APPENDIX A

METHODOLOGY FOR THE 2008 GENERAL AVIATION AND PART 135 ACTIVITY SURVEY

Purpose of Survey

The General Aviation and Part 135 Activity (GA) Survey provides the Federal Aviation Administration (FAA) with information on general aviation and on-demand Part 135 aircraft activity. The survey enables the FAA to monitor the general aviation fleet so that it can anticipate and meet demand for National Airspace System (NAS) facilities and services, assess the impact of regulatory changes on the fleet, and implement measures to assure the safe operation of all aircraft in the NAS. The data are also used by other government agencies, the general aviation industry, trade associations, and private businesses to identify safety problems and to form the basis for research and analysis of general aviation issues.

Background and History

Prior to the first implementation of the annual GA Survey in 1978, the FAA used the Aircraft Registration Eligibility, Identification, and Activity Report (AC Form 8050-73) to collect data on general aviation activity. The form was sent annually to all owners of civil aircraft in the United States and served two purposes: (1) Part 1 was the mandatory aircraft registration revalidation form, and (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. The FAA used this information to estimate aircraft activity.

In 1978, the FAA replaced AC Form 8050-73 with a new system. Part 1 was replaced by a triennial registration program. In January 1978, the FAA implemented a new procedure, known as triennial revalidation, for maintaining its master file. Instead of requiring all aircraft owners to revalidate and update their aircraft registration annually, the FAA only required revalidation for those aircraft owners who had not contacted the FAA Registry for three years. This less frequent updating affected the accuracy and representation in the master file:

1. The accuracy of current owners and their addresses deteriorated.

2. The master file combined a residue of aircraft, which under the old revalidation system would have been re-registered and purged from the file, but now remains under the new system.

Part 2 of AC Form 8050-73 was replaced by the General Aviation Activity Survey. Conducted annually, the survey was based on a statistically selected sample of aircraft, and it requested the same type of information as Part 2 of AC Form 8050-73. The first survey took place in 1978 and collected data on the 1977 general aviation fleet.

In 1993, the name of the survey was changed to the General Aviation and Air Taxi Activity Survey to reflect that the survey included air taxi (that is, on-demand Part 135) aircraft. Starting in 1999, information for the avionics section (which had been included only every other year) was requested every year. As a result, the survey's name was changed to the General Aviation and Air Taxi Activity and Avionics Survey. In 2006, "Part 135" replaced the term "Air Taxi" in the

survey title, the word “Avionics” was removed (though avionics data were still collected annually), and the survey was named the General Aviation and Part 135 Activity Survey. This is the name under which the 2008 survey was conducted. The 2008 statistics in this report were derived from the thirty-first GA Survey, which was implemented in 2009.

The GA Survey has undergone periodic revisions to content, implementation, and definition of the GA population in order to remain current with regulations, activity patterns, and general aviation community. The table below summarizes changes in survey content.

Year	Description of change to survey content
1993	Added sightseeing and external load to use categories
1996	Added public use (i.e., flights for the purpose of fulfilling a government function) to use categories
1999	Significant re-design of the entire survey form to reduce item non-response, add new content, and be compatible with optical scanning Added air medical services to use categories Discontinued the use of a catch-all ‘other’ category as used in previous years Began collecting avionics data every year, rather than every other year
2000	“Public use” asked as a separate question, independent of other use categories (e.g., personal/recreation, business transportation), because it was not mutually exclusive with respect to other flight activity
2002	Use categories refined to be mutually exclusive and exhaustive and match definitions used by National Transportation Safety Board (NTSB) for accident reporting
2004	Air medical services was divided into two separate types to capture air medical flights under Part 135 and air medical flights not covered by Part 135 A more clearly defined ‘other’ category was reintroduced
2005	Fractional ownership question was changed from yes/no to a percentage Reduced the number of fuel type response categories by removing obsolete options Added question asking for average fuel consumption (in gallons per hour) Revised avionics page by adding and rearranging items
2007	Location of aircraft was revised to ask the state or territory in which the aircraft was “primarily flown” rather than where it was "based” Percentage of hours flown in Alaska was added Questions on percentage of hours flown under different flight plans, flight conditions, and day/night were revised into a single tabular format Number of types of landing gear systems was expanded Ice protection equipment was revised and prohibition from flight in icing conditions was added Avionics equipage was significantly revised to reflect changes in technology

The table below summarizes changes in survey implementation.

Year	Description of change to survey implementation
1999	Non-respondent telephone survey conducted to adjust active aircraft and hours flown estimates[1]
2000	Discontinued non-respondent telephone survey because of the variability of telephone non-respondent factors Added Internet response option
2003	Added a reminder/thank-you postcard between the first and second mailings
2004	Introduced "multiple aircraft" summary form to allow owners/operators of multiple aircraft to report aggregate data for their entire fleet on a single form PA and aviation associations placed telephone calls to encourage participation by large fleet operators

The table below summarizes changes to the definition of the general aviation population and sample design.

Year	Description of change to definition of the GA population and sample design
1993	Number of aircraft types classified by the sample was expanded from 13 to 19
1999	Sample design revised to stratify by aircraft type (19 categories) and FAA region (9 categories)[2]
2003	Aircraft with known incorrect addresses and identified as "Postmaster Return" status on the Registry were retained in the definition of the survey population and were eligible for selection into the survey sample
2004	Aircraft reported as "registration pending" or "sold" (if sold status less than 5 years ago) on the Registry were retained in the definition of the survey population and were eligible for selection into the survey sample Sample design revised to stratify by aircraft type (19 categories), FAA region (9 categories), and whether the aircraft is owned by an entity certified to fly Part 135 (2 categories) Introduced 100% sample of the following groups: turbine aircraft, rotorcraft, on-demand Part 135 aircraft, and Alaska-based aircraft
2005	Sample design and reporting revised by introducing light-sport aircraft as a 20th aircraft type sampled at 100%. For purposes of sampling and reporting, "light-sport" included aircraft with Special or Experimental air worthiness certification as well as light-sport aircraft for which air worthiness certificates are not yet final.
2006	Sample design simplified by reducing the number of aircraft types to 14 (removed distinctions based on number of seats and eliminated "Other" subcategories of piston, turboprop, and turbojet aircraft)[3] Sample design included 100% sample of aircraft manufactured in the past five years

[1] Telephone surveys of non-respondents also were conducted in 1977, 1978, 1979, 1997, and 1998. Please refer to the 1999 GA Survey report for a full discussion of the telephone survey of non-respondents.
[2] Before 1999, the sample was stratified by aircraft type (19 categories) and state/territory (54 categories).
[3] Published estimates continue to distinguish 17 aircraft categories by engine type, number of engines, and number of seats.

Year	Description of change to definition of the GA population and sample design
2008	The 100% sample of light-sport aircraft was limited to light-sport aircraft with Special air worthiness certification. All other light-sport aircraft—those with Experimental air worthiness and those with air worthiness certificates that are not final—were sampled at a rate of less than 1.0 but in sufficient numbers to support statistical estimation.

Survey Population and Survey Sample

The survey population for the 2008 General Aviation and Part 135 Activity Survey includes all civil aircraft registered with the FAA that are based in the US or US territories and that were in existence and potentially active between January 1 and December 31, 2008. This includes aircraft operating under:

- Part 91: General operating and flight rules.
- Part 125: Certification and operations: Airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more (but not for hire).
- Part 133: Rotorcraft external load operations.
- Part 135: On-demand (air taxi) and commuter operations not covered by Part 121.
- Part 137: Agricultural aircraft operations.

Aircraft operating under Part 121 as defined in Part 119 are excluded from the survey population. Foreign air carriers, which operate under Part 129, are also not part of the survey population. Civil aircraft that are known not to be potentially active during the survey year are also excluded from the population (i.e., aircraft displayed in museums, aircraft destroyed prior to January 1, 2008).

The Aircraft Registration Master File, maintained by the FAA's Mike Monroney, Aeronautical Center in Oklahoma City, serves as the sample frame or list of cases from which a sample of civil aircraft is selected. The Registration Master File ("Registry") is the official record of registered civil aircraft in the United States. For the purpose of defining the 2008 survey population, we used the Registry's list of aircraft as of December 31, 2008.

The Registry, like many sample frames, is an imperfect representation of the survey population. While it may exclude a small number of aircraft that operate under the FAA regulations governing the operation of general aviation and on-demand Part 135 aircraft, it also includes aircraft that are not part of the survey population. Prior to sample selection, several steps are taken to remove ineligible aircraft from the sample frame. Specifically, this includes removing the following:

- Aircraft missing key identifiers that are necessary for classification or merging with other data sources (e.g., N-number, serial number, make/model information)
- Aircraft whose registration has been cancelled or revoked

- Aircraft based in Europe or registered to a foreign company that have not returned flight hour reports
- Aircraft that operate under Part 121
- Aircraft destroyed or moved to museums prior to January 1, 2008
- Aircraft reported sold before 2003 (5 years prior to survey year)[4]
- Aircraft that are flagged Postmaster Return (known to have incorrect address information) since before 1998 (10 years prior to survey year)
- Aircraft that are missing information on the registrant's name (i.e., the field is blank) (Aircraft for which the registrant is listed as "Pending" are retained in the survey population[5])
- Aircraft that lack information necessary to execute the sample design (i.e., aircraft type, FAA region)

The Registry included 376,124 aircraft as of December 31, 2008. This represents an increase of less than 1 percent (0.74 percent) over the Registry file from 2007 (373,366 records). After excluding the aircraft described above, 311,531 records remain, which is 82.8 percent of the Registry as of December 31, 2008. The 2008 survey population of 311,531 represents an increase of less than 1 percent (0.08 percent) from 2007 (311,288). The 2008 survey population as a percentage of all records on the Registry master file is slightly less than the previous year (82.8 percent compared with 83.4 percent in 2007).

The 2008 GA Survey Sample

The 2008 survey sample design is unchanged from the 2007 survey except for the treatment of light-sport aircraft, which is discussed below (see "Aircraft Sampled at 100 Percent").[6] The sample is stratified by aircraft type (14 categories), FAA region in which the aircraft is registered (9 categories), whether the aircraft operates under a Part 135 certificate (2 categories), and whether the aircraft was manufactured in the past 5 years (2 categories). Aircraft operated under a Part 135 certificate were identified using the FAA's Operations Specifications Subsystem (OPSS) database that was merged with the Registry by N-number. The four stratifying variables yield a matrix of 504 cells.

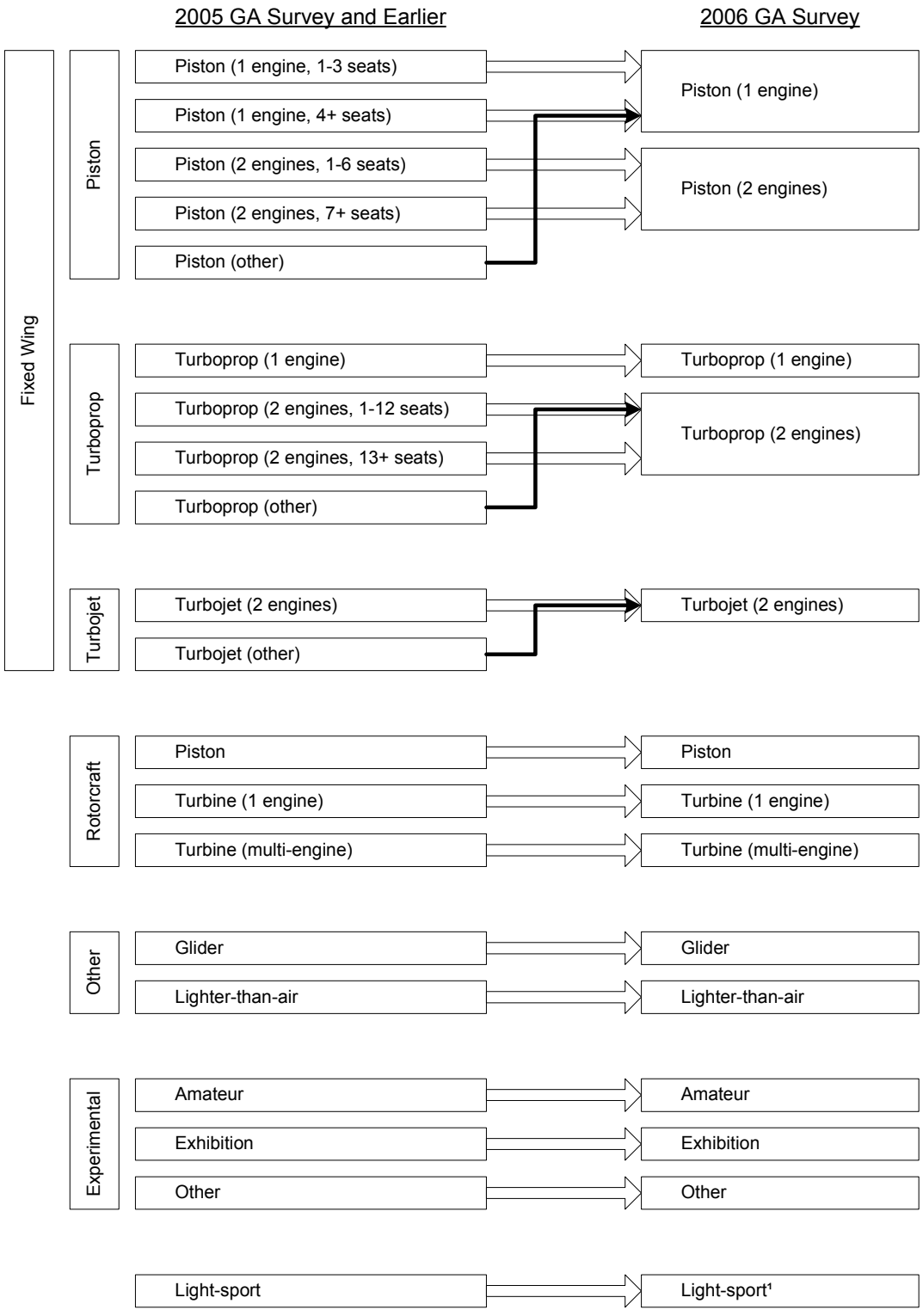
We define 14 aircraft types to execute the sample design as shown in Chart A.1. The classification distinguishes among fixed wing aircraft, rotorcraft, experimental aircraft, light-sport, and other aircraft. Within the major categories of fixed wing and rotorcraft, we differentiate aircraft by type and number of engines (e.g., piston, turboprop, turbojet, turbine, single- and two-engines). Experimental aircraft are subdivided by amateur-built status and air worthiness certification, and we classify "other" aircraft as gliders or lighter-than-air.

[4] Prior to 2004, aircraft were excluded if reported sold more than one year prior to the survey year.
[5] Prior to 2004, aircraft with "Registration Pending" were excluded from the population.
[6] The 2006 survey year initiated changes in the sample design that are retained in 2008. For a complete discussion, see "Appendix A: Methodology for the 2006 General Aviation and Part 135 Activity Survey."

Prior to the 2006 survey year, we defined 20 aircraft types and distinguished aircraft by size (number of seats) as well as by type and number of engines and air worthiness. We eliminated subcategories based on number of seats to increase the efficiency of the sample. We also eliminated three “other” categories. Improvements in the Registry over the years have left relatively few aircraft assigned to three residual categories: Fixed Wing Piston-Other, Fixed Wing Turboprop-Other, and Fixed Wing Turbojet-Other. Because these categories are relatively small and unable to support reliable statistical estimates, the aircraft are reassigned to the modal category in the corresponding larger group as shown in Chart A.1.

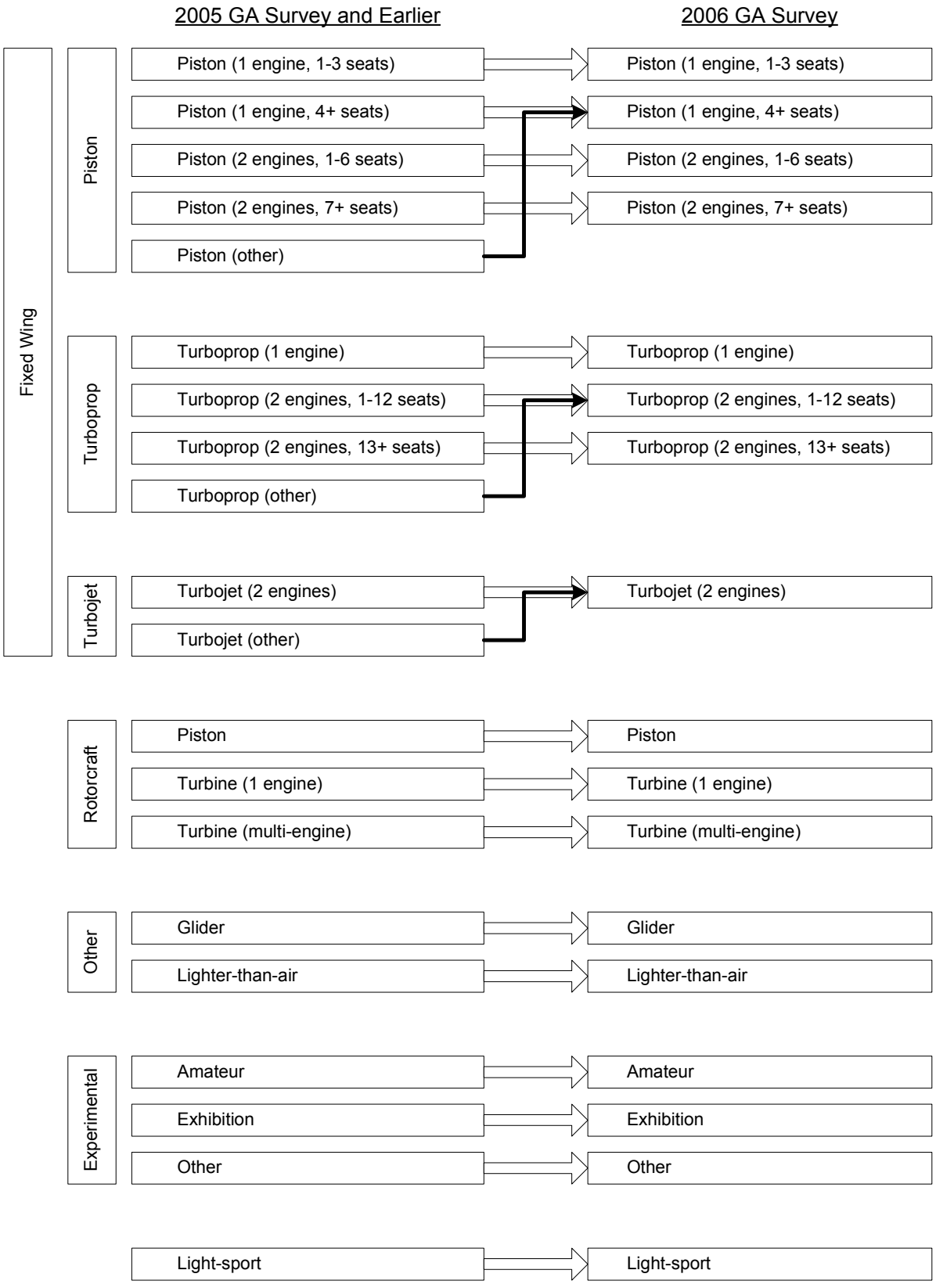
Although we define 14 aircraft types for the purpose of sampling, statistical estimates are reported for 17 aircraft types. Chart A.2 lists the aircraft for which statistical estimates are presented and how they changed beginning with the 2006 survey year. Again, the “other” subcategories of Fixed Wing Piston, Fixed Wing Turboprop, and Fixed Wing Turbojet were dropped, and the relatively small number of aircraft affected was reassigned to the modal category in the corresponding larger group.

Chart A.1—Aircraft Types Used for Sample Design



[1]For the 2005 and 2006 GA Surveys, the survey samples 100 percent of all light-sport aircraft. Starting in 2008, the survey includes all Special light-sport aircraft; Experimental light-sport and light-sport aircraft with air worthiness certificates that are not final are sampled at a rate of less than 1.0. For reporting purposes, the three types of light-sport aircraft are combined.

Chart A.2—Aircraft Types Used for Reporting



Aircraft Sampled at 100 Percent

The 2008 survey sample included several types of aircraft that were sampled at a rate of 1.0. Because of the FAA's interest in better understanding the operation of these aircraft, all such aircraft listed in the Registry were included in the survey sample to ensure a sufficient number of survey completes to support analysis and provide more precise estimates of fleet size and aircraft activity. These include:

- 100 percent sample of turbine aircraft (turboprops and turbojets)
- 100 percent sample of rotorcraft
- 100 percent sample of aircraft operating on-demand Part 135 (or, informally "Air Taxi" aircraft)
- 100 percent sample of aircraft based in Alaska[7]
- 100 percent of Special Light-sport aircraft
- 100 percent sample of aircraft manufactured within the past 5 years (since 2003 inclusive)

Since 2004, the survey design has included the first four 100 percent samples listed above. In 2005, we added the 100 percent sample of light-sport aircraft. In 2006, we added the 100 percent sample of recently-manufactured aircraft. In 2008, we revised the 100 percent sample of light-sport aircraft to include only Special light-sport aircraft. Experimental light-sport and those without final air worthiness documentation are sampled at less than 100 percent but in sufficient numbers to support statistical estimates of flight activity.

Altogether the aircraft sampled at 100 percent contributed 64,191 observations to the 2008 survey sample.

Aircraft Sampled at Less than 100 Percent

Other aircraft that are not part of a 100 percent sample are subject to selection based on sampling fractions defined for each cell in the sample design matrix. "Average annual flight hours" is the primary measure needed by the FAA to address survey goals. Sample fractions for each sample strata are defined to optimize sample size to obtain a desired level of precision for an estimate of flight activity. Data from the previous survey year on average hours flown, variability in hours flown by region and aircraft type, and response rates are used to set precision levels and identify the optimal sample size for each strata. Aircraft are randomly selected from each cell in the matrix, subject to the desired sample size. Strata that yield a very small sample size are examined and adjusted to include all observations in the strata if necessary.

In 2008, an additional 18,086 aircraft were sampled at a rate of less than 1.0. The number of aircraft sampled at a rate of less than 1.0 is 15 percent greater than the 2007 survey when 15,636 such aircraft were included in the sample. Limiting the 100 percent sample of light-sport

[7] Alaska-based aircraft are identified by the state listed in the Registry file, not survey data on where the aircraft is operated.

aircraft to those with Special air worthiness certificates made it possible to sample other categories of aircraft at slightly higher rates without exceeding a maximum possible sample size. However, the number of aircraft selected at a rate of less than 1.0 is still lower than it was before the introduction of multiple 100 percent samples. In 2006, an additional 25,494 aircraft were sampled at a rate of 1.0, and in the 2005 survey year, an additional 34,667 aircraft were sampled. The increase in the 100 percent samples has had the greatest impact on Fixed Wing Piston aircraft, where sampling fractions are necessarily small relative to population size. Other categories, such as “other aircraft” and Experimental aircraft may have a smaller absolute number of aircraft selected into the sample, but the sampling fractions are relatively high because almost all available aircraft are needed to populate the sample design.

The 2008 GA Survey sample included 82,277 aircraft. Table A.1 summarizes the population counts and sample sizes by aircraft type.

Table A.1: Survey Sample and Population Figures by Aircraft Type

Aircraft Type	Population	Sample Size	Sample as Percent of Population
Fixed Wing - Piston	**214,434**	**25,217**	**11.8**
1 engine, 1-3 seats	62,631	5,299	8.5
1 engine, 4+ seats	129,287	14,035	10.9
2 engines, 1-6 seats	15,276	3,660	24.0
2 engines, 7+ seats	7,240	2,223	30.7
Fixed Wing - Turboprop	**9,729**	**9,729**	**100.0**
1 engine	3,734	3,734	100.0
2 engines, 1-12 seats	4,826	4,826	100.0
2 engines, 13+ seats	1,169	1,169	100.0
Fixed Wing - Turbojet	**12,376**	**12,376**	**100.0**
2 engines	12,376	12,376	100.0
Rotorcraft	**12,736**	**12,736**	**100.0**
Piston	5,287	5,287	100.0
Turbine (1 engine)	5,867	5,867	100.0
Turbine (multi-engine)	1,582	1,582	100.0
Other Aircraft	**10,043**	**5,501**	**54.8**
Glider	3,165	2,405	76.0
Lighter-than-air	6,878	3,096	45.0
Experimental	**42,297**	**11,992**	**28.4**
Amateur	36,894	7,542	20.4
Exhibition	3,150	2,416	76.7
Other	2,253	2,034	90.3
Light-sport	**9,916**	**4,726**	**47.7**
Light-sport - Experimental*	8,614	3,424	39.7
Light-sport - Special	1,302	1,302	100.0
Total	**311,531**	**82,277**	**26.4**

*Light-sport - Experimental includes light-sport aircraft with Experimental air worthiness certificates as well as light-sport aircraft for which air worthiness certification is not final.

Weighting the Survey Data

Data from completed surveys are weighted to reflect population characteristics. The weights reflect the proportion of aircraft sampled from the population in each sample strata and differential response as well as a small adjustment for aircraft that are not part of the survey population.

Initially, each aircraft for which we receive a completed survey is given a weight that reflects sampling fraction and differential response. That is:

$WEIGHT = (Population\ N_{ijkl}/Sample\ N_{ijkl}) * (N\ Respondents_{ijkl}/Sample\ N_{ijkl})$

where i, j, k, and l represent the four sample strata of aircraft type, FAA region, Part 135 status, and whether an aircraft was manufactured in the past 5 years.

The weight is subsequently adjusted to reflect new information about non-general aviation aircraft. That is, survey responses that identify an aircraft as not being part of the survey population—destroyed prior to January 1, 2008; displayed in a museum; operated primarily as an air carrier under Part 121 or 129; or a military aircraft—are used to remove aircraft proportionally from the sample and from the population. This adjustment is done at the level of the 14 aircraft types. The procedure assumes that non-GA aircraft occur in the same proportion among survey respondents and non-respondents. To the extent that non-GA aircraft are less likely to receive and complete a survey, this approach will underestimate the adjustment for aircraft that are not part of the general aviation population.

Errors in Survey Data

Errors associated with survey data can be classified into two types—sampling and non-sampling errors. Sampling errors occur because the estimates are based on a sample of aircraft rather than the entire population and we can expect, by chance alone, that some aircraft selected into the sample differ from aircraft that were not selected.

Non-sampling errors can be further subdivided into a) errors that arise from difficulties in the execution of the sample (e.g., failing to obtain completed interviews with all sample units), and b) errors caused by other factors, such as misinterpretation of questions, inability or unwillingness to provide accurate answers, or mistakes in recording or coding data.

Sampling Error

The true sampling error is never known, but in a designed survey we can estimate the potential magnitude of error due to sampling. This estimate is the standard error. The standard error measures the variation that would occur among the estimates from all possible samples of the same design from the same population.

This publication reports a standard error for each estimate based on survey sample data. An estimate and its standard error can be used to construct an interval estimate (“confidence interval”) with a prescribed level of confidence that the interval contains the true population figure. In general, as standard errors decrease in size we say the estimate has greater precision (the confidence interval is narrower), while as standard errors increase in size the estimate is less precise (the confidence interval is wider). Table A.2 shows selected interval widths and their corresponding confidence.

Table A.2: Confidence of Interval Estimates

Width of interval	Approximate confidence that interval includes true population value
1 Standard error	68%
2 Standard error	95%
3 Standard error	99%

This report presents a “percent standard error” for each estimate, which is the standard error relative to the mean. The percent standard error is the ratio of the standard error to its estimate multiplied by 100. For example, if the estimate is 4,376 and the standard error is 30.632, then the percent standard error is (30.632/4,376) * 100 = 0.7. Reporting percent standard errors makes it possible to compare the precision of estimates across categories.

Estimates and percent standard errors reported in Table 2.1 in Chapter 2 ("Population Size, Active Aircraft, Total Flight Hours, and Average Flight Hours by Aircraft Type") provide an example of how to compute and interpret confidence intervals. To obtain a 95 percent confidence interval for the estimated number of total hours flown for turbojets in 2008, where the total hours flown is estimated to be 3,599,767 and the percent standard error of the estimate is 0.8, the following computation applies:

Lower confidence limit: 3,599,767 – 2(0.8/100)(3,599,767) = 3,542,171

Upper confidence limit: 3,599,767 + 2(0.8/100)(3,599,767) = 3,657,363

In other words, if we drew repeated samples of the same design, 95 percent of the estimates of the total hours flown by turbojets would fall between 3,542,171 and 3,657,363.

Non-sampling Error

Sampling error is estimable and can be reduced through survey design (e.g., by increasing sample size), but it is difficult, if not impossible, to quantify the amount of non-sampling error. Although extensive efforts are undertaken to minimize non-sampling error, the success of these measures cannot be quantified.

Steps taken to reduce non-sampling error include strategies to reduce non-response and efforts to minimize measurement and coding errors. To this end, implementation and design of the 2008 GA Survey incorporated the following steps to maximize cooperation among sample members:

- Two modes of administration to facilitate access to the survey—a postcard invitation to complete the survey on the Internet followed by a mail survey to be completed by pen or pencil

- Three mailings of the survey to individuals who had not yet responded, as well as a reminder/thank-you postcard

- Cover letters accompanying each survey mailing clearly explained the purpose of the survey as well as the endorsement (organizational logos) of several aviation associations[8]

- Cover letters assured owners of the confidentiality of their responses and informed them: "Names of individuals are never associated with responses. There is an identification number on your survey only so [survey contractor] knows who should receive the survey."

- Use of additional sources to obtain updated contact information and help ensure the mail survey reaches the sample member (e.g., National Change of Address, updates from aviation associations)

- Use of a toll-free telephone number and email address to respond to questions

- Collaboration with aviation organizations and industry groups to encourage cooperation of owners or operators of multiple aircraft

The survey efforts also minimize measurement error by increasing the likelihood that respondents share a common understanding of survey questions and reducing errors in data coding. These include:

- Close collaboration with the FAA, other federal agencies, and aviation groups to refine and clarify question wording as well as definitions to questions. The questionnaire is re-examined each year to identify ambiguities or revisions necessary to remain consistent with aviation regulations and definitions.

- Significant reviews and re-designs of the questionnaire have been undertaken periodically (see "Background" section of this report). Each re-design is thoroughly pre-tested with a sample of aircraft owners or operators and, if necessary, modified on the basis of the pre-test results.

- Comprehensive editing and verification procedures to ensure the accuracy of data transcription to machine-readable form as well as internal consistency of responses.

We undertake extensive effort to reduce measurement error, particularly where we can anticipate systematic or repeated error on the part of survey respondents, but it is impossible to eliminate all measurement error. Survey participants may misunderstand questions or misreport flight activity in ways that cannot be anticipated or prevented through survey or questionnaire design. Where survey reports appear nonsensical or contradict FAA regulations (e.g., light-sport aircraft operating with a paid flight crew), we manually verify that the data were processed accurately. Instances in which a small number of illogical reports occur may be suppressed and are indicated in Table Notes. No additional steps are taken to "cleanse" the data of apparently illogical reports or assign them to other categories. To do so would introduce additional and systematic error that would be misleading and would affect other uses of the data, such as assessing the risk of accidents among aircraft types or by use of aircraft.

[8] The following associations' logos appear on the 2008 cover letter or the introduction page of the Internet survey: Aircraft Owners and Pilots Association (AOPA), Experimental Aircraft Association (EAA), General Aviation Manufacturers Association (GAMA), Helicopter Association International (HAI), National Agricultural Aviation Association (NAAA), National Air Transportation Association (NATA), National Business Aviation Association (NBAA), Regional Air Cargo Carriers Association (RACCA).

Survey Content

The 2008 GA Survey questionnaire requests the aircraft owner or operator to provide the following information on the sampled aircraft's characteristics and uses:

1. Number of total hours flown in 2008 and hours flown by use
2. Airframe hour reading and where the aircraft was flown most of the survey year
3. Hours flown by flight plan and flight conditions, including flight under Instrumental Meteorological Conditions (IMC) and Visual Meteorological Conditions (VMC) during the day and night
4. Type of landing gear and number of landings in 2008
5. Fuel type and average fuel burn rate
6. Percentage of hours flown in 2008 as part of a fractional ownership program, rented or leased, or used to fulfill a government function
7. Avionics equipage

The 2008 survey questionnaire was not changed from the previous survey year. In 2007, several changes were made to improve data on flight activity under different flight conditions, obtain more information on flight activity in Alaska, and update questions to reflect development of avionics equipment. See Appendix A of the *2007 General Aviation and Part 135 Activity Survey Report* for a detailed summary of changes.

Data Collection Methods

Appendix B presents the materials used to conduct the 2008 survey. The survey form is shown in Figure B.1. The postcard invitation to the Internet component and the reminder/ thank-you postcard are shown in Figure B.2. Each of the three mailings for the survey was accompanied by a cover letter, shown respectively in Figures B.3, B.4, and B.5. Surveys mailed to Alaskan addresses included an insert with the endorsement of Alaska aviation associations encouraging owners to participate (see Figure B.3).

The protocol used for the 2008 survey is similar to that used since the 2000 survey. The survey data were collected from owners and operators of the sampled aircraft through two venues—the Internet and mailings of the questionnaire. We implemented the Internet component before the mailing portion to maximize the number of responses collected electronically. We first sent the owners/operators of sampled aircraft a postcard inviting them to complete the survey on the Internet (mailed on April 21, 2009). The Internet survey site remained open through August 21, 2009.

We mailed survey questionnaires to owners/operators of sampled aircraft three times during the field period as well as a reminder/thank you postcard between the first and second mailings. Each mailing was sent to owners/operators that had not yet responded to the survey at that time and had not been assigned a final disposition (e.g., refused, respondent deceased, undeliverable with no new address). We mailed the first questionnaire on May 20, 2009,

followed by the reminder/thank you postcard on June 5, 2009. The second and third mailings were sent June 26, 2009 and July 17, 2009, respectively.

Collecting Data from Owners/Operators of Multiple Aircraft

The 2008 GA Survey continued the effort initiated in 2004 to increase cooperation among respondents who own or operate multiple aircraft. The 2008 survey employed data collection tools and methods similar to those introduced in 2004, although we increased our efforts to contact owners/operators of multiple aircraft by telephone to encourage participation among non-responders after the first mailing. The survey forms, cover letters, and reminder letter are presented in Appendix B, Figures B.7–B.11.

The responses of multiple-aircraft owners/operators are important for accurately estimating general aviation activity. Because of the increased burden of reporting for multiple aircraft, there was a concern that these high-end, high-use operators were less likely to respond to the survey. After selecting the sample, we identify groups of aircraft belonging to the same operator using three resources: the FAA's Operations Specifications Subsystem (OPSS), databases available from aviation associations, and the Civil Aviation Registry's Master file. Operators or owners with three or more aircraft are classified as "multiple owners/operators" (i.e., "fleets") for survey purposes, regardless of the number of their aircraft present in the survey sample.

Owners/operators of multiple aircraft receive an abbreviated survey form to minimize the reporting burden. The form, developed in cooperation with several aircraft operators and aviation associations, allows an operator to report a summary of activity for a group of aircraft of a similar type instead of requiring the operator to complete a separate and longer questionnaire for each individual aircraft. This survey form (Appendix B, Figure B.6) collects data on key variables for major classes of aircraft (e.g., hours flown, how flown, fuel consumption, fractional ownership, and number of landings). The form does not collect data on flight conditions, fuel type, or avionics.

Data collection for multiple-aircraft owners/operators followed the same timing as that for owners/operators of single aircraft. Like the standard survey protocol, we programmed an Internet survey that matched the hard-copy survey form and the online survey remained open throughout the field period. We mailed survey questionnaires three times during the field period as well as a reminder letter between the first and second mailings. Each mailing was sent to owners/operators of multiple aircraft that had not yet responded to the survey at that time and had not been assigned a final disposition. The first survey mailing was sent May 1, 2009 followed by a reminder letter on May 20, 2009. The second and third mailings were sent June 5, 2009 and June 25, 2009, respectively.

To maximize survey response, we placed follow-up telephone calls to all multiple-aircraft owners/operators who had not responded—beginning with the largest fleets—on June 1, 2009 and continuing through the field period. The calling effort focused on encouraging survey participation as well as ensuring that survey mailings were reaching the appropriate person in the operator's organization.

The alternate survey form for owners/operators of multiple aircraft has reduced respondent burden and improved representation of activity among high-end and high-use aircraft. The alternate data collection track for owners/operators of multiple aircraft consistently accounts for approximately 20 percent or more of all aircraft responding to the survey (24.8 percent of all survey completes in 2008, 20.5 percent in 2007, and 22.8 percent in 2006).

Data Collection Results

Table A.3 summarizes the number of surveys sent in each mailing and the number and rate of returns. Numbers shown in the "sample" column do not include aircraft that were determined not to meet general aviation use at the time of the mailing or for which no address or only a known incorrect address was available. The first hard-copy questionnaire was mailed to 67,236 aircraft owners and 9,571 such forms, or 14.2 percent, were ultimately completed and returned. A total of 21,961 surveys were completed online; however, some Internet responders also completed a mail survey so the total number of returned surveys in Table A.3 does not match the total number of survey responses processed for data analysis.

Table A.3: Summary of Mailed and Returned Surveys, by Data Collection Phase

Phase	Sample	Returned Surveys[9]	Return Rate
Internet	77,588	21,961	28.3%
1st Mailing	67,236	9,571	14.2%
2nd Mailing	54,246	3,591	6.6%
3rd Mailing	45,271	2,146	4.7%
Overall	81,708	37,269	45.6%

Response Rate

The response rate is calculated conservatively following guidelines published by the American Association for Public Opinion Research (AAPOR), a professional association that establishes standards, "best practice" guidelines, and a code of ethics for professional survey researchers and research firms.[10] Specifically, the response rate is computed as the number of completed and partial surveys returned divided by the total number of eligible aircraft in the sample using the following formula.

$$RR = (C + P) / (C + P) + (NR + INS + REF + PMR + UNK)$$

Where

RR = Response Rate

C = Completed survey

P = Partial survey

NR = No response

[9] Figures include duplicate responses across survey mailings. Duplicate returns are identified and removed during data processing.
[10] The American Association for Public Opinion Research. 2000. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. Ann Arbor, MI: AAPOR.

INS = Insufficient complete; a partial survey that is not sufficient to count as a complete

REF = Refused

PMR = Post Master Returned, no new address

UNK = Unknown eligibility

The numerator is comprised of completed surveys and partial surveys that provide enough information to be used for analysis. Partial surveys must include information on hours flown to be included in the numerator.

In addition to completed and partial surveys, the denominator includes cases for which no response was received, insufficiently completed surveys (i.e., no data reported for hours flown), refusals, surveys returned as undeliverable by the USPS, and cases of unknown eligibility. The last category includes aircraft in which the owners cannot be identified or cannot report about aircraft activity (e.g., owner is deceased and the survivors cannot report on the aircraft activity, survey recipient does not own the aircraft listed).

The denominator includes aircraft that were sold or destroyed during the survey year. The survey collects data on flight activity for the portion of the year the aircraft was eligible to fly, and data collection efforts attempt to identify and mail surveys to new owners.

The denominator excludes aircraft known not to be part of the general aviation fleet or known not to be eligible to fly during the survey year. These are aircraft that were destroyed prior to the survey year, displayed in a museum, operated primarily as an air carrier or air cargo carrier, registered outside the US, exported overseas, or owned and operated by the military.

Table A.4 shows the final response rate by mailing and overall, along with the number of completed surveys. The number of completed surveys shown here excludes duplicate surveys after cleaning the returned survey data to retain the form with the most complete information. The overall response rate for the 2008 GA Survey was 43.6 percent. Almost 60 percent of responses were received on the Internet and slightly more than one-quarter were received from the first mailing. The second and third mailings contributed smaller shares to the overall response.

Table A.4: Summary of Survey Response, by Data Collection Phase

Phase	Valid Sample	Completes	Response Rate	% Total Response
Internet	77,588	20,611	26.6%	57.9%
1st Mailing	67,236	9,393	14.0%	26.4%
2nd Mailing	54,246	3,460	6.4%	9.7%
3rd Mailing	45,271	2,143	4.7%	6.0%
Overall	81,708	35,607	43.6%	100.0%

Table A.5 illustrates the steady increase in the Internet response as a percentage of all returned surveys from 2000 to 2008 (32.8 percent for 2000 compared with 57.9 percent for 2008). Continued growth in response via the Internet has made it possible to field an expanded GA Survey, manage larger sample sizes, and process more data efficiently and cost effectively.

Table A.5: Percentage of All Completed Surveys Responding by Internet

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Sample Size	31,039	30,886	30,817	31,996	75,659	77,403	84,486	84,570	82,277
Total Completes	15,689	16,432	15,254	14,471	32,056	34,248	38,973	38,920	35,607
Internet Completes	5,144	5,954	5,304	6,059	13,441	14,555	17,266	19,268	20,611
Internet % of Total	32.8%	36.2%	34.8%	41.9%	41.9%	42.5%	44.3%	49.5%	57.9%

Table A.6 shows response rates by aircraft type. Responses rates for most aircraft types decreased a few percentage points from the previous year, which was not unexpected due to a later start date and shorter data collection period. Response among turbine rotorcraft, experimental-amateur, gliders, and light-sport increased slightly or remained consistently higher than other categories. These results reflect the association of these types of aircraft with more recent manufacture dates or registration (and therefore more accurate contact information) and organization of aircraft into fleets (and therefore additional efforts made to contact owners/operators of multiple aircraft).

Table A.6: Response Rate by Aircraft Type

Aircraft Type	Sample	Invalid Sample[11]	Completes	Response Rate
Fixed Wing - Piston				
1 engine, 1-3 seats	5,299	30	2,056	39.0%
1 engine, 4+ seats	14,035	60	5,670	40.6%
2 engines, 1-6 seats	3,660	24	1,517	41.7%
2 engines, 7+ seats	2,223	11	919	41.5%
Fixed Wing - Turboprop				
1 engine	3,734	34	1,680	45.4%
2 engines, 1-12 seats	4,826	18	1,872	38.9%
2 engines, 13+ seats	1,169	11	364	31.4%
Fixed Wing - Turbojet				
2 engines	12,376	117	5,514	45.0%
Rotorcraft				
Piston	5,287	29	1,597	30.4%
Turbine: 1 engine	5,867	50	2,861	49.2%
Turbine: Multi-engine	1,582	6	900	57.1%
Other Aircraft				
Glider	2,405	22	1,186	49.8%
Lighter-than-air	3,096	40	1,047	34.3%
Experimental				
Amateur	7,542	55	4,306	57.5%
Exhibition	2,416	24	1,051	43.9%
Experimental: Other	2,034	19	706	35.0%
Light-sport	4,726	19	2,361	50.2%
Total	82,277	569	35,607	43.6%

[11] Even though efforts are made to remove non-GA aircraft from the population before the sample is selected, a small number of surveys are returned each year indicating that the aircraft should not be part of the survey population (e.g., the aircraft was used primarily as a Part 121 air carrier, or was a museum piece the entire survey year). The Invalid Sample represents such aircraft, which are excluded from response rate calculations.