31434

PB 244 099

VANDALISM SUPPRESSION BY HELICOPTER

Charles E. Aylworth

Naval Ammunition Depot

Prepared for:

Federal Railroad Administration

January 1973

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

FRA-OPP-74-1
January 1973

PB 244 099

VANDALISM SUPPRESSION BY HELICOPTER

Charles E. Aylworth

JANUARY 1973

FINAL REPORT

Prepared for

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
Office of Policy and Plans
Washington, D.C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

NOTICE

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

ii-a

BIBLIOGRAPHIC DATA SHEET	1. Report No. FRA-OPP-74-1	2.	
4. Title and Subtitle: Vandalism Suppression by Helicopter			5. Report Date: January 1973 6.
7. Author(s): Charles E. Aylworth			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: Behavioral Sciences Division, Naval Ammunition Depot, Crane, Indiana			10. Project/Task/Work Unit No. 11. Contract/Grant No. AR-20013
12. Sponsoring Organization Name and Address: Office of Policy & Plans, Federal Railroad Administration, Department of Transportation, Washington, D. C. 20591			13. Type of Report & Period Covered: Final 14.

15. Supplementary Notes

16. Abstracts

Report on Vandalism Suppression by Helicopter, prepared by Research and Development Department, Naval Ammunition Depot, Crane, Indiana, January 1973.

This research project is a preliminary exploration into procedures, applications and effects of helicopter surveillance of commuter and freight railroad facilities in an urban environment. The project was conducted in the Philadelphia Metropolitan Area in the Spring and Summer of 1972 for the Federal Railroad Administration and with the cooperation of the Penn Central Transportation Company and the Reading Railroad. An attempt was made to document effects of the helicopter patrol and to provide insight into the requirements of a more exhaustive program to attain statistical validation of observed impact of helicopter use.

17. Key Words and Document Analysis. 17a. Descriptors

Vandalism
Helicopter
Patrol
Philadelphia, Pa.
Reading Railroad
Penn Central Transportation Company
Surveillance

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
No restriction on distribution. Available from National Technical Information Service, Springfield, Virginia 22151	UNCLASSIFIED	
	20. Security Class (This Page) UNCLASSIFIED	22

FORM NTIS-35 (REV. 3-72) USCOMM-DC 14952-P72

i-b

PRICES SUBJECT TO CHANGE

NAVAL AMMUNITION DEPOT
CRANE, INDIANA

VANDALISM SUPPRESSION BY HELICOPTER

BY

CHARLES E. AYLWORTH

PREPARED BY:

CHARLES E. AYLWORTH, Research Psychologist, Behavioral Sciences Division

RELEASED BY:

JAMES M. PLAY, Manager, Behavioral Sciences Division

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

PROJECT SUMMARY

This report is part of an ongoing effort aimed at identifying, classifying and preventing acts of vandalism directed against the nation's railroads. The research project represented by this final report was a preliminary exploration into procedures, applications and effects of helicopter surveillance of commuter and freight facilities in an urban environment. This effort was conducted in and around Philadelphia, Pa. during the spring and summer of 1972. The security departments of the Reading Railroad and the Penn Central Transportation Company provided the patrol manpower.

A flexible and adaptive research plan was followed, aimed at providing a broad examination of the helicopter patrols' potential capabilities. Close attention was given to methodological and statistical aspects of research into the vandalism problem in an attempt to document effects of the patrol, and to provide insight into the requirements a more exhaustive program would impose to attain statistical validation of observed impact of helicopter use.

The quantitative data gathered during this study supported the qualitative impression that the helicopter was effective in vandalism suppression. Methodological artifacts, however, prevented the results of this pilot effort from achieving statistical significance. Based on this research, recommendations were made as to specific features to be considered in future patrol programs. In addition, several specific methodological problem areas were identified.

The conclusions, recommendations and opinions expressed in this report are solely those of the author and do not necessarily reflect the policies or official positions of the Department of Navy or the Federal Railroad Administration.

1.6

VANDALISM SUPPRESSION BY HELICOPTER

Introduction

Vandalism, defined as "An act of destruction in which monetary profit is not a prime motive" (quoted in Sanders and Welton 1972, page 13) is a problem of some magnitude for the nation's railroads, particularly those maintaining a sizable percentage of their right-of-way in urban areas. A recent survey of vandalism as experienced by the nation's railroads, conducted by Sanders and Welton, revealed that a median loss of $42,000 annually was sustained due to the acts of vandals. The authors suggest that their estimate was probably somewhat low. Officials of the Penn Central have informally estimated that vandalism costs Penn Central in excess of 1.5 million dollars annually. It should be remembered that these costs do not include the not inconsiderable expenses associated with the operation of railroad security forces, nor do they consider the intangible costs of loss of customer good will and clerical expense for processing damage claims.

Among the nation's railroads, the Penn Central and Reading companies rank as close contenders for the unhappy title of most vandalized. A major portion of these roads' business is conducted within the SEPTA corridor, a highly urbanized area. Since it is axiomatic that railroad right-of-ways tend to run through areas of low socio-economic status, it may be assumed that these companies have a disproportionate exposure

to the population segment most likely to commit acts of vandalism.

Sanders and Welton point out the average vandal is a Caucasian male of between 11 and 16 and of low socio-economic rank. The vandal is most likely to commit his act on an impulsive basis, usually in the context of a peer group, and often in response to peer group social pressure. He is most apt to commit vandalism between the hours of three to eight at night, most commonly on his way home from school, although occasionally he may act on his way to school. The most typical vandalistic act is throwing stones, commonly at signal lights, but often at passenger cars, locomotives, and auto carriers. He will usually choose his target more by opportunity than by design. Attempts to establish motives and attitude set suggest that the vandal usually has not considered the consequences of his act, either in terms of possible catastrophic results for the railroad and its passengers, or with respect to punishment should he be apprehended. Also, most sources examined by Sanders and Welton are in agreement that an apprehended vandal is not likely to repeat his offense.

In view of the above information, the problem of combating vandalism becomes clear. Any measure intended to suppress vandalism must take into account that the incidents are sporadic, unplanned, and, therefore, generally unpredictable. Incidents at any particular location are relatively infrequent, even in high occurrence areas. Any given act of vandalism will most likely be committed by a subject without a prior history of apprehension for vandalism, thus the potential suspect

population must be regarded as the entire community within the critical age band. The Penn Central employs the largest private police force in the United States, a considerable portion of which is deployed in the SEPTA area. However, a majority of vandalism incidents, including most such incidents involving commuter cars, occur in this division. Clearly then, measures other than traditional foot and patrol car monitoring are required.

The requirements of an effective vandalism suppressive measure are in part:

(1) the ability to respond quickly within the area of concern
(2) flexibility to respond to a number of differing events and demands
(3) capability to augment and complement traditional enforcement activities
(4) psychological impact to deter potential vandals prior to destructive acts.

Of course, any method employed must be cost effective and be easily adopted by railroad security forces.

Helicopters as Deterrents

Evaluation of the requirements for an effective vandalism suppressant immediately suggests the possibility of helicopter patrol. Theoretically the helicopter quite adequately meets the criteria for an effective vandalism deterrent. A helicopter is quite able to respond quickly within a fairly large target area. For example, in the urban Philadelphia area nearly all high vandalism locales fall within a circular area of about five miles radius. Assuming that routine patrol will be primarily

confined to this area, the average minimum response time will be less than four minutes. Within the same area, the maximum emergency response time will be less than seven minutes. Response times on this order permit a helicopter patrol to be over a train in trouble quickly enough to identify vandalism participants, and to coordinate apprehensions by ground patrol. It should be noted that, based on Penn Central data, a helicopter patrol should be able to respond to emergency calls in less than a third of the time required by ground patrols.

A helicopter, while tightly constrained as to "ground response", the delivery of an enforcement officer to the site of an incident on the ground, is a most flexible transportation system. Although even a small helicopter may have relatively few potential landing sites, its ability to freely approach most areas of the ground plane to an effective observational distance makes it an outstanding intelligence platform. An officer having an aerial overview of vandalism in progress will effectively multiply many times the ground force, with respect to suspect apprehensions.

Helicopter patrol, when used effectively, would not be divorced from an overall security program, but, rather, would be a complementary agent. Its major impact should not be seen as a new force in security activities, rather it would be expressed as a noticeable increase in departmental efficiency. This increase is ideal in terms of aiding vandalism suppression, however, it makes assessment of a helicopter

patrol's effect more difficult.

Finally, in today's technologically oriented society the helicopter creates a psychological impact on the average citizen greater than might be expected given the machine's size and experiential frequency. This reaction, essentially to the machine itself, can be channeled and directed to give greater impact to the deterrent aspects of a security force. In a low recidivistic population, any agent which increases the rate of apprehension, though mild in its object consequences, will generally have the effect of reducing incident rate. This argues that helicopter surveillance, though only moderately effective in terms of physical arrest, may have a strong deterrent effect on the potential vandal.

Project Objectives

This project began with the above assumptions and conclusions concerning helicopter surveillance as a vandalism suppressant. Previous projects, both by government agencies and by individual railroads, had generally established that helicopter patrol of freight yards did have promising effects toward deterrence of vandalism and cargo theft. Previous experiments had been primarily concerned with patrol of freight facilities. The basic objectives of this research were as follows:

(1) To fly an experimental helicopter patrol over a large urban area (Philadelphia, Pa.) within the SEPTA area of concern. This patrol was to:

(a) Concentrate on commuter car vandalism.

(b) Focus on intra-urban right-of-ways.

(c) Be flexibly conducted in order to fully explore the helicopter's potential.

(2) To develop coordinational and procedural elements to assist two railroad security forces (the Penn Central and the Reading) in cooperative anti-vandalism efforts.

(3) To evaluate existing Penn Central vandalism data as a baseline suitable to statistically document the effects of the patrol.

(4) To consider all possible applications of the helicopter toward suppression of vandalism in a manipulatable and innovative environment, and to make recommendations based on this experience to aid future helicopter patrols.

(5) To attempt to establish a cost-benefit ratio for programs involving non-ownership of the patrol helicopter by participant railroads.

Project Status

Flight activities on this project were substantially complete by 1 November 1972. This report will discuss in detail the accomplishment of the five main objectives, based on the data collected during flight activities and the debriefing of the operating personnel. A list of recommendations for future programs of a similar nature forms the final portion of the report.

CHAPTER 2 - TECHNICAL APPROACH

This chapter will present the physical details of the project and is organized into four parts: equipment, experimental area, helicopter usage, and patrol description. In the last two sections, the usage plan for the flights is explored and a factual narrative illustrating a typical patrol is given.

Equipment and Personnel

The helicopter was obtained through contract bid procedures from one of the commercial helicopter services maintaining operations at Philadelphia International Airport. A bid rate of $80/hour was agreed upon, with a minimum commitment of 180 hours flight time. It was agreed that the railroads would have absolute scheduling authority with respect to the aircraft, providing 24 hours notice of need had been given. The railroad police would also have the aircraft on any notice on an "as available" basis, an arrangement similar to one already in effect with the Philadelphia Municipal Police.

The primary helicopter used was a Bell 47-G-2-A. This aircraft has a bubble type cabin enclosure affording pilot and passengers a clear view forward and down. (See Illustrations 1 and 2). The aircraf can carry three persons and has a patrol capability of nearly three hours. The normal crew was a pilot and a security officer-observer. In order to provide maneuvering margin, all flights in this program were of a nominal two hours duration. The aircraft was equipped with an electronic siren/loudhailer which was operated in either mode by

Illustration 1 - View of Bell 47-G-2-A used in this study (Photo courtesy of Copters, Incorporated)

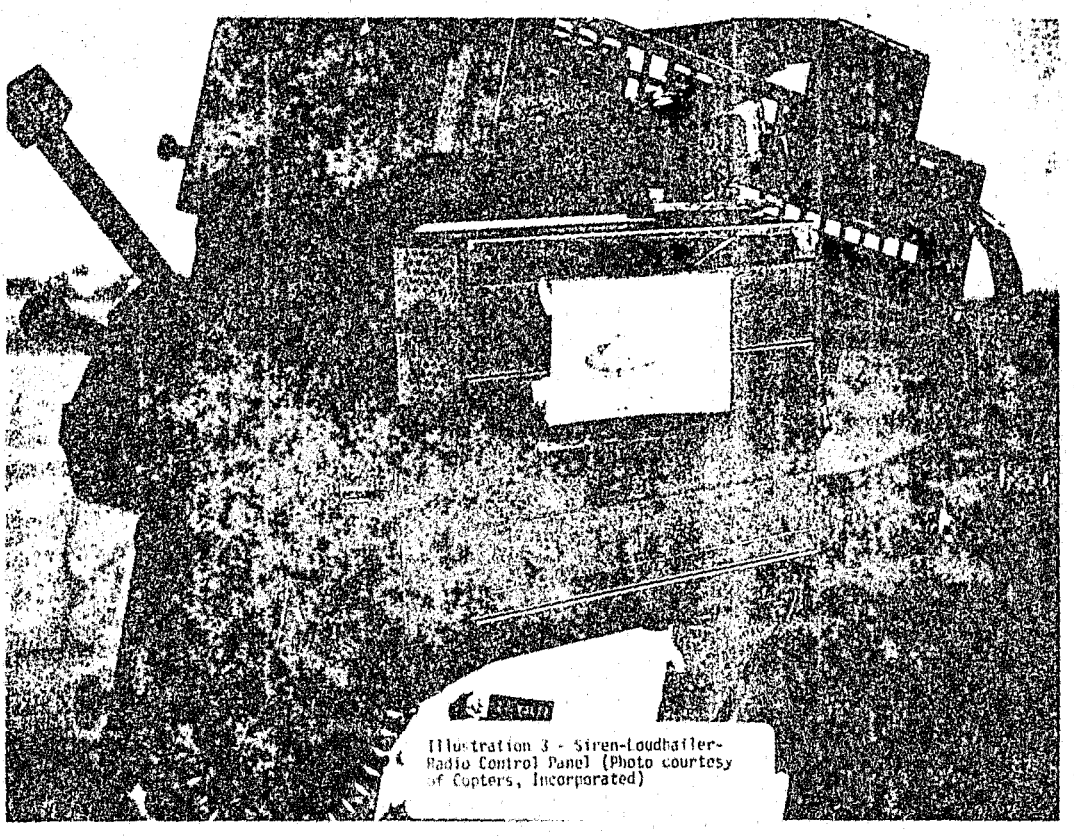


Illustration 3 - Siren-Loudhailer-Radio Control Panel (Photo courtesy of Copters, Incorporated)

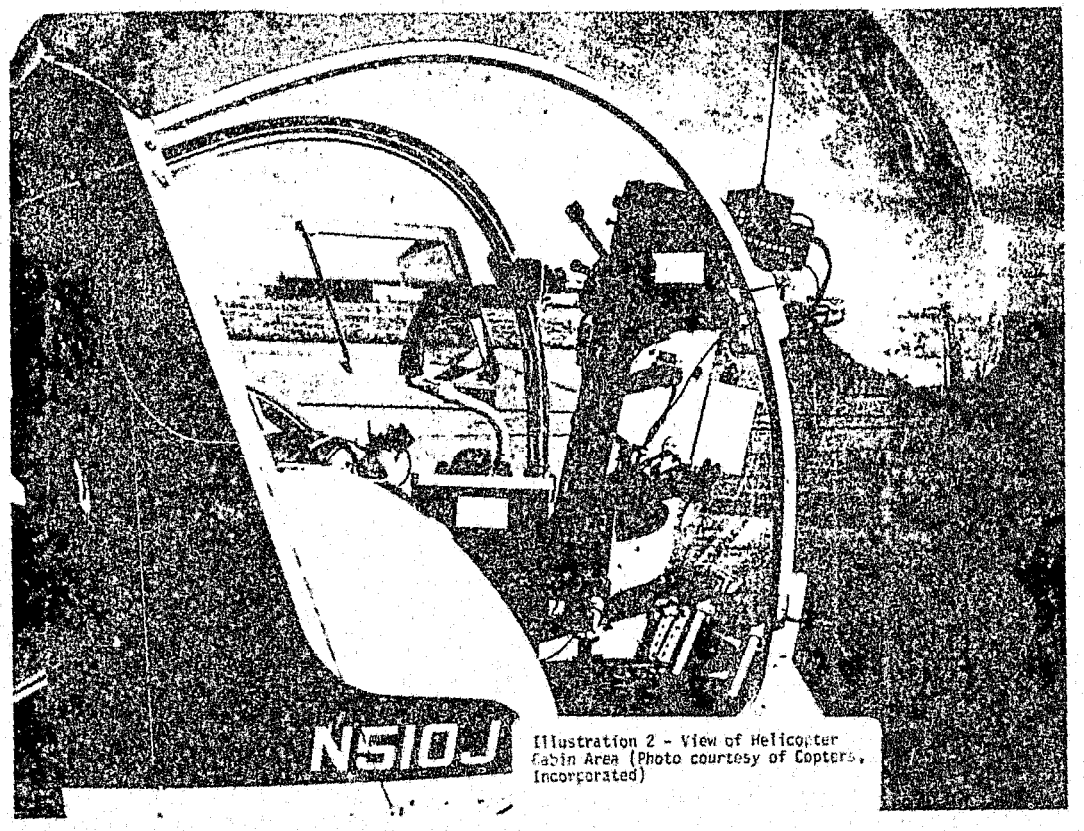


Illustration 2 - View of Helicopter Cabin Area (Photo courtesy of Copters, Incorporated)

the officer-observer (Illustration 3). A fully steerable three million candlepower tungsten-halogen spot light completed the external crime suppression hardware. This light will illuminate nearly the area of a football field from a 1000 feet operating altitude. Used judiciously, it is an invaluable aid on night operations. The NiteSun and its control box are shown in Illustrations 4 and 5 respectively.

The helicopter was equipped with all necessary radios and transponders for legal commercial flight operations conducted in and around Philadelphia. In addition, a multiple channel fm transceiver equipped to operate on four primary channels was installed for observer communications. The observer had available the police and road channels for both railroads. Of these, the observer would regularly guard the security channel for his railroad, occasionally checking with the dispatcher on the other police frequency and the Penn Central road channel. The Reading road channel was provided only for emergency purposes and was not used during the experiment.

Normal ground patrol complements, with some exceptions, made up the rest of the patrol force, the Reading patrols with three ground cars, the Penn Central with six. Both railroads assigned two senior security officers as observers, one man to patrol regularly, one as a backup. The helicopter was piloted by various members of the contractor's staff, although efforts were made to use the same pilots as often as possible.

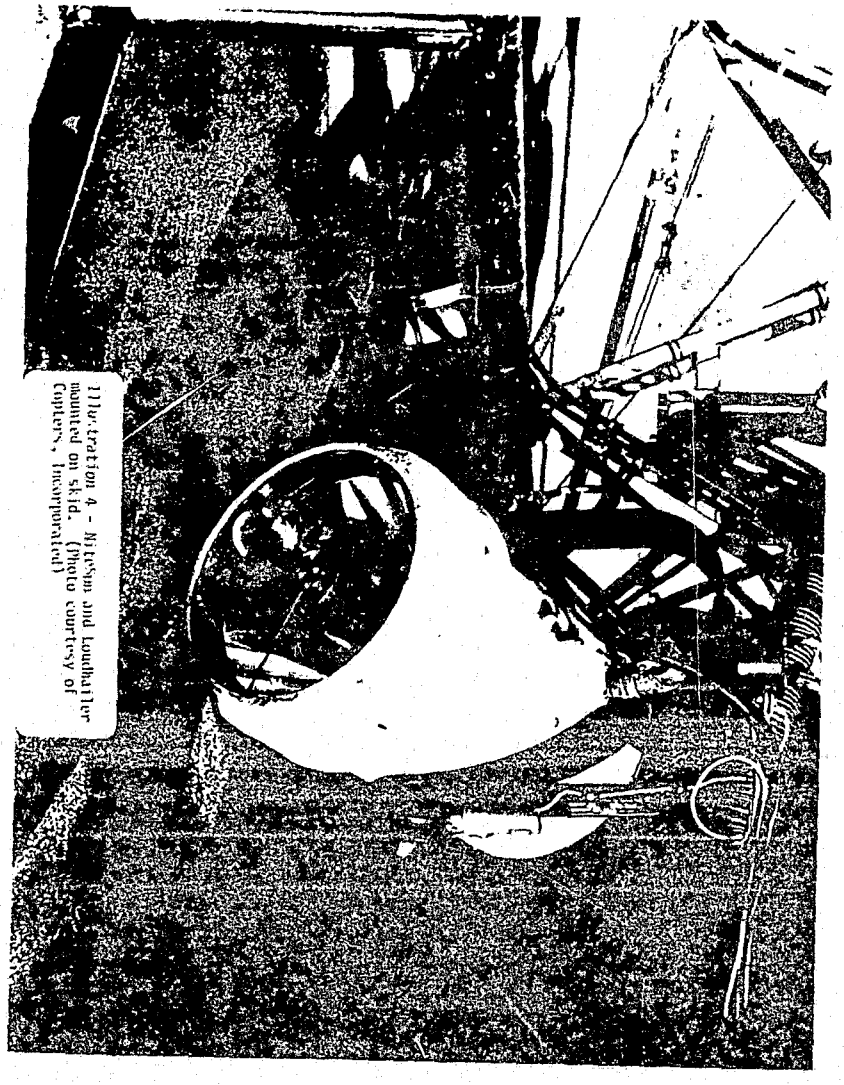


Illustration 4 - NiteSun and Loudhailer mounted on skid. (Photo courtesy of Copters, Incorporated)

Illustration 5 - NiteSun Control Handle. (Photo courtesy of Copters, Inc.)

Experimental Area

The general patrol area within which this investigation was conducted was roughly circular and approximately five miles in diameter. The epicenter of the area was about five miles north and slightly east of downtown Philadelphia in the area of the intersection of Olney Avenue and U. S. 611. A major concentration of rail right-of-ways runs through this area made up of both Penn Central and Reading roadbed. The central portion of the primary patrol area is generally industrial construction. Warehouses, industrial facilities, and some high-density urban housing make up most of the development in this zone. A map of the area may be found in Illustration 6.

Throughout the experimental area, most of the Reading roadbed is used primarily for commuter services. The Penn Central usage runs the gamut of intra-urban passenger service to interstate freight origination. Every type of urban environment, from housing projects to single family residential plots, as well as nearly every sort of railway facility and activity, may be found in the target area. One of the most active areas of vandalism, referred to as the Diamond Street Project, lies in the outer ring of the target zone. Vandalism in the low socio-economic high density housing area is so common that a train passing through unscathed is the exception rather than the rule. (Illustration 7 presents a view of the Diamond Street yard). Throughout the area are holding sidings and commercial spurs servicing various industrial operations. Since these spurs are generally isolated

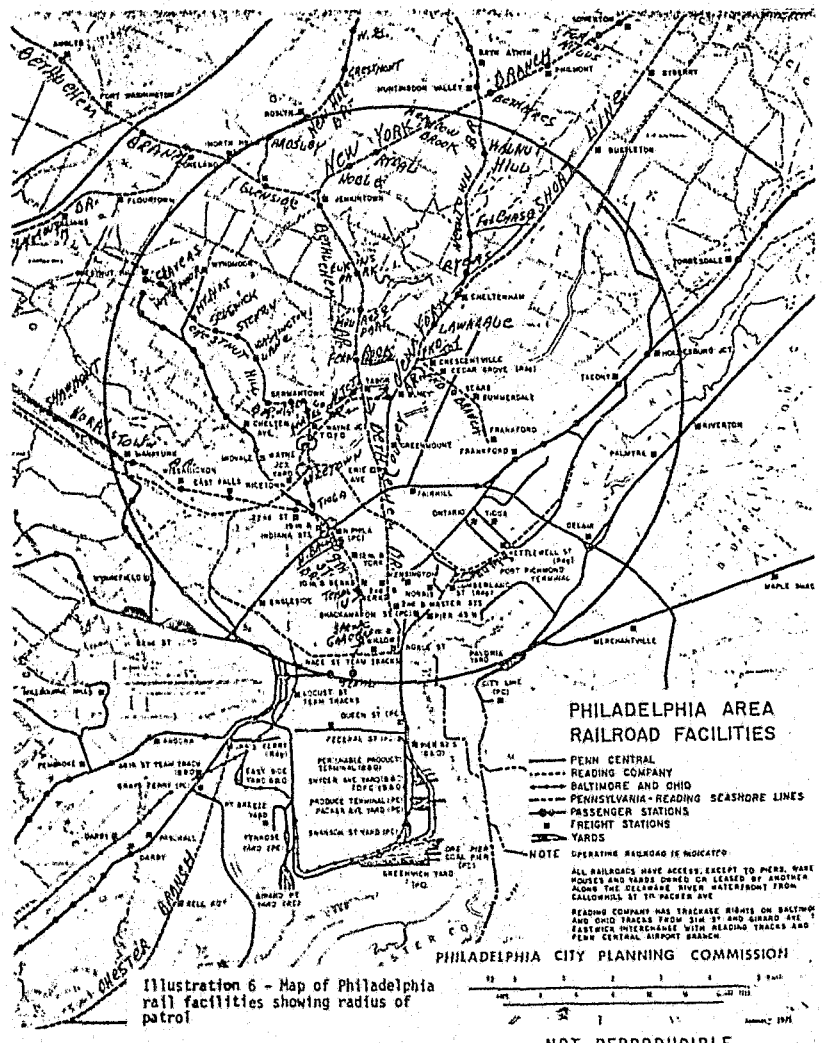


Illustration 6 - Map of Philadelphia rail facilities showing radius of patrol

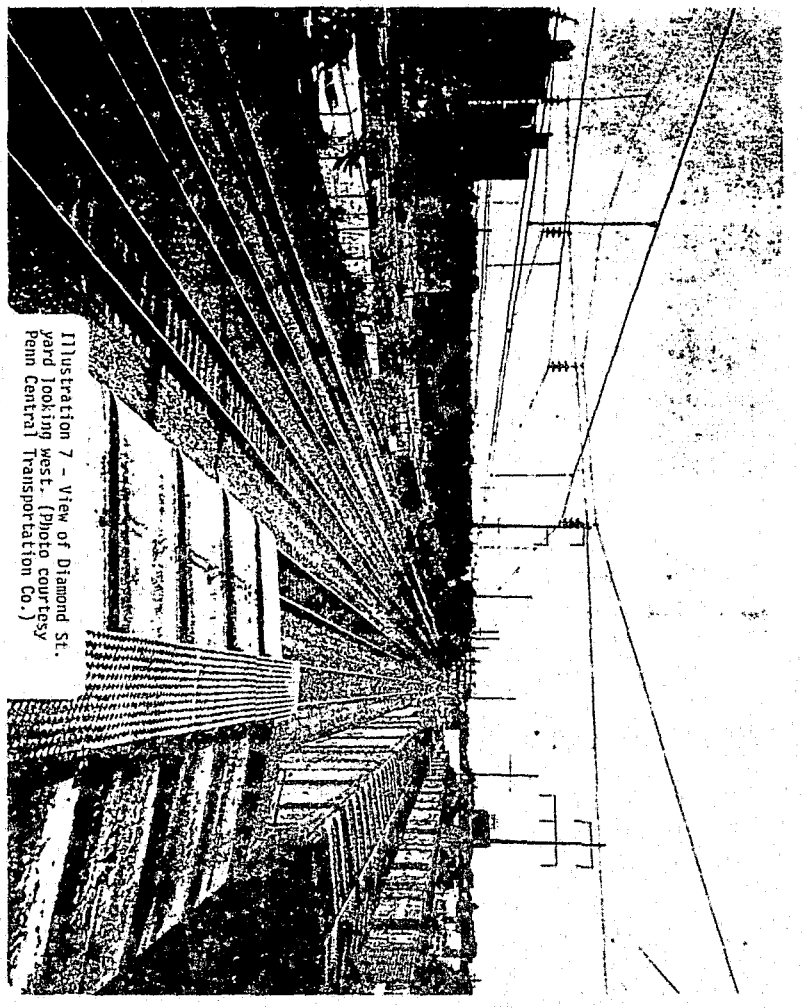


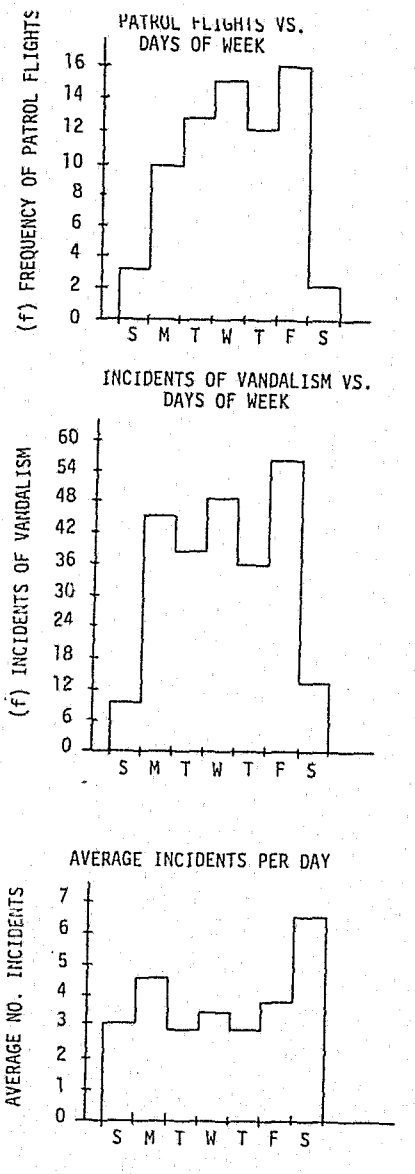
Illustration 7 - View of Diamond St. yard looking west. (Photo courtesy Penn Central Transportation Co.)

from normal ground patrol areas, and often have cars standing for several days, they are prime candidates for destructive mischief. The experimental area can be seen to have provided a wide range of locales and opportunities for vandalism, offering an excellent background against which to assess the effects of helicopter surveillance.

Aircraft Utilization

A major intent of this study was to explore as many potential applications of the helicopter as possible. To this end, scheduling and direction of the patrols was left in the hands of the railroad security departments. The two railroads developed a joint schedule which generally provided three or four flight days per week. These flights were scattered among the days of the week in essentially random order, although more attention was given to school days than to the weekends. Figure 1 presents a graphic representation of flight frequencies by day of the week. By the end of normal flight operations on October 31, 1972, patrol flights had been made on 76 days for a total flight time of 177 1/2 hours. Of these flights, 40 were made by Penn Central observers, and 38 by observers from the Reading. During the month of August, flights were sharply curtailed in order to extend operations through the peak vandalism period occurring around the start of school into the early weeks of October.

The majority of the flights took off between four and six p.m. and lasted about two hours. Originally it had been anticipated that flights



-12-

FIGURE 1 - FLIGHTS AND VANDALISM BY DAY OF WEEK

would be made in the early morning on occasion, but this was found to be too difficult to schedule. At several times during the project, after-dark patrols were conducted. These flights were directed toward establishing the effectiveness of the lighting system and evaluating the capability of the helicopter under conditions of darkness. A few flights were made in the late morning and early afternoon. Scheduling of take-off times roughly corresponded to times of peak vandal activity and reflected, to a large extent, the subjective impression of the observers as to the most effective patrol times.

The patrol plans were developed through discussions by the security chiefs of the participating railroads. The observers took these plans in outline and developed a detailed flight schedule. The observers were encouraged to improvise and innovate while on patrol and were given freedom to make any modifications in the flight plans which they felt would further their mission.

A number of patrol configurations were conducted. During all patrols, the helicopter was available to respond to emergency calls from ground cruisers or trains on the line. On most patrols some time was given to what may be called "random surveillance," a general inspection of areas in which trouble might be expected. Some effort was made to keep the helicopter's search routes unpredictable in order to prevent potential vandals from hiding prior to its approach.

Various methods of protecting both freight and commuter trains were investigated. Three methods of protecting individual trains were over-

flights before, after, and during transit of the train through danger areas. Prior overflight was intended to force potential vandals to seek cover, thus keeping them away from the oncoming train. Following the train was intended to permit apprehension of vandals at the time of attack on a train. Based on the assumption that the copter overhead would represent the probability of immediate apprehension, orbiting over a train was intended to prevent subjects from attacking.

A Typical Patrol

Most patrols followed a standard flight profile varying only in time of take-off and order in which areas were patrolled. A typical patrol would leave Philadelphia International Airport and proceed across the Schuylkill River, passing to the west of the downtown Philadelphia area. A random patrol pattern would be followed, usually beginning with observation of freight facilities.

As the aircraft crossed the river and penetrated the experimental area, the observer would run a communications check, identifying himself to both police dispatchers as "Eagle 1". The dispatcher would report any activity in the area for action by the copter. If no traffic was reported, the observer would continue to guard his company's police channel.

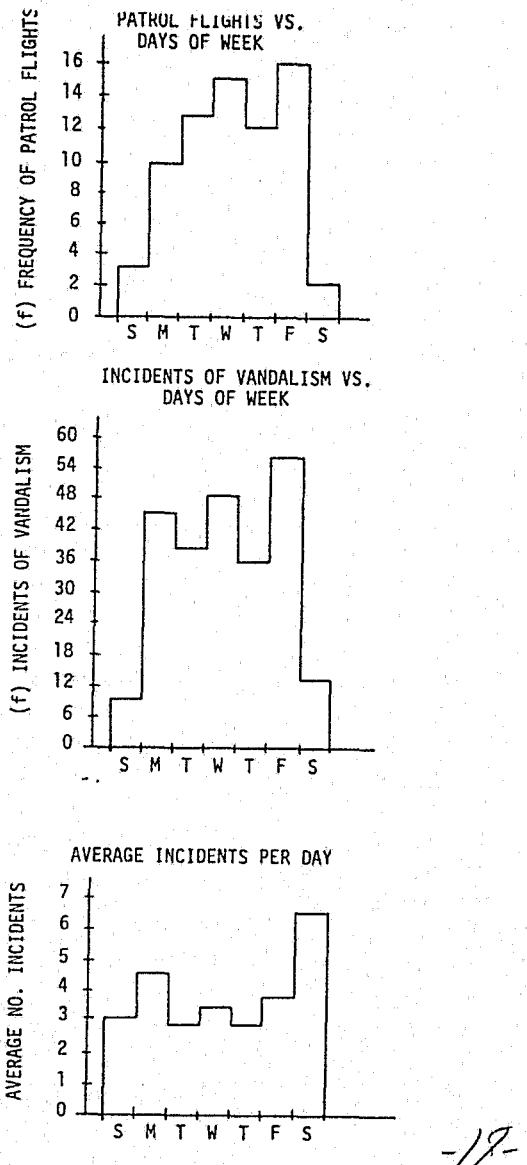
At regular intervals, the observer would check in with both railroad security dispatchers. If trouble calls had been received, or if any particular area of interest had come up (for example, if a train were about to reach a trouble area), the dispatcher would request that Eagle I

from normal ground patrol areas, and often have cars standing for several days, they are prime candidates for destructive mischief. The experimental area can be seen to have provided a wide range of locales and opportunities for vandalism, offering an excellent background against which to assess the effects of helicopter surveillance.

Aircraft Utilization

A major intent of this study was to explore as many potential applications of the helicopter as possible. To this end, scheduling and direction of the patrols was left in the hands of the railroad security departments. The two railroads developed a joint schedule which generally provided three or four flight days per week. These flights were scattered among the days of the week in essentially random order, although more attention was given to school days than to the weekends. Figure 1 presents a graphic representation of flight frequencies by day of the week. By the end of normal flight operations on October 31, 1972, patrol flights had been made on 76 days for a total flight time of 177 1/2 hours. Of these flights, 40 were made by Penn Central observers, and 38 by observers from the Reading. During the month of August, flights were sharply curtailed in order to extend operations through the peak vandalism period occurring around the start of school into the early weeks of October.

The majority of the flights took off between four and six p.m. and lasted about two hours. Originally it had been anticipated that flights



-18-

FIGURE 1 - FLIGHTS AND VANDALISM BY DAY OF WEEK

would be made in the early morning on occasion, but this was found to be too difficult to schedule. At several times during the project, after-dark patrols were conducted. These flights were directed toward establishing the effectiveness of the lighting system and evaluating the capability of the helicopter under conditions of darkness. A few flights were made in the late morning and early afternoon. Scheduling of take-off times roughly corresponded to times of peak vandal activity and reflected, to a large extent, the subjective impression of the observers as to the most effective patrol times.

The patrol plans were developed through discussions by the security chiefs of the participating railroads. The observers took these plans in outline and developed a detailed flight schedule. The observers were encouraged to improvise and innovate while on patrol and were given freedom to make any modifications in the flight plans which they felt would further their mission.

A number of patrol configurations were conducted. During all patrols, the helicopter was available to respond to emergency calls from ground cruisers or trains on the line. On most patrols some time was given to what may be called "random surveillance," a general inspection of areas in which trouble might be expected. Some effort was made to keep the helicopter's search routes unpredictable in order to prevent potential vandals from hiding prior to its approach.

Various methods of protecting both freight and commuter trains were investigated. Three methods of protecting individual trains were over-

flights before, after, and during transit of the train through danger areas. Prior overflight was intended to force potential vandals to seek cover, thus keeping them away from the oncoming train. Following the train was intended to permit apprehension of vandals at the time of attack on a train. Based on the assumption that the copter overhead would represent the probability of immediate apprehension, orbiting over a train was intended to prevent subjects from attacking.

A Typical Patrol

Most patrols followed a standard flight profile varying only in time of take-off and order in which areas were patrolled. A typical patrol would leave Philadelphia International Airport and proceed across the Schuylkill River, passing to the west of the downtown Philadelphia area. A random patrol pattern would be followed, usually beginning with observation of freight facilities.

As the aircraft crossed the river and penetrated the experimental area, the observer would run a communications check, identifying himself to both police dispatchers as "Eagle I". The dispatcher would report any activity in the area for action by the copter. If no traffic was reported, the observer would continue to guard his company's police channel.

At regular intervals, the observer would check in with both railroad security dispatchers. If trouble calls had been received, or if any particular area of interest had come up (for example, if a train were about to reach a trouble area), the dispatcher would request that Eagle I

move to the critical area. All directions were given to the helicopter in terms of railroad properties.

By far the most common action taken by the helicopter crew was the ejection of juveniles from railroad property. Bitter experience has proven to the railroads that all non-employees on railroad right-of-ways must be treated as trespassers and potential vandals. Upon sighting juveniles on the tracks, the observer would switch on the helicopter's siren, and use the p.a. mode to order the subjects off the right-of-way. The wording and tone of the warning was left to the observers. A rather casual and somewhat fatherly approach appeared most successful. ("You boys, get off the railroad. You're trespassing on private property".) In most cases, the subjects would leave the tracks. In those cases in which the subjects were reluctant to obey, or in which evidence existed that vandalism was in progress, the observer would contact the nearest ground cruiser and an apprehension would be attempted.

In most cases the airborne warning in and of itself was enough to eject the trespassing juveniles. If a second more strongly worded warning was not obeyed, a ground cruiser would be called. On occasion the juveniles would react with defiance, making obscene gestures, shaking fists, or futily throwing stones at the helicopter. An effort was usually made to intercept such subjects on the ground, as they were felt to represent high vandalism potential. It is of interest to note that there was no instance during the experiment where vandalism was committed at a site where juveniles had been ejected earlier that day. Apparently,

the loudspeaker warnings were effective.

During the patrol, particular attention would be given to standing boxcars. Often the observer would have the pilot overfly storage sidings several times to make certain that no one was molesting the cars and that all doors were closed. At the same time, adjacent buildings would be checked for signs of burglary or vandalism. When noted, these conditions were reported to the dispatcher who would alert the appropriate municipal police authorities. By the end of the two hour normal patrol period, all areas of the target zone would have been checked, a significant number checked more than once. The flight would terminate at Philadelphia International Airport.

CHAPTER 3 - RESULTS

This chapter discusses the outcome of the project. The first section details some methodological difficulties associated with this study. The second section deals with specific examples of how the helicopter has been used. The next section discusses unusual occurrences beyond the scope of this study which influenced the impact of the helicopter patrol. A final section of the chapter treats the nature of the numerical results and presents those results.

Methodological Difficulties

Sanders and Welton complain (pp. 51-53) of a number of inadequacies in most studies, to date, of vandalism prevention. It is most unfortunate that this study is also plagued with some of these deficiencies. It is appropriate to consider these deficiencies before detailing this study's findings. Some possible solutions to these problems will be offered in the subsequent chapter on recommendations.

A deficiency of this study is the absence of a suitable metric with which to quantify vandalistic activity; to compound the problem, the unavailability of adequate baseline data against which to validate any statistic which might have been developed. According to Sanders and Welton, no published study has dealt adequately with this problem. As will be discussed in a later section of this chapter, existing records of the subject railroads were not useable as baseline data and no meaningful metric could be obtained.

A second qualification which must be applied to quantitative assessments of this project is the contamination of the data. An unusual

set of circumstances has uniquely disturbed the experimental conditions of this project. These are elaborated in the section that is directed toward unusual occurrences relating to this study. Sanders and Welton also observe that vandalism studies usually lack adequate experimental controls; that is, areas matched to the experimental area on as many variables as possible but not exposed to the experimental conditions. Once more, this study is in the majority. The railroads were advised by their legal departments that they might incur a liability if one area was deliberately left unpatrolled. For this reason, they could not cooperate in establishing control areas. The same characteristics which make Philadelphia attractively unique as an experimental area precluded the use of other cities as a control.

A possible means of providing a control comparison would have been to assess vandalism for those days in which the helicopter was not flying against the days on which it was flying. Unfortunately, the security department's methods of reporting incidents were not suitable for a day by day breakdown of events. Had additional funds or manpower been available to institute appropriate reporting procedures, a usable control approximation could have been established. However, since the need for such record keeping was not identified prior to the start of this project, neither the necessary money nor personnel were included in the scope of the program.

The preceding paragraphs should not be interpreted to mean that this study was meaningless, or indeed uninterpretable. They should be taken

to assert that judgment must be reserved on an objective basis, even though evidence may be heard on a less metrified plane. Sanders and Welton assess that ". . .when official police records are used to evaluate a program, the program is almost universally deemed a failure." (p. 52). Because of the difficulties delineated in the preceding paragraphs, the results of the project must be inferred from incidents that took place in the course of operations and from the subjective impressions of the participants.

Critical Incidents

Throughout the study, a number of events have occurred which highlight the various uses to which the helicopter is well suited. On eight occasions, loaded boxcars were observed with doors standing open. All of these cars were protected from further loss, and the condition corrected. In five such incidents, part of the cars' consignments had been thrown to the ground. In all cases, the helicopter prevented any additional pilfering and minimized the loss. It is virtually impossible to assign dollar values to such potential losses. It should be considered that in the cases where pilfering was interrupted, the risk of future thefts, in all probability, was reduced, due to the nature of the subject population. In all of these cases, it is highly improbable that routine ground patrol would have discovered the open doors in time to prevent additional losses.

On three occasions, the patrol spotted fires burning on railroad property. In all cases the fires were of deliberate origin. The

prompt detection of these probably prevented a much greater loss to the companies. Again, it was the unique viewpoint afforded by overflight that made immediate detection possible.

During the course of this program there have been eight cases of track obstructions detected by the helicopter. In six of these cases, patrol cruisers were close and the tracks were cleared without any effect on operations. In one case, no ground car was in a position to respond and the helicopter could not find a landing zone nearby. In this instance, road traffic was held up at the preceding block while a maintenance crew was dispatched to remove the track blockage. In the final case, no ground cruiser was available and a train without communications gear was already in the immediate area. The helicopter was landed and the obstruction, a twelve foot timber which had been wedged into a switch box, was removed by the observer before the train reached it. When the observer left the scene, the intra-urban car, loaded with passengers, was already in sight.

All of the obstruction cases involved commuter service track. Had an intra-urban car struck the obstructions, particularly in the last case, a serious derailment would probably have resulted in serious cost to the passengers. Again, it is extremely difficult to affix a dollar cost to an accident prevented, although derailments average about 35,000 dollars and have run into millions. It is possible that the obstructions might have been detected and cleared by normal methods. The outcome of an uncleared obstruction probably would be an all-out

emergency stop by the commuter car involved, causing slight to moderate injuries to the passengers. However, a train crew can suffer a momentary lapse of vigilance, and a blockaded track can result in a major tragedy. The prevention of only one such tragedy would pay the costs of a full-scale helicopter surveillance program.

By far the most common activity by the patrol was the ejection of trespassers. By the end of the project, 1025 ejections had been affected by the helicopter patrol. Last year, twenty-one trespassers were accidentally killed or seriously injured in the Philadelphia area. The prevention of such accidents is of major concern to the railroad security forces. Often the trespassers ejected were engaged in vandalism at the time of the helicopter's approach. On nine occasions, the helicopter was dispatched to the scene of a train stoning. In each case, use of the siren and loudspeaker was enough to eject the subjects. On three occasions the helicopter drove subjects off of trains after the trains had been deliberately cut. In one such case, twenty-five persons were driven away from a freight even after boxcar doors had been forced. Not once did the subjects ignore or defy the helicopter's challenge. In the course of patrol, subjects were ejected from almost every type of railroad property, including a moving freight.

Several specific incidents made major impressions on the security officers involved in the study. In one case, a signal failure caused ten intra-urban cars to be held at a single location. The incident occurred

at the peak commuting hour, and the cars were loaded to standing capacity with passengers. A group of ten to twelve youths gathered and began to stone the cars. Such incidents have happened before and have always resulted in numerous broken windows, often with accompanying passenger injuries. In this case Eagle I was in the air and arrived over the scene within five minutes. Upon arrival of the helicopter, the vandals fled. The copter patrolled the area until the cars were once more able to move. As a result of the rapid aerial response, not a single car was damaged and no injuries occurred.

One observer related an incident which highlighted the unique psychological impact of helicopter patrol. The persistent trouble spot had been an area where Reading track passed between high embankments in a middle socio-economic residential area. On a majority of patrol flights, trespassers were ejected from this area. On the flight in question, a girl of about 11 was spotted on the right-of-way. When the observer ordered her to leave, she ignored the order and continued to walk along the track. For 5-10 minutes, Eagle I circled overhead alternating orders to leave with blasts of the siren. Finally the girl reached a cross street, her apparent destination, and left railroad property.

The observer noted, as the helicopter continued its patrol, that the repeated p.a. and siren usage had attracted quite a bit of adult attention. "People were hanging out of windows and standing in their

yards trying to figure out what was going on," the observer reported. Although the attempted ejection was an apparent failure with respect to the single subject involved, on future flights the area ceased to be a trouble spot. On all subsequent flights, only one or two trespassers were seen and ejected, in contrast to the frequent ejections previously accomplished. The only acceptable explanation is that the repeated warnings to the girl served to sensitize the neighborhood parents to the problem of railroad trespass and resulted in a much increased parental control over the juvenile trespassers.

In a somewhat similar case, hopper cars loaded with flour were repeatedly vandalized as they stood on a siding near a local bakery. In each case, the pattern of vandalism was the same; the seals on the top hatches were broken, and the vandals urinated and defecated into the flour. Each such case cost the railroad $4,000 in claimed loss. On the second day of patrol, Eagle I ejected four youths who were standing on hopper cars at that site. Through the entire project not a single additional case of flour cars being vandalized occurred, nor did Eagle I spot trespassers at this site at any other time.

Eagle I played a role somewhat different from vandalism suppression on one occasion. Flying over the Greenwich yard of the Penn Central, the observer noticed an auto parked near the back of a shop store building. A window was observed to be open, and articles were being passed to a man on the ground. After radioing for assistance from a ground patrol, the helicopter landed in the yard and the observer placed under arrest three subjects engaged in stealing journal brass.

Subsequent investigation revealed that these persons were responsible for a series of similar burglaries which had cost the company thousands of dollars. A shop foreman was in the building, unaware of the theft in progress, and the area in which the car had been parked was out-of-sight of ground patrol. Again, the unique observational viewpoint afforded by the helicopter made possible arrests that would have been impossible otherwise.

In one case, a community hazard was eliminated by the patrol. A number of juveniles was using an inactive portion of track, in the section called the Trenton Highline, as a hideout for sniffing glue and possibly using other drugs. The youths were bombarding street traffic with cans and bottles and creating a disturbance with profane language. The municipal police were unwilling to act since the subjects were on private property. The railroad police unsuccessfully tried to apprehend the youths, who heard them climbing up to the track level, and fled. On two occasions, subjects were forced from the Trenton Highline to street level by Eagle I. The first time apprehensions were made. The second time, the ground patrol was not in position to intercept the subjects. The helicopter remained over the youths as they ran along the streets and through yards and directed the cruiser to their location where two apprehensions were made. Subsequent checks by Eagle I showed that the elevated track was no longer being used as a glue sniffing den.

Unusual Occurrences

A series of events unrelated to the experimental design unfortunately played a major role in the numerical results of this study. Various factors worked to change the pattern of vandalism from that seen in other years. During the early parts of this year, Philadelphia reached the crest of a wave of spray-can graffiti. For a few months no public building or conveyance was free from hastily sprayed legends, usually of obscene character. During the spring months, the thrill of graffiti apparently wore off somewhat, and the rate of such vandalism dropped sharply. Under normal conditions, station vandalism could serve as an index against which to assess the effects of helicopter surveillance, since theoretically it would be sensitive to the factors influencing vandalism rates but unaffected by the helicopter patrol. During this period, however, the measure was quite abnormal and could not be used.

The overall trend in vandalism was also highly abnormal. One cause of this was the weather. This spring, the Atlantic Seaboard was exposed to one of the heaviest rainstorms in history, Hurricane Agnes. The effects of this storm were felt for some time. The Philadelphia area received several weeks of almost continuous rain which greatly disrupted normal vandalism patterns. Flooding and weather-associated problems diverted security forces from normal routines and produced more opportunities for malicious acts. At the

same time, the bad weather kept many juveniles closer to home and thus generally closer to railroad property. The overall effect was to make the experimental period so abnormal as to render numerical comparisons with prior years useless.

An additional problem occurred in the fall. At the start of school, Philadelphia teachers went on strike. The climate of upheaval introduced by the disruption of the normal schedule of the subject population again altered conditions in an unassessable fashion. There is some evidence that the effect of the strike was to lower the expected fall peak in vandalism. The present study was relying heavily on the back-to-school period for an assessment of results following the contamination of the spring data.

There were also internal contaminations of the data. Human factors researchers are acutely conscious of the so-called "Hawthorne Effect." Stated simply, this effect is a change in work rates due to the fact that employees see that the company is studying their behavior, without respect to the experimental manipulations. In the context of this study, this reflected in two areas. First, the Reading Company has within the last year greatly reorganized and improved its security activities. As a result, greater emphasis is being placed on reporting and record keeping. The employees not concerned with security have perceived this improved responsiveness and are reporting many more minor acts of vandalism than had been reported previously. Although there is little evidence that the actual rates of switch and signal damage have increased, the rates of reported

incidents went up dramatically the last year. In a related development more closely tied to the helicopter patrol, the very presence of a force specifically directed at vandalism has sensitized the operating personnel to minor vandalistic acts. Discussion with supervisory personnel suggests strongly that the train crews have been reporting non-damage stonings which previously would have been ignored. There also appears to be an increased reporting by maintenance crews who otherwise would leave incidents unreported in order to save paperwork. The employees have become aware that management is concerned about vandalism and fear that unreported incidents will now get them into trouble. The effects of these artificial elevations of incident rate again make prior year comparisons meaningless.

Numerical Results

As previous sections of this chapter have demonstrated, no statistically meaningful inferential comparisons could be developed from the data of this study. It must fall to later research to statistically establish the effectiveness of helicopter patrol. This section will present those numeric results that were resolved from the project.

Tables I and II present summary data for Reading operations in the Philadelphia area for 1971 and 1972 to the end of the project, respectively. Table III presents comparable data for the Penn Central. A plot of incident rates for vandalism typical of eastern railroads, taken from Sanders and Welton (p. 46), is given in Figure 2. Comparison

of the tables with Figure 2 will demonstrate that a similar pattern exists in Philadelphia, but that vandalism tends to peak in April and May rather than in March. Table IV presents the data directly attributable to the helicopter patrol. Comparison of these data with the overall data in Tables II and III allows some evaluation of the relative effectiveness of the patrol. Table V presents the average incident rates broken down by day of the week.

During the course of the project, Penn Central forces logged about 18,720 patrol hours and Reading forces logged around 9,360 hours for a total patrol period of 28,080 hours. The helicopter flew 177.5 hours, accounting for approximately .63% of the total patrol time. During this six-tenths of a percent, the helicopter patrol made 3.45% of the Penn Central trespasser ejections and 2.25% of the Reading ejections. These percentages must be considered in the light of the observation that trespassers ejected by the helicopter patrol tended to stay away from the right-of-way, in contrast with the usual experience of ground patrols, who often see the trespassers return as the patrol car drives away. Not only was the helicopter nearly six times more effective in producing ejections, those ejections were much more lasting.

The helicopter was responsible for spotting 13.3% of the track obstructions reported during the experimental period. As with detection of burglaries of standing boxcars, the helicopter is many times more effective in detecting obstructions which may be hidden from a patrol

READING COMPANY

VANDALISM - PHILADELPHIA COMMUTER AREA (SEPTA) - YEAR 1972

MONTH	NUMBER OF STONING INCIDENTS PASSENGER	NUMBER OF WINDOWS BROKEN PASSENGER	PERSONAL INJURY DUE TO VANDALISM	PASSENGER STATION VANDALISM	NUMBER CASES TRACK OBSTRUCTIONS	SWITCH & SIGNAL DAMAGE	TRESPASSERS EJECTED
JANUARY	21	20	4	4	11	9	2,464
FEBRUARY	15	11	2	3	5	11	4,073
MARCH	61	53	9	9	28	28	5,023
APRIL	58	48	1	4	21	34	4,801
MAY	74	43	5	18	26	73	5,458
JUNE	36	23	13	7	11	43	5,595
JULY	31	19	9	8	9	27	5,349
AUGUST	37	25	8	3	13	17	4,969
SEPTEMBER	37	23	14	6	14	19	5,456
OCTOBER	43	32	11	14	13	39	6,286
TOTAL	413	297	76	76	151	300	49,474

TABLE II: READING STATISTICS, 1972

Source of Information:
Office, Superintendent of Police
Reading Company, Philadelphia, Pa.

READING COMPANY

VANDALISM - PHILADELPHIA COMMUTER AREA (SEPTA) 1971

MONTH	NUMBER OF STONING INCIDENTS	NUMBER OF WINDOWS BROKEN	PERSONAL INJURY DUE TO VANDALISM	STATION VANDALISM	NUMBER CASES TRACK OBSTRUCTIONS	SWITCH & SIGNAL DAMAGE	TRESPASSERS EJECTED
JANUARY	18	13	5	12	6	11	2,893
FEBRUARY	34	18	4	6	9	21	2,471
MARCH	39	38	3	7	18	24	3,534
APRIL	65	64	9	10	13	35	3,360
MAY	57	59	9	8	22	22	3,934
JUNE	61	78	12	7	5	41	2,454
JULY	32	21	7	2	12	38	2,710
AUGUST	23	17	-	6	14	16	2,857
SEPTEMBER	32	30	6	7	17	11	3,018
OCTOBER	41	42	11	12	14	33	3,555
NOVEMBER	32	25	3	14	14	20	3,503
DECEMBER	36	44	7	7	12	26	2,995
TOTAL	470	449	76	98	156	298	37,284

Source of Information: Office of Superintendent of Police, Philadelphia, Pa.
Reading Company

TABLE I: READING STATISTICS, 1971

TABLE 4

INCIDENTS OF VANDALISM REPORTED BY HELICOPTER PATROL
MAY 24, 1972 - OCTOBER 31, 1972

TYPE	NUMBER
1. Individuals Ejected	1039
2. Open Boxcars	8
3. Stonings Stopped	9
4. Autos Ejected	1
5. Bicycles Ejected	3
6. Fires Reported	3
7. Burglaries Stopped	2
8. Alcohol & Drug Abuse Stopped	2
9. Rail Obstructions Reported	8
10. Train Cutting Reported	1
Stopped in Progress	1
11. Other Vandalism Stopped	3
TOTAL	1080 (71 Flight Hrs)

PENN CENTRAL TRANSPORTATION COMPANY

VANDALISM - PHILADELPHIA COMMUTER AREA

Comparison of Figures of 1971-72

MONTH	NUMBER OF STONINGS		NUMBER OF TRACK OBSTRUCTIONS		CASES OF TAMPERING SWITCH OR SIGNAL		TRESPASSERS EJECTED	
	1971(A)*	1972(A)	1971(A)	1972(A)	1971(A)	1972(A)	1971	1972
JANUARY	26 (1)	29 (0)	23 (0)	23 (0)	1 (0)	14 (0)	1408	2890
FEBRUARY	70 (15)	26 (8)	39 (0)	32 (0)	12 (0)	32 (1)	1795	3010
MARCH	107 (19)	62 (0)	36 (0)	25 (0)	13 (0)	18 (0)	2350	2920
APRIL	101 (2)	65 (0)	32 (0)	57 (0)	1 (0)	33 (0)	2175	2873
MAY	109 (29)	77 (5)	26 (0)	44 (0)	7 (2)	23 (0)	2756	2701
JUNE	72 (12)	57 (9)	23 (0)	44 (0)	7 (2)	39 (0)	3601	2658
JULY	31 (1)	32 (4)	18 (0)	19 (2)	4 (0)	12 (0)	3204	2484
AUGUST	48 (7)	24 (0)	18 (0)	26 (4)	3 (0)	15 (0)	3120	2501
SEPTEMBER	41 (0)	33 (0)	6 (0)	15 (1)	4 (0)	12 (0)	3361	2360
OCTOBER	81 (6)	35 (3)	22 (0)	38 (5)	11 (0)	15 (0)	3261	2548
TOTAL	686 (92)	440 (29)	423 (0)	323 (12)	63 (4)	213 (1)	27,031	26,945

*(A) = Arrests

Source of Information: Office of Superintendent of Police, Philadelphia, Pa., Penn Central Transportation Co.

TABLE III: PENN CENTRAL STATISTICS, 1971-1972

TABLE 5

Helicopter Activity
Total Number of Incidents of Vandalism per Day of Week:

Day	No.
Sunday	9
Monday	45
Tuesday	38
Wednesday	49
Thursday	35
Friday	57
Saturday	13
TOTAL	246

NOTE: Ejections were measured by incident rather than by number of individuals ejected.

Average: 3.5 Incidents/day $\frac{\text{(total incidents)}}{\text{(total no. of days)}}$

Average incidents per each day of week:

Day	Average
Sunday	3.0
Monday	4.5
Tuesday	2.9
Wednesday	3.3
Thursday	2.9
Friday	3.6
Saturday	6.5

TABLE 5 (Cont.)

Number of Flights per Day of Week:

Day	No.
Sunday	3
Monday	10
Tuesday	13
Wednesday	15
Thursday	12
Friday	16
Saturday	2
TOTAL	71 Flight Days

Figure 2. Average Relative Monthly Vandalism Sustained Over Three Years by Three Eastern Railroads (from Sanders and Melton, page 46, used with permission).

car. The three fires detected were 100% of fires on railroad properties reported by railroad security agents. In at least one case a potentially serious building fire was stopped before major damage occurred.

CHAPTER IV - CONCLUSIONS

This chapter discusses the extent to which the project accomplished its stated objectives, considering each goal in turn. Whenever an objective was not fully accomplished, discussion is given to the contributing factors involved. The chapter concludes with a summation and evaluation of the project's findings.

Objectives

(1) To fly an experimental helicopter patrol over a large urban area (Philadelphia, Pennsylvania) within the SEPTA area of concern. The first objective was accomplished without difficulty. Helicopter patrol was begun on 24 May 1972 and was ended 1 November 1972. The helicopter was used in a flexible and innovative fashion, giving the participating railroads broad experience in the patrolling and protection of commuter and freight facilities. Right-of-way patrols were found to be most effective in suppressing vandalistic activity directed at commuter cars, although protection of individual cars did prove feasible. During the experimental period, eight track obstructions capable of causing emergency conditions with injury potential were detected and removed before any damage was done.

(2) To develop coordinative and procedural elements to assist two railroad security forces (the Penn Central and Reading) in cooperative anti-vandalism efforts. The second objective was accomplished in all

degrees. During the early phases of the operation some problems were encountered in communications while the helicopter was in flight. A procedure for regular checks by the observer with both security dispatchers was instituted and no further problems developed. Throughout the experiment, the two railroads cooperated to an unprecedented degree, often giving the impression of functioning as a single integrated force. For example, in the case of the Trenton Highline glue-sniffers, the Reading observer was aboard Eagle I, but apprehension was accomplished by Penn Central officers. The willingness to accommodate and cooperate demonstrated by the railroads made this portion of the project an outstanding success. A standardized activity reporting form was developed and used during this study, and the information flow between the companies was unhindered. This portion of the study demonstrated that where a willingness to work together exists, more than one company can participate in a common program. Although relatively large amounts of administrative time were initially required to set up the program, this investment paid off in a smooth and integrated operating structure.

(3) To evaluate existing Penn Central vandalism data as a baseline suitable for statistically documenting the effects of the patrol. In conversations with Penn Central security administration staff prior to the start of this program, the existence of a large body of historical data on vandalism occurrence was established. It was hoped that this data might be used to provide a statistical baseline for evaluation of the effectiveness of this patrol. When utilization of this data was attempted, however, a number of

barriers to its use were encountered.

The primary problem was the form in which the data was stored. The original logs were no longer available. The data had been summarized with respect to locale but without respect to occurrence date. Where date of occurrence had been preserved, the incident reports were filed alphabetically by name of injured subject and/or name of reporting officer. The Penn Central staff was willing to cooperate in assembling the data, but they lacked the time and manpower necessary to make even a realistic attempt at gathering it. A library research effort of at least half a man-year would have been required had outside personnel come in and assembled the material. Since no provision for such activity had been made in the funding of the project, this alternative was rejected.

A second problem has been alluded to in previous chapters. Over the last year, the Penn Central and Reading administrations have shown increased interest in vandalism and its suppression. This has caused both security forces and operating personnel to modify and increase their reporting procedures. The effect of these changes has been to make data collected during this project very different from data collected in previous years, without consideration of any experimental variables. In light of these changes, it was clearly unreasonable to expend funds and effort in an attempt to recover the historical data.

Finally, as has been documented elsewhere in this report, the data gathered during this study was not suitable for computation of comparison statistics. The lack of an adequate control group, the difficulty in

determining a reasonable descriptive metric, and contamination of the data by outside factors made it clear that the historical data could not serve as a statistical comparison baseline. Although it is physically present in Penn Central files, the baseline data does not exist in a statistical sense.

(4) To consider all possible applications of the helicopter toward suppression of vandalism in a manipulable and innovative environment, and to make recommendations based on this experience to aid future helicopter patrols.

The fourth objective has been achieved. Recommendations are to be found in the final chapter of this report. The helicopter was utilized in a continually adapting procedure with each observer modifying his patrols along lines which he found to be most effective. In the course of the study almost every form of railroad property was given close attention and action was taken against nearly every sort of vandalistic activity to which the railroads are subject. The command staffs of both railroad security departments cooperated completely in giving the observers the necessary freedom of action. Shortly after patrols were begun, the observers reported difficulty in locating and directing the ground patrols. A solution, consisting of marking the roofs of the patrol cars, was devised and implemented. This is typical of the way in which the companies cooperated with innovation.

(5) To attempt to establish a cost benefit ratio for programs involving non-ownership of the helicopter by participant railroads.

Although a definitive answer will be difficult to produce, this goal has been accomplished to a limited extent. As the data of chapter three suggests, the helicopter is much more effective than a ground unit. In order to calculate a meaningful cost-benefit ratio, it would be necessary to determine the present cost of operating a standard ground patrol car. The two railroad security forces were unable to supply this information. Standard figures for police operations would suggest that the cost would lie between $15-20 an hour, assuming two officers per car. This would be approximately $400 per patrol day. A helicopter on regular patrol would probably average four hours flight per day, making its nominal cost about $350 per patrol day, assuming an officer of command rank would serve as observer. It is apparent then that the cost of adding a helicopter patrol is slightly less than adding an additional ground patrol.

This report has noted a number of important additional capabilities which a helicopter adds to a security force. To review them briefly: it provides an outstanding observational platform, affording direct inspection of otherwise inaccessible and vulnerable facilities; it provides extremely quick response capability to emergency situations, it provides the ability to greatly extend the patrol range of a single officer, allowing "eyes-on" examination of a company's total facility at least once a day; and it carries psychological impact which uniquely suits the young, impulsive, subject population involved in vandalism. It appears to be cost-effective to add these capabilities for no more than the cost of an additional patrol car. Although a hard dollar benefit could not be calculated, it is the

firm opinion of those security officers working with this project that the helicopter saved the railroads a good deal more than it cost.

CHAPTER V - RECOMMENDATIONS

This chapter will detail recommendations for future research efforts in this area, and for working helicopter surveillance programs. The first section details elements that should be designed into future research. The second section is concerned with practical considerations for actual helicopter patrol.

Recommendations for Future Research

There remains a need for a preplanned, well designed study of vandalism, over a period of at least two years. The study should be aimed at producing a stable, well documented baseline against which vandalism suppressive programs can be assessed. The research should be dedicated toward the following goals:

(1) Development of a suitable descriptive statistic which may be used to accurately quantify vandalistic activity.

(2) Validation of the metric developed against as many railroad operations as possible.

(3) Development and implementation of a standardized incident reporting form that will make available information on type, time and date, location, and real costs (if assessible) of vandalistic activity. Such a form should be developed in cooperation with working security personnel and prepared in such fashion that it will be clear, self-explanatory, and easy to use.

(4) Collection and reduction of sufficient data to produce baseline activity scales against which any program may be assessed. Such data collection should encompass at least two calendar years.

Until such a program or its functional equivalent is developed, it will remain virtually impossible to statistically assess programs such as this study.

Recommendations for Helicopter Patrol Program

The following recommendations should be given consideration in any operational helicopter patrol program.

(1) The helicopter should be manned with at least a two man crew. The observer should be experienced in ground patrol activities, and must be intimately familiar with railroad operations in the patrol area. The observer should be responsible for police communications and should be of sufficient rank to command attention from personnel in the ground patrol. The observer should be the mission command and should direct patrol operations, except in those cases where safety or operation of the aircraft takes precedence.

(2) Communications should be a major concern. The helicopter should have the capability of direct communications with all elements of the patrol force, even when normal radio traffic is directed by a central dispatcher. If at all possible, the helicopter should be equipped to communicate directly with trains on the line for emergency use. Arrangements should be made with the local civil police to permit direct radio contact with civil police communications from the helicopter. The observer should be equipped with earphones and a lip mike to free his hands as much as possible, and to make communications more audible in the noisy helicopter

environment.

(3) Some means of visual air-to-ground identification should be established with the ground patrols. In this study, stick-on numerals on the top of the cruisers were found to be simple, inexpensive, and highly effective.

(4) Although observers should be given freedom to modify patrol plans, to a large extent, flights should be pre-programmed. A fixed schedule of patrol should not be established, but rather there should be a changing order of patrol over a set of standard areas. In the same vein, ground patrols should be coordinated with the overflight plan. For example, one car could patrol an area with the copter while a second car was moving to the next area the copter would visit. The aircraft's areas could be planned to include inspection of inaccessible areas while the ground cars were changing patrol zone. The helicopter patrol will remain effective only so long as it is regularly backed up on the ground.

(5) The helicopter is unusually effective in stopping vandalism in progress. As much of the copter's time as possible should be used in protection of trains in vulnerable areas.

(6) The helicopter has a psychological effect disproportionate to its actual ability to effect physical arrest. This should be exploited by a careful and continuing publicity campaign directed both externally to the general public and internally to the railroad employees.

(7) The copter is only effective when it is in the air. Any long term program should be aimed at producing as much flying time as possible.

Ideally, the copter should fly from six to eight in the morning and from four to seven in the afternoon. Any schedule adopted should be based on the observers' impressions as to best patrol times, as determined by a random schedule flown at the beginning of the program.

(8) Any patrol program should be flexible and directed toward innovation. The observers should be kept well informed as to their effectiveness and should be motivated to experiment with additional and unusual applications of the helicopter to the problem of vandalism suppression.

(9) The helicopter achieves its greatest effectiveness through its ability to cover relatively large patrol areas. Programs should be aimed at cooperative involvement of as many companies and jurisdictional areas as possible.

(10) If more than one railroad participates in the program, major efforts should be made early in the operations to insure that all observers are acquainted with all companies' properties. Map books should be prepared including the various locale names that each railroad uses. Extensive map orientation, both on the ground and in the air, should be held before operations are begun.

REFERENCES

1. Sanders, M. and Welton, J. H., Vandalism, in submission, NAD Crane Technical Report, 1972.

APPENDIX A

HELICOPTER PATROL REPORT - MAY 1972

Date	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Wed. 24	Spain	1		15		16		16 ejections/ 4 groups - one stoning stopped
Thur. 25	Spain	6				6		6 ejections/2 groups - loaded boxcar door open
Fri. 26	Spain	8		18		26		18 ejections/ 6 groups crossties reported
Tues. 30	Spain	14		4		18		18 ejections/ 5 groups
Wed. 31	Parker	-		-		-		no trespassers observed

HELICOPTER PATROL REPORT - JUNE 1972

Dates	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Thur. 1	Spain	15		8		23		6 groups
Fri. 2	Burns	16		15		31		Stoners ejected
Sat. 3								
Sun. 4	Burns							
Mon. 5								
Tues. 6								
Wed. 7	Spain	14		20		34		34 ejections/ 7 groups
Thurs 8	Burns	10		6		16		Train cutting
Fri. 9	Spain	11		2		13		13 ejections/ 4 groups
Sat. 10								
Sun. 11								
Mon. 12	Burns	3		23		26		Stoners ejected- Obstructors reported-ejected
Tues. 13	Spain	14		5		19		Covered train emergency 6 groups
Wed. 14								
Thurs. 15	Spain	9		2		11		2 Vandals apprehended - 4 groups

Dates	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Fri. 16	Parker	29		31		60		25 On train
Sat. 17								
Sun. 18								
Mon. 19	Spain	37		13		50		Heavy stoning 3 Apprehensions
Tues. 20	Parker			5		5		Protected trains
Wed. 21	Spain	30		6		36		5 Groups
Thurs. 22								
Fri. 23								
Sat. 24								
Sun. 25								
Mon. 26	Parker	3		12		15		5 Groups
Tues. 27	Morgan	8		0		8		Checked out track obstruction
Wed. 28								
Thurs. 29								
Fri. 30	Parker	0		6		6		2 Groups
Total	15	199		154		353		

HELICOPTER PATROL REPORT - JULY 1972

Date	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Sat. 1								
Sun. 2								
Mon. 3								
Tues. 4								
Wed. 5	Spain	6				6		Automobile ejected
Thurs. 6	Burns	0		6		6	3	Fire on tracks (Night Patrol)
Fri. 7	Spain		1				1	Covered train burglary-1 Arrest
Sat. 8								
Sun. 9								
Mon. 10	Burns			20		20		Broke up beer party (Night)
Tues. 11	Spain					0		
Wed. 12	Spain	3		10		13		(Late flight cancelled) 3 groups
Thurs. 13	Spain					0		
Fri. 14	Burns	0		0		0		Night Patrol
Sat. 15	Burns	0		3		3		3 bicycles ejected

Date	Officer	PENN CENTPAL Ejections	PENN CENTPAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Sun. 16	Burns	0		4		4		2 groups
Mon. 17								
Tues. 18	Parker			8		8		
Wed. 19	Morgan	13	2	5		18	2	3 groups
Thurs. 20	Burns			2		2		
Fri. 21	Morgan	6		4		10		
Sat. 22	Burns	2		5		7		Protected furniture (Train door open) 2 stonings stopped
Sun. 23								
Mon. 24	Burns			7		7		
Tues. 25	Spain	8		9		17		
Wed. 26	Burns			2		2		Stoning trains stopped
Thurs. 27	Spain	12	1	13		25	1	
Fri. 28	Burns	2	2	2		4	2	2 glue sniffers arrested (5 to date)
Sat. 29								
Sun. 30								
Mon. 31	Spain	12		3		15		
TOTAL	21	64	6	100		167	9	

HELICOPTER PATROL REPORT - AUGUST 1972

Date	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Tues. 1								
Wed. 2	Spain	9		12		21		3 Groups
Thurs. 3								
Fri. 4	Spain	17		9		26		Track obstruction removed
Sat. 5								Fire extinguished
Sun. 6								Door opening stopped
Mon. 7								
Tues. 8								
Wed. 9								
Thurs 10								
Fri. 11	Spain	13		9		22		Track obstruction removed
Sat. 12								
Sun. 13								
Mon. 14								
Tues. 15								

Date	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Wed. 16	Spain	13		9		22		5 Adults ejected/ 3 Groups
Thurs 17	Burns	3		1		4		Placing of obstructions stopped
Fri. 18								
Sat. 19								
Sun. 20								
Mon. 21	Burns			3		3		Boxcar doors open
Tues. 22								Soup cans on ground
Wed. 23								
Thurs. 24								
Fri. 25								
Sat. 26								
Sun. 27								
Mon. 28								
Tues. 29								
Wed. 30								
Thurs. 31								
TOTAL	6	55		43		98		

HELICOPTER PATROL REPORT - OCTOBER 1972

Date	Officer	PENN CENTRAL Ejections	PENN CENTRAL Arrests	READING CO. Ejections	READING CO. Arrests	TOTALS Ejections	TOTALS Arrests	Events
Sun. 1	Burns	1		11		12		
Mon. 2	Burns/ Spain	12		5		17		2 Flights
Tues. 3	AM Parker PM Spain	7		10		17		2 Flights 4 Groups
Wed. 4	Spain/ Burns	7		14		21		Fire reported Vandalism stopped(4) 2 Flights
Thurs. 5								
Fri. 6	Parker Spain	3				3		2 Flights
Sat. 7								
Sun. 8								
Mon. 9	Burns/ Spain	12		8		20	1	Open boxcar reported 2 Flights
Tues. 10	Burns	2		2		4		
Wed. 11	Spain	9	3	10		19	3	
Thurs. 12								
Fri. 13	Parker/ Spain	7		29		36		2 Flights
Sat. 14								
Sun. 15								

Date	Officer	PENN CENTRAL		READING CO.		TOTALS		Events
		Ejections	Arrests	Ejections	Arrests	Ejections	Arrests	
Mon. 16								
Tues. 17	Burns/ Spain	11		16		27		2 Flights
Wed. 18	Burns/ Spain	18		5		23		6 Open boxcars reported/2 Flights
Thurs. 19								
Fri. 20								
Sat. 21								
Sun. 22								
Mon. 23								
Tues. 24								
Wed. 25								
Thurs. 26	Spain	10		4		14		3 Groups
Fri. 27	Spain	8		2		10		Track obstructions removed
Sat. 28								
Sun. 29								
Mon. 30	Spain	3				3		
Sun. 31								
TOTAL	14	104	3	111		226	4	
Grand TOTAL	71	524		512		1039	13	

APPENDIX B

A sample of newspaper articles used to publicize the program.

Deleted
Copyright Material

END