Survey Reveals Age and Pathology Trends For Medically Disqualified Airline Pilots

Studies of U.S. Federal Aviation Administration data show cardiovascular disease to be the leading cause of medical certification denials for airline pilots above the age of 45.

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Editor's note: Recent debate about allowing airline pilots to continue flying duties after age 60 has stirred interest in fitness for duty, especially among older pilots. The June 1992 Flight Safety Digest *article, "Preliminary Study Confirms that Pilots Die at Younger Age Than General Population," addressed the issue of pilot mortality rates after retirement. The following article, based on U.S. Federal Aviation Administration (FAA) data, surveys the diseases most frequently cited as reasons for pilot medical disqualifications in the United States.*

Federal Aviation Regulations (FAR) require that pilots for scheduled and nonscheduled airlines possess a first-class medical certificate to validate their air transport pilot certificate. Airline pilots are required to obtain a FAA medical examination at six-month intervals and must meet specific requirements for a first-class medical certificate as set forth in FAR 67.13 (b) through (f). If the medical standards are not met, the application for first-class certification is denied. This denial can result from any of several levels of certification review within the FAA, from the aviation medical examiner (AME) to the Federal Air Surgeon.

FAR Part 67 specifies that a medical certificate will be denied if an applicant has an established medical history or clinical diagnosis of any of the following conditions:

1. A personality disorder that is severe enough to have repeatedly manifested itself by overt acts;

2. A psychosis;

3. Alcoholism, unless there is established clinical evidence of recovery, satisfactory to the Federal Air Surgeon, including sustained and

total abstinence from alcohol for not less than the preceding two years. "Alcoholism" means a condition in which a person's intake of alcohol is great enough to damage physical health or personal or social functioning, or when intake of alcohol has become a prerequisite to normal functioning;

4. Drug dependence;

5. Epilepsy;

6. A disturbance of consciousness without satisfactory medical explanation of the cause;

7. Myocardial infarction;

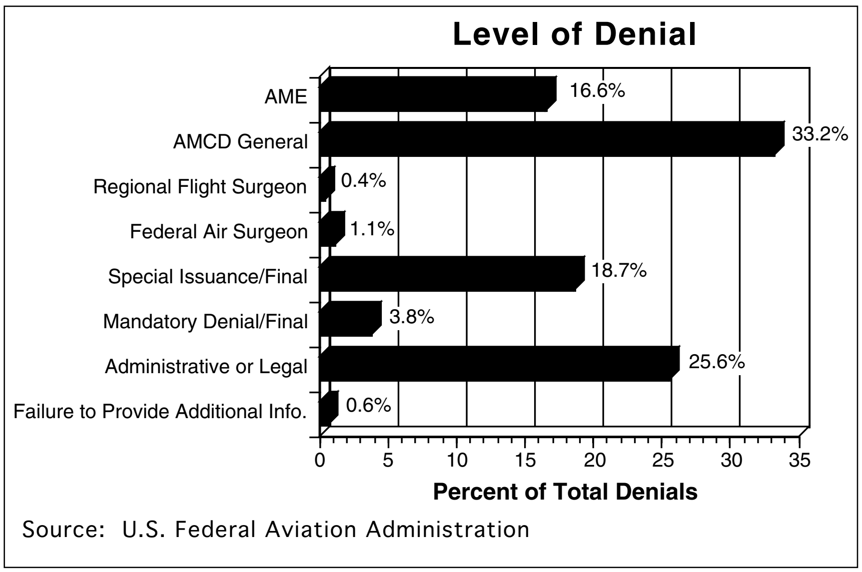


Figure 1

8. Angina pectoris;

9. Coronary heart disease that has required treatment or, if untreated, that has been symptomatic or clinically significant; and

10. Diabetes mellitus, requiring insulin or other drugs for control.

Advances in aviation medicine and changes in FAA policies and procedures in recent years have resulted in the medical certification of pilots who would have been denied before. Persons diagnosed as having alcoholism, coronary heart disease and various other diseases are, in many instances, now certified as a special issuance. For example, pilots with hypertension maintain their certificates while taking medication to control their blood pressure, and the time lapse has been reduced between myocardial infarction and re-application for certification. This study presents comprehensive data that reflect medical and general attributes of those airline pilots denied medical certification in calendar years 1987 and 1988.

Methods

The Aeromedical Certification Division (AMCD) of the Civil Aeromedical Institute (CAMI) is the central screening facility and repository within the FAA for the collection, processing, adjudication, investigation and analysis of medical data generated by the aeromedical certification and related programs.

The airline pilot denial data were obtained from the computer file as of July 1, 1989 for applicants in the calendar years 1987 and 1988. A six-month time lapse was allowed to ensure final certification action in the majority of cases. The active airline pilot population as of December 31, 1987 (the mid-period date), was used for rate computation and comparison.

Five-year age groupings, beginning with age 25 and ending with age 59, were used since they are closest to the age limits set by FAR 61.151 and 121.383(c) for holding an air transport pilot rating and engaging in air carrier operations.

The prevailing data regarding pathology represent the conditions cited as cause for denial — not the number of airline pilots. Annual rates were computed to provide data more useful in answering the many questions received concerning airmen denied medical certification.

Results and Discussion

Observations of the airline pilot group probably give the truest reflection of prevalence of disqualifying disease as is possible to observe. Prescreening by airline companies before employment and FAA requirements for issuance of a first-class medical certificate result in this group being purged of disease prevalence that contributes to higher rates for other non-pilot groups.

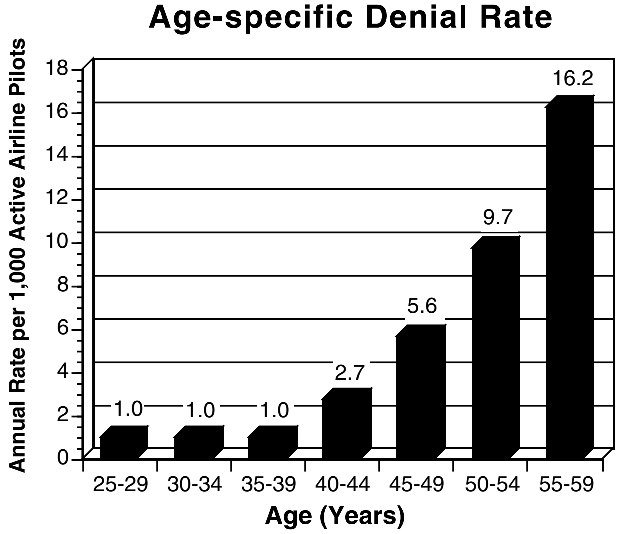
Denials may occur at several different levels within the FAA by the AME (Figure 1, page 2). If an applicant was denied by the AME and did not request further reconsideration from the FAA, the AME denial was considered final. The final level of denial is, however, the one recorded on a pilot's medical record.

Table I
Age Distribution of Airline Pilots

Age Groups	Active Airline Pilots	Percent of Active Airline Pilots	Denied Airline Pilots	Percent of Total Denials	Annual Age-specific Denial Rate*
25-29	5,698	10.2	7	1.5	1.0
30-34	8,809	15.8	16	3.4	1.0
35-39	10,005	18.0	20	4.2	1.0
40-44	9,544	17.2	52	10.9	2.7
45-49	10,288	18.5	115	24.1	5.6
50-54	7,760	13.9	150	31.5	9.7
55-59	3,576	6.4	116	24.4	16.2
Total	55,680	100.0	476	100.0	4.3

*Annual rates per 1,000 active airline pilots.

Source: U.S. Federal Aviation Administration

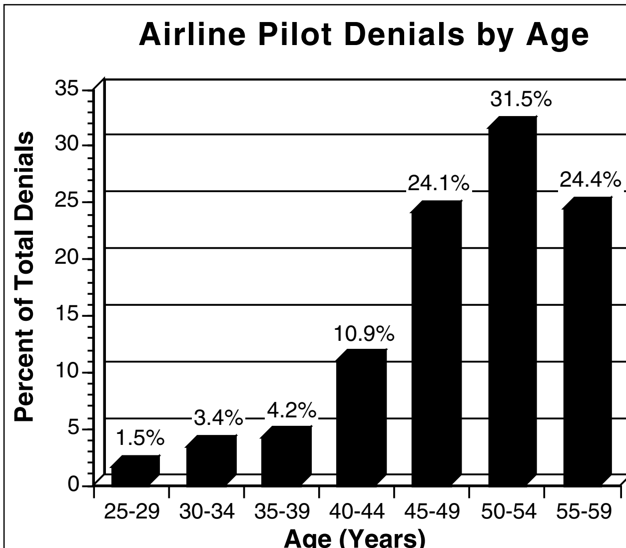


Source: U.S. Federal Aviation Administration

Figure 2

As of December 31, 1987, there were 55,680 airmen between the ages of 25 and 59 who listed their occupation as airline pilot. Of this group, 537 were issued a denial during the calendar years 1987 and 1988. Of those denied, 57 (10.6 percent of total denials) were subsequently issued a medical certificate and were excluded from this study. Of the remaining 480 denials, four were outside the 25 to 59 age range and they were also excluded from the study.

All further findings in this study are based on 476 total denials, with a total of 726 disqualifying conditions. The annual denial rate for airline pilots is 4.3 per 1,000 active airline pilots, increasing from a rate of 1.0 per 1,000 in the 25-29 age interval to 16.2 per 1,000 in the 55-59 age interval (Table I and Figures 2 and 3). Of the 476 airline pilot denials, almost half were either general denials issued by the AMCD or AME denials. In a previous study (1) concerning calendar years 1983 and 1984, the annual denial rate was 4.7 per 1,000 active airline pilots. The rate has decreased slightly since then.



Source: U.S. Federal Aviation Administration

Figure 3

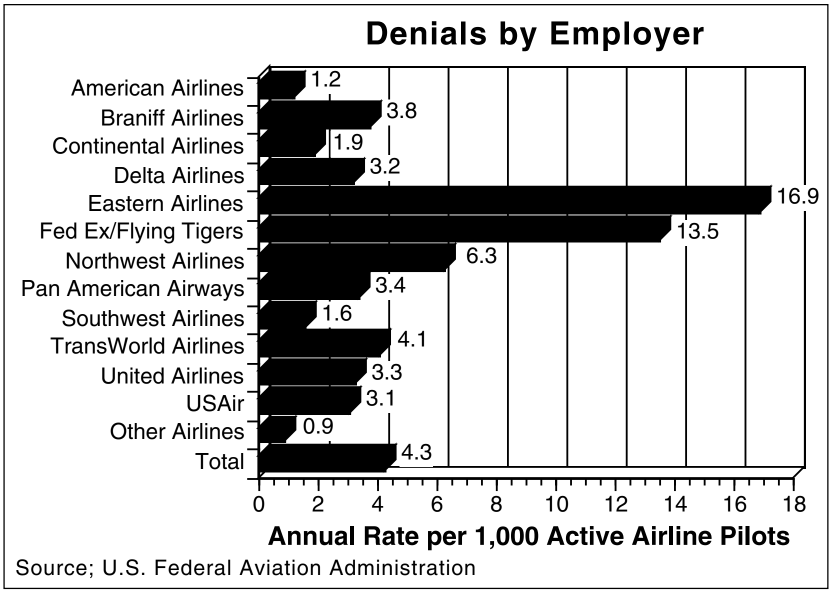


Figure 4

Data on denials by airline employers provide some interesting insight, even though these data are fraught with limitations that make comparison difficult, such as small numbers of subjects studied (Figure 4). Of the 476 denials included in this study, 141 were airline pilots employed by Eastern Airlines. It is possible that some of these denials were associated with Eastern's financial and management/union difficulties during the study period. The majority of these denials were for the following reasons:

1. Use of disqualifying medications (about 65 percent of the disqualifying medications are directly related to cardiovascular diseases);

2. Spinal cord disease (ruptured disc, spinal fusion);

3. Ear pathology (vertigo, labyrinthitis, inner ear pathology);

4. Hypertension with medication; and

5. Psychoneurotic disorders (anxiety, depression, obsessive compulsive behavior, phobias, etc.)

Of the 141 denied Eastern Airlines pilots, 18 (12.8 percent) were less than age 45; 37 (26.2 percent) were in the 45-49 age range; 47 (33.3 percent) were in the 50-54 age range; and 39 (27.7 percent) were in the 55-59 age range. Flying Tigers Lines, purchased by Federal Express near the end of the study period, was attributed with 20 denials. The majority of these denials were in the neuropsychiatric and cardiovascular pathology categories and within

Table II
Denial Rates of Airline Pilots by Medical Condition and Age*

Cause for Denial (Pathology)	25-29 Rate**	30-34 Rate**	35-39 Rate**	40-44 Rate**	45-49 Rate**	50-54 Rate**	55-59 Rate**	Total Annual Rate**
Eye	—	—	—	0.1	0.3	0.9	0.8	0.3
Ear, Nose, Throat	—	—	0.1	0.3	0.5	1.2	1.3	0.4
Respiratory	—	—	—	0.1	0.2	0.2	1.1	0.2
Cardiovascular	0.1	0.1	0.1	0.9	2.7	5.2	11.9	2.2
Abdominal	0.1	—	—	0.1	0.2	0.6	1.1	0.2
Neuropsychiatric	0.5	0.7	0.7	1.4	2.9	3.5	4.6	1.8
Bones & Joints	—	—	0.0	0.3	0.6	0.8	1.0	0.3
Muscles	—	—	—	0.0+	0.0+	0.2	—	0.0+
Miscellaneous	0.2	0.4	0.6	0.8	1.5	1.6	3.8	1.1
Total	0.9	1.2	1.5	4.0	8.9	14.2	25.6	6.5

*Refers to distinct pathological conditions cited as cause/causes for denial. Two hundred and eighty-seven applicants were denied for a single cause; 139 for two causes; 39 for three causes; 9 for 4 causes; 1 for 5 causes; and 1 for 6 causes.
**Annual rates per 1,000 active airline pilots.

Source: U.S. Federal Aviation Administration the age range of 40-54. It is also possible that some of these denials were associated with financial difficulties before the merger with Federal Express.

Annual age-cause-specific denial rates increase to the highest rate at age interval 55-59 (16.2 per 1,000 active airline pilots). The rate of medical disqualification is minimal before the age of 45 but increases rapidly thereafter (Table I). The mean age of active (certificate issued) airline pilots is 41.0, compared to a mean age of 49.4 for denied airline pilots. In a previous study, the mean age of active (certificated) airline pilots was 41.8, compared to a mean age of 48.6 for denied airline pilots (1). Therefore, it appears that the mean age of active airline pilots is decreasing, while the mean age of denied airline pilots is increasing.

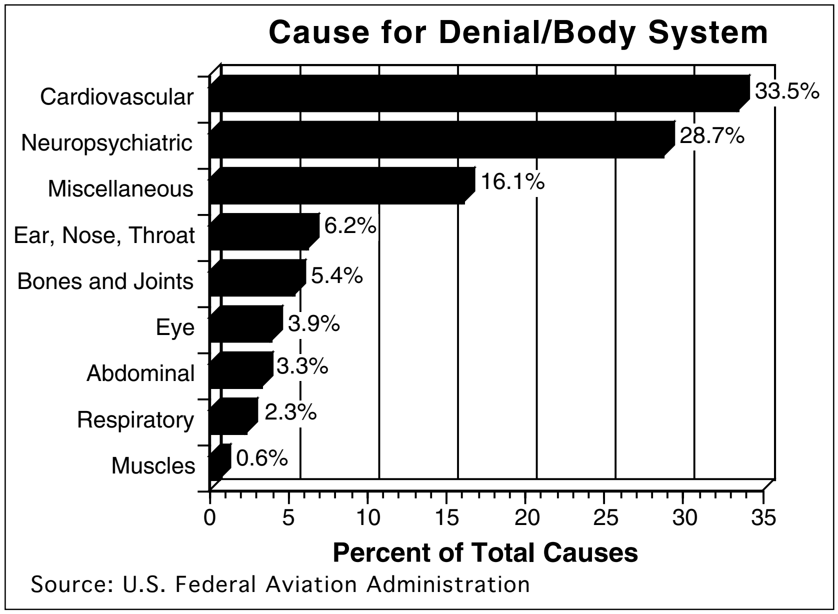


Figure 5

An increase of cardiovascular denials after age 50 is observed in the age-cause-specific annual denial rates. Neuropsychiatric disease is the major cause for denial in the 30-34, 35-39, 40-44, and 45-49 age intervals. Cardiovascular disease is the most prevalent cause for denial in the 50-54 and 55-59 age intervals. Denial rates begin to increase rapidly in the 45-49 age interval with neuropsychiatric disease followed closely by cardiovascular disease, with the miscellaneous pathology category third (Table II).

The overall highest causes for denial by pathology series are: 1) cardiovascular; 2) neuropsychiatric diseases (convulsive reactions, disturbances of consciousness, neuroses, alcoholism, etc.) and 3) the miscellaneous pathology category (endocrinopathies, general systemic conditions, use of disqualifying medications, and denials for failure to provide additional medical information), with annual rates per 1,000 active airline pilots of 2.2, 1.8, and 1.1, respectively (Table II).

The highest causes for denial by specific pathology are: 1) coronary artery disease; 2) use of disqualifying medications; 3) psychoneurotic

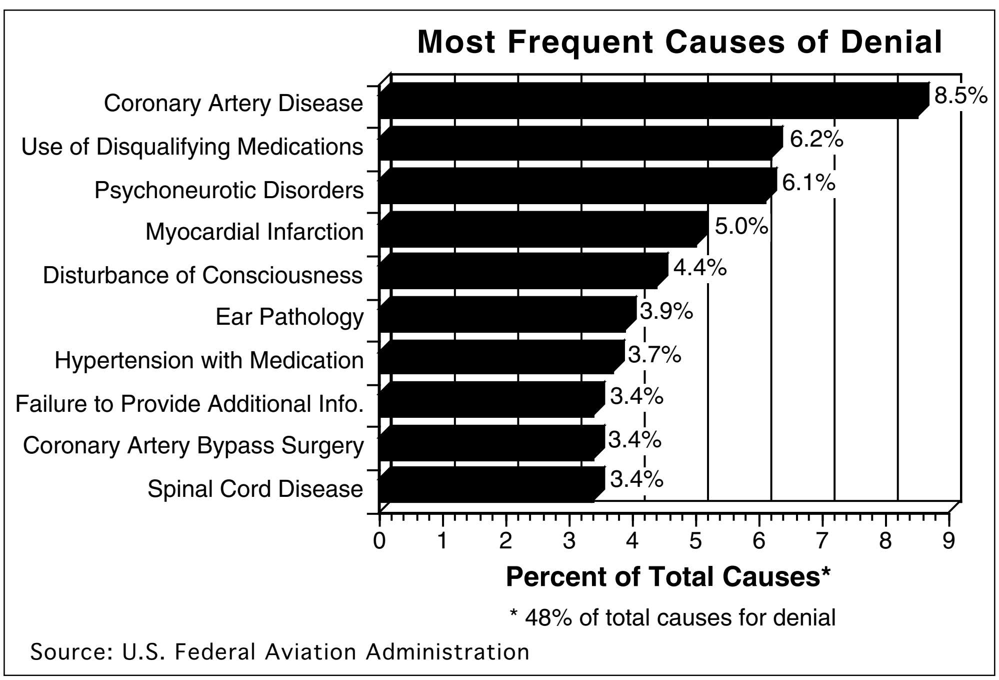


Figure 6

disorders; 4) myocardial infarction; and 5) disturbance of consciousness. These five specific causes account for 30 percent of all causes for denial (Figure 6, page 5).

[Recent studies conducted by Japan's Aeromedical Research Center also showed that cardiovascular disease was a leading cause of certificate denials. In one study of 201 Japanese flight crew who were denied medical certificates a total of 66 suffered from cardiovascular disease.]

In the present study, 62 airline pilots were denied for coronary artery disease; 19 had also suffered a prior myocardial infarction, 13 had also undergone coronary artery bypass surgery and an additional three had suffered a prior myocardial infarction and undergone coronary artery bypass surgery.

Two hundred and eighty-seven airline pilots were denied for a single cause, 139 pilots for two causes, 39 pilots for three causes, nine pilots for four causes, one pilot for five, and one pilot for six causes.

Cardiovascular, neuropsychiatric and the miscellaneous pathology category comprise 78 percent of the causes for medical disqualification. These problems rarely result in disqualification before the age of 45, while above this age the rate increases rapidly, primarily because of cardiovascular disease. The mean age of active airline pilots is decreasing, while the mean age of denied airline pilots is increasing. ♦

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1. Dark S. *Medically Disqualified Airline Pilots*. Washington, D.C. U.S. Federal Aviation Administration, Office of Aviation Medicine, No. FAA-AM-86-7. 1986.

Aviation Statistics

Pilot Deviation Report Cites Trends In U.S. Aviation for Calendar Years 1985-1991

by
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Pilot deviation, as defined by the U.S. Federal Aviation Administration (FAA), is any pilot action that results in a violation of U.S. Federal Aviation Regulations (FAR) or North American Aerospace Defense Command (NORAD) Air Defense Identification Zone (ADIZ) tolerance. Any such pilot actions, either civilian or military, are reportable incidents and are most often reported to the FAA by air traffic facilities. Since 1985, the FAA has maintained a pilot deviation data base and used the information to help monitor national aviation safety.

Control Towers File Most Reports

In a study of pilot deviation published by the FAA in July 1989, typical pilot deviations during the 1985-1987 period were found to have the following characteristics:

- About 50 percent of pilot deviations were airspace violations and 37 percent were clearance violations;
- General aviation pilots were involved in 63 percent of the deviation reports, followed by airline pilots and military pilots;
- In phase of operation, about 33 percent of pilot deviations occurred during cruise and 17 percent on takeoff-climb;
- In cases where the pilot certificate types were known, private pilots were cited in 38 percent of the total deviation reports, followed by airline transport pilots with 31 percent;
- More deviations occurred in the months of August and October, and on Fridays between 2:00 and 4:00 p.m. local time; and,
- More than 54 percent of pilot deviation reports were filed by control towers; about 30 percent were filed by air route traffic control centers, followed by Terminal Radar Approach Control (TRACON) and Flight Service (FSS).

Runway Incursions and Altitude Separation Top List of Deviations

Table I (page 8) lists pilot deviation types summarized by the 1985-1987 reports.

In the surface category, the most frequent deviation is entering runways or taxiways without clearance. In the air traffic control (ATC)

Table I
Pilot Deviation Reports 1985-1987
Pilot Deviation Types by Category

Deviation Category	Deviation Type
	Takeoff without clearance Takeoff on wrong runway or taxiway Landed without clearance Landed on wrong runway or taxiway Entered runway or taxiway without clearance
Surface Deviations	Other surface-related deviations, such as: - Landed at wrong airport - Landed on closed runway - Takeoff or landing below weather minima - Operated contrary to standard or missed approach
Procedure Deviations	
	Runway transgression Runway incursion
ATC Clearance Deviation	From altitude, result in loss of separation From course, results in loss of separation From altitude, with no loss of separation From course, with no loss of separation
Airspace Violated Deviations	Terminal Control Area (TCA) Airport Radar Service Area (ARSA) Airport Traffic Area (ATA) Control Zone (CZ) Positive Control Area (PCA) Special Use Airspace (SUA) Spillout (involves military aircraft only) Spillin (involves military or restricted airspace only) Other airspace type, most often: Air Defense Identification Zone (ADIZ)
Other Deviations	Flying VFR in IFR conditions Unauthorized low-level flying Did not close flight plan Missed compulsory reporting point Other, such as; - Took another pilot's (aircraft's) clearance - Pilot did not follow ATC instructions - Operating aircraft in careless/reckless manner - Operating IFR, but pilot non-instrument rated
Unknown or No Deviations	Unknown (undeterminable) deviation or determined no violation by FAA investigator

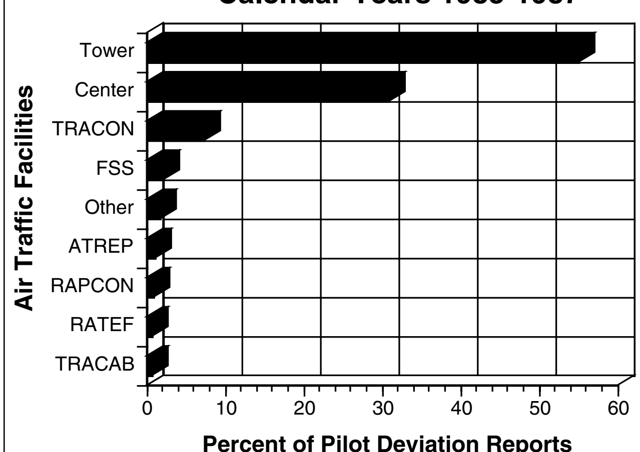
*Note: A PD report may involve several violations; thus, total deviations exceed total reports

Source: U.S. Federal Aviation Administration

category, the most frequent violation is deviation from altitude with separation loss. In deviations involving airspace, the most frequent are TCA (terminal control area) violations. Figure 1 shows the average rates of pilot deviation reports as filed by facility.

Figure 2 (page 9) delineates the distribution of pilot deviations by operation category. During the 1985-1987 period, pilot actions involving airspace violations accounted for 38 percent; followed by ATC clearance violations with 28 percent and surface deviations with 24 percent. All others and sources unknown accounted for the remaining 10 percent.

Pilot Deviation
Total Reports
Calendar Years 1985-1987



Source: U.S. Federal Aviation Administration

Figure 1

Time of Occurrence

Figure 3 (page 9) shows the monthly percentage distribution of pilot deviations by monthly average for the 1985-1987 period, the 1988-1989 period and the 1990-1991 period. In general, the frequencies of pilot actions violating FAR or ADIZ tolerance occurred more often in February, July, August and October, and less often in January and December. Figure 3 also shows no pattern of occurrence in the first six months of the year but almost identical patterns for July to December (all years).

Pilot Involvement

Figure 4 (page 9) shows pilot involvement in violations by pilot certificate for the years 1985, 1986 and 1987. In a three-year average of violations, general aviation pilot violations accounted for 63 percent, airline pilots 14 percent, military 11 percent, followed by commuter and air taxi pilots 5 percent and unknown 7 percent. During the three-year period, the involve-

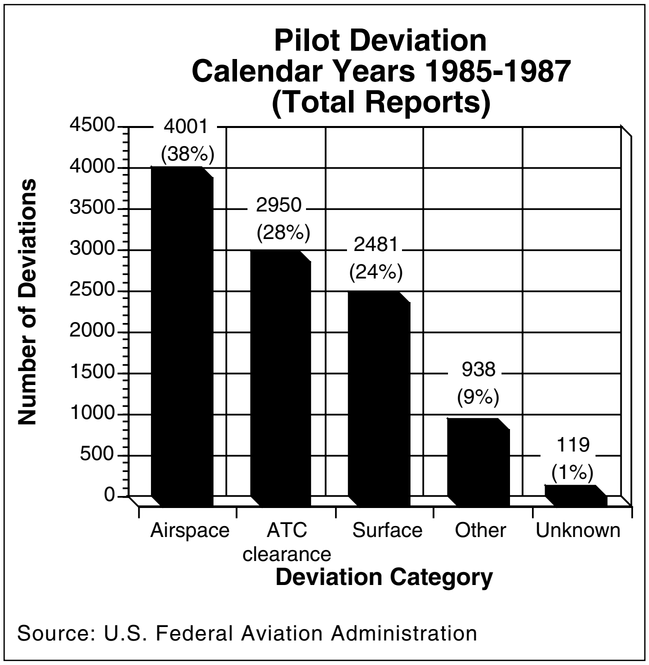


Figure 2

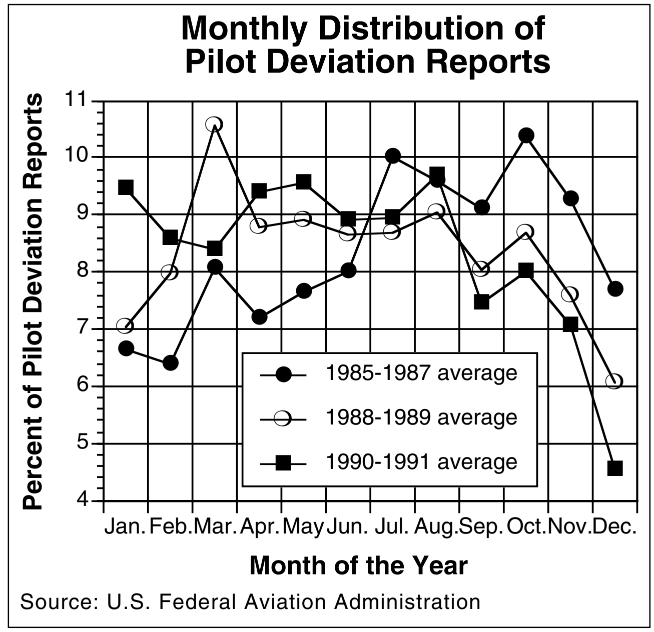


Figure 3

ment of general aviation pilots showed a substantial increase while airline pilot involvement showed a steady decline. Military pilot involvement showed little change.

Pilot Deviation Trends

Figure 5 (page 10) shows the annual frequency of pilot deviation trends for the 1985-1991 period. In the first three years, pilot deviations increased from 1,802 in 1985 to 3,641 in 1987, an increase of more than 100 percent. The significantly high number of reports in 1987 might be partially attributed to the fact that when the system was being initiated the reporting criteria and procedures were not well established. Once the system was established, aircraft operators came to realize that their actions were being watched closely and thus became more cautious. The reporting system could also have influence on pilot performance in terms of complacency. The number of reports decreased to 2,955 in 1988, a decline of 19 percent. The annual deviation dropped to 2,354 in 1990 and to 1,759 in 1991, a decrease of 52 percent since 1987.

Because almost all of the pilot deviation reports were filed by air traffic facilities, the FAA pilot deviation reports do not include any pilot violations that occurred in areas outside air traffic facilities. Based on the annual FAA air traffic reports for fiscal years 1985 through 1990, air traffic activities at air traffic facilities include the following categories:

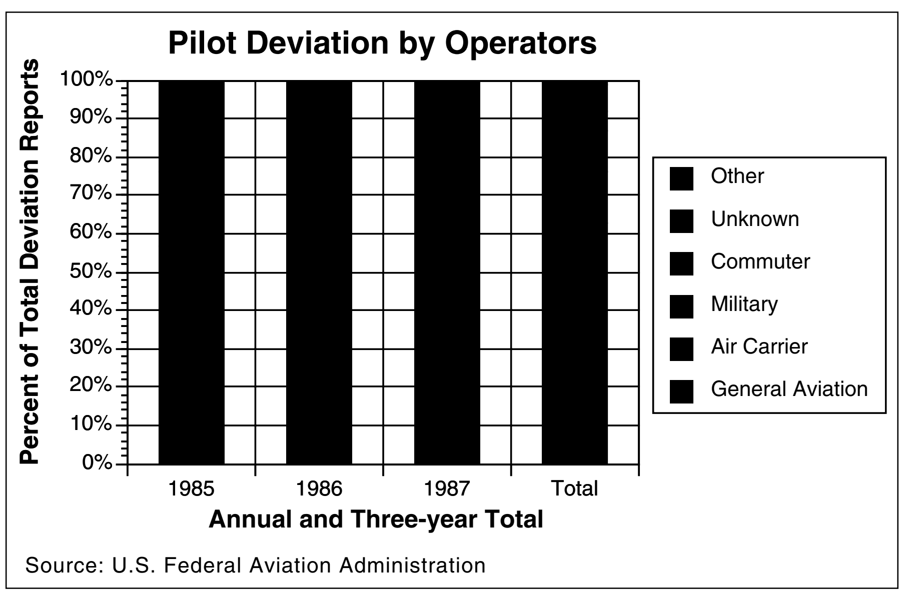


Figure 4

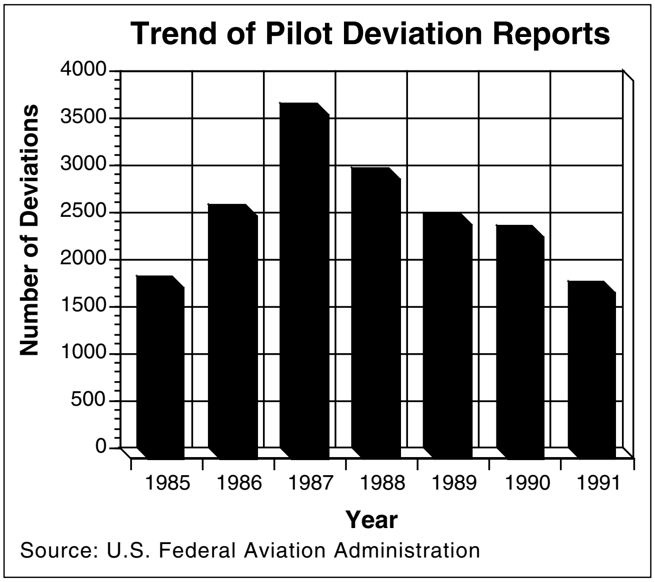


Figure 5

Table II
Pilot Deviation Reports and Rates by Air Traffic Activities

Fiscal Years 1985-1991

Year	Pilot Deviations	Air Traffic Activities	Deviations/100,000 Activities	One Deviation/ Air Traffic Activities
1985	1,888	141,774,000	1,332	75,092
1986	2,144	146,119,000	1,467	68,152
1987	3,763	151,883,000	2,478	40,362
1988	3,106	152,484,000	2,037	49,090
1989	2,540	154,138,000	1,648	60,680
1990	2,460	158,460,000	1,552	64,414
1991*	1,886	152,210,000	1,240	80,658

*Preliminary estimates

Source: U.S. Federal Aviation Administration

- Air traffic activities at air route traffic control centers;
- Air traffic activities at FAA airport traffic control towers;
- Air traffic activities at FAA facilities;
- Aircraft contact at Flight Service Stations (FSS); and
- Air traffic activity at FAA-contracted and operated control towers.

Table II shows the annual pilot deviation reports and total air activity for fiscal years 1985 through 1991.

During the seven-year period, air traffic increased from 142 million activities in 1985 to 158 million in 1990 and then dropped slightly to 152 million in 1991. Because the pilot deviation reports during the period increased sharply in the early years but decreased steadily and significantly in recent years, it appears that the frequency of pilot deviations was not related to air traffic activities. The deviation rate was 1.3 pilot deviations per 100,000 air traffic activities in 1985. The rate went up to 2.5 pilot deviations per 100,000 air traffic activities in 1982 and went down to 1.2 deviations in 1991. There was an average of one pilot deviation per 75,095 air traffic activities in 1985. This rate increased to one deviation per 40,367 air traffic activities in 1987, but improved to one deviation per 80,658 air traffic activities in 1991. ♦

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Aviation Safety Statistics, Monthly Report, December 1991, U.S. FAA *Air Traffic Activity Fiscal Year Annual Report* 1985-1990.

Selected Statistics Concerning Reported Pilot Deviations (1985), U.S. Federal Aviation Administration, July 1989.

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Updated Reference Materials (Advisory Circulars, U.S. FAA)

Numbers	Mo/Yr	Subject
90-91	April 1991	National Route Program (Cancels AC No. 90-82B dated June 29, 1990 and AC No. 90-90 dated December 6, 1990).
23.1309-1A	June 3, 1992	Equipment, Systems, and Installations in Part 23 Airplanes (Cancels AC No. 23.1309-1, Equipment, Systems, and Installations in Part 23 Airplanes, dated September 19, 1989).
150/5000-3P	May 13, 1992	Address List for Regional Airports Divisions and Airports District/Field Offices (Cancels AC No.150/5000-3n dated May 1, 1991).

New Reference Materials

Advisory Circular 20-137, 3/30/92, *Dynamic Evaluation of Seat Restraint Systems & Occupant Restraint for Rotorcraft* (Normal and Transport). Washington, D.C. United States Federal Aviation Administration, 1992. 42 p.; ill. with graphs.

Summary: This Advisory Circular (AC) provides guidance regarding acceptable means, but not the only means, of compliance with Parts 27 and 29 of the U.S. Federal Aviation Regulations (FAR) applicable to dynamic testing of seats intended for use in normal and transport category rotorcraft.

Reports

Air Traffic Control Specialists in the Airway Science Curriculum Demonstration Project, 1984-1990: Third Summative Report. Final Report/Dana Broach (Civil Aeromedical Institute). Washington, D.C. U.S. Federal Aviation Administration, Office of Aviation Medicine; Springfield, Va., U.S. Available through the National Technical Information Service*, [1991]. Report No. DOT/FAA/AM-91/18. 20 p.; charts.

Key Words
1. Aeronautics — Study and Teaching (Higher) — United States.
2. Air Traffic Controllers — Selection and Appointment — United States.
3. United States. Federal Aviation Administration — Officials and Employees — Selection and Appointment.

Summary: The objective of this evaluation of the Airway Science Curriculum Demonstration Project (ASCDP) was to compare the performance, job attitudes, retention rates and perceived supervisory potential of graduates from recognized Airway Science programs with those of individuals recruited through traditional means in the Air Traffic Control Specialist (ATCS) occupation. Previous evaluations described institutional and organization benefits that accrued to the agency, participating institutions and industry. In this technical evaluation, differences between Airway Science hires and a random, stratified sample of traditional ATCS hires on eight program objectives were evaluated according to: (1) interest in an aviation-related career; (2) attrition; (3) technical competence; (4) attitudes toward technological change; (5) managerial potential; (6) human relations skills; (7) female and minority representation; and (8) perceptions of the FAA. Controllers hired from the Airway Science register expressed significantly more interest in an aviation-related career (Objective 1). There were no significant differences between traditional hires and Airway Science hires on the remaining criteria. Overall, the performance of Airway Science hires was about the same as that of traditionally hired controllers. [Abbreviated author abstract]

Human Factors in Aviation Maintenance: Phase 1, Progress Report / William T. Shepherd … [et al.]. Washington, D.C. U.S. Federal Aviation Administration, Office of Aviation Medicine; Springfield, Va., U.S. Available through the National Technical Information Service*, [1991]. Report No. DOT/FAA/AM-91/16. x, 158 p.; charts.

Key Words
1. Aeronautics — Human Factors.
2. Airplanes — Maintenance and Repair.
3. Aviation Mechanics (Persons) — Psychology.

Content: Executive Summary — Maintenance Organization — The Maintenance Technician in Inspection — Advanced Technology Training for Aviation Maintenance — Job Performance Aids — List of Tables.

Summary: This human factors research in aviation maintenance addresses four tasks, including studies of organizational behavior, job and task analysis in maintenance and inspection, advanced technology for training and the application of job aiding to maintenance. The first phase of a three phase research program describes extensive preliminary investigation of airline maintenance practices. Each chapter describes the Phase I investigation and problem definition followed by the plan for the Phase II demonstrations.

New York Downtown Manhattan (Wall Street) Heliports: Operations Analysis/Deborah J. Peisen, Roy Lobosco. Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, 1991. Performed by Systems Control Technology, Inc. under contract No. DTFA01-87-C-00014. vii, 124 p.; charts.

Keywords
1. Heliports — New York (NY) — Management.
2. Heliports — New York (NY) — History.
3. Heliports — New York (NY) — Design and construction.

Summary: In response to increasing helicopter demand, the FAA initiated the FAA/Industry National Prototype Heliport Demonstration and Development Program in 1983. Four cities were selected for the demonstration program: Indianapolis, New Orleans, Los Angeles and New York. This study is an analysis of the operational characteristics of the Downtown Manhattan Heliport located in New York City. The study provides a general overview of the number of helicopter operations since the heliport opened in 1960 and a detailed analysis of the operational characteristics between 1987 and 1989, the time frame for which detailed data were available. Analysis of the operations at the heliport is based on data collected by the Port Authority of New York and New Jersey (PANYNJ), the owner and operator of the heliport. The study's parameters concentrate on the variations and trends in the number of operations by year, month, week, time of day, mission type, engine type, and number of passengers carried. [Modified author's abstract]

Helicopter Physical and Performance Data/ Edwin D. McConkey [et al.] Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, 1991. Report No. DOT/FAA/RD-90/3 Performed by Systems Control Technology under contract No. DTFA01-87-C-00014. 196 p. in various pagings; ill., includes bibliographical references (p. 35-36).

Keywords
1. Helicopters — Aerodynamics.
2. Helicopters — Dynamics.
3. Heliports.
4. Air traffic control.

Summary: This study is one of a series of five reports that address helicopter performance profiles and their relationship to Visual Flight Rules (VFR) approaches and departures at heliports. For this study, physical and performance data for eight civil helicopters were determined. Flight manual data as well as certification, flight test and computer generated performance data were used to complete the study. Approach and departure profiles were developed for several gross weights with varying ambient conditions and translated into graphs. These graphs show that the airspace required for approaches is dependent upon pilot skill and desired approach slope. Pilots can fly approaches steeper than the current standard 8:1 surface if required, although pilot workload tends to increase and comfort levels tend to decrease. The airspace required for departures is a function of aircraft performance and ambient conditions. Three types of departure procedures were studied: "optimum" with respect to airspace, manufacturer's recommended and Category A. Results show that minimum VFR heliport airspace requirements are dictated by departure profiles. Implications of these findings are considered in detail in the followup report, *Heliport VFR Airspace Design Based on Helicopter Performance*, DOT/FAA/RD-90/4. [Modified author's abstract]

Helicopter VFR Airspace Design Based on Helicopter Performance/ Robert K. Anoll ... [et al.] Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, 1991. Report No. DOT/FAA/RD-90/4. Performed by Systems Control Technology under contract No. DTFA01-87-C-00014. 100 p. in various pagings; ill., includes bibliographical references (p. 83-84).

Keywords
1. Heliports.
2. Air traffic control.
3. Avionics.
4. Helicopters — Aerodynamics.

Summary: This report is the second in a series dedicated to the development of a performance-based heliport design system that allows safe and efficient operations at a variety of heliports by defining usable heliport airspace/groundspace and required helicopter performance. This report summarizes the results of the efforts to classify helicopters and heliports based on the performance capabilities of a given rotorcraft and the protected ground and airspace available at a given heliport. This current report applies data contained in *Helicopter Physical and Performance Data* and *Operational Survey — VFR Heliport Approaches and Departures* to the issue of minimum required VFR airspace around the heliport, and it develops a performance-based system for both heliports and helicopters that allows operational credit for certificated performance capability. This report is an analysis of Federal Aviation Regulation's Part 77 VFR surfaces requirements only. [Modified author abstract]

Rotorcraft Acceleration and Climb Performance Model/ Robert K. Anoll, Edwin D. McConkey. Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, [1991]. Report No. DOT/FAA/RD-90/6. Performed by Systems Control Technology under contract No. DTFA01-87-C-00014. 47 p. in various pagings; ill., includes glossary.

Keywords
1. Helicopters — Aerodynamics.
2. Helicopters — Dynamics.
3. Air traffic control.
4. Heliports.

Summary: This report documents the methodology used in developing the helicopter departure profiles presented in *Helicopter Physical and Performance Data* DOT/FAA/RD-90/3. The Helicopter Departure Profile (HEDPRO) program which converts helicopter performance

data and departure procedures into departure profile data is described in detail. The methodology includes identification of the manufacturer's recommended departure procedures, generation of climb and acceleration performance data specific to each helicopter and atmospheric condition and, finally, computation of helicopter performance data using the Helicopter Sizing and Performance Computer Program (HESCOMP) developed by NASA/Boeing. Using the HEDPRO program, the departure paths were computed by determining the height/distance points of the path from the helipad. These points were then graphed to illustrate the departure profiles. [Modified author abstract]

Operational Survey: VFR Heliport Approaches and Departures/ Raymond A. Symons, Randal A. Wiedemann. Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, [1991]. Report No. DOT/FAA/RD-90/5. Performed by Systems Control Technology under contract No. DTFA01-87-C-00014. 66 p. in various pagings; charts.

<u>Keywords</u>
1. Heliports.
2. Air traffic control.
3. Avionics.
4. Helicopters — Aerodynamics.

Summary: This report documents a field survey of helicopter performance and operational considerations important to heliport design issues. Helicopter operators, manufacturers, flight instructors and U.S. Federal Aviation Administration (FAA) Technical Center pilots were surveyed in an attempt to relate their actual VFR helicopter operating techniques to helicopter airspace requirements. Results of the survey show a wide variation in opinion, even among pilots flying the same aircraft models, about what constitutes safe straight approach and departure distances, adequate acceleration distances and realistic climb angles. During the formal review process, a number of FAA officials concluded that in many instances the pilots perceived performance capabilities that exceeded the aircraft's performance capabilities. Also of concern were instances when the aircraft could perform the maneuver, but the steep climb/descent angles needed would substantially increase the risk of an accident. [Modified author abstract]

Helicopter Rejected Takeoff Airspace Requirements/ Edwin D. McConkey, Robert J. Hawley, Robert K. Anoll. Washington, D.C. U.S. Federal Aviation Administration, Research and Development Service; Springfield, Va. Available through the National Technical Information Service*, [1991]. Report No. DOT/FAA/RD-90/7. Performed by Systems Control Technology under contract No. DTFA01-87-C-00014. iv, 37, A-5, B-7 p.; ill., includes bibliographical references (p. 37).

<u>Keywords</u>
1. Heliports.
2. Air traffic control.
3. Avionics.
4. Helicopters — Aerodynamics.

Summary: This report is an analysis of performance data for helicopters certified for one engine inoperative (OEI) performance. The report further relates rejected takeoff and OEI capability to airspace requirements for heliports intended to support U.S. Federal Aviation Regulation (FAR) certification Category A operations. The current U.S. Federal Aviation Administration (FAA) regulation defining protected airspace and the imaginary surfaces associated with heliports does not take into consideration emergency situations involving engine failures during takeoff and landing operations. Moreover, in cases of rejected takeoff, the regulation parameters for air and ground space provide no margin of safety for acceleration or stopping distance. In addition, the regulation defines departure paths (climb-out angles) that are too steep for many helicopters' OEI climb-out capability. Using an analysis of helicopter performance data, this report suggests a more flexible airspace system that should apply to protected airspace at heliports supporting Category A operations.[Modified author abstract]

A Longitudinal Examination of Applicants to the Air Traffic Control Supervisory Identification and Development Program/ Jennifer G. Myers, editor (Civil Aeromedical Institute). Washington, D.C. U.S. Federal Aviation Administration, Office of Aviation Medicine; Springfield, Va. Available through the National Technical Information Service*, [1992]. Report No. DOT/FAA/AM-92/16. Performed under task AM-C-92-HRR-125. 54 p.; includes bibliographical references.

Keywords
1. Air traffic controllers — United States — Recruiting.
2. Air traffic controllers — United States — Longitudinal studies.

Summary: Since the U.S. Federal Aviation Administration's (FAA) development of a longitudinal database of its air traffic controller (ATC) workforce following the strike of 1981, data have been collected on thousands of controllers, spanning a period covering their application for employment to their achievement of first-line supervisor positions. This report includes a collection of papers that examine a subset of ATC specialists who have completed the agency's supervisor selection program, beginning with their performance on the Office of Personnel Management test battery and other cognitive tests administered prior to completion of the air traffic controller Screen Program. Academic, laboratory and overall screen performance were examined in relationship to aspects of performance in the supervisor selection program. Field training profiles were also analyzed to determine differences between successful and unsuccessful selection program candidates. Moreover, analysis was done to find relationships between performance in Air Traffic Control Specialist technical training and supervisory selection programs. Performance in the supervisor selection program was also compared for those who were selected as first-line supervisors and those who were not. [Modified author abstract]

Computer Reservation Systems: Action Needed to Better Monitor the CRS Industry and Eliminate CRS Biases: Report to the Honorable William F. Clinger, Jr., Ranking Minority Member, Subcommittee on Aviation, Committee on Public Works and Transportation, House of Representatives/ United States General Accounting Office. Washington, D.C. United States General Accounting Office**, [1992]. Report No. GAO/RCED-92-130. 28 p.; ill., includes bibliographical references.

Keywords
1. Airlines — United States - Reservation systems — Evaluation.
2. Competition, Unfair — United States.
3. United States. Dept. of Transportation — Auditing.

Summary: This report is in response to the letter written by William F. Clinger, Jr. asking the Subcommittee on Aviation to determine whether differences in computer reservation systems'(CRS) treatment of host and participating airlines allow the CRS-owning airlines to sell additional seats at the expense of other participating airlines and whether separating owner-airlines' internal reservation systems from CRSs ("dehosting") would eliminate significant differences in CRS treatment of host and participating airlines more effectively than existing or proposed CRS technology improvements.

The subcommittee determined that computer programming and architecture design differences in the way CRS treats host airlines and participating or non-host airlines may make it easier and more reliable to obtain information and book a flight on the host airline than on participating airlines. Although there is disagreement over the extent and significance of these differences, CRS vendors and airlines agree that differences should be eliminated.

According to the report, smaller CRS vendors believe that the existing differences in the treatment of host airlines and participating airlines give host airlines a significant competitive advantage over participating airlines, and they further believe that CRS use and reliability will not be equal for all airlines unless they are separated from their owners' internal reservation system (dehosted). According to the subcommittee's report, although the lack of information makes it difficult to determine whether dehosting would eliminate differences in CRS treatment of host and participating airlines, the subcommittee recommends that Congress direct the Secretary of Transportation to revise Department of Transportation's (DOT) existing CRS rules to require that each CRS vendor eliminate those functional differences between host and participating airlines that can be eliminated without dehosting.

The subcommittee further recommends that the Secretary of Transportation gather data both on the technical reliability of data communication linkages used by participating airlines as compared with the internal linkages used by host airlines and on the costs and benefits of dehosting CRSs. Such data would help DOT and others to assess the effect of CRS technical enhancements as well as the potential need for dehosting. [Modified results in brief and recommendations] ♦

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Accident/Incident Briefs

This information is intended to provide an awareness of problem areas through which such occurrences may be prevented in the future. Accident/incident briefs are based upon preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be entirely accurate.

Air Carrier

Boeing 737 Cleared to Land over Holding Aircraft

Boeing 737-200. No damage. No injuries.

The flight first called the tower at a range of eight miles. The tower, without responding, cleared a twin-engine commuter aircraft to hold on runway 27.

Without a transmission pause, the tower told the Boeing 737 that it was cleared to land on runway 27. The runway has a 1,910 foot displaced threshold.

Weather at the time was partially obscured, 600 feet broken, with two and one half miles visibility. As they continued the approach down to about 400 feet above ground level (AGL), the Boeing 737 crew observed an aircraft located on the approach end of the displaced threshold and queried the tower. The tower responded "cleared to land."

As the 737 passed over the commuter, its flight crew immediately asked the tower about the aircraft that had just passed over the top, but was told to hold position. The Boeing 737 continued to an uneventful landing, but the crew again contacted the tower after turning off the runway. The controller responded that he believed the 737 was too low to issue a go-around. The incident is now used in the airline's training programs to increase pilot awareness of the dangers of landing over an aircraft that is positioned for takeoff on any part of an active runway.

Poor Landing Sends 737 Skidding Off Runway

Boeing 737-200. Substantial damage. No injuries.

During a landing in low visibility, the Boeing 737 touched down at an angle to the runway and skidded off the right edge.

The crew managed to realign the aircraft parallel to the runway, but its path crossed a three-foot-wide concrete drainage ditch. Impact with the concrete ditch caused the left main gear to separate and the right main gear to collapse.

The aircraft came to rest on the fuselage and engines with part of the fuselage overhanging a drop in terrain. The nose gear remained in the down and locked position. There was no fire and no reported injuries to crew or passengers.

Electric Seat Traps Captain, Cancels Flight

Boeing 767. No damage. No injuries.

During preflight cockpit preparations, the captain tried to get into his seat by stepping over and across the center pedestal. His leg, however, hit the seat's electric control switch and it moved completely forward, trapping the captain's foot between the seat and the pedestal corner.

The captain's foot was so firmly wedged by the toes and ankle that the control switch was inaccessible.

It took two hours for maintenance personnel to remove the seat and release the captain, who was not injured. The flight was canceled.

Hasty Loading Leads to Short Flight

Cessna 402. Substantial damage. No injuries.

The pilot allowed nine passengers to board the aircraft without obtaining accurate passenger weights. Baggage was loaded into the aft baggage compartment.

As the pilot entered the cabin, the aircraft's tail fell to the ramp in a hard jolt. The pilot raised the tail and decided to continue with the flight. During the climb-out at about 300 feet AGL, the stall horn sounded, and the pilot instructed the passengers to move forward, where they remained until the aircraft completed an emergency landing.

A subsequent inspection revealed substantial damage to the rear bulkhead, elevator control tube and tail navigation light housing. It was determined that no ballast was placed in the forward baggage compartment. The center of gravity was well behind the aft limit.

Go-around Ends In Shoreline Crash

De Havilland DHC-2 Beaver. Aircraft destroyed. One fatality. Two serious injuries.

The single-engine, float-equipped DHC-2 Beaver touched down long on a water swell while attempting a daylight landing in a bowl-shaped cove, and the pilot elected to go around.

During the go-around, the pilot made a steep turn at low altitude to avoid buildings and rising terrain. The aircraft suddenly entered a steep descent and crashed on a wooden walkway along the shoreline near the seaplane dock.

The aircraft caught fire after impact.

A subsequent investigation determined that the pilot had allowed the Beaver to enter an inadvertent stall with insufficient altitude for recovery.

Improper Approach, Wind Gusts Down Twin Otter

De Havilland DHC-6 Twin Otter. Aircraft destroyed. One serious injury. Fifteen minor injuries.

The aircraft entered a right-hand traffic pattern for a daylight landing. A left quartering 15-knot headwind was gusting across the airport. On final, the aircraft's rate of descent accelerated as it neared the runway. The pilot applied full power, but the aircraft struck the ground short of the runway. One passenger was seriously injured.

A post-crash inquiry determined that the pilot had executed an improper approach and that the aircraft had experienced an inadvertent stall due to vertical gusts and turbulence. The pilot was also cited for failing to apply power in a timely fashion.

Corporate Executive

Poor Visibility, Inexperience Cause Predictable End

Piper PA-31P-350 Mojave. Aircraft destroyed. Two fatalities.

The pilot of the twin-engine Piper had begun a night instrument landing systems (ILS) approach to a military airbase and then received a special visual flight rules (VFR) clearance to proceed on to a nearby civilian airport. The last radar return showed the aircraft a mile from the destination airport at an altitude of 1,600 feet MSL (mean sea level).

The aircraft was seen flying low and fast before impact. The aircraft's left wing contacted the ground in a 42 degree left bank and impact was at a slight nose down attitude. The aircraft caught fire on impact.

A subsequent investigation indicated that there were few ground reference lights in the area and that the pilot had a minimum of total night flying time. Visibility at the time of the crash was one mile in fog and haze. The investigation suggested that the pilot likely had experienced visual illusions because of the poor visibility and his lack of night experience.

Beech Bounces to Unintentional Gear-up Landing

Beech 58 Baron. Substantial damage. Three minor injuries.

The Baron carrying five passengers landed, but the pilot forgot to lower the landing gear. The aircraft struck the sod strip, pulled up sharply and then descended back to the ground.

An investigation disclosed substantial damage to the fuselage, engines and propellers. The pilot said he attempted to execute a go-around after he realized his mistake but that the aircraft descended too quickly after the bounce.

Bird Strike Likely Cause of King Air Crash

Beech 90 King Air. Aircraft destroyed. Two fatalities.

The King Air pilot reported climbing from 9,000 to 10,000 feet and was cleared by air traffic control to 21,000 feet. At 17,000 feet, radar contact was lost and no further communication from the aircraft was received.

Witnesses told investigators that the aircraft emerged from clouds in a vertical attitude, with parts falling behind the fuselage. A large section of the right wing was found about two miles away from the crash site. The right engine was found about 1,200 feet from the wreckage. Weather at the time of the crash was 7,000 feet broken, 25,000 feet overcast, with visibility seven miles.

An investigation found no pre-impact failure that could have caused the crash, although organic material was found on the left engine inlet screen. The source could not be determined, but the accident occurred along a bird flyway. There was no indication of what caused the aircraft to descend out of control. The investigation concluded that once in a dive, load factors resulted in structural failure of the wing.

Other General Aviation

Instructor Sets Poor Example for King Air Student

Beech 90 King Air. Substantial damage. No injuries.

During the ground roll of a third touch-and-go landing session, the instructor inadvertently selected gear up instead of flaps. The main gear collapsed and the aircraft veered and came to a stop in the grass. There were no weather factors in the daylight training crash.

Engine Failure, Heavy Rain Force Emergency Landing

Cessna 310. Substantial damage. No injuries.

During cruise, the left engine began to vibrate and failed a short time later. The pilot shut the engine down and requested vectors to the nearest airport. During the dusk approach, the pilot encountered heavy rain and diminishing visibility.

The aircraft landed short of the runway, striking approach lights. It was later determined that the engine crankshaft had broken.

Non-standard Mods Ground Piper Pawnee After Near Collision with Car

Piper Pawnee. No damage. No injuries.

The pilot of the Piper Pawnee was observed attempting to take off from a main road just outside a rural Australian town. The aircraft had no visible registration or engine cowles.

After the take off roll commenced, a car was observed approaching on the road directly into the path of the aircraft. A collision was avoided only by violent evasive action taken by the car's driver. The car was driven into a ditch as the aircraft continued on and became airborne.

A subsequent inquiry determined that the Pawnee was equipped with a car engine and a Tiger Moth propeller. It was determined that the Pawnee had been wrecked by an agricultural operator and sold minus the engine and propeller. The wings and undercarriage were also damaged.

The new owner of the Pawnee fitted the aircraft with a V-8 engine complete with radiator and air vents. The engine had been modified with a Leyland P76 crank shaft and Chevrolet rods. There was even a Volkswagen van axle final reduction unit fitted behind the Tiger Moth propeller.

The aircraft owner was advised that aircraft repair and engine modifications must be made according to strict standards before the airplane could receive a certificate of airworthiness.

Rotorcraft

TwinStar Strikes Power Lines While Rushing Patient to Hospital

Aerospatiale AS355 TwinStar. Aircraft destroyed. One fatality. One serious injury.

The TwinStar was on an emergency medical flight in poor weather when it struck power lines suspended about 40 feet above a road. The pilot lost control of the aircraft and it collided with a retaining wall, struck the tops of trees, and plunged into a 70-foot deep ravine. The helicopter caught fire after impact.

The pilot was killed in the accident. The patient/passenger was rescued.

An investigation determined that the pilot was likely under pressure to continue the flight despite deteriorating weather conditions because of the medical condition of his passenger. A contributing factor was the closure of the trauma center where the patient had been picked up.

Sikorsky Crashes After Tail Rotor Strikes Guard Rail

Sikorsky S-61N. Aircraft destroyed. Six fatalities. Seven minor injuries.

The pilot of the transport helicopter was maneuvering to land on an offshore storage and tanker loading unit. After the aircraft had reached a hovering position adjacent to the heliport deck, witnesses said they noticed it was hovering dangerously close to the installation's crane structure.

A few moments later, the tail rotor blade tips struck a hand rail surrounding an anemometer mast that was attached to the crane. The helicopter crashed onto the helideck and immediately fell over the side of the deck into the sea. Seven passengers managed to escape from the sinking helicopter and were rescued. Six occupants, including the crew, were trapped and killed.

An inquiry determined that the pilot may have elected the approach out of habit, despite the fact that negligible wind offered freedom of choice in the direction of approach. The approach chosen was frequently necessary because of strong wind conditions even though it required narrow maneuvering. The report also concluded that an indeterminate horizon made attitude control more difficult. ♦