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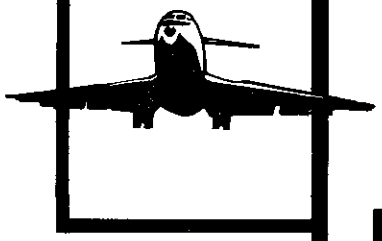

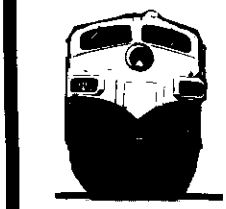

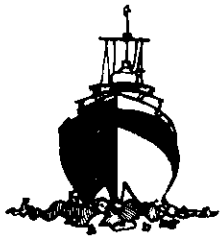

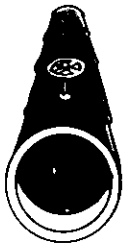

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY REPORT

GENERAL AVIATION ACCIDENTS INVOLVING VISUAL FLIGHT RULES FLIGHT INTO INSTRUMENT METEOROLOGICAL CONDITIONS

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15. Supplementary Notes

16. Abstract

This report presents a statistical compilation of data from the National Transportation Safety Board's Aviation Accident Data System. The data includes 361 general aviation accidents that occurred between 1983 and early 1987. In all of these accidents, visual flight rule flight into instrument meteorological conditions was listed as a probable cause or a related factor. There were 276 fatal accidents which resulted in 583 fatalities. Ninety-four percent of the aircraft involved in these accidents were airplanes; the remainder were helicopters.

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INTRODUCTION

Between 1975 and 1986, accidents involving visual flight rule (VFR) flight into instrument meteorological conditions (IMC) accounted for 4 percent of all general aviation (GA) accidents but produced 19 percent of the resulting fatalities. While the GA accident rate was reduced by 37 percent over the 12-year period, the VFR flight into IMC accident rate decreased by 64 percent. Seventy-two percent of the VFR flight into IMC accidents were fatal which was substantially higher than the corresponding 17 percent of all GA accidents.

This report presents a statistical compilation of data from the National Transportation Safety Board's Aviation Accident Data System. The data includes 361 GA accidents that occurred between 1983 and early 1987.[1] In all of these accidents, VFR flight into IMC was listed as a probable cause or a related factor. There were 276 fatal accidents which resulted in 583 fatalities. Ninety-four percent of the aircraft involved in these accidents were airplanes; the remainder were helicopters.

The Safety Board may designate more than one of its investigative findings as "probable causes" and "related factors" for an accident. For the 361 GA accidents reviewed, 1,121 probable causes and 1,714 related factors are cited (see table 4). Ninety-seven percent of these probable causes are attributed to the flightcrew--361 pilots, 8 copilots, and 2 dual students. Considering only flightcrew-related probable causes, 42 percent cite the manner in which weather information was obtained (or not obtained), assimilated, and used. Aircraft handling, another frequently-cited category in accidents involving VFR flight into IMC, accounts for 30 percent of flightcrew-related probable causes. Findings explicitly related to the crews' planning, decisionmaking, and judgment account for 14 percent; however, it would be reasonable to consider some of the weather-related probable causes (for example, preflight briefing service or flight into known adverse weather) in this category. Training- and experience-related findings do not appear to be a substantial component of the problem since they constitute only 3 percent of the flightcrew probable causes.

Although rarely cited in connection with the probable cause in the 361 accidents examined, environmental conditions account for 69 percent of related factors. Fifty percent of these factors involve weather conditions such as clouds, fog, or precipitation that may have reduced visibility or limited the airspace available for VFR flight. Most (28 of 31 percent) of the remaining (nonenvironmental) factors are attributed to the flightcrew and are distributed fairly uniformly among the five categories of flightcrew causes and factors depicted in chart 6.

Based on the tabulations presented in this data review, the following statistics describe pilots who were involved in VFR flight into IMC accidents:

- 51 percent were between the ages of 40 and 59 (table 5);
- 71 percent held a private pilot's certificate (table 6);
- 52 percent had less than 500 total flight hours (table 9);
- 46 percent had less than 100 flight hours in the type aircraft (table 10);

[1]When this data was compiled, all accidents that occurred since 1983 in which VFR flight into IMC was cited as a probable cause or a related factor were selected. At that time, some of the calendar year 1986 accident investigations had not been finalized, but some 1987 cases were complete. This group of accidents approximate the characteristics of the population of VFR flight into IMC accidents for the years 1983-86. The numbers of VFR into IMC accidents presented in tables 1 and 2 as well as charts 1 through 5 were derived after the data review sample was chosen. Therefore, the tables and charts reflect a larger number of accidents in the period 1983-86.

- 77 percent were not instrument rated (table 12);
- 57 percent had less than 20 hours instrument time (table 14);
- 55 percent received a weather briefing from a flight service station or the National Weather Service (table 15);
- 79 percent had filed no flight plan (table 19);
- 83 percent were flying a single-engine airplane (table 13);
- 62 percent were flying their own aircraft (table 11);
- 75 percent were flying for personal reasons (table 16);
- 62 percent were in the cruise phase of operation when the accident occurred (table 8);
- 61 percent crashed in fog or ground fog (table 20); and
- 75 percent were killed (table 3).

TABLE 1 - ACCIDENTS, FATAL ACCIDENTS, FATALITIES, AND RATES
ALL GENERAL AVIATION
1975 - 1986

Year	Accidents	Fatal Accidents	Percent Fatal	Fatalities
1975	3995	633	15.8	1252
1976	4018	658	16.4	1216
1977	4079	661	16.2	1276
1978	4216	719	17.1	1556
1979	3818	631	16.5	1221
1980	3590	618	17.2	1239
1981	3500	654	18.7	1282
1982	3233	591	18.3	1187
1983	3075	555	18.0	1064
1984	3010	543	18.0	1039
1985	2741	498	18.2	952
1986	2581	471	18.2	961
1975-1986	41,856	7,232	17.3	14,245

Year	Hours Flown	Accident Rate per 100,000 * Aircraft Hours Flown	
		Total	Fatal
1975	28,799,000	13.87	2.19
1976	30,476,000	13.17	2.16
1977	31,578,000	12.91	2.09
1978	34,887,000	12.08	2.06
1979	38,641,000	9.88	1.63
1980	36,402,000	9.86	1.69
1981	36,803,000	9.51	1.78
1982	32,095,000	10.06	1.84
1983	31,048,000	9.90	1.79
1984	31,510,000	9.54	1.72
1985	30,590,000	8.95	1.62
1986	29,318,000	8.80	1.61
1975-1986	392,147,000	10.67	1.84

* Suicide and sabotage accidents excluded from rates as follows:

Total - 1975 (2), 1976 (4), 1977 (1), 1978 (2), 1980 (1), 1982 (3), 1983 (1), 1984 (3), 1985 (3)

Fatal - 1975 (2), 1976 (1), 1977 (1), 1978 (2), 1980 (1), 1984 (2), 1985 (2)

TABLE 2 - ACCIDENTS, FATAL ACCIDENTS, FATALITIES, AND RATES VFR FLIGHT INTO IMC *
1975 - 1986

Year	Accidents	Fatal Accidents	Percent Fatal	Fatalities
1975	184	137	74.5	314
1976	165	97	58.8	213
1977	158	108	68.4	248
1978	187	137	73.3	293
1979	168	124	73.8	281
1980	140	102	72.9	220
1981	167	114	68.3	251
1982	126	98	77.8	215
1983	116	91	78.4	199
1984	97	75	77.3	158
1985	94	70	74.5	148
1986	68	52	76.5	97
1975-1986	1,670	1,205	72.2	2,637

		Accident Rate per 100,000 Aircraft Hours Flown	
Year	Hours Flown	Total	Fatal
1975	28,799,000	0.64	0.48
1976	30,476,000	0.54	0.32
1977	31,578,000	0.50	0.34
1978	34,887,000	0.54	0.39
1979	38,641,000	0.43	0.32
1980	36,402,000	0.38	0.28
1981	36,803,000	0.45	0.31
1982	32,095,000	0.39	0.31
1983	31,048,000	0.37	0.29
1984	31,510,000	0.31	0.24
1985	30,590,000	0.31	0.23
1986	29,318,000	0.23	0.18
1975-1986	392,147,000	0.43	0.31

* For the years 1975 through 1981, the Safety Board coding system contained a code for "Continued VFR flight into adverse weather conditions" which is not necessarily the same as the later coding system's "VFR flight into IMC." The absence of a detectable discontinuity in accident rates across the boundary between the two coding systems supports the assumption that the two codes have been used to indicate the same condition.

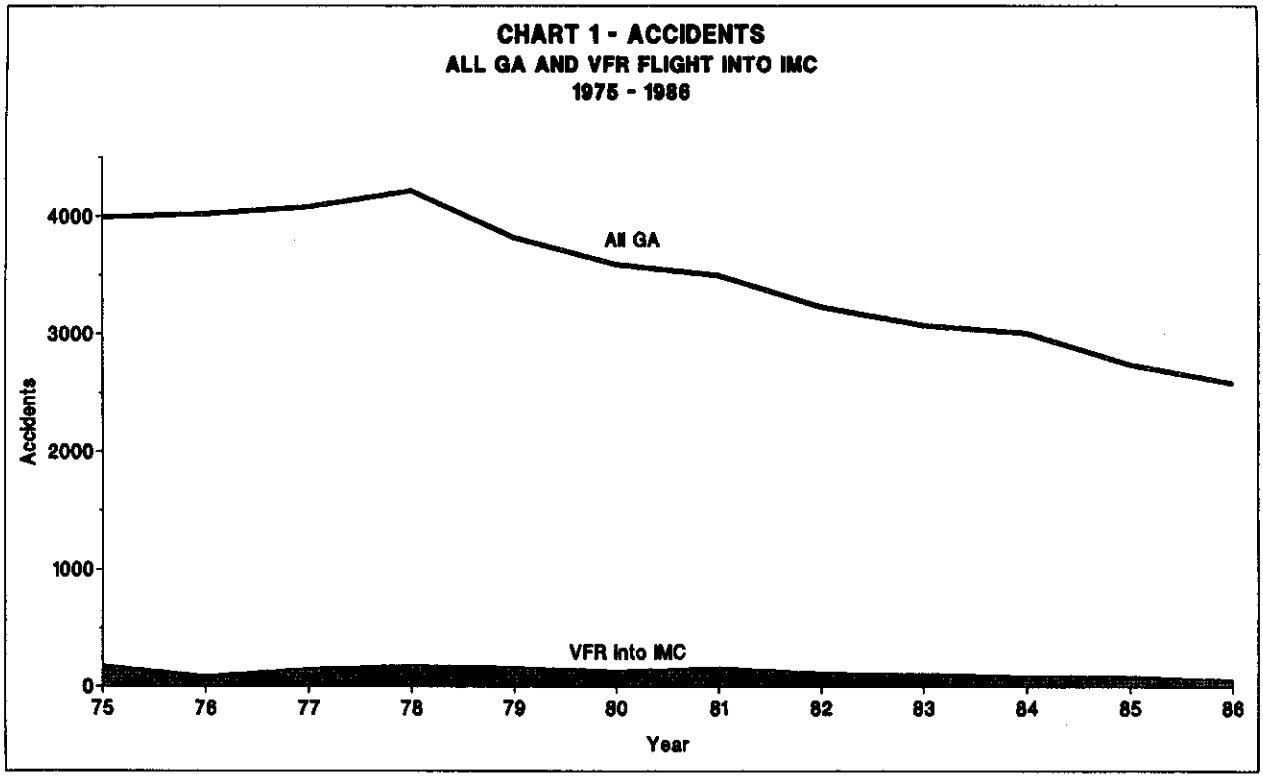
CHART 1 - ACCIDENTS
ALL GA AND VFR FLIGHT INTO IMC
1975 - 1986
4000
3000
2000
1000
0
Accidents
All GA
VFR Into IMC
75
76
77
78
79
80
81
82
83
84
85
86
Year

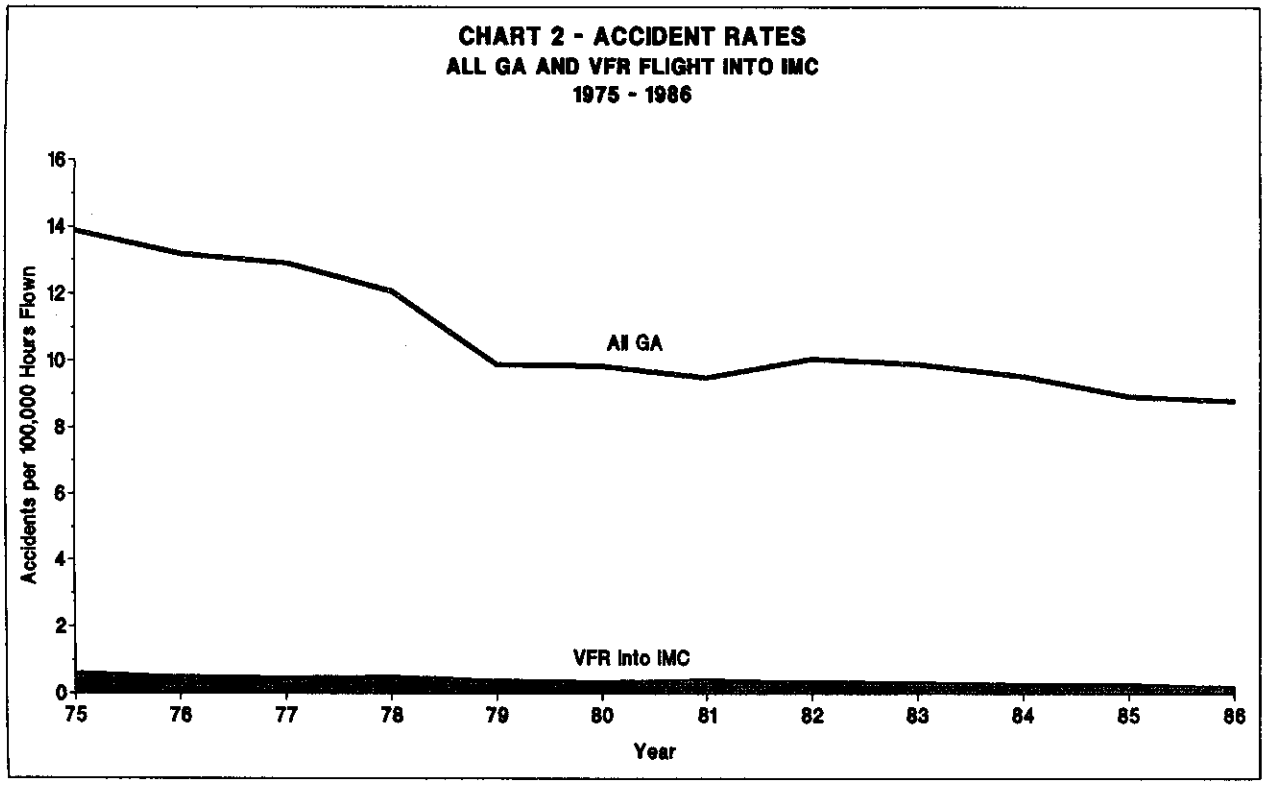
CHART 2 - ACCIDENT RATES
ALL GA AND VFR FLIGHT INTO IMC
1975 - 1986
16
14
12
10
8
6
4
2
0
Accidents per 100,000 Hours Flown
All GA
VFR Into IMC
75
76
77
78
79
80
81
82
83
84
85
86
Year

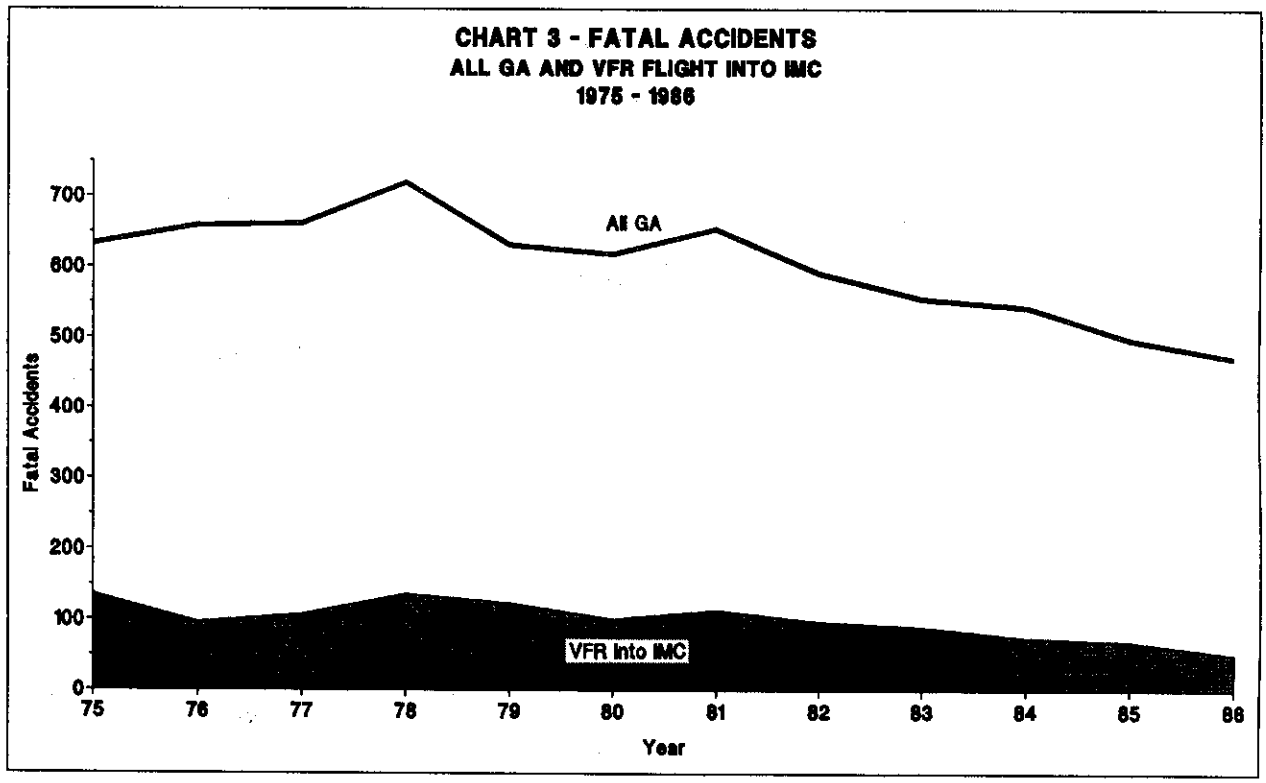
CHART 3 - FATAL ACCIDENTS
ALL GA AND VFR FLIGHT INTO IMC
1975 - 1986
All GA
VFR into IMC
Fatal Accidents
700
600
500
400
300
200
100
0
75
76
77
78
79
80
81
82
83
84
85
86
Year

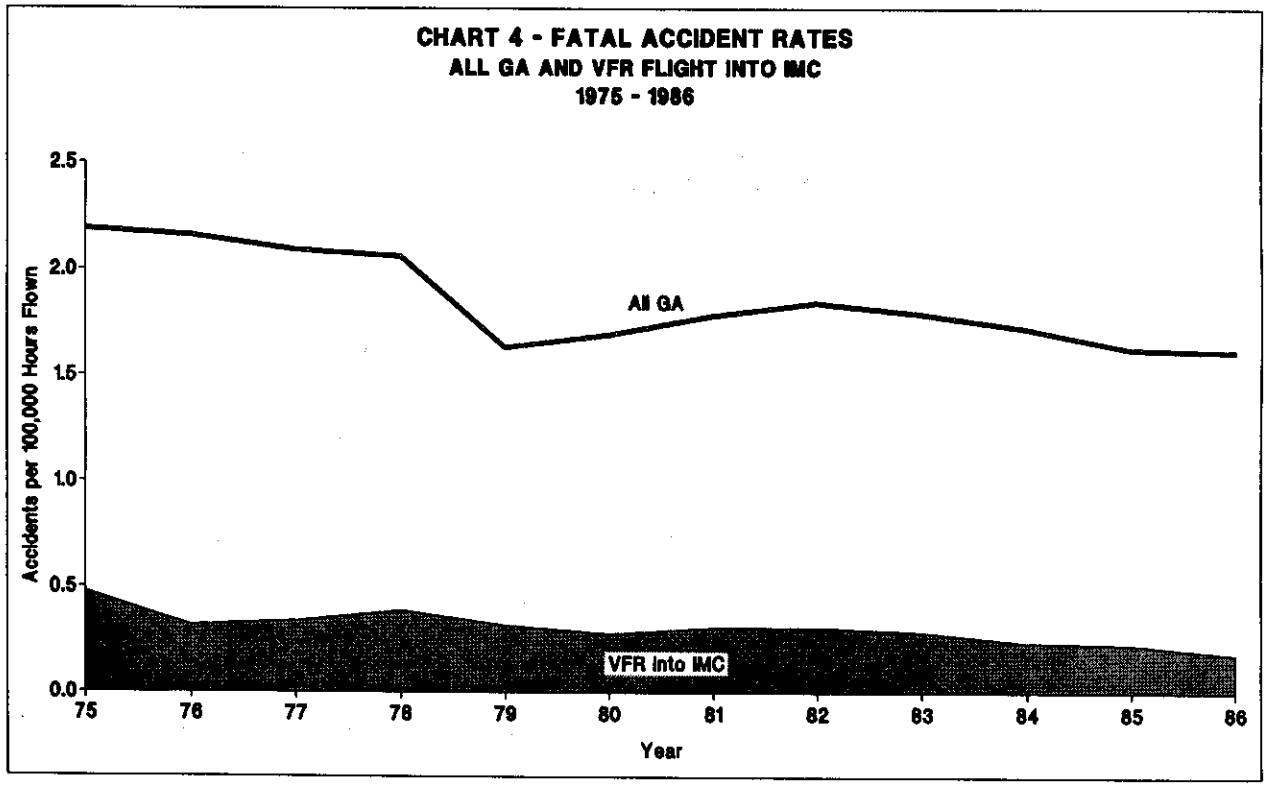
CHART 4 - FATAL ACCIDENT RATES
ALL GA AND VFR FLIGHT INTO IMC
1975 - 1986
All GA
VFR into IMC
Accidents per 100,000 Hours Flown
2.5
2.0
1.5
1.0
0.5
0.0
75
76
77
78
79
80
81
82
83
84
85
86
Year

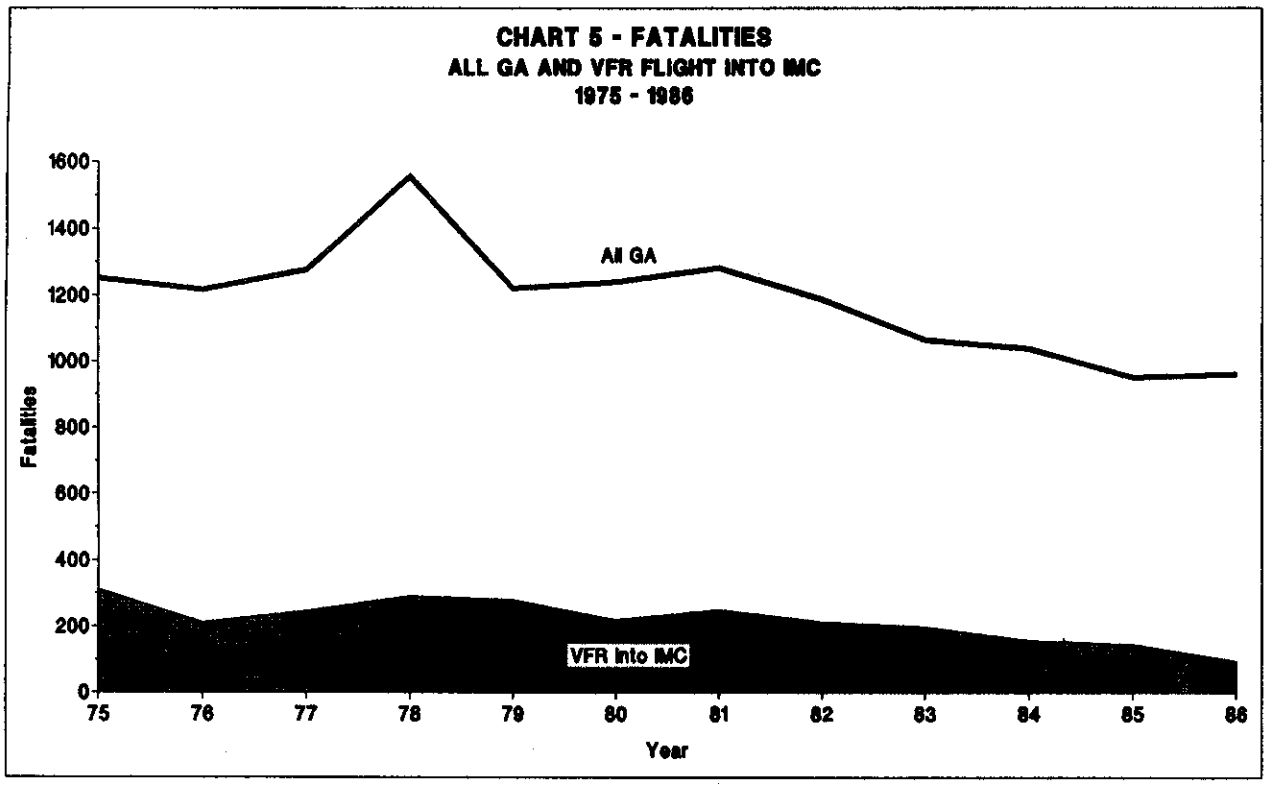

TABLE 3 - PERSONS BY POSITION AND DEGREE OF INJURY
VFR FLIGHT INTO IMC ACCIDENTS

	Degree of Injury				
Position	Fatal	Serious	Minor	None	Total
Pilot	270	31	23	37	361
Copilot	7	1	0	0	8
Dual student	2	0	0	0	2
Passenger	304	35	31	49	419
Total aboard	583	67	54	86	790
Person on ground	0	1	0	0	1
Grand total	583	68	54	86	791
Percent	73.7	8.6	6.8	10.9	

TABLE 4 - CAUSE AND FACTOR CITATIONS*
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Aircraft		
Wing	9	4
Fluid,fuel	8	3
Wing,spar	3	1
Flight control,stabilator	3	0
Fuel system,carburetor	3	0
Wing,bracing strut	3	0
Flight/nav instruments,directional gyro	2	1
Landing gear,main gear	2	1
Comm/nav equipment	2	0
Flight/nav instruments,attitude indicator	2	0
Landing gear,nose gear	2	0
Vacuum system	2	0
Aircraft performance	1	1
Carburetor heat control,cable	1	1
Electrical system	1	1
Flight control,elevator	1	1
Fuel system,ram air	1	1
Autopilot/flight director	1	0
Door,passenger	1	0
Engine assembly	1	0
Flight/nav instruments,heading indicator	1	0
Fuselage	1	0
Instrument lights	1	0
Landing gear,nose gear assembly	1	0
Total Aircraft Causes / Factors	53	15
Facility		
Air navigation aids,VOR	1	0
Airport facilities,rotating beacon	1	0
Airport facilities,runway edge lights	1	0
Approach aids	1	0
Enroute charts	1	0
Total Facility Causes / Factors	5	0

* The numbers given in this table represent citations by the Safety Board of each probable cause or related factor in the 361 accidents reviewed. These numbers may be slightly higher than the number of accidents they represent. In relatively infrequent cases, a factor may be cited more than once in order to encode the sequence of events to accurately reflect the accident scenario.

TABLE 4 (Continued) - CAUSE AND FACTOR CITATIONS
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Environment		
Terrain condition	225	4
Low ceiling	216	1
Fog	167	2
Clouds	93	2
Dark night	83	3
Rain	82	3
Obscuration	71	0
Snow	51	0
Tree(s)	40	1
Thunderstorm	22	2
Turbulence	19	0
Icing conditions	14	0
Night	12	0
Whiteout	12	0
Dusk	11	0
Wire,transmission	10	0
Turbulence(thunderstorms)	9	2
Haze	9	0
High wind	9	0
Guy wire	6	0
Gusts	5	0
Below approach minimums	4	0
Turbulence in clouds	4	0
Unfavorable wind	4	0
Dawn	3	0
Fence	3	0
Lightning	3	0
Utility pole	3	0
Mountain wave	2	0
Windshear	2	0
Carburetor icing conditions	1	0
Crosswind	1	0
Daylight	1	0
Downdraft	1	0
Elect tower(marked)	1	0
High density altitude	1	0
Other person	1	0
Residence	1	0
Runway light	1	0
Vehicle	1	0
Total Environment Causes / Factors	1204	20

TABLE 4 (Continued) - CAUSE AND FACTOR CITATIONS
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Flightcrew		
Obtaining and Using Weather Information		
VFR flight into IMC	364	340
Flight into known adverse weather	100	49
Weather evaluation	49	35
Preflight briefing service	40	17
Weather forecast	7	4
In flight briefing service	6	4
In flight weather advisories	3	2
Hazardous weather advisory	2	1
Weather observation	2	1
In flight weather avoidance assistance	1	1
Meteorological service	1	0
Subtotal	575	454
Aircraft Handling		
Airplane handling	64	63
Proper altitude	40	40
Became lost/disoriented	36	26
Clearance	29	29
Design stress limits of aircraft	25	25
Altitude	23	23
Remedial action	16	14
Precautionary landing	14	6
Visual lookout	13	10
Airspeed	12	12
Procedures/directives	12	10
Flight to alternate destination	11	4
Descent	7	6
Stall	6	6
Directional control	6	5
IFR procedure	5	3
Pull-up	4	4
Unsuitable terrain	4	3
VFR procedures	4	3
Climb	3	3
Spiral	3	3
Stall/spin	3	3
Low pass	3	2
Planned approach	3	2
Refueling	3	1
Flight controls	2	2
Fuel supply	2	2

TABLE 4 (Continued) - CAUSE AND FACTOR CITATIONS
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Flightcrew (Continued)		
Aircraft Handling (Continued)		
Maneuver	2	2
Missed approach	2	2
Stall/mush	2	2
Airspeed(Vs)	2	1
Improper use of equipment/aircraft	2	1
Proper glidepath	2	1
Radio communications	2	1
Total	2	1
Airspeed(Vmc)	1	1
Compensation for wind conditions	1	1
Decision height	1	1
Emergency procedure	1	1
Proper alignment	1	1
Proper descent rate	1	1
Proper touchdown point	1	1
Seat belt	1	0
Subtotal	377	328
Planning and Decision Making		
In-flight planning/decision	92	72
Preflight planning/preparation	86	46
Judgement	30	22
Planning-decision	21	12
Operation with known deficiencies in equipment	7	3
Improper decision	2	2
Maintenance,100 hour inspection	1	0
Subtotal	239	157
Psychological and Physiological		
Spatial disorientation	92	76
Over confidence in personal ability	68	15
Self-induced pressure	23	8
Physical impairment(alcohol)	8	8
Visual/aural perception	6	2
Over confidence in aircraft's ability	4	0
Fatigue	3	0
Pressure induced by others	3	0
Under confidence in personal ability	3	0
Visual/aural detection	3	0

TABLE 4 (Continued) - CAUSE AND FACTOR CITATIONS
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Flightcrew (Continued)		
Psychological and Physiological (Continued)		
Pressure	2	2
Diverted attention	2	1
Mental performance overload	1	1
Anxiety/apprenhension	1	0
Inattentive	1	0
Physical impairment(drugs)	1	0
Physical impairment(hypertension)	1	0
Subtotal	222	113
Training and Experience		
Lack of total instrument time	96	20
Lack of total experience	13	4
Lack of recent instrument time	7	1
Qualification	5	0
Lack of total experience in kind of aircraft	2	1
Experience	2	0
Inadequate recurrent training	2	0
Lack of total experience in type of aircraft	2	0
Improper initial training	1	1
Inadequate transition/upgrade training	1	1
Lack of familiarity with aircraft	1	1
Lack of total experience in type operation	1	1
Inadequate training	1	0
Lack of recent experience	1	0
Lack of recent experience in type of aircraft	1	0
Lack of recent total experience	1	0
Subtotal	137	30
Miscellaneous		
Lack of familiarity with geographic area	4	1
Control tower service	1	0
Information insufficient	1	0
Instructions,written/verbal	1	0
Radar assistance to VFR aircraft	1	0
Stolen aircraft/unauthorized use	1	0
Subtotal	9	1
Total Flightcrew Causes / Factors	1559	1083

TABLE 4 (Continued) - CAUSE AND FACTOR CITATIONS
VFR FLIGHT INTO IMC ACCIDENTS

	Number of Citations	
	Cause or Factor	Cause
Other Person		
Weather forecast	3	2
Meteorological service	2	0
Preflight briefing service	2	0
Clearance	1	1
Aircraft	1	0
Lack of familiarity with geographic area	1	0
Miscellaneous equipment	1	0
Procedures/directives	1	0
Radio communications	1	0
Weather evaluation	1	0
Total Other Person Causes / Factors	14	3
Total All Causes / Factors	2835	1121

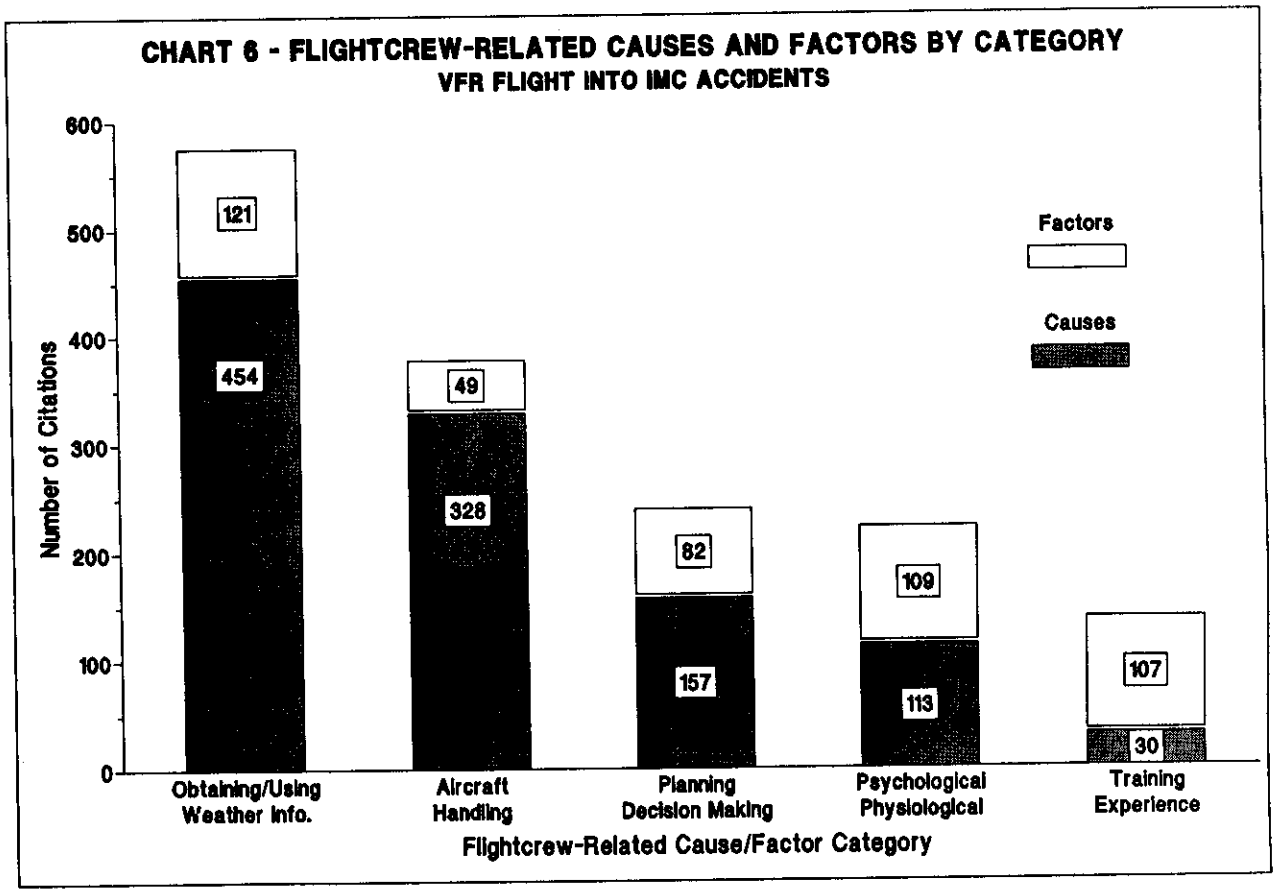
CHART 6 - FLIGHTCREW-RELATED CAUSES AND FACTORS BY CATEGORY
VFR FLIGHT INTO IMC ACCIDENTS
Number of Citations
600
500
400
300
200
100
0
121
454
49
328
82
157
109
113
107
30
Factors
Causes
Obtaining/Using Weather Info.
Aircraft Handling
Planning Decision Making
Psychological Physiological
Training Experience
Flightcrew-Related Cause/Factor Category

TABLE 5 - PILOTS BY AGE GROUP
VFR FLIGHT INTO IMC ACCIDENTS, ALL GENERAL AVIATION ACCIDENTS, AND ACTIVE GENERAL AVIATION PILOTS

Age group of pilot	VFR Flight into IMC Pilots		Other Pilot Samples (Percent)	
	Number	Percent*	Pilots in all GA Accidents+	Active GA Pilots**
15-19	1	0.3	1.2	1.8
20-24	20	5.6	6.3	8.6
25-29	37	10.3	10.4	12.0
30-34	47	13.1	13.7	13.5
35-39	41	11.4	16.0	14.7
40-44	52	14.5	13.9	13.8
45-49	54	15.0	10.7	10.2
50-54	49	13.6	10.1	10.8
55-59	29	8.1	8.5	6.8
60 and over	29	8.1	9.3	7.8
Not reported	2	--	--	--
Total Pilots	361			

* Based on 359 pilots whose age was reported

\+ Accidents which occurred between 1983 and 1986

** "1984 General Aviation Pilot and Aircraft Activity Survey", Federal Aviation Administration, 1985, p. 6.

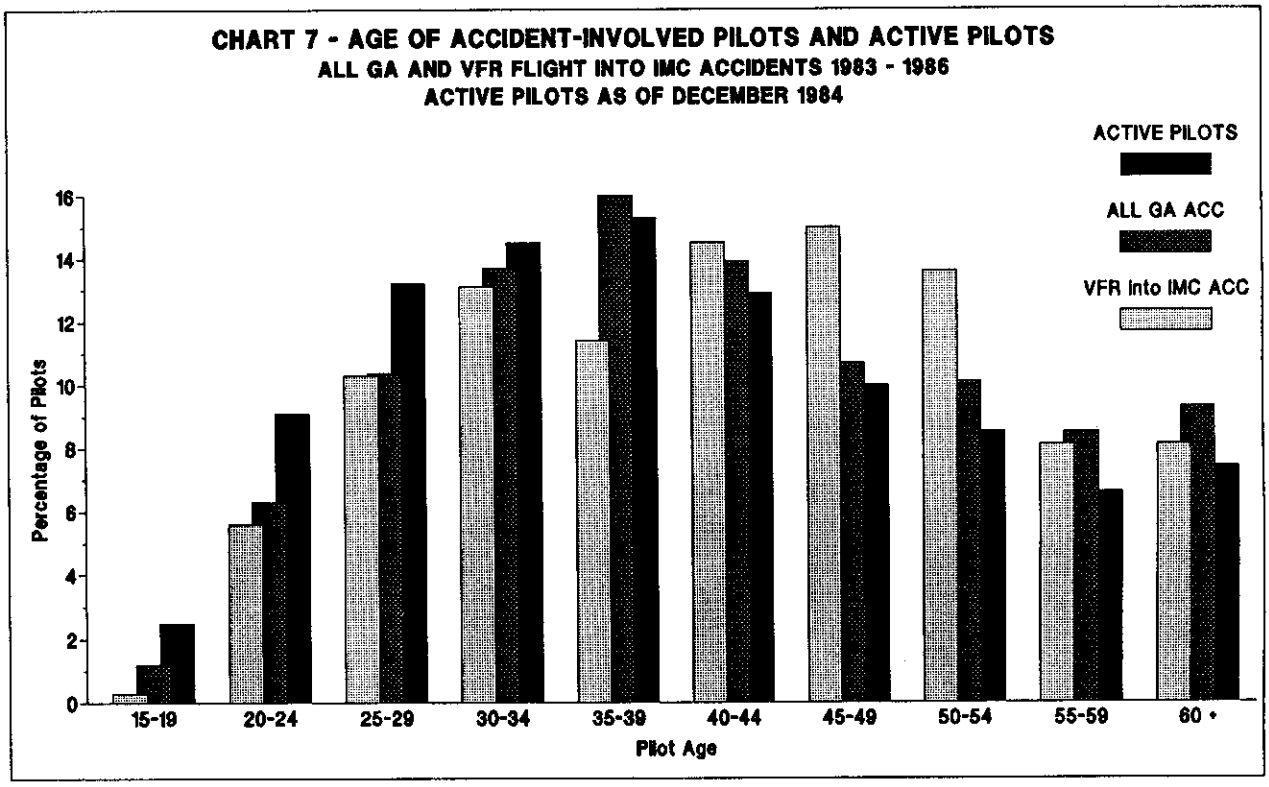
CHART 7 - AGE OF ACCIDENT-INVOLVED PILOTS AND ACTIVE PILOTS
ALL GA AND VFR FLIGHT INTO IMC ACCIDENTS 1983 - 1986
ACTIVE PILOTS AS OF DECEMBER 1984
ACTIVE PILOTS
ALL GA ACC
VFR Into IMC ACC
Percentage of Pilots
0
2
4
6
8
10
12
14
16
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60 +
Pilot Age

TABLE 6 - PILOTS BY CERTIFICATE AND AGE GROUP VFR FLIGHT INTO IMC ACCIDENTS

Age group of pilot	Pilot Certificate					Pilots	
	Student	Private	Comm'l	Airline Transpt	None	Total	Percent
15-19	1	0	0	0	0	1	0.3
20-24	2	15	3	0	0	20	5.5
25-29	4	25	5	2	1	37	10.2
30-34	2	36	7	2	0	47	13.0
35-39	3	27	8	3	0	41	11.4
40-44	1	41	8	2	0	52	14.4
45-49	1	36	12	5	0	54	15.0
50-54	2	30	14	3	0	49	13.6
55-59	0	22	6	1	0	29	8.0
60-64	0	12	3	0	0	15	4.2
65 and over	1	9	4	0	0	14	3.9
Not reported	0	2	0	0	0	2	0.6
Total pilots	17	255	70	18	1	361	
Percent	4.7	70.6	19.4	5.0	0.2		

TABLE 7 - PILOTS BY CERTIFICATE AND TYPE OF FLIGHT PLAN FILED VFR FLIGHT INTO IMC ACCIDENTS

Pilot Certificate	Type of Flight Plan Filed			Pilots	
	None	VFR*	IFR	Total	Percent
Student	16	1	0	17	4.7
Private	207	43	5	255	70.6
Commercial	57	9	4	70	19.4
Airline transport pilot	7	8	3	18	5.0
Not reported	1	0	0	1	0.3
Total pilots	288	61	12	361	
Percent	79.8	16.9	3.3		

* Includes those filed as Company VFR.

TABLE 8 - PILOTS BY CERTIFICATE AND PHASE OF FLIGHT
VFR FLIGHT INTO IMC ACCIDENTS

Phase of Flight*	Pilot Certificate					Pilots	
	Student	Private	Comm'l	ATP	Not rept	Total	Percent
Takeoff	4	20	2	0	0	26	7.2
Climb	0	14	6	0	0	20	5.5
Cruise	8	169	35	12	1	225	62.3
Descent	2	15	3	0	0	20	5.5
Approach	1	13	8	4	0	26	7.2
Landing	0	20	12	2	0	35	9.7
Unknown	1	4	1	0	0	6	1.7
Total Pilots	17	255	70	18	1	361	
Percent	4.7	70.6	19.4	5.0	0.3		

* The phase of flight of the first accident occurrence

TABLE 9 - PILOTS BY TOTAL FLIGHT TIME
VFR FLIGHT INTO IMC AND GENERAL AVIATION ACCIDENTS

Total Time (in hours)	Study pilots		Pilots in all GA accidents (1983-1986)	
	No.	Percent*	No.	Percent*
Under 100	30	9.3	1,498	13.8
100 - 199	56	17.4	1,033	9.5
200 - 299	30	9.3	739	6.8
300 - 399	22	6.8	649	6.0
400 - 499	28	8.7	475	4.4
500 - 999	46	14.3	1,518	14.0
1000 - 1499	16	5.0	854	7.9
1500 - 1999	18	5.6	584	5.4
2000 or more	76	23.6	3,466	32.0
Not reported	39	---	723	---
Total pilots	361	100.0	11,539	100.0

* Based on 322 study pilots and 10,818 general aviation accident involved pilots for whom total flight time is known.

TABLE 10 - PILOTS BY EXPERIENCE IN MAKE AND MODEL VFR FLIGHT INTO IMC ACCIDENTS

Experience in Make and Model (in hours)	Pilots	
	No.	Percent*
less than 10	18	7.5
10 - 19	12	5.0
20 - 29	22	9.2
30 - 39	7	2.9
40 - 49	6	2.5
50 - 99	46	19.2
100 - 199	41	17.1
200 - 299	22	9.2
300 - 399	13	5.4
400 - 499	4	1.7
500 - 999	19	7.9
1000 - 1499	10	4.2
1500 - 1999	5	2.1
2000 or more	15	6.3
Not reported	121	---
All pilots	361	

* Based on the 240 pilots for whom experience in make and model is known.

TABLE 11 - AIRCRAFT BY PILOT OWNERSHIP STATUS AND AIRCRAFT TYPE VFR FLIGHT INTO IMC ACCIDENTS

Aircraft Type	Pilot Ownership Status							Aircraft	
	Owner	Lessee	Renter	Bor-rower	Unauth-orized	Em-ployee	Not rept	Total	Percent
Airplane	219	4	63	17	1	22	13	339	93.9
Single engine	195	3	62	17	1	13	9	300	83.1
Multi-engine	24	1	1	0	0	9	4	39	10.8
Helicopter	5	0	1	1	0	15	0	22	6.1
Single engine	5	0	1	1	0	12	0	19	5.3
Multi-engine	0	0	0	0	0	3	0	3	0.8
Total aircraft	224	4	64	18	1	37	13	361	
Percent	62.0	1.1	17.7	5.0	0.3	10.2	3.6		

TABLE 12 - PERCENTAGE OF PILOTS WITH INSTRUMENT RATING BY TYPE OF PILOT CERTIFICATE VFR FLIGHT INTO IMC PILOTS AND ACTIVE GA PILOTS

Type of pilot Certificate	Percent with Instrument Rating	
	Study Pilots	Active GA Pilots*
Student	0.0	0.0
Private	7.1	34.0
Commercial	68.6	88.9
Airline transport	100.0	97.9
Total pilots	23.3	70.1

* "1984 General Aviation Pilot and Aircraft Activity Survey", Federal Aviation Administration, 1985, p. 8.

TABLE 13 - PILOTS BY INSTRUMENT RATING AND TYPE OF AIRCRAFT VFR FLIGHT INTO IMC ACCIDENTS

Aircraft Type	Pilot Instrument Rating				Study Pilots	Percent	
	No	Yes	Airpl	Helic		Study Aircraft	Active GA Pilots' Aircraft*
Fixed wing aircraft	266	73	(73	1)+	339	93.9	96.7
Single engine	250	50	(50	1)	300	83.1	78.5
Multi-engine	16	23	(23	0)	39	10.8	18.2
Helicopter	11	11	(7	8)	22	6.1	2.0
Single engine	11	8	(5	6)	19	5.3	
Multi-engine	0	3	(2	2)	3	0.8	
Other (Gliders, etc)	0	0			0	0.0	1.3
Total Pilots	277	84	(80	9)	361	100.0	100.0
Percent	76.7	23.3					

* "1984 General Aviation Pilot and Aircraft Activity Survey", Federal Aviation Administration, 1985, p. 14.

\+ A pilot may hold an instrument rating in more than one aircraft type.

TABLE 14 - PILOT INSTRUMENT EXPERIENCE
VFR FLIGHT INTO IMC ACCIDENTS

Instrument time (actual + simulated, in Hours)	Pilots	
	No.	Percent*
Less than 10	92	48.9
10 - 19	16	8.5
20 - 29	9	4.8
30 - 39	7	3.7
40 - 49	6	3.2
50 - 59	5	2.7
60 - 69	2	1.1
70 - 79	5	2.7
80 - 89	5	2.7
90 - 99	3	1.6
100 - 199	13	6.9
200 - 299	10	5.3
300 - 399	4	2.1
400 - 499	1	0.5
500 - 999	5	2.7
1000 - 1499	4	2.1
1500- or more	1	0.5
Not reported	173	---
All pilots	361	

*Based on the 188 pilots for whom instrument experience was known.

TABLE 15 - PILOTS BY METHOD AND SOURCE OF WEATHER BRIEFING VFR FLIGHT INTO IMC ACCIDENTS

Source* of Weather Briefing	Method of Briefing: In persn	Tele-type	Tele-phone	Acft radio	TV/ radio	Not rept	Pilots: Total	Percent
No record of briefing+	0	0	0	0	0	143	143	39.6
National Weather Service	3	0	6	1	0	1	9	2.5
Flight service station	27	3	142	26	0	7	191	52.9
PATWAS**	0	1	2	0	0	0	3	.8
Company	1	0	0	0	0	0	1	.3
TV/radio weather	0	0	0	1	1	0	2	.6
Military	0	0	1	1	1	0	2	.6
Source not reported	0	0	1	3	1	9	12	3.3
Total pilots	29	4	149	30	3	160	361	
Percent	8.0	1.1	41.3	8.3	0.8	44.3		

*Pilots may have received weather briefings from more than one source.

+ No record of briefing does not necessarily mean that the pilot had received no weather information. He may have relied on an unofficial weather forecasting source or he may have obtained an automated weather briefing for which no record is maintained. In the event that a pilot is killed, the source of weather briefing received, if any, may not obtainable.

**Pilot Automated Telephone Weather Answering Service.

TABLE 16 - AIRCRAFT BY PURPOSE OF FLIGHT AND ACCIDENT INJURY INDEX VFR FLIGHT INTO IMC ACCIDENTS

Purpose of Flight	Injury Index*				Aircraft	
	Fatal	Serious	Minor	None	Total	Percent
Personal	202	26	13	28	269	74.5
Business	53	4	1	4	62	17.2
Instructional	4	0	0	1	5	1.4
Executive/corporate	3	0	0	0	3	0.8
Aerial application	0	1	0	0	1	0.3
Other use	14	3	4	0	21	5.8
Total aircraft	276	34	18	33	361	
Percent	76.5	9.4	5.0	9.1		

* The most serious injury sustained by anyone involved in an accident.

TABLE 17 - ACCIDENTS BY LOCATION AND LIGHT CONDITIONS VFR FLIGHT INTO IMC STUDY ACCIDENTS

Light Conditions	Accident Location				Accidents	
	Off airport/ airstrip	On airport	On airstrip	Not Rept	Total	Percent
Dawn	6	2	0	0	8	2.2
Daylight	188	3	1	9	201	55.7
Night (dark)	102	11	0	6	119	33.0
Night (bright)	5	0	0	1	6	1.7
Dusk	21	2	0	1	24	6.6
Not reported	3	0	0	0	3	0.8
Total Accidents	325	18	1	17	361	
Percent	90.0	5.0	0.3	4.7		

TABLE 18 - AIRCRAFT BY TYPE AND TYPE OF CLEARANCE RECEIVED VFR FLIGHT INTO IMC ACCIDENTS

Type of Clearance	Aircraft Type: Air-plane	Aircraft Type: Heli-coptr	Aircraft: Total	Aircraft: Percent
None	301	18	319	88.4
VFR	15	2	17	4.7
Special VFR	7	1	8	2.2
IFR	7	0	7	1.9
Cruise	1	0	1	0.3
VFR flight following	5	0	5	1.4
Not reported	3	1	4	1.1
Total aircraft	339	22	361	
Percent	93.9	6.1		

TABLE 19 - AIRCRAFT BY TYPE OF FLIGHT PLAN FILED AND IFR EQUIPAGE VFR FLIGHT INTO INC ACCIDENTS

Type of Flight Plan Filed	IFR Equipage: Yes	IFR Equipage: No	IFR Equipage: Not reptd	Aircraft: Total	Aircraft: Per-cent
None	201	59	24	284	78.7
Visual flight rules (VFR)	41	9	5	55	15.2
Instrument flight rules (IFR)	12	0	0	12	3.3
Company (VFR)	4	2	0	6	1.7
Not reported	2	2	0	4	1.1
Total Aircraft	260	72	29	361	
Percent	72.0	19.9	8.0		

TABLE 20 - ACCIDENTS BY VISIBILITY RESTRICTIONS AND VISIBILITY
VFR FLIGHT INTO IMC ACCIDENTS

Visibility (in statute miles)	Visibility Restrictions*									Accidents	
	None	Haze	Smoke	Fog	Ground fog	Blown spray	Blown dust	Blown snow	Not rept	Total	Percent
Less than 0.5	0	3	0	31	1	1	0	4	1	36	10.0
0.5 - 0.9	1	1	0	27	2	0	0	5	5	39	10.8
1.0 - 1.9	2	3	0	29	1	0	0	4	3	39	10.8
2.0 - 2.9	4	5	1	22	1	0	0	1	3	34	9.4
3.0 - 3.9	3	5	0	12	0	0	0	0	3	20	5.5
4.0 - 4.9	1	1	0	10	0	0	0	0	0	12	3.3
5.0 and over	46	12	2	35	1	1	1	5	7	103	28.5
Not reported	4	2	0	46	2	0	0	5	21	78	21.6
Total accidents	61	32	3	212	8	2	1	24	43	361	
Percent	16.9	8.9	0.8	58.7	2.2	0.6	0.3	6.6	11.9		

* More than one visibility restriction may be reported for each accident.

TABLE 21 - AIRCRAFT BY MAKE AND MODEL
VFR FLIGHT INTO IMC ACCIDENTS

Make	Model	Number
Aero Commander	520, 680	2
Aerospatiale	SA365N	1
Beech	23-24	1
	33, 35, 36	19
	45	1
	55, 95-55, 58	4
	76	1
	200	1
Bell	206B, 206L	9
	212	1
	UH-1	1
Bellanca	14-19	1
	17-30, 17-31	2
	8KCAB	1
Boeing	A75N1	1
Britten Norman	BN-2A-8	1
Cessna	120, 140, 150 series	27
	170 series	51
	180 series	38
	195	1
	200 series	31
	300 series	10
	400 series	4
Champion	7ECA	1
DeHavilland	Beagle 206	1
Douglas	AD-4NA	1
Enstrom	F-28, 280	2
Ercoupe	415-C	1
Fairchild	BC-12, FH1100	2
Gulfstream (Grumman)	AA-5, 681	9
Helio	H-295	1
Homebuilt	Varieze	1
	Hart-Thorp, T-18 Tiger	1
	Pitts, S-1	1
	Teratorn Arcrft, Tierra II	1
Maule	M-4, M-5	2
McDonnell-Douglas (Hughes)	269, 369	3
Mitsubishi	MU-2B	2
Mooney	M20	9
Navion	Rangemaster	1
North American Rockwell	112	1
Partenavia	P68	1

TABLE 21 (Continued) - ACCIDENT AIRCRAFT BY MAKE/MODEL

Make	Model	Number
Piper	PA-18, PA-22	6
	PA-23	2
	PA-24	5
	PA-28, PA-32 series	76
	PA-60 series	1
	PA-30	2
	PA-31	2
	PA-34	4
	PA-38	3
Robinson	R-22	3
Ryan	ST-A	1
Sikorsky	S76	1
Stinson	106, 150, SR6	5
Total Aircraft		361

TABLE 22 - ACCIDENTS BY LIGHT CONDITION AND TYPE OF PRECIPITATION
VFR FLIGHT INTO IMC ACCIDENTS

Type of Precipitation*	Light Condition						Accidents	
	Dawn	Day-light	Night dark	Night brite	Dusk	Not rept	Total	Percent
None	6	84	58	4	9	0	161	44.6
Rain	1	40	27	1	9	1	79	21.9
Snow	1	29	19	0	4	0	53	14.7
Hail	0	1	3	0	0	0	4	1.1
Rain showers	0	11	5	0	0	0	16	4.4
Freezing rain	0	0	0	1	1	0	2	0.6
Snow showers	0	13	2	0	1	0	16	4.4
Drizzle	0	17	10	0	0	0	27	7.5
Freezing drizzle	0	0	0	0	1	0	1	0.3
Not reported	0	12	4	0	0	2	18	5.0
Total accidents	8	201	119	6	24	3	361	
Percent	2.2	55.7	33.0	1.7	6.6	0.8		

* More than one precipitation type may be reported for an accident

TABLE 23 - AIRCRAFT BY DAMAGE AND DAY OF WEEK
VFR FLIGHT INTO IMC ACCIDENTS

Day of Week	Aircraft Damage				Aircraft	
	None	Minor	Subs	Dest	Total	Percent
Sunday	0	0	16	46	62	17.2
Monday	0	0	9	42	51	14.1
Tuesday	0	0	4	30	34	9.4
Wednesday	0	0	3	46	49	13.6
Thursday	0	1	10	39	50	13.9
Friday	0	0	12	46	58	16.1
Saturday	1	0	14	42	57	15.8
Total aircraft	1	1	68	291	361	
Percent	0.3	0.3	18.8	80.6		

TABLE 24 - ACCIDENTS BY CEILING AND VISIBILITY
VFR INTO IMC ACCIDENTS

Visibility (in statute miles)	Lowest Ceiling (in feet above ground level)								Accidents	
	None	<100	100-199	200-299	300-399	400-499	500 & over	Not rept	Total	Percent
Less than 0.5	0	0	7	6	2	0	6	15	36	10.0
0.5 - 0.9	1	0	6	8	4	0	11	9	39	10.8
1.0 - 1.9	2	0	0	6	9	3	9	10	39	10.8
2.0 - 2.9	2	0	2	0	6	5	16	3	34	9.4
3.0 - 3.9	0	0	0	0	1	0	15	4	20	5.5
4.0 - 4.9	0	0	0	1	1	1	7	2	12	3.3
5.0 and over	2	1	3	1	1	2	77	16	103	28.5
Not reported	0	3	2	3	1	1	10	58	78	21.6
Total Accidents	7	4	20	25	25	12	151	117	361	
Percent	1.9	1.1	5.5	6.9	6.9	3.3	41.8	32.4		

TABLE 25 - ACCIDENTS BY DEGREE OF INJURY AND STATE
VFR FLIGHT INTO IMC ACCIDENTS

State	Degree of Injury				Accidents	
	None	Minor	Serious	Fatal	Total	Percent
Alabama	0	0	0	4	4	1.1
Alaska	4	3	5	9	21	5.8
Arizona	0	0	0	4	4	1.1
Arkansas	0	0	1	4	5	1.4
California	6	3	6	49	64	17.7
Colorado	1	0	3	16	20	5.5
Connecticut	0	0	0	4	4	1.1
Delaware	0	0	0	1	1	0.3
Florida	0	0	1	16	17	4.7
Georgia	0	0	0	4	4	1.1
Hawaii	0	0	0	1	1	0.3
Idaho	0	0	1	7	8	2.2
Illinois	0	0	0	7	7	1.9
Indiana	1	0	0	3	4	1.1
Iowa	0	0	0	3	3	0.8
Kansas	0	0	0	6	6	1.7
Kentucky	2	0	0	2	4	1.1
Louisiana	2	3	0	4	9	2.5
Massachusetts	0	0	0	2	2	0.6
Michigan	1	0	1	5	7	1.9
Minnesota	1	0	2	3	6	1.7
Mississippi	0	1	1	0	2	0.6
Missouri	2	1	0	4	7	1.9
Montana	1	0	0	4	5	1.4
Nebraska	1	0	0	5	6	1.7
Nevada	0	0	0	3	3	0.8
New Hampshire	0	0	0	2	2	0.6
New Jersey	0	0	0	1	1	0.3
New Mexico	1	0	0	11	12	3.3
New York	0	0	2	6	8	2.2
North Carolina	2	1	2	2	7	1.9
North Dakota	1	0	0	3	4	1.1
Ohio	1	0	0	2	3	0.8
Oklahoma	0	2	0	4	6	1.7
Oregon	1	0	0	6	7	1.9

TABLE 25 (Continued) - ACCIDENTS BY DEGREE OF INJURY AND STATE
VFR FLIGHT INTO IMC ACCIDENTS

State	Degree of Injury				Accidents	
	None	Minor	Serious	Fatal	Total	Percent
Pennsylvania	1	0	0	4	5	1.4
Puerto Rico	0	0	0	1	1	0.3
South Dakota	0	1	1	3	5	1.4
Tennessee	0	1	1	7	9	2.5
Texas	0	0	1	18	19	5.3
Utah	2	1	3	4	10	2.8
Vermont	1	0	0	3	4	1.1
Virginia	0	1	0	6	7	1.9
Washington	0	0	1	11	12	3.3
West Virginia	0	0	1	3	4	1.1
Wisconsin	0	0	1	3	4	1.1
Wyoming	1	0	0	6	7	1.9
Total accidents	33	18	34	276	361	
Percent	9.1	5.0	9.4	76.5		

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Member

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

James L. Kolstad, Acting Chairman, disapproved and Lemoine V. Dickinson, Jr., Member, dissented. Member Dickinson filed the following concurring and dissenting statement.

Although I concur with the information that is presented in the narrative and the tables relative to accidents involving VFR into IMC conditions, I do not believe that we have analyzed the reasons that these accidents have occurred or the reasons why the numbers of accidents have decreased over time. It was my understanding that this was the purpose of this safety study and not just a compilation of several years worth of accident data. Therefore, I will approve the compilation of data, but would have preferred that the study indicate the reasons behind these changes.

February 8, 1989

APPENDIX A

TITLE14 CODE OF FEDERAL REGULATION 91.105
BASIC VFR WEATHER MINIMUMS

VISUAL FLIGHT RULES

§ 91.105 Basic VFR weather minimums.

(a) Except as provided in § 91.107, no person may operate an aircraft under VFR when the flight visibility is less, or at a distance from clouds that is less, than that prescribed for the corresponding altitude in the following table:

Altitude	Flight visibility	Distance from clouds
1,200 feet or less above the surface (regardless of MSL altitude)—		
Within controlled airspace	3 statute miles	500 feet below. 1,000 feet above. 2,000 feet horizontal.
Outside controlled airspace	1 statute mile except as provided in § 91.105(b).	Clear of clouds.
More than 1,200 feet above the surface but less than 10,000 feet MSL—		
Within controlled airspace	3 statute miles	500 feet below. 1,000 feet above. 2,000 feet horizontal.
Outside controlled airspace	1 statute mile	500 feet below. 1,000 feet above. 2,000 feet horizontal.
More than 1,200 feet above the surface and at or above 10,000 feet MSL	5 statute miles	1,000 feet below. 1,000 feet above. 1 mile horizontal.

(b) When the visibility is less than one mile, a helicopter may be operated outside controlled airspace at 1,200 feet or less above the surface if operated at a speed that allows the pilot adequate opportunity to see any air traffic or other obstruction in time to avoid a collision.

(c) Except as provided in § 91.107, no person may operate an aircraft, under VFR, within a control zone beneath the ceiling when the ceiling is less than 1,000 feet.

(d) Except as provided in § 91.107, no person may take off or land an aircraft, or enter the traffic pattern of an airport, under VFR, within a control zone—

(1) Unless ground visibility at that airport is at least 3 statute miles; or

(2) If ground visibility is not reported at that airport, unless flight visibility during landing or takeoff, or while operating in the traffic pattern, is at least 3 statute miles.

(e) For the purposes of this section, an aircraft operating at the base altitude of a transition area or control area is considered to be within the airspace directly below that area.

[Amdt. 91-51, 33 FR 2092, Feb. 15, 1968]

APPENDIX B

SAFETY BOARD AVIATION ACCIDENT DATA SYSTEM

In 1983, the Safety Board implemented an improved and more comprehensive data base design. The Safety Board developed new accident data collection forms and designed a data base for storage and retrieval of accident data. The resulting Form 6120.4 consists of a "core" form for each investigation and 21 supplement forms each of which is completed if specified accident parameters are present.

A key component of the revised aviation accident data system is the Safety Board "sequence of events" coding system. This system replaced the previously-used cause and factor coding scheme in which 10 of the approximately 1,360 predefined items (i.e., aircraft components, pilot actions) could be associated with an accident to document its causes and related factors. The sequence of events was designed to offer the investigator greater flexibility when determining the probable causes and related factors. The new system consists of approximately 2,000 "person," "modifier," and "subject" codes that are combined to form "findings" (e.g., pilot-in-command-inadvertent-VFR flight into IMC). Each finding may be designated a cause or factor of the accident or may be included only to complete the coded description of the accident sequence of events.

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