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AIR TAXI SAFETY STUDY

ADOPTED: SEPTEMBER 27, 1972

**NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591**

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16. Abstract <p>This publication contains the report of a special accident prevention study conducted by the National Transportation Safety Board to determine the level of safety in air taxi/commuter operations; to identify the safety factors involved; and to make any necessary recommendations to enhance safety in air/taxi commuter operations.</p> <p>This study contains a historical review of the air taxi industry, accident data, government regulation, results of a field investigation of a select number of representative air taxi/commuter operations, pertinent findings of a public hearing, and recommendations for accident prevention action.</p> <p>A bibliography and several appendices are included.</p>			
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SPECIAL STUDY

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I. INTRODUCTION

Five air taxi accidents claimed the lives of 39 people and seriously injured four others during the latter part of October 1971. These five accidents accounted for one-quarter of the accidents and 60 percent of the fatalities in air taxi operations during the first 10 months of 1971. One of the five accidents involved a Chicago & Southern Airlines aircraft which crashed while making an instrument approach to the Greater Peoria Airport in Illinois. During the course of the investigation, inquiries were made into some safety factors related to air taxi/commuter operations.

In view of a number of deficiencies and questionable practices disclosed in that investigation, and in view of the Safety Board's continuing concern for air taxi safety, the Safety Board announced on December 17, 1971, that it would conduct a special safety investigation of U. S. air taxi/commuter operations.

The Safety Board's concern was first expressed in a series of recommendations presented to the Federal Aviation Administration and the aviation community in March 1968. The following December, the Chairman stressed the Board's concern in a speech to delegates at the annual convention of the National Air Taxi Conference. Since then, the Board has conducted numerous air taxi/commuter accident investigations and held five public hearings in connection with these investigations. In each instance, safety recommendations were

presented to the appropriate organization or agency for consideration.

II. SYNOPSIS

The scope of this special study includes a review and analysis of air taxi accident data; identification of predominant accident causal factors; a review of current air taxi regulations; and an evaluation of a representative number of air taxi/commuter operators by means of on-site surveys. In addition, the Safety Board held a public hearing in Washington, D. C. to explore and develop factual data with Government agencies and representatives of the air taxi industry.

The Safety Board points out in this report that, because of the absence of certain basic data, it is not possible to compare the level of air taxi safety with that of other types of air transportation with any degree of statistical accuracy. Also, the Safety Board finds a number of dissimilarities between air taxi and certificated air carrier industries in regard to regulatory requirements and public expectations. This report discusses a number of regulatory and operational deficiencies found during the field survey of some representative air taxi operators. The Safety Board concludes that less stringent requirements result in a lower level of safety in the air taxi industry. Finally, the Safety Board makes a number of recommendations for enhancing safety in the air taxi/commuter operations.

III. BACKGROUND

A. The Air Taxi Industry

During the late 1940's, a new type of general aviation service -- the commercial hiring of small aircraft with pilot on a regular and recurring basis for various types of relatively short distance air transportation of people and things -- began to emerge as an identifiable segment of civil aviation. The nature of obtaining the service was similar to the hiring of a taxicab, hence, the identification as "air taxi" service.

For the most part, air taxi services were rendered on a demand basis in response to the needs of travelers and shippers for air transportation between small, outlying communities and larger, metropolitan areas served by certificated air carriers.

In the early 1950's the "air taxi" came into being as a separate entity rather than a part of a general aviation fixed-based operation.

Late in 1949, a small group of air taxi operators, whose main business was passenger service, met to organize the National Air Taxi Conference (NATC)¹ which was established in 1950. In an effort to promote this segment of the industry, the Civil Aeronautics Board (CAB) adopted Part 298 of the CAB's Economic Regulation, which established a new classification of air carrier known as the "Air Taxi Operator." Part 298 also exempted operators using small aircraft from certain sections of Title IV of the Act.² This permitted the air taxi operator to conduct scheduled service without any significant economic regulatory restraints. It recognized the limited impact of air taxi operators on certificated air carriers. Accordingly, the CAB did not impose the usual requirements for a Certificate of Public Convenience and Necessity, and related regulations. The CAB

recognized that costs resulting from such detailed economic regulations would inhibit the growth of the industry in that such costs would be borne ultimately by the air taxi passenger.

In the 1960's, the air taxi industry became a sizable component of the air transportation system. This prompted the CAB to make more regulatory changes. In 1969, Part 298 was amended to require the registration of all interstate air taxi operators with the CAB. Interstate operators also were required to provide evidence of public liability insurance coverage comparable to that of certificated, supplemental air carriers.

The CAB also established a class entitled "Commuter Air Carrier" which comprises air taxi operators who conduct at least five round trips per week between two or more points, publish flight schedules, or transport mail under contract with the U. S. Postal Service (USPS). The CAB required all commuter air carriers to file quarterly reports on their flight schedules and volume of traffic (passengers, cargo, and mail).

The continuing growth of the industry was evidenced in the 12-month period ending June 30, 1971, when the country's 161 commuter air carriers carried a total of 4.3 million passengers, 46.6 million pounds of cargo, and 82.2 million pounds of mail on some 700,000 flights.

By 1971, the commuter air industry was larger than the entire domestic airline industry in 1938.

B. Government Regulation

Federal Aviation Administration (FAA). The FAA is charged with regulating all air taxi operations. This includes certification of aircraft, and surveillance and enforcement of operations and maintenance standards through a network of FAA inspectors. Regulations governing air taxi operators of small aircraft are found in Part 135 of the Federal Aviation Regulations (FAR). These regulations include requirements for the carriers' organizational structure, administrative procedures, crewmember qualifications, aircraft, and equipment. Part 135 was

¹ In December 1968, the National Air Taxi Conference and the Association of Commuter Airlines merged to form the present National Air Transportation Conferences.

² Civil Aeronautics Act of 1938, as amended.

promulgated in 1964 to cope with the rapid growth of the air taxi industry. These and other related regulations have been amended on several occasions. The FAA is now considering an additional revision of Part 135 which proposes that commuter air carriers be governed by a separate section of the regulation. This section would contain more stringent regulations such as requirements for key management personnel, limiting the crew's flight time, defining management's responsibility, and denying certificates for previous noncompliance with regulations.

Apart from upgrading the regulations, the FAA is now in the process of taking other actions designed to improve safety in the air taxi field. A program is being implemented to provide for FAA financial-capability safety audits of all commuter air carriers using aircraft with 10 or more passenger seats and air taxi operators using large aircraft. Training programs are being structured for FAA inspectors assigned to air taxi/commercial operator activities. The FAA also has extended its System Worthiness Analysis Program (SWAP)³ and General Aviation Accident Prevention Program to include air taxi operators. Special emphasis is being placed on commuter air carriers, air taxi operators with interline agreements, and air taxi operators with a high volume of passenger traffic. Finally, the FAA has endorsed regional safety awareness meetings conducted by the NATC and will take part in future meetings.

Civil Aeronautics Board (CAB). The CAB has statutory responsibility for the economic regulation of interstate air taxi operators.⁴

On occasion, the CAB has granted exemptions to air taxi operators which permit them to use large aircraft. These exemptions are granted in cases in which there is a substantial demand for

air service which has not been met by certificated carriers. The CAB also has authorized the suspension of certificated air service at certain points and approved agreements for replacement service at these cities between the certificated carriers and the air taxi operators. Until recently the CAB in approving these arrangements made no determination with respect to whether the air taxi could safely operate the replacement service except to state that there was no evidence to show the air taxi had failed to meet the statutory requirements of Section 404(a) to provide safe service, equipment and facilities.⁵

However, by a Show Cause Order (72-9-39, September 12, 1972) the CAB in approving an agreement for replacement service of several air taxis for certificated service made a finding that the air taxis' service would not pose a safety hazard to the public. The finding was based upon an informal check by the staff with the FAA which only indicated that the air taxis' operations appear to be conducted in accordance with the applicable safety regulations. In our opinion, the CAB should be required to make a positive determination based on facts of record that the air taxi operator is capable of providing safe service to the public. An informal *ex parte* check with the FAA is not sufficient.

Currently, the CAB is considering several matters which could have significant impact on the future of the air taxi/commuter industry. For example, as part of its review of community air service requirements for northern New England, the CAB is considering substantial reliance on commuter carriers. This might take the form of certification and/or a subsidy for these carriers.

The CAB also has requested legislation which would permit it to provide federally subsidized air service to selected small communities for an experimental 3-year period. When the communities are selected and the type of air service

³ The SWAP procedure is an in-depth inspection system using audit techniques. Inspections are conducted by FAA teams qualified and trained for this function.

⁴ Conversely, the CAB has no jurisdiction with respect to air taxi operators which engage solely in either intrastate operation or in non-common carrier operations.

⁵ Civil Aeronautics Board Order 69-8-10 (August 4, 1969) and Order 69-4-137 (April 30, 1969).

specified, contracts for such services would be awarded on the basis of competitive bidding. Awards would be made only to operators who meet all the CAB and FAA requirements concerning safety and reliability.

United States Postal Service (USPS). The USPS currently has contracts or agreements with air taxi operators, awarded by competitive bidding, for regularly scheduled transportation of mail 5 nights a week over 147 routes. The use of air taxi service for carrying mail began in 1967 as an experiment to replace discontinued railway and highway post offices. In the initial years of the program, the USPS required postal air taxi operators to meet more stringent standards than those imposed by Part 135 of the FAR's particularly with respect to crew qualifications. In 1970, FAA revisions to Part 135, for the most part, equaled or surpassed USPS regulations. At the present time, USPS requires that postal air taxi operations be conducted in accordance with those sections of Part 135 relating to passenger safety standards. To aid in this effort, USPS established a safety program in 1969. This program provides for a USPS central safety officer and regional operating staff who conduct checks on operators to assure compliance with all air safety rules and regulations pertaining to the transport of mail.

States. The jurisdiction of State governments extends solely to intrastate operations of air taxi operators. Appropriate agencies of many of the states assert some form of regulatory control over air taxi operators. Some forms of economic regulation include certification, limited route protection, and requirements for demonstrated financial competence and minimum insurance coverage. A number of states also have safety regulations which are complementary to, or incorporate by reference, portions of the FAR's. Some states also employ inspectors to ensure compliance with state regulations. In recent years, state aviation departments have sponsored or cosponsored a variety of safety meetings,

seminars, and clinics to assist the air taxi industry.

C. Accident Statistics

Accident statistics relative to air taxi/commercial operations have been compiled by the National Transportation Safety Board since 1967. Similar statistics and records were gathered by the CAB from 1964-1967. These records were combined and are now available for the years 1964 through 1971.⁶

These statistics apply to all operations conducted under Part 135 of the FAR and include the commercial operators of small aircraft as well as the air taxi operators. This mix has been a matter of concern to the Safety Board as well as the air taxi industry. Of further concern has been the method by which flight hour exposure is obtained from air taxi operations. For example, the certificated trunk air carriers are required to report each month to the CAB the number of hours and miles flown including departures and passengers carried. From these figures, accident rates based on exposure are computed and published annually. This information is not available on air taxi operations. However, the Safety Board uses information provided by the FAA.

In air taxi operations, hours flown are estimated by the FAA based on a voluntary reporting system. This does not permit the Safety Board to identify and separate the air taxi from the commercial operator of small aircraft.⁷

In 1968, the Safety Board expanded the accident analysis system to incorporate a coding method for commuter air carrier passenger, cargo, and mail operations. Since hours flown is not a separate reporting requirement of the CAB

⁶ Attachment 5 - Accidents, Accident Rates and Fatalities/U. S. Air Taxi (All Operations) National Transportation Safety Board, May 10, 1972.

⁷ Attachment 4 - FAA AC Form 8050-73, Part 2 Activity & Related Information.

for commuter operations, accident rates are not available for category of operations.⁸

Commuter Accidents - Passenger/Cargo/Mail. In the 3-year period from 1968 through 1970, there have been 141 accidents, 35 of which resulted in fatal injuries. These accidents accounted for 47 crew fatalities and 112 passenger fatalities. Of those seriously injured, 19 were crewmembers while the remaining 42 were passengers. There were 45 aircraft destroyed and 94 others substantially damaged. Of the total of 141 accidents, 14 fatal accidents and 9 nonfatal accidents, resulted in fire after impact.

Commuter Accidents-Passenger. Commuter passenger operations accounted for 92 accidents in the 3-year period (1968-1970). All the accidents involved fixed-wing aircraft, 9 single-engine and 83 multiengine aircraft. Twenty-four of these accidents resulted in fatal injuries and 8 accidents resulted in serious injuries. Of the 24 fatal commuter passenger accidents, 19 occurred in reciprocating engine aircraft and five in turboprop aircraft.

In all, these accidents resulted in the loss of 146 lives, 32 crew, 112 passengers and 2 bystanders on the ground.

Commuter Accidents - Cargo/Mail. In commuter cargo operations, there were 49 accidents. Eleven of these resulted in fatal injuries to 15 crewmembers and five resulted in serious although nonfatal injuries. All 49 accidents occurred in fixed-wing, propeller-driven aircraft, 46 in aircraft equipped with reciprocating engines and 3 in aircraft equipped with turboprops.

From August 1967 through March 1970, there were 39 accidents in commuter mail operations. Fifteen of these 39 accidents resulted in the loss of 22 lives.

D. Field Survey

Prior to making the field survey, the task force undertook to identify the Part 135

⁸ Appendix D, Statistics 1968-1970/Scheduled Passenger and Cargo Accidents.

certificate holders and determine who was engaged in air taxi operations. Due to the relatively high turnover of certificates, this information was not available in any one place. Preliminary FAA data, as of January 1972, indicated 3,084 air taxi/commercial operator certificates were outstanding. Civil Aeronautics Board registration showed 128 certificates held by commuter air carriers and 1,384 operators engaged in on-demand air taxi services. The type of service provided by the remaining 1,572 operators could not be identified.⁹

The task force developed a typical profile of the Part 135 operator. Initial examination of air taxi certificate holders revealed that the entire spectrum of the small aircraft industry was represented, from the one man-one airplane air taxi operator to the large commuter who transports thousands of passengers annually.

A Safety Board survey team then visited 14 representative air taxi operators throughout the United States and Puerto Rico. Those visited included air taxi operators who were engaged in scheduled services, mail operations, and passenger/cargo charter operations.

During the field visits, management, operations, and maintenance personnel were requested to express their views regarding safety in air taxi/commuter operations. In addition, several FAA GADO's were visited.

In order to obtain a typical profile of the various types of air taxi operators and to assure an adequate geographical mix, the country was divided arbitrarily into six regions with Puerto Rico included in the Southeastern region.¹⁰ Operators visited within these regions were selected at random.¹¹

⁹ Attachment 1 - Air Taxi Commercial Operators. Source: CAB March 1972.

¹⁰ Attachment 2 - NTSB Field Survey Locations.

¹¹ Attachment 2 - Geographical Distribution/Air Taxi and Commuter Operators.

These operators included three air taxi charter operators, five small and four large commuter carriers and two air mail operators. Appendix A presents results of the field survey.

The National Transportation Safety Board recognizes that this random selection of air taxi operators is a small portion of all Part 135 certificate holders and the Board does not attempt to infer any statistical conclusions based upon this survey.

Public Hearing

On May 1, 1972, the Safety Board announced that it would hold a public hearing as part of the investigation into safety in air taxi/commuter operations. The hearing was held in Washington, D. C., May 15-17, 1972.¹² The full five-Member Board served as the Board of Inquiry, with the Safety Board Chairman presiding.

Five governmental agencies directly involved with aviation regulation and safety, six organizations with interests in the air taxi/commuter industry, and seven air taxi operators representing a cross-section of the industry were participants in the hearing.

The representatives of these organizations were given an opportunity to express their views on:

- ° Their organization's assessment of safety in air taxi/commuter operations;
- ° What their organization has done, is doing, and plans to do regarding safety in air taxi/commuter operations; and
- ° What recommendations are proposed by their organization for others to act upon to enhance safety in air taxi/commuter operations.

IV. DISCUSSION

A. Commuter Air Carrier Market

Commuter air carriers are an outgrowth of the air taxi segment of the general aviation industry.

These carriers are developing a variety of markets and, thereby, gaining public recognition as a vital part of the national transportation system. Many routes which are potential commuter markets are unproven. One of the basic characteristics of the air taxi industry is its flexibility to move into and out of markets. This also is one of the underlying problems confronting the management of the present commuter system. Overexpansion by some of these air carriers and the dilution of profitable markets by competition have led to the demise of many commuter air carriers.

The majority of commuter air carriers believe that there is a need for route protection in the form of limited certification if the industry is to attain stability and become profitable. Their opinions are not unanimous, however, and the basic question of state or federal route award remains unanswered. The successful operator seeks some type of protection whereas the less stable operator would like to retain the flexibility of a free market until his profitability is assured.

Commuter managements remain concerned that route certification would be related to subsidy programs and they are undecided as to the positive benefits that would accrue. They recognize that state route authorization may be challenged by interstate carriers because interline agreements place commuter air carriers in the interstate class of common carriers.

The executive vice president of one of the large commuter air carriers suggested during the public hearing that route and franchise protection should accompany commuter certification so that adequate financing may be obtained. This official advocated subsidies for certain types of service, such as high-frequency nonstop or one-stop service. He said that periodic semi-confidential financial reports should be required of commuter air carriers and he advocated separating commuter operations from on-demand air taxi operations for regulatory purposes under FAR Part 135. This witness also stated that the commuter industry is being ostracized because "there are people jumping in that don't have

¹²Appendix B - Public Hearing, Safety in Air Taxi/Commuter Operations, Washington, D.C., May 15-17, 1972.

financing, don't have the equipment, don't have the expertise, and they are cutting corners"

Subsidies to the commuter industry were viewed differently. Some type of subsidy was considered necessary by most operators, but there was no general agreement as to the form a subsidy should take. One commuter president stated that there should be no federal subsidies, but that a commuter airline should make every effort to obtain community subsidy.

B. Federal Aviation Regulations

The commuter airline industry as it exists today was not envisioned when FAR 135 was adopted. Many people associated with the industry believe that regulations pertaining to commuters are "awkward and confusing." They believe the lack of clarity in Part 135 leads to varying interpretations and enforcement actions in different FAA districts. Many operators—commuters and air taxi alike—believe that FAR 135 should be redrafted. In their opinion, the industry has outgrown the conditions for which the regulation was originally written. The "umbrella" of this regulation covers too wide a range of operations and is considered inadequate.

The commuter air carrier uses both scheduled and general aviation procedures and practices. While these air carriers adhere to FAR 135 as a basic regulation, some carriers also have adopted provisions of the FAR 121, which govern all certificated air carriers. However, the commuter segment of the air taxi industry reports considerable difficulty with interpretations of the Federal Aviation Regulations. The portion of the air taxi industry comprised of the on-demand certificate holders is operating satisfactorily.

Referring to the FAR's, an executive of one of the organizations stated: "We believe there is a need for more stringent regulation of flight dispatch and flight following by the operators themselves. New operators should be requested to demonstrate adequate management, opera-

tions and maintenance capabilities, including financial resources

"Active enforcement of existing economic and safety regulations is recommended, with more vigorous monitoring of operations by the General Aviation District Offices when their resources so permit

"Maximum crew duty limits should be established and enforced, and the system of penalties imposed on violators of FAR's should be standardized. All pilots carrying passengers should hold current instrument ratings."

An official of a large commuter air carrier advocated close scrutiny of those who propose to enter the commuter field to ensure safe, efficient, and economically sound operations.

C. Financial Structure

The air taxi/commercial operator certificate holder who performs on-demand services usually does so in connection with his aircraft sales division, flight school, and/or an approved maintenance facility. The commuter airline, in most cases, has been an outgrowth of such on-demand service. However, commuter airline ownership has developed from a number of nonaviation sources and there are indications that even more nonaviation interests will enter the commuter field. Many of these commuter carriers have been organized as independent ventures by other business interests which have employed aviation personnel to conduct their commuter businesses. Operations and maintenance departments observed in the field are restricted by budgetary limitations when the carrier's profits are marginal. Moreover, safety priorities are strained when administrative and operational management is controlled by one person.

In uncertain markets, lack of managerial ability to project costs and to predict revenues has threatened the existence of many commuter airlines. To survive — and many do not — management may compromise safety when company personnel, maintenance work, and training programs are reduced to subminimal standards.

In fact, the Safety Board's study indicates that the financial condition of air taxi/commuter air carriers is very closely related to the level of safety at which they operate. As one witness stated: "Any shortcuts or delays in maintenance, any shortcuts or nonstandard techniques or procedures used by pilots for reasons of economy, any tendency to utilize less-experienced pilots because they will work for lower wages, or to require pilots to fly excessive numbers of hours, are strong warning signals that an incident or accident may be developing."

Numerous operators are not adequately financed to withstand months or years of operating deficits. As one witness stated: "The missed or postponed inspection, the overdue part replacement, the too-long-on-duty crew-member are products of financial weakness in commuter operations, and safety is usually first to reflect this inadequacy."

The relationship between economics and safety was summed up by one witness at the hearing who said: "There is a direct connection, we believe, between a profitable operation and a safe operation."

D. Management

The management problems of an aviation company which offers scheduled services to the public differ from the management problems of an on-demand charter operator. However, the majority of commuter airline managements have general aviation backgrounds. The technical skills of flight operations and aircraft maintenance employees are adequate in the small-aircraft field, but management experience is limited. The average commuter air carrier staff has difficulty keeping records and preparing manuals. Many do not consider consulting outside sources in the industry to help solve their problems.

Delegation of authority and internal communications are restricted. A number of managers were not fulfilling their responsibility for developing and implementing policies and

procedures within their assigned areas. In some cases, there was evidence that established policies or regulations were not being supported by senior management.

One witness who represented a foundation which provides management audits of air taxi operators stated at the public hearing: "I found that the airlines that had strong management and good backgrounds in scheduled operation were the good operators, and those that had a shortage in management techniques were the marginal operators."

E. FAA Surveillance

FAA GADO's are responsible for the surveillance of commercial operations conducted under the provisions of FAR 135. Duties of principal inspectors within the district offices are complemented by on-site inspections conducted periodically by Systems Worthiness Analysis Program (SWAP) teams. New commuter carriers' need for operational management guidance can best be furnished by the FAA.

The task force found the SWAP team reports contain many deficiency notations on air taxi operators. Some of the deficiencies cited are lack of required records, inadequate training programs, insufficient explanatory material in company manuals, and imprudent maintenance procedures.

When commuters develop into mature, viable carriers, FAA monitoring of routine operations must be continued. In a survey interview, an FAA inspector remarked that his experience indicated that accidents were occurring not because of the lack of proficiency but because of the failure to follow procedures.

Many GADO principal inspectors are overburdened in their surveillance tasks with some GADO offices having to monitor 60 air taxi/commercial operators. In some instances, the inspector was assigned to an operator who conducted only a few charter flights a month. Another inspector at a different location was responsible for a commuter operation having several hundred flights each month.

Several commuter air carrier officials indicated that air taxi surveillance could best be performed under a system similar to the FAA's air carrier inspection program. While this suggestion may appear impractical, the proposal reflects the need to standardize the GADO's inspection function along the lines of the inspection function in Air Carrier District Offices.

Closely related to the need to adhere to approved operating practices is the question of dispatch function and aircraft release authority. The short-route segments and modern communications systems of commuter air carriers minimize the need for a dispatch function similar to a typical FAR 121 scheduled air carrier. However, there is a need for a system of checks and balances that will prevent the use of aircraft in less than satisfactory circumstances such as below minimum weather conditions, unairworthy aircraft condition, or improper flight and duty periods. In certain cases, the economic pressure has resulted in pilots relinquishing their regulatory command authority. Pilots told the survey team that in a great many cases the airworthiness of the aircraft was questionable, and that aircraft were being released to service with too many deferred maintenance items. A few pilots stated that they had been requested to operate an unairworthy aircraft in regular service, while other pilots objected to cancellation decisions made solely by management. Accordingly, the principal inspector must maintain close liaison with commuter air carrier management and flight personnel to prevent such situations from developing.

One operator, when asked whether there was a lack of standardization in the enforcement of FAR 135, replied: "The enforcement of 135, like the enforcement of any regulation, depends on the individual inspectors in the field, and it's no secret to anybody that some of them are good, some of them are average, and some are poor."

Numerous other operators contended that the provisions of the FAR which regulate the air taxi industry are "vague, disorganized, lacking in

objectivity, and incongruous." When this situation is combined with varying interpretations by many of the GADO's, the result is a lack of harmony or agreement between air taxi and FAA personnel.

F. Flight Operations

A wide range of flight experience and pilot qualifications was found among commuter air carrier personnel. Although the minimum aeronautical experience and knowledge of a commercial pilot may be less than that of an airline transport pilot, the flight environment of the commuter airline pilot is sufficiently demanding to require an equivalent level of piloting skill and competence. Significantly, the commuter pilot operates with a minimum of ground support personnel and preflight management.

Several commuters require the pilot-in-command to hold an airline transport pilot rating and have a minimum of 4,000 hours flying time. Some commuter air carriers, however, follow minimum qualification standards and competency is increased by on-the-job experience with little ground and flight training support. Some air taxi charter and commuter operators utilize part time or uncompensated copilots.

G. Flight and Duty Time Limitations

Commuter airline pilots' duties include numerous ground support activities in addition to piloting the aircraft. The pilots are called upon to perform some or all of the following ground duties: passenger and baggage handling; aircraft inspection and service; maintenance coordination; and flight dispatching. Although commuter aircraft are less complicated machines than those flown by the trunk and regional carriers, the commuter pilot operates in a more demanding environment. Weather involvement in conjunction with flight in "hub" areas places the commuter pilot in the same high density air traffic control environment as larger, certificated air carriers. The commuter pilot's fatigue over

the same time span is no less than that of a scheduled air carrier pilot.

The Safety Board's investigation disclosed that several commuter air carrier accidents were associated with high duty time. For example, the pilot of a commuter air carrier on a cargo flight which crashed during an approach had been on duty more than 13 hours at the time of the accident. During this time, his duties included loading cargo, servicing the aircraft, briefing on weather en route, flight planning, and performing night weather operations without the assistance of a copilot. The commuter pilots voiced common complaints that maximum flight and duty times were often exceeded and that required pilot rest periods were sometimes disregarded.

In another accident involving commuter passenger operations, extensive on-duty time, including 5-1/2 hours of flight time prior to the accident, probably resulted in the fatigue of both pilots and affected their judgment and decisions during the approach.

Several organizations expressed concern over the lack of weekly and monthly maximum duty and flight time limitations.

One witness whose association provides auditing and safety management assistance to air taxi operators stated: "We have audited airlines where four pilots exceeded 200 flight hours in one month and one of them flew 240 hours. On another, the average (monthly) flight time for all pilots for 10 months was 112 hours. On this airline, the chief pilot averaged 105 hours over the same period."

H. Training

Knowledge, experience, and skill form the basis of flightcrew proficiency. Training programs increase proficiency and facilitate standard crew-operating procedures. However, differences in training programs have resulted from different interpretations of regulations and carrier needs. Several commuter carriers have minimal requirements for flight checks and written tests. Some operators who are

authorized to conduct flights in accordance with FAR 135.77¹³ feel that a second-in-command pilot needs only minimum recurrent training. Accordingly, copilots assigned to such authorized flights usually need to demonstrate only three takeoffs and landings to qualify. Usually, little or no additional training is provided or required.

FAR 135.131 governs instrument check procedures of the pilot-in-command. This section prescribes in detail the maneuvers and procedures which the pilot-in-command must demonstrate satisfactorily every 6 months.

Prior to June 19, 1970, the second-in-command pilot was required to pass only a written or oral test once a year. No demonstration of competence in basic flying techniques or instrument proficiency was required. This section (FAR 135.138) was amended to require any person who serves as a pilot or copilot to pass an annual flight check given by the Administrator or an authorized check pilot.

However, the Safety Board found that some commuter airlines were not complying with the amended section of FAR 135.138, which requires initial and recurrent training of second-in-command pilots. The investigation also revealed that some commuter carriers are using part-time or unpaid copilots who are employed in full-time nonflying jobs elsewhere. These second-in-command pilots are usually low flight time pilots who are, in effect, on-the-job trainees. Their inexperience and irregular employment are not conducive to safe operating practices.

I. Flight Rules

FAR 135.75 and 135.99 explain in detail the conditions under which air taxi aircraft may be flown in restrictive weather conditions or when VFR over-the-top-carrying passenger conditions

¹³FAR 135.77 permits flights without a second-in-command if the aircraft is equipped with an approved autopilot system.

exist. Varying flight conditions, as outlined in these regulations, are difficult for a pilot to interpret and apply to a practical flight plan. These operating limitations were not understood by any air taxi operator or pilot who was questioned regarding their applicability.

There was a lack of agreement among the pilots as to interpretation and application of the regulations in marginal weather conditions. Because of interpretation difficulties, the pilots said that they avoid operating under conditions covered by these rules.

J. Air Mail Service

Air mail carriers identified Postal Service bidding procedures as a major problem in the commuter air mail industry. Under the present system, route awards are made to the contractor who submits the lowest bid.

One mail contractor said that many inexperienced bidders fail to account for basic costs when formulating bids and that to invite low bids was to invite nothing but problems. He pointed out that low bidding leads to cutting corners at the expense of safety. A Postal Service representative stated that the Service does not estimate costs or determine a minimum acceptable bid when advertising a route vacancy. Also, when a mail operator withdraws from his contract due to financial loss, the Postal Service does not take this experience into consideration in subsequent bid award procedures.

In many cases, the typical commuter air pilot operates independently from an originating point on the mail route which is remote from the contractor's main facilities. The pilot is responsible for coordinating airport facilities, aircraft maintenance, and hangar and refueling services. If the pilot becomes ill, substitute coverage by other contract pilots is difficult to obtain due to their relative inaccessibility. Dedication to his job, intermingled with fear of repercussions if flights are cancelled, may prompt the pilot to fly regardless of illness or fatigue. Extremely tight schedules increase his difficulties. The time allotted to perform routine

tasks of unloading, loading, and refueling often is not sufficient for proper maintenance and such extra duties as deicing service. The nighttime operation of air mail flights hampers the pilot's ability to arrange additional ground support at some airports. Route schedules are not changed seasonally to compensate for changing weather conditions. Route schedules also can limit the ground time available for necessary job functions.

Nevertheless, Postal Service air taxi accident rates have shown a steady downward trend since commuter airmail service was established in January 1967. In its first year of operations the accident rate for every 100,000 flight hours was 10.54 percent. This rate had declined to 4.9 percent by 1971. According to the Postal Service, the downward trend was due to stepped-up surveillance of air taxi operators by the FAA and the USPS.

K. Equipment Requirements

FAR 135 prescribes conditions under which a second-in-command pilot is mandatory. Although dual controls are required, there is no provision for appropriate flight and navigation instruments for the second-in-command.

L. Maintenance Management

One of the most perplexing maintenance problems is caused by the diversity of aircraft and equipment in air taxi/commuter services. The diversity of maintenance personnel qualifications and experience levels create another major problem. Aircraft and equipment range from small single-engine piston aircraft equipped with simple, basic communication and navigation systems to turbine-powered transports equipped with avionics suitable for instrument flight rules (IFR) operations.

The diversity of aircraft would not be a problem if maintenance personnel were adequately trained to perform scheduled maintenance and if they were supplied with sufficient

stores and equipment to replace worn, defective, or discrepant units.

Operators usually want to establish standards for the highest possible level of safety. However, the necessary expertise, financing, and personnel are not always available.

The expansion of the air taxi/commuter industry, coincident with an increase in all other aviation activities, has posed a problem of considerable magnitude within the FAA. Some FAA personnel expressed their concern that the current reduction in the number of inspectors has not been accompanied by a reduction in the overall workload. They believe that present manpower levels will not be increased in line with the increase in general aviation activities. FAA GADO personnel are general aviation oriented, and some have considerable difficulty in reorienting to large, commuter operations, especially to those that use large, turbine-equipped aircraft. Any reduction in the number of properly oriented FAA inspector personnel only compounds the problem faced by FAA inspectors and creates conditions adverse to safety.

The survey team found that increased FAA surveillance of the larger commuters created an increase in operators' awareness of their responsibility for safety. Such cooperation was not demonstrated by some of the smaller operators.

The exchange of safety information on service difficulties between the FAA and air taxi/commuter operators enhances safety significantly. Some air carriers have found that this exchange of information has been most beneficial to operators as well as to manufacturers and it ultimately leads to increased utility and reliability of equipment.

Most commuter air carriers employ technology used in general aviation. General aviation maintenance procedures are based on an annual inspection program supplemented by 100-hour checks.

Air taxi/commuter aircraft are relatively easy to adapt to a standard inspection procedure. However, aircraft used in air taxi/commuter

operations are becoming more complex and more difficult to inspect for airworthiness.

It is apparent that these procedures are becoming outdated, particularly with reference to new, large types of aircraft. As a result of these changes, FAA GADO inspectors must become familiar with commuter air carrier operations so they may provide more assistance to the operators during these formative years.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Based upon its findings during this investigation of safety in the air taxi/commercial operator segment of the general aviation industry, the Safety Board concludes that:

1. Background

- General aviation air taxi/commercial operators constitute an important segment of this country's air transportation system.

- Within the air taxi/commercial operator segment the commuter air carrier is developing at a rapid pace.

- The number of active U.S. air taxi/commercial operators is estimated to be 3,084.

- Air taxi/commercial operators range from one man one plane operation to the large, sophisticated commuter air carriers with multiengine, multiplane fleets that include turbine-powered aircraft.

- The rapid expansion of the commuter airlines does not permit stabilization within the industry and could prove detrimental in the establishment of safe practices.

- Air taxi accidents have persisted for several years and the associated loss of lives and property is a matter of grave concern to the future of the industry.

- Available data do not provide the means for meaningful comparison of the relative safety levels in air taxi/commercial operations

with other general aviation and certificated air carrier operations.

- Attention has been directed towards improving air taxi safety by the operators themselves, towards self-improvement by industry organizations, towards regulatory upgrading by the Federal Aviation Administration, and to recognition of the need for broader and stricter surveillance by the FAA and the CAB.

- Managerial, supervisory, financial, personnel, training and maintenance practices varied widely among the representative operators who were visited during the survey.

- Management, including directors of operation, directors of maintenance, and chief pilots, have varying degrees of experience ranging from substantial air carrier backgrounds to minimal management experience in their respective fields.

- Corporate type organization is evident in some commuter operations, with responsibilities assigned to well-qualified professionals. Others, however, are tightly controlled proprietorship and an individual, usually the president or senior company officer, makes all the decisions ranging from marketing to maintenance.

- Qualification requirements for management personnel do not exist.

2. Economics

- The assurance of financial responsibility of certificated holders is being introduced as a requirement to enhance safety.

- When a commuter air carrier's profitability becomes marginal, safety considerations and priorities are usually the first to be strained and compromised.

- The USPS air taxi mail contract bid procedures are in need of broader safety considerations.

- Few commuter air carriers have been able to sustain profitable operations. Economic policies have prevented subsidies for commuters.

- Commuter air carrier route protection is limited, resulting in unstable and uneconomic operations offering little benefit towards the maintenance of safety.

3. Operations and Maintenance

- There was a lack of clearly identifiable safety practices in the operation and maintenance functions of commuter air carriers surveyed by the survey team.

- Air taxi/commuter crewmembers usually have additional responsibilities for servicing, dispatching, flight planning, cargo handling and loading passengers in addition to their flight duties.

- Although air taxi/commuter flightcrew personnel operate less complex aircraft, these operations are performed in the same demanding environment as are trunk and regional carrier operations.

- Some air taxi and commuter operators utilize part-time or nonpaid crewmembers.

- Job security implications sometimes compel air taxi/commuter crewmembers to exceed flight duty and rest limitations set forth in current FAR 135.

- Mechanical reliability and defect report data are not compiled and disseminated among air taxi operators as is done within the certificated air carrier industry.

- No program has been established for air taxi operators to use manufacturers recommended overhaul and inspection hours for aircraft, components, powerplants, and propellers as a base line, in order to upgrade changes following submission of substantiating data to FAA.

4. FAA Surveillance

- The FAA surveillance and enforcement varied and in most cases was minimal due to two factors: insufficient numbers of assigned inspectors and the varied interpretations of the applicable rules.

- The FAA does not conduct periodic audits for financial capability in commuter air carrier operations as it does in certificated supplemental air carrier operations.

5. FAA Regulations

- Initial qualification requirements are not adequate to insure the proficiency of commuter airline pilots.

- The majority of air taxi operators have formulated satisfactory crewmember training curriculum. However the requirements for maintenance training programs were found to be marginal.

- Implementation of initial and recurrent training programs are considered marginal to establish and maintain proficiency of crew members.

- There are no daily, weekly, or monthly flight and duty time limitations provided for in FAR 135.

- There are no requirements in FAR 135 for minimum equipment lists, or limiting of continued flight with certain inoperative components.

- Application of FAR 135 is difficult to interpret and enforce due to the wide variations in both the operations being regulated as well as the variations in operator and FAA inspector interpretations of the regulations.

- The less stringent regulatory requirements placed upon the air taxi/commuter industry result in a level of safety lower than that of the certificated air carrier industry.

Recommendations

On the basis of the findings discussed in this report, the National Transportation Safety Board recommends that:

The Federal Aviation Administration:

1. Expedite redrafting of FAR 135 in its entirety, recognizing that commuter air carrier operators are

separate entities from the smaller air taxi charter operators. (Recommendation A-72-171)

2. Establish and maintain a separate listing of all current holders of air taxi operator certificates to permit the identification of each operator by type service being performed. (Recommendation A-72-172)
3. Expedite proposed programs to assure the financial ability of each commuter air carrier and air taxi operator holding interline agreements to conduct safe operations. (Recommendation A-72-173)
4. Amend FAR 135 to include qualification requirements applicable to the Director of Operations, Chief Pilot, Director of Maintenance, and Chief Inspector in all commuter air carrier operations. (Recommendation A-72-174)
5. Amend FAR 135 to provide that a qualified individual be delegated by each commuter air carrier to act in the capacity of safety officer and to monitor all safety aspects of the overall flight and maintenance operations. (Recommendation A-72-175)
6. Amend FAR 135 to require that the pilot-in-command in air taxi commuter air carrier operations hold a current Air Transport Pilot rating. (Recommendation A-72-176)
7. Amend FAR 135.127 to prohibit the use of part-time or nonpaid second-in-command pilots in commuter air carrier operations. (Recommendation A-72-177)
8. Amend FAR 135.136 to provide for daily, weekly, and monthly flight and duty time limitations. (Recommendation A-72-178)
9. Amend FAR 135.136 to provide that all flying, including private as well as commercial, shall not exceed the prescribed flight and duty time

- set forth in this section. (Recommendation A-72-179)
10. Amend FAR 135.75 and 135.99 to clarify the operating conditions and limitations for Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) over-the-top carrying passengers. (Recommendation A-72-180)
 11. Amend FAR 135.143 to include a minimum equipment list to include procedures for continuing flight with inoperative equipment beyond terminal point. (Recommendation A-72-181)
 12. Amend FAR 135.33 to include provisions for training and recurrent training for maintenance personnel and to ensure each person who determines the adequacy of work is fully informed about procedures and techniques. (Recommendation A-72-182)
 13. Amend FAR 135 to include a new section to ensure that each person who takes action in the case of a reported or observed malfunction of an airframe, engine, propeller, or appliance shall make, or have made a record of that action in the aircraft maintenance log. (Recommendation A-72-183)
 14. Amend FAR 135.119 to ensure that the pilot-in-command shall enter or have entered in the maintenance log of the airplane each mechanical irregularity that comes to his attention during flight. Before each flight, he shall ascertain the status of each irregularity entered in the log at the end of the preceding flight. (Recommendation A-72-184)
 15. Amend FAR 135.60 to ensure that each certificate holder shall have an aircraft inspection program acceptable to the Administrator. The certificate holders manual must

contain the program required by (a) of this section. (Recommendation A-72-185)

16. Established a standard program of utilizing manufacturers recommended overhaul and inspection times on aircraft components, and power-plants and propellers. (Recommendation A-72-186)
17. Monitor all manufacturers' maintenance manuals and encourage operators to utilize the information contained therein as it applies to the individual operator. (Recommendation A-72-187)
18. Standardize procedures for the compilation and dissemination of maintenance discrepancy information to all air taxi/commuter operations. (Recommendation A-72-188)
19. Standardize air taxi surveillance procedures and provide specialized commuter airline training to appropriate principal inspectors of General Aviation District Offices. (Recommendation A-72-189)
20. Assign a principal inspector, or inspectors, to commuter airlines, with primary duties of surveillance of the commuter, and secondary duties with the other segments of aviation. It is further recommended that General Aviation District Offices accelerate efforts to assure that FAR 135 certificate holders maintain training programs. (Recommendation A-72-190)

The Civil Aeronautics Board

1. Require all air taxi operators registered with the CAB, and designated as commuter air carrier, to report the hours flown, the miles flown, and the number of departures in scheduled revenue operations. (Recommendation A-72-191)

2. Require all air taxi operators so classified under Part 298 of the Federal Aviation Act of 1958, to report the number of passengers carried, the hours flown and miles flown, and the number of departures in revenue operations. (Recommendation A-72-192)
3. In proceedings involving the suspension of service by a certificated carrier and the substitution of service by an air taxi commuter operator, request of the FAA a written safety evaluation of such operator; make a specific finding as to the operator's safety fitness; and place the FAA evaluation in the public docket of such proceeding. The safety evaluation by the FAA should include all accident data concerning such operator available in the files of the NTSB. (Recommendation A-72-193)

The United States Postal Service

1. Assure that a successful mail contract bidder possess a history of acceptable operations. (Recommendation A-72-194)
2. Reevaluate the commuter airmail contract bid system to insure that carriers being considered demonstrate their capability to provide adequate weather reporting, maintenance support and airport facilities. (Recommendation A-72-195)
3. Reevaluate trip performance standards and sanctions as they relate to safety considerations peculiar to the varying environments in which commuter airmail operations are conducted. (Recommendation A-72-196)
4. Establish fair and expeditious rate adjustment procedures to assure that safety is not compromised by marginal profitability. (Recommendation A-72-197)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

Louis M. Thayer, Member, was absent, not voting

September 27, 1972.

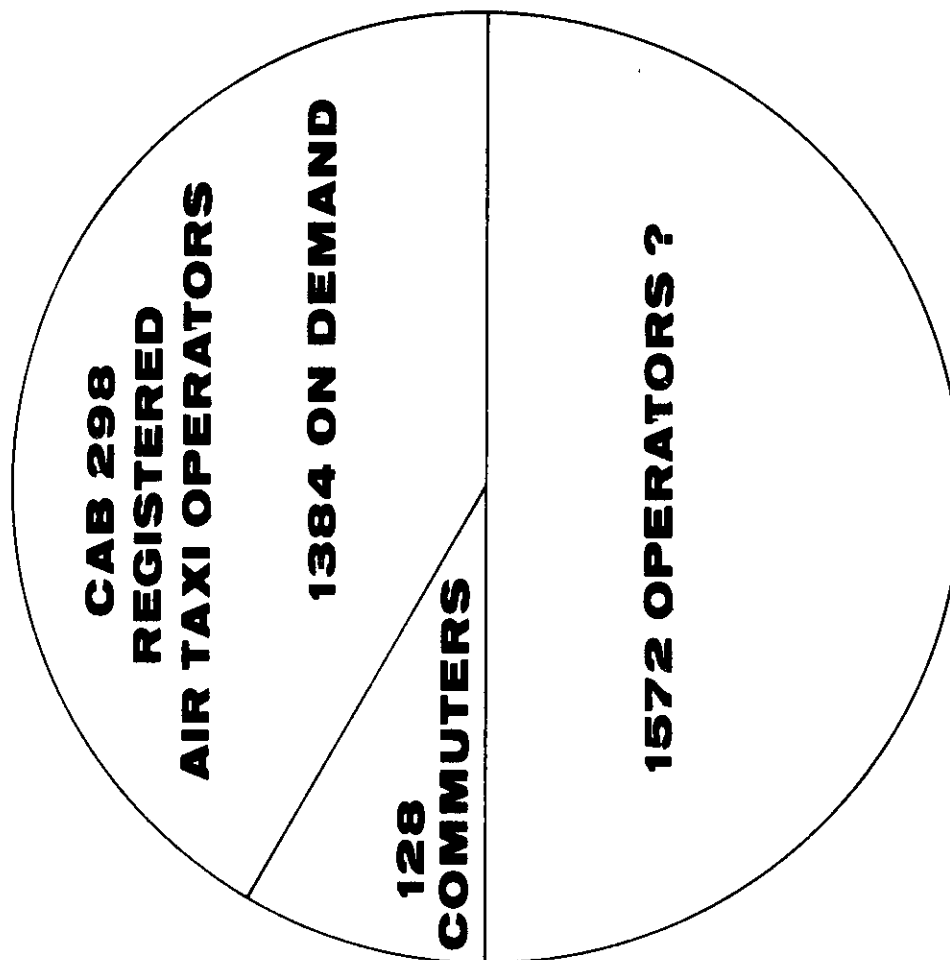
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**AIR TAXI
COMMERCIAL OPERATORS
FAR PART 135**

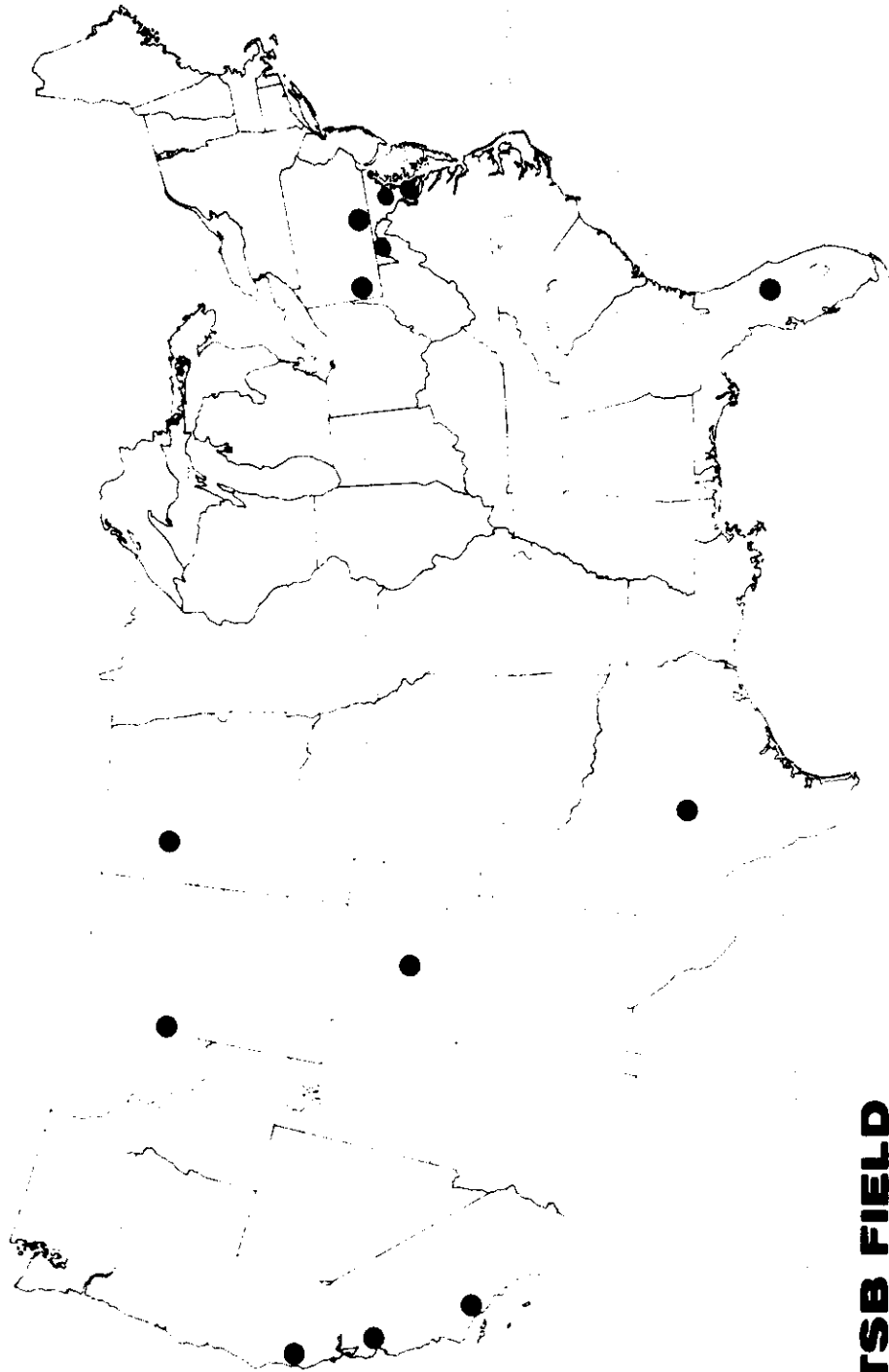


**SOURCE . CAB
MARCH 1972**

AIR TAXI/COMMUTER FIELD ACTIVITIES

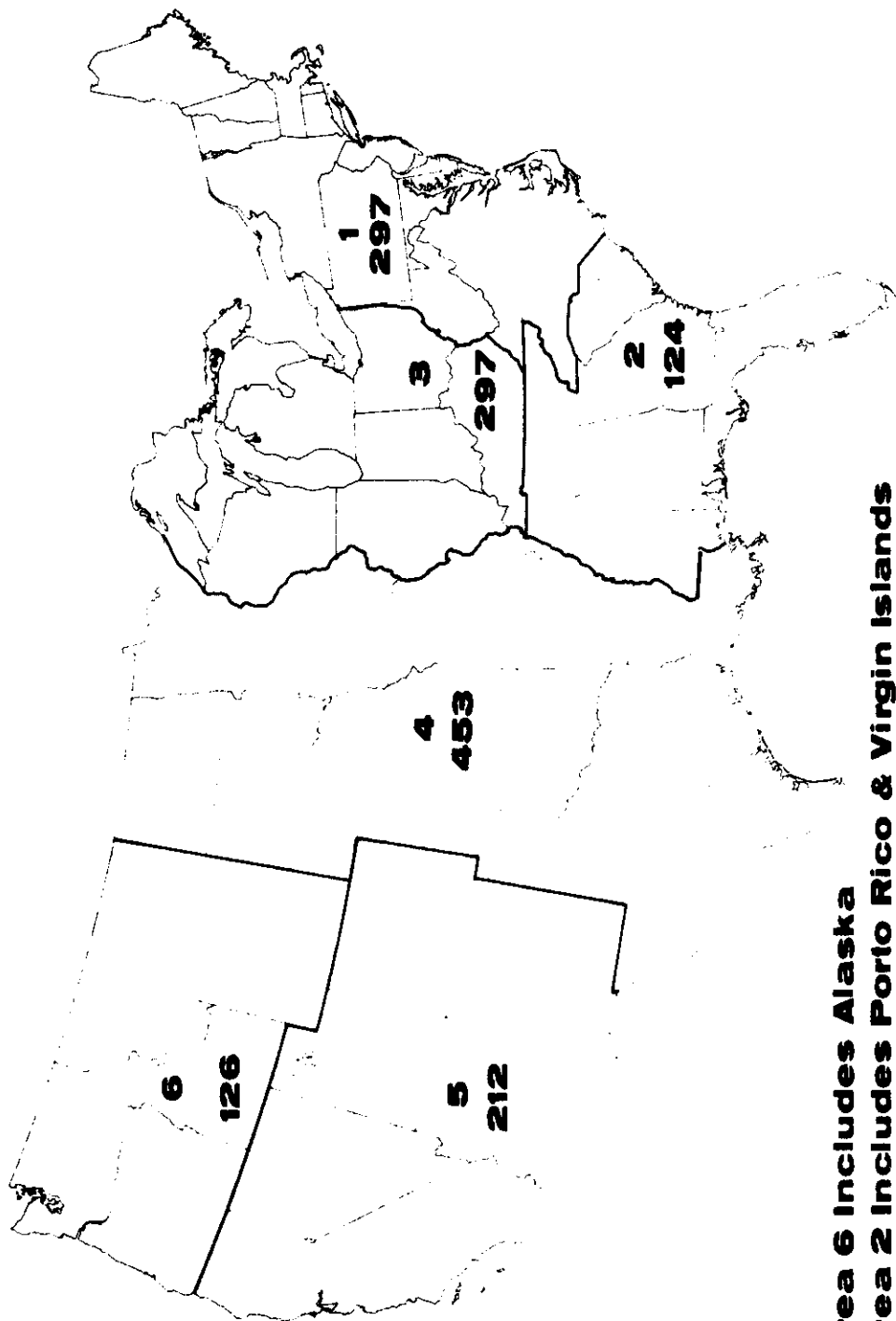
ATTACHMENT 2

• PR



NTSB FIELD
SURVEY LOCATIONS

GEOGRAPHICAL DISTRIBUTION AIR TAXI/COMMUTER OPERATORS



Area 6 Includes Alaska
Area 2 Includes Porto Rico & Virgin Islands
Area 5 Includes Hawaii

ATTACHMENT 4

Please read the instructions at the beginning of each part and on the reverse side before completing this form.	DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION AIRCRAFT REGISTRATION ELIGIBILITY, IDENTIFICATION AND ACTIVITY REPORT	FORM APPROVED BUDGET BUREAU NO 04-RC185
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PART 1—REGISTRATION INFORMATION *FAR 47.44 requires each owner of a U.S. registered aircraft to complete and submit this part of the form by July 1 in order to verify current eligibility for registration.*

A SIGNATURE Sign in (3) complete (5) if applicable and check (1) OR (2) For registration eligibility purposes, I/we, certify I am a, we are U.S. citizen(s) of not a governmental unit, we own the aircraft identified herein and it is not registered under the laws of any foreign country. OR I/we request that registration of the aircraft identified herein in my (our) name(s) be cancelled/registered. Please see reverse side and check reason: Aircraft Sold <input type="checkbox"/> Destroyed <input type="checkbox"/> Other <input type="checkbox"/>	(3) SIGNATURE (4) DATE (5) TITLE (if Partnership, Corporation or Governmental Unit. See reverse side for instructions)
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B OWNER (6) _____ (7) _____ (8) _____ If address is incorrect, please correct in Block E, below.	C REGISTRATION NUMBER Correct here (9) N— (10) N— D AIRCRAFT SERIAL NUMBER (11) _____ (12) _____ (13) _____
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E OWNER CHANGE OF PERMANENT ADDRESS (14) STREET ADDRESS (15) CITY (16) STATE (17) ZIP	F AIRCRAFT MANUFACTURER (18) _____ (19) _____ (20) _____ AIRCRAFT MODEL SERIES (21) _____ (22) _____ (23) _____ (24) _____
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PART 2—ACTIVITY & RELATED INFORMATION *FAR 91.51 requests each owner to submit the information indicated below. For aircraft operating under FAR 121 or 135, owner's name and title are required.*

H BASE AIRPORT OF AIRCRAFT (25) _____ (Correct below if changed) AIRPORT NAME (26) _____ CITY (27) _____ COUNTY (28) _____ STATE (29) _____	I ENGINE MFGR (30) _____ ENGINE MODEL (31) _____ ENGINE TYPE (32) _____ ENGINE POWER (33) _____
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J AVIONICS EQUIPMENT CAPABILITY COMMUNICATIONS EQUIPMENT VHF Receiver Capability Tuner 180 channels or less (34) <input type="checkbox"/> 181 channels or more (35) <input type="checkbox"/> VHF Transmitter Capability 20 channels or less (36) <input type="checkbox"/> 21 thru 180 channels (37) <input type="checkbox"/> 181 or more channels (38) <input type="checkbox"/> NAVIGATION EQUIPMENT VOR Receiver One (39) <input type="checkbox"/> More than one (40) <input type="checkbox"/> Distance Measuring Equipment (DME) Automatic (41) <input type="checkbox"/> Weather Radar (42) <input type="checkbox"/> Approved Area Navigation Equipment (43) <input type="checkbox"/>	RECEPTION CAPABILITY Localizer (44) <input type="checkbox"/> Glide slope (45) <input type="checkbox"/> Marker beacon (46) <input type="checkbox"/> TRANSPONDER EQUIPMENT 64 code (47) <input type="checkbox"/> 4096 code (48) <input type="checkbox"/> Altitude reporting (49) <input type="checkbox"/>
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K LONG TERM (3+ MONTHS) LESSEE OPERATOR IF NOT OWNER (50) CURRENT LESSEE OPERATOR'S NAME (51) STREET ADDRESS (52) CITY (53) STATE (54) ZIP	L HOURS FLOWN BY THIS AIRCRAFT JAN 1 DEC 31 LAST YEAR (55) EXECUTIVE/Corporate flying by professional pilots (56) BUSINESS/Individual flying for business purposes (57) PERSONAL/Individual flying for personal reasons (58) AERIAL APPLICATION: Agriculture, health, forestry, etc. (59) IN-FLIGHT TOWER/Excludes proficiency (60) AIR TAXI/Part of operation, including charter, etc. (61) INDUSTRIAL/SPECIAL: Patrol, survey, photo, etc. (62) AIRCRAFT RENTAL/BUSINESS (63) FLIGHT SCHOOL/Instructor, sport para, etc. (64) OTHER: Air show, display, etc. (65) IF AIRCRAFT NOT FLOWN LAST YEAR, CHECK HERE
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ACCIDENTS, ACCIDENT RATES AND FATALITIES
U. S. AIR TAXI
(ALL OPERATIONS)
1964 - 1971

YEAR	ACCIDENTS			FATALITIES				AIRCRAFT		ACCIDENT RATE PER 100,000 AIRCRAFT HOURS FLOWN	
	TOTAL	FATAL	PASSG	CREW	OTH	TOT	AIRCRAFT HOURS FLOWN*	TOTAL ACCIDENTS	FATAL ACCIDENTS		
1964	169	23	39	23	0	62	1,659,000	10.19	1.39		
1965	192	25	32	19	2	53	1,802,000	10.65	1.39		
1966	217	25	35	25	2	62	1,744,000	12.44	1.43		
1967	237	33	60	31	3	94	1,766,000	13.42	1.87		
1968**	179	46	59	48	4	111	1,999,000	8.95	2.30		
1969	207	29	105	36	1	142	2,238,000	9.25	1.30		
1970	187	37	50	41	5	96	2,293,000	8.16	1.61		
1971***	145	31	72	32	2	106	2,362,000	6.14	1.31		

* AIRCRAFT HOURS ESTIMATED BY FAA

** DEFINITION OF ACCIDENT CHANGED

*** PRELIMINARY DATA

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
MAY 10, 1972

APPENDIX
"A"
FIELD SURVEY

Air Taxi Charter

The Safety Board's survey team found general agreement among all three operators that there is a need for the redrafting of FAR Part 135 in order to separate the small air taxi operator from the larger commuter type carrier. Flight operations and maintenance were well organized and managed. One operator, however, had been engaged in air taxi services for only a short period of time and found the venture to be unprofitable. At the time of the team's visit, this operator was in the process of returning the ATCO certificate to the FAA, thus terminating air taxi service.

In addition to their air taxi services, two of the three operators also maintained the fixed base facilities at the airport and provided flight training, and maintenance and ramp services for transient aircraft. The team found that pilots and maintenance personnel of all three operators were well-trained and capable of performing their duties with an acceptable degree of safety awareness. There was, however, no standard method for the dissemination of maintenance and safety information, and liaison between the operators, the manufacturer and other operators of like equipment was limited.

Air Taxi Commuter - Small

Among the five operators visited by the Safety Board's survey team it was found that management and operation techniques varied considerably. One of the commuter carrier presidents, for example, was active as a line pilot, and the chief pilot and vice president of another carrier were regularly scheduled for duty as line pilots. Two of the five operators used part-time copilots, while another carrier used nonpaid copilots in scheduled operations.

Another operator was in the process of a complete reorganization of its management. New heavier aircraft were being procured that required a CAB exemption to Part 298 in order to be operated. Top-heavy and uncoordinated management resulted in an operation that appeared to be loosely run and continuing financial difficulties resulted in nonpayment of

salaries to crewmembers, mechanics, and certain management personnel for periods up to six weeks.

Another of the five commuters surveyed was found to be a well-directed and well-financed company. The commuter operation was only a small part of the company's overall activity which included flight training, aircraft sales and the management of a fixed base operation. The management was well-staffed, with authority delegated to the person responsible for each activity within the company.

The team found that two of the five operators' maintenance facilities were cluttered and unkempt. The turnover of qualified mechanics on one of these carriers was high and part-time maintenance personnel were used to perform aircraft checks on the week-ends.

Spare parts stock was limited and stock control was questionable in three of the five operations visited.

The FAA operation and maintenance surveillance was adequate with the exception of one commuter operation. This deficiency was attributed to the transfer of GADO activities from one location to another as a result of a recent change in company operating locations.

Air Taxi Commuter - Large

All four of the large commuter operators visited by the Safety Board's survey team were found to be well managed with clear lines of authority delegated to responsible personnel within the companies. Management personnel had widely diversified backgrounds in flight operation, training, maintenance procedures and customer relations.

Flightcrew personnel were well qualified and all four operators' requirements for captain and first officer positions were more stringent than those required by current regulations. Working conditions and pay scales for flightcrews were found to be above the average for the air taxi commuter industry as a whole. One of the operators employed a computer system to update the availability of reservations. Performance

factors, delay analysis, and extra flight-section planning data were retrieved daily from information stored in this reservation computer.

One operator utilized aircraft and flight crewmembers to the maximum limits of the regulation and this practice led to maintenance difficulties due to short turn-around times. Coordination and surveillance by the FAA GADO was on a daily basis and cooperation was satisfactory. The president of one of the carriers, however, indicated that the surveillance was excessive and that the variety of FAA personnel assigned to his operation adversely affected his maintenance schedule.

Each of the four managements took an active part in the development of lines of communication with the aircraft manufacturer for the exchange of information relative to mechanical problem areas.

Maintenance facilities and stock rooms were clean and orderly with an adequate supply of spare parts on hand, and maintenance personnel were found to be well trained and closely supervised.

Air Taxi - Air Mail

The Safety Board's survey team found that the presidents of both air mail companies held all key positions and made all major decisions. In one company, the president functioned as the director of operations, dispatcher, maintenance coordinator and, when the need arose, served as a line pilot.

In the other company the director of maintenance cleared all major decisions through the president before following through with the actions required.

Both companies' procedures required the pilots to fuel their aircraft, load and unload

mail, perform preflight inspections, check weather, and compute the weight and balance data at each en route stop. With the short ground time allowed for each stop en route, the pilot could not perform these duties effectively and complete the mail schedule on time. This problem became more acute during the winter months when deicing procedures added to the ground duty activities of the pilot. Although one company provided each pilot with a Jeppesen Manual of approach and departure plates, it was the responsibility of the pilot to subscribe to and maintain the revision service. A ramp check revealed that some of the pilots were using obsolete charts.

The Operational procedures and requirements of one of the air mail operators were contained in a training manual prepared by company personnel. The survey team found that the training program as outlined in the manual was satisfactory but no proof of a formal training program was in evidence and the company was unable to produce such training information.

No recurrent maintenance training programs were found in either of the air mail operators surveyed and on-the-job training was negligible. In each case the maintenance facilities were small and dirty. There was no apparent system for quality control and spare parts stock was limited.

The maintenance records of one of the air mail operators were found to be inadequate and aircraft discrepancy follow-up procedures were questionable. The company pilots held their discrepancy items until they returned to the main facility and then reported such items orally to maintenance personnel. One operator was unable to provide a single source of information to determine the aircraft maintenance history and some aircraft were being operated with major discrepancies.

APPENDIX
"B"
PUBLIC HEARING
SAFETY IN AIR TAXI/COMMUTER
OPERATIONS
WASHINGTON, D. C.
MAY 15-17, 1972

**PUBLIC HEARING
SAFETY IN AIR TAXI/COMMUTER
OPERATIONS**

On May 15-17, 1972, the Safety Board held a public hearing on the matter of Safety in Air Taxi/Commuter Operations in Washington, D. C. The full five-Member Board served as the Board of Inquiry, with the Chairman presiding over the proceedings.

PARTICIPANTS TO THE HEARING

Department of Transportation, Federal Aviation Administration, Civil Aeronautics Board, United States Postal Services.

National Association of State Aviation Officials, National Air Transportation Conferences, Inc., AOPA Air Safety Foundation, Flight Safety Foundation, Inc., General Aviation Manufacturers Association, Air Line Pilots Association.

Allegheny Airlines, Inc., Nicholson Air Service, Inc., Combs Airways, Inc., Rio Airways, Inc., Shawnee Airlines, Inc., Manufacturers Air Transport Service, Inc., Puerto Rico International Airlines, Inc.

After each organization expressed its views, the spokesman for that organization was questioned on matters of clarification and amplification by the Members of the Board of Inquiry and Members of a technical panel. The technical panel was composed of four staff members of the Safety Board's Bureau of Aviation Safety.

Problem Areas

During the course of the hearing, the organizations and operators were, on the whole, in accord as to difficulties which plague the air taxi/commuter industry. The following is a resume of these problem areas:

Operations

- When a new air mail contract is awarded, not enough lead time is allocated for the operator to establish safe and prudent operational procedures which have been proven on other routes.
- Because of the expenses incurred by the company, pay scales for the pilots are low. As a consequence, the pilot turnover rate is very high.
- Many cost increases are experienced by operators who have been required to add expensive equipment immediately, and then are expected to amortize the cost over the lifetime of the aircraft even though the Postal Service contract is for lesser period of time.
- The "low-bid" system, utilized by the Postal Service when awarding mail carrying contracts, allows untried, untested operators, who attempt operation with little financial support, into the air taxi industry.

Regulations

- The regulatory framework within which the operators have had to work is unclear and at times conducive to unsafe operations.
- An interpretation of pertinent regulations by the regulatory authority in one area of the United States can be completely opposite the interpretations of the same regulations by representatives of the same authority in another area.

- Hardships, even bankruptcy, are being caused by overloading the already financially burdened operators with excessive and costly regulations and controls by federal, state and local agencies.
- Fines are being levied on the operators in situations where the discrepancy could be corrected more advantageously by administrative action. The fines only accentuate the financial problems of the operator.

Recommendations by Industry

Along with the aforementioned problem areas, the organizations and operators offered solutions in the form of recommendations to governmental agencies and to themselves as well. The following is a resume of these recommendations. The Safety Board's findings (Section IV) and conclusions and recommendations (Section V) take the position of these organizations and operators into consideration.

- Commuter airlines and air taxi operations should be placed in separate statistical categories, so that meaningful information can be obtained for comparison and for direction in future regulatory acts.
- Clarify, standardize and separate the requirements and regulations which are applicable to air taxi operations from those applicable to commuter operations. The two categories of operation should be regulated by separate Parts of the Federal Aviation Regulations.
- Any regulations governing air taxi or commuter operations should be simple and concise so as not to leave them wide open for personal interpretation.
- Closer coordination between responsible federal, state, and local governmental agencies, so that individual economic and safety regulations satisfy the requirements of all concerned.
- New operators should be required to satisfy adequate management, operations and maintenance capabilities, including financial stability, prior to the issuance of an air taxi operator certificate.
- Operating manuals should be standardized and simplified to be used industry-wide. A second section could be included to add or delete items pertaining to a particular operator or operation.
- A more stringent system for the regulation of flight following and flight dispatch should be implemented by the operators themselves.
- Broader maximum crew duty time limitations should be established and enforced, i.e., weekly or monthly limits.
- All pilots carrying passengers for hire, should hold a current instrument rating.
- Both pilots of a commuter airline aircraft should hold an Air Transport Pilot Rating.
- Flightcrews and maintenance personnel pay scales should be established at levels adequate to retain qualified employees.
- The system of penalties imposed on violators of Federal Aviation Regulations should be standardized.
- Establish an impartial board, with some members outside government agency control, to review all assessed violations.
- Federal Aviation Administration surveillance of commuter operations should be conducted by specialists in the field.
- The "low-bid" system of awarding postal routes should be revised to evaluate operational experience, equipment, finances, geography, maintenance and other pertinent factors as well as the lowest price.
- The award of Postal Service contracts should give preference to the operators in the immediate vicinity of the new route.

- The Postal Service should take more operational factors, such as seasonal weather and airport facilities, into consideration when planning routes for bid. Certain areas and routes have built-in hazards if the operator is pushed to meet the present performance evaluation criteria.

- States that issue certificate authority to an operator should afford some route protection.

- A determination should be made of those geographical areas that need commuter airline service. Then support should be given that service in the form of subsidies, if the commercial revenues are not sufficient to meet operating costs plus a fair return on investment.

- The Federal Aviation Administration should expedite the implementation of its facilities and equipment program. Eligibility for qualification under this program should be based on realistic forecasts of anticipated operations.

- Where airport development programs are planned, high priority should be assigned to the installation of an Instrument Landing System (ILS).

- Priority should be given to the development of new aircraft to replace the aging, overly-modified fleet of aircraft now being utilized by many commuter and air taxi operators.

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APPENDIX
"C"
AIR TAXI/COMMERCIAL
ACCIDENTS
ALL OPERATIONS
1966 - 1970

AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966-1970

The purpose of this report is to present preliminary statistical and analytical data on air taxi/commercial operation accidents for the five year period 1966-1970. Included are all operations conducted under Federal Aviation Regulation 135 (FAR-135); scheduled commuter airlines, air mail operators, nonscheduled passenger/cargo, and on-demand commercial operators.

During the period 1966-1970, all aircraft in General Aviation flew 118,580,000 hours. Air taxi operators, as estimated by the Federal Aviation Administration, flew 10,040,000 hours or 8.5% of the total. During this period General Aviation aircraft were involved in 26,202 accidents, of which 1,028 or 3.9% were accidents occurring during operations being conducted under FAR-135.

The 1,028 accidents in air taxi/commercial operations involved 1,033 aircraft, signifying 5 collision involvements within FAR-135 operations. Of the 1,028 accidents there were 170 (16.6%) fatal accidents. Of the total of 3,662 persons aboard aircraft involved in FAR-135 accidents, 490 (13.4%) were fatally injured and 285 (7.8%) were seriously injured. Of those fatally injured 181 were crew members and 309 were passengers. Of those seriously injured 89 were crew members and 196 were passengers. Aircraft destroyed numbered 247, and 773 incurred substantial damage.

During the base period (1966-1970), used in this report, accident rates climbed and then decreased following the general economic trend in aviation. The accident rate, based on estimated aircraft hours flown, increased from 12.44 in 1966 to a high of 13.42 in 1967, and then decreased to 5.59 per 100,000 aircraft hours flown in 1970. The rate for fatal accidents per 100,000 hours flown showed a similar pattern - from 1.43 in 1966 to 2.30 in 1968 to 1.31 in 1970. (See Attachment 5.)

TABLE I
AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966-1970

<u>Estimated Hours Flown</u>	<u>1966-1970</u>
In All General Aviation	118,580,000
Air Taxi/Commercial Operations (conducted under FAR-135)	10,040,000
<u>Accidents, Aircraft Involved</u>	
Total Accidents All General Aviation	26,202
Total Accidents FAR-135 Accidents	1,028
<u>Aircraft Damage (FAR-135)</u>	
Destroyed	247
Substantial	773
Minor/None	11
Unknown/Not Reported	2
<u>Injury Index (FAR-135)</u>	
Fatal	170
Serious	92
Minor	124
None	642
<u>Injuries Aboard (FAR-135)</u>	
Fatal	490
Serious	285
Minor	316
None	2,571
<u>Fire After Impact (FAR-135)</u>	
Fatal Accidents	52
Nonfatal Accidents	43

INJURIES, ACCIDENTS
AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966 - 1970

	INJURIES					TOTAL
	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	
PILOT	149	73	97	714		1033
COPILOT	28	16	10	118		172
DUAL STUDENT	1					1
CHECK PILOT						
FLIGHT ENGINEER	1			2		3
NAVIGATOR						
CABIN ATTENDANT	1			7		8
EXTRA CREW	1		1	12		14
PASSENGERS	309	196	208	1718		2431
 TOTAL	 490	 285	 316	 2571	 ABOARD	 3662
 * OTHER AIRCRAFT	 6	 2	 2	 161		 171
OTHER GROUND	9	4	6	9		28
 GRAND TOTAL	 505	 291	 324	 2741		 3861

INVOLVES 1028 TOTAL ACCIDENTS
INVOLVES 170 FATAL ACCIDENTS

* INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

TABLE II

Broad Cause/Factor

The cause/factor category of *Pilot* was cited as a cause (not necessarily *the cause*) in 71.2 percent of the 170 fatal accidents and as a related factor in 8.8 percent. The pilot was cited as a cause and/or a related factor in 72.3 percent or, 123 of the 170 fatal accidents. See Table III for display of broad cause/factors.

Detailed Cause/Factor

Table IV is a detailed cause/factor table which is an accompaniment to the broad cause/factor table. For example one of the broad cause/factor categories is pilot, and the related detailed table gives the specific cause/factors as assigned by the analyst under pilot; such as pilot in command - failed to extend landing gear. Detailed cause/factor are ranked in descending order

<u>Rank</u>	<u>No. Times Cited as Cause/Factor</u>	<u>Broad Category</u>	<u>Detailed Category</u>
1	138	Pilot in Command	Inadequate preflight preparation and/or planning
2	136	Miscellaneous acts, conditions	Overload failure
3	75	Miscellaneous acts, conditions	Material failure
4	74	Weather	Low ceiling
5	68	Weather	Unfavorable wind conditions
6	65	Pilot in Command	Failed to obtain/maintain flying speed.
7	63	Miscellaneous acts, conditions	Aircraft came to rest in water
8	62	Maintenance, servicing, inspection	Inadequate maintenance and inspection
9	45	Powerplant	Powerplant failure for undetermined reasons
10	44	Landing gear	Normal retraction/extension assembly

The above ranked Air Taxi/commercial operator cause/factors did not follow the same pattern as all general aviation accidents for the 5 year period. In U. S. General Aviation all operations, all of the first ten ranked detailed causes/factors fall into the pilot in command area as follows:

Rank Detailed Cause/Factor

- | | |
|---|--|
| <p>1 Failed to obtain/maintain flying speed</p> <p>2 Inadequate preflight preparation and/or planning</p> | |
|---|--|

- | | |
|--|--|
| <p>3 Improper level off</p> <p>4 Improper operation of brakes and/or flight controls</p> <p>5 Selected unsuitable terrain</p> <p>6 Misjudged distance/speed</p> <p>7 Failed to maintain directional control</p> <p>8 Continued VFR into adverse WX conditions</p> <p>9 Failed to see and avoid objects or obstructions</p> <p>10 Exercised poor judgment</p> | |
|--|--|

and/or

control
conditions
effects or

CAUSE/FACTOR TABLE
AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966 - 1970

INVOLVES 1028 TOTAL ACCIDENTS
INVOLVES 170 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	121 71.18	15 8.82	123 72.35	605 70.51	47 5.48	607 70.75	726 70.62	62 6.03	730 71.01
PERSONNEL	19 11.18	10 5.88	28 16.47	129 15.03	24 2.80	150 17.48	148 14.40	34 3.31	178 17.32
AIRFRAME	6 3.53	.00	6 3.53	9 1.05	.00	9 1.05	15 1.46	.00	15 1.46
LANDING GEAR	.00	.00	.00	96 11.19	30 3.50	121 14.10	96 9.34	30 2.92	121 11.77
POWERPLANT	19 11.18	.00	19 11.18	111 12.94	8 .93	119 13.87	130 12.65	8 .78	138 13.42
SYSTEMS	2 1.18	1 .59	3 1.76	16 1.86	2 .23	18 2.10	18 1.75	3 .29	21 2.04
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .59	4 2.35	5 2.94	2 .23	2 .23	4 .47	3 .29	6 .58	9 .88
ROTORCRAFT	2 1.18	.00	2 1.18	15 1.75	.00	15 1.75	17 1.65	.00	17 1.65
AIRPORTS/AIRWAYS/FACILITIES	.00	1.18	1.18	17 1.98	72 8.39	89 10.37	17 1.65	74 7.20	91 8.85
WEATHER	17 10.00	57 33.53	72 42.35	38 4.43	130 15.15	164 19.11	55 5.35	187 18.19	236 22.96
TERRAIN	3 1.76	19 11.18	22 12.94	46 5.36	64 7.46	110 12.82	49 4.77	83 8.07	132 12.84
MISCELLANEOUS	2 1.18	1 .59	3 1.76	41 4.78	3 .35	44 5.13	43 4.18	4 .39	47 4.57
UNDETERMINED	29 17.06	.00	29 17.06	14 1.63	.00	14 1.63	43 4.18	.00	43 4.18

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE III

CAUSE/FACTOR TABLE
AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1964 - 1970

INVOLVES 1028 TOTAL ACCIDENTS
INVOLVES 170 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	4		3	10	1	11	13	1	14
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	3		3	1		1	4		4
BECAME LOST/DISORIENTED	3		3	4	1	5	7	1	8
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	30		30	18		18	48		48
CONTINUED INTO KNOWN AREA OF SEVERE TURBULENCE	1		1				1		1
DELAYED ACTION IN ABORTING TAKEOFF				11	1	12	11	1	12
DELAYED IN INITIATING GO-AROUND	1		1	7		7	8		8
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1		1	11	7	18	12	7	19
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT	1		1	1		1	2		2
FAILED TO EXTEND LANDING GEAR				30		30	30		30
FAILED TO RETRACT LANDING GEAR				2		2	2		2
RETRACTED GEAR PREMATURELY				5		5	5		5
INADVERTENTLY RETRACTED GEAR				34		34	34		34
FAILED TO SEE AND AVOID OTHER AIRCRAFT	3		3	8		8	11		11
FAILED TO SEE AND AVOID OBSTACLES OR OBSTRUCTIONS	2	1	3	27		27	29	1	30
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	23		23	42		42	65		65
FAILED TO MAINTAIN ADEQUATE ROTOR RPM				9		9	9		9
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT				3		3	3		3
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	4		4	9	4	13	13	4	17
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	7		7	15	1	16	22	1	23
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS	1		1	17	1	18	18	1	19
IMPROPER OPERATION OF FLIGHT CONTROLS	5		5	24	1	25	29	1	30
PREMATURE LIFT OFF	1		1	10		10	11		11
IMPROPER LEVEL OFF	1		1	24		24	25		25
IMPROPER IFR OPERATION	16		16	16		16	32		32
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	12	1	13	20	1	21	32	2	34
IMPROPER COMPENSATION FOR WIND CONDITIONS	1		1	7		7	8		8
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	20	6	26	99	13	112	119	19	138
INADEQUATE SUPERVISION OF FLIGHT	1		1	4		4	5		5
LACK OF FAMILIARITY WITH AIRCRAFT	1	3	4	2	6	8	3	9	12
MISMANAGEMENT OF FUEL	8		8	27		27	35		35
EXERCISED POOR JUDGMENT	9		9	35	2	37	44	2	46
OPERATED CARELESSLY				3		3	3		3
SELECTED UNSUITABLE TERRAIN		1	1	54	1	55	54	2	56
IMPROPER STARTING PROCEDURES				1		1	1		1
STARTED ENGINE WITHOUT PROPER ASSISTANCE/EQUIPMENT				3		3	3		3
TAXIED/PARKED WITHOUT PROPER ASSISTANCE				2		2	2		2
FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED				26		26	26		26
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				1		1	1		1
SPONTANEOUS-IMPROPER ACTION				2		2	2		2
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				6		6	6		6
MISJUDGED DISTANCE AND SPEED	2		2	34		34	36		36
MISJUDGED DISTANCE				9		9	9		9
MISJUDGED DISTANCE AND ALTITUDE	1		1	20		20	21		21
MISJUDGED SPEED AND ALTITUDE				2		2	2		2
MISJUDGED SPEED				1		1	1		1
MISJUDGED ALTITUDE AND CLEARANCE	2		2	1		1	3		3
MISJUDGED ALTITUDE	4		4	7		7	11		11
MISJUDGED CLEARANCE				4		4	4		4
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
IMPROPER RECOVERY FROM BOUNCED LANDING	1		1	7		7	8		8
PHYSICAL IMPAIRMENT	1	2	3				1	2	3
SPATIAL DISORIENTATION	11		11	1		1	12		12
PSYCHOLOGICAL CONDITION		1	1					1	1
MISUSED OR FAILED TO USE FLAPS	1	1	2	1	5	6	2	6	8
LEFT AIRCRAFT UNATTENDED ENGINE RUNNING				2	1	3	2	1	3
FAILED TO MAINTAIN DIRECTIONAL CONTROL	1		1	29		29	30		30
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND				7	3	10	7	3	10
FAILED TO ABORT TAKEOFF				10	1	11	10	1	11
FAILED TO INITIATE GO-AROUND				20	1	21	20	1	21
DIRECT ENTRIES	1		1	9		9	10		10

TABLE IV

CAUSE/FACTOR TABLE

PILOT IN COMMAND (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
TOTAL									
SUBTOTAL	183	16	199	795	51	846	978	67	1045
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1		1	1		1	2		2
IMPROPER OPERATION OF FLIGHT CONTROLS	1		1				1		1
IMPROPER LEVEL OFF				1		1	1		1
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
IMPROPER RECOVERY FROM BOUNCED LANDING				1		1	1		1
FAILED TO MAINTAIN DIRECTIONAL CONTROL				1		1	1		1
FAILED TO ABORT TAKEOFF				1		1	1		1
SUBTOTAL	2		2	6		6	8		8
DUAL STUDENT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1		1				1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	2		2				2		2
EXERCISED POOR JUDGEMENT	1		1				1		1
SUBTOTAL	4		4				4		4
** PERSONNEL **									
FLIGHT INSTRUCTOR									
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	1		1	17		17	18		18
IMPROPER MAINTENANCE(OWNER PERSONNEL)				2		2	2		2
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				1		1	1		1
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)				2		2	2		2
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)				1		1	1		1
INADEQUATE MAINTENANCE AND INSPECTION	3	2	5	53	4	57	56	6	62
OTHER				1		1	1		1
OPERATIONAL SUPERVISORY PERSONNEL									
INADEQUATE FLIGHT TRAINING-PROCEDURES					1	1		1	1
INADEQUATE SUPERVISION OF FLIGHT CREW		1	1	1	1	2	1	2	3
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT				2	1	3	2	1	3
DEFICIENCY, COMPANY MAINTAINED EOMT, SERV, REGULATIONS		1	1	1		1	1	1	2
WEATHER PERSONNEL									
INADEQUATE WEATHER OBSERVATION					1	1		1	1
TRAFFIC CONTROL PERSONNEL									
FAILURE TO ADVISE OF UNSAFE WEATHER CONDITION		2	2					2	2
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				1		1	1		1
FAILURE TO ADVISE OF OTHER TRAFFIC		1	1					1	1
ISSUED IMPROPER OR CONFLICTING INSTRUCTIONS	1	3	4	1		1	2	3	5
INADEQUATE SPACING OF AIRCRAFT	1	1	2				1	1	2
OTHER	1		1				1		1
AIRPORT SUPERVISORY PERSONNEL									
IMPROPER MAINTENANCE-AIRPORT FACILITIES				1	3	4	1	3	4
FAILURE TO NOTIFY OF UNSAFE CONDITION				3	2	5	3	2	5
IMPROPER/INADEQUATE SNOW REMOVAL				3	3	6	3	3	6
IMPROPER OPERATION OF FACILITIES					2	2		2	2
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN									
SUBSTANDARD QUALITY CONTROL	2		2	1		1	3		3
INCORRECT FACTORY INSTALLATION				3		3	3		3
POOR/INADEQUATE DESIGN	2		2	5		5	7		7
OTHER				2	1	3	2	1	3
MISCELLANEOUS-PERSONNEL									
PILOT OF OTHER AIRCRAFT	3		3	7	2	9	10	2	12
SPECTATOR				1		1	1		1
GROUND CREWMAN	1		1	1		1	2		2
PASSENGER	3		3	8		8	11		11
DRIVER OF VEHICLE				13	1	14	13	1	14
OTHER	2		2	2	3	5	4	3	7
DIRECT ENTRIES	1		1	1		1	2		2
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	21	11	32	134	25	159	155	36	191

TABLE IV-Continued

CAUSE/FACTOR TABLE

AIRFRAME (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** AIRFRAME **									
WINGS									
SPARS	1		1				1		1
WING ATTACHMENT FITTINGS, BOLTS	1		1	1		1	2		2
SKIN AND ATTACHMENTS				1		1	1		1
OTHER	1		1				1		1
FUSELAGE									
DOORS, DOOR FRAMES	1		1				1		1
FAIRINGS				1		1	1		1
SEATS				3		3	3		3
WHEEL WELL DOORS				1		1	1		1
LANDING GEAR									
MAIN GEAR-SHOCK ABSORBING ASSY, STRUTS, ATTACHMENTS, ETC				8	2	10	8	2	10
NORMAL RETRACTION/EXTENSION ASSEMBLY				42	2	44	42	2	44
EMERGENCY/EXTENSION ASSEMBLY				18		18	18		18
TAILWHEEL ASSEMBLIES				2		2	2		2
NOSEWHEEL ASSEMBLIES				8	1	9	8	1	9
WHEELS, TIRES, AXLES				7		7	7		7
SKI ASSEMBLIES				1		1	1		1
FLOAT ASSEMBLIES					1	1		1	1
BRAKING SYSTEM (NORMAL)				11	5	16	11	5	16
BRAKING SYSTEM (EMERGENCY)				3		3	3		3
LANDING GEAR WARNING AND INDICATING COMPONENTS					14	14		14	14
GEAR LOCKING MECHANISM				13		13	13		13
SWITCHES, LEVERS, CRANKING MECHANISM, ETC				3	6	9	3	6	9
DIRECT ENTRIES				4		4	4		4
FLIGHT CONTROL SURFACES									
ELEVATOR, ASSEMBLY ATTACHMENTS	1		1	1		1	2		2
FLAP ASSEMBLIES				1		1	1		1
OTHER	1		1				1		1
SUBTOTAL	6		6	129	31	160	135	31	166
** POWERPLANT **									
ENGINE STRUCTURE									
CRANKCASE				2		2	2		2
CRANKSHAFT				3		3	3		3
MASTER AND CONNECTING RODS				3		3	3		3
CYLINDER ASSEMBLY				2		2	2		2
PISTON, PISTON RINGS	1		1	3		3	4		4
VALVE ASSEMBLIES	2		2	3		3	5		5
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
MOUNT AND VIBRATION ISOLATORS	1		1				1		1
OTHER				1		1	1		1
IGNITION SYSTEM									
MAGNETOES				3		3	3		3
SPARK PLUG				3		3	3		3
LEADS	1		1	1		1	2		2
FUEL SYSTEM									
TANKS				1	1	2	1	1	2
LINES AND FITTINGS				3		3	3		3
SELECTOR VALVES				1		1	1		1
FILTERS, STRAINERS, SCREENS				1		1	1		1
CARBURETOR				6	1	7	6	1	7
PUMPS				4		4	4		4
FUEL INJECTION SYSTEM				2	1	3	2	1	3
VENTS, DRAINS, TANK CAPS	1		1	2		2	3		3
RAM AIR ASSEMBLY					1	1		1	1
OTHER				3		3	3		3
LUBRICATING SYSTEM									
LINES, HOSES, FITTINGS				1		1	1		1
VALVES				1		1	1		1
FILTERS, SCREENS				1		1	1		1
COOLING SYSTEM									
OTHER				1		1	1		1
PROPELLER AND ACCESSORIES									
BLADES				1		1	1		1
HUBS				2		2	2		2
HYDRAULIC PITCH CONTROL MECHANISM	1		1				1		1
GOVERNORS				1		1	1		1
OTHER				2		2	2		2

TABLE IV-Continued

POWERPLANT (CONTINUED)

43

CAUSE/FACTOR TABLE

SYSTEMS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
OTHER				1		1	1		1
AIR CONDITION, HEATING AND PRESSURIZATION									
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM		1	1					1	1
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL	2	1	3	17	2	19	19	3	22
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
ALTIMETERS		1	1	1	1	2	1	2	3
ATTITUDE GYRO	1		1				1		1
DIRECTIONAL GYRO	1	1	2				1	1	2
OTHER				1		1	1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
COMPASS RECEIVERS		1	1					1	1
OTHER		1	1					1	1
MISCELLANEOUS EQUIPMENT									
OTHER					1	1		1	1
SUBTOTAL	2	4	6	2	2	4	4	6	10
** ROTORCRAFT **									
ROTOR ASSEMBLIES									
TAIL ROTOR BLADES	1		1	4		4	5		5
BEARINGS				1		1	1		1
TRANSMISSION ROTOR DRIVE SYSTEM									
TAIL ROTOR DRIVE SHAFT ASSEMBLY				2		2	2		2
CLUTCH ASSEMBLY				3		3	3		3
OTHER				1		1	1		1
FLIGHT CONTROL SYSTEMS									
CYCLIC PITCH CONTROL SYSTEM	1		1	1		1	2		2
COLLECTIVE PITCH CONTROL SYSTEM	1		1	1		1	2		2
STABILIZING SURFACES-DAMPERS				1		1	1		1
MISCELLANEOUS UNITS AND ASSEMBLIES									
TAIL BOOMS/PYLONS/CONES				1		1	1		1
DIRECT ENTRIES				2		2	2		2
SUBTOTAL	3		3	17		17	20		20
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
APPROACH LIGHTING					1	1		1	1
TAXIWAY LIGHTING AND MARKING				1		1	1		1
OTHER					1	1		1	1
AIRPORT CONDITIONS									
WET RUNWAY					12	12		12	12
ICE/SLUSH ON RUNWAY				1	12	13	1	12	13
SNOW ON RUNWAY	1	1	2	6	16	22	6	17	23
SNOW WINDROWS				1	1	2	1	1	2
UNMARKED OBSTRUCTIONS				2	1	3	2	1	3
SOFT SHOULDERS (RUNWAY)				1	2	3	1	2	3
ROUGH WATER					2	2		2	2
HIGH VEGETATION					3	3		3	3
HIDDEN HAZARD				1	2	3	1	2	3
POORLY MAINTAINED RUNWAY SURFACE				1	6	7	1	6	7
SOFT RUNWAY					1	1		1	1
WET RAMP/TAXIWAY					1	1		1	1
ICE/SLUSH ON RAMP/TAXIWAY				1	2	3	1	2	3
SNOW ON RAMP/TAXIWAY					1	1		1	1
OTHER		1	1	3	14	21	3	19	22
AIRWAYS FACILITIES									
SUBTOTAL		2	2	18	62	100	18	64	102

TABLE IV-Continued

CAUSE/FACTOR TABLE

WEATHER (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** WEATHER **									
LOW CEILING									
RAIN	5	41	46	2	26	28	7	67	74
FOG		14	14	1	13	14	1	27	28
SNOW	3	24	27	3	25	28	6	49	55
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	3	8	11	3	9	12	6	17	23
CONDITIONS CONDUCTIVE TO CARR/INDUCTION SYSTEM ICING	3	7	10	4	9	13	7	16	23
UNFAVORABLE WIND CONDITIONS	1	3	4	3	4	7	4	7	11
SUDDEN WINDSHIFT	2	2	4	17	47	64	19	49	68
TURBULENCE IN FLIGHT, CLEAR AIR				3	7	10	3	7	10
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS	1		1		1	1	1	1	2
DOWNDRAFTS, UPDRAFTS	1	8	9	2		2	3	8	11
LOCAL WHIRLWIND	3	2	5	5	10	15	8	12	20
LIGHTNING STRIKE	1		1	1		1	2		2
ADVERSE WINDS ALOFT				1		1	1		1
HIGH TEMPERATURE		1	1					1	1
OBSTRUCTIONS TO VISION					2	2		2	2
HIGH DENSITY ALTITUDE	1	2	3	1	3	4	2	5	7
THUNDERSTORM ACTIVITY		1	1		18	18		19	19
	1	3	4	1	1	2	2	4	6
SUBTOTAL									
	25	116	141	47	175	222	72	291	363
** TERRAIN **									
WET, SOFT GROUND									
SNOW-COVERED		1	1	4	9	13	4	10	14
ICY	1		1	4	7	11	5	7	12
HIGH VEGETATION					2	2		2	2
HIDDEN OBSTRUCTIONS		1	1	1	3	4	1	4	5
ROUGH/UNEVEN				8	4	12	8	4	12
ROUGH WATER		3	3	13	13	26	13	16	29
GLASSY WATER	1		1	4	4	8	5	4	9
HIGH OBSTRUCTIONS		2	2					2	2
SANDY	1	10	11	6	16	22	7	26	33
OTHER				4	2	6	4	2	6
		3	3	3	6	9	3	9	12
SUBTOTAL									
	3	20	23	47	66	113	50	86	136
** MISCELLANEOUS **									
BIRD COLLISION				2		2			2
VORTEX TURBULENCE				7		7	2		7
PROP/JET/ROTOR BLAST				4		4	4		4
EVASIVE MANEUVER TO AVOID COLLISION	2		2	6		6	8		8
FOREIGN OBJECT DAMAGE				1	1	2	1	1	2
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS		1	1	15	2	17	15	3	18
UNDETERMINED	29		29	14		14	43		43
DIRECT ENTRIES				6		6	6		6
SUBTOTAL									
	31	1	32	55	3	58	86	4	90
GRAND TOTAL									
	302	171	473	1385	447	1832	1687	618	2305
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	1		1	7		7	8		8
CHECKLIST-FAILED TO USE	1	1	2		30	30	1	31	32
CREW COORDINATION-POOR	1		1				1		1
DISREGARD OF GOOD OPERATING PRACTICE					1	1		1	1
IMPROPER EMERGENCY PROCEDURES	7	1	8	16	8	24	23	9	32
GUST LOCKS ENGAGED									
INSTRUMENTS-MISREAD OR FAILED TO READ		1	1					1	1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA	2		2	4		4	6		6
UNWARRANTED LOW FLYING				8	1	9	8	1	9
FAILED TO USE ALL AVAILABLE RUNWAY	1		1	1	1	2	2	1	3
LANDED AT WRONG AIRPORT					5	5		5	5
INATTENTIVE TO FUEL SUPPLY				1	4	5	1	4	5
FLEW INTO BLIND CANYON	2		2	4	3	7	6	3	9
POORLY PLANNED APPROACH		1	1	1		1	1	1	2
MISCALCULATED FUEL CONSUMPTION				2	4	6	2	4	6
				3	2	5	3	2	5

TABLE IV-Continued

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
LANDED ON FOAMED RUNWAY					9	9		9	9
IMPROPERLY SECURED				10	2	12	14	3	17
ROGUS PART	4	1	5		1	1		1	1
ELECTRICAL FAILURE				3	10	13	3	10	13
ENGINE LOADED UP				3		3	3		3
FATIGUE FRACTURE	5		5	19	2	21	24	2	26
HYDRAULIC FAILURE				3		3	3		3
RPM-UNCONTROLLABLE-OVERSPED				1		1	1		1
WINDSHIELD, DIRTY, FOGGY, FTC-RESTRICTED VISION	1		1	2	1	3	3	1	4
WRONG PART					1	1		1	1
IMPROPER ALIGNMENT/ADJUSTMENT	1		1	11	2	13	12	2	14
FAILURE OF TWO OR MORE ENGINES	2	4	6	4	16	20	6	20	26
SEPARATION IN FLIGHT		7	7		13	13		20	20
FIRE IN CABIN/ COCKPIT/ BAGGAGE COMPARTMENT	1		1	1	1	2	2	1	3
FIRE IN ENGINE					5	5		6	6
ASYMMETRICAL FLAPS				1		1	1		1
LATERAL IMBALANCE				1		1	1		1
CORRODED/CORROSION				3	1	4	3	1	4
CARGO SHIFTED	2		2		1	1		1	1
CONGESTED TRAFFIC-PATTERN		1	1	2	5	5	4	6	6
PILOT FATIGUE		6	6		6	6		12	12
FUEL EXHAUSTION	5		5	29		29	34		34
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL				2		2	2		2
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT		1	1					1	1
CARRON MONOXIDE POISONING	1	1	2					1	2
ICE-ENGINE				2		2	2		2
ICE-CARBURETOR	2		2	7		7	9		9
ICE-PROPELLER				1		1	1		1
AIRFRAME ICE	2	2	4	8	5	13	10	7	17
ICE-WINDSHIELD		1	1	1	1	2	1	2	3
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	6	4	10	8	14	22	14	18	32
INTERFERENCE WITH FLIGHT CONTROLS				2		2	2		2
WHITEOUT	1		1	4	3	7	5	3	8
SUNGLARE					6	6		6	6
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM				3	2	5	3	2	5
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM				2	1	3	2	1	3
WATER IN FUEL	2		2	10		10	12		12
AIRCRAFT CAME TO REST IN WATER		21	21		47	47		63	63
FROZEN, MOISTURE				2	1	3	2	1	3
MISSING		1	1	8		8	8	1	9
HYDROPLANING ON WET RUNWAY					2	2		2	2
OVERLOAD FAILURE	3	2	5	11	120	131	14	122	136
MATERIAL FAILURE	4		4	66	5	71	70	5	75
FUEL STARVATION	7		7	30		30	37		37
OIL STARVATION	1		1	3		3	4		4
IMPROPER CLEARANCE-TOLERANCE					2	2		2	2
FUEL SELECTOR POSITIONED BETWEEN TANKS	1		1	2		2	3		3
IMPROPER/INADEQUATE VENTING	1		1				1		1
POOR WELD		1	1	1		1	1	1	2
PREVIOUS DAMAGE				6	10	16	6	10	16
LEAK/LEAKAGE				6	4	10	6	4	10
LOW FLUID LEVEL				1	1	2	1	1	2
CIRCUIT BREAKER POPPED				2	5	7	2	5	7
ARCING				1		1	1		1
RUNWAY CLOSED				1	3	4	1	3	4
DOWNDOWN					22	22		22	22
CARRON DEPOSITS				1		1	1		1
LANDED IN CONSTRUCTION AREA				1		1	1		1
OVER TORQUED				2		2	2		2
LOOSE, PART/FITTING				4	1	5	4	1	5
RENT				2	1	3	2	1	3
RINDING				4		4	4		4
BURNED				2		2	2		2
COLLAPSED				1		1	1		1
DETENIORATED				2	1	3	2	1	3
DISCONNECTED				4	1	5	4	1	5
EXCESSIVE				1		1	1		1
EKRATIC		2	2	1	2	3	1	4	5
FLUCTUATING				2		2	2		2
GROUNDING				1		1	1		1
IMPROPERLY INSTALLED				11		11	11		11
JAMMED	1		1	13		13	14		14

TABLE IV--Continued

First Type of Accident

Engine failure or malfunction is cited as the first type of accident in almost 20% of the air

taxi/commercial operator accidents. Ranked in descending order are the ten leading first types of accidents.

<u>Rank</u>	<u>First Type of Accident</u>	<u>Accidents</u>	<u>Percent of Total</u>
1	Engine failure or malfunction	203	19.6%
2	Wheels-up landing	82	7.9%
3	Ground-water loop-swerve	71	6.9%
4	Gear retracted	65	6.3%
5	Collision with ground/water-controlled	57	5.5%
6	Collided with object	52	5.0%
7	Gear collapsed	40	3.9%
8	Stall-mush	39	3.8%
9	Overshoot	37	3.8%
10	Undershoot	29	2.8%

Except for "Engine failure or malfunction" and "collision with object" most of the other

first type of accident citations would normally take place during the landing phase of operation.

Ranked in
first types

TABLE V

SELECTED ACCIDENT DATA
ALL OPERATIONS
1966-1970

Time of Occurrence

	<u>Accident Records</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
0000-0059	8	12	1.94
0100-0159	4	9	1.26
0200-0259	3	8	1.06
0300-0359	4	8	1.16
0400-0459	3	11	1.36
0500-0559	3	7	.97
0600-0659	4	9	1.26
0700-0759	10	47	5.52
0800-0859	8	52	5.81
0900-0959	12	62	7.16
1000-1059	8	53	5.91
1100-1159	4	53	5.52
1200-1259	9	59	6.58
1300-1359	7	59	6.39
1400-1459	8	54	6.00
1500-1559	14	72	8.33
1600-1659	8	63	6.87
1700-1759	6	52	5.61
1800-1859	11	46	5.52
1900-1959	6	41	4.55
2000-2059	7	34	3.97
2100-2159	9	18	2.61
2200-2259	6	24	2.90
2300-2359	4	9	1.26
Unknown/Not Reported	5	0	.48
	<u>171</u>	<u>862</u>	<u>100.00</u>

normally
operation.

TABLE V—Continued

MONTH OF OCCURRENCE

January	19	67	8.33
February	13	74	8.42
March	20	75	9.20
April	12	65	7.45
May	11	62	7.07
June	9	78	8.42
July	15	83	9.49
August	13	95	10.45
September	12	55	6.49
October	16	66	7.94
November	17	74	8.81
December	14	68	7.94
	<u>171</u>	<u>862</u>	<u>100.00</u>

CONDITIONS OF LIGHT

Dawn	5	7	1.16
Daylight	95	644	71.54
Dusk	3	33	3.48
Night	64	176	23.23
Unknown/Not reported	4	2	.58
	<u>171</u>	<u>862</u>	<u>100.00</u>

AIRPORT PROXIMITY

On Airport	14	489	48.69
On Seaplane base	2	7	.87
On Heliport	0	6	.58
On Barge/ship/platform	0	5	.48
In Traffic pattern	15	71	8.33
Within ¼ mile	3	11	1.36
Within ½ mile	6	5	1.06
Within ¾ mile	2	3	.48
Within 1 mile	6	5	1.06
Within 2 miles	12	18	2.90
Within 3 miles	13	20	3.19
Within 4 miles	7	8	1.45
Within 5 miles	1	4	.48
Beyond 5 miles	83	200	27.40
Unknown/not reported	7	10	1.06
	<u>171</u>	<u>862</u>	<u>100.00</u>

TABLE V—Continued

<u>RANK</u>	<u>STATE OF OCCURRENCE</u>	<u>Accidents</u>		<u>Percent of Total</u>
		<u>Fatal</u>	<u>Nonfatal</u>	
1	Alaska	27	164	18.49
2	California	13	67	7.74
3	New York	6	52	5.61
4	Michigan	5	32	3.58
5	Texas	3	31	3.29
6	Pennsylvania	4	29	3.19
7	Illinois	3	29	3.10
8	Louisiana	4	27	3.00
9	Hawaii	5	20	2.42
10.5	Arizona	2	22	2.32
10.5	New Mexico	5	19	2.32

TYPE OF WEATHER CONDITIONS

	<u>Accident Records</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
VFR	112	783	86.64
IFR	52	69	11.71
Below Minimums	2	7	.87
Unknown/not reported	5	3	.77
	<u>171</u>	<u>862</u>	<u>100.00</u>

SELECTED ACCIDENT DATATYPE OF AIRCRAFT POWER

Reciprocating Engine	151	793	91.38
Turbojet Engine	1	8	.87
Turboprop Engine	11	34	4.36
Turbofan Engine	0	1	.10
Turboshaft Engine	8	26	3.29
TOTAL	<u>171</u>	<u>862</u>	<u>100.00</u>

TABLE V—Continued

TYPE OF FLIGHT PLAN

	<u>Accident Records</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
None	90	539	60.89
VFR	32	207	23.14
IFR	42	98	13.55
Controlled VFR	0	2	.19
DVFR	1	6	.68
VFR Flight Following	0	5	.48
Special VFR	3	1	.39
Unknown/not reported	3	4	.68
	<u>171</u>	<u>862</u>	<u>100.00</u>

TABLE VI
SELECTED ACCIDENT DATA
AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966-1970

<u>Total Pilot Time</u>	<u>Total</u>	<u>ALL RECORDS</u>	
		<u>Fatal</u>	<u>Nonfatal</u>
0 - 25 Hours	0	0	0
26 - 50 Hours	0	0	0
51 - 100 Hours	0	0	0
101 - 300 Hours	11	1	10
301 - 500 Hours	24	1	23
501 - 1000 Hours	90	12	78
1001 - 3000 Hours	325	51	274
3001 - 5000 Hours	185	32	153
5001 - 8000 Hours	162	27	135
8001 - 10000 Hours	64	14	50
Over - 10000 Hours	166	30	136
Unknown/not reported	6	3	3
TOTAL	1033	171	862

Pilot Time In Type

5 - or less Hours	20	6	14
6 - 25 Hours	75	10	65
26 - 50 Hours	88	18	70
51 - 100 Hours	138	21	117
101 - 300 Hours	211	29	182
301 - 500 Hours	131	22	109
501 - 1000 Hours	166	20	146
1001 - 2000 Hours	81	8	73
2001 - 3000 Hours	35	9	26
Over - 3000 Hours	51	6	45
Unknown/not reported	37	22	15
TOTAL	1033	171	862

**AIR TAXI/COMMERCIAL OPERATOR
ALL OPERATIONS
1966-1970**

**Accidents Occurring During The Landing Phase
Of Operation**

Out of the 1,028 accidents occurring during FAR-135 operations for the 1966-1970 period, 468 (45.5%) occurred during the Landing Phase of operation. Forty four involved fatal injury

<u>Type Instrument Approach</u>	<u>Accidents</u>	<u>Percent of Total</u>
VOR/TVOR - Straight-In	13	2.77
VOR/TVOR - Circling	5	1.07
ADF - Straight-In	4	.85
ADF - Circling	1	.21
ILS with Advisory Straight-In	9	1.92
ILS with Advisory Circling	1	.21
ILS without Advisory	11	2.35
PAR	1	.21
Visual Approach	3	.64
Type Approach Unknown	2	.43

**ANALYSIS BY TYPE OF AIRCRAFT
AIR TAXI/COMMERCIAL OPERATORS
ALL OPERATIONS
1966-1970**

Accidents within Air Taxi/Commercial Operations, conducted under Federal Aviation Regula-

and 30 involved serious injury. There were 50 crew fatalities and 53 passenger fatalities out of 1,690 total aboard in "Landing Phase" operations. Aircraft damage resulted in 74 aircraft destroyed, 393 with substantial damage and 2 aircraft with minor damage.

Of the 468 accidents occurring during the Landing Phase of operation 50 accidents occurred while pilots were conducting instrument approaches.

tion-135 (FAR-135), for the 5 year period 1966-1970 totaled 1,028. There were 391 accidents involving Fixed-Wing Single-Engine aircraft, 503 involving fixed wing multiengine aircraft and 137 involving rotorcraft.

<u>Type of Aircraft</u>	<u>Accident Records</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
Fixed-wing Single-engine	47	344	37.81
Fixed-wing Multiengine	104	401	48.84
Rotorcraft	20	118	13.35
TOTAL	171	863	100.00

TABLE VII

TYPE OF AIRCRAFT
1966-1970

LEADING FIRST ACCIDENT TYPES

FIXED-WING SINGLE-ENGINE

<u>Rank</u>	<u>First Accident Type</u>	<u>Accidents</u>	<u>Percent of Total</u>
1	Engine failure or malfunction	80	20.46
2	Collision with object	28	7.16
3	Ground-water loop-swerve	26	6.65
4	Overshoot	25	6.39
5	Nose over/down	22	5.63

FIXED-WING MULTIENGINE

1	Engine failure or malfunction	89	17.62
2	Wheels-up landing	67	13.27
3	Ground-water loop-swerve	45	8.91
4	Gear retracted	44	8.71
5	Collision with ground/water- controlled	30	5.94

ROTORCRAFT

1	Engine failure or malfunction	34	24.64
2	Miscellaneous/other	20	14.49
3	Roll over	15	10.87
4	Hard landing	8	5.80
6	Collision with ground/water- controlled	7	5.07
6	Collision with ground/water- uncontrolled	7	5.07
6	Collision with object	7	5.07

TABLE VII—Continued

FIRST PHASE OF OPERATIONFIXED-WING SINGLE ENGINE

	<u>First Phase of Operation</u>	<u>Accidents</u>	<u>Percent of Total</u>
1	Inflight - Normal cruise	65	16.62
2	Landing - Level off/touchdown	64	16.37
3	Landing - Roll	59	15.09
4	Takeoff - Initial climb	55	14.07
5	Taxi - From landing	22	5.63

FIXED-WING MULTIENGINE

1	Landing - Level off/touchdown	112	22.18
2	Landing - Roll	86	17.03
3	Takeoff - Initial climb	61	12.08
4	Inflight - Normal cruise	58	11.49
5	Takeoff - Run	28	5.54

ROTORCRAFT

1	Inflight - Normal cruise	33	23.91
2	Takeoff - Initial climb	28	20.29
3	Landing - Power-on landing	11	7.97
4	Static - Idling rotor	10	7.25
5	Takeoff - Vertical	8	5.80

TABLE VIII
TYPE OF AIRCRAFT
RANKED BY MAKE AND MODEL

<u>Rank</u>	<u>Make and Model</u>	<u>Fatal</u>	<u>Nonfatal</u>	<u>Total</u>	<u>Percent of Total Accidents</u>
1	Beechcraft 45/18	25	121	146	14.20
2	Bell 47	7	68	75	7.30
3	Cessna 180	8	60	68	6.61
4	Piper PA-23	16	48	64	6.22
5	Piper PA-32	7	42	49	4.77
6.5	Cessna 310	5	32	37	3.60
6.5	Cessna 206	3	34	37	3.60
8	Beechcraft 35	5	28	33	3.21
9	Cessna 182	6	25	31	3.02
10	Aero Cmdr. 500/600	8	20	28	2.72

APPENDIX D
SCHEDULED PASSENGER/CARGO
ACCIDENTS
1968 - 1970

SCHEDULED PASSENGER/CARGO 1968-1970

Starting in 1968, the analysis system was expanded to incorporate coding capability in the area of Scheduled Passenger/Cargo operations. During the three year period, 1968 through 1970, there were 141 accidents in Scheduled air taxi operations, 35 (24.1%) of which resulted in fatal injury. The fatal accidents resulted in 47 crew fatalities and 112 passenger fatalities. Of those seriously injured 19 were crew members and 42 passengers. Aircraft destroyed numbered 45, and 94 incurred substantial damage. There were 14 fatal accidents involving fire after impact and 9 fire after impact accidents with lesser degree of injury.

Hours flown are not a separate reporting requirement for commuter operations, therefore there are no accident rates for this category of operation. The Safety Board is currently exploring methods for the development of rates based on number of departures or some other appropriate index.

Scheduled Passenger Operations

Scheduled passenger operations accounted for 92 accidents in the three year period 1968-1970. All of the accidents occurred in fixed-wing

aircraft, nine in single engine and 83 in multi-engine aircraft. Twenty-four accidents involved fatal injuries and in 8 accidents the highest degree of injury was serious. Of the twenty four fatal injury accidents 19 occurred in aircraft equipped with reciprocating engines and 5 to aircraft equipped with turboprop engines.

Scheduled passenger operations resulted in the loss of 146 lives; 32 crew, 112 passengers, and 2 ground fatalities. Serious injuries involved 10 crew and 42 passengers.

Scheduled Cargo Operations

There were 49 accidents in scheduled cargo operations for the three year period 1968-1970. Eleven accidents resulted in fatal injury to 15 crew members and 5 resulted in serious as the highest degree of injury. All 49 accidents occurred in fixed-wing aircraft; forty-six in reciprocating engine equipped aircraft and 3 in turboprop equipped aircraft.

Air Mail

There have been 39 accidents involving air taxi mail service since the start of the service in August 1967; tabulation as of March 30, 1970. Fifteen of the 39 accidents resulted in fatal injury with the loss of 22 lives.

INJURIES, ACCIDENTS
SCHEDULED AIR TAXI
PASSENGER/CARGO OPERATIONS
1968 - 1970

	INJURIES					TOTAL
	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	
PILOT	31	11	8	91		141
COPILOT	15	8	4	40		67
DUAL STUDENT						
CHECK PILOT						
FLIGHT ENGINEER						
NAVIGATOR						
CABIN ATTENDANT	1			3		4
EXTRA CREW						
PASSENGERS	112	42	31	250		435
TOTAL	159	61	43	384	ABOARD	647
* OTHER AIRCRAFT		1	1	122		124
OTHER GROUND	2		3	1		6
GRAND TOTAL	161	62	47	507		777

INVOLVES 141 TOTAL ACCIDENTS
INVOLVES 35 FATAL ACCIDENTS

* INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

TABLE IX

TABLE X
SELECTED ACCIDENT DATA
SCHEDULED PASSENGER/CARGO
1968-1970

Time of Occurrence

	<u>Fatal</u>	<u>Nonfatal</u>	<u>Percent of Total</u>
0000-0059	2	5	4.96
0100-0159	1	1	1.42
0200-0259	1	4	3.55
0300-0359	3	6	6.38
0400-0459	0	4	2.84
0500-0559	1	0	.71
0600-0659	1	1	1.42
0700-0759	2	3	3.55
0800-0859	2	3	3.55
0900-0959	1	11	8.51
1000-1059	1	7	5.67
1100-1159	0	1	.71
1200-1259	1	4	3.55
1300-1359	1	3	2.84
1400-1459	2	3	3.55
1500-1559	2	5	4.96
1600-1659	1	8	6.38
1700-1759	3	7	7.09
1800-1859	2	7	6.38
1900-1959	2	7	6.38
2000-2059	1	6	4.96
2100-2159	2	3	3.55
2200-2259	2	5	4.96
2300-2359	1	2	2.13
	<u>35</u>	<u>106</u>	<u>100.00</u>

TABLE XI

SELECTED ACCIDENT DATA
SCHEDULED PASSENGER/CARGO
1968-1970

<u>Month of Occurrence</u>	<u>Accidents</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
January	7	16	16.31
February	7	7	9.93
March	3	12	10.64
April	0	4	2.84
May	0	10	7.09
June	0	4	2.84
July	5	3	5.67
August	1	11	8.51
September	3	5	5.67
October	4	7	7.80
November	2	12	9.93
December	3	15	12.77
TOTAL	35	106	100.00

Conditions of Light

Dawn	1	2	2.1
Daylight	14	56	49.6
Dusk	1	7	5.7
Night	14	37	36.2
Unknown/not reported	5	4	6.4
TOTAL	35	106	100.0

Airport Proximity

On Airport	3	71	52.5
On Seaplane Base	1	2	2.1
In Traffic Pattern	3	13	11.4
Within ¼ Mile	0	1	.7
Within ½ Mile	1	0	.7
Within ¾ Mile	0	1	.7
Within 1 Mile	1	1	1.4
Within 2 Miles	1	4	3.6
Within 3 Miles	3	0	2.1
Within 4 Miles	4	0	2.8
Within 5 Miles	1	1	1.4
Beyond 5 Miles	14	10	17.0
Unknown/not reported	3	2	3.6
TOTAL	35	106	100.0

TABLE XI--Continued

Rank	State of Occurrence	Accidents		Percent of Total
		Fatal	Nonfatal	
1	California	6	16	15.60
2	New York	1	11	8.51
3.5	Illinois	0	7	4.96
3.5	Puerto Rico	2	5	4.96
5	Alaska	2	4	4.26
7.5	Florida	0	5	3.55
7.5	Pennsylvania	0	5	3.55
7.5	Texas	0	5	3.55
7.5	Wisconsin	0	5	3.55
10	Minnesota	0	4	2.84

Type of Weather Conditions

VFR	21	88	77.3
IFR	12	17	20.6
Below Minimums	0	1	.7
Unknown/not reported	2	0	1.4
TOTAL	35	106	100.0

Type of Aircraft Power

Reciprocating Engine	28	90	83.7
Turbojet Engine	0	0	0
Turboprop Engine	7	16	16.3
Turbofan Engine	0	0	0
Turboshaft Engine	0	0	0
TOTAL	35	106	100.0

Type of Flight Plan

None	9	39	34.0
VFR	8	34	29.8
IFR	16	32	34.0
Unknown/not reported	2	1	2.2
TOTAL	35	106	100.0

TABLE XI--Continued

<u>Pilot Certificate</u>	<u>Accidents</u>		<u>Percent of Total</u>
	<u>Fatal</u>	<u>Nonfatal</u>	
Student	0	0	0
Private	0	0	0
Commercial	12	43	39.01
Commercial with Flight Instructor	9	17	18.44
Airline Transport	7	29	25.53
Airline Transport with Flight Instructor	5	17	15.60
Unknown/not reported	2	0	1.42
	<u>35</u>	<u>106</u>	<u>100.00</u>

Broad Cause/Factor

The cause/factor category of *Pilot* was cited as a cause in 65.71% of the 35 fatal accidents and as a related factor in 11.43%. Weather was cited as a factor in 37.14% and as a cause in 3.5% of the fatal accidents. Powerplant was cited as a cause in 20.00% of the fatal accidents

but was never coded as a factor. See table XII for a display of broad cause/factors.

Detailed Cause/Factor

The first ten cause/factors in table XIII are ranked as follows:

<u>Rank</u>	<u>Number Times Cited as Cause/Factor</u>	<u>Broad Category</u>	<u>Detailed Category</u>
1	23	Miscellaneous acts, conditions.	Overload failure
2	18	Pilot in command	Inadequate preflight preparation and/or planning
3	17	Weather	Low ceiling
4	14	Weather	Fog
5	13	Miscellaneous act, conditions	Material failure
6.5	12	Personnel	Improper maintenance (maintenance personnel)
6.5	12	Landing gear	Normal retraction/extension assembly
8	11	Pilot in command	Improper IFR operation
9.5	10	Pilot in command	Failed to obtain/maintain flying speed
9.5	10	Miscellaneous acts, conditions	Aircraft came to rest in water

First Type of Accident

Engine failure or malfunction is cited in 26 accidents (18.57%) as first type of accident. In a tie for second place ground-water loop-swerve

and collision with ground/water - controlled, with twelve citations as first type of accident. Ranked in descending order are the ten first types of accidents.

<u>Rank</u>	<u>First Type of Accident</u>	<u>Accident</u>	<u>Percent of Total</u>
1	Engine failure or malfunction	26	18.44
2.5	Ground-water loop-swerve	12	8.51
2.5	Collision with ground/water-controlled	12	8.51
4	Wheels up landing	11	7.80
5	Collision with ground/water uncontrolled	8	5.67
6.5	Gear collapsed	7	4.96
6.5	Hard landing	7	4.96
8.5	Undershoot	6	4.26
8.5	Collision with object	6	4.26
10	Stall mush	5	3.55

controlled,
accident.
then first

Phase of Operation

<u>Rank</u>	<u>Phase of Operation</u>	<u>Accidents</u>	<u>Percent of Total</u>
1	Landing - Level off/touchdown	25	17.73
2	Landing - Roll	20	14.18
3.5	Takeoff - Initial climb	18	12.77
3.5	Inflight - Normal cruise	18	12.77
5	Landing - Final approach	9	6.38
6.5	Takeoff - Run	7	4.96
6.5	Landing - Initial approach	7	4.96
8.5	Taxi - From landing	6	4.26
8.5	Landing - Final approach	6	4.26
10.5	Taxi - To takeoff	4	2.84
10.5	Inflight - Emergency descent	4	2.84

CAUSE/FACTOR TABLE
AIR TAXI
SCHEDULED PASSENGER/CARGO
1968-1970

INVOLVES 141 TOTAL ACCIDENTS
INVOLVES 35 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	23 65.71	4 11.43	25 71.43	68 64.15	10 9.43	69 65.09	91 64.54	14 9.93	94 66.67
PERSONNEL	6 17.14	3 8.57	9 25.71	21 19.81	5 4.72	25 23.58	27 19.15	8 5.67	34 24.11
AIRFRAME	1 2.86	.00	1 2.86	1 .94	.00	1 .94	2 1.42	.00	2 1.42
LANDING GEAR	.00	.00	.00	20 18.87	3 2.83	22 20.75	20 14.18	3 2.13	22 15.60
POWERPLANT	7 20.00	.00	7 20.00	13 12.26	.00	13 12.26	20 14.18	.00	20 14.18
SYSTEMS	1 2.86	1 2.86	2 5.71	.00	.00	.00	1 .71	1 .71	2 1.42
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 2.86	3 8.57	4 11.43	.00	.00	.00	1 .71	3 2.13	4 2.84
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	1 2.86	1 2.86	3 2.83	10 9.43	13 12.26	3 2.13	11 7.80	14 9.93
WEATHER	3 8.57	13 37.14	15 42.86	5 4.72	18 16.98	21 19.81	8 5.67	31 21.99	36 25.53
TERRAIN	.00	3 8.57	3 8.57	3 2.83	3 2.83	6 5.66	3 2.13	6 4.26	9 6.38
MISCELLANEOUS	.00	1 2.86	1 2.86	6 5.66	.00	6 5.66	6 4.26	1 .71	7 4.96
UNDETERMINED	5 14.29	.00	5 14.29	1 .94	.00	1 .94	6 4.26	.00	6 4.26

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE XII

CAUSE/FACTOR TABLE
AIR TAXI
SCHEDULED PASSENGER/CARGO
1968-1970

INVOLVES 141 TOTAL ACCIDENTS
INVOLVES 35 FATAL ACCIDENTS

NTS	TOTAL#	DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
			CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
		** PILOT **									
		PILOT IN COMMAND									
		ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	2		2	1	1	2	3	1	4
94		BECAME LOST/DISORIENTED	1		1				1		1
66.67		CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	2		2	1		1	3		3
		CONTINUED INTO KNOWN AREA OF SEVERE TURBULENCE	1		1				1		1
34		DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				2	3	5	2	3	5
24.11		FAILED TO EXTEND LANDING GEAR				2		2	2		2
		FAILED TO RETRACT LANDING GEAR				1		1	1		1
2		INADVERTENTLY RETRACTED GEAR				4		4	4		4
1.42		FAILED TO SEE AND AVOID OTHER AIRCRAFT				1		1	1		1
		FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS		1	1	2		2	2	1	3
22		FAILED TO OBTAIN/MAINTAIN FLYING SPEED	4		4	6		6	10		10
15.60		FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	2		2	2	1	3	4	1	5
		IMPROPER OPERATION OF POWERPLANT & POWERPLANT CONTROLS	2		2	2		2	4		4
20		IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS				5		5	5		5
14.18		IMPROPER OPERATION OF FLIGHT CONTROLS				1		1	1		1
		PREMATURE LIFT OFF				1		1	1		1
2		IMPROPER LEVEL OFF	1		1	5		5	6		6
1.42		IMPROPER IFR OPERATION	6		6	5		5	11		11
		IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4		4	1		1	5		5
4		INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	4	2	6	9	3	12	13	5	18
2.84		INADEQUATE SUPERVISION OF FLIGHT				2		2	2		2
		LACK OF FAMILIARITY WITH AIRCRAFT				1	2	3	1	2	3
		MISMANAGEMENT OF FUEL	1		1	2		2	3		3
.00		EXERCISED POOR JUDGMENT	2		2	3		3	5		5
		SELECTED UNSUITABLE TERRAIN				4		4	4		4
14		IMPROPER STARTING PROCEDURES				1		1	1		1
9.93		FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED				2		2	2		2
		MISJUDGED DISTANCE, SPEED, AND ALTITUDE				1		1	1		1
36		MISJUDGED DISTANCE AND SPEED				1		1	1		1
25.53		MISJUDGED DISTANCE				2		2	2		2
		MISJUDGED DISTANCE AND ALTITUDE				4		4	4		4
9		MISJUDGED ALTITUDE	1		1	1		1	2		2
6.38		MISJUDGED CLEARANCE				1		1	1		1
		MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
7		IMPROPER RECOVERY FROM BOUNCED LANDING	1		1	2		2	3		3
4.96		SPATIAL DISORIENTATION	3		3				3		3
		MISUSED OR FAILED TO USE FLAPS		1	1					1	1
6		FAILED TO MAINTAIN DIRECTIONAL CONTROL				4		4	4		4
4.26		SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND				2	1	3	2	1	3
		FAILED TO INITIATE GO-AROUND				2		2	2		2
		DIRECT ENTRIES				1		1	1		1
		SUBTOTAL	37	4	41	88	11	99	125	15	140
		COPILOT									
		FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
		IMPROPER LEVEL OFF				1		1	1		1
		MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
		IMPROPER RECOVERY FROM BOUNCED LANDING				1		1	1		1
		FAILED TO ABORT TAKEOFF				1		1	1		1
		SUBTOTAL				5		5	5		5
		** PERSONNEL **									
		FLIGHT INSTRUCTOR									
		MAINTENANCE, SERVICING, INSPECTION									
		IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)				4		4	4		4
		INADEQUATE MAINTENANCE AND INSPECTION	2	2	4	8		8	10	2	12
		OTHER				1		1	1		1
		OPERATIONAL SUPERVISORY PERSONNEL									

TABLE XIII

CAUSE/FACTOR TABLE

PERSONNEL (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
INADEQUATE FLIGHT TRAINING-PROCEDURES					1	1		1	
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT					1	1		1	
WEATHER PERSONNEL									
TRAFFIC CONTROL PERSONNEL									
ISSUED IMPROPER OR CONFLICTING INSTRUCTIONS	1	1	2						
OTHER	1		1				1	1	
AIRPORT SUPERVISORY PERSONNEL									
IMPROPER MAINTENANCE-AIRPORT FACILITIES					1	1		1	
IMPROPER/INADEQUATE SNOW REMOVAL					1	1		1	
IMPROPER OPERATION OF FACILITIES					1	1		1	
AIRWAYS FACILITIES PERSONNEL					1	1		1	
PRODUCTION-DESIGN									
INCORRECT FACTORY INSTALLATION				1		1	1		
POOR/INADEQUATE DESIGN				1		1	1		
OTHER	1		1	1		1	1		
MISCELLANEOUS-PERSONNEL									
PILOT OF OTHER AIRCRAFT									
GROUND CREWMAN				1	1	2	1	1	
DRIVER OF VEHICLE				1		1	1		
OTHER	1		1	3		3	3		
DIRECT ENTRIES	1		1				1		
THIRD PILOT	1		1				1		
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	7	3	10	21	6	27	28	9	3
** AIRFRAME **									
WINGS									
WING ATTACHMENT FITTINGS, BOLTS	1		1				1		
FUSELAGE									
LANDING GEAR									
MAIN GEAR-SHOCK ABSORBING ASSY, STRUTS, ATTACHMENTS, ETC				2		2	2		
NORMAL RETRACTION/EXTENSION ASSEMBLY				12		12	12		1
EMERGENCY/EXTENSION ASSEMBLY				7		7	7		
NOSEWHEEL ASSEMBLIES				1	1	2	1	1	
WHEELS, TIRES, AXLES				3		3	3		
BRAKING SYSTEM (NORMAL)				2	1	3	2	1	
LANDING GEAR WARNING AND INDICATING COMPONENTS					1	1		1	
GEAR LOCKING MECHANISM				1		1	1		
FLIGHT CONTROL SURFACES									
FLAP ASSEMBLIES				1		1	1		
SUBTOTAL	1		1	29	3	32	30	3	3
** POWERPLANT **									
ENGINE STRUCTURE									
VALVE ASSEMBLIES	2		2	1		1	3		
OTHER				1		1	1		
IGNITION SYSTEM									
MAGNETOES				2		2	2		
LEADS	1		1	1		1	2		
FUEL SYSTEM									
SELECTOR VALVES				1		1	1		
CARBURETOR				1		1	1		
PUMPS				1		1	1		
VENTS, DRAINS, TANK CAPS	1		1						
LUBRICATING SYSTEM							1		
COOLING SYSTEM									
PROPELLER AND ACCESSORIES									
EXHAUST SYSTEM									
ENGINE ACCESSORIES									
VACUUM PUMPS	1		1				1		
ENGINE CONTROLS-COCKPIT									
THROTTLE-POWER LEVER ASSEMBLIES				1		1	1		
MIXTURE CONTROL ASSEMBLIES				1		1	1		
POWERPLANT-INSTRUMENTS									
MISCELLANEOUS									
POWERPLANT FAILURE FOR UNDETERMINED REASONS	2		2	1		1	3		
FOREIGN OBJECT DAMAGE				1		1	1		

TABLE XIII-Continued

POWERPLANT (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
REDUCTION GEAR ASSEMBLY									
SHAFT PROPELLER									
COMPRESSOR ASSEMBLY				1		1	1		1
OTHER	1		1				1		1
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
GEARS, ACCESSORY DRIVE				1		1	1		1
LUBRICATING SYSTEM									
FUEL SYSTEM									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
PROPELLER SYSTEM									
CONSTANT SPEED DRIVE									
POWER LEVER									
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
ENGINE INSTALLATION									
SUBTOTAL	8		8	14		14	22		22
** SYSTEMS **									
ELECTRICAL SYSTEM									
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
OTHER	1		1				1		1
ANTI-ICING, DE-ICING SYSTEMS									
AIR CONDITION, HEATING AND PRESSURIZATION									
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM		1	1					1	1
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL	1	1	2				1	1	2
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
ALTIMETERS		1	1					1	1
ATTITUDE GYRO	1		1				1		1
DIRECTIONAL GYRO	1		1				1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
COMPASS RECEIVERS		1	1					1	1
OTHER		1	1					1	1
MISCELLANEOUS EQUIPMENT									
SUBTOTAL	2	3	5				2	3	5
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS									
WET RUNWAY					1	1		1	1
ICE/SLUSH ON RUNWAY					3	3		3	3
SNOW ON RUNWAY		1	1	2	3	5	2	4	6
ROUGH WATER					1	1		1	1
HIGH VEGETATION					1	1		1	1
OTHER				1	3	4	1	3	4
AIRWAYS FACILITIES									
SUBTOTAL		1	1	3	12	15	3	13	16
** WEATHER **									

TABLE XIII--Continued

CAUSE/FACTOR TABLE

WEATHER (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
LOW CEILING	1	9	10	1	6	7	2	15	17
RAIN		2	2		4	4		6	6
FOG		6	6		8	8		14	14
SNOW	1	2	3		1	1	1	3	4
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	2	3	1	3	4	2	5	7
CONDITIONS CONDUCTIVE TO CARB/INDUCTION SYSTEM ICING	1		1		1	1	1	1	2
UNFAVORABLE WIND CONDITIONS				2	3	5	2	3	5
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS		1	1					1	1
DOWNDRAFTS, UPDRAFTS		1	1	1	1	2	1	2	3
LIGHTNING STRIKE				1		1			1
ADVERSE WINDS ALOFT		1	1					1	1
THUNDERSTORM ACTIVITY		1	1					1	1
SUBTOTAL	4	25	29	6	27	33	10	52	62
** TERRAIN **									
WET, SOFT GROUND					1	1		1	1
HIDDEN OBSTRUCTIONS				1		1	1		1
ROUGH/UNEVEN	1	1	1	1		1	1	1	2
ROUGH WATER				1		1			1
GLASSY WATER	1	1	1					1	1
HIGH OBSTRUCTIONS	1	1	1		1	1		2	2
OTHER					1	1		1	1
SUBTOTAL		3	3	3	3	6	3	6	9
** MISCELLANEOUS **									
BIRD COLLISION				1		1	1		1
VORTEX TURBULENCE				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				1		1	1		1
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS		1	1	2		2	2	1	3
UNDETERMINED	5		5	1		1	6		6
DIRECT ENTRIES				1		1	1		1
SUBTOTAL	5	1	6	7		7	12	1	13
GRAND TOTAL	65	41	106	176	62	238	241	103	344
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	1		1	1		1	2		2
CHECKLIST-FAILED TO USE					2	2		2	2
IMPROPER EMERGENCY PROCEDURES		1	1	2	1	3	2	2	4
INSTRUMENTS-MISREAD OR FAILED TO READ				1		1	1		1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA				1	1	2	1	1	2
UNWARRANTED LOW FLYING	1		1				1		1
FAILED TO USE ALL AVAILABLE RUNWAY					2	2		2	2
FLEW INTO BLIND CANYON		1	1					1	1
POORLY PLANNED APPROACH				1		1	1		1
LANDED ON FOAMED RUNWAY					3	3		3	3
IMPROPERLY SECURED	3		3	4		4	7		7
ELECTRICAL FAILURE					1	1		1	1
ENGINE LOADED UP				1		1	1		1
FATIGUE FRACTURE	2		2	3		3	5		5
HYDRAULIC FAILURE				1		1	1		1
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION				1		1	1		1
IMPROPER ALIGNMENT/ADJUSTMENT	1		1	3		3	4		4
FAILURE OF TWO OR MORE ENGINES	1	1	2	1	2	3	2	3	5
SEPARATION IN FLIGHT		1	1		1	1		2	2
FIRE IN CABIN/ COCKPIT/ BAGGAGE COMPARTMENT				1		1	1		1
FIRE IN ENGINE					1	1		1	1
ASYMMETRICAL FLAPS				1		1	1		1
CARGO SHIFTED	1		1				1		1
CONGESTED TRAFFIC-PATTERN					1	1		1	1
PILOT FATIGUE					1	1		1	1
FUEL EXHAUSTION	3		3	1		1	4		4
CARBON MONOXIDE POISONING		1	1					1	1
ICE-CARBURETOR	1		1	1		1	2		2

TABLE XIII-Continued

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

CAUSE/FACTOR TABLE

NTS	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
TOTAL									
17	AIRFRAME ICE	1	2	1	2	3	2	3	5
6	ICE-WINDSHIELD	1	1					1	1
14	IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	1	1	1	2	3	2	2	4
4	LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM			1		1	1		1
7	WATER IN FUEL			1		1	1		1
2	AIRCRAFT CAME TO REST IN WATER								
5	MISSING	7	7		3	3		10	10
1	OVERLOAD FAILURE	1	1	2		2	2	1	3
3	MATERIAL FAILURE	1	1	4	18	22	4	19	23
1	FUEL STARVATION			10	1	11	12	1	13
1	POOR WELD	1	1	4		4	5		5
1	PREVIOUS DAMAGE			1		1	1		1
1	LEAK/LEAKAGE			1	2	3	2	2	3
1	ARCING			2		2	1		2
1	DOWNWIND			1		1	1		1
1	OVER TORQUED				2	2		2	2
62	LOOSE, PART/FITTING			1		1	1		1
	BENT			1		1	1		1
	BINDING			1		1	1		1
	DISCONNECTED			1		1	1		1
	EXCESSIVE			1		1	1		1
	ERRATIC			1		1	1		1
1	IMPROPERLY INSTALLED	1	1					1	1
2	JAMMED			3		3	3		3
1	PRESSURE, NONE			6		6	6		6
1	SHEARED			2	1	3	2	1	3
2	VIBRATION, EXCESSIVE			1		1	1		1
1	CONGESTED RAMP/TAXIWAY			1		1	1		1
9	ICE-INDUCTION				2	2		2	2
	INTENTIONAL GROUND-WATER LOOP-SWERVE	1	1				1		1
	INTENTIONAL WHEELS UP			1		1	1		1
				2	3	5	2	3	5
1	DIRECT ENTRY CAUSES								
1	MISC-DEER CROSSED IN FRONT OF ACFT.								
3	PILOT-CAPT FAILED TO MAINT ALT AT MDA, REASONS UNKN								
6	PERSONNEL-FAA REPLACEMENT TIME REQUIREMENT INADEQUATE.								
1	DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS								
13									
344									

TABLE XIII-Continued