

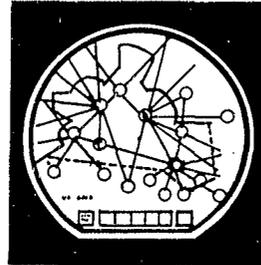
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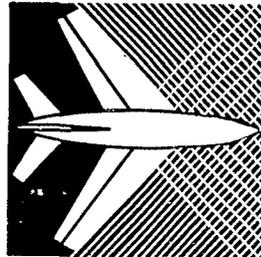
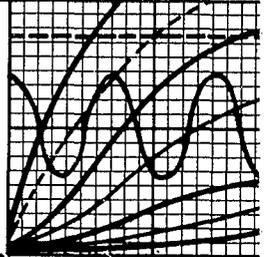
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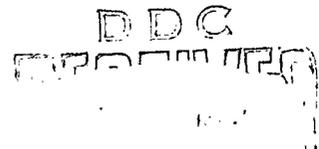
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INTERIM  
MEMORANDUM REPORT  
Project No. 150-25



**CENTRAL ALTITUDE RESERVATION  
FACILITY (CARF)  
ACTIVITY FORECAST, 1962-67**

June 1963



*This report has been approved for general distribution.*



**FEDERAL AVIATION AGENCY**  
Systems Research & Development Service  
**SYSTEMS MANAGEMENT DIVISION**  
**TRAFFIC AND ECONOMIC ANALYSIS AREA**

Washington, D.C.

INTERIM  
MEMORANDUM REPORT

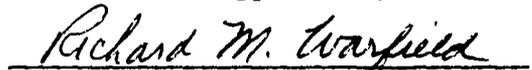
CENTRAL ALTITUDE RESERVATION FACILITY (CARF)  
ACTIVITY FORECAST, 1962-67

Project No. 150-2S

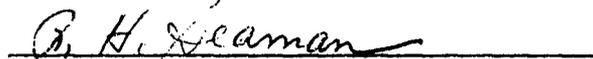
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Traffic and Economic Analysis Area

June 1963

FEDERAL AVIATION AGENCY  
Systems Research and Development Service  
Systems Management Division  
Traffic and Economic Analysis Area  
Washington 25, D. C.

## ABSTRACT

Systems Management Division, Systems Research and Development Service  
Federal Aviation Agency, Washington, D. C.

CENTRAL ALTITUDE RESERVATION FACILITY (CARF) ACTIVITY  
FORECAST, 1962-67

Prepared by Richard G. Brown, Traffic and Economic Analysis Area  
41 pp, includ. 15 figs., Interim Memorandum Report

This report pertains to forecasts of Altitude Reservations processed by the Central Altitude Reservation Facility (CARF) located at Kansas City, Missouri. Altitude reservations are used primarily by the military services for the mass movement of aircraft, or for special requirements which can not be met satisfactorily without altitude reservations.

CARF processes altitude reservation requests by coordinating between the military services, Air Route Traffic Control Centers, and foreign air traffic centers as applicable. CARF detects any conflicts between the requested path of flight and any other enroute aircraft that might be encountered. CARF notifies the parties involved in the conflict and resolves it by changing the time, altitude, fix, or cancelling the mission.

The CARF area of responsibility extends upwards from 15,000 feet east of the 100th meridian and from 24,000 feet west of the 100th meridian within the Continental U. S. and upwards from 24,000 in all applicable oceanic areas except the Bermuda Control Area which utilizes the altitudes from 15,000 feet and up.

The basic objective of this study was to evaluate present and future altitude reservation activity in support of an automation feasibility study of CARF.

There were 14,368 altitude reservations encompassing 43,463 aircraft processed in 1962. The daily average was 39 altitude reservations processed. The average of the 12 monthly peak days was 79 ALTRVs with 181 ALTRVs for the annual peak day. Altitude reservations are expected to rise to a peak of 18,997 in 1964, primarily through the inception of positive control across the country, and decrease to 15,126 annually by 1967 because of reduced usage by the Strategic Air Command.

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## INTRODUCTION

This report has been prepared in response to a request (See Appendix A) from the Program Manager, Data Processing, RD-3042, SMD, SRDS, FAA, for estimates of altitude reservation activity during the period 1962-67 by the Central Altitude Reservation Facility (CARF), Federal Aviation Agency, located at Kansas City, Missouri, to be used in an automation feasibility study.

Altitude reservations (ALTRVs) are utilized primarily by the military services when aircraft must operate in specific altitudes and areas or whenever there are movements of two or more aircraft with less IFR separation between aircraft than permitted by normal air traffic control regulations and procedures.

CARF functions as a central coordinating point between the unit planning the altitude reservation and all other interested parties. This may include other military services, Air Route Traffic Control Centers and foreign air traffic facilities.

Acknowledgement is made to the Central Altitude Reservation Facility for the time and assistance given in obtaining a basic understanding of the part altitude reservations play in their respective flight operations now and in the future; and to AT-10 for information and coordination.

## CARF OPERATIONS

### Activity Forecast

Table 1 is a forecast of CARF activity through 1967. The forecast reflects current thinking of the military services (see Appendices B and C) regarding the effect of positive control implementation upon the number of altitude reservations to be processed. Positive control is to be in effect throughout the United States by the end of 1963. Appendix D contains additional activity data.

### Historical Summary

The Central Altitude Reservation Facility (CARF) was established in 1956 to enable the military services (primarily the Strategic Air Command) to conduct realistic training missions at high altitude under simulated actual combat conditions avoiding unwanted changes in flight plans once a mission was started.

Prior to the establishment of CARF at Kansas City, Missouri, these training missions had been taken care of by the individual Air Route Traffic Control Centers. However, because of an increasing number of civil and military aircraft being flown over the country as well as increased military training requirements it became increasingly time consuming for the individual centers to coordinate flights requesting altitude reservations with the other centers. CARF was formed to act as a central clearing point for requests of mission training flights and to resolve all conflicts between missions for the Strategic Air Command, Air Defense Command, Tactical Air Command, and U.S. Navy. It also performs this function, when requested, presidential and vice presidential international flights, foreign dignitaries on international flights, the Royal Canadian Air Force, National Aeronautics and Space Administration, and civilian agencies.

Table 1  
CENTRAL ALTITUDE RESERVATION FACILITY (CARF) ACTIVITY FORECAST, 1962-1967

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
Annual Altitude Reservations (ALTRV) Processed	14,368*	15,611	18,997	17,752	16,124	15,126
Annual Number of Aircraft in Processed ALTRV'S	43,463*	48,775	60,175	56,456	51,572	48,578
Annual ALTRV'S Entering Foreign Airspace	9,540*	10,467	11,107	10,250	9,151	8,478
Number of ALTRV'S on Hand at a Given Time (Av 10 day lead-time)						
Average	428	425	520	488	440	415
Peak	630	630	768	715	650	610
Number of ALTRV'S Processed						
Daily Average	39*	43	52	49	44	41
Average Monthly Peak Day	79*	86	104	97	88	83
Annual Peak Day	181*	150	182	170	155	145
ALTRV Conflicts						
Daily Average	20*	22	26	25	23	21
Monthly Peak Day	58*	64	77	72	67	62
ALTRV Cancellations						
Daily Average	4*	4	5	5	4	4
Monthly Peak Day	18*	23	28	26	24	22
Personnel Assigned						
Chief, GS-14	1 *	1	1	1	1	1
Assistant Chief, GS-13	1 *	1	1	1	1	1
Secretary, GS-4	1 *	1	1	1	1	1
Cartographer, GS-7	1 *	1	1	1	1	1
Watch Supervisor, GS-12	5 *	5	5	5	5	5
Controllers, GS-11	27 *	29	30	30	30	29
Total	<u>36 *</u>	<u>38</u>	<u>39</u>	<u>39</u>	<u>39</u>	<u>38</u>

\* Actual Reported Values

### Altitude Reservation (ALTRV)

An ALTRV is authorization for airspace utilization under prescribed conditions, normally employed for multiple movements of aircraft or other special user requirements which cannot otherwise be accomplished. An ALTRV will normally include the departure, climb, cruise and arrival phases of flight up to and including the arrival holding pattern or point or time at which air traffic control provides separation between aircraft in accordance with regular air traffic control procedures.

There are two basic types of altitude reservations. Moving reservations are those in which the altitude reservation progresses with the mission. Stationary reservations concern those flight activities which take place in fixed areas, such as aerial refueling, rocket and missile firings, and other similar operations.

Aircraft groupings used in altitude reservations consist of Individual Flight Plan, Cell, and Stream Formations. Individual Flight Plan Formations consist of more than one aircraft which operate by prior agreement on the same route as a single aircraft regarding altitude, navigation, and position reporting, and are contained within one minute of flying time longitudinally. Cell Formations consist of aircraft which operate on the same route and which are contained longitudinally within one minute of flying time, laterally within the route width to be protected and using not more than 3,000 consecutive feet of altitude. Stream Formations consist of a number of aircraft which operate with more than one but not more than fifteen minutes of longitudinal spacing, are laterally contained in the route width to be protected and use no more than 3,000 consecutive feet of altitude.

### Altitude Reservation Approval Request (ALTRV APREQ)

The responsibility for planning and processing an ALTRV APREQ lies with each command and/or service involved in an exercise unless notice is given to CARF that one command or service has accepted joint responsibility. Missions which originate on a JCS or Service headquarters level (USAF, Army, Navy) and require extensive air traffic control support are initially coordinated with the FAA Military Command Liaison Division, AT-10, Washington 25, D. C. Originating units assign a project officer for each ALTRV APREQ. The project officer coordinates with the ARTCC in whose area the flight originates, the designated controlling agency for approval to transit restricted or warning areas, scheduling units of

refueling areas and Oil Burner routes and appropriate FAA Liaison Officer, i. e., SACLO, TACLO or ADLO. An ALTRV APREQ is normally submitted by teletype or mail. The message format and a sample request are illustrated below:

ALTRV APREQ Format

Mission Nickname and its priority

- a. Unit Call Sign
- b. Number and Type of Aircraft
- c. Departure point/s
- d. Control information - departure procedure, route of flight, altitude changes, special maneuvers (orbits, ECM corridors), separation change (cell to stream formation), multi-routes.
- e. Destination/s
- f. Proposed Departure Time/s - includes the departure interval between aircraft.
- g. Remarks - Refueling information, overflights of Canada, planning officer's name and phone number.

Sample ALTRV APREQ

CARF ALTRV APREQ SHOTGUN DELTA/7

- a. Aloof
- b. 3 B-47
- c. SSH
- d. CLIMB 270/380 DRCT CNU 0021 PHREN MNTN 50  
OR BELOW UNTIL SLN 120/10 CROSS SLN 120/38 AT  
100/180 CROSS CNU AT 220 OR ABOVE PAREN CROSS  
BUM 190 RADIAL 250 OR ABOVE LVLOF SGF 250/56  
0030 GOLD ROUTE OPTION CHARLIE. CONTROL POINT  
3030N 7300W 260210.
- e. LEMO
- f. 3P252255 ADMIS 1.
- g. TAS 430. FB001 PADRA. REFUEL WITH REMUS AND  
HIGH TANKERS. PROJ OFCR CAPT NORTON EXT 383  
HOME PHONE TA. 8-8892.

### Area of Jurisdiction

The area in which CARF coordinates and approves altitude reservations within the Continental U. S. extends upwards from 15,000 feet east of the 100th meridian and from 24,000 feet west of the 100th meridian. The increase in altitude west of the 100th meridian is to allow other aircraft a sufficient amount of altitude within which they may safely operate and avoid the mountainous terrain. CARF is also responsible for the approval of altitude reservations in all applicable oceanic areas upwards from 24,000 feet and upwards from 15,000 feet in the Bermuda Control Area. Figure 3 illustrates the area of CARF jurisdiction.

CARF may approve altitude reservations within its area of jurisdiction without obtaining the prior approval of other ATC facilities. When a mission goes outside of the areas and altitudes which are handled by CARF, approval must be obtained with the foreign air traffic control facility in whose area the mission will penetrate.

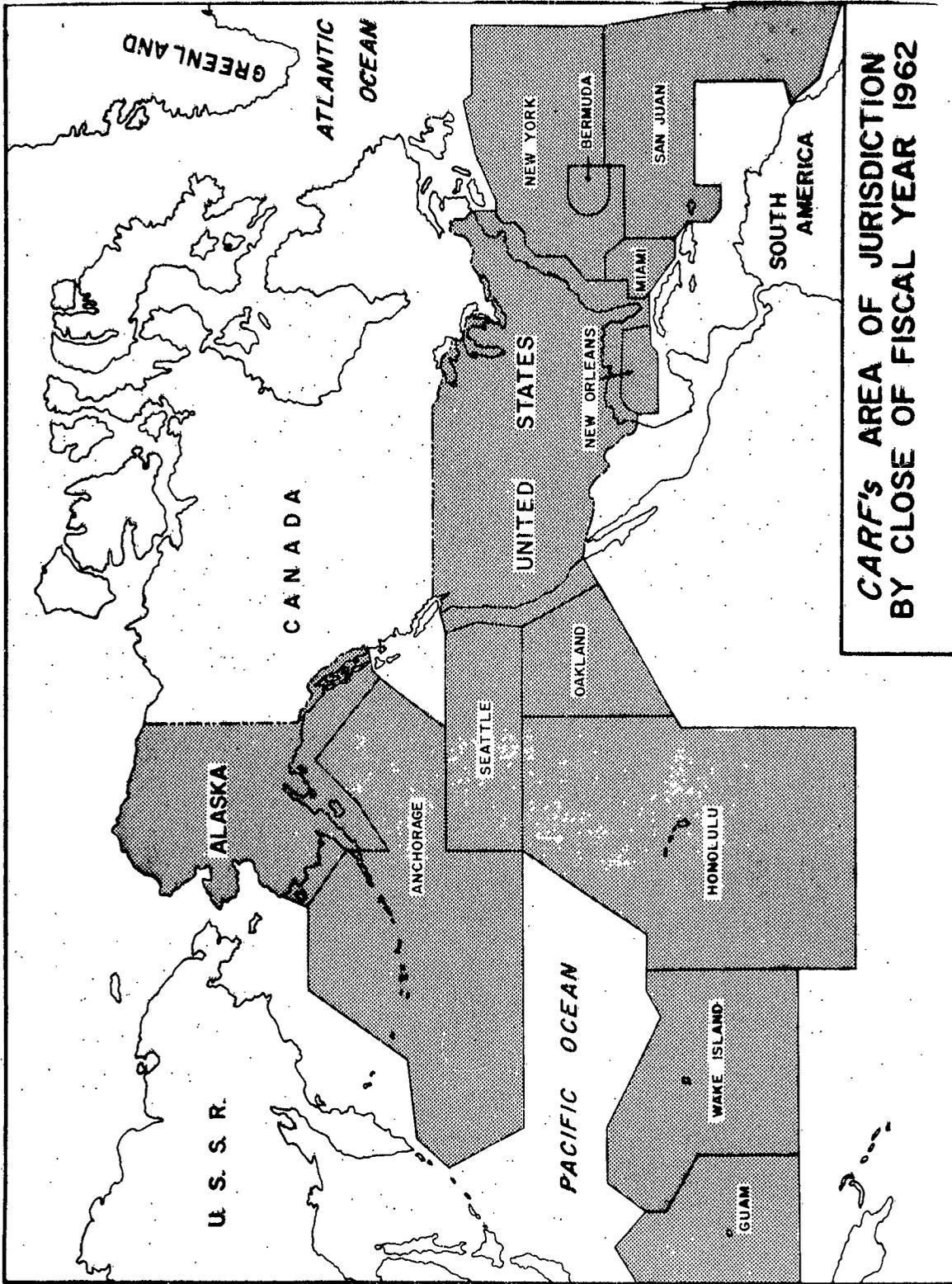


Figure 1 - CARF JURISDICTION

## Separation Standards

The following separation minima are applied in the planning and approval phase of altitude reservations:

### DOMESTIC SEPARATION

1. Longitudinal - 30 minutes between missions
2. Vertical
  - (a) FL 280 and below - 1,000 feet.
  - (b) FL 290 and above - 2,000 feet.
3. Lateral - 30 statute miles between tracks, with deviations when warranted.

### OCEANIC SEPARATION

1. Longitudinal - 60 minutes between missions.
2. Vertical
  - (a) FL 280 and below - 1,000 feet
  - (b) FL 290 and above - 2,000 feet
3. Lateral
  - (a) Miami, New Orleans, Honolulu, Guam, Wake, Oakland - 100 nautical miles between tracks
  - (b) New York, San Juan, Bermuda - 120 nautical miles between tracks
  - (c) Seattle, Anchorage - 140 nautical miles between tracks

The originator of an Altitude Reservation Approval Request is responsible for separation between all aircraft in the altitude reservation and between aircraft in the reservation and other aircraft, or groups of aircraft, with the same mission name. If these separations are to be applied between missions of different names, it will be indicated in the remarks section of the altitude reservation.

## Priorities

All ALTRV APREQ's are assigned a priority number from 1 to 10. The priority number is determined by the type of mission and number of aircraft involved. Each priority has been assigned a minimum filing lead time. Table 2 describes the priority system.

Table 2 - PRIORITIES: Priority Number Assignment for ALTRV APREQ's Showing Type of Mission, Minimum Number of Aircraft in Mission and Minimum Filing Lead Time

<u>Priority Number</u>	<u>Type of Mission</u>	<u>Minimum Number of Aircraft in Mission</u>	<u>Minimum Filing Lead Time (days) 1/</u> <u>As far in advance as possible</u>
1	Aircraft engaged in active defense missions and presidential flts.	1	As far in advance as possible
2	Aircraft implementing portions of limited war or other emergency war plans.	1	"
3	Aircraft engaged in search and rescue operations.	2	"
4	Aircraft engaged in hurricane evacuation or other operations involving safety of lives or property.	2	"
5	Aircraft engaged in important peacetime service, joint or unified/specified command exercises or missions.	2	15
6	Aircraft engaged in large scale missions directed by a Command Headquarters.	2	10
7	Aircraft engaged in overseas deployment or evaluation type operations.	2	8
8	Aircraft engaged in missions directed by specified Air Forces or Air Commands.	3	6
9	Aircraft engaged in other training exercises.	3	5
10	All other aircraft requesting altitude reservations.	3	4

1/ These minimums were established to allow CARF sufficient time in which to process the altitude reservation approval request and forward it to the Air Route Traffic Control Centers concerned at least 24 hours prior to the departure of the mission. The Air Route Traffic Control Centers require 24 hours advance notice, if possible, in order to have enough time to prepare flight progress strips, coordinate, etc. As far in advance as possible may vary from a matter of hours to several weeks, dependent on the nature of the planned operation.

## ALTRV APREQ Processing

CARF is responsible for processing all ALTRV APREQ's submitted to it, detecting any conflicts between requested flight paths, notifying the affected parties of the conflict, and issuing an altitude reservation approval message when a flight has been cleared.

ALTRV APREQ's are processed in the CARF Control Room which contains 16 plotting boards. Figure 2 is a photograph taken in the Control Room. Fourteen of the boards contain maps of the United States. The two remaining boards are concerned with oceanic and foreign areas. Each map is covered with two overlays. One overlay is used for missions departing from 0001 to 1200 and the other overlay is used for missions departing from 1201 to 2400. This is to enable controllers to plot routes on one board for each day while keeping the routes plotted from cluttering up the board, making it hard to read an individual route. When a mission operates before and after 1200 hours it is posted on both plastic overlays, with a 2-hour overlap on each. The same method is used when a mission begins one day and ends on the next day.

When plotting an altitude reservation, CARF controllers use the no-wind times given in the flight plan to calculate estimated times of arrival over fixes on the route. Routes are plotted with different colored grease pencils, to identify different altitude reservations, on large plastic overlays over a map of the United States. The plotted routes contain the requested altitude, route, orbit points, climb and descent points, level-off points, start and end of refuel, and control time.

Missions that depart the area of CARF control are coordinated with the air traffic control centers of the country within whose jurisdiction the mission extends. ALTRV APREQ's received more than 14 days in advance of the proposed departure date are kept in a calendar file. When sufficient time has elapsed so that a board is available for the proposed departure date the request is taken from the file for processing.

A majority of the missions flown consist of: Airborne Alerts (Priority 2) and Reflex Actions (Priority 7). An Airborne Alert will take one controller normally about one week to work up. A Reflex Action will take about 3 hours to work up spread over a period of several weeks by several controllers obtaining the necessary coordination with interested parties. Normally the time spent on the remaining missions will take one controller approximately three hours, however the workload on some missions may vary from as little as one hour to over 1,000 hours depending on mission size and complexity.



Figure 2 - CARF Control Room

Except for Airborne Alert missions an average of 6.3 days elapse from receipt of an ALTRV APREQ message until the approval message is sent. There are an average of 4.5 messages sent and 2.9 received in the processing of each altitude reservation. There are a designated number of airborne alert missions flown each day on altitude reservations. For each of these missions, one message is sent and one message is received.

A significant portion of a controller's time will be spent in coordinating with interested parties via a world-wide SAC telephone network. This coordination may involve the Air Route Traffic Control Centers, the military services, commands and units, foreign air traffic control centers, and FAA regional and Washington offices. Figure 3 shows CARF controllers at a plotting board.

Altitude reservation requests are processed in order of priority from Priority 1, highest, to Priority 10, lowest.

#### Conflicts and Revisions

In all conflicts the mission with the lower priority is contacted by CARF through the project officer and a revision is agreed upon by altitude, time, or change of route. If there is a conflict between missions having the same priority number the determination of the conflict will depend upon the importance, or function, of the missions concerned. Mission conflicts with the same priority and function are determined by the one with the earliest filing date. Depending on the traffic load, anywhere from 50 to 75% of all altitude reservations require conflict resolution with other missions, or re-routing to avoid high density areas, climb corridors, high and low altitude refueling areas, stationary reservations, oil burner routes, high density civil jet routes, restricted areas, reflex action routes, airborne alert routes, RBS & NIKE/RBS routes and Canadian high altitude airways and air routes.

Since approval requests are filed so far in advance, the unit requesting approval frequently needs to revise the flight plan for the successful accomplishment of the mission. On an average day about 40% of all flight plans have been revised prior to departure. These revisions may require so much additional coordination that approval might not be possible before the proposed departure time. For this reason revisions are not accepted later than 12 hours before the departure time for U. S. areas and 24 hours for oceanic areas. The increased time for oceanic approvals is to allow sufficient time for issuance of NOTAM's.

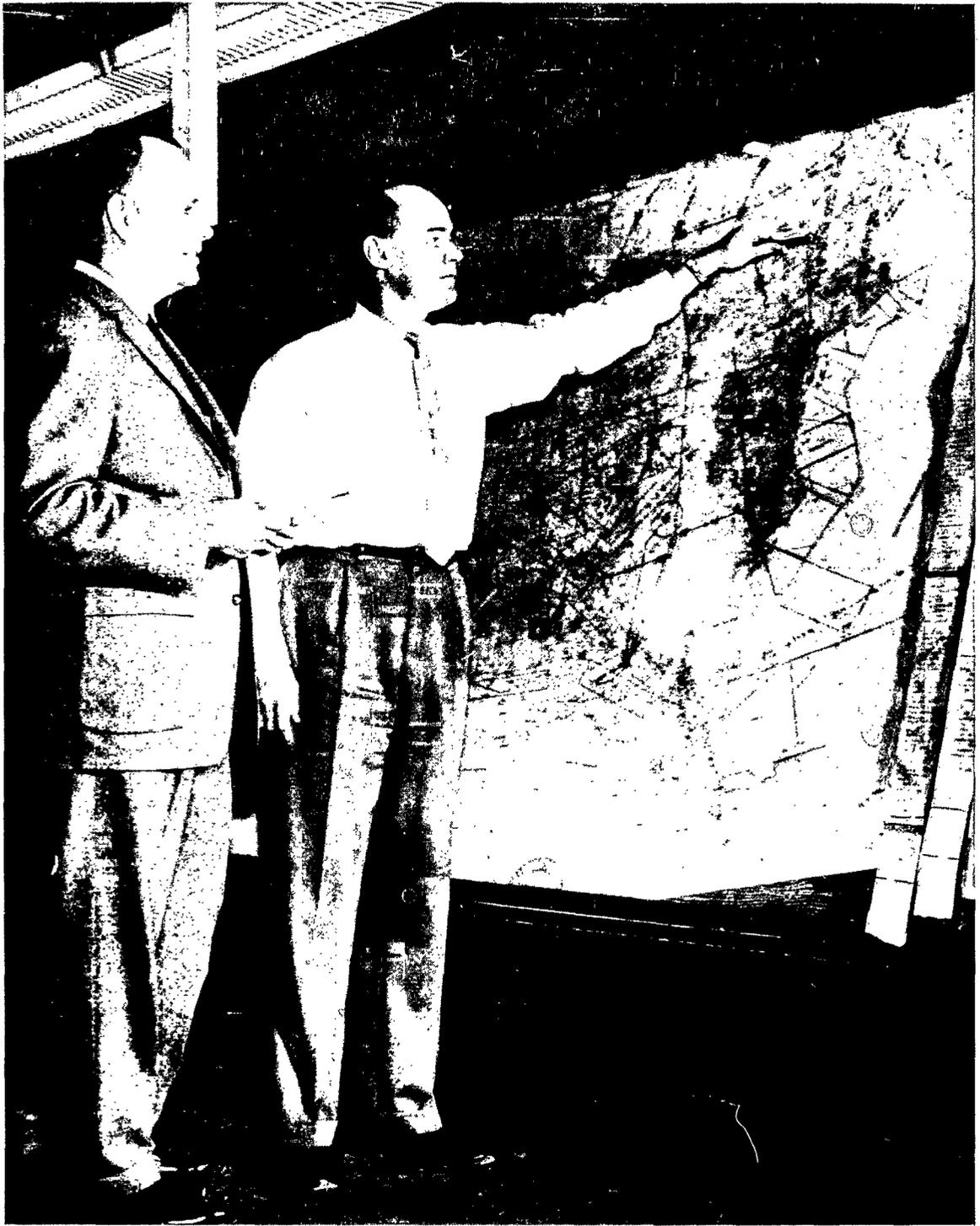


Figure 3 - CARF Controllers at a Plotting Board

Altitude Reservation Approval (ALTRV APVL)

When an altitude reservation has been approved it is sent via teletype to all Air Route Traffic Control Centers which will be affected. The message format (identical to a request) is shown below with a sample approval:

ALTRV APVL Format

Mission Nickname and its priority

- a. Unit Call Sign
- b. Number and Type of Aircraft
- c. Departure point/s
- d. Control information - departure procedure, route of flight, altitude changes, special maneuvers (orbits, ECM corridors), separation change (cell to stream formation), multi-routes.
- e. Destination/s
- f. Proposed Departure Time/s - includes the departure interval between aircraft.
- g. Remarks - Refueling information, overflights of Canada, planning officer's name and phone number.

Sample ALTRV APVL

CNTRS. INFO ZMA. ALTRV APVL SHOTGUN DELTA/7

- a. ALOOF
- b. 3/B47
- c. KSSH
- d. CLIMB 270/280 DRCT CNU 0021 PAREN MNTN 50  
OR BELOW UNTIL SLN 120/10 CROSS SLN 120/38  
AT 100/180 CROSS CNU AT OR ABOVE 220 PAREN  
CROSS BUM 190 RADIAL AT OR ABOVE 250 LVLOF  
AT SGF 250/56 0030 THENCE GOLD ROUTE OPTION  
CHARLIE. CONTROL POINT 3030N/7300W AT 260210Z.
- e. LEMO
- f. ETD 252255 ADMIS 1 AVANA 252327.
- g. 430K. FOXTROT BRAVO 001 PADRA. AIRFL WITH  
REMUS AND HIGH TANKERS.

### NOTAMS and ATC Clearances

A controller at each of the affected centers plots that portion of the route, altitude, and control times on a map of his area. Flight progress strips are prepared and posted and messages forwarded to adjacent centers to the effect that various altitudes are blocked for the mission concerned.

The center in which the flight originates gives the project officer the altitude reservation approval which constitutes an ATC clearance. When the mission departs the center of origin advises all other centers concerned by teletype of the departure times of the first and last aircraft as well as identification of any other aircraft in the mission. Once the mission becomes airborne the responsibility of CARF is ended.

The appropriate Air Route Traffic Control Centers have jurisdiction over the flight once it becomes airborne. If conditions warrant, the centers may revise the CARF approved altitude reservation in the interests of air safety. However, the center controllers, realizing that this normally will abort the purpose of the mission, will revise an airborne altitude reservation only when no other course of action remains open. All center controllers are aware that altitude reservations, while often making their jobs difficult, contribute towards continued improvement in the defense of their country.

Notices to Airmen (NOTAM) will be issued by the Central Altitude Reservation Facility for altitude reservations which will operate within the CARF area of responsibility determined by the altitude to be flown. These NOTAM's will be issued by CARF on Moving Reservations and Stationary Reservations. NOTAM's will be issued on Stationary Reservations as areas to be avoided by project officers submitting altitude reservation requests and all other aircraft which might be concerned with avoiding the area. NOTAM's will be issued on Moving Reservations which might be of sufficient concern in the operation of other aircraft.

### Mission Delays and Cancellations

Whenever it becomes necessary for a mission to delay departure time the altitude reservations will not be held open more than 30 minutes after the proposed departure time of the last aircraft scheduled in the mission flight plan. When the mission becomes delayed more than 30 minutes the altitude reservation is cancelled and the mission will not be rescheduled earlier than 12 hours after the original flight schedule. Air traffic control agencies will be notified as soon as the delay becomes apparent. Large scale exercises which operate through Canadian Air Traffic Control Areas may be delayed not less than 24 hours, or the altitude reservation will be cancelled.

Delays which arrive at the Central Altitude Reservation Facility under the minimum time will be handled on an individual basis and if at all possible, be processed. Dependent on the coordination necessary with other air traffic control facilities, the minimum delay times may not always allow enough time for processing by CARF before granting approval for the delay.

### Mission Characteristics

The normal duration of flight from takeoff to landing is 6.1 hours. The normal duration of flight within the area of CARF responsibility is 4.3 hours. There are an average of 24.4 fixes to be plotted on the route of each altitude reservation. Not considered in the above figures are airborne alert missions. The average flight duration for each of these missions is 23.4 hours for the bombers and 2.6 hours for the tanker support. The normal portion of the flight under the area of CARF responsibility is 15.7 hours for the bombers and 2.6 hours for the tanker support. There are an average of 75.9 fixes to be plotted for each bomber and 9.6 for each tanker support.

APPENDIX A: REQUIREMENT FOR TRAFFIC FORECASTS

United States Government  
MEMORANDUM

FEDERAL AVIATION AGENCY

Date: April 17, 1963

SUBJECT: Traffic analysis in support of CARF automation study  
In Reply Refer to: RD-3042

FROM : Program Manager, Data Processing

TO : Program Manager, Traffic Analysis, RD-308

This request for air traffic estimates is made in support of a Central Altitude Reservation Facility (CARF) automation feasibility study which was discussed in detail at a meeting between Mr. Warren F. Ottinger, RD-3042, Mr. Richard H. Seaman, Mr. Richard G. Brown and Mr. Richard M. Warfield, RD-308, on April 8, 1963.

The following estimates of CARF traffic are requested for the 1962 through 1967 time period.

1. Annual Estimates
  - a. Altitude Reservations (ALTRV's) Processed
  - b. Aircraft Comprising Processed ALTRV's
  - c. ALTRV's Entering Foreign Airspace
2. Average and Peak Day Activity
  - a. ALTRV's
  - b. Request file lead time
  - c. Peak Number of ALTRV's stored in computer
  - d. Revisions and Cancellations
  - e. Average flight time duration of CARF approved missions
    - (1) From takeoff to landing
    - (2) Time under CARF jurisdiction
3. Controller Workload and Staffing
  - a. Present System
  - b. Automated System

The above estimates should be regarded as tentative in nature and may be altered somewhat as the analysis progresses.

Signed/

J. W. Rabb, RD-3042

APPENDIX B: SAC MEMORANDUM

HEADQUARTERS STRATEGIC AIR COMMAND

United States Air Force

Offutt Air Force Base, Nebraska

Reply to  
Attn of: DOOTOA/Maj MacGregor/44216/mk

22 April 1963

SUBJECT: SAC Activity in CARF

TO: FAA/SACLO

1. Reference letter by Mr. Richard G. Brown, Operations Analyst, Research and Development, dated 12 April 1963. The following data concerning SAC activity in CARF is forwarded for your information.

2. Annual estimates (approximates):

1962	13232 ALTRVs
1963	12283 ALTRVs
1964	11297 ALTRVs
1965	10282 ALTRVs
1966	8979 ALTRVs
1967	8181 ALTRVs

Under the present flying hour concept, total flying time will have decreased some 473,000 hours by 1967, or some 39% as compared to 1962. Altitude reservations will decrease approximately 30% in numbers, but will increase 2 to 3% in comparison to total flying hours. However, it is conceivable that with the advent of Area Positive Control throughout the United States, we could foresee a drastic increase of ALTRVs for single aircraft due to Special Operating Areas (SOAs).

3. Average and peak day activity:

- a. File lead time - at least three weeks.
- b. Number of fixes - n/a.
- c. Cancellations - approximately 8%.
- d. Revisions - many, but of a minor nature.
- e. Average per day - approximately 35.
- f. Peak day - 70 ALTRVs (Wednesday is peak day of each week).

APPENDIX B (Continued)

4. Characteristics of GARF activity:

- a. Length of flight - 3 to 24 hours.
- b. Altitude - 500 to 45,000'.
- c. Aircraft speed - 280 TAS - 550 TAS (Does not take high speed dash into consideration).
- d. Type Mission:
  - (1) High level bomb and navigation.
  - (2) Low level bomb and navigation.
  - (3) Sky Shield.
  - (4) Big Blast.
  - (5) Reflex.
  - (6) Chrome Dome.
  - (7) Semi-Large Scale.
  - (8) Tanker support for all the above.
  - (9) ORI

5. It must be kept in mind that these figures are approximations as complete data is not available at this agency. The number of ALTRVs, 1964 through 1967, is dependent on many factors, but basically the future of B-47 aircraft and Operation Stretch Out.

Signed/  
Roscoe L. Bell  
Colonel, USAF  
Directorate of Operations

1 Atch  
Ltr fm Mr. Brown,  
12 Apr 63

APPENDIX C: ADC MEMORANDUM

United States Government  
MEMORANDUM

FEDERAL AVIATION AGENCY  
Colorado Springs, Colorado

AIR MAIL

SUBJECT: ADC/CARF Traffic

Date: May 13, 1963

FROM : Chief, Air Defense Branch

TO : Chief, Military Command Liaison Division, AT-10

Reference is made to the RD-30 letter dated April 17, transmitted with your memorandum of April 22. In response to the request for statistical data pertaining to anticipated altitude reservations initiated by the air defense system we have queried Headquarters NORAD, Headquarters ADC and each of the six domestic NORAD regions. Traffic estimates provided for the 1962-1967 time period are based on actual numbers of target aircraft currently being utilized in air defense exercises in the high-altitude structure. It is anticipated that we will not, in the foreseeable future, be able to provide low-level target operations on ALTRVs in any quantity, therefore, this factor is not included. It is believed that the same number of target aircraft will be utilized in air defense exercises in the reconfigured NORAD structure. The estimates that follow are in anticipation of area positive control being expanded to cover the 48 states.

1. Annual Activity

a. Aircraft - 15,500

b. Altitude Reservations (ALTRV's) requested - 4,000

Note: Each individual ALTRV normally provides for three to four aircraft on a common routing. It is anticipated that the above level of activity will be reached on or about January 1, 1964, and should remain relatively stable except as effected by factors outlined in paragraph 2 below.

2. Significant Factors Affecting Future Annual Activity

a. The expansion of the area positive control program will almost require the air defense system to go to ALTRVs for air defense exercises.

APPENDIX B (Continued)

4. Characteristics of GARF activity:

- a. Length of flight - 3 to 24 hours.
- b. Altitude - 500 to 45,000'.
- c. Aircraft speed - 280 TAS - 550 TAS (Does not take high speed dash into consideration).
- d. Type Mission:
  - (1) High level bomb and navigation.
  - (2) Low level bomb and navigation.
  - (3) Sky Shield.
  - (4) Big Blast.
  - (5) Reflex.
  - (6) Chrome Dome.
  - (7) Semi-Large Scale.
  - (8) Tanker support for all the above.
  - (9) ORI

5. It must be kept in mind that these figures are approximations as complete data is not available at this agency. The number of ALTRVs, 1964 through 1967, is dependent on many factors, but basically the future of B-47 aircraft and Operation Stretch Out.

Signed/  
Roscoe L. Bell  
Colonel, USAF  
Directorate of Operations

1 Atch  
Ltr fm Mr. Brown,  
12 Apr 63

APPENDIX C (Continued)

- b. The elimination of IFR/VFR On Top in the oceanic area, in accordance with a recent ICAO document, will increase ALTRV operations in the coastal area.
- c. A decrease in available funds for exercise flying hours may force the air defense system to make do with less than now accomplished with the current level of target operations.
- d. The streamlining of procedures for filing ALTRVs, that may be anticipated in the event of CARF automation may well serve to make it easier on the part of military project officers to bring more of the smaller scale exercises into the ALTRV concept of operation.

3. Average and Peak Day Activity

Statistics are not available at this time to permit an estimate of average and peak day activities. It might be reflected, however, that no air defense exercise is run simultaneously with another level of exercise.

4. Characteristics of ADC CARF Activity

a. Mission Type

Air defense exercises may be segregated into the following types:

- (1) Hq NORAD directed Operational Evaluations
- (2) Hq ADC directed Operational Readiness Inspections. These may be either a no-notice or a notice type and are normally of a relatively small scale wherein an inspection is conducted of a particular fighter squadron, air defense sector or NORAD radar control facility.
- (3) NORAD region directed exercise wherein an entire region is involved.

APPENDIX C (Continued)

- (4) NORAD sector exercise directed by the NORAD region or the NORAD sector.
  - (5) Special projects such as radar evaluation and testing of new procedures and equipment.
  - (6) ADC/NORAD augmentation of SAC semi-large scale exercises.
- b. Average Duration of Flight - 2 to 4 hours
- c. Altitude Flown - The altitudes of the target aircraft will vary from 500 feet above the ground to above 60,000 feet. At least 60% of these targets will be within the Continental Control Areas as presently defined.

Signed/

George Ingle Smith, AT-14

## APPENDIX D: CARF TRAFFIC ACTIVITY

This appendix contains analyses and summaries of CARF traffic activity data which are presented in various tables and figures. The tables listed below contain basic CARF traffic activity data:

Table 3 - Number of Altitude Reservations Processed

Table 4 - Monthly/Peak Day Altitude Reservation Activity

An analysis of average trends, variations and peak traffic activity are summarized by the following figures:

Figure 4 - Monthly ALTRVs Processed

Figure 5 - Average Daily ALTRVs

An analysis of ALTRV workload and lead times are summarized by the following figures:

Figure 6 - ALTRV Processing Workload

Figure 7 - ALTRV Filing Lead Time

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

Table 3

NUMBER OF ALTITUDE RESERVATIONS PROCESSED  
Central Altitude Reservation Facility

	1956	1957	1958	1959	1960	1961	1962	1963
Jan.		298	399	735	986	1008	1277	1259
Feb.		319	360	869	898	1195	1236	1275
Mar.		257	409	627	924	1597	1250	1209
Apr.		220	327	864	804	1443	1164	
May		187	401	878	957	1516	1119	
Jun.		198	402	941	982	1420	1049	
Jul.		355	435	740	894	1549	1141	
Aug.	237	209	475	690	975	1555	1269	
Sep.	351	396	536	749	694	1506	1153	
Oct.	340	295	491	951	655	1750	1443	
Nov.	194	231	530	892	734	1296	1263	
Dec.	<u>134</u>	<u>196</u>	<u>442</u>	<u>763</u>	<u>645</u>	<u>1137</u>	<u>1004</u>	
TOTALS	1256	3161	5207	9699	10148	16952	14368	

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

Table 4  
Monthly/Peak Day Altitude Reservation Activity  
July 1962 - March 1963

	Altrv's Processed	Number of Aircraft	Cancelled Altrv's	Percent of Missions Flown			Altrv's Entering Foreign Airspace	Messages		Notams Sent
				SAC	ADC	TAC		USN	Sent	
Mar 63	1209/56	2960/175	82/16	85.4	10.7	3.5	0.4	3413/235	2323/178	140
Feb 63	1275/98	3394/382	122/47	90.6	5.2	3.9	0.3	3679/288	2309/183	150
Jan 63	1259/75	3008/175	101/14	91.8	4.9	2.2	1.1	3825/280	2558/210	170
Dec 62	1004/47	2134/145	70/7	93.9	3.7	1.7	0.8	3394/224	2002/110	146
Nov 62	1263/63	4877/352	87/22	92.5	1.5	5.7	0.3	3843/241	2785/138	28
Oct 62	1443/80	4956/304	228/37	88.3	7.4	3.2	1.2	4455/254	3606/249	142
Sep 62	1153/181	3613/754	39/11	89.1	3.5	2.6	4.8	3336/208	3055/241	123
Aug 62	1269/67	4051/222	48/4	92.0	3.6	4.4	0.1	4056/245	3797/200	N/A
Jul 62	1141/66	3373/244	61/6	94.2	2.3	3.0	0.5	3125/197	2652/202	N/A
Jun 62	1049/57	3053/214	68/12	92.2	3.5	3.3	1.0	2651/115	2294/124	N/A
May 62	1119/60	3363/270	110/10	92.4	1.3	6.2	0.2	2979/166	2044/112	N/A
Apr 62	1164/101	3277/440	165/78	94.5	3.1	1.9	0.2	2620/166	2599/152	N/A
Mar 62	1250/61	3937/242	163/13	93.2	1.4	3.8	1.6	3063/182	3016/159	N/A
Feb 62	1236/92	4432/398	137/11	87.3	4.3	5.8	2.9	2567/178	3089/165	N/A
Jan 62	1277/62	3887/222	116/8	91.9	0.7	5.5	2.0	2728/165	3503/184	N/A
Dec 61	1137/71	3124/215	162/14	90.8	3.7	4.9	0.6	2324/150	3191/191	N/A
Nov 61	1296/66	3749/255	107/9	92.4	1.6	5.6	0.4	2473/137	3010/161	N/A
Oct 61	1750/211	4779/964	109/16	89.5	5.0	3.5	2.1	2502/137	3880/239	N/A
Sep 61	1506/79	3793/267	105/10	93.8	0.5	5.5	0.3	2641/157	3497/180	N/A
Aug 61	1565/72	5186/757	67/8	92.3	1.5	5.5	0.7	2049/107	3218/143	N/A
Jul 61	1549/78	3446/235	84/16	94.9	2.4	2.1	0.6	3842/189	3023/130	N/A

N/A - Not available

## APPENDIX D: CARF TRAFFIC ACTIVITY (Continued)

### Monthly ALTRVs Processed

Figure 4 illustrates the number of altitude reservations processed as shown in Table 3. Also illustrated is a 13 month moving average for past years and a projected average month from Table 1, page 3, for each of the forecast years plus a calculated expected annual peak month using the method outlined on page 30.

### Average Daily ALTRVs Processed

Figure 5, page 28, shows average daily ALTRVs processed and the monthly peak days from Table 4. In addition, calculated values of expected monthly and annual peak days are shown using the methods outlined on page 30.

### ALTRV Processing Workload

Figure 6, page 29, shows the average and estimated peak number of ALTRVs being processed (on hand) by CARF on a given day. These estimates are based on the methods outlined on page 30 and the lead time distribution shown by Figure 7, page 31. These estimates include ALTRVs not yet on the plotting boards (i. e., received with more than a 14 day lead time).

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

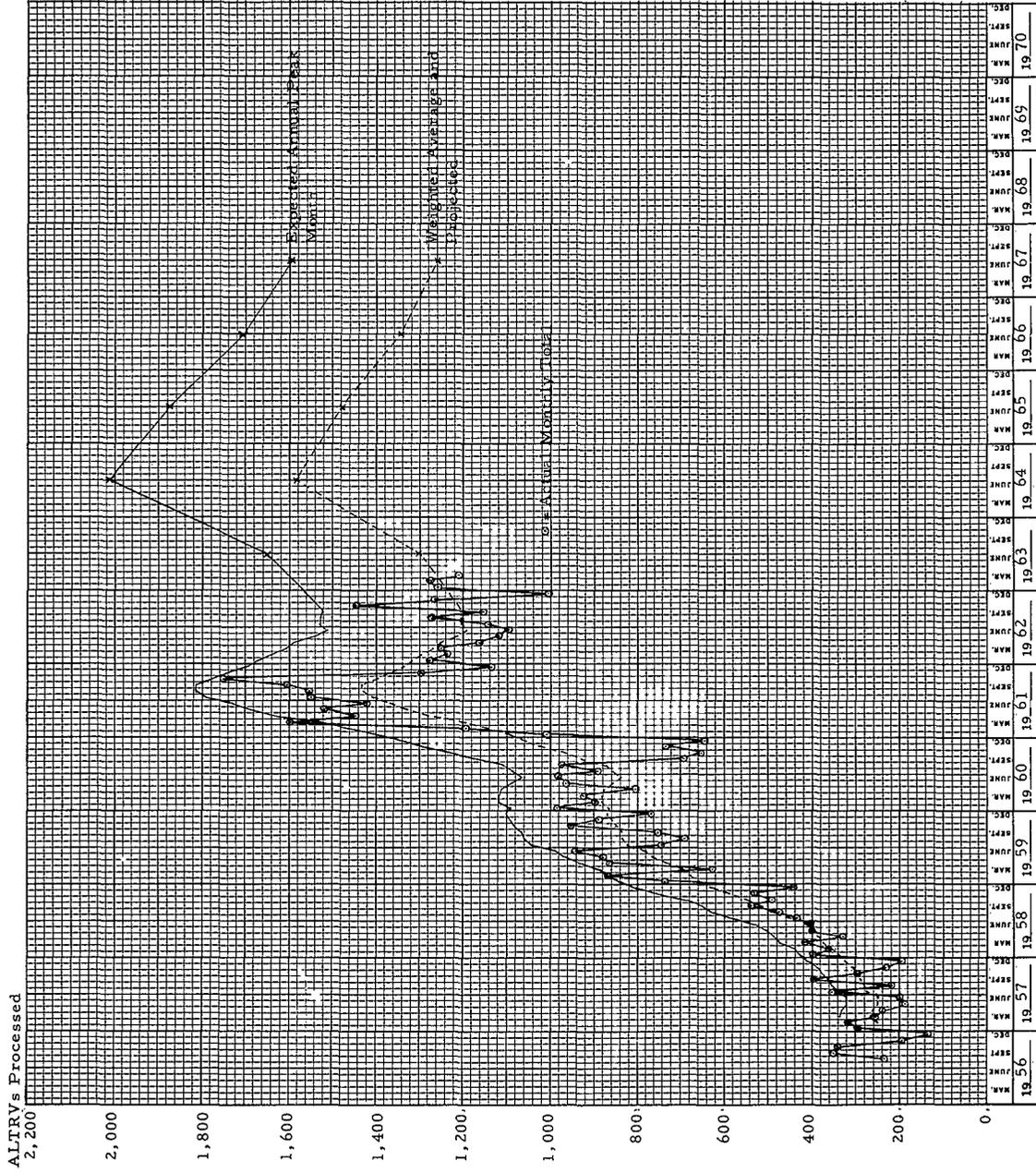


Figure 4 - MONTHLY ALTRVs PROCESSED: Historical Summary and Estimated Projection of Monthly ALTRVs Processed Showing a 13 Month Weighted Average and Expected Annual Peak Month, 1956-1967.

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)  
ALTRVs PROCESSED

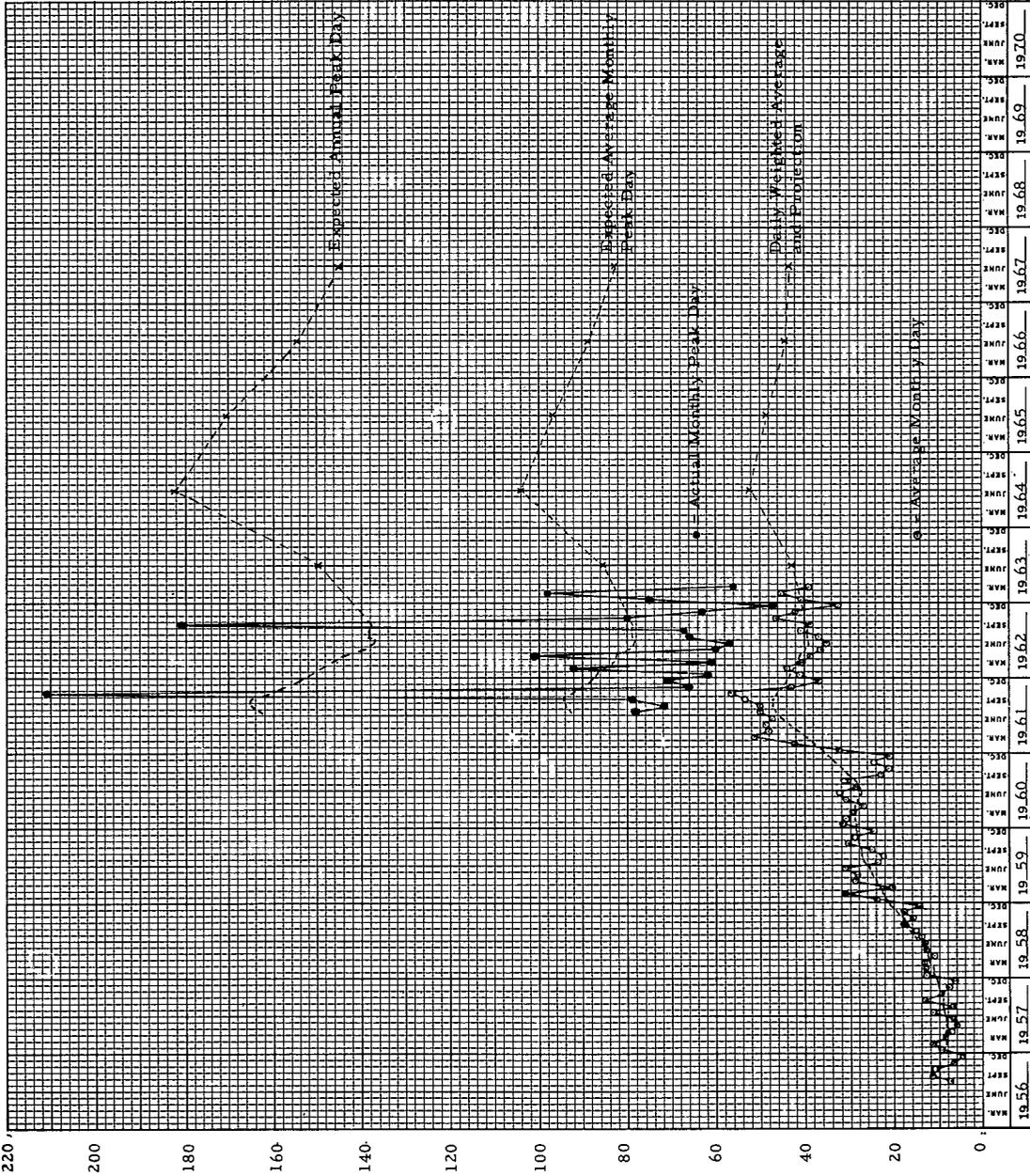


Figure 5 - AVERAGE DAILY ALTRVs: Summary and Estimated Projection of Average Daily ALTRVs Processed Showing Actual Peak Days and Expected (Calculated) Monthly and Annual Peak Days, 1956-1967.

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)  
ALTRVs PROCESSED



Figure 6 - ALTRV PROCESSING WORKLOAD: Estimated Average and Peak Number of ALTRVs Being Processed (on hand) at CARF (Based on an average 10 day lead time), 1956-1967.

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

Estimation of Peak ALTRVs Processed

The following formulas were used to estimate peak ALTRVs processed:

$$\text{Daily Average (past)} = \bar{X} = \text{Monthly Average (13 month)} \\ \text{divided by } 30.4 \text{ days.}$$

$$\text{Daily Average (forecast)} = \bar{X} = \text{Annual Estimate divided by} \\ 365 \text{ days.}$$

$$\text{Standard Deviation (daily)} = \sigma = 0.5 \bar{X}$$

$$\text{Expected Monthly Peak Day} = \bar{X} + 2\sigma = 2.0 \bar{X}$$

$$\text{Expected Annual Peak Day} = \bar{X} + 5\sigma = 3.5 \bar{X}$$

$$\text{Monthly Average} = 30.4 \bar{X}$$

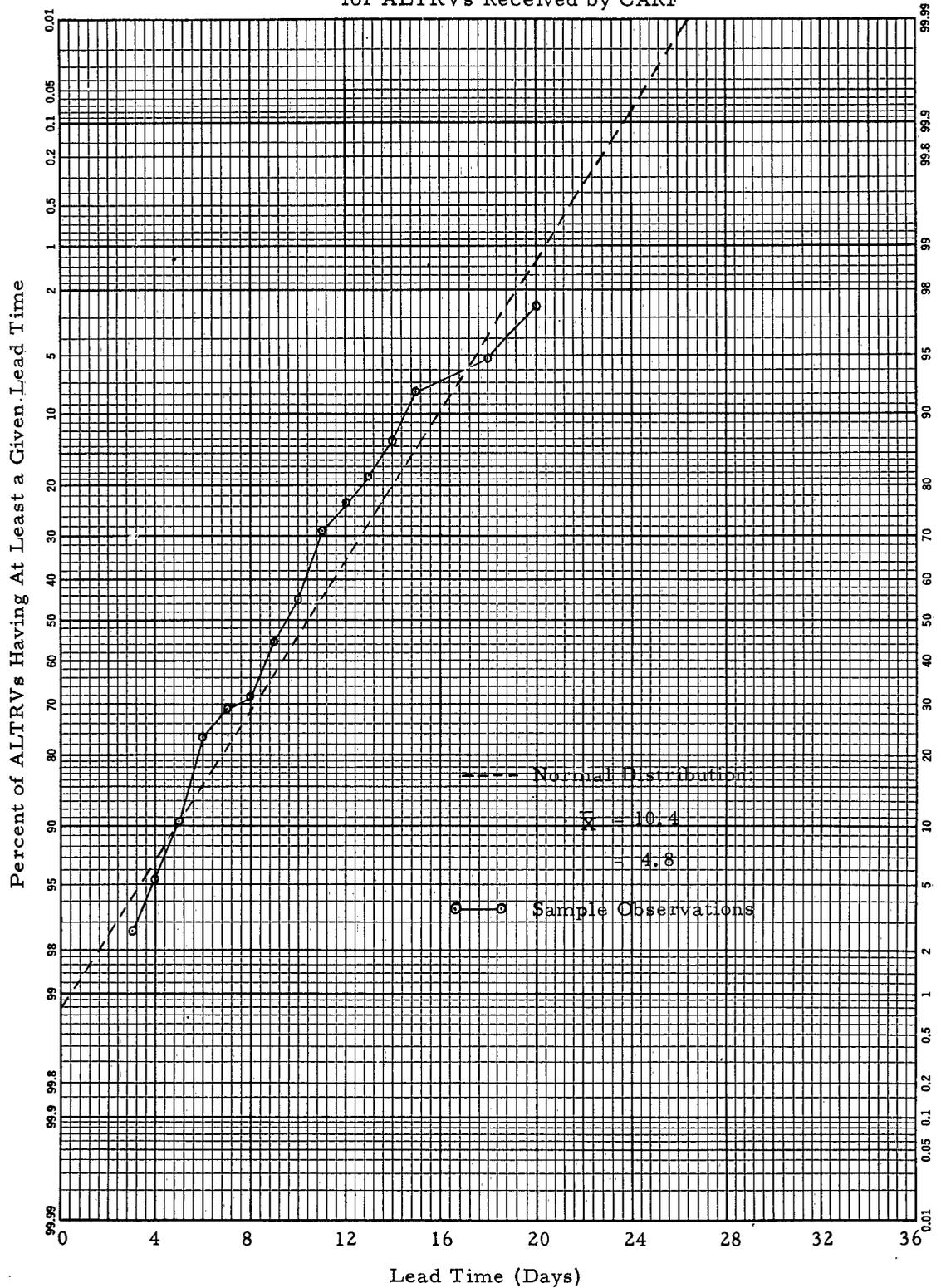
$$\text{Expected Monthly Peak} = 30.4 \left( \bar{X} + \sqrt{\frac{3\sigma}{30.4}} \right) \\ = 38.6 \bar{X}$$

$$\text{Average On Hand} = 10 \bar{X}$$

$$\text{Expected Peak On Hand} = 10 \left( \bar{X} + \sqrt{\frac{3\sigma}{10}} \right) \\ = 14.74 \bar{X}$$

APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

Figure 7 - ALTRV FILING LEAD TIME: Estimated Filing Lead Time for ALTRVs Received by CARF



APPENDIX D: CARF TRAFFIC ACTIVITY (continued)

ALTRV Filing Lead Time

Figure 7, page 31, shows the distribution of ALTRV filing lead times. The observed data represents 38 ALTRVs. The table below shows the average number of ALTRVs which would be on the plotting boards on any given day for a range of earliest plotting lead times (currently ALTRVs are not plotted earlier than 14 days in advance) using a normal distribution of (Fig. 7) ALTRV filing lead time with  $\bar{X} = 10.4$  days and  $\sigma = 4.8$  days:

<u>Earliest Plotting Lead Time (days)</u>	<u>Average Number of ALTRVs on Plotting Boards</u>
1	1.00 $\bar{X}$
2	1.94 "
3	2.88 "
4	3.79 "
5	4.66 "
6	5.48 "
7	6.24 "
8	6.93 "
9	7.54 "
10	8.08 "
11	8.52 "
12	8.89 "
13	9.18 "
14	9.41 "
15	9.57 "
16	9.69 "
17	9.77 "
18	9.83 "
19	9.86 "
20	9.89 "
21	9.90 "
22	9.91 "
23	9.91 "
24	9.91 "
25	9.91 "

## APPENDIX E: MILITARY FLIGHT ROUTES AND FLYING AREAS

This appendix illustrates in the series of figures listed below a number of typical military missions and flying areas associated with CARF altitude reservation activity:

<u>Figure</u>	<u>Title</u>	<u>Page</u>
8	Typical SAC Daily Training Mission	34
9	SAC Reflex Action Routes	35
10	Large Scale Defense Exercise "Sky Shield III"	36
11	SAC Operational Readiness Inspection Evaluation Flight	37
12	SAC High Altitude Supersonic Training and Flight Test Routes	38
13	USAF Low Altitude Refueling Areas	39
14	USAF High Altitude Refueling Areas	40
15	Student Training	41

APPENDIX E: MILITARY FLIGHT ROUTES AND FLYING AREAS (continued)

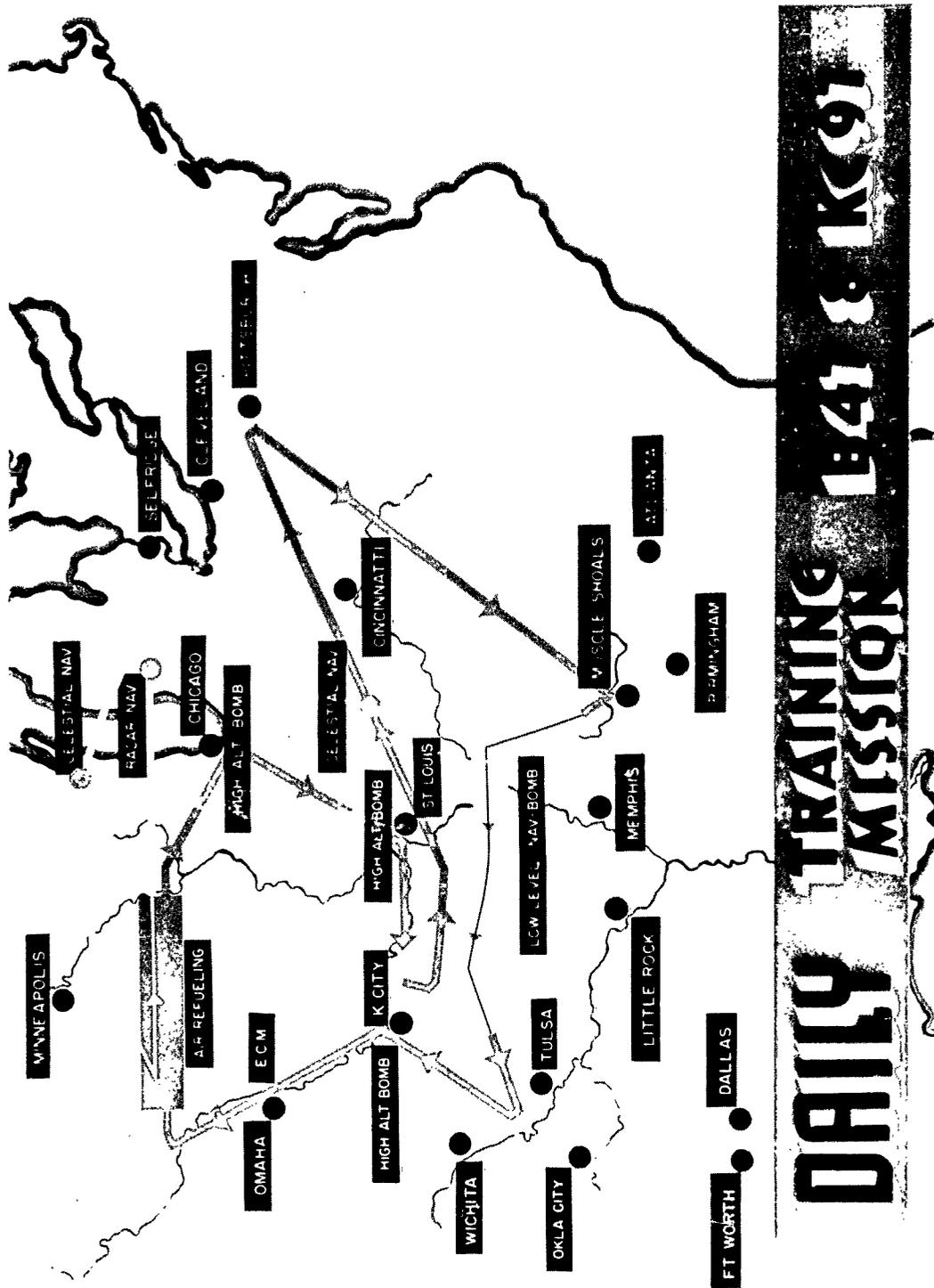


Figure 8 - Typical SAC Daily Training Mission



# SKY SHIELD III

SEPT 1967



<b>SAC ACFT</b>	
<b>BOMBERS</b>	<b>351</b>
<b>TANKER</b>	<b>180</b>
<b>REFUELING</b>	<b>197</b>
<b>STRIKES</b>	<b>799</b>
<b>LANDINGS</b>	<b>538</b>
<b>NORAD</b>	<b>1700</b>
<b>OTHER</b>	<b>700</b>

**TOTAL ACFT 2431**

Figure 10 - Large Scale Defense Exercise "Sky Shield III"



APPENDIX E: MILITARY FLIGHT ROUTES AND FLYING AREAS (continued)  
 SAC HIGH ALTITUDE SUPERSONIC TRAINING AND TEST ROUTES

I-91

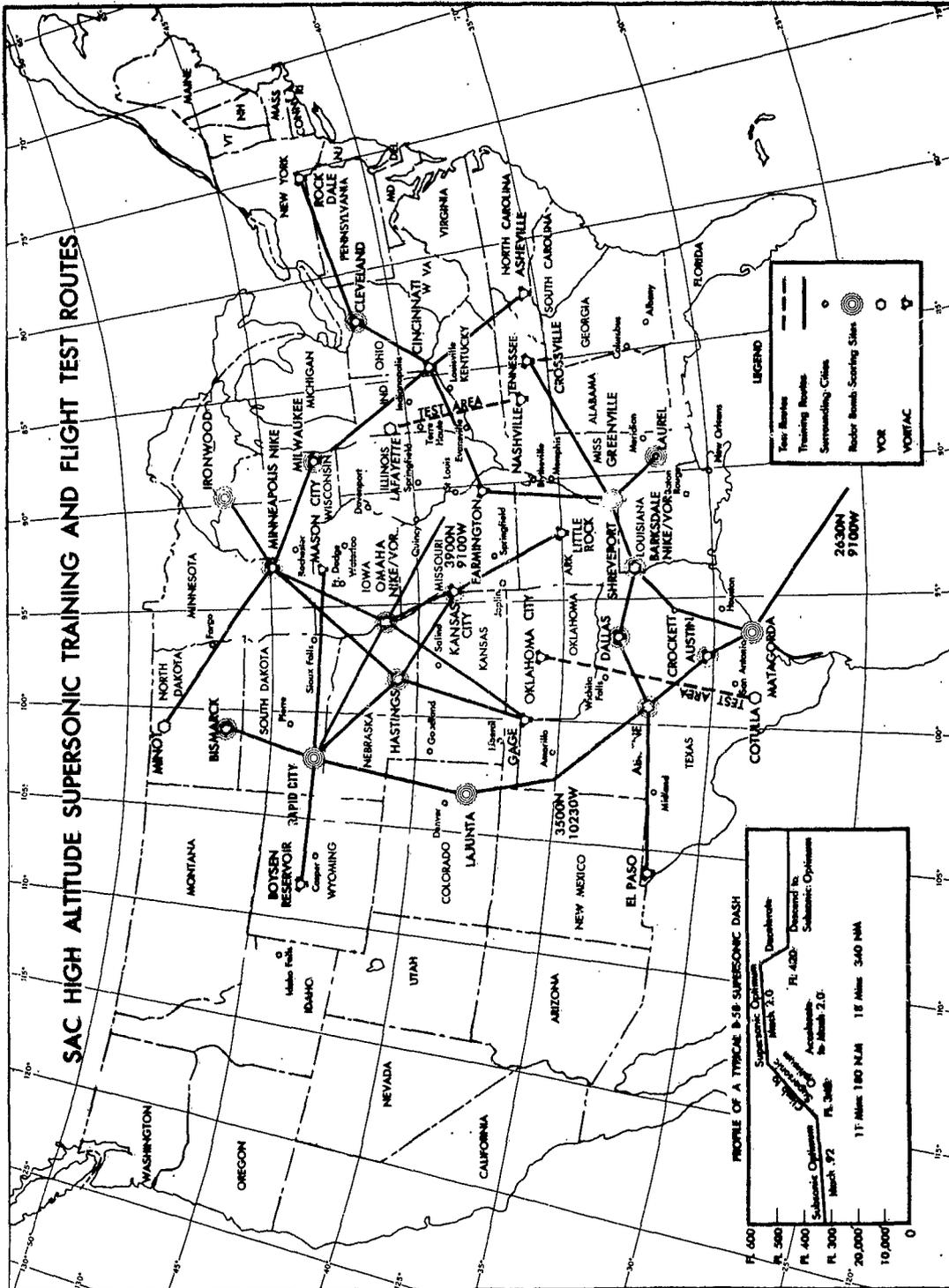


Figure 12 - SAC High Altitude Supersonic Training and Flight Test Routes



APPENDIX E: MILITARY FLIGHT ROUTES AND FLYING AREAS (continued)  
 I-90 USAF HIGH ALTITUDE REFUELING AREAS

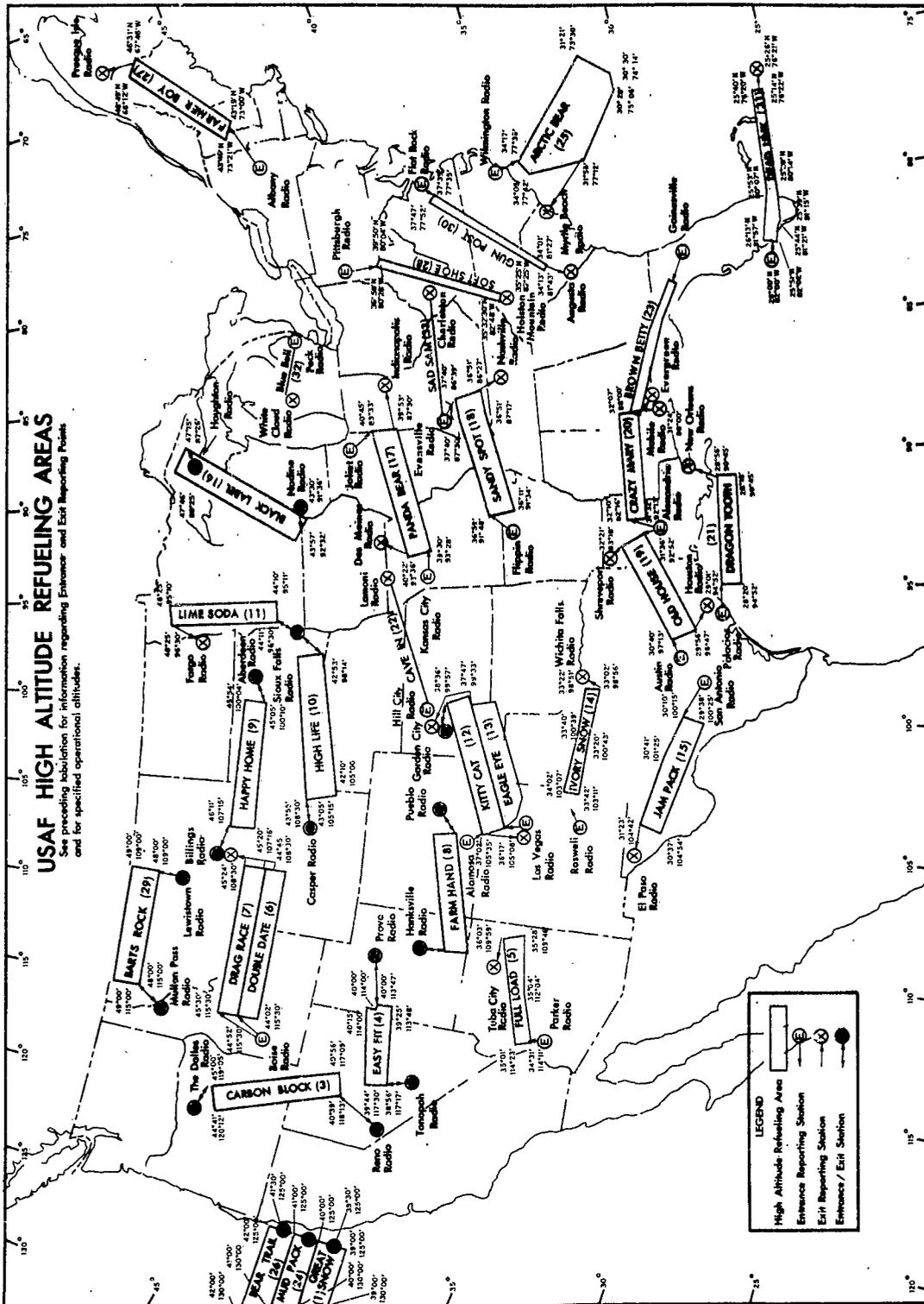


Figure 14 - USAF High Altitude Refueling Areas



Figure 15 - Student Training