise a set of specifications for the candidate aircraft.

Finally, the third factor serves to permit evaluation of each candidate aircraft against the specifications for the given department's requirements. In order to do this, the salient performance characteristics of the

various aircraft are assembled so the field can be narrowed before the final decision criteria are applied. To illustrate this assembly of comparative data, an example is given for five helicopters which may be suitable for police operations. The list is not intended to be exhaustive; it is only intended for illustrative purposes. All of the data given have been obtained directly or inferentially from manufacturer's literature.

Several definitions are given first, so the tables may be understood more readily:

Empty Weight - Weight of aircraft without cargo, crew, passengers, fuel or optional equipment.

HIGE - Hover In Ground Effect. HIGE ceiling is the maximum pressure altitude at which the helicopter can hover in close proximity to the ground (i.e. a 2.5 foot skid height).

HOGE - Hover Out of Ground Effect. HOGE ceiling is the maximum pressure altitude at which the helicopter can hover more than one rotor diameter (e.g. 40 ft.) from the ground.

Payload - Used here to mean useful load less pilot, observer and 2.5 hours of fuel.

Standard Day - International Civil Aviation Organization Standard Atmosphere as derived from year round soundings of pressure, height and temperature. At sea level, the average temperature is 59°F (15°C), and the average barometric pressure is 29.92 inches of Mercury.

Useful Load - Gross Weight less Empty Weight.

Table 8-1 shows the performance and cost parameters of an illustrative group of helicopters, to facilitate a preliminary screening of candidates. For instance, if a cruise speed in excess of 100 mph is required, one of the five is eliminated (the Bell 47G-3B-2). On the other hand, if it may be necessary to hover out of ground effect at gross weight, at high altitudes on a hot day

(95° F at sea level), only the Bell 47G-3B-2 and the Fairchild-Hiller 1100, of the five listed, have such capability. The general data in Table 8-1 may be supplemented by a special purpose table, such as Table 8-2, which goes more intensively into the useful load-altitude relationships. This would be helpful if the jurisdiction is in a mountainous region, for example.

4. The General Guidelines

The foregoing sections of this chapter have provided the background for preparing the preliminary guidelines which LEAA may use to assist in judging the merits of applications for funding assistance for the acquisition and use of aircraft for police service. Accordingly, the guidelines may now be proposed. Two basic guideline sets, with subdivisions, are recommended. One is concerned with the planning which should be done by the applicant; the other set indicates rules of thumb which serve to determine the appropriate aircraft for a given jurisdiction.

A. The grant application should be supplemented by a planning study which has encompassed, as a minimum, four tasks.

1. Present and projected (say, for a 5-year period) patrol and unscheduled mission requirements have been developed and documented. These requirements are to be independent of vehicular type, placing emphasis on the needs rather than the means. Once the needs have been established, a case must be made supporting the use of aircraft to fill a sufficient portion of the needs. Additionally, the classes of aircraft and quantities of each class to be used should be stated, along with supportive data or arguments justifying the statements.

2. The environmental parameters of the area have been assembled and documented. Thus, the region in which the aircraft are to operate is described.

TABLE 8-1

Helicopter Performance Data

Aircraft Type	Bell 47G-3B-2	Bell 206A Jet Ranger	Fairchild-Hiller 1100	Hughes 500	Vought Alouette II
Engine Type	Supercharged Reciprocating	Turbine	Turbine	Turbine	Turbine
Cruise Speed at Gross Wt.	88	122	133	138	103
Useful Load (Gross Wt. less Empty Wt.)	1,084	1,585	1,335	1,464	1,660
Payload (Useful Load Less Pilot, Observer, & 2.5 Hours Fuel)	459	960	757	844	832
HOGE Ceiling at G. Wt. Std. Day	12,330	3,500	8,400	5,300	8,000
HOGE Ceiling at G. Wt. Std. Day + 20°C	10,000	Impossible	2,500	Sea Level	500
Maximum Take-off Altitude @ G.Wt. (HIGE Ceiling) Std. Day	16,600	9,100	13,000	8,200	*
Maximum Take-off Altitude @ G.Wt. (HIGE Ceiling) Std. Day + 20°C	15,600	3,800	8,000	3,400	3,000
Basic Price, January 1970	$55,950	$105,000	$98,000	$95,000	$118,500
Cost per hr. @ 1,000 hrs./yr.					
Direct	$20.83	$35.09	$38.71	$25.25	$42.01
Fixed	16.23	30.45	27.72	27.25	34.37
Total	$37.06	$65.54	$66.43	$52.50	$76.38

*Data Not Available

TABLE 8-2

Helicopter Performance Useful Load vs. Altitude

5,000 Ft. Pressure Altitude Standard Day + 20°C (77°F @ 5000')	Bell 47G-3B-2	Bell 206A Jet Ranger	Fairchild-Hiller 1100	Hughes 500	Vought Alouette II
To Hover Out of Ground Effect					
Useful Load	1084	885	985	1004	1210
Payload	459	260	387	384	382
To Take-Off (HIGE)					
Useful Load	1084	1185	1335	1145	1410
Payload	459	560	737	525	582
9,000 Ft. Pressure Altitude Standard Day (28°F @ 9000')					
To Hover Out of Ground Effect					
Useful Load	1084	1135	1225	1244	*
Payload	459	510	627	624	*
To Take-Off (HIGE)					
Useful Load	1084	1585	1335	1404	*
Payload	459	960	757	784	*

*Data Not Available

3. A comparative analysis of the candidate aircraft for acquisition has been made. Operational characteristics of the aircraft have been evaluated in the context of the service requirements and the environmental parameters. On the basis of the analysis, specific aircraft have been decided upon, or a clear set of specifications, against which vendors may bid in response to a request for procurement, is given.

4. A sound budget must be presented for at least the acquisition and training period, and one or two years of operation of the air arm. The budget should indicate funding sources, and be sufficiently detailed regarding costs of personnel, equipment, operations, tie-down or hangar, training, maintenance, etc.

B. The second basic guideline set is for the judgement by LEAA regarding the appropriateness of the aircraft selected by the applicant department or agency. Largely on the basis of the test operations in Dade County during June and July, 1970, involving a helicopter and a STOL, certain guidelines are relatively clear cut.

1. If the applicant is a city or county police department, the first aircraft to be integrated into patrol operations will in most cases be a helicopter. A second or third craft may be a STOL, depending on the service requirements.

2. If the applicant is a department at the state level, or a political subdivision or group of subdivisions such as a county or planning region, the service requirements may be such that a STOL is preferable as the first aircraft.

3. If a department already operates an air section, additional aircraft could be of either or both classes, depending upon the service needs.

4. In general, most of the performance capabilities of a STOL can be duplicated or exceeded by the appropriate helicopter. But such a helicopter is most likely more expensive than a STOL, both to acquire and to operate.

5. Certain service requirements can best be served by a helicopter; others can best be handled by a STOL. In evaluating an application for funding, these requirements should be present in support of the particular aircraft being sought. They are singled out in the following listings.

a) Requirements best or uniquely met by the helicopter:

- There is a need for occasional or frequent off-airport landings.
- The need for hovering, such as for rescue or evacuation, low altitude illumination, or crowd control, is likely to be present.
- The jurisdiction is compact in area.
- There is a foreseeable need for use of the vehicle as a delivery platform.
- Low altitude search or pursuit over density populated or structured areas is sometimes required.
- Low altitude photography, particularly in support of criminal or accident investigations, is required.
- All anticipated patrols and other missions are of short duration, such as not longer than two hours.

b) Requirements best or uniquely met by the STOL:

- Some anticipated patrols or missions are of long duration, such as in excess of two hours.
- The required payload is sometimes large in terms of personnel and/or equipment.
- The area to be patrolled or otherwise served is large, requiring a flight of eight to ten miles or more to arrive on station.
- No off-airport landings are anticipated.

If an application is reviewed with these guidelines in mind, the evaluation process can be made partially objective, and thereby less difficult and time consuming.

CHAPTER IX RECOMMENDATIONS FOR FURTHER RESEARCH

The study performed by CAL, as consultant to NILECJ, in evaluating the STOL in Dade County, Florida, and the subject of this report, may be regarded as one part of the investigation of the Institute into the STOL as a vehicle for Police Air Mobility. The program under the Dade County grant is another. This chapter is concerned with means for attempting to maximize the retrieval of relevant information from the STOL investigative effort in Dade County, and recommending subjects for investigation and development in further support of general Police Air Mobility study.

1. Additional Technical Support to Dade County

It is likely that a greater amount of useful information can be obtained from the DCPSD grant program if additional technical support is provided to the STOL Project Supervisor, than would otherwise be the case. Specifically, it is believed their evaluation can be made more meaningful in at least two ways - one related to performance in specific missions or incidents, the other in regard to more reliable and meaningful elements of cost/effectiveness data.

While the intensive test period recently concluded was useful in providing data on police air mobility, for preliminary guidelines purposes, the "sharpness" of the evaluation is limited by the minimum altitude constraint under which the STOL has operated, and the small samples of certain incident types which occurred in the normal course of events. To overcome these deficiencies, a form of parametric analysis could be incorporated into the DCPSD study.

Two parametric classifications would be used in interaction with each other, and in independent analysis. One is variation of flight profiles with regard to altitude and speed; the other is controlled incidence of certain "complaints" and service missions.

A scenario approach would be used to provide the desired conditions for the data gatherings. Details of the "incidents" and service missions would be prepared and put into a script. Various flight profiles would be specified

and used not only for the flights made in accordance with the script, but for other missions as well. In this way, effectiveness data can be generated for particular activities, and preferred flight profiles be noted for particular operations.

The scenario would be developed in collaboration with DCPSD and with the aid of such documentary material as Appendix B, TRAINING PROBLEMS in the Los Angeles County Sheriff's Department MANUAL OF AERIAL PATROL. Events would not occur only in a short time frame, such as three or four weeks, but spaced throughout the remaining grant performance period.

As the second direct enhancement of the Dade County evaluation, a set of particular missions would be flown for specific purposes of gathering cost/effectiveness data. For example, an apparent usefulness of the STOL could be in prisoner transport. But, firm data on the cost effectiveness are lacking. In this same context, the cost comparisons which result from the present project are for two aircraft which are not very comparable in performance (i.e. endurance, speed, payload, etc.). It would be more meaningful to compare the STOL directly with a high performance helicopter Jet which is much closer to the Helio Super Courier capabilities than is the 10 year old Bell 47G-2 now in service in Dade County. If such a craft were to be obtained by Dade County, CAL would wish to update the findings of its current study.

The Dade County STOL project can benefit from a continuing review of its data collection, reduction, and analysis. CAL can provide this review in an objective manner on behalf of the Institute. For example, it is believed that additional useful data, which more closely relate the operations of the Air Section to the ground operations of the DCPSD, can be developed by closer liaison with the Data Processing Section. This will facilitate more meaningful evaluation procedures and lead to more informative reporting to the Institute on a periodic basis.

2. Standardized Evaluation Procedures

A second study which should contribute to positive results of the

NILECJ investigation of police air mobility is concerned with standardized evaluation procedures. A start on this has been made in Dade County. And, of course, other jurisdictions using aircraft have maintained records for their own purposes. But, in order to make comparisons among jurisdictions and to compile data for use at the national level, standard data should be collected and standard evaluation procedures used for all police aerial operations of jurisdictions within a given class, such as city, county, or state.

Before indicating how the standard evaluation procedures may be developed, it would be beneficial to digress momentarily and discuss a few of the problems, pitfalls, and other considerations in the evaluation of police air mobility programs.

It is our experience that the evaluation measures which have been used have a built-in positive bias towards the use of aircraft. A case in point is the frequent use of the cost of helicopter patrol per square mile, or per mile of street patrolled, compared to the same coverage by automobile patrol. But overlooked is the face that such analysis fails to relate the expenditure to effectiveness. How many suspicious events or scenes are noted and investigated by ground officers, and related to cost and coverage, compared to the similar accomplishments by airborne officers?

On the other hand, there has been a dearth of evaluation measures that would permit certain advantages of aircraft to assert themselves fairly. For example, speed of response to the scene of some events requiring police action can be a principal superiority of an aircraft. If adequate communications exist, and logs or other records indicate the location of a vehicle (air or ground) with respect to the scene of the incident when it is reported, and details of the outcome can be specifically related to the response action, more meaningful evaluation of effectiveness as a function of response time can be made.

But the above discussion has been presumptuous in that it has alluded to specific components of evaluation of air mobility, before a general base has been developed. For the present purpose of providing background for the discussion below on a program for developing standardized evaluation procedures, a conceptual basis may be more appropriate. First, it should again be noted that an aircraft in police service is a unit in the patrol vehicle fleet. Consequently, detail on its operations should be as complete as it is for a patrol car. Furthermore, evaluation for all vehicles, including the aircraft, should be in terms of not only effectiveness and costs, but also ineffectiveness. What does the vehicle fail to accomplish of the direct or implicit demands upon it? What is the relationship between time-space deployment of the patrol vehicle and the incidence pattern of those crimes which can be detected by observation from the vehicle? The same relationship is important in the context of other crimes which are reportable to the police and whose solution prognosis is dependent upon quickness of reaction.

Obviously, since the scope of the present study and the Phase II studies is essentially restricted to police air mobility, the evaluation standard to be developed would be geared to the use of aircraft. However, there should be a spin off useful to improving the evaluation procedures for ground vehicles as well.

Now, to return to the mainstream of this section, it is proposed that the evaluation standards be developed as part of a two stage study which would have other outputs useful to the overall program in air mobility. The first stage would be a planning study; the second stage would be implementation of the results of the planning study. Output of both stages would include recommendations for the standardized evaluation procedures, a broad-based evaluation of air operations by police jurisdictions, a sharpening of the guidelines for the introduction of air operations into police jurisdictions, and inputs for the third item of proposed effort, development of a planning handbook for the introduction and use of aircraft by police departments. More will be said below about the handbook.

The planning study would address itself to two main tasks. One is concerned with recommendations for standardized evaluation procedures; the second is directed toward a determination of boundary conditions for the use of aircraft in police service. The latter is discussed first.

While the current NILECJ projects at CAL and in Dade County will provide considerable first hand knowledge regarding the use of aircraft in police operations, the sample area is far from typical of the physical features and degree of professionalism to be found in the majority of police jurisdictions. In the interests of the most meaningful guidelines for potentially effective use of aircraft by police, the study sample should consist of representative elements from a sampling frame defined by the broad spectrum of police agencies. Large and small jurisdictions in area and population density, differing terrain conditions, and extremes of weather conditions are examples of variables which interact with the use and effectiveness of police aircraft. Requirements would be drawn up, in the planning study, for the number, types, and physical environments of a set of police jurisdictions which would provide a good sample of police agencies for providing knowledge of police air operations at the extremes as well as in the more typical setting for such operations.

In addition to specifying a more appropriate sample set of agencies for study of police air mobility and fixing of guidelines, the planning study would consider data requirements and procedures for standardized evaluation of police air operations. This, of course, would be an extension of the limited attention to the subject that was possible during the work under the present CAL grant from NILECJ.

As part of the planning study, a number of police agencies which utilize aircraft, would be willing to participate in field testing the standard evaluation procedures, and comprise a sub-set meeting the requirements for the sample as developed during the study, would be selected. Plans for field testing the procedures and a budget for the implementation study would be the final outputs of the planning study.

The implementation of the recommendations of the planning study would serve three principal ends:

- Standardized evaluation procedures would be tested, validated, and revised where necessary.
- A more meaningful, broad-base, objective evaluation of the utility of aircraft in police operations, founded on data collected under uniform controlled conditions, would be made.
- The preliminary guidelines for the introduction of aircraft into a police operation would be validated, supplemented, and amended so as to provide LEAA with better decision rules for action on grant applications concerning the acquisition or use of aircraft by police agencies.

Early in this second stage, an operations evaluation manual would be developed, for use by the participating police departments. This would specify the data they are to collect, and procedures to be used in the data reduction and analysis. Reporting forms would also be given, so there is a standard input for compilation purposes. The data requirements and evaluation procedures which prove to be the most feasible and useful would provide a basis for revision of the manual. In its later version, the manual may be used as the official document for analysis and evaluation of all aerial operations of police agencies.

Another output of the implementation study would be a document containing the more up-to-date guidelines for the introduction of aircraft into police operations. That is, the preliminary guidelines resulting from CAL's current study, when validated and revised as a result of this proposed study, would be firmed up, and used as a basis for a policy for police air operations.

3. Air Mobility Planning Handbook

The outputs of the first and second studies, as indicated above, would provide a sound basis for the development of a planning handbook which police departments could use for the consideration, acquisition, and operation of aircraft as regular service vehicles.

CONTINUED

1 OF 2

This handbook would contain, among other items,

- the guidelines for deciding when the prognosis is favorable for effective use of helicopters and/or STOLs;
- qualifications and training recommendations for pilots and observers;
- on-board equipment recommendations;
- guidance for selection of specific aircraft;
- budgeting considerations;
- recommendations for integration of air operations into departmental operations; and
- evaluation procedures.

APPENDIXES

Appendix A consists of the First Phase Test Manual which was prepared for distribution to the DCPSD personnel, and for the guidance of all concerned with the intensive test operations. The original has been slightly modified to reflect the schedule changes necessitated by the civil disturbance special missions, or crew shortage, and changes made in the Post Flight Evaluation form after the first week of operations.

Appendix B consists of the preliminary evaluation of the first week of operations, and the log of relevant events during the civil disturbance.

APPENDIX A

POLICE AIR MOBILITY EVALUATION
DADE COUNTY PUBLIC SAFETY DEPARTMENT
MIAMI, FLORIDA

FIRST PHASE TEST MANUAL

June 8, 1970

Prepared by: Cornell Aeronautical Laboratory, Consultant to
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PREFACE

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1. INTRODUCTION

The Dade County Public Safety Department (DCPSD) has been awarded a grant by the Law Enforcement Assistance Administration to purchase a Courier type STOL aircraft, hire and train pilots, and provide logistic and administrative support in conducting with the National Institute of Law Enforcement and Criminal Justice (NILECJ) a DCPSD operational testing program to determine the practical aspects of using STOL aircraft in police service.

In the first phase of the program, sufficient intensive testing is required to permit a preliminary analysis and evaluation of the STOL in police service to provide a set of first cut guidelines for STOL operations, along with some measures of cost effectiveness of the STOL aircraft. These findings will be used by NILECJ and DCPSD as a basis for the second phase of the Dade County STOL program.

This manual is concerned primarily with the first phase only, although portions of it will be directly applicable to the second phase as well. It has been prepared as the document governing the implementation by DCPSD of a specific test plan intended to achieve the objectives discussed in the next section. The responsibilities of DCPSD and NILECJ (through its consultant, CAL) are also included.

2. FIRST PHASE OBJECTIVES

The general objective is to provide an operational environment within which meaningful data may be collected for analysis intended to provide a preliminary evaluation of the merits of a STOL aircraft when used as a police air platform. Since there is already considerable experience with the helicopter in the public safety mission, the evaluation of the STOL will make use of helicopter operations for the same missions, as bench marks. This will be facilitated by considering STOL patrol missions as experimental and helicopter patrol missions as control runs. Additionally, and if feasible during this first phase, an attempt will be made to gain initial insights into the merits of combined STOL/helicopter police operations.

More specifically, several objectives, subsumed under the above general objective, may be singled out for the guidance of all personnel participating in the test program.

One immediate objective of the mission set given below is to provide the flight-related data required for the planned analysis of the first phase activity. The data collection, analysis, and evaluation described in this manual are a first cut at a program to identify useful police air mobility systems and determine appropriate cost effectiveness measures. Data generated by the program will contribute towards the development of a more refined methodology for collecting the recommended data on the system, greater awareness of basic data needs, and improved procedures for obtaining these data. Further, the data will also be used to lead to recommendations for measures of effectiveness and other criteria that can be used during an analysis to evaluate and compare police air mobile systems' performances, with particular emphasis on personnel safety, effectiveness, economy of operation, and the ability to interface smoothly with ground operations.

A second objective is to estimate the nature and rigidity of the constraints that may limit the use of the STOL craft. Performance data will permit a limited constraint recognition and guidance for more extensive testing and analysis, to define the design features, elements and dynamic characteristics of STOLs and air police activities which are the significant constraints. Together with enrivonmental factors' interaction with STOL activities, consideration of these factors will not only provide some guidelines for routine police air operations, but will assist in recognition of what the STOL can do, or cannot do effectively and safely. That is, operating limitations or constraints will become more clearly delineated as a result of the first phase flight testing.

Finally, the end result of the first phase cooperative effort by DCPSD and NILECJ (through its consultant, CAL), is to define an initial set of guidelines for evaluating applications for grants to procure STOLs or helicopters for police or other public safety activities. Subsequent analysis, not covered in this manual, but to be performed as evaluation of the full year or 1400 hours of STOL operations, will refine and amplify these guidelines.

It can be seen, therefore, that the personnel participating in this test are pioneering an effort which may have far reaching impact on the effectiveness of American police forces. Consequently, an implicit objective, interwoven with each of the others, is to provide a sound and valid data base in order to allow valid conclusions to be reached.

3. PROGRAM RESPONSIBILITIES

Successful implementation of the intensive test portion of the DCPSD program for evaluating the STOL in police service depends upon both DCPSD and NILECJ (CAL) meeting their respective responsibilities in a conscientious and effective manner. These responsibilities may be stated separately for the two participating agencies. This is not to imply that either agency may consider that its responsibilities are divorced from those of the other. Rather, they are in some cases sequential, in the sense that one agency can not fulfill its responsibilities until the other has met its; in other cases the responsibilities are mutually supportive, in that there is an overlap in time, followed by a merging of responsibilities for successful implementation of a part of the program.

The DCPSD responsibilities are given first.

3.1 DCPSD Responsibilities

Responsibilities of DCPSD may be generally stated as providing logistic and administrative support to NILECJ in designing and conducting the short term intensive test. They are indicated and discussed below.

I. Assist NILECJ (CAL) in arriving at a feasible patrol mission plan, as well as a practicable set of procedures. This responsibility will be discharged in two ways. For one, DCPSD will provide the NILECJ consultant, CAL, with an opinion on the suitability of the specific patrol missions which CAL has scheduled for the intensive test period. If other missions, not originally included, are considered to be more suitable on the basis of Dade County's experience with the use of a helicopter for police air activities, DCPSD will so advise the NILECJ consultant. Or, if any mission suggested by the NILECJ test designers are not appropriate in the Dade County environment, DCPSD will call them to the attention of NILECJ.

Secondly, the test procedures proposed by the NILECJ consultant will be reviewed by DCPSD prior to the start of the test. The NILECJ consultant will expect to be advised by DCPSD with regard to the suitability of the procedures, or their infeasibility, and will receive recommendations for modification in the procedures. The review will be made on the basis of examination of a preliminary copy of this test manual, to be completed and communicated to the consultant in sufficient time to permit suggested revisions in the manual prior to the start of the intensive test period.

II. Follow the specified test procedures, as set forth in this manual, and as may be amended during the course of the test itself by mutual agreement between DCPSD and NILECJ. There are three items of responsibility in this connection which are particularly applicable to the aircraft crew personnel.

a) Fly the assigned patrol mission for the scheduled duration. The mission is not to be aborted except for a call from the ground for assistance, an observed ground situation which requires immediate action within the capability of the aircraft and crew, or in the event of weather or mechanical or other equipment problems which require landing. When an assigned mission has been interrupted, it is the responsibility of the crew to return to station and continuance of the mission as soon as is feasible.

b) Complete any specified data forms, such as the in-flight log and post flight debriefing forms.

c) Participate freely and fully in the verbal post flight debriefing conducted by NILECJ (CAL) and/or DCPSD officials.

III. Provide the DCPSD dispatcher with the daily flight schedule, so the general location of the airborne craft is known for possible use in conjunction with ground forces. If any aerial patrol is scrubbed or aborted, other than when in response to a request from the dispatcher, the dispatcher is to be notified when the air arm is not available, and when it returns to an available status.

IV. Expend all reasonable effort to maintain the STOL and the helicopter in an "up" status so the maximum proportion of scheduled patrols[1] can be met during the intensive test period.

V. Make available to NILECJ all records, written or otherwise recorded, which are in any way related to the flights and ground support during the intensive test period. This includes all data forms, air-ground communication recordings, real time voice commentaries outside the scope of the in-flight log sheet (if arrangements can be made to have suitable portable tape recorders on board during the flights), operating costs, electronic data processing forms routinely used by DCPSD in recording activities, and any others that may be appropriate.

VI. Critically review the results of the preliminary analysis to be made by NILECJ (CAL), and provide NILECJ (CAL) with the critique in a timely fashion to permit enhancement of the analysis.

VII. Review the initial guidelines drawn up by NILECJ (CAL) for STOL operations, for future use by NILECJ, and provide NILECJ (CAL) with the critique in a timely fashion.

VIII. Subsequent to the intensive test period, to assign STOL missions during the balance of the consultant's (CAL) performance period so as to verify and supplement findings from the intensive test, to provide a possible input to the consultant's final report.

[1]Patrol and patrol mission are used interchangeably from this point on.

3.2 NILECJ (CAL) Responsibilities

The responsibilities of NILECJ (CAL) in regard to the intensive test phase of the Dade County grant performance period may be generally stated as the performance of four tasks:

(a) to develop a test plan;

(b) to provide on-site evaluation and modification of DCPSD test and flight operations;

(c) to perform an evaluation and analysis of test data; and

(d) to provide first cut guidelines for STOL operations and cost effectiveness measures.

These are expanded upon below.

I. NILECJ (CAL) is to establish, with the concurrence of DCPSD, a feasible schedule for the intensive flight testing patrol missions. The patrol missions selected are to be from those which DCPSD and other police users of aircraft have found to be useful and recurrent police air operations. Each patrol mission comprises a sustained patrol, yet is not so demanding that it can not be interrupted temporarily while the crew answers a time-priority call for assistance or investigation, or notes ground activity which should be called to the attention of ground officers.

With the guidance of DCPSD, the test planners are to prepare a time schedule and patrol area configuration which will provide the most favorable opportunities for the aircraft to demonstrate the extent of its capabilities for each mission assigned. Only in this way can a realistic first evaluation of the usefulness of the STOL be made.

II. Pre-test briefing of the DCPSD personnel involved in the test is to be provided by the consultant. Personnel who participate in a test of this nature can be expected to perform at highest levels of effectiveness only when they are completely aware of the many ramifications to the test and the importance of their activities. The pre-test briefing will provide the opportunity for test planners to discuss with the Dade County participating personnel the goals, procedures to be followed, and impact of the information to be generated by the intensive test. Questions and comments by the participants will be invited in the interests of complete understanding of the test purposes among all involved. The pre-test briefing should establish a useful rapport among flight crews, ground support, supervision, and planners and evaluators. In addition, this briefing will provide an opportunity for the operations personnel to advise the test planners of any difficulties or contingencies to be expected that the planners may have overlooked. Successful pre-test briefing will eliminate the need for extensive pre-flight briefings several times each day during the intensive test period. The minimal pre-flight briefings can then be conducted by DCPSD supervisory personnel.

III. Another responsibility of the consultant will be to conduct or participate in the post-flight debriefings. Valid and meaningful evaluation can not be made without the direct involvement of the evaluating team in the activity generating the data, and in the data collection process itself. Therefore, the consultants will be present during most or all of the intensive flight testing period, not only so as to be able to understand the information recorded during the post-flight debriefing, but to maximize the information yield from the post-flight comments of the flight crew.

An important part of the evaluation data is the outcome of each action in which the air platform is involved, either as the primary unit or in assistance to a ground unit. When the air unit is the primary unit and/or completes the activity, the outcome will be known from the in-flight log and the post-flight debriefing. However, for those incidents in which the ground unit completes the action, a procedure will be established for obtaining the data on the disposition or outcome from the ground unit.

IV. Any test plan for an exercise involving new applications of an equipment which is itself new to the users may be expected to contain some weaknesses or errors in judgment, no matter how expert the test designers may be. The STOL test in Dade County is no exception. Accordingly, it is the responsibility of the test planners to make preliminary analyses and evaluations concurrently with the flight operations in order to be able to make any changes in the test plan which appear warranted. Any such changes will not be made unilaterally by NILECJ (CAL) but with the concurrence of the DCPSD project director or his designate. In order to meet this responsibility, it is again necessary that the test designers be present during much or all of the intensive test period.

V. Subsequent to the intensive test period, it will be the responsibility of NILECJ (CAL) to prepare a report containing the evaluation of the STOL operations during that test period, and recommending initial guidelines for STOL operations in a police air unit. This report is also to include cost data and cost effectiveness measures.

4. TEST PROCEDURES AND CONSTRAINTS

This section is concerned with the steps and procedures to be followed so that the intensive test period will yield the desired information for evaluation and guideline purposes. Also, the nature of the constraints which may limit the test implementation in any way will be identified.

4.1 The first step involving all personnel participating in the test will be the pre-test briefing conducted by the consultant and the DCPSD grant director. All pilots, observers, flight ground control and support, maintenance, supervisory, administrative or any other personnel whose duties place them in the testing group, are to be present at this briefing.

The test plan objectives and rationale will be presented to the group, along with an outline of procedures to be followed while the test itself is being made. Opportunity will be given the participants to raise questions and discuss their roles and responsibilities with the project director and consultants. A fully informed testing team is essential to maximizing the valid information feedback which is vital to a meaningful evaluation and first-cut guidelines for STOL use.

Also as part of the pre-test briefing, the patrol mission schedule will be presented and explained to the test participants. While the information is given below in Sections 5 and 6 of this manual, a verbal presentation and discussion should serve the interests of clarification and mutual understanding.

4.2 During the performance period of the intensive test flights, each patrol team will be given a pre-flight briefing prior to beginning the specific patrol. The patrol mission and district assignments for the up-coming two hour flying time will be given to the flight crew. Any relevant information

obtained from earlier test flights, or other sources, will be given to the flight crew at this time. In addition, the crew will be provided with the in-flight log forms, a supply of tapes for the on-board tape recorder (if it is obtained), and given any special instructions. Generally, the pre-flight briefing will relate the specific patrol to the overall test design, and communicate to the flight crew any special instructions or circumstances relating to the patrol about to be made.

4.3 Each flight period has one or two assigned missions for that patrol. Except for certain contingencies, given below, the missions will be the exclusive purpose of the particular patrol, so that data may result for the evaluation of the aircraft in the performance of the particular mission. However, since a police officer on routine patrol must respond to conditions which require specific actions on a time-urgency basis, the police aircraft must do likewise.

Therefore, once the patrol has started (is airborne and on station), the crew will follow these Standing Operating Procedures (SOP):

1. Remain on the assigned patrol in the assigned district, until the other aircraft is in the air, except when on the last patrol scheduled for the day, and then return to base for debriefing, unless one or more of the immediately following events occur.

2. If while on the assigned mission, a ground event (or air event such as violation of FAA regulations or an air pollution incident) occurs in which action by the air patrol could be considered as falling within the scope of police or public safety measures, but not within the scope of the assigned mission, the mission is to be interrupted while the necessary action is taken. The action may consist only in notifying ground control of the event, or it may consist of direct involvement until the event has been terminated or the airborne officers cannot be of any further assistance. As soon as

disengagement has taken place, the assigned patrol will be resumed. The initial engagement may be made at the initiative of the air patrol or at the request of ground control. Disengagement is subject to the consent of ground control.

3. If an equipment failure or problem jeopardizes the safety of the crew or compromises the effectiveness of the mission, upon notification to ground control (if feasible), the patrol will return to base or make an emergency landing.

4. If weather conditions become below minimal levels for safety or FAA regulations, the patrol is to be aborted and the aircraft returned to base.

4.3 While in-flight the observer will maintain the in-flight log and, if a voice recorder is on board, he will also record additional commentaries to supplement or amplify the written log, or to record pertinent information which is not within the scope of the in-flight log.

4.4 Upon returning to base, the crew will participate in the post-flight briefing. This briefing will consist of a review of the in-flight log entries, and an open-ended interview by the debriefing personnel for purposes of gaining the maximum insight into the degree of effectiveness of the missions just concluded.

4.5 At the conclusion of the debriefing the pilot and observer will be responsible for the preparation of their aircraft for their next patrol.

4.6 Possible constraints upon the air activities include those previously noted as conditions of maintenance or weather which force the aircraft to land. Other constraints include FAA flight regulations, with limitations imposed by any possible exceptions or deviations permitted by the FAA for the test purposes. A possible constraint also may be the absence of personnel due to illness.

5. DEFINITION OF MISSIONS

Many different mission types have been flown by police aircraft in Dade County and elsewhere. Some are scheduled patrols; however, most may be considered as unscheduled, random events in that they could not be specifically planned, and were engaged in as a result of specific incidents. While such missions comprise a very important part of police activities, their random nature precludes their use as planned, scheduled, missions for a formal test such as the intensive test being held in Dade County. Accordingly, the test plan only calls for those patrol missions which can be scheduled in advance. When needed, the aircraft will deploy to engage in the unscheduled activity in accordance with the SOP set forth in the preceding section.

The set of assignable missions used in this test consists of those which meet two conditions - each has been flown with some success by one or more police agencies, and each is applicable to Dade County. This section defines these missions for the guidance of the pilots and observers. An alphabetical ordering is used for convenience, in the listing below.

1. Fire Detection Patrol: Patrol over high fire risk areas for spotting and reporting location of possible fires.

2. General Surveillance: Equivalent to general ground patrol. Fly randomly over area, observing general conditions; call for ground investigation when unusual or suspicious-appearing activities or circumstances are noted.

3. Illegal Dumping: Patrol areas where illegal dumping of rubbish, scrap, or garbage is commonly done, for purposes of prevention, detection, and assisting ground officers in apprehension of suspects.

4. Lighted Patrol: Patrol with floodlight on, over areas of high incidence of break-ins or street crimes such as mugging, purse-snatching, car-stripping, school vandalism, etc. If light is not operable or unavailable, general surveillance is to be substituted on the mission.

5. Parks and Recreational Area Patrol: Patrol public parks and other recreational areas to maintain order, serve as observation post, and maintain general surveillance.

6. Rooftop Surveillance: Patrol over commercial and industrial areas where roof top entry has high incidence or potential. Request ground investigation when warranted, and remain on station to note any activity and provide illumination if needed.

7. Rural and Vacant Area: Patrol sparsely populated areas, vacated building areas, open land areas, temporarily closed areas such as resorts or amusement parks if in off-season, and rural areas.

8. Search for Stolen Vehicles: Perform systematic coverage of parking areas most likely to contain stolen or abandoned vehicles; give location of suspected vehicles to ground control.

9. Traffic: Patrol over high volume arterials, hazardous stretches of road or intersections, important feeder streets and roads. Look for speeders, imprudently driven vehicles, traffic jams, motorists in need of assistance, ground events that may be conducive to motorist or pedestrian risk increase, and any other situation that has a potential for impeding the normal flow of traffic.

10. Water Patrol: Patrol over waterfront areas such as bathing beaches, docks and marinas, industrial and residential water-front sites, and inland waterways. Maintain general surveillance for hazards to boats or swimmers, speeding or otherwise imprudently operated boats, water pollution, swimmers or boats in need of assistance, and suspicious activities (i.e., possible smuggling or narcotics transfer).

All other missions which are engaged in under the conditions described in the SOP, above, will be identified by their standard Dade County designations.

6. FLIGHT SCHEDULE

During the intensive test period, the plan calls for four hours of airborne patrol each day, seven days a week, for four weeks, by the STOL and by the helicopter, in a program of two hours airborne alternating with two hours on the ground for briefing, debriefing, preventive or pre-flight maintenance of the aircraft, meals, and personal comfort needs. The hours of the day and patrols flown vary from one week to another for several purposes.

One purpose is to provide maximum exposure for some of the missions used under different time conditions, since criminal or civil violations of any one type are not uniformly distributed throughout the day. The effectiveness of the aircraft for a given patrol mission may vary with the time of day. If so, such information is important to the evaluation.

A second purpose is to permit evaluation for different days of the week, for essentially the same reasons as using different times.

A third purpose is to provide additional time for the test participants at the end of one week's operations and before the start of the next since a longer than usual work day is scheduled. This additional time will be useful in at least three ways. The operating personnel (crews, ground support, etc.) will have one or more extra days of relief from the demands of the formal test flights; maintenance needs, which did not cause abortion or cancellation of any patrols, but which require attention and a performance time longer than the ground time between patrols can be satisfied; the DCPSD project director and NILECJ (CAL) will have more time to assess the results to date and decide upon any changes in procedure or missions which appear warranted.

First Week

Date	Aircraft	Time	Mission	Aerial Patrol Zones	
Monday June 15		9:00	Pre-test Briefing		
	STOL	1:00- 2:00	General Surveillance	1b, 2bd, 3b, 6bd	
	STOL	2:00- 3:00	General Surveillance		
	Helicopter	3:00- 4:00	General Surveillance	1b, 2bd, 3b, 6bd	
	Helicopter	4:00- 5:00	General Surveillance		
Tuesday June 16	Helicopter	8:00- 9:00	Traffic	2abc, 5acd	
	Helicopter	9:00-10:00	Search for Stolen Vehicles	1abc, 2abd, 4d	
	STOL	10:00-11:00	Air Pollution & Fire Detection	4, 5ac	
	STOL	11:00-12:00	Search for Stolen Vehicles	1, 2	
	Helicopter	12:00-13:00	General Surveillance	1b, 3b	
	Helicopter	13:00-14:00	General Surveillance	2bd, 6bd	
	STOL	14:00-15:00	Rural & Vacant Areas	4bd	
	STOL	15:00-16:00	Rural & Vacant Areas	6bd, 8bd	
Wednesday June 17	STOL	8:00- 9:00	Traffic	6d, 7abc	Aborted due to civil disturbance duty.
	STOL	9:00-10:00	Search for Stolen Vehicles	7ac, 9a, 4d	
	Helicopter	10:00-11:00	Rural & Vacant Areas	4bd, 6bd, 8bc	
	Helicopter	11:00-12:00	Rural & Vacant Areas		
	STOL	12:00-13:00	General Surveillance	6bc, 7ac, 8bc, 9a	
	STOL	13:00-14:00	General Surveillance		
	Helicopter	14:00-15:00	General Surveillance	1b, 2bd, 3b	
	Helicopter	15:00-16:00	General Surveillance		
Thursday June 18	STOL	14:00-15:00	General Surveillance	1b, 2bd, 3b, 6bd	
	STOL	15:00-16:00	General Surveillance		
	Helicopter	16:00-17:00	General Surveillance	1b, 2bd, 3b, 6bd	
	Helicopter	17:00-18:00	General Surveillance		
	STOL	18:00-19:00	General Surveillance	6bd, 7ac, 8bd, 9a	
	STOL	19:00-20:00	General Surveillance		
	Helicopter	20:00-21:00	Rooftop Surveillance	5b, 7c	
	Helicopter	21:00-22:00	Lighted Patrol	2bd, 3b	

First Week (continued)

Date	Aircraft	Time	Mission	Aerial Patrol Zones	
Friday	STOL	10:00-11:00	General Surveillance	6bd, 7ac, 8bd, 9a	Aborted due to civil disturbance duty.
June 19	STOL	11:00-12:00	General Surveillance		
	Helicopter	12:00-13:00	Fire Detection	4	
	Helicopter	13:00-14:00	Fire Detection		
	STOL	14:00-15:00	Search for Stolen Vehicles	7ac, 9a	
	STOL	15:00-16:00	Recreational Areas	7bc, 9b	
	Helicopter	16:00-17:00	Search for Stolen Vehicles	1abc, 4d	
	Helicopter	17:00-18:00	Traffic	5acd, 3ac	
Saturday	Helicopter	12:00-13:00	Water Patrol	3bd, 5bd, 7bd, 9bd	
June 20	Helicopter	13:00-14:00	Water Patrol		
	STOL	14:00-15:00	Water Patrol	3bd, 5bd, 7bd, 9bd	
	STOL	15:00-16:00	Water Patrol		
	Helicopter	16:00-17:00	Recreational Areas	3ab	
	Helicopter	17:00-18:00	Recreational Areas	5bd	
	STOL	18:00-19:00	Illegal Dumping	2a, 4d, 6bd, 8b	
	STOL	19:00-20:00	Illegal Dumping		
Sunday	Helicopter	12:00-13:00	General Surveillance	1b, 2bd, 3b, 6b	
June 21	Helicopter	13:00-14:00	General Surveillance		
	STOL	14:00-15:00	Recreational Areas	8cd, 5bd, 7b	
	STOL	15:00-16:00	Recreational Areas		
	Helicopter	16:00-17:00	Water Patrol	3bd, 5bd, 7bd, 9bd	
	Helicopter	17:00-18:00	Water Patrol		
	STOL	18:00-19:00	Illegal Dumping	2a, 4d, 6bd, 8b	
	STOL	19:00-20:00	Illegal Dumping		

Third Week

Date	Aircraft	Time	Mission	Aerial Patrol Zones
Monday	STOL	8:00- 9:00	Traffic	5abc, 6d, 7abc
June 29	STOL	9:00-10:00	Search for Stolen Vehicles	4d, 7ac, 9a
	Helicopter	10:00-11:00	Fire Detection	3ac
	Helicopter	11:00-12:00	Fire Detection	5ac
	STOL	12:00-13:00	General Surveillance	6bd, 7ac, 8bd, 9a
	STOL	13:00-14:00	General Surveillance	
	Helicopter	14:00-15:00	General Surveillance	1b, 2bd, 3b
	Helicopter	15:00-16:00	General Surveillance	
Tuesday	Helicopter	8:00- 9:00	Traffic	2abc, 3ac
June 30	Helicopter	9:00-10:00	Search for Stolen Vehicles	4d, 1abc
	STOL	10:00-11:00	Fire Detection	4, 6
	STOL	11:00-12:00	Fire Detection	
	Helicopter	12:00-13:00	General Surveillance	1b, 2bd, 3b, 6bd
	Helicopter	13:00-14:00	General Surveillance	
	STOL	14:00-15:00	General Surveillance	2bd, 6bd, 7ac, 8bd, 9a
	STOL	15:00-16:00	General Surveillance	
Wednesday	Helicopter	14:00-15:00	Rural & Vacant Areas	4bd, 6bd, 8bd
July 1	Helicopter	15:00-16:00	Rural & Vacant Areas	
	STOL	16:00-17:00	General Surveillance	1b, 2bd, 6bd
	STOL	17:00-18:00	Traffic	2abc, 3ac, 5acd
	Helicopter	18:00-19:00	Traffic	2abc, 3ac, 5acd
	Helicopter	19:00-20:00	General Surveillance	1b, 2bd, 3b
	STOL	20:00-21:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	21:11-22:00	Lighted Patrol	6b, 7c
Thursday	STOL	9:00-10:00	General Surveillance	2bd, 6bd, 7ac, 8bd, 9a
July 2	STOL	10:00-11:00	General Surveillance	
	Helicopter	11:00-12:00	Pollution	3bd, 5bd, 7bd, 9bd
	Helicopter	12:00-13:00	Pollution	
	STOL	13:00-14:00	Rural & Vacant Areas	4bd, 6bd, 8bd
	STOL	14:00-15:00	Rural & Vacant Areas	
	Helicopter	15:00-16:00	Crime Lab	2c, 4d, 6bd
	Helicopter	16:00-17:00	Photos	

Third Week (continued)

Date	Aircraft	Time	Mission	Aerial Patrol Zones
Friday	STOL	14:00-15:00	General Surveillance	1b, 2bd, 3b, 6bd
July 3	STOL	15:00-16:00	General Surveillance	
	STOL	17:00-18:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	STOL	18:00-19:00	Water Patrol	
	STOL	20:00-21:00	Rooftop Patrol	5b, 7c
	STOL	21:00-22:00	Lighted Patrol	1b, 2bd
Saturday	STOL	11:00-12:00	Water Patrol	3bd, 5bd, 7bd, 9bd
July 4	STOL	12:00-13:00	Water Patrol	
	STOL	14:00-15:00	Recreational Areas	5bd, 7b, 8cd, 9b
	STOL	15:00-16:00	Recreational Areas	3ab, 5bd, 7b
	STOL	17:00-18:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	STOL	18:00-19:00	Water Patrol	
Sunday	Helicopter	18:00-19:00	Illegal Dumping	2a, 4d, 6bd
July 5	Helicopter	19:00-20:00	Illegal Dumping	
	STOL	20:00-21:00	General Surveillance	2bd, 3b, 6bd
	STOL	21:00-22:00	Rooftop Surveillance	5b, 7c, 9a
	Helicopter	22:00-23:00	Lighted Patrol	1b, 2bd, 3b
	Helicopter	23:00-24:00	Rooftop Surveillance	5b, 2bd
	STOL	24:00- 1:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	1:00- 2:00	Rooftop Surveillance	7c, 8b, 9a

Fourth Week

Date	Aircraft	Time	Mission	Aerial Patrol Zones
Monday	Helicopter	16:00-17:00	Search for Stolen Vehicles	1abc, 2abd, 4d
July 6	Helicopter	17:00-18:00	Traffic	2abc, 5acd, 3ac
	STOL	18:00-19:00	Traffic	6d, 7abc
	STOL	19:00-20:00	Search for Stolen Vehicles	4d, 7ac, 9a
	Helicopter	20:00-21:00	General Surveillance	3b
	Helicopter	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	22:00-23:00	Lighted Patrol	3b, 6b, 7c
	STOL	23:00-24:00	Rooftop Surveillance	9a, 8b, 2bd
Tuesday	STOL	16:00-17:00	Search for Stolen Vehicles	4d, 7ac, 9a
July 7	STOL	17:00-18:00	Traffic	6d, 7abc
	Helicopter	18:00-19:00	Traffic	2abc, 3ac, 5acd
	Helicopter	19:00-20:00	Search for Stolen Vehicles	7ac, 4d
	STOL	20:00-21:00	General Surveillance	1b, 2bd, 6bd
	STOL	21:00-22:00	Rooftop Surveillance	7c, 8b, 9a
	Helicopter	22:00-23:00	Lighted Patrol	6b, 7c
	Helicopter	23:00-24:00	Rooftop Surveillance	2bd, 5b
Wednesday	Helicopter	16:00-17:00	Search for Stolen Vehicles	1abc, 2abd, 4d
July 8	Helicopter	17:00-18:00	Traffic	2abc, 3ac, 5acd
	STOL	18:00-19:00	Traffic	6d, 7abc
	STOL	19:00-20:00	Search for Stolen Vehicles	4d, 7ac, 9a
	Helicopter	20:00-21:00	General Surveillance	1b, 2bd, 3b
	Helicopter	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	22:00-23:00	Lighted Patrol	3b, 6b, 7c
	STOL	23:00-24:00	Rooftop Patrol	2bd, 8b, 9a
Thursday	STOL	16:00-17:00	Search for Stolen Vehicles	2abc, 4d, 7ac
July 9	STOL	17:00-18:00	Traffic	3ac, 5acd, 7abc
	Helicopter	18:00-19:00	Traffic	2abc, 3ac
	Helicopter	19:00-20:00	General	1b, 2bd, 3b
	STOL	20:00-21:00	General	6bd, 7ac, 8bd, 9a
	STOL	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b, 7c
	Helicopter	22:00-23:00	Lighted Patrol	1b, 2bd, 3b
	Helicopter	23:00-24:00	Rooftop Surveillance	5b, 2bd

Fourth Week (continued)

Date	Aircraft	Time	Mission	Aerial Patrol Zones
Friday	STOL	15:00-16:00	Search for Stolen Vehicles	1abc, 2abc, 4b
July 10	STOL	16:00-17:00	Search for Stolen Vehicles	
	STOL	18:00-19:00	Traffic	6d, 2abc
	STOL	19:00-20:00	General Surveillance	1b, 2bd, 3b
	STOL	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	22:00-23:00	Lighted Patrol	1b, 2bd, 3b
Saturday	STOL	12:00-13:00	Water Patrol	3bd, 5bd, 7bd, 9bd
July 11	STOL	13:00-14:00	Water Patrol	
	STOL	15:00-16:00	Recreational Areas	3ab, 5bd, 7b
	STOL	16:00-17:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	STOL	18:00-19:00	Water Patrol	
	STOL	19:00-20:00	Water Patrol	
Sunday	STOL	14:00-15:00	Water Patrol	3bd, 5bd, 7bd, 9bd
July 12	STOL	15:00-16:00	Water Patrol	
	Helicopter	16:00-17:00	Recreational Areas	3ab, 5bd
	Helicopter	17:00-18:00	Recreational Areas	
	STOL	18:00-19:00	Illegal Dumping	2a, 4d, 6bd, 8d
	STOL	19:00-20:00	Illegal Dumping	
	Helicopter	20:00-21:00	Rooftop Surveillance	5b, 7c
	Helicopter	21:00-22:00	Lighted Patrol	2bd, 3b

Fifth Week

Date	Aircraft	Time	Mission	Aerial Patrol Zones
Monday	Helicopter	7:00- 8:00	Traffic	2abc, 3ac, 5acd, 6d, 7abc
July 13	Helicopter	8:00- 9:00	Traffic	
	STOL	9:00-10:00	Rural and Vacant Areas	4bd, 6bd, 8bd
	STOL	10:00-11:00	Rural and Vacant Areas	
	Helicopter	11:00-12:00	Fire Detection	2
	Helicopter	12:00-13:00	Water Patrol	3bd, 5bd
	STOL	13:00-14:00	General	3bd, 5bd, 7bd, 9bd
	STOL	14:00-15:00	General	
Tuesday	STOL	8:00- 9:00	Traffic	5acd, 6d, 7abc
July 14	STOL	9:00-10:00	Search for Stolen Vehicles	1abc, 2abd
	Helicopter	10:00-11:00	General Surveillance	1b, 2bd, 3b, 6bd
	Helicopter	11:00-12:00	General Surveillance	
	STOL	12:00-13:00	General Surveillance	6bd, 7ac, 8bd, 9a
	STOL	13:00-14:00	General Surveillance	
	Helicopter	14:00-15:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	Helicopter	15:00-16:00	Water Patrol	
Wednesday	STOL	10:00-11:00	General Surveillance	1b, 2bd
July 15	STOL	11:00-12:00	General Surveillance	3b, 6bd, 7ac, 8bd, 9a
	Helicopter	12:00-13:00	General Surveillance	1b, 2bd, 3b, 6bd
	Helicopter	13:00-14:00	General Surveillance	
	STOL	14:00-15:00	Rural & Vacant Areas	4bd, 6bd, 8bd
	STOL	15:00-16:00	Rural & Vacant Areas	
	Helicopter	16:00-17:00	Search for Stolen Vehicles	1abc, 2abd, 4d
	Helicopter	17:00-18:00	Traffic	2abc, 3ac, 5acd
Thursday	Helicopter	16:00-17:00	Search for Stolen Vehicles	1abc, 2abd, 4d
July 16	Helicopter	17:00-18:00	Traffic	2abc, 3ac, 5acd
	STOL	18:00-19:00	Traffic	2abc, 5acd, 6d
	STOL	19:00-20:00	Water Patrol	3bd, 5bd, 7bd
	Helicopter	20:00-21:00	General Patrol	1b, 2bd, 3b
	Helicopter	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b
	STOL	22:00-23:00	Lighted Patrol	3b, 6b, 7c
	STOL	23:00-24:00	Rooftop Surveillance	7c, 8b, 9a

Fifth Week (continued)

Date	Aircraft	Time	Mission	Aerial Patrol Zone
Friday	STOL	15:00-16:00	Water Patrol	3bd, 5bd, 7bd, 9bd
July 17	STOL	16:00-17:00	Water Patrol	
	STOL	18:00-19:00	Recreational Areas	3ab, 5bc, 7b
	STOL	19:00-20:00	General Surveillance	3b, 7ac, 9a
	STOL	21:00-22:00	Lighted Patrol	1b, 2bd, 3b
	STOL	22:00-23:00	Rooftop Surveillance	2bd, 5b
Saturday	STOL	18:00-19:00	Illegal Dumping	2a, 4d, 6bd, 8b
July 18	STOL	19:00-20:00	Illegal Dumping	
	STOL	21:00-22:00	Rooftop Surveillance	1b, 2bd, 5b, 7c
	STOL	22:00-23:00	Lighted Patrol	1b, 2bd, 3b
	STOL	24:00- 1:00	Rooftop Surveillance	1b, 2bd
	STOL	1:00- 2:00	Rooftop Surveillance	5b, 7c
Sunday	STOL	10:00-11:00	General Surveillance	3b, 7ac, 8bd, 9a
July 19	STOL	11:00-12:00	General Surveillance	
	Helicopter	12:00-13:00	General Surveillance	2bd, 3b, 6bd
	Helicopter	13:00-14:00	Water Patrol	3bd, 5bd
	STOL	14:00-15:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	STOL	15:00-16:00	Water Patrol	
	Helicopter	16:00-17:00	Water Patrol	3bd, 5bd, 7bd, 9bd
	Helicopter	17:00-18:00	Water Patrol	

The above design results in a reasonable allocation of hours assigned to each mission for each aircraft, such that a comparative evaluation of the STOL versus the helicopter can be made, as may be noted from the tabulation below.

HOURS ASSIGNED TO MISSION, BY TYPE OF AIRCRAFT

Mission	Helicopter	STOL
Fire Detection Patrol	5	3
General Surveillance	25	32
Illegal Dumping Patrol	6	8
Lighted Patrol	7	7
Parks and Recreation Area Patrol	8	7
Rooftop Surveillance	15	12
Rural and Vacant Areas Patrol	4	10
Search for Stolen Vehicles	9	10
Traffic Patrol	13	10
Water Patrol	18	11
Total	110	110

7.0 ANALYSIS TO BE DONE - QUESTIONS TO BE ASKED

The purpose of DCPSD STOL aircraft evaluation is to identify those law enforcement related activities which can be effectively performed by STOL aircraft. The STOL aircraft is viewed as a partial substitute for the law enforcement helicopter. The STOL aircraft cannot completely replace the helicopter, since it can't perform all of the same tasks (i.e. the STOL can neither hover nor operate from all of the areas which are available to the helicopter). As in the case of the helicopter, the STOL is a supplement to the patrol cars and men on the ground and is not a substitute. However, in those tasks for which either the helicopter or STOL are suitable (e.g. traffic monitoring, speed checks, and searches), the STOL is much cheaper to use (30 to 65% of helicopter operating costs).[2]

It is envisioned that where the STOL is employed for law enforcement,[3] it will most often be as part of a mixed fleet of STOL, and helicopters. In this mixed fleet, the helicopter will perform those missions where its unique capabilities are required, and the STOL will do those remaining missions for which it is well suited.

The ultimate objectives of the evaluation are not only to identify those missions suited to STOL aircraft, but also to aid in establishing guidelines regarding the best mix of helicopters, STOLs and patrol cars. To meet these objectives, data must be collected during the evaluation which: (1) describe how, for whom, and for which missions the STOL and helicopter were employed; (2) measure operational factors relating to aircraft (i.e. availability with respect to maintenance and weather); (3) measure the degree of success (i.e. effectiveness) with which these aircraft were employed; and (4) measure the costs associated with helicopter, STOL aircraft and patrol car operations. Many types of data listed below are already collected by the DCPSD, but are included in the listings for completeness.

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[2] Total operating costs excluding crew costs for 3 to 5 place light helicopters.

[3] STOL aircraft are already being used by the Royal Canadian Mounted Police.

7.1 Helicopter/STOL Aircraft Use Data

To assist in subsequent analysis, it is necessary to collect data which describe the manner and extent to which the aircraft are employed for specific types of activities. Specific types of inputs desired include:

(a) Hours, Flights, Calls vs. Purpose of flight (mission type); Agency requesting service; Type of crime involved

(b) Time History of Patrols

(c) Time History of Calls for Service

(d) Distribution of Day and Night Activities

7.2 Operational Factors

It is desirable to compare the STOL and helicopter in terms of their availability to perform scheduled patrols and respond to emergency calls. It would be useful to know what portion of the time the aircraft is in maintenance and/or grounded because of weather. This would give insight into what daily utilizations are readily attainable.

Specific types of data which should be collected include:

(a) Time History of Aircraft Status:

1. Flying
2. Ready
3. Maintenance:
    a. In Maintenance
    b. Awaiting Parts
4. Grounded - Weather, Darkness
5. Grounded - Maintenance & Weather
6. Grounded - No Crew

(b) Scheduled Patrol Hours, Scheduled Patrol Flights, Emergency Calls — Lost because of: Weather, Maintenance or Weather and Maintenance Interactions

(c) Emergency Calls — Lost because of: Weather; Darkness; Maintenance; Response time too great; A/C Not large enough; No crew

(d) Reliability - No. of flights aborted due to mechanical failure
No. of flights aborted due to weather

7.3 Effectiveness

It is desirable not only to know what types of missions the helicopter and STOL can perform, but also how well they perform them. Measures of effectiveness which are applicable to helicopter/STOL evaluation include:

a. Changes in the crime rate (both for patrol areas and entire County)
b. Changes in actual numbers of crimes (by patrol areas and for entire County)
c. Number of felony apprehensions assisted by aircraft
d. Number of traffic citations
e. Number of motorist assists
f. Number of rescues, ambulance runs, lives saved
g. Number of fires reported (and/or fought)
h. Response times:
    (1) Time to get airborne
    (2) Flying to reach scene
    (3) Total response time (one way time for police calls
        round trip time for Rescue or Ambulance)
    (4) Was helicopter, STOL or patrol car first vehicle on scene?
i. Off airport landings
    Helicopter: Could helo land?
    Did helo land?
    If so,could STOL have landed?

STOL: Could helo land?
Could STOL land?
Did STOL land?
Was mission compromised by having STOL instead of helo?

It is important to obtain certain follow-up information. This includes recording the subsequent convictions of criminals apprehended and motorists given citations and the subsequent recoveries (or deaths) of persons rescued or using air ambulance evacuation services. It also includes data on the interaction between the air units and the ground units, and the short term outcomes of such interaction.

In regard to the air-ground interaction, it should be noted that the measures of effectiveness listed above, particularly c. - h., relate mainly to successful missions of the aircraft. They provide the direct and positive measurements of accomplishments of the police air arm. However, such evaluation can present a biased picture of the effectiveness of police aircraft, since it fails to consider the missions which are failures, or the full relationship of the air activities to the total police operations. Consequently, additional measures will be used to evaluate the results of the air operations as they are integrated into the overall operations of DCPSD.

7.4 Costs

The helicopter, because of its capability to land in restricted areas and hover, can perform certain tasks which STOL aircraft cannot. Likewise, the STOL can perform tasks which the patrol car cannot. The helicopter, however, is considerably more expensive to operate than the STOL aircraft, which is, in turn more expensive than a patrol car. We wish to record the costs of operation of these vehicles so that the cost associated with the additional capabilities of the helicopter may be identified. Then, knowing the costs and associated capabilities of STOLs, helicopters and patrol cars, a knowledgeable decision can be made regarding whether additional money is best spent buying helicopters, STOLs or patrol cars.

Types of costs which are of interest for the helicopter, the STOL (and patrol cars) are:

crew costs
maintenance
parts
fuel and oil
depreciation and
insurance.

These costs must be identified with respect to time so that costs can ultimately be computed on a per hour basis.

8.0 DATA FORMS

This section contains examples of data forms which will be used to record the types of information discussed in Section 7. It is not suggested that these forms replace existing DCPSD documentation procedures, but rather should serve as a supplement to those currently in use.

AVIATION UNIT

PLANNING AND RESEARCH BUREAU

DADE COUNTY PUBLIC SAFETY DEPARTMENT

MISSION REPORT

_____
Number

Date _____ Day of Week _____

Time Begun _____ Time Secured _____

Time Committed _____ Flight Time _____

Pilot _____ Weather _____

Observer(s) _____ Visibility _____

_____ Requested by _____

Agency _____

Reasons for
Mission Abort _____

_____

_____

I. MISSION DESCRIPTION (Check)

___ 1. Routine Patrol
___ 2. Search/Rescue Patrol (Check)
  ___ A. Criminal
    ___ (1) Person(s)
    ___ (2) Vehicle(s)
    ___ (3) Other
  ___ B. Non-Criminal
    ___ (1) Person(s)
    ___ (2) Vehicle(s)
    ___ (3) Other
___ 3. Photographic Patrol
___ 4. Surveillance Patrol
___ 5. Community Service Patrol
___ 6. Traffic Patrol
___ 7. Disaster/Disorder Patrol
___ 8. Training
___ 9. Maintenance/Test
___ 10. Other (Explain in Remarks)

Remarks _____

_____

_____

_____

_____

_____

_____

_____

_____

II. MISSION AREA (Check)

1. Jurisdiction
___ A. Municipality
_____
___ B. Unincorporated
_____
___ C. Location
_____

___ 2. Land
___ A. Agricultural
___ B. Business
___ C. Residential
___ D. Industrial
___ E. Undeveloped
___ F. Other
_____

___ 3. Marine
___ A. Bay
___ B. Canal
___ C. Intracoastal
___ D. River
___ E. Rockpit
___ F. Ocean

Remarks_____

III. MISSION EFFECTS (Check)

___ 1. Arrests
___ A. Felony
___ B. Misdemeanor
___ C. Metro Code
___ D. Traffic
___ 2. Citations
___ A. Metro Code
___ Traffic
___ 3. Warnings
___ A. Criminal
___ B. Non-Criminal
___ 4. Recoveries
A. (Explain in Remarks)
___ 5. Locates (Without Recovery)
A. (Explain in Remarks)
___ 6. Other
A. (Explain in Remarks)

Remarks_____

IV. MISSION COSTS (Check)

1. Fuel:_____ gallons @ _____ $_____
2. Oil:_____ quarts @ _____ _____
3. Grease:_____ _____ _____
4. Labor:_____ hours @ _____ _____
5. Parts:_____ TOTAL $_____

Tach Time: Start _____
Finish _____
Elapsed_____

V. EQUIPMENT CONDITION (Check)

___ 1. Structure
___ 2. Engine
___ 3. Electrical System
___ 4. Fuel System
___ 5. Radio
___ 6. P.A./Siren
___ 7. Nightsun
___ 8. Other (Specify)
9. Flight Hours to PM___
A. Type of PM Due___
___ 10. Equipment Unavailable for service_____

_____

_____

_____

_____

_____

VI. COMMENTS

_____

_____

_____

Pilot's Signature

Observer's Signature

_____ _____

Reviewed By:

Date

_____ _____

DCPSD

POST FLIGHT EVALUATION

Day_____
Date _____ Flight No. _____ A/C N_____

Pilot _____

Observer _____ Time _____

Reported by _____

Source of Activity: Observed ( ) Type of Incident _____
Dispatched ( )

Location _____

Other Units Involved:

Flight Data Altitude:

Air Speed:

Tactics Used (describe in detail):

Critique of Tactics Used:

Equipment Used:

Could additional specialized equipment have been used yes ( )
no ( )

Comments:

DCPSD

POST FLIGHT EVALUATION (Continued)

Did your unit assist other units? Yes ( ) No ( )

If Yes, who initiated action? You ( ) Dispatcher ( )
Other Units ( )

How did you assist other units?

What was accomplished on this mission? (i.e. rescues, recoveries, investigations, citations, apprehensions)

Was identification (visual) (radio) of other units effective? Yes ( )
No ( )

Were given land marks and directions adequate? Yes ( ) No. ( )

Were communications satisfactory? Yes ( ) No ( )

Comments:

General Reactions & Suggestions

DCPSD

POST FLIGHT EVALUATION (Continued)

Could another unit have handled activities as effectively as yours?

	Yes	No
Helicopter	( )	( )
STOL	( )	( )
Ground Unit	( )	( )

Comments:

Could activity have been handled only by Helicopter ( ) STOL ( ) or Ground Unit ( ) ?

Comments:

Would it have been advantageous to land at scene? Yes ( ) No ( ).

		Yes	No
For Helo:	Could Helo Land	( )	( )
	Did Helo Land	( )	( )
	If so, could STOL have landed	( )	( )
For STOL:	Could Helo Land	( )	( )
	Could STOL Land	( )	( )
	Did STOL Land	( )	( )
	Was Mission compromised by having STOL instead of Helo	( )	( )

Comments:

PUBLIC SAFETY DEPARTMENT
UNIFORM BUREAU

ACTIVITY REPORT

OFFICER ______________ NO. ______ ZONE ______ VEH. NO. ______ DAY ______ DATE ______ 19 ____
(Opr.)
OFFICER ______________ NO. ______ MILEAGE START ______ MILEAGE FINISH ______ SHIFT ____ M to ____ M
(Driver)

SIGNAL	TIME RECEIVED	ARRIVAL TIME	IN SERVICE	CASE NUMBER	ADDRESS	ACTIVITIES: Names, Arrests, References, Citations, Etc.

114.20-25

DCPSD

DAILY TIME HISTORY OF AIRCRAFT STATUS

N_____ Date_____

Recorded by_____

A. SCHEDULED PATROL FLIGHTS

Flight Number	Scheduled Time of Take-off	Scheduled Duration (Hrs.& Min.)	Actual Time of Take-off	Actual Time of Landing	Mission Completion (Cancelled, Aborted or Completed)

B. UNSCHEDULED ASSISTANCE FLIGHTS

Flight Number	Agency	Purpose	Actual Time of Take-off	Actual Time of Landing

Instructions: All times are EDT on 24-hour clock recorded to nearest minute (e.g. 18:02)
Mission completion - write completed, cancelled or aborted. If cancelled or aborted, give reason.

DCPSD

Daily Time History of Aircraft Status

Tach. Time:
Start_____
Finish_____
Elapsed_____

Helicopter _____
STOL _____
(Check one)

Day_____ Date_____ 19____

Recorded by_____

Signal	Time Received	A/C Ready	Flying as Scheduled	Flying on Request	Aircraft Grounded				
					Fuel	Weather	Maintenance	Maint. (Parts)	Maintenance & Weather

Instructions: For each change in aircraft status, enter the time (and corresponding communication signal code if appropriate) in the appropriate column(s). For each time entry, check (✓) one column which best describes aircraft status.

DCPSD

DISPATCH DATA

(Extracted from Computer Records)

Unit Number

District

Case Number

Zone

Signal (Type of Complaint)

Complaint Officer

NIS - N.R. Code

Day of Week

Year

Month

Complaint Rec'd.

- Day
- Hour

Dispatched

- Day
- Hour

Arrival at Scene

- Day
- Hour

Unit Returned to Service

- Day
- Hour

Location of Incident

Grid Number

APPENDIX B

PRELIMINARY EVALUATION OF FIRST WEEK TEST OPERATIONS, POLICE AIR MOBILITY PROJECT, DADE COUNTY PUBLIC SAFETY DEPARTMENT (DCPSD)*

*This memorandum was requested by Dr. Michael Maltz. An extensive analysis of the first week test operations and data will be included as part of the evaluation report of STOL and helicopter operations of DCPSD.

INTRODUCTION

The first week of the intensive test operations was to be regarded as a shakedown period during which the DCPSD Aviation Section personnel were to become operationally oriented in the flying of routine patrol missions in accordance with the test design, and accustomed to the debriefing routine. On the first day, Monday, June 15, 1970, the planned test schedule was followed with a general briefing in the morning, and a single two hour general surveillance patrol each by the helicopter and the STOL in the afternoon. However, that evening, civil disturbances erupted which required both aircraft to be used operationally during the evenings and nights of June 15 through June 18. The test patrols were postponed during this period and were performed on Saturday, June 20 and Sunday, June 21.

This preliminary report, therefore, is largely devoted to the use of the aircraft during the civil disturbance. A considerable amount was learned or reaffirmed about the capabilities of both aircraft during this week. Mission reports and post flight evaluations were made for each flight made throughout the period.

AIRCRAFT UTILIZATION DURING THE CIVIL DISTURBANCE

Copies of reports made by Mr. Robert H. Michie and Lt. Irving Heller for each day during the disturbance period are appended so that the complete chronological history of the air operations involvement may be reviewed. Initial general comments suitable for consideration in the development of police air mobility guidelines are included in this memorandum.

There were two primary missions requested of the police aircraft during this period of civil disturbance. One may be regarded as general surveillance of citizen activity within the affected area, with reporting of incidents to the Command Post (CP) which require police or other (i.e. fire department) action. The second was providing direct support to ground units,

as requested by the CP. As noted below, both aircraft were equally effective in both missions, with three exceptions:

1. In those instances when tear gas drops were requested, the helicopter could comply with success while the STOL could not be considered for this purpose.
2. The helicopter could land at the CP for refueling, while the STOL had to return to the airfield. However, this was largely balanced out by the comparative fuel capabilities and consumption rates of these two aircraft. The helicopter can remain airborne for approximately two and 1/3 hours, while the STOL can remain airborne for approximately eight to ten hours.
3. The helicopter could be used for photographic missions, while the STOL could not be so utilized without modification and better photographic equipment (more suited to higher altitudes). Photography from the STOL over populated areas would have to be done from 1,000 feet or more, due to lack of an FAA waiver. By contrast, the helicopter can legally fly as low as is required.

Each aircraft successfully accomplished the following, which might have been otherwise undetected, or not detected until a later time:

1. Reported locations of fire bombings, burning cars, roof top and other fires.
2. Observed and reported locations and movements of large gatherings.
3. Dispersed gatherings by illuminating them.
4. Detected fire bombings and lootings while in progress.
5. Pursued suspects, leading to several arrests made by ground units.

6. Illuminated areas to facilitate removal of injured persons (from roof top in one instance), located snipers, flushed out suspects taking cover, and guided ground units to specific locations.
7. Used public address systems to advise citizens that the curfew was still in effect.

It should also be noted that in at least two instances the two aircraft complemented each other successfully in pursuit of suspects. Furthermore, it is believed that the use of the two aircraft was a key factor in the termination of the disturbances on the fourth night. Except for a special task force, all other units and men were withdrawn from ground patrol within the disturbance area during the entire evening, and complete reliance was placed on the aircraft for surveillance and preventive patrol. During this time, a community meeting was held, and small groups of citizens were sent out by the community leaders to advise the residents of the area to keep the peace. Probably as a result of these actions by the DCPSD and the citizens, peace was restored to the troubled area.

While the aircraft were used to support operations during the first three nights, their effectiveness, mobility, and capability to maintain surveillance of large as well as very localized areas lead to positive inferences that either the STOL or a helicopter with a larger payload than that in service by the DCPSD could serve as an airborne command post. Either of these two aircraft could serve as a crowd control device when large gatherings, even of a peaceful nature, occur.

ROUTINE MISSION PERFORMANCE

It was feasible to fly scheduled patrol missions on only two days, Saturday and Sunday, of the first week, subsequent to the first afternoon. Therefore, the findings and initial guidelines are very limited with regard to routine use of the STOL (and helicopter) in police air operations. Once

again, the comparative evaluation must be considered in the context of the two specific equipments used in Dade County for its police air mobility.

The STOL continued to demonstrate its superiority for more sustained patrols and surveillance over larger areas. Even at the altitude of 1000 feet, to which it is presently constrained in urban areas of the County, the STOL pilot or observer could observe and initiate action for such incidences as stranded motorists or boaters, accidents, recovery of abandoned vehicles or other large items of property, fires, illegal dumpings, etc. However, it is clearly evident that an important limitation is its inability to land in as many places as the helicopter. Under the conditions that it can land and it is desirable to do so, the need for landing must be sufficiently great to justify the risk to the personnel and aircraft, especially if the landing and takeoff conditions are marginal.

INITIAL GUIDELINES FOR A STOL IN POLICE AIR MOBILITY APPLICATIONS

Tentative observations may be made on the capabilities and limitations of the STOL, based on the limited experience resulting from flight operations during the week beginning June 15, 1970. These observations permit only broad operational guidelines to be inferred. No attempt is made to measure effectiveness or cost/effectiveness for assistance in establishing the guidelines since the data are so limited.

Where a law enforcement agency has an area of responsibility which is compact and/or has largely high population and structural density, the usefulness of a STOL would be less than that of a small helicopter, with a few exceptions. General patrol and surveillance can be done by the STOL for longer patrol periods than the small helicopter. Also, the STOL can guide ground units to a location about as effectively as a helicopter.

On the other hand, when the police agency has a large area of responsibility, the STOL has capabilities for routine police and other public

safety operations that cannot be matched by a small helicopter. The speed and range of the STOL permit the fixed wing aircraft to do patrol work that would require two or three small helicopters.

The STOL has two apparent limitations. First, since the FAA waiver has not yet been obtained, the STOL cannot fly below 1,000 feet over populated areas, whereas the helicopter routinely patrols at 300 feet. From 1,000 feet, it is impossible to distinguish such characteristics as make and model of automobiles. License plates cannot be read even with binoculars. While the STOL can see most of the things which are visible from the helicopter, the same degree of detailed observation is simply not available from 1,000 feet.

Secondly, the STOL is limited in its effectiveness because of the risks associated with off-airport landings. Whereas the helicopter lands virtually every day for routine on-site investigations, the STOL has so far made no off-airport landings. Thus, whenever the STOL observes something suspicious, it must get a ground unit or the helicopter to check it out. The STOL may even have to orbit the area until another unit arrives at the scene. The helicopter, which usually is able to land at or near the scene, may be more efficient than the STOL in terms of man-hours spent checking out suspicious situations.

Thus, the one clear guideline that has begun to emerge from limited observations on the comparative use of a STOL and a small helicopter is the size of the area to be covered. The larger the area, the more useful is a STOL for police activities; conversely, the smaller the area, the less useful is the STOL. Small helicopters, up to twice as costly as the Helio-Courier in use at Dade County, would be required to perform as well as a STOL operating in larger areas.

Robert M. Michie, Supervisor
Planning and Research Bureau

Lieutenant I. Heller, Supervisor
Aviation Section

June 16, 1970

After Action Report -
Liberty City Disturbance,
June 16, 1970

The Supervisor of the Aviation Section was initially contacted at 2:05 a.m., June 16, 1970, in reference to the implementation of Control Plan I regarding a civil disturbance in the Liberty City area. The following is the official Aviation Section Log pertaining to the disturbance.

2:05 AM Supervisor of Aviation Section was contacted at home by Major Black and was advised that the STOL Aircraft was requested for lighted surveillance of the area of 54th Street and N.W. 27th Avenue.

2:07 AM Lieutenant Hartles, Shift Commander, Communications Bureau, called in reference to the use of the STOL Aircraft. He advised that Captain Butterbrodt, Central District Commander, be contacted at the Command Post regarding availability of the STOL.

2:10 AM Captain Butterbrodt was telephonically contacted at the Command Post. Information revealed that the disturbance centered around N.W. 27th Avenue between 50th Street and 54th Street. Captain Butterbrodt commented that the use of the STOL Aircraft should be considered; however, he also mentioned there was rain and overcast skies in the immediate area.

2:15 AM Contacted Mr. Robert Michie, Supervisor, Planning and Research Bureau, and advised him of the situation. Mr. Michie advised that he would respond by reporting to the Aviation Section office.

2:16 AM Contacted Helio Pilot N. Shubert and advised him to report to the Aviation office.

2:17 AM Contacted Helio Pilot B. Riggs and advised him to report to the Aviation office.

2:19 AM Contacted STOL Pilot Elliott and advised him to report to the Aviation office.

2:21 AM Contacted STOL Pilot Williams and advised him to report to the Aviation office.

2:23 AM Contacted Cornell Aeronautical Laboratory representatives Dr. S. Zobel and Allen Kidder and Special Consultant to LEAA, Mr. Red Jones, and advised them to report to the Aviation office. Aforementioned representatives are in Miami conducting an Air Mobility Study on the STOL Aircraft.

2:30 AM Sergeant Elliott arrived.

2:38 AM Lieutenant I. Heller arrived.

2:40 AM Pilot Williams arrived.

2:53 AM Mr. Michie arrived.

2:55 AM Communications Shift Commander, Lieutenant Hartles, called and stated that the Supervisor of the Aviation Section contact Chief H. W. Barney at Communications - 377-7601.

2:56 AM Chief H. W. Barney was contacted. Chief Barney instructed the Supervisor of the Aviation Section to recheck with Captain Butterbrodt on existing conditions at the disturbance scene before sending the STOL aloft. Chief Barney commented that the use of the "Nightsun" spotlight might stir up more confusion within the affected community boundaries if in fact the scene was quiet and orderly.

2:58 AM Captain Butterbrodt was contacted. A joint decision was made between the Supervisor of the Aviation Section and Captain Butterbrodt to fly a surveillance mission over the trouble area and refrain from using the "Nightsun" spotlight unless advised to do so by the Command Post.

3:00 AM Helio Pilot Riggs arrived.

3:02 AM Chief H. W. Barney again contacted and advised of the decision to use the STOL.

3:07 AM Check with weather conditions revealed rain had stopped, partly cloudy, visibility appeared to be good.

3:10 AM Helio Pilot Shubert arrived.

3:12 AM STOL engine warm up and taxi to take-off position.

3:18 AM Cleared for take-off, STOL off the ground and in flight to scene.

3:22 AM STOL approaching trouble area (4 minutes response time from take-off to target area).

3:23 AM-3:45 AM STOL flew over disturbance area at 1,000 feet, cleared with Miami International Airport control tower, concentrated surveillance on N.W. 27th Avenue, east to N.W. 22nd Avenue, Southbound from N.W. 54th Street to N.W. 46th Street. Concerted surveillance effort made on second apartment building north of 50th Street. Affected site was well marked with flares. Visibility excellent. STOL reported to Command Post that the area appeared quiet. Only activity was that of PSD ground units.

3:46 AM Command Post cleared STOL to return to base.

4:22 AM Control Plan I cancelled.

4:40 AM Contacted M.I.A.P. control tower and expressed our thanks for their cooperation.

7:15 AM-8:15 AM Helicopter sent aloft with PSD cameraman to photograph disturbance scene. Movies and stills were taken.

Summary

The STOL aircraft remained in flight over the disturbance area for a period of 23 minutes out of a total flight time of 38 minutes. During this time the aircraft communicated with the Command Post and advised of the absence of hostile activities.

The Supervisor of the Aviation Section conferred with Captain Butterbrodt on the effectiveness of the STOL Aircraft. He related that in his opinion the use of many additional man hours was avoided by employing aerial reconnaissance. The cancellation of Control Plan I prior to daylight was made possible by the use of the STOL according to Captain Butterbrodt. Twenty (20) minutes after the final decision to deploy the STOL, the aircraft was over the immediate scene.

It is recommended that the Aviation Section office in Opa Locka be equipped with a base station, as ground radio communications were accomplished by driving a police vehicle up to an open door and monitoring the radio transmissions.

IH/wm

E. Wilson Purdy, Director
Public Safety Department

Robert M. Michie, Supervisor
Planning and Research Bureau

June 16, 1970

After Action Report -
Liberty City Disturbance
June 15-16, 1970
(Case #72498-N)

Please find below a chronological itemization of activities and/or incidents involving the writer in relation to the above subject matter. Also, please find attached a similar report from Lieutenant I. Heller, Supervisor, Aviation Section, regarding this same matter.

0200 The writer received a telephone call from Communications Shift Commander Lieutenant Stanley Hartles, requesting a verification of Lieutenant I. Heller's home telephone number. The number, as recorded in the Communications Bureau, was in error and Lieutenant Hartles was advised of the proper number (624-1565).

During this conversation, Lieutenant Hartles advised that Central District Commander Captain David Butterbrodt and Acting Chief, Police Division, Major Charles Black, were desirous of deploying the STOL Aircraft for the purposes of illuminating an area of disturbance described as being along 27th Avenue between 50th and 54th Streets.

0215 Lieutenant Heller telephoned the writer and advised that he had received a telephonic request from Major Black along the lines described above and he was requested to activate the Aviation Section and to verify through Captain Butterbrodt the efficacy of deploying that sections elements.

0215-0225 The writer monitored Central and "D" Frequencies for the purpose of obtaining on-site information.

0253 The writer arrived at the Opa Locka Airport and met with officers of the Aviation Section, representatives of the Cornell Aeronautical Laboratory and Special Consultant from the U.S. Department of Justice.

0425 Subsequent to the completion of a surveillance mission by the STOL Aircraft (see attached report) and upon the securing of Control Plan I, (0422), the writer contacted Executive Assistant H. W. Barney at 377-7601 in reference to the maintaining of a standby status by Aviation Section personnel.

0435 Met with Executive Assistant H. W. Barney, Captain Butterbrodt, Mr. James R. Jorgenson and Mr. Howard Levine in Room 315 of the Public Safety Department for the purpose of evaluating information available to meeting participants.

0600 Secured from activities directly relating to the above subject matter and commenced preparation for routine daily activities.

RMM/wm
Attachment
cc - R. L. Starling, Chief
Administrative Division

Lieutenant I. Heller, Supervisor
Aviation Section

Robert M. Michie, Supervisor
Planning and Research Bureau

June 17, 1970

Police Aviation Section Log,
Disturbance in Liberty City,
After Action Report
Master Case #73166N

Lieutenant I. Heller, Supervisor
Aviation Section

Attached is the official Police Aviation Section Log commencing at 6:20 p.m., June 16, 1970, and ending at 2:49 a.m., June 17, 1970.

The above mentioned times reflect the height of the disturbance.

IH/wm
Attachment

AVIATION SECTION - LOG

June 16, 1970

6:20 PM Chief Starling, Administrative Division, called the Supervisor, Aviation Section, at home and advised of Control Plan I and the location of the Command Post at Fire Station 2.

6:25 PM Mr. R. Michie, Supervisor, Planning and Research Bureau, called and advised he would meet Lieutenant I. Heller at the Aviation Building, Opa Locka.

6:28 PM Contacted Officer Riggs - advised to report to Aviation Section.

6:30 PM Contacted Sergeant Elliott - advised to report to Aviation Section.

6:35 PM Contacted Officer Shubert - advised to report to Aviation Section.

6:45 PM Officer Riggs arrived.

6:50 PM Lieutenant Heller arrived.

6:55 PM Sergeant Elliott arrived.

6:58 PM Mr. R. Michie arrived.

6:59 PM Called the Communications Bureau Shift Commander and advised that the Aviation Section was operational.

7:00 PM Lieutenant Pletcher was contacted at the Command Post at Fire Station 2, phone 691-6501. The Lieutenant was advised that the Aviation Section was ready for service.

7:01 PM Officer Shubert arrived.

7:05 PM Attempted to contact Lieutenant Leathers at his residence in reference to obtaining tear gas. Lieutenant Leathers was not at home.

7:05 PM Lieutenant Portz was contacted in regard to obtaining a supply of liquid tear gas. Lieutenant Portz stated he would call back.

7:10 PM Lieutenant Portz called back and stated that Mr. Getzman, Business Management, was enroute to PSD building in order to procure the liquid tear gas.

7:20 PM-
9:40 PM STOL departed on an aerial surveillance of trouble area. Illumination of troublesome areas requested by ground forces located burning vehicles, crowd formations, house fires, checked roofs for snipers and advised locations of burning fire bombs.

7:30 PM- 8:25 PM — Helicopter departed for aerial surveillance of area - N.W. 36th Street north to N.W. 79th Street, from N.W. 32nd Avenue, east to N.W. 7th Ave.

7:40 PM — Mr. McDonald contacted the Aviation Section and advised that Control Plan II was in effect. Also advised that Mr. Michie inform his personnel as to control status.

7:50 PM — Cornell Aeronautical Laboratory Representatives and Mr. "Red" Jones of LEAA arrived.

8:05 PM — Mr. Britton, Animal Control, called. Stated Officer Miller will be arriving at the Opa Locka Aviation Section office with two trucks in order to transport equipment to the disturbance area.

8:35 PM — Mr. McDonald called for Mr. Michie as per Chief Starling's request.

8:38 PM — Helicopter returned. Mr. Michie left the Aviation office enroute to the PSD building.

9:23 PM — Attempted to contact Officer Williams at home with negative results.

9:45 PM — Mr. Michie called reference status of Aviation Section.

9:50 PM — Command Post requested STOL or helicopter for illumination of area at N.W. 52nd Street and 27th Avenue and N.W. 27th Avenue and 72nd Street.

10:00 PM- 11:10 PM — Helicopter illuminated rooftop near N.W. 27th Avenue and 72nd Street where two subjects had been shot.

10:13 PM- 11:50 PM — STOL flew lighted rooftop surveillance. Located auto and house fires.

11:35 PM — Officer Williams arrived.

11:50 PM — Contacted Captain Butterbrodt, at C.P., 691-8940. Decision was made to keep the helicopter in service.

11:55 PM — It was decided that Officer Riggs would remain at the C.P. with the helicopter. C.P. would supply the observer if one was needed. All other personnel were dismissed and told to return at 9:00 a.m. the following morning.

June 17, 1970

12:01 AM- 1:10 AM — Helicopter participated in another aerial surveillance. Located and advised on a burning motor vehicle.

2:49 AM — Control Plan I in effect - Officer Riggs allowed to secure as per Captain Butterbrodt. Officer Riggs placed on off duty telephone standby.

Mission Effectiveness

Between 7:20 p.m., June 16, 1970 and 1:10 a.m., June 17, 1970, (period of five hours and 50 minutes) the STOL Aircraft and the helicopter participated in five missions totalling seven hours and two minutes of actual flight time.

During the aforementioned time, the STOL flew two missions for a total of three hours and 57 minutes. The helicopter participated in three missions for a total of three hours and five minutes.

Sergeant Elliott piloted the STOL Aircraft while Lieutenant I. Heller rode as an observer in the same craft during the nighttime operations. Officers Shubert and Riggs alternately piloted the helicopter during the same time period. With the exception of the time devoted as an observer on the STOL, Lieutenant Heller remained in the Police Aviation office, acting in the capacity of a flight operations supervisor. Plans are now in effect to seek and train police officers within the districts to be aerial observers in both the STOL and the helicopter.

The STOL and the helicopter were utilized in aerial surveillance during the height of the disturbance. The STOL Aircraft was repeatedly asked to illuminate certain areas by the ground forces. The STOL and the helicopter were successful in aiding the ground forces by reporting locations of burning vehicles, rooftop fires and gatherings of large crowds.

TO: E. Wilson Purdy, Director
Public Safety Department

DATE: June 18, 1970

FROM: Robert M. Michie, Supervisor
Planning and Research Bureau

SUBJECT: After Action Report - Liberty City Disturbance, June 16-17, 1970

Please find below a chronological itemization of activities and/or incidents involving the writer in relation to the above subject matter. Also please find attached a similar report from Lieutenant I. Heller, Supervisor, Aviation Section, regarding this same matter.

1800 Secured from Northern District Substation one portable radio Model HH300 for installation at the Public Safety Department Aviation Section's office (Opa Locka Airport).

1858 Arrived at Aviation Section office and participated in the pre-flight briefing session with members of this section.

1930 Participated as observer with Unit 250 (helicopter) in aerial reconnaissance of the area of disturbance in Liberty City. This reconnaissance generally included the area bounded by N.W. 37th Avenue on the west, N.W. 72nd Street on the north, N.W. 17th Avenue on the east and Interstate 195 on the south. Particular attention was directed to those areas surrounding N.W. 27th Avenue and 46th Street; N.W. 27th Avenue and 54th Street; N.W. 27th Avenue and 62nd Street; N.W. 22nd Avenue and 46th Street; N.W. 22nd Avenue and 54th Street; N.W. 22nd Avenue and 62nd Street; N.W. 17th Avenue and 46th Street; N.W. 17th Avenue and 54th Street; N.W. 17th Avenue and 62nd Street; and N.W. 17th Avenue and 72nd Street intersections.

Response time from time of departure to arrival at the Command Post (Fire Station 2) approximated eight minutes. During a portion of this flight, ground units requested that an attempt be made to disperse a group of approximately 25 bystanders in the area of N.W. 27th Avenue and 46th Street. Aerial observation indicated that this group included a number of sub-teenagers and the aerial drop of tear gas cannisters from our operational altitude (250-300 feet) was determined inadvisable by the writer because of the presence of these juveniles. Some effect was noted, however, through the use of the airborne public address system.

2035 Secured from airborne observation activities and reported to the headquarters Command Post Operations Room located in the Communications Bureau portion of the Public Safety Department Activities were related to my role as the Acting Chief of the Administrative Division (Bravo shift) and continued until Control Plan II was secured by field personnel at 0225.

RMM/wm
Attachment

Robert M. Michie, Supervisor
Planning and Research Bureau

Lieutenant I. Heller, Supervisor
Aviation Section

June 18, 1970

Police Aviation Section
Log, Disturbance in Liberty
City - After Action Report
Master Case #73166N

Attached is the official Aviation Section log starting at 6:51 p.m., June 17, 1970 and terminating at 4:00 a.m., June 18, 1970.

The above mentioned times reflect the height of the disturbance.

IH/wm
Attachment

AVIATION SECTION - LOG

June 17, 1970

6:51 PM Contacted the complaint desk in order to determine the location of the Command Post. (Gladeview Elementary School, 62nd Street and N.W. 27th Avenue, phone 691-8940).

7:05 PM Called C.P., spoke to school security guard Kominsky and advised to have Captain Butterbrodt to call Aviation Section.

7:08 PM Sergeant Elliott arrived.

7:30 PM Spoke to Captain Butterbrodt and advised him that the Aviation Section was operational.

7:55 PM Officer Williams arrived.

8:00 PM Officer Riggs left with the gas truck and proceeded to the C.P. Officer Shubert will fly the helicopter to the C.P. and pick Riggs up.

8:05 PM Communications advised of curfew times.

8:15 PM Decision made to assign Officer Riggs and helicopter to the C.P.

8:20 PM- 2:31 AM Helicopter on aerial surveillance mission. Helicopter recorded four hours and twenty minutes of actual flight time. Sergeant Bobby West flew as an observer during this period of time.

8:33 PM- 11:40 PM STOL assigned to aerial surveillance mission. Recorded three hours and ten minutes of actual flight time. Illuminated areas requested by ground forces. Checked areas for fires, snipers and large crowds.

9:00 PM Officer Shubert went home, told to report back at 9:00 a.m. next morning.

10:18 PM Phone check with C.P. to determine present status.

11:00 PM Check with complaint desk on departmental status.

June 18, 1970

2:00 AM Sergeant Elliott, Dr. Zobel, Allen Kidder, and Red Jones of LEAA left for home.

2:15 AM Lieutenant Heller left for home.

4:00 AM Officer Riggs went home - will remain on telephone standby.

Mission Effectiveness

Between 8:20 p.m., June 17, 1970 and 2:31 a.m., June 18, 1970 (period of six hours and 11 minutes) the STOL Aircraft and the helicopter participated in two missions totalling seven hours and 30 minutes. The STOL flew one mission for a total of three hours and ten minutes. The helicopter flew one mission for a total of four hours and 20 minutes.

Sergeant Elliott piloted the STOL Aircraft and Officer Williams rode as the observer. Officer Riggs commanded the helicopter and Sergeant Bobby West was the observer.

During their flight mission, the STOL Aircraft responded to approximately 30 ground calls. The STOL performed aerial surveillance over the disturbance area locating fire bombings and in turn reporting the affected areas to the ground forces. The STOL illuminated rooftops, sniper suspects and suspicious trouble areas with its "nightsun" spotlight. On one occasion the STOL observed subjects looting a store and advised the helicopter (Unit 250) of the circumstances. The area was illuminated and one subject was shot and apprehended by the Task Force.

The helicopter utilized its spotlights (two converted DC3 landing lights) by illuminating trouble spots pointed out by the ground units. The helicopter successfully dropped tear gas cannisters on suspected snipers. The helicopter was also instrumental in directing fire units to the scene of a burning school building.

Lieutenant Heller remained in the Aviation Section office throughout the entire operations in order to coordinate flight activities.

TO: E. Wilson Purdy, Director
Public Safety Department

DATE: June 18, 1970

FROM: Robert M. Michie, Supervisor
Planning and Research Bureau

SUBJECT: After Action Report -
Liberty City Disturbance,
June 17-18, 1970

Please find below a chronological itemization of activities and/or incidents involving the writer in relation to the above subject matter. Also please find attached a similar report from Lieutenant I. Heller, Supervisor, Aviation Section, regarding this same matter.

1700 Remained on post in Planning and Research Bureau in anticipation of the possible implementation of control plans concerning disturbances in the Model City Area.

2230 Visited Public Safety Department Aviation Section office (Opa Locka Airport) for the purpose of on-site examination of that section's operations and have consultation with Aviation Section personnel and with consultants from the U.S. Department of Justice and the Cornell Aeronautical Laboratory.

2400 Secured from Aviation Section office and returned to Planning and Research Bureau for discussions with Chief R. L. Starling and other members of the Division who had also remained on board for possible activation (Transportation Officer Leo Portz, Fiscal Officer C. M. McDonald and Policewoman Carol Coleman).

0115 Secured from office routine.

RMM/wm
Attachment

Robert M. Michie, Supervisor
Planning and Research Bureau

June 19, 1970

Police Aviation Section Log -
Disturbance in Liberty City
After Action Report
Master Case #73166N

Lieutenant I. Heller, Supervisor
Aviation Section

Attached is the official Police Aviation Section log commencing at 4:30 p.m. June 18, 1970 and ending at 2:10 a.m., June 19. 1970.

The above mentioned times reflect the height of the disturbance.

IH/wm
Attachment

AVIATION SECTION - LOG

June 18, 1970

1:15 PM- 2:15 PM — Helicopter requested for aerial surveillance. One hour flight time.

4:30 PM — Received a call from Mr. Michie reference standby status. Was advised that all forces would be pulled out of the Liberty City area and regrouped at the Command Post, Gladesview Elementary School, 62nd Street and N.W. 27th Avenue.

Additional information received indicated that the STOL Aircraft and the helicopter would be the only units patrolling within the disturbance area. Flight operations were to commence at 6:00 p.m. and remain in effect until 8:30 p.m. During this time a meeting was to be held at the Brownsville Community Center in order to arrive at a solution to the disturbance problem.

4:35 PM — Contacted Sergeant Elliott - advised to report to Aviation Section.

4:40 PM — Contacted Officer Riggs - advised to report to Aviation Section.

4:47 PM — Lieutenant Grose contacted Aviation Section - advised of flight boundary zones, 36th Street north to 79th Street and N.W. 7th Avenue to N.W. 32nd Avenue.

4:50 PM — Contacted Lieutenant Farr, City of Miami Police Department Command Post phone numbers 635-1990 and 635-0542, and advised them of PSD flight operations and boundary zones.

4:51 PM — Received four five-gallon cannisters of liquid tear gas.

5:10 PM — Called Captain Butterbrodt at C.P. and advised him of the liquid tear gas.

5:35 PM — Riggs arrived.

5:36 PM — Elliott arrived.

5:40 PM — Williams arrived.

5:50 PM- 8:00 PM — Aerial surveillance of disturbance area with helicopter (two hours and ten minutes flight time).

6:00 PM- 9:20 PM — Aerial surveillance of disturbance with the STOL Aircraft (three hours and twenty minutes flight time).

7:50 PM — Curfew will be in effect starting 8:30 p.m.

8:05 PM — Checked with C.P. on control status.

9:20 PM-10:20 PM — Helicopter refueled and headed back to disturbance area. (Two hours flight time.)

10:05 PM-12:10 AM — STOL called in again for aerial surveillance. (Two hours flight time.)

10:45 PM-12:45 AM — Helicopter returned to disturbance area for air surveillance. (Two hours flight time.)

11:00 PM — Check with communications on disturbance status.

11:30 PM — Checked with C.P. reference effectiveness of STOL and helicopter.

11:35 PM — Mr. Michie arrived at Aviation Section office for briefing with Supervisor, Aviation Section.

June 19, 1970

12:30 AM — Check with communications on control status.

1:30 AM — Checked with the C.P., Captain Butterbrodt stated that both aircraft could be grounded as the intensity of the disturbance had deescalated.

2:00 AM — All personnel left for home. Riggs remained on telephone standby for the helicopter.

Mission Effectiveness

Between 1:15 p.m., June 18, 1970 and 2:00 a.m., June 19, 1970, (period of 12 hours and 45 minutes) the STOL Aircraft and the helicopter participated in six missions totalling 12 hours. The STOL flew two missions for a total of five hours and 50 minutes. The helicopter flew four missions for a total of six hours and ten minutes. In addition, the helicopter flew a one hour aerial photographic mission over the disturbance area at 10:30 a.m. on the same date.

Sergeant Elliott, Officer Riggs and Officer Williams alternated as pilots and observers on the STOL Aircraft during the aerial flights over the disturbance area. Officer Shubert and Officer Riggs alternated as pilot and observer on the helicopter during the same times, from the hours of 6:00 p.m., June 18, 1970 to 1:00 a.m., June 19, 1970. The STOL Aircraft and the helicopter were the only units patrolling the disturbance area located south to N.W. 36th Street, North to N.W. 79th Street, West to N.W. 32nd Avenue, and East to the City of Miami limits. The only other units in this immediate area were the special task force. All other patrol units and men were withdrawn and repositioned at the Command Post, Gladesview Elementary School, N.W. 62nd Street and 27th Avenue.

Mission Effectiveness (cont'd)

The STOL Aircraft flew aerial surveillance and reported on the locations of suspected snipers, crowd gatherings, looters, fire bombings and motor vehicle accidents. The STOL Aircraft kept a constant vigilance on the Brownsville Community Center, 49th Street and N.W. 27th Avenue, where a meeting of county and local officials was being conducted in regards to negotiating a suitable solution to the disturbance problem.

The STOL's spotlight was effectively utilized in lighting up questionable trouble locations when requested by the special task force.

The helicopter also participated in night aerial surveillance. The rotary craft responded to numerous requests of assistance by the task force. The helicopter utilized its landing lights to illuminate trouble spots. It verified, via radio communications, fire bombings at the Pic & Pay Grocery, 54th Street & N.W. 27th Avenue, and another uncontrolled fire at the Palm Movie Drive-In located at 69th Street and N.W. 27th Avenue. The same craft advised of rock throwings, crowd gatherings and suspected sniper locations. The Florida Highway Patrol requested assistance in the area of 34th Street and N.W. 29th Avenue in apprehending a group of subjects hiding in the bushes that were allegedly armed with rifles. The helicopter complied and dropped tear gas cannisters over the affected location. The subjects apparently scattered and fled the area.

SPECIAL INFORMATION:

Aviation Section personnel flying both the STOL and the helicopter advise that the police shield decal on the Police Officers' helmets were observed as being brightly illuminated from the air with or without the help of the aircrafts' spotlight. This was especially noticeable when the officers were running between the houses. The same decals can just as easily be seen by snipers. This matter has been discussed with Major Black, Detective Bureau.

TO: E. Wilson Purdy, Director
Public Safety Department

FROM: Robert M. Michie, Supervisor
Planning and Research Bureau

DATE: June 24, 1970

SUBJECT: After Action Report -
Liberty City Disturbance,
June 19, 1970

Please find below a chronological itemization of activities and/or incidents involving the writer in relation to the above subject matter. Also, please find attached a similar report from Lieutenant I. Heller, Supervisor, Aviation Section, for the period June 18-19, 1970, regarding this same matter.

1700 Remained on duty at the Planning and Research Bureau office for the purpose of determining that the "all quiet" was continuing.

1830 Secured from duty.

RMM/wm
Attachment

TO: E. Wilson Purdy, Director
Public Safety Department

DATE: June 24, 1970

FROM: Robert M. Michie, Supervisor
Planning and Research Bureau

SUBJECT: After Action Report - Liberty City Disturbance, June 18, 1970

Please find below a chronological itemization of activities and/or incidents involving the writer in relation to the above subject matter.

1630 Advised Lieutenant Heller that strategies relating to police activities in the Brownsville area for this evening involved the withdrawal of all Public Safety Department personnel from the area of disturbance, with positions to be taken at particular staging areas outside the perimeter of the subject area.

Further advised that both the STOL and helicopter units of the Aviation Section, between the hours of 1800 and 2000, were to maintain aerial surveillance of the Brownsville area for the purpose of providing intelligence as to the movements and/or civilian activities which would be in contravention to an agreement between officials of Dade County and certain "representatives" of the Brownsville colored community. This agreement concerned the withdrawal of Public Safety Department personnel during the hours cited above and the granted "freedom of movement" so that a meeting could be held by members of the Negro community in the Brownsville Community Center.

Further advised Lieutenant Heller to establish liaison with the Command Post established by the City of Miami Police Department and to advise the Officer in Charge of our Aviation Section's availability to support that department's field units if necessary and/or requested.

2030 Secured from office post for dinner while monitoring Central Frequency for on-site information.

2145 Arrived at the Aviation Section office for contacts with members of that section and with representatives of Cornell Aeronautical Laboratory and the Law Enforcement Assistance Administration.

2335 Secured from duty.

RMM/wm

END

7 ... / ...