CORNELL AERONAUTICAL LABORATORY, INC.

Report No. JA-1266-S-10

A REVIEW OF AIRSPACE USE IN RESTRICTED AREAS R-54 AND R-82

Contract No. FAA/BRD-15
Task Order No. 10

January 15, 1959

BUFFALO, NEW YORK

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Prepared By SYSTEMS SYNTHESIS DEPARTMENT

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ACKNOWLEDGMENTS

The Cornell Aeronautical Laboratory, Inc. acknowledges the assistance provided by the personnel of the Development and Proof Services of APG.

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Mr. E. L Budnick, Chief, Range Service Branch

Mr. C. P. Treppe, Range Control Section

Mr. H. A. Noble, Assistant to the Deputy Director of Engineering Testing

A REVIEW OF AIRSPACE USE IN RESTRICTED AREAS R-54 AND R-82

SUMMARY

Introduction

The use of airspace by the Aberdeen Proving Ground in Restricted Areas R-54 and R-82 was examined by reviewing the activities at APG during Fiscal 1958. A representative sample of working days was selected and used to describe the activity. In addition, some data available for the complete year were reviewed to establish the reliability of the sample. Organizational information describing the Aberdeen Proving Ground and its operation also was obtained as part of the survey.

The Aberdeen Proving Ground

Restricted Areas R-54 of the Aberdeen Proving Ground (APG) and R-82 of the Army Chemical Center (ACC) are located near Baltimore, Maryland and are controlled by APG. Red 17 airway crosses R-54 and is controlled by ATC. About two requests per day are received by APG to cross R-54 and about eighty violations of the Airspace are observed per month. The land and water restricted area is limited to the ground reservation which is about 1/2 the size of the air restricted area.

Of the 9300 APG Personnel, about 3000 are involved in range operations. 2400 are in the Ballistic Research Laboratory (BRL) and the Development and Proof Services (D&PS) who perform 95-98% of all range operations. The Engineering Testing Division of D&PS formulate all test programs and all range operations are under the control of the Range Services Branch.

About 91.2 million dollars has been invested in the range operations, this constitutes approximately 50% of the total APG investment for land, facilities, and equipment.

Radio and telephone are the primary means of inter-range communication. However visual signals and other warning devices are used. Surveillance of the airspace is visual by APG range personnel. Two VHF and two UHF frequencies are assigned to APG for test aircraft flights.

The APG also has remote bases of operation at Yuma, Arizona and Fort Churchill, Manitoba, Canada. Yuma activities are similar to APG and include desert and hot weather testing as well as a considerable amount of automotive testing. Fort Churchill is used January thru March for all extreme cold environmental tests.

Survey of APG Activities (Fiscal 1958)

Daily firing schedules and control tower clearance records were used to determine the APG range activity. Three average days and the peak day of each month were used for the representative sample. The 48 day sample reviews 21% of the 4445 firings made in fiscal 1958. During the year 4% of the firings were made outside of the normal week day working hours of 0800 to 1630. Vertical firings, weapon utilization, and aircraft test flights were compared for the sample and the year with good agreement. Vertical firings, about 2% of the total activity, use the highest altitudes. Most of these firings go to 30,000 ft. with some as high as 69,000 ft. Primary trajectory and ricochet altitudes were considered separately to show the effect of each on the over-all airspace utilization.

Some tests performed by the Army Chemical Center and by BRL were not available for analysis. However, the altitude used was always below 5000 ft., and for most tests below 1000 ft.

The range utilization was distributed evenly throughout the land reservation with a few firings falling south of the north boundary of Red 17. The firing clearances varied in length from a few minutes to several hours but no predominate duration was in evidence.

A majority of the clearances were in effect between 0900 and 1600 hrs and only 4% were in effect outside of working hours. It was noted that high altitude testing (in excess of 20,000 ft.) was performed throughout the day regardless of the percentage of firings in effect. Less than 10% of the firings use airspace above 10,000 ft. However, 77% use airspace over 2000 ft.

Summary - Activity

Organization

1. (A) D&PS and BRL (with 25% of APG personnel) performed 95-98% of the firings.
   (B) 50% of the APG investment is for range operations.
2. R-82 (ACC) is controlled by APG.
3. APG has no surface control outside of the land reservation.
4. APG also performs tests at Yuma and Churchill.

Firings

1. 4445 firings were made in Fiscal 1958 and averaged 18 firings per working day with 30 firings on the peak day of the year.
2. (A) 770,000 rounds were fired in the 48 day sample.
   (B) 98% of the rounds fired were 30-60 cal. and 20mm.
3. Firing clearances varied from minutes to the entire day and averaged three hours.
4. 13% of clearances were in effect 0800 to 0900 hrs.
   11% " " " " " 1600 to 1700 hrs.
   4% " " " " " outside working hrs.
   28 firings (0.6%) were made on 12 weekend days

Summary - Airspace

Use

1. Vertical firings (2%) up to 70,000 ft. were made at one point.
2. (A) 3% of firings exceeded 20,000 ft.
   8% " " " 10,000 ft.
   28% " " " 5,000 ft.
   77% " " " 2,000 ft.
   (B) 0.4% of firings used no airspace.
3. 267 "Firing Clearances" (6%) were for test aircraft flights.
4. Very few firings entered Red 17. No firings crossed the airway centerline.

Coordination

1. All means of inter-range communications are available.
2. Airspace surveillance is primarily visual.
3. Direct communication between APG and Baltimore ATC exists. Requests for clearances go through Olmsted Flight Service Center, as do notifications of closing of Red 17 airway.
4. About 80 airspace violations occurred each month. No action against violators has been successful.
5. About 2 R-54 clearances were requested per day each involving flights of from 1 to 50 aircraft.

A REVIEW OF AIRSPACE USE IN RESTRICTED AREAS R-54 AND R-82

I. INTRODUCTION

The Cornell Aeronautical Laboratory under Contract FAA-BRD 15, Task Order#10, with the Federal Aviation Agency, performed a study of the utilization of the Aberdeen and Edgewood Restricted Areas, R-54 and R-82, with particular attention given to activities which affect outside aviation flight activity. To reach the objective of the program, a survey of the activities between July 1, 1957 and July 1, 1958 was made Time limitation and the form in which the factual information was available prevented a detailed survey of all the activities for the entire Fiscal 1958 period. Therefore, a representative sample of the year's data was used for detailed analysis. In addition to the sample data, some information for the full year was obtained when available, to determine the reliability of the sample data. The survey was augmented by other factual data which describe the over-all Aberdeen Proving Ground operation.

A REVIEW OF AIRSPACE USE IN
RESTRICTED AREAS R-54 AND R-82

II. ABERDEEN PROVING GROUND

The information included in this part of the report was extracted from letters exchanged between CAL and APG (Appendix I).

A. Restricted Areas

Restricted airspaces R-54 of the Aberdeen Proving Ground (APG) and R-82 of the Edgewood Arsenal or Army Chemical Center (ACC) are shown in Figure 1. Although the airspaces carry separate designations, R-82 is wholly within the boundaries of R-54 and is controlled with R-54 by APG. Also shown in Figure 1 is the network of VOR and LF/MF airways in the adjacent east coast region.

Approximately 2 requests to cross the restricted areas are received each day for flights of from 1 to 50 aircraft. In addition to the requested clearances, approximately 80 violations of the airspace per months have been observed. Because the detailed information required to report violators could not be obtained, action against those who make unauthorized penetrations has been unsuccessful.

Figure 2 presents a more detailed picture of the restricted areas and the ground reservation of the Aberdeen Proving Ground. It also shows that one LF/MF airway, Red 17, crosses restricted area R-54 at approximately the midpoint. The north boundary of Red 17 has been accepted as an imaginary dividing line between "North R-54" and "South R-54". To facilitate the use of Red 17 airway, a procedure has been established whereby, with prior ATC approval, it is open to aircraft unless closed by APG.

Control of the ground reservation is accomplished by patrol boats in Chesapeake Bay, and fences and gates on land. However, no surface control is available to clear the area for firings outside of the ground reservation.

B. APG Organization

Figure 3 shows the general organization of the Aberdeen Proving Ground. The APG is a permanent Army post manned by about 9300 permanent personnel, of whom approximately 50% are military. Of the several branches in the organization, only two are primarily involved in the range operations. These are the Ballistic Research Laboratory (BRL) and Development and Proof Services (D&PS), who together perform 95-98% of all range operations. BRL has about 1000 personnel and D&PS about 1400. In addition to the personnel of BRL and D&PS approximately 600 others are involved in range operations.

The pro-rated investment in range operations at APG represents 50% of the total investment. A breakdown of this pro-rated value is shown below

	Value in Millions of Dollars
Land (71, 734 acres)	2.5
Improvement to Land	16.1
Utilities	3 4
Buildings and Other Structures	16.2
Equipment	53.0
Total	91.2

Although BRL uses the range, the responsibility for scheduling and operation of range activities is assigned to D&PS. D&PS also has the responsibility for technical guidance of the remote base operation at Yuma, Arizona and Fort Churchill, Manitoba, Canada, even though they are under the direction of the Special Missions Activity.

Scheduling procedures of the D&PS have been outlined in Figure 4. When test requirements have been established, a test director is assigned He coordinates the program with the cost centers and the supporting services and submits a program through his division director to the monthly planning meeting of Engineering Tests. All test programs are reviewed and a tentative schedule is prepared to utilize fully the facilities and manpower of APG. The test program outline is presented to the Scheduling Committee who prepare weekly schedules of range activities on Wednesday at 0900. The purpose of this schedule is to alert all personnel of the impending test program and to notify them of the services required in the following week. At 0900 each day the Scheduling Committee prepares a daily firing schedule which is issued by 1200 hrs. This schedule for the following day contains detailed information about the scheduled range activity. A sample item from a typical daily firing schedule is presented in Appendix III. The daily schedule is about 75% accurate when issued and approximately 10% is added to the program before the scheduled test day is over. The daily schedule is final notification of range operations and includes all activity that will occur in the range area.

Control of the range operations is divided among 5 control towers. Tower A, B, C, L, and Range Control. (Figure 5) All personnel entering the range must receive permission by telephone or radio from the control towers and all firings or test aircraft flights must be coordinated through the towers. An excellent safety record indicates that the range control system is effective.

C. Communications

Radio and a complete inter-range telephone system are the primary means of range communication. Various other signals and warning devices are also used to augment the main communication systems as shown in the following table.

1. Radio

Frequency	Use	No. of Units		
		Fixed	Mobile	Portable
32.1 MC	Automotive Testing	9	10	4
* 38.1 MC	Main Range Control	30	13	12
136.08 MC 139.14 MC	Air to Ground (VHF)	2	2	0
252.00 MC	Air to Ground (UHF)	2	2	0
* 170.025MC	Main Range Control	4	4	0

* 170.025 MC will replace 38.1 MC

2. Telephone Network — Direct lines from towers to permanent firing points. Dial phones to towers, operating points, all range gates, and throughout proving ground. Direct line, Friendship Airport to APG

3. Visual — Signal lights and panels for aircraft.

4. Warning Devices — Sirens, lights, flags, barricades, and loud speakers.

Although a direct telephone line exists between Friendship Airport, Baltimore and APG, it is not used in control of the restricted airspace. NOTAMS will not be accepted by Friendship and clearances must be routed through Olmsted FSC

No means are available for surveillance of the airspace other than visual observations by APG Personnel

D. APG Remote Bases

The following listings describe the extent and use of the APG remote base operations.

Yuma Test Station, Arizona

use (1) Research, Development, Engineering Tests

(2) U.S. Navy, Marine Corps, Air Force Equipment Tests

(3) Environmental Tests (Desert and hot weather)

(4) Surveillance Tests

(5) Acceptance and Inspection Tests of Production Items

(6) Automotive Testing

Land Reservation - 880,000 acres Firing Front - 5 miles

Restricted Airspace - 300,000 acres Instrumented Range - 40 miles

Ordnance Test Activity Personnel - 86 Mil., 239 Civ. - 325 Total

All the types of activity which take place at Aberdeen also take place at this base.

Fort Churchill, Manitoba, Canada

Extreme Cold Environmental Testing (January-March)

Expansion to year round operation is not contemplated, recommended, or likely.

E. SUMMARY

1. Organization Activity

a. D&PS & BRL (with 25% of APG personnel) perform 95-98% of firings.

50% of the APG investment is for range operations.

b. R-82 (ACC) is controlled by APG.

c. APG has no surface control outside reservation.

d. APG also performs tests at Yuma and Churchill.

2. Airspace Coordination

a. All means of inter-range communication are available.

b. Airspace surveillance is primarily visual.

c. Direct communication between APG and Baltimore ATC exists. Requests for clearances go through Olmsted FSC.

d. About 80 airspace violations occurred each month. No action against violators has been successful.

e. About 2 R-54 clearances were requested per day involving 1-50 A/C.

III. APG ACTIVITIES STUDY

A. Data Collection

The data available to describe the firing activity at APG were in the form of daily firing schedules, special firing schedules, and range clearances from the five control towers.

The daily firing schedules are published and distributed after the schedule meetings. The special firing schedules are issued each day for firings that have not been included in the daily firing schedule. Range clearances are issued by the control tower operators for every firing, and these records indicate the firing point, weapon used, and the times the range was opened and closed for the firing.

By combining the information from these three records, it was possible to prepare data sheets for each firing (Appendix III, Table 1). D&PS personnel provided the data on the starred items (e. g , altitude and number of rounds fired)

Monthly summary records of tower firing clearances (Appendix III, Tables 5 thru 16), were used to determine the total number of firings for the year and the days to be used in the representative sample (Appendix III, Table 18). An average day in each quarter of the year was first selected to determine seasonal variations in firings, then an average day per month, a peak day per month and finally random average days selected from the entire year's activity, resulting in three average and one peak day per month for a total of 48 days through the year. The selection of the average days was based not only on the total daily firings but also on the firing distribution for the various towers. All the data given are for firing clearances, which were the only means available to

define firing activity. A firing clearance, or "firing", is a block of time issued by a control tower for a firing test or for an aircraft test flight. In some instances several blocks of time were issued for a single firing test with time intervals between them. In such cases, the data reflects the total time interval between the starting time of the first block and the ending time of the last block The utilization of the reserved firing time for actual testing could not be determined.

B. Results

1. Ground Area and Typical Altitude Utilization

Data pertaining to the ground area utilized by various groups and typical maximum altitude utilization for two ranges were supplied by APG The areas of APG assigned to Aberdeen Proving Ground, Ballistic Research Laboratories, Army Chemical Center, and troop training are shown in Fig. 5 along with the five firing clearance control towers and the numerous observation towers.

Although D&PS controls the range operations, Army Chemical Center does perform tests in its own area (Carroll and Battery Point) without firing clearance Data pertaining to these tests were not available for analysis, however, it was stated by D&PS personnel that they are tests which always involve less than 5000 feet of altitude and, for the most part, less than 1000 feet. The Ballistic Research Laboratory also conducted tests on which data were not available However these tests, confined to the northern area of APG, namely Spesutie Island, also involved less than 5000 feet of airspace.

A typical altitude utilization breakdown, as supplied by APG, for two firings at different ranges, and vertical firings, is shown in Fig. 6.

2. Analysis of Fiscal '58 Data

a Reliability of Sample

Various data were collected from the tower firing clearance records for the entire fiscal '58 period for "sample vs year" comparison purposes. Fiscal year data showed a total of 4445 firing clearances issued over 254 days (Fig. 7). Of these, 174 (4%) were performed outside of the normal working hours (0800 to 1630 hours, Monday through Friday). These firings either started after normal working hours or started during normal working hours and continued past the normal end of the working day. In addition to the 174 after-hour firings, 28 firings occurred on 12 Saturdays or Sundays during the year. One hundred and seventy-four (4%) were closed range firings (firings conducted in a completely enclosed range). Thirty firings occurred on the peak day of the year with an average of 18 clearances per day for the year The 48 day sample data included a total of 942 firings or 21% of the fiscal year activity (Fig 7). Of these 41 (4%) were conducted outside of normal working hours and 48 (5%) were closed range clearances Review of a three-month (April-June 1958) firing activity survey conducted by APG personnel (Appendix II) indicated that 7% of the tests were conducted outside of working hours.

Both the sample and total year's data were analyzed for weapon utilization Comparison of the "sample vs. year" use of each of the 25 various weapons agrees within 1 to 2% (Appendix III, Table 19). A comparison of "sample vs. year" use of six weapon groups also agrees within 1 to 2% (Fig. 8).

Vertical firings (90° elevation) conducted throughout the fiscal year showed that a total of 72 firings were conducted at "I" Field on Gunpowder Neck These vertical firings represent 1 6% of the APG activity. Most of the firings reached altitudes of 30, 000 feet and some reached an altitude of 69, 000 feet. Of these 72 firings, 22 occurred on selected sample days representing 2 3% of the firings. Figure 9 shows that the sample data reflects the altitude utilization of the year's firing

The close agreement in weapon utilization, off-hour firings, vertical firings and closed range firings between data from the sample and the entire year indicates that the sample represents the entire year's activity with reasonable accuracy

3 Analysis of Sample Data

The 48 day sample data was studied to determine the extent of utilization of azimuth, range, altitude, and time Of the 942 firing clearances occurring during the sample, 48 were closed range firings which, because they involve neither range nor altitude, have been disregarded in the analysis of the data Therefore all percentage quantities are referred to 894 sample firings.

a Firing Point Azimuth, Range, and Altitude Utilization

Many firing points were used, therefore, they were grouped into nine general areas as noted below. Details of the grouping are shown in Appendix III

A firing point location distribution of the 894 firings was performed with the following results

Firing Point	% Firing at APG
1. Gunpowder Neck	11
2. Main Front	7
3. Water Front	14
4. Michaelsville	26
5 Spesutie Island	6
6. Airfield Area	13
7. New Bombing Field Area	7
8. Poverty Island Area	9
9. Aircraft flights	7

The firings at each location were then analyzed for azimuth, range, and altitude utilization A composite of the maximum range utilization of each firing point indicates that few firings have ranges extending below the north border of Red 17 airway and none extend below the centerline (Fig. 10). Detailed information concerning azimuth, range, and maximum ordinate and ricochet altitude utilization was obtained from the data from each firing point (Figs. 11-18, Appendix III, Tables 25-32).

In these figures, ordinate altitude is the trajectory altitude of the projectile and depends on the weapon elevation angle. Ricochet altitude is the altitude the projectile or fragments attain after impact with some object. In general, weapon firings at elevation angles of less than 10° will ricochet while those at higher angles will not. Personnel of the Ballistic Research Lab. at APG provided a general method for calculating ricochet altitude, which was used by APG personnel to supply the ricochet data for the firings used in this analysis. This method assumed that, upon impact, ricochet will occur with a projectile or fragment velocity equal to one-half of the weapon muzzle velocity and an equivalent elevation angle of 65°. To simplify their calculations, D&PS personnel employed an equation for computing ricochet altitude which utilized full weapon muzzle velocity at an equivalent elevation angle of 20°. There is a distinct difference between the maximum ordinate and ricochet types of altitude utilization -- therefore, they have been treated separately to show the effect of each on the over-all airspace utilization.

The aircraft flights occurring in the sample data were studied to determine flight paths and altitude range (Appendix III, Table 35) Traffic density along the various flight routes is shown in Fig. 19. The maximum altitude of the flights varied from 50 to 15,000 feet.

b. Firing Clearances

A study of the durations of the sample firing clearances indicated that firing clearances varied in duration length from a few minutes to several hours, with no definite pattern. Eighty-five percent of the clearance periods varied between a few minutes and five hours in length (Fig. 20), and the average duration was three hours

The hourly distribution of the clearances simultaneously in effect was also examined and the maximum ordinate and ricochet altitude utilization for each hour was analyzed (Fig. 21) There was no definite period of the day when peak activity occurred. The firing clearances were distributed quite evenly throughout the working hours of the day except that only 13% of the clearances were in effect between 0800 and 0900 hours and 11% between 1600 and 1700 hours The bulk of the activity occurred between 1000 and 1600 hours, and 4% of the clearances were in effect outside of normal working hours. Although the primary utilization of airspace throughout the working day was less than 5000 feet, clearances for firings to altitudes exceeding 20, 000 feet were in effect throughout all hours of the day

c. Weapon Type

The 25 various weapons utilized during the 942 sample firings were segregated into various groups according to size as follows

1. 105 through 280 mm
2 30 through 90 mm
3. small caliber through 20 mm
4. aircraft
5. closed range
6. miscellaneous

The weapon group distribution of the firings was examined and the altitude utilization by the firings of each weapon group was analyzed (Fig 22). The average number of rounds per firing for each weapon type was also calculated. A total of 770, 000 rounds of ammunition were expended with 98% fired from 30-60 caliber and 20 mm weapons The larger weapons, 30 through 280 mm, attained ordinate altitudes exceeding 20, 000 feet while all other weapons used altitudes under 20, 000 feet. Some weapons produced ricochet altitudes as high as 25, 000 feet, but most of the airspace utilization was below 5000 feet.

d Airspace Utilization

The airspace utilization of all the sample firings (excluding the closed ranges) was studied (Fig. 23) The maximum ordinate and ricochet altitudes were first treated separately to point out the airspace utilization of each. Then the maximum altitude distribution of all the firings, disregarding the differentiation between ordinate and ricochet altitudes, was examined.

The maximum ordinate altitude distribution indicates that approximately 3% of the firings exceed 20, 000 feet, 5% exceed 10, 000 feet and 13% exceed 5000 feet. The maximum ricochet altitude distribution shows that only 0. 1% of the firings exceed 20, 000 feet, 2. 5% exceed 10, 000 feet, and 16% exceed 5000 feet. However, if the differentiation between ordinate and ricochet altitude is disregarded and only the maximum of either ordinate or ricochet altitude is considered, a more representative picture of the actual utilization of airspace is obtained. Then 3% of the firings exceed 20, 000 feet, 8% exceed 10, 000 feet, 28% exceed 5000 feet, and 77% exceed 2000 feet, with only 0. 4% using no airspace Review of the three-month APG survey conducted by APG personnel indicates that, of the 1097 firings sampled (including closed range firings) 13% exceed 10, 000 feet and 56% exceed 2000 feet

C. Summary

1. Firings

a. 4445 firings were performed in fiscal '58 with an average of 18 firings per working day and 30 firings on the peak activity day of the year.

b. The firings conducted during the 48 day sample expended 770, 000 rounds of ammunition of which 98% were fired from 30 to 60 caliber and 20 mm weapons.

c. Firing clearances varied in duration from minutes to the entire day and averaged three hours in length

d. 13% of the clearances were in effect from 0800 to 0900 hours
11% " " " " " " 1600 " 1700 "
4% " " " " " " outside working hours
28 firings (0. 6%) were conducted on 12 weekend days throughout the year.

2. Airspace Utilization

a. Vertical firings, consisting of 1. 6% of the total APG activity, attained altitudes up to 70, 000 feet.

b 3% of the firings exceeded 20, 000 feet.
8% " " " " 10, 000 feet.
28% " " " " 5, 000 feet.
77% " " " " 2, 000 feet.
0 4%" " " used no airspace.

c 267 firing clearances (6%) during fiscal '58 were for test aircraft flights.

d Very few firings extended into the Red 17 airway. No firings crossed the centerline of the airway.

APPENDIX I

GENERAL APG OPERATIONS DATA

I (A) Letter, CAL to APG, MS mja 167, dated 5 December 1958

II (B) Letter, APG to CAL, dated 12 December 1958

The general APG Operations data were obtained from the Development and Proof Services by the correspondence I (A) and I (B), following. Of the five enclosures, only Nos. 4 and 5 have been included in this appendix. Number 1 is for Planning, Coordinating, and Scheduling Productive Resources. It is an operational procedure booklet issued by D&PS and is designated D&PS Procedure No. 160.16 Data from this report were used in the body of the report under APG Organization. Enclosure No. 2 showing the range utilization by various groups was used to prepare Fig. No 5 for the report. Enclosure No. 3 which shows the typical airspace utilization of ordinate firing has been used as Fig. No. 6 in the report.

APPENDIX I (A)

CORNELL AERONAUTICAL LABORATORY, INC.
Buffalo 21, New York

5 December 1958
MS.mja 167

Col. J. D. Armitage, Director
Development and Proof Services
Aberdeen Proving Ground, Maryland

Attention: Mr. E L. Budnick, Chief
Range Service Branch

Subject: Information required to complete the study of restricted airspace R-54 and R-82.

Reference: (a) FAA-Cornell Contract AMB-15, Task 10 - Aberdeen Study.

Enclosure: (1) Work statement contract AMB-15, Task 10, Attachment No. 1.

Dear Sir

To fulfill the requirements of reference (a), it will be necessary to obtain information from the APG to supplement the detailed sample firing data that is now being compiled by APG and Cornell Personnel. The information required is outlined as Job 2b, c, and d of enclosure (1).

The general operating procedures of the Aberdeen Proving Grounds have been reviewed with APG Personnel and it is believed that the requirements of reference (a) would be fulfilled if answers could be provided for the following questions:

I Range Firing and Operation

A Scheduling Procedures

1. How is scheduling done?
2. What information is on scheduling documents?
3. Number and type of scheduling documents issued.
4. Distribution of schedules.
5 Do schedules cover all firings in Edgewood, BRL, APG Areas (this does not mean schedule changes)?
6. How are schedule changes made and who is notified?
7. How are aircraft flights scheduled for test or others?

B Range Control and Operations

1. Communications

a. Radio - Location of transmitters and receivers (ground, mobile, aircraft, boat) and frequency of each with its intended use.
b. Phone network - Location (tower, control, range, gates, etc.) and use.
c. Warning devices - Kind (siren, flag, flare, etc.) and use.
d. Visual.

2. Range sites by maps

a. Firing points as listed in daily schedules.
b. Towers (control and observation).
c. Location of ranges as they would be scheduled for various use (firing point, range of azimuth and elevation, range of distance, type of test, altitude, etc.).
d. Range locations used by various agencies (APG, BRL, Edgewood, and others).

C Aircraft Operations

1 Method of obtaining clearance for aircraft to use or cross R-54, R-82 Areas (both test and others).
2. Times required to obtain a clearance to areas
3. Method of communication between range control and CAA Air Traffic Control.
4. Airspace Monitoring System (radar, visual, etc.).
5. Number of APG test aircraft used in restricted area from 7-1-57 to 7-1-58. Breakdown by month and day if possible and altitude if known.
6. Number of aircraft invading restricted area without clearance per month (7-1-57 to 7-1-58).
7. Routine flight scheduling for area (Sage, Martin Test, etc.).
8. Number of clearances given for R-54, R-82 to aircraft other than APG Test Aircraft (5, above) and same breakdown as (5) above if possible.

II APG, BRL, and Edgewood Operations

Job 2 (d) of enclosure (1) requires general information which is not readily obtainable by Cornell personnel. It is also difficult to know the manner in which such data is available at APG. Therefore, it is requested that APG personnel supply the general type of information outlined as Job 2 (d) in enclosure

(1). It would be desirable to break the data down into: Personnel, land, facilities, equipment, investment, time, or any other more applicable form from the records available. This should be for a period between 7-1-57 to 7-1-58. However, if this is not practical, the current status would be satisfactory.

III Remote Bases

It is recognized that some of the operations are transferred to remote bases such as Yuma and Churchill Therefore, to complete the study of Aberdeen Proving Grounds it would be advantageous to describe the remote bases in brief form. The information desired is as follows for each remote base Size, altitude limitations, number of personnel, type of testing, facilities, equipment, etc

IV APG Reports

It is requested that permission be granted to use the following APG reports as a supplement or reference in the Cornell Aeronautical Laboratory study.

A Secret - Review of Restricted Area R-54 by Col. G. F. Powell dated 10 July, 1958.
B Daily Firing Conducted with the APG, D & PS Proof Ranges by Col. J. D. Armitage dated 28 August 1958.

The above information as well as the firing data that is being compiled by APG and CAL Personnel will be presented to the FAA - BR&D in the form of a briefing and a report. Therefore, the security classification of the data should be provided by APG. To accomplish the tasks outlined in Enclosure (1), it will be necessary to analyze and prepare in final form all of the information by January 2, 1958. Therefore, it would be desirable to obtain the above data from APG by 15 December 1958.

I wish to thank you for the cooperation and assistance that is being provided by the Development and Proof Services of the Aberdeen Proving Ground and believe that the mutual effort will provide a representative indication of the APG activities - as they affect the R-54 and R-82 Restricted Airspaces.

Sincerely yours,

/s/

Milton D. Smith
Systems Synthesis Dept.

CC:

Mr. R. Seaman, FAA - BRD

APPENDIX I (B)

DEVELOPMENT AND PROOF SERVICES

12 December 1958

Mr. Milton D. Smith
Cornell Aeronautical Laboratory, Inc.
4455 Genesee Street
Buffalo 21, New York

Dear Mr. Smith

In reply to your letter dated 5 December 1958 requesting additional information in connection with the study of Restricted Airspace R54 and R82, the following data is submitted. Answers to individual questions have been made in accordance with the outline submitted.

I. Range Firing and Operations.

A. Scheduling Procedure.

1. See inclosure #1.
2. See inclosure #1.
3. See inclosure #1.
4. See inclosure #1.
5. Published Schedule of Firings and Range Operations covers only the daily operations for which D&PS is responsible for granting final clearance. In the case of BRL this would apply only to such programs that would require a danger zone extending beyond Spesutie Island shoreline. In the case of Army Chemical Center, programs scheduled and conducted including any range of operations by that organization, will not appear on the daily operations order. Since the review and tabulation of data has been extracted from such order, Army Chemical Center activities would not be listed. The tower record from "C" Field Safety Office would, however, contain all clearances granted and tests conducted on Gunpowder Neck.
6. Changes in the schedule are authorized under existing procedures and are accomplished by the issuance of a special number by the Range Control Section. Any changes that occur including the addition of a complete program are handled in such a manner. The Chairman of the Scheduling Committee, Range Control and Control Tower are all immediately notified of any changes found necessary.

7. Any aircraft flights required in connection with testing that involve the aircraft to be within the R54 area are placed on the schedule the same as a firing program or range operation. Priorities, courses, altitudes, etc. are indicated and are considered in the make-up of the daily operations order. Any emergency arising whereby aircraft are required to be within the R54 area, such notification is transmitted to all control towers by the most expeditious means. Flights conducted by BRL and Army Chemical Center would appear on the control tower records, however would not necessarily be a part of the range operations order

B. Range Control and Operations

1. Communications.

a. Development and Proof Services are presently assigned seven (7) radio frequencies utilized as a means of communication to maintain the necessary safety, control, and coordination of all operations Such frequencies are as follows and include the number of fixed, mobile, and portable units on each frequency, as well as their assigned use

38.1 MC. This frequency is the main range control means of communication to all towers, boats, and outlying stations and contains thirty (30) fixed stations, thirteen (13) mobile units and twelve (12) portables

32.1 MC This frequency is utilized to maintain communication to all automotive test operations, both on the post and off-post and contains nine (9) fixed stations, ten (10) mobile units, and four (4) portables

252.00 MC and 272.6 MC These frequencies are in the Ultra-High Frequency Band and are utilized as a means of air-to-ground communication and execution of such aircraft operations equipped for this band This network contains two (2) fixed stations, and two (2) mobile units, capable of operating on either or both frequencies depending on the requirement.

136.08 MC and 139.14 MC These frequencies are in the Very High Frequency Band are utilized as a means of air-to-ground communication and execution of such aircraft operations that are equipped only to operate within such band This networks consists of two (2) fixed stations and two (2) mobile units capable of operating on either or both frequencies depending on the requirement.

170 025 MC This frequency has been obtained as a replacement for the 38 1 MC band (the main radio network) to place all communications into the higher band and to get such network out of the commercial band A limited amount of equipment has been obtained and at some future date will be the main communication network of D&PS. This network at present consists of four (4) fixed stations and four (4) mobile units, and are supplementing the equipment presently operating on 38. 1 MC.

b Phone Network There exists within the Proving Ground a complete dial system telephone network, having available at all established locations of operations the necessary telephone circuits Such facilities are available at all range entrances, firing positions, and at key locations that normally or in cases of emergency would require telephone communication Such a system is augmented by additional switch boards located in the control towers carrying lines and cables to permanent firing sites within each area Further communication is available in the form of speaker systems to key locations and firing positions from the control towers

c. Warning Devices. Various signals are employed in the form of sirens, lights, flags, and barricades which have certain significant meanings and are utilized continuously for control purposes The use of such signals and their meaning are contained in the A. P. G. Safety Regulations and are daily employed as a means of communication and warnings to all personnel within an area. Such a system is also supplemented by loud speaker units of sufficient size and capable of reaching all desired personnel within a given area.

d. Visual Several means employing signals lights, and panels are employed especially involving aircraft when normal communications are not available or inoperative for some reason.

2 Range Sites by Maps.

a. See inclosure #2.
b. See inclosure #2.
c See inclosure #2.
d. See inclosure #2.

C. Aircraft Operations.

1 Programs requiring the use of aircraft for their accomplishment are scheduled the same as other projects They would appear on the daily operations order and contain the necessary data as altitude, course, and items to be dropped. Tracking missions would also be indicated One control tower, "C" Tower, is designated as the ground control for all aircraft operations in the R54 and R82 area Any aircraft taking off from Phillips Field, immediately

changes radio equipment to some one of the previously designated frequencies and all contacts for clearance, designating courses, and any changes are accomplished thru that control tower The radio frequencies listed above are assigned to A. P. G. for test purposes and during any aircraft operation such frequency is monitored during the conduct of any missions within R54 and R82. Outside aircraft entering the R54 and R82 area for purposes of a test are informed prior to such entry, and at the time of flight arrangements, the frequency on which to make contact and come under A. P. G control Aircraft violating the R54 and R82 area of course make no contact and enter such area at their own risk.

2. Stand-by areas and areas for gaining altitude are included in the procedure for handling local aircraft Under normal circumstances aircraft on local flights, and on scheduled projects are coordinated immediately, and clearances granted for their accomplishments On several instances such as aircraft being lost in this vicinity whereby outside aircraft are ordered into the area for searching purposes, all firings are suspended and entrance clearances granted. A procedure is available for practically an immediate cessation of all firing in such cases

3. Since the removal of the Air Force detachment from Phillips Field there is no direct means of communication between A P. G and C A. A Air Traffic Control. Information on the closing of the southern portion of R54 must therefore be made from A. P. G. to Olmsted Air Force Base, Pennsylvania and then to Flight Service. There is a direct telephone circuit from A. P. G. to C A. A control at Friendship Airport but this agency will not accept NOTAMS intended for Flight Service, Washington. It would appear that such a telephone circuit is for the purpose of obtaining a clearance when desired thru R54 by Friendship Airport

4 The monitoring of R54 airspace is normally accomplished by visual means through the various tower operators, observers, patrol boats, and gun crew members On occasions, local aircraft have been employed as means to intercept outside aircraft entering the area, having previously been detected by the use of radar Due to costs, use of excessive amounts of equipment including aircraft, such a system has only been resorted to in cases of top level demonstrations, and tests wherein a delay, due to entry of outside aircraft, would be detrimental to the results and execution of the program.

5 See attached inclosure #4 Consideration must be given to the fact that such aircraft operations are conducted during the normal work week with Saturdays, Sundays, and holidays being excluded

6 See attached inclosure #5. The number of aircraft invading the restricted area is difficult to determine In reporting violations to Flight Service it is necessary to furnish complete identification, otherwise no action is taken. Since the identification number is on the side of the craft, it is almost impossible to identify aircraft from the ground and therefore it is valueless to record the violation. High altitude violations are constantly occurring as can be occasionally determined by contrails This station is aware of continued violation of this airspace by outside aircraft which in a number of cases causes delays in the test programs and likely endangers undetected aircraft violators.

7. Teletypes are received daily requesting clearance thru R54 airspace from Air Force Bases throughout the Continental United States, as well as flights originating outside of the continent Such requests are normally well in advance of the date of execution and must be analyzed to determine actual course, altitude, date and time of penetration. Since some requests are received as much as a month ahead of the date of scheduled fly-over, and since our schedules at A. P. G. are not firmly established that far in advance, clearances must be delayed or disapproved as the case may be The volume of such requests, as well as the de-coding of messages, and plotting of courses involves considerable time of our range control personnel. If possible such schedule of flights are approved and clearances granted

8 The number of clearances granted for any particular period in the past is unknown since records are destroyed upon completion of scheduled mission. In general such requests would average approximately two (2) per day, involving from one (1) to fifty (50) aircraft Such requests have shown an increase this year (1958) over the same period last year (1957)

II. APG, BRL, and Edgewood Operations The number of persons directly engaged in activities which involve use of the restricted airspace at Aberdeen Proving Ground is relatively small, but in no way reflects the tremendous amount of supporting effort which goes into such activities The same is true of facilities and equipment which are directly involved for here again the extent thereof is not indicative of that required for support. A large percentage of men, facilities and equipment in almost every activity on the installation contribute a considerable portion of their time toward support of restricted airspace activities For this reason, a prorata share of these support elements has been determined and is included in the following data -

Personnel - 2,945	Land (71,734 acres)	$ 2,445,000
	Facilities	
	(Improvement to land	16,100,000
	(Utilities -	3,375,000
	(Bldgs & other structures	16,235,000
	Equipment	53,025,000
	Total	$91,180,000

III. Remote Bases Ordnance Test Activity, Yuma Test Station, Yuma, Arizona, under command jurisdiction of the Commanding General, Aberdeen Proving Ground, is serviced by various technical and administrative agencies of Aberdeen Proving Ground and Development and Proof Services The organizations operation within assigned mission are under the technical direction of Development and Proof Services Major test activities are

A. Research, development, and engineering tests of Ordnance equipment and materiel, and tests of equipment of such other services as the U. S. Navy, Marine Corps, and Air Forces.

B. Environmental testing of Ordnance equipment and materiel under desert and hotweather conditions

C Surveillance testing of ammunition and ammunition components and other Ordnance material

D Acceptance and inspection and control testing of production items of Ordnance equipment.

E. Environmental testing of fuels and lubricants

For the most part the operations of Ordnance Test Activity are accomplished within Yuma Test Station reservation of some 880, 000 acres The facilities for testing various arms and ammunition items include a firing front five (5) miles in width, instrumented downrange for forty (40) miles Present restricted airspace is that over the Arms and Ammunition Firing Range and a prolongation of the range westward to the western boundary of the reservation. This restricted airspace is over approximately 300, 000 acres of land area The restricted airspace will be inadequate in the very near future, if planned programs materialize at Yuma Test Station. The present manpower allocation for OTA is 239 civilians and 86 military for a total of 325 people Actual personnel strength varies somewhat and currently it is 318. In addition to instrumented ranges and associated equipment, facilities are available for ammunition assembly and disassembly, weapons maintenance and inspection, and physical tests and measurements Considerable automotive testing is conducted by Ordnance Test Activity There are some fifteen (15) different test courses ranging in length up to some seven (7) miles for Combat Vehicle Tests. Established highway courses including highways off the reservation total better than sixty (60) miles. Necessary laboratory equipment and automotive shop facilities are also available to meet minimum requirements Ordnance Environmental testing at Fort Churchill, Manitoba, Canada is conducted only during extreme cold periods (January to March) The organization at Fort Churchill is supplemented by personnel from Ordnance Test Activity and APG as necessary. Since the location is suitable for special extremes in environmental testing, the expansion of Fort Churchill for year round use is not contemplated, recommended, or likely available

IV APG Reports A copy of Reports A and B and Aberdeen Study Firing Data sheets for the firing dates selected for the sampling have been submitted to personnel of Cornell Aeronautical Laboratory, Inc. The security classification of the complete report is secret.

In connection with Par 2. c of Section I B of reference letter, it is to be noted that various calibers at various horizontal ranges, at various altitudes, and on various azimuths are fired on such firing lines as Main Front, Water Range, Trench Warfare, C-Field, etc. This means that all of these firing points can involve all of the available range area and airspace individually and collectively Only a few firing points are restricted as to caliber and range. To illustrate an unlimited range and airspace potential at most of the firing points produces a drawing which is only a maze. To simplify the condition, the manner of presentation as shown in Inclosure #3 was selected. This inclosure only shows several current firings which endanger a portion of the range area and airspace.

The subject of ricochet altitudes was discussed with Messrs. Hitchcock, Tolch, and Odom of the Ballistic Research Laboratories, APG, Maryland The conclusion was that no data is presently available covering the subject matter and that the problem was difficult to solve due to the number of parameters present such as descending angle, type of projectile, velocity of projectile, homogenity of soil, etc. Mr. Odom suggested a modification of the method locally employed for determination of ricochet ranges, that is, where the projectile is assumed as being refired at some angle of elevation at the reduced velocity after impact. Accordingly, the ricochet altitude was presumed as equivalent to the maximum ordinate at 65° elevation at about 1/2 the muzzle velocity. For purposes of simplification, the equivalent of this presumption, or the maximum ordinate at 20° elevation, was used as the ricochet altitude It is likely that the submitted ricochet altitudes is a limiting altitude for the majority of ricochets, however it is possible that this altitude can be exceeded in a small number of cases.

While most of the present testing by Ballistic Research Laboratories on Spesutie Island does not involve altitudes above 5000 feet, tests in past involving radio and radar controlled drones, jatos and missiles involving not only altitude but large operational air area could conceivably be scheduled for Spesutie Island in future. Outside of such test activity on Gunpowder Neck, Army Chemical Center test activity does not ordinarily involve or endanger altitudes above 5000 feet.

Flights by outside agencies in R-54 can only be conducted with due regard for security. Certain ground radars, guns, equipment, and ground configurations are in the category of classified material and cannot be observed or photographed from air when exposed. Consideration of flights through R-54 will require adherence to security regulations.

The local test potential and future plans of APG as well as the projected plans of the Chief of Ordnance for Aberdeen Proving Ground are intimately involved in the status of Restricted Airspace R-54.

Sincerely yours,

/s/

JOHN D. ARMITAGE
Colonel, Ord Corps
Director

5 Incls
1-D&PS Procedure No 160.16
2-Firing locations (map)
3-Airspace (map)
4-Daily Flight Data
5-Monthly Flight Data

JULY 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft		Hours Duration
1	1	3000'	H-19		5
2	2	100'-300'	H-19	L-20	3
3	1	5000'	H-19		4
9	2	3000'-8000'	H-19	B-26	3
10	2	10000'	B-26		3
11	1	8000'	B-26		2
12	1	8000'	B-26		1
15	1	10000'	B-26		5
16	3	10000'-15000'	B-26		5
18	1	4000'-8000'	F86		5
19	2	2500'-8000'	F-86	H-19	5
22	2	900'-8000'	F-86	B-26	4
23	1	4000'-8000'	F-86		1
24	1	4000'-8000'	F-86		4
25	2	2000'-2150'	F-86	B-26	5
26	1	2000'-10000'	F-86		3
29	1	4000'-8000'	B-26		1
31	2	500'-8000'	F-86	B-26	5

AUGUST 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
1	1	500'	F-86	7
2	2	500'-8000'	B-26 F-86	6
5	3	500'-8000'	F-86 H-19	5
7	1	4000'-8000'	B-26	2
13	3	100'-8000'	F-86 B-26	6
14	2	100'-4000'	F-86 B-26	7
16	3	25'-5000'	H-19 L-19 B-26	7
20	2	500'-1000'	C47 B-26	4
21	2	12000'-20000'	L-19 B-26	5
23	1	20000'	B-26	6
27	1	20000'	B-26	6
28	1	8000'	B-26	2
29	2	3000'-10000'	H-19 B-26	5

SEPTEMBER 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
3	1	50'-100'	H-19	3
5	2	2700'-10000'	F-86 B-26	5
12	1	1000'	H-21	3
13	1	1000'	H-21	5
17	1	1000'	H-21	2
18	1	1000'	H-21	1
19	2	1000'-10000'	B-26	4
20	1	300'-2000'	H-19	2
24	2	15000'	B-26	7
25	1	10000'	B-26	4
26	3	1000'-10000'	AD 2 B-26	7
27	2	1000'-10000'	B-26	7

OCTOBER 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
1	1	1000'	B-26	6
2	1	15000'	B-26	5
10	1	5000'	B-26	4
11	1	10000'	B-26	3
14	1	1000'	B-26	1
15	1	100'	L-20	1
16	1	100'	H-19	2
17	2	130'-500'	L-20 H-19	6
21	1	500'	L-19	4
22	1	1250'	L-20	1
23	2	500'-1000'	L-20 Beech Bonanza	3
25	2	200'-6500'	H-19 Beech Bonanza	6
29	1	4000'-6000'	Beech Bonanza	2
31	1	4000'	Beech Bonanza	2

NOVEMBER 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
5	1	1250'	L-20	1
6	1	4000'-6500'	Beech Bonanza	2
7	2	100'-6500'	L-20 Beech Bonanza	4
12	2	1500'-6500'	H-19 Beech Bonanza	5
13	2	1250'-6500'	L-20 Beech Bonanza	5
15	1	1250'	L-20	5
20	1	4000'-6500'	Beech Bonanza	6
21	3	150'-6500'	H-19 Beech Bonanza	6
22	2	200'-1250'	L-20	5
25	1	4000'-6500'	Beech Bonanza	2
26	1	1250'	L-20	1

DECEMBER 1957

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
2	1	100'-200'	H-19	3
3	2	225'-1500'	H-21 L-20	5
11	1	200'	H-19	1
16	2	100'-6500'	Cessna Bobcat Beech Bonanza	3
17	3	100'-5000'	H-21 Cessna Bobcat Beech Bonanza	6
18	1	1500'	H-21	3
23	1	4000'-8000'	Beech Bonanza	3
31	1	3000'-6000'	Beech Bonanza	2

JANUARY 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
2	1	1000'-1300'	H-21	1
8	2	500'-5000'	H-19 C-131	4
9	1	4000'-8000'	TV 2	5
10	2	100'-8000'	TV 2 L-120	6
20	1	0'-2000'	H-19	6
22	2	0'-12000'	H-19 Beech Bonanza	2
23	1	4000'-6500'	Beech Bonanza	5
29	3	100'-10000'	L-20 C-131 Cessna Bobcat	6
30	2	100'-8000'	L-20 Cessna Bobcat	3
31	1	1000'	H-21	2

FEBRUARY 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
5	3	400'-8000'	L-20 H-19 C131	4
10	1	4000'-6500'	Beech Bonanza	5
11	3	300'-10000	H-21 C-131 Beech Bonanza	6
13	2	4000'-10000	TV 2 C-131	6
14	2	7500'-15000	C-131 F-86	7
20	1	2000'	H-19	2
24	1	15000'	C-131	2
25	2	4000'-15000'	C-131 Beech Bonanza	6
26	1	7500'	F-86	1

MARCH 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
3	1	0'-3000'	H-19	1
4	1	4000'-6500'	Beech Bonanza	3
5	2	3000'-4000'	F-86 Beech Bonanza	6
6	1	4000'-6500'	F-86	2
7	2	0'-6000'	H-19 F-86	6
10	1	4000'-6500'	Beech Bonanza	2
11	2	100'-6500'	L-20 Beech Bonanza	2
13	1	2000'	F-86	1
17	1	4000'-6500'	Beech Bonanza	1
18	1	4000'	F-86	1
24	1	150'	L-20	2
28	1	4000'-7500'	F-86	1

APRIL 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
1	2	50'-2000'	F-86 L-20	6
2	2	3000'-7500'	H-19 F-86	6
3	3	50'-10000'	B-25 F-86 L-20	6
4	1	2000'-6000'	L-20	2
7	1	500'-3000'	Beech Bonanza	2
8	2	3500'-10000'	F-86 B-25	8
9	3	200'-7500'	F-86 L-20 Beech Bonanza	3
10	2	1000'-3000'	H-19 Beech Bonanza	7
14	1	1000'	H-19	1
15	2	150'-7500'	L-20 F-86	5
16	2	500'-10000'	F-86 B-26	5
17	1	1000'-10000'	F-86	5
18	2	6000'-10000'	B-25 F-86	6
23	2	7500'-10000'	B-25 F-86	3
24	1	7500'	F-86	6
25	2	7500'-10000'	F-86 B-25	8
29	1	4000'	F-86	5
30	1	7500'	F-86	7

MAY 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
2	1	7000'-10000'	B-25	2
8	1	4000'	TV 2	1
9	4	2000'-8000'	PV2 F-86 L-20 B-25	7
12	1	150'-1000'	L-20	2
13	2	150'-7500'	L-20 F-86	7
14	2	7500'-10000'	F-86 B-25	6
15	1	4000'	F-86	4
16	2	100'-1500'	C-47 Beech Bonanza	5
19	2	10'-1000'	H-19 C-54	2
20	3	200'-7500'	H-19 C-54 F-86	6
21	2	500'-10000'	H-19 B-25	8
23	1	6000'	H-19	2
27	2	2000'-6000'	H-19 F-86	6

JUNE 1958

Flight Date	No. of Aircraft	Altitude	Type of Aircraft	Hours Duration
2	2	100'-10000	H-19 L-20	2
4	1	6000'	H-19	3
5	1	7000'	F-86	4
11	1	10000'	B-25	3
12	2	500'-7000'	H-19 Beech Bonanza	4
17	1	100'-300'	C-47	1
18	1	100'-300'	C-47	2
25	1	1000'-2000'	Beech Bonanza	6
26	1	5000'	F-86	1
27	1	5000'	F-86	1

Month	Test Days	Flight Days	No. of Aircraft	Duration Hrs. Ea.	Violators
1957					
July	21	18	27	2.20	84
August	22	13	24	3 00	88
September	20	12	18	3 00	80
October	23	14	17	3 00	92
November	18	11	17	2 30	72
December	17	8	12	2 00	68
1958					
January	22	10	16	2 30	88
February	17	9	16	2.30	68
March	19	12	15	2:00	76
April	22	18	31	3 00	88
May	21	13	24	2 30	84
June	21	10	12	2.00	84

APPENDIX II

APG SUMMARY REPORT

II (A) List of Firings outside normal work hours prior to 0800 and after 1630 including weekends for April, May, June 1958.

II (B) List of Firings conducted from 0800 to 0900 for April, May, June 1958

II (C) List of Firings conducted after 1615 hours for April, May, June 1958

II (D) Breakdown of daily firings for April, May, June, July 1958, showing altitude utilization.

A cover letter for the APG Summary Report was classified SECRET. However, it did not contain information that would contribute to the results of the survey of Aberdeen activity. All enclosures to the letter were regarded unclassified when removed from the original letter dated 10 July 1958 Therefore, they have been included in this Appendix to augment the data obtained in the survey.

A summary of the data in this Appendix is presented in the following chart. Data for July 1958 in Appendix II (D) were omitted to make the time period coincide with the CAL survey

SUMMARY OF APG FIRING SURVEY - APRIL, MAY, JUNE 1958

Total Firings = 1097 including closed ranges

Firing Description	April	May	June	Total	Per Cent
Outside of Normal Working Hours (including weekends)	39	24	15	78	7 1%
Weekend	5	1	2	8	0.7%
Firing Between 0800-0900 Hours	43	42	35	120	10.9%
After 1615 Hours	24	6	5	35	3.2%
Under 2000 ft -altitude	186	142		155	44 %
2000 - 10,000 ft. - altitude	171	123	178	472	43 %
10,000 ft. & above altitude	46	44	52	142	13 %
TOTAL	403	309	385	1097	

APPENDIX II (A)

APRIL 1958

List of firings outside normal work hours prior to 0800 and after 1630 including week-ends for April, May, June 1958

Date	Gun Position	Weapon	Firing Time	Test
1	Romney Creek	Cal. .30 & .50	2030-2230	Accept Test Tracer
2	Romney Creek	20 mm	2030-2300	Test of Wpns
	Romney Creek	Cal. .30 & .50	2030-2230	Accept Test Tracer
	Trench Warfare	81 mm Mortar	1800-0130	Dev of Ammu
3	Trench Warfare	81 mm Mortar	1800-0130	Dev of Ammu
4	Trench Warfare	81 mm Mortar	1800-0130	Dev of Ammu
5	B-C	90 mm	1129-1522	Blind Primer
	B-B	90 mm	1219-1452	Proof Accept
7	Romney Creek	Cal. .30 & .50	2030-2200	Accept Test Tracer
9	Romney Creek	Cal. .30 & .50	2030-2230	Accept Test Tracer
12	B-C	90 mm	0924-1215	Blind Primer
	B-C	76 mm	1435-1554	Blind Primer
	B-A	90 mm	1000-1507	Accept of Ammu
	Transonic Rge	155 mm	0857-1555	Polaris Nose Cone
14	Romney Creek	Cal. .30 & .50	2030-2215	Accept Test Tracer
	Romney Creek	Cal. .30	0600-1136	Dev of Ammu
15	Romney Creek	Cal. .30	0600-1121	Dev of Ammu
16	Romney Creek	Cal. .30	0600-1148	Dev of Ammu
	Romney Creek	Cal. .30 & .50	2045-2300	Accept Test Tracer
	B-C	90 mm	1614-2033	Blind Primer
	Rge B	106 mm	1630-1909	Blind Primer
	AA Range	90 mm	1918-2038	Fuze Test
17	Range B	106 mm	1315-1900	Blind Primer
	B-C	90 mm	1720-2120	Blind Primer
18	B-C	90 mm	1650-2227	Blind Primer
	Range B	106 mm	1630-1837	Blind Primer

APPENDIX II (A)

Date	Gun Position	Weapon	Firing Time	Test
19	Range B	106 mm	0833-1502	Blind Primer
	Transonic Rge	155 mm H	0848-1601	Nose Cone
	B-3	105 mm H	0859-1527	Blind Primer
	B-C	90 mm	0920-1930	Blind Primer
20	B-C	90 mm	0922-1440	Blind Primer
	B-C	105 mm H	0950-1404	Blind Primer
	B-C	120 mm	1827-2227	Blind Primer
21	B-C	120 mm	1814-2137	Blind Primer
23	Range A	106 mm	1740-1819	Ammu Test
	Hi-Vel Rge	90 mm	1751-2050	Ammu Test
	Romney Creek	Cal .30 & .50	2045-2230	Accept Test Tracer
26	B-1	120 mm	0957-1209	Accept Test of Ammu
	B-1	90 mm	1400-1458	Accept Test of Ammu

MAY 1958

Date	Position	Weapon	Firing Time	Test
1	Trench Warfare	4.2" Shell	2000-0330	Surveillance
2	Trench Warfare	4.2" Shell	2000-0230	Surveillance
5	Trench Warfare	4.2" Shell	2000-0230	Surveillance
6	Trench Warfare	4.2" Shell	2000-0230	Surveillance
7	Trench Warfare	4.2" Shell	2000-0230	Surveillance
8	Trench Warfare	4.2" Shell	2000-0230	Surveillance
	Romney Creek	Cal. .30 & .50	2000-2200	Tracers
12	Trench Warfare	4.2" Shell	2000-0230	Surveillance
13	Trench Warfare	4.2" Shell	2000-0230	Surveillance
14	Trench Warfare	4.2" Shell	2000-0230	Surveillance
15	Trench Warfare	4.2" Shell	2000-0230	Surveillance
	Romney Creek	Cal. .30 & .50	2000-2200	Tracers
16	Trench Warfare	Davy Crockett	1930-2030	
	Trench Warfare	4.2" Shell	2000-0230	Surveillance

APPENDIX II (A)

Date	Gun Position	Weapon	Firing Time	Test
21	Hi-Vel	90 mm Gun	1620-1953	Arrow Test
24	B-4	90 mm	1512-1712	Accept of Ctg
26	Main Front	S.A.	1907-1924	Function Fire-West Pt.
	Main Front	Various	2030-2145	Dry Run - West Pt.
27	Trench Warfare	81 & 60 mm Mortar	1745-2005	FET of Fuse
	B-5	90 mm	1955-2241	L.P. Gun
28	Railway Rge	76 mm	0724-1250	West Pt. Show
	Main Front	Various	1456-2152	West Pt. Show
	B-A	90 mm	1645-1900	Accept of Case
29	Trench Warfare	80 & 60 mm Mortar	1734-2015	FET of Fuse

JUNE 1958

Date	Position	Weapon	Firing Time	Test
5	Trench Warfare	60 and 81 mm Mortar	1528-2113	Fuze Test
	Range E	90 mm	1330-2220	Dev of Ammu
9	Rge D	105 mm Gun	1605-2000	Test of Ammu
10	Main Front	105 mm Gun	1800-2002	Test of Ammu
	AA Range	8" How	2015-2140	Test of Ammu
11	AA Range	8" How	2018-2238	Test of Ammu
13	Trench Warfare	81 mm Mortar	1756-1830	Fuse Test
14	Trench Warfare	81 mm Mortar	1015-1315	Fuse Test
15	Trench Warfare	60 mm Mortar	0845-1230	Fuse Test
19	Romney Creek	Cal. .30 & .50	2045-2300	Accept Test Tracer
24	Trench Warfare	60 & 81 mm Mortar	1515-2050	Fuse Test
	AA Range	280 mm	2016-2250	Fuze Test
25	Hi-Vel Rge	76 mm	1400-1645	Ammu Test
	B-680	280 mm	2009-2116	Fuze Test
26	Trench Warfare	60 & 81 mm Mortar	1606-2030	Fuze Test

APPENDIX II (B)

APRIL 1958

List of Firings Conducted from 0800 to 0900 for April, May June 1958

Date	Gun Position	Weapon	Firing Times	Test
1	Pos 19A	20 mm	0835-1530	Accept of Ammu
2	Pos 11	20 mm	0820-1534	Dev of Ammu
	Pos 4	20 mm	0837-1622	Dev of Ammu
	Romney Creek	Cal. .30	0852-1541	Dev of Ammu
3	Pos 11	20 mm	0850-1609	Dev of Ammu
4	Pos 11	20 mm	0845-1625	Dev of Ammu
	Romney Creek	Cal. .30	0855-1542	Dev of Ammu
7	I-Field	57 mm	0855-0925	Vert Firing
8	I-Field	57 mm	0840-0908	Vert Firing
	Cold Room #2	20 mm	0802-0822	Weapon Test
	Transonic Rge	105 mm H	0822-1146	Dev of Ammu
9	Cold Room #2	20 mm	0804-0810	Weapon Test
	Pos 11	20 mm	0818-1543	Weapon Test
	Lt Rifle Rge	Cal .30	0841-1330	Weapon Test
	Pos 19A	20 mm	0847-1150	Accept of Ammu
	Old Bomb Fld	Rifle Grenade	0845-1445	Drop Test
10	Cold Room #2	20 mm	0815-0819	Weapon Test
	Pos 11	20 mm	0831-1535	Weapon Test
11	I-Field	57 mm	0805-1000	Vert Firing
	Pos 11	20 mm	0805-1531	Weapon Test
	Cold Room #2	20 mm	0810-0815	Weapon Test
14	I-Field	57 mm	0855-1020	Vert Firing
	Cold Room #2	20 mm	0806-0822	Weapon Test
	Pos 11	20 mm	0855-1528	Weapon Test
15	Cold Room #2	20 mm	0803-0839	Weapon Test
	Transonic Rge	155 mm H	0810-1130	Weapon Dev
16	Cold Room #2	20 mm	0802-0818	Weapon Test
	Pos 11	20 mm	0824-1540	Weapon Test
17	Cold Room #2	20 mm	0810-0827	Weapon Test

APPENDIX II (B)

Date	Gun Position	Weapon	Firing Times	Test
	Pos 11	20 mm	0828-1544	Weapon Test
	Pos 19A	20 mm	0844-1543	Ammu Dev
18	Cold Room #2	20 mm	0834-0939	Weapon Test
	Range M	Cal. .50	0841-1620	Barrel Erosion
	Pos 11	20 mm	0841-1521	Weapon Test
21	Pos 11	20 mm	0833-1521	Weapon Test
22	Range M	Cal .50	0850-1547	Barrel Erosion
	Pos 11	20 mm	0855-1620	Weapon Test
23	Pos 11	20 mm	0820-1540	Weapon Test
24	I-Field	57 mm	0845-0940	Vert Firing
	Pos 11	20 mm	0845-1540	Weapon Test
25	Pos 11	20 mm	0819-1542	Weapon Test
	M-Range	Cal. .50	0847-1150	Barrel Erosion
28	Pos 11	20 mm	0830-1522	Weapon Test
		MAY 1958		
1	Pos 19A	20 mm	0847-1619	
	Pos 22	20 mm	0850-1624	
	Closed Rge #2	Cal. .30 & 50	0851-1628	
	I-Field	57 mm	0850-0935	
2	Pos 11	20 mm	0820-1519	
	Closed Rge #2	Cal .30 & .50	0837-1626	
	RR Range B	105 mm	0845-1554	Blind Primer
	Pos 22	20 mm	0846-1059	
5	Pos 11	20 mm	0817-1517	
	Closed Rge #2	Cal 30 & .50	0830-1628	
6	Pos 11	20 mm	0830-1525	
	RR Rge B	57 mm	0900-1537	Blind Primer
7	RR Rge B	75 mm	0836-1408	Blind Primer
	Pos 11	20 mm	0830-1536	
	Pos 22	20 mm	0850-1135	

APPENDIX II (B)

Date	Gun Position	Weapon	Firing Times	Test
8	Pos 11	20 mm	0810-1545	
	RR Range B	75 mm	0835-1145	Blind Primer
	I-Field	57 mm	0847-0910	
9	Pos 11	20 mm	0820-1535	
	RR Rge B	75 mm	0843-0959	Blind Primer
12	Pos 11	20 mm	0805-1535	
13	Pos 11	20 mm	0822-1536	
14	Pos 11	20 mm	0820-1530	
	Lt Rifle Rge	Cal. .30	0835-1614	
15	Pos 11	20 mm	0815-1540	
	Lt Rifle Rge	Cal. .30	0900-1105	
16	Pos 11	20 mm	0845-1522	
19	Pos 11	20 mm	0810-1543	
20	Pos 11	20 mm	0828-1419	
21	Pos 11	20 mm	0824-1531	
22	Main Front	Various	0855-1015	Rging in Demonstra.
	Lt Rifle Rge	Cal. 30	0855-1520	Test of MG
23	Pos 19A	20 mm	0848-1100	Accept Ctg
26	B-C	90 mm	0853-1543	Blind Primer
27	B-C	90 mm	0852-1552	Blind Primer
	Closed Rge 4	Niblick	0850-1446	
28	Pos 11	20 mm	0806-1541	
	RR Rge B	106 mm	0853-1351	Blind Primer
29	Hi-Vel	90 mm	0852-1320	Accept of Cases
	Pos 11	20 mm	0827-1542	
	RR Rge B	106 mm	0849-1127	Blind Primer
	I-Field	57 mm	0850-0930	

APPENDIX II (B)

JUNE 1958

Date	Gun Position	Weapon	Firing Times	Test
2	Pos 11	20 mm	0835-1200	Bbl Erosion Test
3	Pos 11	20 mm	0832-1550	Bbl Erosion Test
4	Pos 11	20 mm	0828-1500	Parts Life Test
	Lt Rifle Rge	7.62 mm	0857-1441	Dev Test
	I-Field	8" How	0850-1035	Vert Firing
5	Pos 13	Cal. .30	0821-1547	Dev of Lt MG
	Transonic Rge	105 mm How	0826-1600	Dev of Ammu
6	Cold Room #2	20 mm	0832-1515	Parts Life Test
	Transonic Rge	105 mm How	0846-1540	Dev of Ammu
9	Cold Room #2	20 mm	0815-0833	Weapon Test
	Transonic Rge	105 mm How	0841-1155	Dev of Ammu
	Closed Rge #2	20 mm	0852-1600	Ammu Test
10	Cold Room #2	20 mm	0830-0840	Weapon Test
	Pos 12	Cal. 22 & .30	0837-1539	Weapon Test
	Closed Rge #2	20 mm	0840-1624	Ammu Test
11	Cold Room #2	20 mm	0810-0815	Weapon Test
	Pos 19A	20 mm	0854-1530	Ammu Test
12	Cold Room #2	20 mm	0808-0811	Weapon Test
	Lt Rifle Rge	Cal. .22 & .30	0845-1524	Weapon Test
	M-Range	Cal .50	0855-1109	Cal. .50 Frag
13	Lt Rifle Rge	Cal. .30	0840-1319	Weapon Test
16	Pos 11	20 mm 08	0835-1555	Parts Life Test
17	Pos 11	20 mm	0814-1327	Parts Life Test
18	Fuze Range	81 mm Mortar	0855-1003	Fuze Test
20	Pos 11	20 mm	0832-1507	Parts Life Test
	Pos 19A	20 mm	0855-1622	Proof Accept Test
23	Pos 11	20 mm	0820-1525	Parts Life Test
	Pos 4	20 mm	0847-1507	Ammu Test
24	Pos 11	20 mm	0816-1335	Parts Life Test
25	Lt Rifle Rge	Cal .30	0855-1609	Weapon Test

APPENDIX II (B)

Date	Gun Position	Weapon	Firing Times	Test
27	Trench Warfare	60 & 81 mm Mortar	0814-1100	Fuze Test
	Transonic Rge	155 mm	0835-1120	Ammu Devel
	Pos 11	20 mm	0835-1002	Parts Life Test
30	Closed Rge #2	20 mm	0815-1625	Ammu Test
	Pos 19A	20 mm	0855-1543	Parts Life Test

APPENDIX II (C)

APRIL 1958

List of firings conducted after 1615 hours for April, May, June 1958

Date	Gun Position	Weapon	Firing Times	Test
1	Mich, Pos 20	20 mm	1352-1620	
2	Mich, Pos 1B	Cal. .50	0905-1620	Erosion Test
	Mich, Pos 4	20 mm	0837-1622	
4	Mich, Pos 11	20 mm	0845-1628	Prod Bbl Test
8	40 mm Range	90 mm	0930-1616	Accept of Cases
11	AA #3 Mine Fld	T37 Mine	1007-1617	Test of Mine, APERS
15	Mich, Pos 1B	Cal. .50	0910-1625	Erosion Test
	Mich, Pos 4	20 mm	0959-1615	
16	B-C	90 mm	1614-2033	Blind Primer Test
17	RR Rge B	106 mm	1016-1900	Blind Primer Test
18	Mich, M-Range	Cal. .50	0841-1620	Test of MG
	B-C	90 mm	1604-1625	Blind Primer Test
21	B-C	120 mm	1557-1625	Blind Primer Test
22	B-3	90 mm	1001-1625	Blind Primer Test
	Mich, Pos 11	20 mm	0855-1620	Prod Bbl Test
24	Mich, Lt Rfl Rge	Cal. .30	0932-1619	Test of MG
	Hi-Vel Rge	90 mm	1558-1628	Accept of Ammu
25	Mich, Pos 1B	20 mm	0914-1627	Erosion Test
28	Mich, Pos 4	20 mm	0917-1621	
	Mich, Pos 22	20 mm	1054-1622	Accept of Ammu
	Mich, Pos 20	20 mm	1235-1629	
29	Mich, Pos 22	20 mm	1020-1621	Accept of Ammu
30	Mich, Pos 19A	20 mm	1052-1619	
	Mich, Pos 4	20 mm	1310-1619	

APPENDIX II (C)
MAY 1958

Date	Gun Position	Weapon	Firing Times	Test
1	Mich, Pos 19A	20 mm	0847-1619	
	Mich, Pos 22	20 mm	0850-1624	Accept of Ammu
13	Mich, Lt Rfle Rge	Cal. .20	1030-1629	Test of MG
21	Mich, Lt Rfle Rge	Cal .30	1300-1625	Test of MG
	Hi-Vel Rge	90 mm	1620-1953	Test of Shell, T320
23	Railway Rge	76 mm	1325-1615	Prep - West Pt Demo

JUNE 1958

9	Lt Armor Rge D	105 mm	1605-2000	Test of British Gun
11	B-4	105 mm	1345-1620	Test of British Gun
12	Range #9	Static Chg 3#	1627-1930	Dot-Dash Test
24	Trench Warfare	81mm & 60mm Mortar	1515-2050	Test of Fuse
25	Hi-Vel Rge	76 mm	1400-1645	Test of Shell

APPENDIX II (D)

Following is breakdown of Daily Firings on the APG D&PS Proof Ranges for April, May, June and July 58 showing these programs with:

A. Maximum Ordinate - below 2000 feet
B. Maximum Ordinate - between 2000 and 10,000
C. Maximum Ordinate - above 10,000 feet

Month	Day	Daily Totals	Category A	Category B	Category C	Percentage A	Percentage B	Percentage C
April	1	19	7	9	3	37	47	16
	2	18	8	7	3	44	39	17
	3	18	7	9	2	39	50	11
	4	17	7	7	3	41	41	18
	5	2	0	2	0	0	100	0
	7	16	6	7	3	37	44	19
	8	21	9	10	2	43	47	10
	9	22	12	7	3	54	32	14
	10	15	9	4	2	60	27	13
	11	13	7	4	2	54	31	15
	12	3	1	2	0	33	67	0
	13	1	0	1	0	0	100	0
	14	19	7	9	3	37	47	16
	15	16	8	4	4	50	25	25
	16	20	7	9	4	35	45	20
	17	22	11	7	4	50	32	18
	18	21	12	8	1	57	38	5
	19	4	1	3	0	25	75	0
	20	2	0	2	0	0	100	0
	21	15	6	9	0	40	60	0
	22	20	11	8	1	55	40	5
	23	18	8	9	1	44	50	6
	24	22	9	12	1	41	55	4
	25	16	9	7	0	56	44	0
	28	7	5	2	0	71	29	0
	29	18	7	8	3	39	49	17
	30	18	12	5	1	67	28	5
April Totals		403	186	171	46	46	42	12

APPENDIX II (D)

Following is breakdown of Daily Firings on the APG D&PS Proof Ranges for April, May, June and July 58 showing these programs with·

A. Maximum Ordinate - below 2000 feet
B. Maximum Ordinate - between 2000 and 10,000 feet
C. Maximum Ordinate - above 10,000 feet

Month	Day	Daily Totals	Category A	Category B	Category C	Percentage A	Percentage B	Percentage C
May	1	18	11	5	2	61	27	11
	2	20	9	7	4	65	35	20
	5	10	3	6	1	30	60	10
	6	8	3	2	3	38	24	38
	7	9	5	4	0	56	44	0
	8	16	8	6	2	50	38	12
	9	18	5	10	3	28	55	17
	12	18	8	8	2	44	44	12
	13	19	10	8	1	53	42	5
	14	18	7	11	0	39	61	0
	15	19	11	5	3	58	26	16
	16	19	8	10	1	43	52	5
	19	15	7	6	2	47	40	13
	20	12	6	5	1	50	42	8
	21	15	8	5	2	53	33	14
	22	17	6	6	5	35	35	30
	23	10	6	2	2	60	20	20
	24	3	0	3	0	0	100	0
	26	8	5	2	1	62	25	13
	27	10	5	4	1	50	40	10
	28	13	6	3	4	46	23	31
	29	14	5	5	4	36	36	28
May Totals		309	142	123	44	46	40	14

APPENDIX II (D)

Following is breakdown of Daily Firings on the APG D&PS Proof Ranges for April, May, June and July 58 showing these programs with

A. Maximum Ordinate - below 2000 feet
B. Maximum Ordinate - between 2000 and 10,000 feet
C Maximum Ordinate - above 10,000 feet

Month	Day	Daily Totals	Category A	Category B	Category C	Percentage A	Percentage B	Percentage C
June	2	17	7	7	3	41	41	18
	3	22	11	9	2	50	41	9
	4	21	8	9	4	38	43	19
	5	18	6	10	2	33	56	11
	6	17	8	8	1	47	47	6
	7	1	0	1	0	0	100	0
	9	14	6	6	2	43	43	14
	10	17	7	7	3	41	41	18
	11	16	6	7	3	38	44	18
	12	21	10	9	2	48	43	9
	13	20	9	7	4	45	35	20
	14	1	0	1	0	0	100	0
	16	21	6	14	1	29	67	4
	17	16	4	9	3	25	56	19
	18	21	6	13	2	29	62	9
	19	25	13	10	2	52	40	8
	20	11	6	2	3	55	18	27
	21	1	0	1	0	0	100	0
	23	16	0	5	3	50	31	18
	24	17	8	5	4	47	29	24
	25	21	9	9	3	43	43	14
	26	19	8	9	2	42	47	11
	27	20	5	13	2	25	65	10
	30	12	4	7	1	33	58	9
June Totals		385	155	178	52	40	46	14

APPENDIX II (D)

Following is breakdown of Daily Firings on the APG D&PS Proof Ranges for April, May, June and July 58 showing these programs with

A. Maximum Ordinate - below 2000 feet
B. Maximum Ordinate - between 2000 and 10,000 feet
C. Maximum Ordinate - above 10,000 feet

Month	Day	Daily Totals	Category A	Category B	Category C	Percentage A	Percentage B	Percentage C
July	1	17	9	7	1	53	41	6
	2	14	6	6	2	43	43	14
	3	8	5	2	1	63	25	12
	7	12	6	5	1	50	42	8
	8	8	1	6	1	12	75	13
	9	16	8	7	1	50	44	6
	10	19	10	6	3	53	32	15
	11	22	8	9	5	36	41	13
	14	13	4	8	1	31	61	8
	15	13	5	5	3	38	38	24
	16	15	7	5	3	47	33	20
	17	14	10	0	4	72	0	28
	18	13	6	3	4	46	24	30
	19	2	1	1	0	50	50	0
	21	13	4	6	3	30	46	24
	22	14	2	10	2	14	72	14
	23	21	9	9	3	43	43	14
	24	19	7	8	4	37	42	21
	25	15	6	7	2	40	47	13
	26	3	0	2	1	0	67	33
	28	15	6	6	3	40	40	20
	29	17	8	6	3	47	35	18
	30	14	6	5	3	43	36	21
	31	18	8	9	1	44	50	6
July Totals		335	142	138	55	42	41	17

Grand Total for four (4) months

Total Programs	Category A	Category B	Category C	Percentage A	Percentage B	Percentage C
1432	625	610	197	43	43	14

APENDIX III

APG FIRING DATA

This appendix contains all of the data on the APG firing activity with the collection and coding procedures.

Data Collection and Coding Procedure

Data sheets as per sample, Table 1, were filled out for each firing of each day that was selected for detailed analysis. These sheets were coded and IBM cards were punched with this coded information. The basic data were derived from the "Schedule of Firings and Range Operations", see Table 2, the "Tower Firing Records", and the "Special Firing Clearances" record. The starred items were filled out from the firing records wherever possible and APG personnel checked these items and filled in those remaining.

Data sheets were numbered consecutively, with the date and initials of the tabulators at the top, and the remainder of the data were recorded as follows

Item 1 Sequence number of the firing for a particular day coded as indicated

Item 2 Date of the firing, coded without the year.

Item 3 Day of week, coded starting with Monday as 1.

Item 4 Project number not coded but is useful for obtaining information on starred items.

Item 5 Firing point location, coded from Table 3.

Item 6 Type of test - not coded

Item 7 Type of weapon - coded from Table 4

Item 8 Type of projectile - coded from Table 4.

Item 10 Azimuth bearing of weapon from magnetic south. When two or more azimuths are used for a firing the mean azimuth is used - coded with three digits.

Item 11 Elevation of weapon - when two or more elevations are used for a firing the maximum elevation is used - coded with three digits

Item 12 Possibility of projectile having a ricochet, and, if so, the type of ricochet surface - coded from Table 4.

Item 13 Ricochet altitude - maximum possible altitude after ricochet - coded per note 1, Table 1.

Item 14 Impact range-distance between firing point and point of impact on target, ground or water-coded to nearest 100 yards.

Item 15 Danger range - distance from firing point to maximum point the projectile could reach - coded as per note 1, Table 1.

Item 16 Maximum ordinate altitude of projectile before impact - coded as per note 1, Table 1.

Item 17 Altitude of explosive shell at time of burst - coded as per note 2, Table 1.

Item 18 Lethal radius - the radius of a circular area about the danger range point into which a projectile can fall - coded to nearest 100 ft. in three digits.

Item 19 Clearance tower designation - coded per Table 4.

Item 20 Time out - on 24 hour clock to nearest minute and coded in four digits to nearest tenth of hour. When time was not available from the date the time was assumed as 1630 and coded 1651, the "1" in the last digit denoting an assumed time.

Item 21 Time in - on 24 hour clock to nearest minute and coded in four digits to nearest tenth of hour. When time was not available from data the time was assumed at 0800 and coded 0801, the "1" in the last digit denoting an assumed time.

Item 22 Firing duration - total clearance time for a firing to nearest minute and coded to nearest tenth of hour. When either "time in" or "time out" was unavailable, a "1" is added to duration time. When more than one clearance time was indicated for a firing the total duration time was used for the data.

Item 23 Total number of rounds fired - coded in five digits.

Item 24 Number of cycles - the number of separate bursts or firings in the total firing clearance - coded in two digits.

Item 25 Rounds per cycle - item 23 divided by item 24.

Item 26 Cycle interval - time between cycles in tenths of hours - usually not available.

Item 27 Firing record number - not coded but useful for other information.

When available from firing records the projectile velocity was indicated on the data sheets.

TABLE 1

ABERDEEN STUDY FIRING DATA

Where: A firing is a tower firing clearance block of time

Sheet No. A-135
By. RAD/LWT
Date. 11-25-58
MDS:A11-10

* Consult Aberdeen personnel

Shell Velocity - Not Available

	Card Space	Item	No.	Description	Code Spaces	Code	Card Space
	1-2	Serial No.	1	14	2	14	1-2
	3-6	Date of Firing	2	11-12-57	4	1112	3-6
	7	Day of Firing	3	Wednesday	1	3	7
	8-17	Project No.	4	TR3-3017/TR 301	10	---	8-17
	18-20	Firing Pt. Location	5	Main Front	3	200	18-20
	21-22	Type Test	6	Cooling Test	2	---	21-22
	23-24	Type Weapon	7	90 MM Gun	2	04	23-24
	25-26	Type Projectile	8	Ap, T33 E7	2	02	25-26
	27-28		9		2		27-28
	29-31	Azimuth (mean)	10	33°-30' degrees	3	034	29-31
	32-34	Elevation (max.)	11	2° degrees	3	002	32-34
	35-36	Ricochet & Type	*12	Yes - ground	2	03	35-36
(1)	37-38	Ricochet Altitude	*13	1900 ft. 000 feet	2	01	37-38
	39-41	Impact Range	*14	1000 yds. 00 yards	3	010	39-41
(1)	42-43	Danger Range	*15	6000 yds. 000 yards	2	06	42-43
(1)	44-45	Max. Altitude	*16	500 ft. 000 feet	2	-0	44-45
(2)	46-47	Burst Altitude	*17	None 000 feet	2	0-	46-47
	48-50	Lethal Radius	*18	3000 ft. 00 feet	3	030	48-50
	51-52	Tower	19	A	2	01	51-52
	53-56	Time Out	20	1150	4	1180	53-56
	57-60	Time In	21	0800	4	0800	57-60
	61-64	Firing Duration	22	350	4	0380	61-64
	65-67	No. of Rounds	*23	2000	5	02000	65-69
	68	No. of Cycles	*24	20	2	20	70-71
	69-71	Rounds per Cycle	*25	100	3	100	72-74
	72	Cycle Interval	*26	N. A.	1	---	75
	73-79	Firing Record	*27	N. A.	4	---	76-79

Note (1) -- = 0 Altitude
00 = 0-500 foot altitude
-0 = 500-1000 foot altitude
01 = 1000-2000 foot altitude
Etc.

Note (2) 0- = No Burst
-- = 0 Altitude
00 = 0-500 foot altitude
-0 = 500-1000 foot altitude
01 = 1000-2000 foot altitude

TABLE 2

SCHEDULING COMMITTEE

DEVELOPMENT AND PROOF SERVICES

ABERDEEN PROVING GROUND, MARYLAND

DAILY OPERATIONS ORDER 246

SUBJECT Schedule of Firings and Range Operations for Wednesday, 12 November 1958

FIRINGS A Tower Observer Phones 21246 or 21256

T-5 (R) TR3-3017/TR301 - by Mr. Grepps - 0800 at Main Front Laminar Cooling Test. 90 mm. Gun. B-4. 2000 rds. AP, T33E7 proj. 2^{o} elev. 10 rds. to be fired a/1000 yard elevated target, 80 rds. to be fired over top target, then 10 rds. a/1000 yard elevated target, change tube and repeat sequence. (D & PS Memo 97-67)
VEL, YAW CARDS. Dir. of fire 33^{o} 30'. W.O. 393-305-25

TABLE 3

LOCATION (ITEM 5) CODING

Gun Powder Neck Complex	100
57 mm Vert	101
90 mm Vert	102
120 mm Vert	103
8" Vert	104
Field I	105
Field H	106
Field D	107
Field N	108
Field C	109
A-Range	110
B-Range	111
C-Range	112
Pooles Island	113
Field M	114
Robbins Pt.	115
L Field	116
Main Front	200
B-1	201
B-2	202
B-3	203
B-4	204
Cold Room	205
B-5	206
Depression Firing	207
Closed Range	208
Waterfront	300
Light Armor Range	301
Hi Vel Range	302
Plate Range	303
Railway	304
AA Range, New Barr	305
Ball Range	306
Michaelsville	400
Mich. KD Range	401
Lt Rifle Range	402
Mich Pos #1-22	403
M-Range	404
Transonic Range	405
Mine Field #2, Range #10	406
Mich Closed Ranges	407
Spesutie Island	500
Fuse Range	501
Bomb Blast	502
Keen House #2	503
R-18	504
Air to Ground Range	505
R-14	506
Airfield Area	600
Block 49	601
Block 53	602
Trench Warfare Range	603
Recoiless Rifle Range	604
Range #1	605
Range #2	606
Range #3	607
Range #4	608
Range #5	609
Range #6	610
Range #7	611
Range #8	612
Range #9	613
BTD Area	614
New Bombing Field Area	700
New Bombing Field	701
Doan Brook Site	702
OBF	703
Brian Pt	704
Abbey Pt.	705
Poverty Island Area	800
Poverty Island	801
Romney Creek	802
AA #5	803
Fords Farm	804
12,500 Yd. Field	805
Aircraft Flights	900
Short Lane to Turkey Pt.	901
Pooles Isl Narrows	902
Havre De Grace to Howell Pt	903
℄ Course from Main Front	904
Watson Creek to Main Front	905
E. to W N Carroll's Isl.	906
OBF to Askania STA	907
Concord Pt. to Cecilton	909
H Tower to Chillberry Pt.	909
"M" Field E to W	910
Over Gunpowder River	911
APG to Washington	912
Edge of Airstrip	913
Edgewood	914
"M" Field & Maxwell Pt.	915
3-Mile Straightaway	916
Upper Bush River	917

TABLE 4

Weapon, Projectile, and Ricochet Coding (Items 7, 8, & 12)				Tower Coding (Item 19)
Code No	Weapon* Item 7	Type Projectile Item 8	Ricochet & Type Item 12	Tower
01	57 mm	Ball	Yes - plate	A
02	75 mm	AP	Yes - tank	B
03	76 mm.	APHE	Yes - ground	C
04	90 mm	Inert	Yes - turret	L
05	105 mm	Inert, HEAT	Yes - water	Range Control
06	106 mm.	Ill. shell	Yes - sand	
07	120 mm.	BNT charge	Yes - marsh	
08	155 mm	Aircraft	Yes - cases	
09	175 mm	Special charge		
10	8 inch	12 gauge ball	No ricochet	
11	Mine	HE		
12	Aircraft	Tracer		
13	Static Det.	HEAP		
14	Small Caliber	Fragment		
15	Closed Range	Inert, air burst		
16	Rocket	TP		
17	20 mm.	Grenade		
18	30 mm.	HEAT		
19	37 mm.	WP		
20	Mortar	Rocket		
21	Data Capsule	Demo - HE, AP, TP, WP, inert		
22	Demonstration	Mine, HE		
23	40 mm.	TNT charge		
24	127 mm	HE charge		
25	280 mm.	JATO unit		
26		Powder Burning		

* NOTES WEAPON CODING

1. Static Detonation - includes all ground explosions such as
   a) explosive charges - from $\frac{1}{2}$# to 90#
   b) burning scrap powder, destroying duds
   c) static detonation of shells (90 mm., 105 mm., etc.), bombs
   d) grenade detonation
   e) static detonation of JATO units, rocket motors
2. Small Caliber Weapons - includes all small arms
   7.62 mm., 10.62 mm., 15 cal., 22, 30, 50, 60 cal. rifles and MG's
3. Rockets - includes all rockets
   From 2" to $4\frac{1}{2}$" SS-10 Missile (anti-tank, ground-to-ground)
4. Mortar - includes all mortars - from 40 mm to 81 mm.
5. Demonstration - includes firings where various weapons were fired ranging from small arms to 175 mm. Does not include troop training demonstrations such as' static detonation, grenades, etc.

TABLE 5

TOWER RECORD - JANUARY 1958

Date	Day	Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample Day
		Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	
1	W	-	-	-	-	-	-	-	-	-	-	-	
2	T	-	-	7	4	1	1	0	0	2	1	6	
3	F	-	-	9	4	0	0	0	0	1	0	4	
4	S	-	-	-	-	-	-	-	-	-	-	-	
5	S	-	-	-	-	-	-	-	-	-	-	-	
6	M	7	2	7	5	3	3	0	0	-	-	10	
7	T	5	2	8	4	6	3	0	0	7	0	9	
8	W	5	2	7	4	7	6	0	0	-	-	12	
9	T	7	5	9	5	5	5	0	0	6	2	17	
10	F	7	7	9	3	2	4	0	0	7	0	14	M Avg
11	S	-	-	-	-	-	-	-	-	-	-	-	
12	S	-	-	-	-	-	-	-	-	-	-	-	
13	M	6	5	8	2	4	4	2	2	-	-	13	
14	T	5	2	10	3	4	1	2	1	1	0	7	
15	W	7	4	10	4	4	4	3	3	7	1	16	Q & M Avg.
16	T	6	4	10	6	6	4	3	3	3	0	17	
17	F	8	6	10	2	4	3	3	1	3	1	13	
18	S	-	-	-	-	-	-	-	-	-	-	-	
19	S	-	-	-	-	-	-	-	-	-	-	-	
20	M	8	7	9	3	6	4	2	1	7	0	15	
21	T	9	8	10	3	5	3	2	1	7	0	15	M Avg
22	W	11	9	12	5	6	6	2	2	7	0	22	
23	T	11	9	7	1	7	7	2	2	17	2	21	
24	F	7	5	7	0	3	3	3	2	8	2	12	
25	S	-	-	-	-	-	-	-	-	-	-	-	
26	S	-	-	-	-	-	-	-	-	-	-	-	
27	M	7	6	10	4	3	2	4	4	10	0	16	
28	T	11	7	10	4	8	6	2	2	6	3	22	
29	W	11	7	11	6	9	4	2	-	12	2	19	Peak
30	T	11	7	9	4	5	5	2	1	12	4	21	
31	F	9	7	10	2	3	1	2	1	9	2	13	
TOTAL			111		78		79		26		20	314	
AVERAGE			5.0		3 5		3 6		1.2		0 9	14 2	

WORKING DAYS - 22

TABLE 6

TOWER RECORD - FEBRUARY 1958

Date	Day	Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample Day
		Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	
1	S	-	-	-	-	-	-	-	-	-	-	-	
2	S	-	-	-	-	-	-	-	-	-	-	-	
3	M	7	5	9	3	4	3	1	1	6	-	12	
4	T	9	7	8	1	3	1	2	1	5	2	12	Ran.
5	W	9	6	10	5	6	5	3	2	10	1	19	
6	T	11	7	9	3	7	4	5	3	7	-	17	
7	F	10	7	10	2	4	0	3	1	2	-	10	
8	S	-	-	-	-	-	-	-	-	-	-	-	
9	S	-	-	-	-	-	-	-	-	-	-	-	
10	M	9	7	12	7	2	2	2	1	8	1	18	Ran.
11	T	10	9	11	6	5	6	-	-	8	-	21	
12	W	13	11	11	6	3	1	4	2	6	1	21	
13	T	12	9	12	6	6	6	5	2	4	-	23	
14	F	13	10	13	5	6	5	3	-	5	2	22	
15	S	-	-	-	-	-	-	-	-	-	-	-	
16	S	-	-	-	-	-	-	-	-	-	-	-	
17	M	-	-	10	-	4	-	1	-	-	-	-	
18	T	-	-	-	-	-	-	-	-	-	-	-	
19	W	-	-	1	1	-	-	-	-	-	-	1	
20	T	11	3	12	3	3	1	2	1	1	-	8	
21	F	10	7	10	2	5	2	2	1	3	-	12	
22	S	-	-	-	-	-	-	-	-	-	-	-	
23	S	-	-	-	-	-	-	-	-	-	-	-	
24	M	11	6	8	2	7	6	4	2	5	-	16	
25	T	11	8	10	4	5	6	2	1	9	1	20	
26	W	16	12	11	4	3	3	6	3	6	1	23	Peak
27	T	10	4	8	-	6	2	3	1	5	-	7	
28	F	-	6	11	4	4	2	3	-	5	1	13	Mo Avg
TOTAL			125		64		55		22		10	275	
AVERAGE			6 2		3.2		2 8		1 1		0.5	13 7	

WORKING DAYS - 20

TABLE 7
TOWER RECORD - MARCH 1958

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	S	-	-	-	-	-	-	-	-	-	-	-	
2	S	-	-	-	-	-	-	-	-	-	-	-	
3	M	8	5	10	2	2	1	3	2	6	1	11	
4	T	10	9	9	4	5	5	3	3	10	1	22	
5	W	11	8	11	7	6	6	3	3	9	-	24	
6	T	11	7	9	4	5	4	3	2	9	3	20	Mo Avg
7	F	6	5	9	6	5	6	3	2	9	2	21	
8	S	-	-	-	-	-	-	-	-	-	-	-	
9	S	-	-	-	-	-	-	-	-	-	-	-	
10	M	7	5	11	9	6	4	2	2	9	1	21	Ran
11	T	12	5	11	7	12	10	3	3	11	-	25	
12	W	13	12	16	7	8	6	1	-	11	1	26	
13	T	11	10	13	10	7	5	2	-	5	1	26	
14	F	12	5	12	5	4	2	2	-	5	1	13	
15	S	-	-	-	-	-	-	-	-	-	-	-	
16	S	-	-	-	-	-	-	-	-	-	-	-	
17	M	11	9	12	8	5	5	1	-	9	-	22	
18	T	13	12	12	5	6	6	3	2	7	-	25	
19	W	12	5	10	3	6	3	3	3	3	-	14	Ran
20	T	-	-	SNOWED			-	-	-	-	-	-	
21	F	-	-	OUT			-	-	-	-	-	-	
22	S	-	-	-	-	-	-	-	-	-	-	-	
23	S	-	-	-	-	-	-	-	-	-	-	-	
24	M	1	6	2	2	4	5	1	1	3	-	14	
25	T	15	8	8	4	4	3	3	2	2	-	17	
26	W	13	9	4	-	1	-	4	2	6	1	12	
27	T	13	8	4	2	2	1	5	4	3	2	17	
28	F	14	11	7	5	6	5	6	4	6	3	28	Peak
29	S	-	-	-	-	-	-	-	-	-	-	-	
30	S	-	-	-	-	-	-	-	-	-	-	-	
31	M	14	8	9	3	4	1	6	2	1	-	14	
TOTAL			147		93		78		37		17	372	
AVERAGE			7		4 4		3 7		1 8		0 8	17 7	

WORKING DAYS - 21

TABLE 8

TOWER RECORD - APRIL 1958

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	T	13	11	10	6	4	5	4	2	15	2	26	Mo. Avg
2	W	14	9	13	6	5	7	2	2	-	-	24	
3	T	15	7	9	4	9	11	2	1	8	1	24	
4	F	14	8	8	4	6	5	3	1	5	-	18	
5	S	-	-	2	2	-	-	-	-	-	-	2	
6	S	-	-	-	-	-	-	-	-	-	-	-	
7	M	15	8	13	5	7	4	2	1	7	2	20	Ran.
8	T	14	8	13	9	8	8	3	3	13	2	30	
9	W	17	12	17	12	6	7	2	1	14	2	34	
10	T	11	6	12	6	8	6	2	1	-	-	19	
11	F	13	7	12	3	3	2	3	1	5	1	14	
12	S	-	-	3	4	-	-	-	-	-	-	4	
13	S	-	-	1	1	-	-	-	-	-	-	1	
14	M	15	10	11	4	8	6	4	2	8	1	23	
15	T	14	9	11	7	6	7	2	2	8	-	25	
16	W	13	9	16	15	4	5	4	4	10	2	35	Peak
17	T	12	9	13	9	6	4	4	4	9	2	28	
18	F	17	12	11	11	4	5	5	5	2	-	33	
19	S	-	-	4	4	-	-	-	-	--	-	4	
20	S	-	-	4	3	-	-	-	-	-	-	3	
21	M	15	11	8	4	4	2	3	2	8	-	19	
22	T	14	12	12	4	5	3	5	5	11	1	25	
23	W	17	13	10	7	4	4	5	4	12	2	30	
24	T	16	10	11	8	6	6	4	4	9	3	31	
25	F	12	11	16	9	4	5	2	2	7	-	27	
26	S	-	-	2	2	-	-	-	-	-	-	2	
27	S	-	-	-	-	-	-	-	-	-	-	-	
28	M	13	6	10	3	2	1	2	-	2	-	10	
29	T	14	10	12	6	5	3	3	2	3	1	22	Ran.
30	W	14	11	13	6	4	4	4	4	10	1	26	
TOTAL			209		164		110		53		23	559	
AVERAGE			9 5		7.5		5 0		2 4		1 0	25.4	

WORKING DAYS - 22

TABLE 9

TOWER RECORD - MAY 1958

Date	Day	Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
		Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	T	16	11	10	4	5	1	3	3	-	2	21	
2	F	13	12	13	5	3	4	3	2	-	2	25	Ran
3	S	-	-	-	-	-	-	-	-	-	-	-	
4	S	-	-	-	-	-	-	-	-	-	-	-	
5	M	12	8	8	2	5	1	3	3	-	-	14	
6	T	16	8	14	4	6	1	4	3	-	1	17	
7	W	14	7	11	3	6	1	5	3	-	-	14	
8	T	12	7	13	10	8	5	5	4	-	2	28	
9	F	11	7	13	9	9	8	3	2	-	4	30	
10	S	-	-	-	-	-	-	-	-	-	-	-	
11	S	-	-	-	-	-	-	-	-	-	-	-	
12	M	15	12	13	7	7	4	4	3	-	1	27	
13	T	14	12	13	9	10	4	6	3	-	2	30	Peak
14	W	12	10	13	8	7	5	5	5	-	1	29	
15	T	11	9	14	5	6	5	4	3	-	2	24	
16	F	10	9	16	7	9	6	4	2	-	3	27	
17	S	-	-	-	-	-	-	-	-	-	-	-	
18	S	-	-	-	-	-	-	-	-	-	-	-	
19	M	7	5	11	4	10	10	3	3	-	1	23	
20	T	11	7	12	5	7	5	4	3	-	2	22	
21	W	11	9	13	7	8	4	5	3	-	1	24	Qtr Mo. Avg
22	T	8	5	14	7	7	4	2	-	-	3	19	
23	F	6	4	14	7	6	5	-	-	-	-	16	
24	S	-	-	5	5	-	-	-	-	-	-	5	
25	S	-	-	-	-	-	-	-	-	-	-	-	
26	M	7	10	12	6	4	1	-	-	-	1	18	
27	T	11	9	12	11	6	4	-	-	-	1	25	Ran
28	W	8	8	13	5	5	2	-	-	-	1	16	
29	T	10	6	12	9	5	4	-	-	-	1	20	
30	F	-	-	1	-	-	-	-	-	-	-	-	
31	S	-	-	1	-	-	-	-	-	-	-	-	
TOTAL			175		139		84		45		31	474	
AVERAGE			8.3		6.6		4 0		2 2		1 5	22 6	

WORKING DAYS - 21

TABLE 10

TOWER RECORD - JUNE 1958

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	S	1	-	1	-	-	-	-	-	-	-	-	
2	M	10	5	13	7	6	6	2	1	-	-	19	
3	T	13	11	12	7	5	1	4	4	-	1	24	
4	W	14	10	14	8	7	8	2	2	-	3	31	
5	T	14	9	11	9	6	4	4	2	-	2	26	Mo. Avg
6	F	15	11	8	4	6	3	5	-	-	1	19	
7	S	-	-	2	1	-	-	-	-	-	-	1	
8	S	-	-	1	-	-	-	-	-	-	-	-	
9	M	11	8	11	6	10	6	-	-	-	1	21	
10	T	14	12	12	9	8	2	-	-	-	1	24	
11	W	14	10	16	7	8	7	3	3	-	-	27	
12	T	15	9	14	5	9	8	3	3	-	3	28	
13	F	10	6	14	7	11	6	2	2	-	4	25	Ran
14	S	-	-	1	1	-	-	-	-	-	-	1	
15	S	-	-	1	1	-	-	-	-	-	-	1	
16	M	12	10	12	5	7	5	3	3	-	1	24	
17	T	9	6	15	8	7	6	-	3	-	2	25	
18	W	15	8	19	10	5	4	-	4	-	4	30	
19	T	12	9	15	9	8	5	-	4	-	3	30	Peak
20	F	15	8	15	4	5	5	-	-	-	3	20	
21	S	-	-	1	1	-	-	-	-	-	-	1	
22	S	-	-	-	-	-	-	-	1	-	-	1	
23	M	12	8	15	11	6	3	-	-	-	-	22	
24	T	11	8	13	8	2	7	-	2	-	1	26	Ran
25	W	15	11	18	10	10	6	-	2	-	1	30	
26	T	14	10	14	9	8	7	-	2	-	1	29	
27	F	18	11	13	4	10	9	-	4	-	1	29	
28	S	-	-	-	-	-	-	-	-	-	-	-	
29	S	-	-	-	-	-	-	-	-	-	-	-	
30	M	13	7	14	7	8	4	-	4	-	1	23	
TOTAL			187		158		112		46		34	536	
AVERAGE			8 9		7.5		5 4		2.2		1 6	25 6	

WORKING DAYS - 21

TABLE 11

TOWER RECORD - JULY 1957

		Tower A		Tower B		Tower C		Tower L		Range Control		Total Sample	
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	M		3	7	5	5	3	1	1		1	13	
2	T		3	8	6	4	5	5	4		2	20	Avg
3	W		4	9	8	5	3	2	0			15	
4	T		-	-	-	-	-	-	-		-	-	
5	F		-	6	4	-	-	-	-		-	4	
6	S		-	-	-	-	-	-	-		-	-	
7	S		-	-	-	-	-	-	-		-	--	
8	M		2	7	3	3	2	2	1		1	9	
9	T		5	6	3	3	3	3	2		2	15	
10	W		6	8	7	4	4	5	4		-	21	
11	T		14	5	3	4	3	5	4		1	25	
12	F		7	6	6	4	2	4	4		2	21	
13	S		-	-	-	-	-	-	-		-	-	
14	S		-	-	-	-	-	-	-		-	-	
15	M		6	8	5	3	4	1	1		3	19	
16	T		9	9	7	4	6	1	1		2	25	
17	W		9	8	4	4	4	2	2		4	23	
18	T		14	7	4	4	5	3	2		1	26	M Peak
19	F		13	7	5	3	4	-	-		1	23	
20	S		-	-	-	-	-	-	-		-	-	
21	S		-	-	-	-	-	-	-		-	-	
22	M		7	-	4	4	4	3	1		2	18	Avg
23	T		7	-	2	2	2	-	-		2	13	
24	W		9	-	3	2	2	-	-		2	16	
25	T		8	-	4	5	6	4	3		1	22	
26	F		9	-	4	5	5	3	3		1	22	
27	S		-	-	-	-	-	-	-		-	-	
28	S		-	-	-	-	-	-	-		-	-	
29	M		6	-	3	3	3	3	2		-	14	
30	T		6	-	1	2	1	3	3		3	14	
31	W		7	-	4	3	4	2	2		1	18	Q_{Avg} & M
TOTAL			154		92		75		40		32	396	
AVERAGE			7		4		3 5		2		1 5	18	

WORKING DAYS - 22

TABLE 12

TOWER RECORD - AUGUST 1957

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	T		4	8	4	5	4	2	2	10	2	16	Avg.
2	F		10	7	1	5	6	0	0	8	0	17	
3	S		-	-	-	-	-	-	-	-	-	-	
4	S		-	-	-	-	-	-	-	-	-	-	
5	M		4	7	6	2	5	0	0	7	0	15	
6	T		5	8	5	2	1	2	1	14	0	12	
7	W		4	8	3	4	4	2	2	8	0	13	
8	T		5	7	1	6	5	1	1	5	3	15	
9	F		3	7	5	3	3	1	1	9	1	13	
10	S		-	-	-	-	-	-	-	-	-	-	
11	S		-	-	-	-	-	-	-	-	-	-	
12	M		5	6	1	2	1	2	2	5	2	11	
13	T		6	6	0	6	5	3	2	11	2	15	
14	W		9	6	3	5	5	1	1	11	2	20	
15	T		7	7	4	4	2	1	0	11	2	15	
16	F		9	4	2	5	5	-	-	7	0	16	Avg
17	S		-	-	-	-	-	-	-	-	-	-	
18	S		-	-	-	-	-	-	-	-	-	-	
19	M		13	4	3	3	0	2	2	7	1	19	
20	T		10	5	4	8	4	2	1	15	2	21	
21	W		6	5	4	6	6	2	2	10	0	18	
22	T		11	5	5	2	0	-	-	9	3	19	
23	F		10	6	5	4	4	1	1	8	1	21	
24	S		-	-	-	-	-	-	-	-	-	-	
25	S		-	-	-	-	-	-	-	-	-	-	
26	M		10	4	4	1	0	-	-	8	1	15	
27	T		11	4	4	3	2	2	2	8	1	20	
28	W		10	12	6	4	2	2	2	9	2	22	M Peak
29	T		8	10	3	4	5	2	0	6	2	18	M Avg
30	F		10	9	4	6	4	0	0	9	0	18	
31	S		-	-	-	-	-	-	-	-	-	-	
TOTAL			170		77		73		22		27	369	
AVERAGE			8		3 5		3		1		1	16 8	

WORKING DAYS - 22

TABLE 13

TOWER RECORD - SEPTEMBER 1957

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	S		-	-	-	-	-	-	-	-	-	-	
2	M		-	-	-	-	-	-	-	-	-	-	
3	T		9	7	3	3	3	0	0	9	1	16	M. Avg.
4	W		9	6	2	2	1	0	0	7	1	13	
5	T		9	7	3	7	6	1	1	12	1	20	
6	F		7	9	2	7	5	1	1	7	2	17	
7	S		-	-	-	-	-	-	-	-	-	-	
8	S		-	-	-	-	-	-	-	-	-	-	
9	M		6	8	3	1	0	0	0	3	1	10	
10	T		5	8	1	4	1	0	0	7	1	8	
11	W		5	11	5	3	2	1	1	8	3	16	
12	T		5	9	5	5	3	0	0	8	2	15	Avg
13	F		8	13	5	4	4	0	0	5	1	18	
14	S		-	-	-	-	-	-	-	-	-	-	
15	S		-	-	-	-	-	-	-	-	-	-	
16	M		6	9	3	5	3	1	1	10	0	13	
17	T		5	9	3	5	3	0	0	10	0	11	
18	W		6	9	5	4	4	1	1	12	2	18	
19	T		5	11	4	6	2	1	1	10	1	13	
20	F		5	9	5	5	4	1	0	10	1	15	
21	S		-	-	-	-	-	-	-	-	-	-	
22	S		-	-	-	-	-	-	-	-	-	-	
23	M		6	9	5	4	3	2	1	8	1	16	
24	T		9	9	4	5	7	0	0	18	1	21	M Peak
25	W		9	7	2	6	8	0	0	10	1	20	
26	T		7	9	3	7	6	0	0	9	1	17	
27	F		8	8	4	7	5	0	0	11	0	17	
28	S		-	-	-	-	-	-	-	-	-	-	
29	S		-	-	-	-	-	-	-	-	-	-	
30	M		7	10	3	7	3	1	1	5	0	14	Avg.
TOTAL			136		70		73		8		21	308	
AVERAGE			7		3 5		3 5		.5		1	15 5	

WORKING DAYS - 20

TABLE 14

TOWER RECORD - OCTOBER 1957

		Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample
Date	Day	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	Day
1	T		7	9	2	7	6	2	2	15	2	19	
2	W		7	11	7	6	5	2	2	15	0	21	
3	T		8	9	5	5	3	2	2	13	0	18	
4	F		7	10	4	4	1	3	2	13	1	15	Avg.
5	S		-	-	-	-	-	-	-	-	-	-	
6	S		-	-	-	-	-	-	-	-	-	-	
7	M		2	8	2	1	0	1	1	11	1	6	
8	T		1	7	1	3	1	1	1	9	1	5	
9	W		6	11	5	2	2	0	0	13	0	13	
10	T		5	10	5	3	2	2	1	13	1	14	Q Avg
11	F		5	10	6	3	2	2	1	9	0	14	
12	S		-	-	-	-	-	-	-	-	-	-	
13	S		-	-	-	-	-	-	-	-	-	-	
14	M		6	8	3	6	5	1	1	12	1	16	
15	T		6	7	3	5	5	1	1	16	1	16	M Avg
16	W		6	8	4	4	5	1	1	10	0	16	
17	T		6	7	3	4	5	2	2	15	0	16	
18	F		6	8	2	2	0	0	0	3	0	8	
19	S		-	-	-	-	-	-	-	-	-	-	
20	S		-	-	-	-	-	-	-	-	-	-	
21	M		6	9	6	7	6	1	1	12	0	19	
22	T		6	8	5	7	5	1	2	11	1	19	
23	W		5	8	4	4	2	2	2	7	0	13	
24	T		3	11	3	7	1	1	1	3	0	8	
25	F		8	12	9	5	5	1	1	8	1	24	
26	S		-	-	-	-	-	-	-	-	-	-	
27	S		-	-	-	-	-	-	-	-	-	-	
28	M		7	10	6	6	3	1	1	10	1	18	
29	T		9	9	5	9	8	2	1	14	2	25	M Peak
30	W		8	8	5	4	2	2	2	10	0	17	
31	T		11	11	4	7	5	3	2	6	1	23	
TOTAL			141		99		79		30		14	363	
AVERAGE			6		4		3		1		5	15 7	

WORKING DAYS - 23

TABLE 15

TOWER RECORD - NOVEMBER 1957

Date	Day	Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample Day
		Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	
1	F	13	7	10	4	4	1	2	0	4	0	12	
2	S	-	-	-	-	-	-	-	-	-	-	-	
3	S	-	-	-	-	-	-	-	-	-	-	-	
4	M	9	9	8	5	3	2	1	0	17	0	16	Avg
5	T	7	7	10	6	9	5	1	1	10	0	19	
6	W	6	5	8	4	7	7	1	1	13	2	19	
7	T	8	7	9	5	4	4	1	1	12	2	19	
8	F	5	4	6	3	3	2	2	2	5	0	11	
9	S	-	-	-	-	-	-	-	-	-	-	-	
10	S	-	-	-	-	-	-	-	-	-	-	-	
11	M	-	-	-	-	-	-	-	-	-	-	-	
12	T	4	3	7	5	7	5	2	1	10	1	15	Avg
13	W	6	5	5	3	7	6	1	1	10	1	16	
14	T	8	6	7	5	6	3	1	0	10	1	15	
15	F	6	4	8	3	6	3	1	1	9	1	12	
16	S	-	-	-	-	-	-	-	-	-	-	-	
17	S	-	-	-	-	-	-	-	-	-	-	-	
18	M	6	5	8	2	3	0	2	1	2	1	9	
19	T	6	4	9	3	6	5	3	3	7	1	16	
20	W	6	3	8	3	4	7	3	3	12	3	19	M. Peak
21	T	6	3	8	4	6	5	3	3	11	3	18	Avg
22	F	7	6	8	3	3	4	4	4	12	2	19	
23	S	-	-	-	-	-	-	-	-	-	-	-	
24	S	-	-	-	-	-	-	-	-	-	-	-	
25	M	4	4	8	5	1	1	2	2	11	4	16	
26	T	5	3	8	3	5	3	3	3	11	2	14	
27	W	3	1	6	4	4	3	1	1	4	2	11	
28	T	-	-	-	-	-	-	-	-	-	-	-	
29	F	6	2	6	2	-	-	1	1	-	-	5	
30	S	-	-	-	-	-	-	-	-	-	-	-	
TOTAL			88		72		64		29		26	279	
AVERAGE			4 6		3.8		3 4		1.5		1.4	14 7	

WORKING DAYS - 19

TABLE 16

TOWER RECORD - DECEMBER 1957

Date	Day	Tower A		Tower B		Tower C		Tower L		Range Control		Total	Sample Day
		Sch	Act	Sch	Act	Sch	Act	Sch	Act	Sch	Act	Actual	
1	S	-	-	-	-	-	-	-	-	-	-	-	
2	M	7	3	8	2	4	3	0	0	6	0	8	
3	T	5	4	7	4	6	7	2	2	12	2	19	
4	W	4	3	6	0	5	0	2	2	3	1	6	
5	T	4	1	11	3	-	-	1	0	-	-	4	
6	F	5	5	1	5	6	1	1	0	2	2	13	Avg
7	S	-	-	-	-	-	-	-	-	-	-	-	
8	S	-	-	-	-	-	-	-	-	-	-	-	
9	M	8	4	7	0	4	0	1	0	6	0	4	
10	T	8	2	10	4	4	1	2	0	3	0	7	
11	W	12	8	9	3	3	1	2	0	3	0	12	Avg
12	T	9	7	8	5	4	2	2	1	7	2	17	
13	F	12	9	7	3	2	1	1	1	3	1	15	
14	S	-	-	-	-	-	-	-	-	-	-	-	
15	S	-	-	-	-	-	-	-	-	-	-	-	
16	M	13	12	6	2	3	4	1	1	9	1	20	
17	T	10	8	9	4	7	6	1	1	8	2	21	M Peak
18	W	9	8	8	3	4	4	-	-	7	0	15	
19	T	11	10	6	3	2	1	-	-	11	3	17	
20	F	8	5	7	1	0	0	-	-	7	1	17	
21	S	-	-	-	-	-	-	-	-	-	-	-	
22	S	-	-	-	-	-	-	-	-	-	-	-	
23	M	9	6	0	3	0	2	-	-	-	-	11	M Avg
24	T	-	-	-	-	-	-	-	-	1	0	0	
25	W	-	-	-	-	-	-	-	-	-	-	-	
26	T	2	2	2	0	-	-	-	-	-	-	2	
27	F	4	3	0	1	-	-	-	-	-	-	4	
28	S	-	-	-	-	-	-	-	-	-	-	-	
29	S	-	-	-	-	-	-	-	-	-	-	-	
30	M	-	-	8	7	-	-	-	-	1	0	7	
31	T	-	-	2	1	-	-	-	-	-	-	1	
TOTAL			101		54		33		8		15	211	
AVERAGE			4 9		2 6		1 6		4		72	10 5	

WORKING DAYS - 21

TABLE 17

FIRINGS PER MONTH PER WEAPON

July 1957 - June 1958

WEAPON	'58						'57						TOTAL	% YEAR TOTAL	AVG/MO
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC			
Small Caliber	36	39	51	88	77	54	44	32	33	47	45	20	566	12 7	47
20 MM	57	42	63	90	56	78	58	58	68	53	38	41	702	15 8	58
30 MM	-	-	2	-	1	2	-	2	-	1	7	2	17	0 4	1
37 MM	1	1	3	3	-	-	5	-	5	14	9	2	43	1 0	4
40 MM	-	1	2	-	4	-	3	8	3	1	1	-	23	5	2
57 MM	1	2	5	10	17	9	8	16	4	6	2	1	81	1 8	7
75 MM	3	1	2	1	5	4	4	5	5	5	8	2	45	1 0	4
90 MM	38	31	66	92	56	55	67	46	43	30	22	27	573	12 9	48
105 MM	12	10	13	20	37	32	11	22	2	13	16	8	196	4 4	16
106 MM	9	5	13	21	12	17	26	40	22	18	11	10	204	4 7	17
120 MM	15	4	15	40	22	50	9	6	2	4	3	11	181	4 1	15
127 MM	2	1	-	6	11	2	3	9	6	12	2	-	54	1 2	4
155 MM	8	5	9	22	7	17	1	2	3	8	6	4	92	2 1	8
175 MM	-	10	3	5	5	-	7	4	1	-	-	1	36	0 8	3
280 MM	-	5	5	-	-	2	5	-	-	2	-	-	19	0 4	2
8 Inch	3	-	1	2	2	7	-	-	1	3	5	1	25	0 6	2
Mine	12	9	5	6	20	15	1	1	1	7	6	5	88	2 0	7
Static Detonation	66	55	65	61	40	92	62	64	60	67	55	39	726	16 3	60
Rocket	11	-	3	10	13	25	7	3	3	13	11	4	103	2 3	9
Mortar	3	9	3	17	26	33	8	3	5	12	9	1	129	2 9	11
Data Capsule	-	-	-	-	2	-	1	-	-	-	-	2	5	0 1	0
Closed Range	17	19	12	9	13	12	28	10	8	25	5	16	174	3 9	14
Aircraft	16	20	23	52	31	10	28	25	13	16	19	14	267	6 0	22
Demonstration	1	2	-	-	8	-	4	2	4	1	1	-	23	0 5	2
76 MM	5	8	5	7	8	27	2	2	1	2	-	6	73	1 6	6
TOTAL	316	279	369	562	473	543	392	360	293	360	281	217	4445		
%	7 1	6 3	8 3	12 6	10 6	12 2	8 8	8 1	6 6	8 1	6 3	4 9		100	

TABLE 18

SUMMARY OF DAYS SELECTED FOR ANALYSIS

Month	Date	No of Firings	Date	No of Firings	Date	No of Firings	Date	No of Firings	No of Days	Total No of Firings
July 1957	2	20	18 (3)	26	22	18	31 (2)(1)	18	4	82
August 1957	1	16	16	16	28 (3)	22	29 (1)	18	4	72
September 1957	3 (1)	16	12	15	24 (3)	21	30	14	4	66
October 1957	4	15	10 (2)	14	15 (1)	16	29 (3)	25	4	70
November 1957	4	16	12 (1)	15	20 (3)	19	21	18	4	68
December 1957	6	13	11	12	17 (3)	21	23 (1)	11	4	57
January 1958	10	14	15 (1) (2)	16	21	15	29 (3)	19	4	64
February 1958	4	12	10	18	26 (3)	23	28 (1)	13	4	66
March 1958	6 (1)	20	10	21	19	14	28 (3)	28	4	83
April 1958	1 (1)	26	7	20	16 (3)	35	29	22	4	103
May 1958	2	25	13 (3)	30	21 (2) (1)	24	27	25	4	104
June 1958	5 (1)	26	13	25	19 (3)	30	24	26	4	107
TOTAL		219		228		258		237	48	942

(1) Average Day for Month

(2) Average Day for Quarter

(3) Peak Day for Month

TABLE 19

COMPARISON OF SAMPLE TO YEARLY FIRINGS

ALL FIRINGS					
Weapon	No Firings Sample	% Firings Sample	No Rounds Sample	No Firings Year	% Firings Year
57 MM	16	1 7	481	81	1 8
75 MM	9	1 0	129	45	1 0
76 MM	19	2 0	266	73	1 6
90 MM	116	12 3	2729	573	12 9
105 MM	37	3 9	1080	196	4 4
106 MM	42	4 5	1914	204	4 7
120 MM	32	3 4	710	181	4 1
155 MM	21	2 2	407	92	2 1
175 MM	2	0 2	22	36	0 8
8 Inch	5	0 5	175	25	0 6
Mines	26	2 8	175	88	2 0
Aircraft	60	6 4	974	267	6 0
Static Det	143	15 2	1450	726	16 3
30-60 Cal	119	12 6	578, 158	566	12 7
Closed Range	48	5 1	-	174	3 9
Rockets	26	2 8	316	103	2 3
20 MM	142	15 0	176, 354	702	15 8
30 MM	7	0 8	100	17	0 4
37 MM	9	1 0	231	43	1 0
Mortar	37	3 9	3002	129	2 9
Data Capsule	1	0 1	16	5	0 1
Demo	5	0 5	1321	23	0 5
40 MM	4	0 4	1488	23	0 5
127 MM	10	1, 1	45	54	1 2
280 MM	6	0 6	99	19	0 4
TOTAL	942	100	771, 650	4445	100

VERTICAL FIRINGS				
Altitude 1000 Ft	No Firings Year	% Firings Year	No Firings Sample	% Firings Sample
0-5			1	4 8
5-10				
10-15				
15-20				
20-25	1	1 4		
25-30			12	57 2
30-35	45	62 4		
35-40	7	9 7	4	19 0
40-45	4	5 6		
45-50	10	13 9	4	19 0
50-55				
55-60				
60-65				
65-70	5	7 0		
70-75				
TOTAL	72	100	21	100

TABLE 20
FIRING CLEARANCES,
HOUR DISTRIBUTION

Hour of Day	No. of Clearances			
	Clearances Starting	Clearances Remaining From Previous Hour	Clearances Ending	Clearances In Effect
0800 - 0900	109	0	0	109
0900 - 1000	248	109	16	357
1000 - 1100	193	341	63	534
1100 - 1200	88	471	100	559
1200 - 1300	37	459	29	496
1300 - 1400	93	467	68	560
1400 - 1500	68	492	150	560
1500 - 1600	28	410	352	438
1600 - 1700	6	86	75	92
After 1630	24	17		41
TOTAL	894			

TABLE 21

DURATION OF FIRING CLEARANCES

Total Clearances												
Hour ↓ / Tenths Of Hour →	0-.1	.1- 2	.2- 3	3- 4	4- 5	.5-.6	6-.7	.7- 8	.8-.9	.9-1.0	Total	% of Total
0000	5	15	24	20	20	22	18	20	24	13	181	20.2
0100	28	11	15	22	11	8	11	12	20	11	149	16.7
0200	14	11	15	14	10	10	8	7	7	5	101	11 3
0300	16	9	7	8	11	8	7	9	11	5	91	10.2
0400	14	15	11	10	6	12	9	8	12	13	110	12 3
0500	13	14	11	15	8	12	16	16	14	11	130	14 6
0600	11	8	9	6	8	8	6	4	5	4	69	7.7
0700	10	4	7	7	9	6	2	2	2	2	51	5 7
0800	1	2	1	1		3	1		1		10	1.1
0900			1								1	.1
1000												
1100							1				1	.1
											894	100%

After Hour Clearances (1)												
Hour ↓ / Tenths Of Hour →	0-.1	.1-.2	2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0	Total	% of Total
0000		1								1	2	.22
0100	4			2			1				7	.78
0200	6			1		1		1	1		10	1.12
0300	4					1			1		6	.67
0400			1	2				2			5	.56
0500			1			1			2		4	.45
0600						1					1	.11
0700	3										3	.34
0800							1		1		2	.22
0900												
1000												
1100							1				1	.11
											41	4.58%

Note (1) After hour clearances are clearances continuing after 1630 or starting after 1630

TABLE 22

ALTITUDE UTILIZATION BY WEAPON GROUP

Weapon Group	Total No. Firings	Ordinate Altitude 1000 ft.					
		0	0-2	2-5	5-10	10-20	20 & Above
105 mm - 280 mm	155	38	68	23	11	8	7
30 mm - 90 mm	177	83	62	7	3	3	19
20 mm & 30-60 cal	261	97	157	0	4	3	0
Aircraft	60	0	15	15	23	7	0
Misc.	241	10	101	100	27	3	0
Total	894	228	403	145	68	24	26
% of Total		25 5	45.1	16.2	7.6	2.7	2.9

Weapon Group	Total No. Firings	Ricochet Altitude 1000 ft.					
		0	0-2	2-5	5-10	10-20	20 & Above
105 mm - 280 mm	155	44	13	58	39	1	0
30 mm - 90 mm	177	35	3	51	70	18	0
20 mm & 30 - 60 cal.	261	9	55	193	4	0	0
Aircraft	60	60	0	0	0	0	0
Misc	241	217	12	6	2	3	1
Total	894	365	83	308	115	22	1
% of Total		40.8	9.3	34.5	12.8	2.5	.1

ALTITUDE UTILIZATION BY TYPE OF FIRING

Maximum of either ordinate or ricochet altitudes

Type of Firing	Altitude 1000 ft.						Above 20
	0	0-1	1-2	2-5	5-10	10-20	
Ordinate Max.	4	65	56	127	44	18	26
Ricochet Max.			66	296	109	22	1
Aircraft		10	5	15	23	7	
Total	4	75	127	438	176	47	27
% of Total	0.45	8.4	14.2	49	19.7	5.3	3

TABLE 23

MAXIMUM ORDINATE & RICOCHET ALTITUDES - HOUR DISTRIBUTION

Hour of Day / Alt 1000 ft	Maximum Ordinate Altitude — No of Clearances in Effect										Maximum Ricochet Altitude — No of Clearances in Effect									
	08	09	10	11	12	13	14	15	16	After Hrs	08	09	10	11	12	13	14	15	16	After Hrs
0	31	96	151	166	137	148	147	114	28	5	26	99	178	186	155	185	200	152	18	15
0- 5	47	149	189	198	190	209	201	162	41	18	-	3	4	6	9	9	9	6	1	-
5-1	5	20	30	28	26	30	28	23	6	6	-	2	3	3	2	4	5	1	1	-
1-2	14	25	35	31	21	28	32	31	5	-	21	36	47	46	45	52	49	43	16	2
2-3	3	11	22	22	17	21	23	19	2	2	47	142	180	193	173	187	182	153	37	15
3-4	2	16	36	46	37	45	52	32	2	3	1	8	12	15	16	17	16	9	-	-
4-5	-	3	14	15	11	8	8	8	-	-	3	7	20	21	16	18	17	13	4	2
5-6	1	3	8	6	9	11	10	8	-	1	2	11	16	17	13	14	10	7	1	-
6-7	1	6	11	13	16	18	22	15	3	2	6	21	35	35	33	38	38	29	5	2
7-8	1	1	4	4	4	6	6	4	1	-	-	1	2	1	1	2	2	2	1	1
8-9	-	3	7	6	6	7	5	4	-	-	1	14	20	17	16	18	16	11	4	1
9-10	-	-	-	-	1	2	2	2	-	-	-	2	2	2	2	2	1	1	-	-
10-11	-	1	1	1	1	5	7	5	2	2	-	-	-	-	-	-	-	-	-	-
11-12	-	1	1	1	1	1	1	1	-	-	-	1	1	1	1	1	-	-	-	-
12-13	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	1	-	-
14-15	-	-	-	2	3	4	3	1	-	1	1	8	11	13	11	11	12	9	2	1
15-16	-	3	3	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
16-17	1	1	1	2	2	3	2	1	-	-	-	-	1	1	1	-	-	-	-	-
19-20	-	1	2	2	2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
21-22	-	-	1	1	1	1	1	-	-	-	-	-	-	-	-	-	1	-	-	-
29-30	2	9	8	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30-31	1	1	2	2	2	2	2	2	1	-	1	1	1	1	1	1	1	1	1	-
36-37	-	2	3	4	2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
37-38	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40-41	-	-	-	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
45-46	-	4	4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 24

VERTICAL FIRINGS

July '57 - June '58

Date	Weapon	Time Out	Time In	Time Dur	Altitude 1000 Ft.	Date	Weapon	Time Out	Time In	Time Dur	Altitude 1000 Ft
7-15	105 MM	1030	0915	0115	31	12-16	155 MM	1300	0950	0310	37
7-16	155 MM	1045	0925	0120	69	12-19	155 MM	1045	0915	0130	37
7-17	4 2" Mort	1035	0928	0107	23	12-24	57 MM	0930	0845	0045	30
7-22	57 MM	1003	0907	0056	30	1-17	57 MM	0950	0855	0055	30
7-23	90 MM	1045	0845	0200	46	1-28	105 MM	1252	0925	0327	31
7-25	75 MM	1125	0945	0140	41	2-12	57 MM	1500	1150	0310	30
7-26	57 MM	1030	0947	0043	30	2-25	57 MM	1300	0852	0408	30
7-30	57 MM	0945	0916	0029	30	3-6	90 MM	1332	0920	0412	46
8-1	90 MM	1113	0922	0151	46	3-7	90 MM	1023	1000	0023	46
8-19	57 MM	1200	0918	0242	30	3-10	90 MM	1340	0945	0355	46
8-22	57 MM	1150	1118	0032	30	3-12	90 MM	1515	1045	0430	46
8-23	57 MM	0950	0930	0020	30	3-26	57 MM	1050	0910	0140	30
8-26	57 MM	1030	0905	0125	30	3-28	57 MM	1205	0915	0250	30
8-28	75 MM	0958	0910	0048	41	4-1	57 MM	0944	0900	0044	30
8-28	57 MM	1055	1030	0025	30	4-7	57 MM	0925	0855	0030	30
8-29	57 MM	1010	0918	0052	30	4-8	57 MM	0908	0840	0028	30
9-11	57 MM	1015	0935	0040	30	4-11	57 MM	1000	0850	0110	30
9-12	57 MM	0910	0845	0025	30	4-14	57 MM	1020	0855	0125	30
9-20	57 MM	0950	0900	0050	30	4-17	57 MM	1030	0920	0110	30
9-21	57 MM	1105	1035	0030	30	4-24	57 MM	0940	0845	0055	30
9-25	75 MM	1135	0912	0223	37	5-1	57 MM	0935	0850	0045	30
9-26	90 MM	1131	1007	0124	46	5-2	57 MM	1040	1010	0030	30
10-1	57 MM	0925	0910	0015	30	5-6	57 MM	1217	1140	0037	30
10-10	155 MM	1500	1300	0200	37	5-8	57 MM	0910	0847	0023	30
10-14	57 MM	1045	1000	0045	30	5-9	57 MM	1120	1033	0047	30
10-15	155 MM	1240	0935	0305	69	5-16	57 MM	1057	0940	0117	30
10-22	57 MM	1255	1230	0025	30	5-26	57 MM	1200	1010	0150	30
10-28	155 MM	1330	1133	0157	69	5-28	90 MM	1020	0925	0055	46
10-29	155 MM	1100	0833	0227	37	5-29	57 MM	0930	0850	0040	30
11-15	57 MM	1035	0925	0110	30	6-3	8" How.	1448	1315	0133	41
11-18	105 MM	1100	0945	0115	31	6-4	8" How.	1035	0850	0145	41
11-20	155 MM	1112	1030	0042	69	6-5	57 MM	0940	0900	0040	30
11-21	57 MM	1348	0945	0403	30	6-13	57 MM	1015	0947	0028	30
11-25	155 MM	1350	0924	0426	37	6-20	57 MM	1125	1025	0100	30
11-27	155 MM	1145	0915	0230	69	6-24	90 MM	1000	0915	0045	46
12-4	155 MM	1235	1120	0115	37	6-27	90 MM	1040	0910	0130	46

Total Vertical Firing for Year = 72 All from "I" Field

TABLE 25

FIRING POINT 1 Gun Powder Neck
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

11% of
Total Activity

	Total Or Max													
Azimuth Range		0°	0°-25°	25°-30°	30°-35°	35°-40°	40°-45°	230°-245°	245°-250°	250°-255°	255°-260°	260°-280°	310°-315°	330°-355°
No of Firings	98 (21 Vert) (16 Static)	2	0	3	3	3	1	4	11	7	11	3	10	3
Max Range Yds	15,000	14,000		13,000	15,000	11,000	11,000	15,000	15,500	11,000	5,000	8,000	10,000	8,000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0 5	0 5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total	Range Distribution	2	3	9	15	23	17	24	5	0	0	0	0	0	0	98
Firings	Ord Alt Distribution	25	24	7	1	13	6	2	0	0	12	0	4	0	4	98
At Pt 1	Ricochet Alt Distribution	47	0	0	3	27	21	0	0	0	0	0	0	0	0	98
Azimuth	Range Distribution	0	0	0	0	1	0	6	2							9
25°-40°	Ord Alt Distribution	3	1	1	0	3	1	0	0							9
Firings	Ricochet Alt Distribution	4	0	0	0	0	5	0	0							9
Azimuth	Range Distribution	0	0	0	1	4	7	14	2							28
245°-260°	Ord Alt Distribution	12	12	1	0	0	2	1	0							28
Firings	Ricochet Alt Distribution	2	0	1	0	11	14	0	0							28
Azimuth	Range Distribution	0	0	0	0	7	3									10
310°-315°	Ord Alt Distribution	4	5	1	0	0	0									10
	Ricochet Alt Distribution	0	0	0	0	0	0									10

TABLE 26

FIRING POINT 2 Main Front
Range and Altitude Utilization
Showing Number of Firing Clearances
at Various Altitudes and Ranges

7% of
Total Activity

	Total Or Max									
Azimuth Range		10°-15°	20°-25°	25°-30°	30°-35°	35°-40°	40°-45°	45°-50°	50°-55°	55°-60°
No of Firings	62 (4 Static)	2	2	21	18	13	1			1
Max Range Yds.	25,000	5000	11,000	19,000	25,000	25,000	4000			4000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0.5	0.5 To 1.0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firings At Pt 2	Range Distribution	3	0	0	2	4	14	29	6	1	3					62
	Ord Alt Distribution	14	23	7	5	9	0	1	3	0	0					62
	Ricochet Alt Distribution	13	0	0	1	13	31	4	0	0	0					62
Azimuth 25°-40° Firings	Range Distribution	1	0	0	0	1	13	27	6	1	3					52
	Ord Alt Distribution	11	20	7	5	5	0	1	3	0	0					52
	Ricochet Alt Distribution	7	0	0	1	11	29	4	0	0	0					52

TABLE 27

FIRING POINT 3 Water Front — 14% of Total Activity
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

	Total Or Max												
Azimuth Range		0	10°-15°	25°-30°	30°-35°	35°-40°	40°-45°	45°-50°	50°-55°	305°-310°	310°-315°	340°-345°	350°-355°
No of Firings	142 (6 Static)	2	1	20	40	29	36	2	1	1	1	1	2
Max Range Yds	33,000	10,000	4000	9000	19,000	26,000	33,000	10,000	14,000	3000	10,000	13,000	14,000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0.5	0.5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firings At Pt 3	Range Distribution	0	2	0	5	27	41	35	22	4	5	1	0	0		142
	Ord Alt Distribution	50	45	7	5	10	15	3	5	0	0	1	0	1		142
	Ricochet Alt Distribution	30	2	0	3	51	39	16	1	0	0	0	0	0		142
Azimuth 25°-45° Firings	Range Distribution	0	0	0	2	23	41	28	22	3	5	1	0	0		125
	Ord Alt Distribution	49	42	5	3	5	12	3	4	0	0	1	0	1		125
	Ricochet Alt Distribution	20	1	0	2	50	36	15	1	0	0	0	0	0		125

TABLE 28

FIRING POINT 4 Michaelsville
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

26% of
Total Activity

	Total Or Max											
Azimuth Range		0°-5°	5°-10°	10°-15°	20°-25°	25°-30°	30°-35°	35°-40°	60°-65°	280°-285°	285°-290°	335°-340°
No of Firings	232 (13 Static)	2	10	163	3	2	1	2	21	7	7	1
Max Range Yds	19,000	8000	3000	19,000	10,000	4000	8000	5000	4000	5000	5000	2000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0.5	0.5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firings At Pt 4	Range Distribution	0	5	4	10	75	127	10	1							232
	Ord Alt Distribution	84	130	6	0	10	2	0	0							232
	Ricochet Alt Distribution	14	0	1	49	157	10	1	0							232
Azimuth 10°-15° Firings	Range Distribution	0	0	0	1	41	112	8	1							163
	Ord Alt Distribution	42	116	3	0	1	1	0	0							163
	Ricochet Alt Distribution	0	0	0	13	139	10	1	0							163
Azimuth 60°-65° Firings	Range Distribution	0	0	0	3	18										21
	Ord Alt. Distribution	18	3	0	0	0										21
	Ricochet Alt Distribution	0	0	0	21	0										21
Azimuth 280°-290° Firings	Range Distribution	0	0	0	0	3	11									14
	Ord Alt Distribution	12	2	0	0	0	0									14
	Ricochet Alt Distribution	0	0	0	0	14	0									14

TABLE 29

FIRING POINT 5 Spesutie Island — 6% of Total Activity

Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

	Total Or Max										
Azimuth Range		20°-25°	25°-30°	35°-40°	45°-50°	60°-65°	65°-70°	325°-330°			
No. of Firings	54 (8 Static)	1	11	2	23	3	2	4			
Max Range Yds.	25,000	4000	7000	7000	25,000	13,000	4000	2000			

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0.5	0.5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firings At Pt 5	Range Distribution	0	0	0	12	17	11	8	3	2	1	0	0			54
	Ord Alt. Distribution	1	6	5	6	28	4	0	0	1	0	0	0			54
	Ricochet Alt Distribution	43	0	0	2	6	2	0	0	0	1	0	3			54
Azimuth 25°-50° Firings	Range Distribution	0	0	0	1	12	11	6	3	2	1	0	0			36
	Ord. Alt Distribution	1	6	5	4	13	3	0	0	1		0	3			36
	Ricochet Alt Distribution	27	0	0	2	5	1	0	0	0	1	0	0			36

TABLE 30

FIRING POINT 6 Airfield Area
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

13% of
Total Activity

	Total Or Max										
Azimuth Range		0	15°-20°	25°-30°	30°-35°	35°-40°	40°-45°	310°-315°	315°-320°	320°-325°	350°-355°
No of Firings	110 (52 Static)	13	1	1	2	9	9	19	1	1	2
Max Range Yds	11,000	5000	3000	4000	5000	4000	4000	10,000	4000	6000	2000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0 5	0 5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firing At Pt 6	Range Distribution	0	14	32	13	46	3	2								110
	Ord Alt Distribution	22	12	8	29	30	9	0								110
	Ricochet Alt Distribution	75	1	2	7	13	12	0								110
Azimuth 310°-315° Firings	Range Distribution	0	0	0	0	18	0	1								19
	Ord Alt Distribution	12	7	0	0	0	0	0								19
	Ricochet Alt Distribution	0	0	0	0	7	12	0								19
Azimuth 35°-45° Firings	Range Distribution	0	1	2	1	14	0									18
	Ord Alt Distribution	0	2	1	0	9	6									18
	Ricochet Alt Distribution	16	0	1	1	0	0									18
Azimuth 0° Firings	Range Distribution	0	5	1	2	4	1									13
	Ord Alt Distribution	6	1	3	2	1	0									13
	Ricochet Alt Distribution	7	0	1	4	1	0									13
Static Firings	Range Distribution	0	0	0	0	0										
	Ord Alt Distribution	4	2	4	22	20										52

TABLE 31

FIRING POINT 7 New Bombing Field Area — 7% of Total Activity
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

	Total Or Max													
Azimuth Range		0°	30°-35°	60°-65°	70°-75°	115°-120°	200°-205°	210°-215°	220°-225°	240°-245°	245°-250°	250°-255°	260°-265°	290°-295°
No of Firings	59 (36 Static)	3	1	1	2	1	2	1	1	6	2	1	1	1
Max Range Yds	9000	2000	9000	500	500	500	8000	500	1000	8000	8000	6000	1000	5000

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0 5	0 5 To 1 0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firing At Pt 7	Range Distribution	0	16	12	16	3	12									59
	Ord Alt Distribution	12	11	3	10	16	7									59
	Ricochet Alt Distribution	40	6	2	0	11	0									59
Static Firings	Range Distribution	0	0	0	0	0	0									
	Ord Alt Distribution	2	4	3	0	14	3									36
	Ricochet Alt Distribution	0	0	0	10	0	0									

TABLE 32

FIRING POINT 8 Poverty Island Area
Range and Altitude Utilization
Showing Number of Firing Clearances
At Various Altitudes and Ranges

9% of Total Activity

	Total Or Max										
Azimuth Range		0	10°-15°	30°-35°	35°-40°	40°-45°	235°-240°	305°-310°			
No of Firings	77 (32 Static)	6	1	3	30	2	2	1			
Max Range Yds	13,000	5000	5000	13,000	7000	13,000	6000	4000			

		Altitude in 1000 Ft or Range in 1000 Yards														
	Range or Altitude	0	0 To 0.5	0.5 To 1.0	1 To 2	2 To 5	5 To 10	10 To 15	15 To 20	20 To 25	25 To 30	30 To 35	35 To 40	40 To 45	45 To 50	Total
Total Firings At Pt 8	Range Distribution	0	14	10	13	11	26	3	0							77
	Ord Alt Distribution	17	21	10	6	17	3	1	2							77
	Ricochet Alt Distribution	44	0	1	3	29	0	0	0							77
Azimuth 35°-45° Firing	Range Distribution	0	0	3	2	6	19	2								32
	Ord Alt Distribution	10	18	0	1	1	2	0								32
	Ricochet Alt Distribution	7	0	1	3	21	0	0								32
Static Firing	Range Distribution	0	0	0	0	0										
	Ord Alt Distribution	0	3	10	5	14										32

TABLE 33

MAXIMUM RANGE AT VARIOUS FIRING POINTS

Firing Point	No.	Total Firings		Maximum Range - 1000 Yards									
			0	0-0.5	0.5-1.0	1-2	2-5	5-10	10-15	15-20	20-25	25-30	30-35
Gun Powder Neck Complex	1	98	2	3	9	15	23	17	24	5			
Main Front	2	62	3	0	0	2	4	14	29	6	1	3	
Water Front	3	142		2		5	27	41	35	22	4	5	1
Michaelsville	4	232		5	4	10	75	117	10	10	1		
Spesutie Island	5	54				12	17	11	8	3	2	1	
Airfield Area	6	110		14	32	13	46	3	2				
New Bombing Field Area	7	59		16	12	16	3	12					
Poverty Island Area	8	77		14	10	13	11	26	3				
Aircraft	9	60		7	3	5	15	23	6	1			
Total		894	5	61	70	91	221	264	117	47	8	9	1
% Total Firings		100%	0.6	6.8	7.8	10.2	24.7	29.5	13.1	5.3	9	10	.1

TABLE 34

FIRING POINT ALTITUDE UTILIZATION

NUMBER OF FIRINGS AT VARIOUS ALTITUDES

Firing Point		Total	Ordinate Altitude - 1000 Feet													
Name	No.	Firings	0	0-0 5	0 5-1	1-2	2-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
Gunpowder Neck	1	98	25	24	7	1	13	6	2	-	-	12	-	4	-	4
Main Front	2	62	14	23	7	5	9	-	1	3	-	-	-	-	-	-
Water Front	3	142	50	45	7	5	10	15	3	5	-	-	1	-	1	-
Michaelsville	4	232	84	130	6	-	10	-	2	-	-	-	-	-	-	-
Spesutie Island	5	54	1	6	5	6	28	4	-	-	1	-	-	3	-	-
Airfield Area	6	110	22	12	8	29	30	9	-	-	-	-	-	-	-	-
New Bombing Field Area	7	59	12	11	3	10	16	7	-	-	-	-	-	-	-	-
Poverty Island Area	8	77	17	21	10	6	17	3	1	2	-	-	-	-	-	-
Aircraft	9	60		7	3	5	15	23	7	-	-	-	-	-	-	-
Total		894	225	279	56	67	148	67	16	10	1	12	1	7	1	4
% of Total Firings		100%	25 2%	31 2%	6 3%	7 5%	16 6%	7 5%	1 8%	1 1%	0.1%	1 3%	0 1%	0.8%	0 1%	0 4%

Firing Point		Total	Ricochet Altitude - 1000 Feet													
Name	No	Firings	0	0-0 5	0 5-1	1-2	2-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
Gunpowder Neck	1	98	47	-	-	3	27	21	-	-	-	-	-	-	-	-
Main Front	2	62	13	-	-	1	13	31	4	-	-	-	-	-	-	-
Water Front	3	142	30	2	-	3	51	39	16	1	-	-	-	-	-	-
Michaelsville	4	232	14	-	1	49	157	5	5	1	-	-	-	-	-	-
Spesutie Island	5	54	43	-	-	2	6	2	-	-	1	-	-	-	-	-
Airfield Area	6	110	75	1	2	7	13	12	-	-	-	-	-	-	-	-
New Bombing Field Area	7	59	40	6	2	-	11	-	-	-	-	-	-	-	-	-
Poverty Island Area	8	77	44	-	1	3	29	-	-	-	-	-	-	-	-	-
Aircraft	9	60	60	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		894	366	9	6	68	307	110	25	2	1					
% of Total Firings		100	41 0	1.0	0 7	7 6	34 3	12.3	2 8	0.2	0 1					

TABLE 35

AIRCRAFT FLIGHTS,

ROUTE & ALTITUDE DISTRIBUTION

* Coded Route	Map Route	Max. Altitude of Flight, 1000 Ft.												Total No. of Flights
		0-.5	.5-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	10-15	above 15	
901	1				4		3	1	7	4	6			25
908														
902	2							1				1		2
903	3		2							1				3
904	4											1		1
905	5	1												1
906														
911	6	1		2				1	1				1	6
914														
907	7					2						1		3
909														
910	8	4		1	1	3	1							10
912														
913	9		1	2		1						2		6
916														
915	10	1												1
917	11										1	1		2
Total	Flights	7	3	5	5	6	4	3	8	5	7	6	1	60

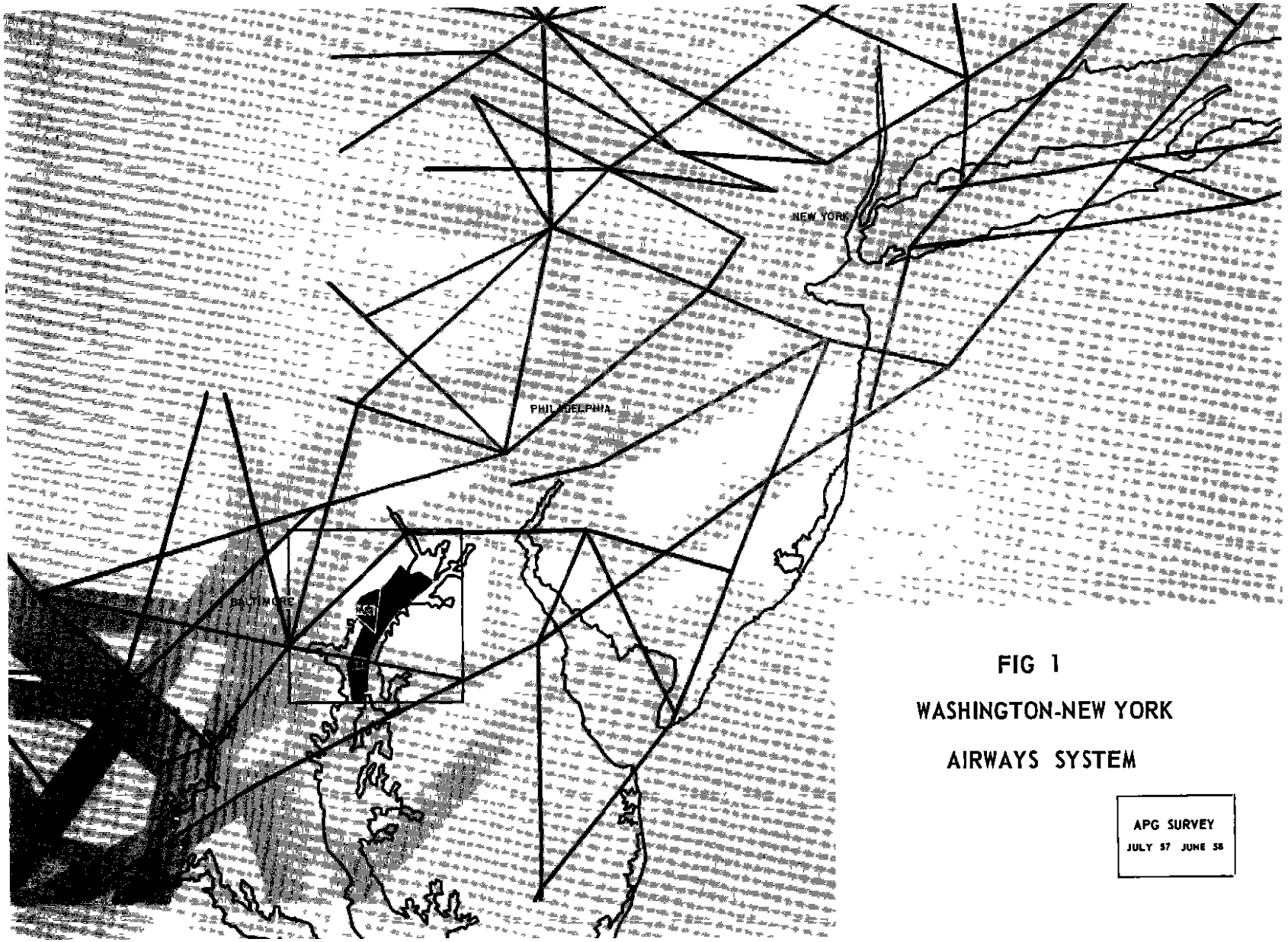


FIG 1

WASHINGTON-NEW YORK

AIRWAYS SYSTEM

APG SURVEY
JULY 57 JUNE 58

FIG. 2 A.P.G. GROUND RESERVATION WITH RESTRICTED AREAS

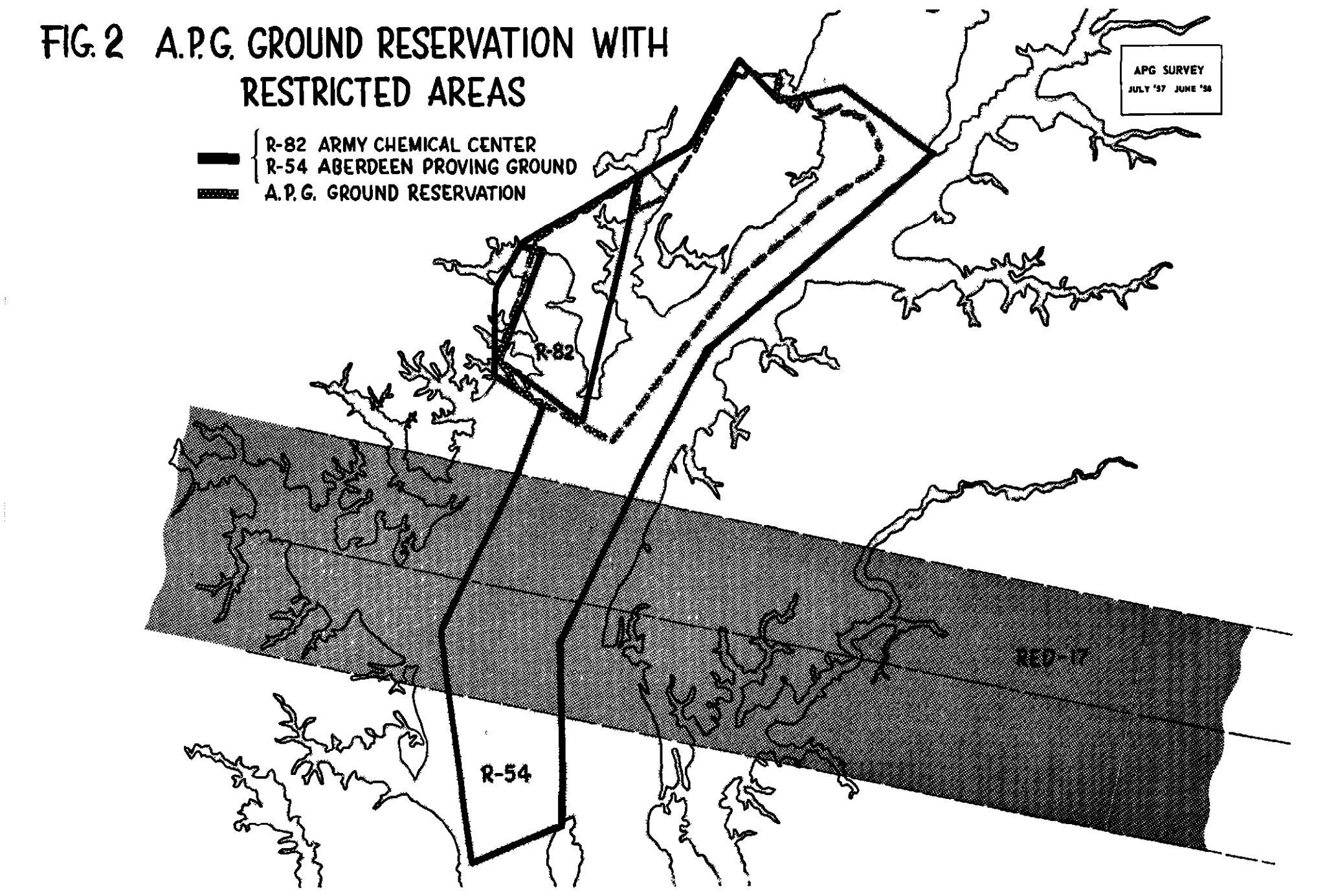


FIG 3 ORGANIZATIONAL DIRECTORY
ABERDEEN PROVING GROUND MARYLAND

APG SURVEY
JULY '57 JUNE '58
DATA FROM
APG D & PS

POST PERSONNEL
4850 CIVILIANS
4468 MILITARY
9318 TOTAL

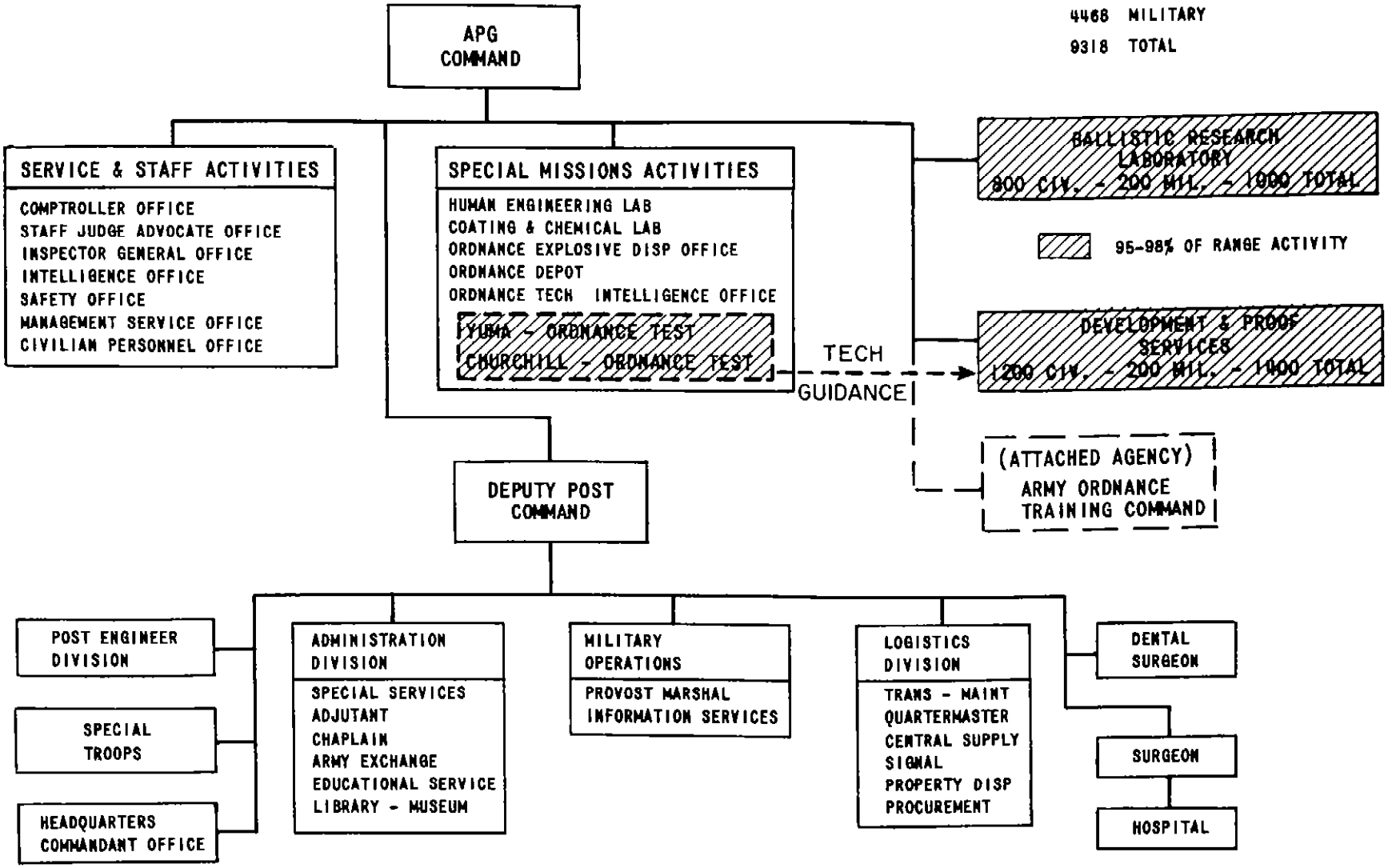
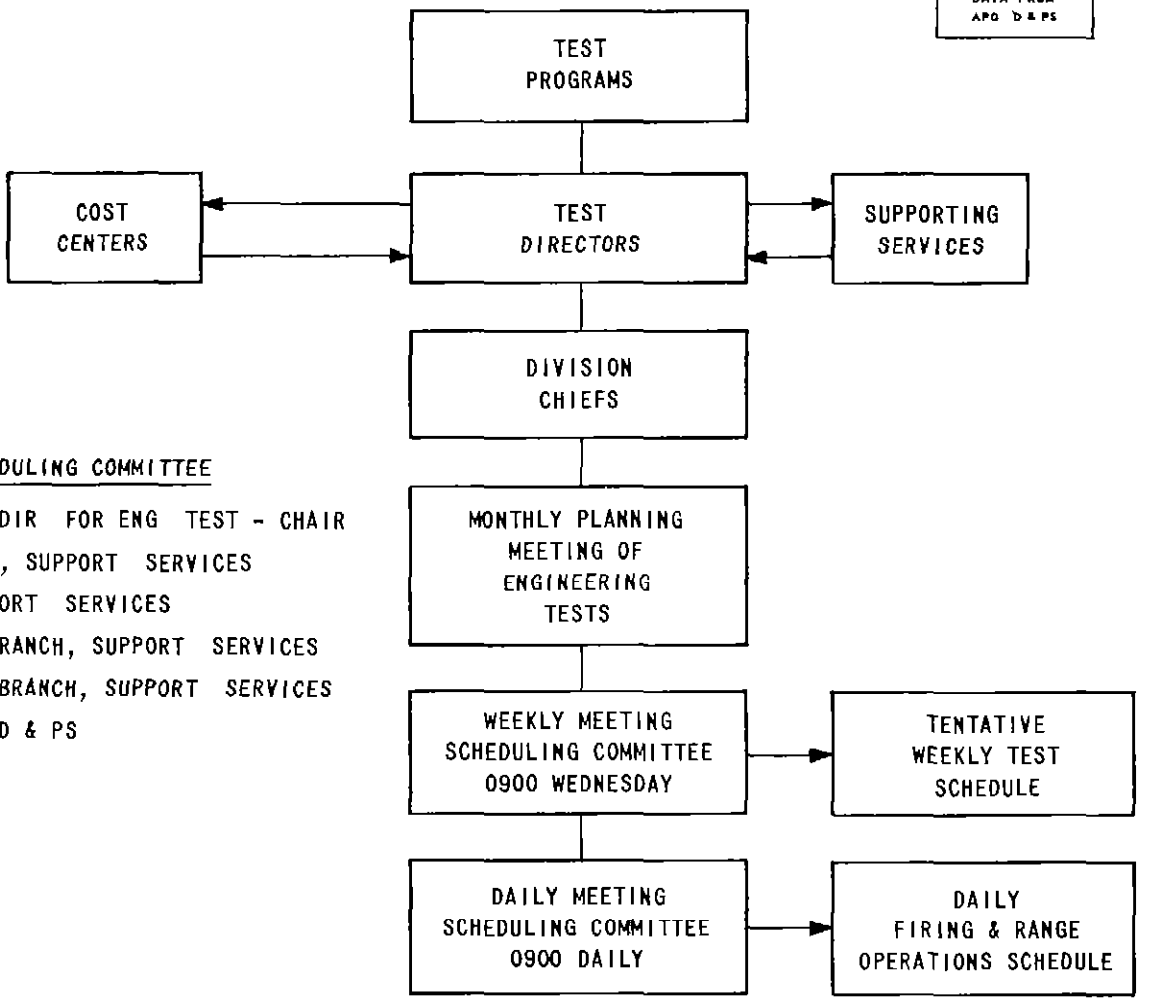


FIG. 4 PLANNING & COORDINATING
OF D & PS TEST ACTIVITIES

APG SURVEY
JULY 57 JUNE 58
DATA FROM
APG D & PS



SCHEDULING COMMITTEE

OFFICE OF DEP DIR FOR ENG TEST - CHAIR
OPERATIONS DIV , SUPPORT SERVICES
ENG LAB , SUPPORT SERVICES
ENG SERVICES BRANCH, SUPPORT SERVICES
RANGE SERVICES BRANCH, SUPPORT SERVICES
SAFETY OFFICE, D & PS

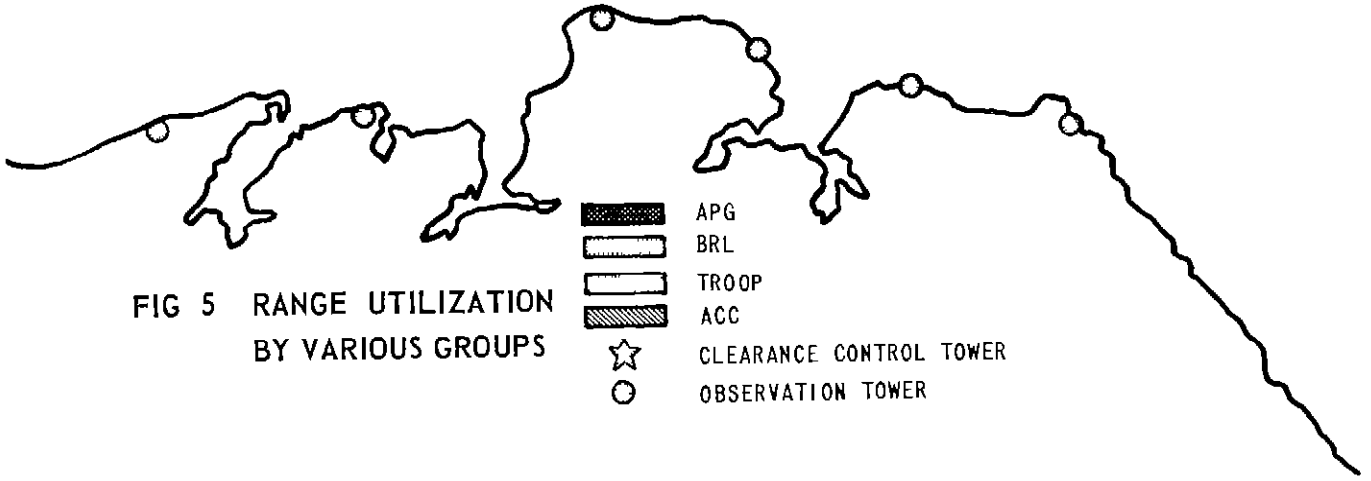


FIG 5 RANGE UTILIZATION BY VARIOUS GROUPS

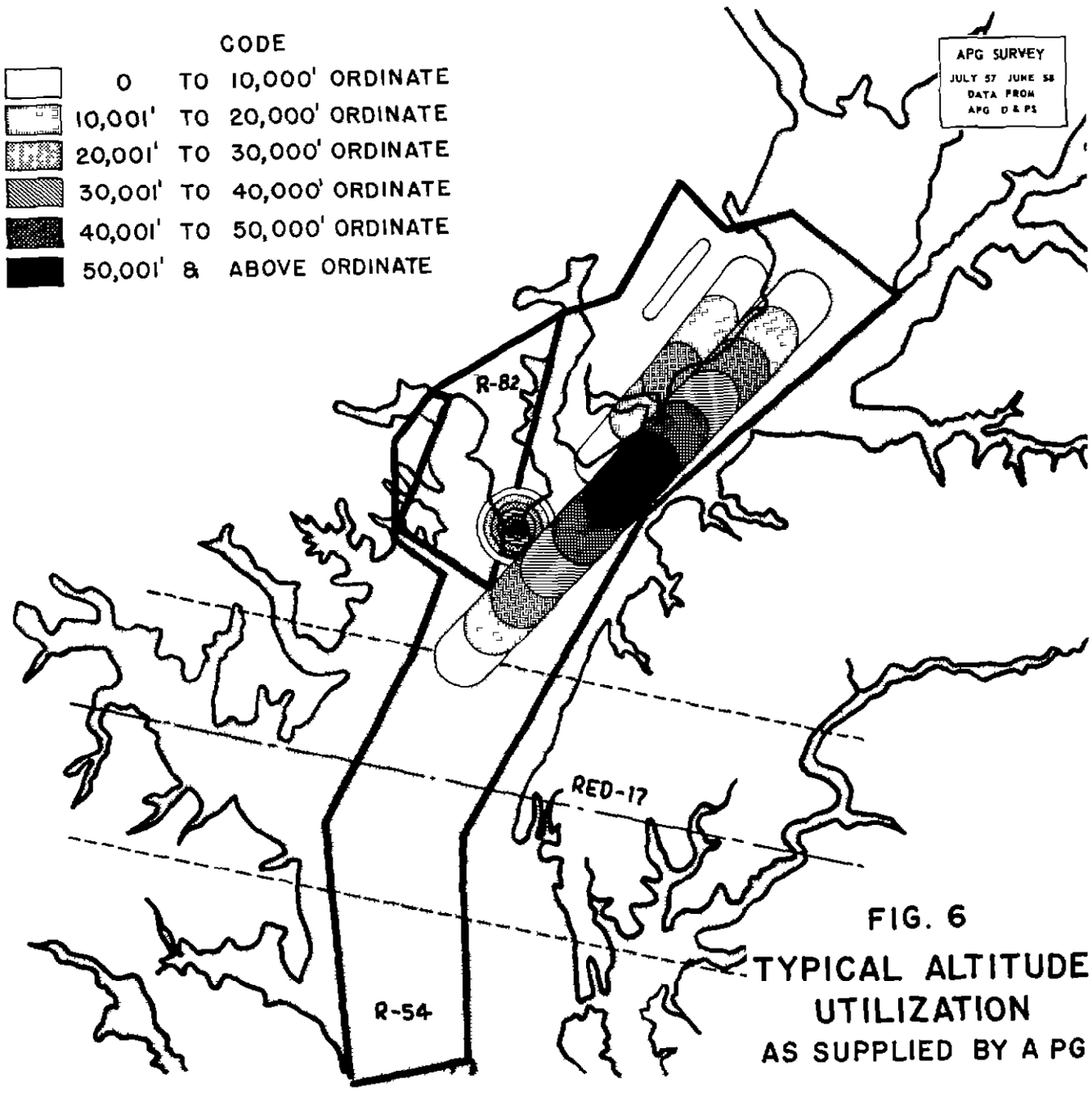


FIG. 6

TYPICAL ALTITUDE UTILIZATION AS SUPPLIED BY A PG

FIG. 7 APG FIRING DATA SUMMARY
JULY 1957 - JUNE 1958

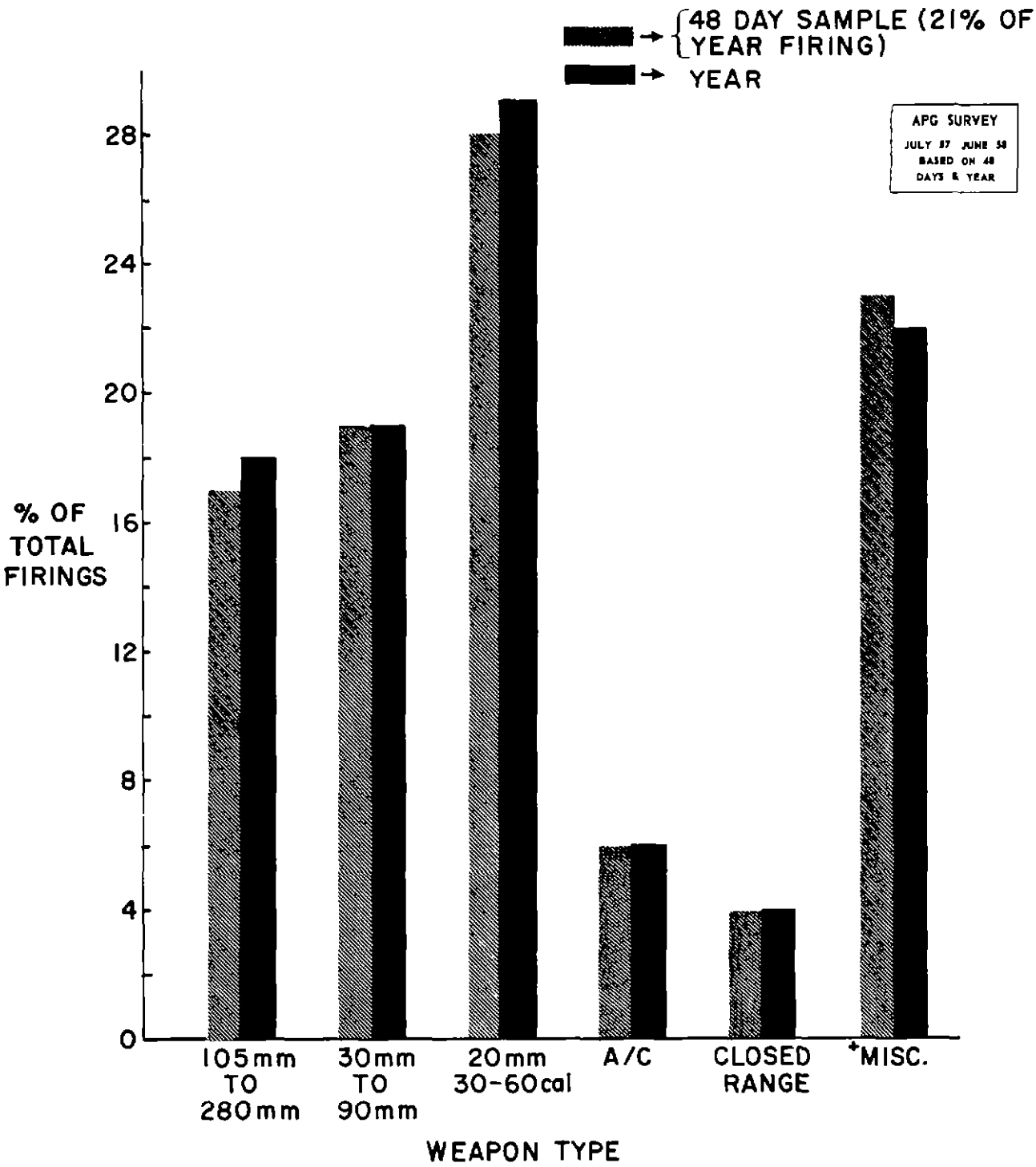
APG SURVEY
JULY 57 JUNE 58
BASED ON 48
DAYS & YEAR

	YEAR	NUMBER SAMPLE	PERCENT
*FIRINGS	4445	942	21%
FIRING DAYS	254	48	19%
OFF HOUR FIRINGS	174		4%
		41	4%
CLOSED RANGE FIRINGS	174		4%
		48	5%
PEAK DAY FIRINGS	30		
AVERAGE DAILY FIRINGS	18		
JULY - SEPT 1957	18		
OCT - DEC 1957	14		
JAN - MARCH 1958	16		
APRIL - JUNE 1958	24		

*A FIRING IS A TOWER CLEARANCE BLOCK OF TIME FOR ACTUAL FIRINGS OR AIRCRAFT TEST FLIGHTS

FIG. 8 WEAPON UTILIZATION

COMPARISON OF 48 DAY SAMPLE & YEAR



+MISC → ROCKETS, MINES, STATIC DET., MORTAR, DATA CAPSULE, DEMONSTRATION, NOT AVAIL.

FIG. 9 VERTICAL FIRING ACTIVITY

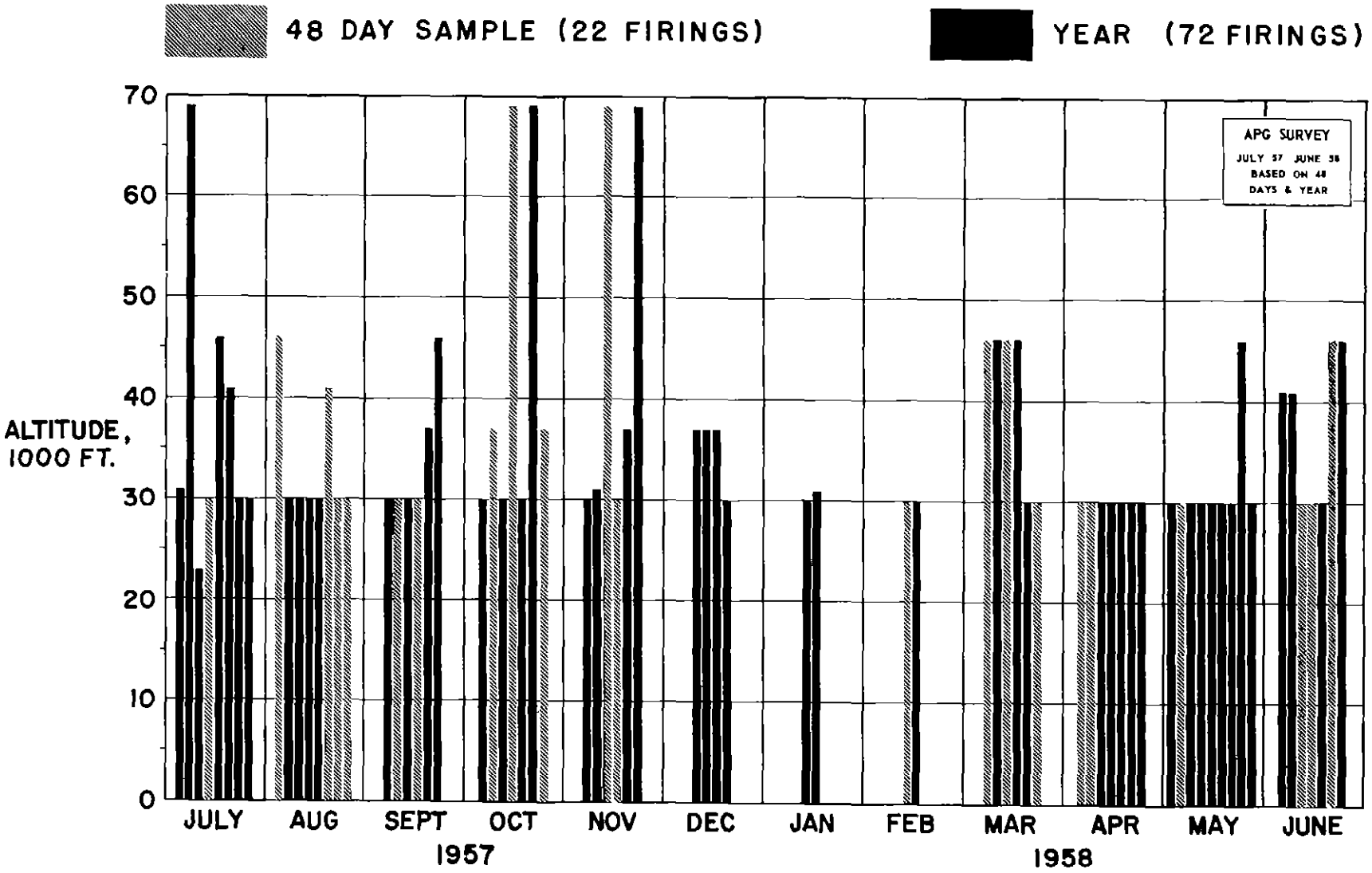
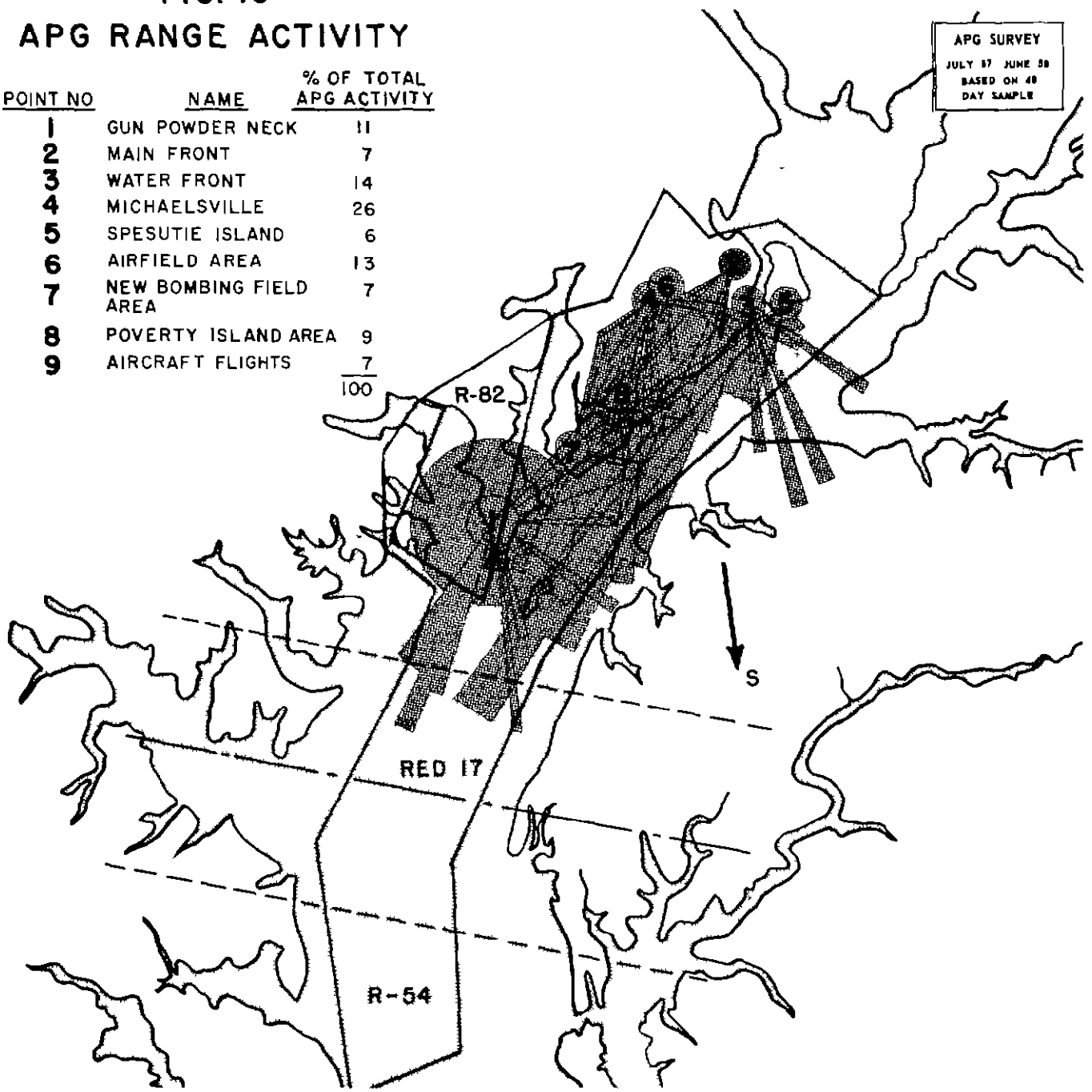
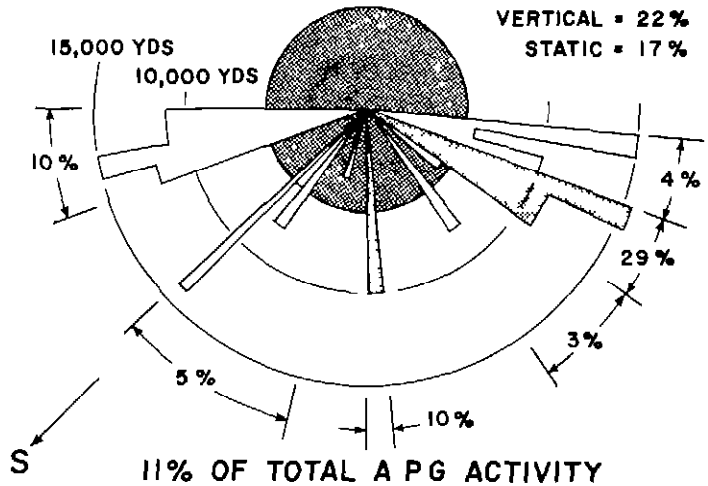


FIG. 10
APG RANGE ACTIVITY

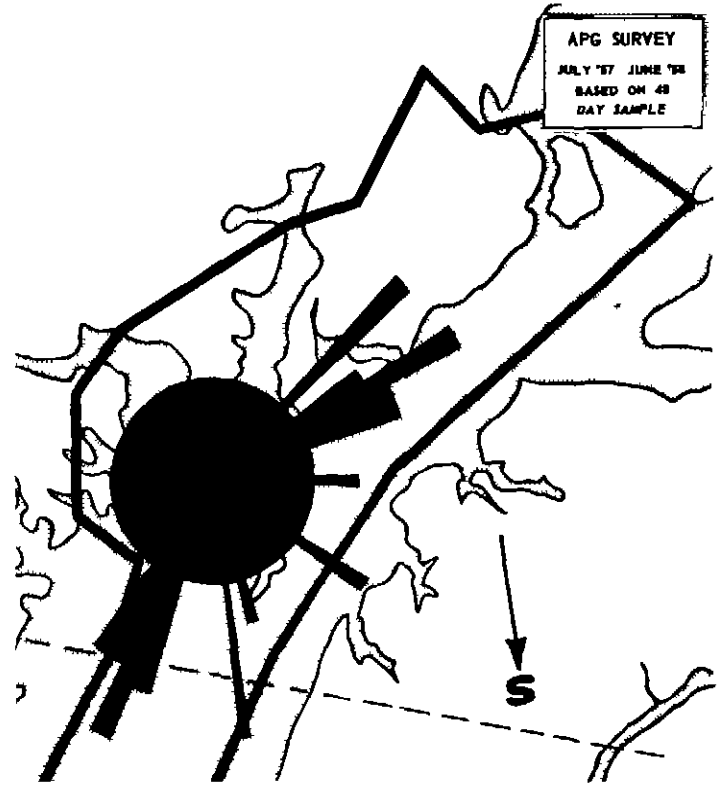
POINT NO	NAME	% OF TOTAL APG ACTIVITY
1	GUN POWDER NECK	11
2	MAIN FRONT	7
3	WATER FRONT	14
4	MICHAELSVILLE	26
5	SPESUTIE ISLAND	6
6	AIRFIELD AREA	13
7	NEW BOMBING FIELD AREA	7
8	POVERTY ISLAND AREA	9
9	AIRCRAFT FLIGHTS	7
		100

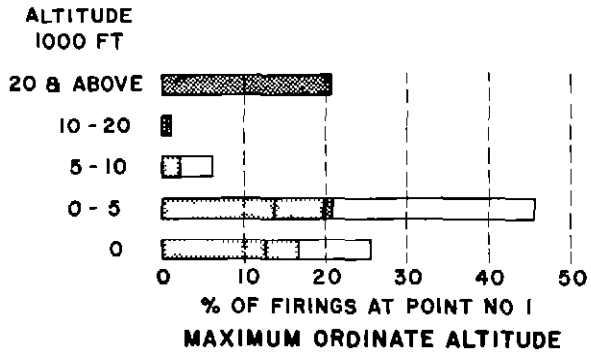


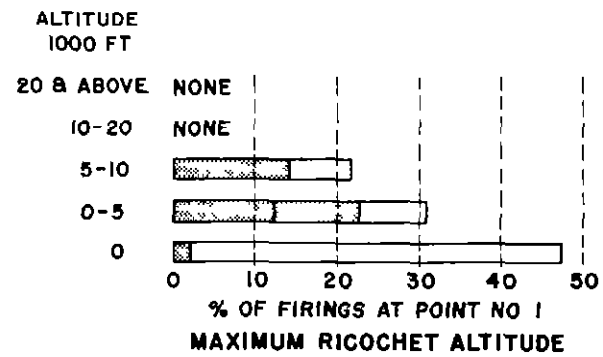


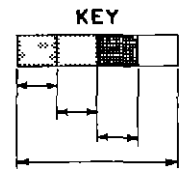
11% OF TOTAL A P G ACTIVITY

NOTE
AZIMUTH UTILIZATION IN %









% 245 - 260° AZIMUTH FIRINGS
% 310 - 315° AZIMUTH FIRINGS
% VERTICAL FIRINGS
% OF TOTAL FIRINGS

FIG. 11 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION FIRING POINT NO. 1 (GUNPOWDER NECK)

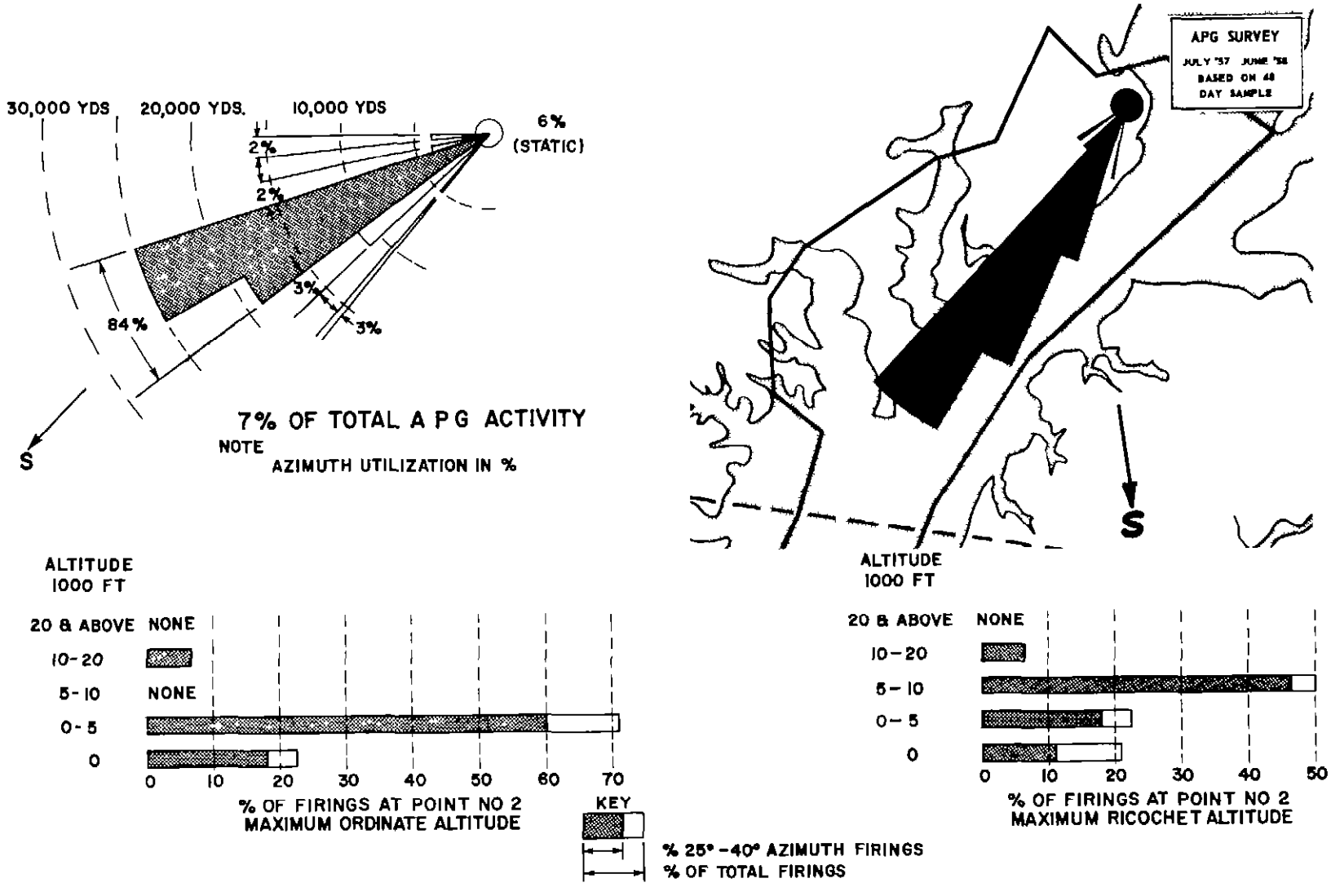


FIG. 12 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION FIRING POINT NO. 2 (MAIN FRONT)

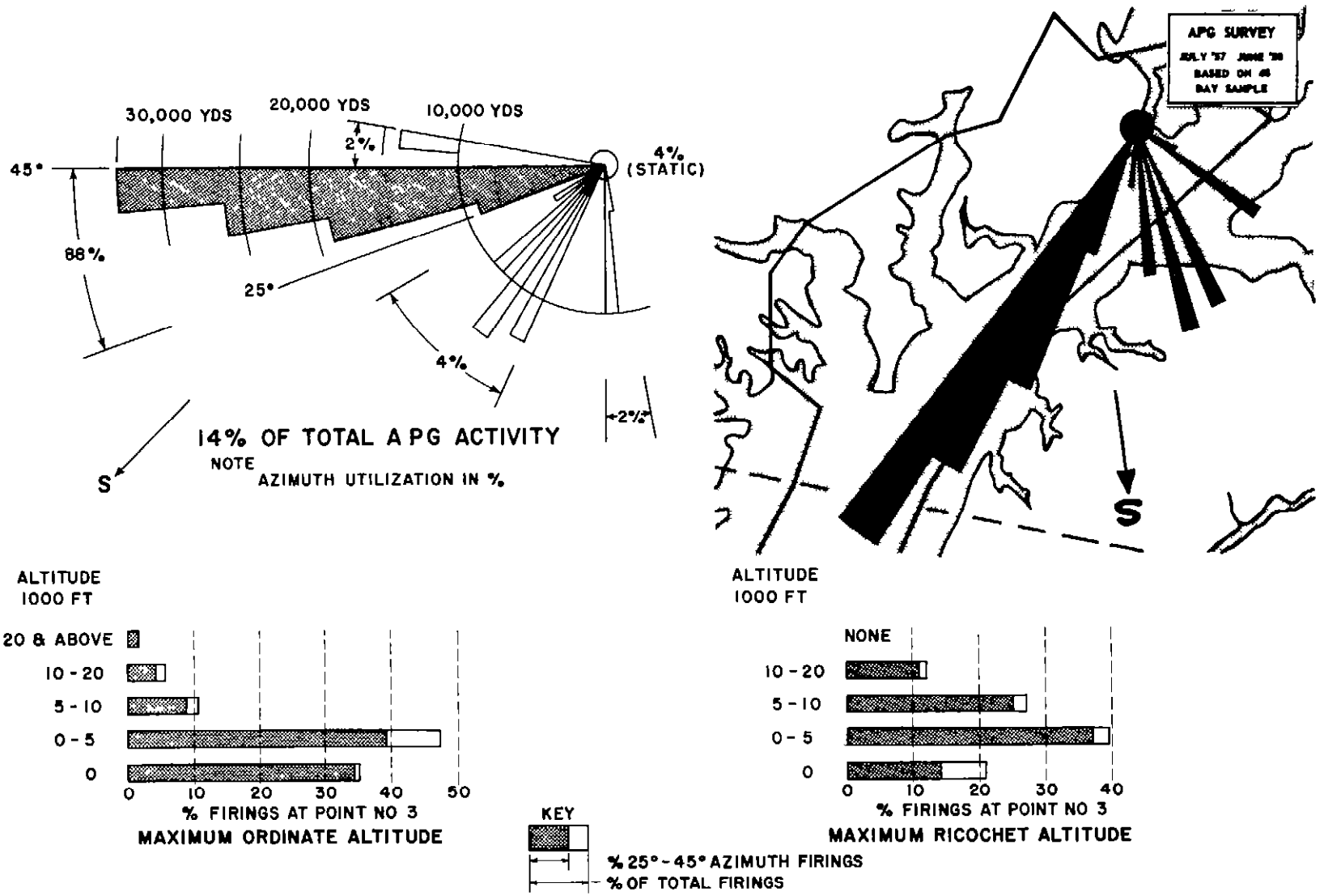


FIG. 13 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 3 (WATER FRONT)

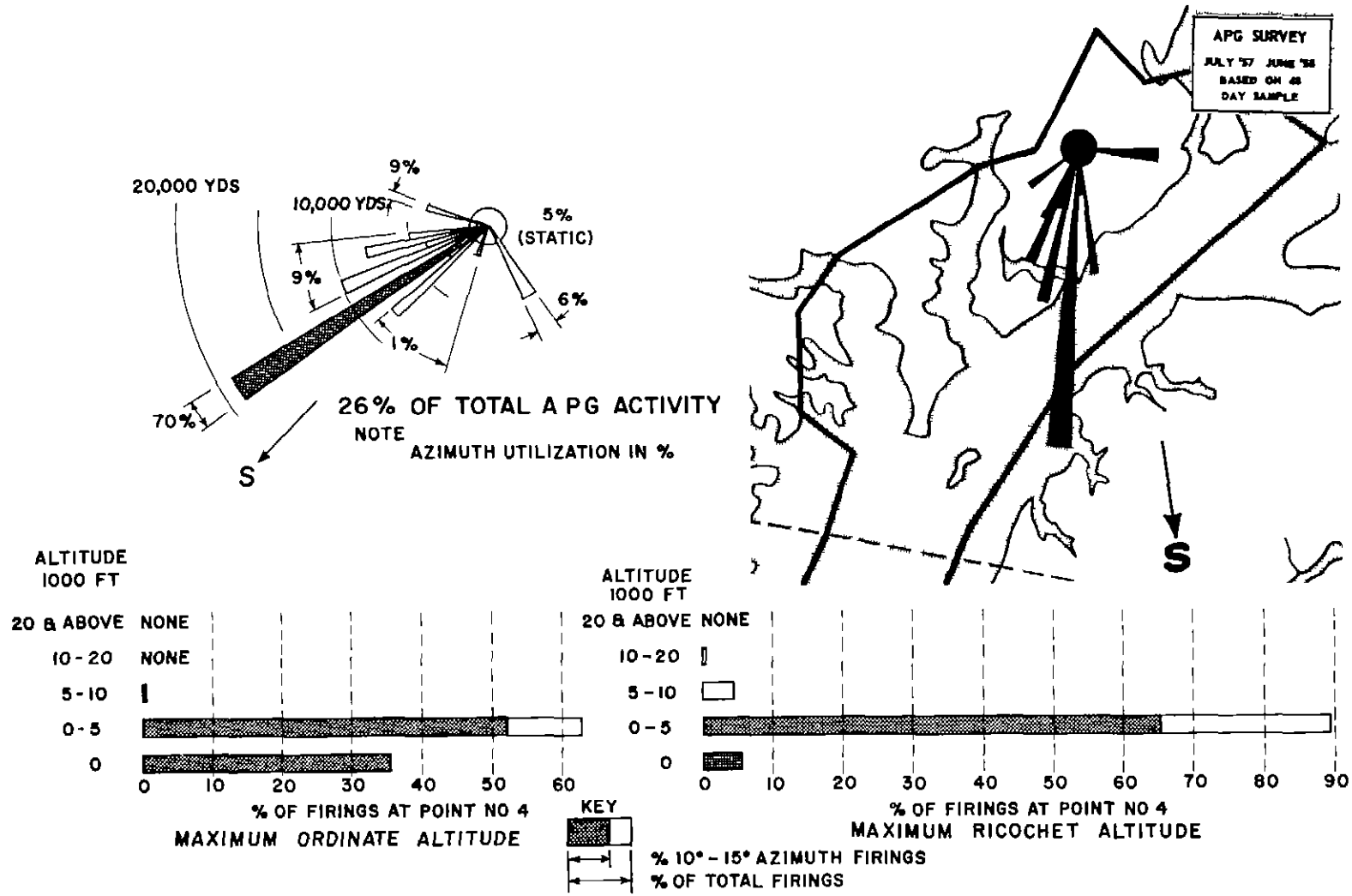


FIG. 14 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 4 (MICHAELSVILLE)

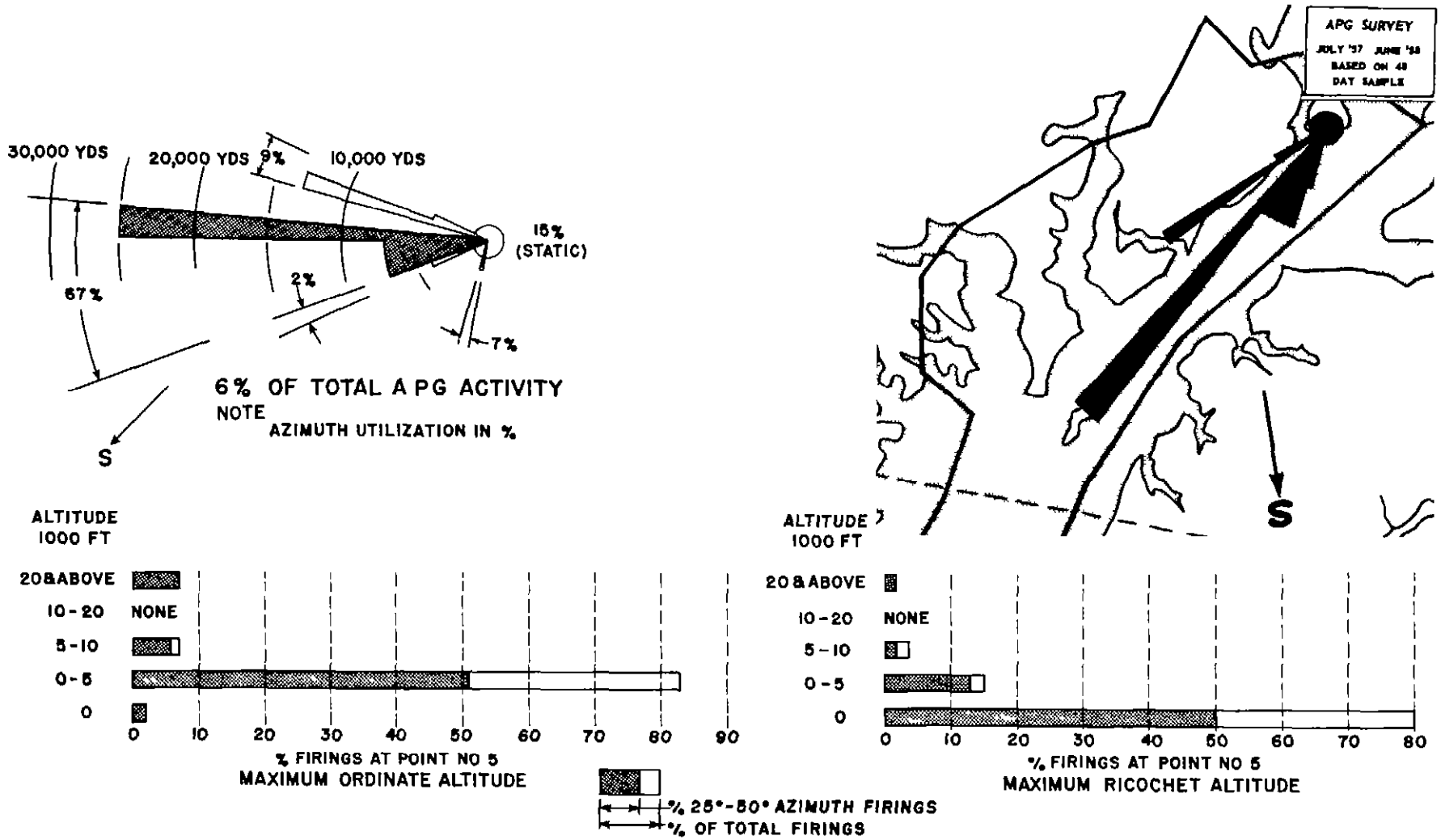


FIG. 15 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 5 (SPESUTIE ISLAND)

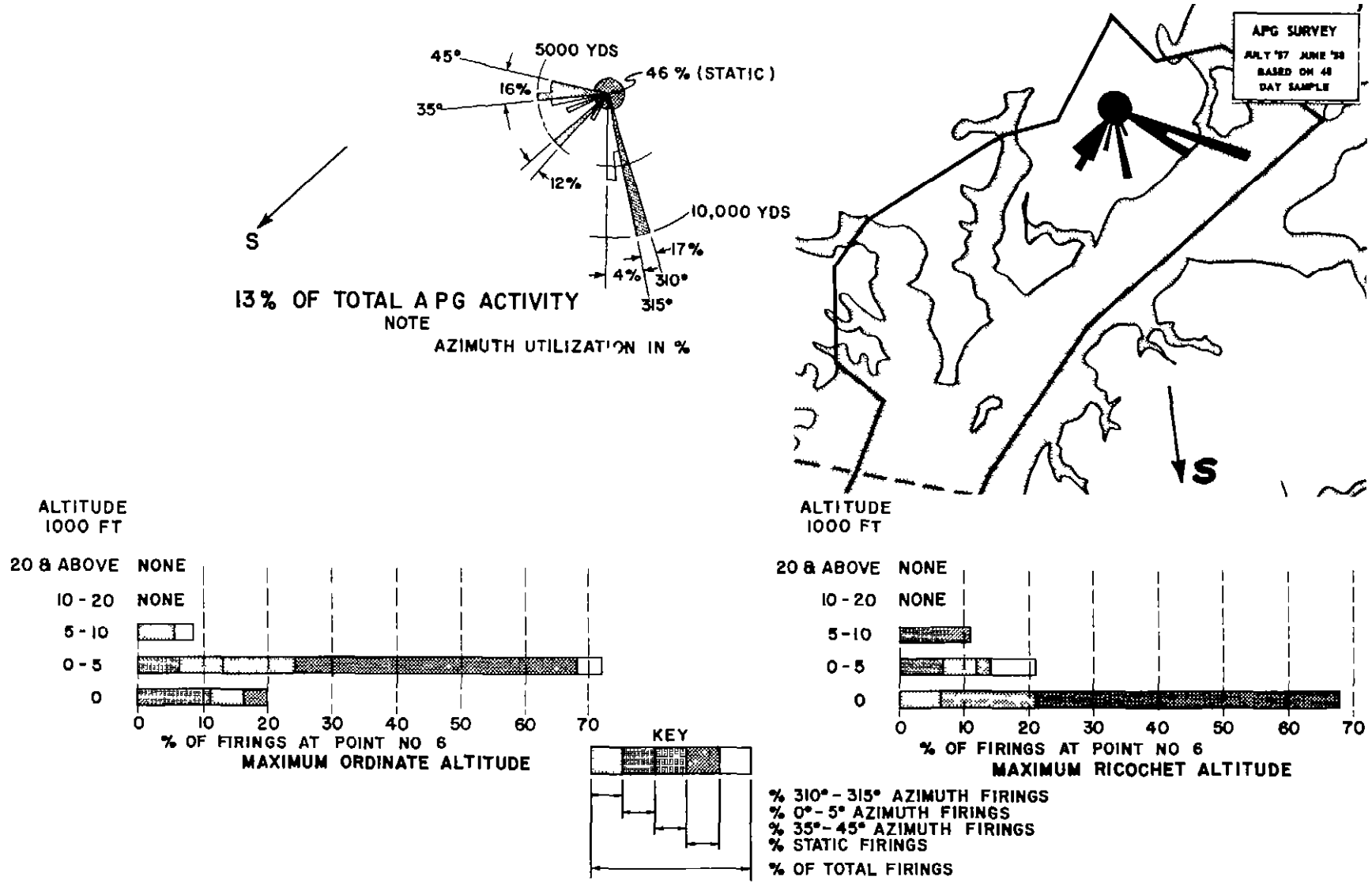


FIG. 16 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 6 (AIRFIELD AREA)

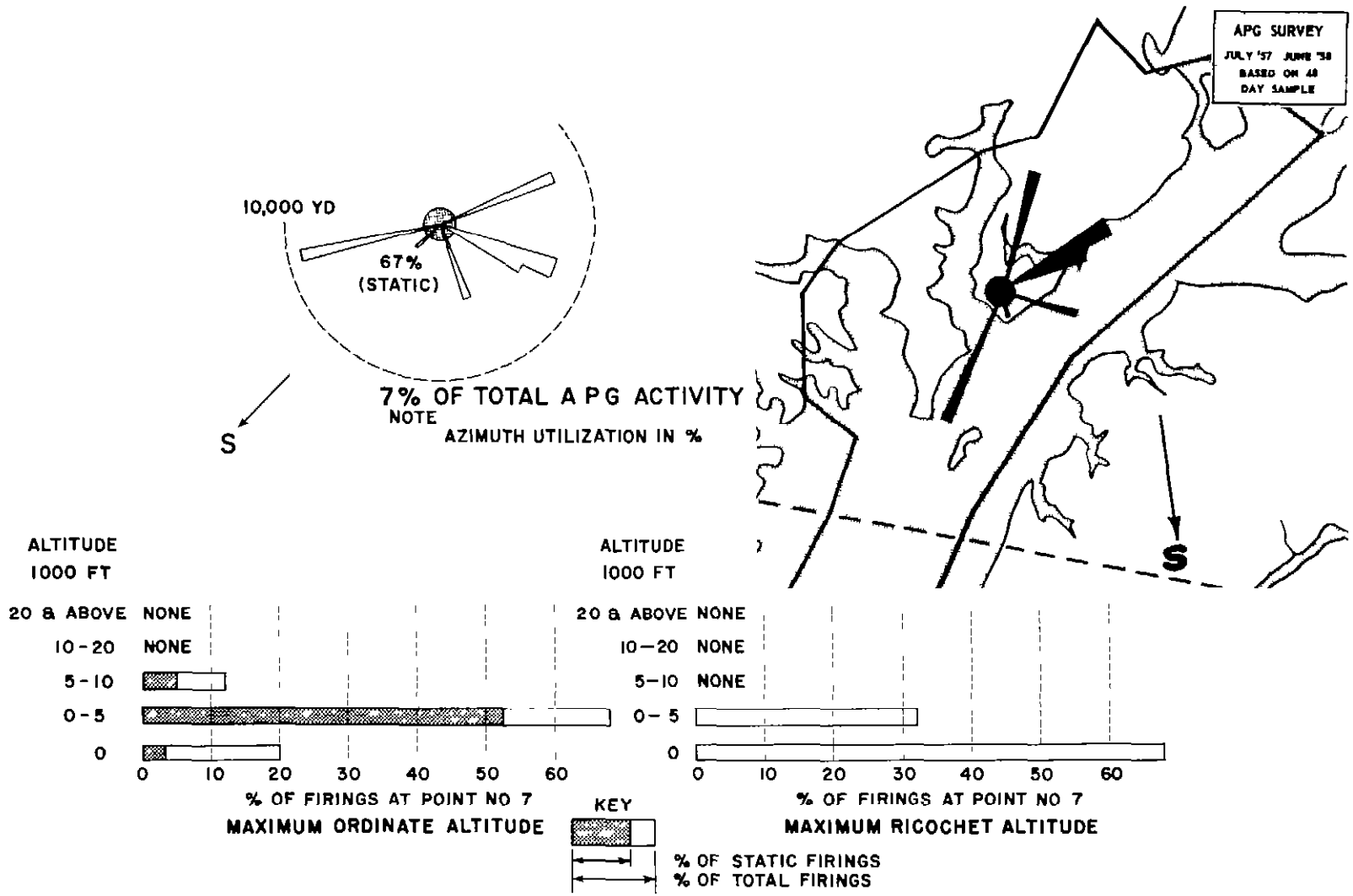


FIG. 17 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 7 (NEW BOMBING FIELD AREA)

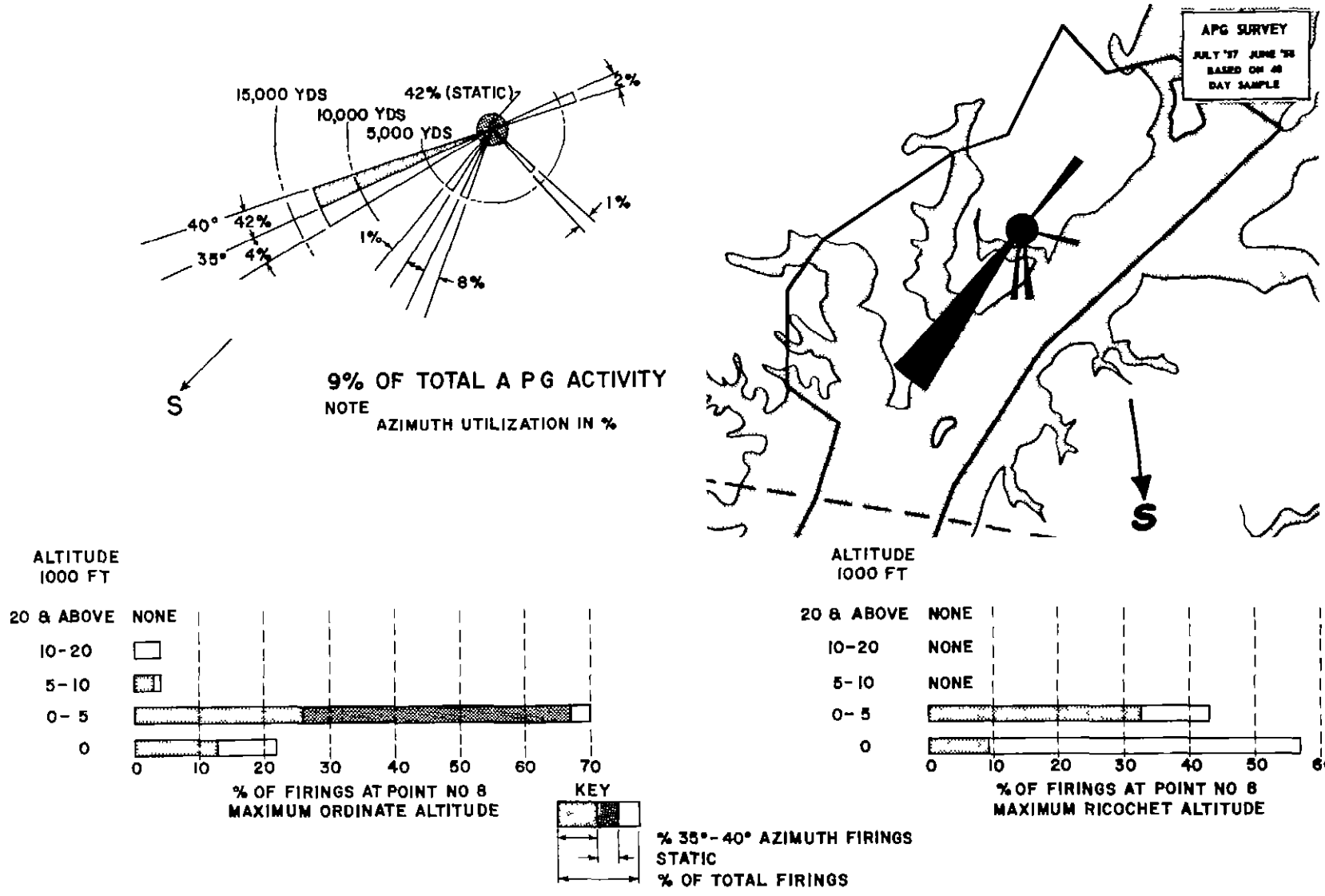


FIG. 18 AZIMUTH, RANGE, AND ALTITUDE UTILIZATION
FIRING POINT NO. 8 (POVERTY ISLAND AREA)

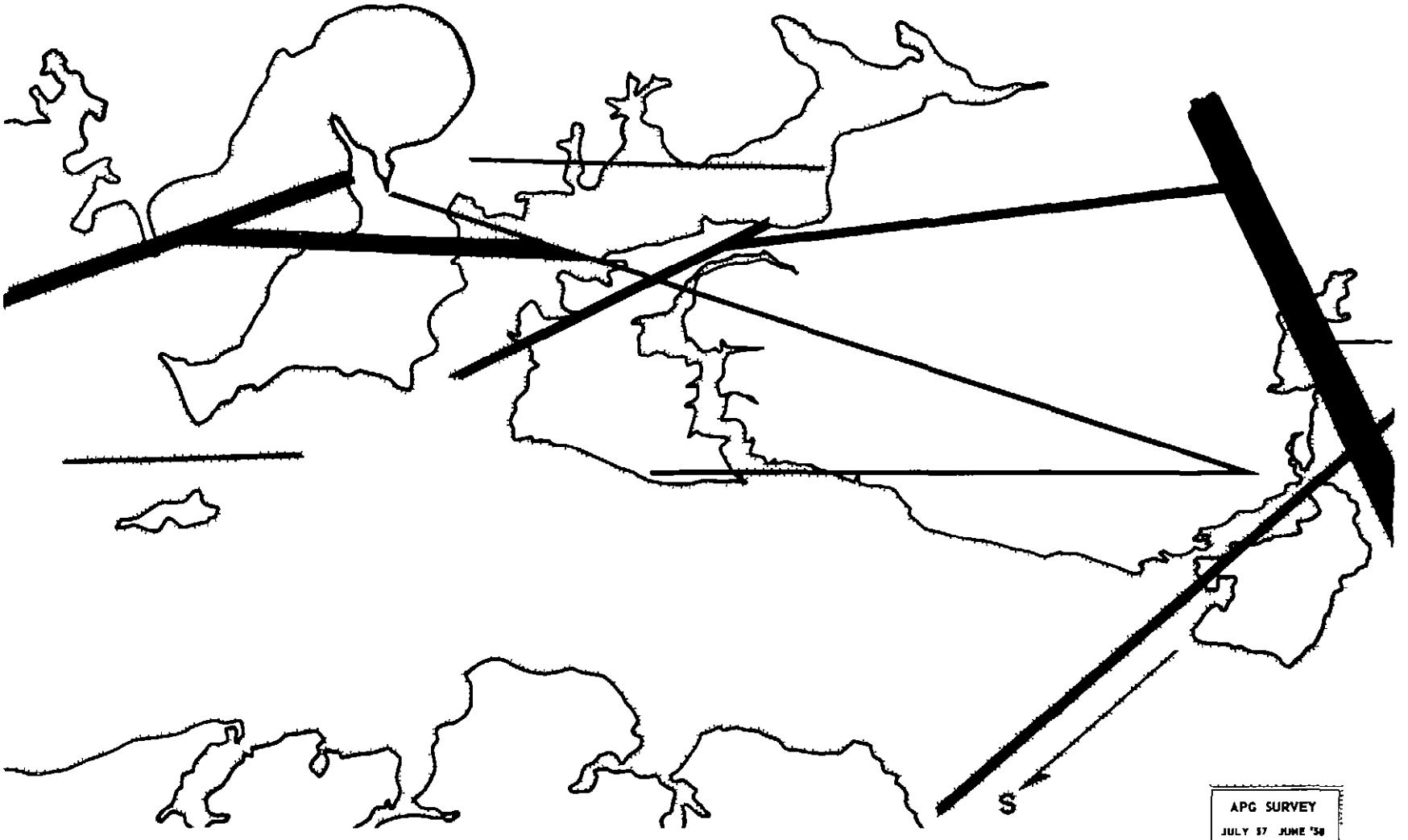


FIG. 19 AIRCRAFT FLIGHT PATHS

7 % OF TOTAL A P G. ACTIVITY

1) WIDTH OF LINE INDICATES USE
2) ALTITUDE RANGE TO 15,000 FT

FIG. 20 FIRING CLEARANCE DURATION

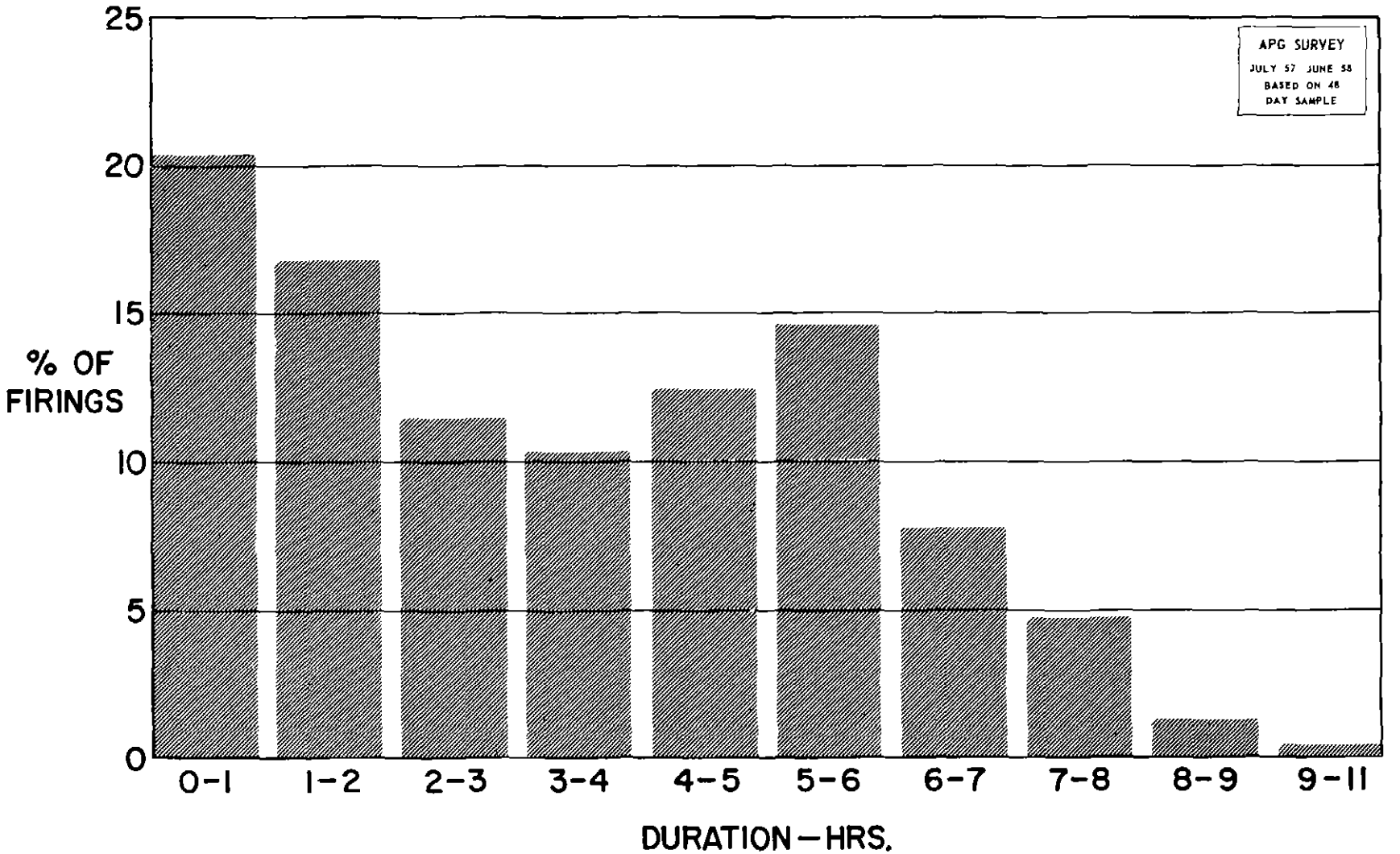


FIG 21
HOURLY CLEARANCE DISTRIBUTION WITH ALTITUDE UTILIZATION

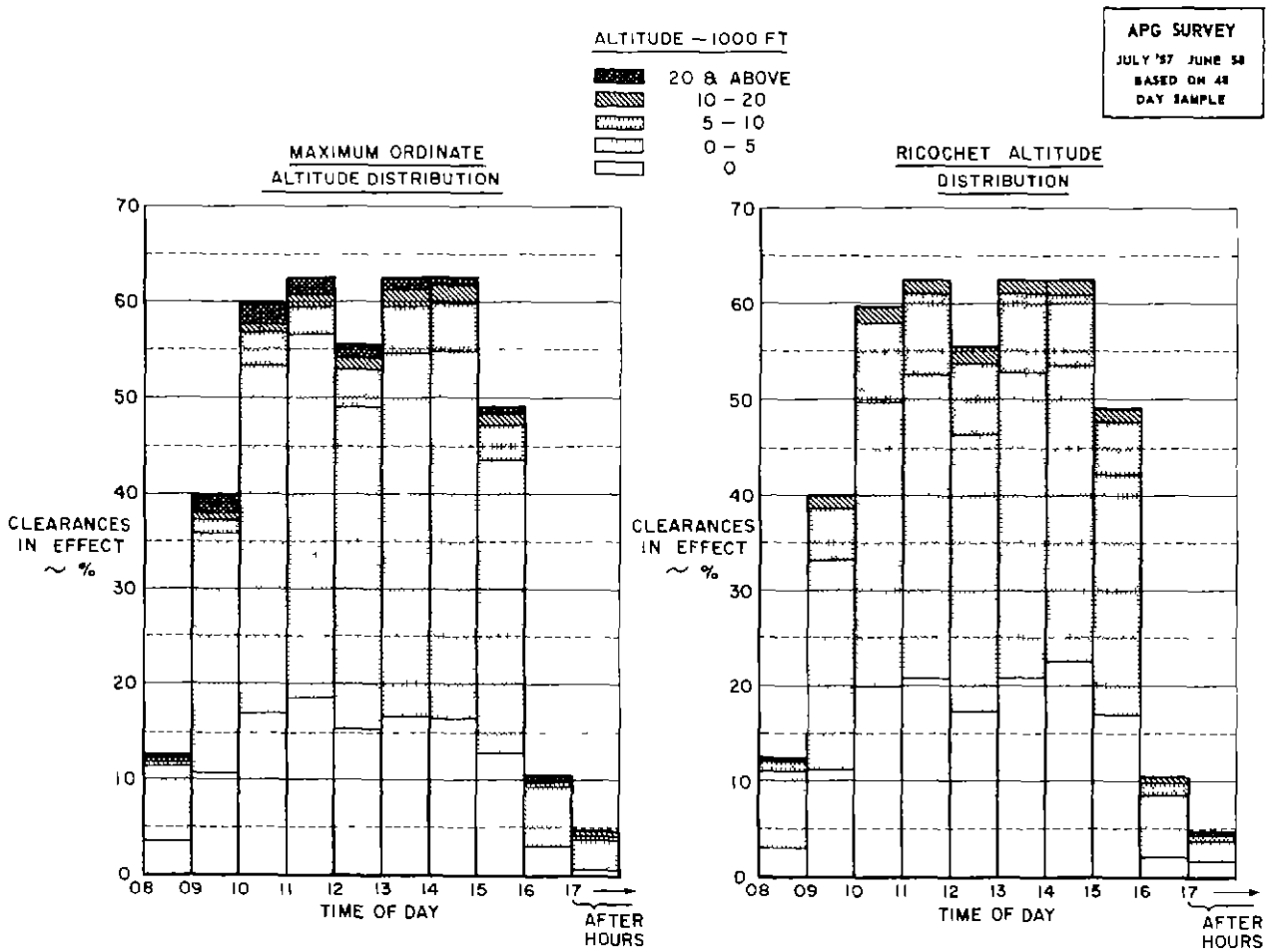


FIG. 22 ALTITUDE UTILIZATION BY WEAPON TYPE

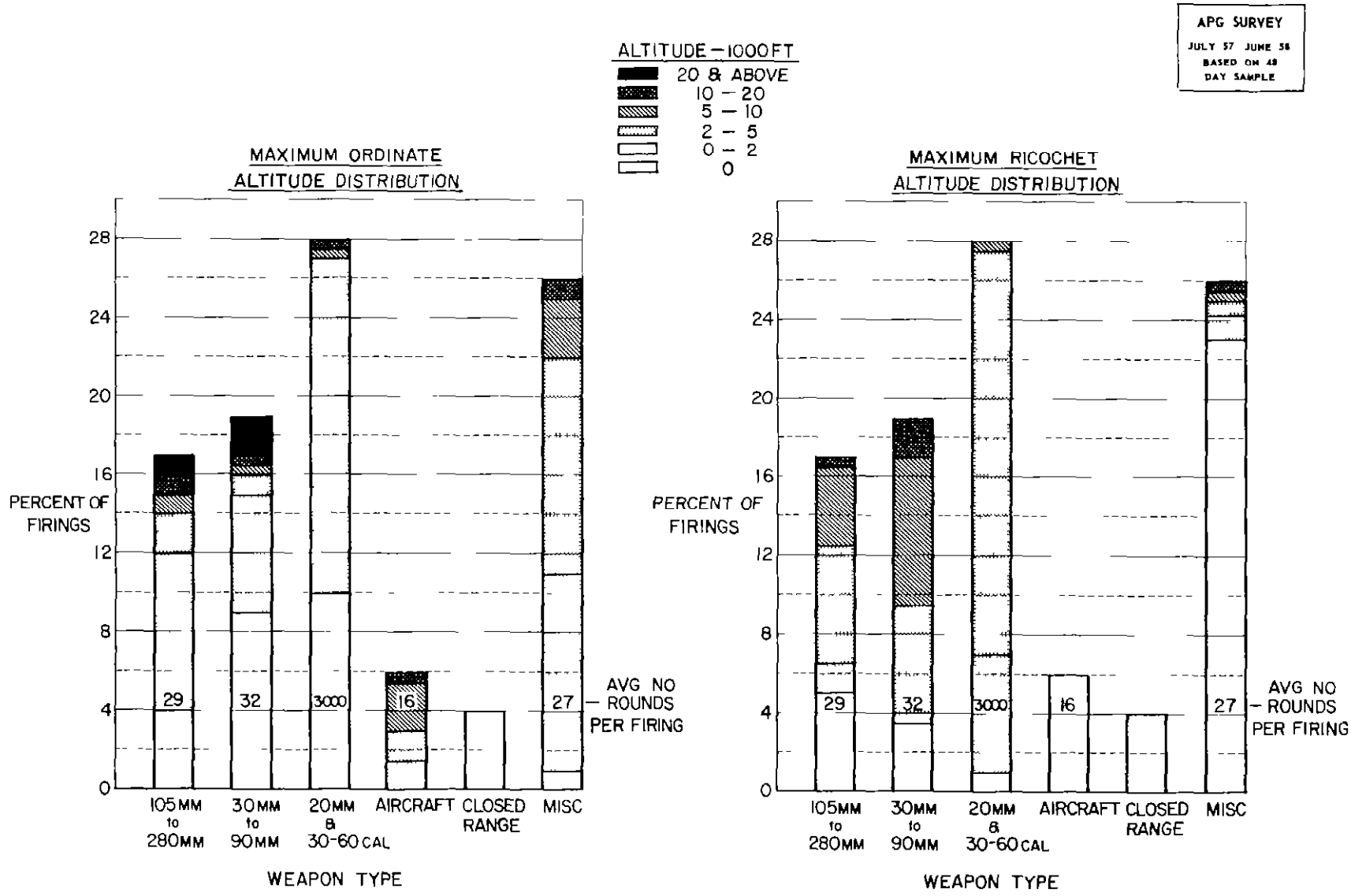


FIG. 23

CUMULATIVE DISTRIBUTION OF MAXIMUM ALTITUDES

MAXIMUM ORDINATE AND RICOCHET WITH CLOSED RANGE FIRINGS OMITTED (174)