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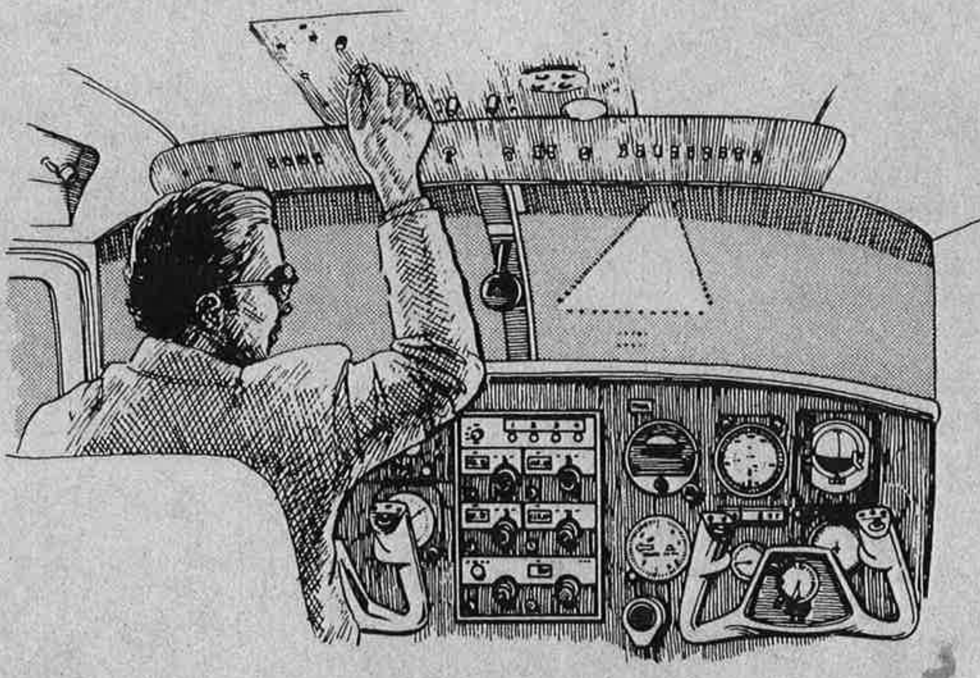
GENERAL AVIATION AVIONICS STATISTICS



DECEMBER 1980

ANNUAL REPORT
1978 DATA

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U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION
OFFICE OF MANAGEMENT SYSTEMS
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16. Abstract

This report presents avionics statistics for the 1978 general aviation (GA) aircraft fleet and is the fifth 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 flight rules 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 Sample File of results from the 1978 GA Activity and Avionics Survey is the source of all the statistical data used in this report.

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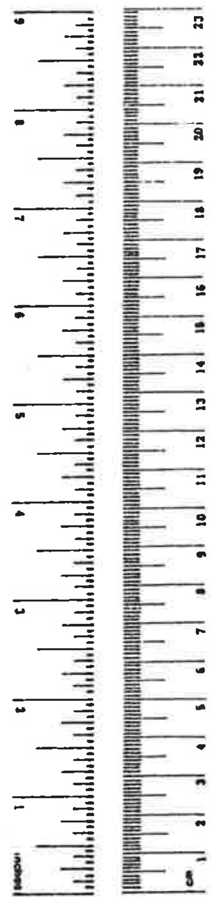
METRIC CONVERSION FACTORS

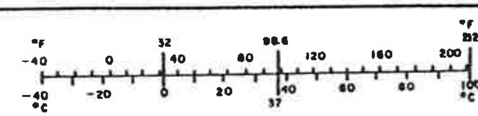
Approximate Conversions to Metric Measures

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	0.95	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



PREFACE

This report describes the 1978 avionics data study performed by the Transportation Systems Center (TSC) and Wilson Hill Associates, Inc., under Project Plan Agreement FA-143 sponsored by the Federal Aviation Administration (FAA), Office of Management Systems, Information and Statistics Division. It is the fifth in the series General Aviation Avionics Statistics, which TSC produced for the same sponsor. 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-220, assisted and guided the project as sponsor; Paula Shafer and Preeti Pandit of Wilson Hill Associates were responsible for manipulating the data, writing the computer programs to produce the tables appearing in this publication, and performing the data analysis.

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EXECUTIVE SUMMARY

This document is the fifth in the General Aviation Avionics Statistics report series, and presents avionics statistics and other descriptive information for the 1978 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 1978 Sample File of results from the GA Activity and Avionics Survey, conducted in 1979 by the Federal Aviation Administration (FAA) to obtain information on the activities and avionics of the 1978 general aviation aircraft fleet, the major component of civil aviation in the United States. The FAA selected a statistically designed sample of about 13.3 percent of the registered general aviation fleet to participate in the survey. The sampled aircraft represented all states and FAA regions, and all of the major manufacturer - model groups of aircraft.

In developing the framework for analyzing 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 type of flight rules 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 computing estimates of the number of GA aircraft in each capability group according to aircraft avionics configurations, 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 21,512 sampled GA aircraft for which avionics information was available, are listed below:

- While only about 18 percent of the GA fleet have the avionics equipment required to fly above 18,000 feet in positive controlled airspace, this proportion has grown nearly 147 percent since 1974.
- Seventy five percent of the GA fleet can fly by Instrument Flight Rules (IFR).
- About 22 percent of the GA fleet can land at Group I Terminal Control Areas (TCA's).
- At least 49 percent of the GA fleet have some degree of instrument landing system (ILS) receiving capability.
- From 1977 to 1978 there was an 18 percent increase in the proportion of aircraft with avionics equipment enabling them both 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, and
  - the age of the aircraft decreases.
- Over 80 percent of the GA fleet have two-way communication equipment.

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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 subsequent 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 1978 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

The basic source of data for this report series is the owners of the GA fleet. For each of the years 1974, 1975, and 1976, the FAA collected GA activity and avionics data through a voluntary census of the owners of all GA aircraft using Part 2 of the annual Aircraft Registration Eligibility, Identification and Activity Report, AC Form 8050-73. For each of the 1977 and 1978 reports, FAA obtained GA activity and avionics

[1]Source: Census of U.S. Civil Aircraft Calendar Year 1978, U.S. Department of Transportation, Federal Aviation Administration (Washington DC, 1979), p.3.

[2]This figure includes operations for both GA and air taxi. Source: FAA Air Traffic Activity, Calendar Year 1978, U.S. Department of Transportation, Federal Aviation Administration (Washington DC, 1979), p.2.

data by conducting a sample survey of around 14-15 percent of the registered GA fleet. This annual survey is known as the General Aviation Activity and Avionics Survey. Figure 1 shows the 1978 questionnaire. For a detailed description of the survey design, see Appendix A.

In this report, because of the survey method activity and avionics figures are in the form of statistical estimates rather than exact counts. These figures have standard errors because they are based on information obtained from only a portion of the GA fleet which is expanded to form an estimate for the whole fleet. Appendix A contains a thorough description of the standard errors, their interpretation, and use. Results of the survey were compiled into a computerized file known as the 1978 Sample File. A record layout appears in Appendix B.

1. CONTROL NUMBER

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

GENERAL AVIATION ACTIVITY and AVIONICS SURVEY
(As of December 31, 1978)

Form Approved
OMB No. 04–R0185

This report is authorized by Section 311 of the Federal Aviation Act of 1958, as amended. While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate and timely. Information collected in this survey will be used for statistical purposes only and not to disclose individual aircraft activity.

2. ☐ "X" here if you operate your aircraft principally as an air carrier (under FAR 121 or 127). If so, DO NOT complete remainder of form. However please return to address shown below.

3. AIRCRAFT CHARACTERISTICS

N–

INSTRUCTIONS: Please answer questions for the aircraft identified at right.
Mail the completed questionnaire in the enclosed postage paid envelope to

Federal Aviation Administration
P.O. Box 26045
Oklahoma City, Oklahoma 73126

4. What were the total lifetime airframe hours as of December 31, 1978? .... HOURS ☐

5. Was aircraft flown in Calendar Year 1978? *(Check one)*
1 ☐ Yes 2 ☐ No *(Skip to question 10)*

6. Did you own this aircraft for the entire year of 1978?
1 ☐ Yes 2 ☐ No

If "No," include previous owner's hours for 1978 in your estimates below.

7. HOURS FLOWN DURING CALENDAR YEAR 1978

	HOURS
EXECUTIVE—Corporate flying with professional crew .... a.	
BUSINESS—All non-executive flying for business reasons .... b.	
PERSONAL—Individual flying for personal reasons .... c.	
AERIAL APPLICATION—Agriculture, health, forestry .... d.	
INSTRUCTIONAL— Flying with or under supervision of a flight instructor .... e.	
AIR TAXI—All Part 135 passenger, cargo, and mail operations, including charter .... f.	
INDUSTRIAL/SPECIAL—Patrol, survey, photo, hoist, etc.—Other than Part 135 .... g.	
AIRCRAFT RENTAL BUSINESS—Commercial flying club, leased and rental aircraft activity .... h.	
OTHER—R&D, government, air show, sales, parachuting, etc .... i.	

8. Was this aircraft flown on an Instrument Flight Plan in 1978? 1 ☐ Yes 2 ☐ No
If "Yes," how many hours were flown on an Instrument Flight Plan? .... IFR HOURS ☐

9. Estimate of this aircraft's average rate of fuel consumption *(gal./hr.)* during 1978 *(Report whole gals. only)* GAL./HR. ☐

10. State *(Abbreviation)* or foreign country in which aircraft was based as of December 31, 1978 .... STATE ☐

11. AVIONICS EQUIPMENT CAPABILITY *("X" ALL boxes that reflect this aircraft's current capability. If none, check the last box in each group.)*

	"X"
VHF COMMUNICATIONS EQUIPMENT	
VHF Communications System:	
360 Channels or less .... a.	☐
720 Channels or more .... b.	☐
More than one comm. system .... c.	☐
No VHF Communications Equipment .... *d.*	☐
TRANSPONDER EQUIPMENT	
4096 Code .... e.	☐
Altitude Encoding Equipment .... f.	☐
No Transponder Equipment .... *g.*	☐
NAVIGATION EQUIPMENT	
VOR Receiver:	
100 Channels .... h.	☐
200 Channels .... i.	☐
More than one VOR Receiver .... j.	☐
Automatic Direction Finder (ADF) .... k.	☐
Distance Measuring Equipment (DME) .... l.	☐
Area Navigation Equipment (RNAV) .... m.	☐
Long Range Nav. (Doppler, INS, Other) .... n.	☐
Automatic Pilot .... o.	☐
Radar Altimeter .... p.	☐
Weather Radar .... q.	☐
No Navigation Equipment .... *r.*	☐
ILS RECEIVING EQUIPMENT	
Localizer .... s.	☐
Marker Beacon .... t.	☐
Glide Slope .... u.	☐
Microwave Landing System .... v.	☐
No ILS Receiving Equipment .... *w.*	☐

THANK YOU
FOR YOUR COOPERATION

FAA Form 1800–54 (11-78) Supersedes previous edition

FIGURE 1. SURVEY QUESTIONNAIRE

2. DEVELOPMENT AND METHODOLOGY

2.1 FLEET SIZE AND REPORT COVERAGE

The 1978 GA aircraft fleet contained 234,190 registered aircraft as of December 31, 1978. The avionics data in this report cover all GA aircraft, but are developed from the results of a 13.3% sample survey of the aircraft (see Appendix A). The survey sample size was 31,208 and achieved a response rate of 69 percent to the avionics questions (see Figure 2).

2.2 PROFILE OF GA AVIONICS

Table 1 summarizes the basic avionics data provided by the 1978 Sample File for the analysis of the 1978 GA fleet. It shows the estimates of the number of aircraft containing each piece of avionics equipment listed on the FAA 1800-54 forms. 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 avioncs 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, what type of flying it can do, 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

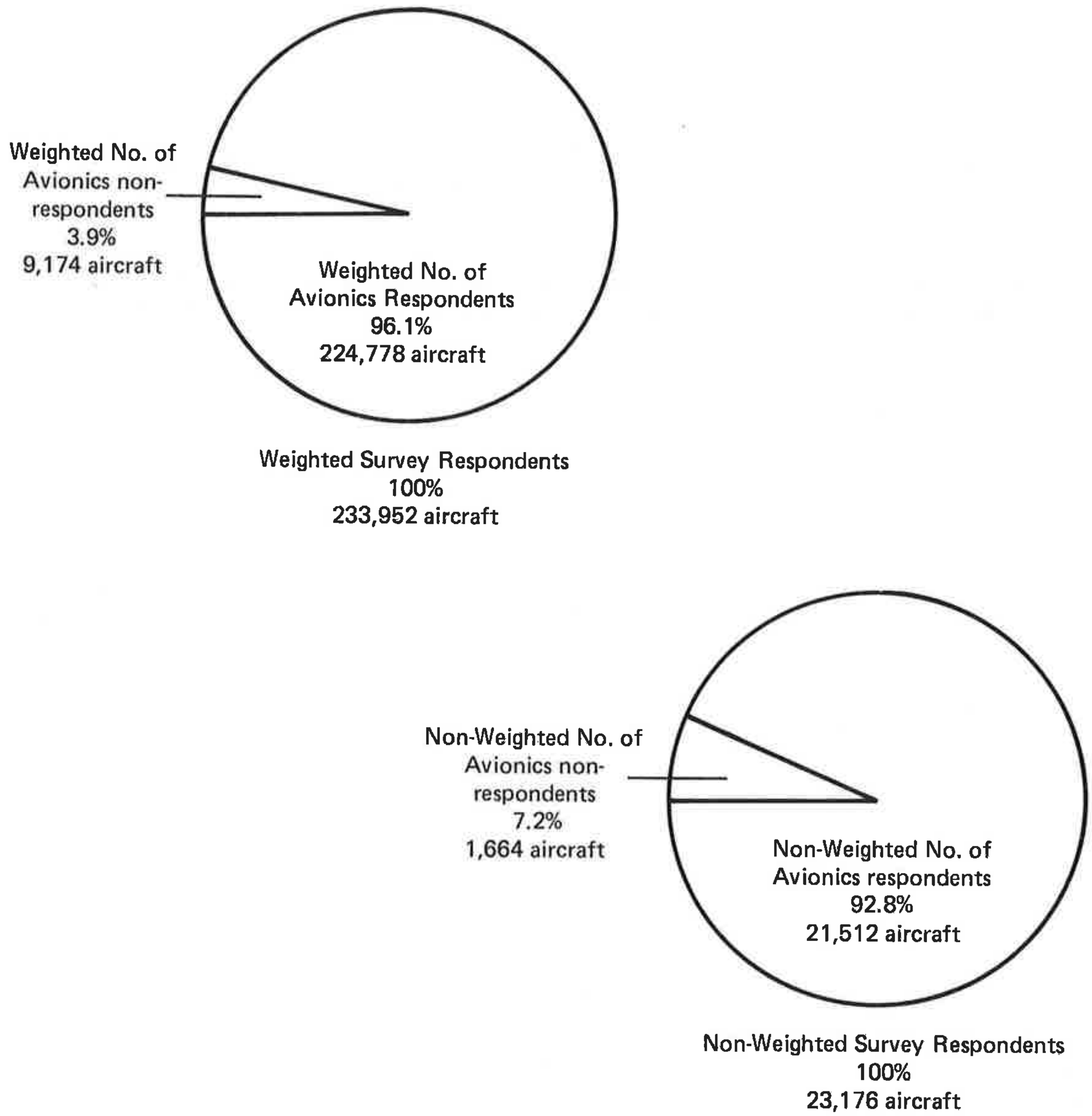

Figure 2. Survey Response to Avionics Questions

TABLE 1. BASIC AVIONICS DATA FOR 1978 GA FLEET*

VHF Communications Equipment	Estimates of Aircraft	% Standard Error
360 channels or less	130,367	A
720 channels or more	66,858	A
2 systems or more	98,688	A
None	45,787	A
Transponder Equipment		
4096 code	124,603	A
Altitude encoding	52,225	A
None	109,344	A
Navigation Equipment		
100 channels VOR receiver	90,408	A
200 channels VOR receiver	93,886	A
More than 1 VOR receiver	106,705	A
Automatic direction finder (ADF)	107,973	A
Distance measuring equipment (DME)	57,906	A
Area navigation equipment (RNAV)	16,133	A
Long range RNAV	2,292	B
Automatic pilot	62,000	A
Radar altimeter	12,790	A
Weather radar	15,202	A
None	53,157	A
Instrument Landing System		
Localizer	113,395	A
Marker beacon	99,484	A
Glide slope	81,113	A
Microwave landing system	464	D
None	114,623	A

*Based on the GA Activity and Avionics Survey for 1978.

STANDARD ERROR Greater Than	STANDARD ERROR Less Than or Equal To	CODE
0 %	10 %	A
10 %	20 %	B
20 %	30 %	C
30 %		D

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 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.

---

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

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

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 different types of flying, 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 the FAA Survey Form 1800-54. 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 D shows the various segments of the airspace and the flying regulations pertaining to the airspace, airports, and type of flying.

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 under visual flight rules (VFR) and instrument flight rules (IFR) type of flight, 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) type of flying 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 type of flying, 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 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.

2.4 DESCRIPTION OF AIRCRAFT CHARACTERISTICS

Eight aircraft characteristics were available on the 1978 Sample File for analysis in the framework of the CG's. They are listed below with appropriate comment.

a. Primary use of aircraft during 1978.

b. Hours flown during 1978: This variable was categorized into 50-hour intervals for easier reporting.

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 III TCA's All helicopters...Group I and II TCA's below 1,000 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 & altitude reporting: Group I TCA's and positive controlled airspace

TABLE 2. HIERARCHICAL CAPABILITY GROUPS (CONTINUED)

AVIONICS	CAPABILITIES
<u>Group 3</u> 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 1,000 feet AGL
<u>Group 4</u> 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 altitude 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 1,000 feet AGL
<u>Group 5</u> 4096 code transponder Altitude encoding equipment	1. Non-positive controlled airspace 2. VFR flight, day and night 3. Uncontrolled airports Group III TCA's

TABLE 2. HIERARCHICAL CAPABILITY GROUPS (CONTINUED)

AVIONICS	CAPABILITIES
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

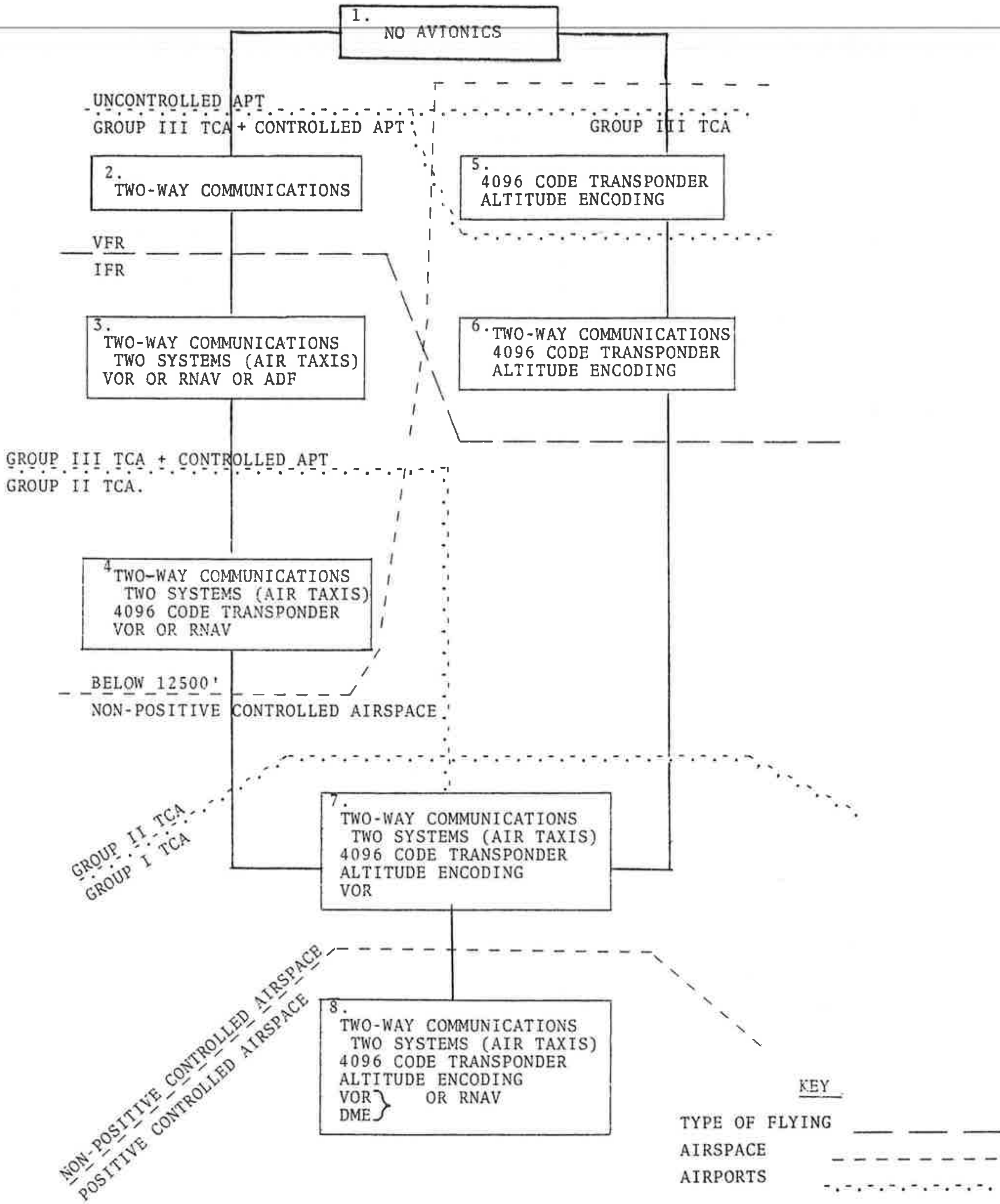

FIGURE 3. HIERARCHICAL CAPABILITY GROUPS (CG'S)

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 MLS	Backup landing systems
Group 9 Long Range RNAV MLS	Sophisticated navigational and landing capabilities

[1]See Appendix D, "Weather Category Definitions."

c. Age of aircraft in 1978: This variable was categorized into 5-year intervals for easier reporting.

d. 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.

e. Aircraft type (simple).

f. Engine type.

g. Number of engines.

h. Number of seats.

TABLE 4. COMPUTED AIRCRAFT TYPE

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 estimates of the number of GA aircraft found in 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 composed of four lines: aircraft estimate, standard error, percent of the row or non-hierarchical capability that estimate represents, and percent of the column or hierarchical capability that estimate represents.

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

3.1.1 <u>Hierarchical CG's</u>

Changes in the hierarchical CG's include the following:

a. More than 18 percent of GA aircraft have the avionics equipment enabling them to fly above 18,000 feet in positive controlled airspace. Approximately 78 percent of the GA fleet cannot fly above 12,500 feet due to avionics limitations alone.

b. Almost 75 percent of GA aircraft are equipped to fly IFR.

c. More than 19 percent of the GA fleet are limited to landing at uncontrolled airports. Approximately 29 percent can land at either uncontrolled airports or Group III TCA's. Approximately 30 percent can land at any type of airport except a Group I TCA. About 22 percent can land at Group I TCA's. This proportion has increased constantly over the past 5 years.

d. Hierarchical CG's 5 and 6 together contain only 0.4 percent of the GA fleet, showing no change from prior years.

TABLE 5. NON-HIERARCHICAL VS. HIERARCHICAL CAPABILITY GROUPS

1978

		1	2	3	4	5	6	7	8	TOTALS
L	ESTIMATE	123	649	7918	9496	0	60	920	469	19636
	% STD ERR	*	37.4	15.1	15.0	0.0	*	43.5	38.1	9.5
	ROW %	0.6	3.3	40.3	48.4	0.0	0.3	4.7	2.4	
	COLUMN %	0.3	5.4	14.4	13.7	0.0	10.1	10.7	1.1	8.4
L,MB	ESTIMATE	21	40	2564	10333	0	87	977	1985	16008
	% STD ERR	38.5	*	28.8	13.6	0.0	*	40.2	28.2	10.5
	ROW %	0.1	0.2	16.0	64.5	0.0	0.5	6.1	12.4	
	COLUMN %	0.0	0.3	4.7	15.0	0.0	14.7	11.3	4.6	6.8
L,MB,GS	ESTIMATE	46	432	2477	28315	81	303	5428	29493	66576
	% STD ERR	44.5	*	18.2	7.8	*	48.0	17.3	5.5	3.7
	ROW %	0.1	0.6	3.7	42.5	0.1	0.5	8.2	44.3	
	COLUMN %	0.1	3.6	4.5	41.0	62.8	51.1	62.9	68.8	28.5
L,MB,GS,RA	ESTIMATE	2	19	98	602	18	59	502	9875	11175
	% STD ERR	*	*	*	29.3	*	*	*	5.7	5.8
	ROW %	0.0	0.2	0.9	5.4	0.2	0.5	4.5	88.4	
	COLUMN %	0.0	0.2	0.2	0.9	14.0	9.9	5.8	23.0	4.8
LRN	ESTIMATE	0	54	116	236	0	5	10	1871	2292
	% STD ERR	0.0	24.7	*	42.0	0.0	*	*	13.9	12.6
	ROW %	0.0	2.4	5.1	10.3	0.0	0.2	0.4	81.6	
	COLUMN %	0.0	0.4	0.2	0.3	0.0	0.8	0.1	4.4	1.0
RA	ESTIMATE	17	31	1362	634	25	65	571	100[illegible]	12790
	% STD ERR	*	*	*	28.5	*	*	49.1	5.[illegible]	7.8
	ROW %	0.1	0.2	10.6	5.0	0.2	0.5	4.5	78.9	
	COLUMN %	0.0	0.3	2.5	0.9	19.4	11.0	6.6	23.5	5.5
ML	ESTIMATE	1	2	1	73	0	4	10	373	464
	% STD ERR	*	*	*	*	0.0	*	*	48.5	43.2
	ROW %	0.2	0.4	0.2	15.7	0.0	0.9	2.2	80.4	
	COLUMN %	0.0	0.0	0.0	0.1	0.0	0.7	0.1	0.9	0.2
L,MB,GS,ML	ESTIMATE	0	0	0	42	0	0	10	371	423
	% STD ERR	0.0	0.0	0.0	*	0.0	0.0	*	48.8	45.2
	ROW %	0.0	0.0	0.0	9.9	0.0	0.0	2.4	87.7	
	COLUMN %	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.9	0.2

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

1978

		1978								
		1	2	3	4	5	6	7	8	TOTALS
LRN,ML	ESTIMATE	0	0	0	3	0	0	0	198	201
	% STD ERR	0.0	0.0	0.0	38.0	0.0	0.0	0.0	*	*
	ROW %	0.0	0.0	0.0	1.5	0.0	0.0	0.0	98.5	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1
NO GROUP	ESTIMATE	45450	10880	41718	20271	23	74	793	1014	120222
	% STD ERR	2.8	6.5	4.9	9.6	*	46.8	34.6	*	2.0
	ROW %	37.8	9.0	34.7	16.9	0.0	0.1	0.7	0.8	
	COLUMN %	99.5	90.0	76.0	29.3	17.8	12.5	9.2	2.4	51.4
ALL CRAFT	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

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
MLS:	Microwave Landing System
RA:	Radar Altimeter
LRN:	Long Range RNAV
NO GROUP[3]:	Non-grouped aircraft

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[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.

A comparison of hierarchical CG's from 1974 through 1978 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 five year period. Figures 4, 5, 6, and 7 illustrate the changes which occurred in these two basic capabilities.

Figures 4 and 6 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 consistently over the past five years.

Figures 5 and 7 present normalized[1] growth of the capabilities from 1974 to 1978 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 5 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 7 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) 81.5 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, 88.4 percent of the aircraft possessing a complete ILS and a radar altimeter fall into hierarchical CG 8.

Figures 8 and 9 illustrate the changes which occurred to the hierarchical CG's from 1974 to 1978. Figure 8 provides a comparison of the major hierarchical CG percentages over the four 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 GA fleet, but that group 8 is gaining in importance.

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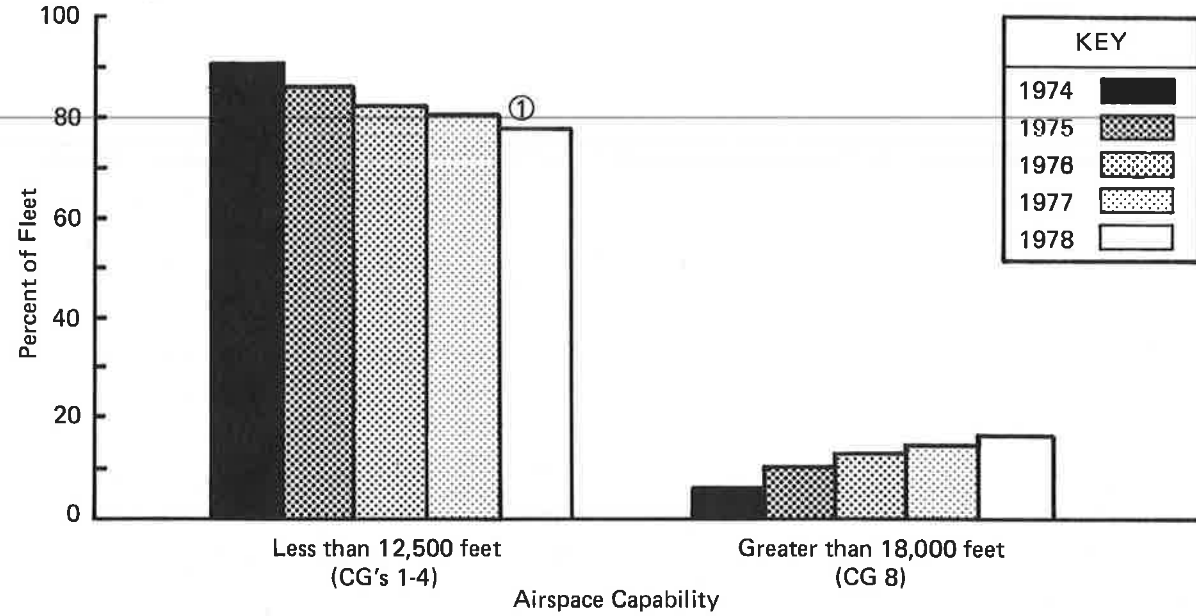
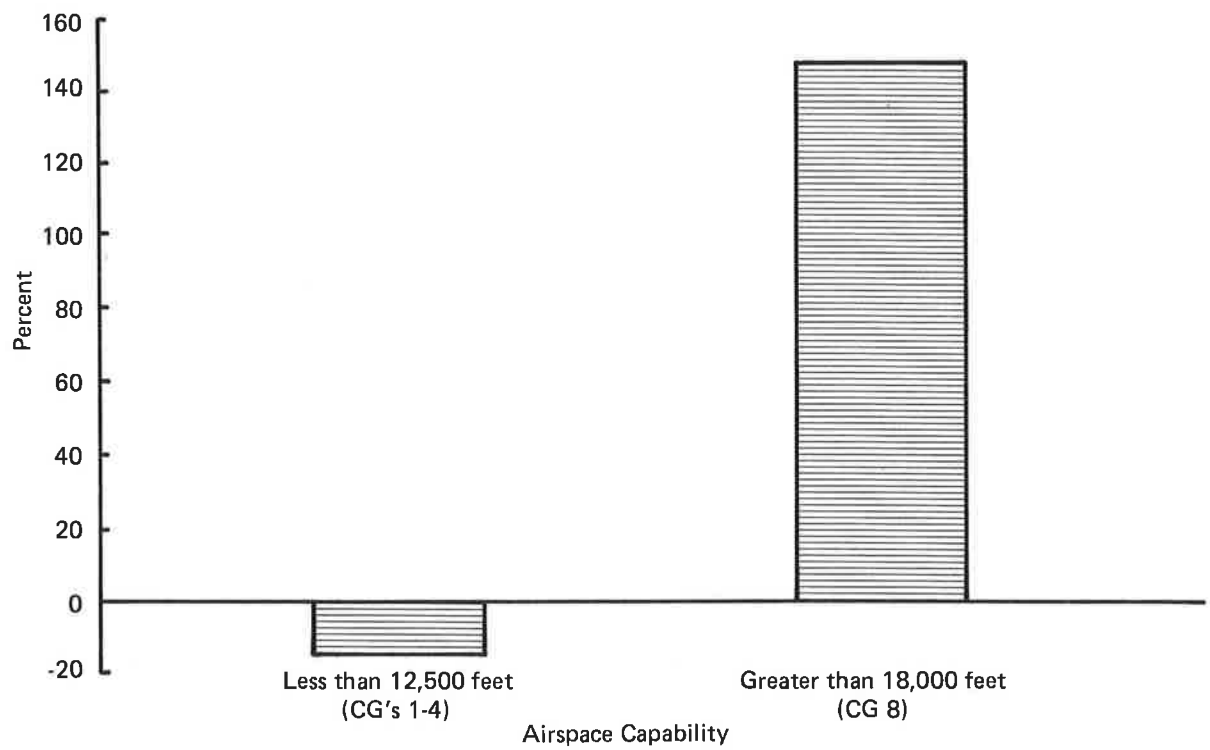
[1]Each group is normalized by the following formula: [(percent aircraft in 1978) - (percent aircraft in 1974)] ÷ (percent aircraft in 1974).



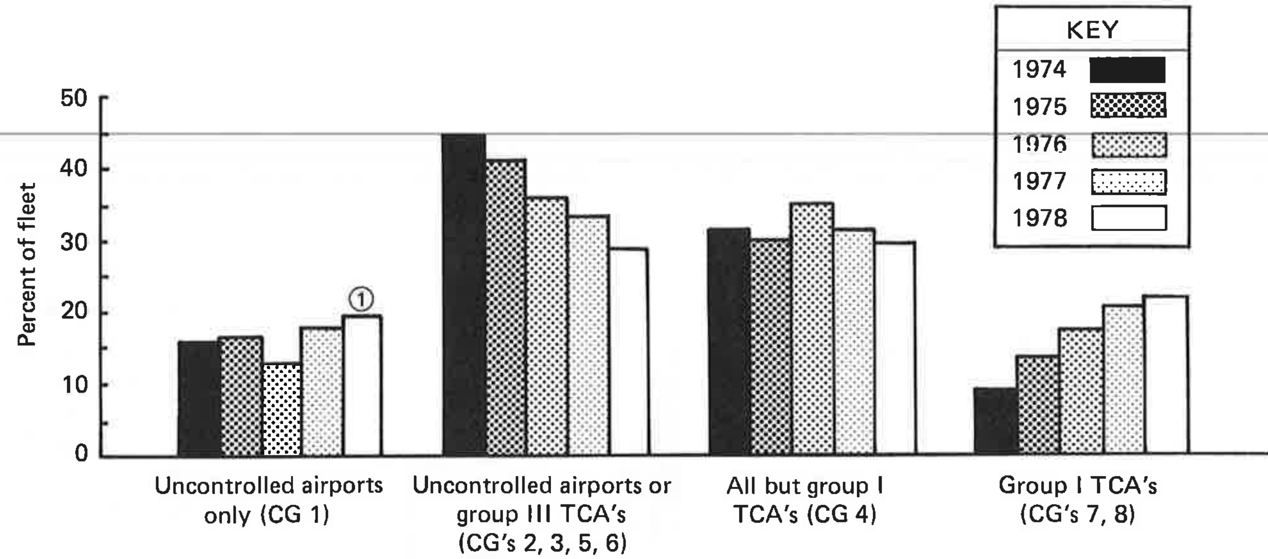
① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 4. A Comparison of Airspace Capabilities from 1974 to 1978



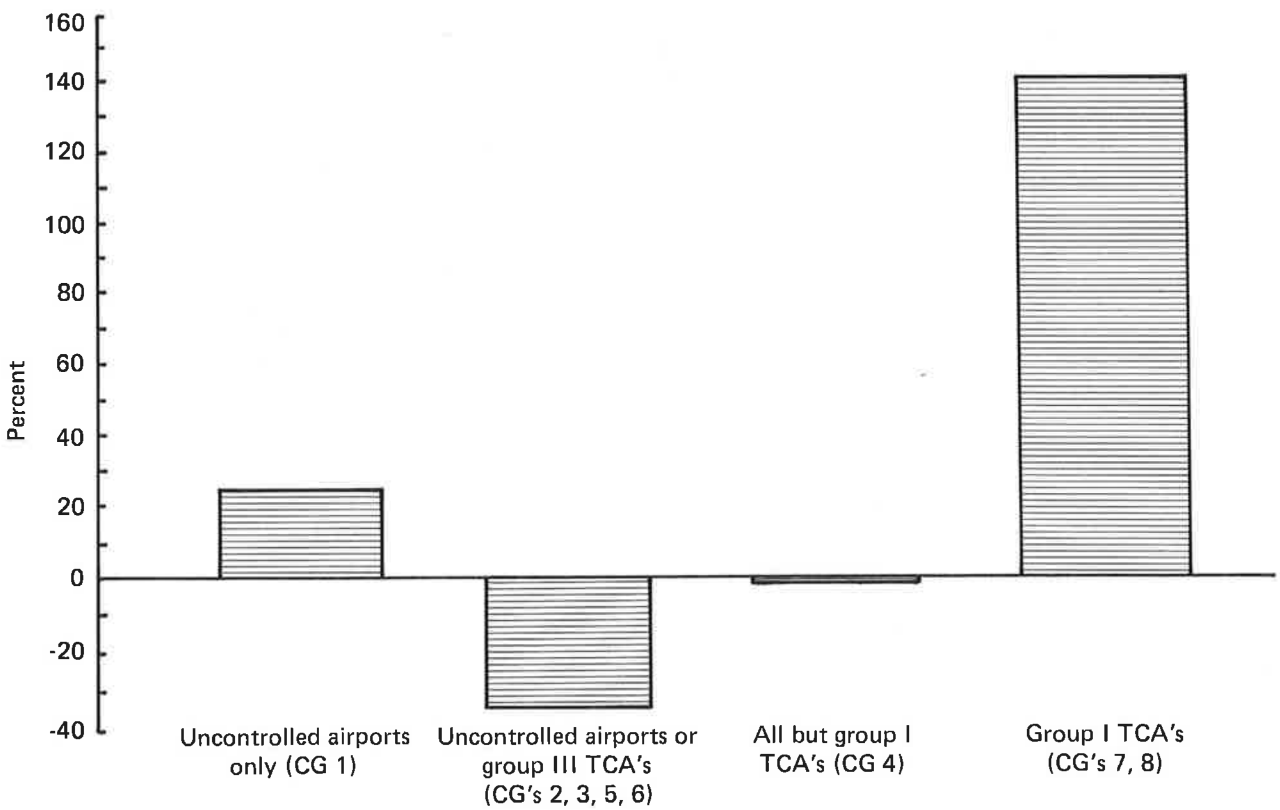
The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 5. Normalized Growth in Airspace Capabilities from 1974 to 1978



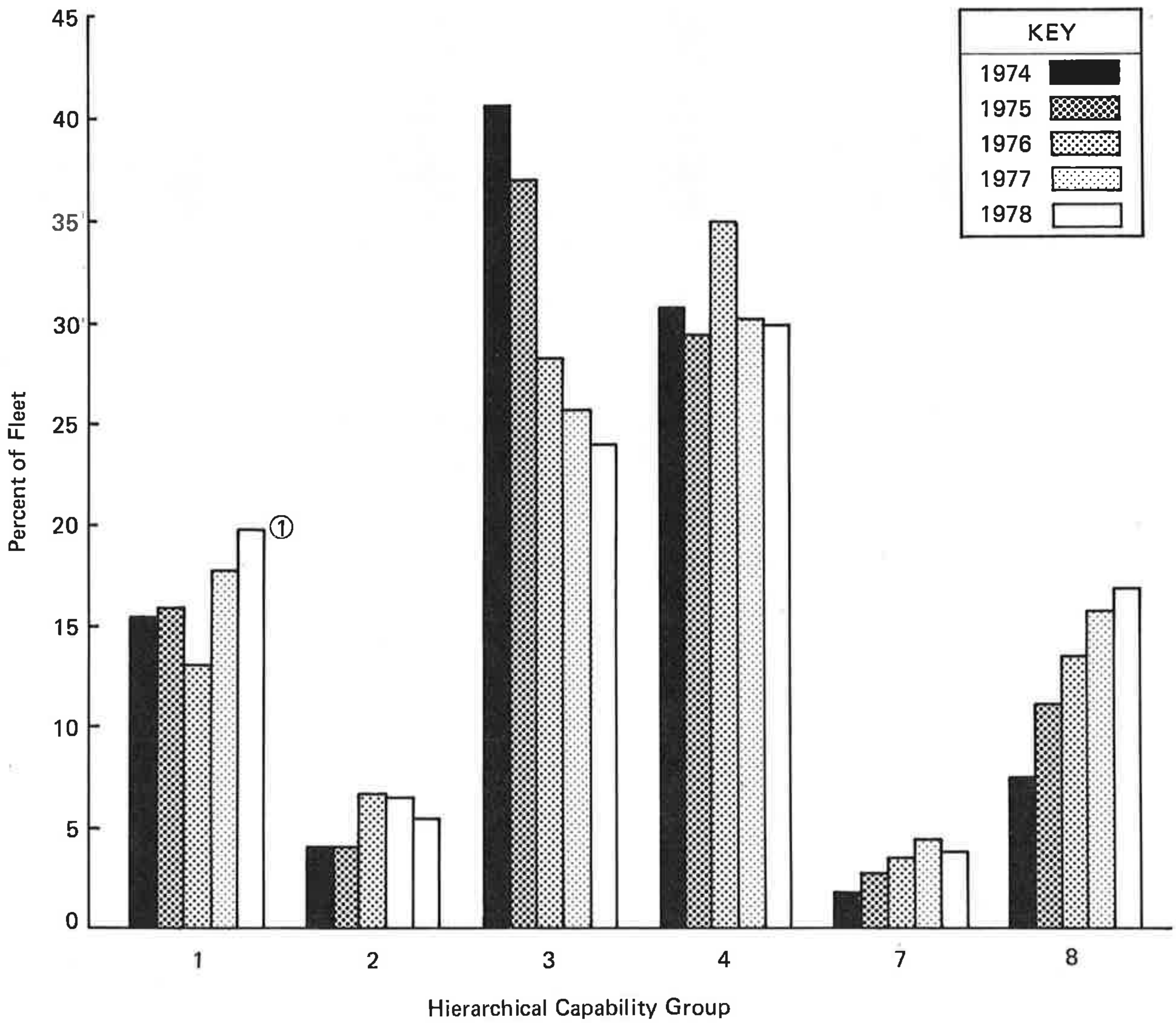
① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 6. A Comparison of Airport Capabilities from 1974 to 1978



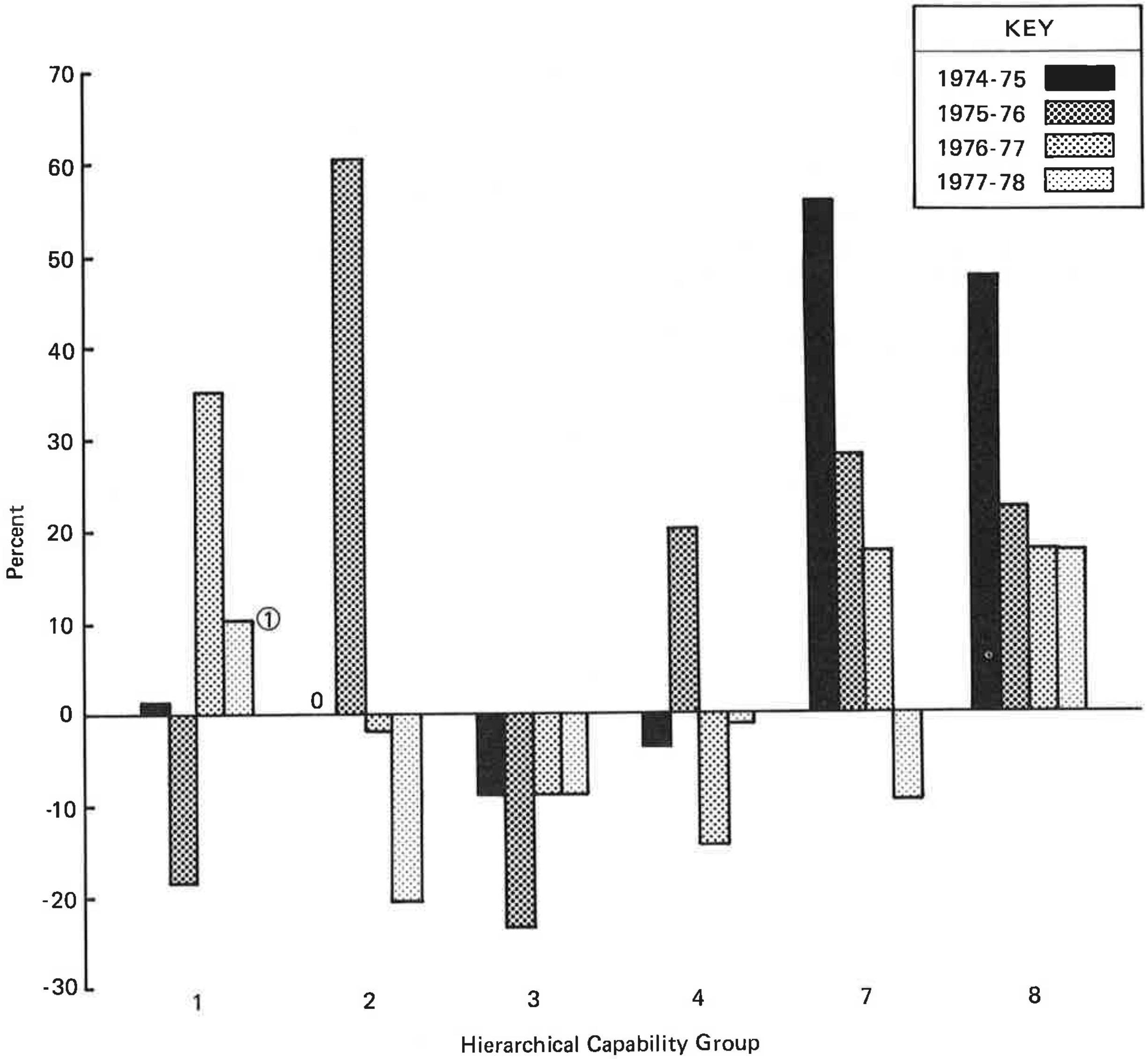
The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 7. Normalized Growth in Airport Capabilities from 1974 to 1978



① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 8. A Comparison of Hierarchical CG's from 1974 to 1978



① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 9. Normalized Growth in Hierarchical Group Size from 1974 to 1978

Figure 9 presents the normalized growth of the CG's relative to the growth of the fleet as a whole on a year by year basis. A study of Figure 9 reveals that CG's 1 and 8 grew faster from 1977 to 1978 than the overall fleet.

The decrease shown by CG 7 is probably due to an increase in RNAV equipment causing more aircraft to fall into CG 8, which exhibited an overall growth. Growth exhibited by CG 1 is only 10 percent and therefore relatively insignificant in the 1978 sample survey. Growth in CG 8 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 10 and 11 illustrate the changes from 1974 to 1978 in these three CG's. Figure 12 illustrates the change from 1976 to 1977, and 1977 to 1978 in the remaining non-hierarchical capability groups. A study of Figures 10 and 11 shows a decrease in partial ILS groups, and an increase in full ILS groups. This indicates the same trend toward sophistication in avionics noted in the hierarchical CG's and a willingness of GA aircraft owners to invest in sophisticated avionics equipment.

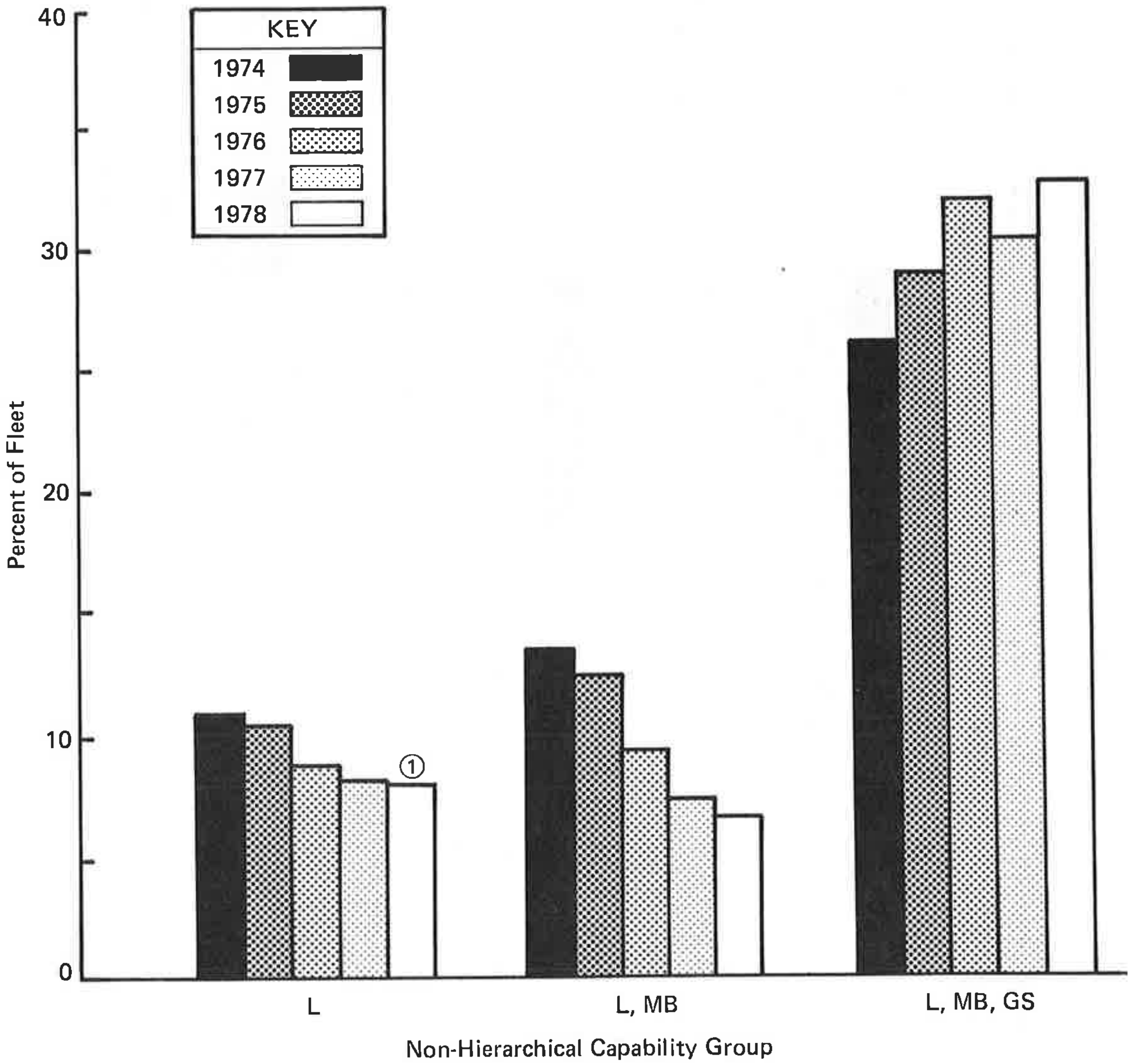
3.2 CHARACTERISTICS OF CAPABILITY GROUPS (CG's)

Tables 6 through 21 show four numbers in each cell. The first is the estimate of the number of aircraft falling into the particular capability group-category combination represented by the cell. The second is the percent standard error. The third number is the percent of the row or category that the number of aircraft represents. The fourth 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.

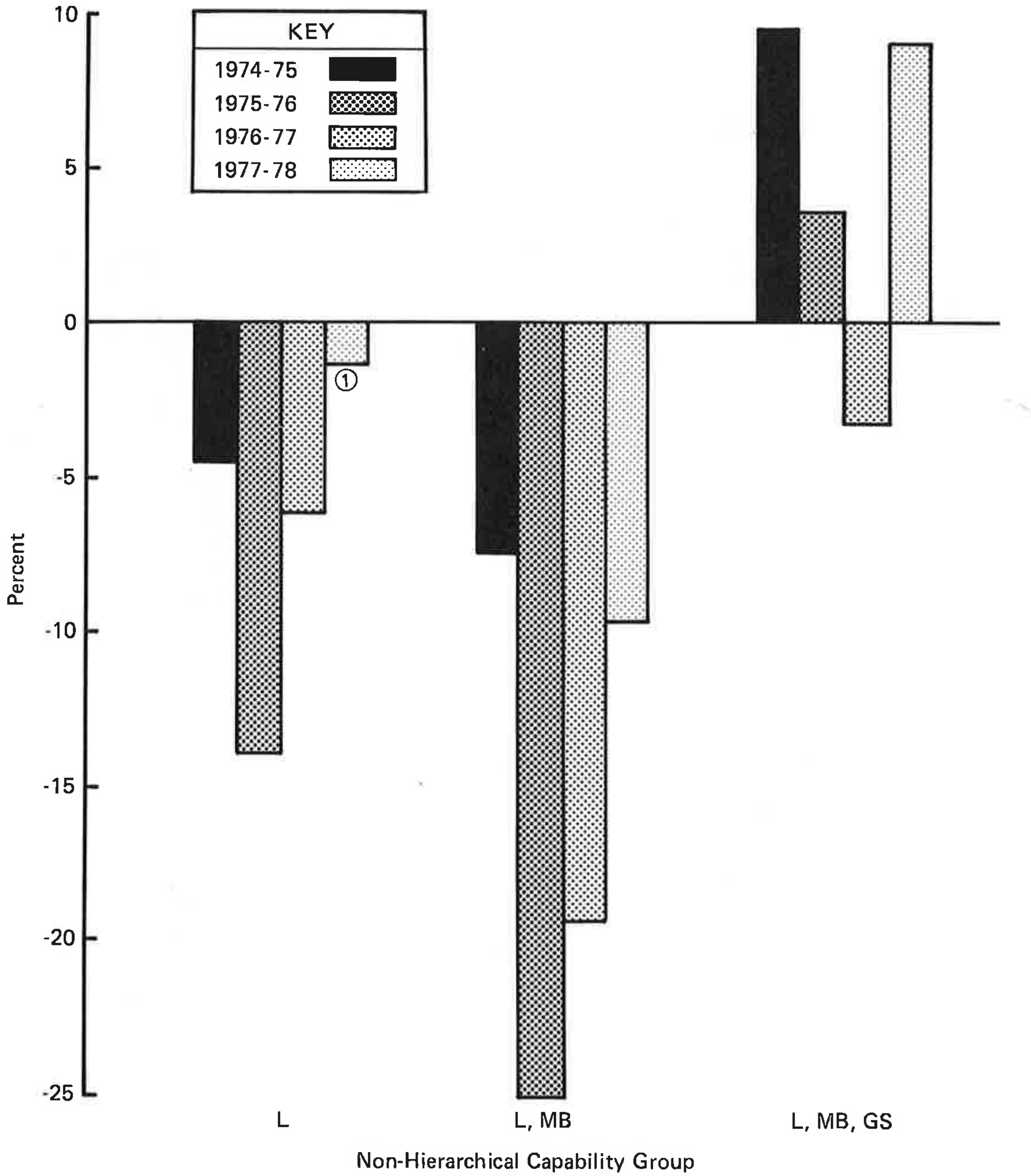
3.2.1 Characteristics of Hierarchical CG's

As mentioned in the discussion of Table 5, there was significant growth in hierarchical CG 8 from 1977 to 1978 attributable to both upgrading avionics systems in pre-1978 aircraft and installing complex avionics equipment in new aircraft. Tables 6 through 14 and Figures 13 through 16 show the



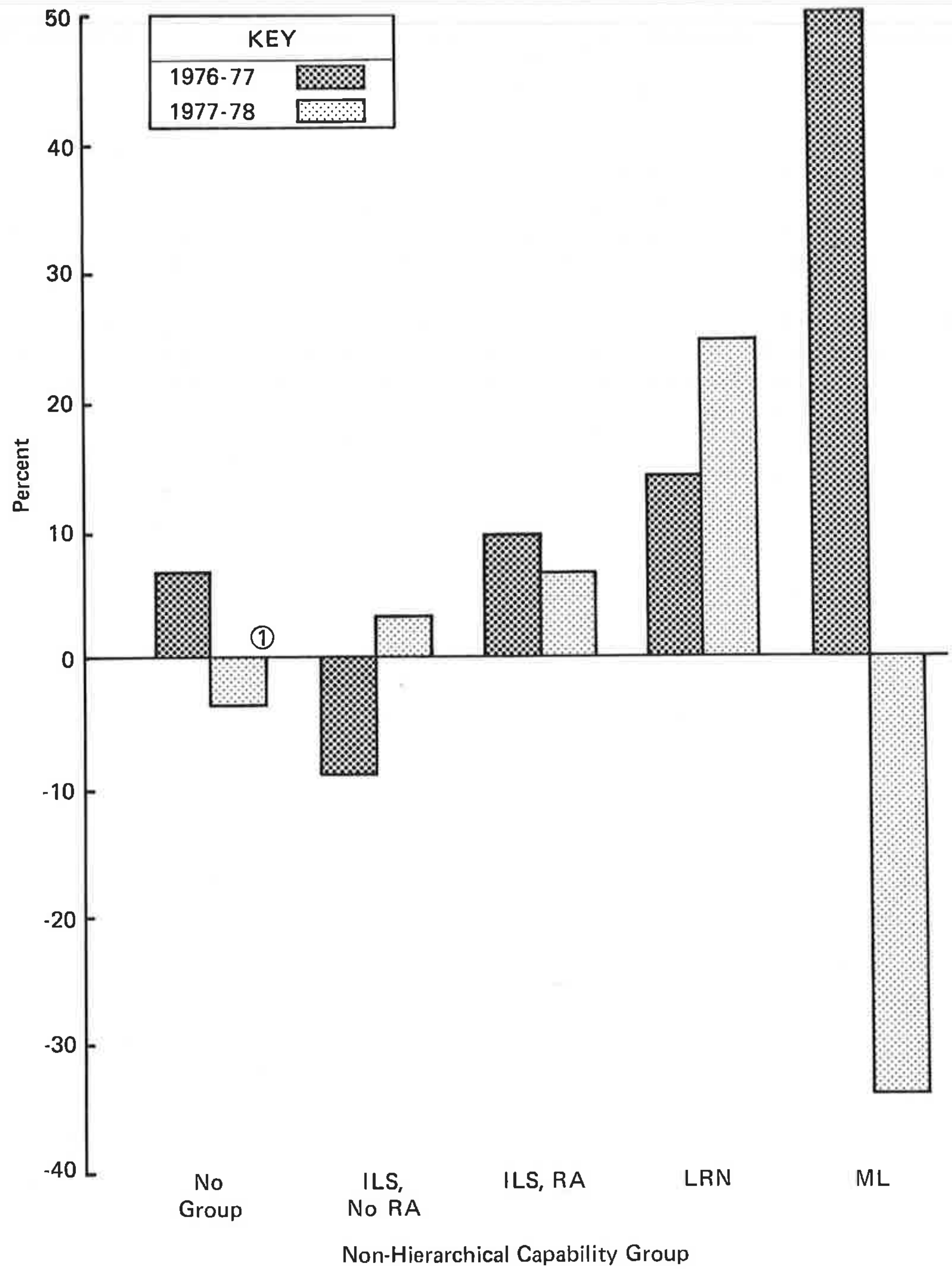
① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 10. A Comparison of Non-Hierarchical Groups from 1974 to 1978



① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 11. Normalized Growth in Non-Hierarchical Groups from 1974 to 1978



① The 1977 and 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 12. Normalized Growth in Non-Hierarchical Groups from 1976 to 1977, and 1977 to 1978

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, Figure 13).

b. Aircraft containing more avionics equipment and capabilities are flown more hours than those with smaller investments in avionics equipment (Table 7, Figure 14).

c. High order CG's contain newer aircraft on the average than low order CG's (Table 8, Figure 15).

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 9 through 13, Figure 16).

A comparison of the 1978 tables with the 1977 tables reveals that the growth in hierarchical CG 8 was overall with no particular category showing a significant change.

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 changed substantially from 1977 to 1978. Tables 14 through 21 and Figures 17 through 20 help to identify which kinds of GA aircraft installed these avionics systems during 1978, and to characterize in general the kinds of GA aircraft equipped with these avionics.

Tables 14 through 21 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 50 percent of the aircraft reporting both a complete ILS and a radar altimeter and about 52 percent of the aircraft reporting a long range RNAV, yet executive aircraft compose only 5.5 percent of the fleet (Table 14 and Figure 17).

b. Aircraft containing more avionics equipment and capabilities fly more hours than aircraft with smaller investments in avionics equipment (Table 15 and Figure 18).

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 16 and Figure 19).

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 17 through 21 and Figure 20).

No significant changes in aircraft non-hierarchical avionics occurred from 1977 to 1978.

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

1978

		1	2	3	4	5	6	7	8	TOTALS
EXECUTIVE	ESTIMATE	515	101	581	1928	20	8	163	9510	12827
	% STD ERR	45.8	*	38.7	27.8	*	*	*	4.9	6.2
	ROW %	4.0	0.8	4.5	15.0	0.2	0.1	1.3	74.1	
	COLUMN %	1.1	0.8	1.1	2.8	15.5	1.3	1.9	22.2	5.5
BUSINESS	ESTIMATE	2030	752	5855	16551	63	67	2682	15536	43535
	% STD ERR	29.9	26.7	18.9	10.2	*	*	23.0	7.1	5.1
	ROW %	4.7	1.7	13.4	38.0	0.1	0.2	6.2	35.7	
	COLUMN %	4.4	6.2	10.7	24.0	48.8	11.3	31.1	36.2	18.6
PERSONAL	ESTIMATE	14182	3474	33155	34139	36	101	2982	10673	98743
	% STD ERR	5.4	11.2	5.7	6.8	*	*	25.3	13.5	2.7
	ROW %	14.4	3.5	33.6	34.6	0.0	0.1	3.0	10.8	
	COLUMN %	31.1	28.7	60.4	49.4	27.9	17.0	34.5	24.9	42.2
AERIAL AP.	ESTIMATE	6032	901	348	209	0	4	92	54	7641
	% STD ERR	4.2	19.5	32.0	20.1	0.0	*	*	46.8	3.1
	ROW %	78.9	11.8	4.6	2.7	0.0	0.1	1.2	0.7	
	COLUMN %	13.2	7.5	0.6	0.3	0.0	0.7	1.1	0.1	3.3
INSTRUCT.	ESTIMATE	670	610	7570	4928	0	0	339	860	14977
	% STD ERR	14.3	45.7	16.3	21.5	0.0	0.0	*	37.6	10.8
	ROW %	4.5	4.1	50.5	32.9	0.0	0.0	2.3	5.7	
	COLUMN %	1.5	5.0	13.8	7.1	0.0	0.0	3.9	2.0	6.4
AIR TAXI	ESTIMATE	55	2230	70	1832	13	368	304	3221	8093
	% STD ERR	*	16.5	*	30.9	*	43.2	49.4	11.9	9.7
	ROW %	0.7	27.6	0.9	22.6	0.2	4.5	3.8	39.8	
	COLUMN %	0.1	18.5	0.1	2.7	10.1	62.1	3.5	7.5	3.5
INDUSTR SF	ESTIMATE	104	358	271	804	0	10	164	409	2121
	% STD ERR	*	19.6	45.1	36.3	0.0	*	41.0	*	20.9
	ROW %	4.9	16.9	12.8	37.9	0.0	0.5	7.7	19.3	
	COLUMN %	0.2	3.0	0.5	1.2	0.0	1.7	1.9	1.0	0.9
RENTAL	ESTIMATE	226	282	1428	4576	0	0	618	1197	8327
	% STD ERR	28.3	36.0	32.6	24.6	0.0	0.0	*	34.3	16.2
	ROW %	2.7	3.4	17.1	55.0	0.0	0.0	7.4	14.4	
	COLUMN %	0.5	2.3	2.6	6.6	0.0	0.0	7.2	2.8	3.6

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

1978

		1	2	3	4	5	6	7	8	TOTALS
OTHER	ESTIMATE	871	1161	769	1531	0	6	745	1060	6142
	% STD ERR	22.0	24.8	39.3	32.0	0.0	*	41.4	19.5	12.3
	ROW %	14.2	18.9	12.5	24.9	0.0	0.1	12.1	17.3	
	COLUMN %	1.9	9.6	1.4	2.2	0.0	1.0	8.6	2.5	2.6
INACTIVE	ESTIMATE	20090	2432	5142	2949	4	5	314	1135	32071
	% STD ERR	4.1	13.8	11.5	21.9	*	*	*	24.2	3.8
	ROW %	62.6	7.6	16.0	9.2	0.0	0.0	1.0	3.5	
	COLUMN %	44.0	20.1	9.4	4.3	3.1	0.8	3.6	2.6	13.7
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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
   ALTITUDE ENCODING EQUIPMENT
8. TWO-WAY COMMUNICATIONS
   TWO SYSTEMS - AIR TAXIS
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   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 7. HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP

1978

		1	2	3	4	5	6	7	8	TOTALS
1-49	ESTIMATE	9722	2680	14802	8867	14	21	898	2490	39494
	% STD ERR	6.8	13.9	9.1	13.1	*	45.4	36.1	19.5	4.9
	ROW %	24.6	6.8	37.5	22.5	0.0	0.1	2.3	6.3	
	COLUMN %	21.3	22.2	27.0	12.8	10.9	3.5	10.4	5.8	16.9
50-99	ESTIMATE	5456	1658	14637	15749	9	26	1652	7260	46446
	% STD ERR	10.2	16.1	10.3	10.9	*	*	32.4	16.6	5.3
	ROW %	11.7	3.6	31.5	33.9	0.0	0.1	3.6	15.6	
	COLUMN %	11.9	13.7	26.7	22.8	7.0	4.4	19.1	16.9	19.9
100-149	ESTIMATE	3026	1172	6774	11406	17	67	1263	5543	29268
	% STD ERR	21.6	16.5	14.4	12.5	*	*	34.8	13.7	6.7
	ROW %	10.3	4.0	23.1	39.0	0.1	0.2	4.3	18.9	
	COLUMN %	6.6	9.7	12.3	16.5	13.2	11.3	14.6	12.9	12.5
150-199	ESTIMATE	1143	487	3577	6302	24	0	651	4588	16772
	% STD ERR	18.7	42.9	24.7	18.2	*	0.0	48.9	14.5	9.6
	ROW %	6.8	2.9	21.3	37.6	0.1	0.0	3.9	27.4	
	COLUMN %	2.5	4.0	6.5	9.1	18.6	0.0	7.5	10.7	7.2
200-249	ESTIMATE	1150	428	1821	6189	27	53	946	4916	15528
	% STD ERR	20.3	40.8	34.8	17.5	*	*	37.0	12.1	9.2
	ROW %	7.4	2.8	11.7	39.9	0.2	0.3	6.1	31.7	
	COLUMN %	2.5	3.5	3.3	9.0	20.9	8.9	11.0	11.5	6.6
250-299	ESTIMATE	575	353	780	3247	0	107	530	2616	8208
	% STD ERR	28.2	33.1	44.7	25.2	0.0	*	*	17.4	12.9
	ROW %	7.0	4.3	9.5	39.6	0.0	1.3	6.5	31.9	
	COLUMN %	1.3	2.9	1.4	4.7	0.0	18.0	6.1	6.1	3.5
300-349	ESTIMATE	662	397	2026	4659	0	60	722	3423	11949
	% STD ERR	23.9	38.9	36.2	24.3	0.0	*	*	16.6	12.6
	ROW %	5.5	3.3	17.0	39.0	0.0	0.5	6.0	28.6	
	COLUMN %	1.4	3.3	3.7	6.7	0.0	10.1	8.4	8.0	5.1
350-399	ESTIMATE	442	327	524	1900	0	3	179	2009	5384
	% STD ERR	28.3	39.6	*	36.1	0.0	*	*	22.0	16.9
	ROW %	8.2	6.1	9.7	35.3	0.0	0.1	3.3	37.3	
	COLUMN %	1.0	2.7	1.0	2.8	0.0	0.5	2.1	4.7	2.3

TABLE 7. HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP (Continued)

1978

		1	2	3	4	5	6	7	8	TOTALS
400-449	ESTIMATE	446	364	1129	2409	0	35	59	2580	7023
	% STD ERR	35.2	40.1	39.4	28.4	0.0	*	*	18.8	13.7
	ROW %	6.4	5.2	16.1	34.3	0.0	0.5	0.8	36.7	
	COLUMN %	1.0	3.0	2.1	3.5	0.0	5.9	0.7	6.0	3.0
450 UP	ESTIMATE	1944	1967	3820	5628	41	191	1172	7040	21804
	% STD ERR	15.1	19.8	19.6	21.5	*	*	42.7	9.1	7.6
	ROW %	8.9	9.0	17.5	25.8	0.2	0.9	5.4	32.3	
	COLUMN %	4.3	16.3	7.0	8.1	31.8	32.2	13.6	16.4	9.3
INACTIVE	ESTIMATE	20090	2432	5142	2949	4	5	314	1135	32071
	% STD ERR	4.1	13.8	11.5	21.9	*	*	*	24.2	3.8
	ROW %	62.6	7.6	16.0	9.2	0.0	0.0	1.0	3.5	
	COLUMN %	44.0	20.1	9.4	4.3	3.1	0.8	3.6	2.6	13.7
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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
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VOR OR RNAV
DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 8. HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP

1978

		1	2	3	4	5	6	7	8	TOTALS
0-4 YRS	ESTIMATE	7635	3241	8208	17727	86	263	2652	16318	56129
	% STD ERR	10.1	14.1	17.2	11.4	*	*	27.9	6.8	4.6
	ROW %	13.6	5.8	14.6	31.6	0.2	0.5	4.7	29.1	
	COLUMN %	16.7	26.8	15.0	25.7	66.7	44.4	30.7	38.1	24.0
5-9 YRS	ESTIMATE	4942	1772	8763	11595	39	140	1486	9730	38468
	% STD ERR	10.2	15.0	12.3	13.3	*	*	34.1	12.1	5.7
	ROW %	12.8	4.6	22.8	30.1	0.1	0.4	3.9	25.3	
	COLUMN %	10.8	14.7	16.0	16.8	30.2	23.6	17.2	22.7	16.4
10-14 YRS	ESTIMATE	5790	2185	11837	18856	6	118	1401	8456	48649
	% STD ERR	12.2	15.8	12.4	10.2	*	*	30.2	9.1	5.1
	ROW %	11.9	4.5	24.3	38.8	0.0	0.2	2.9	17.4	
	COLUMN %	12.7	18.1	21.6	27.3	4.7	19.9	16.2	19.7	20.8
15-19 YRS	ESTIMATE	3797	1141	5636	12003	9	36	339	4002	26962
	% STD ERR	18.7	28.7	18.6	12.0	44.8	43.2	47.8	17.5	7.2
	ROW %	14.1	4.2	20.9	44.5	0.0	0.1	1.3	14.8	
	COLUMN %	8.3	9.4	10.3	17.4	7.0	6.1	3.9	9.3	11.5
20-24 YRS	ESTIMATE	1933	885	6003	5363	0	24	1781	2136	18125
	% STD ERR	15.6	29.1	17.4	16.0	0.0	*	30.2	24.0	8.2
	ROW %	10.7	4.9	33.1	29.6	0.0	0.1	9.8	11.8	
	COLUMN %	4.2	7.3	10.9	7.8	0.0	4.0	20.6	5.0	7.7
25-29 YRS	ESTIMATE	1831	358	5170	2540	0	5	123	694	10721
	% STD ERR	13.8	27.6	8.9	21.3	0.0	42.0	37.5	45.6	7.0
	ROW %	17.1	3.3	48.2	23.7	0.0	0.0	1.1	6.5	
	COLUMN %	4.0	3.0	9.4	3.7	0.0	0.8	1.4	1.6	4.6
30-34 YRS	ESTIMATE	11997	1807	8185	2158	12	11	159	298	24626
	% STD ERR	4.5	15.5	6.2	16.1	*	41.1	48.7	34.7	2.4
	ROW %	48.7	7.3	33.2	8.8	0.0	0.0	0.6	1.2	
	COLUMN %	26.3	15.0	14.9	3.1	9.3	1.9	1.8	0.7	10.5
35+ YRS	ESTIMATE	7737	717	1041	429	0	2	99	225	10249
	% STD ERR	4.6	19.1	16.6	31.8	0.0	*	38.2	22.4	3.9
	ROW %	75.5	7.0	10.2	4.2	0.0	0.0	1.0	2.2	
	COLUMN %	16.9	5.9	1.9	0.6	0.0	0.3	1.1	0.5	4.4

TABLE 8. HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP (Continued)

1978

		1	2	3	4	5	6	7	8	TOTALS
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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
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   ALTITUDE ENCODING EQUIPMENT
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   4096 CODE TRANSPONDER
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   4096 CODE TRANSPONDER
   ALTITUDE ENCODING EQUIPMENT
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   TWO SYSTEMS - AIR TAXIS
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   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 9. HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP

1978

		1	2	3	4	5	6	7	8	TOTALS
Single engine Piston 1-4 seats	ESTIMATE	34635	4936	30455	8586	17	15	1138	510	80293
	% STD ERR	2.7	11.2	4.1	10.8	*	27.6	34.0	*	0.0
	ROW %	43.1	6.1	37.9	10.7	0.0	0.0	1.4	0.6	
	COLUMN %	75.9	40.8	55.5	12.4	13.2	2.5	13.2	1.2	34.3
Single engine Piston 4+ seats	ESTIMATE	4116	2246	22974	54179	52	210	5681	19189	108648
	% STD ERR	19.5	20.6	8.3	4.5	*	*	18.2	8.5	0.0
	ROW %	3.8	2.1	21.1	49.9	0.0	0.2	5.2	17.7	
	COLUMN %	9.0	18.6	41.9	78.4	40.3	35.4	65.8	44.8	46.4
Two engine Piston 1-6 seats	ESTIMATE	369	107	286	3714	47	186	996	11384	17089
	% STD ERR	35.5	*	37.2	10.7	*	*	21.7	3.9	0.0
	ROW %	2.2	0.6	1.7	21.7	0.3	1.1	5.8	66.6	
	COLUMN %	0.8	0.9	0.5	5.4	36.4	31.4	11.5	26.6	7.3
Two engine Piston 7+ seats	ESTIMATE	322	110	165	1212	0	107	610	6046	8571
	% STD ERR	33.9	*	26.0	18.1	0.0	*	30.7	3.9	0.0
	ROW %	3.8	1.3	1.9	14.1	0.0	1.2	7.1	70.5	
	COLUMN %	0.7	0.9	0.3	1.8	0.0	18.0	7.1	14.1	3.7
Piston Other	ESTIMATE	60	23	47	151	0	0	12	86	379
	% STD ERR	13.3	15.3	17.4	7.0	0.0	0.0	29.7	9.9	0.0
	ROW %	15.8	6.1	12.4	39.8	0.0	0.0	3.2	22.7	
	COLUMN %	0.1	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.2
Two engine Turboprop 1-12 seats	ESTIMATE	54	0	21	47	0	19	9	2446	2596
	% STD ERR	*	0.0	*	49.2	0.0	*	27.4	3.2	0.0
	ROW %	2.1	0.0	0.8	1.8	0.0	0.7	0.3	94.2	
	COLUMN %	0.1	0.0	0.0	0.1	0.0	3.2	0.1	5.7	1.1
Two engine Turboprop 13+ seats	ESTIMATE	7	10	10	48	0	5	22	492	594
	% STD ERR	*	*	*	38.2	0.0	*	49.7	4.4	0.0
	ROW %	1.2	1.7	1.7	8.1	0.0	0.8	3.7	82.8	
	COLUMN %	0.0	0.1	0.0	0.1	0.0	0.8	0.3	1.1	0.3
Turboprop Other	ESTIMATE	15	6	4	13	0	0	0	69	107
	% STD ERR	13.8	23.0	43.2	15.9	0.0	0.0	0.0	4.5	0.0
	ROW %	14.0	5.6	3.7	12.1	0.0	0.0	0.0	64.5	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

TABLE 9. HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP (Continued)

1978

		1	2	3	4	5	6	7	8	TOTALS
Turbojet Two engine	ESTIMATE	10	0	0	51	0	5	38	2075	2180
	% STD ERR	*	0.0	0.0	38.5	0.0	39.9	39.8	1.2	0.0
	ROW %	0.5	0.0	0.0	2.3	0.0	0.2	1.7	95.2	
	COLUMN %	0.0	0.0	0.0	0.1	0.0	0.8	0.4	4.8	0.9
Turbojet Other	ESTIMATE	85	6	18	57	5	3	9	449	633
	% STD ERR	4.8	22.9	13.1	23.4	25.6	*	19.8	3.0	0.0
	ROW %	13.4	0.9	2.8	9.0	0.8	0.5	1.4	70.9	
	COLUMN %	0.2	0.0	0.0	0.1	3.9	0.5	0.1	1.0	0.3
Rotorcraft Piston	ESTIMATE	2668	1664	483	106	3	23	67	13	5027
	% STD ERR	4.7	7.4	15.3	25.0	*	*	*	*	0.0
	ROW %	53.1	33.1	9.6	2.1	0.1	0.5	1.3	0.3	
	COLUMN %	5.8	13.8	0.9	0.2	2.3	3.9	0.8	0.0	2.1
Rotorcraft Turbine	ESTIMATE	92	1114	382	906	0	6	45	109	2654
	% STD ERR	19.8	16.9	17.2	20.5	0.0	*	*	42.6	0.0
	ROW %	3.5	42.0	14.4	34.1	0.0	0.2	1.7	4.1	
	COLUMN %	0.2	9.2	0.7	1.3	0.0	1.0	0.5	0.3	1.1
Other	ESTIMATE	3226	1863	43	19	4	14	7	1	5177
	% STD ERR	2.7	4.6	32.9	*	*	*	*	*	0.0
	ROW %	62.3	36.0	0.8	0.4	0.1	0.3	0.1	0.0	
	COLUMN %	7.1	15.4	0.1	0.0	3.1	2.4	0.1	0.0	2.2
All Craft	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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
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   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

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

1978

		1	2	3	4	5	6	7	8	TOTALS
GLIDER	ESTIMATE	1894	1707	38	19	2	14	0	0	3674
	% STD ERR	4.4	4.8	35.8	*	*	*	0.0	0.0	0.9
	ROW %	51.6	46.5	1.0	0.5	0.1	0.4	0.0	0.0	
	COLUMN %	4.1	14.1	0.1	0.0	1.6	2.4	0.0	0.0	1.6
BALLOON	ESTIMATE	1332	156	5	0	2	0	0	1	1496
	% STD ERR	3.2	20.5	*	0.0	*	0.0	0.0	*	2.2
	ROW %	89.0	10.4	0.3	0.0	0.1	0.0	0.0	0.1	
	COLUMN %	2.9	1.3	0.0	0.0	1.6	0.0	0.0	0.0	0.6
BLIMP	ESTIMATE	0	0	0	0	0	0	7	0	7
	% STD ERR	0.0	0.0	0.0	0.0	0.0	0.0	*	0.0	*
	ROW %	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
FIXED WING ENG=1	ESTIMATE	38843	7194	53446	62794	74	225	6828	19758	189163
	% STD ERR	3.2	10.0	4.3	4.1	*	*	16.2	8.4	0.0
	ROW %	20.5	3.8	28.3	33.2	0.0	0.1	3.6	10.4	
	COLUMN %	85.1	59.5	97.4	90.9	57.4	37.9	79.1	46.1	80.9
FIXED WING ENG>1	ESTIMATE	830	250	536	5264	47	325	1688	22987	31927
	% STD ERR	22.0	40.3	22.8	8.6	*	43.4	17.0	2.2	0.0
	ROW %	2.6	0.8	1.7	16.5	0.1	1.0	5.3	72.0	
	COLUMN %	1.8	2.1	1.0	7.6	36.4	54.8	19.5	53.6	13.6
ROTORCRAFT	ESTIMATE	2759	2778	865	1013	3	29	112	122	7681
	% STD ERR	4.6	8.1	11.4	18.5	*	*	*	39.7	0.0
	ROW %	35.9	36.2	11.3	13.2	0.0	0.4	1.5	1.6	
	COLUMN %	6.0	23.0	1.6	1.5	2.3	4.9	1.3	0.3	3.3
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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

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
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   4096 CODE TRANSPONDER
   VOR OR RNAV

5. 4096 CODE TRANSPONDER
   ALTITUDE ENCODING EQUIPMENT

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8. TWO-WAY COMMUNICATIONS
   TWO SYSTEMS - AIR TAXIS
   ALTITUDE ENCODING EQUIPMENT
   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

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

1978

		1	2	3	4	5	6	7	8	TOTALS
RECIPROCAT	ESTIMATE	42280	9116	54433	67949	120	541	8511	37227	220178
	% STD ERR	3.0	8.1	4.2	3.9	*	33.8	13.4	4.7	0.0
	ROW %	19.2	4.1	24.7	30.9	0.1	0.2	3.9	16.9	
	COLUMN %	92.6	75.4	99.2	98.3	93.0	91.2	98.6	86.8	94.1
TURBOPROP	ESTIMATE	76	16	36	108	0	24	31	3007	3297
	% STD ERR	*	*	*	27.4	0.0	*	36.2	2.7	0.0
	ROW %	2.3	0.5	1.1	3.3	0.0	0.7	0.9	91.2	
	COLUMN %	0.2	0.1	0.1	0.2	0.0	4.0	0.4	7.0	1.4
TURBOSHAFT	ESTIMATE	91	1114	382	906	0	6	45	109	2653
	% STD ERR	19.9	16.9	17.2	20.5	0.0	*	*	42.6	0.1
	ROW %	3.4	42.0	14.4	34.2	0.0	0.2	1.7	4.1	
	COLUMN %	0.2	9.2	0.7	1.3	0.0	1.0	0.5	0.3	1.1
TURBOJET	ESTIMATE	97	6	18	108	5	8	47	2524	2814
	% STD ERR	9.9	22.9	13.1	22.0	25.6	34.2	32.4	1.1	0.1
	ROW %	3.4	0.2	0.6	3.8	0.2	0.3	1.7	89.7	
	COLUMN %	0.2	0.0	0.0	0.2	3.9	1.3	0.5	5.9	1.2
TUR AIR GEN	ESTIMATE	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMJET	ESTIMATE	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NO ENGINE	ESTIMATE	3116	1832	21	18	4	14	0	1	5006
	% STD ERR	2.8	4.7	45.7	*	*	*	0.0	*	0.6
	ROW %	62.2	36.6	0.4	0.4	0.1	0.3	0.0	0.0	
	COLUMN %	6.8	15.2	0.0	0.0	3.1	2.4	0.0	0.0	2.1
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

TABLE 11. HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP (Continued)

1978

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
   ALTITUDE ENCODING EQUIPMENT
8. TWO-WAY COMMUNICATIONS
   TWO SYSTEMS - AIR TAXIS
   ALTITUDE ENCODING EQUIPMENT
   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 12. HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP

1978

		1	2	3	4	5	6	7	8	TOTALS
ONE	ESTIMATE	41695	9922	54317	63728	78	254	6940	19844	196779
	% STD ERR	3.0	7.6	4.2	4.1	*	46.5	16.0	8.4	0.0
	ROW %	21.2	5.0	27.6	32.4	0.0	0.1	3.5	10.1	
	COLUMN %	91.3	82.1	99.0	92.2	60.5	42.8	80.4	46.3	84.1
TWO	ESTIMATE	780	307	497	5152	47	322	1682	22479	31266
	% STD ERR	23.4	33.2	24.5	8.8	*	43.8	17.0	2.3	0.0
	ROW %	2.5	1.0	1.6	16.5	0.2	1.0	5.4	71.9	
	COLUMN %	1.7	2.5	0.9	7.5	36.4	54.3	19.5	52.4	13.4
THREE	ESTIMATE	1	1	2	7	0	0	0	128	140
	% STD ERR	*	*	*	*	0.0	0.0	0.0	0.8	4.0
	ROW %	0.7	0.7	1.4	5.0	0.0	0.0	0.0	91.4	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1
FOUR	ESTIMATE	66	22	52	185	0	3	12	417	756
	% STD ERR	12.2	12.8	16.1	9.0	0.0	*	29.7	3.9	0.9
	ROW %	8.7	2.9	6.9	24.5	0.0	0.4	1.6	55.2	
	COLUMN %	0.1	0.2	0.1	0.3	0.0	0.5	0.1	1.0	0.3
MORE THAN FOUR	ESTIMATE.	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NONE	ESTIMATE	3116	1832	21	18	4	14	0	1	5006
	% STD ERR	2.8	4.7	45.7	*	*	*	0.0	*	0.6
	ROW %	62.2	36.6	0.4	0.4	0.1	0.3	0.0	0.0	
	COLUMN %	6.8	15.2	0.0	0.0	3.1	2.4	0.0	0.0	2.1
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

TABLE 12. HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP (Continued)

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
   ALTITUDE ENCODING EQUIPMENT
8. TWO-WAY COMMUNICATIONS
   TWO SYSTEMS - AIR TAXIS
   ALTITUDE ENCODING EQUIPMENT
   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

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

1978

		1	2	3	4	5	6	7	8	TOTALS
1 SEAT	ESTIMATE	12094	2959	883	234	10	11	125	57	16372
	% STD ERR	3.8	10.3	25.5	42.9	*	*	*	42.4	2.7
	ROW %	73.9	18.1	5.4	1.4	0.1	0.1	0.8	0.3	
	COLUMN %	26.5	24.5	1.6	0.3	7.8	1.9	1.4	0.1	7.0
2 SEATS	ESTIMATE	22319	3506	26392	8104	11	19	1036	512	61899
	% STD ERR	3.8	13.2	4.4	11.3	*	34.8	36.2	*	0.7
	ROW %	36.1	5.7	42.6	13.1	0.0	0.0	1.7	0.8	
	COLUMN %	48.9	29.0	48.1	11.7	8.5	3.2	12.0	1.2	26.5
3 SEATS	ESTIMATE	5563	1485	3656	444	6	22	100	19	11295
	% STD ERR	6.7	11.4	9.3	27.4	*	*	*	*	1.7
	ROW %	49.3	13.1	32.4	3.9	0.1	0.2	0.9	0.2	
	COLUMN %	12.2	12.3	6.7	0.6	4.7	3.7	1.2	0.0	4.8
4 SEATS	ESTIMATE	3864	2217	21457	47302	52	48	4538	11731	91209
	% STD ERR	20.6	19.8	8.8	5.0	*	*	21.7	12.8	0.9
	ROW %	4.2	2.4	23.5	51.9	0.1	0.1	5.0	12.9	
	COLUMN %	8.5	18.3	39.1	68.5	40.3	8.1	52.6	27.4	39.0
5 SEATS	ESTIMATE	865	823	1116	3610	0	13	576	2066	9070
	% STD ERR	19.6	23.1	17.6	16.0	0.0	*	42.9	21.2	7.5
	ROW %	9.5	9.1	12.3	39.8	0.0	0.1	6.4	22.8	
	COLUMN %	1.9	6.8	2.0	5.2	0.0	2.2	6.7	4.8	3.9
6 SEATS	ESTIMATE	214	629	964	7385	47	336	1437	16208	27221
	% STD ERR	32.9	27.5	23.8	9.2	*	44.9	20.7	5.2	3.1
	ROW %	0.8	2.3	3.5	27.1	0.2	1.2	5.3	59.5	
	COLUMN %	0.5	5.2	1.8	10.7	36.4	56.7	16.6	37.8	11.6
7-11 SEATS	ESTIMATE	330	173	238	1447	0	126	694	10409	13416
	% STD ERR	37.1	40.9	22.9	17.7	0.0	*	29.6	3.1	1.7
	ROW %	2.5	1.3	1.8	10.8	0.0	0.9	5.2	77.6	
	COLUMN %	0.7	1.4	0.4	2.1	0.0	21.2	8.0	24.3	5.7
12-19 SEATS	ESTIMATE	171	293	77	218	0	5	27	584	1374
	% STD ERR	10.0	7.2	20.7	14.7	0.0	*	42.2	7.0	3.1
	ROW %	12.4	21.3	5.6	15.9	0.0	0.4	2.0	42.5	
	COLUMN %	0.4	2.4	0.1	0.3	0.0	0.8	0.3	1.4	0.6

TABLE 13. HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP (Continued)

1978

		1	2	3	4	5	6	7	8	TOTALS
20-49 SEATS	ESTIMATE	140	11	72	154	0	10	87	685	1159
	% STD ERR	26.7	*	37.3	25.0	0.0	41.3	37.2	7.3	2.3
	ROW %	12.1	0.9	6.2	13.3	0.0	0.9	7.5	59.1	
	COLUMN %	0.3	0.1	0.1	0.2	0.0	1.7	1.0	1.6	0.5
50+ SEATS	ESTIMATE	86	2	36	194	0	3	16	598	934
	% STD ERR	10.6	*	20.6	7.8	0.0	*	26.3	2.7	1.4
	ROW %	9.2	0.2	3.9	20.8	0.0	0.3	1.7	64.0	
	COLUMN %	0.2	0.0	0.1	0.3	0.0	0.5	0.2	1.4	0.4
TOTALS	ESTIMATE	45659	12085	54890	69090	129	593	8635	42868	233952
	% STD ERR	2.8	6.4	4.2	3.8	*	31.1	13.2	4.1	
	ROW %	19.5	5.2	23.5	29.5	0.1	0.3	3.7	18.3	

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
   ALTITUDE ENCODING EQUIPMENT
8. TWO-WAY COMMUNICATIONS
   TWO SYSTEMS - AIR TAXIS
   ALTITUDE ENCODING EQUIPMENT
   4096 CODE TRANSPONDER
   VOR OR RNAV
   DME

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 14. NON-HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
EXECUTIVE	ESTIMATE	762	317	4775	5602	1189	5763	262	262	150	1350	12827
	% STD ERR	46.0	*	11.6	5.6	8.5	5.4	36.6	36.6	3.7	27.0	6.2
	ROW %	5.9	2.5	37.2	43.7	9.3	44.9	2.0	2.0	1.2	10.5	
	COLUMN %	3.9	2.0	7.2	50.1	51.9	45.1	56.5	61.9	74.6	1.1	5.5
BUSINESS	ESTIMATE	2757	4276	22680	2679	480	2727	117	117	59	11082	43535
	% STD ERR	24.6	22.4	6.8	14.7	40.2	14.5	*	*	*	12.9	5.1
	ROW %	6.3	9.8	52.1	6.2	1.1	6.3	0.3	0.3	0.1	25.5	
	COLUMN %	14.0	26.7	34.1	24.0	20.9	21.3	25.2	27.7	29.4	9.2	18.6
PERSONAL	ESTIMATE	8912	9234	23018	1142	234	1257	34	30	28	56342	98743
	% STD ERR	15.0	13.8	8.8	32.5	*	30.1	*	*	*	3.9	2.7
	ROW %	9.0	9.4	23.3	1.2	0.2	1.3	0.0	0.0	0.0	57.1	
	COLUMN %	45.4	57.7	34.6	10.2	10.2	9.8	7.3	7.1	13.9	46.9	42.2
AERIAL AP.	ESTIMATE	130	14	172	0	2	0	0	0	0	7325	7641
	% STD ERR	*	*	24.0	0.0	*	0.0	0.0	0.0	0.0	3.0	3.1
	ROW %	1.7	0.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	95.9	
	COLUMN %	0.7	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0	6.1	3.3
INSTRUCT.	ESTIMATE	4260	389	2733	110	28	1510	3	1	1	7457	14977
	% STD ERR	25.3	*	28.8	*	*	*	*	*	*	13.8	10.8
	ROW %	28.4	2.6	18.2	0.7	0.2	10.1	0.0	0.0	0.0	49.8	
	COLUMN %	21.7	2.4	4.1	1.0	1.2	11.8	0.6	0.2	0.5	6.2	6.4
AIR TAXI	ESTIMATE	656	259	5304	535	174	551	81	81	40	1285	8093
	% STD ERR	35.0	*	13.1	23.3	35.3	22.6	*	*	*	19.2	9.7
	ROW %	8.1	3.2	65.5	6.6	2.2	6.8	1.0	1.0	0.5	15.9	
	COLUMN %	3.3	1.6	8.0	4.8	7.6	4.3	17.5	19.1	19.9	1.1	3.5
INDUSTR SP	ESTIMATE	194	635	343	108	29	120	0	0	0	831	2121
	% STD ERR	43.7	*	38.8	*	*	*	0.0	0.0	0.0	20.8	20.9
	ROW %	9.1	29.9	16.2	5.1	1.4	5.7	0.0	0.0	0.0	39.2	
	COLUMN %	1.0	4.0	0.5	1.0	1.3	0.9	0.0	0.0	0.0	0.7	0.9
RENTAL	ESTIMATE	1087	423	3741	94	37	96	0	0	0	2982	8327
	% STD ERR	46.1	*	26.4	*	*	*	0.0	0.0	0.0	24.6	16.2
	ROW %	13.1	5.1	44.9	1.1	0.4	1.2	0.0	0.0	0.0	35.8	
	COLUMN %	5.5	2.6	5.6	0.8	1.6	0.8	0.0	0.0	0.0	2.5	3.6

TABLE 14. NON-HIERARCHICAL GROUPS - PRIMARY USE VS. CAPABILITY GROUP (Continued)

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
OTHER	ESTIMATE	303	348	1794	408	142	412	9	9	9	3290	6142
	% STD ERR	45.9	*	24.5	23.0	25.5	22.8	*	*	*	15.5	12.3
	ROW %	4.9	5.7	29.2	6.6	2.3	6.7	0.1	0.1	0.1	53.6	
	COLUMN %	1.5	2.2	2.7	3.7	6.2	3.2	1.9	2.1	4.5	2.7	2.6
INACTIVE	ESTIMATE	1358	716	1973	527	86	540	67	31	31	27449	32071
	% STD ERR	27.2	*	18.2	43.9	39.1	42.8	*	*	*	3.8	3.8
	ROW %	4.2	2.2	6.2	1.6	0.3	1.7	0.2	0.1	0.1	35.6	
	COLUMN %	6.9	4.5	3.0	4.7	3.8	4.2	14.4	7.3	15.4	22.8	13.7
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 15. NON-HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP

1978

		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	ESTIMATE	4486	3023	4867	869	246	2355	35	34	29	26158	39494
	% STD ERR	21.3	21.9	15.7	26.3	43.6	34.1	*	*	*	5.5	4.9
	ROW %	11.4	7.7	12.3	2.2	0.6	6.0	0.1	0.1	0.1	66.2	
	COLUMN %	22.8	18.9	7.3	7.8	10.7	18.4	7.5	8.0	14.4	21.8	16.9
50-99	ESTIMATE	5210	4244	11540	842	268	889	62	61	57	24561	46446
	% STD ERR	21.6	20.8	12.0	30.6	*	29.2	*	*	*	7.4	5.3
	ROW %	11.2	9.1	24.8	1.8	0.6	1.9	0.1	0.1	0.1	52.9	
	COLUMN %	26.5	26.5	17.3	7.5	11.7	7.0	13.4	14.4	28.4	20.4	19.9
100-149	ESTIMATE	2071	2776	10582	878	156	901	48	46	5	12938	29268
	% STD ERR	27.0	26.2	11.6	29.0	*	28.5	*	*	*	10.4	6.7
	ROW %	7.1	9.5	36.2	3.0	0.5	3.1	0.2	0.2	0.0	44.2	
	COLUMN %	10.5	17.3	15.9	7.9	6.8	7.0	10.3	10.9	2.5	10.8	12.5
150-199	ESTIMATE	1360	1422	6960	1088	69	1090	29	29	0	5938	16772
	% STD ERR	41.2	41.3	14.2	25.0	32.1	25.0	*	*	0.0	17.1	9.6
	ROW %	8.1	8.5	41.5	6.5	0.4	6.5	0.2	0.2	0.0	35.4	
	COLUMN %	6.9	8.9	10.5	9.7	3.0	8.5	6.3	6.9	0.0	4.9	7.2
200-249	ESTIMATE	736	876	7423	750	69	760	15	13	0	5735	15528
	% STD ERR	48.5	47.1	12.8	20.9	*	20.7	*	*	0.0	16.7	9.2
	ROW %	4.7	5.6	47.8	4.8	0.4	4.9	0.1	0.1	0.0	36.9	
	COLUMN %	3.7	5.5	11.1	6.7	3.0	5.9	3.2	3.1	0.0	4.8	6.6
250-299	ESTIMATE	713	431	3792	640	118	640	20	20	10	2632	8208
	% STD ERR	*	*	18.3	22.2	*	22.2	38.5	38.5	0.0	24.9	12.9
	ROW %	8.7	5.3	46.2	7.8	1.4	7.8	0.2	0.2	0.1	32.1	
	COLUMN %	3.6	2.7	5.7	5.7	5.1	5.0	4.3	4.7	5.0	2.2	3.5
300-349	ESTIMATE	736	1223	6817	924	152	934	22	22	7	2249	11949
	% STD ERR	48.8	*	17.8	21.4	24.3	21.2	*	*	*	24.2	12.6
	ROW %	6.2	10.2	57.1	7.7	1.3	7.8	0.2	0.2	0.1	18.8	
	COLUMN %	3.7	7.6	10.2	8.3	6.6	7.3	4.7	5.2	3.5	1.9	5.1
350-399	ESTIMATE	636	425	1943	537	129	548	3	3	1	1835	5384
	% STD ERR	43.6	*	31.5	17.6	41.1	17.4	*	*	*	29.0	16.9
	ROW %	11.8	7.9	36.1	10.0	2.4	10.2	0.1	0.1	0.0	34.1	
	COLUMN %	3.2	2.7	2.9	4.8	5.6	4.3	0.6	0.7	0.5	1.5	2.3

TABLE 15. NON-HIERARCHICAL GROUPS - HOURS FLOWN VS. CAPABILITY GROUP (Continued)

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
400-449	ESTIMATE	298	415	2617	1142	152	1153	15	15	0	2549	7023
	% STD ERR	*	*	25.1	17.7	25.2	17.5	*	*	0.0	24.3	13.7
	ROW %	4.2	5.9	37.3	16.3	2.2	16.4	0.2	0.2	0.0	36.3	
	COLUMN %	1.5	2.6	3.9	10.2	6.6	9.0	3.2	3.5	0.0	2.1	3.0
450 UP	ESTIMATE	2761	1022	7903	3003	954	3156	257	257	178	7033	21804
	% STD ERR	27.2	47.7	14.3	10.9	11.4	11.0	37.3	37.3	31.8	12.7	7.6
	ROW %	12.7	4.7	36.2	13.8	4.4	14.5	1.2	1.2	0.8	32.3	
	COLUMN %	14.1	6.4	11.9	26.9	41.6	24.7	55.4	60.8	88.6	5.9	9.3
INACTIVE	ESTIMATE	1358	716	1973	527	86	540	67	31	31	27449	32071
	% STD ERR	27.2	*	18.2	43.9	39.1	42.8	*	*	*	3.8	3.8
	ROW %	4.2	2.2	6.2	1.6	0.3	1.7	0.2	0.1	0.1	85.6	
	COLUMN %	6.9	4.5	3.0	4.7	3.8	4.2	14.4	7.3	15.4	22.8	13.7
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 16. NON-HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP

1978

		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	ESTIMATE	5558	1955	21888	4620	865	5959	149	145	53	22006	56129
	% STD ERR	21.4	42.8	8.6	9.7	16.3	15.4	*	*	*	8.0	4.6
	ROW %	9.9	3.5	39.0	8.2	1.5	10.6	0.3	0.3	0.1	39.2	
	COLUMN %	28.3	12.2	32.9	41.3	37.7	46.6	32.1	34.3	26.4	18.3	24.0
5-9 YRS	ESTIMATE	1851	2409	14237	2470	440	2513	85	83	14	17431	38468
	% STD ERR	29.3	31.0	10.8	13.9	27.7	13.8	*	*	24.0	8.4	5.7
	ROW %	4.8	6.3	37.0	6.4	1.1	6.5	0.2	0.2	0.0	45.3	
	COLUMN %	9.4	15.0	21.4	22.1	19.2	19.6	18.3	19.6	7.0	14.5	16.4
10-14 YRS	ESTIMATE	3926	5777	14649	2373	441	2558	62	59	13	21907	48649
	% STD ERR	24.6	19.2	10.7	12.6	40.7	12.1	*	*	*	7.7	5.1
	ROW %	8.1	11.9	30.1	4.9	0.9	5.3	0.1	0.1	0.0	45.0	
	COLUMN %	20.0	36.1	22.0	21.2	19.2	20.0	13.4	13.9	6.5	18.2	20.8
15-19 YRS	ESTIMATE	3384	2079	7272	615	214	630	18	18	9	13595	26962
	% STD ERR	28.1	25.3	11.8	28.5	22.2	27.8	*	*	*	11.3	7.2
	ROW %	12.6	7.7	27.0	2.3	0.8	2.3	0.1	0.1	0.0	50.4	
	COLUMN %	17.2	13.0	10.9	5.5	9.3	4.9	3.9	4.3	4.5	11.3	11.5
20-24 YRS	ESTIMATE	1679	2197	4238	543	222	668	60	60	59	9368	18125
	% STD ERR	32.0	25.9	15.9	39.9	*	35.2	*	*	*	12.6	8.2
	ROW %	9.3	12.1	23.4	3.0	1.2	3.7	0.3	0.3	0.3	51.7	
	COLUMN %	8.6	13.7	6.4	4.9	9.7	5.2	12.9	14.2	29.4	7.8	7.7
25-29 YRS	ESTIMATE	1104	959	2560	55	9	60	33	2	0	6007	10721
	% STD ERR	21.1	32.3	20.6	*	*	*	*	*	0.0	8.7	7.0
	ROW %	10.3	8.9	23.9	0.5	0.1	0.6	0.3	0.0	0.0	56.0	
	COLUMN %	5.6	6.0	3.8	0.5	0.4	0.5	7.1	0.5	0.0	5.0	4.6
30-34 YRS	ESTIMATE	1343	807	834	68	29	72	34	29	22	21565	24626
	% STD ERR	19.6	30.8	23.6	50.0	*	47.3	*	*	*	2.6	2.4
	ROW %	5.5	3.3	3.4	0.3	0.1	0.3	0.1	0.1	0.1	87.6	
	COLUMN %	6.8	5.0	1.3	0.6	1.3	0.6	7.3	6.9	10.9	17.9	10.5
35+ YRS	ESTIMATE	218	56	519	71	30	75	19	19	19	9335	10249
	% STD ERR	21.6	26.9	26.6	40.5	*	38.9	*	*	*	4.0	3.9
	ROW %	2.1	0.5	5.1	0.7	0.3	0.7	0.2	0.2	0.2	91.6	
	COLUMN %	1.1	0.3	0.8	0.6	1.3	0.6	4.1	4.5	9.5	7.8	4.4

TABLE 16. NON-HIERARCHICAL GROUPS - AGE OF AIRCRAFT VS. CAPABILITY GROUP (Continued)

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 17. NON-HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP

1978

		L	L,MB	L,MB,GS	L,MB,GS,RA	LRN	RA	ML	L,MB,GS,ML	LRN,ML	NO GROUP	ALL CRAFT
Single engine Piston 1-4 seats	ESTIMATE	6060	1470	2827	67	82	67	56	49	49	69861	80293
	% STD ERR	13.4	28.5	20.6	*	*	*	*	*	*	1.4	0.0
	ROW %	7.5	1.8	3.5	0.1	0.1	0.1	0.1	0.1	0.1	87.0	
	COLUMN %	30.9	9.2	4.2	0.6	3.6	0.5	12.1	11.6	24.4	58.1	34.3
Single engine Piston 4+ seats	ESTIMATE	12109	13721	44393	1337	449	2655	141	141	56	36956	108648
	% STD ERR	13.7	11.7	5.2	34.2	*	33.6	*	*	*	5.9	0.0
	ROW %	11.1	12.6	40.9	1.2	0.4	2.4	0.1	0.1	0.1	34.0	
	COLUMN %	61.7	85.7	66.7	12.0	19.6	20.8	30.4	33.3	27.9	30.7	46.4
Two engine Piston 1-6 seats	ESTIMATE	580	580	12473	2657	186	2724	83	83	39	783	17089
	% STD ERR	32.5	33.3	3.4	12.3	*	12.2	*	*	*	24.2	0.0
	ROW %	3.4	3.4	73.0	15.5	1.1	15.9	0.5	0.5	0.2	4.6	
	COLUMN %	3.0	3.6	18.7	23.8	8.1	21.3	17.9	19.6	19.4	0.7	7.3
Two engine Piston 7+ seats	ESTIMATE	177	144	5574	2112	223	2217	79	47	4	526	8571
	% STD ERR	*	*	5.4	13.9	45.0	13.0	*	*	42.4	23.0	0.0
	ROW %	2.1	1.7	65.0	24.6	2.6	25.9	0.9	0.5	0.0	6.1	
	COLUMN %	0.9	0.9	8.4	18.9	9.7	17.3	17.0	11.1	2.0	0.4	3.7
Piston Other	ESTIMATE	8	4	207	31	12	31	0	0	0	128	379
	% STD ERR	39.8	*	4.0	22.8	40.5	22.8	0.0	0.0	0.0	6.9	0.0
	ROW %	2.1	1.1	54.6	8.2	3.2	8.2	0.0	0.0	0.0	33.8	
	COLUMN %	0.0	0.0	0.3	0.3	0.5	0.2	0.0	0.0	0.0	0.1	0.2
Two engine Turboprop 1-12 seats	ESTIMATE	0	26	278	2230	142	2265	9	9	0	54	2596
	% STD ERR	0.0	*	29.8	4.6	27.5	4.4	*	*	0.0	*	0.0
	ROW %	0.0	1.0	10.7	85.9	5.5	87.2	0.3	0.3	0.0	2.1	
	COLUMN %	0.0	0.2	0.4	20.0	6.2	17.7	1.9	2.1	0.0	0.0	1.1
Two engine Turboprop 13+ seats	ESTIMATE	2	0	340	244	69	244	20	20	2	7	594
	% STD ERR	*	0.0	7.0	9.8	16.1	9.8	*	*	*	*	0.0
	ROW %	0.3	0.0	57.2	41.1	11.6	41.1	3.4	3.4	0.3	1.2	
	COLUMN %	0.0	0.0	0.5	2.2	3.0	1.9	4.3	4.7	1.0	0.0	0.3
Turboprop Other	ESTIMATE	6	0	29	48	22	52	2	2	0	24	107
	% STD ERR	23.0	0.0	9.2	6.9	17.4	6.4	*	*	0.0	11.8	0.0
	ROW %	5.6	0.0	27.1	44.9	20.6	48.6	1.9	1.9	0.0	22.4	
	COLUMN %	0.0	0.0	0.0	0.4	1.0	0.4	0.4	0.5	0.0	0.0	0.0

TABLE 17. NON-HIERARCHICAL GROUPS - COMPUTED AIRCRAFT TYPE VS. CAPABILITY GROUP (Continued)

1978

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
Turbojet Two engine	ESTIMATE	0	17	215	1928	707	1945	45	45	27	20	2180
	% STD ERR	0.0	*	19.5	2.3	7.4	2.2	31.2	31.2	22.5	*	0.0
	ROW %	0.0	0.8	9.9	88.4	32.4	89.2	2.1	2.1	1.2	0.9	
	COLUMN %	0.0	0.1	0.3	17.3	30.8	15.2	9.7	10.6	13.4	0.0	0.9
Turbojet Other	ESTIMATE	15	4	70	418	262	428	16	16	14	119	633
	% STD ERR	14.6	49.8	15.7	2.6	16.5	2.5	*	*	*	3.5	0.0
	ROW %	2.4	0.6	11.1	66.0	41.4	67.6	2.5	2.5	2.2	18.8	
	COLUMN %	0.1	0.0	0.1	3.7	11.4	3.3	3.4	3.8	7.0	0.1	0.3
Rotorcraft Piston	ESTIMATE	45	0	6	13	10	25	14	10	10	4950	5027
	% STD ERR	36.4	0.0	*	*	*	*	*	*	*	0.5	0.0
	ROW %	0.9	0.0	0.1	0.3	0.2	0.5	0.3	0.2	0.2	98.5	
	COLUMN %	0.2	0.0	0.0	0.1	0.4	0.2	3.0	2.4	5.0	4.1	2.1
Rotorcraft Turbine	ESTIMATE	588	39	159	91	126	124	0	0	0	1682	2654
	% STD ERR	30.0	*	*	32.2	17.8	28.9	0.0	0.0	0.0	11.0	0.0
	ROW %	22.2	1.5	6.0	3.4	4.7	4.7	0.0	0.0	0.0	63.4	
	COLUMN %	3.0	0.2	0.2	0.8	5.5	1.0	0.0	0.0	0.0	1.4	1.1
Other	ESTIMATE	46	2	5	0	1	13	0	0	0	5113	5177
	% STD ERR	39.6	*	*	0.0	*	*	0.0	0.0	0.0	0.4	0.0
	ROW %	0.9	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	98.8	
	COLUMN %	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	4.3	2.2
All Craft	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 18. NON-HIERARCHICAL GROUPS - AIRCRAFT TYPE VS. CAPABILITY GROUP

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
GLIDER	ESTIMATE	46	0	0	0	0	0	0	0	0	3628	3674
	% STD ERR	39.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.9
	ROW %	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.7	
	COLUMN %	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.6
BALLOON	ESTIMATE	0	0	0	0	1	11	0	0	0	1484	1496
	% STD ERR	0.0	0.0	0.0	0.0	*	*	0.0	0.0	0.0	2.2	2.2
	ROW %	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	99.2	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.2	0.6
BLIMP	ESTIMATE	0	2	5	0	0	2	0	0	0	0	7
	% STD ERR	0.0	*	*	0.0	0.0	*	0.0	0.0	0.0	0.0	*
	ROW %	0.0	28.6	71.4	0.0	0.0	28.6	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
FIXED WING ENG=1	ESTIMATE	18191	15191	47272	1416	537	2744	198	192	106	106947	189163
	% STD ERR	10.1	10.9	5.1	32.4	44.6	32.5	*	*	*	2.2	0.0
	ROW %	9.6	8.0	25.0	0.7	0.3	1.5	0.1	0.1	0.1	56.5	
	COLUMN %	92.6	94.9	71.0	12.7	23.4	21.5	42.7	45.4	52.7	89.0	80.9
FIXED WING ENG>1	ESTIMATE	767	776	19134	9656	1618	9883	252	221	85	1531	31927
	% STD ERR	28.2	28.7	2.8	4.7	10.0	4.6	47.2	47.3	*	15.3	0.0
	ROW %	2.4	2.4	59.9	30.2	5.1	31.0	0.8	0.7	0.3	4.8	
	COLUMN %	3.9	4.8	28.7	86.4	70.6	77.3	54.3	52.2	42.3	1.3	13.6
ROTORCRAFT	ESTIMATE	632	39	165	103	136	149	14	10	10	6631	7681
	% STD ERR	28.0	*	*	31.6	19.3	26.4	*	*	*	2.8	0.0
	ROW %	8.2	0.5	2.1	1.3	1.8	1.9	0.2	0.1	0.1	86.3	
	COLUMN %	3.2	0.2	0.2	0.9	5.9	1.2	3.0	2.4	5.0	5.5	3.3
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 19. NON-HIERARCHICAL GROUPS - ENGINE TYPE VS. CAPABILITY GROUP

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
RECIPROCAT	ESTIMATE	18981	15922	65484	6217	962	7722	372	331	157	113366	220178
	% STD ERR	9.8	10.5	3.7	10.2	28.9	12.9	*	*	*	2.1	0.0
	ROW %	8.6	7.2	29.7	2.8	0.4	3.5	0.2	0.2	0.1	51.5	
	COLUMN %	96.7	99.5	98.4	55.6	42.0	60.4	80.2	78.3	78.1	94.3	94.1
TURBOPROP	ESTIMATE	9	26	647	2522	234	2561	31	31	2	85	3297
	% STD ERR	30.9	*	13.3	4.2	17.4	4.0	*	*	*	*	0.0
	ROW %	0.3	0.8	19.6	76.5	7.1	77.7	0.9	0.9	0.1	2.6	
	COLUMN %	0.0	0.2	1.0	22.6	10.2	20.0	6.7	7.3	1.0	0.1	1.4
TURBOSHAFT	ESTIMATE	588	39	159	91	126	124	0	0	0	1680	2653
	% STD ERR	30.0	*	*	32.2	17.8	28.9	0.0	0.0	0.0	11.0	0.1
	ROW %	22.2	1.5	6.0	3.4	4.7	4.7	0.0	0.0	0.0	63.3	
	COLUMN %	3.0	0.2	0.2	0.8	5.5	1.0	0.0	0.0	0.0	1.4	1.1
TURBOJET	ESTIMATE	15	21	286	2346	969	2373	61	61	41	140	2814
	% STD ERR	14.6	*	15.1	1.9	7.0	1.9	49.0	49.0	*	8.8	0.1
	ROW %	0.5	0.7	10.2	83.4	34.4	84.3	2.2	2.2	1.5	5.0	
	COLUMN %	0.1	0.1	0.4	21.0	42.3	18.6	13.1	14.4	20.4	0.1	1.2
TUR AIR GEN	ESTIMATE	0	0	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAMJET	ESTIMATE	0	0	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NO ENGINE	ESTIMATE	43	0	0	0	1	11	0	0	0	4951	5006
	% STD ERR	41.7	0.0	0.0	0.0	*	*	0.0	0.0	0.0	0.7	0.6
	ROW %	0.9	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	98.9	
	COLUMN %	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	4.1	2.1
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
GS:	GLIDE SLOPE	ML:	MICROWAVE LANDING SYSTEM

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 20. NON-HIERARCHICAL GROUPS - NUMBER OF ENGINES VS. CAPABILITY GROUP

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
ONE	ESTIMATE	18805	15230	47429	1450	576	2814	212	202	116	113662	196779
	% STD ERR	9.8	10.9	5.1	31.7	41.7	31.7	*	*	*	2.1	0.0
	ROW %	9.6	7.7	24.1	0.7	0.3	1.4	0.1	0.1	0.1	57.8	
	COLUMN %	95.8	95.1	71.2	13.0	25.1	22.0	45.7	47.8	57.7	94.5	84.1
TWO	ESTIMATE	780	769	18892	9240	1425	9477	236	205	72	1468	31266
	% STD ERR	27.7	29.0	2.8	4.9	10.9	4.8	49.1	49.3	*	16.0	0.0
	ROW %	2.5	2.5	60.4	29.6	4.6	30.3	0.8	0.7	0.2	4.7	
	COLUMN %	4.0	4.8	28.4	82.7	62.2	74.1	50.9	48.5	35.8	1.2	13.4
THREE	ESTIMATE	1	0	0	128	36	128	11	11	11	11	140
	% STD ERR	*	0.0	0.0	0.8	*	0.8	*	*	*	47.5	4.0
	ROW %	0.7	0.0	0.0	91.4	25.7	91.4	7.9	7.9	7.9	7.9	
	COLUMN %	0.0	0.0	0.0	1.1	1.6	1.0	2.4	2.6	5.5	0.0	0.1
FOUR	ESTIMATE	7	9	255	356	253	360	5	5	2	131	756
	% STD ERR	34.0	32.9	5.3	3.7	5.8	3.7	34.3	34.3	47.2	7.6	0.9
	ROW %	0.9	1.2	33.7	47.1	33.5	47.6	0.7	0.7	0.3	17.3	
	COLUMN %	0.0	0.1	0.4	3.2	11.0	2.8	1.1	1.2	1.0	0.1	0.3
MORE THAN FOUR	ESTIMATE	0	0	0	0	0	0	0	0	0	0	0
	% STD ERR	0.0	0.0	0.0	0.0	0.0	0.0	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	
	COLUMN %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NONE	ESTIMATE	43	0	0	0	1	11	0	0	0	4951	5006
	% STD ERR	41.7	0.0	0.0	0.0	*	*	0.0	0.0	0.0	0.7	0.6
	ROW %	0.9	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	98.9	
	COLUMN %	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	4.1	2.1
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

TABLE 20. 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

NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.

TABLE 21. NON-HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP

1978

		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	ESTIMATE	127	17	120	8	11	32	8	8	8	16075	16372
	% STD ERR	*	31.6	48.5	*	*	*	*	*	*	2.7	2.7
	ROW %	0.8	0.1	0.7	0.0	0.1	0.2	0.0	0.0	0.0	98.2	
	COLUMN %	0.6	0.1	0.2	0.1	0.5	0.3	1.7	1.9	4.0	13.4	7.0
2 SEATS	ESTIMATE	5686	1396	2798	64	74	64	50	41	41	51946	61899
	% STD ERR	14.0	29.7	20.7	39.2	*	39.2	*	*	*	2.1	0.7
	ROW %	9.2	2.3	4.5	0.1	0.1	0.1	0.1	0.1	0.1	83.9	
	COLUMN %	29.0	8.7	4.2	0.6	3.2	0.5	10.8	9.7	20.4	43.2	26.5
3 SEATS	ESTIMATE	349	61	21	15	15	15	13	11	11	10845	11295
	% STD ERR	35.9	*	*	*	*	*	*	*	*	2.0	1.7
	ROW %	3.1	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	96.0	
	COLUMN %	1.8	0.4	0.0	0.1	0.7	0.1	2.8	2.6	5.5	9.0	4.8
4 SEATS	ESTIMATE	10895	12299	32100	720	152	2029	71	71	56	35071	91209
	% STD ERR	15.0	12.8	7.1	*	*	41.9	*	*	*	6.1	0.9
	ROW %	11.9	13.5	35.2	0.8	0.2	2.2	0.1	0.1	0.1	38.5	
	COLUMN %	55.5	76.8	48.2	6.4	6.6	15.9	15.3	16.8	27.9	29.2	39.0
5 SEATS	ESTIMATE	907	906	4312	216	22	278	0	0	0	2710	9070
	% STD ERR	25.6	25.9	15.1	*	*	46.5	0.0	0.0	0.0	12.2	7.5
	ROW %	10.0	10.0	47.5	2.4	0.2	3.1	0.0	0.0	0.0	29.9	
	COLUMN %	4.6	5.7	6.5	1.9	1.0	2.2	0.0	0.0	0.0	2.3	3.9
6 SEATS	ESTIMATE	1383	1085	19350	3230	536	3267	159	159	39	2110	27221
	% STD ERR	19.9	25.9	4.6	12.7	38.0	12.6	*	*	*	15.0	3.1
	ROW %	5.1	4.0	71.1	11.9	2.0	12.0	0.6	0.6	0.1	7.8	
	COLUMN %	7.0	6.8	29.1	28.9	23.4	25.5	34.3	37.6	19.4	1.8	11.6
7-11 SEATS	ESTIMATE	172	219	6755	5539	751	5701	89	58	4	686	13416
	% STD ERR	*	*	5.7	5.7	16.6	5.4	*	*	42.4	19.7	1.7
	ROW %	1.3	1.6	50.4	41.3	5.6	42.5	0.7	0.4	0.0	5.1	
	COLUMN %	0.9	1.4	10.1	49.6	32.8	44.6	19.2	13.7	2.0	0.6	5.7
12-19 SEATS	ESTIMATE	50	7	368	455	225	466	18	18	2	460	1374
	% STD ERR	19.5	43.7	6.0	9.1	14.9	9.0	*	*	35.1	6.3	3.1
	ROW %	3.6	0.5	26.8	33.1	16.4	33.9	1.3	1.3	0.1	33.5	
	COLUMN %	0.3	0.0	0.6	4.1	9.8	3.6	3.9	4.3	1.0	0.4	0.6

TABLE 21. NON-HIERARCHICAL GROUPS - NUMBER OF SEATS VS. CAPABILITY GROUP (Continued)

1978

		L	L,MB	L,MB, GS	L,MB, GS,RA	LRN	RA	ML	L,MB, GS,ML	LRN,ML	NO GROUP	ALL CRAFT
20-49 SEATS	ESTIMATE	61	11	478	426	266	432	21	21	17	175	1159
	% STD ERR	47.9	*	10.3	9.5	9.6	9.4	33.3	33.3	38.3	22.7	2.3
	ROW %	5.3	0.9	41.2	36.8	23.0	37.3	1.8	1.8	1.5	15.1	
	COLUMN %	0.3	0.1	0.7	3.8	11.6	3.4	4.5	5.0	8.5	0.1	0.5
50+ SEATS	ESTIMATE	7	7	275	503	240	507	34	34	23	142	934
	% STD ERR	34.0	41.2	4.6	2.6	18.1	2.5	*	*	*	8.7	1.4
	ROW %	0.7	0.7	29.4	53.9	25.7	54.3	3.6	3.6	2.5	15.2	
	COLUMN %	0.0	0.0	0.4	4.5	10.5	4.0	7.3	8.0	11.4	0.1	0.4
TOTALS	ESTIMATE	19636	16008	66576	11175	2292	12790	464	423	201	120222	233952
	% STD ERR	9.5	10.5	3.7	5.8	12.6	7.8	43.2	45.2	*	2.0	
	ROW %	8.4	6.8	28.5	4.8	1.0	5.5	0.2	0.2	0.1	51.4	

KEY

GROUP		GROUP	
L:	LOCALIZER	RA:	RADAR ALTIMETER
MB:	MARKER BEACON	LRN:	LONG RANGE RNAV
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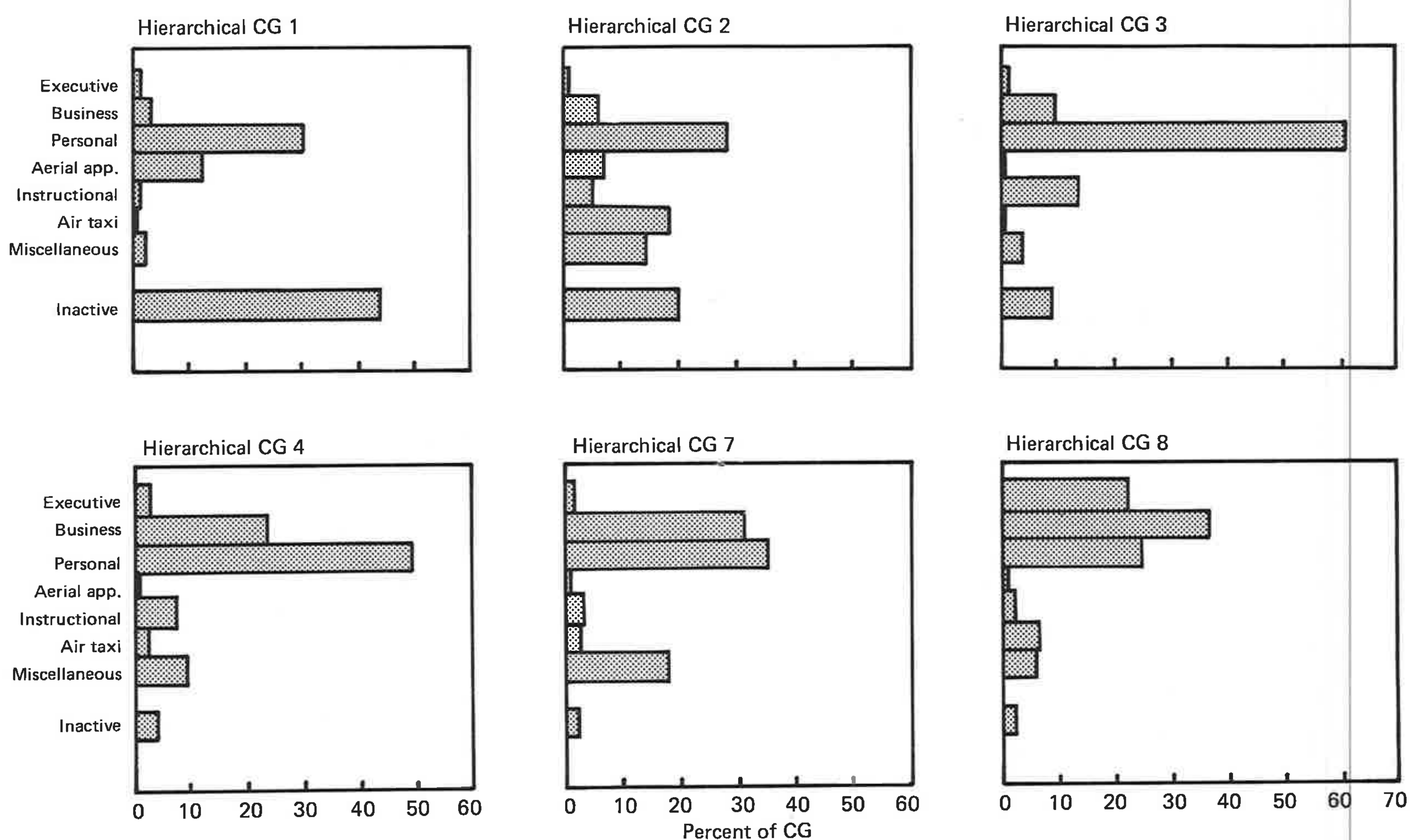
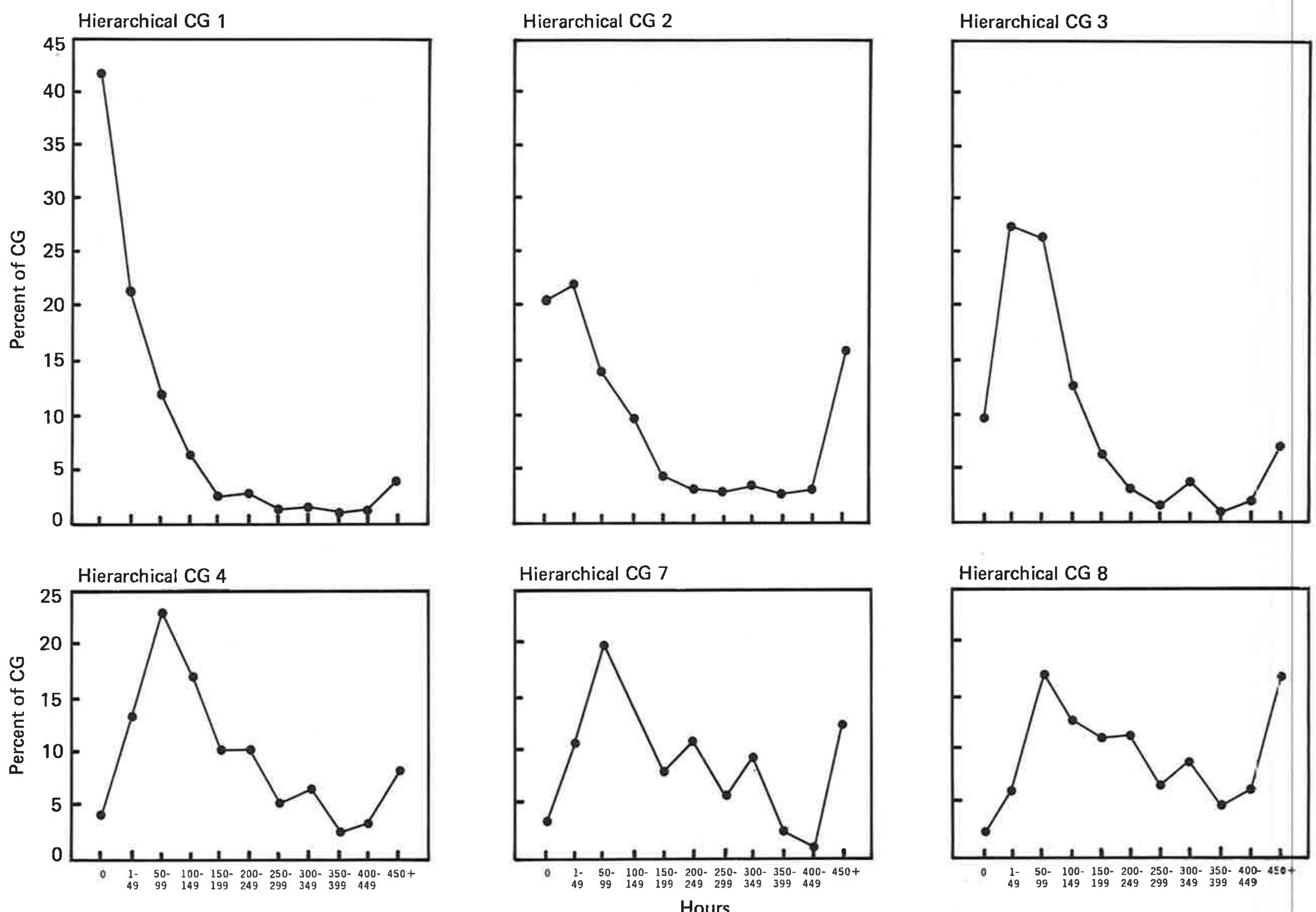
NOTE : ROWS AND COLUMNS MAY NOT SUM TO PRINTED TOTALS DUE TO ESTIMATION PROCEDURES.
* STANDARD ERROR GREATER THAN 50 PERCENT.



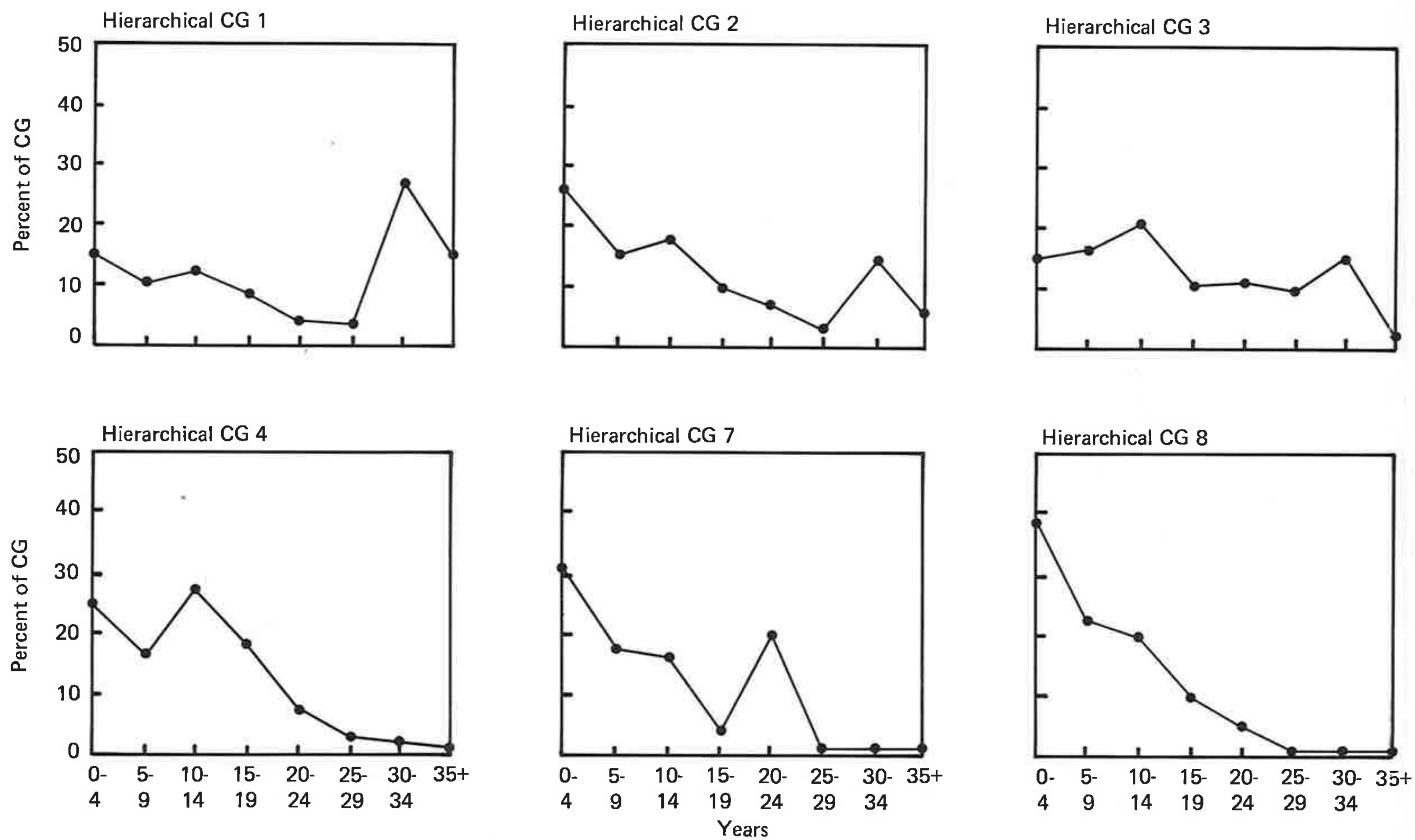
The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

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



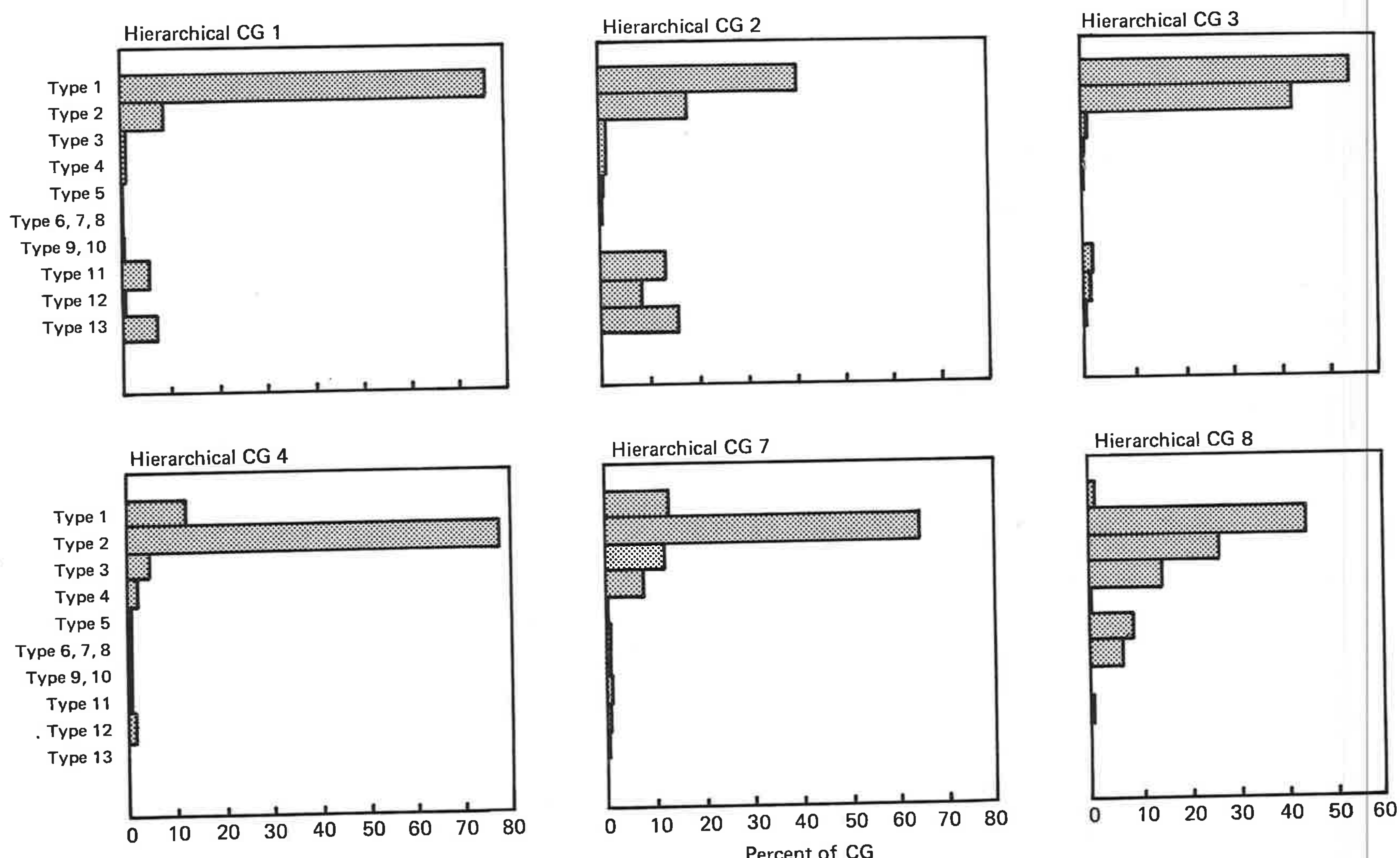
The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 14. Percent Distribution of Hierarchical CG's by Annual Hours Flown



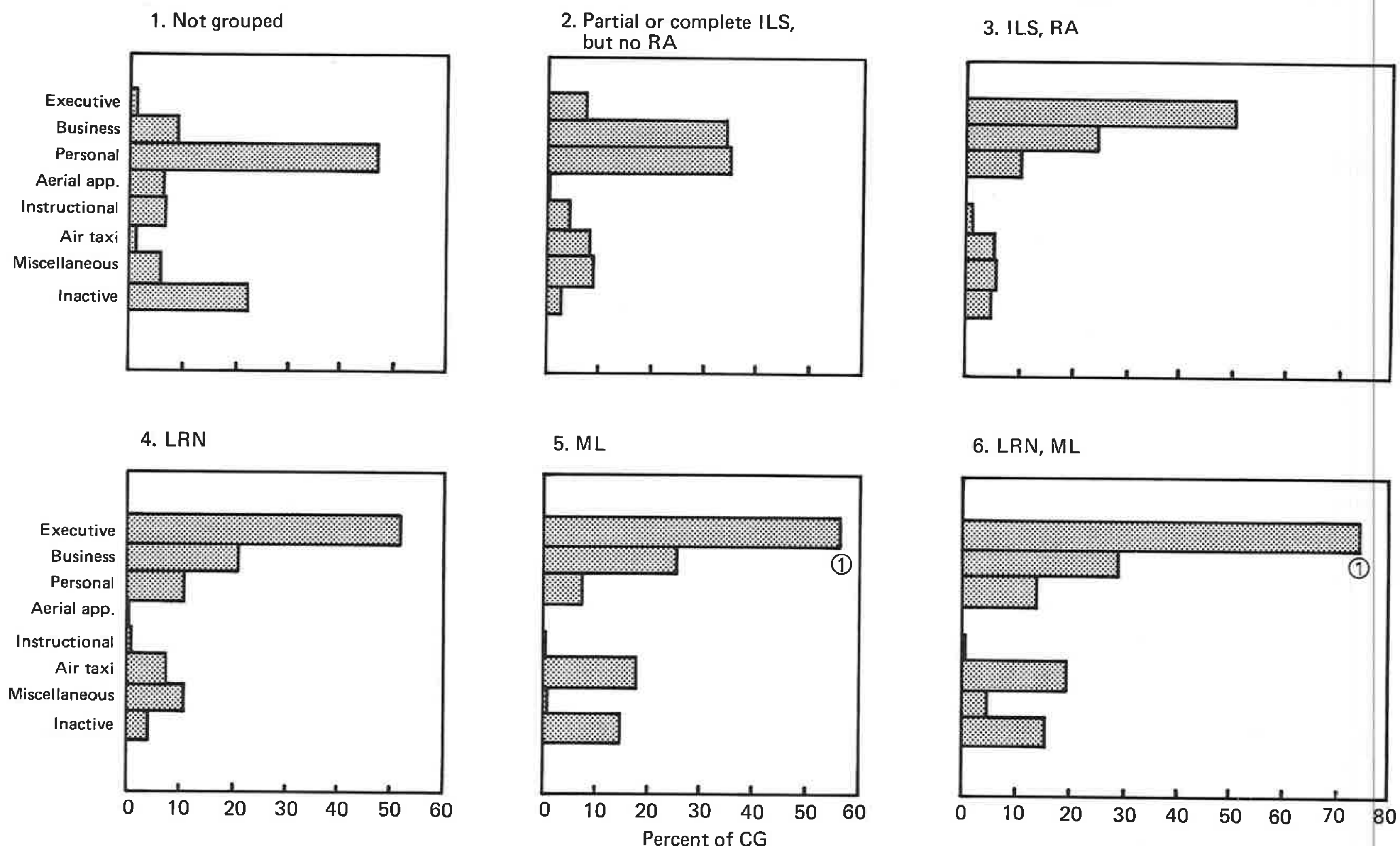
The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 15. Percent Distribution of Hierarchical CG's by Age



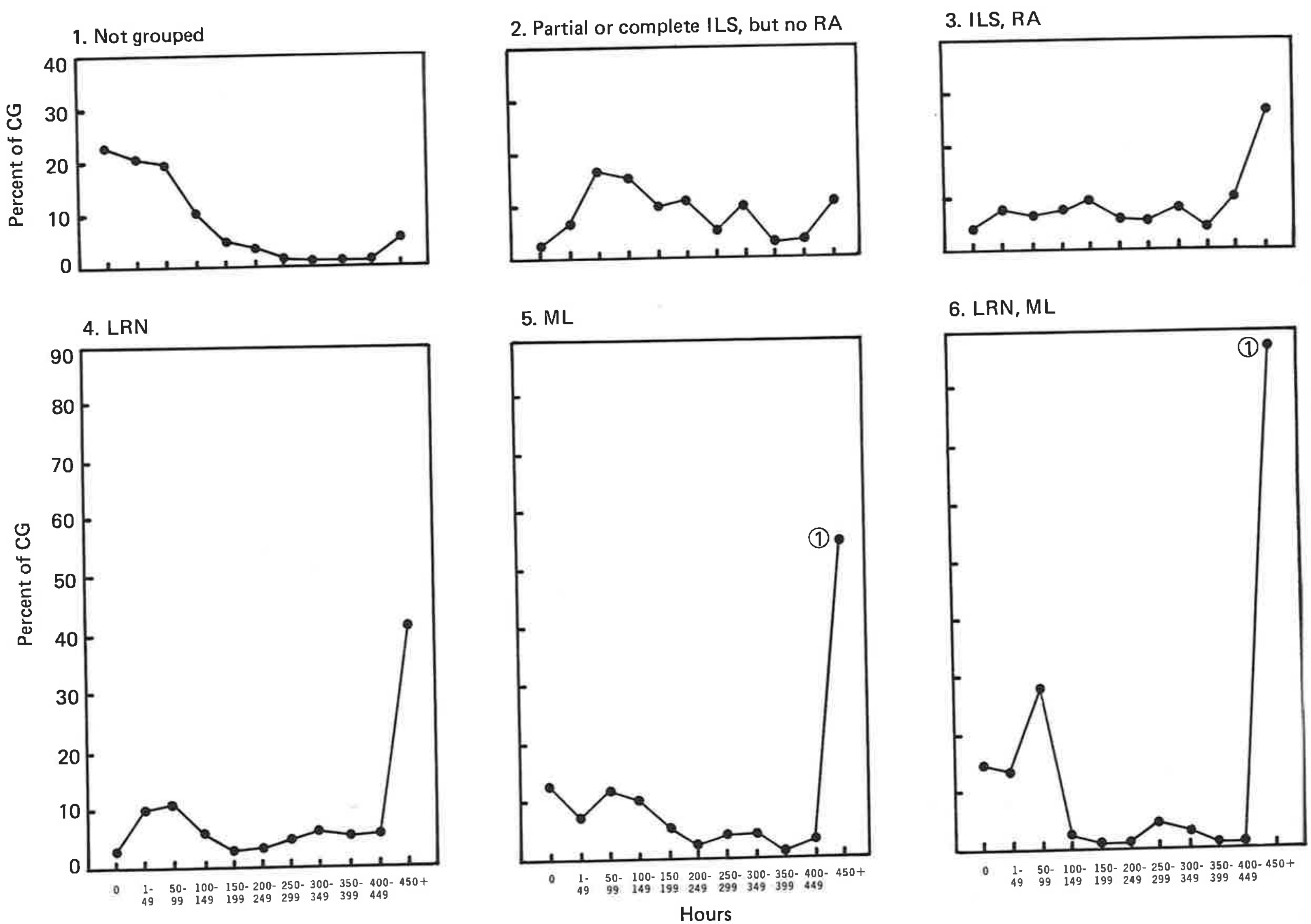
The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 16. Percent Distribution of Hierarchical CG's by Computed Aircraft Type



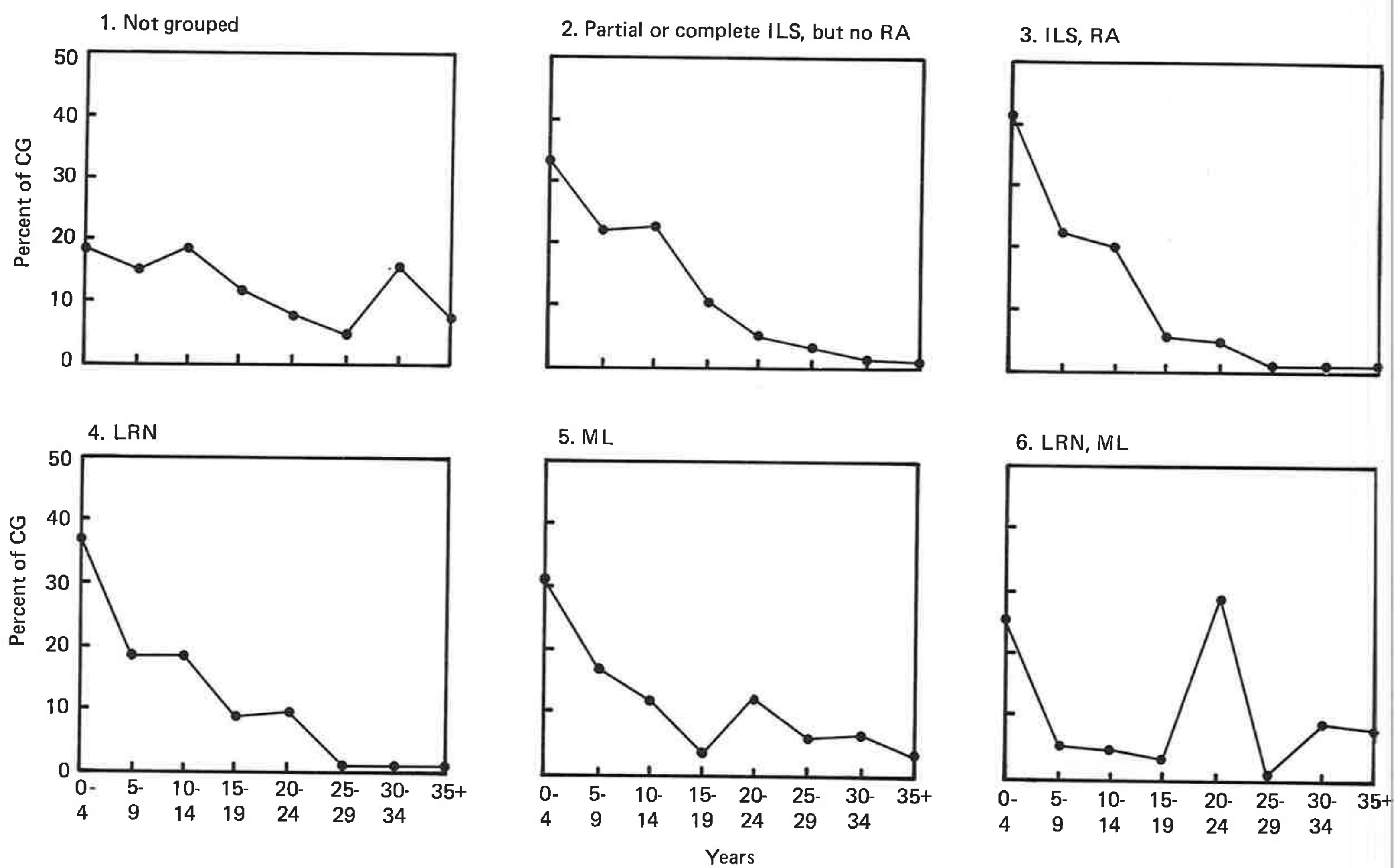
① The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 17. Percent Distribution of Non-Hierarchical CG's by Primary Use



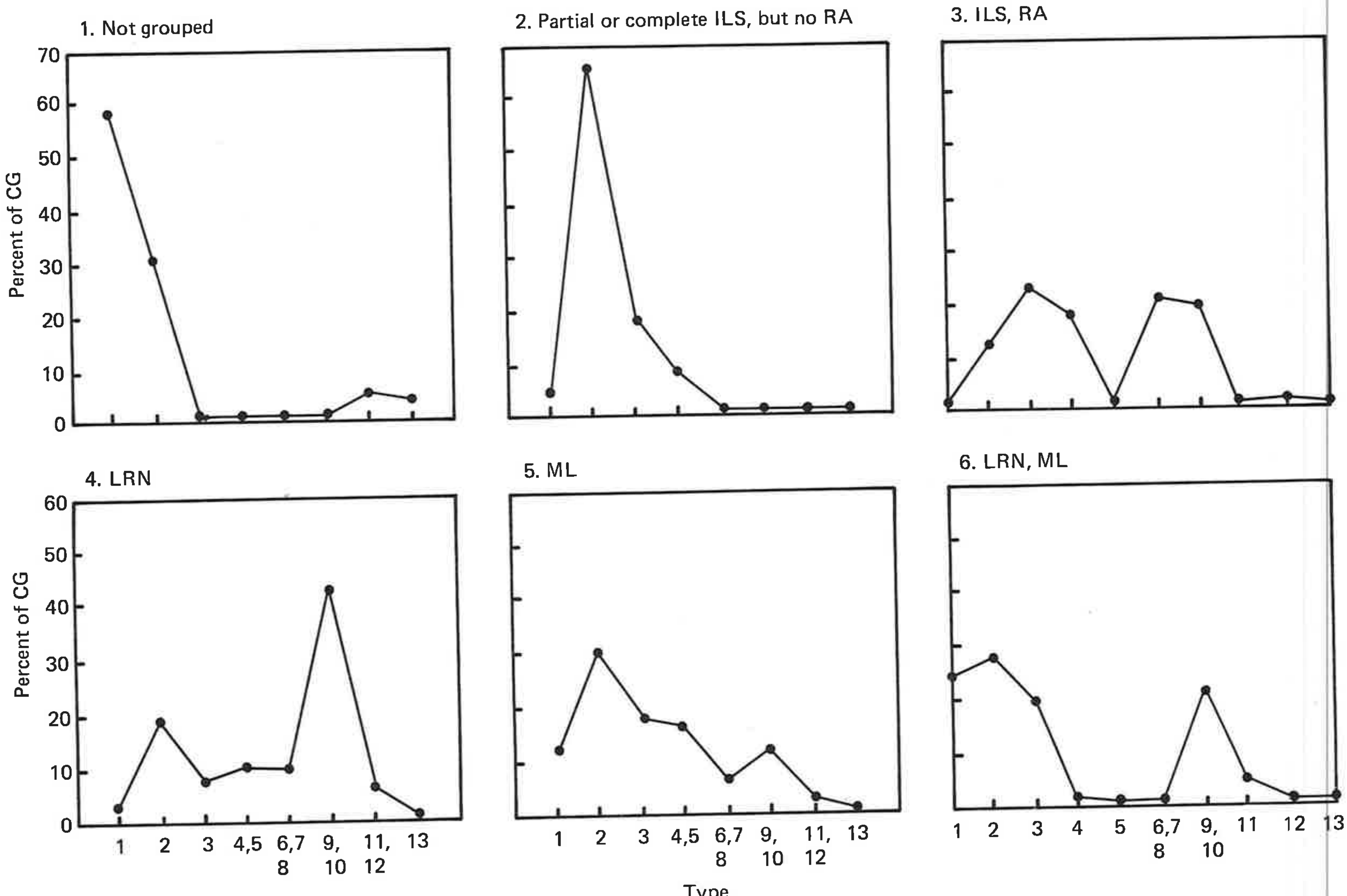
① The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 18. Percent Distribution of Non-Hierarchical CG's by Annual Hours Flown



The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 19. Percent Distribution of Non-Hierarchical CG's by Age of Aircraft



The 1978 figures are based on a sample survey rather than a census, therefore are subject to sampling error.

Figure 20. Percent Distribution of Non-Hierarchical CG's by Computed Aircraft Type

APPENDIX A

GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY DESIGN

APPENDIX A[1]

GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY DESIGN

A.1 BACKGROUND

Prior to the current survey method, the FAA used the Aircraft Registration Eligibility, Identification, and Activity Report, AC Form 8050-73 in its data collection program on general aviation activity and avionics. The form, sent annually to all owners of civil aircraft in the U.S., served two purposes: (1) Part 1 was the mandatory aircraft registration renewal form; (2) Part 2 was voluntary and applied to general aviation aircraft only, asking questions on the owner-discretionary characteristics of the aircraft such as flight hours, avionics equipment, base location, and use. In 1978, the FAA replaced AC form 8050-73 with a new system: Part 1 was replaced by a triennial registration program; Part 2 was replaced by the General Aviation Activity and Avionics Survey, FAA Form 1800-54 (see Figure 1). The survey was to be conducted annually based on a statistically selected sample of general aviation aircraft, requesting the same type of information as Part 2 of AC Form 8050-73. The first General Aviation Activity and Avionics Survey took place in 1978, collecting data on the 1977 general aviation aircraft fleet. The 1978 statistics in this report were derived from the second survey which took place in 1979. Benefits resulting from the new method of data collection included quicker processing of the results, improved data quality, and a considerable savings in time and money to both the public and the Federal Government.

A.2 SURVEY COVERAGE

A.2.1 Aircraft

The General Aviation Activity and Avionics Survey covers, through a stratified probability sample, all general aviation aircraft registered in the United States.

A.2.2 Geographic

The sample survey covers general aviation aircraft registered with the United States Aircraft Registry as of December 31, 1978. Over 99 percent of these aircraft are registered to owners living in the 50 states and Washington, D.C., with about 0.2 percent (583 aircraft) in Puerto Rico and

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[1] Source: <u>1978 General Aviation Activity and Avionics Survey.</u>

other U.S. Territories, and 0.2 percent (440 aircraft) registered to owners living in foreign countries.[2]

A.2.3 Content

Figure 1 is a copy of the survey questionnaire, FAA Form 1800-54. The questionnaire requests the owner to provide information on the sampled aircraft's characteristics and uses for various time periods:

(1) Hours by use, IFR hours, and fuel consumption for entire calendar year 1978,

(2) Airframe hour reading and location of aircraft base as of December 31, 1978, and,

(3) Avionics equipment currently on board.

A.3 SAMPLE DESIGN

A.3.1 Sample Frame and Size

The Aircraft Registration Master File, maintained by the FAA Mike Monroney Aeronautical Center in Oklahoma City, provided the sample frame, the list of aircraft from which the sample was selected, for the survey. This file is the official record of registered civil aircraft in the U.S., containing one record per aircraft.

Between the 1977 and 1978 survey cycles several changes occurred to this file which had an impact on the sample population and frame, and ultimately on the survey results. In January 1978, FAA implemented a new procedure for maintaining the file, known as triennial revalidation. Instead of requiring all owners to revalidate and update their aircraft registration annually, FAA required revalidation for only those owners who had not contacted the registry for three years. The less frequent updating affected the accuracy of the file and its representativeness. Two major consequences for the survey results are discussed below:

(1) The accuracy of owners' names and addresses deteriorated causing the number of questionnaires returned by the post office to double from 1977 to 1978. This partially accounted for a lower survey response rate in 1978.

(2) The file contained a residue of aircraft which, under the old revalidation system, would have been deregistered and purged from

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[2]Source: FAA Aircraft Registration Master File as of December 31, 1978.

the file, but remained under the new system. Consequently, the population counts were inflated resulting in artificially large increases in the estimates of the number of active general aircraft from 1977 to 1978.

Also during this period, the entire Aircraft Registration System was installed on a new computer system. At the same time, FAA modified many of the updating and processing procedures. It is quite possible that these changes affected the registration file, although it is not known in what way.

Finally, new legislation required two categories of aircraft, formerly ineligible, to be registered with the U.S. Registry, namely:

(1) Aircraft owned by individual citizens of foreign countries who are permanent residents of the U.S., and

(2) Aircraft owned by non-U.S. corporations which are organized and doing business under U.S. law as long as the aircraft are based and used primarily in the U.S.

The definition of a registered general aviation aircraft changed from 1977 to 1978 to include the two new groups. It is estimated that these aircraft comprise less than one half percent of the general aviation fleet.

Thus these changes discussed above affected the contents of the Aircraft Registration Master File and, consequently, the survey results. While it is difficult to quantify the effects of the changes, FAA estimates that they caused the survey results to overestimate population and hours flown by not more than five percent.

All aircraft identified as general aviation in the file according to the definition in Section 1.1.1 comprise the sample frame with the following exceptions:

(1) Aircraft registered to dealers.

(2) Aircraft with "Sale Reported" or "Registration Pending" appearing in the records instead of the owner's name.

(3) Aircraft with a known inaccurate owner's address.

(4) Aircraft with missing state of registration, aircraft make-model-series code, or aircraft type information.

For calendar year 1978, the sample frame consisted of 233,952 general aviation aircraft records from which 31,208 records were sampled, yielding a 13.3 percent sample. Table A-1 shows the distribution of the sample compared to that of the population by aircraft type. Table A-2 shows similar distributions by FAA region. (See Appendix C for the FAA regional map.) These displays clearly demonstrate the disproportionality of the sample to the population, an intended result of the sample design to gain efficiency and to control errors.

A.3.2 Description of Sample Design

The sample design employed was a stratified, systematic design from a random start. The sample was selected from a two-way stratified frame matrix. The two stratification criteria were:

(1) State or territory of aircraft registration.

(2) A variable called make-model index constructed from the thirteen aircraft types and the 300+ aircraft manufacturer/model groups of 20 or more general aviation aircraft.

The 54 levels of the state criterion and the 327 levels of the make-model index yielded a matrix of 54 by 327, or 17,658 cells (strata) among which the frame was divided for sampling.

The FAA's primary requirement was for estimates of mean annual flight hours per aircraft, necessitating optimal determination of sample sizes based on flight hour variation within the cells, and not on cell size. Hence, the sample was not proportional to cell size, and a sampling fraction was determined for each cell with a non-zero population. Sampling was then performed systematically from a random start within individual cells.

Initially, each aircraft in the sample was given a weight which was the inverse of its cell's sampling fraction, and which corresponded to the number of aircraft in the sample frame represented by that aircraft. When all responses to the survey were tallied, each weight was adjusted in two ways: one, according to the response rate for the aircraft's make-model index, and the other according to the response rate for the aircraft's state of registration, counting an aircraft for which no survey questions were answered as a non-respondent

TABLE A-1. SAMPLE AND POPULATION DISTRIBUTIONS BY AIRCRAFT TYPE

TYPE	POPULATION	SAMPLE SIZE	SAMPLE AS % OF POPULATION
Fixed Wing			
Piston			
1 engine, 1-3 seats	80,293	12,361	15.4
1 engine, 4+ seats	108,648	7,985	7.3
2 engines, 1-6 seats	17,089	2,247	13.1
2 engines, 7+ seats	8,571	1,784	20.8
Other Piston	379	301	79.4
Turboprop			
2 engines, 1-12 seats	2,597	389	15.0
2 engines, 13+ seats	597	207	34.7
Other Turboprop	107	98	91.6
Turbojet			
2 engines	2,180	536	24.6
Other Turbojet	633	356	56.2
Rotorcraft			
Piston	5,027	2,165	43.1
Turbine	2,654	579	21.8
Other	5,177	2,200	42.5
TOTAL	233,952	31,208	13.3

TABLE A-2. SAMPLE AND POPULATION DISTRIBUTIONS BY REGION OF REGISTERED AIRCRAFT

REGION	APPROXIMATE POPULATION	SAMPLE SIZE	SAMPLE AS % OF POPULATION
Alaskan	6,602	827	12.5
Central	16,642	2,552	15.3
Eastern	24,012	4,653	19.4
European (Foreign)	448	175	39.1
Great Lakes	41,294	3,760	9.1
New England	8,239	2,842	34.5
Northwestern	15,955	2,501	15.7
Pacific	607	601	99.0
Rocky Mountain	13,343	3,239	24.3
Southern	37,330	4,997	13.4
Southwestern	31,916	2,521	7.9
Western	37,564	2,540	6.8
TOTAL	233,952	31,208	13.3

and an aircraft for which at least one question was answered as a respondent. The make-model index adjustment is described below; the state adjustment is analogous.

(1) Non-respondents' weights were changed to zero.

(2) The weights of all responding aircraft in make-model indices where there were fewer than five telephone follow-up contacts were adjusted uniformly by dividing the initial weight by the response rate.

(3) In make-model indices where there were five or more telephone follow-up contacts, the weights of the mail respondents remained unchanged, and the weights of the telephone respondents were increased by dividing their initial weights by the proportion of non-respondents contacted by telephone.

This method of weight adjustment has several attributes. It actually incorporates the response rates into the final weights and simplifies estimation procedures. In addition, (3) above removes non-response bias from the affected make-model indices and states of registration by weighting the telephone sample of mail non-respondents to adjust for the remaining non-respondents. When calculating final estimates, the state weights are used for all state and regional estimates, the make-model index weights for all other estimates.

A.3.3 Error

Errors associated with estimates derived from sample survey results fall into two categories: sampling and non-sampling errors.[1] Sampling errors occur because the estimates are based on a sample - not the entire population. Non-sampling errors arise from a number of sources such as non-response, inability or unwillingness of respondents to provide correct information, differences in interpretation of questions, mistakes in recording or coding the data obtained, and others. The following sections discuss the two types of errors.

A.3.3.1 Sampling Error

In a designed survey, the sampling error associated with an estimate is generally unknown, but a measurable quantity

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[1] Standards for Discussion and Presentation of Errors in Data, Department of Commerce, Bureau of the Census, (Washington, D.C., 1974), pp. 11-14.

known as the standard error is often used as a guide to the magnitude of sampling error. The standard error measures the variation which would occur among the estimates from all possible samples of the same design from the same population. It thus measures the precision with which an estimate approximates the average result of all possible samples or the result of a survey in which all elements of the population were sampled.

Through sample design techniques, the statistican can control the sizes of standard errors on a few key variables, known as design variables, in the survey. In the General Aviation Activity and Avionics Survey, the design variables were the mean annual hours flown per aircraft by aircraft type, by aircraft manufacturer/model group, and by state of aircraft registration. The sample was designed to produce standard errors on these variables at levels specified by the FAA. No controls were placed on the standard errors of the non-design variables.

Thus every estimate resulting from a sample survey, whether it be for a design or non-design variable, has sampling error associated with it. The user of survey results must consider this error along with the point estimate itself when making inferences or drawing conclusions about the sample population. A large standard error relative to an estimate indicates lack of precision and, inversely, a small standard error indicates precision. To facilitate the comparison of estimates and their errors, the tables in Section 3 of this publication display the percent standard errors for all estimated quantities. In some cases, the tables contain the percent standard error, which is the standard error divided by the corresponding estimate. The paragraphs below explain the proper interpretation and use of the errors.

An estimate and its standard error make it possible to construct an interval estimate with prescribed confidence that the interval will include the average value of the estimate from all possible samples of the population. Table A-3 below shows selected interval widths and their corresponding confidence.

TABLE A-3. CONFIDENCE OF INTERVAL ESTIMATES

WIDTH OF INTERVAL	APPROXIMATE CONFIDENCE THAT INTERVAL INCLUDES AVERAGE VALUE
1 Standard error	68%
2 Standard errors	95%
3 Standard errors	99%

As an example, from Table 8 a 95 percent confidence interval for the estimated number of aircraft in the 0-4 years age category would be 56129 $\pm$ 2(.046)(56129) or 56129 $\pm$ 5164 or (50965, 61293). One would say that the number of aircraft in the 0-4 years age category lies somewhere between 50965 and 61293 with 95 percent confidence.

A.3.3.2 Non-Sampling Error

Non-sampling error can be reduced through survey design although the amount of reduction is difficult, if not impossible, to quantify in any given design. Nevertheless, through controlled experiments, various techniques have been identified which limit non-sampling error. Several of these techniques were incorporated into the design of the general aviation survey and are itemized below:

- The second mailing and telephone survey of a sample of non-respondents were conducted in addition to the original mailing to improve the response rate, since a low response rate is a major cause of non-sampling error. Seventy-four percent of those aircraft sampled responded to at least one question of the survey. While acceptable, this rate nevertheless represents a decrease in response from 1977 when the survey achieved an 80 percent response rate. Possible causes of the decrease include:

  (1) The deterioration of aircraft owners' names and addresses in the Aircraft Registration Master File, the sample frame. This increased the number of questionnaires returned undelivered by the postmaster from around 500 in 1977 to over 1000 in 1978, hence decreasing the response rate.

  (2) The inadvertent omission of the postpaid return envelopes from the materials sent out in the first mailing. Although the envelopes were mailed to the owners in a separate mailing and were included in the second mailing of the survey, it is likely the omission had some adverse effect on the response rate.

  (3) Repeated sampling of aircraft in both 1977 and 1978. Due to the design of the

sample to achieve specified precision in estimates for states and manufacturer/model groups of aircraft, it is impossible to avoid sampling some of the same aircraft in consecutive years. Owners of such aircraft may have been less willing to respond in 1978 than in 1977.

While the second cause above was peculiar to the 1978 survey, the first and third causes reflect situations which will not improve. An 80 percent response rate may thus be an unreasonable expectation for future surveys.

Tables A-4 and A-5 show the response rates broken down by FAA region and aircraft type, respectively. The lowest response rate for any region was 48 percent for the European (Foreign) Region due to mail delivery and telephone contact difficulties. The Pacific and Alaskan Regions rates were low at 62 percent for similar reasons. These three regions together, however, represented only 3 percent of the active U.S. general aviation fleet. Twin engine fixed wing piston aircraft with 7 or more seats had the lowest response rate at 63 percent of any of the aircraft types, but these aircraft represented less than 4 percent of the fleet.

- The telephone sample of mail non-respondents helped to minimize bias in results caused by differences in attributes between respondents and non-respondents.
- The survey questionnaire was designed and tested to minimize misinterpretation of questions by the aircraft owners.
- To assure the owners of the confidentiality of their responses, the questionnaire cover letter informed them that the intended use of the responses was "only to produce summary statistics and not to disclose individual operations nor to make changes to your aircraft records."
- Comprehensive editing procedures insured the accuracy of the data transcription to machine readable form and the internal consistency of responses.

TABLE A-4. RESPONSE RATES BY REGION

Region	Response Rate (%)	Region	Response Rate (%)
Alaskan	62	Pacific	62
Central	76	Rocky Mountain	75
Eastern	76	Southern	72
European (Foreign)	48	Southwestern	74
Great Lakes	78	Western	74
New England	77		
Northwestern	74	TOTAL	74

TABLE A-5. RESPONSE RATES BY AIRCRAFT TYPE

Aircraft Type	Response Rate (%)	Aircraft Type	Response Rate (%)
Fixed Wing			
Piston		Turbojet	
1 engine, 1-3 seats	76	2 engines	75
1 engine, 4+ seats	74	Other	74
2 engines, 1-6 seats	72		
2 engines, 7+ seats	63		
Other	72		
Turboprop		Rotorcraft	
2 engines, 1-12 seats	74	Piston	75
2 engines, 13+ seats	74	Turbine	80
Other	76	Other	74
		TOTAL	74

- The official and most accurate source of information available on the general aviation fleet, the FAA Aircraft Registration Master File, was used as the sampling frame.

A.4 SURVEY METHOD

The main method of collecting data for this survey was the mail questionnaire, sent to the owners of the sampled aircraft in two mailings. The first mailing on March 8, 1979, covered all 31,208 aircraft in the sample and had a response rate of 56 percent as shown in Table A-6 below. This was about 76 percent of the total responses to the survey. The second mailing conducted on April 9, 1979, included only those aircraft in the sample that had not yet responded. The second mailing had a response rate of 35 percent which accounted for 21 percent of the total responses to the survey. The combined response rate for the two mailings was 72 percent of the sample.

A telephone follow-up survey was conducted during June and early July using the same questions appearing in the mail survey. A sample of the mail non-respondents was selected for the telephone survey weighing most heavily those states and make-model groups in the sampling strata that had the lowest mail response rates. Of a total telephone sample of 3076 aircraft, only 790, or 26 percent, responses could be obtained due to difficulty in obtaining telephone numbers, finding owners at home, and obtaining cooperation of owners over the telephone. Nevertheless, the 790 telephone responses contributed the remaining three percent of the responses and increased the overall response rate of the survey to 74 percent.

TABLE A-6. SUMMARY OF RESPONSE INFORMATION BY SURVEY PHASE

SURVEY PHASE	SAMPLE SIZE (S)	NUMBER OF RESPONSES (R)	RESPONSE RATE (R/S X 100%)	PORTION OF TOTAL RESPONSE [(R/TOTAL R) X 100%]
FIRST MAILING	31,208	17,620	56%	76%
SECOND MAIILNG	13,588	4,766	35%	21%
COMBINED MAILINGS	31,208	22,386	72%	97%
TELEPHONE SURVEY	3,076	790	26%	3%
TOTAL	31,208	23,176	74%	100%

APPENDIX B

SAMPLE FILE AIRCRAFT RECORD LAYOUT

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
1. Blank	A/N7	1-7	Unique for each sampled aircraft. Data verification purposes
2. Control Number	N6	8-13	
3. Blank	A/N20	14-33	
4. Aircraft manufacturer/model/series code	N7	34-40	Standard FAA numeric code.
5. Aircraft category code	N1	41	1 - Land 2 - Sea 3 - Amphibian
6. Aircraft type	N1	42	1 - Glider 2 - Balloon 3 - Blimp/Dirigible 4 - Fixed Wing Single Engine 5 - Fixed Wing Multi-Engine 6 - Rotorcraft
7. Engine type code	N1	43	1 - Reciprocating 2 - Turbopropeller 3 - Turboshaft 4 - Turbojet 5 - Turbine Air Generator 6 - Ram Jet 9 - Unknown 0 - No Engine
8. Engine manufacturer/model code	N5	44-48	Standard FAA numeric code.

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
9. Number of engines	N2	49-50	
10. Engine horsepower	N5	51-55	Per engine
11. Year of manufacture	N2	56-57	00 if unknown
12. Registrant type	N1	58	1 - Individual 2 - Partnership 3 - Corporation 4 - Co-ownership 5 - Government
13. Number of co-owners	N2	59-60	Does not include principal owner.
14. Aircraft base state numeric code	N2	61-62	
15. Aircraft base region code	A/N1	63	
16. Engine SDR group name	A/N12	64-75	Standard FAA numeric code.
17. Final weight-state	N6	76-81	Weight used when compiling state or regional statistics XXXX.X
18. Blanks	A/N48	82-129	
19. Registrant city	A/N18	130-147	
20. Registrant zip code	A/N5	148-152	
21. Registrant region	A/N1	153	
22. Registrant state code	N2	154-155	

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
23. Registrant county/ country code	A/N3	156-158	
24. Airworthiness class	N1	159	1 - Standard 2 - Limited 3 - Restricted 4 - Experimental 5 - Provisional 6 - Multiple 8 - Special Flight Permit
25. Certificate issue date	N6	160-165	
26. State abbreviation	A/N2	166-167	Standard FAA name.
27. Aircraft manufacturer name	A/N30	168-197	Standard FAA name.
28. Aircraft model name	A/N20	198-217	
29. Number of seats	N3	218-220	
30. Respondent type	N1	221	1 - Respondent to First Mailout 2 - Respondent to Second Mailout 3 - Respondent to Telephone Survey 5 - Address Unknown 6 - Non-respondent
31. GA/air carrier indicator	N1	222	0 for GA 1 for air carrier

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
32. Lifetime airframe hours	N5	223-227	
33. Active/inactive	N1	228	0, if not reported; 1, if active; 2, if inactive.
34. Owned part of year	N1	229	0, if owned full year; 1, if owned part of year.
35. Executive use hours	N4	230-233	These hours contain both current and previous owners' hours. (Fields 35–43)
36. Business use hours	N4	234-237	
37. Personal use hours	N4	238-241	
38. Aerial application hours	N4	242-245	
39. Instructional use hours	N4	246-249	
40. Air taxi hours	N4	250-253	
41. Industrial/special use hours	N4	254-257	
42. Rental use hours	N4	258-261	
43. Other use hours	N4	262-265	
44. Annual hours flown	N4	266-269	Sum of Fields 35 through 43 inclusive.

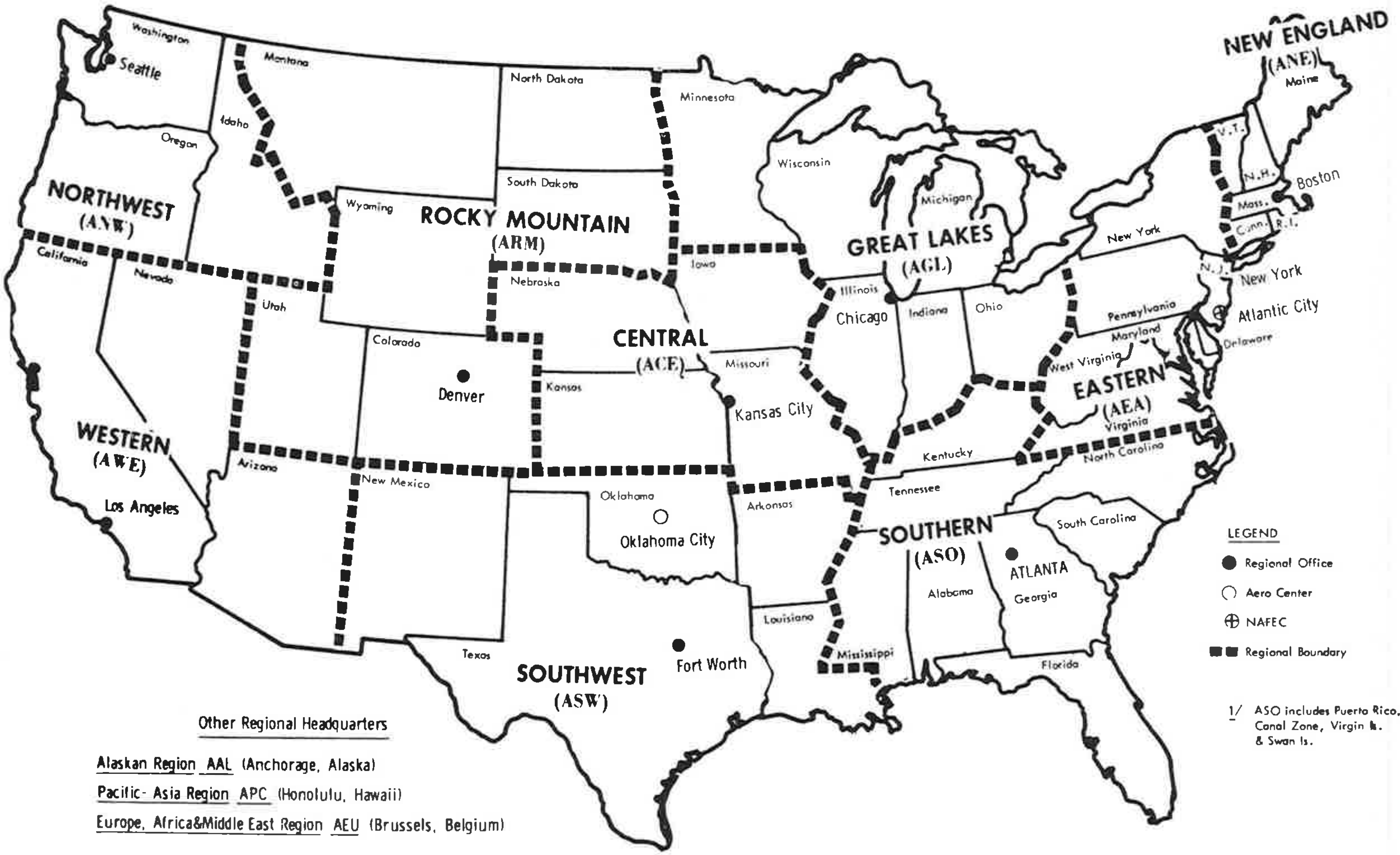
FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
45. Primary use	N1	270	0 - Unknown or inactive 1 - Executive 2 - Business 3 - Personal 4 - Aerial application 5 - Instruction 6 - Air taxi 7 - Industrial/special 8 - Aircraft rental business 9 - Other
46. IFR flight	N1	271	0, if not reported; 1, if flown IFR; 2, if not flown IFR.
47. IFR hours	N4	272-275	
48. Fuel consumption	N4	276-279	Gallons per hour for the aircraft.
49. Aircraft base state or foreign country	A/N2	280-281	Standard Postal Abbreviation
50. Base foreign country code	A/N1	282	Blank, if aircraft base is a state. F, if aircraft base is a foreign country or U.S. territory.

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
51. VHF; 360 channels or less	N1	283	
52. VHF; 720 channels or more	N1	284	
53. VHF; more than one	N1	285	
54. No VHF	N1	286	
55. 4096 code transponder	N1	287	
56. Altitude encoding equipment	N1	288	
57. No transponder equipment	N1	289	
58. VOR; 100 channels	N1	290	0, if not checked; 1, if checked.
59. VOR; 200 channels	N1	291	
60. VOR; more than one receiver	N1	292	
61. ADF	N1	293	
62. DME	N1	294	
63. RNAV	N1	295	
64. Long range RNAV	N1	296	
65. Auto Pilot	N1	297	
66. Radar altimeter	N1	298	
67. Weather radar	N1	299	

FIELD NAME	FIELD DESCRIPTION/LENGTH	POSITION	COMMENTS
68. No navigation equipment	N1	300	0, if not checked; 1, if checked. (applies to 68–73)
69. Localizer	N1	301	
70. Marker beacon	N1	302	
71. Glide slope	N1	303	
72. MLS	N1	304	
73. No ILS equipment	N1	305	
74. Computed aircraft type	N2	306-307	See Table 4.
75. Final weight make-model	N6	308-313	XXXX.X
76. Manufacturer/model/ type index	N3	314-316	A unique number for each make-model index level of stratification criterion 2. (M-M).
77. Aircraft SDR group name	A/N12	317-328	Standard FAA name.

APPENDIX C

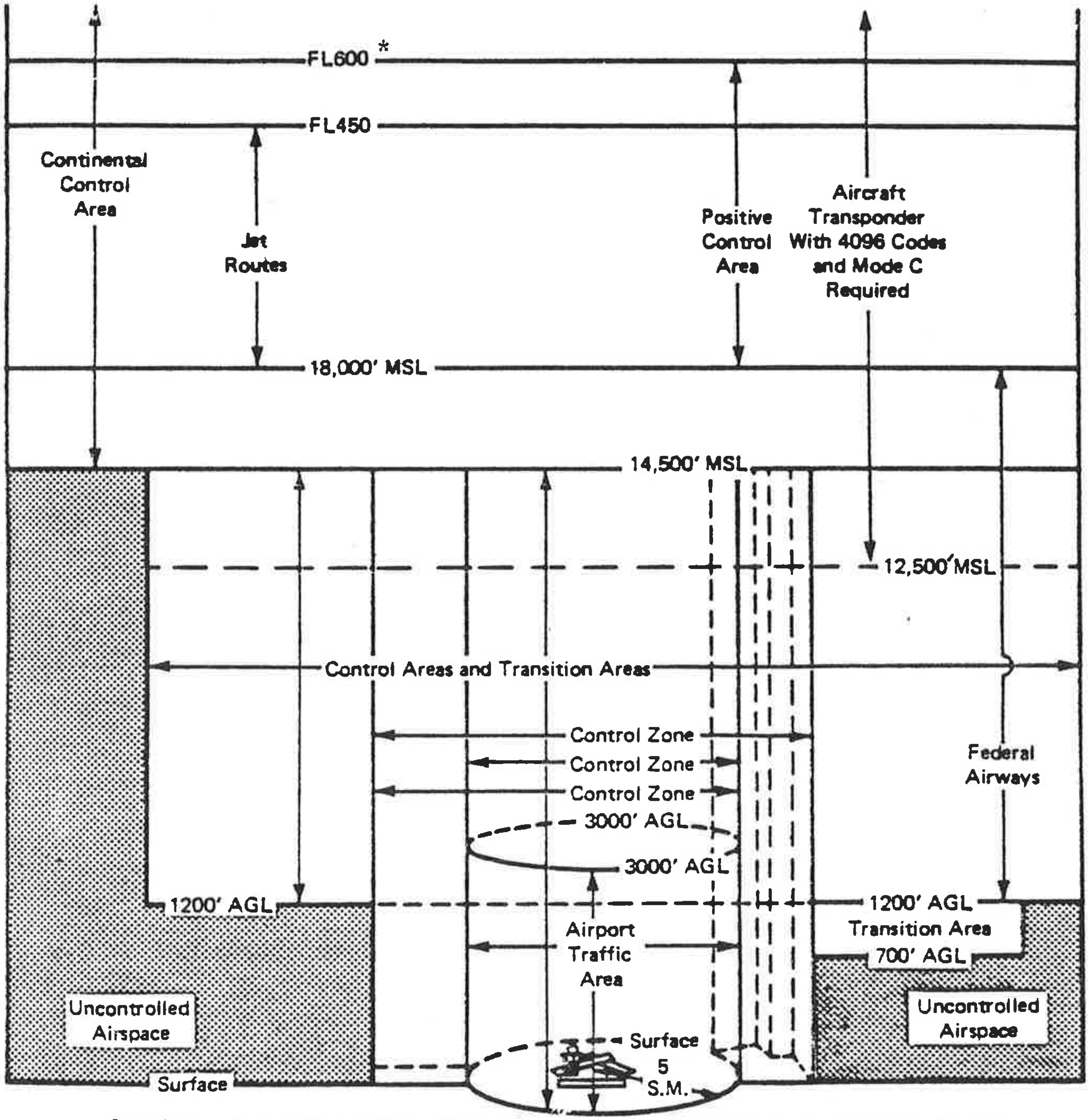
FEDERAL AVIATION ADMINISTRATION REGIONAL MAP



Census of U.S. Civil Aircraft Calendar Year 1978, (1979), p. vii.

APPENDIX D

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.

WEATHER CATEGORY DEFINITIONS[1]

Category	Definition (Ceiling in ft., Visibility in mi.)
VFR	≥ 1500 ft.[2] and 3 mi.
IFR 0	< 1500 ft. and/or 3 mi., but ≥ 400 ft. and 1 mi.
IFR I	< 400 ft. and/or 1 mi., but ≥ 200 ft. and 1/2 mi.
IFR II	< 200 ft. and/or 1/2 mi., but ≥ 100 ft. and 1/4 mi.
IFR III	< 100 ft. and/or 1/4 mi.

[1] Ceiling-Visibility Climatological Study and Systems Enhancement Factors (Washington, 1975), p. 15.

[2] This altitude may vary depending on the minimum approach altitude for the airport.

APPENDIX D. (CONTINUED)

Summary of Major Airspace Designated Areas

Designation	Measure	Present system 1975	Future system In plan 1976–85	Future system Total 1985
En route:				
Jet routes	Number	216	−66	150
Jet area navigation routes	Number	163	+47	200
Low altitude routes:				
Low frequency	Number	24	−24	0
VHF/UHF	Number	462	−214	248
Area navigation VHF	Number	8	+192	200
Area positive control	Altitude (FL)			
Conterminous U.S.		180–600	—	180–600
Alaska		240–600	—	240–600
Parallel	Number	0	+500	500
Three dimensional	Number	0	+1000	1000
Terminal:				
Control zones	Number	806	+287	1093
Transition areas	Number	1,495	−9	1486
Control area extension	Number	1	—	1
Terminal control areas (Group I & II)	Number	18	3	21
STARs/SIDs	Number	414	−239	175
RNAV STARs/SIDs	Number	2	+448	450
Special use:				
Prohibited areas	Number	7	+2	9
	Square Miles	1,626	—	—
Restricted areas	Square Miles	77,639	—	—
Joint use	Number	163	+6	169
Nonjoint use	Number	29	−18	11
Warning areas	Number	68	−33	35
	Square Miles	408,970	—	—
Alert areas	Number	35	−5	30
Jet training areas	Number	35	−5	30
	Square Miles	87,183	—	—

<u>The National Aviation System Plan Fiscal Years 1976-1985</u>, (March, 1975), p. 6-3.

Airborne Equipment Requirements

Types of Airspace	Flight condition	Equipment Requirements 1975		Equipment Requirements 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 IFR	Same as uncontrolled VFR plus transponder [2] Same as uncontrolled IFR plus transponder [2]		Same as 1975 Same as 1975
Positive control	VFR IFR	Requires prior ATC approval 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 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.

National Terminal Radar Programs

Location	Terminal airspace designation	Equipment Requirements: Present	Equipment Requirements: Under Consideration	Services provided
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.

APPENDIX D. (CONCLUDED)

Designated Terminal Airspace (All ARTS-III Locations); Terminal Control Areas

GROUP I	Date designated or planned	GROUP II	Date designated or planned
1. Atlanta	June 1970	1. St. Louis	Jan. 1974
2. Chicago	Aug. 1970	2. Seattle	Jan. 1974
3. Washington National	Feb. 1971	3. Minneapolis	Feb. 1974
4. New York (LGA, JFK, EWR)	Sept. 1971	4. Denver	Mar. 1974
5. Los Angeles	Sept. 1971	5. Houston	Mar. 1974
6. San Francisco	Dec. 1972	6. Cleveland	May 1974
7. Boston	Feb. 1973	7. Detroit	May 1974
8. Miami	Apr. 1973	8. Pittsburgh	May 1974
9. Dallas	Jan. 1974	9. Las Vegas	Nov. 1974
		10. Philadelphia	Mar. 1975
		11. Kansas City	Mar. 1975
		12. New Orleans	Jul. 1975

Group III Terminal Areas (42 locations)

Albany	El Paso	Omaho	San Diego
Albuquerque	Hartford	Orlando	San Juan
Baltimore	Honolulu	Portland, Oreg.	Santa Ana/Long Beach
Birmingham	Indianapolis	Phoenix	Shreveport
Buffalo	Jacksonville	Providence	Syracuse
Burbank	Louisville	Raleigh–Durham	Tampa
Charlotte	Memphis	Ontario, California	Tucson
Cincinnati	Milwaukee	Rochester, N.Y.	Tulsa
Columbus, Ohio	Nashville	Sacramento	Washington-Dulles
Dayton	Norfolk	Salt Lake City	
Des Moines	Oklahoma City	San Antonio	

The National Aviation System Plan Fiscal Years 1976-1985, (March, 1975), p. 6-5.

GLOSSARY

Aerial Application - Aerial application in agriculture consists of those activities that involve the discharge of materials from aircraft in flight and a miscellaneous collection of minor activities that do not require the distribution of any materials.

Air Carrier - The term "Air Carrier," as used in this report, refers to aircraft operators certified by the Federal Aviation Administration for the transportation by air of persons, property, and mail.

Air Carrier Operations - Aircraft operations under certificates of public convenience and necessity, issued by the Civil Aeronautics Board authorizing the performance of scheduled air transportation over specified routes and a limited amount of non-scheduled operations.

Airport Advisory Area - The area within five statute miles of an airport not served by a control tower, i.e., there is no tower or the tower is not in operation, on which is located a Flight Service Station.

Airport Traffic Area - Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport. Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at, or taking off from, an airport within that area. ATC authorization may be given as individual approval of specific operations or may be contained in written agreements between airport users and the town concerned. (Refer to FAR Parts 1 and 91.)

Airport Traffic Control Tower - A central operations facility in the terminal air traffic control system, consisting of tower cab structure, including an associated common IFR room if radar equipped, using air/ground communications and/or radar, visual signalling and other devices, to provide safe and expeditious movement of terminal air traffic.

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

*These definitions have been taken from the following three sources: Airman's Information Manual, Part 1, Census of U.S. Civil Aircraft, and FAA Air Traffic Activity.

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 an 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 purpose of transportation required by a business in which he/she is engaged.

Certified Pilot - A person who holds a certificate issued by FAA, which qualifies him/her 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, Word 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 operations 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 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 flights.

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: pipeline 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 above 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 - Include 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 form 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. It is used by pilots and controllers to indicate the 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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