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Airman Research Questionnaire: Methodology and Overall Results

David R. Hunter
Office of Aviation Medicine
Federal Aviation Administration
Washington, DC 20591

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David R. Hunter, Ph.D.

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16. Abstract

A nationwide survey of 19,657 pilots was performed to collect information on their aviation qualifications and experiences, their participation in training activities, their involvement in critical aviation incidents, their personal minimums and usual practices when planning and conducting a flight, and their attitudes about flying issues. Results are based on returns received from 35% of the overall sample. Analyses were conducted to assess possible bias due to nonresponse effects by comparing respondent and nonrespondent groups on accident involvement, age, gender, and recent and total flight experience. No differences in accident involvement or in total flight experience were found. However, on average, the respondent group tended to be slightly older and to have slightly less recent flight experience than the nonrespondent group. The implications of these findings are discussed and cautions regarding the interpretation of the results are given. This initial report describes the methodology used in construction of the questionnaire and the procedures used for data collection. The percentages of respondents selecting each of the response alternatives for each question in the questionnaire are provided. Means, standard deviations, and medians are reported for those questions requiring exact numerical entries. Separate analyses of all items are given for private, commercial, and airline transport certificate categories. Possible applications of the data obtained from this study are discussed and proposed follow-on analyses to be conducted and reported in additional reports are described.

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Finally, I want to thank the almost 7,000 pilots who sat down with their logbooks for up to four hours in some cases and filled out the questionnaire. Whatever measure of success this project achieves is due largely to their efforts.

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AIRMAN RESEARCH QUESTIONNAIRE: METHODOLOGY AND OVERALL RESULTS

INTRODUCTION

This report describes a large-scale, nationwide survey of pilots conducted by the Federal Aviation Administration. The survey was originally conceived as a means of obtaining data to be used in support of research on aeronautical decision making (ADM). While formulating plans for the ADM research it soon became clear that certain underlying data were not available—specifically data which described the population of pilots in the United States. Although the characteristics of pilots who are involved in accidents are routinely tabulated (c.f., NTSB, 1989), such information was lacking for the much larger group of pilots who had not experienced an accident. Thus, while the numerator (the pilots involved in accidents) was well known, the denominator (the population of pilots in general) in accident risk equations was often only poorly estimated. This was of particular concern in the ADM research, because of the need to focus interventions on those groups of pilots most at-risk for accident involvement. This requirement dictated that information be available on the underlying population in order to properly distinguish at-risk groups from those with comparatively little likelihood of experiencing an accident.

Beyond this basic requirement, which would primarily be served by a detailed enumeration of flight times and similar characteristics, the use of a survey also provided a means for the collection of collateral information which could be of significant use when planning a marketing strategy for new ADM interventions. At present the primary vehicle for disseminating safety information used by the FAA is the safety seminar. These seminars are conducted at hundreds of locations across the country and draw thousands of pilots annually. Yet, little is known about which pilots attend the seminars, why they attend, what formats of instruction and topics are favored, and how often they attend. Therefore, the scope of the survey was broadened to include questions relating to training in general, and safety seminars specifically.

Besides including questions on training issues, additional sections were developed to assess other factors which might be related to safety and accident involvement. These sections included questions on involvement in hazardous events (such as running out of fuel), personal minimums, and attitudes toward flying. One section was also added specifically dealing with the career patterns of professional pilots, in anticipation of future research in that area.

As eventually formulated, the goal of the survey was twofold. First, the survey should provide a reliable normative description of the pilot population that would serve as a basis for comparisons for relative risk evaluations. Secondly, the survey should provide an adequate database for exploratory research to evaluate the relationships among various pilot characteristics, behavior, and attitudes, and involvement in accidents or other critical events.

The information gained from the survey will be used, therefore, both by the sponsoring organization in evaluating its safety seminar programs and by the research community in conducting ADM and other aviation safety-related research.

METHOD

Subjects

Subjects were selected using simple random sampling without replacement from the population of active airmen listed in the FAA Airmen Certification System. An active airman is one who has been issued a valid airman medical certificate within the preceding 25 months. The total population is approximately 561,486 pilots (excluding student pilots), from which 20,000 subjects were drawn.

Computer files were generated containing names, addresses, certificate types, and certain information (i.e., total flight times, employer) from the FAA Aeromedical Certification database and these files were in turn used to create a research database. That database was examined to identify ineligible subjects (i.e., those residing outside the United States) who were then eliminated. This process reduced the sample to 19,657.

Questionnaire Development

The questionnaire was designed to provide a thorough demographic profile of the pilot population and at the same time to provide initial information on a number of areas of particular interest. These areas included training experiences, involvement in incidents which had the potential for accidents, personal preferences and practices when flying, and attitudes about flying. The questions were refined a number of times and the questionnaire was reviewed by both general aviation and airline pilots for clarity of instructions, completeness of alternatives, and the use of appropriate language and terms. The questionnaire and survey principles established in the literature (Dillman, 1978; Kanuk & Berenson, 1975; Kish, 1965; Patten, 1950) were utilized in layout and overall design of the instrument. The questionnaire was submitted to the Office of Management and Budget for approval and was subsequently assigned the OMB Approval Number of 2120-0566.

A trial version of the questionnaire was printed in an optically scannable booklet format and distributed to a small sample of pilots (500 cases independent of the 20,000 cases described above) to pre-test the questionnaire and the scanning and data reduction process. Along with the questionnaire an additional sheet was included which asked for the amount of time required to complete the questionnaire, assessments of the clarity of instructions, and any other comments which the respondents might care to make. Approximately 50 responses were received to this pilot study. The average time required for this group to complete the questionnaire was one hour. Instructions were all rated as very clear and no comments requiring substantial modifications to the instrument were received. However, the questionnaire was shortened somewhat by reducing the number of questions relating to the numbers and types of jobs held by professional airmen in an effort to increase the response rates.

The final version of the questionnaire contained 143 items, 16 dealing with general aviation qualifications, 19 dealing with the number of hours logged during the last 6 months, last 12 months, and during the entire career of the respondent, 8 questions dealing with the type of aircraft flown most frequently over the past year, 3 dealing with the careers of professional airmen, 15 dealing with training experiences, 13 questions regarding critical aviation incidents, 34 dealing with personal minimums and practices, 27 dealing with attitudes about flying, 5 dealing with participation in future research studies, and 3 dealing with general demographic information.

The questionnaire was printed as an optically-scannable booklet and incorporated a cover letter describing the project as the first page of the booklet. Each booklet contained a unique code number identifying the recipient.

Mailing

Questionnaire booklets were mailed to the sample of pilots along with a self-addressed business reply envelope. One week after the booklets were mailed, a postcard containing a reminder was mailed to all the sample.

All returned questionnaires were reviewed for stray marks and other damage before being scanned using an NCS Sentry 3000 optical mark scanner. Response files created by the scanner were transferred to a desk-top PC for further analysis using SPSS for Windows.

Handwritten comments were received from approximately 500 respondents and were categorized using a procedure developed by the author and a summer intern. The analysis of those comments is outside the scope of this report, but will be described in a future publication.

RESULTS

Return Rates

Of the 19,657 questionnaires mailed out, 390 were returned as undeliverable—usually because the pilot had moved and the time limit on forwarding of mail had expired. In addition, 19 were returned because the pilot was deceased. This reduced the effective sample to 19,248. There were 6,808 questionnaire booklets returned, of which 6,735 were usable—the others having been so damaged in transit that they were not scannable. The effective return rate for the survey was therefore 35% (6,735/19,248).

Generalizability

When dealing with self-administered mail survey data, such as are given in this report, one must appreciate the sources of error to which the data are subject. In general, these sources fall into two groups: sampling error and nonsampling error. Because it is important that these factors be understood to properly evaluate the results of this study, each will be described in some detail. The interested reader is also referred to any of several excellent texts on this subject (c.f., Henry, 1990; Fowler, 1993; Rea & Parker, 1992).

Sampling Error. Sampling error is that error which is attributable to the sample drawn from the population of interest. It is the margin of error most commonly reported in descriptions of surveys and is typically stated to the effect that the survey responses are accurate to within plus or minus 5%. This statement means that there is a 95% (or greater) certainty that the observed value (for example, the percentage of pilots possessing an instrument rating in the current study) falls within 5% of the true or population value—that value which one would obtain if the entire population were measured on that attribute.

It is necessary to state this confidence interval because the values obtained from any particular sample are only estimates of the population values. If one were to draw samples repeatedly from a large population one would find that the values obtained vary. In the present study we obtained the responses of one sample of pilots drawn from the total population of pilots. However, if we were to draw another sample of 20,000 pilots at random from the population and ask them the same questions in exactly the same way then we would expect that their responses might differ slightly from those we obtained from the first sample. This is simply due to random fluctuations in the characteristics of the individuals comprising the samples.

In general, the larger the samples we draw from the population, the smaller will be these differences. Further, for a large population such as we are dealing with here, the percentage of the population represented by a particular sample does not influence the accuracy of the data. Rather, it is the size of the sample. Thus, a sample of 20,000 individuals drawn from a population of 500,000 produces the same degree of accuracy as a sample of 20,000 individuals drawn from a population of 5,000,000. This is because the variability of the results depends solely upon the size of the sample and it is this variability that we are referring to when we talk about the accuracy of the results.

For the most part the data to be presented in this study consist of proportions (usually expressed as percentages) which indicate what portion of the specified sample chose a particular alternative for each question. For example, one of the first questions asks whether the pilot has a multi-engine rating. The possible alternatives are yes and no, and the numbers reported are the percentages of pilots in each of the three certificate categories who chose each of those alternatives. Of the Private Pilots, 11.3% indicated they had a multi-engine rating, while 88.7% indicated they did not. As noted earlier, if we were to repeat this survey with another group of randomly selected pilots, the responses to this question might be slightly different, simply as a result of random fluctuation in the group drawn from the population. The number which we obtain from any particular sample of that population is simply an estimate of the population value, and hence will be somewhat inaccurate. Fortunately, because we know the properties of this random variation, we know how accurate we may expect our results to be and can specify that accuracy as a function of the sample size. If we were examining the total respondent group (N = 6,735), then we could say (as illustrated in Table 1) that we were 99% sure that the true population value (for example the proportion of the total population that held a multi-engine rating) fell within the range of the observed value plus or minus 1.6%. That is, there is less than one chance out of a hundred that the true population value for the proportion of all pilots with multi-engine ratings falls outside the range 47.4% to 50.0% (48.7% ± 1.3%). Further, if we are willing to accept a somewhat more liberal level of confidence, as shown in the second column of Table 1 (labeled 95% Confidence Interval), then we may narrow the range to 48.7% ± 1.2%, and be assured that the population value would exceed that range in only 5 cases out of a hundred.

If we were limiting our analysis to only private pilots, then we might choose to use a 95% confidence interval of ± 2.0% (midway between the entries for 2,000 and 3,000 subjects in Table 1), and our range for the proportion of private pilots who hold multi-engine ratings would be 9.3% to 13.3%. Similarly, if we wished to be 99% certain that our range included the true population value, then we would use ± 2.7% as the confidence interval.

Although Table 1 shows confidence intervals for a number of representative sample sizes, in the present analysis we need be concerned only with three values, corresponding to the sample sizes for the private, commercial, and airline transport certificate categories. Those samples are 2,548, 2,845, and 1,218, respectively. The associated 95% confidence intervals are 2.0%, 1.9%, and 2.9%; the 99% confidence intervals are 2.7%, 2.5%, and 3.9%. When examining the results for the private and commercial pilots, then, we may be sure (with 95% confidence) that the results are accurate within about 2%, while the results for the airline transport pilots are accurate within about 3%.

Nonsampling Error. Nonsampling error is that error which is attributable to factors which include: nonresponse, erroneous entries or deliberate falsehoods by the respondent, and data scanning or entry errors. Every survey is subject to these sources of error which may bias the results and efforts are typically undertaken to minimize these effects. Modern optically-scannable answer sheets greatly reduce the instances of erroneous data entry; however, even these devices are not error-free and some responses, particularly where the respondent has not followed the instruction and completely darkened the answer circle, may be misinterpreted. For this reason all the answer sheets in the current study were individually examined and, where necessary, extraneous marks were erased and responses darkened. It is more difficult to detect erroneous responses or deliberate falsehoods. Range-checking and comparison to other sources of information for the respondents can identify some questionable entries. In the current effort that process was used

Table 1

Representative sample sizes and confidence intervals.

Respondent N	95% Confidence Interval	99% Confidence Interval
6,700	1.2%	1.6%
6,000	1.3%	1.7%
5,000	1.4%	1.8%
4,000	1.5%	2.0%
3,000	1.8%	2.4%
2,000	2.2%	2.9%
1,000	3.1%	4.1%
500	4.4%	5.8%
400	4.9%	6.4%

to check on flight time entries by comparing respondents' values to those reported at the last airman medical examination. Even so, some errors remain, as indicated by the small number of Airline Transport pilots who reported having no instrument rating—an impossible combination.

Additionally, in some cases respondents may not provide truthful answers to certain questions in order to place themselves in a more favorable light. Or, they may respond with what they believe to be more socially desirable answers or with the answers which they believe the researcher wants to hear, as opposed to the truth. The magnitude of these effects in the current instance is unknown, but may be assumed to be operating to at least some extent. To the degree these effects are present, of course, the results will be subject to additional error variance and possible bias.

By far the largest potential source of nonsampling error in a mail survey is associated with nonresponse. In any survey of this type some number of persons who receive the questionnaire will fail to complete and return it. This may occur because they simply forget about the survey or lose it, they may not perceive the benefits of completing the survey to be worth the effort required, the questions contained in the survey may be considered too personal or irrelevant to the stated purpose of the survey, they may be disinclined to cooperate with the requesting organization, they may be unable to answer the questions posed, or they may have a personal policy about never completing mail surveys. This list of reasons for nonresponse is certainly not exhaustive, but simply serves to illustrate that individuals may choose not to participate in a survey for any number of reasons. If the reasons for not responding are unrelated to the purpose and content of the survey then no bias is introduced. For example, if a survey asked about number of household pets, some people might chose not to respond because they did not consider the survey important enough to bother with. If there is no correlation between the number of household pets and the choice to respond or not respond, then the nonresponse does not bias the results and accuracy does not suffer. However, if those with few pets felt the survey to be irrelevant while those with many pets considered it an important inquiry, then the results would show an inflated or biased estimate of the true number of household pets, because those with many pets responded while those with few pets did not.

For the most part, we can never be certain of the extent to which bias exists because of non-response. Clearly, having a small proportion of nonrespondents strengthens the argument that the results are not biased. However, even in those cases where there is a considerable proportion of nonrespondents the results may still be valid if the choice to respond or not respond was not based upon factors being assessed by the survey. To support the argument that the results were not biased by nonresponse, one typically compares the respondent and nonrespondent groups on those attributes for which information are available. Since in the present instance approximately 35% of the total sample of 20,000 pilots completed the survey while approximately 65% did not, a comparison of the respondent and nonrespondent groups to assess the presence of bias is certainly required and is presented in the tables which follow.

Remember that one of the primary goals of this data collection effort was the development of a database that would support future inquiries into aviation safety and accident risk. Clearly, then, one of the primary concerns would be whether the respondent and nonrespondent groups differed on the key element of previous accident involvement. One might hypothesize that pilots who had been involved in accidents would be more reluctant to respond to a survey which asks questions regarding involvement in accidents and other critical events, possibly fearing some sort of retaliation by the FAA based upon their responses, or simply because of a general reluctance to rekindle past painful memories. This hypothesis is evaluated in Table 2 that compares the accident rates for the total respondent and nonrespondent groups. Accident data for this table were obtained by matching the sample against the database maintained by the National Transportation Safety Board. As shown, the results do not support that hypothesis. The accident rates of the

Table 2
Comparison of accident rates for all respondents and nonrespondents

	Accident Involvement	
	Accident	No Accident
Response	3.0%	97.0%
Nonresponse	3.3%	96.7%

χ^2 (df =1) = 1.13 (nonsignificant)

Table 3
Comparison of response status for certificate type

	Certificate		
	Private	Commercial	Airline Transport
Response	39.5%	42.2%	18.1%
Nonresponse	38.8%	40.4%	20.3%

χ^2 (df =2) = 15.65 ($p < .01$)

Table 4
Comparison of response status by gender for all pilots

	Gender	
	Male	Female
Response	96.7%	3.3%
Nonresponse	96.3%	3.7%

χ^2 (df =1) = 1.13 (nonsignificant)

Table 5
Comparison of age and flight experience for all respondents and nonrespondents

	Respondents			Nonrespondents			
	N	Mean	S.D.	N	Mean	S.D.	Z
Age	6727	50	13	12952	47	13	17.21**
Recent Flight Time	6727	66	105	12952	75	120	5.86**
Total Flight Time	6727	3340	5360	12952	3454	5310	1.42

** $p < .01$

respondent and nonrespondent groups are very similar and a nonsignificant chi square is obtained leading us to believe that past accident involvement did not influence the decision to respond to the survey.

Tables 3, 4, and 5 provide some additional general comparisons of the respondent and nonrespondent groups. Table 3 demonstrates a significant difference in the response rates among the three pilot certificate levels. Although the absolute differences are not large (not more than 2% for any of the certificate groups) there is a significant difference in the response rates, with private pilots being the most likely to participate.

Tables 4 and 5 continue the comparison of the combined groups on gender, age, and flight time. In the combined certificate group there was no significant difference in gender between the respondent and nonrespondent groups, as demonstrated by the nonsignificant chi square shown in Table 4. Overall, there was a three year difference in the mean ages of the respondent and nonrespondent groups which was statistically significant. Respondents tended to be slightly older than nonrespondents. Similarly, though not the degree obtained for age, there was a significant difference in the recent flight time. Nonrespondents reported having flown an average of 75 hours of recent flight time, while respondents reported having flown 66 hours. Comparison of total flight time, however, showed no significant difference between the two groups.

While the results shown in Tables 3, 4, and 5 give some overall sense of the differences which might exist between the respondent and nonrespondent groups, a much better understanding may be obtained by analyzing each of the pilot certificate groups separately, since in all the analyses which follow those three groups will be treated separately. Tables 6 through 11 shown the comparisons of the respondent and nonrespondent groups on gender, age, and flight time for each of the three certificate levels separately. Generally, these results follow the same pattern as was noted for the combined groups. Gender (except for the airline pilots) is unrelated to participation, as is total flight time. However, respondents for all the certificate levels tended to be somewhat older that the nonrespondents and, except for the private pilots, to have slightly less recent flight experience.

Interpreting the results. Since we can never be certain that those who chose not to respond did not in some way bias the results of the survey, we are left with only logic and caution to guide us. Logic suggests that, based upon the foregoing analyses, the survey results underestimate recent flight time slightly. In any future analyses in which this would be a critical element, statistical manipulations of the results might well be called for to correct that imbalance. It would be particularly important to apply separate correction factors to each of the three certificate groups, since, as shown in Tables 7-11 the magnitude and even the direction of the differences vary among these groups. In addition, the respondent group tends to be slightly older than the nonrespondent group. If a variable of interest were shown to covary with age, then some correction might also be necessary to account for this bias.

Based upon the results of the analysis shown in Table 2 we have some reason to believe that accident involvement and, presumably, those factors associated with accident involvement, did not

Table 6

Comparison of response status by gender for private pilots

	Gender	
	Male	Female
Response	96.4%	3.6%
Nonresponse	96.4%	3.6%

χ^2 (df =1) = 0 (nonsignificant)

Table 7
Comparison of age and flight experience for respondent and nonrespondent private pilots

	Respondents			Nonrespondents			
	N	Mean	S.D.	N	Mean	S.D.	Z
Age	2658	49	13	5021	46	13	9.61**
Recent Flight Time	2658	25	35	5021	23	39	2.64**
Total Flight Time	2658	803	1338	5021	807	1556	0.13

** $p < .01$

Table 8
Comparison of response status by gender for commercial pilots

	Gender	
	Male	Female
Response	96.4%	3.6%
Nonresponse	95.9%	4.1%

χ^2 (df = 1) = 1.21 (nonsignificant)

Table 9
Comparison of age and flight experience for respondent and nonrespondent commercial pilots

	Respondents			Nonrespondents			
	N	Mean	S.D.	N	Mean	S.D.	Z
Age	2836	52	14	5227	47	14	12.84**
Recent Flight Time	2836	55	83	5227	63	102	3.97**
Total Flight Time	2836	2846	4227	5227	2702	3929	1.49

** $p < .01$

Table 10
Comparison of response status by gender for airline transport pilots

	Gender	
	Male	Female
Response	98.3	1.7
Nonresponse	96.9	3.1

$\chi^2(df = 1) = 5.86$ $(p < .05)$

Table 11
Comparison of age and flight experience for respondent and nonrespondent airline transport pilots

	Respondents			Nonrespondents			
	N	Mean	S.D.	N	Mean	S.D.	Z
Age	1216	49	12	2634	47	1[illegible]	6.11**
Recent Flight Time	1216	178	159	2634	198	163	3.63**
Total Flight Time	1216	10010	7337	2634	9958	6767	0.21

** $p < .01$

influence the decision to respond. Hence, there is some justification for accepting the results of those questions dealing with involvement in critical incidents, personal minimums, and attitudes about flying as not having been biased by nonresponse effects.

Nevertheless, those who utilize these results must bear in mind the possible inaccuracies which may enter into the self-report data given here and are cautioned against making sweeping generalizations based upon these data without considering the possible range of error and the impact such error could have upon their conclusions. The sample sizes used here are more than sufficient to provide good control of sampling error which may be reliably estimated based upon the numbers provided. However, nonresponse bias is, more or less by definition, unknown and unknowable. No doubt the length of this survey (some participants reported spending over four hours completing it) dissuaded many from even attempting it. In addition, many comments were received from nonrespondents to the effect that they were unwilling to trust the FAA not to use the information to their detriment. How these and other factors combined to influence the nonresponse rate is unknown. As noted before, it appears that these factors had only a limited effect on the accuracy of the results. Thus, these data seem to represent the best reasonably accurate estimates of these variables available; but, caution in their interpretation and use is strongly urged.

Analyses of Responses

In the sections which follow we present the percentages of respondents selecting each of the response alternatives for each question. Where an exact numerical entry was required, as for example in the questions regarding flight time, the mean and standard deviation of the responses are given. For almost all of the questions requiring a numerical entry the median of the responses is also given.

The values are provided for all questions separately for each of the three pilot certificate categories: Private (N = 2,548), Commercial (N = 2,845), and Airline Transport (N = 1,218). Cases that did not fall into one of these three categories (for example, those pilots who reported having a student or recreational pilot license or who left this question blank) were excluded from the analyses. There were 124 cases so excluded.

The order of presentation in these analyses generally follows the order of presentation in the questionnaire. The exact wording given in the questionnaire may be compared to the abbreviated wording given in the analyses by referring to Appendix A, which contains the actual instrument used for data collection.

Given the extent of this database, an exhaustive analysis of the data in a single report is neither feasible nor desirable. Additional analyses of the characteristics associated with particular subgroups may be conducted in the future, provided there are sufficient numbers of cases available. At some points in the discussion of the results, follow-on analyses of this sort may be suggested where the results seem to raise particularly interesting questions. The reader must keep in mind however, that these are only suggestions at this point and that any analyses of that type must be predicated upon the availability of adequate data. Since it is difficult, if not impossible, to know *a priori* the research needs which may be served by these data and the exact form of the questions which need to be addressed, such analyses will not be undertaken at this time. It is the intent in this initial report, therefore, to simply present the basic enumerations of responses and to defer more extensive analyses, particularly those involving subgroupings of the data where feasible, for future reports.

Aviation Qualifications and Experience

One of the goals of this research was to develop a normative database which could be used in later research to compare accident-involved pilots with those who have not been involved in accidents and, if feasible, to develop a procedure for describing at-risk pilots. The data in Table 12 are the first elements of that normative database and provide information not formerly available on the characteristics of the pilot population. Although it is possible to make comparisons among the three certificate categories, the primary interest at this point is to better understand the characteristics of each individual group — recognizing that those with higher level certificates have of necessity passed through the lower stages at some point.

Aircraft Most Frequently Flown

Several questions asked about the characteristics of the aircraft that had been flown most frequently over the last year. Table 13 presents the responses for those questions. As might be expected, private pilots predominately flew single-engine piston aircraft with fixed landing gear, while those pilots with more advanced certificates flew a progressively wider variety of aircraft types. For all pilot groups, however, the median number of different aircraft flown was two.

Professional Aviation Careers

One section of the questionnaire was devoted specifically to developing a better understanding of the career process of professional airmen. This section was included to provide baseline data on career progression that might be of use in later studies. The data also allow us to better break down the hetrogeneous Commercial and ATP groups for possible studies dealing with only flight instructors or Part 121 pilots, for example. Because the first question in this series asked whether the pilot had ever been employed as a professional airman and directed those who had not to skip the following section, the numbers of pilots completing these questions is somewhat reduced. In addition, the question corresponding to Table 18 allowed for multiple responses, therefore no total is given.

Table 12
Aviation Qualifications and Experience

	Most Advanced Certificate Private	Commercial	ATP
Q1. Source of training			
Military flying school	0.8%	10.4%	19.1%
Civilian (141) school	19.2%	21.4%	25.1%
CFI at a FBO	47.5%	38.9%	32.6%
CFI at a Club	11.5%	11.6%	8.3%
CFI independent	18.4%	14.1%	11.8%
Other	2.5%	3.5%	3.1%
Q5. Instrument rating			
No	60.9%	11.2%	0.5%
Yes, for airplane	39.1%	86.0%	93.2%
Yes, for rotorcraft		*0.7%*	*0.4%*
Yes, for both		2.1%	5.9%
Q6. Multi-engine rating			
Yes	11.3%	61.0%	98.7%
No	[illegible]3.7%	39.0%	1.3%
Q7. Rotorcraft rating			
Yes	1.4%	8.4%	12.8%
No	98.6%	91.6%	87.2%
Q8. Glider rating			
Yes	3.8%	9.8%	12.9%
No	96.2%	90.2%	87.1%
Q9. Ever fly as a military pilot			
Yes	1.9%	15.1%	28.4%
No	98.1%	84.9%	71.6%
Q10. Certified Flight Instructor			
Never	99.6%	51.7%	26.2%
Expired	0.4%	12.3%	24.2%
Yes, current		36.0%	49.6%
Q11. Type of Medical Certificate			
None/Expired	*2.5%*	*2.6%*	*3.0%*
Class 3	65.6%	18.4%	5.0%
Class 2	30.3%	71.3%	29.4%
Class 1	1.6%	7.7%	62.6%
Q12. Have a special issuance medical			
Yes	23.8%	13.5%	11.2%
No	76.2%	86.5%	88.8%

Table 13
Most Frequently Flown Aircraft

		Most Advanced Certificate		
		Private	Commercial	ATP
Q36.	Number of engines:			
	None	8.6%	7.7%	5.6%
	One engine	85.7%	78.8%	27.2%
	Two engines	5.6%	12.9%	55.5%
	Three engines	0.0%	0.1%	6.9%
	Four engines	0.2%	0.5%	4.8%
Q37.	Type of engines:			
	None/NA	7.7%	7.4%	5.3%
	Piston engine	91.3%	87.9%	37.3%
	Turbo-Prop	0.6%	2.5%	18.5%
	Jet	0.4%	2.2%	38.9%
Q38.	Wing configuration:			
	None/NA	7.5%	6.7%	5.5%
	High Wing	52.0%	48.4%	21.8%
	Low Wing	38.7%	40.7%	65.8%
	Mid Wing	1.0%	1.9%	4.6%
	Rotary wing	0.8%	2.4%	2.2%
Q39.	Landing gear:			
	None/NA	7.6%	6.6%	5.0%
	Fixed gear	67.8%	58.1%	19.8%
	Retractable gear	24.7%	35.3%	75.2%
Q40.	Number of places:			
	1 Place	0.8%	2.3%	0.8%
	2 Places	17.3%	16.2%	5.7%
	3-4 Places	70.5%	61.1%	20.8%
	5-6 Places	10.2%	15.6%	12.8%
	7-12 Places	1.0%	3.3%	25.0%
	13-24 Places		0.5%	6.8%
	25-50 Places		0.4%	6.9%
	51-100 Places		0.2%	2.5%
	101+ Places	0.2%	0.3%	18.6%
Q41.	Cruising speed (MPH):			
	Less than 50	0.4%	0.6%	0.4%
	50-100	10.4%	9.1%	2.3%
	101-150	66.4%	56.6%	20.9%
	151-250	21.7%	30.2%	23.2%
	251-400	0.6%	2.1%	15.8%
	400+	0.4%	1.4%	37.5%
Q42.	Pressurized:			
	Yes	2.3%	6.0%	59.4%
	No	97.7%	94.0%	40.6%
Q43.	How many different aircraft flown in last year			
	Mean	2	3	4
	Median	2	2	2
	Standard Deviation	7	9	5

Table 14
Present Employer

	Commercial		ATP	
	N	%	N	%
Flight School	149	28.9%	56	7.2%
Air Taxi	42	8.1%	55	7.1%
Self Employed	109	21.1%	34	4.3%
Part 135	13	2.5%	46	5.9%
Part 121	19	3.6%	301	38.8%
Corporate	46	8.9%	175	22.5%
Agricultural	25	4.8%	1	0.1%
Military	46	8.9%	17	2.1%
Other Govt	27	5.2%	51	6.5%
Other	39	7.5%	39	5.0%
Total	515		775	

Table 15
Present Position

	Commercial		ATP	
	N	%	N	%
Flight Instructor	253	48.2%	80	10.5%
Co-pilot/First Officer	44	8.4%	124	16.4%
Pilot/Captain	176	33.5%	473	62.5%
Navigator	4	0.7%	0	0.0%
Flight Engineer	6	1.1%	11	1.4%
Other	41	7.8%	68	8.9%
Total	524		756	

Table 16
First Employer

	Commercial		ATP	
	N	%	N	%
Flight School	262	45.8%	408	50.0%
Air Taxi	39	6.8%	80	9.8%
Self Employed	69	12.0%	28	3.4%
Part 135	1	0.1%	19	2.3%
Part 121	7	1.2%	29	3.5%
Corporate	21	3.6%	50	6.1%
Agricultural	19	3.3%	5	0.6%
Military	95	16.6%	160	19.6%
Other Govt	15	2.6%	10	1.2%
Other	43	7.5%	27	3.3%
Total	571		816	

Table 17
First Professional Aviation Position

	Commercial		ATP	
	N	%	N	%
Flight Instructor	324	57.2%	442	54.9%
Co-pilot/First Officer	39	6.8%	132	16.4%
Pilot/Captain	162	28.6%	194	24.1%
Navigator	7	1.2%	5	0.6%
Flight Engineer	10	1.7%	24	2.9%
Other	24	4.2%	8	0.9%
Total	566		805	

Table 18
Locations worked during aviation career

	Commercial		ATP	
	N	%	N	%
Flight School	371	62.6%	574	68.8%
Air Taxi	207	34.9%	561	67.2%
Self Employed	263	44.4%	316	37.8%
Part 135	60	10.1%	336	40.2%
Part 121	31	5.2%	379	45.4%
Corporate	120	20.2%	449	53.8%
Agricultural	56	9.4%	41	4.9%
Military	119	20.1%	214	25.6%
Other Govt	53	8.9%	90	10.7%
Other	91	15.3%	105	12.5%

Training

An area of particular interest to organizations disseminating safety information is that dealing with training. The questions relating to the number of training experiences over the last two years are given in Table 19. Clearly, the ATP and Commercial groups engage in more and different training activities than the Private group; however, even the majority of the Private pilots report having had some generic ground-based training over the last two years. In addition, 80% of the Private Pilots have had some in-flight training during that period.

Safety Seminars

As shown in Table 20, the FAA Safety Seminars attract predominately Private and Commercial pilots. Even among these groups, however, half report having never attended or having attended only once in the last two years. The most frequently reported reason for not attending among all three groups is that they are too busy, with location being another major consideration. Interestingly, the most appealing topic—pilot techniques—is probably the one least amenable to instruction in the typical lecture-oriented safety seminar.

Over the last several years the FAA has produced publications, videotapes, and other training materials dealing with aeronautical decision making. In most of these training materials the concept of hazardous thoughts, developed by Berlin et al. (1982a, b, c) based upon work by Jensen and Benel (1977), has been presented. The responses to Question 60 would suggest that, despite these efforts, this concept has reached only about half of the pilot population.

Critical Aviation Incidents

Like the tip of the iceberg, accidents are only the visible part of a much larger body of events which, for various reasons, do not result in catastrophe. Many times pilots are involved in situations that do not develop into reportable accidents or incidents but might have done so had the situation changed even slightly. Because of the skill of the pilot, the reliability of the mechanical systems, or the capacity of the air traffic control system, situations which have the potential for serious consequences are neutralized. Yet, had the pilot been a little rusty, had the backup system also failed, or had the controller not provided a vital bit of information, then the chain of events leading to an accident might have ensued.

Accidents are relatively rare events in modern aviation. Demonstrating an impact on accident rates is therefore difficult because of the small number of events involved. However, if accidents are outgrowths of hazardous events and if hazardous events are much more common, even though they do not in the vast majority of times lead to an accident, then one might evaluate the impact of a safety training program by measuring the reduction in hazardous events. The logic being, if there are fewer hazardous events, then there should be fewer accidents.

Table 21 lists many hazardous events and the proportions of each certificate group who have experienced such events. Quite clearly, the data show that the more you fly, the more likely you are to have experienced one or more such events. Whereas 9% of the Private Pilots have been in an accident, 18% of the Airline Transport Pilots reporting having been in one or more accidents.

Continued VFR flight into IMC is the single largest cause of fatal accidents (particularly among the general aviation community). It is interesting to note, therefore, that 25% of the Private Pilots report having flown into these conditions at least once. Turning back because of weather is a common practice, however, with about 72% of the Private Pilots reporting having turned back at some time.

Table 19
Number of Training Experiences over Preceding Two Years

	Private	Commercial	ATP
Q47. Generic ground-based — not for a specific aircraft/system.			
0 (None)	42.4%	40.9%	37.3%
1 time	16.8%	15.1%	12.5%
2 times	11.6%	11.6%	15.0%
3 times	6.6%	6.6%	6.4%
4-6 times	9.6%	8.7%	11.4%
7-10 times	4.2%	4.8%	5.6%
11-20 times	3.5%	3.3%	4.4%
21+ times	5.2%	9.0%	7.5%
Q48. Ground-based for a specific aircraft/system.			
0 (None)	63.3%	58.5%	22.1%
1 time	12.6%	11.4%	9.8%
2 times	8.6%	9.6%	19.8%
3 times	4.7%	4.0%	6.6%
4-6 times	4.6%	6.1%	15.3%
7-10 times	2.4%	2.8%	4.5%
11-20 times	2.0%	3.1%	4.8%
21 + times	1.8%	4.5%	17.1%
Q49. Generic procedure trainer — not for a specific aircraft/system.			
0 (None)	84.5%	85.3%	84.0%
1 time	4.9%	4.3%	4.0%
2 times	3.7%	2.8%	2.8%
3 times	1.4%	1.8%	1.3%
4-6 times	1.9%	2.2%	3.7%
7-10 times	1.1%	1.2%	2.7%
11-20 times	.6%	.8%	.5%
21 + times	1.9%	1.7%	1.0%
Q50. Procedure trainer for a specific aircraft/system.			
0 (None)	85.2%	83.2%	54.8%
1 time	5.0%	4.2%	8.5%
2 times	3.7%	3.4%	9.0%
3 times	1.1%	1.6%	3.6%
4-6 times	2.2%	2.7%	9.6%
7-10 times	.6%	1.6%	4.7%
11-20 times	1.0%	1.3%	3.6%
21 + times	1.2%	2.0%	6.3%
Q51. Generic flight simulator (not motion based).			
0 (None)	85.7%	81.9%	85.2%
1 time	3.6%	4.2%	3.2%
2 times	2.1%	2.9%	2.2%
3 times	1.1%	1.9%	1.1%
4-6 times	2.2%	3.0%	3.0%
6-10 times	2.2%	1.9%	1.8%
11-20 times	1.3%	1.5%	1.5%
21 + times	1.8%	2.8%	1.9%

Table 19 (Continued)

	Private	Commercial	ATP
Q52. Flight simulator for a specific aircraft (not motion based).			
0 (None)	94.2%	90.2%	83.2%
1 time	1.5%	2.6%	4.5%
2 times	0.8%	1.3%	2.2%
3 times	0.5%	0.6%	1.6%
4-6 times	0.9%	1.6%	2.6%
6-10 times	0.5%	1.4%	2.1%
11-20 times	0.6%	0.8%	1.4%
21 + times	0.8%	1.3%	2.3%
Q53. Generic flight simulator (motion based).			
0 (None)	98.1%	96.4%	92.8%
1 time	0.7%	1.3%	1.7%
2 times	0.4%	0.4%	1.0%
3 times	0.0%	0.4%	0.7%
4-6 times	0.2%	0.5%	1.6%
6-10 times	0.2%	0.3%	0.6%
11-20 times	0.1%	0.4%	0.3%
21 + times	0.3%	0.4%	1.3%
Q54. Flight simulator for a specific aircraft (motion based).			
0 (None)	96.5%	91.4%	38.3%
1 time	1.5%	2.6%	6.9%
2 times	0.7%	1.5%	7.1%
3 times	.1%	0.5%	2.6%
4-6 times	0.4%	0.8%	14.0%
6-10 times	0.3%	0.9%	4.4%
11-20 times	0.3%	0.9%	9.5%
21 + times	0.4%	1.4%	17.1%
Q55. In-flight training.			
0 (None)	20.9%	23.4%	30.8%
1 time	14.1%	12.0%	11.7%
2 times	14.3%	14.2%	12.4%
3 times	8.2%	8.2%	8.7%
4-6 times	13.0%	14.9%	16.0%
6-10 times	7.0%	8.0%	5.0%
11-20 times	7.6%	6.9%	5.6%
21 + times	14.9%	12.4%	9.8%

Table 20
Attendance at Safety Seminars

	Private	Commercial	ATP
Q56. How many FAA safety seminars attended over last two years:			
Never	35.2%	33.2%	58.1%
One	19.7%	20.8%	15.2%
Two to Five	38.0%	38.1%	21.0%
Move than five	7.1%	7.8%	5.7%
Q57. Why do you not attend:			
Location	17.3%	15.8%	11.7%
Time	11.8%	10.0%	7.7%
Irrelevant material	2.2%	4.0%	18.6%
Too busy	20.2%	19.3%	22.2%
Poor quality	1.6%	2.0%	1.9%
Other	8.8%	8.8%	11.9%
NA, I attend	38.2%	40.2%	26.0%
Q58. Most appealing seminar subject:			
FARs	14.5%	19.1%	26.9%
Airspace	13.8%	12.3%	11.4%
Weather	21.6%	18.7%	15.1%
Flight Planning	3.4%	2.8%	1.9%
Pilot Techniques	23.3%	22.7%	17.4%
Stall/Spin	2.7%	1.6%	2.2%
Pilot Certification & Training	1.4%	3.4%	5.1%
Local Flying Environment	15.7%	14.5%	9.6%
Other	3.6%	4.9%	10.5%
Q59. How many non-FAA Seminars over last two years:			
Never	50.0%	38.9%	27.0%
One	19.4%	23.5%	16.8%
Two to Five times	23.6%	27.6%	41.3%
More than five times	7.0%	10.0%	14.8%
Q60. Hazardous thoughts discussed in any training:			
Yes	43.4%	49.5%	57.0%
No	56.6%	50.5%	43.0%
Q61. Interested in voluntary FAA checks?			
Yes	68.5%	65.2%	56.2%
No	31.5%	34.8%	43.8%

Table 21
Involvement in Hazardous Events

	Private	Commercial	ATP
Q62. Number of aircraft accidents			
0	90.9%	82.6%	82.4%
1	7.6%	12.6%	12.8%
2	1.2%	3.1%	3.6%
3	0.2%	1.2%	1.0%
4	0.0%	0.3%	0.1%
5		0.1%	0.1%
6+		0.1%	0.1%
Q63. Low fuel incidents			
0	80.2%	66.0%	63.4%
1	15.9%	23.8%	24.6%
2	3.0%	6.8%	8.4%
3	0.7%	1.6%	1.7%
4	0.1%	0.6%	0.6%
5		0.2%	0.3%
6+	0.2%	1.0%	1.0%
Q64. On-Airport Precautionary/forced landings			
0	54.1%	40.5%	34.7%
1	23.0%	20.6%	19.0%
2	11.0%	15.2%	14.5%
3	4.0%	6.8%	9.9%
4	2.0%	4.5%	4.7%
5	1.1%	2.1%	2.5%
6+	4.7%	10.3%	14.7%
Q65. Off-airport precaution/forced landings			
0	93.4%	82.4%	82.4%
1	4.9%	9.9%	12.1%
2	1.0%	2.8%	1.8%
3	0.1%	1.7%	1.3%
4	0.2%	0.6%	0.3%
5	0.1%	0.4%	0.3%
6+	0.3%	2.3%	1.8%
Q66. Inadvertent stalls			
0	94.2%	90.2%	90.9%
1	4.5%	6.2%	5.4%
2	0.7%	1.7%	1.8%
3	0.3%	0.4%	0.3%
4	0.0%	0.1%	0.3%
5		0.1%	0.2%
6+	0.2%	1.1%	1.3%

Table 21 (Continued)

	Private	Commercial	ATP
Q67. Disoriented (lost)			
0	82.8%	83.0%	85.7%
1	14.3%	13.4%	11.5%
2	2.3%	2.6%	2.4%
3	0.4%	0.7%	0.2%
4		0.1%	0.1%
5		0.1%	0.2%
6+		0.1%	0.1%
Q68. Mechanical failures			
0	54.7%	32.6%	16.0%
1	27.3%	26.1%	16.5%
2	10.2%	16.8%	17.8%
3	4.0%	9.0%	14.7%
4	1.5%	5.0%	8.9%
5	0.5%	2.0%	3.8%
6+	1.7%	8.6%	22.3%
Q69. Engine quit due to fuel starvation.			
0	92.7%	84.0%	83.1%
1	5.6%	12.0%	11.9%
2	0.9%	2.6%	3.2%
3	0.4%	0.9%	0.7%
4	0.1%	0.1%	0.2%
5		0.1%	0.1%
6+	0.2%	0.4%	0.8%
Q70. Flown VFR into IMC			
0	76.7%	77.9%	84.7%
1	14.7%	13.8%	9.4%
2	5.5%	4.9%	4.3%
3	1.2%	1.5%	0.8%
4	0.8%	0.6%	0.4%
5	0.1%	0.1%	0.2%
6+	0.8%	1.1%	0.2%
Q71. IMC disorientation (vertigo)			
0	94.6%	90.5%	91.4%
1	4.1%	7.2%	6.0%
2	1.0%	1.6%	2.0%
3	0.2%	0.4%	0.2%
4	0.1%	0.2%	0.2%
6+		0.1%	0.2%

Table 21 (Continued)

	Private	Commercial	ATP
Q72. Turned back due to weather			
0	28.6%	22.9%	32.9%
1	20.8%	16.1%	10.9%
2	18.5%	17.8%	16.7%
3	10.1%	11.2%	11.1%
4	4.5%	5.9%	4.8%
5	2.8%	2.8%	2.3%
6+	14.6%	23.3%	21.3%
Q73. Practice DF approach			
0	63.7%	42.4%	32.6%
1	12.7%	12.9%	10.0%
2	9.8%	11.2%	11.1%
3	4.6%	6.9%	8.0%
4	2.0%	3.7%	4.6%
5	1.0%	1.9%	2.7%
6+	6.0%	21.1%	31.0%
Q74. Made a very bad decision			
0	47.9%	33.2%	28.1%
1	31.7%	29.0%	22.6%
2	13.3%	20.4%	22.2%
3	3.8%	8.8%	10.3%
4	1.6%	3.3%	5.1%
5	0.6%	0.9%	2.0%
6+	1.0%	4.4%	9.7%

Personal Minimums

Although the FAA establishes the legal minimum conditions under which a pilot may undertake a flight, many individuals adopt more stringent personal minimums as a way of controlling risk and ensuring safety. These personal minimums reflect individual pilots' self-assessment of skill and knowledge and their estimate of the degree of risk associated with operating under varying weather conditions. This topic has been widely discussed in the popular aviation literature (c.f., Clausing, 1990) and Kirkbride, Jensen, Chubb, and Hunter (in press) have developed a personal minimums tool to assist pilots in managing risk during preflight planning.

Table 22 presents the minimum conditions under which pilots would conduct a VFR flight in a light general aviation aircraft. The results clearly show a tendency for pilots to be more conservative both in terms of increased visibility and increased ceiling when considering night or cross-country flights, compared to local day flights. Interestingly, however, 9% of the private pilots indicated they would start a local day flight with less than 3 miles visibility. Although there are conditions under which this would be legal (for example, operating outside controlled airspace, departing a controlled airport under Special VFR) whether it is an advisable practice is another matter. Subsequent analyses will examine the characteristics

Table 22

Personal Minimums for VFR Flight

	Private	Commercial	ATP
Q75. Local day minimum visibility			
1 MILE	3.8%	6.8%	6.1%
2 MILES	5.3%	6.5%	5.7%
3 MILES	45.3%	54.8%	57.7%
4 MILES	6.0%	6.1%	3.8%
5 MILES	29.8%	21.3%	22.6%
6 MILES	2.5%	1.5%	0.6%
8 MILES	1.7%	0.7%	0.3%
10 MILES	4.5%	1.5%	2.1%
15 MILES	1.1%	0.8%	1.1%
Q76. Local night minimum visibility			
1 MILE	1.0%	0.9%	1.0%
2 MILES	0.5%	0.7%	0.9%
3 MILES	10.5%	16.4%	27.6%
4 MILES	1.6%	2.8%	2.6%
5 MILES	33.4%	42.0%	43.5%
6 MILES	6.0%	5.7%	3.7%
8 MILES	6.0%	5.2%	3.1%
10 MILES	26.3%	18.7%	13.4%
15 MILES	4.7%	7.6%	4.2%
Q77. Cross-country day minimum visibility.			
1 MILE	0.9%	1.1%	1.3%
2 MILES	1.1%	1.2%	1.0%
3 MILES	18.1%	25.6%	28.6%
4 MILES	2.7%	4.0%	2.5%
5 MILES	37.3%	40.9%	41.1%
6 MILES	5.9%	5.2%	4.2%
8 MILES	6.6%	4.6%	4.1%
10 MILES	19.5%	13.6%	13.1%
15 MILES	7.9%	3.8%	4.2%

Table 22 (Continued)

		Private	Commercial	ATP
Q78.	Cross-Country night minimum visibility			
	1 MILE	0.7%	0.4%	0.9%
	2 MILES	0.1%	0.2%	0.2%
	3 MILES	5.8%	7.8%	12.9%
	4 MILES	0.9%	1.5%	0.8%
	5 MILES	19.5%	29.2%	35 4%
	6 MILES	3.5%	4.5%	3.0%
	8 MILES	6.2%	6.2%	6.2%
	10 MILES	28.0%	27.1%	26.3%
	15 MILES	35.3%	23.1%	14.3%
Q79.	Local day minimum ceiling			
	1000 FEET	14.6%	28.4%	36.5%
	1500 FEET	24.1%	31.1%	27.1%
	2000 FEET	29.4%	23.5%	9.3%
	3000 FEET	25.0%	14.2%	12.7%
	4000 FEET	3.5%	1.7%	1.2%
	5000 FEET	3.4%	1.0%	3 1%
Q80.	Local night minimum ceiling			
	1000 FEET	1.9%	5.7%	11.9%
	1500 FEET	5.2%	11.4%	15.8%
	2000 FEET	16.3%	25.4%	28.0%
	3000 FEET	33.4%	34.1%	28.7%
	4000 FEET	12.8%	7.5%	3.6%
	5000 FEET	30.3%	15.9%	12.1%
Q81.	Cross-Country day minimum ceiling			
	1000 FEET	2.7%	5.8%	8.0%
	1500 FEET	4.8%	9.6%	9.8%
	2000 FEET	14.2%	22.0%	20.4%
	3000 FEET	38.4%	37.8%	36.6%
	4000 FEET	15.5%	11.2%	8.1%
	5000 FEET	24.2%	13.6%	17.2%
Q82.	Cross-Country night minimum ceiling			
	1000 FEET	1.0%	2.1%	4.6%
	1500 FEET	1.1%	2.9%	3.3%
	2000 FEET	5.2%	9.4%	12.6%
	3000 FEET	18.2%	25.0%	29.8%
	4000 FEET	12.8%	14.7%	8.9%
	5000 FEET	61.8%	46.0%	40.8%

of those pilots who indicated more conservative minimums compared to those who have less conservative minimums

Common Practices

Table 23 and 24 present, for local and cross-country flights, respectively, the percentages of times that pilots perform many common activities related to flight safety. As was found in the personal minimums questions, pilots are clearly more conservative when undertaking cross-country as compared to local flights. Although only about 56% of the private pilots get a weather briefing more than half of the time before taking off for a local flight. 96% of the pilots indicate they get a weather briefing more than half of the time before taking off for a cross-country flight.

Table 23.
Usual Practices — Local Flights

	Private	Commercial	ATP
Q83. Get weather briefing before take off			
0 PERCENT	9.5%	8.9%	8.0%
10 PERCENT	10.2%	12.2%	9.2%
25 PERCENT	8.8%	9.6%	8.1%
50 PERCENT	14.3%	14.8%	13.1%
75 PERCENT	8.4%	8.0%	7.4%
90 PERCENT	12.4%	11.9%	9.5%
100 PERCENT	36.0%	33.5%	40.3%
NA	0.5%	1.3%	4.4%
Q84. Top off/check fuel tanks			
0 PERCENT	0.1%	0.2%	0.3%
10 PERCENT	0.3%	0.6%	0.8%
25 PERCENT	0.3%	.4%	0.5%
50 PERCENT	1.4%	1.4%	1.6%
75 PERCENT	1.4%	1.1%	1.5%
90 PERCENT	2.6%	3.2%	1.8%
100 PERCENT	93.6%	92.3%	89.4%
NA	0.2%	0.6%	4.1%
Q85. Compute weight/balance			
0 PERCENT	22.5%	17.7%	13.0%
10 PERCENT	22.0%	23.3%	17.9%
25 PERCENT	11.8%	11.3%	9.2%
50 PERCENT	14.0%	14.5%	13.7%
75 PERCENT	5.1%	5.0%	4.7%
90 PERCENT	2.5%	2.6%	2.4%
100 PERCENT	19.8%	22.7%	33.0%
NA	2.2%	2.9%	6.1%
Q86. Perform complete pre-flight			
0 PERCENT		0.1%	0.2%
10 PERCENT	0.2%	0.4%	0.4%
25 PERCENT	0.5%	0.5%	0.5%
50 PERCENT	0.7%	1.0%	1.1%
75 PERCENT	0.6%	1.1%	0.8%
90 PERCENT	3.0%	3.8%	3.0%
100 PERCENT	94.7%	92.2%	90.0%
NA	0.4%	0.9%	3.9%

Table 23 (Continued)

	Private	Commercial	ATP
Q87. Use a checklist for landing & takeoff			
0 PERCENT	3.3%	3.3%	2.8%
10 PERCENT	1.5%	2.8%	1.7%
25 PERCENT	1.6%	1.7%	1.0%
50 PERCENT	4.1%	4.6%	4.1%
75 PERCENT	2.6%	3.5%	2.4%
90 PERCENT	7.5%	7.5%	5.4%
100 PERCENT	79.0%	75.9%	78.7%
NA	0.4%	0.8%	3.9%
Q88. Compute expected fuel consumption			
0 PERCENT	18.7%	17.2%	8.6%
10 PERCENT	8.2%	8.2%	6.1%
25 PERCENT	6.4%	6.3%	3.8%
50 PERCENT	10.6%	9.0%	7.3%
75 PERCENT	4.4%	3.3%	3.1%
90 PERCENT	3.6%	3.7%	4.4%
100 PERCENT	46.5%	50.0%	61.5%
NA	1.6%	2.3%	5.1%
Q89. File a flight plan			
0 PERCENT	35.7%	33.1%	28.5%
10 PERCENT	24.7%	25.9%	19.5%
25 PERCENT	13.9%	13.6%	12.1%
50 PERCENT	13.9%	13.4%	17.6%
75 PERCENT	3.8%	4.1%	5.5%
90 PERCENT	1.8%	1.8%	2.0%
100 PERCENT	3.7%	5.2%	8.8%
NA	2.5%	2.8%	6.1%
Q90. Request weather updates			
0 PERCENT	35.7%	33.1%	28.5%
10 PERCENT	24.7%	25.9%	19.5%
25 PERCENT	13.9%	13.6%	12.1%
50 PERCENT	13.9%	13.4%	17.6%
75 PERCENT	3.8%	4.1%	5.5%
90 PERCENT	1.8%	1.8%	2.0%
100 PERCENT	3.7%	5.2%	8.8%
NA	2.5%	2.8%	6.1%
Q91. Fly VFR above clouds			
0 PERCENT	75.5%	66.0%	58.9%
10 PERCENT	14.8%	20.0%	21.3%
25 PERCENT	3.9%	5.6%	5.0%
50 PERCENT	2.3%	4.2%	6.1%
75 PERCENT	0.5%	0.8%	0.7%
90 PERCENT	0.3%	0.3%	0.3%
100 PERCENT	1.1%	1.3%	1.7%
NA	1.6%	1.8%	6.0%

Table 23 (Continued)

		Private	Commercial	ATP
Q92.	Fly below 1,000 AGL under clouds			
	0 PERCENT	69.9%	58.4%	54.9%
	10 PERCENT	20.0%	28.3%	26.2%
	25 PERCENT	3.1%	4.8%	5.1%
	50 PERCENT	1.8%	2.7%	4.0%
	75 PERCENT	0.6%	0.9%	0.6%
	90 PERCENT	0.7%	0.6%	0.5%
	100 PERCENT	2.0%	2.1%	2.9%
	NA	2.0%	2.2%	5.8%
Q93.	Fly below 500 AGL under clouds			
	0 PERCENT	94.4%	90.5%	85.7%
	10 PERCENT	2.0%	4.8%	5.3%
	25 PERCENT	0.4%	0.5%	0.3%
	50 PERCENT	0.4%	0.8%	1.0%
	75 PERCENT	0.0%	0.3%	0.2%
	90 PERCENT	0.3%	0.0%	0.2%
	100 PERCENT	0.6%	0.7%	1.0%
	NA	1.9%	2.3%	6.3%
Q94.	Verify fuel consumption in flight			
	0 PERCENT	22.7%	16.5%	8.6%
	10 PERCENT	7.4%	7.2%	4.1%
	25 PERCENT	7.2%	6.4%	2.9%
	50 PERCENT	10.6%	9.3%	7.6%
	75 PERCENT	5.3%	5.4%	3.7%
	90 PERCENT	5.6%	5.2%	6.8%
	100 PERCENT	38.3%	46.1%	59.7%
	NA	2.9%	4.0%	6.6%
Q95.	Use shoulder harness			
	0 PERCENT	5.8%	4.7%	3.2%
	10 PERCENT	1.0%	1.2%	0.9%
	25 PERCENT	1.0%	1.0%	1.1%
	50 PERCENT	2.6%	3.1%	3.6%
	75 PERCENT	1.4%	1.8%	0.9%
	90 PERCENT	2.2%	2.6%	2.6%
	100 PERCENT	73.9%	76.3%	80.5%
	NA	12.1%	9.3%	7.1%

Table 24
Usual Practices — Cross Country Flights

	Private	Commercial	ATP
Q96. Get a weather brief before takeoff			
0 PERCENT	0.1%	0.2%	0.2%
10 PERCENT	0.5%	0.5%	0.5%
25 PERCENT	0.5%	0.7%	0.4%
50 PERCENT	1.7%	2.0%	1.8%
75 PERCENT	2.2%	2.5%	3.0%
90 PERCENT	5.8%	6.3%	5.2%
100 PERCENT	88.8%	87.0%	84.3%
NA	0.4%	0.7%	4.6%
Q97. Top off/check fuel tanks			
0 PERCENT	0.0%		0.1%
10 PERCENT	0.2%	0.2%	0.3%
25 PERCENT		0.1%	0.1%
50 PERCENT	0.2%	0.2%	0.4%
75 PERCENT	0.2%	0.1%	0.4%
90 PERCENT	0.8%	1.3%	1.0%
100 PERCENT	98.2%	97.4%	93.1%
NA	0.4%	0.8%	4.5%
Q98. Compute weight & balance			
0 PERCENT	9.4%	6.9%	5.9%
10 PERCENT	13.0%	12.3%	9.4%
25 PERCENT	8.1%	8.6%	7.0%
50 PERCENT	14.4%	16.6%	14.1%
75 PERCENT	7.4%	8.5%	4.9%
90 PERCENT	5.1%	5.1%	5.8%
100 PERCENT	40.8%	39.9%	47.6%
NA	1.9%	2.1%	5.3%
Q99. Complete pre-flight			
0 PERCENT		0.1%	0.2%
10 PERCENT	0.2%	0.3%	0.5%
25 PERCENT	0.0%	0.3%	0.3%
50 PERCENT	0.2%	0.6%	0.6%
75 PERCENT	0.3%	0.5%	0.2%
90 PERCENT	1.1%	1.7%	1.5%
100 PERCENT	97.8%	95.7%	92.4%
NA	0.4%	0.9%	4.4%
Q100. Use a checklist for takeoff & /landing			
0 PERCENT	2.9%	2.9%	2.8%
10 PERCENT	1.8%	2.4%	1.7%
25 PERCENT	0.8%	1.6%	1.1%
50 PERCENT	4.1%	3.4%	3.4%
75 PERCENT	2.2%	2.9%	2.1%
90 PERCENT	4.9%	5.7%	4.8%
100 PERCENT	82.8%	80.2%	79.6%
NA	0.4%	0.9%	4.5%

Table 24 (Continued)

	Private	Commercial	ATP
Q101. Computed expected fuel consumption			
0 PERCENT	2.1%	2.5%	1.1%
10 PERCENT	1.7%	1.7%	1.2%
25 PERCENT	1.7%	1.8%	0.8%
50 PERCENT	3.7%	3.3%	2.4%
75 PERCENT	3.3%	2.7%	1.8%
90 PERCENT	4.6%	5.2%	4.5%
100 PERCENT	82.3%	81.6%	83.8%
NA	0.5%	1.1%	4.6%
Q102. File a flight plan			
0 PERCENT	10.2%	11.2%	9.6%
10 PERCENT	8.9%	8.7%	4.5%
25 PERCENT	6.3%	6.9%	6.0%
50 PERCENT	15.1%	15.7%	14.6%
75 PERCENT	8.4%	8.6%	7.0%
90 PERCENT	8.3%	8.3%	7.5%
100 PERCENT	42.1%	39.6%	46.2%
NA	0.6%	1.0%	4.6%
Q103. Request weather updates			
0 PERCENT	7.0%	3.5%	1.2%
10 PERCENT	10.3%	9.3%	4.8%
25 PERCENT	12.2%	12.0%	10.0%
50 PERCENT	26.4%	25.9%	25.6%
75 PERCENT	12.1%	13.6%	12.6%
90 PERCENT	6.9%	8.3%	7.9%
100 PERCENT	24.1%	26.3%	32.9%
NA	1.0%	1.1%	4.8%
Q104. Fly VFR above clouds			
0 PERCENT	62.1%	49.2%	42.4%
10 PERCENT	19.9%	25.5%	22.8%
25 PERCENT	7.6%	10.6%	11.2%
50 PERCENT	4.9%	8.6%	11.4%
75 PERCENT	1.3%	1.9%	2.1%
90 PERCENT	0.6%	0.6%	0.6%
100 PERCENT	2.2%	2.0%	3.5%
NA	1.5%	1.6%	6.0%
Q105. Fly 1,000 AGL under clouds			
0 PERCENT	75.4%	69.6%	62.9%
10 PERCENT	15.7%	20.3%	20.6%
25 PERCENT	2.2%	3.0%	3.8%
50 PERCENT	1.7%	2.4%	3.1%
75 PERCENT	0.2%	0.6%	0.3%
90 PERCENT	0.6%	0.3%	0.3%
100 PERCENT	2.4%	2.0%	2.7%
NA	1.8%	1.7%	6.3%

Table 24 (Continued)

	Private	Commercial	ATP
Q106. Fly 500 AGL under clouds			
0 PERCENT	94.3%	92.1%	86.2%
10 PERCENT	2.1%	3.7%	5.0%
25 PERCENT	0.3%	0.5%	0.5%
50 PERCENT	0.3%	0.5%	0.6%
75 PERCENT	0.1%	0.1%	0.1%
90 PERCENT	0.2%	0.1%	0.1%
100 PERCENT	0.9%	0.9%	1.0%
NA	1.7%	2.0%	6.5%
Q107. Verify fuel consumption			
0 PERCENT	8.5%	5.6%	2.6%
10 PERCENT	4.4%	2.9%	1.9%
25 PERCENT	3.0%	3.4%	1.7%
50 PERCENT	8.3%	6.5%	3.9%
75 PERCENT	6.3%	5.7%	3.7%
90 PERCENT	7.4%	8.6%	6.6%
100 PERCENT	59.0%	64.0%	73.2%
NA	3.0%	3.4%	6.4%
Q108. Use shoulder harness			
0 PERCENT	5.8%	4.4%	3.3%
10 PERCENT	0.9%	1.1%	0.9%
25 PERCENT	1.0%	1.0%	1.1%
50 PERCENT	2.4%	2.9%	3.8%
75 PERCENT	1.0%	1.7%	1.0%
90 PERCENT	2.0%	2.5%	2.5%
100 PERCENT	73.9%	76.5%	79.8%
NA	13.0%	9.9%	7.5%

Although the responses indicate that pilots follow safe practices most of the time, there are still many pilots who, for example, do not always perform a thorough pre-flight inspection or do not always check their fuel tanks before a cross-country flight. Special circumstances, not easily captured in a survey instrument, may explain their practices, but it is also possible that these pilots have simply fallen into bad habits that may be placing them at greater risk for an accident. As noted in the previous section, additional analyses will examine these outlier groups in more detail and will be the subject of future reports.

Attitudes Toward Flying

Pilots' attitudes about a number of issues were captured through 27 questions using a Likert scale. This section of the questionnaire included questions about pilots' capabilities (for example, instrument flight capability), knowledge (how to get ATC help), and skill levels (I fly enough to maintain proficiency), and several items reflecting the hazardous thought patterns described by Berlin, et al. (1982a,b,c).

It is interesting to note that the first item in this section calls for a statement regarding agreement with a potentially illegal act — ducking below minimums to get home — and that many pilots indicated that they agreed or strongly agreed with the statement.

It is hoped that this apparent willingness to admit agreement with such an act is indicative of candid responses to the questionnaire in general This question is also interesting in that the group who agreed least with the statement were those holding the ATP certificate — arguably the best-qualified, highest-skilled group of respondents. Although 2.8% of the ATPs indicated agreement, 3.7% of the private pilots and 4.1% of the commercial pilots indicated they would duck below minimums to get home. As before, future analyses will examine these groups in more detail and will hopefully lead to an understanding of why the pilots with the lowest skills are the most willing to undertake such a hazardous behavior

As we will see in the section dealing with flight time, the median number of hours flown by private pilots is on the order of 2 hours per month It is hardly surprising therefore, to find, as shown in Question 129, that only about half of the private pilots feel that they fly enough to maintain proficiency. Conversely, approximately half of the private pilots felt they were capable of instrument flight, yet only 40% of them have instrument ratings One must wonder upon what basis this confidence is built, since two hours of flight per month, even if devoted solely to instrument work, might be considered a minimum for maintenance of instrument proficiency.

Table 25
Opinions About Flying

	Private	Commercial	ATP
Q109. I would duck below minimums to get home			
STRONGLY AGREE	1.1%	0.9%	0.5%
AGREE	2.6%	3.2%	2.3%
NEITHER AGREE NOR DISAGREE	7.9%	7.4%	6.3%
DISAGREE	27.4%	25.4%	21.1%
STRONGLY DISAGREE	61.1%	63.1%	69.8%
Q110. I am capable of instrument flight			
STRONGLY AGREE	23.3%	44.6%	82.1%
AGREE	28.8%	38.1%	15.7%
NEITHER AGREE NOR DISAGREE	14.6%	6.9%	1.1%
DISAGREE	16.9%	6.0%	0.7%
STRONGLY DISAGREE	16.5%	4.5%	0.4%
Q111. I am a very careful pilot			
STRONGLY AGREE	48.7%	49.7%	65.6%
AGREE	45.5%	45.3%	31.6%
NEITHER AGREE NOR DISAGREE	4.2%	3.9%	2.4%
DISAGREE	0.4%	0.4%	0.1%
STRONGLY DISAGREE	1.2%	0.6%	0.3%
Q112. I never feel stressed while flying			
STRONGLY AGREE	8.1%	8.3%	13.4%
AGREE	25.9%	26.4%	26.7%
NEITHER AGREE NOR DISAGREE	27.7%	27.2%	24.8%
DISAGREE	34.9%	35.1%	31.3%
STRONGLY DISAGREE	3.5%	3.0%	3.8%

Table 25 (Continued)

	Private	Commercial	ATP
Q113. The rules on flying are too strict			
STRONGLY AGREE	3.7%	4.4%	5.0%
AGREE	10.4%	11.3%	10.9%
NEITHER AGREE NOR DISAGREE	30.6%	30.4%	30.2%
DISAGREE	38.9%	38.7%	36.7%
STRONGLY DISAGREE	16.4%	15.1%	17.3%
Q114. I am a very capable pilot			
STRONGLY AGREE	21.5%	34.5%	60.4%
AGREE	55.8%	53.2%	35.0%
NEITHER AGREE NOR DISAGREE	20.5%	10.8%	3.9%
DISAGREE	1.9%	0.9%	0.2%
STRONGLY DISAGREE	0.3%	0.5%	0.5%
Q 115. I am so careful I will never have accident			
STRONGLY AGREE	1.3%	2.2%	2.9%
AGREE	7.9%	6.5%	9.8%
NEITHER AGREE NOR DISAGREE	42.8%	42.8%	44.9%
DISAGREE	33.2%	33.5%	27.6%
STRONGLY DISAGREE	14.8%	14.9%	14.8%
Q116. I am very skillful on the controls			
STRONGLY AGREE	10.8%	21.5%	42.3%
AGREE	50.6%	53.3%	45.5%
NEITHER AGREE NOR DISAGREE	34.7%	23.2%	11.7%
DISAGREE	3.7%	1.9%	0.5%
STRONGLY DISAGREE	0.2%	0.2%	
Q117. I know aviation procedures very well			
STRONGLY AGREE	7.0%	14.3%	34.0%
AGREE	47.9%	55.8%	53.8%
NEITHER AGREE NOR DISAGREE	36.3%	25.1%	10.3%
DISAGREE	8.3%	4.6%	1.8%
STRONGLY DISAGREE	0.4%	0.3%	0.1%
Q118. I deal with stress very well			
STRONGLY AGREE	12.7%	13.9%	22.8%
AGREE	56.9%	56.7%	51.6%
NEITHER AGREE NOR DISAGREE	26.9%	26.0%	22.3%
DISAGREE	3.2%	3.2%	3.1%
STRONGLY DISAGREE	0.3%	0.2%	0.2%
Q119. It is riskier to fly at night than in day			
STRONGLY AGREE	32.7%	27.8%	19.2%
AGREE	49.1%	48.3%	41.7%
NEITHER AGREE NOR DISAGREE	9.7%	11.2%	17.5%
DISAGREE	7.0%	10.0%	15.6%
STRONGLY DISAGREE	1.6%	2.7%	6.1%

Table 25 (Continued)

	Private	Commercial	ATP
Q120. Most accidents are beyond the pilot's control			
STRONGLY AGREE	0.7%	0.8%	0.6%
AGREE	2.1%	2.0%	2.5%
NEITHER AGREE NOR DISAGREE	12.6%	11.3%	14.9%
DISAGREE	53.5%	53.8%	47.8%
STRONGLY DISAGREE	31.2%	32.1%	34.2%
Q121. I have thorough knowledge of my aircraft			
STRONGLY AGREE	22.9%	30.9%	46.8%
AGREE	59.8%	58.8%	48.4%
NEITHER AGREE NOR DISAGREE	14.3%	8.9%	4.4%
DISAGREE	2.7%	1.1%	0.3%
STRONGLY DISAGREE	0.2%	0.3%	0.2%
Q122. Weather forecasts are usually accurate			
STRONGLY AGREE	2.2%	1.9%	3.9%
AGREE	48.3%	44.5%	48.0%
NEITHER AGREE NOR DISAGREE	32.2%	34.2%	31.1%
DISAGREE	15.5%	17.1%	14.2%
STRONGLY DISAGREE	1.8%	2.3%	2.9%
Q123. I am a very cautious pilot			
STRONGLY AGREE	32.9%	31.5%	42.6%
AGREE	57.3%	55.9%	46.5%
NEITHER AGREE NOR DISAGREE	9.2%	11.6%	10.1%
DISAGREE	0.5%	0.9%	0.8%
STRONGLY DISAGREE	0.2%	0.1%	
Q124. Pilots should have more control over how they fly			
STRONGLY AGREE	7.0%	8.3%	9.2%
AGREE	26.3%	27.4%	27.1%
NEITHER AGREE NOR DISAGREE	54.4%	52.7%	52.6%
DISAGREE	10.9%	10.5%	9.6%
STRONGLY DISAGREE	1.4%	1.3%	1.5%
Q125. Your first response is usually the best response			
STRONGLY AGREE	4.2%	5.7%	5.6%
AGREE	44.7%	46.3%	46.7%
NEITHER AGREE NOR DISAGREE	39.7%	37.2%	37.2%
DISAGREE	10.9%	10.0%	9.4%
STRONGLY DISAGREE	0.6%	0.8%	1.1%
Q126. It is easy to understand weather information			
STRONGLY AGREE	7.8%	11.4%	25.8%
AGREE	56.6%	59.5%	58.5%
NEITHER AGREE NOR DISAGREE	17.5%	17.1%	9.9%
DISAGREE	16.2%	11.0%	5.3%
STRONGLY DISAGREE	1.9%	0.9%	0.5%

Table 25 (Continued)

	Private	Commercial	ATP
Q127. You should decide quickly & adjust later			
STRONGLY AGREE	2.1%	2.4%	2.9%
AGREE	22.7%	22.3%	13.2%
NEITHER AGREE NOR DISAGREE	35.4%	33.0%	32.8%
DISAGREE	33.0%	35.2%	40.3%
STRONGLY DISAGREE	6.7%	7.0%	10.7%
Q128. It is unlikely I would have an accident			
STRONGLY AGREE	1.2%	2.2%	3.5%
AGREE	11.5%	13.1%	15.5%
NEITHER AGREE NOR DISAGREE	39.2%	37.1%	38.3%
DISAGREE	37.[illegible]%	37.0%	30.7%
STRONGLY DISAGREE	10.5%	10.7%	11.9%
Q129. I fly enough to maintain proficiency			
STRONGLY AGREE	8.6%	14.2%	36.6%
AGREE	43.8%	46.1%	38.6%
NEITHER AGREE NOR DISAGREE	19.9%	17.2%	10.9%
DISAGREE	20.2%	17.5%	10.1%
STRONGLY DISAGREE	7.5%	5.0%	3.8%
Q130. I know how to get ATC help			
STRONGLY AGREE	27.1%	36.0%	56.6%
AGREE	64.5%	58.9%	40.7%
NEITHER AGREE NOR DISAGREE	5.8%	3.4%	2.2%
DISAGREE	2.0%	1.4%	0.5%
STRONGLY DISAGREE	0.5%	0.3%	
Q131. *There are few situations I couldn't get out of*			
STRONGLY AGREE	2.9%	3.4%	9.9%
AGREE	20.6%	27.6%	31.9%
NEITHER AGREE NOR DISAGREE	45.0%	44.2%	39.7%
DISAGREE	25.8%	20.9%	15.1%
STRONGLY DISAGREE	5.7%	3.9%	3.4%
Q132. You should push yourself & aircraft to find limits			
STRONGLY AGREE	0.7%	0.9%	1.1%
AGREE	10.5%	11.1%	7.6%
NEITHER AGREE NOR DISAGREE	22.0%	23.5%	20.9%
DISAGREE	42.5%	41.2%	38.0%
STRONGLY DISAGREE	24.2%	23.3%	32.4%
Q133. I often feel stressed in/near weather			
STRONGLY AGREE	2.3%	2.2%	2.0%
AGREE	36.4%	28.4%	16.4%
NEITHER AGREE NOR DISAGREE	32.1%	30.2%	22.1%
DISAGREE	26.6%	34.3%	44.9%
STRONGLY DISAGREE	2.7%	4.9%	14.6%

	Private	Commercial	ATP
Q134. Sometimes you have to depend on luck			
STRONGLY AGREE	0.5%	0.6%	0.6%
AGREE	1.6%	1.6%	1.9%
NEITHER AGREE NOR DISAGREE	8.3%	8.3%	7.9%
DISAGREE	35.4%	36.4%	29.2%
STRONGLY DISAGREE	54.2%	53.0%	60.5%
Q135. Speed more important than accuracy in a emergency			
STRONGLY AGREE	0.9%	1.0%	0.7%
AGREE	3.4%	2.4%	0.6%
NEITHER AGREE NOR DISAGREE	15.2%	12.7%	6.9%
DISAGREE	44.1%	42.8%	31.9%
STRONGLY DISAGREE	36.5%	41.1%	60.0%

Participation in Future Research

Uniformly the respondents indicated a high degree of willingness to participate in future research, although home-based activities were preferred over activities that would require going to some outside location, such as the airport. Considering the length of time required of some pilots to complete this survey (four hours in some cases), this willingness to participate in future efforts is encouraging.

In parallel with this survey effort are other efforts aimed at developing exportable interventions to improve aviation safety. Because of its dynamic

Table 26
Participation in Future Research

	Private	Commercial	ATP
Q136. I would participate in surveys			
YES	89.3%	88.3%	85.0%
NO	10.7%	11.7%	15.0%
Q137. I would participate in tests in my home			
YES	86.0%	84.7%	80.3%
NO	14.0%	15.3%	19.7%
Q138. I would participate in tests at the airport			
YES	59.2%	58.8%	53.7%
NO	40.8%	41.2%	46.3%
Q139. I would participate in repeated tests			
YES	67.6%	68.1%	65.6%
NO	32.4%	31.9%	34.4%
Q140. I have access to a computer (IBM PC)			
YES	66.3%	61.7%	58.2%
NO	33.7%	38.3%	41.8%

characteristics, the computer is the preferred medium for presentation of many of these interventions. It is significant to note therefore that two-thirds of the private pilots (the targeted group of most of the interventions under development) have access to a personal computer. This makes the distribution of computer-based safety training programs, either directly via floppy disk or through a bulletin board system, a feasible intervention strategy for the majority of pilots in this group.

Pilot Demographics

Table 27 presents the basic demographic information collected of respondents to the survey. As noted in the discussion of generalizibility of results, female pilots are slightly under-represented in the sample drawn from the population. The results of the question on education indicate a highly educated group, with a large number of respondents possessing a Doctorate in some field (i.e., medicine, law, academic field). With an average age of around 50, this is also a mature group, reflecting, perhaps, the popularity of pilot training in the decade of the 1960s and the subsequent decline in the numbers of people entering training.

Flight Experience

Table 28 contains the reported flight time over the previous 6 months, 12 months, and entire career for a number of categories. The mean flight time, median flight time, and standard deviation are given. The mean is simply the arithmetic average and provides a good picture of the state of affairs when there is a normal distribution. Unfortunately, for most of the data reported in this section, the distributions of flight times are not normal, but are heavily skewed—with most pilots reporting a low number of hours and a few pilots reporting very high numbers of hours. In these cases, the median may provide a better understanding of the distribution of hours. The median is the value below and above which there is an equal number of values. For example, half of the private pilots report having flown more than 12 hours in the previous 6 months, while half of the private pilots report having flown fewer than 12 hours during the same period. As can be seen, the median is substantially smaller than the average (22 hours)—indicating the presence of a small number of private pilots who flew a very large number of hours during that period.

Table 27
Demographic Information

	Private	Commercial	ATP
Q142. Sex			
Male	96.0%	96.2%	98.0%
Female	4.0%	3.8%	2.0%
Q143. Education			
Grade School	0.7%	0.3%	0.1%
High School	17.3%	15.3%	16.1%
Associate Degree	18.9%	19.4%	24.9%
College Degree	31.8%	33.1%	40.7%
Master's	17.3%	18.6%	13.7%
Doctorate	14.0%	13.3%	4.6%
Q141. Age			
Mean	49	51	49
Standard Deviation	13	14	12

Table 28
Flight Time During the Preceding 6 Months, 12 Months, and Total Career

	Private	Commercial	ATP
Total Time - 6 Months			
Mean	22	46	161
Median	12	20	120
Standard Deviation	34	97	151
Total Time - 12 Months			
Mean	50	108	340
Median	30	53	272
Standard Deviation	68	230	303
Total Time - Career			
Mean	819	2857	10412
Median	445	1574	9066
Standard Deviation	1293	3771	6809
Airplane - Last 6 Months			
Mean	21	46	158
Median	12	20	111
Standard Deviation	32	154	163
Airplane - Last 12 Months			
Mean	49	102	331
Median	30	50	245
Standard Deviation	65	230	364
Airplane - Career			
Mean	798	2611	9861
Median	427	1420	8300
Standard Deviation	1310	3686	7236
Rotorcraft - Last 6 Months			
Mean	1	6	3
Median	0	0	0
Standard Deviation	21	130	21
Rotorcraft - Last 12 Months			
Mean	1	7	8
Median	0	0	0
Standard Deviation	7	50	51
Rotorcraft - Career			
Mean	5	185	301
Median	0	0	0
Standard Deviation	52	1219	1351
Single Engine - Last 6 Months			
Mean	22	33	23
Median	10	13	0
Standard Deviation	154	89	53

Table 28 (Continued)

	Private	Commercial	ATP
Single Engine - Last 12 Months			
Mean	46	76	52
Median	25	35	4
Standard Deviation	184	181	112
Single Engine - Career			
Mean	725	2098	2648
Median	392	1134	1981
Standard Deviation	1462	3710	3439
Multi Engine - Last 6 Months			
Mean	4	15	139
Median	0	0	80
Standard Deviation	28	131	155
Multi Engine - Last 12 Months			
Mean	8	29	292
Median	0	0	175
Standard Deviation	41	200	365
Multi Engine - Career			
Mean	150	767	7566
Median	0	30	5850
Standard Deviation	1037	2662	6784
Day - Last 6 Months			
Mean	24	44	128
Median	11	18	90
Standard Deviation	152	150	293
Day - Last 12 Months			
Mean	46	96	263
Median	27	47	193
Standard Deviation	95	231	357
Day - Career			
Mean	777	2403	7642
Median	396	1361	6697
Standard Deviation	1664	3267	5517
Night - Last 6 Months			
Mean	3	5	38
Median	0	0	13
Standard Deviation	13	18	58
Night - Last 12 Months			
Mean	5	11	76
Median	0	2	28
Standard Deviation	18	29	114

Table 28 (Continued)

	Private	Commercial	ATP
Night - Career			
Mean	108	339	2423
Median	22	117	1280
Standard Deviation	644	771	2950
Simulator - Last 6 Months			
Mean	1	1	7
Median	0	0	0
Standard Deviation	4	6	35
Simulator - Last 12 Months			
Mean	1	2	14
Median	0	0	4
Standard Deviation	5	12	59
Simulator - Career			
Mean	10	61	249
Median	0	12	122
Standard Deviation	50	491	484
Under Hood - Last 6 Months			
Mean	2	2	1
Median	0	0	0
Standard Deviation	5	5	3
Under Hood - Last 12 Months			
Mean	4	4	3
Median	0	1	0
Standard Deviation	9	13	7
Under Hood - Career			
Mean	41	108	137
Median	20	70	92
Standard Deviation	67	265	178
Actual Instrument - Last 6 Months			
Mean	2	4	19
Median	0	0	9
Standard Deviation	7	13	32
Actual Instrument - Last 12 Months			
Mean	4	9	40
Median	0	0	20
Standard Deviation	16	25	64
Actual Instrument - Career			
Mean	60	219	1357
Median	2	50	700
Standard Deviation	316	573	2728

Table 28 (Continued)

	Private	Commercial	ATP
Piston-Powered - Last 6 Months			
Mean	19	36	35
Median	10	15	2
Standard Deviation	28	64	96
Piston-Powered - Last 12 Months			
Mean	44	81	73
Median	25	40	5
Standard Deviation	73	126	149
Piston-Powered - Career			
Mean	698	2023	4076
Median	375	1131	3000
Standard Deviation	1132	2858	4174
Turbo Prop - Last 6 Months			
Mean	1	6	45
Median	0	0	0
Standard Deviation	16	130	115
Turbo Prop - Last 12 Months			
Mean	1	8	95
Median	0	0	0
Standard Deviation	13	63	232
Turbo Prop - Career			
Mean	21	109	1690
Median	0	0	406
Standard Deviation	273	607	2545
Jet - Last 6 Months			
Mean	1	2	82
Median	0	0	0
Standard Deviation	10	20	133
Jet - Last 12 Months			
Mean	2	4	170
Median	0	0	0
Standard Deviation	35	40	342
Jet - Career			
Mean	30	286	3731
Median	0	0	900
Standard Deviation	403	1889	5343
Student - Last 6 Months			
Mean	1	1	0
Median	0	0	0
Standard Deviation	5	6	4

Table 28 (Continued)

	Private	Commercial	ATP
Student - Last 12 Months			
Mean	3	1	1
Median	0	0	0
Standard Deviation	13	9	4
Student - Career			
Mean	95	138	147
Median	64	75	100
Standard Deviation	863	1134	135
Instructor - Last 6 Months			
Mean	0	12	18
Median	0	0	0
Standard Deviation	0	40	51
Instructor - Last 12 Months			
Mean	0	29	45
Median	0	0	0
Standard Deviation	0	124	153
Instructor - Career			
Mean	3	655	1692
Median	0	8	1052
Standard Deviation	67	2042	2299
Personal Business - Last 6 Months			
Mean	6	7	5
Median	0	0	0
Standard Deviation	28	22	18
Personal Business - Last 12 Months			
Mean	13	17	11
Median	0	0	0
Standard Deviation	65	52	40
Personal Business - Career			
Mean	217	483	348
Median	0	9	0
Standard Deviation	802	2792	1891
Pleasure - Last 6 Months			
Mean	19	15	6
Median	7	6	0
Standard Deviation	151	74	16
Pleasure - Last 12 Months			
Mean	36	38	15
Median	20	15	0
Standard Deviation	77	184	47

Table 28 (Continued)

	Private	Commercial	ATP
Pleasure - Career			
Mean	573	849	557
Median	336	528	215
Standard Deviation	931	1139	936
Commercial - Last 6 Months			
Mean	0	13	133
Median	0	0	58
Standard Deviation	12	55	156
Commercial - Last 12 Months			
Mean	5	27	271
Median	0	0	132
Standard Deviation	164	106	311
Commercial - Career			
Mean	35	713	6699
Median	0	0	5050
Standard Deviation	822	2565	7049
Military - Last 6 Months			
Mean	0	1	2
Median	0	0	0
Standard Deviation	5	10	19
Military - Last 12 Months			
Mean	4	3	4
Median	0	0	0
Standard Deviation	157	31	31
Military - Career			
Mean	35	489	1101
Median	0	0	0
Standard Deviation	301	1500	2242

As was noted earlier, from these data we may see that the median number of hours flown over the last year was 30 hours; roughly 2.5 hours per month. This means that while half of the private pilots flew, on average, more than the 2.5 hours per month, half flew less than that amount.

The distribution of total career hours for private pilots is shown graphically in Figure 1. To enhance the depiction of the distribution of hours around the median, the figure only includes those private pilots with less than 3,000 total hours.

For the private pilots, the results depict a group that predominately flies single-engine aircraft, almost exclusively during the day, has received almost no instruction or practice flying under the hood over the last year, and flies mainly for pleasure, as compared to personal business. They report making, on average, 1.5 landings per flight hour, indicating either short flights, or some degree of self-practice on that aspect of flying.

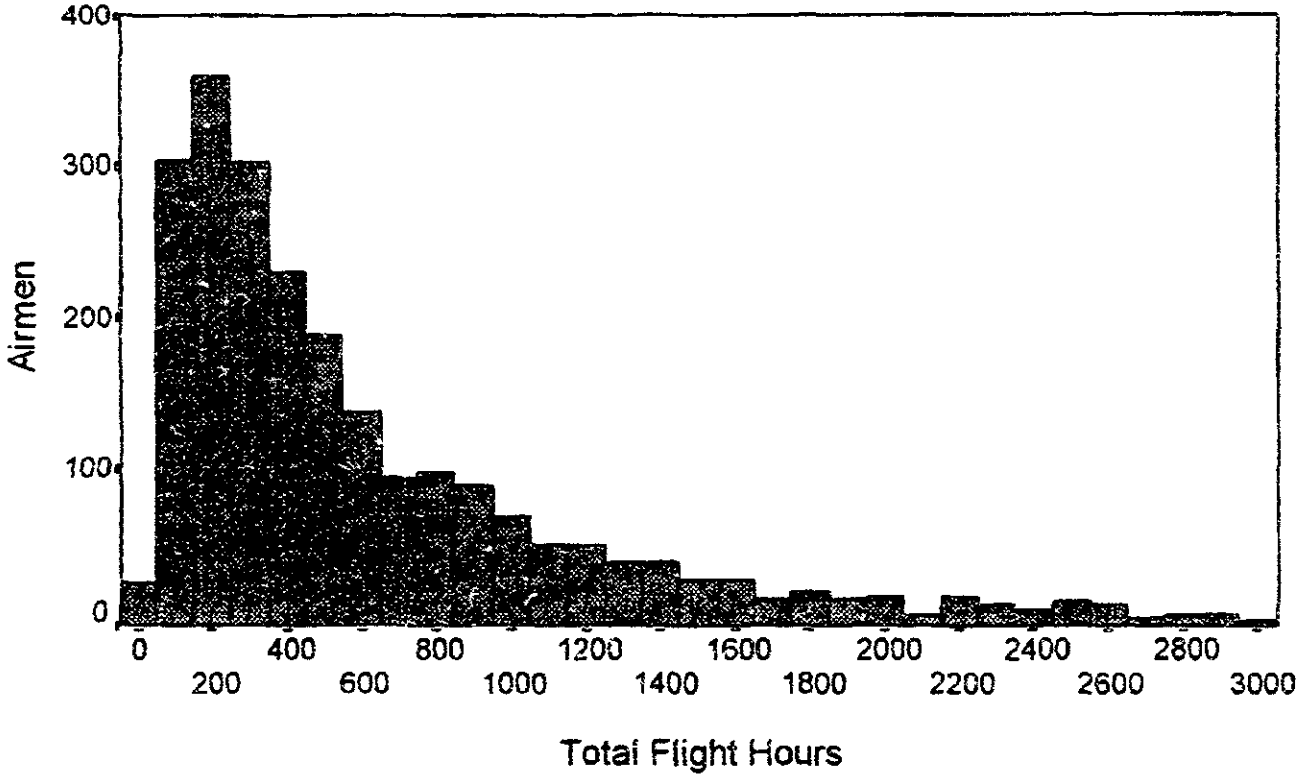

Figure 1. Total flight hours for private pilots

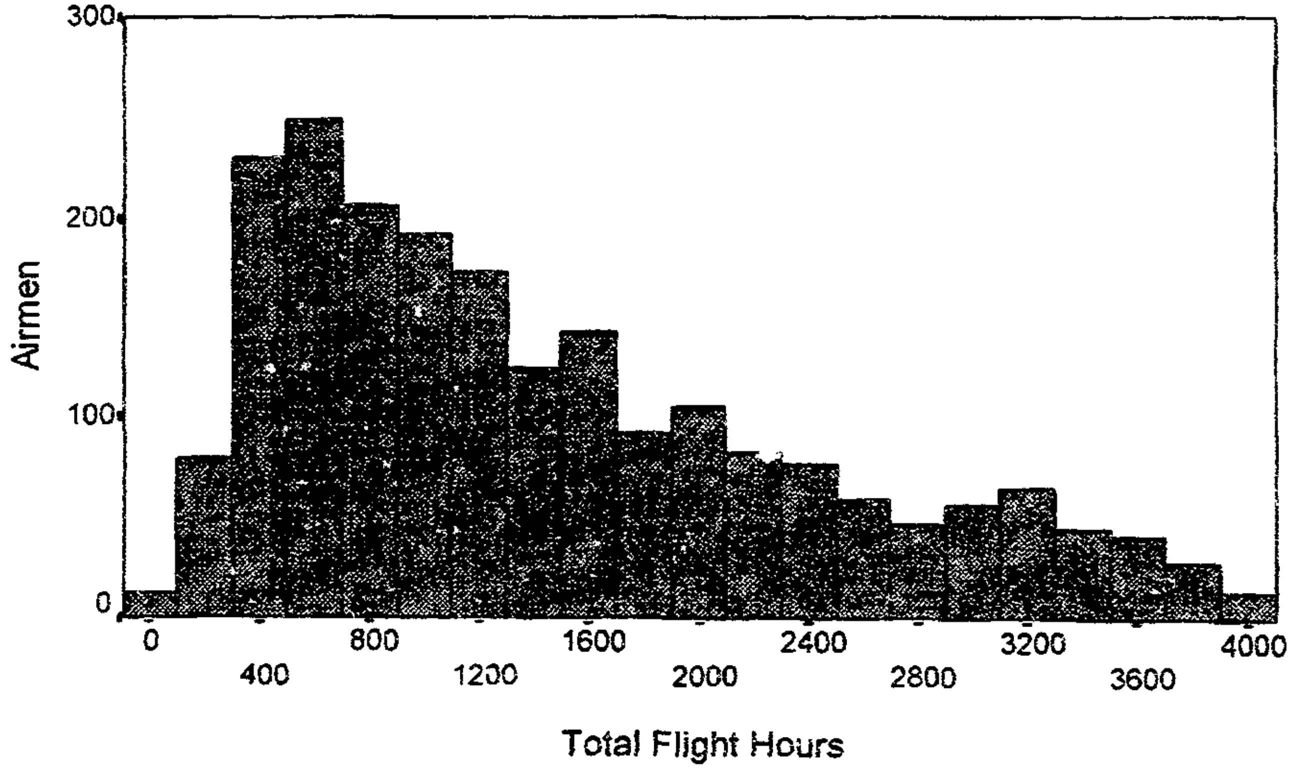

Figure 2. Total flight hours for commercial pilots

The distribution of recent and total flight hours for the commercial pilots is skewed in the same manner as the private pilots. Note that the mean total time is 2,857 hours, while the median total time is approximately half that figure. For the most part, while the numbers are larger than for the private pilots, the pattern of times for commercial pilots is quite similar to that of the private pilots. This may be explained, in part, by the numbers reported for commercial (for hire) flights by commercial pilots. Although the mean total number of commercial hours is 713, the median is zero. This indicates that while pilots may possess a commercial license, half of them have never actually flown commercially. This suggests that there may be some other motivation for obtaining a commercial license, other than the desire to be able to hire oneself out as a pilot and raises some interesting questions which might be addressed on any subsequent surveys. The distribution of hours is depicted graphically in Figure 2 for those commercial pilots with less than 4,000 hours.

Unlike the distributions of the private and commercial pilots, the flight hour distributions of the ATP certificate holders much more closely approximates a normal distribution, as indicated by the similarity of the mean and median values. The responses show a much broader range of experiences, with approximately equal levels of experience in piston and jet aircraft. They also report substantially more experience in simulators and as military pilots than the other groups.

Tables 29 and 30 further depict the different experiences of the three certificate groups in terms of numbers of landings and numbers of instrument approaches made.

Table 29
Number of Landings Made

	Private	Commercial	ATP
Landings in last year			
Mean	61	117	226
Median	40	55	120
Standard Deviation	109	227	435
Landings in last 6 Months			
Mean	29	51	97
Median	16	23	50
Standard Deviation	43	201	146

Table 30
Number of Instrument Approaches Made

	Private	Commercial	ATP
Number of instrument approaches in last year			
Mean	9	15	47
Median	0	6	25
Standard Deviation	19	28	66
Number of instrument approaches in last 6 Months			
Mean	4	7	46
Median	0	2	13
Standard Deviation	10	14	447

While the private pilot group averaged around 1.5 landings per flight hour, the commercial and ATP groups averaged approximately 1 and 0.5 landings per flight hour, respectively, indicating longer flight segments for these groups. In terms of instrument approaches, the median number of approaches for the private pilots was zero, reflecting the general lack of an instrument rating by members of this group. Interestingly, the numbers of instrument approaches reported by both the commercial and ATP groups were also quite low compared to their total number of flight hours. Over a one year period, the ATP group reported a mean of 47 instrument approaches and a median of 25. This works out to about one instrument approach per week, using the mean value, or one every two weeks using the median value. Further, the difference between the mean and median values indicates a skewed distribution, with some ATP certificate holders performing many instrument approaches, while a large number perform very few—a reflection, perhaps, of regional weather differences. Additional analyses will certainly be needed to develop a better understanding of this observation.

DISCUSSION AND CONCLUSIONS

Within the limits on generalizability discussed earlier, the results of this survey provide a basis for the conduct of future aviation safety research. Previously, information at this level of detail was not available on the population of non-accident involved pilots. Hence, comparisons between the characteristics of pilots who had been involved in accidents and those who had not been involved in accidents were not possible. It is believed that the present study will alleviate to some degree, this lack of information about the general population of pilots and facilitate future safety studies by providing an empirical database for comparisons.

The normative purposes of the survey are also served by the development of information on the career paths of professional pilots. As the recent report of the Pilot and Aviation Maintenance Technician Blue Ribbon Panel (DOT, 1993) indicates, aviation is in a state of change, and the old career paths which, for many of the major air carriers, led from the military cockpit to the civil airliner are being dissolved by the cutbacks in military training and increased retention of military pilots. The data contained here represent a snapshot to some degree of the pilot workforce at a time when those changes are just starting to be felt and may well prove very useful in assessing the impact of these environmental forces as they progress.

To a large degree this survey was not intended as an end in itself, but as a basis or resource for a variety of research. The normative information gathered here, particularly that dealing with flight hours, will prove especially useful to those performing analyses of aviation accidents. The information on career paths will be used in studies of pilot selection and career management and training. Ongoing research on improving pilots risk management skills through the use of personal minimums will use the data on personal minimums. In addition, that and other intervention-oriented research will use the information on participation in training activities and safety seminars in the development of effective marketing strategies.

This initial report has only just begun the process of analyzing the data obtained from the survey. In the brief discussions which accompanied the tabulated results several potential analyses were suggested to investigate the characteristics of various groups of interest. Where the data permit such analyses, a number of additional studies of the data reported here will be undertaken, to further examine the relationships between pilot characteristics and behaviors of interest, such as attendance at safety seminars.

This survey was unique in both the scope of its content and the size of the sample used. However, due caution must be observed in utilizing these results because of the limitations and potential for error associated with self-report survey research described earlier. Nevertheless, if properly conducted the future analyses alluded to above can do much to expand our understanding of the nature of the relationships among the factors assessed by this survey and our understanding of the dynamic pilot population— furthering both our scientific knowledge and helping to bring about our ultimate goal of a safer pilot.

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APPENDIX A

U.S. Department of Transportation
Federal Aviation Administration

800 Independence Ave., S.W.
Washington, D.C. 20591

Dear Airman:

In order to improve aviation safety, the FAA has begun a long-term, scientific study of American airmen. This study will examine how airmen make decisions critical to the safety of flight, how airmen develop and maintain their skills, how professional airmen progress through their careers and how training, experience and other personal factors affect flight safety.

As the first step in this study, I need your help in completing the enclosed AIRMAN RESEARCH QUESTIONNAIRE.

You are one of a random sample of airmen selected from across the country to participate in this study. Your opinions and experiences will be combined with those of the others in the sample to represent the thoughts and experiences of all the airmen within the United States. Therefore, it is very important that you complete and return the questionnaire.

The survey includes questions about your background, your career as an airman, your aviation experience, training, and involvement in accidents, and your opinions on a variety of issues. As you will see, some questions are oriented toward non-commercial general aviation pilots and some toward commercial pilots. However, you should answer all the questions based upon your personal experiences.

YOUR RESPONSES WILL REMAIN CONFIDENTIAL.

All questionnaires will be machine-scored, and only summarized results will be released. No action will be taken against you by the FAA using the information you provide in this survey.

When you are ready to complete the questionnaire, first review the instructions carefully before you begin answering the questions. When you are through, return only the answer sheet, along with any comments you might want to include, using the return envelope provided in the packet. Please do not fold or staple the answer sheets.

The results of this study will be described in reports published by the Office of Aviation Medicine *and will be made available to the public through the National Technical Information Service.*

If you have any questions regarding this survey, you may write or call me at:

Office of Aviation Medicine, AAM-240
Federal Aviation Administration
600 Independence Avenue, S.W.
Washington, DC 20591

(202) 366-6935

I appreciate your assistance, and hope that you will take the time to complete the questionnaire as soon as possible.

Sincerely,

David R. Hunter, Ph.D.
Program Scientist

Enclosed:
1. Questionnaire
2. Return Envelope

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AIRMAN RESEARCH QUESTIONNAIRE

This information collection conforms to legal and administrative standards established by the Federal Government to assure confidential treatment of statistical information. The information you provide will be used only for statistical purposes and will not be published or released in any form that would reveal specific information reported by an individually identifiable respondent. This questionnaire has been approved by the Office of Management and Budget, and has been given an OMB Approval Number of 2120-0566.

AGENCY DISPLAY OF ESTIMATED BURDEN

The public reporting burden for this collection of information is estimated to average one hour per response. If you wish to comment on the accuracy of the estimate or make suggestions for reducing this burden, please direct your comments to OMB and the FAA at the following addresses:

Office of Management and Budget
Paperwork Reduction Project (2120-0566)
Washington, DC 20503

and

US Department of Transportation
Federal Aviation Administration
Office of Aviation Medicine, AAM-240
Washington, DC 20591

READ THIS BEFORE YOU ANSWER ANY QUESTIONS

VOLUNTARY PARTICIPATION: This is a voluntary survey—you do not have to take part if you do not wish to do so and the FAA will take no action based upon your refusal.

PURPOSE OF STUDY: This is a scientific study of airmen's careers and their decision making processes.

USES OF DATA: The data you provide will be combined with similar data from other responding airmen and analyzed to identify career patterns and to develop models of airman decision processes. The data will be kept on file and will periodically be compared with aviation accident reports to develop profiles of airmen at risk for decision-related accidents.

SAFEGUARDS AGAINST DISCLOSURE: The information you provide in this survey will be protected. Information identifying you personally (for example, your name and certificate number) will be removed from all data files. Only the Program Scientist will have access to the key which links your Subject Identification Number with your name and certificate number. That key will be kept secured at all times to prevent inadvertent disclosure of personal information.

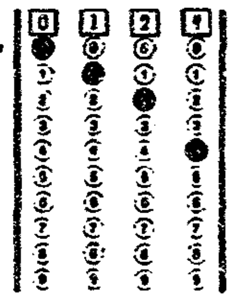
INSTRUCTIONS

- USE NO. 2 PENCIL
- Make heavy black marks that completely fill the circle.
- Erase any changes cleanly and completely.
- Do not make any stray marks in this booklet.
- Please do not fold this document.
- Answer each question except when directed to skip a section.
- Read the questions carefully before selecting an answer.
- If you select an answer that is not identified in the list of options, write only in the space provided.

CORRECT MARKS ● INCORRECT MARKS

You will be asked to give numbers for some answers.
EXAMPLE: If your answer is 124

- Write the number in the boxes, making sure the LAST NUMBER is always placed in the RIGHT HAND BOX.
- Fill in the UNUSED boxes with ZEROS.
- Then mark the matching circle below EACH box.



PLEASE DO NOT WRITE IN THIS AREA

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