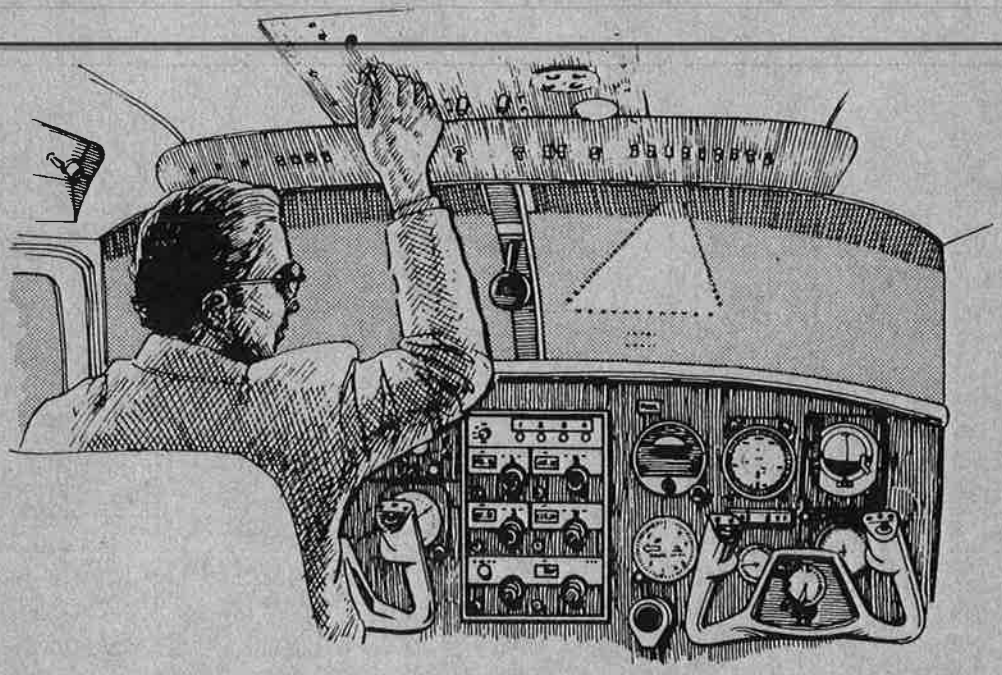
REPORT NO. FAA-MS-79-6

GENERAL AVIATION AVIONICS STATISTICS: 1976



NOVEMBER 1979

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION
OFFICE OF MANAGEMENT SYSTEMS
INFORMATION AND STATISTICS DIVISION

GENERAL AVIATION
AVIONICS STATISTICS: 1976

NOVEMBER, 1979

ANNUAL REPORT

PREPARED BY

RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
TRANSPORTATION SYSTEMS CENTER
TRANSPORTATION INFORMATION DIVISION
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PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
OFFICE OF MANAGEMENT SYSTEMS
WASHINGTON, D.C. 20591

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-MS-79-6		

4. Title and Subtitle	5. Report Date
GENERAL AVIATION AVIONICS STATISTICS: 1976	November, 1979
	6. Performing Organization Code: DTS/231
7. Author(s) Judith C. Schwenk, Task Manager, TSC, Paula Shafer, Wilson-Hill*	8. Performing Organization Report No.: DOT-TSC-FAA-79-28
9. Performing Organization Name and Address: U.S. Department of Transportation, Research and Special Programs Administration, Transportation Systems Center, Transportation Information Division, Cambridge, MA 01242	10. Work Unit No. (TRAIS): FA-943/R9116
	11. Contract or Grant No.: DOT-TSC-1750
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Office of Management Systems, Information and Statistics Division, Washington, D.C. 20591	13. Type of Report and Period Covered: ANNUAL REPORT CY1976
	14. Sponsoring Agency Code: AMS/230

15. Supplementary Notes

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Washington, D.C. 20005

16. Abstract

This report presents avionics statistics for the 1976 general aviation (GA) aircraft fleet and is the third in a series titled General Aviation Avionics Statistics. The statistics are presented in a capability group framework which enables one to relate airborne avionics equipment to the capability for a GA aircraft to function in the National Airspace System. The word "capability" is used in this report to mean in what segments of the airspace an aircraft can fly, under what conditions it can fly, and at what airports it can land. The framework permits the GA fleet to be divided into groups according to their capabilities as dictated by the avionics configurations of the aircraft. Differences in various characteristics of the aircraft are examined among the capability groups. The FAA's 1976 Aircraft Statistical Master File is the source of all the statistical data used in this report.

17. Key Words	18. Distribution Statement
Avionics, Capability Groups, General Aviation	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

PREFACE

This report describes the 1976 avionics data study performed by the Transportation Systems Center (TSC) and Wilson-Hill Associates, Inc., under Project Plan Agreement FA-943, sponsored by the Federal Aviation Administration (FAA), Office of Management Systems, Information and Statistics Division. It is the third in the series General Aviation Avionics Statistics, which TSC produced for the same sponsor and which contains the groundwork for future issues. TSC performed the previous studies as part of a continuing program to assure the quality and usefulness of general aviation data. The study is based on information collected by the FAA and processed by the TSC.

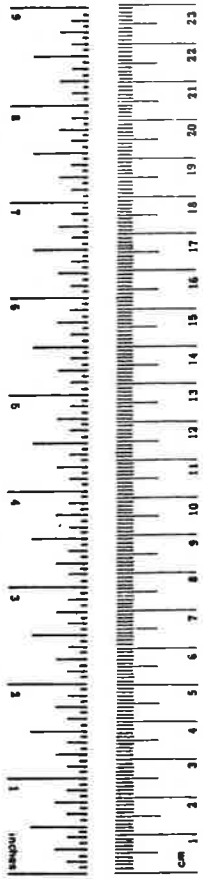
The authors would like to acknowledge the contributions to this report by several people: Carolyn Edwards of FAA-AMS-230, assisted and guided the project as sponsor; Robert Crosby of Kentron International, Inc., was responsible for manipulating the data and writing the computer programs to produce the tables appearing in this publication.

Distribution: ZMS-348C. FAS-1, FAT-0, FFS-1, 2, 3, 5, 7, 8, FIA-0 (1 copy only)

METRIC CONVERSION FACTORS

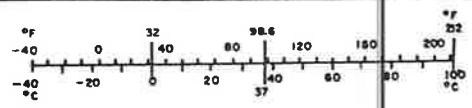
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

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



EXECUTIVE SUMMARY

This document is the third in the General Aviation Avionics Statistics report series, and presents avionics statistics and other descriptive information for the 1976 general aviation (GA) aircraft fleet. The report series results from a study which was designed first, to develop a framework for the GA fleet relating airborne avionics equipment to aircraft capability to perform in the National Airspace System (NAS), and second, within this framework to analyze the activity and other characteristics of the GA fleet.

The source of data for the study was the FAA's 1976 Aircraft Statistical Master (ASM) File, created by merging information from two primary sources: 1) GA aircraft owners' responses to the Aircraft Registration Eligibility, Identification and Activity Report, AC Form 8050-73, mailed annually to all U.S. civil aircraft owners, and 2) the Aircraft Registration File. In addition to air carrier records, the ASM File contained one record for each of the 203,332 validly registered GA aircraft as of December 31, 1976. However, because avionics information was not available for all GA aircraft, this report is based only on 128,827 GA aircraft, or 63.4 percent of the 1976 GA fleet.

In developing the framework for analyzing the capabilities of the GA fleet, the main assumption was that the avionics equipment contained in an aircraft determined the maximum capabilities of that aircraft to perform in the NAS. The word "capability" was used to mean where and under what conditions an aircraft could fly, at what airports it could land, and to what extent it could participate in various navigation, communication, and landing systems. Capability groups were defined, each group consisting of a combination of avionics equipment and the associated capabilities.

By assigning each GA aircraft to its appropriate capability groups according to its avionics configuration, and then studying the differences in characteristics among the groups, relationships between the level of avionics in an aircraft and other physical and operating characteristics could be drawn.

Some of the significant findings, based on the 128,827 GA aircraft for which avionics information was available, are listed below:

- While only about 13 percent of the GA fleet have the avionics equipment required to fly above 18,000 feet in positive controlled airspace, this number has grown nearly 80 percent since 1974.
- Almost 80 percent of the GA fleet can fly IFR.
- Over 16 percent of the GA fleet can land at Group I Terminal Control Areas (TCA's).
- At least 50 percent of the GA fleet have some degree of instrument landing system (ILS) receiving capability.
- From 1975 to 1976 there was a significant increase in the proportion of aircraft with avionics equipment enabling them to land at Group I TCA's and to fly in positive controlled airspace.
- As the level of avionics in an aircraft increases,
  - primary uses change from mostly personal to mostly business and executive,
  - the type of aircraft becomes more sophisticated,
  - the aircraft usage (number of hours flown) increases,
  - the age of the aircraft decreases.
- From 1976 to 1976 there was a ten percent increase in the proportion of aircraft with two-way communications.

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1. INTRODUCTION

1.1 DEFINITIONS

1.1.1 General Aviation (GA)

The term "general aviation" is defined for the purposes of this report as all aircraft in the U.S. civil air fleet except those operated under Federal Aviation Regulations (FAR) Parts 121 and 127. These two parts cover the operations of fixed wing aircraft and rotorcraft, respectively, that 1) have been issued a certificate of public convenience and necessity by the Civil Aeronautics Board authorizing the performance of scheduled air transportation over specified routes and a limited amount of non-scheduled operations, and 2) are used by large aircraft commercial operators. General aviation thus includes aircraft operated under FAR:

Part 91: General operating and flight rules.

Part 123: Certification and operations: air travel clubs using large airplanes.

Part 133: Rotorcraft external load operations.

Part 135: Air taxi operators and commercial operators of small aircraft.

Part 137: Agricultural aircraft operations.

General aviation offers such varied services as air taxi, air cargo, industrial, agricultural, business, personal, instructional, research, patrol, and sport flying. General aviation aircraft range in complexity from simple gliders and balloons to four engine turbojets.

1.1.2 Avionics

The term avionics, as used in this report, refers to the airborne electronic equipment used by aircraft to transmit and receive various forms of radio signals for purposes of navigation, communication, tracking and landing the aircraft. Some examples are the VHF communications equipment which transmits and receives voice communications via very high frequency radio waves, and the radar altimeter which determines the aircraft's altitude above the terrain by bouncing radio waves off the ground below.

1.2 BACKGROUND

The General Aviation Avionics Statistics report series began with a report on the 1974 GA fleet. The report revealed the findings of a study designed first, to develop a framework for the GA fleet relating airborne avionics equipment to aircraft capability to perform in the National Airspace System (NAS), and second, within this framework to analyze the activity and other characteristics of the GA fleet. The 1976 and 1975 reports are updates of the 1974 report and follow the 1974 format to facilitate year to year comparisons.

The usefulness of such reports is easily established when one considers GA's dominance of the civil air fleet, and the scarcity of reliable information on GA activities. In calendar year 1976 GA aircraft comprised almost 99 percent of the U.S. civil air fleet,[1] and accounted for over 84 percent of civilian operations at FAA towered airports.[2] However, in contrast to the air carriers which account for the remaining civilian aircraft and operations, GA has no requirement for reporting activity and avionics information to the Federal government. Therefore one's knowledge of GA is confined to what can be extracted from the limited data available, acquired mostly through voluntary surveys. Analyses of the data and resulting inferences provide much needed insight into the nature of the GA fleet.

1.3 SOURCE OF DATA

In January of every year from 1970 through 1977 the FAA mailed AC Form 8050-73 to all U.S. civil aircraft owners requesting information on the previous year's activities. The form was revised for the 1977 mailing to include modern avionics technology and is shown in Figure 1.

The FAA combined the information from Part 2 of the 8050-73 form with the records from the Aircraft Registration File to create the Aircraft Statistical Master (ASM) File. The 1976 ASM File contained one record for every U.S. civil aircraft validly registered on December 31, 1976, and was the source of data for this report. A record layout appears in Appendix A.

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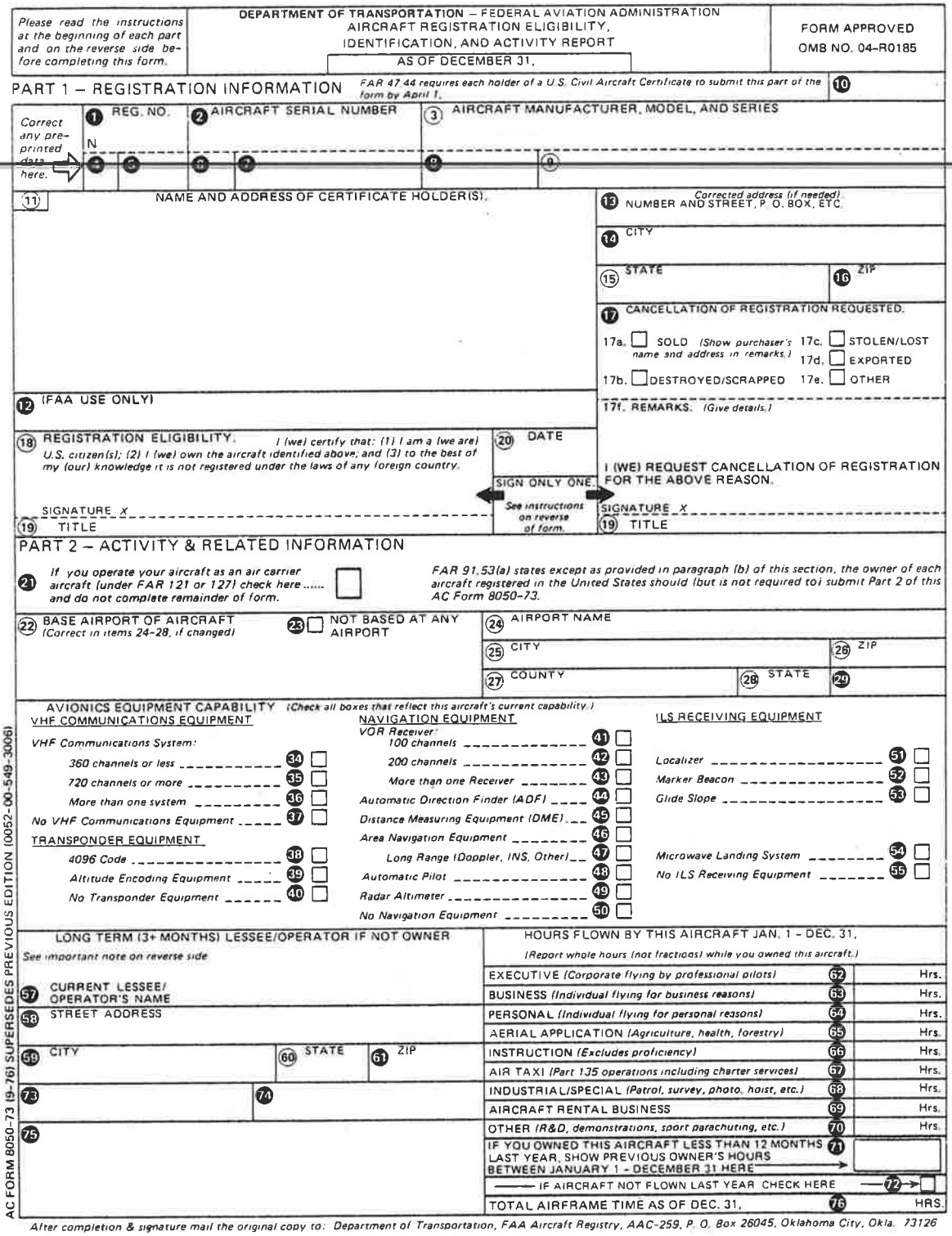
[1] Source: Census of U.S. Civil Aircraft Calendar Year 1976, U.S. Department of Transportation, Federal Aviation Administration (Washington DC, 1978), p. 4.

[2] This figure includes operations for both GA and air taxi. Source: FAA Aircraft Activity Calendar Year 1976, U.S. Department of Transportation, Federal Aviation Administration, (Washington DC, 1977), p. 2.



Please read the instructions at the beginning of each part and on the reverse side before completing this form.

DEPARTMENT OF TRANSPORTATION – FEDERAL AVIATION ADMINISTRATION
AIRCRAFT REGISTRATION ELIGIBILITY, IDENTIFICATION, AND ACTIVITY REPORT
AS OF DECEMBER 31,

FORM APPROVED
OMB NO. 04-R0185

PART 1 – REGISTRATION INFORMATION
FAR 47.44 requires each holder of a U.S. Civil Aircraft Certificate to submit this part of the form by April 1.

Correct any pre-printed data here.

1 REG. NO. N
2 AIRCRAFT SERIAL NUMBER
3 AIRCRAFT MANUFACTURER, MODEL, AND SERIES
4 5 6 7 8 9

11 NAME AND ADDRESS OF CERTIFICATE HOLDER(S).

13 Corrected address (if needed) NUMBER AND STREET, P. O. BOX, ETC.
14 CITY
15 STATE
16 ZIP

17 CANCELLATION OF REGISTRATION REQUESTED.
17a. ☐ SOLD (Show purchaser's name and address in remarks.)
17b. ☐ DESTROYED/SCRAPPED
17c. ☐ STOLEN/LOST
17d. ☐ EXPORTED
17e. ☐ OTHER

12 (FAA USE ONLY)

17f. REMARKS. (Give details.)

18 REGISTRATION ELIGIBILITY. I (we) certify that: (1) I am a (we are) U.S. citizen(s); (2) I (we) own the aircraft identified above; and (3) to the best of my (our) knowledge it is not registered under the laws of any foreign country.

20 DATE

SIGN ONLY ONE. See instructions on reverse of form.

I (WE) REQUEST CANCELLATION OF REGISTRATION FOR THE ABOVE REASON.

SIGNATURE X
19 TITLE

SIGNATURE X
19 TITLE

PART 2 – ACTIVITY & RELATED INFORMATION

21 If you operate your aircraft as an air carrier aircraft (under FAR 121 or 127) check here ..... ☐ and do not complete remainder of form.

FAR 91.53(a) states except as provided in paragraph (b) of this section, the owner of each aircraft registered in the United States should (but is not required to) submit Part 2 of this AC Form 8050-73.

22 BASE AIRPORT OF AIRCRAFT (Correct in items 24-28, if changed)
23 ☐ NOT BASED AT ANY AIRPORT
24 AIRPORT NAME
25 CITY
26 ZIP
27 COUNTY
28 STATE
29

AVIONICS EQUIPMENT CAPABILITY (Check all boxes that reflect this aircraft's current capability.)

VHF COMMUNICATIONS EQUIPMENT
VHF Communications System:
34 360 channels or less ☐
35 720 channels or more ☐
36 More than one system ☐
37 No VHF Communications Equipment ☐

TRANSPONDER EQUIPMENT
38 4096 Code ☐
39 Altitude Encoding Equipment ☐
40 No Transponder Equipment ☐

NAVIGATION EQUIPMENT
VOR Receiver:
41 100 channels ☐
42 200 channels ☐
43 More than one Receiver ☐
44 Automatic Direction Finder (ADF) ☐
45 Distance Measuring Equipment (DME) ☐
46 Area Navigation Equipment ☐
47 Long Range (Doppler, INS, Other) ☐
48 Automatic Pilot ☐
49 Radar Altimeter ☐
50 No Navigation Equipment ☐

ILS RECEIVING EQUIPMENT
51 Localizer ☐
52 Marker Beacon ☐
53 Glide Slope ☐
54 Microwave Landing System ☐
55 No ILS Receiving Equipment ☐

LONG TERM (3+ MONTHS) LESSEE/OPERATOR IF NOT OWNER
See important note on reverse side
57 CURRENT LESSEE/ OPERATOR'S NAME
58 STREET ADDRESS
59 CITY
60 STATE
61 ZIP
73
74
75

HOURS FLOWN BY THIS AIRCRAFT JAN. 1 – DEC. 31,
(Report whole hours (not fractions) while you owned this aircraft.)

EXECUTIVE (Corporate flying by professional pilots)	62	Hrs.
BUSINESS (Individual flying for business reasons)	63	Hrs.
PERSONAL (Individual flying for personal reasons)	64	Hrs.
AERIAL APPLICATION (Agriculture, health, forestry)	65	Hrs.
INSTRUCTION (Excludes proficiency)	66	Hrs.
AIR TAXI (Part 135 operations including charter services)	67	Hrs.
INDUSTRIAL/SPECIAL (Patrol, survey, photo, hoist, etc.)	68	Hrs.
AIRCRAFT RENTAL BUSINESS	69	Hrs.
OTHER (R&D, demonstrations, sport parachuting, etc.)	70	Hrs.
IF YOU OWNED THIS AIRCRAFT LESS THAN 12 MONTHS LAST YEAR, SHOW PREVIOUS OWNER'S HOURS BETWEEN JANUARY 1 - DECEMBER 31 HERE →	71	
—— IF AIRCRAFT NOT FLOWN LAST YEAR CHECK HERE ——	72 → ☐	
TOTAL AIRFRAME TIME AS OF DEC. 31,	76	HRS.

After completion & signature mail the original copy to: Department of Transportation, FAA Aircraft Registry, AAC-259, P. O. Box 26045, Oklahoma City, Okla. 73126

AC FORM 8050-73 (9-76) SUPERSEDES PREVIOUS EDITION (0052-00-549-3006)

FIGURE 1. AIRCRAFT REGISTRATION ELIGIBILITY, IDENTIFICATION, AND ACTIVITY REPORT FORM

NOTE: Entries made on the original will appear on the second copy without using carbon paper. The second copy of this form should be retained by the aircraft owner as evidence of submission. Shaded areas are for FAA use only.

INSTRUCTIONS FOR COMPLETING AND SIGNING THE FORM ON THE REVERSE.

For your convenience this form has been preprinted with all available information in FAA records as of December 31. Where the preprinted information is correct, no entry is needed. Where the information is incorrect or out-of-date insert the correct information in the space provided. Where no information is preprinted please enter the information requested in the space provided.

Part 1. The purpose of Part 1 is to maintain the Civil Aircraft Registry. It is used to verify continued eligibility for aircraft registration. Refusal or failure to submit this part may be cause for suspension or revocation of the holder's Certificate of Aircraft Registration and loss of the aircraft registration number.

Part 2. The purpose of Part 2 is to gather general aviation aircraft fleet statistical information. It will be used to develop statistics for FAA publications and analytical studies. Individual aircraft information is available on magnetic tape at cost. There is no penalty for failure to complete this part of the form.

GUIDELINES FOR COMPLETING SIGNATURE BLOCKS 17 AND 18.

1. If this aircraft is still eligible for registration, and you wish to continue its registration, sign Block 18 and enter the date in Block 20. Follow the guidelines for signature below.
2. If the aircraft is now ineligible for registration in your name or you wish to cancel its registration for other reasons, complete and sign Block 17 and enter the date in Block 20, following the guidelines for signature below.

GUIDELINES FOR SIGNATURE

1. INDIVIDUAL OWNER. An individual owner whose name appears in Block 11 must sign his name.
2. PARTNERSHIP. Any general partner may sign for the partnership but must show his title "partner."
3. CORPORATIONS. Any corporate officer or person holding a managerial position with the corporation may sign for the corporation. He must also indicate the title of his office below his signature.
4. CO-OWNER. Unless cancellation of registration is requested, any co-owner may sign certifying citizenship and ownership for all co-owners. If cancellation is requested, the signature of each co-owner must appear on this form or on an attached sheet.
5. GOVERNMENT. Any authorized person may sign showing his title.

IMPORTANT NOTE – AIRWORTHINESS DIRECTIVES may not be received by the aircraft lessee/operator, unless blocks 57 through 61 are completed by the registered owner, as requested.

After you complete and sign the form send the original (first copy) to:

DEPARTMENT OF TRANSPORTATION
FAA AIRCRAFT REGISTRY AAC-259
P.O. BOX 26045
OKLAHOMA CITY, OKLAHOMA 73126

THIS IS AN ANNUAL REPORTING FORM ONLY AND IS NOT TO BE SUBMITTED WITH OTHER AIRCRAFT REGISTRATION DOCUMENTS OR MONEY.

FIGURE 1. AIRCRAFT REGISTRATION ELIGIBILITY, IDENTIFICATION, AND ACTIVITY REPORT FORM (CONTINUED)

2. DEVELOPMENT AND METHODOLOGY

2.1 FLEET SIZE AND REPORT COVERAGE

The 1976 GA aircraft fleet, as represented by the 1976 ASM File, contained 203,332 registered aircraft as of December 31, 1976. The response rate to Part 2 of the 8050-73 form was 63.4 percent or 128,827 aircraft (see Figure 2). Avionics information from prior years could not be incorporated into the 1976 data due to the revised AC Form 8050-73, thus the data represents only 1976 respondents.

The tables appearing in this report are all based on the 128,827 GA aircraft for which avionics information was available. Therefore the absolute aircraft counts do not represent the entire GA fleet. Further, because the responses are not the result of any scientific sampling design, the potential for bias exists in the relative capability group sizes and in the distributions of aircraft across the various classifications. In a non-respondent follow-up to a sample survey conducted by Price Waterhouse & Company, results indicated that non-respondents usually fly fewer hours than responding GA aircraft.[1] The same results were noted in a FAA non-respondent follow-up to the 1977 General Aviation Activity and Avionics Survey. Hence the reader should note that the distribution of aircraft across hours flown shown in this report most likely has an upward bias. A more extensive follow-up study would be required to determine the extent of this and other possible biases.

Aircraft statistics found in this report agree generally with those appearing in other FAA sources. Some FAA publications, such as the Census of U.S. Civil Aircraft 1976, are based on the entire GA fleet size of 203,332. This report, as mentioned earlier, deals with only the 63.4 percent of the GA aircraft for which avionics information is available. Other FAA publications, such as General Aviation: Aircraft, Owner and Utilization Characteristics, are based on those fractions of the GA fleet selected to participate in sample surveys. Sample survey results are estimates with bounded errors rather than true population values, introducing another cause for differences in figures between this report and reports based on samples: sampling error. However, results of this report fall within the intervals of estimates found in General Aviation.

[1] Design of an On-Going Statistical Sampling Survey to Collect and Estimate General Aviation Aircraft Activity Measures, Price Waterhouse and Co., (Washington, DC, 1976), Exhibit 3.

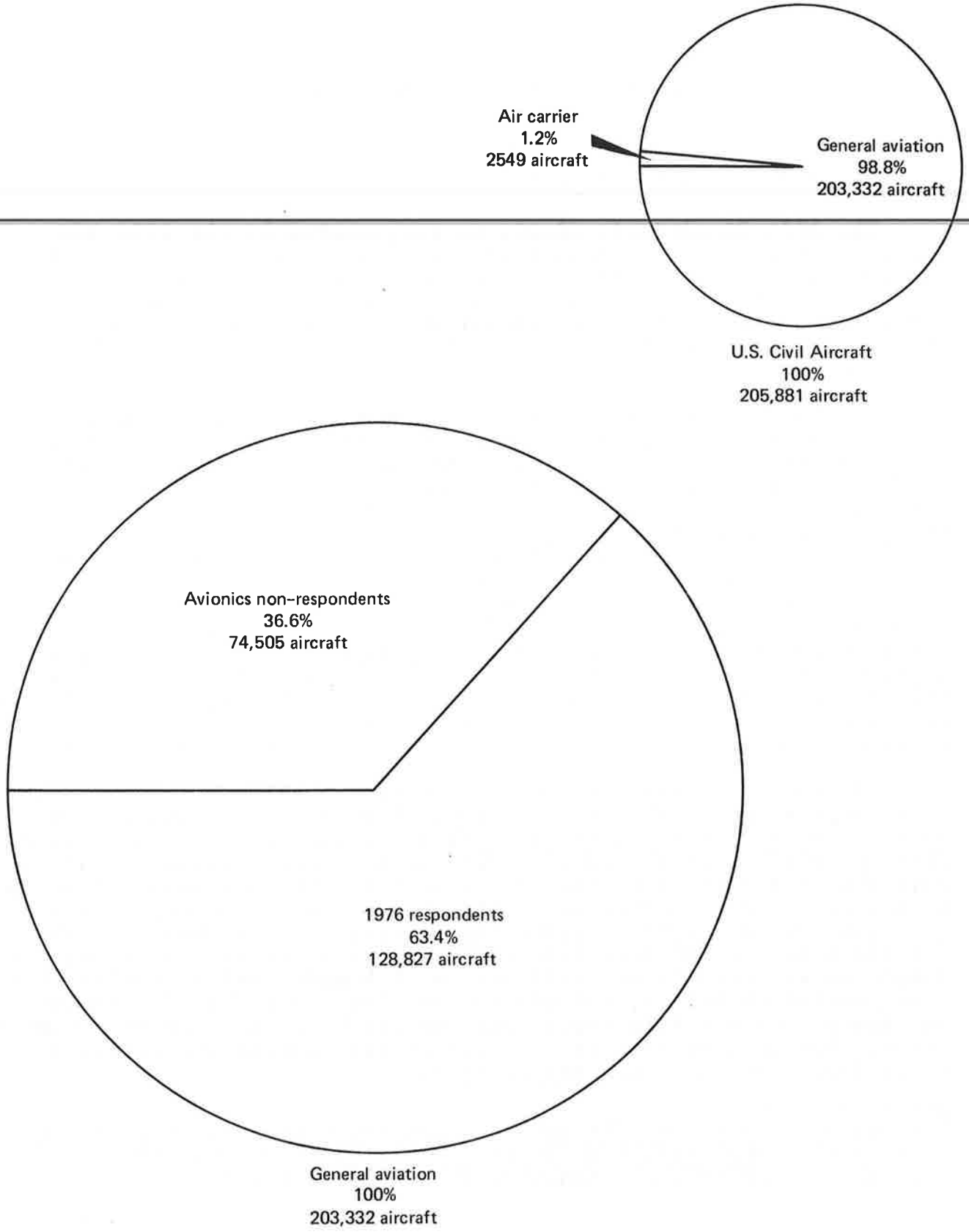


Figure 2. Composition of the U.S. Civil Air Fleet (As of December 31, 1976)

2.2 PROFILE OF GA AVIONICS

Table 1 summarizes the basic avionics data provided by the 1976 ASM File for the analysis of the 1976 GA fleet. It shows the number of aircraft containing each piece of avionics equipment listed on the 8050-73 form. The usefulness of Table 1 is limited because it does not provide the means to determine the number of aircraft containing important groups of equipment, but deals solely with individual types of equipment. For example, one cannot determine the number of aircraft with all three components of an instrument landing system (ILS): localizer, glide slope, and marker beacon receivers. Thus the capability groups, discussed below, were developed to make the study of groups of avionics equipment possible.

2.3 AVIONICS CAPABILITY GROUPS

2.3.1 Function of Capability Groups

Avionics capability groups (CG's) are the means through which significant groups of avionics equipment are associated with aircraft capability to perform in the NAS. The word "capability" takes on a number of meanings in conjunction with the NAS. It can refer to where an aircraft can fly, at what airports it can land, under what flying conditions it can fly, or to what extent it can participate in the air route, landing, and communications systems. Avionics equipment is installed in an aircraft because of the capabilities gained from it; consequently, one should be able to identify an aircraft's general potential capabilities from knowledge of its avionics equipment configuration. Often several pieces of equipment are required to obtain a certain capability in the NAS; it thus becomes necessary to study groups of avionics, rather than individual pieces. The CG definitions are designed to provide the link between groups of avionics equipment and capabilities. In addition, the CG's provide a framework within which other aspects of the GA fleet can be examined.

2.3.2 Assumptions

Several assumptions must be made in order to simplify the process of designing the groups and to minimize the number of groups needed. First, it is assumed that an aircraft's avionics equipment defines its capability to perform in the NAS. In actuality, an aircraft's engine size and power, pilot's certification, lack of cabin pressurization, or lack of other types of required equipment may prevent the aircraft from performing at its highest capability level according to its avionics configuration. Second, the capability groups are based on regulations and equipment requirements for the majority of general aviation aircraft. There may be exceptions to the avionics needed for certain capabilities depending on the use of the aircraft, the model of the aircraft, and the pilot's skill at maximizing the capabilities that his avionics equipment gives him. Third, it is assumed that

TABLE 1. BASIC AVIONICS DATA FOR 1976 GA FLEET*

VHF Communications Equipment	No. of Aircraft
360 channels or less	85,156
720 channels or more	28,941
2 systems or more	53,958
None	13,306
Transponder Equipment	
4096 code	69,170
Altitude encoding	22,278
None	39,287
Navigation Equipment	
100 channels VOR receiver	55,987
200 channels VOR receiver	50,117
More than 1 VOR receiver	60,028
Automatic direction finder (ADF)	59,917
Distance measuring equipment (DME)	28,502
Area navigation equipment (RNAV)	5,492
Long range RNAV	887
Automatic pilot	33,717
Radar altimeter	5,545
None	18,450
Instrument Landing System	
Localizer	64,630
Marker beacon	57,080
Glide slope	42,048
Microwave landing system	229
None	33,938

*Based on 128,827 aircraft for which avionics information was available.

area navigation (RNAV) equipment[1] on GA aircraft is comprised of VOR/DME-based course line computers rather than inertial or Doppler systems since as of January 1, 1975, fewer than 0.5 percent of GA aircraft contained the self-contained type of RNAV equipment.[2] Thus, RNAV equipment is considered to comply with FAA requirements for both VOR equipment and distance measuring equipment (DME).

2.3.3 Methodology

Two classifications of capability groups evolved: the first type consisted of avionics equipment meeting FAA requirements for use of the various aspects of the NAS; the second type was avionics equipment which gave an aircraft additional capability, but which was not required equipment according to FAA regulations. These two types of equipment necessitated the formation of two types of CG's.

To form the first type of CG, three sets of avionics requirements were obtained: one for flight in different segments of the airspace, another for flight in different flying conditions, and the third for landing at different airports. The three sets of requirements were combined into one set of avionics requirements dealing with the above three aspects of the NAS simultaneously. These combined requirements formed the basis for the first type of capability group. They were augmented by miscellaneous requirements for helicopters, air taxis, and gliders.

The formation of the second type of CG was a simpler task. It involved grouping component pieces of avionics equipment which together would form a complete avionics system for enabling an aircraft to make full use of a landing, communications, or navigation system in the NAS. However, except for the instrument landing system (ILS), it was found that an aircraft can gain full use of a system in the NAS by installing only one piece of airborne avionics equipment. Consequently, the second type of CG consists mainly of "groups" containing one piece of equipment each.

2.3.4 Definition of Capability Groups

Definitions of the two types of CG's mentioned above, known as hierarchical and non-hierarchical CG's respectively, are given below in terms of the avionics equipment found in AC Form 8050-73. A glossary at the end of this report explains the numerous terms relating to avionics equipment and the NAS found in the definitions below. Appendix B shows the various segments of the airspace and the regulations pertaining to the airspace, airports, and flying conditions.

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[1] See the Glossary for definitions of area navigation equipment and other technical terms.

[2] Avionics Installation Navigation and Communication Report, FAA/AEM.

2.3.4.1 Hierarchical CG's

The FAA has established airborne avionics equipment requirements for aircraft use of the various segments of the NAS. In this regulatory sense, an aircraft's avionics equipment determines its capabilities to perform in areas of the NAS. FAA regulations deal with three basic capabilities: (1) to fly in different segments of the airspace, (2) to fly in visual flight rules (VFR) and instrument flight rules (IFR) flying conditions, and (3) to land at different classes of airports. In the formation of CG's of avionics equipment which relate to these three capabilities, the groups take on a hierarchical nature, that is, there is an order to the groups. In general, the avionics equipment and the associated capabilities for one capability group are a subset of the avionics equipment and the associated capabilities for the next higher group.

These groups have the additional properties that they are mutually exclusive and exhaustive. When assigning individual aircraft to CG's, mutual exclusiveness means that an aircraft can be assigned to only one group. Exhaustiveness means that every aircraft will fall into a group.

Table 2 describes the hierarchical CG's in terms of avionics equipment and capabilities. The capabilities described represent the highest level at which an aircraft has avionics potential to participate in the NAS. Generally, an aircraft can also participate at all lower levels. Each group of equipment below is described in terms of (1) airspace capability, (2) flying condition capability, and (3) airport capability. Exceptions to airport and airspace capabilities are noted for helicopter and glider operations, respectively.

Figure 3 is a schematic diagram of the hierarchical capability groups, which summarizes the relationship of three types of aircraft capabilities to their required avionics equipment, namely flying conditions, airspace, and airport capabilities. In the diagram, the capabilities increase from top to bottom. To determine the capability associated with a particular avionics box, simply position the box relative to the lines of the capability of interest.

2.3.4.2 Non-Hierarchical CG's

Many kinds of avionics equipment exist which give an aircraft additional capabilities to the three types discussed in the previous section. Whereas the latter capabilities are derived from regulatory considerations, those to be discussed in this section are based on engineering and safety considerations. The avionics CG's of this section have none of the properties of the

TABLE 2. HIERARCHICAL CAPABILITY GROUPS

AVIONICS		CAPABILITIES
Group 1 No regulatory avionics	(1)	Up to and including 12,500 feet mean sea level (MSL) Gliders...Up to and including 18,000 feet MSL ADF...Colored airways below 12,500 feet MSL VOR or RNAV...VOR airways below 12,500 feet MSL RNAV...Low altitude RNAV airways below 12,500 feet MSL
	(2)	VFR flight, day and night
	(3)	Uncontrolled airports
Group 2 Two-way communications	(1)	Up to and including 12,500 feet MSL Gliders...Up to and including 18,000 feet MSL
	(2)	VFR flight, day and night
	(3)	Non-TCA controlled airports Group III TCA's Helicopters with 4096 code transponders...Group II TCA's All helicopters...Group I and II TCA's below 1000 feet above ground level (AGL)
	Note:	Air taxis with navigation system and transponder: Group II TCA's Air taxis with navigation system, transponder and altitude reporting: Group I TCA's and non-positive controlled airspace Air taxis with navigation system, DME, transponder and altitude reporting: Group I TCA's and positive controlled airspace.

TABLE 2. HIERARCHICAL CAPABILITY GROUPS (CONTINUED)

AVIONICS		CAPABILITIES
Group 3 Two-way communications Two systems---air taxis VOR or Automatic Direction Finder (ADF) or RNAV	(1)	Up to and including 12,500 feet MSL Gliders...Up to and including 18,000 feet MSL ADF...Colored airways below 12,500 feet MSL VOR or RNAV...VOR airways below 12,500 feet MSL RNAV...Low altitude RNAV airways below 12,500 feet MSL
	(2)	IFR flight
	(3)	Non-TCA controlled airways Group III TCA's Helicopters with 4096 code transponders...Group II TCA's All helicopters...Group I and II TCA's below 1000 feet AGL
Group 4 Two-way communications Two systems---air taxis 4096 code transponder VOR or RNAV	(1)	Up to and including 12,500 feet MSL Gliders...Up to and including 18,000 feet MSL VOR airways below 12,500 feet MSL RNAV...Low altitutde RNAV airways below 12,500 feet MSL
	(2)	IFR flight
	(3)	Non-TCA controlled airports Group II TCA's Helicopters...Group I TCA's below 1000 feet AGL
Group 5 4096 code transponder Altitude encoding equipment	(1)	Non-positive controlled airspace
	(2)	VFR flight, day and night

TABLE 2. HIERARCHICAL CAPABILITY GROUPS (CONTINUED)

AVIONICS	CAPABILITIES
	(3) Uncontrolled airports Group III TCA's
Group 6 Two-way communications 4096 code transponder Altitude encoding equipment	(1) Non-positive controlled airspace
	(2) VFR flight, day and night
	(3) Non-TCA controlled airports Group III TCA's Helicopters...Group I TCA's
Group 7 Two-way communications Two systems---air taxis 4096 code transponder Altitude encoding equipment VOR	(1) Non-positive controlled airspace VOR airways
	(2) IFR flight
	(3) Group I TCA's
Group 8 Two-way communications Two systems---air taxis 4096 code transponder Altitude encoding equipment VOR, DME } or RNAV	(1) Positive controlled airspace Jet routes RNAV...RNAV routes
	(2) IFR flight
	(3) Group I TCA's

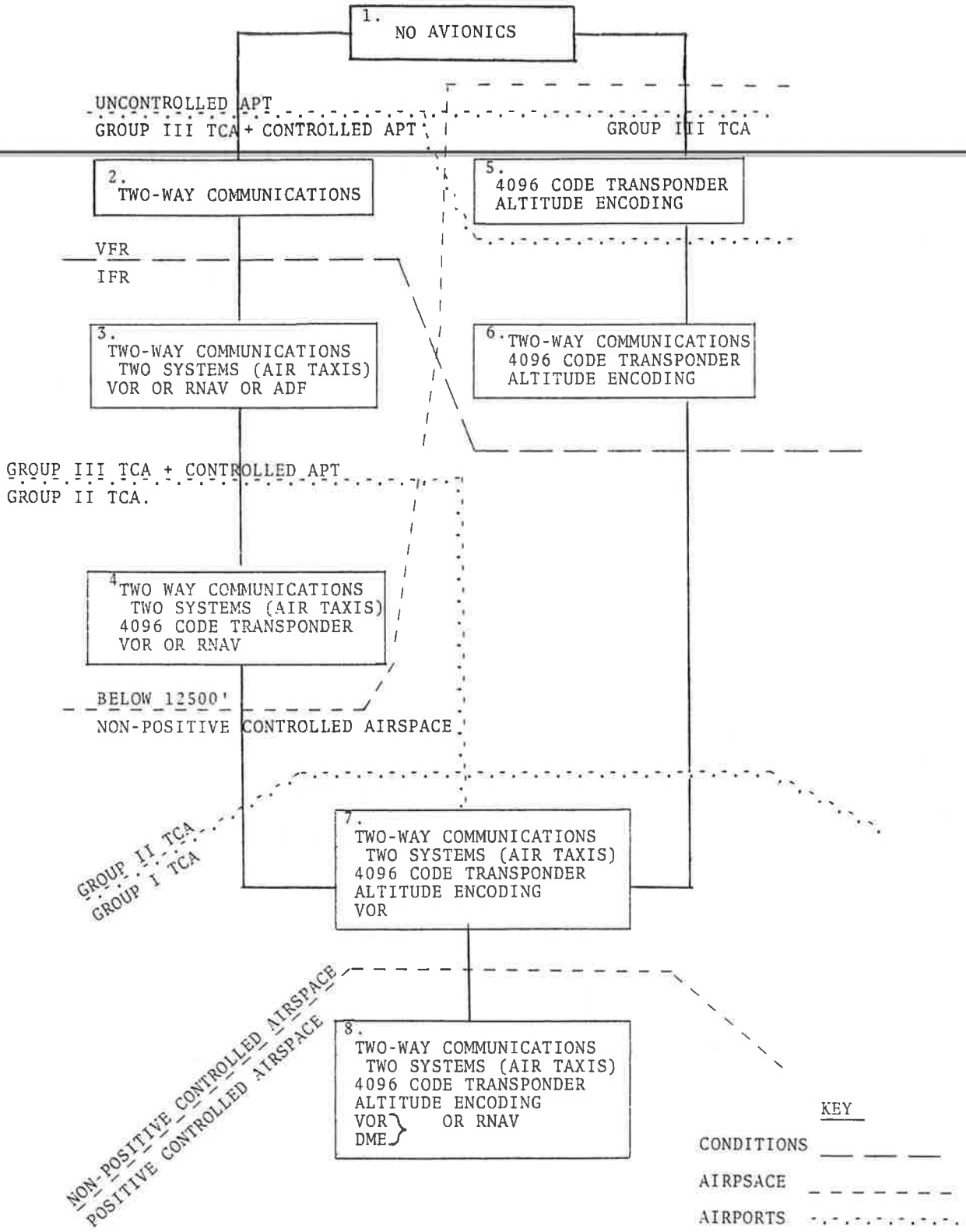


FIGURE 3. HIERARCHICAL CAPABILITY GROUPS (CG'S)

previous groups. That is, they are not hierarchical in nature, nor are they mutually exclusive and exhaustive. The CG's are described in Table 3 in terms of the avionics equipment and associated capabilities.

TABLE 3. NON-HIERARCHICAL CAPABILITY GROUPS

AVIONICS	CAPABILITIES
Group 1 Localizer	Partial use of airport ILS.
Group 2 Localizer Marker Beacon	Partial use of airport ILS.
Group 3 Localizer Marker Beacon Glide Slope	Full use of airport ILS.
Group 4 ILS Radar Altimeter	Landing approach in Category III [1] weather conditions at airports with Category III equipment.
Group 5 Long Range RNAV	Area navigation over long distances and large bodies of water.
Group 6 Radar Altimeter	Determination of altitude above level of terrain.
Group 7 Microwave Landing System (MLS)	More accurate and flexible landing approaches especially at airports with mountains and large buildings nearby.
Group 8 ILS Microwave Landing System (MLS)	Backup landing systems.
Group 9 Long Range RNAV Microwave Landing System (MLS)	Sophisticated navigational and landing capabilities.

[1] See Appendix B, "Weather Category Definitions"

2.4 DESCRIPTION OF AIRCRAFT CHARACTERISTICS

Nine aircraft characteristics were available on the 1976 ASM File for analysis in the framework of the newly developed CG's. They are listed below with appropriate comment.

a. Primary use of aircraft during 1976.

b. Base airport region: See Figure 4 for an FAA regional map.

c. Hours flown during 1976: This variable was discretized into 50-hour intervals for easier reporting.

d. Age of aircraft in 1976: This variable was discretized into 5-year intervals for easier reporting.

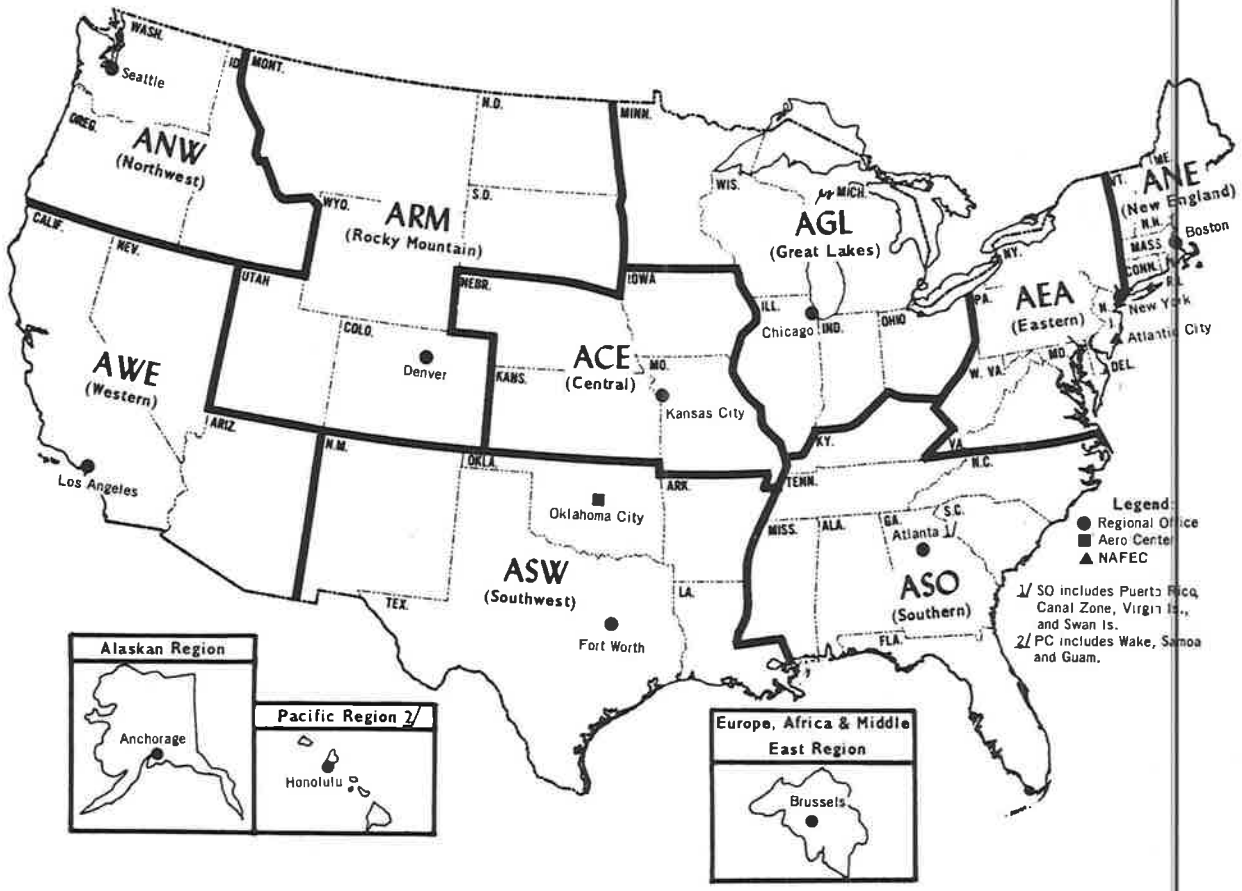
e. Computed aircraft type: The 13 computed aircraft types listed in Table 4 combine the four aircraft characteristics of engine type, number of engines, aircraft type (simple), and number of seats into meaningful combinations for the GA fleet.

f. Aircraft type (simple).

g. Engine type.

h. Number of engines.

i. Number of seats.



FAA Air Traffic Activity Calendar Year 1976, (March 1976), p. 10.

FIGURE 4. FEDERAL AVIATION ADMINISTRATION REGIONAL MAP AS OF JUNE 30, 1976

TABLE 4. COMPUTED AIRCRAFT TYPES

TYPE	DESCRIPTION
1.	Fixed wing single engine piston 1-3 seats
2.	Fixed wing single engine piston 4+ seats
3.	Fixed wing two engine piston 1-6 seats
4.	Fixed wing two engine piston 7+ seats
5.	Fixed wing piston other
6.	Fixed wing two engine turboprop 1-12 seats
7.	Fixed wing two engine turboprop 13+ seats
8.	Fixed wing turboprop other
9.	Fixed wing two engine turbojet
10.	Fixed wing turbojet other
11.	Rotorcraft piston
12.	Rotorcraft turbine
13.	Other aircraft

3, RESULTS

3.1 NON-HIERARCHICAL VERSUS HIERARCHICAL CAPABILITY GROUPS (CG's)

Table 5 presents the distribution of the 128,827 reporting GA aircraft among the hierarchical and non-hierarchical CG's. Hierarchical CG's vary across the columns and non-hierarchical CG's vary across the rows, each beginning with the least sophisticated CG in the upper left hand corner of the table. Entries in the table are aircraft counts, percent of the row or hierarchical capability that count represents, and percent of column or non-hierarchical capability that count represents.

Examination of Table 5 reveals the following observations on the reporting GA fleet.

3.1.1 Hierarchical CG's

a. About 13 percent of these aircraft have the avionics equipment enabling them to fly above 18,000 feet in positive controlled airspace. Approximately 83 percent of the reporting GA fleet cannot fly above 12,500 feet due to avionics limitations alone.

b. As in 1974 and 1975 almost 80 percent of these aircraft are equipped to fly IFR.

c. 13 percent of the reporting GA fleet are limited to landing at uncontrolled airports. Approximately 35 percent can land at either uncontrolled airports or Group III TCA's. Approximately 35 percent can land at any type of airport except a Group I TCA. Only about 17 percent can land at Group I TCA's.

d. Hierarchical CG's 5 and 6 together contain only 0.5 percent of the reporting GA fleet. Examination of the avionics equipment associated with these groups reveals that both include transponder equipment, but neither includes navigation equipment. One includes two-way communications. This suggests that the reason for the small number of aircraft in these groups and the comparatively large number in the remaining groups is that the most common path of acquisition of avionics equipment proceeds from communications to navigation to transponder equipment.

A comparison of hierarchical CG's from 1974, 1975, and 1976 reveals that significant changes occurred in two of the basic capabilities: airspace and airport. Growth occurred in the capability of flying above 18,000 feet (CG 8) in positive controlled airspace

and the capability of landing at Group I TCA's (CG's 7 and 8). This indicates a general increase in avionics sophistication over the three year period. Figures 5, 6, 7, and 8 illustrate the changes which occurred in these two basic capabilities.

Figures 5 and 7 present the percentages of the fleet within the subdivisions of the airspace and airport capabilities, respectively. Those subdivisions requiring more sophisticated avionics increased while those requiring less sophistication decreased.

Figures 6 and 8 present normalized[1] growth of the capabilities from 1974 to 1976 relative to growth of the fleet as a whole. Normalization allows one to observe clearly changes in group sizes which are significant in relation to changes in the overall fleet. Figure 6 shows that the proportion of the fleet capable of flying above 18,000 feet grew much more rapidly than the fleet. In contrast growth of planes flying below 12,500 feet (CG's 1-4) lagged behind growth of the fleet as a whole. Figure 8 shows that growth in the proportion of the fleet capable of landing at Group I TCA's was much larger than overall fleet growth.

In general Table 5 indicates that those aircraft in the least sophisticated non-hierarchical CG's also comprise the bulk of the least sophisticated hierarchical CG's. Of the aircraft possessing none of the non-hierarchical CG equipment (i.e., NO GROUP), 81 percent fall into hierarchical CG's 1, 2, and 3. Similarly, those aircraft in the most sophisticated non-hierarchical CG's are also in the most sophisticated hierarchical CG's. For example, 87 percent of the aircraft possessing a complete ILS and a radar altimeter fall into hierarchical CG 8.

Figures 9 and 10 illustrate the changes which occurred to the hierarchical CG's from 1974 to 1976. Figure 9 provides a comparison of the major hierarchical CG percentages over the three year period and also enables one to gauge the group sizes relative to each other. It is evident that groups 3 and 4 comprise more than half the reporting GA fleet, but that groups 7 and 8 are gaining in importance.

Figure 10 presents the normalized growth of the CG's relative to the growth of the fleet as a whole from 1974 to 1975, and from 1975 to 1976. A study of Figure 10 reveals that CG's 2, 4, 7, and 8 grew faster than the overall fleet. The excessive growth

[1] Each group is normalized by the following formula: [percent aircraft in 1976) - (percent aircraft in 1974)] (percent aircraft in 1974)

exhibited by CG 2 is somewhat artificial due in large part to a shift of air taxi aircraft from high order CG's to CG 2. The shift resulted from the addition in 1976 of the two communications systems question to the avionics questions. Air taxis must have two systems to fly IFR. In 1974 and 1975, it was not possible to determinc if aircraft had two systems, so air taxis were treated like non-air taxi aircraft. In 1976, however, air taxis without two systems were identified and shifted to their proper VFR CG. Not shown in Figures 9 and 10 is CG 6 which comprised only 0.4% of the GA fleet in 1976. This represented a normalized growth of over 1,000% from 1975. All of these CG's have one commonality: two-way communications. Therefore one may conclude that GA owners are acquiring such systems in much greater numbers than in the past. Growth in CG's 7 and 8 also indicates a general trend toward greater sophistication in avionics.

3.1.2 Non-Hierarchical CG's

Because the non-hierarchical capability groups were revised in 1976, comparison with previous years can be done only for the groups L; L,MB; and L, MB, GS. Figures 11 and 12 illustrate the changes from 1974 to 1976 in these three CG's. A study of these figures indicates the same trend toward sophistication in avionics noted in the hierarchical CG's, indicating the willingness of GA aircraft owners to invest in sophisticated avionics equipment.

TABLE 5. NON-HIERARCHICAL VS. HIERARCHICAL CAPABILITY GROUPS

1976

	1	2	3	4	5	6	7	8	TOTALS
L	89	394	5593	5240	9	43	297	112	11777
ROW %	0.8	3.3	47.5	44.5	0.1	0.4	2.5	1.0	100.0
COLUMN %	0.5	4.7	15.4	11.7	9.2	8.1	6.6	0.7	9.1
L,MB	53	135	1701	8965	4	12	705	443	12018
ROW %	0.4	1.1	14.2	74.6	0.0	0.1	5.9	3.7	100.0
COLUMN %	0.3	1.6	4.7	20.0	4.1	2.3	15.6	2.6	9.3
L,MB,GS	123	274	1289	18936	52	305	2865	11780	35624
ROW %	0.3	0.8	3.6	53.2	0.1	0.9	8.0	33.1	100.0
COLUMN %	0.7	3.2	3.6	42.2	53.1	57.8	63.5	68.6	27.7
L,MB,GS,RA	9	8	46	459	9	38	112	4583	5264
ROW %	0.2	0.2	0.9	8.7	0.2	0.7	2.1	87.1	100.0
COLUMN %	0.1	0.1	0.1	1.0	9.2	7.2	2.5	26.7	4.1
LRN	4	12	164	86	1	22	37	564	890
ROW %	0.4	1.3	18.4	9.7	0.1	2.5	4.2	63.4	100.0
COLUMN %	0.0	0.1	0.5	0.2	1.0	4.2	0.8	3.3	0.7
RA	31	37	79	526	15	60	149	4658	5555
ROW %	0.6	0.7	1.4	9.5	0.3	1.1	2.7	83.9	100.0
COLUMN %	0.2	0.4	0.2	1.2	15.3	11.4	3.3	27.1	4.3
ML	4	0	36	53	0	9	7	121	230
ROW %	1.7	0.0	15.7	23.0	0.0	3.9	3.0	52.6	100.0
COLUMN %	0.0	0.0	0.1	0.1	0.0	1.7	0.2	0.7	0.2
L,MB,GS,ML	1	0	33	43	0	8	5	118	208
ROW %	0.5	0.0	15.9	20.7	0.0	3.8	2.4	56.7	100.0
COLUMN %	0.0	0.0	0.1	0.1	0.0	1.5	0.1	0.7	0.2
LRN,ML	0	0	33	2	0	7	1	11	54
ROW %	0.0	0.0	61.1	3.7	0.0	13.0	1.9	20.4	100.0
COLUMN %	0.0	0.0	0.1	0.0	0.0	1.3	0.0	0.1	0.0
NO GROUP	16573	7620	27612	11264	20	106	505	225	63925
ROW %	25.9	11.9	43.2	17.6	0.0	0.2	0.8	0.4	100.0
COLUMN %	98.2	90.1	76.1	25.1	20.4	20.1	11.2	1.3	49.6
ALL CRAFT	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NUMBER OF PLANES NOT REPORTING AVIONICS INSTRUMENTATION: 74505

TABLE 5. NON-HIERARCHICAL VS. HIERARCHICAL CAPABILITY GROUPS (CONTINUED)

KEY

Hierarchical Capability Groups

1. No regulatory avionics[1]
2. Two-way communications
3. Two-way communications
   Two systems - air taxis
   VOR or ADF or RNAV
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equipment
   VOR
8. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equipment
   VOR, DME } or RNAV

Non-hierarchical Capability Groups[2]

L: Localizer
MB: Marker beacon
GS: Glide slope
ML: Microwave landing system
RA: Radar altimeter
LRN: Long range RNAV
NO GROUP[3]: Non-grouped aircraft

[1]Aircraft assigned to hierarchical CG 1 (No regulatory avionics) contain either no avionics equipment whatsoever or a combination of equipment which does not match or exceed the specified requirements for any other hierarchical CG.

[2]Since non-hierarchical groups are not all mutually exclusive (they overlap), the columns do not add to the counts at the bottom of the table. The first four groups (L through L, MB, GA, RA) are mutually exclusive among themselves. However there is some overlap between the first four groups and the next five groups. The last group is mutually exclusive of the other nine.

[3]Non-grouped aircraft (NG) are those aircraft possessing none of the avionics covered by the other nine non-hierarchical CG's.

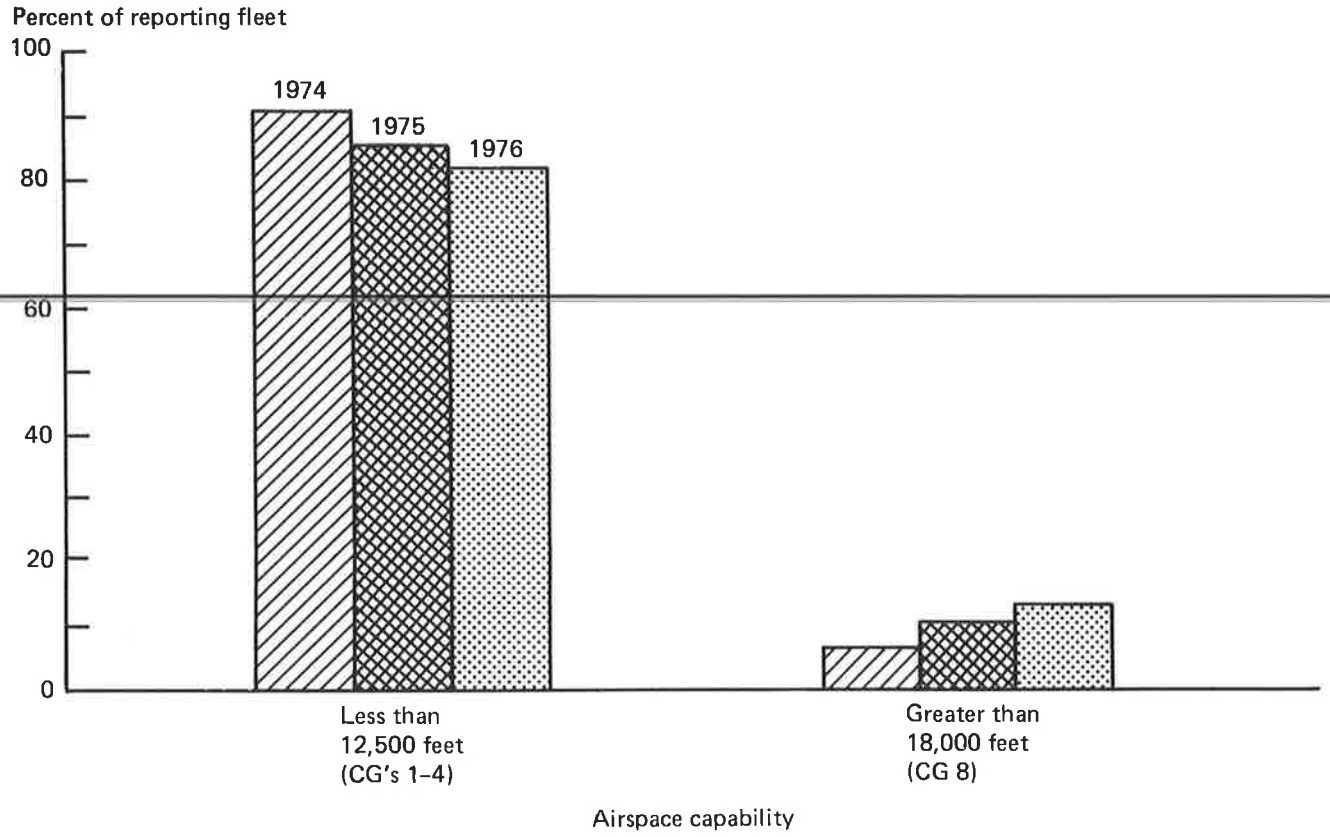


Figure 5. A Comparison of Airspace Capabilities for 1974, 1975, and 1976

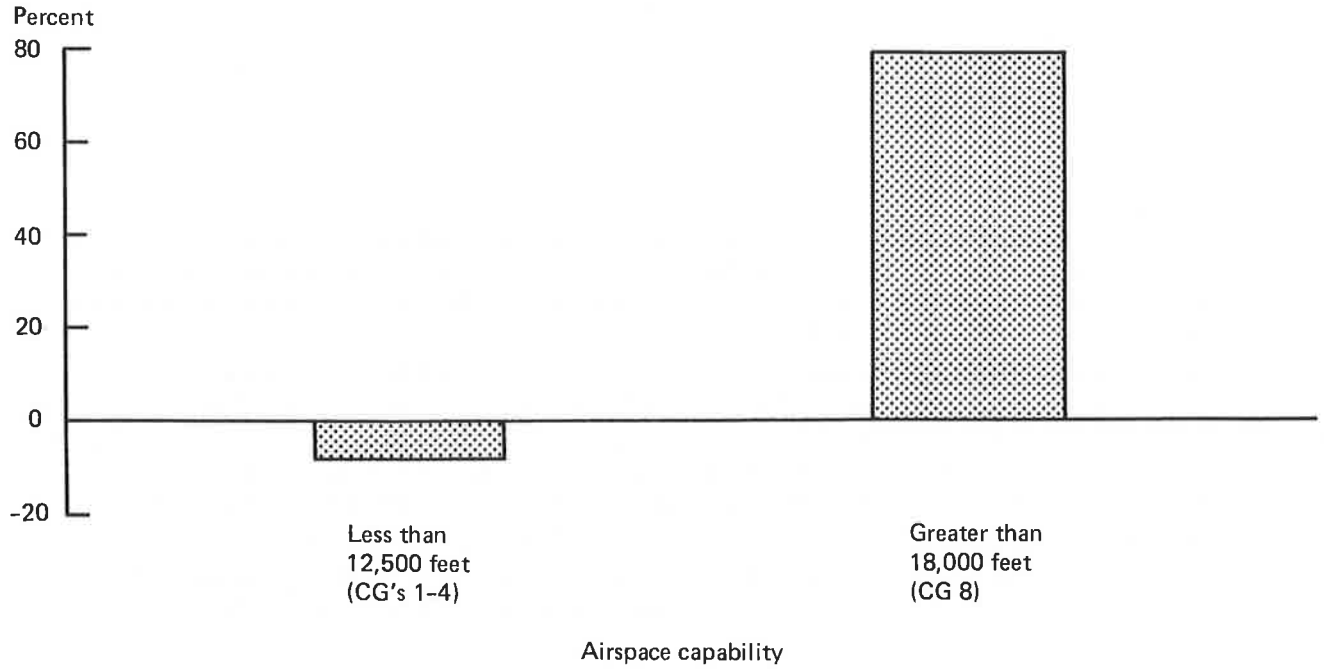


Figure 6. Normalized Growth in Airspace Capabilities from 1974 to 1976

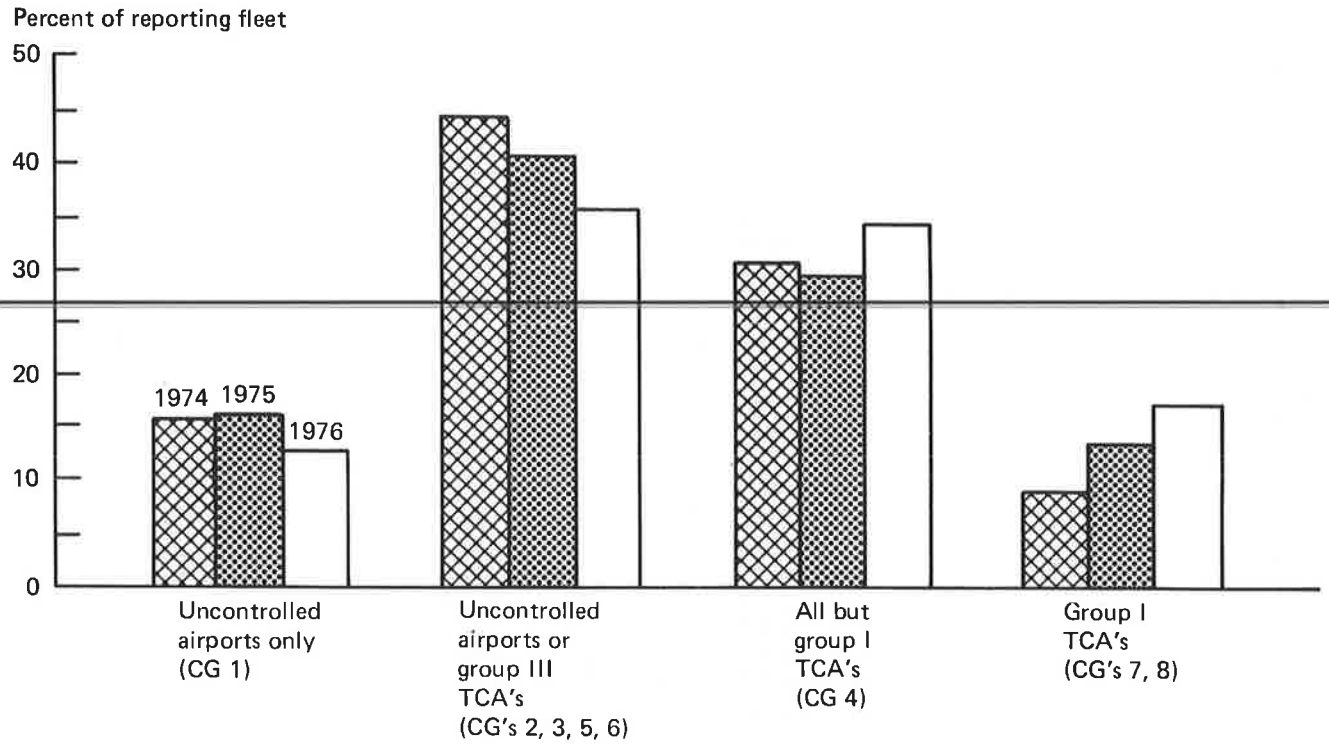


Figure 7. A Comparison of Airport Capabilities for 1974, 1975, and 1976

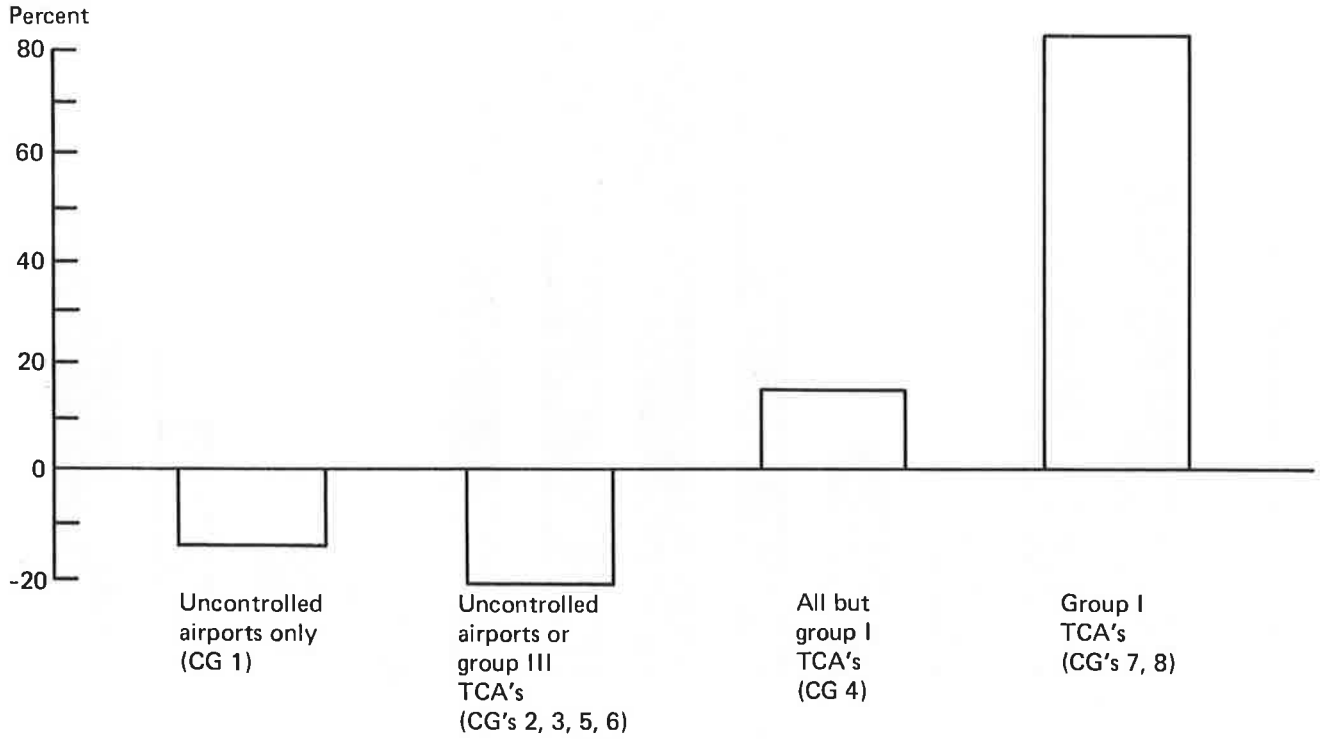


Figure 8. Normalized Growth in Airport Capabilities from 1974 to 1976

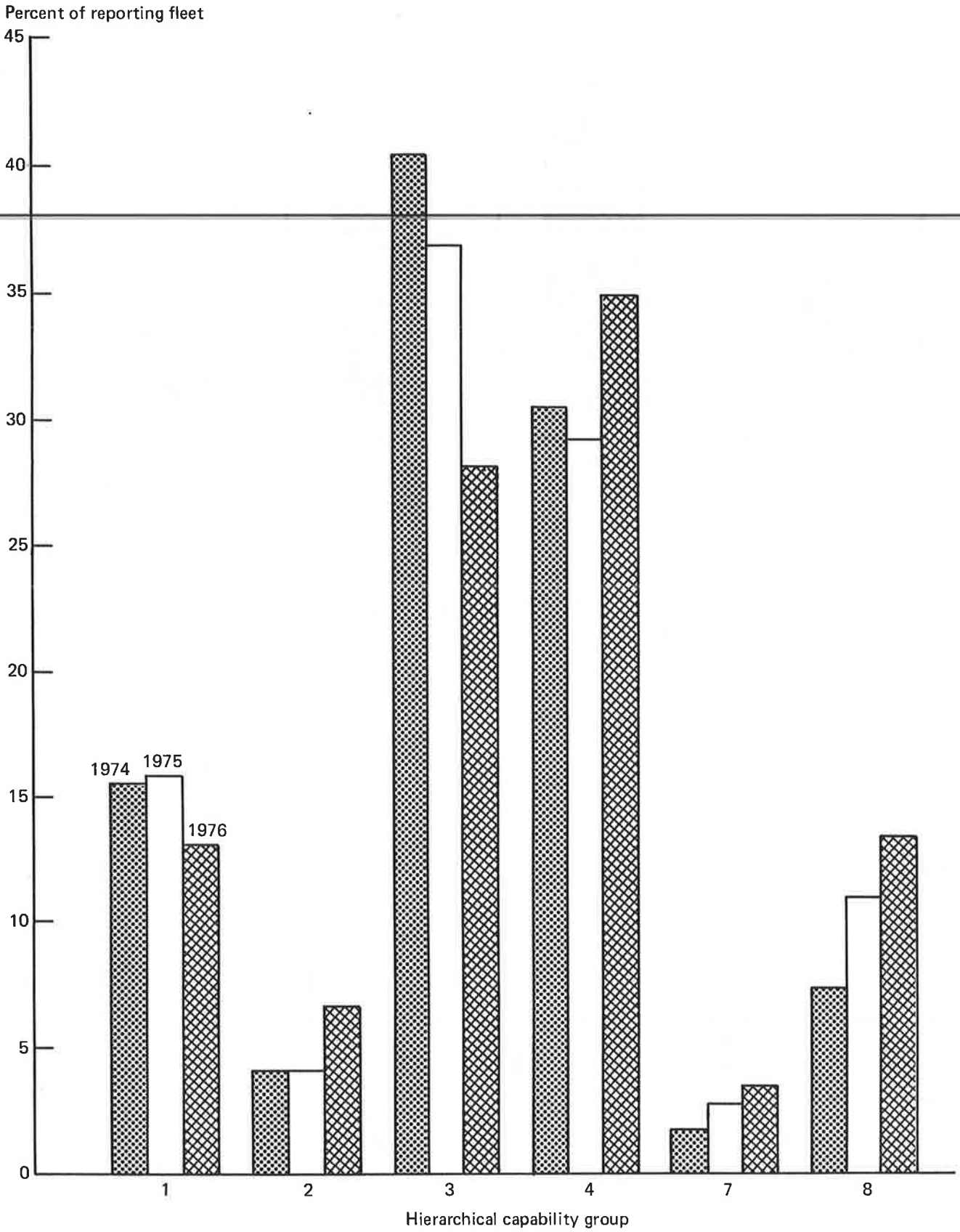


Figure 9. A Comparison of Hierarchical CG's from 1974 to 1976

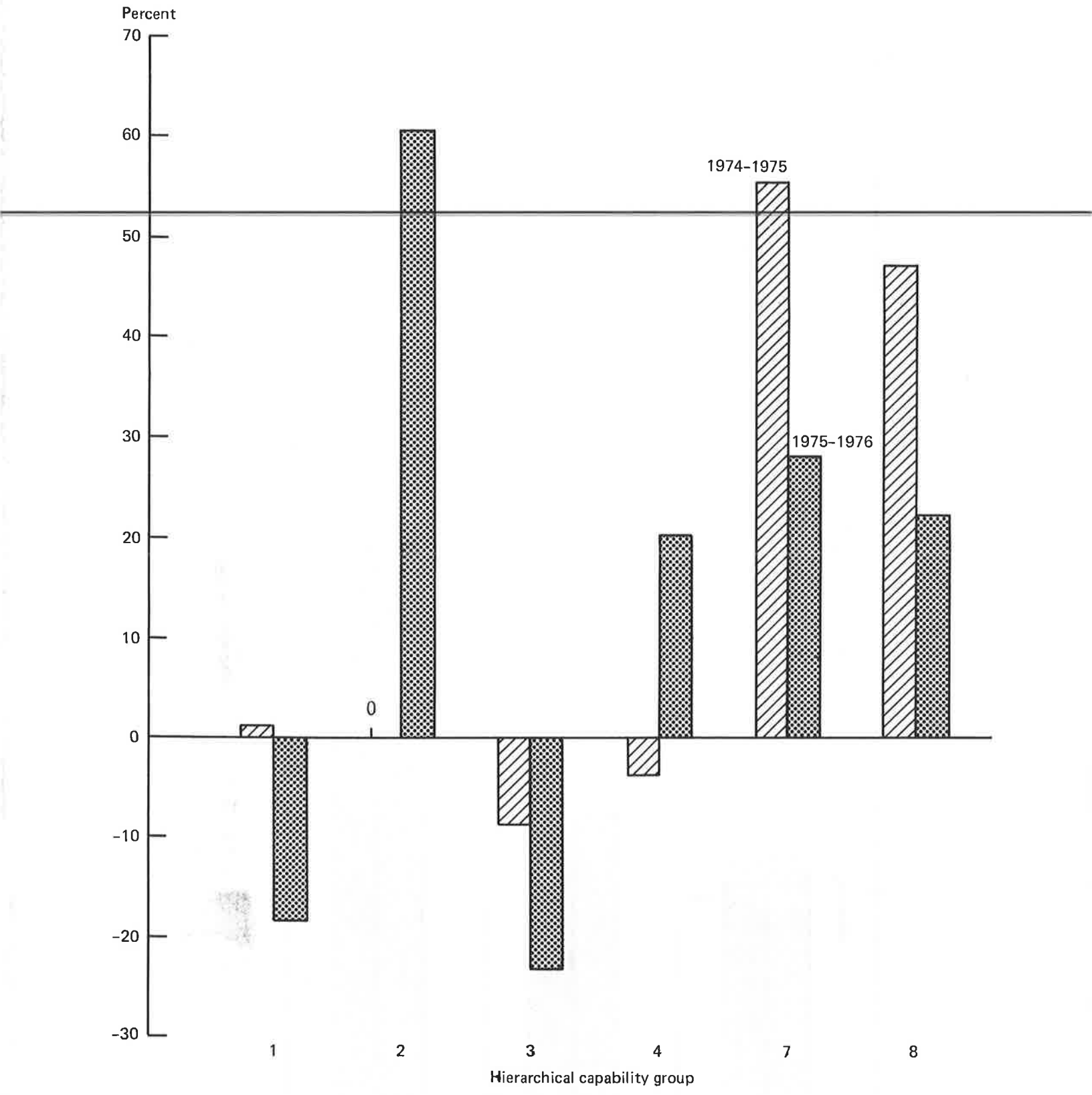


Figure 10. Normalized Growth in Hierarchical Group Size from 1974 to 1975 and 1975 to 1976

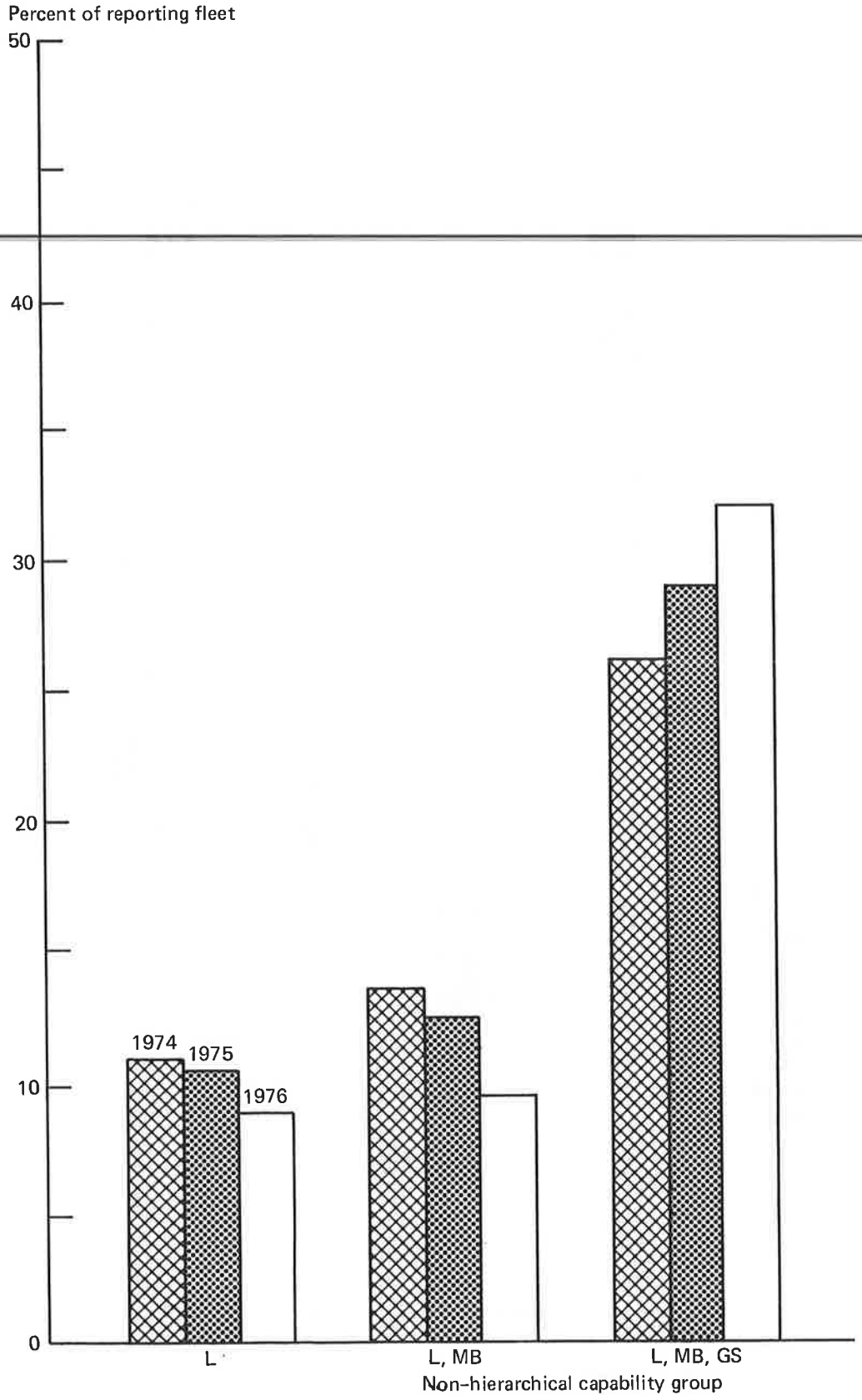


Figure 11. A Comparison of Non-Hierarchical Groups from 1974 to 1976

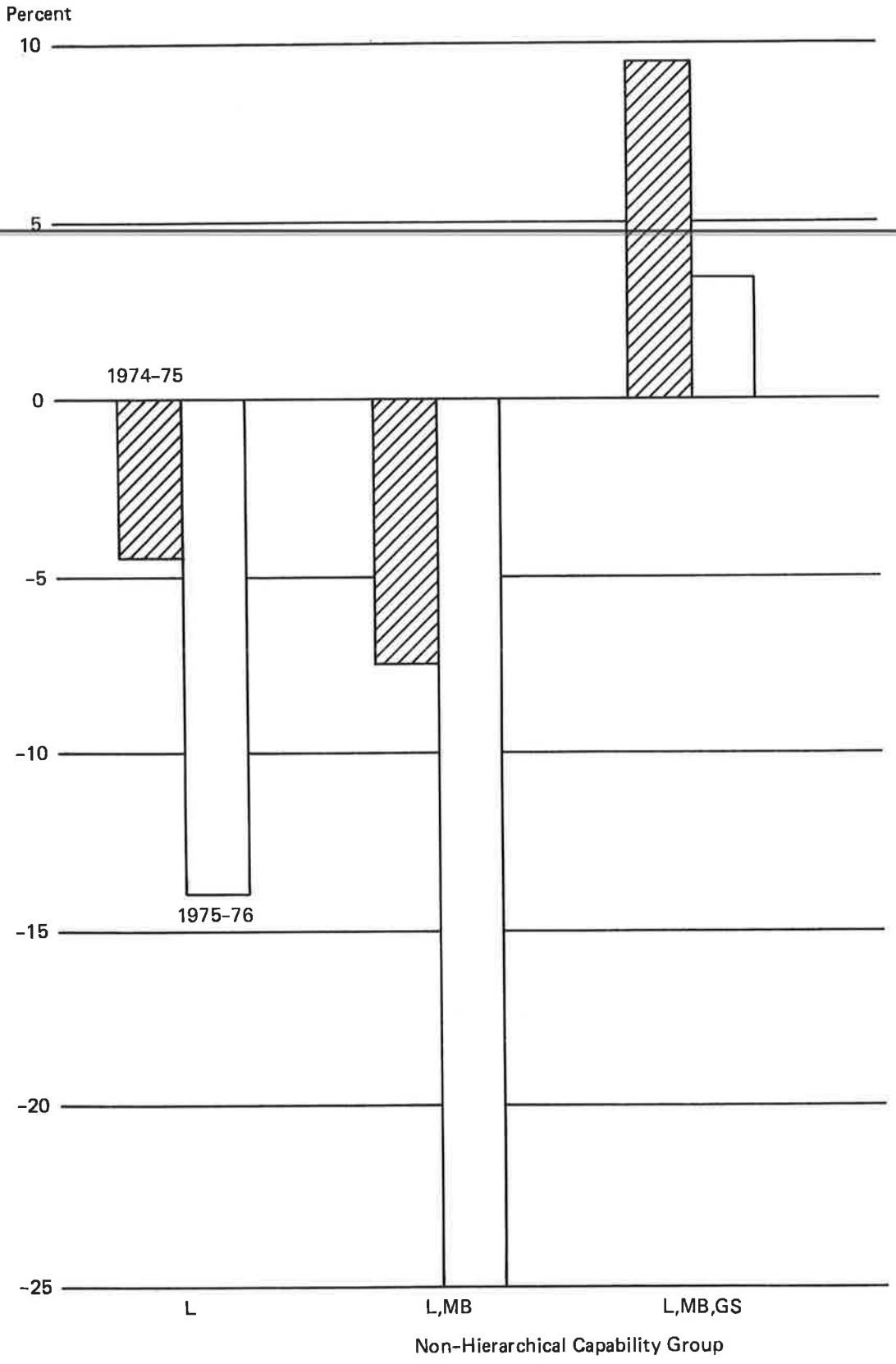


Figure 12. Normalized Growth in Non-Hierarchical Groups from 1974 to 1975 and 1975 to 1976

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3.2 CHARACTERISTICS OF CAPABILITY GROUPS (CG'S)

Tables 6 through 23 show three numbers in each cell. The first is the number of aircraft falling into the particular capability group-category combination represented by the cell. The second number is the percent of the row or category that the number of aircraft represents. The third number is the percent of the column or capability group that the number of aircraft represents.

The key appearing at the bottom of each table gives the avionics associated with the CG's. Hierarchical group reports are additive across the columns as these groups are mutually exclusive. The numbers in the right-hand columns of the non-hierarchical group reports are the marginal distributions of the GA fleet across the categories, but are not row totals since non-hierarchical CG's are not mutually exclusive.

3.2.1 Characteristics of Hierarchical CG's

As mentioned in the discussion of Table 5, there was significant growth in hierarchical CG's 7 and 8 from 1975 to 1976, attributable to both upgrading avionics systems in pre-1976 aircraft and installing complex avionics equipment in new aircraft. Tables 6 through 14 and Figures 13 through 18 show the kinds of aircraft exhibiting these changes and present other characteristics of the GA fleet.

Generally, those aircraft in low order CG's have less sophisticated characteristics than those aircraft in high order CG's as follows:

a. As the hierarchical CG's increase in sophistication, the predominant uses also grow in sophistication from personal, to business and personal, to executive, business and personal (Table 6, Figures 13 and 14).

b. Aircraft containing more avionics equipment and capabilities are flown more hours than those with smaller investments in avionics equipment (Table 8, Figure 15).

c. High order CG's contain newer aircraft on the average than low order CG's (Table 9, Figure 16).

d. As in a. above, the computed aircraft type, as well as the four individual characteristics which are combined to form computed aircraft type (simple aircraft type, engine type, number of engines, number of seats), become progressively more sophisticated moving from low to high order CG's (Tables 10 through 14, Figures 17 and 18).

A comparison of the 1976 tables with the 1975 tables reveals the following characteristics of the aircraft responsible for the growth in hierarchical CG's 2, 4, 6, 7, and 8:

a. The changes in primary uses of aircraft in CG's 4, 7, and 8 were not significant. However, the primary use of those aircraft in CG's 2 and 6 was air taxi. In 1975, 4.78 percent air taxis fell in CG 2, as compared to 31.1 percent in 1976. Similarly, in 1975, 0.02 percent of air taxis fell in CG 6 as compared to 6.6 percent in 1976 (Table 6). As explained in Section 3.1.1, these increases most likely result from the ability acquired through the revised avionics questions for 1976 to differentiate between IFR and VFR air taxis and to place them in their proper CG's.

b. All regions exhibited the same increases as the fleet as a whole. However, the Alaskan and Pacific regions increased more in CG 2 than the U.S. as a whole, but increased less in CG's 7 and 8 (Table 7).

c. The aircraft flown more than 150 hours during 1976 made the largest contribution to the surge in CG's 2 and 6, likely due to the influx of air taxis into these CG's. The aircraft not flown or flown fewer than 150 hours exhibited major changes in CG 4. Very little changes from 1975 occurred in CG's 7 and 8 (Table 8).

d. The largest growth by far in CG 8 was exhibited by planes in the 0 to 4 year age category, indicating that new planes are being more fully equipped with avionics than at any time in the past. CG 8 contained 18 percent of planes 0 to 4 years old in 1975. In 1976 this number increased to 23 percent (Table 9).

e. The main aircraft types shifting into CG's 2, 4, 6, 7, and 8 are fixed wing twin engine piston aircraft with 1-6 seats and 7 or more seats. For example, in 1975, 46 and 50 percent, respectively of these two types fell into CG 8; in 1976, 54 and 62 percent fell into CG 8. Other aircraft types exhibited little or no changes (Table 10).

3.2.2 Characteristics of Non-Hierarchical CG's

In the discussion of Table 5 it was noted that the non-hierarchical groups containing complete ILS, grew substantially from 1975 to 1976. Tables 15 through 23 and Figures 19 through 22 help to identify which kinds of GA aircraft installed these avionics systems during 1976, and to characterize in general the kinds of GA aircraft equipped with these avionics.

Tables 15 through 23 show that sophisticated aircraft in terms of characteristics such as primary use, aircraft type, flying hours, etc., are more likely to possess advanced avionics systems than the simpler aircraft in the GA fleet as follows:

a. As non-hierarchical CG's increase in sophistication, the predominant primary uses of aircraft change from personal and business, to personal, business and executive, to business and executive. For example, executive aircraft alone compose over 49 percent of the aircraft reporting both a complete ILS and a radar altimeter and over 51 percent of the aircraft reporting both a long range RNAV and a MLS, yet executive aircraft compose only 5.0 percent of the reporting fleet (Table 15 and Figure 19).

b. Aircraft containing more avionics equipment and capabilities fly more hours than aircraft with small investments in avionics equipment (Table 17 and Figure 20).

c. Aircraft falling into the non-grouped category are older than those falling into the other non-hierarchical CG's. Within the latter groups, age decreases as the level of avionics increases (Table 18 and Figure 21).

d. Computed aircraft type increases in sophistication as the level of avionics increases. This direct relationship also holds for the following four characteristics which are combined to form computed aircraft type: simple aircraft type, engine type, number of engines, and number of seats (Tables 19 through 23 and Figure 22).

Comparing Tables 15 through 23 with the equivalent tables from 1975 identifies the characteristics of aircraft which acquired new avionics equipment during 1976 as follows:

a. Business and personal use aircraft accounted for the bulk of new complete ILS's in 1976. Other primary use categories showed smaller increases in the number of ILS's or remained approximately equal (Table 15).

b. All regions of the U.S. showed increases in the proportion of complete ILS's except the foreign region (Table 16).

c. Increases in complete ILS's were evident in all hours flown categories except the inactive one (Table 17).

d. Addition of a complete ILS was evident in all age categories with the largest gain in the 25-29 year bracket (Table 18).

TABLE 6. HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
EXECUTIVE	56	72	293	1066	11	18	131	4736	6383
ROW %	0.9	1.1	4.6	16.7	0.2	0.3	2.1	74.2	100.0
COLUMN %	0.3	0.9	0.8	2.4	11.2	3.4	2.9	27.6	5.0
BUSINESS	664	568	4038	11603	39	65	1279	6235	24491
ROW %	2.7	2.3	16.5	47.4	0.2	0.3	5.2	25.5	100.0
COLUMN %	3.9	6.7	11.1	25.8	39.8	12.3	28.4	36.3	19.0
PERSONAL	6145	3355	20701	20454	20	89	1574	2681	55019
ROW %	11.2	6.1	37.6	37.2	0.0	0.2	2.9	4.9	100.0
COLUMN %	36.4	39.7	57.1	45.6	20.4	16.9	34.9	15.6	42.7
AERIAL AP.	2272	424	244	178	0	0	33	53	3204
ROW %	70.9	13.2	7.6	5.6	0.0	0.0	1.0	1.7	100.0
COLUMN %	13.5	5.0	0.7	0.4	0.0	0.0	0.7	0.3	2.5
INSTRUCT.	336	418	3709	3053	1	9	248	255	8029
ROW %	4.2	5.2	46.2	38.0	0.0	0.1	3.1	3.2	100.0
COLUMN %	2.0	4.9	10.2	6.8	1.0	1.7	5.5	1.5	6.2
AIR TAXI	30	1251	117	882	6	266	237	1230	4019
ROW %	0.7	31.1	2.9	21.9	0.1	6.6	5.9	30.6	100.0
COLUMN %	0.2	14.8	0.3	2.0	6.1	50.4	5.3	7.2	3.1

TABLE 6. HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
INDUSTR SP	77	343	410	512	3	6	139	167	1657
ROW %	4.6	20.7	24.7	30.9	0.2	0.4	8.4	10.1	100.0
COLUMN %	0.5	4.1	1.1	1.1	3.1	1.1	3.1	1.0	1.3
RENTAL	132	175	1318	2927	2	6	403	423	5386
ROW %	2.5	3.2	24.5	54.3	0.0	0.1	7.5	7.9	100.0
COLUMN %	0.8	2.1	3.6	6.5	2.0	1.1	8.9	2.5	4.2
OTHER	366	275	443	533	2	6	80	283	1988
ROW %	18.4	13.8	22.3	26.8	0.1	0.3	4.0	14.2	100.0
COLUMN %	2.2	3.3	1.2	1.2	2.0	1.1	1.8	1.6	1.5
INACT UNKN	6793	1579	5010	3694	14	63	386	1112	18651
ROW %	36.4	8.5	26.9	19.8	0.1	0.3	2.1	6.0	100.0
COLUMN %	40.3	18.7	13.8	8.2	14.3	11.9	8.6	6.5	14.5
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

1. No regulatory avionics
2. Two-way communications
3. Two-way communications
   Two systems - air taxis
   VOR or ADF or RNAV
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitide encoding equipment
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equipment
   4096 code transponder
   VOR, DME } or RNAV

TABLE 7. HIERARCHICAL GROUPS - BASE AIRPORT REGION VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
NEW ENGLND	621	270	1412	1325	5	25	280	582	4520
ROW %	13.7	6.0	31.2	29.3	0.1	0.6	6.2	12.9	100.0
COLUMN %	3.7	3.2	3.9	3.0	5.1	4.7	6.2	3.4	3.5
EASTERN	1842	808	4016	5238	10	87	898	2425	15324
ROW %	12.0	5.3	26.2	34.2	0.1	0.6	5.9	15.8	100.0
COLUMN %	10.9	9.6	11.1	11.7	10.2	16.5	19.9	14.1	11.9
SOUTHERN	2014	987	4209	6329	16	84	535	2718	16892
ROW %	11.9	5.8	24.9	37.5	0.1	0.5	3.2	16.1	100.0
COLUMN %	11.9	11.7	11.6	14.1	16.3	15.9	11.9	15.8	13.1
GREAT LAKE	3276	1206	7214	8493	15	85	604	3102	23995
ROW %	13.7	5.0	30.1	35.4	0.1	0.4	2.5	12.9	100.0
COLUMN %	19.4	14.3	19.9	18.9	15.3	16.1	13.4	18.1	18.6
CENTRAL	1365	449	2491	3329	4	36	167	1088	8929
ROW %	15.3	5.0	27.9	37.3	0.0	0.4	1.9	12.2	100.0
COLUMN %	8.1	5.3	6.9	7.4	4.1	6.8	3.7	6.3	6.9
ROCKY MTS	956	515	1982	2042	4	22	166	600	6287
ROW %	15.2	8.2	31.5	32.5	0.1	0.3	2.6	9.5	100.0
COLUMN %	5.7	6.1	5.5	4.5	4.1	4.2	3.7	3.5	4.9
NORTHWEST	1054	614	2394	2621	5	13	177	688	7566
ROW %	13.9	8.1	31.6	34.6	0.1	0.2	2.3	9.1	100.0
COLUMN %	6.2	7.3	6.6	5.8	5.1	2.5	3.9	4.0	5.9

TABLE 7. HIERARCHICAL GROUPS - BASE AIRPORT REGION VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
WESTERN	2058	1372	5100	7146	12	79	958	2224	18949
ROW %	10.9	7.2	26.9	37.7	0.1	0.4	5.1	11.7	100.0
COLUMN %	12.2	16.2	14.1	15.9	12.2	15.0	21.2	12.9	14.7
SOUTHWEST	2166	1018	3595	5273	17	47	403	2591	15110
ROW %	14.3	6.7	23.8	34.9	0.1	0.3	2.7	17.1	100.0
COLUMN %	12.8	12.0	9.9	11.7	17.3	8.9	8.9	15.1	11.7
PACIFIC	29	53	92	105	0	1	3	10	293
ROW %	9.9	18.1	31.4	35.8	0.0	0.3	1.0	3.4	100.0
COLUMN %	0.2	0.6	0.3	0.2	0.0	0.2	0.1	0.1	0.2
ALASKAN	197	501	1349	344	0	3	11	34	2439
ROW %	8.1	20.5	55.3	14.1	0.0	0.1	0.5	1.4	100.0
COLUMN %	1.2	5.9	3.7	0.8	0.0	0.6	0.2	0.2	1.9
FOREIGN	3	7	48	28	0	0	6	41	133
ROW %	2.3	5.3	36.1	21.1	0.0	0.0	4.5	30.8	100.0
COLUMN %	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.1
UNKNOWN	1290	660	2381	2629	10	46	302	1072	8390
ROW %	15.4	7.9	28.4	31.3	0.1	0.5	3.6	12.8	100.0
COLUMN %	7.6	7.8	6.6	5.9	10.2	8.7	6.7	6.2	6.5
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
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   ment

GROUP
8. Two-way communications
   Two systems - air taxis
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   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 8. HEIRARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
1-49	4398	2045	9583	5129	10	53	332	825	22375
ROW %	19.7	9.1	42.8	22.9	0.0	0.2	1.5	3.7	100.0
COLUMN %	26.1	24.2	26.4	11.4	10.2	10.0	7.4	4.8	17.4
50-99	2146	1392	8575	9216	15	56	693	1589	23682
ROW %	9.1	5.9	36.2	38.9	0.1	0.2	2.9	6.7	100.0
COLUMN %	12.7	16.5	23.6	20.5	15.3	10.6	15.4	9.3	18.4
100-149	1079	725	4695	8533	16	45	804	2394	18291
ROW %	5.9	4.0	25.7	46.7	0.1	0.2	4.4	13.1	100.0
COLUMN %	6.4	8.6	12.9	19.0	16.3	8.5	17.8	13.9	14.2
150-199	480	407	1974	4868	6	36	517	1938	10226
ROW %	4.7	4.0	19.3	47.6	0.1	0.4	5.1	19.0	100.0
COLUMN %	2.8	4.8	5.4	10.8	6.1	6.8	11.5	11.3	7.9
200-249	480	382	1353	3774	11	42	469	1991	8502
ROW %	5.6	4.5	15.9	44.4	0.1	0.5	5.5	23.4	100.0
COLUMN %	2.8	4.5	3.7	8.4	11.2	8.0	10.4	11.6	6.6
250-299	297	237	766	1984	7	32	247	1333	4903
ROW %	6.1	4.8	15.6	40.5	0.1	0.7	5.0	27.2	100.0
COLUMN %	1.8	2.8	2.1	4.4	7.1	6.1	5.5	7.8	3.8
300-349	311	302	809	1827	6	29	205	1400	4889
ROW %	6.4	6.2	16.5	37.4	0.1	0.6	4.2	28.6	100.0
COLUMN %	1.8	3.6	2.2	4.1	6.1	5.5	4.5	8.2	3.8

TABLE 8. HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
350-399	188	158	479	1061	4	17	131	872	2910
ROW %	6.5	5.4	16.5	36.5	0.1	0.6	4.5	30.0	100.0
COLUMN %	1.1	1.9	1.3	2.4	4.1	3.2	2.9	5.1	2.3
400-449	197	176	500	1005	2	30	152	906	2968
ROW %	6.6	5.9	16.8	33.9	0.1	1.0	5.1	30.5	100.0
COLUMN %	1.2	2.1	1.4	2.2	2.0	5.7	3.4	5.3	2.3
450 UP	502	1057	2539	3811	7	125	574	2815	11430
ROW %	4.4	9.2	22.2	33.3	0.1	1.1	5.0	24.6	100.0
COLUMN %	3.0	12.5	7.0	8.5	7.1	23.7	12.7	16.4	8.9
INACTIVE	5214	817	2395	569	4	11	49	99	9158
ROW %	56.9	8.9	26.2	6.2	0.0	0.1	0.5	1.1	100.0
COLUMN %	30.9	9.7	6.6	1.3	4.1	2.1	1.1	0.6	7.1
UNKNOWN	1579	762	2615	3125	10	52	337	1013	9493
ROW %	16.6	8.0	27.5	32.9	0.1	0.5	3.5	10.7	100.0
COLUMN %	9.4	9.0	7.2	7.0	10.2	9.8	7.5	5.9	7.4
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
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3. Two-way communic-tions
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   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
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   Altitude encoding equipment

GROUP
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   Altitude encoding equip-
   ment

GROUP
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   ment
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   DME }

TABLE 9. HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
0-4 YRS	3110	2129	5387	12099	35	186	1592	7291	31829
ROW %	9.8	6.7	16.9	38.0	0.1	0.6	5.0	22.9	100.0
COLUMN %	18.4	25.2	14.8	26.9	35.7	35.2	35.3	42.5	24.7
5-9 YRS	1667	1662	6630	10833	23	132	928	4528	26403
ROW %	6.3	6.3	25.1	41.0	0.1	0.5	3.5	17.1	100.0
COLUMN %	9.9	19.6	18.3	24.1	23.5	25.0	20.6	26.4	20.5
10-14 YRS	1392	1199	7214	10866	23	76	940	3394	25104
ROW %	5.5	4.8	28.7	43.3	0.1	0.3	3.7	13.5	100.0
COLUMN %	8.3	14.2	19.9	24.2	23.5	14.4	20.8	19.8	19.5
15-19 YRS	940	780	5268	6066	4	57	570	1121	14806
ROW %	6.3	5.3	35.6	41.0	0.0	0.4	3.8	7.6	100.0
COLUMN %	5.6	9.2	14.5	13.5	4.1	10.8	12.6	6.5	11.5
20-24 YRS	652	518	3757	2651	4	29	254	344	8209
ROW %	7.9	6.3	45.8	32.3	0.0	0.4	3.1	4.2	100.0
COLUMN %	3.9	6.1	10.4	5.9	4.1	5.5	5.6	2.0	6.4
25-29 YRS	1669	777	4243	1567	0	21	116	120	8513
ROW %	19.6	9.1	49.8	18.4	0.0	0.2	1.4	1.4	100.0
COLUMN %	9.9	9.2	11.7	3.5	0.0	4.0	2.6	0.7	6.6

TABLE 9. HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
30-34 YRS	4654	951	3137	537	5	17	64	143	9508
ROW %	48.9	10.0	33.0	5.6	0.1	0.2	0.7	1.5	100.0
COLUMN %	27.6	11.2	8.6	1.2	5.1	3.2	1.4	0.8	7.4
35+ YRS	2275	287	340	70	2	4	13	39	3030
ROW %	75.1	9.5	11.2	2.3	0.1	0.1	0.4	1.3	100.0
COLUMN %	13.5	3.4	0.9	0.2	2.0	0.8	0.3	0.2	2.4
UNREPORTED	512	157	307	213	2	6	33	195	1425
ROW %	35.9	11.0	21.5	14.9	0.1	0.4	2.3	13.7	100.0
COLUMN %	3.0	1.9	0.8	0.5	2.0	1.1	0.7	1.1	1.1
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
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   Two systems - air taxis
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   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 10. HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
TYPE 1	13146	3578	18609	5114	11	57	247	73	40835
ROW %	32.2	8.8	45.6	12.5	0.0	0.1	0.6	0.2	100.0
COLUMN %	77.9	42.3	51.3	11.4	11.2	10.8	5.5	0.4	31.7
TYPE 2	1638	2040	16571	34756	42	188	3614	5964	64813
ROW %	2.5	3.1	25.6	53.6	0.1	0.3	5.6	9.2	100.0
COLUMN %	9.7	24.1	45.7	77.4	42.9	35.6	80.1	34.7	50.3
TYPE 3	90	125	454	3421	28	129	371	5501	10119
ROW %	0.9	1.2	4.5	33.8	0.3	1.3	3.7	54.4	100.0
COLUMN %	0.5	1.5	1.3	7.6	28.6	24.4	8.2	32.0	7.9
TYPE 4	104	106	209	901	11	105	189	2619	4244
ROW %	2.5	2.5	4.9	21.2	0.3	2.5	4.5	61.7	100.0
COLUMN %	0.6	1.3	0.6	2.0	11.2	19.9	4.2	15.2	3.3
TYPE 5	8	7	27	86	0	1	4	36	169
ROW %	4.7	4.1	16.0	50.9	0.0	0.6	2.4	21.3	100.0
COLUMN %	0.0	0.1	0.1	0.2	0.0	0.2	0.1	0.2	0.1
TYPE 6	1	1	17	51	1	4	6	1261	1342
ROW %	0.1	0.1	1.3	3.8	0.1	0.3	0.4	94.0	100.0
COLUMN %	0.0	0.0	0.0	0.1	1.0	0.8	0.1	7.3	1.0
TYPE 7	1	6	11	39	1	5	15	308	386
ROW %	0.3	1.6	2.8	10.1	0.3	1.3	3.9	79.8	100.0
COLUMN %	0.0	0.1	0.0	0.1	1.0	0.9	0.3	1.8	0.3
TYPE 8	1	2	3	14	0	0	0	18	38
ROW %	2.6	5.3	7.9	36.8	0.0	0.0	0.0	47.4	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0

TABLE 10. HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
TYPE 9	3	1	18	29	2	17	2	1181	1253
ROW %	0.2	0.1	1.4	2.3	0.2	1.4	0.2	94.3	100.0
COLUMN %	0.0	0.0	0.0	0.1	2.0	3.2	0.0	6.9	1.0
TYPE 10	24	3	12	21	0	0	2	144	206
ROW %	11.7	1.5	5.8	10.2	0.0	0.0	1.0	69.9	100.0
COLUMN %	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.2
TYPE 11	810	1010	197	65	0	8	7	6	2103
ROW %	38.5	48.0	9.4	3.1	0.0	0.4	0.3	0.3	100.0
COLUMN %	4.8	11.9	0.5	0.1	0.0	1.5	0.2	0.0	1.6
TYPE 12	27	523	137	400	0	8	47	62	1204
ROW %	2.2	43.4	11.4	33.2	0.0	0.7	3.9	5.1	100.0
COLUMN %	0.2	6.2	0.4	0.9	0.0	1.5	1.0	0.4	0.9
TYPE 13	1018	1058	18	5	2	6	6	2	2115
ROW %	48.1	50.0	0.9	0.2	0.1	0.3	0.3	0.1	100.0
COLUMN %	6.0	12.5	0.0	0.0	2.0	1.1	0.1	0.0	1.6
ALL CRAFT	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
3. Two-way communic-tions
   Two systems - air taxis
   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment

GROUP
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equip-
   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 11. HIERARCHICAL GROUPS - AIRCRAFT TYPE VS. CAPABILITY GROUP

1976

		1	2	3	4	5	6	7	8	TOTALS
	GLIDER	690	998	16	3	1	2	1	1	1712
	ROW %	40.3	58.3	0.9	0.2	0.1	0.1	0.1	0.1	100.0
	COLUMN %	4.1	11.8	0.0	0.0	1.0	0.4	0.0	0.0	1.3
	BALLCON	328	60	2	2	1	4	0	0	397
	ROW %	82.6	15.1	0.5	0.5	0.3	1.0	0.0	0.0	100.0
	COLUMN %	1.9	0.7	0.0	0.0	1.0	0.8	0.0	0.0	0.3
	BLIMP	0	0	0	0	0	0	5	1	6
	ROW %	0.0	0.0	0.0	0.0	0.0	0.0	83.3	16.7	100.0
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
FIXED	WING, ENG=1	14808	5623	35192	39886	53	245	3863	6052	105722
	ROW %	14.0	5.3	33.3	37.7	0.1	0.2	3.7	5.7	100.0
	COLUMN %	87.8	66.5	97.0	88.8	54.1	46.4	85.7	35.2	82.1
FIXED	WING,ENG>1	208	246	739	4546	43	261	587	11053	17683
	ROW %	1.2	1.4	4.2	25.7	0.2	1.5	3.3	62.5	100.0
	COLUMN %	1.2	2.9	2.0	10.1	43.9	49.4	13.0	64.4	13.7
	ROTORCRAFT	837	1533	334	465	0	16	54	68	3307
	ROW %	25.3	46.4	10.1	14.1	0.0	0.5	1.6	2.1	100.0
	COLUMN %	5.0	18.1	0.9	1.0	0.0	3.0	1.2	0.4	2.6

TABLE 11. HIERARCHICAL GROUPS - AIRCRAFT TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
UNREPORTED	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
3. Two-way communic-tions
   Two systems - air taxis
   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment

GROUP
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equip-
   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 12. HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
RECIPROCAT	15816	6879	36067	44344	92	489	4437	14200	122324
ROW %	12.9	5.6	29.5	36.3	0.1	0.4	3.6	11.6	100.0
COLUMN %	93.7	81.3	99.4	98.8	93.9	92.6	98.4	82.7	95.0
TURBOPROP	3	9	33	104	2	9	21	1587	1768
ROW %	0.2	0.5	1.9	5.9	0.1	0.5	1.2	89.8	100.0
COLUMN %	0.0	0.1	0.1	0.2	2.0	1.7	0.5	9.2	1.4
TURBOSHAFT	27	523	135	400	0	8	47	62	1202
ROW %	2.2	43.5	11.2	33.3	0.0	0.7	3.9	5.2	100.0
COLUMN %	0.2	6.2	0.4	0.9	0.0	1.5	1.0	0.4	0.9
TURBOJET	27	4	30	50	2	17	4	1325	1459
ROW %	1.9	0.3	2.1	3.4	0.1	1.2	0.3	90.8	100.0
COLUMN %	0.2	0.0	0.1	0.1	2.0	3.2	0.1	7.7	1.1
TUR AIR GEN	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMJET	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 12. HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
NO ENGINE	998	1045	18	4	2	5	1	1	2074
ROW %	48.1	50.4	0.9	0.2	0.1	0.2	0.0	0.0	100.0
COLUMN %	5.9	12.4	0.0	0.0	2.0	0.9	0.0	0.0	1.6
UNREPORTED	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
3. Two-way communic-tions
   Two systems - air taxis
   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment

GROUP
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equip-
   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 13. HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
ONE	15664	7113	35519	40325	53	262	3915	6107	108958
ROW %	14.4	6.5	32.6	37.0	0.0	0.2	3.6	5.6	100.0
COLUMN %	92.8	84.1	97.9	89.8	54.1	49.6	86.8	35.6	84.6
TWO	200	295	716	4468	43	260	590	10884	17456
ROW %	1.1	1.7	4.1	25.6	0.2	1.5	3.4	62.4	100.0
COLUMN %	1.2	3.5	2.0	10.0	43.9	49.2	13.1	63.4	13.5
THREE	0	3	2	2	0	0	1	8	16
ROW %	0.0	18.8	12.5	12.5	0.0	0.0	6.3	50.0	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOUR	9	4	28	103	0	1	3	175	323
ROW %	2.8	1.2	8.7	31.9	0.0	0.3	0.9	54.2	100.0
COLUMN %	0.1	0.0	0.1	0.2	0.0	0.2	0.1	1.0	0.3
MORE	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NONE	998	1045	18	4	2	5	1	1	2074
ROW %	48.1	50.4	0.9	0.2	0.1	0.2	0.0	0.0	100.0
COLUMN %	5.9	12.4	0.0	0.0	2.0	0.9	0.0	0.0	1.6
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 13. HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP (CONTINUED)

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
3. Two-way communic-tions
   Two systems - air taxis
   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment

GROUP
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equip-
   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR } or RNAV
   DME }

TABLE 14. HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP

1976

	1	2	3	4	5	6	7	8	TOTALS
1 SEAT	4369	1524	553	84	1	4	11	14	6560
ROW %	66.6	23.2	8.4	1.3	0.0	0.1	0.2	0.2	100.0
COLUMN %	25.9	18.0	1.5	0.2	1.0	0.8	0.2	0.1	5.1
2 SEATS	8204	2724	16159	4894	11	51	218	72	32333
ROW %	25.4	8.4	50.0	15.1	0.0	0.2	0.7	0.2	100.0
COLUMN %	48.6	32.2	44.5	10.9	11.2	9.7	4.8	0.4	25.1
3 SEATS	2178	1208	2081	224	1	17	28	7	5744
ROW %	37.9	21.0	36.2	3.9	0.0	0.3	0.5	0.1	100.0
COLUMN %	12.9	14.3	5.7	0.5	1.0	3.2	0.6	0.0	4.5
4 SEATS	1546	1866	15332	30178	23	117	2998	3492	55552
ROW %	2.8	3.4	27.6	54.3	0.0	0.2	5.4	6.3	100.0
COLUMN %	9.2	22.1	42.3	67.2	23.5	22.2	66.5	20.3	43.1
5 SEATS	191	407	976	2768	5	18	325	815	5505
ROW %	3.5	7.4	17.7	50.3	0.1	0.3	5.9	14.8	100.0
COLUMN %	1.1	4.8	2.7	6.2	5.1	3.4	7.2	4.7	4.3
6 SEATS	141	449	802	5520	42	187	690	7317	15148
ROW %	0.9	3.0	5.3	36.4	0.3	1.2	4.6	48.3	100.0
COLUMN %	0.8	5.3	2.2	12.3	42.9	35.4	15.3	42.6	11.8

TABLE 14. HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP (CONTINUED)

1976

	1	2	3	4	5	6	7	8	TOTALS
7-11 SEATS	130	144	251	907	13	115	192	4456	6208
ROW %	2.1	2.3	4.0	14.6	0.2	1.9	3.1	71.8	100.0
COLUMN %	0.8	1.7	0.7	2.0	13.3	21.8	4.3	25.9	4.8
12-19 SEATS	44	111	45	112	0	5	18	368	703
ROW %	6.3	15.8	6.4	15.9	0.0	0.7	2.6	52.3	100.0
COLUMN %	0.3	1.3	0.1	0.2	0.0	0.9	0.4	2.1	0.5
20-49 SEATS	29	26	53	119	2	5	27	445	706
ROW %	4.1	3.7	7.5	16.9	0.3	0.7	3.8	63.0	100.0
COLUMN %	0.2	0.3	0.1	0.3	2.0	0.9	0.6	2.6	0.5
50+ SEATS	6	0	31	96	0	9	3	189	334
ROW %	1.8	0.0	9.3	28.7	0.0	2.7	0.9	56.6	100.0
COLUMN %	0.0	0.0	0.1	0.2	0.0	1.7	0.1	1.1	0.3
UNREPORTED	33	1	0	0	0	0	0	0	34
ROW %	97.1	2.9	0.0	0.0	0.0	0.0	0.0	0.0	100.0
COLUMN %	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	16871	8460	36283	44902	98	528	4510	17175	128827
ROW %	13.1	6.6	28.2	34.9	0.1	0.4	3.5	13.3	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP
1. No regulatory avionics
2. Two-way communications
3. Two-way communic-tions
   Two systems - air taxis
   VOR or ADF or RNAV

GROUP
4. Two-way communications
   Two systems - air taxis
   4096 code transponder
   VOR or RNAV
5. 4096 code transponder
   Altitude encoding equipment

GROUP
6. Two-way communications
   4096 code transponder
   Altitude encoding equipment
7. Two-way communications
   Two systems - air taxis
   4096 code transponder
   Altitude encoding equip-
   ment

GROUP
8. Two-way communications
   Two systems - air taxis
   Altitude encoding equip-
   ment
   4096 code transponder
   VOR, DME } or RNAV

TABLE 15. NON-HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
EXECUTIVE	229	149	2903	2616	469	2647	72	70	28	465	6383
ROW %	3.6	2.3	45.5	41.0	7.3	41.5	1.1	1.1	0.4	7.3	100.0
COLUMN %	1.9	1.2	8.1	49.7	52.7	47.7	31.3	33.7	51.9	0.7	5.0
BUSINESS	1633	2730	11878	1286	127	1350	74	67	9	6926	24491
ROW %	6.7	11.1	48.5	5.3	0.5	5.5	0.3	0.3	0.0	28.3	100.0
COLUMN %	13.9	22.7	33.3	24.4	14.3	24.3	32.2	32.2	16.7	10.8	19.0
PERSONAL	5422	6815	10461	428	77	520	34	25	0	31832	55019
ROW %	9.9	12.4	19.0	0.8	0.1	0.9	0.1	0.0	0.0	57.9	100.0
COLUMN %	46.0	56.7	29.4	8.1	8.7	9.4	14.8	12.0	0.0	49.8	42.7
AERIAL AP.	95	21	113	10	5	21	1	1	0	2955	3204
ROW %	3.0	0.7	3.5	0.3	0.2	0.7	0.0	0.0	0.0	92.2	100.0
COLUMN %	0.8	0.2	0.3	0.2	0.6	0.4	0.4	0.5	0.0	4.6	2.5
INSTRUCT.	1645	470	1913	47	9	50	2	2	0	3947	8029
ROW %	20.5	5.9	23.8	0.6	0.1	0.6	0.0	0.0	0.0	49.2	100.0
COLUMN %	14.0	3.9	5.4	0.9	1.0	0.9	0.9	1.0	0.0	6.2	6.2
AIR TAXI	262	209	2331	327	31	337	22	22	13	879	4019
ROW %	6.5	5.2	58.0	8.1	0.8	8.4	0.5	0.5	0.3	21.9	100.0
COLUMN %	2.2	1.7	6.5	6.2	3.5	6.1	9.6	10.6	24.1	1.4	3.1

TABLE 15. NON-HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
INDUSTR SP	265	98	324	60	34	70	0	0	0	900	1657
ROW %	16.0	5.9	19.6	3.6	2.1	4.2	0.0	0.0	0.0	54.3	100.0
COLUMN %	2.3	0.8	0.9	1.1	3.8	1.3	0.0	0.0	0.0	1.4	1.3
RENTAL	780	462	2320	54	13	59	8	7	0	1764	5386
ROW %	14.5	8.6	43.1	1.0	0.2	1.1	0.1	0.1	0.0	32.8	100.0
COLUMN %	6.6	3.8	6.5	1.0	1.5	1.1	3.5	3.4	0.0	2.8	4.2
OTHER	208	95	488	120	49	138	2	1	1	1062	1988
ROW %	10.5	4.8	24.5	6.0	2.5	6.9	0.1	0.1	0.1	53.4	100.0
COLUMN %	1.8	0.8	1.4	2.3	5.5	2.5	0.9	0.5	1.9	1.7	1.5
INACT UNKN	1238	969	2893	316	76	363	15	13	3	13195	18651
ROW %	6.6	5.2	15.5	1.7	0.4	1.9	0.1	0.1	0.0	70.7	100.0
COLUMN %	10.5	8.1	8.1	6.0	8.5	6.5	6.5	6.3	5.6	20.6	14.5
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 16. NON-HIERARCHICAL GROUPS - BASE AIRPORT REGION VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
NEW ENGLND	414	489	1226	145	17	154	4	4	2	2242	4520
ROW %	9.2	10.8	27.1	3.2	0.4	3.4	0.1	0.1	0.0	49.6	100.0
COLUMN %	3.5	4.1	3.4	2.8	1.9	2.8	1.7	1.9	3.7	3.5	3.5
EASTERN	1422	1920	4500	736	184	782	33	30	13	6716	15324
ROW %	9.3	12.5	29.4	4.8	1.2	5.1	0.2	0.2	0.1	43.8	100.0
COLUMN %	12.1	16.0	12.6	14.0	20.7	14.1	14.3	14.4	24.1	10.5	11.9
SOUTHERN	1531	1475	5325	766	109	807	49	46	20	7762	16892
ROW %	9.1	8.7	31.5	4.5	0.6	4.8	0.3	0.3	0.1	46.0	100.0
COLUMN %	13.0	12.3	14.9	14.6	12.2	14.5	21.3	22.1	37.0	12.1	13.1
GREAT LAKE	2235	2643	6208	1095	121	1141	41	38	5	11787	23995
ROW %	9.3	11.0	25.9	4.6	0.5	4.8	0.2	0.2	0.0	49.1	100.0
COLUMN %	19.0	22.0	17.4	20.8	13.6	20.5	17.8	18.3	9.3	18.4	18.6
CENTRAL	831	751	2385	392	33	410	7	6	0	4557	8929
ROW %	9.3	8.4	26.7	4.4	0.4	4.6	0.1	0.1	0.0	51.0	100.0
COLUMN %	7.1	6.2	6.7	7.4	3.7	7.4	3.0	2.9	0.0	7.1	6.9
ROCKY MTS	572	405	1394	138	16	149	4	4	0	3771	6287
ROW %	9.1	6.4	22.2	2.2	0.3	2.4	0.1	0.1	0.0	60.0	100.0
COLUMN %	4.9	3.4	3.9	2.6	1.8	2.7	1.7	1.9	0.0	5.9	4.9
NORTHWEST	702	656	1882	184	34	194	6	2	0	4133	7566
ROW %	9.3	8.7	24.9	2.4	0.4	2.6	0.1	0.0	0.0	54.6	100.0
COLUMN %	6.0	5.5	5.3	3.5	3.8	3.5	2.6	1.0	0.0	6.5	5.9

TABLE 16. NON-HIERARCHICAL GROUPS - BASE AIRPORT REGION VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB GS	L,MB, GS,RA	L,MB, LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
WESTERN	1631	2002	5566	548	100	585	28	24	4	9178	18949
ROW %	8.6	10.6	29.4	2.9	0.5	3.1	0.1	0.1	0.0	48.4	100.0
COLUMN %	13.8	16.7	15.6	10.4	11.2	10.5	12.2	11.5	7.4	14.4	14.7
SOUTHWEST	1301	1090	4513	900	187	934	40	37	7	7264	15110
ROW %	8.6	7.2	29.9	6.0	1.2	6.2	0.3	0.2	0.0	48.1	100.0
COLUMN %	11.0	9.1	12.7	17.1	21.0	16.8	17.4	17.8	13.0	11.4	11.7
PACIFIC	27	13	74	4	2	4	0	0	0	175	293
ROW %	9.2	4.4	25.3	1.4	0.7	1.4	0.0	0.0	0.0	59.7	100.0
COLUMN %	0.2	0.1	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.3	0.2
ALASKAN	286	87	267	28	6	35	0	0	0	1767	2439
ROW %	11.7	3.6	10.9	1.1	0.2	1.4	0.0	0.0	0.0	72.4	100.0
COLUMN %	2.4	0.7	0.7	0.5	0.7	0.6	0.0	0.0	0.0	2.8	1.9
FOREIGN	14	5	45	18	18	18	0	0	0	51	133
ROW %	10.5	3.8	33.8	13.5	13.5	13.5	0.0	0.0	0.0	38.3	100.0
COLUMN %	0.1	0.0	0.1	0.3	2.0	0.3	0.0	0.0	0.0	0.1	0.1
UNKNOWN	811	482	2239	310	63	342	18	17	3	4522	8390
ROW %	9.7	5.7	26.7	3.7	0.8	4.1	0.2	0.2	0.0	53.9	100.0
COLUMN %	6.9	4.0	6.3	5.9	7.1	6.2	7.8	8.2	5.6	7.1	6.5
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 17. NON-HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
1-49	2086	1524	2675	206	54	251	11	8	0	15851	22375
ROW %	9.3	6.8	12.0	0.9	0.2	1.1	0.0	0.0	0.0	70.8	100.0
COLUMN %	17.7	12.7	7.5	3.9	6.1	4.5	4.8	3.8	0.0	24.8	17.4
50-99	2510	2868	4857	336	63	375	21	17	3	13084	23682
ROW %	10.6	12.1	20.5	1.4	0.3	1.6	0.1	0.1	0.0	55.2	100.0
COLUMN %	21.3	23.9	13.6	6.4	7.1	6.8	9.1	8.2	5.6	20.5	18.4
100-149	1663	2501	6013	474	68	509	24	21	3	7619	18291
ROW %	9.1	13.7	32.9	2.6	0.4	2.8	0.1	0.1	0.0	41.7	100.0
COLUMN %	14.1	20.8	16.9	9.0	7.6	9.2	10.4	10.1	5.6	11.9	14.2
150-199	818	1366	4230	434	53	467	23	18	2	3360	10226
ROW %	8.0	13.4	41.4	4.2	0.5	4.6	0.2	0.2	0.0	32.9	100.0
COLUMN %	6.9	11.4	11.9	8.2	6.0	8.4	10.0	8.7	3.7	5.3	7.9
200-249	664	1012	3752	539	55	562	22	20	1	2523	8502
ROW %	7.8	11.9	44.1	6.3	0.6	6.6	0.3	0.2	0.0	29.7	100.0
COLUMN %	5.6	8.4	10.5	10.2	6.2	10.1	9.6	9.6	1.9	3.9	6.6
250-299	366	447	2279	389	35	402	15	14	1	1415	4903
ROW %	7.5	9.1	46.5	7.9	0.7	8.2	0.3	0.3	0.0	28.9	100.0
COLUMN %	3.1	3.7	6.4	7.4	3.9	7.2	6.5	6.7	1.9	2.2	3.8
300-349	419	388	2175	446	62	456	17	17	4	1451	4889
ROW %	8.6	7.9	44.5	9.1	1.3	9.3	0.3	0.3	0.1	29.7	100.0
COLUMN %	3.6	3.2	6.1	8.5	7.0	8.2	7.4	8.2	7.4	2.3	3.8

TABLE 17. NON-HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
350-399	250	218	1249	352	51	358	12	12	5	838	2910
ROW %	8.6	7.5	42.9	12.1	1.8	12.3	0.4	0.4	0.2	28.8	100.0
COLUMN %	2.1	1.8	3.5	6.7	5.7	6.4	5.2	5.8	9.3	1.3	2.3
400-449	273	181	1281	403	54	412	13	13	1	822	2968
ROW %	9.2	6.1	43.2	13.6	1.8	13.9	0.4	0.4	0.0	27.7	100.0
COLUMN %	2.3	1.5	3.6	7.7	6.1	7.4	5.7	6.3	1.9	1.3	2.3
450 UP	1490	544	4220	1369	319	1400	57	55	31	3767	11430
ROW %	13.0	4.8	36.9	12.0	2.8	12.2	0.5	0.5	0.3	33.0	100.0
COLUMN %	12.7	4.5	11.8	26.0	35.8	25.2	24.8	26.4	57.4	5.9	8.9
INACTIVE	443	209	439	46	14	63	2	1	0	8012	9158
ROW %	4.8	2.3	4.8	0.5	0.2	0.7	0.0	0.0	0.0	87.5	100.0
COLUMN %	3.8	1.7	1.2	0.9	1.6	1.1	0.9	0.5	0.0	12.5	7.1
UNKNOWN	795	760	2454	270	62	300	13	12	3	5183	9493
ROW %	8.4	8.0	25.9	2.8	0.7	3.2	0.1	0.1	0.0	54.6	100.0
COLUMN %	6.8	6.3	6.9	5.1	7.0	5.4	5.7	5.8	5.6	8.1	7.4
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 18. NON-HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
0-4 YRS	3244	1488	12763	2384	324	2459	87	85	20	11880	31829
ROW %	10.2	4.7	40.1	7.5	1.0	7.7	0.3	0.3	0.1	37.3	100.0
COLUMN %	27.5	12.4	35.8	45.3	36.4	44.3	37.8	40.9	37.0	18.6	24.7
5-9 YRS	2179	3144	8423	1641	236	1718	55	48	14	10968	26403
ROW %	8.3	11.9	31.9	6.2	0.9	6.5	0.2	0.2	0.1	41.5	100.0
COLUMN %	18.5	26.2	23.6	31.2	26.5	30.9	23.9	23.1	25.9	17.2	20.5
10-14 YRS	2167	3643	7710	801	172	859	48	43	8	10744	25104
ROW %	8.6	14.5	30.7	3.2	0.7	3.4	0.2	0.2	0.0	42.8	100.0
COLUMN %	18.4	30.3	21.6	15.2	19.3	15.5	20.9	20.7	14.8	16.8	19.5
15-19 YRS	1531	2005	3834	226	80	250	29	26	11	7192	14806
ROW %	10.3	13.5	25.9	1.5	0.5	1.7	0.2	0.2	0.1	48.6	100.0
COLUMN %	13.0	16.7	10.8	4.3	9.0	4.5	12.6	12.5	20.4	11.3	11.5
20-24 YRS	984	910	1526	58	23	78	4	2	1	4717	8209
ROW %	12.0	11.1	18.6	0.7	0.3	1.0	0.0	0.0	0.0	57.5	100.0
COLUMN %	8.4	7.6	4.3	1.1	2.6	1.4	1.7	1.0	1.9	7.4	6.4
25-29 YRS	931	591	650	28	13	43	2	1	0	6301	8513
ROW %	10.9	6.9	7.6	0.3	0.2	0.5	0.0	0.0	0.0	74.0	100.0
COLUMN %	7.9	4.9	1.8	0.5	1.5	0.8	0.9	0.5	0.0	9.9	6.6

TABLE 18. NON-HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
30-34 YRS	573	164	391	38	14	51	5	3	0	8331	9508
ROW %	6.0	1.7	4.1	0.4	0.1	0.5	0.1	0.0	0.0	87.6	100.0
COLUMN %	4.9	1.4	1.1	0.7	1.6	0.9	2.2	1.4	0.0	13.0	7.4
35+ YRS	66	20	87	3	1	7	0	0	0	2850	3030
ROW %	2.2	0.7	2.9	0.1	0.0	0.2	0.0	0.0	0.0	94.1	100.0
COLUMN %	0.6	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	4.5	2.4
UNREPORTED	102	53	240	85	27	90	0	0	0	942	1425
ROW %	7.2	3.7	16.8	6.0	1.9	6.3	0.0	0.0	0.0	66.1	100.0
COLUMN %	0.9	0.4	0.7	1.6	3.0	1.6	0.0	0.0	0.0	1.5	1.1
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 19. NON-HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
TYPE 1	4348	1372	1038	11	23	62	8	5	1	34015	40835
ROW %	10.6	3.4	2.5	0.0	0.1	0.2	0.0	0.0	0.0	83.3	100.0
COLUMN %	36.9	11.4	2.9	0.2	2.6	1.1	3.5	2.4	1.9	53.2	31.7
TYPE 2	6851	10065	22911	707	153	840	66	51	4	24192	64813
ROW %	10.6	15.5	35.3	1.1	0.2	1.3	0.1	0.1	0.0	37.3	100.0
COLUMN %	58.2	83.7	64.3	13.4	17.2	15.1	28.7	24.5	7.4	37.8	50.3
TYPE 3	197	484	7699	1341	82	1372	43	42	4	381	10119
ROW %	1.9	4.8	76.1	13.3	0.8	13.6	0.4	0.4	0.0	3.8	100.0
COLUMN %	1.7	4.0	21.6	25.5	9.2	24.7	18.7	20.2	7.4	0.6	7.9
TYPE 4	83	44	2974	873	73	882	46	45	14	265	4244
ROW %	2.0	1.0	70.1	20.6	1.7	20.8	1.1	1.1	0.3	6.2	100.0
COLUMN %	0.7	0.4	8.3	16.6	8.2	15.9	20.0	21.6	25.9	0.4	3.3
TYPE 5	3	2	100	9	5	10	5	5	3	55	169
ROW %	1.8	1.2	59.2	5.3	3.0	5.9	3.0	3.0	1.8	32.5	100.0
COLUMN %	0.0	0.0	0.3	0.2	0.6	0.2	2.2	2.4	5.6	0.1	0.1
TYPE 6	1	3	361	964	54	967	17	16	6	12	1342
ROW %	0.1	0.2	26.9	71.8	4.0	72.1	1.3	1.2	0.4	0.9	100.0
COLUMN %	0.0	0.0	1.0	18.3	6.1	17.4	7.4	7.7	11.1	0.0	1.0
TYPE 7	3	1	232	144	48	148	12	12	5	5	386
ROW %	0.8	0.3	60.1	37.3	12.4	38.3	3.1	3.1	1.3	1.3	100.0
COLUMN %	0.0	0.0	0.7	2.7	5.4	2.7	5.2	5.8	9.3	0.0	0.3
TYPE 8	1	2	17	13	4	13	0	0	0	5	38
ROW %	2.6	5.3	44.7	34.2	10.5	34.2	0.0	0.0	0.0	13.2	100.0
COLUMN %	0.0	0.0	0.0	0.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0

TABLE 19. NON-HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
TYPE 9	1	7	192	1037	313	1046	28	28	14	12	1253
ROW %	0.1	0.6	15.3	82.8	25.0	83.5	2.2	2.2	1.1	1.0	100.0
COLUMN %	0.0	0.1	0.5	19.7	35.2	18.8	12.2	13.5	25.9	0.0	1.0
TYPE 10	9	3	47	118	103	118	3	3	3	29	206
ROW %	4.4	1.5	22.8	57.3	50.0	57.3	1.5	1.5	1.5	14.1	100.0
COLUMN %	0.1	0.0	0.1	2.2	11.6	2.1	1.3	1.4	5.6	0.0	0.2
TYPE 11	52	5	8	2	2	10	0	0	0	2029	2103
ROW %	2.5	0.2	0.4	0.1	0.1	0.5	0.0	0.0	0.0	96.5	100.0
COLUMN %	0.4	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	3.2	1.6
TYPE 12	226	24	45	45	30	81	1	1	0	825	1204
ROW %	18.8	2.0	3.7	3.7	2.5	6.7	0.1	0.1	0.0	68.5	100.0
COLUMN %	1.9	0.2	0.1	0.9	3.4	1.5	0.4	0.5	0.0	1.3	0.9
TYPE 13	2	6	0	0	0	6	1	0	0	2100	2115
ROW %	0.1	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	99.3	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	3.3	1.6
ALL CRAFT	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 20. NON-HIERARCHICAL GROUPS - AIRCRAFT TYPE VS. CAPABILITY GROUP

1976

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
	GLIDER	2	0	0	0	0	4	1	0	0	1705	1712
	ROW %	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	99.6	100.0
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	2.7	1.3
	BALLCON	0	0	0	0	0	2	0	0	0	395	397
	ROW %	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	99.5	100.0
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3
	BLIMP	0	6	0	0	0	0	0	0	0	0	6
	ROW %	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIXED	WING, ENG=1	11209	11440	23973	723	177	907	74	56	5	58239	105722
	ROW %	10.6	10.8	22.7	0.7	0.2	0.9	0.1	0.1	0.0	55.1	100.0
	COLUMN %	95.2	95.2	67.3	13.7	19.9	16.3	32.2	26.9	9.3	91.1	82.1
FIXED	WING, ENG>1	288	543	11598	4494	681	4551	154	151	49	732	17683
	ROW %	1.6	3.1	65.6	25.4	3.9	25.7	0.9	0.9	0.3	4.1	100.0
	COLUMN %	2.4	4.5	32.6	85.4	76.5	81.9	67.0	72.6	90.7	1.1	13.7
	ROTORCRAFT	278	29	53	47	32	91	1	1	0	2854	3307
	ROW %	8.4	0.9	1.6	1.4	1.0	2.8	0.0	0.0	0.0	86.3	100.0
	COLUMN %	2.4	0.2	0.1	0.9	3.6	1.6	0.4	0.5	0.0	4.5	2.6

TABLE 20. NON-HIERARCHICAL GROUPS - AIRCRAFT TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
UNREPORTED	0	0	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 21. NON-HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
RECIPROCAT	11534	11978	34730	2943	338	3176	168	148	26	60972	122324
ROW %	9.4	9.8	28.4	2.4	0.3	2.6	0.1	0.1	0.0	49.8	100.0
COLUMN %	97.9	99.7	97.5	55.9	38.0	57.2	73.0	71.2	48.1	95.4	95.0
TURBOPROP	5	6	610	1121	106	1128	29	28	11	24	1768
ROW %	0.3	0.3	34.5	63.4	6.0	63.8	1.6	1.6	0.6	1.4	100.0
COLUMN %	0.0	0.0	1.7	21.3	11.9	20.3	12.6	13.5	20.4	0.0	1.4
TURBOSHAFT	226	24	45	45	30	81	1	1	0	823	1202
ROW %	18.8	2.0	3.7	3.7	2.5	6.7	0.1	0.1	0.0	68.5	100.0
COLUMN %	1.9	0.2	0.1	0.9	3.4	1.5	0.4	0.5	0.0	1.3	0.9
TURBOJET	10	10	239	1155	416	1164	31	31	17	41	1459
ROW %	0.7	0.7	16.4	79.2	28.5	79.8	2.1	2.1	1.2	2.8	100.0
COLUMN %	0.1	0.1	0.7	21.9	46.7	21.0	13.5	14.9	31.5	0.1	1.1
TURAIR GEN	0	0	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMJET	0	0	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 21. NON-HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB,	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
NO ENGINE	2	0	0	0	0	6	1	0	0	2065	2074
ROW %	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	99.6	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	3.2	1.6
UNREPORTED	0	0	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

TABLE 22. NON-HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
ONE	11479	11467	24021	748	202	971	74	56	5	61064	108958
ROW %	10.5	10.5	22.0	0.7	0.2	0.9	0.1	0.1	0.0	56.0	100.0
COLUMN %	97.5	95.4	67.4	14.2	22.7	17.5	32.2	26.9	9.3	95.5	84.6
TWO	293	547	11463	4381	577	4442	147	144	43	739	17456
ROW %	1.7	3.1	65.7	25.1	3.3	25.4	0.8	0.8	0.2	4.2	100.0
COLUMN %	2.5	4.6	32.2	83.2	64.8	80.0	63.9	69.2	79.6	1.2	13.5
THREE	0	0	3	7	3	7	1	1	1	6	16
ROW %	0.0	0.0	18.8	43.8	18.8	43.8	6.3	6.3	6.3	37.5	100.0
COLUMN %	0.0	0.0	0.0	0.1	0.3	0.1	0.4	0.5	1.9	0.0	0.0
FOUR	3	4	137	128	108	129	7	7	5	51	323
ROW %	0.9	1.2	42.4	39.6	33.4	39.9	2.2	2.2	1.5	15.8	100.0
COLUMN %	0.0	0.0	0.4	2.4	12.1	2.3	3.0	3.4	9.3	0.1	0.3
MORE	0	0	0	0	0	0	0	0	0	0	0
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NONE	2	0	0	0	0	6	1	0	0	2065	2074
ROW %	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	99.6	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	3.2	1.6
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 22. NON-HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP (CONTINUED)

KEY

GROUP		GROUP	
L:	Localizer	RA:	Radar altimeter
MB:	Marker beacon	LRN:	Long range RNAV
GS:	Glide slope	ML:	Microwave landing system

TABLE 23. NON-HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
1 SEAT	94	9	35	2	0	12	2	1	0	6409	6560
ROW %	1.4	0.1	0.5	0.0	0.0	0.2	0.0	0.0	0.0	97.7	100.0
COLUMN %	0.8	0.1	0.1	0.0	0.0	0.2	0.9	0.5	0.0	10.0	5.1
2 SEATS	3986	1336	1007	13	19	59	6	3	0	25946	32333
ROW %	12.3	4.1	3.1	0.0	0.1	0.2	0.0	0.0	0.0	80.2	100.0
COLUMN %	33.8	11.1	2.8	0.2	2.1	1.1	2.6	1.4	0.0	40.6	25.1
3 SEATS	316	39	27	3	7	8	1	1	1	5353	5744
ROW %	5.5	0.7	0.5	0.1	0.1	0.1	0.0	0.0	0.0	93.2	100.0
COLUMN %	2.7	0.3	0.1	0.1	0.8	0.1	0.4	0.5	1.9	8.4	4.5
4 SEATS	6179	8799	17531	384	132	497	40	28	3	22580	55552
ROW %	11.1	15.8	31.6	0.7	0.2	0.9	0.1	0.1	0.0	40.6	100.0
COLUMN %	52.5	73.2	49.2	7.3	14.8	8.9	17.4	13.5	5.6	35.3	43.1
5 SEATS	507	735	2533	138	30	168	10	9	0	1570	5505
ROW %	9.2	13.4	46.0	2.5	0.5	3.1	0.2	0.2	0.0	28.5	100.0
COLUMN %	4.3	6.1	7.1	2.6	3.4	3.0	4.3	4.3	0.0	2.5	4.3
6 SEATS	562	1012	10418	1752	115	1804	62	59	6	1376	15148
ROW %	3.7	6.7	68.8	11.6	0.8	11.9	0.4	0.4	0.0	9.1	100.0
COLUMN %	4.8	8.4	29.2	33.3	12.9	32.5	27.0	28.4	11.1	2.2	11.8

TABLE 23. NON-HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP (CONTINUED)

1976

	L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
7-11 SEATS	93	74	3337	2331	255	2351	72	70	21	362	6208
ROW %	1.5	1.2	53.8	37.5	4.1	37.9	1.2	1.1	0.3	5.8	100.0
COLUMN %	0.8	0.6	9.4	44.3	28.7	42.3	31.3	33.7	38.9	0.6	4.8
12-19 SEATS	24	5	223	270	90	282	20	20	9	172	703
ROW %	3.4	0.7	31.7	38.4	12.8	40.1	2.8	2.8	1.3	24.5	100.0
COLUMN %	0.2	0.0	0.6	5.1	10.1	5.1	8.7	9.6	16.7	0.3	0.5
20-49 SEATS	14	8	341	257	169	259	4	4	3	78	706
ROW %	2.0	1.1	48.3	36.4	23.9	36.7	0.6	0.6	0.4	11.0	100.0
COLUMN %	0.1	0.1	1.0	4.9	19.0	4.7	1.7	1.9	5.6	0.1	0.5
50+ SEATS	2	1	172	114	73	115	13	13	11	45	334
ROW %	0.6	0.3	51.5	34.1	21.9	34.4	3.9	3.9	3.3	13.5	100.0
COLUMN %	0.0	0.0	0.5	2.2	8.2	2.1	5.7	6.3	20.4	0.1	0.3
UNREPORTED	0	0	0	0	0	0	0	0	0	34	34
ROW %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
TOTALS	11777	12018	35624	5264	890	5555	230	208	54	63925	128827
ROW %	9.1	9.3	27.7	4.1	0.7	4.3	0.2	0.2	0.0	49.6	100.0
COLUMN %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

KEY

GROUP

L: Localizer

MB: Marker beacon

GS: Glide slope

GROUP

RA: Radar altimeter

LRN: Long range RNAV

ML: Microwave landing system

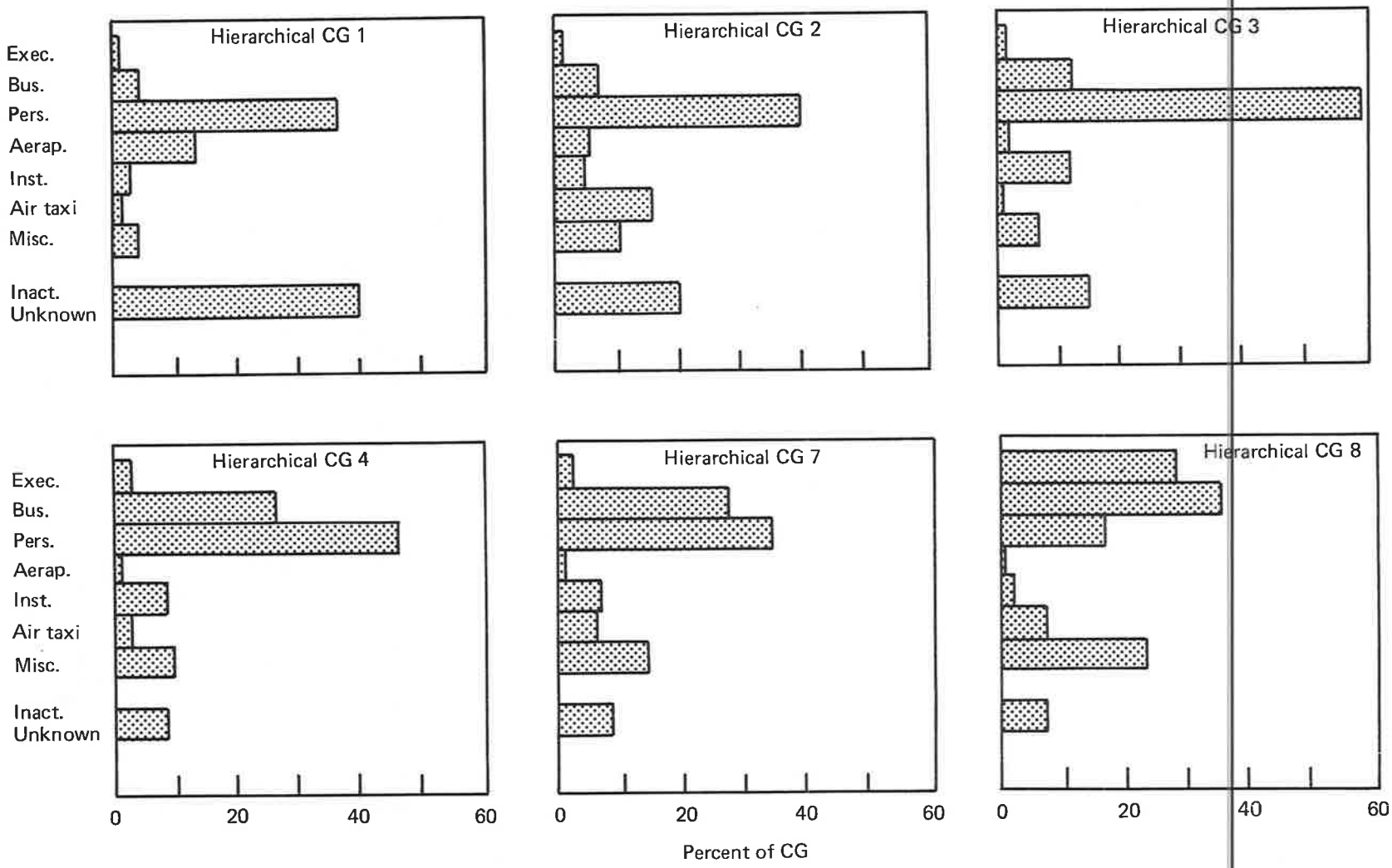
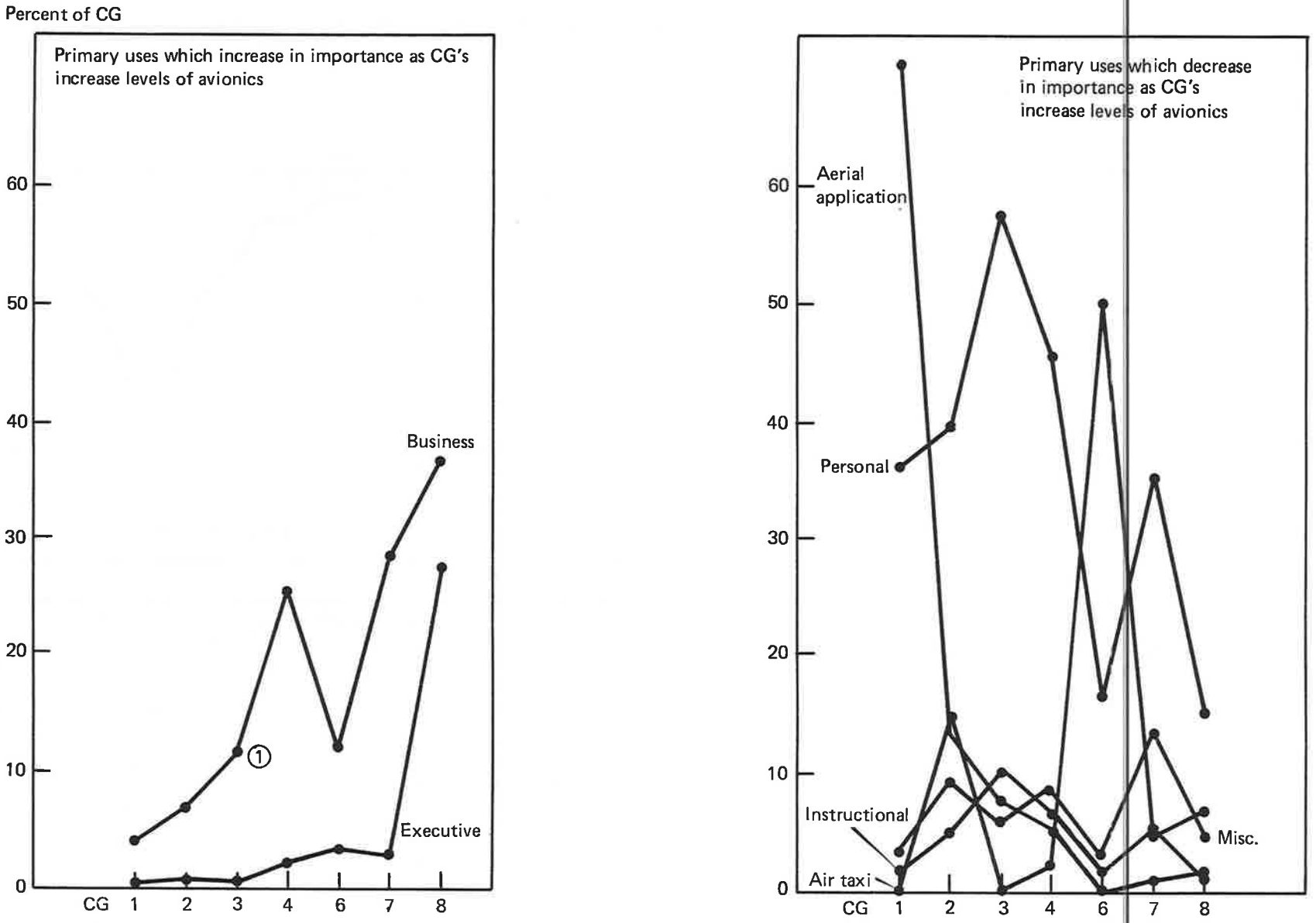


Figure 13. Percent Distribution of Hierarchical CG's by Primary Use



① This point represents the percent of hierarchical CG 3 which have a primary use of business

Figure 14. Primary Use Trends in Hierarchical CG's

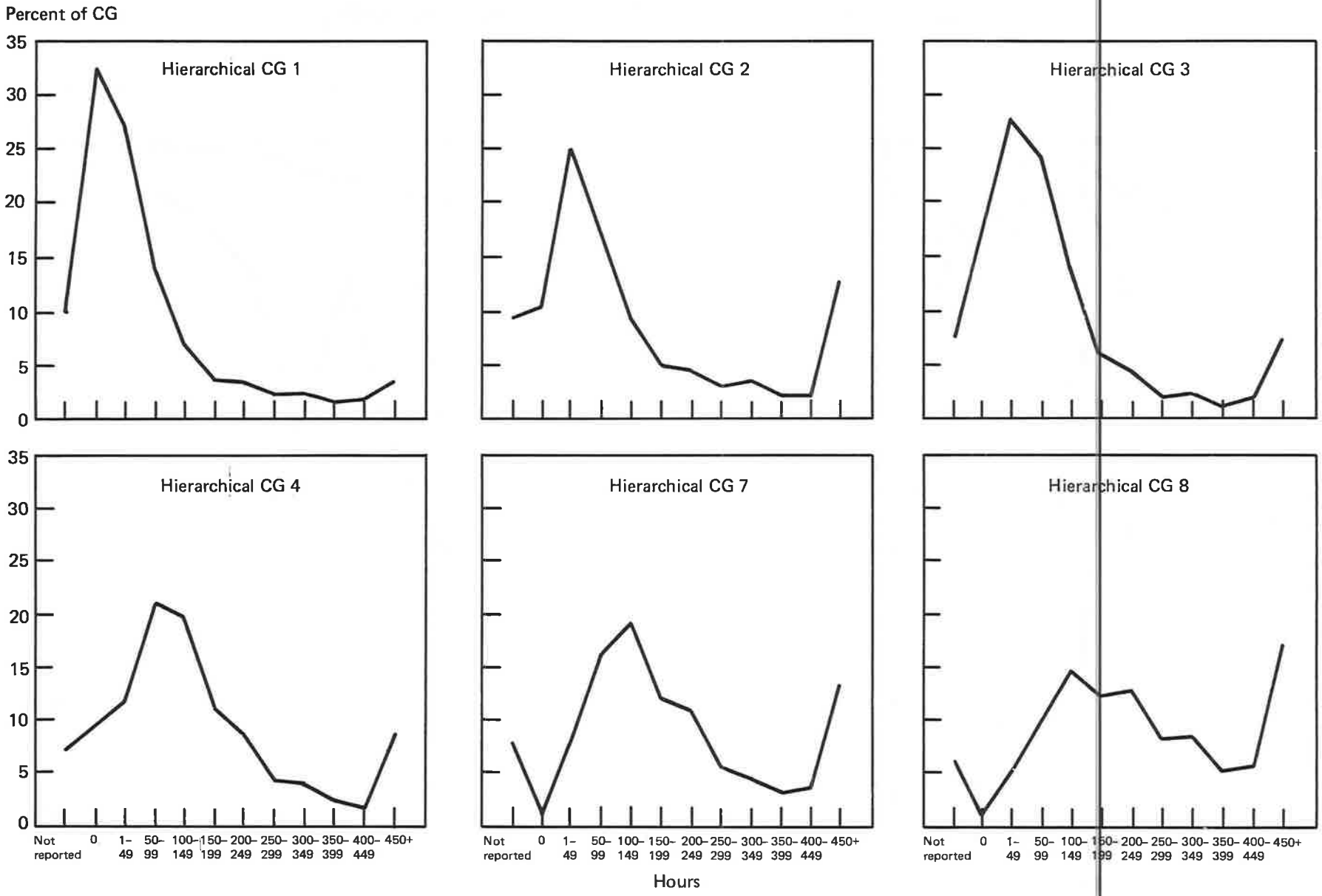


Figure 15. Percent Distribution of Hierarchical CG's by Annual Hours Flown

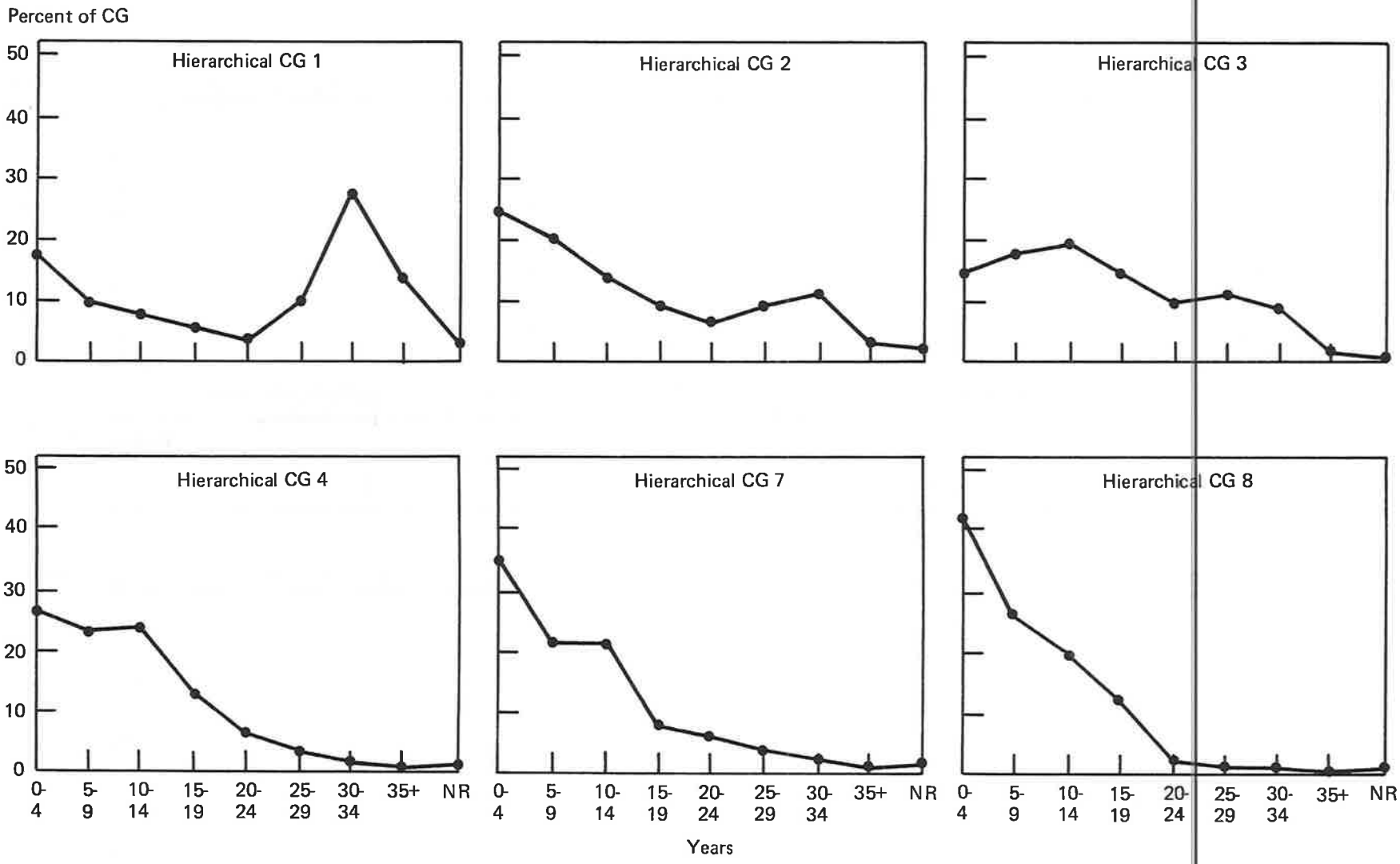


Figure 16. Percent Distribution of Hierarchical CG's by Age

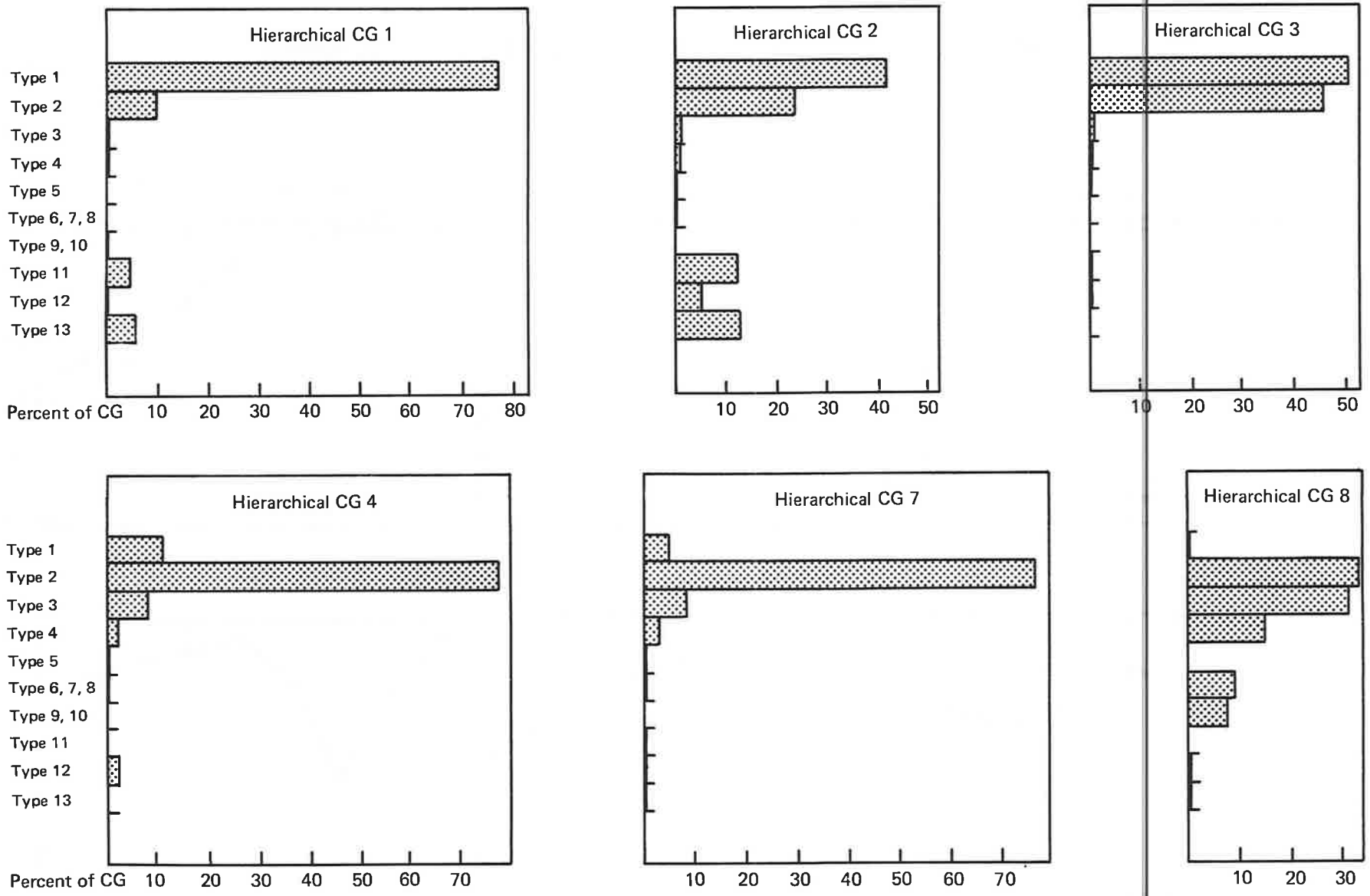
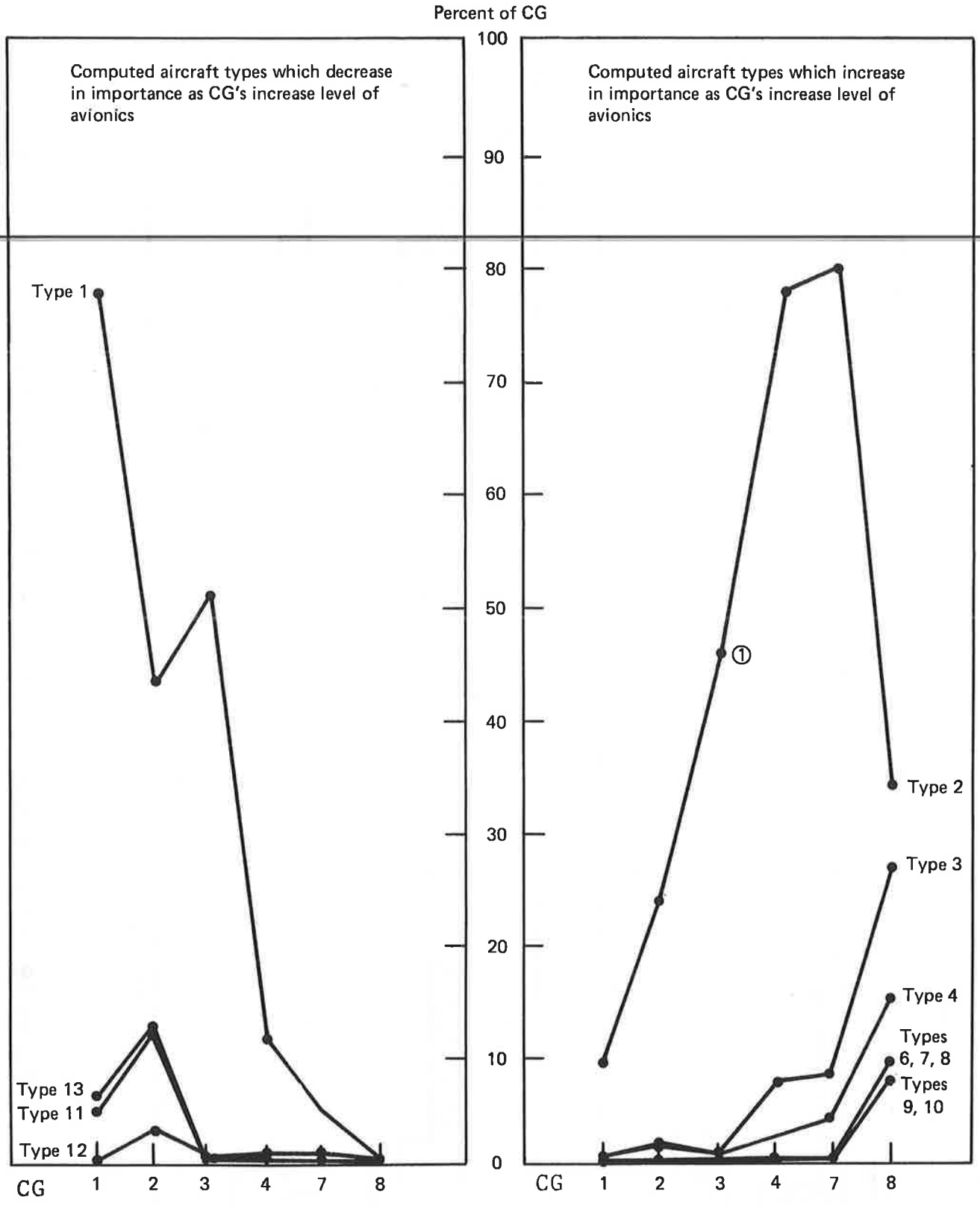


Figure 17. Percent Distribution of Hierarchical CG's by Computed Aircraft Type



① This point represents the percent of hierarchical group 3 which are computed aircraft type 2, fixed wing single engine, piston 4+ seats.

Figure 18. Computed Aircraft Type Trends in Hierarchical CG's

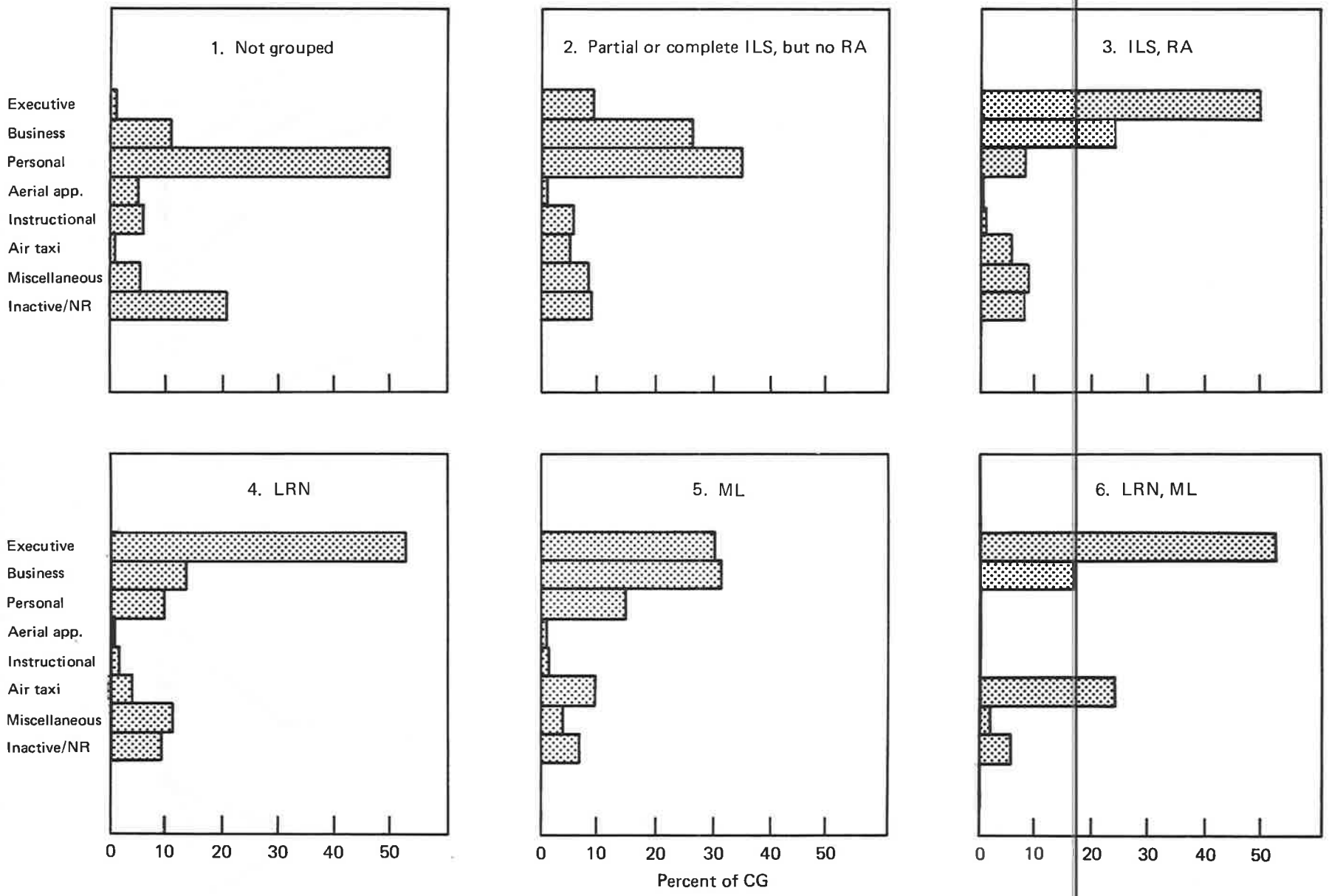


Figure 19. Percent Distribution of Non-Hierarchical CG's by Primary Use

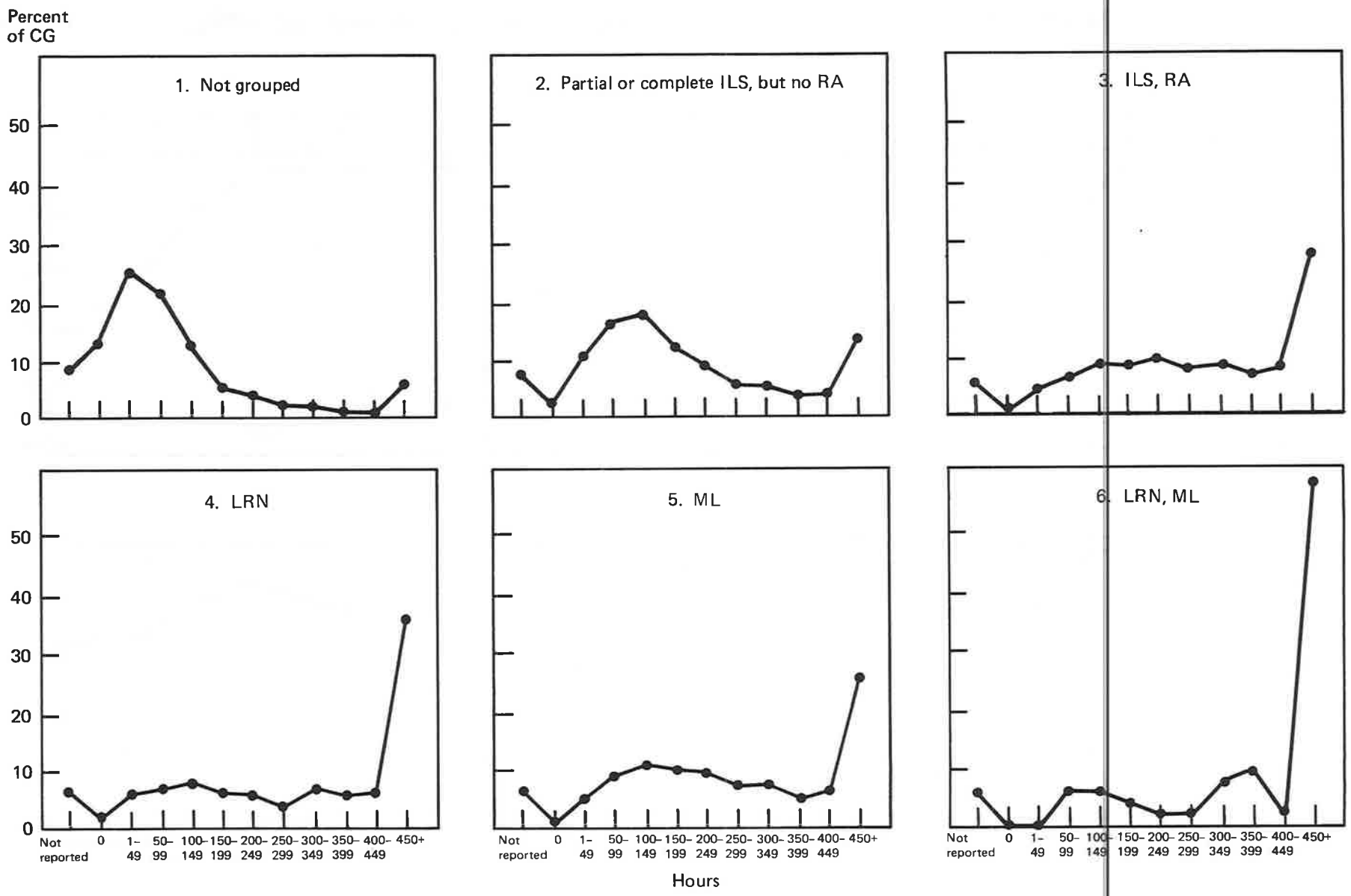


Figure 20. Percent Distribution of Non-Hierarchical CG's by Annual Hours Flown

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APPENDIX A

AIRCRAFT STATISTICAL MASTER FILE RECORD LAYOUT

Data Element	Field Description	Position	Length	Comments
1. N-Number	A/N	1-5	5	Left adjusted
2. Serial Number	A/N	6-20	15	Right adjusted
3. Aircraft				
Manufacturer	N	21-23	3	
Model	N	24-25	2	Type Codes: 1 - Glider; 2 - Balloon; 3 - Blimp/Dirigible; 4 - Fixed Wing Single Engine; 5 - Fixed Wing Multi Engine; 6 - Rotorcraft
Series	A/N	26-27	2	
Type	N	28	1	
4. Engine				
Type	N	29	1	
Manufacturer	N	30-32	3	Type Codes: 1 - Reciprocating; 2 - Turbopropeller; 3 - Turboshaft; 4 - Turbojet; 5 - Turbine Air Generator; 6 - Ram Jet; 9 - Unknown
Model	N	33-34	2	
5. Engine Horsepower (each engine)	N	35-39	5	Tens of pounds of thrust for turbojet only
6. Number of Engines	N	40-41	2	
7. Number of Seats	N	42-44	3	
8. Weight	N	45-51	7	Maximum gross takeoff
9. Cruise Speed	N	52-55	4	75% of average cruising speed times hours flown = miles flown
10. Wing Code	A/N	56	1	1 - Low Wing; 2 - High Wing; 3 - Biwing

Data Element	Field Description	Position	Length	Comments
11. Aircraft Category Code	N	57	1	1 - Land 2 - Sea 3 - Amphibian
12. Amateur Certification Code	A/N	58	1	Blank - Not Amateur 1 - Amateur Certification
13. Fuel Consumed	N	59-64	6	Fuel consumed per engine. Gallons of fuel consumed per hour, recorded in 2 decimal positons, decimal assumed.
14. Airworthiness Class	N	65	1	1 - Standard 2 - Limited 3 - Restricted 4 - Experimental 5 - Provisional 6 - Multiple 8 - Special Flight Permit
15. Approved Operations Code	A/N	66	1	
16. Year Manufactured	N	67-68	2	ØØ is unknown
17. G/A Indicator	A/N	69	1	1 - Air carrier aircraft Type unknown X - Aircarrier aircraft type Passenger Y - Air carrier aircraft type Cargo/Passenger Z - Air carrier aircraft type Cargo

Data Element	Field Description	Position	Length	Comments
				2 - General aviation aircraft
				D - Dealer aircraft
				3 - General aviation continuous maintenance
18. Type of Registrant	A/N	70	1	1 - Individual 2 - Partnership 3 - Corporation 4 - Co-ownership 5 - Government
19. Base Airport ID	A/N	71-75	5	
20. Base Airport				
Region	A/N	76	1	
State	N	77-78	2	
GADO	A/N	79-81	3	
County	N	82-84	3	
Site	A/N	85-93	9	
21. Owner				
Zip	N	94-98	5	
Region	A/N	99	1	
State	N	100-101	2	
GADO	A/N	102-104	3	
County	N	105-107	3	
22. Operator				
Zip	N	108-112	5	
Region	A/N	113	1	
State	N	114-115	2	
GADO	A/N	116-118	3	
County	N	119-121	3	

Data Element	Field Description	Position	Length	Comments
23. Hours Flown by Use				
Executive	A/N	122-125	4	Distribution of previous owner's hours included in other 9 use categories
Business	A/N	126-129	4	
Personal	A/N	130-133	4	
Aerial Application	A/N	134-137	4	
Instructional	A/N	138-141	4	
Air Taxi	A/N	142-145	4	
Industrial/Special	A/N	146-149	4	
Rental	A/N	150-153	4	
Other	A/N	154-157	4	
Previous Owner	A/N	158-161	4	
24. Not Flown	A/N	162	1	1 - Inactive Blank - Active
25. Primary Use	N	163	1	Ø - Unknown or not reported 1 - Executive 2 - Business 3 - Personal 4 - Aerial application 5 - Instruction 6 - Air taxi 7 - Industrial/special 8 - Aircraft rental business 9 - Other
26. VHF Communications Equipment				
360 Channels or Less	A/N	164	1	Blank - None reported Ø - None 1 - Yes
720 Channels or More	A/N	165	1	
More than One	A/N	166	1	
None	A/N	167	1	

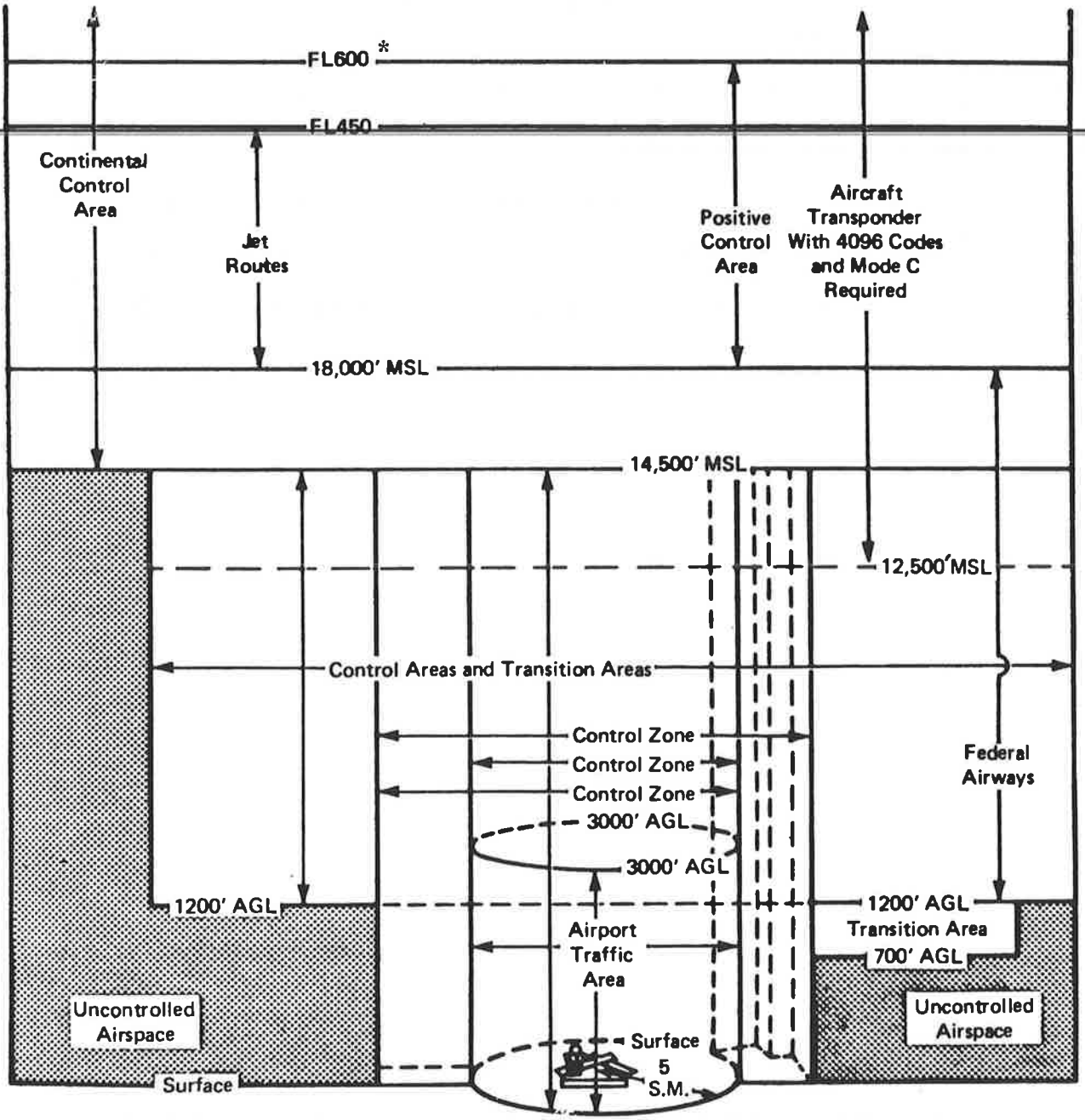
Data Element	Field Description	Position	Length	Comments
27. Transponder Equipment				
4096 Code	A/N	168	1	Blank - Not reported Ø - None 1 - Yes
Altitude Encoding	A/N	169	1	
None	A/N	170	1	
28. Navigation Equipment				
100 Channel VOR	A/N	171	1	Blank - Not reported Ø - None 1 - Yes
200 Channel VOR	A/N	172	1	
More than 1 VOR	A/N	173	1	
ADF	A/N	174	1	
DME	A/N	175	1	
RNAV	A/N	176	1	
Long Range RNAV	A/N	177	1	
Auto Pilot	A/N	178	1	
Radar Altimeter	A/N	179	1	
None	A/N	180	1	
29. Instrument Landing Equipment				
Localizer	A/N	181	1	Blank - Not reported Ø - None 1 - Yes
Marker Beacon	A/N	182	1	
Glide Scope	A/N	183	1	
MLS	A/N	184	1	
None	A/N	185	1	
30. Certification Issue Date				
Month	N	186-187	2	
Day	N	188-189	2	
Year	N	190-191	2	
31. Date Entered System				
Month	N	192-193	2	
Day	N	194-195	2	
Year	N	196-197	2	
32. Statistical Year	N	198-199	2	
33. Imputed Hours	N	200	1	1 - Yes (imputed) Ø - No (reported)

Data Element		Field Description	Position	Length	Comments
34.	Imputed Airport	N	201	1	1 - Yes (imputed) Ø - No (reported)
35.	Type Aircraft Sort	A/N	202-204	3	
36.	Aircraft Manufacturer Name	A/N	205-234	30	
37.	Aircraft Model & Series Name	A/N	235-254	20	
38.	Engine Manufacturer Name	A/N	255-264	10	
39.	Engine Model Name	A/N	265-277	13	
40.	Airport State Name	A/N	278-292	15	
41.	Airport County Name	A/N	293-314	22	
42.	Airport Name	A/N	315-344	30	
43.	Engine Sort Code	N	345	1	Engine types 1 -- Engine sort code 1 2,3 -- 2 4,5,6,9 -- 4
44.	Total Recalcitrant	N	346	1	1 - Yes Ø - No
45.	Total Air Frame	N	347-351	5	
46.	Blank	A/N	352	1	

APPENDIX B

AIRSPACE STRUCTURE

APPENDIX B. AIRSPACE STRUCTURE



General Dimensions of Control Zones, Airport Traffic Areas, and the Vertical Extent of Airspace Segments.

* FL600 means "Flight Level 60,000 feet MSL"

Airman's Information Manual, Basic Flight Manual and ATC Procedures, Part 1, (May, 1976), p. 1-23.

Airborne Equipment Requirements

Types of Airspace	Flight condition	Equipment Requirements 1975		1985
Uncontrolled	VFR (day)	1. Airspeed indicator 2. Altimeter 3. Compass 4. Tachometer 5. Oil temperature 6. Emergency locator transmitter [1]	7. Manifold pressure 8. Fuel gage 9. Landing gear 10. Belts 11. Special equipment for over water flights (FAR 91.33)	Same as 1975
Uncontrolled	VFR (night)	All above plus: 1. Position lights 2. Anti-collision light	3. Landing light (if for hire) 4. Electrical source	Same as 1975
Uncontrolled	IFR	Same as VFR plus: 1. Two-way radio 2. Navigation system 3. Gyro turn/bank 4. Sensitive altimeter adjustable for barometric pressure 5. Clock with sweep second hand	6. Artificial horizon 7. Directional gyro or equivalent 8. Generator	Same as 1975
Controlled (non-positive)	VFR	Same as uncontrolled VFR plus transponder [2]		Same as 1975
	IFR	Same as uncontrolled IFR plus transponder [2]		Same as 1975
Positive control	VFR	Requires prior ATC approval		Same as 1975
	IFR	Same as uncontrolled IFR plus: 1. DME (if VOR/TACAN equipment carried) 2. Transponder [2] 3. VOR (In TCA's) 4. ADF (Air Carrier only) 5. ILS (Air Carrier only)		Same as 1975

[1] Does not apply to turbojet aircraft, scheduled air carriers (except charter), or certain training and agricultural flights.

[2] 4096 code, Mode 3A transponder with Mode C automatic altitude reporting capability will be required at Group I and II TCA Locations and in APC, and in controlled airspace of the 48 States above 12,500 feet. All non-participating aircraft operating within Group III TCA's will be transponder equipped with Mode C capability.

The National Aviation System Plan Fiscal Years 1976-1985, (March, 1975), p. 13-5.

APPENDIX B. (CONTINUED)

National Terminal Radar Programs

Location	Terminal airspace designation	Equipment Requirements		Services provided
		Present	Under Consideration	
Top 9 Large Hub locations.	Group I TCA	(Effective Jan 1. 1975) 4096 Code Transponder and Mode C Automatic Altitude Reporting Capability; Two-way Radio; VOR or TACAN Receiver.	Relaxation of Transponder Requirements During Periods of Low Activity.	TCA Procedures
Next 12 Large Hub locations	Group II TCA	(Effective July 1, 1975) 4096 Code Transponder and Mode C Automatic Altitude Reporting Capability; Two-way Radio; VOR or TACAN Receiver.	Deletion of Altitude Encoding Requirement. (Has been deleted)	TCA Procedures
Remaining 42 ARTS-III locations.	Group III TCA	(Effective July 1, 1975) 4096 Code Transponder and Mode C Automatic Altitude Reporting Capability *or* Two-way Radio Communications.		TCA Procedures
All other radar facilities	TRSA where Stage III service is provided	----------		Stage II or III service

The National Aviation System Plan Fiscal Years 1976-1985, (March, 1975), p. 6-4.

Air Taxi Operations - Air Taxi operations (takeoffs and landings) carry passengers, mail or cargo for revenue in accordance with FAR Part 135.

Airway/Federal Airway - A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids. (Refer to FAR Part 7.)

Altitude - The height of the level, point or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

1. MSL Altitude - Altitude, expressed in feet measured from mean sea level.

2. AGL Altitude - Altitude, expressed in feet measured above ground level.

3. Indicated Altitude - The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

Area Navigation/RNAV - A method of navigation that permits aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of self-contained system capability. (Refer to FAR Part 71.)

a. Area Navigation Low Route - An area navigation route within the airspace extending upward from 1,200 feet above the surface of the earth to, but not including, 18,000 feet MSL.

b. Area Navigation High Route - An area navigation route within the airspace extending upward from and including 18,000 feet MSL to flight level 450.

c. Random Area Navigation Routes/Random RNAV Routes - Direct routes, based on area navigation capability, between waypoints, defined in terms of degree/distance fixes or offset from published or established routes/airways at specified distance and direction.

d. RNAV Waypoint/W/P - A predetermined geographical position used for route or instrument approach definition or progress reporting purposes that is defined to a VORTAC station position.

Automatic Altitude Reporting - That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

Automatic Direction Finder/ADF - An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

Balloon - A lighter-than-air aircraft that is not engine driven.

Business Transportation - Any use of an aircraft not for compensation or hire by an individual for the purposes of transportation required by a business in which he is engaged.

Certificated Pilot - A person who holds a certificate issued by FAA, which qualified him to operate aircraft within the limitations prescribed on the certificate.

Colored (L/MF) Airway - Low altitude airway over the state of Alaska predicated on L/MF navigation aids. It is depicted on aeronautical charts by color and number.

Continental United States - The 49 states located on the continent of North America and the District of Columbia.

Conterminous U.S. - The forty-eight adjoining states and the District of Columbia.

Controlled Airport - An airport at which a control tower is in operation.

Controlled Airspace - Airspace, designated as a continental control area, control area, control zone, terminal control area, or transition area, within which some or all aircraft may be subject to air traffic control (Refer to FAR Part 71.)

Types of U.S. Controlled Airspace:

a. Continental Control Area - The airspace of the 48 contiguous states, the District of Columbia and Alaska, excluding the Alaska peninsula west of Long. 160 00'00"W at and above 14,500 MSL, but does not include:

   1. The airspace less than 1,500 feet above the surface of the earth or,

   2. Prohibited and restricted areas, other than the restricted areas listed in FAR Part 71.

b. Control Area - Airspace designated as Colored Federal Airways, VOR Federal Airways, Terminal Control Areas, Additional Control Areas, and Control Area Extensions, but not including the Continental Control Area. Unless otherwise designated, control areas also include the airspace between a segment of a main VOR airway and its associated alternate segments. The vertical extents of the various categories of airspace contained in control areas are defined in FAR Part 71.

c. Control Zone - Controlled airspace which extends upward from the surface and terminates at the base of the continental control area. Control zones that do not underlie the continental area have no upper limit. A control zone may include one or more airports and is normally a circular area within a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

d. Terminal Control Area/TCA - Controlled airspace extending upward from the surface or higher to specified altitudes within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. TCA's are depicted on Sectional, World Aeronautical, En Route Low Altitude and TCA charts. (Refer to FAR Part 91).

e. Transition Area - Controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed, or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise limited, transition areas

terminate at the base of the overlying controlled airspace. Transition areas are designed to contain IFR operatings in controlled airspace during portions of the terminal operations and while transiting between the terminal and en route environment.

Dirigible - A lighter-than-air aircraft, engine propelled, with an inward metal frame which maintains its shape.

Distance Measuring Equipment/DME - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigation aid.

En Route - The route of flight from point of departure to point of destination, including intermediate stops (excludes local operations).

Executive Transportation - Any use of an aircraft by a corporation, company or other organization for the purposes of transporting its employees and/or property not for compensation or hire and employing professional pilots for the operation of the aircraft.

FAA - Federal Aviation Administration.

Fixed-Wing Aircraft - Aircraft having wings fixed to the airplane fuselage and outspread in flight, i.e., nonrotating wings.

Flight Service Station/FSS - Air Traffic Service facilities within the National Airspace System (NAS) which provide preflight pilot briefing and en route communications with VFR flights, assist lost IFR/VFR aircraft, assist aircraft having emergencies, relay ATC clearances, originate, classify, and disseminate Notices to Airmen, broadcast aviation weather and NAS information, receive and close flight plans, monitor radio NAVAIDS, notify search and rescue units of missing VFR aircraft, and operate the national weather teletypewriter systems. In addition, at selected locations FSS's take weather observations, issue airport advisories, administer airman written examinations, advise Customs and Immigrations of transborder flight.

General Aviation/GA - That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board, and large aircraft commercial operators.

General Aviation Aircraft - All civil aircraft except those classified as air carrier.

Group I Terminal Control Area - A TCA representing one of the nine busiest locations in the U.S. in terms of aircraft operations and passengers carried within which it is necessary for safety reasons to have strict requirements for operation.

Group II Terminal Control Area - A TCA representing one of the twelve less busy locations than a Group I TCA and requiring less stringent pilot and equipment requirements.

Group III Terminal Control Area - One of the 43 least busy TCA's where an ARTS-III system exists.

IFR Conditions - Weather conditions below the minimum for flight under visual rules.

Industrial/Special - Any use of an aircraft for specialized work allied with industrial activity; excluding transportation and aerial application. (Examples: pipe line patrol; survey; advertising; photography; helicopter hoist; etc.)

Instructional Flying - Any use of an aircraft for the purposes of formal instruction with the flight instructor aboard, or with the maneuvers on the particular flight(s) specified by the flight instructor.

Instrument Flight Rules/IFR - Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan (See Visual Flight Rules).

Instrument Landing System/ILS - A precision instrument approach system consisting of the following electronic components and visual aids:

a. Localizer
b. Glide Slope
c. Outer Marker
d. Middle Marker
e. Approach Lights

Refer to FAR Part 91.

Jet Route - A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as "J" routes with numbering to identify the designated route, e.g., J 105. (Refer to FAR Part 71.)

Low Altitude Airway Structure/Federal Airways - The network of airways serving aircraft operations up to but not including 18,000 feet MSL. (See Airway.)

Microwave Landing System/MLS - An instrument landing system operating in the microwave spectrum which provides lateral and vertical guidance to aircraft having compatible avionics equipment. (See Instrument Landing System.)

Non-Positive Controlled Airspace - Controlled airspace below 18,000 feet MSL.

Personal and Pleasure Flying - Any use of an aircraft for personal purposes not associated with business or profession, and not for hire. This includes maintenance of pilot proficiency.

Pilot Briefing - Information furnished a pilot to assist in flight planning. Principal items are weather conditions, notices to airmen, routes, and preparation and handling of the flight plan.

Piston-Powered Aircraft - An aircraft operated by engines in which pistons moving back and forth work upon a crank shaft or other device to create rotational movement.

Positive Controlled Area/PCA - Airspace designated in FAR Part 71 wherein aircraft are required to be operated under Instrument Flight Rules (IFR). Vertical extent of PCA is from 18,000 feet to and including flight level 600 throughout most of the conterminous United States and from flight level 240 to and including flight level 600 in designated portions of Alaska.

Radio Altimeter/Radar Altimeter - Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

Region (FAA) - A principal subdivision of the Federal Aviation Administration organized to carry out FAA programs under the executive direction of a regional director within the specific geographic boundaries.

Registered Aircraft - Aircraft registered with FAA.

Rotorcraft - A heavier-than-air aircraft that derives lift from one or more revolving "wings" or blades, engine-driven about an approximately vertical axis. A rotorcraft does not have conventional fixed wings, nor in any but some earlier models is provided with a conventional propeller, forward thrust and lift being furnished by the rotor. The powered rotor blades also enable the machine to hover, and to land and take off vertically.

Transponder - The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS), which automatically receives signals from interrogations being received on the mode to which it is set to respond.

Turbine-Powered Aircraft - Includes aircraft with either turbojet, turbofan, turboprop, or turboshaft engines.

Turbojet - Aircraft operated by jet engines incorporating a turbine-driven air compressor to take in and compress the air for the combustion of fuel, the gases of combustion (or the heated air) being used both to rotate the turbine and to create a thrust-producing engine.

Turboprop - Aircraft in which the main propulsive force is supplied by a gas turbine-driven conventional propeller. Additional propulsive force may be supplied from the discharge turbine engine gas.

Uncontrolled Airport - Also known as a non-tower airport, an airport at which no control tower is in operation. It may have an FSS, UNICOM operator, or no facility at all.

Uncontrolled Airspace - That portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area. (See Controlled Airspace).

UNICOM - A non-government air/ground radio communication facility, which may provide airport advisory service at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

U.S. Civil Aircraft Fleet - All aircraft under U.S. registry exclusive of Military.

Visual Flight Rules/VFR - Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan. (See Instrument Flight Rules). (Refer to FAR Part 91.)

VOR Airway - Low altitude airway designated from 1,200 feet AGL to 18,000 feet MSL predicated on VOR/VORTAC navigation aids. Also known as a "Victor" airway, it is indicated by a "V" on aeronautical charts and is numbered similarly to the U.S. highway system.

VOR/Very High Frequency Omnidirectional Range Station - A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by morse code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots.

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