An American Tableau: The Changing Accident Experience

A critical look at the safety aspects of deregulation and a call for the air transportation industry to earn the public's trust in its safety performance during the next decade.

by
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"Safety is an accumulative process; it does not stop or start on signal. It is not a year-to-year affair. It must be measured period by period." — Stuart Tipton, president Air Transport Association, U.S., before the U.S. Senate Aviation Subcommittee, March 3, 1961.

Accident statistics are unreliable indicators of the industry's safety performance; they do not reflect the true risk of flying because the elements of chance often play a role in the uneventful outcome of potential accident situations. Unfortunately, such statistics remain the only available yardstick until more realistic safety indicators are developed.

What makes accident rates even more questionable is the widely used International Civil Aviation Organization (ICAO) accident definition; it does not differentiate between aircraft accidents and industrial mishaps due to the inflexibility of the intent-for-flight clause. The result is that accident rates are weighted with occurrences that unnecessarily downgrade the industry's safety performance. In addition, official accident rates often do not take into account a type of mishap that is of great concern to the traveling public: accidents involving suicide, sabotage, and military action.

These biasing effects have been avoided as much as possible in the preparations for this study. Furthermore, to limit the scope of this discussion while at the same time zeroing in on the traveling public's safety concerns, the data deal only with Fatal accidents, involving jet transports in Part 121 passenger operations (scheduled and non-scheduled) during the 20-year period 1970-1989.

According to U.S. National Transportation Safety Board (NTSB) data, 61 fatal accidents fall into that category. However, 11 of these are more appropriately identified as industrial accidents and are excluded from this study. These were all single-fatality accidents, mostly involving ground crew personnel working around aircraft. None of these mishaps would have preyed upon the public's basic fear of becoming involved in a fatal accident.

A prime example of the lack of the realism in the accident definition can be found in the 1981 record of U.S. air carriers. That year they were statistically charged with four fatal accidents in passenger operations characterized even by the NTSB as "four bizarre single-fatality accidents." Although the board admitted that "those four accidents produced a distorted [fatal accident] rate," there are no indications that efforts are in progress to formulate a more meaningful accident definition.

The officially reported hours flown in U.S. Federal

Aviation Regulation (FAR) Part 121 operations are all-inclusive. Since this study is concerned only with passenger operations in jet transports, these yearly totals were reduced by 10 percent before calculating the hours flown between fatal accidents. The reported deaths involve aircraft occupants only. Deaths of others are listed in Table 3.

The 1970-1989 Record

When the provisos in the previous section are applied to the published NTSB accident data, the fatal accident experience of U.S. air carriers during the decade before and after deregulation (1978) compares as shown in Table

Table 1

	Fatal Accidents	Aircraft Occupant Deaths	Hours Flown Between Fatal Accidents
1970-1979	30	2088	1,930,000
1980-1989	20	1438	3,970,000
Change	-33%	-31%	+105%

1.

According to this broad comparison the carriers made striking improvements in their accident record; they doubled the number of hours flown between fatal accidents during the first decade of deregulation. One is tempted to conclude that the airline deregulation Act of 1978 had no negative impact on a steadily improving record. However, that favorable impression turns out to be a delusion when the

Table 2

	Fatal Accidents	Aircraft Occupant Deaths	Hours Flown Between Fatal Accidents
1970-1974	19	1058	1,500,000
1975-1979	11	1030	2,700,000
1980-1984	5	222	6,600,000
1985-1989	15	1216	3,100,000

20-year record is tabulated in 5-year segments as shown in Table 2.

The interpretation of this table presents two challenges:

- The best-ever performance of the industry occurred during the first five years of deregulation (1980-1984). Operating more than six million hours between fatal accidents is a superlative achievement using any criteria.

- Following five years of steady improvement, the 1985-1989 period shows an abrupt reversal of that trend.

These two unusual aspects of the post-deregulation period will be addressed under the separate headings of "The 1980-1984 Period" and "The 1985-1989 Period."

The 1980-1984 Period

It can hardly be claimed that deregulation's destabilizing effect on the work force — compounded by the 1981 air traffic controllers' strike — was instrumental in setting the industry's remarkable record. One the contrary, it seems more likely that this feat was accomplished despite deregulation. By way of explanation it can be postulated that the first half of the 1980s saw the payoff of safety initiatives taken in the 1970s, such as line-oriented flight training (LOFT) and cockpit resource management (CRM).

It should be noted that there were no fatal accidents in three of the five years concerned (See Table 3). Moreover, the NTSB listed a crew member as a factor in only two of the five accidents: The Boeing 737 takeoff accident in Washington, D.C., U.S., and the McDonnell Douglas DC-10 runway excursion in Boston, Mass., U.S., both during January 1982.

In its report of the Boeing 737 accident, the NTSB implicated a new phenomenon in air carrier operations when it attributed the crew's "low experience in jet transport winter opera-

Table 3

Fatal Jet Transport Accidents
U.S. Passenger Operations under Part 121
1980-1989

Fatalities

Date	Location	ACFT.	Carrier	Crew & Pass.	Flight Other	Phase	Nature of Accident
13 Jan. 82	Wash. DC	B-737	Air Florida	74	4	T/O	Stalled after T/O. (Contam. wings & insuf. thrust)
23 Jan. 82	Boston	DC-10	World	2	-	A/L	Runway excursion during landing (Icy runway)
9 July 82	New Orleans	B-727	PanAm	145	8	T/O	Windshear during T/O
11 Aug. 82	Honolulu	B-747	PanAm	1	-	Other	Suicide/Sabotage
20 Dec. 83	Sioux Falls	DC-9	Ozark	-	1	A/L	Collision with snow sweeper during landing
1 Jan. 85	La Paz	B-727	Eastern	29	-	Other	Controlled flight into terrain (cause undeterm.)
2 Aug. 85	Dallas	L-1011	Delta	134	1	A/L	Windshear during landing approach
6 Sep. 85	Milwaukee	DC-9	Midwest Ex.	31	-	T/O	Stalled following engine failure on T/O
12 Dec. 85	Gander	DC-8	Arrow Air	256	-	T/O	Stalled after T/O. (Cause undeterm./Disputed)
14 Feb. 87	Durango	B-707	Skyworld	1	-	Other	Turbulence
16 Aug. 87	Detroit	DC-9	Northwest	154	2	T/O	Stalled after T/O. (Configuration problem)
15 Nov. 87	Denver	DC-9	Continental	28	-	T/O	Stalled after T/O. (Contamin. wings)
7 Dec 87	San L. Obispo	BA-146	PSA	43	-	Other	Suicide/sabotage
28 Apr. 88	Hawaii	B-737	Aloha	1	-	Other	Explosive decompression (Cabin roof rupture)
31 Aug. 88	Dallas	B-727	Delta	14	-	T/O	Stalled after T/O. (Configuration problem)
21 Dec. 88	Lockerbie	B-747	PanAm	259	11	Other	Sabotage
8 Feb. 89	Azores	B-707	Indep. Air	144	-	A/L	Controlled flight into terrain
24 Feb. 89	Honolulu	B-747	United	9	-	Other	Explosive decompression (Cargo door failure)
19 July 89	Sioux City	DC-10	United	111	-	Other	Catastrophic engine failure (Loss of hydraulics)
20 Dec. 89	New York	B-737	USAir	2	-	T/O	Rejected T/O (Rudder trim problem)
				1438	27		

tions" to the "rapid expansion of (the carrier) wherein pilots were upgrading faster than the industry norm to meet the increasing demands of growing schedules."

Whether it was the NTSB's intent or not, that explanation for the crew's low experience established a link between the competitive pressure designed into deregulation and the degrading of existing and proven industry norms. Furthermore, by factoring the crew's limited experience into its causal statement, the NTSB gave indirect recognition in 1982 to a new accident-enabling agent: the deregulation factor.

The other takeoff accident in this period was attributed to windshear and, in essence, was treated as an act of God, thereby absolving the crew.

The 1985-1989 Period

There was only one accident-free year (1986) in the most recent 5-year period. (See Table 3). The fatal accidents are spread evenly over the other four years. Although no statistical significance can be attached to these relatively low numbers, a comparison of the frequency of occurrence of certain types of accidents over the 20-year period may highlight the changes in the accident experience that took place over the last 10 and, specifically, the last five years. (See Table 4).

To start on a positive note, consider the following statements: the air carriers were not involved in any fatal midair collisions in the 1980s; the number of fatal approach and landing accidents was reduced from 19 in the pre-deregulation period to four in the subsequent period; and the number of controlled-flight-into-terrain (CFIT) accidents decreased from seven to two.

Perhaps the most disturbing change over the years is the increase in the number of fatal takeoff accidents. Following a distribution of 3-2-2 over three previous 5-year periods, these went up to 6 in the 1985-1989 period. In five of these six cases the aircraft stalled on take-off; the circumstances were:

- Engine failure (1)
- Wrong aircraft configuration (2)
- Contaminated wings (1)
- Unknown (1) (The DC-8 accident in Gander, Newfoundland)

The other takeoff accident during this period occurred during a rejected takeoff (RTO) involving the rudder trim setting.

In each of the 1985-1989 takeoff accidents investigated by the NTSB, the first sentence in the causal statement attributes the accident to some form of failure on the part of the flight crew. A similar judgment was made in one of the two takeoff accidents in the 1980-1984 period. (This was the already-discussed Boeing 737 accident.)

When crew involvement in takeoff accidents during the 10 years of deregulation is compared with that of the preceding years, one begins to wonder what has happened to crew proficiency. (See Table 5).

The disproportionate element of the crew as a factor in takeoff accidents during the 1980-1989 period suggests a general decline in the commitment to excellence on the part of the crews as well as the system behind them. Since deregulation is the principal variable in this comparison, it seems logical to review the accident reports of the most recent 5-year period for evidence similar to that revealed in the Boeing 737 takeoff accident in the 1980-1984 period.

In two of its reports covering 1985-1989 takeoff accidents, the NTSB alludes to what can only be interpreted as a deregulation factor. In the DC-9 accident in Denver, U.S., (1987), the NTSB found the pairing of the two pilots inappropriate due to the "low experience level of both crew members in the DC-9." In the causal statement, the board cited "the absence of regulatory or management controls governing operations by newly qualified flight crew members." A safety recommendation which addresses that hazard was made to the FAA. To the writer's knowledge, this safety issue arose for the first time in post-deregulation

Table 4

Selected Elements of Fatal Jet Transport Accidents U.S. Passenger Operations Under Part 121 1970-1989

	1970-1974	1975-1979	1980-1984	1985-1989
Fatal Accidents	19	11	5	15
Crew/Pass. Deaths	1058	1030	222	1216
Phase of Flight:				
Takeoff	3	2	2	6
Approach/Landing	12	7	2	2
Other	4	2	1	7
Midair Collisions	3	1	-	-
Sabotage/Suicide	1	-	1	2
Windshear	-	1	1	1
CFIT	6	1	-	2
Stalled on Takeoff	-	-	1	5
Improper T/O Configuration	-	-	-	3
Catastr. Equipment Failure	-	1	-	3

years.

The second accident involving crew experience and crew pairing was the Boeing 737 RTO in New York, N.Y., U.S., in September 1989 (FSF *Human Factors and Aviation Medicine* bulletin, January/February 1991, "When A Rejected Takeoff Goes Bad,"). However, this factor was not listed in the NTSB's causal statement. One of the board members took exception to this omission; he would have preferred the addition of a contributing factor dealing with the carrier's failure to provide an adequately experienced and seasoned flight crew. Although the NTSB does not make the connection, certain eyebrow-raising elements in the circumstances surrounding the takeoff can only be associated with deregulation's relaxing influence on operational practices. To mention just a few: the first officer, who was at the controls during the night takeoff, was making his first unsupervised line takeoff; this was his first trip after a 39-day nonflying period; the captain had about 140 hours as a Boeing 737 captain.

In its causal statement dealing with the Boeing 727 takeoff accident in Dallas, Texas, U.S., (1988), the NTSB included as a contributing factor the carrier's "slow implementation of necessary modifications to its operating procedures, manuals, checklists, training, and crew checking programs which were necessitated by significant changes in the airline following rapid growth and merger." The accident report contains this interesting reaction of a concurring/dissenting board member: "I cannot support the language in the board-adopted probable cause which suggests that [the carrier], one of the major players in the airline industry and the aviation economy, was somehow victimized by the circumstances of its economic environment."

This review of the 1980-1989 takeoff accident experience suggests that the deregulation factor was involved in at least the three cases where lack of crew experience and inappropriate crew pairing were cited. The extent to which the deregulation factor serves as an explanation for the crew's substandard performance in some of the other cases is difficult to assess.

It can only be observed that a crew's disregard of checklist procedures and sound operating practices is not a problem that develops overnight. There must be deeper roots. As the NTSB found in one of these cases: "[The carrier's] corporate philosophy of permitting maximum captain discretion contributed to the poor discipline and performance of [the] flight crew." Perhaps, corporate preoccupation with competition and economic survival detracts attention from the operational norms that have served the industry so well in the past.

Table 5

	1970-1979	1980-1989
No. of takeoff accidents	5	8
No. of T/O accidents for which causes were determined	4	7
No. of cases in which the crew was cited as "primary factor"	0	6

Catastrophic Equipment Failures

There were three catastrophic equipment failures in the recent five-year period which put the lives of 746 aircraft occupants in extreme jeopardy. Levelheaded and competent crews managed to save 625 of them.

In retrospect, at least two of the accidents demonstrate a tendency that has existed in the industry and its regulatory arm for years that can only have been aggravated by deregulation: delaying the costly fix of a known problem until an accident changes the priorities puts a stop to procrastination.

The Boeing 747 cargo door accident near Hawaii in 1989 had its parallel in the events preceding the catastrophic DC-10 accident near Paris in 1974. In both cases the handwriting had been on the wall for a considerable time but, apparently, there was no one in a responsible position with the intelligence and the integrity needed to accept the significance and consequences of that message.

With regard to the Boeing 737 cabin roof separation over the Hawaiian Islands in 1988, it suffices to say that the problems with aging aircraft were known long before this grim reminder.

The final report on the DC-10 that crashed in Sioux City in 1989 cites the cause as the disintegration of the number two engine fan disk, which severed the aircraft's three hydraulic systems thus disabling the flight controls, leaving it to the crew's skill and ingenuity to get the aircraft to an airport. (An allusion by the NTSB to maintenance deficiencies that could have allowed an existing hairline fracture in the fan disk go undetected for some time before the failure has been disputed by the carrier's engine overhaul facility.)

There had been a similar occurrence in September 1981, when the fan module of the number two engine of a Lockheed L-1011 separated through the "S" duct above the aft fuselage, following a fan shaft failure. Three of the four hydraulic systems were crippled; the fourth was damaged but not severed, and the crew was able to make a safe landing. In its report on the accident, the NTSB stated, "A separation of the entire fan module, however, was not considered as a possible occurrence during the design of the airframe and, thus, was not an influencing factor in the placement of redundant systems."

The Sioux City accident provided some belated preventive insight. The FAA has come out with a proposed airworthiness directive (AD) that would require modification of DC-10 hydraulic systems to prevent a loss of flight control in case of major damage to the system.

The Role of Regional Airlines

A review of air carrier accident experience in passenger operations would not be complete without considering the growing dependence of smaller communities on regional airlines (commuters). Of particular interest in that regard is the development of the hub-and-spoke system, dominated by the large carriers. Did the proliferation of smaller aircraft that serve the spoke dwellers now only add to the congestion of airspace and airports, or did it also discriminate against that segment of the population safety-wise?

According the the April 1988 report of the Presidential Aviation Safety Commission, "The commuter industry has amassed a safety record in the post-deregulation years that is about four times worse than that of the jet carriers." The Commission emphasizes that the record of the larger commuter carriers is about twice as good as the commuter industry's overall record. Recognizing the higher risks for the spoke dwellers, the Commission recommended "reducing differences in equipment standards … and operating practices between regional and national carriers." That recommendation is supported by Table 6.

Actually, in terms of hours flown between fatal accidents in scheduled service, the record of the commuter industry as a whole during its best five-year period (1985-1989) was eight times worse than that of the major carriers during the same period. The only encouraging aspect of this record is that it has been steadily improving.

The public's apparent acceptance of the regional carriers' accident record might be interpreted to mean that the major carriers can afford to further reduce their safety-related expenditures. This would be a grave mistake. The public's perception of air safety is governed mainly by the frequency of headline-making mishaps. Commuter accidents seldom meet that criterion on a national scale.

Deregulation proved that it was not concerned about safety but the price of the air fare that previously had kept people from flocking to the airports. However, if the major air carriers were to assume that the public would tolerate the lowering of their performance to one million hours between news-making fatal accidents in passenger operations, there would be about one such event each month. In that case the public might find cause to differentiate between "good" and "bad" carriers and, perhaps, even to shun certain types of aircraft. This would make safety a competitive issue, at least to the extent that the public still has options in long-distance travel.

As an aside, it should be mentioned that deregulation discriminated against the spoke dweller in another respect. The author's situation can be used as an example. He lives 171 air miles from the nearest hub airport. Before deregulation his community was served by five daily DC-9 fights; the same service is now performed by 15 commuter flights. The standard, one-way DC-9 fare in 1979, during the height of a fuel crisis, was $51. In July 1990 (before the events in the Middle East), the fare of the largest of the two commuters was $125. Deregulation gave the hub dwellers an economic as well as a safety advantage over spoke dwellers.

Growing Need to Address Safety Aspects of Deregulation

The study shows that there was a distinct change for the worse in the accident experience of U.S. air carriers in passenger operations during the second half of the 1980s. The contribution of deregulation to that record could be substantiated only in those accidents where flight crew experience was identified as a factor. This does not mean that experience levels in other areas, like maintenance, have not been affected since it is mainly the flight crew's experience that gets routine scrutiny in accident investigations.

In this author's view, the Airline Deregulation Act of 1978 was a well-intended but draconian experiment implemented with some naive assumption about the infrastructure's capacity to absorb the anticipated growth in the traffic and the FAA's ability to monitor the burgeoning industry. By giving free rein to the driving forces of economics and corporate ambition, the industry entered a period of upheaval whose full impact on the competence and the commitment to safety of the work force may not be felt until the 1990s.

Table 6

Regional Airlines

	Fatal Accidents	Hours Flown	Hours Flown Between Fatal Accidents
1975-1979	33	4,500,000	136,000
1980-1984	30	7,000,000	233,000
1985-1989	25	9,500,000	380,000

The subject was addressed by John H. Enders, president, Flight Safety Foundation, and Jerome F. Lederer, FSF president emeritus during their presentation at the 1987 Conference on Transportation Deregulation and Safety. They declared that "safety and economics are inextricably linked." They further stated, "there appears to be an uncoupling that has taken place between the economics of airline operation and the technical operation itself." The latter statement brings to mind the following metaphor. Deregulation was expected to trim excess fat from the pampered goose that lays the golden eggs. This occurred without delay. However, in the process the goose lost not only its fat but also some of its resistance to abuse, because of the uncoupling between those who look after the daily health of the goose and those who claim its eggs.

The ostensible and nobel goal of deregulation was to make air travel affordable to the masses. In that regard it has been declared a "smashing success" that has saved the public about $100 billion over the last 10 years. These alleged benefits went mainly to those who had the willingness and the time to put up with the uncertainties, inconveniences and callousness of a deregulated environment for the sake of a non-refundable discount ticket. The concomitant crowding of more seats into the economy section of airplanes without increasing their emergency exit potential is a safety-related deregulation factor in itself. And so may be the trend towards smaller crews and fewer engines in overwater operations.

The eventual success of the U.S. deregulation experiment will depend upon the industry's ability to maintain the public's trust in its safety performance in the next decade. The industry's record over the past five years seems to justify this final conclusion: Unless the deregulation factor is treated with the same concern as the human factor, the accident experience of the 1990s may force a return to square one. ♦

About the Author

Gerard M. Bruggink has been an aviation consultant since his retirement from the U.S. National Transportation Safety Board (NTSB) in 1979. He has published more than 25 papers on various aspects of aviation safety during that period.

During his 10 years at the NTSB, Bruggink served as field investigator, chief of the Human Factors Branch, accident inquiry manager, and deputy director of the Bureau of Accident Investigation. He was an air safety investigator for the U.S. Army Safety Center, chief of the Human Factors Branch at the Aviation Crash Injury Research Division of the Flight Safety Foundation and was a flight instructor, safety officer and accident investigator for the U.S. Air Force and U.S. Army contract flight schools.

Prior to emigrating to the United States, Bruggink was a flight instructor, safety officer and accident investigator for the Netherlands Air Force. A native of the Netherlands, he was a fighter pilot during World War II. He saw action in the Pacific theater and became interned as a prisoner of war.

Bruggink has been honored with the James H. McClellan Award from the Army Aviation Association of America and the Jerome Lederer Award from the International Society of Air Safety Investigators.

Aviation Statistics

An Update of Two Safety Rules Relating to Age and Alcohol

by
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The Age 60 Rule

The U.S. Court of Appeals in Chicago, U.S., recently upheld a 30-year-old Federal Aviation Regulation (FAR) that requires commercial pilots to retire at age 60.

The U.S. Federal Aviation Administration (FAA) established the retirement rule in 1960 and has argued consistently that pilots older than 60 years have higher accident rates and that allowing pilots to continue flying after age 60 would be dangerous.

Critics of the rule say that commercial pilots in their 60s have experience that benefits passengers. They cite the 1989 accident involving a United Airlines jetliner in Sioux City, Iowa, to back their case. In that crash, a 57-year-old pilot landed the jet despite a crippled hydraulic system and loss of flight controls. Another airline jet accident is cited by critics to support their arguments. On February 24, 1989, a cargo door of a United Airlines Boeing 747 failed and a 10- by 40-foot section of front fuselage tore away shortly after takeoff from Hawaii, causing an explosive decompression and destroying two engines. Nine passengers were sucked into the void. At the controls was Capt. David Cronin, 59 years old, a 35-year veteran, who used his experience, skills and good judgment to bring the aircraft back to Honolulu and landed safely. His courage and experience saved more than 335 lives. But within four weeks David Cronin reached age 60 and United Airlines retired him.

The three-judge panel of the Court of Appeals for the Seventh Circuit voted 2-1 on October 31, 1990 against a group of airline pilots who wanted to overturn the age 60 rule. In its opinion, the Court criticized the evidence presented by both sides. While the court said it had seen no compelling evidence that granting exemptions would increase the risk of accidents, it also said it had not seen strong evidence that the experience and skill of a 60-year-old pilot clearly overwhelms the danger of deterioration of piloting skills or sudden incapacity associated with aging.

The court said it could not "justify a conclusion that, on average, experience sufficiently offsets possible age-related impairment of health or skills to clearly guarantee a net constancy [of] or increase in safety." In writing for the majority, Judge Richard Cudagy said that "safety is the dominant and controlling consideration," but that "the FAA should not take this as a signal that the age 60 rule is sacrosanct and untouchable." However, the senior judge, Hubert Will, wrote a strongly worded dissent. Because there was no compelling contrary evidence, the court did not overrule the agency's concerns and deferred to the FAA, concluding that the agency's order denying the petitions for exemption was supported by substantial evidence. The court, however, urged the FAA to increase its effort to accommodate the pilots' points of view.

The No Drinking Rule

U.S. Federal Aviation Regulations prohibit the use of alcohol by crew members within eight hours of flight and also prohibit a person from acting as a flight crew member while under the influence of alcohol (Appendix 1).

In March, 1990, three airline pilots flew a Boeing 727 with 91 passengers aboard from Hector International Airport, Fargo, North Dakota, U.S., to Minneapolis-St. Paul International Airport, Minnesota, while intoxicated. Based on an anonymous tip to the FAA and action by two of the agency's inspectors, the pilots were arrested when the plane landed. On an emergency basis, the FAA quickly revoked the licenses of the pilots and the airline fired them afterwards.

In August 1990, a Minnesota jury convicted the three pilots of a felony count of operating a common carrier while under influence of alcohol or drugs. In late October, a federal judge sentenced them from 12 months to 16 months in jail. The captain was given a 16-month jail term; the co-pilot and the flight engineer were sent to jail for one year. All three were also placed on three years of "supervised release," similar to probation.

On November 29, 1990, a new regulation became effective that was intended to detect pilots who may have a history of drug and alcohol abuse before cockpit safety is affected. It was designed to identify and ground pilots involved in alcohol- or drug-related motor vehicle offenses that result in conviction or administration actions such as driver's license suspension or revocation.

Under the new rule (14 CFR Parts 61 and 67 as amended — Appendix B), the FAA may deny an application for any certification or rating, or suspend or revoke any pilot certificate or rating if the person has two or more alcohol- or drug-related driving convictions or administrative actions within a three-year period after the rule became effective.

In addition, a pilot is required to provide a written report to the FAA within 60 days after any covered motor vehicle action. The report must include name, address, date of birth, airman certificate number, date of conviction and the name of the state that holds the record, together with a statement to describe whether the motor vehicle action is related to the same incident or "arose out of the same factual circumstances related to a previously-reported motor vehicle action." The FAA may, from time to time, review the National Driver Register files to uncover failures to report such convictions (Appendix C). Pilots failing to report such convictions would be subject to denial of an application for any certificate or rating, or suspension or revocation of any certificate.

The new rules also require that at the time of application for a pilot certificate, each person who applies for a medical certificate shall consent to the release of information from the National Driver Register to enable the FAA to obtain and review motor vehicle offense information relating to the applicant. ♦

Appendix A

14 CFR Part 91 - General Operating and Flight Rules

91.11 Alcohol or drugs.

(a) No person may act or attempt to act as a crew member of a civil aircraft—

(1) Within eight hours after the consumption of any alcoholic beverage;

(2) While under the influence of alcohol;

(3) While using any drug that affects the person's faculties in any way contrary to safety; or

(4) While having .04 percent of weight or more alcohol in the blood.

(b) Except in an emergency, no pilot of a civil aircraft may allow a person who appears to be intoxicated or demonstrates by manner or physical indications that the individual is under the influence of drugs (except a medical patient under proper care) to be carried in that aircraft.

(c) A crew member shall do the following:

(1) On request of a law enforcement officer, submit to a test to indicate the percentage by weight of alcohol in the blood, when—

(i) The law enforcement officer is authorized under state or local law to conduct the test or to have the test conducted; and

(ii) The law enforcement officer is requesting submission to the test to investigate a suspected violation of state or local law governing the same or substantially similar conduct prohibited by paragraph (a)(1), (a)(2), or (a)(4) of this section.

(2) Whenever the Administrator has a reasonable basis to believe that a person may have violated paragraph (a)(1), (a)(2), or (a)(4) of this section, that person shall, upon request by the Administrator, furnish the Administrator, or authorize any clinic, hospital, doctor, or other person to release to the Administrator, the result of each test taken within four hours after acting or attempting to act as a crew member that indicates percentage by weight of alcohol in the blood.

(d) Whenever the Administrator has reasonable basis to believe that a person may have violated paragraph (a)(3) of this section, that person shall, upon request by the Administrator, furnish the Administrator, or authorize any clinic, hospital, doctor, or other person to release to the Administrator, the results of each test taken with four hours after acting or attempting to act as a crew member that indicates the presence of any drugs in the body.

(e) Any test information obtained by the Administrator under paragraph (c) or (d) of this section may be evaluated in determining a person's qualifications for any airman certificate or possible violations of this chapter and may be used as evidence in any legal proceeding under section 602, 609, or 901 of the [U.S.] Federal Aviation Act of 1958.

Appendix B

14 CFR Parts 61 & 67 as amended

14 CFR Part 61

Aircraft, Airmen, Alcoholism, Aviation safety, Drug abuse, Recreation and recreation areas, Reporting and record keeping requirements.

14 CFR Part 67

Airmen, Aviation safety, Health, Reporting and record keeping requirements.

The Amendments

In consideration of the foregoing, the [U.S.] Federal Aviation Administration amends part 61 and part 67 of the [U.S.] Federal Aviation Regulations (14 CFR parts 61 and 67) as follows:

Part 61—Certification: Pilots and Flight instructors

1. The authority citation for part 61 is revised to read as follows:

Authority: 49 U.S.C. App. 1354(a), 1355 1421, 1422, and 1427; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983).

2. By amending § 61.15 by adding new paragraphs (c), (d), (e), and (f) to read as follows:

§ 61.15 Offenses involving alcohol or drugs.

(c) For the purposes of paragraphs (d) and (e) of this section, a motor vehicle action means—

(1) A conviction after November 29, 1990, for the violation of any Federal or state statute relating to the

operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug, or while under the influence of alcohol or a drug;

(2) The cancellation, suspension, or revocation of a license to operate a motor vehicle by a state after November 29, 1990, for a cause related to the operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug, or while under the influence of alcohol or a drug; or

(3) The denial after November 29, 1990, of an application for a license to operate a motor vehicle by a state for a cause related to the operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug or while under the influence of alcohol or drug.

(d) Except in the case of a motor vehicle action that results from the same incident or arises out of the same factual circumstances, a motor vehicle action occurring with three years of a previous motor vehicle action is grounds for—

(1) Denial of an application for any certificate or rating issued under this part for a period of up to one year after the date of the last motor vehicle action; or

(2) Suspension or revocation of any certificate or rating issued under this part.

(e) Each person holding a certificate issued under this part shall provide a written report of each motor vehicle action to the FAA, Civil Aviation Security Division (AAC-700), P.O. Box 25810, Oklahoma City, OK 73125, not later than 60 days after the motor vehicle action. The report must include—

(1) The person's name, address date of birth, and airman certificate number,

(2) The type of violation that resulted in the conviction or the administrative action;

(3) The date of the conviction or administrative action;

(4) The state that the holds the record of conviction or administrative action; and

(5) A statement of whether the motor vehicle action resulted from the same incident or arose out of the same factual circumstances related to a previously-reported motor vehicle action.

(f) Failure to comply with paragraph (e) of this section is grounds for—

(1) Denial of an application for any certificate or rating issued under this part for a period of up to 1 year after the date of the motor vehicle action; or

(2) Suspension or revocation of any certificate or rating issued under this part.

Part 67—Medical Standards and Certification

3. The authority citation for part 67 is revised to read as follows:

Authority: 49 U.S.C. App. 1345(a), 1355, 1421, and 1427; 49 U.S.C. 106(g) (Revised, Pub. L. 97-449, January 12, 1983).

4. By adding new § 67.3 to read as follows:

§ 67.3 Access to the National Driver Register.

At the time of application for a certificate issued under this part, each person who applies for a medical certificate shall execute an express consent form authorizing the Administrator to request the chief driver licensing official of any state designated by the Administrator to transmit information contained in the National Driver Register about the person to the Administrator. The Administrator shall make information received from the National Driver Register, if any, available on request to the person for review and written comment.

Issued Washington, DC, on July 26, 1990.
James B. Busey,
Administrator.

Appendix C

National Driver Register

The National Driver Register (NDR) is a computerized file of persons whose driver permits have been suspended or revoked. The NDR is maintained by the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation. While participation of permit-issuing jurisdictions is voluntary, it is a central contact point for federal and state authorities in their efforts to ascertain possible problem drivers applying for original and renewal licenses.

The NDR is not a file on all licensed drivers in the United States but an index of adverse driver record files maintained by the states. It contains only data appropriate to its service as a clearinghouse for information pertaining to license actions. The NDR contains information regarding any individual:

1. who is denied a motor vehicle operator's license for cause
2. whose operator's license is canceled, revoked, or suspended for cause
3. who is convicted of:
    a. operation while under the influence of alcohol or a controlled substance
    b. a traffic violation in connection with a fatal accident, or reckless driving
    c. failure to render aid or provide identification when involved in an accident
    d. perjury or false affidavits relating to motor vehicle operation.

Any individual who has applied for or has received an airman's certificate may request the chief driver licensing official of a state of transmit information contained in the National Driver Register about the individual to the Administrator. The Administrator shall made information received from the National Driver Register, if any, available on request to the individual for review and written comment.

Questions regarding the NDR should be directed to:
National Highway Traffic Safety Administration
U.S. Department of Transportation
Washington, D.C. 20590

Reports Received at FSF Jerry Lederer Aviation Safety Library

Reports

Reducing Runway Incursions: An FAA Report/ U.S. Federal Aviation Administration. — Washington, D.C.: U.S. Federal Aviation Administration, April 1990. 72p. in various pagings. [Copies available from FAA assistant administrator for aviation safety, safety Information Office at (202) 267-7770.]

Key Words
1. Airports — Runways — Safety Measures.
2. Airports — Ground Operations.
3. Runway Incursions.

Contents: Introduction — Approach — Principal Causal Factors of Runway Incursions — Runway Incursion Activities (Associate Administrator for Air Traffic) — Runway Incursion Activities (Office of Airport Safety and Standards) — Runway Incursion Activities (Office of Flight Standards) — Runway Incursion Activities (Advanced System Design Service) — Conclusions and Recommendations — Appendix A: Runway Incursion Team Members — References — Glossary of Acronyms.

Summary: In 1987, the FAA administrator directed that the assistant administrator for aviation safety (ASF) undertake a focused effort to identify the causes of runway incursions and recommend measures for alleviating the problem. This report is a product of the Phase II effort, designed to examine the runway incursion problem from the multiple perspectives involved — the tower cab, the airport, the cockpit, and engineering — and to combine these perspectives in an analysis that would serve as the basis for an integrated FAA program to address the problem. Recommendations include procedures; training; awareness; signs, marking, and lighting; and simplification of surface traffic movements.

Medical Risk Assessment and the Age 60 Rule for Airline Pilots. Requested by Subcommittee on Investigations and Oversight, Committee on Public works and Transportation, U.S. House of Representatives. — Washington, D.C. : U.S. Congress, Office of Technology Assessment (OTA), September 1990. 13p., charts, graphs.

Key Words
1. Air Pilots — Certification — United States.
2. Air Pilots — Legal Status, Laws, etc.. — United States.
3. Air Pilots — Health and Hygiene — United States.
4. Retirement Age — United States.
5. Aeronautics, Commercial — Law and Legislation — United States.
6. Aeronautics, Commercial — Safety Measures — United States.

Summary: Early in 1990, the Subcommittee on Investigations and Oversight of the House Committee on Public Works and Transportation asked OTA to examine the medical aspects of the federal regulation (14 CFR 121.383(c) and 14 CFR 67) prohibiting pilots older than 60 from flying for airlines. The Subcommittee also requested that OTA analyze the state of the art of medical risk assessment. To respond to the Subcommittee's questions, OTA interviewed FAA officials and medical experts and reviewed aeromedical literature, pilot health and safety data, and medical technologies. The key findings include statistical data on pilot performance and age (pilots between 60 and 69 years old who are permitted to fly under FAA's strictest medical requirements (Class I and II medical certificates) have an accident rate twice as high as similar pilots who are in the 50s; sudden physical impairment has not been a factor in airline accidents); medical screening technologies do not exist which would predict the development of medical conditions that could affect pilot performance and even if the procedures did exist they would not be sufficient to ensure that current levels of pilot performance would be maintained if the age rule were abolished; improved neuropsychological measures of cognitive performance would need to be developed and validated before FAA could reliably ground on the "high risk" pilots who are over 60; medical costs, and other economic issues. [Summary]

Windshear Case Study: Denver, Colorado, July 11, 1988. Final Report / Herbert W. Schlickenmaier (Federal Aviation Administration). — Washington, D.C. : U.S. Federal Aviation Administration Advanced System Design Service; Springfield, Virginia, U.S. : Available from NTIS*, November 1989. Report DOT/FAA/DS-89/19. 552p., ill., charts.

Key Words
1. Verticial Wind Shear — Colorado — Denver.
2. Wind Shear — Colorado — Denver.
3. Wind Shear — Detection — United States.
4. Microbursts.
5. Airports — Colorado — Denver — Traffic Control.
6. Aeronautics — Safety Measures.
7. Meterology in Aeronautics.

Summary: On Monday, July 11, 1988, four successive United flights had inadvertent encounters with microburst windshear conditions while on final approach to Denver Stapleton Airport, each resulting in a missed approach, subsequent delay, and uneventful arrival. A fifth flight executed a missed approach without encountering the phenomena. All of the flight crews were trained utilizing the resources of the Windshear Training Aid. There was no damage to aircraft and no passenger injuries. At the time the aircraft encountered the microburst, the Terminal Doppler Weather Radar (TDWR) Operations Test and Experiment was in progress and detected divergent flow that intersected the operating zones for the approach runways. This Windshear Case Study outlines the technical details of the encounter, as well as describes insights gained from this confrontation that should be applied to future investigations of aircraft encountering windshear. This study summarized information from several sources including flight crew comments, air traffic control operations and surveillance radar data, flight data recorders, data from the TDWR and the Low-Level Wind Shear Alert System, technical details of the event meteorology, and data from the Terminal Area Simulation System.

Medically Disqualified Airline Pilots in Calendar Years 1987 and 1988. Final Report / Leslie E. Downey and Shirley J. Dark (Civil Aeromedical Institute). — Washington, D.C. : U.S. Federal Aviation Administration Office of Aviation Medicine; Springfield, Virginia, U.S. : Available from NTIS*, June, 1990. Report DOT/FAA/AM-90/5. 11p.

Key Words
1. Air Pilots — Certification — United States.
2. Air Pilots — Medical Examinations — United States.
3. Air Pilots — Diseases — United States.
4. Airlines — Employees — Medical Examinations — United States.

Summary: This study presents comprehensive data reflecting pertinent denial rates regarding the medical and general attributes of those airline pilots denied medical certification in calendar years 1987 and 1988. The overall denial rate of this group is 4.3 per 1,000 active airline pilots. Age-specific denial rates for airline pilots increase to the highest rate at age interval 55-59. The most significant causes for denial by pathology series are: (1) cardiovascular (34%); (2) neuropsychiatric; and (3) the miscellaneous category. The most significant causes for denial by specific pathology are: (1) coronary artery disease; (2) use of disqualifying medications; (3) psychoneurotic disorders; (4) myocardial infarction; and (5) disturbance of consciousness.

Development of a Crashworthy Seat for Commuter Aircraft. Final Report / Van Gowdy (Civil Aeromedical Institute). — Washington, D.C. : U.S. Federal Aviation Administration Office of Aviation Medicine; Springfield, Virginia, U.S.: Available from NTIS*, September, 1990. Report DOT/FAA/AM-90/11. 12p.

Key Words
1. Airplanes — Seats — Testing.
2. Airplanes — Seats — Design and Construction.
3. Airplanes — Seats — Safety Measures.

4. Airplanes — Seats — Crashworthiness.

Summary: A series of dynamic impact tests was conducted using a prototype seat with an energy absorbing mechanism as part of the seat pan. The seat frame was designed to represent a typical commuter aircraft passenger seat. Tests were conducted in an orientation simulating a vertical impact with a 30-degree nose-down aircraft attitude. The impact severity for these tests ranged from 15 to 33 Gs. Seat pan stroke and occupant lumbar reaction forces were measured. Results indicate the axial force measured in the lumbar spine of a fiftieth percentile Hybrid II dummy can be limited to a peak value less than 1500 pounds during vertical impact tests of 33 G with a seat pan stroke distance of 6.3 inches.

New Zealand Civil Aircraft Accidents 1989. — Wellington, New Zealand : Office of Air Accidents Investigation; [September], 1990. 35p.

Key Words
1. Aeronautics — Accidents — Statistics — New Zealand.

Summary: The information in this Summary covers all notifiable accidents to civil aircraft of New Zealand registry which occurred and were notified, during the calendar year 1989. Includes Airline, Public Aircraft, General Aviation, Gliding, Hang Gliding.

Human Error in the Cockpit / Beat Ruegger. Zurich : Swiss Reinsurance Company, Aviation Department, Mythenqual 50/60, P.O. Box 8022 Zurich, Switzerland; [October], 1990. 43p.; ill, charts, graphs, color photos.

Key Words
1. Aeronautics — Accidents — Human Factors.
2. Aeronautics — Human Factors.
3. Aeronautics — Safety Measures.
4. Air Pilots — Errors.
5. Airplanes — Piloting — Human Factors.

Contents: Introduction — Aerospace medicine — On the origins of human error — Human support — The costly and tedious lessons of accidents — Incidents as a source of knowledge — Enterprise and responsibility — Public and civil aviation authorities — Quality control to promote progress.

Windshear—Optimum Trajectory, Human Factors and Miscellaneous Information / William W. Melvin (Air Lines Pilots Association). — Warrendale, PA : Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pa. 15096-0001 USA; 1990. Report SAE 901995. 14p., ill, references. Presented at the Aerospace Technology Conference and Exposition, Long Beach, California, October 1-4, 1990.

Key Words
1. Air Pilots — Training.
2. Airplanes — Piloting — Human Factors.
3. Meteorology in Aeronautics.
4. Windshear.

Summary: Optimal trajectory studies of aircraft in wind shear have resulted in insight as how to best fly an aircraft in a wind shear; these also question some previous (and current) recommendations. Recent accidents and incidents give new support for some old ideas. Human factors problems of information transfer to and from the cockpit and pilot interface with the aircraft are discussed. Some miscellaneous information is included for the record with reintroduction of some old data which are important but not currently provided to pilots. Because of the chronological record, the miscellaneous information is discussed first. [author abstract]

Aircraft Accident Report, Boeing 737-2L9, OY-MBV, Roenne Airport, Bornholm, 24 March 1989. — [Copenhagen], Denmark : Aircraft Accident Investigation Board; [September] 1990. Report AAIB 3/90. 85 p. in various pagings, ill.

Key Words
1. Aeronautics — Accidents — 1989.
2. Aeronautics — Accidents — Approach.
3. Aeronautics — Accidents — Flaps.
4. Aeronautics — Accidents — Hydraulic Systems.
5. MAERSK Air — Accidents — 1989.

Summary: The scheduled Maersk Air flight from Copenhagen to Roenne, 4 crew and 63 passengers, had proceeded normally until the final approach to land. When flap 30 was

called and selected, the flap did not travel from the flap 25 position. The First Officer informed the Captain, who was the pilot flying, about the flap problem. About 25 seconds later the First Officer advised the Captain that the "A" hydraulic system had failed. No warning lights were observed by either pilot at this stage. On landing the engine thrust reversers could not be activated, the speed brake lever was activated manually and wheel braking was not noticeable. The aircraft continued at high speed, overran the runway end and came to a standstill 425 meters beyond the runway end, the left main gear and nose gear collapsed. There was no fire. An emergency evacuation was executed. There were no injuries to persons.

Examination of the aircraft by the AAIB revealed that the flap flow limiter valve had fractured, releasing the hydraulic fluid and rendering the "A" hydraulic system inoperative. The "B" hydraulic system was operative and so was the "standby" hydraulic system, but the "standby" hydraulic system was not selected.

The following causal factors were identified:

1. The Captain became the victim of task saturation leading to fixation.

2. The Captain only perceived the flap problem and decided that a landing should be made. He disregarded the hydraulic failure as he stated that he did not observe any warning lights. Thus the non-normal procedure was not performed.

3. The Captain did not discontinue the approach and perform a go-around as he should, since the aircraft was not configured for landing as briefed.

4. Crew coordination was not satisfactory.

5. It is probable that the aircraft hydroplaned during portion of the roll on the runway.

6. Under the given circumstances the aircraft could not be stopped on the runway. [Synopsis]

*U.S. Department of Commerce
National Technical Information Service (NTIS)
Springfield, Virginia, U.S. 22161 U.S.
Telephone: (703) 487-4780.

Reference

Advisory Circular 120-35B, 9/6/90, Line Operation Simulations: Line-Oriented Flight Training, Special Purpose Operational Training Line Operational Evaluation. — Washington, D.C. : U.S. Federal Aviation Administration, AFS-210; September, 1990. 22p.

Key Words
1. Flight Simulators — Design.
2. Line-Oriented Flight Training (LOFT).

Note: Cancels AC 120-35A dated August 11, 1981.

Summary: This advisory circular presents guidelines for the design and implementation of Line Operation Simulations, including Line-Oriented Flight Training (LOFT), Special Purpose Operational Training, and Line Operational Flight Evaluation. This document does not interpret the regulations; interpretations are issued only under established agency procedures.

Advisory Circular 121.195(d) - 1A, 6/19/90, Operational Landing Distances for Wet Runways; Transport Category Airplanes. — Washington, D.C. : U.S. Federal Aviation Administration, June, 1990. 5p.

Key Words
1. Airports — Runways — Law and Legislation — United States.
2. Airports — Runways — Length.
3. Slush on Pavement, Runways, Etc.

Notes: Cancels AC 121.195(d) - 1, dated 11/19/65.

Summary: This advisory circular (AC) sets forth an acceptable means, but not the only means, of showing compliance with Federal Aviation Regulations Part 121.195(d) pertaining to operational landing distances on wet runways. It is for guidance purposes and provides an example of a method of compliance that has been found acceptable. [purpose] ♦

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 accurate.

Runway Incursion in Fog

McDonnell Douglas DC-9: Aircraft destroyed. Fatal injuries to eight, various injuries to 21.

Boeing 727: Damage to right wingtip. No injuries.

The DC-9 was taxiing toward the takeoff end of runway 21C for a southbound departure from Detroit Metropolitan Airport, Michigan, U.S., headed for Pittsburg. The Boeing 727 was preparing to take off on runway 3C, the other end of runway 21C, headed for Memphis.

According to preliminary information, the weather was so foggy at 1400 hours that the DC-9 crew members told ground controllers that they were having trouble "keeping track of where they were" and that the aircraft missed one assigned taxiway turnoff and was directed to another taxiway that would take it to the takeoff end of its assigned runway. Visibility was one-quarter mile in fog when the DC-9 departed its gate.

The DC-9 apparently entered runway 21C inadvertently and the crew was reported to have indicated uncertainty of the aircraft's location in the fog; mentioning to ground controllers the possibility that they may have strayed onto the active runway by mistake and being advised to exit the runway immediately. The aircraft was headed south along the runway.

In the meantime, the Boeing 727 had been cleared for takeoff from the other end of the same runway.

About one minute after the DC-9 crew realized it may have entered the active runway, the Boeing 727 appeared out of the mists from the opposite direction traveling approximately at rotation speed. The right wingtip of the 727 sliced along the top of the fuselage of the DC-9 and sheared off its right engine. The DC-9 caught fire and was gutted down to the window line during which eight persons in the passenger compartment, including a flight attendant, received fatal injuries.

The Boeing 727 was stopped about 2,500 feet farther along the runway. There was damage to the wingtip but there was no fire and no one aboard was injured.

The accident is currently under investigation by the U.S. National Transportation Safety Board (NTSB) which is expected to release its findings later.

The Aircraft That Moved by Itself

Lockheed L-1011 TriStar: No damage. No injuries.

The ground crew indicated that wheel chocks were in place shortly after arrival at the sloping ramp. The parking brake was released and the passengers disembarked. While the baggage was being loaded for the next flight leg, the air turbine motor (ATM) was operated to check its serviceability since it had produced a low pressure warning during the approach.

When the passengers were about to board, the senior cabin crew member reported that the jetway was misaligned with the aircraft door making it difficult to board the passengers. While this was being checked, it was also noticed that the nosewheel tires were turned about 50 degrees from the straight-ahead position that they had been left in during parking. It was estimated that the aircraft had rolled back about 18 inches.

The ground crew reported that the aircraft had been properly chocked on arrival and the engineering officer reported that the captain's steering handwheel had been centered before and after the check of the ATM. Investigators considered the most probable cause was inadequate chocking on the sloping parking ramp and procedures were instituted by the carrier to chock the main wheel tires in addition to the nose wheel tires in such instances.

The Long and Short of It

Cessna 402: Substantial damage. No injuries.

The pilot was on a visual flight rules charter flight carrying seven passengers. The flight had proceeded normally toward the destination that was at an unimproved airstrip. Wind was light and variable.

After a normal approach, the pilot landed approximately 650 feet beyond the threshold of the 2,700-foot runway which consisted of short grass. (The runway had a 180-foot overrun, followed by a shallow depression 115 feet wide and a highway with powerlines above it.) The pilot immediately applied maximum braking but the grass was wet from a recent rain. The aircraft skidded on the slippery surface. The pilot decided not to attempt a go-around because of the obstructions at the end of the runway. He could not stop the aircraft in time to avoid overrunning the runway and the aircraft rolled through the depression and turned 90 degrees to the left. The left main gear and the nosewheel collapsed and the aircraft stopped approximately 400 feet from the end of the runway. The occupants all departed the aircraft without sustaining injury.

The pilot had operated into the airport one time previously and had not received any report in the runway condition prior to departure. According to investigators, the aircraft owner's manual indicated that the aircraft would have required at least 2,400 feet to stop under the existing conditions.

The cause of the accident was attributed to the fact that the pilot did not receive runway condition information prior to departure, the poor braking because of the wet grass surface and the touchdown 650 feet beyond the runway threshold.

It Started Off By Being Late

Piper PA-34-200T Seneca: Substantial damage. No injuries.

The pilot of the charter flight was behind schedule. As he rushed through pre-takeoff preparations, the top latch of the passenger door was inadvertently left unlatched.

After takeoff, the pilot realized that the passenger door was not locked and decided to return to the airport to correct the situation but, to save time, he landed downwind. However, a high sink rate developed during the flareout with the aircraft in a right-wing-low attitude and it landed hard in the right gear during a sideslip to the right despite the addition of power by the pilot. He went around and, after selecting gear up, noticed that full aileron deflection and considerably rudder deflection were required to keep the aircraft flying straight. A visual check by ground personnel during a flyby confirmed that the right gear was hanging down and was rotated 90 degrees from its normal alignment.

The pilot diverted to an airport that had better facilities and executed a successful emergency landing. During the rollout on the left main and nose gear, the pilot held the right wing off the ground until the airspeed decreased to the point where the wing could no longer be held up aerodynamically and the aircraft's right wing settled to the runway. The aircraft sustained substantial damage but there was no fire and there were no injuries.

The cause was attributed to the failure of the right main landing gear due to overload. A contributing factor was the unlatched door and mention was made that the pilot also was preoccupied with business matters and had not received adequate rest for a few days.

Corporate Executive

Heavy Weather Weighs Down Aircraft

Cessna 310: Aircraft destroyed. Fatal injuries to one.

The pilot planned to make a business flight between two points in the northeastern section of the United States. It was dark at the time of departure approximately 2115 hours and the weather was misty and foggy, with a partial obscuration and a ceiling of 1,000 feet overcast, four miles visibility, fog and haze.

Before departure, the pilot was cleared to takeoff or runway 21 and, after departure, to turn right on a heading of 340 degrees and climb to and to maintain 5,000 feet. Two radio transmissions were received from the pilot by ATC personnel following which there was no further contact. Wreckage was later found two miles from the airport on a bearing of 170 degrees from the airport. The aircraft had crashed in wooded, rolling terrain and was destroyed; the pilot, the only occupant, had received fatal injuries.

The cause was reported as pilot disorientation (vertigo) during the initial climb and a loss of control. Factors contributing to the accident were listed as darkness, low ceiling and fog.

Landed Long At Wrong Airport

British Airspace BA-31 Jetstream: Substantial damage. No injuries.

The business aircraft with two crew members and nine passengers had departed an Oregon, U.S., airport headed for Tri-Cities Airport, Pasco, Washington, as its intended destination. The time was 2238 hours on a moonlit night.

The pilot mistook nearby Kennewick Vista Airport, with its similarly oriented runway pattern, for his destination airport and made the approach to the wrong airport. He landed long and was unable to stop on the paved surface. The aircraft overran the 3,490-foot runway 2 at Kennewick Vista and collided with runway end lights; it came to rest 450 feet beyond the end of the runway. The aircraft sustained substantial damage to tires and landing gear but there were no injuries to the 11 occupants.

Lengths of the two similarly oriented runways at the intended destination airport were 4,435 feet (runway 3R) and 7,700 feet (runway 3L).

Other General Aviation

Fatal Set-Up

de Havilland HD82A Tiger Moth and Piper PA-28-181 Archer: Both aircraft destroyed. Fatal injuries to four.

The Archer was returning to the U.K. airfield from a training flight and the Tiger Moth was taking off. There were three persons aboard the Piper, an instructor, a student pilot and a passenger. The single occupant of the Tiger Moth was flying the aircraft from the rear cockpit.

At about 1642 hours, the pilot of the Archer reported inbound to the airport from the northwest and that he had the field in sight. Approximately a minute later, the pilot of the Tiger Moth reported that he was climbing out, heading away from the airport to the northwest.

About two minutes later a Mayday message from the pilot of another aircraft reported that he had just witnessed a midair collision and that both aircraft were down. He subsequently helped direct rescue services to the scene. Both aircraft had been destroyed and all occupants had received fatal injuries. Later examination of the wreckage established that the aircraft had struck each other with their right-hand wings, each in a relative bank to the left of 50 degrees to each other and each about 20 degrees to the left of directly opposing headings.

According to eye witness reports and a review of radar records, investigators noted that the two aircraft had been flying directly towards each other for about two minutes at a closing speed of about 180 knots, with the Archer descending for landing and the Tiger Moth climbing out on course. With his northwesterly heading, the pilot of the Tiger Moth would have been heading almost directly into the late afternoon sun, towards an airplane with colors of light grey and blue. Weather was clear, with visibility of more than 12 miles and one-eighth cloud coverage at 4,000 feet; the collision occurred at 1,800 feet above ground level. The pilot of the descending Archer faced a background of rural countryside, and an airplane that was painted green and white, and was possibly hidden below his field of vision by the nose cowling of his aircraft. Although the Archer was equipped with strobe and landing lights, investigators could not determine from the wreckage whether any lights had been on prior to the collision.

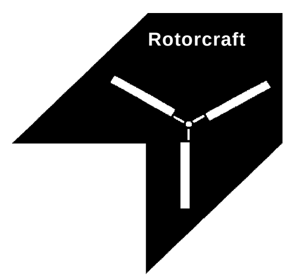
Considering that the aircraft were banked away from each other at the time of the accident, the pilots may have seen each other's aircraft at the last moment but too late to avoid the collision.

Simulated Shutdown Became Realistic

Piper PA-23-250 Aztec: Substantial damage. No injuries.

During a dual instruction flight at Chandler, Arizona, U.S., the pilot receiving training was accomplishing a go-around maneuver. As the aircraft was climbing through a height of 400 feet, the instructor shut down the left engine by closing the mixture control. The pilot properly feathered the left engine.

The instructor went to bring the left engine back out of the feather position but the propeller remained feathered. The instructor was unable to restart the left engine and the aircraft could not climb. The aircraft was force-landed with gear-up.



Backed into Obstruction

Sikorsky S-61: Aircraft destroyed. Fatal injuries to six, other injuries to seven.

The rotorcraft with a crew of two and 11 passengers was headed for a floating oil platform in the North Sea off the Shetland Islands. The rig had a helipad on top adjacent to a derrick mounted at the edge of the tower. Nine outgoing passengers were assembled on a level below the landing pad.

Weather in the area was calm and improving from early morning fog to low-lying stratus cloud up to heights between 100 to 600 feet. Visibility varied between one and four nautical miles. During its approach, the rotorcraft passed behind a tanker moored to the oil rig and established a hover adjacent to and approximately 50 feet higher than the landing pad. It then moved to its right, crossing the edge of the deck. According to witnesses, at this point the aircraft seemed to drift slightly backwards and appeared in imminent danger of striking the crane with its tail rotor.

Before the helipad landing officer could radio a warning to the crew, the tail rotor blades struck the crane structure and the helicopter yawed to the right and descended. It impacted the edge of the deck and the main rotor blades began to disintegrate as they struck the surface. Before any occupants were able to evacuate, the aircraft fell from the deck into the water, 100 feet below.

The aircraft sank in a minute and shortly afterwards seven persons were sighted floating in the water and were rescued. The wreckage was salvaged with the bodies of the remaining occupants inside. Initial investigation of the aircraft and the cockpit recorder indicated no evidence of an unusual incident or aircraft malfunction.

Instructor Confuses Lesson Instructions

Robinson R22: Substantial damage. No injuries.

It was the instructor's fourth instructional flight of the day. He was about to end a one-hour exercise teaching traffic patterns and emergencies. He had just demonstrated an engine-off landing that he had initiated by closing the throttle when the helicopter had reached 300 feet after a takeoff; a successful touchdown was completed on the designated grass area to the west of runway 01. Wind was from the north at seven knots.

The instructor next briefed the student on the technique for a low-level, power-off landing following a normal transition from takeoff to forward flight. After the rotorcraft had attained a height of between 50 and 60 feet and a forward speed of approximately 65 knots, the instructor closed the throttle, lowered the collective pitch and flared the rotorcraft. The aircraft was leveled as it approached the ground but it ran on with a high forward speed. Because of the rough terrain in the touchdown area, the aircraft bounced twice and yawed to the left before stopping upright, but with the right-hand skid displaced because of upward bending of the cross tubes. The tail boom had been severed by the main rotor and the detached tail rotor assembly had ended up halfway between the location of the helicopter's second bounce and where it stopped.

Written instructions relating to engine failure practice after takeoff stipulated that this was not to be done below 200 feet and at a wind speed of less than 10 knots. The instructor noted that when planning the final exercise he had temporarily confused the conditions for an engine failure after takeoff with those for one from low-level cruise.

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LEGEND: AP-Accident Prevention • AO-Airport Operations • AMB-Aviation Mechanics Bulletin • CCS-Cabin Crew Safety • FSD-Flight Safety Digest • HFAM-Human Factors & Aviation Medicine • HSB-Helicopter Safety Bulletin • FSFN- Flight Safety Foundation News

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	Business Aviation in the ’90s	FSD	July
	Congested Airspace	FSD	July
	Corporate and Commuter Technology	FSD	July
	East German ATC Coordination	FSD	July
	ECAC Task Force on the Integration of European Air Traffic Control Systems	FSD	July
	FSF President, Secretary Briefed by Flight Research Institute-USSR	FSFN	Sept/Oct
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	The Future of the Civil Aviation System	FSD	January
	Today’s Professional Airline Pilot: All the Old Skills — and More	FSD	June
	U.S.S.R. to Share Aviation Safety Data With Flight Safety Foundation	FSFN	July/Aug
	What is the IAC?	FSFN	Sept/Oct
0.50	**Obituaries**		
	John J. Swearingen, Safety Pioneer	FSFN	Nov/Dec
1.50	**Accident/Incident Briefs**		
	Aborted Takeoff		
	Abort after Liftoff	FSD	August
	Whoa, Nellie! Go, Nellie! Oops!	FSD	December
	Approach		
	Continued Approach After Windshear	FSD	September
	Crashing the Gate	FSD	January
	Is That GPWS For Real?	FSD	October
	Light in the Gloom Almost Spelled Doom	FSD	May
	Power Reduced, Aircraft Settled	FSD	December
	Problems During Foggy Approach	FSD	February
	Rainy Night, Unstabilized Approach	FSD	March
	Storm Diversion Ends in River	FSD	January
	Vision Problems During Approach	FSD	January
	Cargo		
	Unexpected Tie-Down	FSD	May
	Collision With Ground/Obstacles		
	Base Leg was the Final One	FSD	May
	Better of Two Evils	FSD	December
	Crash into Sea	FSD	January
	Heavy Helo Has Departure Problem	FSD	February
	Into the Trees And Back Out Again	FSD	June
	Mountain Encounter in Heavy Weather	FSD	February
	No Safe Way Through the Pass	FSD	October
	Not Enough Elbow Room	FSD	April
	Rocks in the Clouds	FSD	June
	Short Cut Wasn’t	FSD	July
	Sun Gets in my Eyes	FSD	May

Code	Subject	Bulletin	Date
	Things that Go Clunk Before the Flight	FSD	January
	Too Close For Comfort	FSD	October
	'Twas a Dark And Stormy Night…	FSD	July
	Who Has the Runway?	FSD	August
	Control Loss		
	Midair Stop Went Awry	FSD	May
	Watch Out For the Wind Machine	FSD	May
	Well, Blow Me Over	FSD	July
	Crew Associated		
	Approach Didn't Work-Neither Did 'Salvage'	FSD	April
	Careless Paperwork Stowage Can Affect Safety	FSD	June
	Fatal Combination Comes Together	FSD	December
	Flapless Landings Flop	FSD	April
	Forgot Something After Go-Around	FSD	April
	Invitation to Murphy	FSD	July
	Lack of Sleep Affects Performance	FSD	November
	Not in Top Form?	FSD	March
	Pilot's Pocket Snags Collective	FSD	February
	Poor Choice of Runway	FSD	March
	Pull a Tiger's Tail And You Get Bit	FSD	August
	Reading Road Signs Can Lead to Trouble	FSD	April
	Remember the NOTAM	FSD	December
	Too Low, Too Slow	FSD	November
	Unattended Helo Has Mind of Own	FSD	December
	Who Put on the Brakes	FSD	March
	Distraction		
	Check — and Recheck	FSD	June
	Confusion During Look-See	FSD	June
	Distraction and Busted Altitudes	FSD	January
	Distraction Bugaboo Strikes Again	FSD	February
	Distraction Leaves Murphy at Controls	FSD	August
	Distractions Permitted — Checklist Items Omitted	FSD	June
	Flaps Came Up Instead of Gear	FSD	August
	Look What You Made Me Do	FSD	April
	Rough Weather Causes Distraction	FSD	October
	Third Bounce No Charm	FSD	February
	Emergency Landing		
	Late Change of Mind Has Unwelcome Result	FSD	September
	Lessons Learned From Hijacking	FSD	December
	Pilotage A 'Lost' Art?	FSD	October
	Engine(s)		
	Engine Problem After Takeoff	FSD	June
	Horn Blows Before Power Goes	FSD	January
	Low Reversal After Takeoff	FSD	September
	No Power of Demand	FSD	January
	With One Engine Gone, It Didn't Carry On	FSD	May
	Fire - Inflight		
	Another Reason Smoking and Flying Do Not Mix	FSD	May
	Fuel Exhaustion		
	Forgot to Refuel?	FSD	August
	Fuel on Board But None Available	FSD	November
	No Juice, No Go	FSD	November
	Seeing the Sights	FSD	June
	Waited too Late with Low Fuel State	FSD	April
	Ground Obstacles		
	Roller Coaster Thrills Pilot	FSD	February
	When Things get Hurried, The Harried get Hassled	FSD	April
	Ice		
	Ice in the Intake Causes Close Call	FSD	February
	The Carburetor Ice Gremlin	FSD	March

Code	Subject	Bulletin	Date
	Incorrect Procedure		
	Airplane Worked Just Fine	FSD	July
	Automatic Rough Over the Boondocks	FSD	November
	Classic Case of Wrong Handle-itis	FSD	May
	Confusion over Flame Causes Consternation	FSD	February
	Downwind Turn Close to the Ground	FSD	August
	Extra Hand on Controls Foils Demonstration	FSD	February
	Flaps Not Set for Takeoff	FSD	June
	Is That GPWS For Real?	FSD	October
	Lever Location Confuses Pilot	FSD	July
	No, the Other Left!	FSD	April
	Overzealous Nose Lowering Leads to Confusion	FSD	May
	Pitch Down Results in Helicopter Put-Down	FSD	June
	Plastic Fuel Can	FSD	June
	Practiced too Hard?	FSD	December
	Student Did Not Relinquish Controls	FSD	February
	The Trap of Assumption	FSD	March
	Things That Almost Go Bang in the Night	FSD	November
	When the Whistle Blows, It's Time to Go Around	FSD	May
	Inspection		
	Secure All Loose Articles	FSD	January
	The Ice Man Took Control	FSD	December
	Landing		
	Assumed Zig Became Zag	FSD	May
	It All Started With a Delayed Descent	FSD	June
	Punch in the Nose	FSD	June
	Remembered Gear But Not in Time	FSD	July
	Landing Gear		
	But I Saw the Three Green Lights	FSD	February
	Close Encounter of the Wrong Kind	FSD	January
	Did I or Didn't I?	FSD	February
	Go-Around Attempt After No-gear Touchdown	FSD	September
	The Mystery of the 'Up' Gear Lever	FSD	October
	Why Checklists Were Invented	FSD	December
	Mechanical		
	Unheeded Light Makes For Interesting Flight	FSD	July
	Which Instrument Can Be Trusted?	FSD	January
	Runway/Taxiway Excursions		
	A Word of Caution Thrown to the Winds	FSD	November
	Back to the 'Good Old' Tailwheel Days	FSD	April
	Easy on the Brakes	FSD	February
	Excessive Expediting Leads to Embarrassment	FSD	September
	Finish of a Fortress	FSD	January
	Flying Before The Storm — Almost	FSD	October
	Go-Around Ends in Overshoot	FSD	February
	Little Lights Can Cause Big Problems	FSD	October
	One Thing Led to Another	FSD	March
	The Uselessness Of Runway Behind	FSD	July
	Wet Runway Causes Grief	FSD	August
	Where Did the Runway Go?	FSD	February
	Takeoff/Overrotation		
	Go-Around Against the Odds	FSD	May
	It's a Pull — Not a Yank	FSD	May
	Late, Long And Unlucky	FSD	October
	Unneeded Training Realism Gives Hard Lesson	FSD	September
	Undetermined		
	Takeoff Emergency in Wilderness	FSD	February
	Weather		
	A Hop, A Skip And a Bump	FSD	July
	A Load of Trouble	FSD	March
	Continued VFR Flight Into…	FSD	September

Code	Subject	Bulletin	Date
	Continued Visual Flight Into … ?	FSD	March
	Continued VMC in IMC	FSD	April
	Disappeared in Rain	FSD	March
	Fickle Winds Demand Vigilance	FSD	July
	Fickle Winds Fracture Airplane	FSD	August
	Inadvertent Flight Into Turbulence	FSD	July
	Inadvertently Entered Clouds	FSD	May
	Into the Mists Without a Flight Plan	FSD	April
	Sudden Entry Into Fog Bank	FSD	February
	'Twas a Dark and Rainy Night	FSD	September
	Untimely Gust Encounter Upsets Rotorcraft	FSD	September
	Windshear Affects Helo Pilots, Too	FSD	July
	Windshear on Final Bends Airplane	FSD	November
	Wire Strike		
	A Light in the Gloom Almost Spelled Doom	FSD	May
	Helicopter Pulls The Plug at Show	FSD	October
	Low on Height and Experience	FSD	April
	Obstruction Observed Too Late	FSD	June
	Too Low, Too Fast	FSD	November
	Weight and Balance		
	Check that Loadsheet To Prevent Surprises	FSD	September
	Everybody Up Front Is Only for Church	FSD	June
	Heavy Load Leads to Trouble	FSD	August
	Improper Loading Proves Fatal	FSD	November
1.75	**Maintenance Alerts**		
	A Little Dab Will Do Ya	AMB	May/June
	Airing the Brakes Is Not a Good Practice	AMB	May/June
	Another Exhaust System Failure	AMB	Nov/Dec
	Assumption Leads To Takeoff Abort	AMB	July/Aug
	Blocked Line Stops Fuel	AMB	May/June
	Brake Failure Wreaks Ramp Havoc	AMB	Jan/Feb
	Broken Brakes Bring Bother	AMB	Mar/Apr
	Broken Rule Results In Broken Hip	AMB	Sept/Oct
	Can of Worms	AMB	May/June
	Clutch Slips, Helicopter Falls	AMB	May/June
	Corrosion Again Rears its Ugly Head	AMB	Jan/Feb
	Does Murphy Make Blue Ice?	AMB	Nov/Dec
	Drag Didn't Stay	AMB	Jan/Feb
	Easily Fixed Wire Gives False Fire Warning	AMB	Mar/Apr
	Engine Failure	AMB	Jan/Feb
	Expensive Fix	AMB	July/Aug
	Fatigued Brakes Couldn't Take the Heat	AMB	July/Aug
	Fatigue Fractures Flap Fitting	AMB	Jan/Feb
	For Want of Bolt A Nose Gear as Lost	AMB	Mar/Apr
	Fouled Valve Squanders Fuel	AMB	July/Aug
	Fuel Tank Explosion Results in Fatalities	AMB	Sept/Oct
	Half a Shim Not Enough	AMB	July/Aug
	Hard Landings Find Weakness	AMB	Mar/Apr
	Helicopter Dances To Strange Beat	AMB	Mar/Apr
	Insulation Interference	AMB	Sept/Oct
	Loose Fit Sinks Airplane	AMB	July/Aug
	Loose Joint Causes Anxious Moment	AMB	Mar/Apr
	Loss of Stability Bends Helicopter	AMB	May/June
	Lube Block Breaks Engine	AMB	May/June
	Murphy's Law Strikes Again	AMB	Sept/Oct
	Muscles No Match for Volts	AMB	May/June
	Mystery of the Missing Fuel	AMB	Nov/Dec
	Pass the Earplugs, Please	AMB	Sept/Oct
	Powered-Down Ferry Flight	AMB	July/Aug

Code	Subject	Bulletin	Date
	Spark + Oxygen Leak = FIRE	AMB	Nov/Dec
	Surprise Safety Hazard	AMB	Mar/Apr
	Unexpected Retraction	AMB	July/Aug
	Unlocked Drag Links Can Cause Trouble	AMB	Mar/Apr
	Unset Sealant Restricts Visibility	AMB	July/Aug
	Water Leak + High Altitude = Ice	AMB	Sept/Oct
	Wheel Declares Independence	AMB	May/June
	Whoops!	AMB	Nov/Dec
	With This Ring I Put Thee at Risk	AMB	Jan/Feb
	Worn Safety Pin Retracts Nose Gear	AMB	Nov/Dec
2.00	**Airports**		
	Design Airports for Safety	AO	July/Aug
	Maintaining Safety and Security During On-Airport Construction	AO	Nov/Dec
	Precision Runway Monitors	AO	Mar/Apr
2.50	**Approach and Landing**		
	Facing the Runway Overrun Dilemma	AP	September
	Foundation Briefed On Curved ILS Approach	FSFN	July/Aug
	Improved Microburst Warnings Aim for Safer Terminal Operations	AP	July
3.00	**Aviation Medicine**		
	Aspartame — Not For The Dieting Pilot	HFAM	Mar/Apr
	Foundation Endorses Drug/Alcohol Safeguards	FSFN	May/June
3.50	**Awards**		
	Aviation Maintenance Technician of 1989 Honored in U.S.	AMB	Jan/Feb
	Awards Recognize Safety Accomplishment	FSFN	Nov/Dec
	Call for Nominations for the Joe Chase Award	AMB	Jan/Feb
	First Aviation Mechanic Recognized Posthumously	AMB	May/June
	Flight Instructor and Maintenance Technician of the Year Honored	FSFN	Nov/Dec
	Foundation Twice Blessed With U.S.S.R. Gagarin Medal	FSFN	July/Aug
	Heath Honored by Academy	FSFN	Nov/Dec
	Joe Chase Award Goes to Krumal	AMB	May/June
	Maintenance Technican of the Year Honored	AMB	Nov/Dec
	Plaque Honors Foundation	FSFN	May/June
	Recognition for Helo Technicians	AMB	July/Aug
	Technical Educator Recognized by FAA	AMB	July/Aug
	U.S.S.R. Foundation Presents Awards	FSFN	Nov/Dec
5.00	**Birds**		
	FSF Zeros in on Bird Hazard	FSFN	Sept/Oct
	How Airports Reduce Dangers of Bird-Strikes	AO	Jan/Feb
12.00	**Communications**		
	Communication from the Cabin Crew To the Cockpit Crew	CCS	Jan/Feb
	My Own Mouth Shall Condemn Me	AP	June
	Readback Error	AP	May
	Satellite Communications and Navigation	FSD	July
	Some Aviation Frequency Management Concerns	FSD	June
	The Communications Procedures That Save Lives	AP	June
18.00	**Ditching**		
	Helicopter Ditchings: Canada Studies the Impact	HSB	May/June

Code	Subject	Bulletin	Date
19.00	**Education & Training**		
	Aviation Computer Science Course Developed	AMB	Sept/Oct
	Cooperative Training for Aviation Technicians: An Opportunity for the Corporate and Commuter Communities	AMB	July/Aug
	Corporate Operator Training in the '90s	FSD	July
	Decision Making Workshop is First Lederer Library Lecture Series Offering	FSFN	Mar/Apr
	Enders to Consult for Aviation Psychology Publication	FSFN	July/Aug
	Foundation Helps Organize Industry Training Committee	FSFN	May/June
	Foundation Intern's Paper Published	FSFN	July/Aug
	Lederer Library Tests New Software To Provide Worldwide Electronic Access	FSFN	Nov/Dec
	Meeting the Demand For Aviation Technicians	AMB	July/Aug
	Preparing for the Unexpected: A Psychologist's Case for Improved Training	FSD	March
	Recruitment and Training	FSD	July
	Safety Book Presented to Lederer Library	FSFN	July/Aug
	Technical Education — Working Within the System	FSD	March
	Technical Scholarships	AMB	Mar/Apr
	The Importance of Training In Aviation's Future	FSD	December
	The Pilot Shortage and the Effect of Entry Level Experience on Type Conversion Training	FSD	July
	Training the Aviation Professional of thes: Recognizing the Needs	FSD	July
	Training the Entire Flight Department	FSD	February
	Troubleshooting Taught by Computer	AMB	July/Aug
	Welding Training 'On the Tube'	AMB	May/June
20.00	**Emergency Procedures**		
	Disaster Preparation for Corporate Operators	AP	October
	Passenger Protection and Safety	CCS	May/June
24.00	**Flight Operations**		
	A Typical Aviation Safety Audit	FSD	August
	Enter At Own Risk	HSB	Sept/Oct
	Mountaintop Disaster	HSB	May/June
	When is a Hard Landing Hard?	AP	May
	Whose License is it Anyway?	FSD	April
27.75	**Helicopters**		
	Helicopter Crashworthiness — Part Two	HSB	Jan/Feb
	HELP — A Lifesaver Plan That Works	HSB	Mar/Apr
	Inflight Icing and the Helicopter	HSB	Nov/Dec
27.85	**Hijacking & Terrorism**		
	Civil Aviation and the Aircraft Bomb	FSD	Sept/Oct
28.00	**Human Factors**		
	Aircraft Accidents Aren't	AP	December
	Cockpit Resource Management — A Practical Application	FSD	July
	Cockpit Resource Management — The Only Way to Go	AP	November
	Color Vision and Cockpit Operations	HFAM	May/June
	Contact Lenses in Aviation	HFAM	Sept/Oct
	Decision Making for Air Ambulance Administrators	HSB	July/Aug
	How Effective is Cockpit Resource Management Training?	FSD	May
	Human Factors and National Goals	HFAM	Jan/Feb
	Human Factors in Cabin Safety	CCS	Mar/Apr
	Human Factors in the Aircraft Cabin	CCS	Nov/Dec

Code	Subject	Bulletin	Date
	Human Factors Worth Considering When Starting CRM Training	FSD	July
	Minimizing Diurnal Desynchronization	HFAM	Nov/Dec
	Orchestrating The Human Symphony In Flight Operations	HFAM	Mar/Apr
	Pilots' Sunglasses: Mystique or Mandate?	HFAM	July/Aug
	Resource Management in the Cockpit	FSD	July
	Stress, Behavior, Training and Safety	CCS	May/June
	Subtle Incapacitation of Pilots: How To Tell If Your Captain Has Died	AP	January
	The Flight and Duty Time Dilemma	AP	February
	The Human Factor	AO	May/June
	Visual Illusions Can Spoil Your Whole Day	AP	March
30.75	**Cabin Safety**		
	Foundation Endorses Infant Seat Improvements	FSFN	May/June
	Improved Child Protection Endorsed	CCS	July/Aug
	Industry Proposal Addresses Service Carts	CCS	May/June
	The Case for Upgrading Cabin Crew Status	CCS	Sept/Oct
31.25	**Investigation**		
	Investigating Foreign Aircraft Accidents In the U.S.S.R.	FSD	December
35.00	**Maintenance**		
	Airworthiness Directives Aimed at Aging Aircraft	AMB	May/June
	Are Wooden Propellers On the Way Out?	AMB	Mar/Apr
	Blast Room Claims Safer Paint Stripping	AMB	May/June
	Borescope by the Book	AMB	Sept/Oct
	Borescopes Help Solve Inspection and Maintenance Problems In Aviation	AMB	Jan/Feb
	Bulletins Describe Use and Care of Aviation Tires	AMB	Jan/Feb
	Carrying the Flame is for Love and The Olympics	AMB	Jan/Feb
	Continued Airworthiness of Aging Corporate Aircraft	AMB	Mar/Apr
	Cylinder Coating Process	AMB	July/Aug
	Don't Get Caught With Your Parka Down	AMB	Nov/Dec
	Fokker 50 Hot-High Variant to use PW 127 Turboprop Engines	AMB	Nov/Dec
	Frostbite Warning Worth Repeating	AMB	Jan/Feb
	FSF Represented at Aging Airplane Symposium	FSFN	May/June
	How to Practice Good Tire Sense	AMB	May/June
	Industry Updated On Aging Aircraft	AMB	Mar/Apr
	Lights, Air, Power, Action	AMB	Sept/Oct
	New Engineering Resource: Lightning Protection of Aircraft	AMB	Nov/Dec
	Piper Gear Leg Checks Called For	AMB	July/Aug
	Program Introduced to Prevent Back Injuries on the Job	AMB	Jan/Feb
	Put Some Ears in Your Toolbox	AMB	Sept/Oct
	The SRM — A Book for Many Reasons	AMB	Sept/Oct
	Twinjets Mark Five Years in Extended Range Service	AMB	Sept/Oct
35.50	**Maintenance Equipment/Services**		
	Adjustable Wrenches	AMB	Sept/Oct
	Barrel Top Mat	AMB	Nov/Dec
	Carpet Tape Resists Fire	AMB	Jan/Feb
	Continuous-Length Cable Ties	AMB	Sept/Oct
	Corny Absorbent Is Environmental	AMB	Nov/Dec
	Drip Pan Catches Leaks	AMB	July/Aug
	Flame-Resistant Fiber Developed for Aircraft Interiors	AMB	Sept/Oct
	Fluid Service Carts Go to the Aircraft	AMB	July/Aug
	Fuel Test Instrument Measures Contamination	AMB	Nov/Dec
	Hydraulic Lift Table Eases Manual Strain	AMB	July/Aug
	Icemelter Promises Safety with No Corrosion	AMB	Nov/Dec
	Infrared Heaters	AMB	Mar/Apr

Code	Subject	Bulletin	Date
	Lifting Table Lightens Loads	AMB	Mar/Apr
	Socket System Claims Better Grip	AMB	Mar/Apr
	Metal Fires Meet Their Match	AMB	Sept/Oct
	Monitor “Cleans” Aviation Fuel	AMB	Jan/Feb
	Scissor-Lifts Take the Strain	AMB	May/June
	Water Detector For Fuel Checks	AMB	May/June
	Wind Shelter Shields Mechanics	AMB	May/June
36.00	**Management**		
	Air Safety Management — Executive Aspects	FSD	July
	Intern Joins Foundation Staff	FSFN	Mar/Apr
	Lessons Learned from Safety Audits	FSD	July
	Maginnis Elected Vice President of Foundation	FSFN	Nov/Dec
	Safety Audits and Operator Goals	FSD	August
37.00	**Meetings**		
	CAC Meets	FSFN	July/Aug
	Corporate Seminar Convenes in Montreal	FSFN	July/Aug
	European Seminar Addresses Future	FSFN	May/June
	FSF and FSF-USSR Meet	FSFN	Mar/Apr
	FSF to Hold Safety Data Meeting	FSFN	July/Aug
	Get Your CASS Cassettes Here	FSFN	July/Aug
	IAC Holds Summer Meeting and Workshop	FSFN	Sept/Oct
	IASS Committee Meets in Rome	FSFN	July/Aug
	Regional Safety Conference Convened In Amman, Jordan	FSFN	May/June
	Trade Shows Coming Up	AMB	Jan/Feb
	Volanic Ash Symposium Scheduled	FSFN	Sept/Oct
	Workshops Highlight IAC Meeting	FSFN	May/June
51.50	**Sabatoge/Security**		
	Radical Right Terrorists vs. Radical Left Terrorists: Their Theory and Threat	FSD	April
	Dangerous Goods and Air Safety	FSD	September
	Security for Corporate and Regional Operators	FSD	July
53.00	**Statistics**		
	A Decade of Development and Safety Performance Worldwide Civil Aviation 1980-1989	FSD	November
	A Decade of Progress and Difficulty. A review of U.S. Airline Growth and Safety Performance 1979-1989	FSD	March
	A Statistical Analysis of General Aviaiton Flying In Relation to Pilot Age and Certificate	FSD	April
	An Inferential Analysis of Safety Performance of U.S. General Aviation Fixed-wing Aircraft 1978-1987	FSD	August
	Back to Basics II - An FAA Accident Prevention Program For The Nineties	FSD	July
	Civil Aviation and Safety in United Kingdom A Decade of Progress 1980-1989	FSD	October
	The Head and Tail of U.S. General Aviation	FSD	May
	The Medical Risk of Airline Pilots Over Age 60	FSD	December
	Untimely Gust Encounter Upsets Rotorcraft	FSD	September
	U.S. Transportation Fatalities and Trends In the Eighties	FSD	September
	Worldwide Airline Safety Records Calendar Year 1989	FSD	February
	Worldwide Airline Jet Transport Aircraft Fatal Accidents and Hull Losses - A Review of 31 Years of Operations	FSD	June
59.75	**Weather**		
	Insidious Rotor Ice	HSB	Jan/Feb
	The Lowest Form of Cloud	AP	August