APPENDIX A

METHODOLOGY FOR THE 2024 GENERAL AVIATION AND PART 135 ACTIVITY SURVEY

Purpose of Survey

The General Aviation and Part 135 Activity Survey (GA Survey) provides the Federal Aviation Administration (FAA) information on general aviation and on-demand Part 135 aircraft activity. The survey enables the FAA to monitor the general aviation fleet to 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

Before 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: a) Part 1 was the mandatory aircraft registration revalidation form; and b) 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. In 2010, the FAA eliminated the voluntary Triennial Aircraft Registration Report Program and established rules that require the renewal of an aircraft registration every three years and place time limits on interim statuses.[1] This ruling was amended in 2023 to extend the certificate duration to seven years, retroactively extending any registration certificates issued in the previous three years.[2]

The General Aviation Activity Survey replaced Part 2 of AC Form 8050-73. The survey was conducted annually, based on a statistically selected sample of aircraft, and 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. The 2024 statistics in this report are based on the 47th GA Survey, which was implemented in 2025.[3]

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[1] *Federal Register* Vol 75, No. 138, Tuesday, July 20, 2010, Rules and Regulations, “Re-Registration and Renewal of Aircraft Registration.”

[2] *Federal Register* Vol 87, No. 224, Tuesday, November 22, 2022, Rules and Regulations, “Increase the Duration of Aircraft Registration.”

[3] The name of the survey has changed periodically since 1977. In 1993, the survey was entitled “General Aviation and Air Taxi Activity Survey” to reflect the inclusion of air taxi (on-demand Part 135) aircraft. In 1999, the survey name changed to General Aviation and Air Taxi Activity and Avionics Survey because

The GA Survey has undergone periodic revisions to content, implementation, and definition of the GA population to remain current with regulations, activity patterns, and aviation technology. Chapter 1 of this report ("Historical General Aviation and Air Taxi Measures") presents statistical estimates of fleet size and activity for the current and ten previous years. Tables A.1 through A.3 summarize changes in survey content and design, data collection methods, sample and population definitions that may affect the comparability of statistical estimates across surveys.

Table A.1. Changes in Form or Content of Survey Questionnaire by Survey Year

Year	Change in form or content of the survey questionnaire
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	Re-design the 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 "other" use 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
2002	Use categories refined to be mutually exclusive and exhaustive and match definitions used by National Transportation Safety Board for accident reporting
2004	Air medical services was divided into two types to capture air medical flights under Part 135 and air medical flights not covered by Part 135 A more clearly defined "other" use category was reintroduced
2005	Fractional ownership question was changed from yes/no to a percentage of hours flown Reduced the number of fuel-type response categories by removing obsolete options Average fuel consumption (in gallons per hour) was added Revised questions about avionics equipment by adding and rearranging items
2007	Location of aircraft revised to ask the state or territory in which the aircraft was "primarily flown" during the survey year rather than where it was "based" as of December 31st of the survey year 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 Questions about avionics equipment were revised
2009	Two questions about avionics equipment were revised: "Air Bag/Ballistic Parachute" was asked as two items—"Air Bag" and "Ballistic Parachute" "ADS-B (Mode S)" was separated into two questions—"ADS-B (Mode S) Transmit Only (Out)" and "ADS-B (Mode S) Transmit and Receive (In)"

questions about avionics were included every year rather than every other year. Since 2006, the survey has been conducted as the General Aviation and Part 135 Activity Survey.

Year	Change in form or content of the survey questionnaire
2010	Removed the skip instruction in the mail survey based on responses to Part 121/129 operations Added “Specify” option if reason not flown was “Other”
2013	Added “Specify” option if fuel type was “Other” Added response categories for reason not flown (“Under maintenance or repair,” “Parted out/salvaged,” and “In storage”) The text “Corporate/Executive Transportation” was removed from the description of this use category and replaced with “Business Transportation – (*with* a paid flight crew).” The definition of this use is unchanged.
2014	Added response category for kind/grade of fuel primarily used (”Propane/LP Gas”)
2016	The following questions on the 2016 full survey form underwent additions, deletions, and text changes: • Reason not flown • Percentage of total hours flown under fractional ownership • Percentage of total hours flown under filed flight plans • Fuel type • Avionics. Other questions and response categories were re-ordered. Data end-users should consult the survey documents in Appendix B of the current and previous year’s survey report.
2018	Designed and implemented a one-page (front, back) short-form survey that would be sent to a randomly selected subset of individually owned aircraft. The survey form collected data on key activity metrics (active/not active, hours flown, and purpose of flight) and requested an email address. Data end-users can find a copy of the form in Appendix B.
2019	Eliminated non-mutually exclusive transponder selection options in “Installed Transponder/Surveillance Equipment” section of avionics questions
2021	Added “Aviation Fuel: Low Octane Unleaded (UL91, UL94)” as a response category to kind/grade of fuel primarily used by the aircraft
2024	The web survey for single aircraft introduced new logic that allowed aircraft to skip questions on installed avionics equipment if they had responded within the past three years *and* answered questions on installed avionics equipment.

Table A.2. Changes in Data Collection Methodology, by Survey Year

Year	Change in data collection methodology
1999	Non-respondent telephone survey conducted to adjust active aircraft and hours flown estimates[4]
2000	Discontinued non-respondent telephone survey Added Internet response option
2003	Added a reminder/thank-you postcard between the first and second mailings
2004	Introduced “large fleet” summary form for owners/operators of multiple aircraft. Initiated telephone follow-up effort to contact owners/operators of multiple aircraft who had not responded.
2010	Introduced end-of-field-period follow-up postcard to owners/operators of single aircraft that participated in the previous survey year but had not yet completed the current year’s survey
2014	Introduced the use of email to invite sampled aircraft owners/operators to complete the survey
2018	The one-page short-form survey was sent as Mail 2 to 10,000 randomly selected aircraft that had not yet completed the survey. This practice was continued through the 2023 survey year.
2024	The short-form survey was sent to 20,000 randomly selected aircraft (instead of 10,000). Additionally, the form was sent at Mail 1 and as needed, follow-up mailings to aircraft that had not yet completed the survey. Aircraft that had responded in the past three years and answered questions about their installed avionics were prioritized for the random selection.

Table A.3. Changes in Sample Design or Definition of Survey Population, by Survey Year

Year	Change in sample design or survey population
1993	Number of aircraft types classified by the sample was expanded from 13 to 19
1999	Sample design revised to stratify by aircraft type and FAA region [5]
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 eligible for sample selection
2004	Aircraft listed on the Registry as “registration pending” or “sold” (if sold status less than five years ago) were retained in the definition of the survey population and eligible for sample selection. Sample design revised to stratify by aircraft type, FAA region, and whether the aircraft is certified to fly Part 135. Introduced 100 percent samples of turbine aircraft, rotorcraft, on-demand Part 135, and Alaska-based aircraft
2005	Introduced light-sport aircraft as an aircraft type sampled at 100 percent. Light-sport included aircraft with special or experimental airworthiness as well as aircraft for which airworthiness was not yet final.
2006	Sample design simplified to fewer aircraft types and included 100 percent sample of aircraft manufactured in the past five years
2008	100 percent sample of light-sport aircraft was limited to special light-sport aircraft. Experimental light-sport and light-sport without completed airworthiness sampled at a rate less than 1.0.

[4] 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.

[5] Before 1999, the sample was stratified by aircraft type and state or territory.

Year	Change in sample design or survey population
2010	Aircraft excluded from the survey population if "sale reported" or "registration pending" more than 12 months. These aircraft no longer eligible for sample selection due to implementation of the re-registration rule.
2012	Aircraft excluded from the survey population if registration was expired. These aircraft no longer eligible for sample selection because they do not have valid registrations due to implementation of the re-registration rule. Unmanned aerial vehicles are excluded from the survey population.

Survey Population and Survey Sample

The survey population for the 2024 General Aviation and Part 135 Activity Survey includes all civil aircraft registered with the FAA based in the US or US territories that were in existence, potentially active between January 1 and December 31, 2024, and had a valid registration. 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) operations
- 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 known as not being potentially active during the survey year are excluded from the population (e.g., aircraft on static display, destroyed before January 1, 2024).

The Aircraft Registration Master File, maintained by the FAA's Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma, 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. To define the 2024 survey population, we used the Registry's list of aircraft posted on January 6, 2025.[6]

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. Before sample selection, the following ineligible aircraft are removed:

[6] The Civil Aviation Registry updates the Master file approximately weekly but there can be a backlog of records to process. The Registry Master file available on January 6, 2025, reflected records processed through December 9, 2024.

- Aircraft that operate under Part 121
- Aircraft destroyed or moved to static display before January 1, 2024
- Aircraft based in Europe or registered to a foreign company that has not returned flight hour reports
- Aircraft that are unmanned aerial vehicles
- Aircraft whose registration has been canceled, revoked, or expired before January 1, 2024
- Aircraft listed as "sale reported" or "registration pending" for more than 12 months (before January 1, 2023)[7]

The Registry Master file used to define the 2024 survey population included 299,830 aircraft. After excluding the aircraft described above, 278,670 records remain (93 percent of the Registry Master file).

The 2024 GA Survey Sample

The 2024 survey sample is stratified by aircraft type, FAA region in which the aircraft is registered, whether the aircraft operates under a Part 135 certificate, and whether the aircraft was manufactured in the past five years. Aircraft operated under a Part 135 certificate were identified using the FAA's Operations Safety System (OPSS) database merged with the Registry by N-number.

Aircraft are classified into FAA regions by the state or US territory of registration. Table A.4 summarizes how states and territories are mapped to region.[8]

[7] The registration rule allows aircraft to be listed as sale reported for registration pending for a maximum of six months. To define the survey population, we allow aircraft to hold this status for 12 months because we cannot consistently differentiate among aircraft that did or did not hold valid statuses for the other six months of the year. The number of aircraft mistakenly included in the survey population should be small. The error of including ineligible aircraft has a smaller impact on statistical estimates of activity than erroneously excluding eligible and potentially active aircraft.

[8] The FAA defines the regions at www.faa.gov/about/office_org/headquarters_offices/arc/ro_center. Statistical estimates reported by region in which an aircraft is primarily flown follow the same mapping based on the state in which the aircraft is primarily operated.

Table A.4. Regions and States/Territories Constituting Region

Region	States/Territories
Alaska	Alaska
Central	Iowa, Kansas, Missouri, Nebraska
Eastern	Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia, Washington, DC, West Virginia
Great Lakes	Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, South Dakota, Wisconsin
New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Northwest Mountain	Colorado, Idaho, Montana, Oregon, Utah, Washington, Wyoming
Southern	Alabama, Florida, Georgia, Kentucky, Mississippi, Navassa Island, North Carolina, Puerto Rico, South Carolina, Tennessee, US Virgin Islands
Southwestern	Arkansas, Louisiana, New Mexico, Oklahoma, Texas
Western-Pacific	American Samoa, Arizona, Baker, Howland, and Jarvis Islands, California, Guam, Hawaii, Johnston Atoll, Kingman Reef, Midway Islands, Nevada, Palmyra Atoll, Wake Island

We define 15 aircraft types for the sample design. The classification distinguishes among fixed wing aircraft, rotorcraft, experimental, light-sport, and other aircraft. Within categories of fixed wing and rotorcraft, we differentiate by type and number of engines (e.g., piston, turbine, single- and twin-engine). Experimental aircraft are subdivided by amateur-built status and airworthiness certification, and we classify “other” aircraft as gliders or lighter-than-air. Light sport is subdivided into special and experimental based on airworthiness certification. Light-sport aircraft without final airworthiness certificates are included with experimental light-sport.

Aircraft Sampled at 100 Percent

The 2024 survey sample includes several types of aircraft sampled at a rate of 1.0. Because of the FAA’s interest in understanding their operations, all such aircraft listed in the Registry are included in the survey sample to ensure enough responses to support analysis and provide more precise estimates of fleet size and aircraft activity. These aircraft include:

- 100 percent sample of turbine aircraft (turboprops and turbojets)
- 100 percent sample of rotorcraft
- 100 percent sample of special light-sport aircraft
- 100 percent sample of aircraft operating on-demand Part 135
- 100 percent sample of aircraft registered in Alaska
- 100 percent sample of aircraft manufactured within the past five years (since 2020 inclusive).

Aircraft sampled at 100 percent account for 64,810 observations in the survey sample.

Aircraft Sampled at Less than 100 Percent

Aircraft not part of a 100-percent sample are selected based on sampling fractions defined for each cell in the sample design matrix. Flight hours is the primary measure needed by the FAA. Sample fractions for each sample strata are defined to optimize sample size to obtain the 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 target sample sizes for each stratum. Aircraft are randomly selected from each cell in the matrix, subject to the desired sample size. Strata where the desired sample size exceeds the population are examined, and the sample size is adjusted to include all observations.[9] The survey sample includes 20,200 aircraft selected at a rate of less than 1.0.

The 2024 GA Survey sample included 85,010 aircraft. Table A.5 summarizes the population counts[10] and sample sizes by aircraft type.

[9] An additional nine strata were sampled at 100 percent to meet precision requirements (1,296 aircraft).
[10] Population counts in Table A.5 reflect the starting population, as defined by information available on the Registry. Final population estimates in Chapters 1–7 of this report adjust for ineligible aircraft identified during data collection.

Table A.5. Population and Survey Sample Counts by Aircraft Type

Aircraft Type	Population[1]	Sample Size	Sample as Percent of Population
Fixed Wing - Piston	**178,972**	**28,438**	**15.9**
1 engine, 1–3 seats	49,631	5,981	12.1
1 engine, 4+ seats	114,133	14,878	13.0
2 engines, 1–6 seats	10,818	5,222	48.3
2 engines, 7+ seats	4,390	2,357	53.7
Fixed Wing - Turboprop	**13,028**	**13,028**	**100.0**
1 engine	7,809	7,809	100.0
2 engines, 1–12 seats	3,524	3,524	100.0
2 engines, 13+ seats	1,695	1,695	100.0
Fixed Wing - Turbojet	**17,592**	**17,592**	**100.0**
Rotorcraft	**12,666**	**12,666**	**100.0**
Piston	4,171	4,171	100.0
Turbine (1 engine)	6,252	6,252	100.0
Turbine (multi-engine)	2,243	2,243	100.0
Other Aircraft	**7,129**	**2,100**	**29.5**
Glider	2,635	1,016	38.6
Lighter-than-air	4,494	1,084	24.1
Experimental	**45,597**	**7,500**	**16.4**
Amateur	35,153	4,304	12.2
Exhibition	3,231	1,075	33.3
Experimental light-sport[2]	6,104	1,093	17.9
Other experimental	1,109	1,028	92.7
Special light-sport	**3,686**	**3,686**	**100.0**
Total	**278,670**	**85,010**	**30.5**

[1] Starting population as defined by information available on the Registry. Final population estimates in Chapters 1–7 of this report adjust for ineligible aircraft identified during data collection.

[2] Includes light-sport aircraft with experimental airworthiness and light-sport aircraft for which airworthiness 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 and 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:

$$\text{WEIGHT} = (\text{Population } N_{ijkl}/\text{Sample } N_{ijkl}) * (\text{Sample } N_{ijkl}/\text{N Respondents}_{ijkl})$$

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 five years.

The weight is subsequently adjusted to reflect information about non-general aviation aircraft. Survey responses that indicate an aircraft is not part of the survey population—e.g., destroyed before January 1, 2024; displayed in a museum; or operated primarily under Part 121 or 129—are used to remove aircraft from the sample and the population. The procedure assumes that ineligible aircraft occur similarly among survey respondents and non-respondents. To the extent that ineligible aircraft are less likely to receive and complete a survey, this approach will underestimate the adjustment for aircraft not part of the general aviation population.

Errors in Survey Data

Errors associated with survey data include 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 include 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.6 shows selected interval widths and their corresponding confidence.

Table A.6. Confidence Interval Estimates

Width of interval	Approximate confidence that interval includes true population value
1 Standard error	68%
2 Standard errors	95%
3 Standard errors	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) x 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 twin-engine fixed-wing piston aircraft with 1–6 seats in 2024, where the total hours flown is estimated to be 1,206,818 and the percent standard error of the estimate is 5.3, the following computation applies:

Lower confidence limit: 1,206,818 – 1.96(5.3/100)(1,206,818) = 1,081,454

Upper confidence limit: 1,206,818 + 1.96(5.3/100)(1,206,818) = 1,332,182

In other words, if we drew repeated samples of the same design, 95 percent of the estimates of the total hours flown by twin-engine fixed-wing piston aircraft with 1–6 seats would fall between 1,081,454 and 1,332,182.

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. The 2024 GA Survey incorporated the following steps to maximize cooperation among sample members:

- Three methods for completing the survey (web, paper-pencil mail form, telephone follow-up to fleets) and three methods of inviting survey participation (mail, email, and telephone).
- Three mailings of the paper survey, reminder letters and postcards, and end-of-field-period follow-up postcard and email.

- Deploying a shorter, less burdensome survey form for a randomly selected subsample of aircraft.

- Cover letters accompanying each survey mailing explained the purpose of the survey and the endorsement (organizational logos) of several aviation associations.

- 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 letter.”

- Use of additional sources to obtain updated contact information and help ensure the mail survey reaches the sample member.

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

- Collaboration with aviation organizations and industry groups to raise awareness of the survey and encourage cooperation.

- Telephone follow-up to owners or operators of multiple aircraft who had not yet responded.

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

- Collaboration with the FAA, other federal agencies, and aviation groups to refine question wording and definitions to questions. The questionnaire is reviewed regularly to identify ambiguities or revisions necessary to remain consistent with aviation regulations and definitions.

- Periodic re-design of the survey questionnaire and pre-testing significant revisions with a sample of aircraft owners or operators.

- Comprehensive editing and verification procedures to ensure the accuracy of data transcription to machine-readable form.

- Manual review and verification of a subset of single-aircraft mail surveys throughout the field period.

- Programmed logic checks for web surveys to identify illogical, unusual, or inconsistent data.

- Analysis of preliminary data to identify unusual or illogical values and place follow-up inquiries with participants to verify or correct responses.

We try to reduce measurement errors, but it is impossible to eliminate all measurement error. Survey participants may misunderstand questions or misreport flight activity in ways that cannot be prevented through survey design. Where survey reports appear nonsensical or contradict FAA regulations, we verify the accuracy of data processing. Instances in which 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 errors that would be misleading and would affect other uses of the data.

Imputation of Missing Data

Imputation of missing data is important for stabilizing the estimates of aircraft activity and equipment. Values are imputed for variables if the survey response is incomplete, the survey form did not include the question, or the Registry data field is blank. Table A.7 lists the variables for which values are imputed, describes the procedure, and shows imputation rates among active aircraft that received the long-form survey form sent to individually-owned aircraft (first column of numbers) and rates including active aircraft that completed the abbreviated large fleet survey and the small fleet short-form survey (last column). Asterisks note the questions not asked on the large fleet survey form or the small fleet short-form survey.

Table A.7. Variables with Imputed Values, Imputation Procedure, and Percentage Imputed Among Active Aircraft

Variable	Imputation Procedure	Percent Imputed (long-form survey form only)	Percent Imputed (all responses)
Hours by use (e.g., personal, business transport)	Mean values by aircraft type	1.0	2.1
Fractional ownership hours[11]	Nearest neighbor by aircraft type by make model series	29.9	26.2
Hours rented/leased *	Nearest neighbor by aircraft type by make model series	1.3	51.6
Public use hours **	Nearest neighbor by aircraft type by make model series	1.4	18.7
Hours by flight plans/flight conditions *	Mean values by aircraft type	2.7	52.3
Airframe hours *	Nearest neighbor by aircraft type by hours flown	8.9	55.3
Number of landings **	Nearest neighbor by aircraft type by make model series by age	3.1	20.7
Landing gear *	Nearest neighbor by aircraft type by make model series	2.8	52.3
Fuel type *	Nearest neighbor by aircraft type by make model series	3.0	52.2
Fuel burn rate	Nearest neighbor by aircraft type by make model series	0.5	0.6

[11] Fractional ownership is asked only on the large fleet survey form.

Variable	Imputation Procedure	Percent Imputed (long-form survey form only)	Percent Imputed (all responses)
Avionics equipment *	Nearest neighbor by aircraft type by make model series by age	6.8 to 25.8	27.1 to 47.5
State primarily flown **	Assign state of registration from Registry	0.6	21.5
Year of manufacture (Registry data field)	Nearest neighbor by aircraft type by make model series	0.5	1.3

Percentages are based on unweighted survey responses among active aircraft (total 25,330).[12]

* Question not asked on the abbreviated survey form administered to owners/operators of multiple aircraft or the small fleet short-form survey.

** Question not asked on the small fleet short-form survey.

For aircraft that completed the full survey form, imputation rates for most variables are 1 to 3 percent. Item non-response is lowest for fuel burn rate (0.5 percent), year of manufacture (0.5 percent), state primarily flown (0.6 percent), and hours flown by use (1.0 percent). Imputation rates are higher for lifetime airframe hours (8.9 percent).

Imputation rates for avionics equipment are reported as a range because the rates vary by item. The long-form survey collects data on 58 types of avionics equipment, and the imputation rates range from 6.8 percent to 25.8 percent. Ten of the 58 items have imputation rates below 10 percent; another 23 items have rates below 20 percent. Imputation rates are higher when data from the abbreviated large fleet form and the small fleet short-form survey are included, as shown in the last column of Table A.7. These survey forms do not include questions on avionics.

Survey Content

The 2024 GA Survey questionnaire requests the aircraft owner or operator to provide information on flight activity, flight conditions, where the aircraft was flown, and aircraft characteristics. Variables derived from the survey responses include:

- Number of total hours flown in 2024, hours flown by use, and lifetime airframe hours
- The state in which the aircraft was primarily flown
- Hours flown by filed flight plan, including flight under Visual Flight Rules (VFR), Instrument Flight Rules (IFR), and without flight plans
- Hours flown as part of a fractional ownership program (large fleet survey only), rented or leased, or used to fulfill a government function

[12] Prior to the 2015 survey, the imputation rates were calculated based on *all* survey responses (active and inactive aircraft). The rates shown here will not be comparable to those reported for 2014 or earlier.

- Type of landing gear and number of landings in 2024
- Fuel type and average fuel burn rate
- Avionics equipment installed in the aircraft.

Data Collection Methods

Collecting Data from Owners/Operators of a Single Aircraft

Appendix B presents the materials used to conduct the 2024 survey. Figures B.1 through B.10 present the materials sent to owners/operators of a single aircraft. These include the survey questionnaire (long- and short-form), postcards and endorsement inserts, and the cover letters accompanying each of the three survey mailings. Inserts and endorsements include a notice to individuals who started but did not complete a web survey and an endorsement by Alaska aviation associations sent to Alaska-based aircraft (Figures B.4 and B.5, respectively).

The survey data were collected from owners and operators of the sampled aircraft through two modes—the web and mailings of the questionnaire. We implemented the web survey before mailing paper surveys to maximize online survey response. We first sent the owners/operators of sampled aircraft a postcard (mailed on February 14, 2025) or email (sent February 10, 2025) inviting them to complete the survey on the Internet.

We mailed survey questionnaires to owners/operators of sampled aircraft three times during the field period. We also sent a reminder/thank-you postcard between the first and second mailings and an end-of-field-period follow-up postcard. Each mailing was sent to owners or operators who had not yet responded to the survey or had not been assigned a final disposition. We mailed the first questionnaire on April 10, 2025, followed by the reminder/thank-you postcard on May 2. The second mailing was sent on June 3. The final postcard was mailed on June 20 and the final survey on July 8. A web survey that matched the mail survey form was open throughout the field period. All single-aircraft surveys received through August 15 (online or by mail) were processed and included in the analysis.

Collecting Data from Owners/Operators of Multiple Aircraft

The survey materials sent to owners/operators of multiple aircraft are presented in Appendix B, Figures B.11–B.15. These materials include the survey questionnaire and cover letters accompanying each of the three survey mailings. In addition to the web and mail survey efforts, telephone follow-up calls are made to nonresponding fleets to increase survey participation.

Owners or operators of multiple aircraft are sent an abbreviated survey form to minimize the reporting burden. The form 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 (Figure B.11) 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 plans, fuel type, landing gear, or avionics.

Unlike data collection for single aircraft, there is not a period of online-only data collection: While the survey is available for completion in both web and paper form, invitations to participate online are always accompanied by a mail survey. Providing the mail survey facilitates response

among organizations where reporting is more complex and may involve communication or coordination among multiple units. We conducted three full survey mailings to owners/operators of multiple aircraft for the 2024 GA Survey and sent a reminder letter between the first and second mailings. Each mailing was sent to owners or operators of multiple aircraft who had not yet responded to the survey and had not been assigned a final disposition. We mailed the first questionnaire on April 11, 2025, followed by the reminder letter on May 2. The second mailing was sent on June 3 and the final survey on July 8. Telephone contacts with nonresponding fleets began the week of April 11, 2025, and continued through August 15. A web survey that matched the mail survey form was open throughout the field period. All large fleet surveys received through August 15 were processed and included in the analysis.

A delayed and extended mail timeline

While the online survey was launched as scheduled during the first week of February, full-scale data collection activities were delayed for several weeks, and the data collection period was extended by one month. Three factors caused these delays and schedule changes:

1) The Office of Management and Budget (OMB) did not renew study clearance under the Paperwork Reduction Act (PRA) until January 31, 2025, less than one week before the planned survey launch. The survey's three-year OMB authorization expired November 30, 2024. An application for renewal had been submitted several months earlier.

2) Survey cover letters could not be submitted and reviewed for FAA approval and signature until the OMB renewal was confirmed. The FAA approved the cover letters on March 25.

3) Upon launching the mail survey, we encountered significant delays in mail processing by the US Postal Service. In all previous survey years, we received completed surveys 1 to 1.5 weeks after a survey mailing. For the 2024 survey, we did not receive *any* completed surveys until four weeks after mailing. Mail processing delays continued, and we revised the mail timeline to allow longer intervals between mailings.

As a result of the above delays, the first small fleet mail survey was postponed three weeks from the planned schedule, and all large fleet data collection was delayed three weeks. The late start in combination with the longer intervals between mailings extended the field period to mid-August; typically, data collection ends in mid-July. The impact of the delayed approval on response rates is difficult to quantify but postponing the survey mailings and changing the intervals between mailings (resulting in less frequent and timely reminders to participate) undoubtedly negatively impacted survey response.

Response Rate

The response rate is calculated following the American Association for Public Opinion Research (AAPOR) guidelines. This professional association establishes standards, best practice guidelines, and a code of ethics for survey researchers and research firms.[13] We compute Response Rate 1 (RR1), which AAPOR describes as the minimum response rate because it

[13] The American Association for Public Opinion Research. 2023. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 10th edition.* AAPOR.

retains all non-responding surveys in the denominator: We do not adjust the denominator by estimating the number of non-responding aircraft of unknown eligibility that might be ineligible. 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

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

REF = Refused

PMR = Postmaster 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 analyzed.

In addition to completed and partial surveys, the denominator includes cases for which no response was received, insufficiently completed surveys, refusals, surveys returned as undeliverable by the US Postal Service, 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, operated primarily as an air carrier, operated outside the US, or exported overseas.

Table A.8 shows the number of completed surveys associated with each mailing and their proportion of the total number of responses. Most responses (62 percent) were received online, a result that has been consistent for many years. Sixteen percent of completed surveys were returned from the first mailing, which is slightly lower than the 2023 survey. The second survey mailing yielded 5.4 percent of all completed surveys, which is slightly less than 2023 (5.9 percent). The third mailing resulted in 951 completed surveys or 3.2 percent of all completed

surveys. This is consistent with the responses from the third mailing in 2023.[14] Additionally, 13.6 percent of the survey responses were completed by telephone by interviewers conducting non-response follow-up calls to large fleets. This is a 3.6-point increase from 2023.[15]

Table A.8.: Completed Surveys by Mailing

Mailing	Completes	% Total Response
Internet	18,086	61.5
1st Mailing	4,778	16.2
2nd Mailing	1,593	5.4
3rd Mailing	951	3.2
Large Fleet Calling	3,999	13.6
Overall	29,407	100.0%

Table A.9 shows response rates by aircraft type. The overall response rate in 2024 is 34.8 percent, which is a decrease of 2.3 points from the previous survey year. Participation is highest among multi-engine turbine rotorcraft, gliders, and experimental amateur, all with response rates 45 percent or higher. Like previous years, piston rotorcraft and twin-engine turboprop aircraft have the lowest participation rates (27 to 29 percent). Several types of aircraft had larger declines in response than the overall drop of 2.3 points: The largest decreases occurred among other aircraft (gliders and lighter-than-air, 5.3 points) and multi-engine turbine rotorcraft (4.8 points). Response among fixed-wing turboprops and 1-engine fixed-wing piston aircraft with four or more seats also decreased by larger margins (3 and 3.9 points, respectively). No aircraft type responded to the 2024 survey at a higher rate than in 2023.

[14] These tabulations reflect which survey form or mode a respondent completed, not the timing of receipt. If a third survey mailing prompted an online survey submission, the complete is tallied as “Internet,” not Mail 3. Likewise, if a respondent submits the Mail 1 survey form after receiving the second survey mailing, the completed survey is tallied as Mail 1 (the survey form scanned as complete), not Mail 2.

[15] Prior to the 2023 survey year, surveys completed by large fleeting calling were tracked with internet completions.

Table A.9. Response Rate by Aircraft Type

Aircraft Type	Sample	Invalid Sample	Completes	Response Rate
Fixed Wing - Piston	**28,438**	**450**	**9,786**	**35.0%**
1 engine, 1–3 seats	5,981	132	2,007	34.3%
1 engine, 4+ seats	14,878	172	5,347	36.4%
2 engines, 1–6 seats	5,222	82	1,667	32.4%
2 engines, 7+ seats	2,357	64	765	33.4%
Fixed Wing - Turboprop	**13,028**	**151**	**3,924**	**30.5%**
1 engine	7,809	55	2,466	31.8%
2 engines, 1–12 seats	3,524	69	966	28.0%
2 engines, 13+ seats	1,695	27	492	29.5%
Fixed Wing - Turbojet	**17,592**	**257**	**5,289**	**30.5%**
Rotorcraft	**12,666**	**206**	**4,601**	**36.9%**
Piston	4,171	83	1,096	26.8%
Turbine: 1 engine	6,252	95	2,444	39.7%
Turbine: Multi-engine	2,243	28	1,061	47.9%
Other Aircraft	**2,100**	**18**	**871**	**41.8%**
Glider	1,016	11	460	45.8%
Lighter-than-air	1,084	7	411	38.2%
Experimental	**7,500**	**143**	**3,098**	**42.1%**
Amateur	4,304	92	1,892	44.9%
Exhibition	1,075	12	377	35.5%
Experimental light-sport*	1,093	19	472	43.9%
Experimental Other	1,028	20	357	35.4%
Special light-sport	**3,686**	**16**	**1,601**	**43.6%**
Total	**85,010**	**1,241**	**29,170**	**34.8%**

* Experimental light-sport includes aircraft with experimental airworthiness certification and light-sport aircraft for which airworthiness certificates are not final.