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**THE CURRENT ROLE OF ALCOHOL AS
A FACTOR IN CIVIL AIRCRAFT ACCIDENTS**

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16. Abstract Ethyl alcohol continues as a serious adverse factor in general aviation flight safety. According to FAA figures, the level of alcohol-associated general aviation fatal accidents has remained relatively static at a 16% general level since 1969. A recent survey of the attitudes of pilots toward alcohol and flying reveals a lack of appreciation among one-third of the pilots concerning the adverse effects of alcohol on safe flight. A renewed pilot education program on alcohol and flight safety appears indicated.					
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THE CURRENT ROLE OF ALCOHOL AS A FACTOR IN CIVIL AIRCRAFT ACCIDENTS

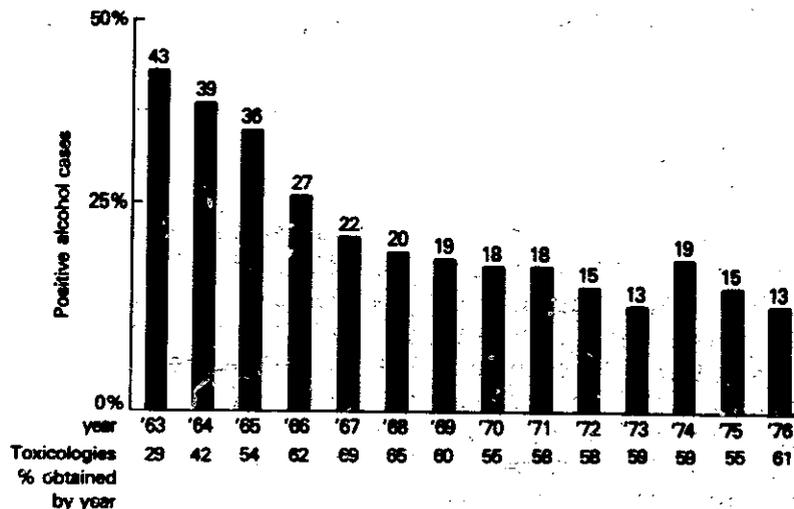
Introduction.

The effects of alcohol on pilot flight performance continues as a major safety concern. The Federal Aviation Administration has conducted toxicological studies on the remains of crew members involved in fatal civil aviation accidents since 1963. Lacefield and co-workers, in a publication on toxicological findings in fatal civil aviation accidents for 1969-1974, reported toxicological analyses on 1,345 accidents having 2,635 victims(1). This report states: "Findings worthy of consideration in developing the human factors history of an accident were found in 588 cases (44%). Alcohol was found in 359 victims (26.7%), 262 of which were pilots (19.5%)." Further, "by far the largest number of positive findings involve alcohol." This paper presents an analysis of alcohol-associated fatal accidents occurring in general aviation through 1976.

Results:

Prior reports have shown significant alcohol involvement in fatal civil aircraft accidents. Since the report of Harper and Albers in 1963, revealing a 43 percent association of fatal civil aircraft accidents with alcohol, a steady decline to 19 percent occurred through 1969. Since 1969 the level of alcohol-associated accidents has remained relatively static at the 16 percent level(3). Figure 1 shows the trend in general aviation fatal accidents from 1963 through 1976.

Figure 1. General Aviation Fatal Accidents



The bottom of Figure 1 gives the percent of fatal general aviation accidents in which the FAA conducted toxicological analyses. In 1976, toxicological analysis was performed on pilots in approximately 60 percent of fatal general aviation accidents. Ideally, the FAA would like to obtain autopsies and toxicological analyses on all U.S. civilian pilot victims of fatal aircraft accidents. For various reasons, this cannot be done. Some accidents are so destructive that adequate tissue and blood samples are not available. Tissue contamination may ruin the sample for toxicological purposes (for example, premature embalming or microbial action producing alcohol). In regard to microbial alcohol production: Lacefield reports that of the samples received in his laboratory containing alcohol, about one-fourth must be discarded because they contain microorganisms shown by culture to have the ability to produce alcohol(11).

Table I. Alcohol in General Aviation Accidents

YEAR	NUMBER OF FATAL ACCIDENTS	NUMBER OF FATALITIES	PILOT TOXICOLOGY OBTAINED	NUMBER WITH POSITIVE ALCOHOL*
1963	477	900	136 (29%)	50 (43%)
1964	510	980	215 (42%)	82 (39%)
1965	543	1020	233 (54%)	106 (36%)
1966	564	1123	347 (62%)	94 (27%)
1967	605	1200	394 (69%)	83 (22%)
1968	713	1458	444 (65%)	91 (20%)
1969	655	1418	383 (60%)	76 (19%)
1970	626	1293	346 (55%)	61 (18%)
1971	665	1331	384 (58%)	71 (18%)
1972	684	1438	329 (58%)	58 (16%)
1973	717	1396	420 (59%)	53 (13%)
1974	673	1349	397 (59%)	74 (19%)
1975	647	1277	350 (56%)	54 (15%)
1976**	629	1179	385 (61%)	50 (13%)

*75 mg % Blood Level, or Greater
 ** As of March 22, 1977
 Source: FAA Records

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Table I presents data on fatal accidents from 1963 to 1976. In 1963 there were 477 fatal general aviation accidents with 900 fatalities. The number of fatal accidents increased gradually until 1968 when the number of fatal accidents reached 713 with 1458 fatalities. Since 1968 the number of total accidents has averaged 662 (for the years 1969-1976). In 1976 there were 639 fatal accidents, for which reports had been received as of March 22, 1977, with 1179 fatalities. Toxicological analyses were performed on 385 of the fatally involved pilots. It was found that 50 had positive alcohol levels.

Table II. Percent of Total Positive Alcohols at Various Milligram Percent Levels

YEAR	LESS THAN 50 mg%	50-99 mg%	100-149 mg%	150 OR MORE mg%
1963	32	21	15	32
1964	27	22	27	23
1965	43	19	15	23
1966	47	19	17	17
1967	32	18	22	28
1968	29	18	18	36
1969	34	17	16	32
1970	36	20	13	31
1971	30	14	17	40
1972	47	22	5	26
1973	42	17	15	26
1974	34	19	17	30
1975	50	13	11	24
1976*	30	18	20	32

*AS OF MARCH 22, 1977
SOURCE: FAA RECORDS

Table II presents data on the positive alcohol findings in terms of milligram percent levels. In a preliminary report in 1972 (one year after the "8-hour abstinence rule" went into effect on December 5, 1970), it was reported that the rule appeared to have diminished the amount of flying on the part of "social drinkers" but had less effect on the "hard-core" heavy drinker, the person with an alcohol dependence or addiction problem(2). This suggestion was made because in 1971 the relative percent of pilots with positive alcohol levels above 100 milligrams percent had increased to 63 percent (lower level of 37 percent). For the 8-year prior period, the relative percent of pilots above 100 mg% was about 50 percent. Since 1971, the data show that the lower levels of alcohol have risen once again to the 50 percent level.

The National Transportation Safety Board (NTSB) establishes the probable cause of civil aircraft accidents. In order for an alcohol level to be considered as a cause by the NTSB, their policy has been that the level must be measured at the 50 mg% level or higher. Of course, a number of other factors are also considered before the cause/factors are established.

For the years 1969-1975 the National Transportation Safety Board listed alcohol as a cause/factor for 297 accidents, 258 of which were fatal(4). In a review of the National Transportation Safety Board briefs of accidents involving alcohol as a cause

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1970	36	20	13	31
1971	30	14	17	40
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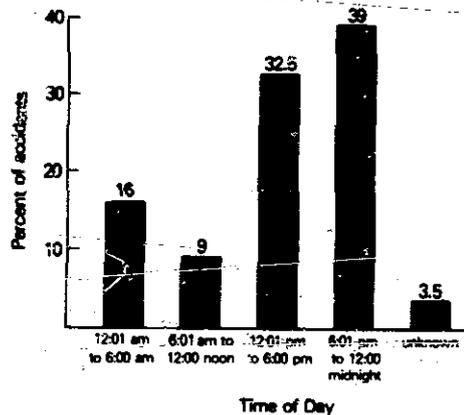
or factor for these years, it was found that 79% of the pilots were flying for pleasure or personal transportation (Table III). The next single largest purpose was for business, 5%. Under "other" are included fire fighting, hunting, test, air show, racing and unknown. This category accounted for 5%.

Table III. Percent of Accidents with Alcohol as Cause/Factor for Various Flight Purposes 1969-1975*

Pleasure/ Personal Transportation	Search and Rescue	Aerial Application	Instructional/ Practice	Business	Ferry	Other
79 (234)**	1 (3)	4 (11)	4.5 (14)	5 (16)	2 (5)	4.5 (14)

* Source: NTSB Records
 ** () = Number of Pilots

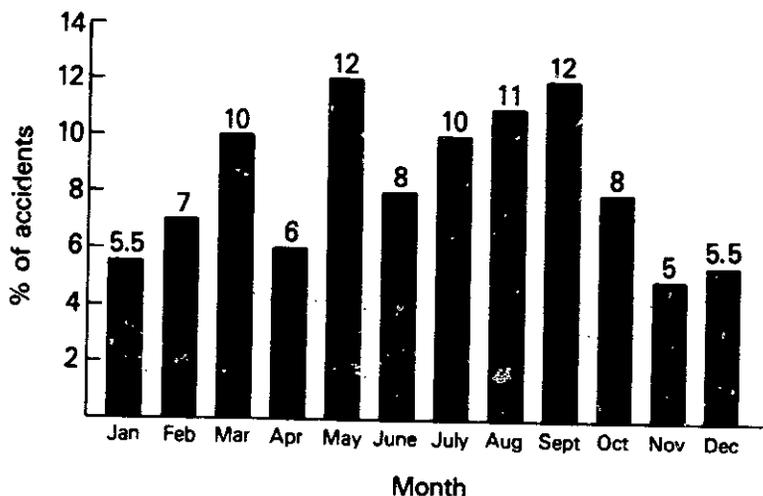
Figure 2. Percent of Accidents with Alcohol as Cause/Factor Occurring at Various Times of Day



Source: NTSB Records

The time of day of NTSB-reported alcohol-associated accidents is shown in Figure 2. Most of the accidents occurred between 12:00 noon and 12:00 midnight (71.5%), with 39% occurring between 6:00 p.m. and midnight. Only 9% of the accidents occurred between 6:00 a.m. and 12:00 noon. The accidents were distributed throughout the year with slightly smaller proportions occurring from November through January (Figure 3).

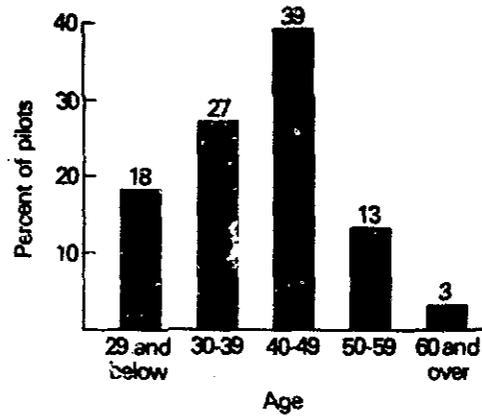
Figure 3. Percent of Accidents with Alcohol as Cause/Factor Occurring in Each Month



Source: NTSB Records

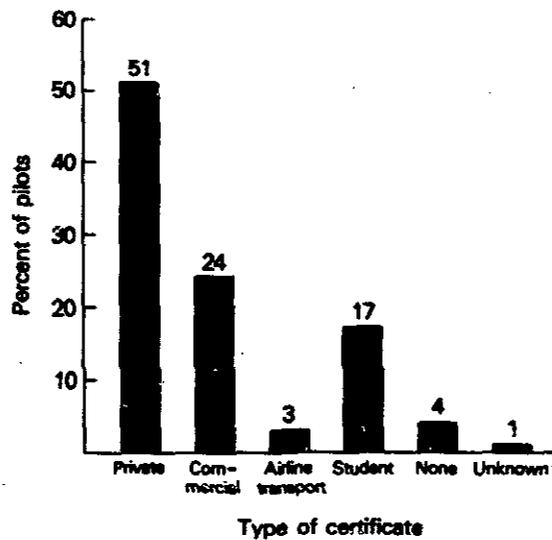
The phase of flight during which the accidents occurred is shown in Table IV. As seen in the Table, the alcohol accidents occurred in all phases of flight. The "other" category includes all operations that are not listed including ground operations and unknown operations. A review of the ages of the pilots involved in these accidents reveals that 63% of them were between the ages 30 and 50 (See Figure 4). Figure 5 shows the type of pilot certificate. Most of the pilots held a private pilot certificate (51%), 24% held a commercial certificate, 17% held a student certificate, 3% had an airline transport certificate, with 1% unknown. Of the pilots that held a private pilot certificate, only 7% were instrument rated. Of those holding a commercial certificate, almost half, 48%, were instrument rated.

Figure 4. Percent of Pilots Involved in Accidents with Alcohol as Cause/Factor in Various Age Groups



Source: NTSB Records

Figure 5. Percent of Pilots Involved in Accidents with Alcohol as Cause/Factor with Various Type Pilot Certificate



Source: NTSB Records

Table IV. Percent of Accidents with Alcohol as Cause/Factor at Various Phases of Flight 1969-1975*

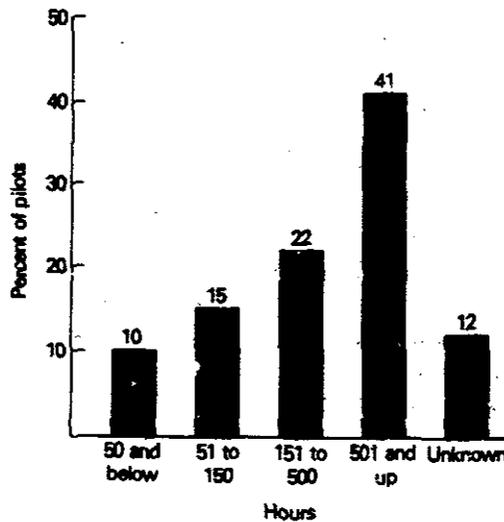
Climb	Cruise	Descending	Landing	Low Pass	Acrobatics	Buzzing	Aerial Application	Other
7.5 (22)**	13 (40)	17 (51)	16 (46)	6 (23)	7 (20)	8.5 (26)	3 (9)	20 (60)

*Source: NTSB Records

** () = Number of Pilots

Since such a large percent of the pilots involved in the accidents where alcohol was a cause/factor had no instrument rating, the total flight time of each was examined to determine if the pilots involved were relatively inexperienced. Figure 6 shows the results of the examination. Sixty-three percent of the pilots had flown more than 150 hours and 41% had flown over 500 hours. Only 10% had flown less than 50 hours.

Figure 6. Total Flight Time of Pilots Involved in Accidents with Alcohol as Cause/Factor 1969-1975



Source: NTSB Records

Discussion

A number of studies have demonstrated the adverse effects of alcohol on psychosensory and psychomotor functions. For example, although Collins and co-workers have shown that eye-hand coordination reveals little or no impairment following alcohol ingestion in static situations, marked degradation occurs during motion when the blood alcohol levels are in the 29 mg% range(5,6). Alcohol and darkness together produced even more pronounced impairments. The results indicate that even one ounce of an alcoholic drink consumed immediately prior to or during flight can be unsafe. The above laboratory findings are supportive of the finding that 55 percent of the alcohol-associated accidents occurred between 6:00 p.m. and 6:00 a.m. for the years 1969-1975.

Billings and co-workers studied the effects of alcohol on pilot performance during instrument flight under actual flight conditions(7). They used pilots under alcohol influence at 40, 80, and 120 mg% blood levels. The subjects showed significant decrements of performance at all of the levels. Both experienced and inexperienced pilot exhibited progressive increases in the number and seriousness of procedural errors with increasing levels of alcohol. The report concludes "that even 40 mg% of blood alcohol exerts decremental effects on performance which are incompatible with flight safety."

A publication by Parker and Noble reports that when social drinking amounts of alcohol are ingested there are decrements in adaptive abilities, concept formation, and capacity to shift from one idea to another(8). These effects would definitely be adverse to safe pilot performance.

Brown and Lane have reported post-mortem blood alcohol levels associated with fatal general aviation accidents in Australia, 1962-1975(9). Their results reveal that 18% of the pilots involved in fatal aircraft accidents had positive blood alcohol levels, a finding remarkably close to FAA data in the period since 1969. A recent U.S. survey on general aviation pilot attitude toward alcohol and flying, finds that "27-32% of the respondents considered flying after drinking, within a time period which would result in a 15 mg% blood alcohol level or higher, to be safe behavior(10)."

Conclusions

Alcohol-associated general aviation fatal accidents have plateaued since 1969 at the 16% level, according to FAA records (15 mg% or higher blood level). A recent survey indicates that about one-third of general aviation pilots considered flying after drinking, within a time period which would result in a 15 mg% blood alcohol level or higher, to be safe behavior. In

consideration of the protracted association of alcohol and general aviation accidents, it appears that an intensified pilot education program concerning the adverse effects of even small amounts of alcohol on safe flight is now warranted.

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