JOURNAL OF AIRCRAFT
Vol. 40, No. 2, March–April 2003

Identification and Analysis of Key Barriers to the Utility of General Aviation

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Barriers to the utility of general aviation were identified through a web-based survey of active general aviation pilots based in North America. An analytical travel mode choice model was also developed to examine further some of these barriers and their impact on general aviation utility. Several key issues emerged as being important to increasing the utility of general aviation transportation. Improved weather information as well as near all-weather capability for general aviation aircraft and better access to ground transportation at the travel destination would significantly increase utility. Furthermore, modifying the business model for owning and operating general aviation aircraft may be the best near-term strategy for lowering the expense of general aviation transportation. Analysis with the mode choice model also indicates that increasing the cruise speed of general aviation aircraft does not necessarily translate into an increase in the utility of general aviation transportation.

Introduction

IN 1998 there were nearly 185 million valid drivers' licenses in the United States,[1] while in the same year the Federal Aviation Administration documented 618,298 active U.S. pilot certificates.[2] Over 5.5 million cars were produced domestically in 1998 (Ref. 3), and the General Aviation Manufacturers Association reported that 2220 units were shipped by general aviation manufacturers based in the United States.[4] Furthermore, in 1998 over 463 billion revenue passenger miles were flown on domestic commercial air carriers.[5] These statistics clearly indicate that the automobile is a mode of transportation accessible to, and utilized by, far more people in the United States than is general aviation (GA) transportation. In addition, over the past 50 years commercial air travel has become a widely accepted mode of transportation for both business and leisure purposes, whereas travel by GA aircraft has not enjoyed the same level of popularity. These observations raise the important question of what barriers may be acting to limit the utility of general aviation transportation.

Barriers to the utility of general aviation were identified through a web-based survey of active general aviation pilots. Analysis of the survey data indicated several key barriers that were thought by pilots to be currently limiting their ability to utilize GA transportation to its fullest extent. A mode choice model was then constructed to examine further some of the major barriers. The model considered only key quantitative factors such as travel distance, time, and the travelers' value of time, but proved to be quite powerful in demonstrating how GA utility was affected by changes in the key factors.

Survey

An Internet-based survey was developed to establish a basis for determining the relative importance of various barriers to travel by GA aircraft. The survey was maintained on a computer server at the Massachusetts Institute of Technology and made publicly available to any person, worldwide, with an Internet connection and World Wide Web browser software. Survey participants submitted their results anonymously via the Internet, and all completed surveys were then analyzed for this research.

The survey consisted of 20 questions regarding how the participant considered and ultimately used various forms of transportation, as well as the relative advantages and disadvantages of these transportation modes. Demographic and statistical information, such as age and flight experience was also gathered in the survey. Whereas some survey questions restricted the user to simple yes/no responses or guided the user to respond on a discrete scale, for example, not important/somewhat important/very important, most survey questions allowed participants to write their responses in text boxes in an open-ended, free-form manner. The goal of this technique was to prevent the survey from guiding participants into answers preconceived by the survey designers. Actual responses on completed surveys varied from short, numbered items to quite lengthy essays on the topic at hand. Free-form responses were individually analyzed by the authors, and responses were categorized according to issues mentioned by the survey participants. For example, question 15 in the survey asked participants to cite some advantages that traveling by automobile had over traveling by GA aircraft. The following represents a typical response: 1) much more convenient and flexible over short distances, 2) cheaper, 3) safer, 4) can handle heavy and bulky cargo, and 5) can drive in most bad weather.

The various categories marked for this response would then include ease of access, flexibility, less expensive, safety, payload capacity, and weather not a factor. Obviously there is room for interpretation in each response, but best efforts were made to at least maintain consistency in how responses were categorized for each question. The topics of some survey questions were also designed to be purposely repetitive so that consistency in the responses (and analysis) could be checked. A complete copy of the survey, as well as a detailed discussion of the survey design, execution and analysis may be found in Ref. 6.

Survey Population Profile

The major goal of the survey was to aid in determining what barriers are currently reducing the utility of GA travel in North America. Pilots who currently travel by GA aircraft on a relatively regular basis were targeted by the survey with the rationale that any factors that reduced the utility of GA travel to this group would likely reduce utility for less frequent, and perhaps less experienced, users as well.

Over the two month period in which the survey was made available, 1471 complete and distinct surveys were submitted and

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Received 1 March 2002; revision received 25 October 2002; accepted for publication 3 November 2002.

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subsequently used in this research. In many respects, the survey participants generally reflected nationwide active pilot population characteristics as reported by the Federal Aviation Administration. As shown in Fig. 1, slightly over half of the survey participants hold a private pilot certificate, with another 35% holding a commercial certificate. (In Fig. 1, N = 1464 indicates the number of responses received for that question.) Two-thirds of the pilots surveyed were instrument flight rules rated (Fig. 2). Survey respondents' total reported flight hours are shown in Fig. 3, with a median of 800 h. Nearly one-third reported having between 100 and 500 h of flight experience. The term "general aviation" was never defined in the survey, but instead pilots were asked to define what type of aircraft they would be considering as a GA aircraft for the survey. Note that the majority of the pilots taking the survey considered a single-engine piston aircraft as GA for the purposes of this survey (Fig. 4). A complete copy of the survey results may be found in Ref. 6.

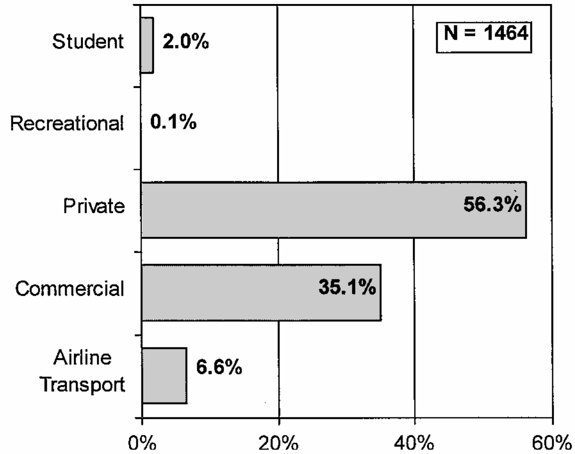

Fig. 1 Survey respondents' pilot certificate.

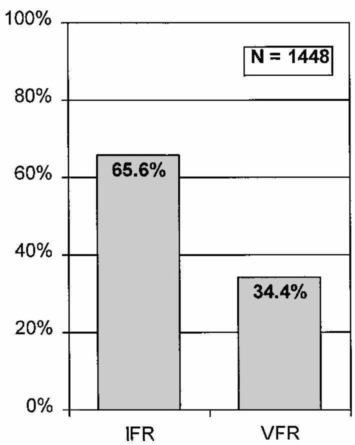

Fig. 2 Survey respondents' instrument rating.

Factors Affecting Survey Results

The nature of the survey makes the statistical significance of the results indeterminate because it is impossible to know how many pilots were exposed to the survey. Therefore, the authors make no claim as to the statistical significance of the results, but instead describe here the survey methodology and present collected data for evaluation. The fundamental assumption underlying the discussion in this paper is that the barriers presented are valid for current GA users and are likely valid for new entrants and infrequent users as well. Barriers specific to entering the GA transportation system, for example, initial pilot training, have not been explicitly addressed by this research. In addition, all survey responses were submitted before the 11 September 2001 terrorist attacks on America. The full course of new restrictions for both airline and GA (and possibly automobile) travel are yet unknown and may significantly affect the barriers discussed here.

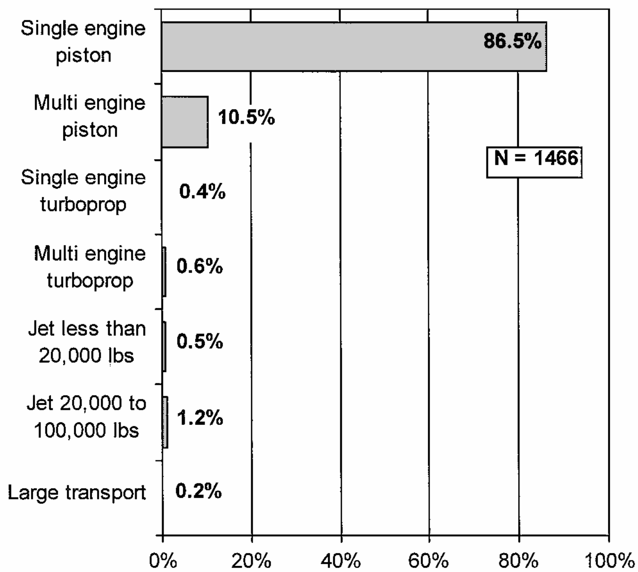

Fig. 4 Survey respondents' GA airplane type considered for survey.

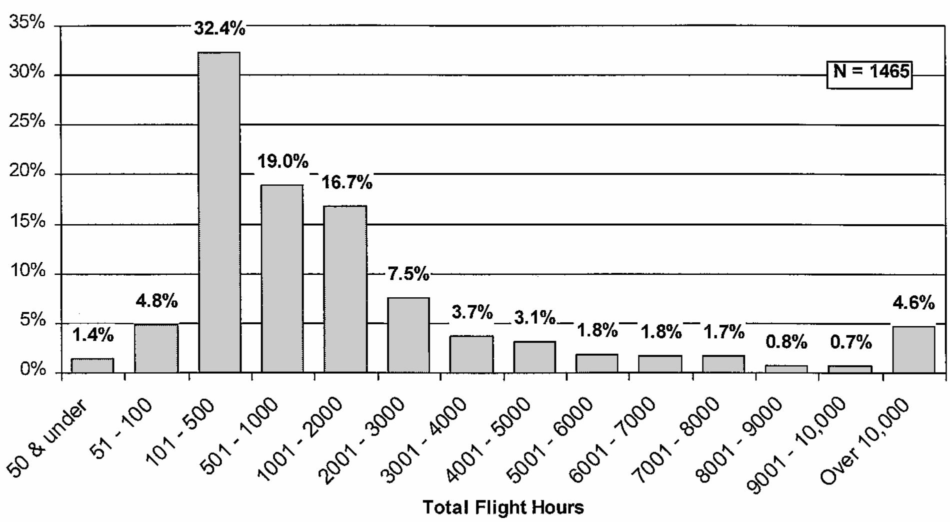

Fig. 3 Survey respondents' total flight hours.

Key Barriers to the Utility of GA

From the survey data, the following four key issues emerge as being important barriers to the utility of general aviation transportation: weather, expense of the travel mode, a lack of mobility at the destination, and the doorstep-to-destination travel time. Each will be briefly discussed.

Weather

Of those responding to the survey, 48% cited weather as a major consideration in choosing among various travel modes for any given trip (Fig. 5). Over 65% of those surveyed also indicated adverse weather as a major reason they would choose to not travel by GA (Fig. 6). In addition, when asked what the most important things were that could be done to improve the utility of GA transportation, nearly 20% of those responding cited improved weather information, including improved access to information on the ground plus real-time information in the cockpit. Furthermore, weather is not a factor that discriminates as to how an individual accesses their GA transportation. Both aircraft renters and owners alike mentioned weather equally frequently as a major consideration in travel mode choice.[6]

Clearly, weather acts as a key barrier to more fully utilizing GA transportation. Utility is limited due to the uncertainty of weather conditions during a travel period, resulting in a reduction of the reliability of GA travel. Of those naming weather as a factor as shown in Fig. 5, 25% indicated that it influenced their ability to reach their destination reliably as scheduled. As further evidence, GA travel was not viewed by those who took the survey as a reliable travel mode relative to other available modes. Just over 2% of the survey population felt GA travel was more reliable in comparison to commercial airline or automobile travel.[6] Likewise, the second most

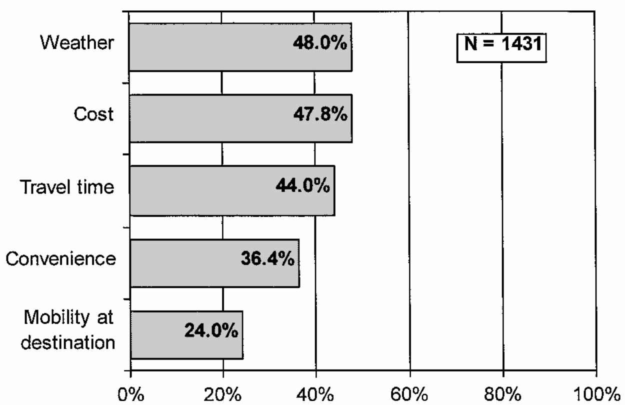

Fig. 5 Question 6, "what factors are your major considerations in choosing among the various modes of transportation?": top five responses.

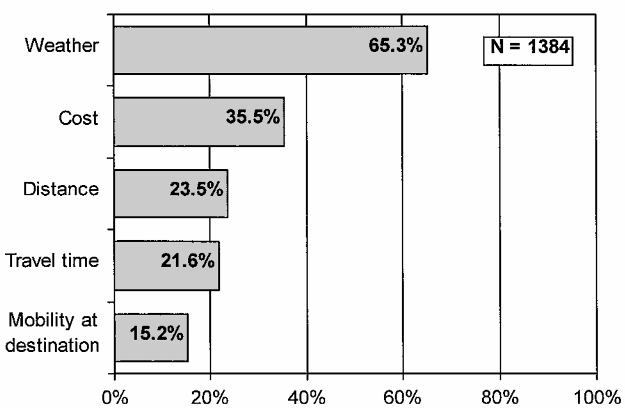

Fig. 6 Question 8, "please list what you consider to be the major reasons you would choose not to travel by GA aircraft on any given trip": top five responses.

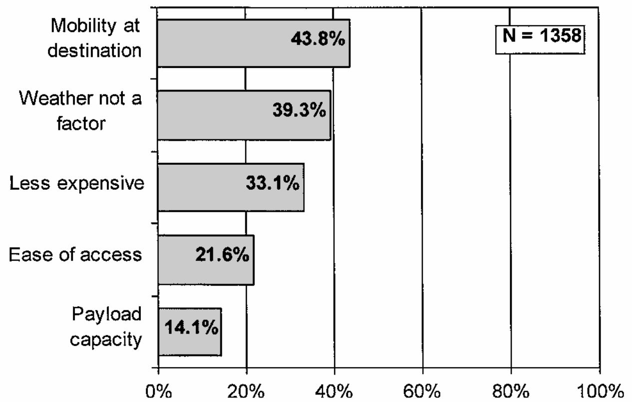

Fig. 7 Question 15, "what advantages does traveling by automobile have over travel by GA aircraft?": top five responses.

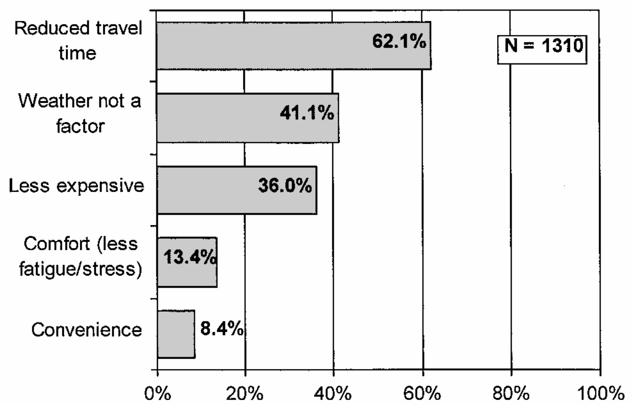

Fig. 8 Question 16, "what advantages does traveling by scheduled airline have over travel by GA aircraft?": top five responses.

frequently cited major advantage that the automobile and airlines held over GA travel was that weather was largely eliminated as a factor in traveling by those alternative modes (Figs. 7 and 8). Only the most extreme weather conditions, for example, severe icing, blizzards, were noted by survey participants as barring travel by automobile or airline.

Attempts to mitigate the reliability risks associated with weather may actually reduce the overall value of GA transportation. Even with sophisticated in-cockpit weather information, certain types of weather still cannot be safely traversed in the typical single-engine piston aircraft indicated by the vast majority of those surveyed (Fig. 4). This leaves a principal mitigation strategy of seeking alternative modes of travel in case of degraded weather. Under some conditions, this strategy then couples the otherwise unrelated barriers of weather and expense, having the effect of further reducing the overall value of GA travel. One scenario for risk mitigation, articulated here, is planning for use of the commercial airlines if adverse weather prevents reliable GA travel.

Consider, for example, that GA is the preferred travel mode for some given trip several weeks in the future. The ability to complete the trip on a schedule (date and time of day) is required, but the weather on the day of the trip is currently uncertain, thus making the trip by GA aircraft a risky proposition. The individual mitigates this risk by planning to take a commercial airline flight if the weather is bad enough on the day of the trip to prevent reliable GA travel. The question then becomes "at what point does the individual purchase an airline ticket, and what type of ticket is purchased?" Mitigating the risk due to reliability is now coupled with travel expense because there is a temporal variation in airline ticket prices. The variation of ticket price with days of advance purchase was studied for several of the top 1000 airline origin and destination pairs in North America.[7] These data indicated that, under current airline pricing models, tickets purchased 5 days in advance can be from two to five times more expensive than tickets purchased 30 days in advance.[6] The ability to plan travel in advance is, thus, key to the commercial airlines' cost advantage over GA travel, whereas the cost of GA travel is relatively invariant with the amount of advance planning.

Is the risk of purchasing more expensive tickets five or ten days in advance, when the weather forecast is more certain, outweighed by the possibility of not having to purchase any airline tickets and being able to travel by GA aircraft? The threshold for delaying this decision likely varies with the individual and is based on their risk tolerance. A similar argument may be made regarding the decision to purchase more expensive, refundable airline tickets in the hopes that the weather will permit GA travel and that the ticket price may be refunded. Regardless, under this contemplated scenario, the overall utility of GA travel will be adversely impacted due to the higher expense of considering the transportation mode. If risks due to adverse weather are to be mitigated, the risk of higher costs may grow.

Expense

In the survey, responses largely focused on the cost disadvantages of traveling by GA. Expense of the travel mode was surpassed only by weather as a major consideration in choosing among various travel modes for any trip (Fig. 5). Over 35% of those taking the survey mentioned the expense of traveling by GA as a major reason for choosing an alternative travel mode for their trips (Fig. 6). In addition, when asked what the most important things were that could be done to improve the utility of GA transportation, the most frequently mentioned issue was a reduction in the costs of flying GA.[6]

Alternative travel modes were also perceived as holding a lower-cost advantage over GA, at least at certain trip distances. When asked what the major advantages of airline travel were when compared to GA travel, lower costs were cited by 36% of those responding (Fig. 8). Likewise, 33% responded that lower costs were a major advantage held by automobile travel when compared to GA travel (Fig. 7). As already mentioned, the ability to plan ahead is key to the airlines' cost advantage. In all cases, the airlines were viewed as the lower-cost mode for longer travel distances, whereas the automobile was cited for shorter trip distances.

These results raise important questions regarding what costs can be reduced to most effectively improve GA utility and at what trip distances GA travel holds the cost advantage. Development of a simple travel mode choice model can aid in answering these questions.

Mode Choice Model

A model was developed to aid in illustrating how travelers make choices between available transportation modes for trips. Only three modes will be considered in this model because the survey data indicated that only the automobile, commercial airlines, and GA were considered for travel by the majority of those taking the survey.[6] Traveler preferences for the three transportation modes are considered in this model as they are influenced by the relationship of speed (or time), travel distance, and price. The total price of a trip via any given transportation mode is treated as a linear combination of the trip cost (dollars) and the elapsed trip time (hours) multiplied by the traveler's value of time [(VOT), dollars per hour]:

$$P_{\text{total}} = \text{cost} + \text{time} \cdot \text{VOT}$$

The cost of travel could include factors such as airline tickets and the price of gas for a car, plus amortized insurance and finance payments, as well as maintenance fees. The elapsed trip time would include the travel time, for example, gate-to-gate time for commercial airlines, as well as time spent accessing the transportation mode (driving to the airport or to the highway entrance), checking baggage, etc. Note that both costs and time will be used in the model for one-half of a round trip, that is, one-way travel either to or from a destination. The traveler's value of time is an equivalent monetary value assigned to a unit of time, for example, \$20/h. The value of time will, as one might imagine, vary among individuals and even

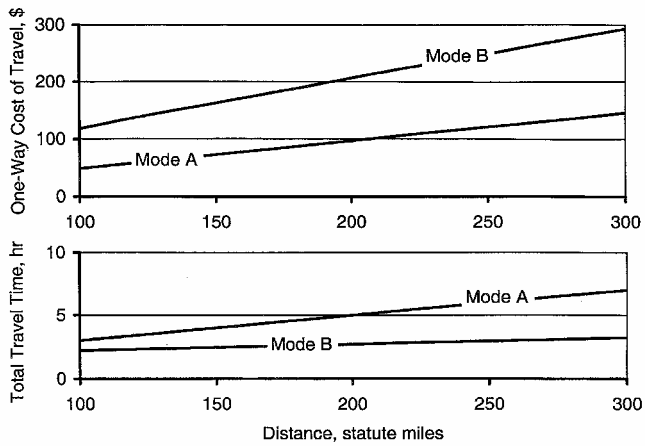

Fig. 9 Total cost and travel time for two sample modes.

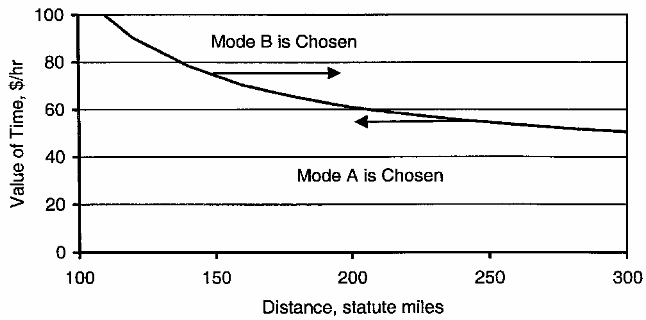

Fig. 10 Mode choice model results for two sample modes.

vary for one individual with the time of day and activities at hand. Transportation economists tend to treat VOT as equivalent to the individual's hourly income, but this disputable issue will be avoided here by treating VOT parametrically.

The point at which the traveler is indifferent between two transportation modes is when the total price of the modes is equal:

$$C_{\text{mode A}} + T_{\text{mode A}} \cdot \text{VOT} = C_{\text{mode B}} + T_{\text{mode B}} \cdot \text{VOT}$$

Treating the traveler's VOT parametrically, the mode choice model then determines the VOT (in dollars per hour) at which the traveler is indifferent between the two modes:

$$\text{VOT} = \frac{C_{\text{mode A}} - C_{\text{mode B}}}{T_{\text{mode B}} - T_{\text{mode A}}}$$

Both the total costs and total time will vary with travel distance, so that the VOT for indifference between two modes will vary with travel distance as well. For example, if the costs and time for travel by mode A and mode B are as shown in Fig. 9, then the VOT for indifference between the two modes is that shown in Fig. 10. It is simple to show that, although mode B is the more expensive travel option at all distances, for a VOT of \$60/h mode B becomes the preferred transportation choice for travel distances greater than approximately 200 miles due to its lower overall price of travel. Mode B's overall price is lower beyond 200 miles because of its superior speed. In other words, mode B has greater utility to the \$60/h VOT traveler, based on this simple model, for trips beyond 200 miles. In this manner, the mode choice model illustrates how important the relationship between cost and travel time (or speed) can be to overall utility.

Indifference lines may be determined for the three modes under consideration and directly compared, as shown in Fig. 11. The light gray lines (also with text superimposed over them) indicate portions of the indifference line that are irrelevant and may be deleted. The results in Fig. 11, based on the costs and travel times shown in Fig. 12, will be used as a baseline for later comparisons (with the extraneous lines deleted).

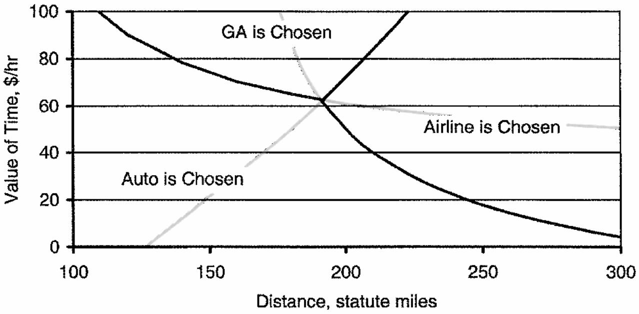

Fig. 11 Mode choice model results for automobile, airline, and GA.

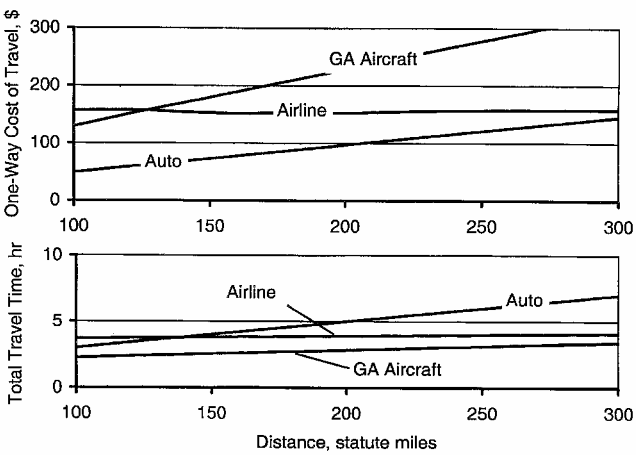

Fig. 12 Total cost and travel time for automobile, airline, and GA.

The airline data in Fig. 12 is based on sample airline ticket prices and gate-to-gate travel times for round-trip travel between city pairs listed in the top 1000 origin and destination pairs in North America,[7] as published by the airlines in July 2001. Additional time has been added to the gate-to-gate travel times to account for travel to and from the airport, baggage check in, and airplane boarding, as well as airplane taxi and maneuvering within the air traffic control system (the latter two factors based on data by Roskam[8]).

The costs in Fig. 12 to drive an intermediate sized car, estimated by the American Automobile Association,[9] are 10.8 cents per mile for variable costs such as gas, maintenance, and tires, plus an additional 37.63 cents per mile for fixed costs such as insurance, registration, taxes, license, depreciation, and financing. Automobile travel time was based on an effective travel speed estimated at 50 mph, accounting for an average highway speed of 65 mph reduced by the degree of circuity of any given trip. (Straight-line distances cannot typically be driven between the trip origin and destination.) Additional time was added, as with airline travel, to include factors such driving from the trip origin (a house or place of business) to the highway entrance, putting gas in the car on the way to the highway, and routine preventative measures such as airing up the tires. Naturally these estimated costs and travel times may vary according to the individual traveling, but the model described here will be used only to illustrate the issues at hand qualitatively.

For Fig. 12, representative costs were also estimated for a 160-kn single-engine piston GA aircraft, based on data available in Refs. 10 and 11 and the methods described by Roskam.[8] Similar costs for a 190-kn single-engine piston and 200-kn twin-engine turboprop are also shown in Table 1 and used later in this analysis. See Downen[6] for greater detail on the costs and travel time for each of the three transportation modes considered.

Changing the GA Business Model

Return to the questions at hand: What costs can be reduced to most effectively improve GA utility, and at what trip distances does GA travel hold the cost advantage? It is obvious from the mode choice model that these two issues are closely related. Responses to survey questions indicate that cost is an ill-defined concept for most of those surveyed. Item awareness for major transportation costs studied in the survey suggests that most pilots consider the same top three factors in their costs for both automobile and GA travel: fuel/oil, maintenance, and insurance.[6] When asked in the survey to specify which costs were acting as the major barriers to GA utility, answers varied widely with no clear majority in any category (Fig. 13). This would suggest that perhaps pilots consider many or most costs associated with GA travel as major barriers.

An estimate of GA aircraft costs for the mode choice model shows that the fixed costs of aircraft ownership (insurance, financing, hangar fees, etc.) are significantly higher than the variable costs (fuel, oil, and maintenance), ranging from 40 to 100% higher in the cases examined (Table 1). Instead of focusing on one source of GA travel expense for mitigation of the cost disadvantage, reducing the fixed costs through sharing of the costs (joint ownership) and/or increasing utilization (annual hours) would seem to be the best near-term strategy for effective reductions in overall expenses. The mode choice model can illustrate how this would affect the utility of GA travel. The change in utility between sole ownership of a GA aircraft and a two-person partnership (fixed costs evenly split) is shown in Fig. 14. The model shows a significant increase in the distance and value of time over which GA becomes the transportation mode of choice. General aviation has higher utility to a larger traveling population over a greater range of trip distances. If the annual utilization of the aircraft had also been increased in Fig. 14 (based on two people now using the aircraft more often than one alone) the utility would have been further increased due to spreading

Table 1 Representative costs associated with three types of GA aircraft[a]

High speed cruise (KTAS)	Single-engine piston 160 kn	Single-engine piston 190 kn	Twin turboprop 200 kn
Purchase price, $	200,000	290,000	550,000
Annual usage, h/yr	400	400	400
Insurance, $/yr	4,000	5,800	11,000
Depreciation, $/yr	16,000	23,200	44,000
Hanger, $/yr	600	600	600
Financing, $/yr	19,260	27,927	52,965
Total fixed costs, $/yr	39,860	57,527	108,565
Total fixed costs, $/h	99.70	143.80	271.40
Fuel and oil, $/h	30.00	30.00	66.00
Maintenance, $/h	40.00	40.00	99.00
Total variable costs, $/h	70.00	70.00	165.00

[a]See Refs. 8, 10 and 11.

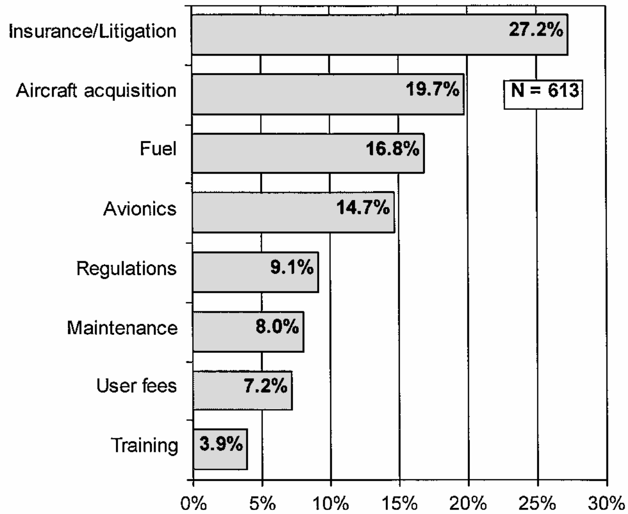

Fig. 13 Question 19, "what are the most important things that could be done to reduce barriers to general aviation travel?": specific areas cited for cost reduction.

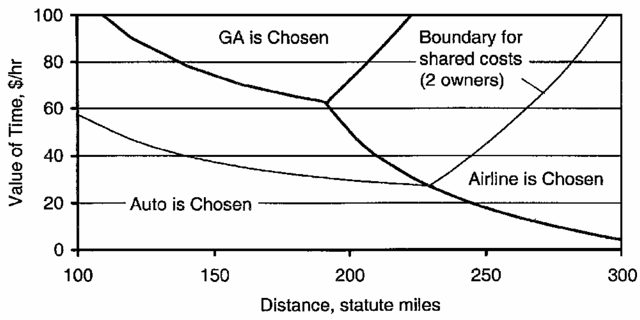

Fig. 14 Mode choice with shared fixed costs.

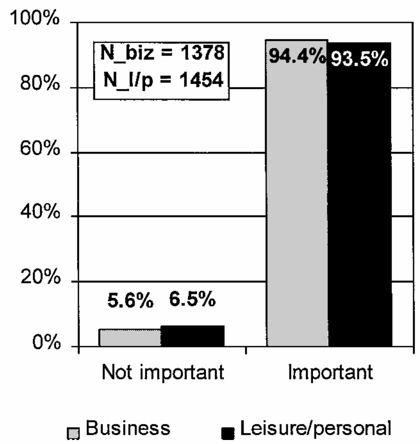

Fig. 15 Question 10, "For business and leisure/personal trips, how important to you are the following issues in choosing your mode of travel?": issue of mobility at destination answer.

the fixed costs out over a greater number of flight hours. Sharing of fixed costs and increased utilization is often cited as the basis for the recent astonishing growth in popularity of fractional ownership programs for larger, more expensive jet aircraft.

Note, however, that most of those surveyed were not taking advantage of the benefits of shared costs. Over 45% of survey participants indicated that they wholly own their aircraft whereas only 13% share an aircraft through a partnership with one or more people or through a formal fractional ownership program.[6] In addition, of those surveyed nearly one-third indicated that they typically rent their GA aircraft. Although aircraft rental does spread fixed costs among several users to some extent, profit requirements increase rental fees and, as some survey participants indicated, overnight charges are often prohibitive, thus reducing the utility of the aircraft for longer duration trips.

Mobility at the Destination

The ability to access ground transportation to complete a trip is an important factor in choosing the travel mode. Nearly one-in-four of those who took the survey identified the availability of transportation at their destination as a major consideration in choosing their mode of transportation (Fig. 5). This included access to public transportation, taxis, or rental cars. Also under consideration was the cost of the transportation (often mentioned as being higher at GA airports than equivalent transportation at commercial airports), as well as reduced access after business hours and on weekends. The importance of ground transportation was reinforced by mobility at the destination being rated as an important factor in choosing travel mode by over 90% of those responding to survey question 10, regardless of travel purpose (Fig. 15). In addition, the issue was rated as very important by over half of those indicating that it was an important issue.[6]

Mobility at the travel destination is elevated as an issue because survey responses also indicate that a lack of ground transportation is resulting in decisions to travel by modes other than general aviation. Poor transportation from GA airports to the final travel destination was mentioned as a major reason for choosing against GA travel by 15.2% of those responding to the survey (Fig. 6). Responses indicated that the automobile was favored over GA for shorter trips because ground transportation was inherently available. For longer trips when the automobile is not practical, the commercial airlines were considered superior to GA because access to ground transportation was typically better, that is, more accessible and less expensive, at commercial airports. In addition, the most frequently cited advantage of traveling by automobile when compared to GA aircraft was that travelers would have ready access to ground transportation at their destination (Fig. 7).

Mobility at the destination is likely not an obvious issue to industry proponents and policy makers seeking to improve the utility of general aviation transportation. However, note that the inability to complete the last few miles of any given trip can overcome any superior value of using GA as a transportation mode.

Doorstep-to-Destination Travel Time

The total travel time is important to choosing the transportation mode. A unique characteristic of this issue is that it can both work for and against GA travel because travel time varies with travel distance as well as with the speed of the transportation mode.

The travel time was surpassed only by weather and travel expense as a major consideration in choosing among the various modes of transportation (Fig. 5). In this and other questions, it was apparent that many of those surveyed were considering the total doorstep-to-destination travel time, which may include factors such as driving to the airport, waiting in lines to check in, and preflight activities for GA. Travel time was also rated as an important factor in choosing travel mode by most of those responding to survey question 10, regardless of travel purpose (Fig. 16).

The major advantage of general aviation travel identified in the survey was that it was faster, overall, than the automobile and commercial airlines, but only for a limited range of trip distances. This is demonstrated qualitatively by the mode choice model and raises the duality of total travel time as both an advantage and disadvantage of GA travel depending on the distance traveled. Survey respondents generally indicated that they were cognizant of this duality when answering all survey questions pertinent to travel time. For shorter travel distances, the additional time involved with preflight planning and preparation for travel by GA caused many to favor travel by automobile. At longer distances, those surveyed noted that the airlines were able to fly faster than the GA aircraft available to them, so that the total travel time was reduced in favor of the commercial airlines. The exact travel distance limits of where GA is the preferred mode of travel will be highly dependent on the cruise speed of the aircraft, as well as assumptions on required travel preparation times. Under the assumptions associated with creating Fig. 12, a 160-kn single-engine aircraft clearly has a travel time advantage over the entire

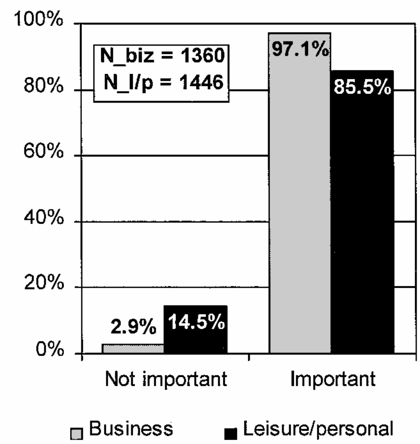

Fig. 16 Question 10, "For business and leisure/personal trips, how important to you are the following issues in choosing your mode of travel?": issue of total travel time answer.

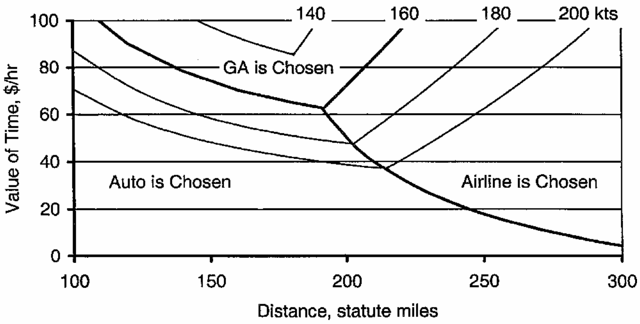

Fig. 17 Mode choice with increasing GA cruise speed.

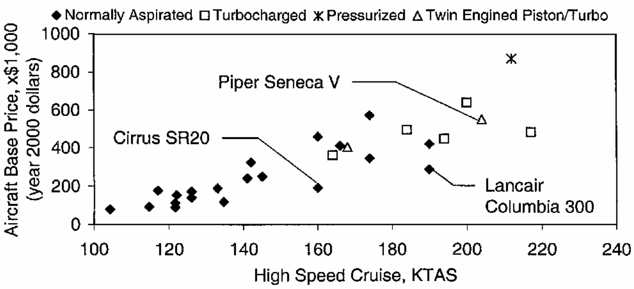

Fig. 18 Variation of GA airplane cost with cruise speed.

range of trip distances studied. When combined with cost factors in the mode choice model, Fig. 11 indicates that GA is the mode of choice for a more limited range of trip distances, depending on the traveler's value of time.

The value of increasing the cruise speed of GA aircraft to reduce the total travel time can be seen by using the mode choice model as well. The cruise speed of the single-engine piston GA aircraft was simply varied from 140 to 200 kn with resulting changes in the mode choice model shown in Fig. 17. The area over which the GA aircraft becomes the mode of choice increases significantly with higher cruise speeds under these assumptions. It would appear to be quite easy to increase the utility of GA transportation simply by making faster aircraft available.

The assumptions underlying the preceding analysis are too simplistic, however, and lead to the false conclusion that higher speeds directly increase utility. One must also consider that increased speed typically comes at a higher price, for example, purchase price, maintenance, insurance. The change in GA aircraft new purchase price with increasing cruise speed is shown in Fig. 18. Prices and speeds shown are those for actual aircraft quoted in Ref. 10, and three popular aircraft are identified in Fig. 18 for reference. Representative fixed and variable costs were calculated for three different types of GA aircraft (Table 1 and Downen[6]), including the baseline 160-kn single-engine piston, a 190-kn single-engine piston, and a 200-kn twin-engine turboprop. The new costs and speeds associated with these aircraft were used in the mode choice model and are shown in Fig. 19. (Note the expanded vertical axis scale in Fig. 19.) When only sole ownership scenarios for these aircraft are considered, the overall utility has been reduced for both aircraft once the higher costs of ownership offset the higher cruise speeds. Note that these are only representative examples and that under varying assumptions the aircraft utility may increase, but the underlying assumption that faster aircraft naturally have greater utility should at least be placed in some doubt by this simple example.

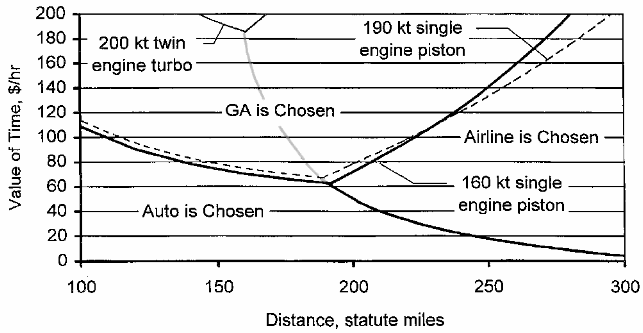

Fig. 19 Mode choice with increasing GA cruise speed offset by increasing airplane costs.

Conclusions

Four key issues were identified as important for improving the utility of GA transportation. Improved weather information and near all-weather capability is needed to increase the reliability of being able to travel on GA aircraft within a given schedule. Desired weather information included real-time information in the aircraft cockpit, as well as improved access to information on the ground. Strategies for mitigating diminished reliability due to weather, such as traveling by an alternative mode, can in some cases actually reduce the overall utility of GA travel by coupling the otherwise disparate key GA barriers of expense and weather.

Modifying the business model for owning and operating GA aircraft may be the best near-term strategy for lowering the expense of GA transportation. Sharing of fixed costs through fractional programs or partnerships, plus increased utilization of GA aircraft, can significantly improve the utility of the aircraft. Furthermore, better access to ground transportation at the travel destination would also increase the utility of GA transportation. Analysis with the mode choice model also indicates that increasing the speed of GA aircraft will not necessarily translate into an increase in the utility of GA transportation.

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