

SINGLE PILOT IFR ACCIDENT DATA ANALYSIS

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Abstract

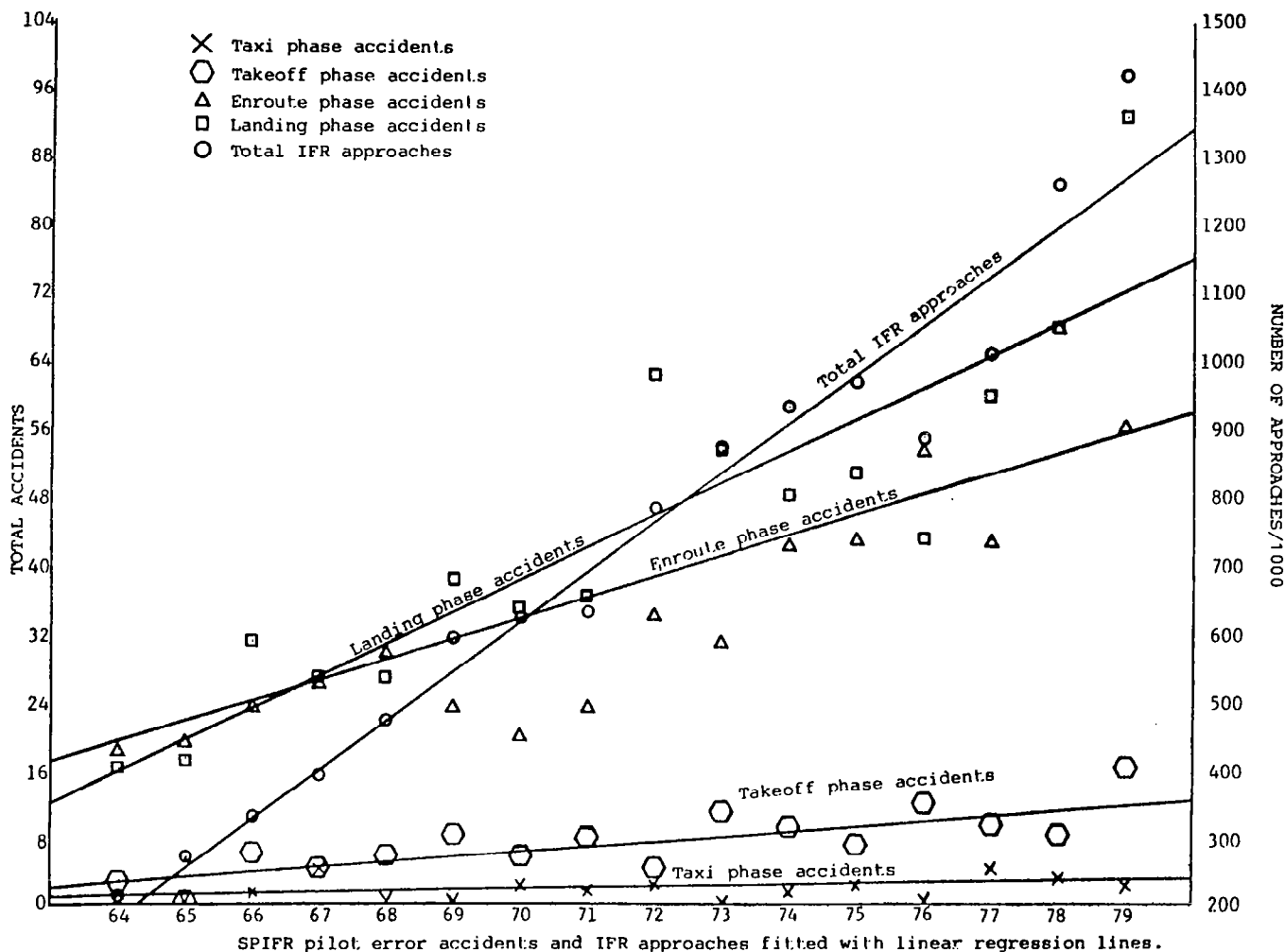
The aircraft accident data recorded by the National Transportation and Safety Board (NTSB) for 1964-1979 were analyzed to determine what problems exist in the general aviation (GA) single pilot instrument flight rule (SPIFR) environment [1]. A previous study conducted in 1978 for the years 1964-1975 provided a basis for comparison [2].

This effort was generally limited to SPIFR pilot error landing phase accidents but includes some SPIFR takeoff and enroute accident analysis as well as some dual pilot IFR accident analysis for comparison. Analysis was performed for 554 accidents of which 39% (216) occurred during the years 1976-1979.

Previous Trends Re-Examined

Linear regression and 95% confidence intervals were used to see if trends identified in the previous research were continuing. In general, previously identified trends are continuing. The absolute number of SPIFR pilot error accidents continues to increase but the accident rate per 10,000 approaches is decreasing. Each year, however, sees the accident rate decreasing more slowly.

About 50% of the SPIFR accidents occurred during the landing phase, 40% during the enroute phase, and 10% during taxi/takeoff.



Accidents by Phase of Landing

The table below shows SPIFR landing accidents and ratios related to phase of instrument approach. The initial approach phase statistically improved during the 1976-79 period. Most accidents continue to occur during the final approach phase. There are three times as many night final approach accidents as during the day. This led to a further study of night accidents.

SPIFR LANDING ACCIDENTS AND RATIOS RELATING TO
TO PHASE OF INSTRUMENT APPROACH

PHASE OF FLIGHT	FINAL IFR	INITIAL IFR	MISSED APPR	PATRN CIRC	LEVEL TCHDWN	ROLL	FINAL VFR	GO-RND VFR	OTHER	TOTAL
TOTALS										
1964-1975	139	59	20	7	59	27	16	1	7	335
1964-1979	224	75	41	16	107	46	26	5	14	554
PROPORTION OCCURRED 1964-79	.38	.21	.51	.56	.45	.41	.38	.80	.50	.39
NIGHT/DAY										
1964-1975	3.30	1.20	.42	.75	.36	6.50	1.00	0.00	2.00	1.40
1964-1979	3.00	1.00	.85	.78	.38	.87	1.40	4.00	3.30	1.30

Day Versus Night Accident Rate

The absolute number of night SPIFR accidents involving pilot error has increased over the past four years at essentially the same rate as that of day and total accidents. The significance of the numbers does not become very meaningful, however, until they are converted to rates in the context of overall day and night activity. An FAA report, "General Aviation Pilot and Aircraft Activity Summary 1979" was used to estimate GA IFR activity in terms of approaches flown [3]. The results indicate that 87.6% of all GA IFR approaches are flown in the day and 12.4% are flown at night. The table below shows day versus night accident rates for single pilot (SP) and dual pilot (DP) operations. The night accident rate is about ten times the day rate.

RATIOS OF DAY TO NIGHT ACCIDENT RATES FOR
SPIFR AND DPIFR LANDING PHASE ACCIDENTS

YEAR	SP(D)/DP(D)	SP(N)/DP(N)	SP(N)/SP(D)	DP(N)/DP(D)	ALL(N)/ALL(D)
1964	.75	.54	24.1	33.1	26.2
1965		2.73	23.4		25.6
1966	1.36	1.75	8.6	6.7	8.9
1967	1.14	4.26	12.4	3.3	10.2
1968	1.59	.39	5.8	23.9	9.4
1969	1.57	1.17	8.2	11.1	9.0
1970	.66	.82	6.7	5.3	6.1
1971	1.02	.63	5.4	8.8	6.3
1972	.83	1.95	10.5	4.5	8.6
1973	.73	2.14	11.2	3.8	8.8
1974	2.23	1.23	7.5	13.7	8.3
1975	1.33	.99	9.0	12.1	9.8
1976	1.53	2.92	6.2	3.3	5.6
1977	1.55	1.75	9.2	8.1	9.0
1978	.49	2.41	12.9	2.6	8.4
1979	2.10	1.06	6.2	12.3	6.9
MEAN	1.26	1.67	10.5	10.2	10.4

Vertigo Induced Uncontrolled Collisions With the Ground

The table below compares profiles of pilots involved in vertigo related accidents with those of other populations. Actual instrument experience and total flight hours appear to be the most critical experience factors when compared to other populations. Although not shown by this table, icing related uncontrolled collisions point to lack of time in type as an important factor.

SPIFR VERTIGO INDUCED UNCONTROLLED COLLISIONS WITH GROUND/WATER
STATISTICAL PROFILES

	TOTAL HOURS	TIME LAST 90 DAYS	ACTUAL INSTRUMENT	SIMULATED INSTRUMENT
GA SURVEY RESPONSE PROFILE				
MEAN	3814	98	245	166
STD. DEVIATION	4961	119	449	280
MEDIAN	2051	57	150	75
SPIFR TOTAL ACCIDENT PROFILE				
MEAN	3868	98	320	95
STD. DEVIATION	4457	86	499	164
MEDIAN	2394	71	150	61
SPIFR LANDING PHASE VERTIGO				
MEAN	2582	73	189	101
STD. DEVIATION	3405	73	430	116
MEDIAN	1399	53	48	66
SAMPLE SIZE	26	20	20	16
SPIFR ENROUTE PHASE VERTIGO				
MEAN	2802	59	128	63
STD. DEVIATION	4282	51	230	51
MEDIAN	975	38	48	63
SAMPLE SIZE	28	19	19	17

SPIFR Controlled Collisions With the Ground

A detailed analysis of controlled collisions with the ground was conducted. Descent below minimum altitudes consistently was the most prevalent factor in these accidents. The table below compares profiles of pilots involved in these accidents with those of other populations. The comparisons indicate that total flight experience is not an important factor.

SPIFR CONTROLLED COLLISIONS WITH GROUND/WATER
STATISTICAL PROFILES

	TOTAL HOURS	TIME LAST 90 DAYS	ACTUAL INSTRUMENT	SIMULATED INSTRUMENT
GA SURVEY RESPONSE PROFILE				
MEAN	3814	98	245	166
STD. DEVIATION	4961	119	449	280
MEDIAN	2051	57	150	75
SPIFR TOTAL ACCIDENT PROFILE				
MEAN	3868	98	320	95
STD. DEVIATION	4457	86	499	164
MEDIAN	2394	71	150	61
NIGHT CONTROLLED COLLISIONS				
MEAN	3775	104	341	78
STD. DEVIATION	4464	90	545	87
MEDIAN	2365	69	145	59
DAY CONTROLLED COLLISIONS				
MEAN	5041	97	276	101
STD. DEVIATION	4893	76	312	111
MEDIAN	3134	84	191	59

Summary

National Transportation Safety Board general aviation (GA) aircraft accident data for the years 1964 to 1979 were examined for single pilot instrument flight rule (SPIFR) accidents caused by pilot error. The 1396 accidents found were analyzed to determine the relationship of SPIFR accident types to phase of flight, pilot experience, and mission variables such as condition of light, ceiling, visibility, and type of approach. An estimate of GA day and night activity was made in order to estimate actual day and night accident rates.

The results of the data analysis indicate that about 50 percent of the SPIFR accidents occurred during the landing phase of flight, 40 percent occurred during the enroute phase, and 10 percent occurred during the taxi/takeoff phases.

Experienced pilots tended to have a lower accident rate than less experienced pilots. This trend was especially significant with vertigo related accidents and much less significant with icing related accidents.

The estimate of day GA activity was 87.6 percent of all GA activity and night activity was 12.4 percent. Based on these estimates and the number of day and night accidents the night accident rate was judged to be 10 times the day accident rate.

References

1. Harris, D. F.; and Morrisette, J. A.: Single Pilot IFR Accident Data Analyses. NASA CR-3650, Nov. 1982.
2. Forsyth, D. L.; and Shaughnessy, J. D.: Single-Pilot IFR Operating Problems Determined From Accident Data Analyses. NASA TM-78773, Sept. 1978.
3. General Aviation Pilot and Aircraft Activity Summary 1979. U.S. Dept. of Transportation, 1979.