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Nonfatal, Weather-Involved General Aviation Accidents

National Transportation Safety Board

May 27, 1976

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16. Abstract The National Transportation Safety Board is concerned about the large number of weather-involved general aviation accidents. This study is based on 7, 856 such accidents, which have occurred from 1964 through 1974.

During the 11-year study period, "inadequate preflight planning preparation and/or planning" was the most frequently cited cause in which both pilots and weather were involved. Statistics reveal that most of the nonfatal, weather-involved general aviation accidents occurred during the landing regime, i.e., either during the landing roll or during leveloff and touchdown, when unfavorable wind conditions existed, and the weather was VFR. Unfavorable winds were cited 5 times more frequently as a cause or a factor than were low ceilings, and 16 times more frequently than was thunderstorm activity. Statistics also reveal that a pilot was 12 times more likely to encounter weather as predicted than to encounter weather worse than predicted.

As a result of its findings, the Safety Board urges general aviation pilots to attend the various safety seminars, clinics, and courses of instruction sponsored by both Government and industry. For familarization purposes, there is no substitute for visiting National Weather Service and Federal Aviation Administration facilities to determine what data are available and the means by which they can be obtained. The Board urges all pilots to postpone any flight until a timely and thorough preflight weather briefing can be obtained and reiterates that if there is any doubt--DON'T GO.

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SPECIAL STUDY

NONFATAL, WEATHER-INVOLVED GENERAL AVIATION ACCIDENTS

Adopted: May 27, 1976

SYNOPSIS

The National Transportation Safety Board is concerned about the large number of weather-involved[1] general aviation accidents. This study is based on 7,856 such accidents, which have occurred from 1964 through 1974.

During the 11-year study period, "inadequate preflight planning preparation and/or planning" was the most frequently cited cause in which both pilots and weather were involved. Statistics reveal that most of the nonfatal, weather-involved general aviation accidents occurred during the landing regime, i.e., either during the landing roll or during leveloff and touchdown, when unfavorable wind conditions existed, and the weather was VFR. Unfavorable winds were cited 5 times more frequently as a cause or a factor than were low ceilings, and 16 times more frequently than was thunderstorm activity. Statistics also reveal that a pilot was 12 times more likely to encounter weather as predicted than to encounter weather worse than predicted.

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OVERVIEW OF THE DATA

From 1964 through 1974, weather was the most frequently cited causal factor for nonfatal general aviation accidents. From 1964 through 1974, 7,856 nonfatal, weather-involved accidents resulted in injuries to 3,637 persons. (See Tables 1 and 2.) Serious

TABLE 1

GENERAL AVIATION ACCIDENTS

Year	Total	Nonfatal	Weather-Involved	Nonfatal Weather-Involved
1964	5,069	4,543	798	620
1965	5,196	4,658	669	457
1966	5,712	5,139	909	728
1967	6,115	5,512	1,112	912
1968	4,968[1]	4,276	1,067	820
1969	4,767	4,120	986	751
1970	4,718	4,071	1,014	780
1971	4,640	3,987	947	703
1972	4,256	3,561	983	688
1973	4,255	3,532	976	689
1974	4,343	3,694	1,010	708
TOTAL	54,039	47,093	10,471	7,856

[1] For purposes of this study, a weather-involved accident was considered to be one for which the Safety Board had determined that weather had been a cause or a contributing factor.

[1] The decrease in the total number of accidents was caused by a change in the definition of "substantial damage" included in the definition of an accident. The change was effective on January 1, 1968.

injuries resulted in 16.2 percent of these accidents. Although slightly more than half of the accidents resulted in no injuries, there was substantial damage to the aircraft. Although complete data on economic losses are not available, data are available for 1970 through 1972. Based on these data, hull damage alone cost $8,000,000 for that 3-year period.

TABLE 2

INJURIES
1964 THROUGH 1974

	Serious	Minor	None	Unknown	Total
Pilot	687	1,188	5,984	1	7,860
Copilot	18	25	106	-	149
Dual Student	11	43	231	-	285
Check Pilot	-	-	10	-	10
Flt. Eng.	-	1	1	-	2
Cabin Att.	1	1	6	-	8
Extra Crew	5	7	27	-	39
Passengers	553	1,097	5,629		7,285
TOTAL	1,275	2,362	11,994	1	15,638

Statistics show that from 1964 through 1974, there were 54,039 general aviation accidents. Of this total, 47,093 were nonfatal accidents, 16.7 percent of which were weather-involved accidents and 14.5 percent of which were nonfatal, weather-involved accidents. Nonfatal accidents comprised 75 percent of the total weather-involved accidents.

From 1965 to 1968, the percentage of nonfatal accidents which were weather-involved increased dramatically and that percentage has remained at a relatively high level. (See Figure 1.) On the other hand, the accident rate per 100,000 hours flown (all nonfatal accidents) has been downward over most of the period from 1964 through 1974.

About 50 percent of the nonfatal, weather-involved accidents have occurred during pleasure flying and more than 12 percent during noncommercial business flying; the remainder occurred during other kinds of flying. (See Table 3.)

FIGURE 1

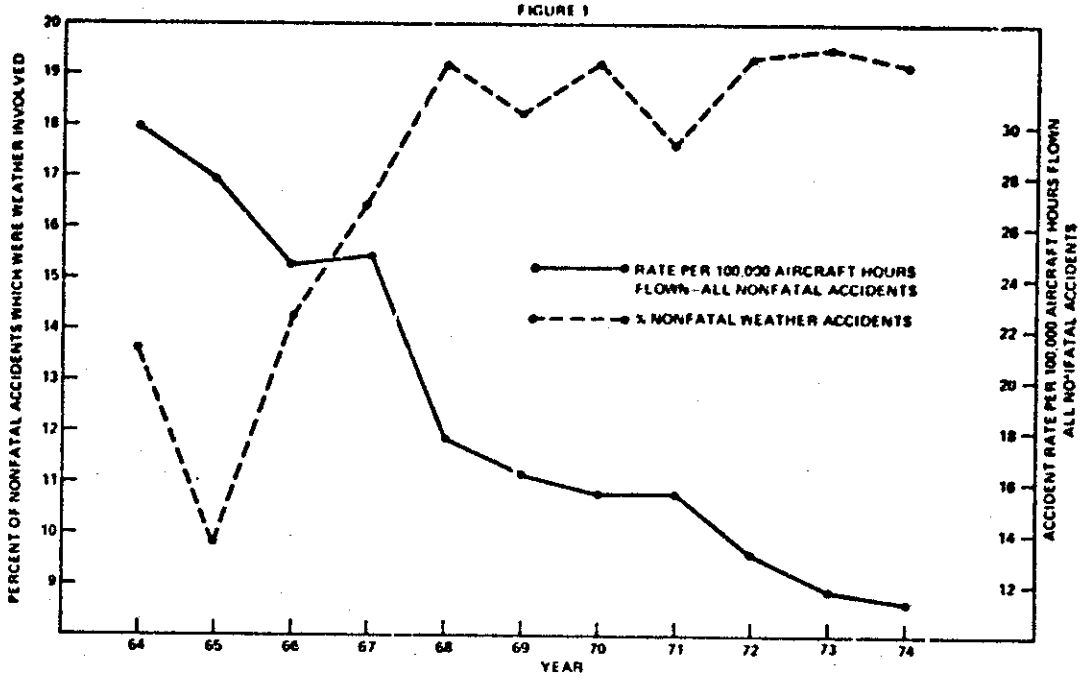

TABLE 3

KIND OF FLYING
1964 - 1974

Kind of Flying[1]	Accidents	Percent
Pleasure	3,925	49.94
Business (noncommercial)	994	12.65
Solo (Instructional)	491	6.26
Training (Instructional)	412	5.24
Dual (Instructional)	288	3.66
Crop Control Related	285	3.63
Air Taxi Passenger Operations	239	3.04
TOTAL	6,634	84.42

[1] The foregoing represent the kind of flying being conducted in most of the accidents. The remaining accidents occurred during more than 30 other kinds of flying.

TABLE 4

CONDITIONS OF LIGHT Vs.
TYPE OF WEATHER CONDITIONS
1964 through 1974

LIGHT CONDITIONS	WEATHER CONDITIONS: None	VFR	IFR	Below Minima[1]	Unknown	Accidents	Percent
None	4[2]	–	–	–	–	4	.05
Dawn	–	33	13	3	–	51	.65
Daylight	–	6,426	478	38	29	6,967	88.69
Dusk (twilight)	–	176	60	1	2	239	3.04
Night (dark)	–	301	225	40	2	568	7.23
Night (moonlight-bright)		18	7	1	–	26	.33
Unknown/Not Reported	–	–	–	–	1	1	.01
Accidents	4	6,950	785	83	34	7,856	

[1] Landing and takeoff accidents only.
[2] Invalid data fields.

Almost 89 percent of the accidents examined in this study occurred during daylight hours and in visual flight rules (VFR) conditions; only about 7 percent occurred at night. (See Table 4.) By contrast, for fatal, weather-involved accidents from 1964 through 1972, 60 percent occurred during daylight hours, 36 percent occurred at night and only 40 percent occurred in VFR conditions.

The accidents examined in this study occurred during 56 phases of flight. The phase most frequently coded was the landing roll (fixed wing)–22.8 percent. The next six phases in descending order of frequency were: Level off/touchdown–17.9 percent, initial climb–11.6 percent, normal cruise–7.6 percent, final approach (VFR),–6.6 percent, takeoff run–5.8 percent, and taxi from landing–4.5 percent. (See Table 5.)

TABLE 5

PHASE OF FLIGHT
1964 through 1974

Phase[1]	Accidents	Percent
Landing Roll (fixed wing)	1,791	22.8
Leveloff/Touchdown	1,404	17.9
Initial Climb	912	11.6
Normal Cruise	595	7.6
Final Approach (VFR)	518	6.6
Takeoff Run	456	5.8
Taxi from Landing	353	4.5

[1] Top 7 of 56 phases coded.

PILOT DATA

General aviation pilots with low total flight times were frequently involved in weather accidents. (See Figure 2 and Table 6.) In about 84 percent of the accidents for which data were available, the pilots involved had less than 100 hours total flight time.

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FIGURE 2

TOTAL PILOT TIME

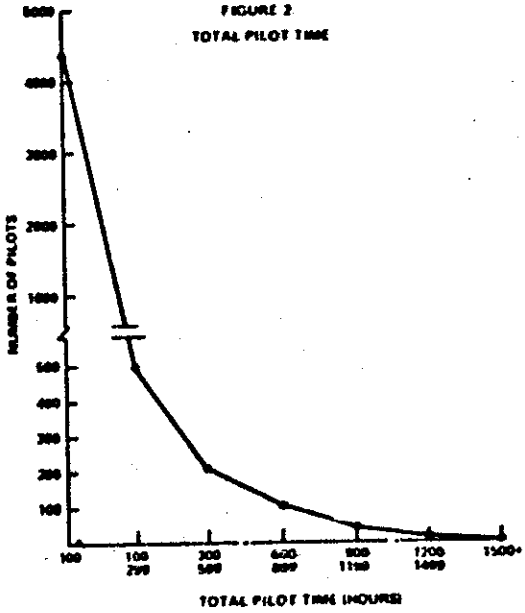

TABLE 6

TOTAL PILOT TIME

HOURS	Student	Private	Commercial	ATP	Private 1-3	Comm'l 1-3	ATP 1-3	Flt Engr	Same Type	Unknown	TOTAL
< 100	1,324	2,601	900	1	112	3	1	21	1		4,964
100-299	1	164	207	2	89	2			1		466
300-599		48	99	5	56	3		1			212
600-899		10	55	10	28	5	1				109
900-1199		1	26	4	10	1					42
1200-1499		1	10	1	2						14
1500-1799											
1800-2099				2	1	1					4
2100-2399				1	1						2
2400+											
TOTAL	1,325	2,830	1,297	25	298	15	2	22	2	5	5,832

It is significant to note that in more than 95 percent of the cases examined, the pilots involved had less than 100 hours in the type of aircraft flown. (See Table 7 and Figure 3.) Nearly 67 percent of these pilots had 10 hours or less in type.

Information concerning pilot time during the 90-days before the accident was available

TABLE 7

TIME IN TYPE

HOURS	Student	Private	Commercial	ATP	Private 1-3	Comm'l 1-3	ATP 1-3	Flt Engr	Same Type	Unknown	TOTAL
< 100	1,324	2,601	900	1	112	3	1	21	1		4,964
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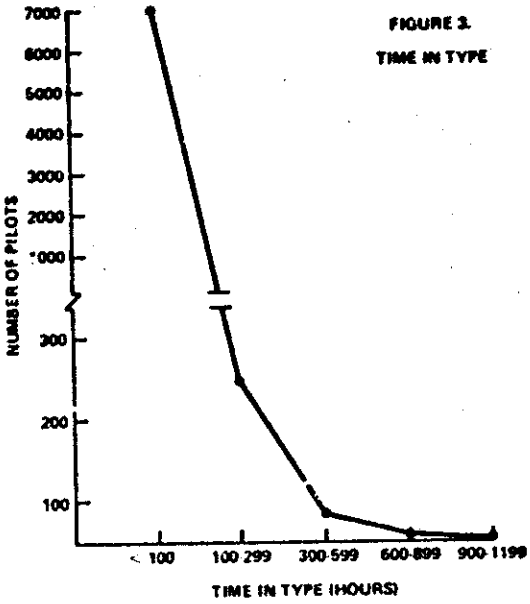
300-599		48	99	5	56	3		1			212
600-899		10	55	10	28	5	1				109
900-1199		1	26	4	10	1					42
1200-1499		1	10	1	2						14
1500-1799											
1800-2099				2	1	1					4
2100-2399				1	1						2
2400+											
TOTAL	1,325	2,830	1,297	25	298	15	2	22	2	5	5,832

FIGURE 3.

TIME IN TYPE



in a majority of the accident cases examined. In 75 percent of the cases examined, the pilots involved had less than 50 hours of flight time during the 90 days before the accident. (See Table 8 and Figure 4.) More than 21 percent of those pilots had less than 10 hours of flight time during that 90-day period.

Pilot Certification

Since 1964, private pilots have been involved in more weather accidents than any other type of pilot and, as would be antici-

TABLE 8

PILOT TIME LAST 90 DAYS

HOURS	Student	Private	Commercial	ATP	Private [illegible]	Comm. [illegible]	ATP [illegible]	[illegible]	[illegible]	[illegible]	TOTAL
< 50	927	2,229	504	16	2	162	21	2	14	1	3,88[illegible]
50-99	41	322	196	16		132	10		2		719
100-299	1	65	240	41		163	21		5		542
300-599			8			9					17
TOTAL	969	2,615	956	75	2	466	52	2	21	1	5,161

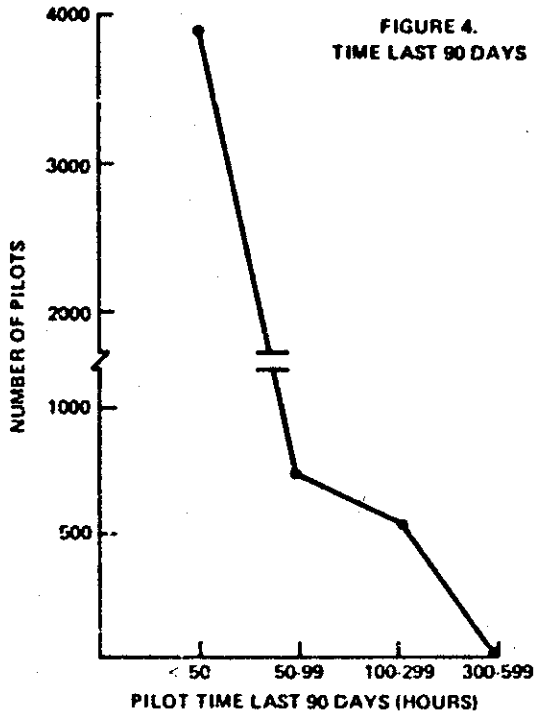


FIGURE 4.
TIME LAST 90 DAYS

pated, most pilots involved in nonfatal, weather-involved accidents held private pilot certificates. (See Table 9 and 10.) Of the nonfatal, weather-involved accidents, 46.8 percent of the pilots held private certificates while 41.5 percent of the total pilot population had private certificates. As shown in Table 11, most pilots were in the single engine, land category. The Board's statistics also show that there were more than 40 pilots who either had no certificates or were flying with certificates which had expired.

Geographical Distribution of Accidents and Pilots Involved Compared with Total Active Pilots

Accident exposure to various geographical areas was determined by separating the nonfatal, weather-involved accidents into FAA regions and comparing the number of accidents in each region with the number of active pilots in that particular region. (See Figures 5 and 6; Tables 12 and 13.) The New England region had the best record with 252 accidents, and Alaska was next with 355 accidents. However, when those figures are compared with the numbers of active pilots in the respective regions, it can be seen that the record in Alaska is the worst for any FAA region and that the Alaskan record is about 6 times worse than that of the Southern region, which has the best record. The Great Lakes and the Western regions rank No. 1 and No. 2 both in numbers of accidents and in numbers of active pilots, but their records are equiva-

TABLE 9

ACTIVE AIRMAN CERTIFICATES HELD JAN. 1, 1964–DEC. 31, 1974

Category	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	11 Year Average Number	Per Cent
Pilots Total*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Student	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Commercial	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Airline transport	21,572	22,440	23,917	25,817	28,607	31,442	34,430	35,949	37,714	38,139	41,002	31,003	4.8

*Totals include other categories such as helicopter only and glider only.

TABLE 10

TYPE OF PILOT CERTIFICATE

Type of Certificate	Number	Percent
Student	1,353	17.2
Private	3,677	46.8
Commercial	1,601	20.4
ATP	144	1.8
Private/F.I.	2	0
Commercial/F.I.	923	11.7
ATP/F.I.	110	1.4
Foreign	3	0
None/Expired	37	.5
Unknown	6	.1
TOTAL	7,856	

TABLE 11

CATEGORY AND CLASS RATING

	Accidents	Percent
Single engine land	5,100	64.96
Multiengine land	17	.22
Single engine sea	14	.18
Single engine land and inst.	370	4.71
Multiengine land and inst.	31	.39
Single engine sea and inst.	1	.01
Single engine land and sea	180	2.29
Multiengine land and sea	1	.01
Single engine land and sea and inst.	31	.39
Multiengine land and sea and inst.	2	.03
Single-multiengine land	411	5.23
Single-multiengine sea	1	.01
Single-multiengine land and inst.	947	12.06
Single-multiengine sea and inst.	1	.01
Single-multiengine land and sea	57	.73
Single-multiengine land, sea and inst.	141	1.80
Rotorcraft	331	4.22
Rotorcraft and inst.	36	.46
Glider	110	1.40
Lighter than air	6	.08
None	49	.62
Unknown	19	.24
Accidents	7,856	

lent and rank high when compared with the other regions.

Pilot Age

The ages of pilots in nonfatal, weather-involved accidents were categorized into groups. (See Table 14.) The peak group was 31 to 35 years; however, both the 26 to 30 year group and the 36 to 40 group were near the peaks. By contrast, pilots involved most often in fatal, weather involved accidents were between 41 and 46 years old. Updated statistics on pilot age were solicited from the FAA in order to determine the age group to which most pilots belong. (See Table 15.) These data indicate that at least since 1968 there have been more pilots in the younger age groups than in the 36 to 40 year group.

Pilot-Involvement as a Cause or Factor

During the 11 years studied, "Inadequate Preflight Preparation and/or Planning" was the most frequently cited cause in which both pilot and weather were involved (See Table 16.) The next most frequently cited causes by order of frequency were: "Failed to obtain/maintain flying speed," "improper leveloff," "failed to maintain directional control," and "selected unsuitable terrain."

Flight Plans

More than 80 percent of the pilots in the 7,856 nonfatal, weather-involved accidents did not file flight plans of any type, less than 14 percent filed VFR flight plans, and less than 5 percent filed instrument flight rules

FIGURE 5
GEOGRAPHICAL DISTRIBUTION OF ACCIDENTS
NONFATAL, WEATHER-INVOLVED ACCIDENTS U.S.
GENERAL AVIATION
1964-1974

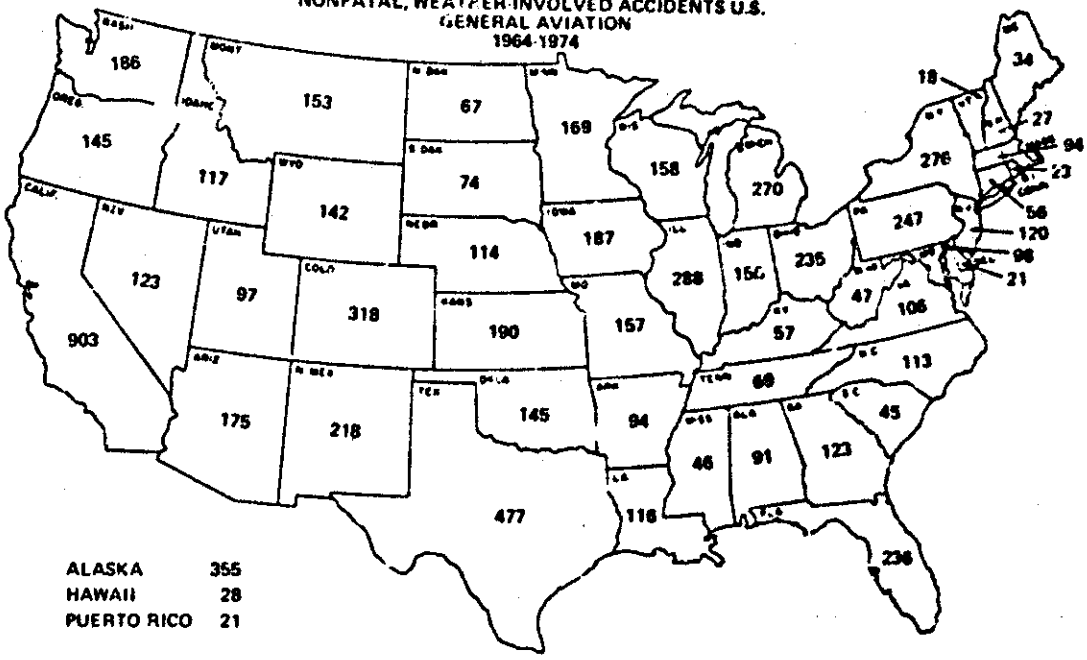


FIGURE 6

TOTAL ACTIVE PILOTS BY FAA REGION (1974)

(NUMBERS IN PARENTHESES ARE NONFATAL, WEATHER INVOLVED ACCIDENTS 1964 THROUGH 1974)

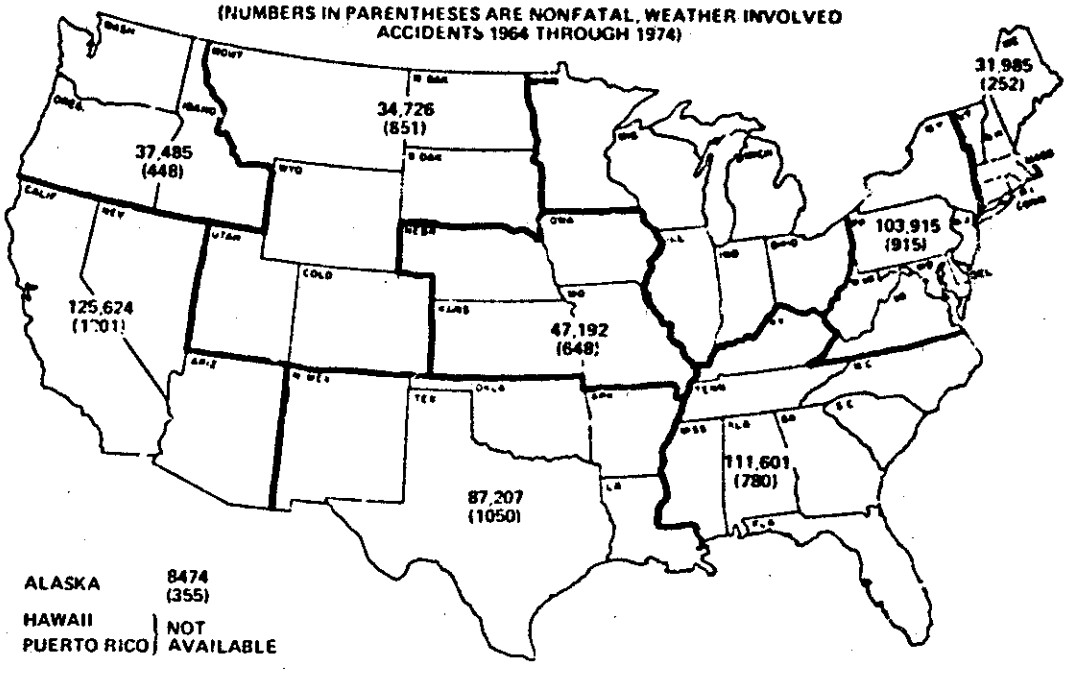


TABLE 12

TOTAL ACTIVE PILOTS AND FLIGHT INSTRUCTORS[1] BY FAA REGION AND STATE: DECEMBER 31, 1974

FAA region and state	Total pilots
Total	733,728[2]
United States total	724,366
New England total	31,985
Maine	3,440
New Hampshire	3,251
Rhode Island	1,669
Massachusetts	12,913
Connecticut	9,241
Vermont	1,530
Eastern total	103,915
New York	31,080
Pennsylvania	23,428
Virginia	15,428
Maryland	10,576
West Virginia	2,824
Delaware	1,877
New Jersey	17,835
District of Columbia	857
Great Lakes total	133,201
Illinois	37,963
Indiana	15,765
Minnesota	17,172
Michigan	24,562
Ohio	30,442
Wisconsin	12,297
Central total	47,192
Kansas	12,908
Iowa	11,009
Missouri	16,080
Nebraska	7,275
Southern total	111,601
North Carolina	13,294
South Carolina	6,655
Georgia	16,163
Florida	42,493
Mississippi	6,109
Alabama	9,371
Tennessee	11,216
Kentucky	6,300
Southwest total	87,207
Louisiana	9,808
Oklahoma	13,156
Texas	52,006
New Mexico	5,880
Arkansas	6,357
Rocky Mountain total	34,726
Colorado	15,659
Wyoming	2,208
Utah	4,892
Montana	4,776
North Dakota	3,738
South Dakota	3,453
Western total	125,624
California	107,702
Arizona	13,268
Nevada	4,654
Northwest total	37,485
Washington	21,186
Oregon	11,630
Idaho	4,669
Alaskan region total	8,474
Pacific region total	2,956
Outside U.S. total	9,362

NOTE: Puerto Rico and Virgin Island are included in Outside U.S. total.

[1] Not included in total.
[2] Includes Outside U.S.

TABLE 13

PERCENTAGE OF TOTAL ACTIVE PILOTS WHO WERE INVOLVED IN NONFATAL WEATHER-INVOLVED ACCIDENTS (BY FAA REGION)

FAA Region	Pilots Involved in Nonfatal, Weather-Involved Accidents 1964-1974	Rank	Active Pilots (1974)	Rank	Pilots in Nonfatal Weather-Involved Accidents / Active Pilots Percent	Rank
New England	252	9	31,985	8	.79	7
Eastern	915	4	103,915	4	.88	6
Great Lakes	1,275	1	133,201	1	.96	5
Central	648	7	47,192	6	1.37	3
Southern	780	6	111,601	3	.70	8
Southwest	1,050	3	82,207	5	1.20	4
Rocky Mountain	851	5	34,726	8	2.45	2
Western	1,201	2	125,624	2	.96	5
Northwest	448	7	37,485	7	1.20	4
Alaska	355	8	8,474	9	4.19	1

TABLE 14

PILOT AGE

Age Group	Number of Accidents
<16	1
16-20	297
21-25	892
26-30	1,217
31-35	1,232
36-40	1,221
41-45	1,163
46-50	892
51-55	493
56-60	245
61-65	99
66-70	42
70+	18
Unknown	44
Total	7,856

FIGURE 7
AGE GROUPS

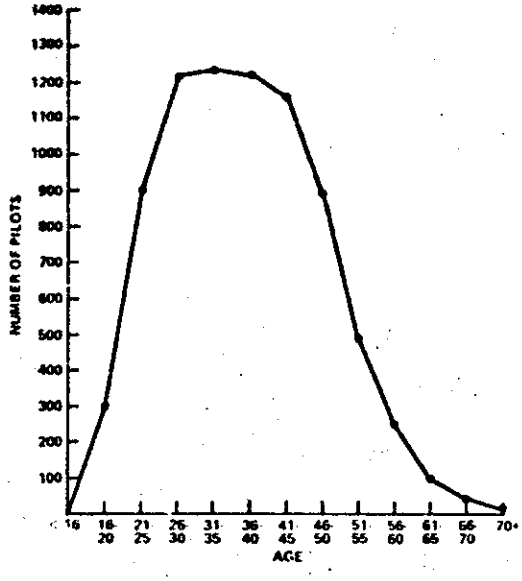


TABLE 15

ACTIVE PILOT CERTIFICATES HELD BY AGE GROUP OF HOLDER

Age	1968 Number	1968 Percent	1970 Number	1970 Percent	1972 Number	1972 Percent	1974 Number	1974 Percent
14-15	–	–	–	–	–	–	173	<1
16-19	31,957	5	34,817	5	32,701	4	31,989	4
20-24	96,516	14	101,238	14	92,023	12	90,401	12
25-29	117,465	17	124,363	17	124,416	17	118,111	16
30-34	98,899	14	105,784	14	113,251	15	113,514	15
35-39	95,939	14	96,633	13	97,869	13	95,081	13
40-44	89,951	13	89,642	12	93,047	12	87,899	12
45-49	83,531	12	86,186	12	82,215	11	75,211	10
50-54	45,277	6	54,952	8	65,729	9	66,610	9
55-59	19,471	3	24,335	3	30,440	4	34,828	5
60+	12,689	2	14,779	2	17,785	3	19,911	3
Total	691,695		732,729		750,869		733,728	

TABLE 16

CAUSE/FACTOR TABLE NONFATAL WEATHER INVOLVED ACCIDENTS 1964 THROUGH 1974

Detailed Cause/Factor	Nonfatal Accidents		
Pilot In-Command	Cause	Factor	Total
1. Inadequate preflight preparation and/or planning	3,949	418	4,367
2. Failed to obtain/ maintain flying speed	3,900	4	3,904
3. Improper level off	3,712	8	3,720
4. Failed to maintain directional control	3,348	9	3,357
5. Selected unsuitable terrain	2,880	83	2,963

(IFR) flight plans. (See Table 17.) In more than 88 percent of the cases, the weather at the accident site was VFR. By comparison, from 1964 to 1974, for fatal, weather-involved accidents the weather at the accident site was VFR only in 40 percent of the accidents and IFR in 54 percent of the accidents.

WEATHER PHENOMENA AS A CAUSE/FACTOR

Unfavorable wind was the most frequently cited weather factor in nonfatal, weather-involved accidents. Low ceiling and updrafts or downdrafts were the next most frequently cited factors, followed by conditions conducive to carburetor icing, fog, rain, sudden windshifts and thunderstorm activity. (See Table 18.)

TABLE 17

TYPE OF WEATHER
(AT ACCIDENT SITE)
VS. TYPE OF FLIGHT PLAN

	None	VFR	IFR	Below Minima[1]	Unknown/ Not Reported	Accidents	Percent
None[2]	4	3	1	-	-	8	.10
None	-	5,828	429	32	27	6,313	80.36
VFR	-	960	130	5	4	1,098	13.98
IFR	-	114	194	44	-	352	4.48
Controlled VFR	-	2	4	1	-	7	.09
IFR (VFR on top)	-	-	3	-	-	3	.04
DVFR	-	5	1	-	-	6	.08
VFR Ht. Flwg.	-	14	5	-	-	19	.24
Special VFR	-	4	14	1	-	19	.24
Other	-	1	-	-	-	1	.01
Unknown/not reported	-	23	4	-	3	30	.38
Accidents	4	6,950	785	83	34	7,856	
Percent	.1	88.5	10.0	1.1	.4		

[1] Landing and takeoff accidents only.
[2] Invalid data fields.

WEATHER FORECASTS

Information concerning weather forecasts was not available in many of the accidents examined because most of them occurred during VFR conditions and in the immediate vicinity of the airport. However, based on available data, a pilot was 12 times more likely to encounter weather as predicted than to encounter weather worse than predicted. (See Table 19.) As the Board indicated in its previous special study, experienced pilots generally are aware that forecasts cannot be considered completely accurate, but they also know that they cannot be ignored. Forecasts should be treated as the best professional advice available.

TABLE 18

WEATHER PHENOMENA CONSIDERED AS A CAUSE/FACTOR IN NONFATAL WEATHER-INVOLVED ACCIDENTS 1964 THROUGH 1974

Phenomenon	Cause	Factor	Total
Unfavorable wind	1,564	2,373	3,937
Low Ceiling	72	614	686
Downdraft/Updraft	190	435	625
Conditions conducive to carburetor icing	290	278	568
Fog	65	483	548
Rain	40	332	372
Sudden windshift	125	146	271
Thunderstorm activity	44	196	240

TABLE 19

ACCURACY OF WEATHER
FORECASTS VS. TYPE OF WEATHER
CONDITIONS AT ACCIDENT SITE
NONFATAL WEATHER-INVOLVED
ACCIDENTS
1964 THROUGH 1974

	VFR	IFR	Below Minima[1]	Unknown	Accidents	Percent
Forecast substantially correct	1,786	388	60	4	2,237	41.56
Weather slightly better than forecast	1				1	.02
Weather considerably better than forecast	2				2	.04
Weather slightly worse than forecast	84	37	3	-	123	2.28
Weather considerably worse than forecast	31	22	2		55	1.02
Forecast completely erroneous	3	4			7	.13
Unknown/not reported	2,637	282	13	26	2,958	54.95
Accidents	4,542	733	78	30	5,383	
Percent	84.38	13.62	1.45	.55		

[1] Landing and takeoff accidents only.

WEATHER BRIEFINGS

Information concerning weather briefing was also not available in many accident cases examined, probably because most accidents occurred during VFR conditions and in the vicinity of airports. Nevertheless, for those cases in which the pilot was briefed, most briefings were received from Flight Service Station personnel by telephone. (See Table 20.) In those cases for which information was available, more than 45 percent of the pilots were not briefed. The Board's statistics also show that of the 2,704 pilots who were not briefed, 2,615 also did not file flight plans. Of the 2,698 pilots who were briefed on weather, 1,093 also filed flight plans of some type.

TABLE 20

SOURCE OF WEATHER BRIEFING NONFATAL WEATHER-INVOLVED ACCIDENTS 1964 THROUGH 1974

Source	Accidents	Percent
Pilot, self-help	54	.9
In person, NWS[1]	76	1.3
Phone, NWS	138	2.4
In person, FSS[2]	330	5.7
Phone, FSS	1,258	21.8
Radio, FSS	422	7.3
Recorded by phone	9	.2
Recorded L/MF radio	86	1.5
Pilot to forecaster	2	.0
Partial, phone NWS	2	.0
Partial, FSS in person	10	.2
Partial, FSS phone/radio	21	.4
No briefing received	2,704	46.8
Briefing received, method unknown	181	3.1
Company dispatch	1	.0
Other	108	1.9
Unknown, not reported	374	6.4
Total Accidents	5,775	

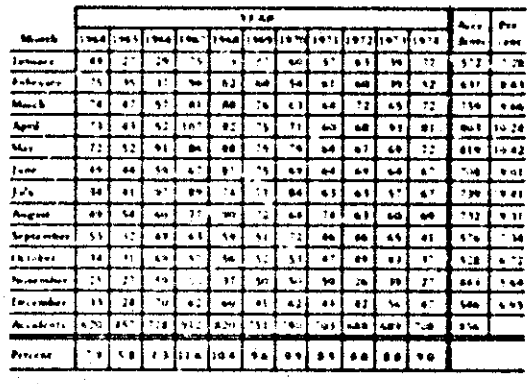
[1] National Weather Service
[2] Flight Service Station personnel

TIME OF YEAR

During April and May, more nonfatal, weather-involved accidents occurred than during any other time of the year. (See Table 21 and Figure 8.) Beginning in November, the accident trend began to rise and peaked in May. From May, the trend was downward until the low point was reached in November. The largest rise in accidents was from February to March and the largest drop in accidents was from August to September.

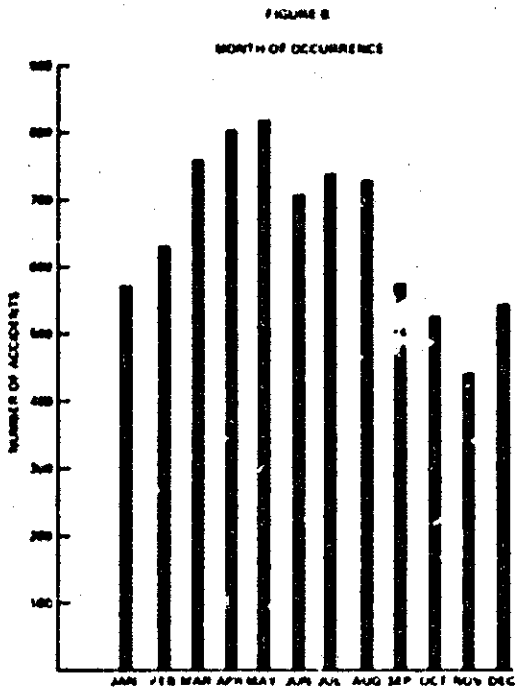
TABLE 21

MONTH OF OCCURRENCE



STATISTICAL SUMMARY

Based only on the statistics presented, a pilot most likely to have been involved in a nonfatal, weather-involved general aviation accident:



1. Received a preflight briefing from a Flight Service Station which utilized Weather Service Forecasts which were reasonably accurate.
2. Was proposing a pleasure flight.
3. Had less than 100 total flight-hours.
4. Had less than 100 hours in type of aircraft (and most probably had less than 10 hours in type.)
5. Had less than 50 hours in the 90 days before the accident (and probably had less than 10 hours.)
6. Had a private pilot certificate with a single-engine, land rating.
7. Had not filed a flight plan.
8. Was between the ages of 31 and 35.
9. Crashed in VFR conditions with unfavorable winds involved.
10. Was accompanied by at least one passenger.

ACTIONS BY GOVERNMENT AND INDUSTRY TO MINIMIZE WEATHER-INVOLVED GENERAL AVIATION ACCIDENTS

National Weather Service and Federal Aviation Administration

The growth of general aviation, particularly during the past 10 years, has caused many problems to surface, among them—the difficulty of providing required preflight weather information to pilots. There is little doubt that the best preflight briefing is one which is obtained, face to face, from a professional meteorologist who has used the latest current and forecast weather information, including charts and radar weather data. Unfortunately, because of the large increase in the pilot population, it is becoming physically impossible and economically impractical to provide individual, personal weather service.

The next most practical method for obtaining a preflight briefing is by telephone, and statistics indicate that the telephone is the most popular method. However, when weather is bad or marginal, it is difficult to contact the local Flight Service Station (FSS) or NWS office by phone because the lines are kept busy. To alleviate the problem, a few years ago the FAA and NWS initiated the program, "Pilot's Automatic Telephone Weather Answering Service (PATWAS)." By calling the PATWAS number, in 70 areas where the service is available, a pilot can receive a recorded weather briefing for areas within a 250-mile radius of his location. However, because of heavy demand, even the PATWAS lines have become saturated during periods of inclement weather. In order to overcome this difficulty, the NWS and the FAA are cooperating in a test at New York to improve the PATWAS. The FAA is providing the equipment, and the NWS is providing the space and the manpower to keep the tapes

updated. The objective of the test is to determine if a sophisticated telephone recording system can provide an adequate briefing for pilots and reduce the demand for personal weather briefings. The New York City PATWAS is made up of 3 separate phone numbers for New York City and 3 for northern New Jersey. The PATWAS contains 34 incoming lines. In addition to providing route forecasts and a weather synopsis, the test PATWAS contains flight precautions, winds aloft reports, terminal forecasts, hourly weather observations, and notices to airmen (NOTAMS), which are updated and amended regularly. Normal PATWAS systems are time-limited, but the New York PATWAS system is flexible and the length of the tape is controlled by the forecaster.

Indications are that use of PATWAS in New York has increased 300 percent. If the test proves it to be successful, the New York PATWAS will become an integral part of a National PATWAS System.

As a result, in part, of a previous Safety Board recommendation, the FAA and the NWS have issued jointly, the updated booklet entitled, "Aviation Weather." The revised version has been published and is now available in a two-volume set; "Aviation Weather" (Advisory Circular 006A) and "Aviation Weather Services" (Advisory Circular 00-45). "Aviation Weather" is a general text on the principles of meteorology and their applications to aviation operations. It is used primarily by pilots and flight operations personnel, but also serves as an excellent introductory text on weather for nonaviation interests. "Aviation Weather Services" discusses services provided to the pilot by NWS and FAA facilities, the structure and interpretation of weather observations and forecasts, data communications, the use of analytic and prognostic charts, graphs, and conversion tables. The book is also used as a text in the NWS Pilot Weather Briefer's Course and will be updated periodically as new products, forecast techniques, and briefing services are developed. The two volumes are available at a nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

After extensive coordination between Government agencies and the aviation community, a new and standardized format for pilot reports (PIREPS) has been developed and was implemented on a test basis. This is a coordinated program which includes the FAA, the military, and the air carriers. FAA Flight Service Stations in 15 States are involved in the test. Present plans call for implementation of the new format nationwide during the summer of 1976. The advantages of the new format include ease of reading, since the various parameters are in the same place in each report and the reports can be computer-processed to develop charts of phenomena such as icing and turbulence. These types of charts are planned for development in the near future and are expected to be of great benefit to briefers who will then have a pictorial guide to locate icing and turbulence areas.

The NWS has also implemented a program that summarizes the PIREPS, by States, into nine bulletins every 30 minutes. These PIREPS are disseminated on the Service-A weather teletype. The bulletins are then sent to the FAA's Weather Message Switching Center at Kansas City where they are retained for 2 hours and are available to those locations which have request-reply capability.

Since June 1975, the NWS has participated with the FAA and the Department of Defense (DOD) in a 1-year test at the Kansas City Air Route Traffic Control Center (ARTCC). Seven forecasters provide on-site, 24-hour weather information to controllers and keep them advised of weather that may impact the air traffic control system. They are also attempting to place more PIREPS into the system, alerting military bases at night of potentially hazardous weather, and briefing some military pilots. An interagency group is examining the possibility of extending the

test at Kansas City and expanding it to other ARTCC's.

The FAA has recently awarded a multi-million dollar contract for automated FSS equipment which is designed to improve the speed and quality of preflight and in-flight pilot briefings.

The computer-based system, called Automated Weather and Notice to Airmen System (AWANS) is considered a key element in FAA's program to automate its FSS network. It will be installed in the Washington FSS for operational testing early next year.

The AWANS computer processes flight data automatically replacing the present manual system whereby FSS specialists must sort through lengthy teletypewriter printouts. Using a special keyboard, the specialists can call up a variety of vital flight and weather information from the computer for viewing on a cathode ray tube display. This enables them to brief pilots with increased speed and efficiency while providing more up-to-date flight information. A prototype of the AWANS system is undergoing a year long test at the FSS in Atlanta, Georgia.

AWANS will be installed at the Washington FSS after that facility is relocated from National Airport to Leesburg, Va., where it will be collocated with the FAA's ARTCC. Until AWANS is ready, FAA will use a less sophisticated, semi-automated display system at the relocated Washington FSS.

In its Special Study, "Fatal, Weather-Involved, General Aviation Accidents," the Safety Board recommended that the FAA, among other things, take priority action in order to adhere to the proposed 4-year implementation plan for the En Route Flight Advisory Service (EFAS) which had begun at four West Coast FSS's in 1972. Because of budgetary constraints and difficulties concerning actions involving FSS's in fiscal year 1975, the FAA was unable to adhere to the 4-year plan. However, at least eight FSS's in the eastern U.S. are expected to add the EFAS function in 1976. It is also anticipated that during 1976, 220 EFAS specialists will be given an additional 4-week intensive training course devised and instructed by NWS meteorologists. As envisioned, the EFAS program eventually will be composed of 44 FSS's coast-to-coast, specially equipped and manned to enable pilots in flight to get the latest weather information on a discrete radio frequency. The EFAS stations will be on the National Facsimile Circuit, they will have request-reply teletype capability, and NWS radar remote equipment wherever available. They will also have a telephone connection to the nearest NWS forecast office in order to make available professional meteorological consultation in problem situations.

With funding by the FAA, the NWS has developed a new computer-based, short-term technique which makes it possible to forecast thunderstorms 2 to 6 hours after an observation. The new technique was made available to forecasters on a nationwide basis at the end of March 1976. The second program is one which is designed to provide the general aviation pilot with much needed wind information at the runway threshold. The program is experimental and utilizes a pole and streamers to provide wind direction and speed indications to the pilot and is said to be an improvement over the windsock.

Partially in response to Safety Board recommendations, the NWS and the FAA have established a number of working groups to work on priority items to improve aviation weather services. Among these are groups working on:

(1) Faster and more complete dissemination of hazardous and potentially hazardous weather information to the National Airspace System,
(2) Improved pilot and air traffic specialist education,
(3) Improved aviation weather products and
(4) Better quality control of observations and services.

Aircraft Owners And Pilots Association (AOPA)

AOPA's Air Safety Foundation offers many training programs for airmen at various locations across the country. One of these programs is the Practical Aviation Weather Course. During 1975, the course was attended by more than 400 persons. Practical Aviation Weather is a 16-hour course. The course includes basic weather theory, types of weather-briefing information, weather flying, and preflight and in-flight decisionmaking. Finally, the course covers items such as in-flight weather situations, live weather briefings, and air route traffic control capabilities and limitations with regard to avoidance of hazardous weather situations.

CONCLUSIONS

Statistics reveal that most of the nonfatal, weather-involved, general aviation accidents occurred during the landing regime, i.e., either during the landing roll or during leveloff and touchdown, when unfavorable wind conditions existed and the weather was VFR. Unfavorable winds were cited 5 times more frequently as a cause or factor than were low ceilings, and 16 times more frequently than was thunderstorm activity.

Most of the pilots involved in the "unfavorable wind" accidents simply didn't compensate for the wind conditions or used poor judgment where they attempted to land. Although some of the pilots may not have been aware of the exact wind conditions, one pass over the intended runway would have revealed those conditions. On the other hand, the lack of appropriate wind measuring equipment on the ground or the misinterpretation of a windsock, for example, could have contributed to some of the accidents. Although a windsock provides valuable information concerning wind direction and some information on wind speed, the windsock is of little or no value for gust information.

The Safety Board believes that many of the accidents attributed to "unfavorable wind" could have been prevented by increased emphasis on the subject during pilot training and by the expedited development of a simple, economical wind-measuring system for use particularly at relatively small airports which are used primarily by general aviation aircraft.

The Safety Board continues to believe that the general aviation accident prevention efforts by both Government and industry have been progressive, but that even greater efforts are needed to reverse the trend of weather-involved accidents.

RECOMMENDATIONS

Based on the results of this study, the National Transportation Safety Board recommended that the Federal Aviation Administration:

"Expedite the development, for operational purposes, of a simple, economical wind measuring system for use particularly at relatively small airports which are used primarily by general aviation aircraft.

"... in coordination with the National Oceanic and Atmospheric Administration/National Weather Service:

"Through the FAA/NWS Working Group on Improving Pilot Education, place special emphasis on the hazards associated with unfavorable winds during the landing regime, by various means such as:

1. Discussions at safety seminars and clinics sponsored by the General Aviation Accident Prevention Program Specialists.
2. Changes in the Private Pilot's Test Guide (AC 61-32A).
3. Changes in the Private Pilot's Handbook of Aeronautical knowledge (AC 61-23A).

4. Changes in Pilot Exam-O-Grams.

5. Addition of appropriate questions in both written and oral pilot examinations and checks.

6. Assuring through FAA Inspectors that Pilot Schools certificated under 14 CFR 141, highlight the problem in their training syllabi specified in 14 CFR 141.55 (6)(b)(2)."

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

May 27, 1976

END

DATE

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