SPECIAL STUDY

ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION U.S. GENERAL AVIATION 1965 –1969

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16.Abstract

This report presents the record of engine failure/malfunction accidents for fixed-wing aircraft which occurred in all operations of U. S. General Aviation during the period 1965-1969. It includes a comparison of the engine-failure accident rates for single-engine and multiengine aircraft. Analyses are included concerning causes and related factors of engine-failure accidents by selected makes and models of aircraft and engines. Injury tables, analytic tables, and cause/factor tables are presented for all fixed-wing aircraft along with single-engine and multiengine fixed-wing aircraft.

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FOREWORD

This special study, *Accidents Involving Engine Failure/Malfunction*, is based on data describing 4,310 U. S. general aviation accidents which occurred during the 5-year period 1965 - 1969. Each accident involved a fixed-wing aircraft and was precipitated by engine failure or malfunction.

The statistical base for this study was provided by the automated aircraft-accident data bank of the National Transportation Safety Board. The period 1965 - 1969 was the most recent complete 5-year period of data contained in the bank at the time of the study. The data concerning aircraft-hours flown by aircraft make and model were obtained from the Federal Aviation Administration.

For ease of reference, this study has been divided into three sections. Section I provides a comparative analysis of engine-failure accident rates by aircraft make and model. Section II analyzes the causes of and related factors in engine-failure accidents by selected aircraft and engine makes and models. Section III displays graphically the relative severity of accident types which follow an engine failure or malfunction.

Appendices A, B, and C present supporting data in the form of injury tables, analytic tables, and cause/factor tables. Appendix A includes data for all 4,310 accidents. These data are then segregated into two separate groupings, one for single-engine aircraft and the other for multi-engine aircraft (Appendix B and Appendix C, respectively).

The various ways in which different makes and models of aircraft are used may alter operating conditions to an extent that is reflected in the engine-failure accident rates. For example, the Boeing A-75 is used most often for aerial application and associated crop-control activities. The Cessna 150, on the other hand, is used for instructional flying and personal transportation. Thus, in evaluating the accident rates shown for the various makes and models, care should be taken to consider all factors involved.

All aircraft and engine makes and models contained in this study were certificated in accordance with airworthiness requirements. Although the study includes comparative analyses which serve to highlight specific pilot and powerplant cause/factor involvement, these analyses are not intended to be an evaluation of the overall safety of a specific aircraft or powerplant, or as a criticism of any manufacturer. The comparative studies were made to identify the differences (between these aircraft and engines) of specific cause/factor citations which seemed to be statistically significant. To properly measure the importance of these differences in terms of defining specific remedial solutions in most cases will require additional engineering, operational, and design study.

Engine Failure
Engine Malfunction

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EXPLANATORY NOTES

GENERAL AVIATION

General Aviation refers to the operation of aircraft owned and operated by persons, corporations, etc., other than those aircraft engaged in air carrier operations authorized by a Certificate of Public Convenience and Necessity, issued by the Civil Aeronautics Board.

AIRCRAFT ACCIDENT

The accidents included herein are occurrences incident to flight in which, as a result of the operation of an aircraft, any person (occupant or nonoccupant) receives fatal or serious injury or any aircraft receives substantial damage. Comparisons of annual totals of engine-failure accidents or total accidents should be made with care because of the effect of an amendment to Section 430.2 of the National Transportation Safety Board's Regulations. The change helped to decrease the number of accidents by redefining "substantial damage" to aircraft of 12,500 pounds maximum certificated takeoff weight or less.

Prior to January 1, 1968, the definition of substantial damage was as follows:

(1) Except as provided in subparagraph (2) of this paragraph:
   (i) Substantial damage in aircraft of 12,500 pounds maximum certificated takeoff weight or less means damage or structural failure reasonably estimated to cost $300 or more to repair.
   (ii) Substantial damage in aircraft of more than 12,500 pounds maximum certificated takeoff weight means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repairs or replacement of the affected component.

(2) Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, taxiing damage to propeller blades, damage to tires, engine accessories, brakes or wingtips are not considered "substantial damage" for the purpose of this part.

The amendment, effective January 1, 1968, changed the definition of substantial damage as follows:

(1) Except as provided in subparagraph (2) of this paragraph, substantial damage means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.

(2) Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes or wingtips are not considered "substantial damage" for this part.

INJURY INDEX

Injury index describes the highest degree of personal injury sustained as a result of the accident.

TYPE OF ACCIDENT

The type of accident relates to the immediate circumstances of the occurrence. Many accidents involve a series of circumstances and

therefore require a second type to more fully describe the sequence of events. Some examples of types of accidents are gear collapsed, gear retracted, airframe failure, and engine failure or malfunction. Engine failure or malfunction includes engine stoppage, power interruption, or power loss for any reason. For an engine failure to be classified as an accident, the occurrence must be in combination with another accident type, unless serious or fatal injuries or structural damage resulted from flying parts.

PHASE OF OPERATION

The phase of operation relates to the particular segment of the flight or operation during which the accident occurred.

KIND OF FLYING

Kind of flying describes the purpose for which the aircraft was being operated at the time of the accident. There are four broad categories of kind of flying:

1. *Instructional Flying*
   Flying accomplished with supervised training under the direction of an accredited instructor.
2. *Noncommercial Flying*
   Use of an aircraft for pleasure, personal transportation, private business, corporate/executive operations, and other operations for which no direct monetary fee is charged. Categories of noncommercial flying are defined as follows:
   Pleasure
   Flying by individuals in their own or rented aircraft for pleasure or personal transportation not in furtherance of their occupation or company business.
   Business
   The use of aircraft by pilots (not receiving direct salary or compensation for piloting) in connection with their occupation or in the furtherance of private business.
   Corporate/Executive Operations
   The use of owned or leased aircraft, operated by a corporation or business firm for the transportation of personnel or cargo in furtherance of the corporation's or firm's business, and flown by professional pilots receiving a direct salary or compensation for piloting.
3. *Commercial Flying*
   All general aviation flying normally conducted for direct financial return except instructional flying. This includes air taxi operations, aerial application, fire control, aerial mapping or photography, aerial advertising, power/pipelines patrol and fish spotting.
4. *Miscellaneous Flying*
   Other kinds of flying not covered under the other three broad categories.

CAUSE AND RELATED FACTORS

In determining probable cause(s) of an accident, all facts, conditions, and circumstances are considered. The objective is to ascertain those cause-effect relationships in the accident sequence about which something can be done to prevent recurrence of the type of accident under consideration. For statistical purposes, where two or more causes exist in an accident, each is recorded and no attempt is made to establish a primary cause. Therefore, in the cause/related factor tables, the figures shown in the columns dealing with cause will exceed the total number

of accidents. The term "factor" is used, in general, to denote those elements of an accident which further explain or supplement the probable cause(s). This provision was incorporated into the coding system to increase its flexibility and to provide a means for collecting essential items of information which could not be readily categorized elsewhere in the system.

Several specific cause/factor citations and the broad cause/factor category, powerplant, are defined below:

1. *Inadequate Preflight Preparation and/or Planning.*
   Refers to ground preparation for flight. The preflight check of the aircraft and its equipment, the planning of the flight, weather briefing, fuel reserve, etc., are examples of actions which could be improperly performed or omitted.
2. *Mismanagement of Fuel*
   Any act of omission or commission by the pilot with reference to fuel or the fuel system considered causative in the accident.
3. *Improper Operation of Powerplant and Powerplant Controls*
   Improper operation of the powerplant from a mechanical standpoint, through improper use of throttles, super-charger, cowl flaps, carburetor heat, mixture controls, propeller controls, etc., under the conditions and circumstances involved. Causes used in conjunction with the misuse of powerplant controls include "anti-icing/deicing equipment – improper operation of/or failed to use" and "conditions conducive to carburetor/induction system icing" together with "ice-carburetor" or "ice-engine" when engine failure or malfunction is determined to have been the result of such ice and the weather conditions are reported as such.
4. *Fuel Starvation and Fuel Exhaustion*
   Fuel starvation occurs when ample fuel is aboard the aircraft but for some reason the flow of fuel to the engine is interrupted, reduced, or completely stopped, while fuel exhaustion means that there is no useable fuel aboard the aircraft.
5. *Powerplant*
   Refers to any malfunction of the engine, the fuel system, lubricating system, propeller and accessories, exhaust system, etc.

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I. INTRODUCTION

During the 5-year period 1965 – 1969, 4,310 fixed-wing general aviation aircraft were involved in accidents precipitated by engine failure or malfunction, i.e., occurrences in which engine failure or malfunction (hereinafter called engine failure) was cited as the first type of accident. In order for an engine failure to be considered as a first accident type, it must be followed by a second type of accident which results in substantial damage to the aircraft or in serious injury to an individual.

Engine failure was the most frequently cited first type of accident in general aviation from 1965 through 1969. The purposes of the study described in this report were:

(1) To compare these 4,310 accidents by make and model of aircraft,
(2) To compare the causes/factors of these accidents by selected makes and models of aircraft as well as by selected makes and models of engines,
(3) To examine the nature and severity of the second accident types which followed these engine failures, and
(4) To determine findings that could help to reduce the frequency of engine-failure accidents.

Overview

Of the 4,310 aircraft involved in these accidents, 841 (19.5%) were destroyed, and the remainder were substantially damaged. The pilot-in-command was cited as a probable cause or related factor in 51.81% of the engine-failure accidents, while the powerplant was cited in 44.62%. Although these two categories do not account for all of the engine-failure accidents, they do comprise the majority of them. Particularly frequent cause/factor citations found in accidents involving pilot error and/or powerplant failure were:

DETAILED CAUSE/FACTORS	FREQUENCY
Pilot-In-Command Involvement	
Inadequate preflight preparation or planning	934
Mismanagement of fuel	615
Improper operation of powerplant and powerplant controls	504
Improper in-flight decisions or planning	127
Became lost/ disoriented	101

DETAILED CAUSE/FACTORS	FREQUENCY
Powerplant Involvement	
Valve assemblies	130
Carburetor	102
Master and connecting rods	86
Cylinder assembly	72
Piston, piston rings	70
Magnetos	64
Crankshaft	57
Spark plug	53

Table 1 presents engine-failure accident rates per 100,000 aircraft-hours flown for single-engine and multiengine aircraft. The rate for multiengine aircraft was consistently lower than that for single-engine aircraft in each of the five years studied. Overall, the average engine-failure accident rate was 2.3 per 100,000 aircraft-hours flown for multiengine aircraft compared with 4.6 for single-engine aircraft.

A lower rate for the multiengine aircraft does not necessarily indicate a lesser degree of hazard. In Table 1, the ratio of fatal to total accidents was 2,426/22,352 (10.9%) for single-engine aircraft compared with 473/2,884 (16.4%) for multiengine aircraft. Furthermore, of the 3,855 engine-failure accidents involving single-engine aircraft, 208 (5.4%) were fatal accidents, which resulted in 375 fatalities or 5.2% of the 7,169 people aboard all the aircraft (Table 1, Appendix B). In comparison, multi-engine aircraft were involved in 455 engine-failure accidents, of which 104 (22.9%) were fatal and resulted in the deaths of 264 people, 18.1% of the 1,461 people aboard all the aircraft (Table 1, Appendix C.)

The number of total, fatal, and engine-failure accidents along with corresponding rates by kind of flying for the 5-year period 1965-69 are displayed in Table 2. Aerial applications as a kind of flying had the highest engine-failure accident rate per 100,000 hours flown, followed by pleasure, instructional, business/corporate, and air taxi.

Findings

1. The average engine-failure accident rate for multiengine aircraft was 2.3 accidents per 100,000 aircraft-hours flown compared with 4.6 for single-engine aircraft.
2. The percentage of fatal to total engine-failure accidents was 22.9 for multiengine aircraft compared with 5.4 for single-engine aircraft.
3. Over 18% of the occupants were fatally injured aboard multiengine aircraft involved in engine-failure accidents compared with 5.2% for single-engine aircraft.
4. The incidence of severe injury-producing accidents (such as stall, stall/spin, stall/spiral, and collision with the ground/water – controlled and uncontrolled) that follow engine-failure accidents was 24.6% for multi-engine aircraft compared to 7.3% for single-engine aircraft.
5. The pilot was cited as a probable cause/related factor in over 51% of the engine-failure accidents. The predominant pilot cause/factor citations were:
   a. inadequate preflight preparation and/or planning
   b. mismanagement of fuel
   c. improper operation of powerplant and powerplant controls
   d. improper in-flight decisions
   e. became lost/disoriented

TABLE 1

ACCIDENTS, RATES, HOURS FLOWN
U. S. GENERAL AVIATION
1965 - 1969

YEAR	ACCIDENTS TOTAL	ACCIDENTS FATAL	ACCIDENTS ENGINE FAILURE	AIRCRAFT-HOURS FLOWN	ACCIDENT RATES PER 100,000 AIRCRAFT-HOURS FLOWN TOTAL	FATAL	ENGINE FAILURE
SINGLE ENGINE, FIXED-WING AIRCRAFT							
1965	4365	440	686	12,031,200	36.3	3.7	5.7
1966	4774	464	750	16,148,000	29.6	2.9	4.6
1967	5133	471	827	17,526,000	29.3	2.7	4.7
1968	4165*	555*	765	18,987,950	21.9	2.9	4.0
1969	3918	499	827	19,547,915	20.0	2.6	4.2
TOTAL	22355*	2429*	3855	84,241,065	26.5	2.9	4.6
MULTIENGINE, FIXED-WING AIRCRAFT							
1965	564	80	80	3,185,800	17.7	2.5	2.5
1966	599	76	79	4,315,000	13.9	1.8	1.8
1967	687	103	98	3,450,000	19.9	3.0	2.8
1968	498	100	94	4,326,982	11.5	2.3	2.2
1969	536	114	104	4,892,626	11.0	2.3	2.1
TOTAL	2884	473	455	20,170,408	14.3	2.4	2.3

* THREE SUICIDE/SABOTAGE ACCIDENTS INCLUDED IN ALL COMPUTATIONS EXCEPT RATES.

TABLE 2

TOTAL, FATAL, AND ENGINE FAILURE
ACCIDENTS AND RATES
BY KIND OF FLYING
U. S. GENERAL AVIATION
1965 - 1969

	KIND OF FLYING								
	NONCOMMERCIAL					COMMERCIAL			MISC
	INSTR	PLEASURE	BUSINESS	CORPORATE	ALL OTHER	AERIAL APPLIC*	AIR TAXI	ALL OTHER	
ACCIDENTS									
TOTAL	4,653	11,840	3,576	446	1,548	1,834	1,025	486	1,494
FATAL	242	1,651	384	59	74	198	157	81	239
ENGINE FAILURE	602	1,998	534	45	218	419	168	42	284
HOURS FLOWN(000)	27,784	32,122	26,927	**	NA	6,019	9,549	NA	NA
ACCIDENT RATES PER 100,000 HOURS									
TOTAL ACCIDENTS	16.75	36.86	14.94	**	NA	30.47	10.73	NA	NA
FATAL ACCIDENTS	0.87	5.14	1.64	**	NA	3.29	1.64	NA	NA
ENGINE FAILURE ACCIDENTS	2.17	6.22	2.15	**	NA	6.96	1.76	NA	NA

* INCLUDES ASSOCIATED CROP CONTROL ACTIVITIES.

** BUSINESS AND CORPORATE FIGURES ARE COMBINED.

6. The powerplant was cited as a probable cause/related factor in over 44% of the engine-failure accidents. The predominant powerplant cause/factor citations were:
   a. valve assemblies
   b. carburetor
   c. master and connecting rods
   d. cylinder assembly
   e. piston and piston rings
   f. magnetos
   g. crankshaft
   h. spark plugs

7. Fuel starvation was recorded as a probable cause/related factor in 833 (19.3%) of the 4,310 engine-failure accidents. The following aircraft had a statistically higher-than-average incidence of fuel starvation:
   a. Beech 23 (Table 13)
   b. Beech 35 (Table 14)
   c. Callair A-9 (Table 16)
   d. Piper PA-22 (Table 30)
   e. Piper PA-28 (Table 34)
   f. Piper PA-32 (Table 35)

   Fuel starvation was commonly associated with error on the part of the pilot-in-command, such as:
   a. mismanagement of fuel
   b. inadequate preflight preparation and/or planning
   c. inattentive to fuel supply
   d. improper operation of powerplant and powerplant controls

8. Fuel exhaustion was cited as a probable cause/related factor in 811 (18.8%) of the engine-failure accidents. Pilot-in-command cause/factor citations most commonly associated with fuel exhaustion were:
   a. inadequate preflight preparation and/or planning
   b. mismanagement of the fuel
   c. improper inflight decisions or planning
   d. became lost/disoriented
   e. inattentive to fuel supply
   f. miscalculated fuel consumption

9. Maintenance, servicing, and inspection personnel were cited as a probable cause/related factor in 425 (9.9%) of the engine-failure accidents. The predominant cause/factor citations were:
   a. inadequate maintenance and inspection
   b. improper maintenance (maintenance personnel)
   c. improperly serviced aircraft (owner-pilot)
   d. improper maintenance (owner personnel)

10. Specific engine makes and models which had significantly higher-than-expected involvement in individual powerplant cause/factor citations were:
   a. Avco/Lycoming O-235: fuel system – vents, drains, tank caps (Table 38)
   b. Avco/Lycoming O-290: exhaust system – mufflers (Table 39)
   c. Avco/Lycoming O-320: engine structure – valve assemblies; lubicating system – lines, hoses, fittings (Table 40)
   d. Avco/Lycoming IO-360: engine structure – master and connecting rods (Table 42)
   e. Avco/Lycoming O-540: fuel system – vents, drains, tank caps; fuel system – tanks; exhaust system – mufflers (Table 43)
   f. Continental A-65: engine controls – throttle power lever assemblies (Table 45)
   g. Continental C-75 and C-85: engine controls – throttle power lever assemblies (Table 46)
   h. Continental E-225: fuel system – pumps (Table 51)

i. Continental O-470: fuel system – carburetor (Table 53)
j. Continental IO-470: engine structure – cylinder assemblies, master and connecting rods, crankshaft; fuel system – lines and fittings (Table 54)
k. Continental IO-520: engine structure – piston, piston rings, crankshaft (Table 55)
l. Franklin 6A4 and 6AG4; engine structure – valve assemblies; ignition system – magnetos (Table 56)
m. Pratt and Whitney Military R-985: engine structure – cylinder assembly, master and connecting rods, blower impeller assembly (Table 57)

SECTION I

COMPARISON OF ENGINE-FAILURE ACCIDENTS BY AIRCRAFT MAKE AND MODEL

Individual makes and models of single-engine and multiengine aircraft are considered in this section. The engine makes and models installed in the various aircraft are shown in Tables 3 and 4. Engine-failure accident rates (per 100,000 aircraft-hours flown) by aircraft make and model are presented in Tables 5 and 6 for those aircraft for which exposure data (aircraft-hours flown) were available. Comparisons of engine-failure accidents by make and model of aircraft are given in Tables 7 and 8. No attempt has been made to analyze the aircraft according to kind of flying because doing so would create subcell sample sizes and expected values too small for meaningful statistical comparisons.

The qualitative ratings of Tables 7 and 8 were derived from numerical values which were calculated using a single degree of freedom chi-square analysis.[1] The formula for the numerical rating is

$$X^2 = \frac{(F_o - F_e)^2}{F_e}$$

where F_o is the observed number of the engine-failure accidents for a given make and model and F_e is the expected number of engine-failure accidents.

To calculate the expected number of engine-failure accidents for a particular make and model, it was assumed that the ratio of total engine-failure accidents to total aircraft hours was proportional to the ratio of engine-failure accidents by make and model to aircraft hours by make and model, i.e.,

$$\frac{\text{total engine failures}}{\text{total aircraft hours}} = \frac{\text{engine failures by make and model}}{\text{aircraft hours by make and model}}$$

Hence,

$$\text{engine failures by make and model} = \frac{\text{total engine failures}}{\text{total aircraft hours}} \times \text{aircraft hours by make and model}$$

When the result of the chi-square equation was above 3.84 but equal to or less than 10.8, a qualitative rating of low (L) or high (H) was recorded, depending on whether the sign of the difference $F_o - F_e$ was negative or positive. When the numerical rating fell above 10.8, a qualitative rating of very low (VL) or very high (VH) was given. When the numerical rating was less than or equal to 3.84, a qualitative rating of average (a) was assigned. A rating of L or H means that the statistical difference between F_o and F_e would have a probability between 0.05 and 0.001 of occurring by chance alone if there really were no difference between the given make and model and other makes and models. A rating of VL or VH means that the difference would have a probability of less than 0.001 of occurring by chance.

Example. For the Aeronca 11 aircraft shown in Table 7, the observed number of engine-failure accidents was 24, the expected number was 8, and the numerical rating was 32.0. A qualitative rating of VH was therefore assigned to this make and model. The expected number of engine failures was found as follows: total engine failures for single-engine aircraft = 3,855; total aircraft hours for single-engine aircraft = 84,241,065; and the aircraft hours flown for the Aeronca 11 = 175,762; hence, Expected engine failures, Aeronca 11 = (3,855/84,241,065) x 175,762 = 8.

[1] Hagan, Acheson J., "Report on the Differential Accident Performance of Single Engine Non-Air Carriers, 1949-51."

TABLE 3

ENGINES INSTALLED IN VARIOUS
SINGLE-ENGINE AIRCRAFT MAKES AND MODELS

Aircraft Make and Model	Engine Make and Model
Aeronca 11	Continental A-65 series, C-75 and C-85 series, C-145 series
Aeronca 15	Continental C-145 series
Aeronca 7	Avco/Lycoming O-235 series, O-290 series, O-320 series, Continental A-65 series, C-75 and C-85 series, C-90 series, O-200 series
Beech 35	Continental E-165 and E-185 series, E-225 series, IO-470-A, -C; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO – 470-A, IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; TSIO – 520 series
Beech 23	Avco/Lycoming O-320 series, O-360 series, LTC1B-1, IO-360 series, AIO-360 series
Beech A45, T34	Continental E-225 series; O-470-4, -11, -13, -13A, -15, -11CI; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R
Bellanca 14-13	Avco/Lycoming O-435 series, Franklin 4AC-150 series 40, 50, A; 6A4 and 6AG4 series
Bellanca 14-19	Avco/Lycoming O-435 series, Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-470 -A, -C; IO-470 -D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470 -A, IO-520 -A, -B, -C, -D, -E, -F, -J, -K, -L
Boeing A-75	Avco/Lycoming R-680, R-680-B4 series, R-680-4, R-680-E series, Continental R-670-A, -C, -E, -G; R-670-B, -D, -F, -H; W-670 -6A, -6N, -K, -M Jacobs L-6 series, Pratt and Whitney Wasp Jr. T1B2, T1B3, Military R-985 series, Military R-1340 series, Curtiss-Wright R-975, A, B, D, E
Callair A-9	Avco/Lycoming O-320 series, O-360 series, O-540 series, IO-540 series

TABLE 3 (continued)

Aircraft Make and Model	Engine Make and Model
Cessna 120/140	Continental C-75 and C-85 series, C-90 series
Cessna 150	Continental C-90 series, O-200 series
Cessna 170	Avco/Lycoming O-360 series, O-435 series, Continental C-145 series, O-300 series, Franklin 6A4 and 6AG4 series
Cessna 172	Avco/Lycoming O-320 series, O-360 series, Continental C-145 series, O-200 series, GO-300-A, -B, -C, -D, -E, -F; O-300 series, O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R
Cessna 175	Continental GO-300-A, -B, -C, -D, -E, -F; O-300 series
Cessna 180	Continental O-470 -A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L
Cessna 182	Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-470-A, -C; IO-520 -A, -B, -C, -D, -E, -F, -J, -K, -L
Cessna 195	Continental A-65 series, W-670-16, -23, -24; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; Jacobs L-4 series, L-6 series, R-755 series
Cessna 210	Continental IO-470-A, -C; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A, TSIO-470-B, -C, -D; IO-360-A, -B, -C, -D, -E; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; GTSIO-520-C, -D, -E; TSIO-520 series
Cessna 206	Continental IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; TSIO-520 series
Cessna 188	Continental O-470-4, -11, -13, -13A, -15, -11CI; O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L
Cessna 177	Avco/Lycoming O-320 series, O-360 series
Forney 415	Continental A-65 series, A-75 series, C-75 and C-85 series, C-90 series, E-165 and E-185 series
Grumman G-164	Avco/Lycoming R-680-E series, Continental W-670-6A, 6N, -K, -M; W-670-16, -23, -24;

TABLE 3 (continued)

Aircraft Make and Model	Engine Make and Model
Grumman G-164 (cont)	Jacobs L-4 series, R-755 series, Military R-755-7, Pratt and Whitney Military R-985 series, Military R-1340 series
Luscombe 8	Avco/Lycoming O-290 series, Continental A-65 series, C-75 and C-85 series, C-90 series
Mooney M20	Avco/Lycoming O-320 series, O-360 series, IO-360 series, AIO-360 series
Navion L-17	Avco/Lycoming O-320 series, GO-435 and Military O-435-6, -17; Continental E-165 and E-185 series and Military O-470-7, -7A, -7B; E-225 series, O-470-4, -11, -13, -13A, -15, -11CI; IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L
Piper J-3	Avco/Lycoming O-145-A series, O-235 series, O-290 series, O-320 series, Continental A-65 series, A-75 series, C-75 and C-85 series, C-90 series
Piper PA-12	Avco/Lycoming O-235 series, O-290 series, O-320 series
Piper PA-16	Avco/Lycoming O-235 series
Piper PA-18	Avco/Lycoming O-235 series, O-290 series, O-320 series Continental A-65 series, C-90 series
Piper PA-20	Avco/Lycoming O-290 series, O-320 series
Piper PA-22	Avco/Lycoming O-235 series, O-290 series, O-320 series
Piper PA-24	Avco/Lycoming O-320 series, O-360 series, O-540 series, IO-540 series, IO-720-A1A
Piper PA-25	Avco/Lycoming O-290 series, O-320 series, O-540 series, IO-540 series
Piper PA-28	Avco/Lycoming O-235 series, O-320 series, O-360 series, O-540 series, IO-360 series, AIO-360 series, IO-540 series

TABLE 3 (continued)

Aircraft Make and Model	Engine Make and Model
Piper PA-32	Avco/Lycoming O-540 series, IO-540 series
Globe GC-1A, 1B	Avco/Lycoming O-320 series, Continental A-65 series, C-115 and C-125 series, O-300 series
Stinson 108	Avco/Lycoming O-145-B, -C; GO-145 series; O-435 series; Continental A-40, -2, -3, -4; Franklin 6A4 and 6AG4 series
Taylorcraft BC	Avco/Lycoming O-235 series, O-320 series, Continental A-65 series, C-75 and C-85 series

TABLE 4

ENGINES INSTALLED IN VARIOUS
MULTIENGINE AIRCRAFT MAKES AND MODELS

Aircraft Make and Model	Engine Make and Model
Aero Commander 500, 520, 560, 500S	Avco/Lycoming GO-435, GO-480 series, O-540 series, IO-540 series, Continental IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T; LIO-470-A
Aero Commander 560F, 680, 680T	Avco/Lycoming GO-480 series, GSO-480 series, IGSO-480, Airesearch TPE, 331 series
Beech 18, C-45	Pratt and Whitney Military R-985 series, Airesearch TPE 331 series
Beech 50	Avco/Lycoming GO-435, GO-480 series, GSO-480 series, IGSO-480
Beech 65	Avco/Lycoming GSO-480 series, IGSO-480, IO-540 series
Beech 95	Avco/Lycoming O-360 series, IO-360 series, AIO-360 series, IO-540 series, Continental IO-470-D, -E, -F, -G, -H, -J, -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; United Aircraft PT6A-6, -6A, -6B, -20, -27, -28, -29, PT6B-9
Cessna 310	Avco/Lycoming IO-540 series, Continental O-470-A, -B, -E, -G, -H, -J, -K, -L, -M, -N, -P, -R; IO-470-D, -E, -F, -G, -H, -J. -K, -L, -M, -N, -P, -R, -S, -T, -U; LIO-470-A, TSIO-470-B, -C, -D; TSIO-520 series
Cessna 320	Avco/Lycoming IO-540 series; Continental TSIO-470-B, -C, -D; IO-520-A, -B, -C, -D, -E, -F, -J, -K, -L; TSIO-520 series
Cessna 336, 337	Continental IO-360-A, -B, -C, -D, -E; TSIO-360 series
Cessna 401, 402, 411, 421	Continental GTSIO-520-C, -D, -E; TSIO-520 series
DeHavilland DH104, DH114	Avco/Lycoming IO-720-A1A; DeHavilland Gypsy Queen 30MK.2; Gypsy Queen 70-4, 70MK2, 70MK3

TABLE 4 (continued)

Aircraft Make and Model	Engine Make and Model
Piper PA-23	Avco/Lycoming O-320 series, O-340 series, O-360 series, O-540 series, IO-360 series, AIO-360 series, IO-540 series, Franklin 6V-350-A, -B; GA-350-D, -D1, -C1, C2
Piper PA-30	Avco/Lycoming LTC1B-1, IO-320 series
Piper 31	Avco/Lycoming IO-540 series, TIO-540-A1A, -A1B, -A2A, -A2B, C1A
Lear	General Electric CJ-610-1, -4, -5, -6, -8, -9

TABLE 5

ENGINE-FAILURE ACCIDENTS, RATES
FOR SELECTED MAKE AND MODEL OF AIRCRAFT
SINGLE-ENGINE AIRCRAFT
1965 – 1969

Make and Model	Engine-Failure Accidents	Aircraft-Hours Flown	Engine-Failure Accidents Per 100,000 Aircraft-Hours Flown
Aeronca 11	24	175,762	13.65
Aeronca 15	17	61,055	27.84
Aeronca 7	112	2,075,159	5.40
Beech 35	194	5,278,580	3.68
Beech 23	64	1,392,673	4.60
Beech A45, T34	13	231,842	5.61
Bellanca 14-13	15	27,802	53.95
Bellanca 14-19	18	118,619	15.17
Boeing A-75	138	1,475,846	9.35
Callair A-9	50	164,482	30.40
Cessna 120/140	99	1,723,086	5.74
Cessna 150	390	15,137,844	2.58
Cessna 170	57	1,281,719	4.45
Cessna 172	232	10,013,792	2.32
Cessna 175	32	773,806	4.14
Cessna 180	47	1,793,611	2.62
Cessna 182	136	5,295,105	2.57
Cessna 185	11	426,909	2.58

TABLE 5 (continued)

Make and Model	Engine-Failure Accidents	Aircraft-Hours Flown	Engine-Failure Accidents Per 100,000 Aircraft-Hours Flown
Cessna 195	14	219,355	6.38
Cessna 210	72	1,353,610	5.32
Cessna 206	30	713,938	4.20
Cessna 188	14	123,747	11.31
Cessna 177	51	445,007	11.46
Forney 415	78	827,488	9.43
Grumman G-164	48	594,448	8.07
Luscombe 8	87	681,268	12.77
Mooney M20	133	3,082,733	4.31
Navion L-17	62	586,882	10.56
Piper J-3	99	1,157,927	8.55
Piper PA-12	44	567,934	7.75
Piper PA-16	8	116,006	6.90
Piper PA-18	93	2,068,290	4.50
Piper PA-20	12	183,352	6.54
Piper PA-22	275	3,848,707	7.14
Piper PA-24	137	2,823,300	4.85
Piper PA-25	116	1,665,856	6.96
Piper PA-28	322	10,262,616	3.14
Piper PA-32	53	700,336	7.57

TABLE 5 (continued)

Make and Model	Engine-Failure Accidents	Aircraft-Hours Flown	Engine-Failure Accidents Per 100,000 Aircraft-Hours Flown
Globe GC-1A, 1B	35	184,456	18.97
Stinson 108	71	603,908	11.76
Taylorcraft BC	30	514,106	5.84
All Others	322	3,468,103	9.28
TOTAL	3855	84,241,065	

TABLE 6

ENGINE-FAILURE ACCIDENTS, RATES
FOR SELECTED MAKE AND MODEL OF AIRCRAFT
MULTIENGINE AIRCRAFT
1965 – 1969

Make and Model	Engine-Failure Accidents	Aircraft-Hours Flown	Engine-Failure Accidents Per 100,000 Aircraft-Hours Flown
Aero Commander 500, 520, 560, 500S	31	727,664	4.26
Aero Commander 560F, 680, 680T	22	720,714	3.05
Beech, 18, C-45	53	2,178,848	2.43
Beech 50	7	621,980	1.12
Beech 65	14	1,083,477	1.29
Beech 95	45	935,668	4.81
Cessna 310	42	2,060,138	2.04
Cessna 320	11	474,226	2.32
Cessna 336, 337	22	614,553	3.58
Cessna 401, 402, 411, 421	7	574,370	1.22
DeHavilland DH104, DH114	7	100,385	6.97
Piper PA-23	103	3,328,122	3.09
Piper PA-30	28	1,259,670	2.22
Piper PA-31	2	165,628	1.21
Rear	2	194,920	1.03
All Others	59	5,130,045	1.15
TOTAL	455	20,170,408	

TABLE 7

COMPARISON OF ENGINE-FAILURE ACCIDENTS
FOR SELECTED MAKE AND MODEL OF AIRCRAFT
SINGLE-ENGINE AIRCRAFT

Make and Model	ENGINE-FAILURE ACCIDENTS Observed	Expected	$(F_o - F_e)^2/F_e$	
Aeronca 11	24	8	32.0	VH
Aeronca 15	17	3	65.3	VH
Aeronca 7	112	95	3.0	a
Beech 35	194	242	9.5	L
Beech 23	64	64	0	a
Beech A45, T34	13	11	0.4	a
Bellanca 14-13	15	1	196.0	No test
Bellanca 14-19	18	5	33.8	VH
Boeing A-75	138	68	72.1	VH
Callair A-9	50	8	220.5	VH
Cessna 120/140	99	79	5.1	H
Cessna 150	390	693	132.5	VL
Cessna 170	57	59	0.1	a
Cessna 172	232	458	111.5	VL
Cessna 175	32	35	0.2	a
Cessna 180	47	82	14.9	VL
Cessna 182	136	242	46.4	VL
Cessna 185	11	20	4.0	L

TABLE 7 (continued)

Make and Model	ENGINE-FAILURE ACCIDENTS Observed	Expected	$(F_o - F_e)^2/F_e$
Cessna 195	14	10	1.6 a
Cessna 210	72	62	1.6 a
Cessna 206	30	33	0.3 a
Cessna 188	14	6	10.7 H
Cessna 177	51	20	48.0 VH
Forney 415-C	78	38	42.1 VH
Grumman G-164	48	27	16.3 VH
Luscombe 8	87	31	101.2 VH
Mooney M20	133	141	0.4 a
Navion L-17	62	27	45.4 VH
Piper J-3	99	53	39.9 VH
Piper PA-12	44	26	12.5 VH
Piper PA-16	8	5	1.8 a
Piper PA-18	93	95	0.04 a
Piper PA-20	12	8	2.0 a
Piper PA-22	275	176	55.7 VH
Piper PA-24	137	129	0.5 a
Piper PA-25	116	76	21.0 VH
Piper PA-28	322	470	46.6 VL
Piper PA-32	53	32	13.8 VH
Globe GC-1A, 1B	35	8	91.1 VH

TABLE 7 (continued)

Make and Model	ENGINE-FAILURE ACCIDENTS Observed	Expected	$(F_o - F_e)^2/F_e$
Stinson 108	71	28	66.0 VH
Taylorcraft BC	30	24	1.5 a

TABLE 8

COMPARISON OF ENGINE-FAILURE ACCIDENTS
FOR SELECTED MAKE AND MODEL OF AIRCRAFT
MULTIENGINE AIRCRAFT

Make and Model	Observed	Expected	$(F_o - F_e)^2/F_e$	
Aero Commander 500, 520, 560, 500S	31	16	14.1	VH
Aero Commander 560F, 680, 680T	22	16	2.2	a
Beech 18, C-45	53	49	0.3	a
Beech 50	7	14	3.5	a
Beech 65	14	24	4.2	L
Beech 95	45	21	27.4	VH
Cessna 310	42	46	0.3	a
Cessna 320	11	11	0	a
Cessna 336, 337	22	14	4.6	H
Cessna 401, 402, 411, 421	7	13	2.8	a
Havilland DH 104, DH114	7	2	12.5	No test
Piper PA-23	103	75	10.4	H
Piper PA-30	28	28	0	a
Piper PA-31	2	4	1.0	a
	2	4	1.0	a

SECTION II

COMPARISON OF ENGINE-FAILURE ACCIDENT CAUSES(S)/FACTOR(S) BY SELECTED AIRCRAFT AND ENGINE MAKES AND MODELS

The purpose of Section II is to analyze the causes and related factors of engine-failure accidents by selected aircraft and engine makes and models. Four broad cause/factor categories were studied: (1) pilot-in-command, (2) maintenance, servicing, and inspection personnel, (3) powerplant, and (4) fuel exhaustion and fuel starvation.

Each cause/factor table included in Section II presents only those citations which fall within these four categories and thus does not represent the total causes/factors recorded. Also, the individual cause/factor citations refer only to the first type of accident (the engine failure or malfunction).

Several kinds of engine-failure accidents were excluded from the statistical base used in Section II. These are: (1) accidents which involved either homebuilt or experimental aircraft, (2) accidents which were caused by simulated engine failures, and (3) accidents in which the cause/factor citation was either "undetermined" or "powerplant failure for undetermined reasons."

Because these restrictions had to be imposed after the selection of a particular make and model, only those makes and models involved in at least 50 engine-failure accidents could be considered. Although arbitrary, this selection criterion was necessary in order to obtain adequate frequency distribution of the cause/factor citations.

A listing of aircraft makes and models selected for study in this section is given in Table 9, along with the number of eligible aircraft by make and model as of December 31, 1969.

Table 10 presents a summary of the number of engine-failure accidents by both aircraft makes and models and engine makes and models.

Aircraft Make and Model Causes/Factors

In Tables 11 through 36, detailed causes/factors for a particular aircraft make and model were compared with those of all other aircraft. To make the comparisons, the two-sample case of the normal approximation to the binomial technique was used.[2] The technique tested the hypothesis that $P_1 = P_2 = P$ where P_1 and P_2 represent the parameters of two binomial populations. The parameter P_1 was estimated by the sample proportion X_1/N_1, where X_1 represents the number of times a cause/factor (such as valve assemblies) was cited for a particular aircraft make and model involved in N_1 engine-failure accidents. P_2 was estimated by the sample proportion X_2/N_2 (the expected proportion), where X_2 represents the number of times the same cause/factor was cited for all aircraft involved in N_2 accidents, excluding the particular make and model in question. The hypothesis was tested on the basis of the statistic

$$Z = \frac{X_1/N_1 - X_2/N_2}{[\hat{P}(1-\hat{P})(1/N_1 + 1/N_2)]^{1/2}}$$

where $\hat{P} = (X_1 + X_2)/(N_1 + N_2)$.

Whenever the calculated Z value fell outside the range −1.96 to +1.96 it was concluded that P_1 was significantly different from P_2 at the 0.05 level of significance. This means that there is a 95-percent probability that P_1 and P_2 were genuinely different, and that the observed difference was not due to chance alone.

In Tables 11 through 36, an asterisk (*) denotes that the percent of total accidents involving a specific cause/factor citation was significantly greater than the expected percent at the 0.05 level of significance. A number sign (#) denotes the opposite of the asterisk. The absence of a symbol indicates that no significant difference was detected from the samples.

It should be noted that statistical significance does not necessarily imply practical significance. Taking for example the Cessna 150 aircraft (Table 18), even though the cause/factor, "operated carelessly," was cited only

[2]Freund, John E. *Mathematical Statistics*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1962.

once, the observed percentage was significantly higher than the expected percent. The practical significance of "operated carelessly" as a cause/factor is therefore questionable in Cessna 150 engine-failure accidents. In such a case, a subjective judgment or an engineering judgment has to be made.

Example. There were a total of 3,015 engine-failure accidents involving single-engine aircraft excluding undetermined causes/factors, homebuilt and experimental aircraft, and accidents involving simulated engine failures. Improper operation of powerplant and powerplant controls was cited as a cause/factor in 436 (14.5%) of these accidents. The Cessna 150 was involved in 280 engine-failure accidents, in 94 (33.6%) of which improper operation of powerplant and powerplant controls was cited as a cause/factor. The expected percent was the percentage of times in which improper operation of powerplant and powerplant controls was cited as a cause/factor for the set of all remaining makes and models, i.e., $(X_2/N_2) \times 100 = [(436-94)/(3015-280)] \times 100 = 12.5$. Calculation of the Z statistic yields

$$Z = \frac{33.6 - 12.5}{[(14.5)(85.5)(1/280 + 1/2735)]^{1/2}} = 9.6$$

which is larger than 1.96. Therefore, at the 0.05 level of significance, improper operation of powerplant and powerplant controls in the Cessna 150 was cited as a cause/factor of engine-failure accidents a significantly higher percentage of times than that of the remaining set of makes and models.

Summary of the comparisons. The causes and related factors involving human error which were significantly higher (*) or lower (#) than expected in percentage involvement by aircraft makes and models are summarized below.

With few exceptions, whenever mismanagement of fuel was significantly higher than expected for a particular aircraft, fuel starvation was also significantly higher than expected. The same was true when mismanagement of fuel was significantly lower than expected for a particular aircraft. More than 53% of the 167 engine-failure accidents involving the Beech 35 aircraft were associated with fuel starvation. The Piper PA-32, Callair A-9, Beech 23, Piper PA-28, and Piper PA-22 aircraft all had over 35% of their engine-failure accidents associated with fuel starvation. For these aircraft, a high percentage of the engine-failure accidents (more than 35%) were a result of the pilot mismanaging the fuel, which led to fuel starvation and an engine-failure accident.[3]

With few exceptions, whenever inadequate preflight preparation and/or planning for a particular aircraft was higher (lower) than expected, fuel exhaustion was also higher (lower) than expected for the same aircraft. The Cessna 177, Cessna 172, Piper PA-25, Cessna 182, Piper PA-24, Cessna 150, and Beech 18, C-45 aircraft had from 34.4% to 63.9% of their engine-failure accidents associated with fuel exhaustion. A high percentage of these engine-failure accidents (over 34%) also involved the pilot not making adequate preflight preparation or planning, perhaps becoming lost and disoriented, and exhausting the fuel which ended in an engine-failure accident.

Review of Tables 11 through 36 reveals that most of the engine-failure accidents for each aircraft make and model were caused by pilot-in-command error, such as inadequate preflight preparation and/or planning, mismanagement of fuel, and improper operation of powerplant controls. These same causal citations were found to be significant in engine-failure accidents which preceded stall/spins.[4] Increased emphasis to overcome these errors along with increased awareness of fuel starvation and fuel exhaustion could reduce the occurrence of

[3]The Bureau of Aviation Safety while under the Civil Aeronautics Board published a more detailed examination of fuel mismanagement as a cause/factor of engine-failure accidents. See study entitled "Aircraft Design - Induced Pilot Error," Civil Aeronautics Board, Report Number: PB 175-629, July 1967.

[4]National Transportation Safety Board, "General Aviation Stall/Spin Accidents," NTSB-AAS-72-8.

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Pilot-In-Command	
	Improper Inflight Decisions or Planning	
Cessna 172	11.7*	3.0
Mooney M20	11.2*	3.2
Piper PA-24	7.0*	3.4
	Became Lost/Disoriented	
Cessna 172	9.0*	2.8
Cessna 150	8.2*	2.6
	Lack of Familiarity With Aircraft	
Beech 35	6.6*	1.5
	Inadequate Supervision of Flight	
Piper PA-28	4.0*	1.1
Cessna 150	3.2*	1.2
	Spontaneous Improper Action	
Cessna 150	2.5*	.2
	Continued VFR Flight Into Adverse Weather Conditions	
Mooney M20	4.3*	1.2
Cessna 172	3.2*	1.2
	Failed to Follow Approved Procedures, Directives, etc.	
Luscombe 8	8.4*	.4

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Improper Operation of Powerplant and Powerplant Controls	
Cessna 150	33.6*	12.5
Piper PA-18	23.9*	14.2
Piper PA-22	9.5#	14.9
Beech 35	4.8#	15.0
Boeing A-75	3.7#	14.9
Navion L-17	3.6#	14.7
	Inadequate Preflight Preparation and/or Planning	
Cessna 177	61.1*	27.8
Piper PA-25	46.4*	27.7
Cessna 172	38.3*	27.5
Piper PA-18	16.2#	28.5
Beech 35	12.0#	29.1
Beech 23	10.0#	28.4
	Mismanagement of Fuel	
Beech 35	45.5*	16.3
Callair A-9	36.1*	17.7
Piper PA-32	31.7*	17.8
Piper PA-28	30.2*	17.0
Beech 23	30.0*	17.8
Piper PA-18	27.0*	17.7
Piper PA-22	25.9*	17.3

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Mismanagement of Fuel (continued)	
Cessna 150	10.4#	18.7
Piper PA-23	9.4#	28.3
Aeronca 7	8.5#	18.2
Piper PA-25	7.1#	18.3
Luscombe 8	7.0#	18.2
Forney 415	6.2#	18.2
Piper J-3	4.2#	18.3
Boeing A-75	3.7#	18.5
	Miscellaneous Acts and Conditions	
	Fuel Starvation	
[illegible]ech 35	53.2*	23.0
[illegible]r PA-32	46.3*	24.3
[illegible]ir A-9	41.7*	24.4
[illegible]ch 23	40.0*	24.4
[illegible]r PA-28	38.7*	23.5
[illegible]r PA-22	35.3*	23.8
[illegible] 182	14.5#	25.0
[illegible] 177	13.9#	24.8
[illegible]ca 7	13.4#	25.0
[illegible] 172	13.3#	25.4
[illegible]A-23	12.5#	30.5

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Fuel Starvation (continued)	
Piper PA-25	11.9#	25.0
Cessna 150	10.0#	26.1
Boeing A-75	7.4#	25.3
	Fuel Exhaustion	
Cessna 177	63.9*	24.7
Cessna 172	48.4*	23.6
Piper PA-25	44.0*	24.6
Cessna 182	41.8*	24.5
Piper PA-24	39.1*	24.6
Cessna 150	35.0*	24.2
Beech 18, C-45	34.4*	15.5
Piper PA-22	13.8#	26.1
Cessna 120/140	13.4#	25.5
Beech 35	12.6#	25.9
Forney 415	6.2#	25.6
Piper PA-18	5.4#	25.7
Piper PA-32	4.9#	25.5
	Personnel (Maintenance, Servicing, Inspection)	
	Inadequate Maintenance and Inspection	
Luscombe 8	16.9*	8.9
Stinson 108	16.4*	9.0
Cessna 150	4.6#	9.6

engine-failure accidents significantly for all aircraft.

The causes and related factors involving the powerplant which were significantly higher or lower than expected in percentage involvement by aircraft makes and models are summarized below.

The explanation for a particular aircraft having a significantly higher-than-expected percentage of engine-failure accidents for a specific powerplant cause/factor involves identification of the engines installed in the aircraft (Table 10).

The Piper PA-25 experienced significantly higher-than-expected engine-structure crankshaft problems. The engine most common to the Piper PA-25 was the Avco/Lycoming 0-540 series engine (Table 43), which had higher-than-expected involvement with engine-structure crankshaft problems. Likewise, the Pratt and Whitney Military R-985 series engine (Table 57), which most often powered the Boeing A-75, had higher-than-expected problems with engine-structure crankshaft.

The Mooney M20 and Boeing A-75 aircraft had significantly higher-than-expected involvement with master and connecting rods. The Mooney M20 was powered most often by the Avco/Lycoming 0-360 series engine (Table 41) and the Avco/Lycoming I0-360 series engine (Table 42).

The Pratt and Whitney R-985 engine used in the Boeing A-75 also had significantly higher-than-expected involvement with cylinder-assembly problems.

The frequency of piston and piston-ring problems was significantly higher than expected for the Navion L-17 and the Cessna 210. The Continental E-165 and E-185 series (Table 49) and Continental I0-470-D, -E, etc., (Table 54) engines were used in the Navion L-17. Both these engines had a higher-than-expected frequency of piston and piston-ring problems. The Cessna 210 was equipped with the Continental I0-470-D, -E, etc., and the Continental I0-520-A, -B, etc. engines (Table 55), which also had a significantly higher piston and piston ring cause/factor frequency.

Valve-assembly problems were significantly higher than expected for the Piper PA-18, Stinson 108, Piper PA-24, and Piper PA-22 aircraft. The engines installed in the Piper PA-18 were the Avco/Lycoming 0-290 and 0-320 series engines, both of which had higher-than-expected or significantly higher-than-expected valve-assembly problems (Tables 39 and 40). The Stinson 108 was powered by the Franklin 6A4, 6AG4 series engine (Table 56), which had significantly high valve-assembly problems. The Piper PA-24 was equipped with the Avco/Lycoming 0-360, Avco/Lycoming 0-540 (Table 43), and Avco/Lycoming I0-540 (Table 44) series engines, each of which had higher-than-expected valve-assembly problems. The Piper PA-22 was generally powered by the Avco/Lycoming 0-290 series engine (Table 39) and the Avco/Lycoming 0-320 series engines; both engines had a higher- or a significantly higher-than-expected number of engine-structure valve assembly cause/factor citations.

The Boeing A-75 equipped with the Pratt and Whitney Military R-985 series engine was the only aircraft make and model which had a significantly higher-than-expected number of problems with the engine-structure blower and impeller assembly.

The Stinson 108 aircraft had significantly higher-than-expected involvement with ignition-system magnetos.

The fuel-system carburetor caused a problem area for the Cessna 182 and the Boeing A-75. The Cessna 182 was powered by the Continental 0-470 engine (Table 53), which had a significantly higher-than-expected frequency of fuel-system carburetor cause/factor citations.

The Forney 415, powered by the Continental C-75 and C-85 series engine (Table 46), had higher-than-expected involvement in the fuel-system pumps causal area, as did the Beech 35 aircraft with the Continental E-225 and Continental I0-470 engines (Tables 51 and 54).

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Engine Structure – Crankshaft	
Piper PA-25	4.8*	1.8
Boeing A-75	4.6*	1.8
	Engine Structure – Master and Connecting Rods	
Mooney M-20	6.0*	2.3
Boeing A-75	5.6*	2.4
	Engine Structure – Cylinder Assembly	
Boeing A-75	13.9*	1.6
	Engine Structure – Piston, Piston Rings	
Navion L-17	7.3*	2.0
Cessna 210	6.9*	2.0
	Engine Structure – Valve Assemblies	
Piper PA-18	13.5*	3.9
Stinson 108	13.1*	4.0
Piper PA-24	8.7*	4.0
Piper PA-22	7.8*	3.9
Beech 35	1.2#	4.4
	Engine Structure – Blower, Impeller Assembly	
Boeing A-75	3.7*	.3
	Ignition System– Magnetos	
Stinson 108	6.6*	1.8

Aircraft	Percent of Total Engine-Failure Accidents	Expected Percent
	Fuel System–Carburetor	
Cessna 182	8.2*	3.0
Boeing A-75	6.5*	3.1
	Fuel System – Pumps	
Forney 415	6.2*	.7
Beech 35	4.2*	.6
	Fuel System – Vents, Drains, Tank Caps	
Aeronca 7	4.9*	1.3
Piper PA-24	3.5*	1.3
	Lubricating System – Lines, Hoses, Fittings	
Piper PA-23	12.5*	.0
	Lubricating System – Filters, Screens	
Beech 35	2.4*	.1
	Lubricating System – Seals and Gaskets	
Piper PA-22	1.7*	.2
	Exhaust Systems – Mufflers	
Piper PA-25	6.0*	.4
Piper PA-22	1.7*	.4
	Powerplant Instruments – Fuel Quantity Gauge	
Cessna 177	11.1*	1.1

Vents, drains, and tank caps were a problem for the Aeronca 7 aircraft with the Avco/Lycoming 0-235 series engine (Table 38). Likewise, the Piper PA-24 aircraft with the Avco/Lycoming 0-540 series engine had a significantly higher-than-expected number of problems with its fuel-system vents, drains, and tank caps.

The Piper PA-23 when powered by Avco/Lycoming 0-320 series engine was the only aircraft which had significant citations concerning the lubricating-system lines, hoses, and fittings.

The Beech 35 aircraft, powered by the Continental E-225, Continental 0-470, Continental I0-470, and Continental I0-520 series engines, had more problems than expected with the lubricating-system filters and screens, with no single engine dominating the problem area.

Lubricating-system seals and gaskets caused more problems than expected for the Avco/Lycoming 0-290 and the Avco/Lycoming 0-320 series engines, both of which were used in the Piper PA-22 aircraft.

The Piper PA-25 aircraft had higher-than-expected involvement with exhaust-system mufflers cause/factor citations. This aircraft experienced the majority of its engine-failure accidents with the Avco/Lycoming 0-320 and the Avco/Lycoming 0-540 series engine, both of which were either higher-or significantly higher-than-expected in the exhaust-system muffers causal area. Likewise, the Piper PA-22, powered by the Avco-Lycoming 0-290 and 0-320 series engines, experienced significantly higher-than-expected problems with its exhaust-system mufflers.

The Cessna 177 aircraft with the Avco/Lycoming 0-320 series engine had significantly higher-than-expected involvement in the powerplant-instruments-fuel quantity gauge causal area.

TABLE 9

ELIGIBLE AIRCRAFT
BY SELECTED MAKE AND MODEL
December 31, 1969

Make and Model	Eligible Aircraft
Aeronca 7	3,626
Beech 18	1,357
Beech 23	1,411
Beech 35	7,099
Boeing A-75	1,048
Callair A-9	119
Cessna 120/140	3,064
Cessna 150	10,221
Cessna 170	2,599
Cessna 172	11,135
Cessna 177	1,052
Cessna 182	7,485
Cessna 210	1,931
Piper J-3	2,329
Piper PA-18	2,372
Piper PA-22	4,925
Piper PA-23	3,120
Piper PA-24	3,368
Piper PA-25	1,642

TABLE 9 (continued)

Make and Model	Eligible Aircraft
Piper PA-28	10,805
Piper PA-32	1,311
Forney 415	1,660
Luscombe 8	1,771
Mooney M20	3,977
Navion L-17	1,159
Stinson 108	1,697

TABLE 10

ENGINE FAILURE ACCIDENTS PER SELECTED AIRCRAFT MAKES AND MODELS AND ENGINE MAKES AND MODELS

Engine Make and Model	Aeronca 7	Beech 18	Beech 23	Beech 35	Boeing A-75	Callair A-9	Cessna 120/140	Cessna 150	Cessna 170	Cessna 172	Cessna 177	Cessna 182	Cessna 210	Forney 415	Luscombe 8	Mooney M20	Navion L-17	Piper J-3	Piper PA-18,18A	Piper PA-22	Piper PA-23	Piper PA-24	Piper PA-25	Piper PA-28	Piper PA-32	Stinson 108
Avco/Lycoming:																										
O-145-A																		1								
O-145-B, -C																		2								
O-235	7																	4	2	40				1		
O-290	4														1			8	13	60			1			
O-320	5		20			5				6	35					8	1	1	57	132	48	1	15	131		
O-340																					1					
O-360			1			1				1						70					1	24		54		
IO-360			3								1					38								12		
O-435																										2
GO-435									2								10									
GO-480																	7									
O-540						22											1				6	77	67	27	29	
IO-540						8															7	11	1		12	
R-670					1																					
R-680-B4					1																					
R-680-E					3																					
IO-720																						2				
Continental:																										
A-65	35													1	43			32	1							
A-75														1	2			6								
C-75, C-85	8						70							51	19			12								
C-90	20						12	1						12	6			5	1							
C-145									35	3																
E-165, E-185				52									1				29									
O-200	3							279		1																
E-225				39																						
O-300									7	174																
GO-300										2																
IO-346			16										1													
IO-360																										
O-470				15						1		107					2									
IO-470-A, -C				13								1	7													
IO-470-D, -E, etc.				27								2	30				4									
TSIO-470													1													
IO-520				20									11				1									
TSIO-520				1									6													
GTSIO-520													1													
R-670-A					1																					
R-670-B					1																					
W-670					10																					
Curtiss-Wright:																										
R-975, A,B,D,E,					1																					
Military R-975					1																					
Franklin:																										
6A4, 6AG4									1																	59
6VS0																					1					
Jacobs:																										
R-755					2																					
Pratt and Whitney:																										
Military R-985		30			77																					
Military R-1340					8																					
WASP, JR.					2																					
Airesearch:																										
TPE 331		2																								
TOTAL	72	32	40	167	108	36	82	280	45	188	36	110	58	65	71	116	55	71	74	232	64	115	84	225	41	61

TABLE 11 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
AERONCA 7 AIRCRAFT

TOTAL ACCIDENTS - 82

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	26	31.7	28.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	17	20.7	14.3
MISMANAGEMENT OF FUEL	7	8.5#	18.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4	4.9	3.5
BECAME LOST/DISORIENTED	2	2.4	3.2
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.2	1.8
SPONTANEOUS-IMPROPER ACTION	1	1.2	.4
PHYSICAL-IMPAIRMENT	1	1.2	.2
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	10	12.2	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	2.4	1.4
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	1.2	.8
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	1.2	.3
POWERPLANT			
FUEL SYSTEM - CARBURETOR	5	6.1	3.1
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	4	4.9*	1.3
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	3.7	4.2
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	2.4	2.5
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	2	2.4	.9
ENGINE STRUCTURE - CRANKSHAFT	1	1.2	1.9
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	1.2	2.1
FUEL SYSTEM - LINES AND FITTINGS	1	1.2	1.0
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.2	.5
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	1.2	.3
PROPELLER AND ACCESSORIES - OTHER	1	1.2*	.03
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	28	34.1	24.9
FUEL STARVATION	11	13.4#	25.0

TABLE 12 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 18, C-45 AIRCRAFT

TOTAL ACCIDENTS - 32

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	11	34.4	23.0
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	10	31.2	25.7
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	3	9.4	10.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	9.4	5.3
IMPROPER IFR OPERATION	2	6.2*	.4
BECAME LOST/DISORIENTED	1	3.1	1.9
INADEQUATE SUPERVISION OF FLIGHT	1	3.1	.8
PHYSICAL IMPAIRMENT	1	3.1*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	1	3.1	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	3.1	.4
POWERPLANT			
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	3.1	3.8
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	3.1	3.0
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	3.1	1.9
FUEL SYSTEM - PUMPS	1	3.1	.8
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	3.1	1.9
COMPRESSOR ASSEMBLY - OTHER	1	3.1*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	11	34.4*	15.5
FUEL STARVATION	9	28.1	26.4

TABLE 13 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 23 AIRCRAFT

TOTAL ACCIDENTS - 40

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	12	30.0*	17.8
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	8	20.0	14.4
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	4	10.0#	28.4
INADEQUATE MAINTENANCE AND INSPECTION	4	10.0	9.1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	5.0	3.5
LACK OF FAMILIARITY WITH AIRCRAFT	2	5.0	1.7
DELAYED IN INITIATING GO-AROUND	1	2.5*	.03
BECAME LOST/DISORIENTED	1	2.5	3.2
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	2.5*	.2
EXERCISED POOR JUDGMENT	1	2.5	.6
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	2.5	1.4
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	2.5	.8
POWERPLANT			
FUEL SYSTEM - CARBURETOR	3	7.5	3.2
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	5.0	2.0
FUEL SYSTEM - PUMPS	2	5.0*	.7
ENGINE STRUCTURE - CRANKCASE	1	2.5*	.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	2.5	4.2
ENGINE STRUCTURE - OTHER	1	2.5	1.2
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	2.5	.9
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	16	40.0*	24.4
FUEL EXHAUSTION	5	12.5	25.3

TABLE 14 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE BEECH 35 AIRCRAFT

TOTAL ACCIDENTS - 167

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	76	45.5*	16.3
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	20	12.0#	29.1
BECAME LOST/DISORIENTED	13	1.8	3.2
LACK OF FAMILIARITY WITH AIRCRAFT	11	6.6*	1.5
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	8	4.8#	15.0
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	5	3.0	3.6
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2	1.2*	.2
INADEQUATE SUPERVISION OF FLIGHT	2	1.2	1.4
IMPROPER STARTING PROCEDURE	2	1.2*	0.0
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	.6	.8
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.6	.6
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.6	.2
IMPROPER IFR OPERATION	1	.6*	0.0
MISJUDGED DISTANCE AND ALTITUDE	1	.6*	0.0
PHYSICAL IMPAIRMENT	1	.6	.2
FAILED TO ABORT TAKEOFF	1	.6*	.07
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	17	10.2	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	4	2.4	1.4
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	3	1.8*	.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.6	.7
POWERPLANT			
FUEL SYSTEM - PUMPS	7	4.2*	.6
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	5	3.0	2.5
ENGINE STRUCTURE - PISTON, PISTON RINGS	4	2.4	2.1
FUEL SYSTEM - LINES AND FITTINGS	4	2.4	.9
FUEL SYSTEM - CARBURETOR	4	2.4	3.3
LUBRICATING SYSTEM - FILTERS, SCREENS	4	2.4*	.1
ENGINE STRUCTURE - CRANKSHAFT	3	1.8	1.9
ENGINE STRUCTURE - CYLINDER ASSEMBLY	3	1.8	2.1
ENGINE STRUCTURE - OTHER	3	1.8	1.2
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	1.2#	4.4
IGNITION SYSTEM - SPARK PLUG	2	1.2	1.5
FUEL SYSTEM - SELECTOR VALVES	2	1.2	.7
FUEL SYSTEM - RAM AIR ASSEMBLY	2	1.2*	.1
IGNITION SYSTEM - MAGNETOES	1	.6	2.0
IGNITION SYSTEM - DISTRIBUTOR	1	.6*	.04
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.6	.5
FUEL SYSTEM - PRIMING SYSTEM	1	.6*	.1
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	.6	.4
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.6	1.4
FUEL SYSTEM - OTHER	1	.6	.2
LUBRICATING SYSTEM - PUMP-PRESSURE	1	.6	.1
LUBRICATING SYSTEM - PUMP-SCAVENGER	1	.6*	.04
LUBRICATING SYSTEM - SEALS AND GASKETS	1	.6	.3
EXHAUST SYSTEM - MANIFOLDS	1	.6*	.04
ENGINE ACCESSORIES - STARTERS	1	.6*	0.0
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.6	1.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	89	53.3*	23.0
FUEL EXHAUSTION	21	12.6#	25.9

TABLE 15 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
BOEING A-75 AIRCRAFT

TOTAL ACCIDENTS - 108

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	35	32.4	28.0
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	4	3.7#	14.9
MISMANAGEMENT OF FUEL	4	3.7#	18.5
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.9	.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	.9	3.6
LACK OF FAMILIARITY WITH AIRCRAFT	1	.9	1.8
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	5.6	9.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	2	1.9	.8
POWERPLANT			
ENGINE STRUCTURE - CYLINDER ASSEMBLY	15	13.9*	1.6
FUEL SYSTEM - CARBURETOR	7	6.5*	3.1
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	6	5.6*	2.4
ENGINE STRUCTURE - CRANKSHAFT	5	4.6*	1.8
ENGINE STRUCTURE - OTHER	5	4.6*	1.1
ENGINE STRUCTURE - BLOWER, IMPELLER ASSEMBLY	4	3.7*	.3
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	2.8	4.2
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.9	2.1
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	1.9	1.3
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	2	1.9	1.2
IGNITION SYSTEM - SPARK PLUG	1	.9	1.5
FUEL SYSTEM - LINES AND FITTINGS	1	.9	1.0
FUEL SYSTEM - RAM AIR ASSEMBLY	1	.9	.1
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	.9	.5
MISCELLANEOUS - FOREIGN OBJECT DAMAGE	1	.9*	.0
MISCELLANEOUS - DETONATION	1	.9	.1
REDUCTION GEAR ASSEMBLY - OTHER	1	.9*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	32	29.6	25.0
FUEL STARVATION	8	7.4#	25.3

TABLE 16 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CALLAIR A-9 AIRCRAFT

TOTAL ACCIDENTS - 36

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	13	36.1*	17.7
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	12	33.3	28.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	2	5.6	14.6
EXERCISED POOR JUDGMENT	2	5.6*	.6
IMPROPER OPERATION OF FLIGHT CONTROLS	1	2.3*	.2
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	3	8.3*	.7
INADEQUATE MAINTENANCE AND INSPECTION	2	5.6	9.2
POWERPLANT			
ENGINE STRUCTURE - CRANKSHAFT	2	5.6	1.8
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	5.6	4.2
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	2.3	2.5
ENGINE STRUCTURE - OTHER	1	2.3	1.2
ENGINE CONTROLS - COCKPIT - INDUCTION AIR, PREHEAT CONTROLS	1	2.3*	.2
REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIVE	1	2.3*	.07
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	15	41.7*	24.4
FUEL EXHAUSTION	4	11.1	25.3

TABLE 17 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 120/140 AIRCRAFT

TOTAL ACCIDENTS - 82

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	18	22.0	28.4
MISMANAGEMENT OF FUEL	17	20.7	17.9
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	15	18.3	14.4
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	2	2.4*	.5
LACK OF FAMILIARITY WITH AIRCRAFT	2	2.4	1.7
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	2.4	3.6
BECAME LOST/DISORIENTED	1	1.2	3.2
INADEQUATE SUPERVISION OF FLIGHT	1	1.2	1.4
FAILED TO INITIATE GO-AROUND	1	1.2*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	7	8.5	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	2.4	1.4
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	2	2.4*	.3
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.2	.7
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.2	.8
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	5	6.1	4.1
FUEL SYSTEM - CARBURETOR	5	6.1	3.1
IGNITION SYSTEM - SPARK PLUG	3	3.7	1.5
ENGINE STRUCTURE - CRANKSHAFT	2	2.4	1.8
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	2.4	2.5
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	2.4	2.1
FUEL SYSTEM - LINES AND FITTINGS	2	2.4	.9
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	1.2	2.1
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.2*	.2
FUEL SYSTEM - SELECTOR VALVES	1	1.2	.8
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	1.2	1.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	24	29.3	24.5
FUEL EXHAUSTION	11	13.4#	25.5

TABLE 18 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CESSNA 150 AIRCRAFT

TOTAL ACCIDENTS - 280

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	94	33.6*	12.5
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	78	27.9	28.2
MISMANAGEMENT OF FUEL	29	10.4#	18.7
BECAME LOST/DISORIENTED	23	8.2*	2.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	11	3.9	3.5
INADEQUATE SUPERVISION OF FLIGHT	9	3.2*	1.2
SPONTANEOUS IMPROPER ACTION	7	2.5*	.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	5	1.8	1.2
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	2	.7	.3
EXERCISED POOR JUDGMENT	2	.7	.6
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	.4	.9
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	.4	.07
LACK OF FAMILIARITY WITH AIRCRAFT	1	.4	1.9
OPERATED CARELESSLY	1	.4*	.04
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS	1	.4*	.0
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS	1	.4*	.0
PHYSICAL IMPAIRMENT	1	.4	.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	13	4.6#	9.6
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	.7	1.5
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	9	3.2	2.0
ENGINE STRUCTURE - VALVE ASSEMBLIES	6	2.1	4.4
IGNITION SYSTEM - MAGNETOES	5	1.8	1.9
FUEL SYSTEM - CARBURETOR	5	1.8	3.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	4	1.4	2.6
ENGINE STRUCTURE - CYLINDER ASSEMBLY	4	1.4	2.1
IGNITION SYSTEM - SPARK PLUG	3	1.1	1.6
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	3	1.1*	.3
LUBRICATING SYSTEM - OTHER	3	1.1*	.3
ENGINE STRUCTURE - OTHER	2	.7	1.2
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	2	.7	.5
ENGINE STRUCTURE - CRANKSHAFT	1	.4	2.0
FUEL SYSTEM - LINES AND FITTINGS	1	.4	1.0
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.4	1.5
LUBRICATING SYSTEM - MAGNETIC PLUGS	1	.4*	.0
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.4	1.0
INDUCTION AIR, PREHEAT CONTROLS	1	.4	.2
OTHER	1	.4*	.0
ENGINE INDICATING EQUIPMENT - TACHOMETER	1	.4*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	98	35.0*	24.2
FUEL STARVATION	28	10.0#	26.1

TABLE 19 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 170 AIRCRAFT

TOTAL ACCIDENTS - 45

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	17	37.8	28.0
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	8	17.8	14.4
MISMANAGEMENT OF FUEL	4	8.9	18.1
BECAME LOST/DISORIENTED	1	2.2	3.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	2.2	3.6
EXERCISED POOR JUDGMENT	1	2.2	.6
MISUSED OR FAILED TO USE FLAPS	1	2.2*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	2.2	.8
POWERPLANT			
ENGINE STRUCTURE - CYLINDER ASSEMBLY	3	6.7*	2.0
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	6.7*	2.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	6.7	4.1
INADEQUATE MAINTENANCE AND INSPECTION	2	4.4	9.2
IGNITION SYSTEM - SPARK PLUG	1	2.2	1.5
FUEL SYSTEM - SELECTOR VALVES	1	2.2	.7
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	2.2	1.3
LUBRICATING SYSTEM - OTHER	1	2.2*	.3
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	9	20.0	25.3
FUEL STARVATION	7	15.6	24.8

TABLE 20 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CESSNA 172 AIRCRAFT

TOTAL ACCIDENTS - 188

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	72	38.3*	27.5
MISMANAGEMENT OF FUEL	27	14.4	18.2
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	26	13.8	14.5
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	22	11.7*	3.0
BECAME LOST/DISORIENTED	17	9.0*	2.8
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	6	3.2*	1.2
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.5	.4
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	.5	.07
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.5	.6
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.5	.2
INADEQUATE SUPERVISION OF FLIGHT	1	.5	1.4
LACK OF FAMILIARITY WITH AIRCRAFT	1	.5	1.8
EXERCISED POOR JUDGMENT	1	.5	.6
MISJUDGED SPEED	1	.5*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	14	7.4	9.2
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	2	1.1	.8
POWERPLANT			
IGNITION SYSTEM - SPARK PLUG	4	2.1	1.5
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	1.6	4.4
IGNITION SYSTEM - MAGNETOES	3	1.6	1.9
FUEL SYSTEM - CARBURETOR	3	1.6	3.3
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	1.1	2.6
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.1	2.2
FUEL SYSTEM - SELECTOR VALVES	2	1.1	.7
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	1.1	1.4
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	2	1.1	.3
ENGINE STRUCTURE - OTHER	1	.5	1.2
IGNITION SYSTEM - SWITCHES	1	.5	.07
FUEL SYSTEM - LINES AND FITTINGS	1	.5	1.0
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.5	.5
LUBRICATING SYSTEM - VALVES	1	.5*	.03
LUBRICATING SYSTEM - FILTERS, SCREENS	1	.5	.2
ENGINE CONTROLS - COCKPIT -			
THROTTLE - POWER LEVER ASSEMBLIES	1	.5	1.0
MIXTURE CONTROL ASSEMBLIES	1	.5	.5
INDUCTION AIR, PREHEAT CONTROLS	1	.5	.2
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	.5	1.3
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	91	48.4*	23.6
FUEL STARVATION	25	13.3#	25.4

TABLE 21 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CESSNA 177 AIRCRAFT

TOTAL ACCIDENTS - 36

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	22	61.1*	27.8
MISMANAGEMENT OF FUEL	8	22.2	17.9
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	5	13.9	14.5
BECAME LOST/DISORIENTED	3	8.3*	3.1
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	2.8	1.3
INADEQUATE SUPERVISION OF FLIGHT	1	2.8	1.3
POWERPLANT			
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	4	11.1*	1.1
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	5.6*	1.3
FUEL SYSTEM - SELECTOR VALVES	1	2.8	.7
FUEL SYSTEM - CARBURETOR	1	2.8	3.2
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	2.8*	.3
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	23	63.9*	24.7
FUEL STARVATION	5	13.9#	24.8

TABLE 22 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CESSNA 182 AIRCRAFT

TOTAL ACCIDENTS - 110

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	34	30.9	28.1
MISMANAGEMENT OF FUEL	19	17.3	18.0
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	12	10.9	14.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	6	5.5	3.5
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	3	2.7*	.8
BECAME LOST/DISORIENTED	1	.9	3.2
EXERCISED POOR JUDGMENT	1	.9	.6
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	14	12.7	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	.9	1.5
IMPROPER MAINTENANCE(OWNER PERSONNEL)	1	.9	.7
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	.9	.2
POWERPLANT			
FUEL SYSTEM - CARBURETOR	9	8.2*	3.0
ENGINE STRUCTURE - VALVE ASSEMBLIES	7	6.4	4.1
FUEL SYSTEM - TANKS	3	2.7	.3
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	3	2.7	1.3
ENGINE STRUCTURE - CRANKSHAFT	2	1.8	1.9
IGNITION SYSTEM - MAGNETOES	2	1.8	1.9
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	.9	2.1
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	.9	2.2
ENGINE STRUCTURE - OTHER	1	.9	1.2
IGNITION SYSTEM - SPARK PLUG	1	.9	1.5
FUEL SYSTEM - LINES AND FITTINGS	1	.9	1.0
FUEL SYSTEM - RAM AIR ASSEMBLY	1	.9	.1
FUEL SYSTEM - OTHER	1	.9	.2
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.9	.3
LUBRICATING SYSTEM - VALVES	1	.9*	.03
LUBRICATING SYSTEM - OTHER	1	.9	.3
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.9	1.0
INDUCTION AIR, PREHEAT CONTROLS	1	.9	.2
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	.9	1.3
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	46	41.8*	24.5
FUEL STARVATION	16	14.5#	25.0

TABLE 23 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CESSNA 210 AIRCRAFT

TOTAL ACCIDENTS - 58

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	13	22.4	17.9
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	10	17.2	28.4
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	4	6.9	14.6
LACK OF FAMILIARITY WITH AIRCRAFT	3	5.2*	1.7
BECAME LOST/DISORIENTED	2	3.4	3.1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	3.4	3.6
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	1.7	.8
ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL	1	1.7	.3
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	1.7	1.3
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	1.7*	.2
SELECTED UNSUITABLE TERRAIN	1	1.7*	.07
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	10.3	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.7	1.5
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	1.7	.3
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	4	6.9*	2.0
ENGINE STRUCTURE - CYLINDER ASSEMBLY	3	5.2	2.0
ENGINE STRUCTURE - CRANKSHAFT	2	3.4	1.8
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	3.4	2.5
IGNITION SYSTEM - SPARK PLUG	2	3.4	1.5
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	3.4	1.3
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	2	3.4	1.2
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	1.7	4.2
ENGINE STRUCTURE - OTHER	1	1.7	1.2
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.7*	.2
IGNITION SYSTEM - OTHER	1	1.7*	.03
FUEL SYSTEM - TANKS	1	1.7	.4
FUEL SYSTEM - SELECTOR VALVES	1	1.7	.7
FUEL SYSTEM - PUMPS	1	1.7	.8
FUEL SYSTEM - RAM AIR ASSEMBLY	1	1.7*	.1
LUBRICATING SYSTEM - FILTERS, SCREENS	1	1.7*	.2
PROPELLER AND ACCESSORIES - BLADES	1	1.7*	.0
EXHAUST SYSTEM - GASKETS	1	1.7*	.0
EXHAUST SYSTEM - STACKS	1	1.7*	.1
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	1.7	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	20	34.5	24.5
FUEL EXHAUSTION	10	17.2	25.3

TABLE 24 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
FORNEY 415 AIRCRAFT

TOTAL ACCIDENTS - 65

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	23	35.4	28.0
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	12	18.5	14.4
MISMANAGEMENT OF FUEL	4	6.2#	18.2
BECAME LOST/DISORIENTED	2	3.1	3.2
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	1.5	.8
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	1.5	.2
INADEQUATE SUPERVISION OF FLIGHT	1	1.5	1.4
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	4	6.2	9.2
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.5	.7
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	1.5	.3
POWERPLANT			
FUEL SYSTEM - PUMPS	4	6.2*	.7
ENGINE STRUCTURE - CRANKSHAFT	2	3.1	1.8
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	3.1	2.5
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	3.1	4.2
FUEL SYSTEM - CARBURETOR	2	3.1	3.2
ENGINE STRUCTURE - OTHER	1	1.5	1.2
IGNITION SYSTEM - MAGNETOES	1	1.5	1.9
FUEL SYSTEM - LINES AND FITTINGS	1	1.5	.9
FUEL SYSTEM - OTHER	1	1.5*	.2
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	1.5	.9
POWER LEVER - CABLE	1	1.5*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	18	27.7	24.6
FUEL EXHAUSTION	4	6.2#	25.6

TABLE 25 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
LUSCOMBE 8 AIRCRAFT

TOTAL ACCIDENTS - 71

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	19	26.8	28.2
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	14	19.7	14.3
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	6	8.4*	.4
MISMANAGEMENT OF FUEL	5	7.0#	18.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	2.8	3.6
EXERCISED POOR JUDGMENT	2	2.9*	.6
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	1.4	.3
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	1.4	1.3
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	1.4	.2
INADEQUATE SUPERVISION OF FLIGHT	1	1.4	1.4
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.4	1.8
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	12	16.9*	8.9
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	2.8	1.4
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.4	.7
POWERPLANT			
FUEL SYSTEM - CARBURETOR	5	7.0	3.1
ENGINE STRUCTURE - CRANKSHAFT	3	4.2	1.8
IGNITION SYSTEM - MAGNETOES	2	2.8	1.9
FUEL SYSTEM - LINES AND FITTINGS	2	2.8	.9
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	2	2.8*	.5
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	2.8	1.3
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	2	2.8	.9
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	1.4	2.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	1.4	4.2
ENGINE STRUCTURE - OTHER	1	1.4	1.2
FUEL SYSTEM - SELECTOR VALVES	1	1.4	.7
EXHAUST SYSTEM - BAFFLES	1	1.4*	.07
MISCELLANEOUS - DETONATION	1	1.4*	.1
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	14	19.7	25.3
FUEL STARVATION	13	18.3	24.8

TABLE 26 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
MOONEY M20 AIRCRAFT

TOTAL ACCIDENTS - 116

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	34	29.3	28.1
MISMANAGEMENT OF FUEL	26	22.4	17.8
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	13	11.2*	3.2
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	11	9.5	14.7
BECAME LOST/DISORIENTED	5	4.3	3.1
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	5	4.3*	1.2
LACK OF FAMILIARITY WITH AIRCRAFT	3	2.6	1.7
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	1.7	.8
INADEQUATE SUPERVISION OF FLIGHT	2	1.7	1.3
PHYSICAL IMPAIRMENT	1	.9	.2
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	5.2	9.3
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	.9	1.5
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	.9	.7
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.9	.8
POWERPLANT			
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	7	6.0*	2.3
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	2.6	4.2
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	1.7	2.1
FUEL SYSTEM - CARBURETOR	2	1.7	3.3
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	1.7	1.3
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	2	1.7	1.2
ENGINE STRUCTURE - CRANKSHAFT	1	.9	1.9
ENGINE STRUCTURE - OTHER	1	.9	1.2
IGNITION SYSTEM - MAGNETOES	1	.9	2.0
FUEL SYSTEM - LINES AND FITTINGS	1	.9	1.0
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	.9	.3
FUEL SYSTEM - OTHER	1	.9	.2
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.9	.3
LUBRICATING SYSTEM - OIL COOLERS	1	.9*	.1
LUBRICATING SYSTEM - SEALS AND GASKETS	1	.9	.3
LUBRICATING SYSTEM - OTHER	1	.9	.3
ENGINE CONTROLS - COCKPIT -			
THROTTLE - POWER LEVER ASSEMBLIES	1	.9	1.0
INDUCTION AIR, PREHEAT CONTROLS	1	.9	.2
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	37	31.9	24.4
FUEL EXHAUSTION	34	29.3	25.0

TABLE 27 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE NAVION L-17 AIRCRAFT

TOTAL ACCIDENTS - 55

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	14	25.5	28.2
MISMANAGEMENT OF FUEL	8	14.5	18.0
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	5.5	3.5
BECAME LOST/DISORIENTED	2	3.6	3.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	2	3.6#	14.7
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.8	1.8
MISJUDGED SPEED AND ALTITUDE	1	1.8*.	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	7	12.7	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.8	1.5
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.8	.7
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	1.8*	.2
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	1.8*	.1
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	4	7.3*	2.0
ENGINE STRUCTURE - CRANKSHAFT	3	5.5*	1.8
ENGINE STRUCTURE - CYLINDER ASSEMBLY	3	5.5	2.0
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	5.5*	1.2
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	3.6	2.5
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	3.6	4.2
FUEL SYSTEM - LINES AND FITTINGS	2	3.6*	.9
IGNITION SYSTEM - MAGNETOES	1	1.8	1.9
IGNITION SYSTEM - SPARK PLUG	1	1.8	1.5
FUEL SYSTEM - TANKS	1	1.8	.4
FUEL SYSTEM - SELECTOR VALVES	1	1.8	.7
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.8	.5
FUEL SYSTEM - CARBURETOR	1	1.8	3.2
FUEL SYSTEM - PUMPS	1	1.8	.8
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	1.8	1.4
PROPELLER AND ACCESSORIES			
HYDRAULIC PITCH CONTROL MECHANISM	1	1.8*	.0
EXHAUST SYSTEM - MUFFLERS	1	1.8	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	17	30.9	25.1
FUEL STARVATION	12	21.8	24.7

TABLE 28 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER J-3 AIRCRAFT

TOTAL ACCIDENTS - 71

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	20	28.2	28.2
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	17	23.9*	14.2
MISMANAGEMENT OF FUEL	3	4.2#	18.3
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	2.8	.8
ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL	1	1.4	.3
BECAME LOST/DISORIENTED	1	1.4	3.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	1.4	1.3
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1	1.4*	.03
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	1.4	3.6
INADEQUATE SUPERVISION OF FLIGHT	1	1.4	1.4
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.4	1.8
EXERCISED POOR JUDGMENT	1	1.4	.6
SPONTANEOUS IMPROPER ACTION	1	1.4	.4
FAILED TO ABORT TAKEOFF	1	1.4*	.07
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	11	15.5	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.4	1.5
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.4	.8
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	5	7.0	4.1
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	4.2	2.1
IGNITION SYSTEM - MAGNETOES	3	4.2	1.9
FUEL SYSTEM - CARBURETOR	3	4.2	3.2
FUEL SYSTEM - PRIMING SYSTEM	2	2.8*	.07
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	1.4	2.5
ENGINE STRUCTURE - OTHER	1	1.4	1.2
FUEL SYSTEM - LINES AND FITTINGS	1	1.4	1.0
LUBRICATING SYSTEM - PUMP-PRESSURE	1	1.4*	.1
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	1.4	1.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	13	18.3	25.3
FUEL STARVATION	13	18.3	24.8

TABLE 29 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PIPER PA-18 AIRCRAFT

TOTAL ACCIDENTS - 74

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	20	27.0*	17.7
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	12	16.2#	28.5
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	11	14.9	14.5
LACK OF FAMILIARITY WITH AIRCRAFT	3	4.1	1.7
INADEQUATE SUPERVISION OF FLIGHT	1	1.4	1.4
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.4	1.5
INADEQUATE MAINTENANCE AND INSPECTION	7	9.5	9.1
IMPROPER MAINTENANCE (OWNER PERSONNEL)	2	2.7*	.6
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.4	.8
OTHER	1	1.4*	.03
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	10	13.5*	3.9
FUEL SYSTEM - CARBURETOR	3	4.1	3.2
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	2.7	2.5
IGNITION SYSTEM - MAGNETOES	2	2.7	1.9
IGNITION SYSTEM - SPARK PLUG	2	2.7	1.5
FUEL SYSTEM - SELECTOR VALVES	2	2.7	.7
ENGINE STRUCTURE - CRANKSHAFT	1	1.4	1.9
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	1.4	2.1
ENGINE STRUCTURE - OTHER	1	1.4	1.2
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.4*	.2
LUBRICATING SYSTEM - SEALS AND GASKETS	1	1.4	.3
EXHAUST SYSTEM - MUFFLERS	1	1.4	.5
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	1.4	.5
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	1.4	1.3
POWERPLANT-INSTRUMENTS (FUEL QUANTITY GUAGE	1	1.4	1.3
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	23	31.1	24.5
FUEL EXHAUSTION	4	5.4#	25.7

TABLE 30 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-22 AIRCRAFT

TOTAL ACCIDENTS - 232

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	65	28.0	28.2
MISMANAGEMENT OF FUEL	60	25.9*	17.3
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	22	9.5#	14.9
BECAME LOST/DISORIENTED	7	3.0	3.2
LACK OF FAMILIARITY WITH AIRCRAFT	7	3.0	1.7
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4	1.7	3.7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	3	1.3	1.3
EXERCISED POOR JUDGMENT	3	1.3	.6
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	.9	.8
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	2	.9	.5
INADEQUATE SUPERVISION OF FLIGHT	2	.9	1.4
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.4	.2
PHYSICAL IMPAIRMENT	1	.4	.3
SPATIAL DISORIENTATION	1	.4*	.04
PSYCHOLOGICAL CONDITION	1	.4*	.04
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	20	8.6	9.2
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	3	1.3	1.5
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	2	.9	.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.4	.8
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	.4	.1
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	18	7.8*	3.9
ENGINE STRUCTURE - PISTON, PISTON RINGS	6	2.6	2.1
ENGINE STRUCTURE - CYLINDER ASSEMBLY	4	1.7	2.1
IGNITION SYSTEM - MAGNETOES	4	1.7	1.9
IGNITION SYSTEM - SPARK PLUG	4	1.7	1.5
FUEL SYSTEM - CARBURETOR	4	1.7	3.3
LUBRICATING SYSTEM - SEALS AND GASKETS	4	1.7*	.2
EXHAUST SYSTEM - MUFFLERS	4	1.7*	.4
FUEL SYSTEM - LINES AND FITTINGS	3	1.3	.9
FUEL SYSTEM - SELECTOR VALVES	3	1.3	.7
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	3	1.3	.4
ENGINE STRUCTURE - CRANKSHAFT	2	.9	1.9
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	.9	2.6
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	2	.9	.5
LUBRICATING SYSTEM - OIL COOLERS	2	.9*	.07
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	2	.9	1.3
ENGINE STRUCTURE - CRANKCASE	1	.4	.1
IGNITION SYSTEM - LEADS	1	.4	.07
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.4	1.4
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.4	.4
EXHAUST SYSTEM - STACKS	1	.4	.1
EXHAUST SYSTEM - BAFFLES	1	.4	.07
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.4	1.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	82	35.3*	23.8
FUEL EXHAUSTION	32	13.8#	26.1

TABLE 31 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-23 AIRCRAFT

TOTAL ACCIDENTS - 64

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	20	31.2	24.9
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	9	14.1	9.4
MISMANAGEMENT OF FUEL	6	9.4#	28.3
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4	6.2	5.6
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	3	4.7	2.6
BECAME LOST/DISORIENTED	2	3.1	1.7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	1.6	.4
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	1.6	.4
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT	1	1.6*	.0
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1	1.6*	.0
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	1.6	4.3
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.6	2.6
SPATIAL DISORIENTATION	1	1.6*	.0
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	1	1.6*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	9.4	8.2
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.6	.4
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.6*	.0
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.6	.4
POWERPLANT			
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	8	12.5*	.0
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	3.1	1.7
IGNITION SYSTEM - SPARK PLUG	2	3.1	2.1
ENGINE STRUCTURE - CRANKSHAFT	1	1.6*	.0
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	1.6	3.4
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	1.6	1.3
IGNITION SYSTEM - MAGNETOES	1	1.6	1.7
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.6*	.0
FUEL SYSTEM - SELECTOR VALVES	1	1.6	1.3
FUEL SYSTEM - CARBURETOR	1	1.6	.9
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	1.6	2.1
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	1.6	2.1
FUEL SYSTEM - RAM AIR ASSEMBLY	1	1.6*	.0
LUBRICATING SYSTEM - SEALS AND GASKETS	1	1.6*	.0
LUBRICATING SYSTEM - OTHER	1	1.6	.9
PROPELLER AND ACCESSORIES - OTHER	1	1.6*	.0
EXHAUST SYSTEM - MANIFOLDS	1	1.6*	.0
MISCELLANEOUS - OTHER	1	1.6*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	8	12.5#	30.5
FUEL EXHAUSTION	7	10.9	19.3

TABLE 32 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-24 AIRCRAFT

TOTAL ACCIDENTS - 115

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	38	33.0	28.0
MISMANAGEMENT OF FUEL	25	21.7	17.8
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	12	10.4	14.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	8	7.0*	3.4
BECAME LOST/DISORIENTED	4	3.5	3.1
LACK OF FAMILIARITY WITH AIRCRAFT	3	2.6	1.7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	2	1.7	1.3
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.9	.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	7	6.1	9.2
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	3	2.6	1.4
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	.9*	.1
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	10	8.7*	4.0
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	4	3.5*	1.3
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	3	2.6	2.5
IGNITION SYSTEM - SPARK PLUG	3	2.6	1.5
FUEL SYSTEM - TANKS	3	2.6*	.3
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	2.6	1.2
ENGINE STRUCTURE - CRANKSHAFT	2	1.7	1.9
ENGINE STRUCTURE - OTHER	2	1.7	1.2
FUEL SYSTEM - CARBURETOR	2	1.7	3.3
LUBRICATING SYSTEM - SEALS AND GASKETS	2	1.7*	.3
EXHAUST SYSTEM - MUFFLERS	2	1.7	.5
FUEL SYSTEM - LINES AND FITTINGS	1	.9	1.0
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	.9	.3
LUBRICATING SYSTEM - FILTERS, SCREENS	1	.9	.2
LUBRICATING SYSTEM - PUMP-PRESSURE	1	.9	.1
LUBRICATING SYSTEM - OIL COOLERS	1	.9*	.1
EXHAUST SYSTEM - MANIFOLDS	1	.9*	.03
ENGINE ACCESSORIES - OTHER	1	.9*	.0
ENGINE CONTROLS - COCKPIT -			
THROTTLE - POWER LEVER ASSEMBLIES	1	.9	1.0
MIXTURE CONTROL ASSEMBLIES	1	.9	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	45	39.1*	24.6
FUEL STARVATION	27	23.5	24.7

TABLE 33 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-25 AIRCRAFT

TOTAL ACCIDENTS - 84

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	39	46.4*	27.7
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	10	11.9	14.5
MISMANAGEMENT OF FUEL	6	7.1#	18.3
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	1.2	3.6
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	12	14.3	9.0
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	3	3.4*	.7
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	2.4	1.4
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	1.2	.2
POWERPLANT			
EXHAUST SYSTEM - MUFFLERS	5	6.0*	.4
ENGINE STRUCTURE - CRANKSHAFT	4	4.8*	1.8
IGNITION SYSTEM - MAGNETOES	3	3.4	1.9
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	3	3.4	1.3
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	3.6	1.2
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	2.4	4.2
IGNITION SYSTEM - SPARK PLUG	2	2.4	1.5
FUEL SYSTEM - SELECTOR VALVES	2	2.4	.7
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	1.2	2.5
IGNITION SYSTEM - LOW TENSION WIRING	1	1.2*	.03
IGNITION SYSTEM - HIGH TENSION WIRING	1	1.2*	.0
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.2*	.2
IGNITION SYSTEM - SWITCHES	1	1.2*	.07
FUEL SYSTEM - TANKS	1	1.2	.4
FUEL SYSTEM - CARBURETOR	1	1.2	3.3
EXHAUST SYSTEM - STACKS	1	1.2*	.1
EXHAUST SYSTEM - BAFFLES	1	1.2*	.07
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	1.2	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	37	44.0*	24.6
FUEL STARVATION	10	11.9#	25.0

TABLE 34 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-28 AIRCRAFT

TOTAL ACCIDENTS - 225

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	68	30.2*	17.0
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	51	22.7	28.6
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	34	15.1	14.4
BECAME LOST/DISORIENTED	11	4.9	3.0
INADEQUATE SUPERVISION OF FLIGHT	9	4.0*	1.1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	8	3.6	3.5
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	6	2.7	1.2
LACK OF FAMILIARITY WITH AIRCRAFT	5	2.2	1.7
EXERCISED POOR JUDGMENT	3	1.3	.6
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	.9	.8
ATTEMPTED OPERATION BEYOND EXPER/ABILITY LEVEL	1	.4	.4
DELAYED IN INITIATING GO-AROUND	1	.4	.04
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.4	.6
SPATIAL DISORIENTATION	1	.4	.04
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	15	6.7	9.3
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	.9	1.5
IMPROPER MAINTENANCE (OWNER PERSONNEL)	2	.9	.7
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	.4	.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.4	.8
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	.4	.4
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	14	6.2	4.0
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	7	3.1	2.4
IGNITION SYSTEM - SPARK PLUG	5	2.2	1.5
ENGINE STRUCTURE - OTHER	3	1.3	1.2
IGNITION SYSTEM - MAGNETOES	3	1.3	2.0
FUEL SYSTEM - CARBURETOR	3	1.3	3.4
FUEL SYSTEM - FUEL INJECTION SYSTEM	3	1.3*	.3
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	3	1.3	1.4
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	1.3	1.3
ENGINE STRUCTURE - CRANKCASE	2	.9*	.07
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	.9	2.2
FUEL SYSTEM - LINES AND FITTINGS	2	.9	1.0
LUBRICATING SYSTEM - OTHER	2	.9	.3
EXHAUST SYSTEM - MUFFLERS	2	.9	.5
ENGINE STRUCTURE - CRANKSHAFT	1	.4	2.0
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	.4	2.3
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	.4	.2
FUEL SYSTEM - SELECTOR VALVES	1	.4	.8
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.4	.5
FUEL SYSTEM - PUMPS	1	.4	.8
FUEL SYSTEM - OTHER	1	.4	.2
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.4	.4
LUBRICATING SYSTEM - FILTERS, SCREENS	1	.4	.3
LUBRICATING SYSTEM - SEALS AND GASKETS	1	.4	.3
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.4	1.0
MISCELLANEOUS - OTHER	1	.4*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	87	38.7*	23.5
FUEL EXHAUSTION	46	20.4	25.6

TABLE 35 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
PIPER PA-32 AIRCRAFT

TOTAL ACCIDENTS - 41

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	13	31.7*	17.8
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	7	17.1	28.3
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	4	9.8	14.5
LACK OF FAMILIARITY WITH AIRCRAFT	3	7.3*	1.7
INADEQUATE SUPERVISION OF FLIGHT	2	4.9	1.3
BECAME LOST/DISORIENTED	1	2.4	3.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	2.4	1.3
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	2.4	3.6
OPERATED CARELESSLY	1	2.4*	.03
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	4.9	1.4
INADEQUATE MAINTENANCE AND INSPECTION	1	2.4	9.2
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	4.9	4.2
FUEL SYSTEM - CARBURETOR	2	4.9	3.2
ENGINE STRUCTURE - CRANKSHAFT	1	2.4	1.8
ENGINE STRUCTURE - OTHER	1	2.4	1.2
IGNITION SYSTEM - MAGNETOES	1	2.4	1.9
FUEL SYSTEM - SELECTOR VALVES	1	2.4	.7
FUEL SYSTEM - PUMPS	1	2.4	.8
FUEL SYSTEM - FUEL INJECTION SYSTEM	1	2.4	.3
FUEL SYSTEM - OTHER	1	2.4*	.2
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	2.4	.9
POWERPLANT-INSTRUMENTS (FUEL QUANTITY GUAGE	1	2.4	1.2
REDUCTION GEAR ASSEMBLY - GEARS, ACCESS DRIVE	1	2.4	.07
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	19	46.3*	24.3
FUEL EXHAUSTION	2	4.9#	25.5

TABLE 36 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
STINSON 108 AIRCRAFT

TOTAL ACCIDENTS - 61

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
ADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	12	19.7	28.4
PROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	10	16.4	14.4
MANAGEMENT OF FUEL	9	14.8	18.0
NTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	2	3.3	1.2
MPTED OPERATION BEYOND EXPER/ABILITY LEVEL	1	1.6	.3
NE LOST/DISORIENTED	1	1.6	3.2
OF FAMILIARITY WITH AIRCRAFT	1	1.6	1.8
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
DEQUATE MAINTENANCE AND INSPECTION	10	16.4*	9.0
ROPER MAINTENANCE (OWNER PERSONNEL)	2	3.3*	.6
ROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.6	1.5
POWERPLANT			
NE STRUCTURE - VALVE ASSEMBLIES	8	13.1*	4.0
TION SYSTEM - MAGNETOES	4	6.6*	1.8
SYSTEM - CARBURETOR	4	6.6	3.1
E STRUCTURE - CRANKSHAFT	2	3.3	1.8
E STRUCTURE - MASTER AND CONNECTING RODS	2	3.3	2.5
STRUCTURE - CYLINDER ASSEMBLY	1	1.6	2.1
STRUCTURE - PISTON, PISTON RINGS	1	1.6	2.1
STRUCTURE - MOUNT AND VIBRATION ISOLATORS	1	1.6*	.0
ION SYSTEM - SPARK PLUG	1	1.6	1.5
ION SYSTEM - LOW TENSION WIRING	1	1.6*	.03
SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.6	.5
ATING SYSTEM - LINES, HOSES, FITTINGS	1	1.6	.3
LANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	1.6	1.3
MISCELLANEOUS ACTS AND CONDITIONS			
STARVATION	16	26.2	24.6
EXHAUSTION	9	14.8	25.4

Engine Make and Model Causes/Factors

The causes/factors associated with the engines involved in the 3,312 engine-failure accidents being considered in Section II are presented in Table 37. The pilot was a cause/factor in the majority (64.31%) of the accidents while the powerplant was a cause/factor in 38.82% of the occurrences.

Predominant pilot-in-command causes/factors were: inadequate preflight preparation and/or planning, mismanagement of fuel, and improper operation of powerplant and powerplant controls. Improper and inadequate maintenance was involved as a cause/factor in 420 occurrences or 12.68% of the 3,312 accidents. The leading powerplant causes/factors involved the engine structure and fuel system; for example, valve assemblies (130), master and connecting rods (86), cylinder assembly (71), piston and piston rings (70), and carburetor (100) were the most-recorded citations.

To investigate the problems which caused engine-failure accidents, twenty engine types were examined using the same technique described in the previous subsection concerning aircraft makes and models. The comparisons made of the causes/factors for each engine make and model are presented in Tables 38 through 57. Of particular interest were the powerplant causes/factors, because these involved mechanical or equipment problems that resulted in engine-failure accidents.

Summary of the Comparisons. Powerplant causes/factors which were significantly higher (*) or lower (#) than expected in percentage involvement by engine makes and models are summarized below.

The predominant causes and factors involved engine structures. For example, 13.0% of the engine-failure accidents involving the Avco/Lycoming IO-360 engine were attributed to the master and connecting rods. Failure of piston and piston rings were a cause in 11.9% of the Continental IO-520 engine-failure accidents, while valve assemblies were cited in 11.1% of the Franklin 6A4, 6AG4 engine-failure accidents. The cylinder assembly was cited as a cause/factor in 10.8% of the engine-failure accidents involving the Pratt and Whitney R-985 engine and in 9.2% of the Continental IO-470 engine-failure accidents.

All the 20 engines considered in this study, excluding the Pratt and Whitney Military R-985 series engine, are basically the same type of engine, i.e., horizontally opposed engines. (The Pratt and Whitney R-985 is a radial engine). For the horizontally opposed engines, engine-structure valve assemblies were cited as a cause/factor in 119 (4.4%) of the 2,709 engine-failure accidents while for the Pratt and Whitney engine 1.4% of the 139 engine-failure accidents were attributed to valve assemblies. The Avco/Lycoming engines had frequent valve-assembly involvements, with this causal area being higher-than-expected or significantly higher-than-expected for the 0-290, 0-320, 0-360, 0-540 and IO-540 series engines.

Some of the engines considered in this study are very old and may be out of production, such as the Continental A-65, C-75, C-85 and C-90 series engines, and many of the problems associated with these engines may have already been recognized and corrective action taken by the issuance of service bulletins by the manufacturers. There still remains in use today, however, a large number of these older engines in the general aviation fleet. Owners and operators of the older aircraft should be cognizant of the problems which the older engines had which led to engine-failure accidents. Maintenance personnel should be certain that they comply with the most recent manufacturer's service bulletins and Federal Aviation Administration's airworthiness directives when repairing older engines.

Engine	Percent of Total Engine-Failure Accidents	Expected Percent
	Engine Structure – Crankshaft	
Continental IO-520	6.0*	1.6
Continental IO-470	5.1*	1.6
Avco/Lycoming O-320	.6#	1.9
	Engine Structure – Master and Connecting Rods	
Avco/Lycoming IO-360	13.0*	2.4
Continental IO-470	6.1*	2.5
Pratt and Whitney Military R-985	5.8*	2.5
Avco/Lycoming O-540	.4#	2.8
	Engine Structure – Cylinder Assembly	
Pratt and Whitney Military R-985	10.8*	1.8
Continental IO-470	9.2*	1.9
	Engine Structure – Piston, Piston Rings	
Continental IO-520	11.9*	1.9
	Engine Structure – Valve Assemblies	
Franklin 6A4, 6AG4	11.1*	3.9
Lycoming O-320	6.8*	3.4
	Engine Structure – Blower, Impeller Assembly	
Pratt and Whitney Military R-985	5.0*	.2
	Ignition System – Magnetos	
Franklin 6A4, 6AG4	6.9*	1.8

Engine	Percent of Total Engine-Failure Accidents	Expected Percent
	Fuel System – Tanks	
Avco/Lycoming O-540	1.7*	.4
	Fuel System – Lines and Fittings	
Continental IO-470	4.1*	.9
	Fuel System – Carburetor	
Continental O-470	6.2*	3.2
Avco/Lycoming O-540	.9#	3.6
	Fuel System –Pumps	
Continental E-225	8.5*	.7
	Fuel System – Vents, Drains, Tank Caps	
Avco/Lycoming O-235	4.0*	1.3
Avco/Lycoming O-540	3.5*	1.3
	Lubricating System – Lines, Hoses, Fittings	
Avco/Lycoming O-320	1.6*	.4
	Exhaust System – Mufflers	
Avco/Lycoming O-290	3.5*	.4
Avco/Lycoming O-540	1.7*	.4
	Engine Controls – Cockpit Throttle – Power Lever Assemblies	
Continental A-65	2.3*	.8
Continental C-75, C-85	2.2*	.8

TABLE 37

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
ALL ENGINES
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS
INVOLVES 220 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	150 68.18	11 5.00	150 68.18	1977 63.94	66 2.13	1980 64.04	2127 64.22	77 2.32	2130 64.31
PERSONNEL	38 17.27	6 2.73	44 20.00	393 12.71	31 1.00	423 13.68	431 13.01	37 1.12	467 14.10
AIRFRAME	1 .45	.00	1 .45	1 .03	.00	1 .03	2 .06	.00	2 .06
LANDING GEAR	.00	.00	.00	1 .03	.00	1 .03	1 .03	.00	1 .03
POWERPLANT	72 32.73	3 1.36	74 33.64	950 30.72	68 2.20	1013 32.76	1022 30.86	71 2.14	1087 32.82
SYSTEMS	.00	1 .45	1 .45	16 .52	1 .03	17 .55	16 .48	2 .06	18 .54
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .45	.00	1 .45	5 .16	5 .16	10 .32	6 .18	5 .15	11 .33
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	1 .03	1 .03	2 .06	1 .03	1 .03	2 .06
WEATHER	12 5.45	20 9.09	30 13.64	143 4.62	161 5.21	301 9.73	155 4.68	181 5.46	331 9.99
TERRAIN	.00	.00	.00	.00	.00	.00	.00	.00	.00
MISCELLANEOUS	10 4.55	.00	10 4.55	114 3.69	8 .26	122 3.95	124 3.74	8 .24	132 3.99
UNDETERMINED	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE 37 (CONTINUED)

CAUSE/FACTOR TABLE

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	6	1	7	22	5	27	28	6	34
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	3		3	8	1	9	11	1	12
BECAME LOST/DISORIENTED	8		8	82	11	93	90	11	101
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	9		9	28	4	32	37	4	41
DELAYED IN INITIATING GO-AROUND				2		2	2		2
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				3	2	5	3	2	5
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	2		2	1		1	3		3
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	7		7	9		9
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	23	4	27	24	4	28
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	25		25	442		442	467		467
IMPROPER OPERATION OF FLIGHT CONTROLS				7		7	7		7
IMPROPER IFR OPERATION	1		1	3		3	4		4
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	13		13	104	7	111	117	7	124
IMPROPER COMPENSATION FOR WIND CONDITIONS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	61	1	62	861	5	866	922	6	928
INADEQUATE SUPERVISION OF FLIGHT				44		44	44		44
LACK OF FAMILIARITY WITH AIRCRAFT	4	6	10	28	22	50	32	28	60
MISMANAGEMENT OF FUEL	59		59	553	1	554	612	1	613
EXERCISED POOR JUDGMENT	2		2	17		17	19		19
OPERATED CARELESSLY				1	1	2	1	1	2
SELECTED UNSUITABLE TERRAIN				3		3	3		3
IMPROPER STARTING PROCEDURES	1		1	2		2	3		3
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				1		1	1		1
SPONTANEOUS-IMPROPER ACTION				12		12	12		12
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				1		1	1		1
MISJUDGED DISTANCE AND SPEED		1	1					1	1
MISJUDGED DISTANCE AND ALTITUDE					1	1		1	1
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED SPEED				1		1	1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
INCAPACITATION	5	1	6	3		3	8	1	9
PHYSICAL IMPAIRMENT	1		1	2		2	3		3
SPATIAL DISORIENTATION		1	1		1	1		2	2
PSYCHOLOGICAL CONDITION					2	2		2	2
MISUSED OR FAILED TO USE FLAPS					1	1		1	1
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	3		3	1		1	4		4
FAILED TO ABORT TAKEOFF				1		1	1		1
FAILED TO INITIATE GO-AROUND	1		1	11		11	12		12
DIRECT ENTRIES									
SUBTOTAL	207	11	218	2280	68	2348	2487	79	2566
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				1		1	1		1
DIRECT ENTRIES				1		1	1		1
SUBTOTAL				4		4	4		4
DUAL STUDENT									
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1

TABLE 37 (CONTINUED)

DUAL STUDENT (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				17		17	17		17
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	5		5
LACK OF FAMILIARITY WITH AIRCRAFT					1	1		1	1
MISMANAGEMENT OF FUEL				10	1	11	10	1	11
SPONTANEOUS-IMPROPER ACTION				1		1	1		1
SUBTOTAL				35	2	37	35	2	37
** PERSONNEL **									
FLIGHT INSTRUCTOR									
INADEQUATE SUPERVISION OF FLIGHT				2	1	3	2	1	3
INADEQUATE TRAINING OF STUDENT				7	3	10	7	3	10
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	5		5	41		41	46		46
IMPROPER MAINTENANCE(OWNER PERSONNEL)	3		3	17	2	19	20	2	22
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				9	2	11	9	2	11
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	1		1	23	2	25	24	2	26
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)	2		2	9		9	11		11
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)		1	1	3		3	3	1	4
INADEQUATE MAINTENANCE AND INSPECTION	25	4	29	259	12	271	284	16	300
OTHER				2		2	2		2
UNK/NR	1		1				1		1
OPERATIONAL SUPERVISORY PERSONNEL									
INADEQUATE SUPERVISION OF FLIGHT CREW		1	1					1	1
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT				1		1	1		1
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS				1	1	2	1	1	2
WEATHER PERSONNEL									
INCORRECT WEATHER FORECAST	1		1		1	1	1	1	2
INCOMPLETE WEATHER REPORT	1		1				1		1
INADEQUATE/INCORRECT WEATHER BRIEFING				1		1	1		1
TRAFFIC CONTROL PERSONNEL									
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				1		1	1		1
AIRPORT SUPERVISORY PERSONNEL									
IMPROPER MAINTENANCE-AIRPORT FACILITIES				2		2	2		2
FAILURE TO NOTIFY OF UNSAFE CONDITION					1	1		1	1
IMPROPER INSPECTION OF FACILITIES				1	1	2	1	1	2
OTHER					1	1		1	1
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN									
INCORRECT FACTORY INSTALLATION	1		1	5		5	6		6
POOR/INADEQUATE DESIGN	1		1	6	2	8	7	2	9
OTHER	1		1	3	1	4	4	1	5
MISCELLANEOUS-PERSONNEL									
PASSENGER				4	1	5	4	1	5
OTHER				1		1	1		1
DIRECT ENTRIES				2		2	2		2
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	42	6	48	400	31	431	442	37	479
** AIRFRAME **									
WINGS									
BRACING WIRES, STRUTS	1		1				1		1
FUSELAGE									
WINDSHIELDS, WINDOWS, CANOPIES				1		1	1		1
LANDING GEAR									
NORMAL RETRACTION/EXTENSION ASSEMBLY				1		1	1		1
FLIGHT CONTROL SURFACES									
AILERON, SURFACES ATTACHMENTS	1		1				1		1
SUBTOTAL	2		2	2		2	4		4
** POWERPLANT **									
ENGINE STRUCTURE									
CRANKCASE				6		6	6		6
CRANKSHAFT	2		2	54	1	55	56	1	57

TABLE 37 (CONTINUED)

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
MASTER AND CONNECTING RODS	6		6	80		80	86		86
CYLINDER ASSEMBLY	3	1	4	67		67	70	1	71
PISTON, PISTON RINGS	6	1	7	62	1	63	68	2	70
VALVE ASSEMBLIES	6		6	123	1	124	129	1	130
BLOWER, IMPELLER ASSEMBLY				14		14	14		14
MOUNT AND VIBRATION ISOLATORS				1		1	1		1
OTHER	5		5	36		36	41		41
IGNITION SYSTEM	6	1	7	55	1	56	61	2	63
MAGNETOES	1		1	1		1	2		2
DISTRIBUTOR	8	1	9	41	3	44	49	4	53
SPARK PLUG				1		1	1		1
COILS				2		2	2		2
LOW TENSION WIRING				1		1	1		1
HIGH TENSION WIRING				7	1	8	7	1	8
IGNITION HARNESS, SHIELDING				3		3	3		3
SWITCHES	1		1	3		3	4		4
LEADS				2		2	2		2
OTHER									
FUEL SYSTEM				11	4	15	11	4	15
TANKS	3		3	29	2	31	32	2	34
LINES AND FITTINGS	4		4	21	2	23	25	2	27
SELECTOR VALVES	2		2	14	1	15	16	1	17
FILTERS, STRAINERS, SCREENS	2		2	2		2	4		4
PRIMING SYSTEM	10		10	89	1	90	99	1	100
CARBURETOR	6		6	21		21	27		27
PUMPS	4		4	12	1	13	16	1	17
FUEL INJECTION SYSTEM	1		1	38	8	46	39	8	47
VENTS, DRAINS, TANK CAPS				6		6	6		6
RAM AIR ASSEMBLY	1		1	6		6	7		7
OTHER									
LUBRICATING SYSTEM				18	1	19	18	1	19
LINES, HOSES, FITTINGS				2		2	2		2
VALVES				8		8	8		8
FILTERS, SCREENS				5		5	5		5
PUMP-PRESSURE				2		2	2		2
PUMPS-SCAVENGER				4		4	4		4
OIL COOLERS				1		1	1		1
MAGNETIC PLUGS				11		11	11		11
SEALS AND GASKETS				13	1	14	13	1	14
OTHER									
COOLING SYSTEM				1		1	1		1
BAFFLES				1		1	1		1
OTHER									
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES				1		1	1		1
HYDRAULIC PITCH CONTROL MECHANISM	1		1	2		2	3		3
OTHER									
EXHAUST SYSTEM				3		3	3		3
MANIFOLDS	1		1	14	1	15	15	1	16
MUFFLERS				1		1	1		1
GASKETS				6		6	6		6
STACKS				3		3	3		3
BAFFLES									
ENGINE ACCESSORIES				1		1	1		1
STARTERS				1		1	1		1
OTHER									
ENGINE CONTROLS-COCKPIT	1		1	28	1	29	29	1	30
THROTTLE-POWER LEVER ASSEMBLIES	1		1	15		15	16		16
MIXTURE CONTROL ASSEMBLIES				6		6	6		6
INDUCTION AIR, PREHEAT CONTROLS				1		1	1		1
OTHER									
POWERPLANT-INSTRUMENTS		1	1	4	40	44	4	41	45
FUEL QUANTITY GAUGE									
MISCELLANEOUS				2		2	2		2
BIRD INGESTION				1		1	1		1
FOREIGN OBJECT DAMAGE				1		1	1		1
COMPRESSOR STALLS				6		6	6		6
DETONATION	1/2		1/2	1		1	2		2
				40	1	41	42	1	43

TABLE 37 (CONTINUED)

POWERPLANT (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
OTHER									
COMPRESSOR ASSEMBLY				1		1	1		1
OTHER									
COMBUSTION ASSEMBLY	1		1				1		1
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
OTHER									
SAFETY SYSTEM				1		1	1		1
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
OTHER									
PROPELLER SYSTEM				1		1	1		1
GOVERNOR									
CONSTANT SPEED DRIVE				1		1	1		1
GOVERNOR VALVE									
POWER LEVER				1		1	1		1
CABLE				1		1	1		1
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
TACHOMETER									
ENGINE INSTALLATION				1		1	1		1
SUBTOTAL	85	5	90	1023	72	1095	1108	77	1185
** SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES					1	1			
GENERATORS/ALTERNATORS				1		1	1	1	1
HYDRAULIC SYSTEM									1
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS									
CARBURETOR DE-ICING SYSTEM				14		14	14		14
OTHER				1		1	1		1
AIR CONDITION, HEATING AND PRESSURIZATION									
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM		1	1					1	1
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	16	1	17	16	2	18
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
COMPASS				1		1	1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
TRANSMITTERS AND/OR RECEIVERS				1	3	4	1	3	4
VOR RECEIVERS				1	3	4	1	3	4
COMPASS RECEIVERS	1		1	1		1	2		2
OTHER				1	1	2	1	1	2
MISCELLANEOUS EQUIPMENT									
SPRAY, DUSTING EQUIPMENT				1		1	1		1
SUBTOTAL	1		1	6	7	13	7	7	14
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS									
SNOW ON RUNWAY				1	1	2	1	1	2
AIRWAYS FACILITIES									

TABLE 37 (CONTINUED)

AIRPORTS/AIRWAYS/FACILITIES (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL				1	1	2	1	1	2
** WEATHER **	1	11	12	2	24	26	3	35	38
LOW CEILING		4	4	2	9	11	2	13	15
RAIN	1	3	4	3	15	18	4	18	22
FOG	2	3	5		6	6	2	9	11
SNOW	4	2	6	8	13	21	12	15	27
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	9	8	17	131	98	229	140	106	246
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING		1	1		8	8		9	9
UNFAVORABLE WIND CONDITIONS		1	1	1	1	1	1	2	2
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS					1	1			1
LOCAL WHIRLWIND					4	4		4	4
ADVERSE WINDS ALOFT		2	2					2	2
HIGH TEMPERATURE		1	1		6	6	1	7	7
OBSTRUCTIONS TO VISION		1	1	1	5	6		6	7
HIGH DENSITY ALTITUDE		1	1		4	4		5	5
THUNDERSTORM ACTIVITY					1	1		1	1
OTHER	17	38	55	148	194	342	165	232	397
SUBTOTAL									
** MISCELLANEOUS **				1		1	1		1
BIRD COLLISION				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				5	4	9	5	4	9
UNQUALIFIED PERSON OPERATED AIRCRAFT				1		1	1		1
SABOTAGE	9		9	102	4	106	111	4	115
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	1		1	5		5	6		6
DIRECT ENTRIES	10		10	115	8	123	125	8	133
SUBTOTAL	364	61	425	4030	384	4414	4394	445	4839
GRAND TOTAL									
** MISCELLANEOUS ACTS, CONDITIONS **	16		16	388	4	392	404	4	408
ANTI-ICING/DEICING EQUIP-IMPROPER OPER, OF/FAILED TO USE	1	1	2	4	10	14	5	11	16
CHECKLIST-FAILED TO USE	1		1				1		1
CREW COORDINATION-POOR				1	1	2	1	1	2
DISREGARD OF GOOD OPERATING PRACTICE	6	2	8	8	12	20	14	14	28
IMPROPER EMERGENCY PROCEDURES	1		1				1		1
FEATHERED WRONG ENGINE				2	2			2	2
INSTRUMENTS-MISREAD OR FAILED TO READ				1	1			1	1
SEAT BELT NOT FASTENED				2	2			2	2
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA				4	4			4	4
UNWARRANTED LOW FLYING	13	1	14	115	26	141	128	27	155
INATTENTIVE TO FUEL SUPPLY				1	6	7	1	6	7
POORLY PLANNED APPROACH	3	2	5	70	17	87	73	19	92
MISCALCULATED FUEL CONSUMPTION					8	8		8	8
JETTISONED LOAD	1	2	3		5	5	1	7	8
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	4		4	37	3	40	41	3	44
IMPROPERLY SECURED				3		3	3		3
BOGUS PART				4	3	7	4	3	7
ELECTRICAL FAILURE	1		1	96	14	110	97	14	111
ENGINE LOADED UP	5		5	44	1	45	49	1	50
FATIGUE FRACTURE				7		7	7		7
FUEL GRADE-IMPROPER				2		2	2		2
IMPROPER GRADE OIL-LUBRICATING SYSTEM					2	2		2	2
RPM-UNCONTROLLABLE-OVERSPEED					2	2		3	3
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION		1	1			1	1	1	2
WRONG PART		1	1	1		1	1	1	2
IMPROPER ALIGNMENT/ADJUSTMENT	4		4	18	1	19	22	61	23
FAILURE OF TWO OR MORE ENGINES	7	8	15	21	53	74	28	12	89
SEPARATION IN FLIGHT		1	1	1	11	12	1	2	13
FIRE IN ENGINE	1		1	2	2	4	3	1	5
CORRODED/CORROSION	1		1	6	1	7	7	2	8
CONGESTED TRAFFIC-PATTERN		2	2	1		1	1	3	3
PILOT FATIGUE	1		1		3	3	1	1	4
FUEL EXHAUSTION	44	1	45	766	2	766	810	1	811
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	1		1	60		62	61	2	63

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT									
CARBON MONOXIDE POISONING	5	2	7	4		4	9	2	11
ICE-IN FUEL		1	1					1	1
ICE-ENGINE	1		1	10	2	12	11	2	13
ICE-CARBURETOR	1		1	5		5	6		6
ICE-PROPELLER	16		16	324	7	331	340	7	347
AIRFRAME ICE				1		1	1		1
ICE-WINDSHIELD				5	4	9	5	4	9
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG				1		1	1		1
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1	3	4		2	2	1	5	6
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	1		1	10	1	11	11	1	12
OIL EXHAUSTION-PROPELLER SYSTEM	4		4	54	2	56	58	2	60
OIL CONTAMINATION				2		2	2		2
FUEL SIPHONING				5		5	5		5
WATER IN FUEL				3	1	4	3	1	4
AIRCRAFT CAME TO REST IN WATER	7		7	182	5	187	189	5	194
FROZEN, MOISTURE		4	4		19	19		23	23
MISSING				4		4	4		4
TOUCH AND GO LANDING	1	2	3	14	3	17	15	5	20
OVERLOAD FAILURE		1	1		5	5		6	6
MATERIAL FAILURE				1		1	1		1
FUEL STARVATION	18	1	19	463	11	474	481	12	493
OIL STARVATION	73	2	75	747		747	820	2	822
IMPROPER CLEARANCE-TOLERANCE	5		5	35	1	36	40	1	41
FUEL SELECTOR POSITIONED BETWEEN TANKS	3		3	18	1	19	21	1	22
FIRE OF UNDETERMINED ORIGIN	8	2	10	30	5	35	38	7	45
UNAPPROVED MODIFICATION				1		1	1		1
IMPROPER/INADEQUATE VENTING				5	2	7	5	2	7
ACTION, LACK OF				5	3	8	5	3	8
POOR WELD					1	1		1	1
PREVIOUS DAMAGE				2		2	2		2
LEAK/LEAKAGE				5	3	8	5	3	8
LOW FLUID LEVEL	3		3	22	4	26	25	4	29
ARCING					2	2		2	2
LOW COMPRESSION	1		1				1		1
DOWNWIND				7		7	7		7
CARBON DEPOSITS		1	1		4	4		5	5
OVER TORQUED	5	1	6	24	3	27	29	4	33
UNDER TORQUED				1		1	1		1
LOOSE, PART/FITTING				1		1	1		1
BENT	6		6	27	3	30	33	3	36
BINDING				3		3	3		3
BURNED	3		3	5	1	6	8	1	9
CHAFFED		1	1	11	2	13	11	3	14
COLLAPSED	1		1	2	2	4	3	2	5
CROSSED	1		1	5	1	6	6	1	7
DETERIORATED	1		1				1		1
DISCONNECTED	1	1	2	4	1	5	5	2	7
EXCESSIVE		1	1	13	1	14	13	2	15
ERRATIC	1		1	5		5	6		6
FRICTION, EXCESSIVE				2	14	16	2	14	16
GROUNDED				1		1	1		1
HIGH VOLTAGE BREAKDOWN				5		5	5		5
IMPROPERLY INSTALLED				1		1	1		1
JAMMED	1	1	2	26	3	29	27	4	31
OBSTRUCTED				4		4	4		4
OPEN		1	1	21		21	21	1	22
OUT OF BALANCE					1	1		1	1
OVERHEATED				1	2	3	1	2	3
PINCHED				14	1	15	14	1	15
EXCESSIVE PRESSURE				1		1	1		1
PRESSURE TOO LOW				4		4	4		4
PRESSURE, NONE				11	1	12	11	1	12
SCORED				9	2	11	9	2	11
SHEARED	2		2	2		2	4		4
STICKING	2		2	6		6	8		8
STRIPPED				8	2	10	8	2	10
STUCK				1		1	1		1
EXCESSIVE TEMPERATURE	1		1	10	3	13	11	3	14
VIBRATION, EXCESSIVE	2		2	4	4	8	6	4	10
WARPED				4	4	8	4	4	8
ICE-INDUCTION				1		1	1		1
	1		1	1		1	2		2

TABLE 37 (CONTINUED)

DIRECT ENTRY CAUSES (CONTINUED)

DIRECT ENTRY CAUSES

PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CAM REDUCTION GEAR FAILED.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-DETONATION IN ALL CYLINDERS.
PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-ACCELERATOR PUMP JAMMED BY DUST COVER.
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PILOT-MISCALCULATED FUEL CONSUMPTION.
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-OIL FILLER CAP MISSING.
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-GASKET BLOWN NO 3 CYL.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PWR PLT-THROTTLE CONTROL BINDING IN CABLE HOUSING.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-INADVERTENTLY TURNED ENG OFF.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

TABLE 38 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING O-235 SERIES ENGINE

TOTAL ACCIDENTS - 99

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	22	22.2	18.4
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	21	21.2	28.2
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	17	17.2	14.0
BECAME LOST/DISORIENTED	5	5.0	3.0
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	2.0	3.8
INADEQUATE SUPERVISION OF FLIGHT	2	2.0	1.3
LACK OF FAMILIARITY WITH AIRCRAFT	2	2.0	1.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	1.0	1.0
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	1.0	.3
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	1.0	1.2
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	1.0	.8
EXERCISED POOR JUDGMENT	1	1.0	.6
SPONTANEOUS IMPROPER ACTION	1	1.0	.3
PHYSICAL IMPAIRMENT	1	1.0	.2
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	12	12.1	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	2.0	1.4
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.0	.8
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	1.0*	.1
POWERPLANT			
FUEL SYSTEM - CARBURETOR	5	5.0	3.4
IGNITION SYSTEM - MAGNETOES	4	4.0	1.8
IGNITION SYSTEM - SPARK PLUG	4	4.0	1.5
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	4	4.0*	1.3
ENGINE STRUCTURE - VALVE ASSEMBLIES	3	3.0	4.0
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	3	3.0*	.8
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	3.0	1.3
ENGINE STRUCTURE - CRANKCASE	1	1.0	.2
ENGINE STRUCTURE - CRANKSHAFT	1	1.0	1.7
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	1.0	2.6
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	1.0	2.1
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.0	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	31	31.3	24.6
FUEL EXHAUSTION	14	14.1#	24.8

TABLE 39 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING O-290 SERIES ENGINE

TOTAL ACCIDENTS - 114

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	24	21.1	28.3
MISMANAGEMENT OF FUEL	21	18.4	18.5
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	14	12.3	14.2
LACK OF FAMILIARITY WITH AIRCRAFT	6	5.3*	1.7
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	1.8	3.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	.9	1.0
BECAME LOST/DISORIENTED	1	.9	3.1
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.9	.8
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.9	.2
INADEQUATE SUPERVISION OF FLIGHT	1	.9	1.3
EXERCISED POOR JUDGMENT	1	.9	.3
SELECTED UNSUITABLE TERRAIN	1	.9*	.06
SPONTANEOUS IMPROPER ACTION	1	.9	.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	14	12.3	8.9
IMPROPER MAINTENANCE (OWNER PERSONNEL)	2	1.8	.6
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	.9	1.4
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.9	.8
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	8	7.0	3.8
IGNITION SYSTEM - MAGNETOES	4	3.5	1.8
FUEL SYSTEM - CARBURETOR	4	3.5	3.4
LUBRICATING SYSTEM - SEALS AND GASKETS	4	3.5	.2
EXHAUST SYSTEM - MUFFLERS	4	3.5*	.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	1.8	2.6
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.8	2.1
FUEL SYSTEM - SELECTOR VALVES	2	1.8	.8
ENGINE CONTROLS - COCKPIT -			
THROTTLE - POWER LEVER ASSEMBLIES	2	1.8	.9
MIXTURE CONTROL ASSEMBLIES	2	1.8*	.4
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	2	1.8	1.3
ENGINE STRUCTURE - CRANKSHAFT	1	.9	1.8
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	.9	2.2
IGNITION SYSTEM - SPARK PLUG	1	.9	1.6
IGNITION SYSTEM - COILS	1	.9*	.0
IGNITION SYSTEM - LEADS	1	.9*	.1
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.9	.5
FUEL SYSTEM - PUMPS	1	.9	.8
FUEL SYSTEM - OTHER	1	.9	.2
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.9	.6
LUBRICATING SYSTEM - PUMP-PRESSURE	1	.9	.1
LUBRICATING SYSTEM - OIL COOLERS	1	.9*	.1
LUBRICATING SYSTEM - OTHER	1	.9	.4
EXHAUST SYSTEM - BAFFLES	1	.9*	.1
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	33	28.9	24.7
FUEL EXHAUSTION	13	11.4#	25.0

TABLE 40 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING O-320 SERIES ENGINE

TOTAL ACCIDENTS - 487

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	148	30.4	27.6
MISMANAGEMENT OF FUEL	107	22.0*	17.9
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	69	14.2	14.1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	14	2.9	3.9
BECAME LOST/DISORIENTED	12	2.5	3.2
INADEQUATE SUPERVISION OF FLIGHT	10	2.1	1.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	8	1.6	1.2
LACK OF FAMILIARITY WITH AIRCRAFT	8	1.6	1.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	4	.8	1.1
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	3	.6	.9
EXERCISED POOR JUDGMENT	3	.6	.6
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.2	.4
DELAYED IN INITIATING GO-AROUND	1	.2	.04
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	.2	.3
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.2	.2
SELECTED UNSUITABLE TERRAIN	1	.2	.07
PHYSICAL IMPAIRMENT	1	.2	.3
SPATIAL DISORIENTATION	1	.2	.07
PSYCHOLOGICAL CONDITION	1	.2	.04
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	1	.2*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	36	7.4	9.3
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	7	1.4	1.4
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	4	.8	.8
IMPROPER MAINTENANCE (OWNER PERSONNEL)	3	.6	.7
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	3	.6	.3
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	2	.4	.3
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	33	6.8*	3.4
FUEL SYSTEM - CARBURETOR	14	2.9	3.5
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	9	1.8	2.7
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	9	1.8	1.3
ENGINE STRUCTURE - PISTON, PISTON RINGS	8	1.6	2.2
IGNITION SYSTEM - SPARK PLUG	8	1.6	1.6
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	8	1.6*	.4
FUEL SYSTEM - SELECTOR VALVES	6	1.2	.7
ENGINE STRUCTURE - CYLINDER ASSEMBLY	5	1.0	2.3
FUEL SYSTEM - LINES AND FITTINGS	5	1.0	1.0
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	5	1.0	1.5
EXHAUST SYSTEM - MUFFLERS	5	1.0	.4
IGNITION SYSTEM - MAGNETOES	4	.8	2.1
ENGINE STRUCTURE - CRANKSHAFT	3	.6#	1.9
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	3	.6	.2
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	3	.6	.5
FUEL SYSTEM - PUMPS	3	.6	.8
LUBRICATING SYSTEM - SEALS AND GASKETS	3	.6	.3
EXHAUST SYSTEM - STACKS	3	.6*	.1
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES MIXTURE CONTROL ASSEMBLIES	3	.6	1.0
ENGINE STRUCTURE - CRANKCASE	2	.4	.5
IGNITION SYSTEM - HIGH TENSION WIRING	1	.2	.2
LUBRICATING SYSTEM - OIL COOLERS	1	.2*	.0
EXHAUST SYSTEM - MANIFOLDS	1	.2	.1
ENGINE CONTROLS - COCKPIT - INDUCTION AIR, PREHEAT CONTROLS	1	.2	.07
MISCELLANEOUS - BIRD INGESTION	1	.2	.2
REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIVE	1	.2	.04
	1	.2	.1
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	140	28.7*	24.1
FUEL EXHAUSTION	99	20.3#	25.2

TABLE 41 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING O-360 SERIES ENGINE

TOTAL ACCIDENTS - 169

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	51	30.2*	17.9
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	49	29.0	28.0
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	20	11.8	14.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	14	8.3*	3.5
BECAME LOST/DISORIENTED	9	5.3	2.9
LACK OF FAMILIARITY WITH AIRCRAFT	6	3.6	1.7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	4	2.4	1.2
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	1.2	1.0
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.6	.3
INADEQUATE SUPERVISION OF FLIGHT	1	.6	1.4
IMPROPER STARTING PROCEDURE	1	.6*	.06
PHYSICAL IMPAIRMENT	1	.6	.2
SPATIAL DISORIENTATION	1	.6*	.06
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	8	4.7#	9.3
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	4	2.4	1.3
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	.6	.7
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	.6	.3
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	7	4.1	2.0
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	4	2.4	2.6
FUEL SYSTEM - CARBURETOR	4	2.4	3.5
IGNITION SYSTEM - MAGNETOES	3	1.8	1.9
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	1.8	1.3
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	1.2	2.2
ENGINE STRUCTURE - OTHER	2	1.2	1.2
IGNITION SYSTEM - SPARK PLUG	2	1.2	1.6
FUEL SYSTEM - LINES AND FITTINGS	2	1.2	.4
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	2	1.2	.9
ENGINE STRUCTURE - CRANKSHAFT	1	.6	1.8
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.6	1.5
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.6	.6
LUBRICATING SYSTEM - FILTERS, SCREENS	1	.6	.2
LUBRICATING SYSTEM - OIL COOLERS	1	.6*	.1
LUBRICATING SYSTEM - SEALS AND GASKETS	1	.6	.3
EXHAUST SYSTEM - MUFFLERS	1	.6	.5
MIXTURE CONTROL ASSEMBLIES	1	.6	.5
INDUCTION AIR, PREHEAT CONTROLS	1	.6	.2
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	56	33.1*	24.4
FUEL EXHAUSTION	54	32.0*	24.1

TABLE 42 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING IO-360 SERIES, AIO-360 SERIES ENGINE

TOTAL ACCIDENTS - 54

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	17	31.5	28.0
MISMANAGEMENT OF FUEL	9	16.7	18.5
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	6	11.1*	3.6
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	4	7.4*	1.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	3	5.6	14.2
BECAME LOST/DISORIENTED	2	3.7	3.0
INADEQUATE SUPERVISION OF FLIGHT	1	1.9	1.3
EXERCISED POOR JUDGMENT	1	1.9	.6
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	3	5.6	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.9	1.4
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.9	.8
POWERPLANT			
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	7	13.0*	2.4
FUEL SYSTEM - FUEL INJECTION SYSTEM	4	7.4	3.9
LUBRICATING SYSTEM - OTHER	3	5.6*	.3
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	3.7	1.4
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	2	3.7*	.5
ENGINE STRUCTURE - CRANKCASE	1	1.9*	.2
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	1.9	2.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	1.9	4.0
ENGINE STRUCTURE - OTHER	1	1.9	1.2
FUEL SYSTEM - OTHER	1	1.9*	.2
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	16	29.6	24.4
FUEL STARVATION	15	27.8	24.8

TABLE 43 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE AVCO/LYCOMING O-540 SERIES ENGINE

TOTAL ACCIDENTS - 231

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	83	35.9*	24.4
MISMANAGEMENT OF FUEL	54	23.4*	18.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	24	10.4	14.4
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	6	2.6	3.8
BECAME LOST/DISORIENTED	3	1.3	3.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	3	1.3	1.2
INADEQUATE SUPERVISION OF FLIGHT	3	1.3	1.3
LACK OF FAMILIARITY WITH AIRCRAFT	3	1.3	1.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	.9	1.0
EXERCISED POOR JUDGMENT	2	.9	.6
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.4	.4
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1	.4	.06
OPERATED CARELESSLY	1	.4*	.03
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	16	6.9	9.2
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	6	2.6*	.6
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	3	1.3	1.4
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	.4	.7
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	.4	.1
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	14	6.1	3.8
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	8	3.5*	1.3
ENGINE STRUCTURE - CRANKSHAFT	7	3.0	1.6
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	6	2.6	1.3
ENGINE STRUCTURE - OTHER	5	2.2	1.2
FUEL SYSTEM - TANKS	4	1.7*	.4
EXHAUST SYSTEM - MUFFLERS	4	1.7*	.4
IGNITION SYSTEM - MAGNETOES	3	1.3	1.9
IGNITION SYSTEM - SPARK PLUG	3	1.3	1.6
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	.9	2.2
FUEL SYSTEM - SELECTOR VALVES	2	.9	.8
FUEL SYSTEM - CARBURETOR	2	.9#	3.6
REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIVE	2	.9*	.06
ENGINE STRUCTURE - CRANKCASE	1	.4	.2
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	.4#	2.8
IGNITION SYSTEM - LOW TENSION WIRING	1	.4*	.03
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	.4	.2
IGNITION SYSTEM - SWITCHES	1	.4	.06
FUEL SYSTEM - LINES AND FITTINGS	1	.4	1.1
FUEL SYSTEM - PUMPS	1	.4	.8
FUEL SYSTEM - OTHER	1	.4	.2
LUBRICATING SYSTEM - PUMP-PRESSURE	1	.4	.1
LUBRICATING SYSTEM - SEALS AND GASKETS	1	.4	.3
EXHAUST SYSTEM - MANIFOLDS	1	.4	.06
EXHAUST SYSTEM - STACKS	1	.4	.2
EXHAUST SYSTEM - BAFFLES	1	.4*	.06
ENGINE ACCESSORIES - OTHER			.0
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	.4	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	74	32.0*	23.9
FUEL STARVATION	69	29.9	24.4

TABLE 44 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
AVCO/LYCOMING IO-540 SERIES ENGINE

TOTAL ACCIDENTS - 50

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	13	26.0	28.0
MISMANAGEMENT OF FUEL	7	14.0	18.6
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	4	8.0	14.5
LACK OF FAMILIARITY WITH AIRCRAFT	3	6.0*	1.7
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	2	4.0	3.7
BECAME LOST/DISORIENTED	1	2.0	3.1
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	2.0*	.1
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT	1	2.0*	.0
IMPROPER OPERATION OF FLIGHT CONTROLS	1	2.0*	.2
EXERCISED POOR JUDGMENT	1	2.0	.6
SPATIAL DISORIENTATION	1	2.0*	.06
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	12.0	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	4.0	1.3
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	4	8.0	3.9
FUEL SYSTEM - FUEL INJECTION SYSTEM	4	8.0	3.8
ENGINE STRUCTURE - CRANKSHAFT	2	4.0	1.7
IGNITION SYSTEM - MAGNETOES	2	4.0	1.9
IGNITION SYSTEM - SPARK PLUG	2	4.0	1.6
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	4.0	1.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	1	2.0	2.6
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	2.0	2.1
IGNITION SYSTEM - LEADS	1	2.0*	.1
FUEL SYSTEM - SELECTOR VALVES	1	2.0	.8
FUEL SYSTEM - OTHER	1	2.0*	.2
LUBRICATING SYSTEM - FILTERS, SCREENS	1	2.0*	.2
LUBRICATING SYSTEM - OIL COOLERS	1	2.0*	.1
LUBRICATING SYSTEM - SEALS AND GASKETS	1	2.0	.3
EXHAUST SYSTEM - MUFFLERS	1	2.0	.5
[illegible]GINE CONTROLS - COCKPIT -			
[illegible]ROTTLE - POWER LEVER ASSEMBLIES	1	2.0	.9
[illegible]PLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	2.0	1.3
MISCELLANEOUS ACTS AND CONDITIONS			
[illegible]STARVATION	12	24.0	24.8
[illegible]EXHAUSTION	8	16.0	24.6
[illegible]E.			

TABLE 45 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL A-65 SERIES ENGINE

TOTAL ACCIDENTS - 172

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	45	26.2	28.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	39	22.7*	13.6
MISMANAGEMENT OF FUEL	9	5.2#	19.2
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	6	3.5*	.7
EXERCISED POOR JUDGMENT	5	2.9*	.4
INADEQUATE SUPERVISION OF FLIGHT	4	2.3	1.3
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	3	1.7	1.0
BECAME LOST/DISORIENTED	3	1.7	3.1
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	3	1.7	1.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	1.7	3.8
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	2	1.2*	.03
LACK OF FAMILIARITY WITH AIRCRAFT	2	1.2	1.8
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.6	.4
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	.6	.2
SPONTANEOUS IMPROPER ACTION	1	.6	.4
PHYSICAL IMPAIRMENT	1	.6	.2
FAILED TO ABORT TAKEOFF	1	.6*	.1
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	21	12.2	8.9
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	3	1.7	1.4
IMPROPER MAINTENANCE (OWNER PERSONNEL)	3	1.7	.6
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.6	.8
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	.6	.3
INADEQUATE INSPECTION OF AIRCRAFT (OWNER-PILOT)	1	.6*	.1
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	7	4.1	3.9
FUEL SYSTEM - CARBURETOR	7	4.1	3.4
ENGINE STRUCTURE - CRANKSHAFT	4	2.3	1.7
THROTTLE - POWER LEVER ASSEMBLIES	4	2.3*	.8
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	1.7	2.1
ENGINE STRUCTURE - OTHER	3	1.7	1.2
IGNITION SYSTEM - MAGNETOES	3	1.7	1.9
FUEL SYSTEM - LINES AND FITTINGS	3	1.7	1.0
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	1.2	2.2
FUEL SYSTEM - PRIMING SYSTEM	2	1.2*	.06
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	2	1.2	1.4
IGNITION SYSTEM - SPARK PLUG	1	.6	1.7
FUEL SYSTEM - SELECTOR VALVES	1	.6	.8
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.6	.5
PROPELLER AND ACCESSORIES - OTHER	1	.6*	.06
EXHAUST SYSTEM - BAFFLES	1	.6*	.06
ENGINE CONTROLS - COCKPIT - INDUCTION AIR, PREHEAT CONTROLS	1	.6	.2
MISCELLANEOUS - DETONATION	1	.6	.2
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	38	22.1	24.6
FUEL STARVATION	27	15.7#	25.3

TABLE 46

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL C-75 AND C-85 SERIES ENGINE

TOTAL ACCIDENTS - 186

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	58	31.2	27.8
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	28	15.1	14.0
MISMANAGEMENT OF FUEL	21	11.3#	18.9
LACK OF FAMILIARITY WITH AIRCRAFT	3	1.6	1.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	1.1	1.0
BECAME LOST/DISORIENTED	2	1.1	3.2
IMPROPER, IN-FLIGHT DECISIONS OR PLANNING	2	1.1#	3.9
INADEQUATE SUPERVISION OF FLIGHT	2	1.1	1.3
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.5	.4
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	.5	.3
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.5	.9
PHYSICAL IMPAIRMENT	1	.5	.3
FAILED TO INITIATE GO-AROUND	1	.5*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	22	11.8	8.9
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	5	2.7	1.3
IMPROPER MAINTENANCE (OWNER PERSONNEL)	3	1.6	.6
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	3	1.6*	.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.5	.8
POWERPLANT			
FUEL SYSTEM - CARBURETOR	11	5.9	3.3
ENGINE STRUCTURE - VALVE ASSEMBLIES	7	3.8	3.9
ENGINE STRUCTURE - CRANKSHAFT	6	3.2	1.6
IGNITION SYSTEM - MAGNETOES	5	2.7	1.9
IGNITION SYSTEM - SPARK PLUG	5	2.7	1.5
ENGINE CONTROLS - COCKPIT -	4	2.2*	.8
THROTTLE - POWER LEVER ASSEMBLIES	3	1.6	2.7
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	3	1.6	1.2
ENGINE STRUCTURE - OTHER	3	1.6	1.0
FUEL SYSTEM - LINES AND FITTINGS	3	1.6*	.4
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	2	1.1	.8
FUEL SYSTEM - PUMPS	2	1.1	2.2
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	1.1	2.2
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	.5	1.4
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.5	.2
IGNITION SYSTEM - IGNITION HARNESS, SHIELDING	1	.5	.8
FUEL SYSTEM - SELECTOR VALVES	1	.5	.5
ENGINE CONTROLS - COCKPIT -	1	.5*	.0
MIXTURE CONTROL ASSEMBLIES			
POWER LEVER - CABLE			
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	46	24.7	24.8
FUEL EXHAUSTION	25	13.4#	25.1

TABLE 47 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL C-90 SERIES ENGINE

TOTAL ACCIDENTS - 59

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	18	30.5*	13.8
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	14	23.7	28.1
MISMANAGEMENT OF FUEL	7	11.9	18.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	5.1	3.7
BECAME LOST/DISORIENTED	1	1.7	3.1
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	1.7	.8
INADEQUATE SUPERVISION OF FLIGHT	1	1.7	1.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	10.2	9.0
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	1.7	.3
POWERPLANT			
FUEL SYSTEM - CARBURETOR	3	5.1	3.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	3.4	2.6
FUEL SYSTEM - LINES AND FITTINGS	2	3.4	1.0
ENGINE STRUCTURE - VALVE ASSEMBLIES	1	1.7	4.0
IGNITION SYSTEM - MAGNETOES	1	1.7	1.9
FUEL SYSTEM - SELECTOR VALVES	1	1.7	.8
FUEL SYSTEM - OTHER	1	1.7*	.2
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	1.7	.9
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	17	28.8	24.7
FUEL EXHAUSTION	11	18.6	24.6

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL C-145 SERIES ENGINE

TOTAL ACCIDENTS - 54

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	23	42.6*	27.8
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	8	14.8	14.1
MISMANAGEMENT OF FUEL	5	9.3	18.7
BECAME LOST/DISORIENTED	3	5.6	3.0
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	1.9	3.8
EXERCISED POOR JUDGMENT	1	1.9	.6
MISUSED OR FAILED TO USE FLAPS	1	1.9*	.03
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	2	3.7*	.7
INADEQUATE MAINTENANCE AND INSPECTION	2	3.7	9.1
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	5.6	2.1
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	3.7	2.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	3.7	3.9
FUEL SYSTEM - TANKS	2	3.7*	.4
ENGINE STRUCTURE - OTHER	1	1.9	1.2
IGNITION SYSTEM - SPARK PLUG	1	1.9	1.6
FUEL SYSTEM - SELECTOR VALVES	1	1.9	.8
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.9	.5
FUEL SYSTEM - CARBURETOR	1	1.9	3.5
LUBRICATING SYSTEM - OTHER	1	1.9	.4
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	18	33.3	24.3
FUEL STARVATION	8	14.8	25.0

TABLE 49 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL E-165 AND E-185 SERIES ENGINE

TOTAL ACCIDENTS - 82

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	37	45.1*	17.8
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	13	15.9#	28.3
LACK OF FAMILIARITY WITH AIRCRAFT	7	8.5*	1.6
BECAME LOST/DISORIENTED	4	4.9	3.0
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4	4.9	3.7
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	2	2.4#	14.4
INADEQUATE SUPERVISION OF FLIGHT	2	2.4	1.3
FAILED TO ABORT TAKEOFF	1	1.2*	.1
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	8	9.8	9.0
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.2	1.4
IMPROPER MAINTENANCE (OWNER PERSONNEL)	1	1.2	.7
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	1.2	.3
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	1.2	.3
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	3.7	2.1
FUEL SYSTEM - SELECTOR VALVES	3	3.7*	.7
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	2	2.4	2.6
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	2.4	2.1
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	2.4	4.0
FUEL SYSTEM - LINES AND FITTINGS	2	2.4	1.0
FUEL SYSTEM - CARBURETOR	2	2.4	3.5
FUEL SYSTEM - RAM AIR ASSEMBLY	2	2.4*	.1
ENGINE STRUCTURE - CRANKSHAFT	1	1.2	1.7
IGNITION SYSTEM - MAGNETOES	1	1.2	1.9
IGNITION SYSTEM - SPARK PLUG	1	1.2	1.6
FUEL SYSTEM - TANKS	1	1.2	.4
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.2	.5
FUEL SYSTEM - PRIMING SYSTEM	1	1.2*	.1
FUEL SYSTEM - PUMPS	1	1.2	.8
PROPELLER AND ACCESSORIES - HYDR PITCH CONT MECH MECH	1	1.2*	.0
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	1.2	.9
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	1.2	1.4
REDUCTION GEAR ASSEMBLY - GEARS, ACCESSORY DRIVE	1	1.2*	.1
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	43	52.4*	24.1
FUEL EXHAUSTION	16	19.5	24.6

TABLE 50 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL O-200 SERIES ENGINE

TOTAL ACCIDENTS - 284

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	94	33.1*	12.3
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	79	27.8	28.0
MISMANAGEMENT OF FUEL	30	10.6#	19.3
BECAME LOST/DISORIENTED	23	8.1*	2.6
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	11	3.9	3.7
INADEQUATE SUPERVISION OF FLIGHT	10	3.5*	1.1
SPONTANEOUS IMPROPER ACTION	7	2.5*	.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	5	1.8	1.2
EXERCISED POOR JUDGMENT	2	.7	.6
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	2	.7	.3
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	.4	1.1
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	.7*	.1
LACK OF FAMILIARITY WITH AIRCRAFT	1	.4	1.9
OPERATED CARELESSLY	1	.4*	.03
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS	1	.4*	.0
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS	1	.4*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	14	4.9#	9.4
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	.7	1.5
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	9	3.2	2.0
ENGINE STRUCTURE - VALVE ASSEMBLIES	6	2.1	4.1
IGNITION SYSTEM - MAGNETOES	5	1.8	1.9
FUEL SYSTEM - CARBURETOR	5	1.8	3.6
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	4	1.4	2.7
ENGINE STRUCTURE - CYLINDER ASSEMBLY	4	1.4	2.2
IGNITION SYSTEM - SPARK PLUG	3	1.1	1.7
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	3	1.1	.5
LUBRICATING SYSTEM - OTHER	3	1.1	.4
ENGINE STRUCTURE - OTHER	2	.7	1.3
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	2	.7	.5
ENGINE STRUCTURE - CRANKSHAFT	1	.4	1.8
FUEL SYSTEM - LINES AND FITTINGS	1	.4	1.1
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	1	.4	1.5
LUBRICATING SYSTEM - MAGNETIC PLUGS	1	.4*	.0
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.4	1.0
INDUCTION AIR, PREHEAT CONTROLS	1	.4	.2
ENGINE INDICATING EQUIPMENT - TACHOMETER	1	.4*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	98	34.5*	23.5
FUEL STARVATION	29	10.2#	26.2

TABLE 51 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE CONTINENTAL E-225 SERIES ENGINE

TOTAL ACCIDENTS - 47

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	16	34.0*	18.3
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	9	19.1	28.1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4	8.5	3.7
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	2.1	1.0
IMPROPER IFR OPERATION	1	2.1*	.1
LACK OF FAMILIARITY WITH AIRCRAFT	1	2.1	1.8
IMPROPER STARTING PROCEDURE	1	2.1*	.1
PHYSICAL IMPAIRMENT	1	2.1*	.2
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	4	8.5	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	2	4.3	1.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	2.1	.8
INADEQUATE INSPECTION OF AIRCRAFT (MAINT PERSONNEL)	1	2.1*	.3
POWERPLANT			
FUEL SYSTEM - PUMPS	4	8.5*	.7
ENGINE STRUCTURE - CRANKSHAFT	2	4.3	1.7
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	4.3	3.9
ENGINE STRUCTURE - OTHER	2	4.3	1.2
FUEL SYSTEM - LINES AND FITTINGS	1	2.1	1.0
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	2.1	.5
FUEL SYSTEM - CARBURETOR	1	2.1	3.4
LUBRICATING SYSTEM - FILTERS, SCREENS	1	2.1*	.2
LUBRICATING SYSTEM - PUMP-SCAVENGER	1	2.1*	.03
EXHAUST SYSTEM - MANIFOLDS	1	2.1*	.1
ENGINE ACCESSORIES - STARTERS	1	2.1*	.0
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	17	36.2	24.7
FUEL EXHAUSTION	9	19.1	24.6

TABLE 52 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL O-300 SERIES ENGINE

TOTAL ACCIDENTS - 191

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	70	36.6*	27.5
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	28	14.7	14.1
MISMANAGEMENT OF FUEL	24	12.6#	18.9
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	23	12.0*	3.3
BECAME LOST/DISORIENTED	17	8.9*	2.7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	6	3.1*	1.1
INADEQUATE SUPERVISION OF FLIGHT	2	2.4	1.3
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	.5	.4
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1	.5	.1
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	1	.5	.9
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.5	.2
INADEQUATE SUPERVISION OF FLIGHT	1	.5	1.4
LACK OF FAMILIARITY WITH AIRCRAFT	1	.5	1.9
EXERCISED POOR JUDGMENT	1	.5	.6
MISJUDGED SPEED	1	.5*	0.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	14	7.3	9.2
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	2	1.0	.8
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	5	2.6	4.0
IGNITION SYSTEM - SPARK PLUG	4	2.1	1.6
FUEL SYSTEM - CARBURETOR	3	1.6	3.6
IGNITION SYSTEM - MAGNETOES	3	1.6	1.9
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	3	1.6	1.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	3	1.6	2.7
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.0	2.2
FUEL SYSTEM - SELECTOR VALVES	2	1.0	.8
IGNITION SYSTEM - SWITCHES	1	.5	.1
FUEL SYSTEM - TANKS	1	.5	.4
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	.5	.6
LUBRICATING SYSTEM - VALVES	1	.5*	0.0
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	1	.5	.9
INDUCTION AIR - PREHEAT CONTROLS	1	.5	.5
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GUAGE	1	.5	.2
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	1	.5	1.1
FUEL SYSTEM - LINES AND FITTINGS	1	.5	1.1
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.5	.5
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	86	45.0*	23.2
FUEL STARVATION	24	12.6#	25.6

TABLE 53 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
CONTINENTAL O-470-A,B,E,G,H,J,K,L,M,N,P,R ENGINE

TOTAL ACCIDENTS - 176

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	54	30.7	27.9
MISMANAGEMENT OF FUEL	36	20.5	18.4
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	22	12.5	14.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	8	4.5	3.7
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	4	2.3	1.0
BECAME LOST/DISORIENTED	1	.6#	3.2
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	.6	.9
LACK OF FAMILIARITY WITH AIRCRAFT	1	.6	1.9
EXERCISED POOR JUDGMENT	1	.6	.6
PSYCHOLOGICAL CONDITION	1	.6*	.03
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	22	12.5	8.9
IMPROPER MAINTENANCE (OWNER PERSONNEL)	2	1.1	.6
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	.6	1.4
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	1	.6	.3
POWERPLANT			
FUEL SYSTEM - CARBURETOR	11	6.2*	3.2
ENGINE STRUCTURE - VALVE ASSEMBLIES	8	4.5	3.9
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	5	2.8	1.3
IGNITION SYSTEM - MAGNETOES	4	2.3	1.9
ENGINE STRUCTURE - CRANKSHAFT	3	1.7	1.7
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	3	1.7	2.6
FUEL SYSTEM - TANKS	3	1.7*	.4
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	1.7	1.3
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.1	2.2
IGNITION SYSTEM - SPARK PLUG	2	1.1	1.6
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	2	1.1	.5
ENGINE CONTROLS - COCKPIT - THROTTLE - POWER LEVER ASSEMBLIES	2	1.1	.9
ENGINE CONTROLS - COCKPIT - MIXTURE CONTROL ASSEMBLIES	2	1.1	.4
ENGINE STRUCTURE - CYLINDER ASSEMBLY	1	.6	2.2
ENGINE STRUCTURE - OTHER	1	.6	1.3
FUEL SYSTEM - LINES AND FITTINGS	1	.6	1.1
FUEL SYSTEM - RAM AIR ASSEMBLY	1	.6	.2
FUEL SYSTEM - OTHER	1	.6	.2
LUBRICATING SYSTEM - VALVES	1	.6*	.03
LUBRICATING SYSTEM - FILTERS, SCREENS	1	.6	.2
LUBRICATING SYSTEM - OTHER	1	.6	.4
ENGINE CONTROLS - COCKPIT - INDUCTION AIR, PREHEAT CONTROLS	1	.6	.2
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	61	34.7*	23.9
FUEL STARVATION	36	20.5	25.1

TABLE 54 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE

CONTINENTAL IO-470-D,E,F,G,H,J,K,L,M,N,P,R,S,T,U LIO-470-A ENGINE

TOTAL ACCIDENTS - 98

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	34	34.7*	18.0
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	15	15.3#	28.4
LACK OF FAMILIARITY WITH AIRCRAFT	6	6.1*	1.7
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	5	5.1#	14.4
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	3.1	3.8
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	2	2.0	1.0
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	2	2.0	.8
BECAME LOST/DISORIENTED	1	1.0	3.1
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1	1.0	.2
IMPROPER COMPENSATION FOR WIND CONDITIONS	1	1.0*	.0
INADEQUATE SUPERVISION OF FLIGHT	1	1.0	1.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	8	8.2	9.1
POWERPLANT			
ENGINE STRUCTURE - CYLINDER ASSEMBLY	9	9.2*	1.9
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	6	6.1*	2.5
ENGINE STRUCTURE - CRANKSHAFT	5	5.1*	1.6
FUEL SYSTEM - LINES AND FITTINGS	4	4.1*	.9
ENGINE STRUCTURE - PISTON, PISTON RINGS	3	3.1	2.1
FUEL SYSTEM - PUMPS	3	3.1*	.7
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	3	3.1	1.3
IGNITION SYSTEM - SPARK PLUG	2	2.0	1.6
LUBRICATING SYSTEM - FILTERS, SCREENS	2	2.0*	.2
NGINE STRUCTURE - VALVE ASSEMBLIES	1	1.0	4.0
INE STRUCTURE - OTHER	1	1.0	1.2
TION SYSTEM - IGNITION HARNESS, SHIELDING	1	1.0	.2
SYSTEM - TANKS	1	1.0	.4
SYSTEM - SELECTOR VALVES	1	1.0	.8
SYSTEM - FUEL INJECTION SYSTEM	1	1.0	5.5
SYSTEM - OTHER	1	1.0	.2
CATING SYSTEM - SEALS AND GASKETS	1	1.0	.3
CATING SYSTEM - OTHER	1	1.0	.4
ST SYSTEM - GASKETS	1	1.0*	.0
ST SYSTEM - STACKS	1	1.0	.2
E CONTROLS - COCKPIT -	1	1.0	.5
XTURE CONTROL ASSEMBLIES			
MISCELLANEOUS ACTS AND CONDITIONS			
STARVATION	39	39.8*	24.4
EXHAUSTION	17	17.3	24.7

TABLE 55 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
CONTINENTAL IO-520-A,B,C,D,E,F,J,K,L ENGINE

TOTAL ACCIDENTS - 84

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
MISMANAGEMENT OF FUEL	20	23.8	18.4
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	18	21.4	28.2
FAILED TO FOLLOW APPROVED PROCEDURES DIRECTIVES,ETC	4	4.8*	.7
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	4	4.8#	14.3
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	1.2	1.0
BECAME LOST/DISORIENTED	1	1.2	3.1
IMPROPER OPERATION OF FLIGHT CONTROLS	1	1.2*	.2
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	1	1.2	3.8
INADEQUATE SUPERVISION OF FLIGHT	1	1.2	1.3
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.2	1.8
SELECTED UNSUITABLE TERRAIN	1	1.2*	.06
IMPROPER STARTING PROCEDURE	1	1.2*	.06
MISJUDGED DISTANCE AND ALTITUDE	1	1.2*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	6	7.1	9.1
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	4	4.8*	1.3
IMPROPERLY SERVICED AIRCRAFT (GROUND CREW)	2	2.4*	.3
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	1.2	.8
POWERPLANT			
ENGINE STRUCTURE - PISTON, PISTON RINGS	10	11.9*	1.9
ENGINE STRUCTURE - CRANKSHAFT	5	6.0*	1.6
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	4	4.8	2.5
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	2.4	2.1
IGNITION SYSTEM - SPARK PLUG	2	2.4	1.6
FUEL SYSTEM - FUEL INJECTION SYSTEM	2	2.4	4.9
LUBRICATING SYSTEM - FILTERS, SCREENS	2	2.4*	.2
ENGINE STRUCTURE - OTHER	1	1.2	1.2
IGNITION SYSTEM - OTHER	1	1.2*	.03
FUEL SYSTEM - LINES AND FITTINGS	1	1.2	1.0
FUEL SYSTEM - PUMPS	1	1.2	.8
FUEL SYSTEM - RAM AIR ASSEMBLY	1	1.2*	.2
LUBRICATING SYSTEM - PUMP-PRESSURE	1	1.2*	.1
PROPELLER AND ACCESSORIES - BLADES	1	1.2*	.0
ENGINE CONTROLS - COCKPIT -	1	1.2	.9
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	1.2	1.4
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	32	38.1*	24.5
FUEL EXHAUSTION	11	13.1#	24.8

TABLE 56 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
FRANKLIN 6A4 AND 6AG4 SERIES ENGINE

TOTAL ACCIDENTS - 72

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	13	18.1#	29.1
MISMANAGEMENT OF FUEL	13	18.1	19.1
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	11	15.3	14.5
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	2	2.8	1.2
ATTEMPTED OPERATION WITH KNOWN DEFICIENCIES IN EQUIP	1	1.4	1.0
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1	1.4	.4
BECAME LOST/DISORIENTED	1	1.4	3.2
LACK OF FAMILIARITY WITH AIRCRAFT	1	1.4	1.9
SPONTANEOUS IMPROPER ACTION	1	1.4	.4
MISJUDGED DISTANCE AND SPEED	1	1.4*	.0
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	13	18.1*	8.9
IMPROPER MAINTENANCE (OWNER PERSONNEL)	3	4.2*	.6
IMPROPER MAINTENANCE (MAINTENANCE PERSONNEL)	1	1.4	1.4
POWERPLANT			
ENGINE STRUCTURE - VALVE ASSEMBLIES	8	11.1*	3.9
IGNITION SYSTEM - MAGNETOES	5	6.9*	1.8
FUEL SYSTEM - CARBURETOR	4	5.6	3.4
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	3	4.2	2.6
ENGINE STRUCTURE - CRANKSHAFT	2	2.8	1.8
ENGINE STRUCTURE - CYLINDER ASSEMBLY	2	2.8	2.2
IGNITION SYSTEM - SPARK PLUG	2	2.8	1.6
ENGINE STRUCTURE - PISTON, PISTON RINGS	1	1.4	2.2
ENGINE STRUCTURE - OTHER	1	1.4	1.3
IGNITION SYSTEM - LOW TENSION WIRING	1	1.4*	.03
FUEL SYSTEM - LINES AND FITTINGS	1	1.4	1.0
FUEL SYSTEM - SELECTOR VALVES	1	1.4	.8
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	1.4	.5
FUEL SYSTEM - PUMPS	1	1.4	.8
LUBRICATING SYSTEM - LINES, HOSES, FITTINGS	1	1.4	.6
POWERPLANT-INSTRUMENTS - FUEL QUANTITY GAUGE	1	1.4	1.4
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL STARVATION	22	30.6	25.5
FUEL EXHAUSTION	9	12.5#	25.5

TABLE 57 ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE PRATT AND WHITNEY MILITARY R-985 SERIES ENGINE

TOTAL ACCIDENTS - 139

CAUSE/FACTOR	FREQUENCY	PER CENT OF TOTAL ACCIDENTS	EXPECTED PER CENT
PILOT IN COMMAND			
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	37	26.6	28.1
MISMANAGEMENT OF FUEL	18	12.9	18.8
IMPROPER OPERATION OF POWERPLANT + PWRPLANT CONTROLS	8	5.8#	14.5
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	3	2.2	3.8
IMPROPER IFR OPERATION	2	1.4*	.1
BECAME LOST/DISORIENTED	1	.7	3.2
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1	.7	1.3
IMPROPER OPERATION OF FLIGHT CONTROLS	1	.7	.2
INADEQUATE SUPERVISION OF FLIGHT	1	.7	1.4
PHYSICAL IMPAIRMENT	1	.7	.3
PERSONNEL (MAINTENANCE, SERVICING, INSPECTION)			
INADEQUATE MAINTENANCE AND INSPECTION	11	7.9	9.1
IMPROPERLY SERVICED AIRCRAFT (OWNER-PILOT)	1	.7	.8
POWERPLANT			
ENGINE STRUCTURE - CYLINDER ASSEMBLY	15	10.8*	1.8
ENGINE STRUCTURE - MASTER AND CONNECTING RODS	8	5.8*	2.5
FUEL SYSTEM - CARBURETOR	8	5.8	3.3
ENGINE STRUCTURE - BLOWER, IMPELLER ASSEMBLY	7	5.0*	.2
ENGINE STRUCTURE - CRANKSHAFT	5	3.6	1.6
ENGINE STRUCTURE - OTHER	4	2.9	1.2
FUEL SYSTEM - VENTS, DRAINS, TANK CAPS	3	2.2	1.4
ENGINE STRUCTURE - PISTON, PISTON RINGS	2	1.4	2.
ENGINE STRUCTURE - VALVE ASSEMBLIES	2	1.4	4.
FUEL SYSTEM - PUMPS	2	1.4	.
IGNITION SYSTEM - MAGNETOES	1	.7	2.
IGNITION SYSTEM - SPARK PLUG	1	.7	1.
IGNITION SYSTEM - OTHER	1	.7*	.
FUEL SYSTEM - LINES AND FITTINGS	1	.7	1.
FUEL SYSTEM - SELECTOR VALVES	1	.7	.
FUEL SYSTEM - FILTERS, STRAINERS, SCREENS	1	.7	.
PROPELLER AND ACCESSORIES - OTHER	1	.7*	.
ENGINE CONTROLS - COCKPIT -	1	.7	
THROTTLE - POWER LEVER ASSEMBLIES	1	.7	
MIXTURE CONTROL ASSEMBLIES	1	.7*	
MISCELLANEOUS - FOREIGN OBJECT DAMAGE	1	.7	
MISCELLANEOUS - DETONATION	1	.7*	
REDUCTION GEAR ASSEMBLY - OTHER			
MISCELLANEOUS ACTS AND CONDITIONS			
FUEL EXHAUSTION	39	28.1	2
FUEL STARVATION	24	17.3#	2

Interrelationship of Causes/Factors

In the previous two subsections, causes and related factors of engine-failure accidents for specific aircraft and engine makes and models were discussed. In this subsection, the interrelationship between fifteen frequently cited causes/factors is further examined. Table 58 is a matrix display of the causes/factors.

Became Lost/Disoriented. This cause/factor was cited in 101 engine-failure accidents. The pilots, after becoming lost, continued to fly until their fuel supply was exhausted, which resulted in 96 engine-failure accidents.

Improper Operation of Powerplant, Powerplant Controls. This cause usually meant the pilot improperly used or failed to use the anti-icing or de-icing equipment, which led to carburetor icing or conditions conducive to carburetor/induction system icing.

Improper In-flight Decisions or Planning. This cause/factor was related to other citations, such as the pilot becoming lost/disoriented, mismanaging the fuel supply, being inattentive to the fuel supply, miscalculating the fuel supply, and ending up with fuel exhaustion and an engine-failure accident.

Inadequate Preflight Preparation. Inadequate preflight preparation or planning resulted engine-failure accidents because of water in fuel (182 accidents), fuel starvation (120 accidents), or fuel exhaustion (563 accidents).

Mismanagement of Fuel. This causal area related to the pilot not making adequate flight preparations or planning, being inattentive to the fuel supply, lacking familiarity with aircraft, miscalculating fuel consumption, having the fuel selector positioned between tanks.

Fuel Exhaustion. Fuel exhaustion was primarily by the pilot making inadequate flight preparations, mismanaging the fuel, improper in-flight decisions, becoming disoriented, being inattentive to the fuel and miscalculating the fuel supply.

Fuel Starvation. Fuel starvation resulted primarily from the pilot mismanaging the fuel, making inadequate preflight perparations, and being inattentive to the fuel supply, along with inadequate maintenance and inspection, and foreign material affecting normal operations.

Inadequate Maintenance and Inspection. This cause/factor was closely associated with fuel starvation, foreign material affecting normal operations, and mechanical problems such as material failure, fuel system-carburetor, and ignition system – spark plugs and magnetos.

Improper Maintenance (Maintenance Personnel). This cause/factor was associated with improperly installed parts, fuel system – carburetor, and fuel starvation.

Engine Structure – Valve Assemblies. Fifty-eight of the 130 valve assembly failures were due to material failure and 19 were due to inadequate maintenance and inspection.

Engine Structure – Cylinder Assembly. Failures of the cylinder assembly were caused primarily by material failure. Inadequate maintenance and inspection contributed, along with fatigue fractures.

Engine Structure – Master and Connecting Rods. The 86 master-and-connecting-rod failures were due to material failure and fatigue fracture.

Ignition System – Magnetos. The principle causes attributed to the magneto failures were inadequate maintenance and inspection and material failure.

Ignition System – Spark Plugs. Failure of the spark plugs was a result of inadequate maintenance and inspection, along with carbon deposits.

Fuel System – Carburetor. The causes/factors associated with carburetor failures were inadequate maintenance and inspection, improper maintenance by maintenance personnel, material failure, the engine being loaded-up, and improper alignment or adjustment. Carburetor failure contributed to fuel starvation in 44 engine-failure accidents.

TABLE 58

SELECTED CAUSE/FACTOR MATRIX
ENGINE FAILURE OR MALFUNCTION ACCIDENTS
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

	Became Lost, Disoriented	Improper Operation Powerplant	Improper Inflight Decisions	Inadequate Preflight	Mismanagement of Fuel	Fuel Exhaustion	Fuel Starvation	Inadequate Maintenance, Inspection	Improper Maintenance (Maint. Pers.)	Valve Assembly	Cylinder Assembly	Master and Connecting Rods	Magnetoes	Spark Plugs	Carburetor	Material Failure	Carbon Deposits	Engine Loaded Up	Improper Alignment Adjustment	Piston, Piston Rings	Fatigue Fracture	Fuel Contamination (Except Water)	Inattentive to Fuel Supply	Improper Emergency Procedures	Lack of Familiarity with Aircraft
Became Lost, Disoriented	(101)		12	31	8	96	3																4	7	10
Improper Operation Powerplant, Powerplant Controls		(467)		13	8		39											77							
Improper Inflight Decisions or Planning	12	6	(124)	25	18	113	9									8							7	5	
Inadequate Preflight	31	13	22	(928)	116	563	120	21								8						28	68		15
Mismanagement of Fuel	8	7	12	116	(613)	142	465																99	8	40
Fuel Exhaustion	96		112	563	142	(811)		14															92	5	
Fuel Starvation		39		119	465		(822)	83		9					44	27						24	62	9	43
Inadequate Maintenance, Inspection				22	6	14	83	(300)			19	9	6	31	33	39	39		10	19	13				
Improper Maintenance, (Maint. Pers.)							9		(46)						10										
Engine Structure (Valve Assembly)								19		(130)						96	7				9	9			
Engine Structure (Cylinder Assembly)								9				(71)				49					3	5			
Engine Structure (Master and Connecting Rod)								6					(86)			74					4	8			
Ignition System (Magnetoes)								31						(63)		22									
Ignition System (Spark Plugs)								33		4					(53)		21								
Fuel																(100)	16	11	11						

TABLE 58 (continued)

	Foreign Material Affecting Normal Operations	Failure of Two or More Engines	Low Ceiling, Precipitation and/or Obstruction to Vision	Continued VFR Flight Into Adverse Weather Conditions	Conditions Conducive to Carburetor/ Induction Sys. Icing	Anti Icing/De-Icing Equipment Failed to Use	Carburetor Ice	Miscalculated Fuel Consumption	Water in Fuel	Fuel Selector Positioned Between Tanks	Fuel Quantity Gauge
Became Lost Disoriented		4	29	13							
Improper Operation Powerplant Powerplant Controls		14	44	12	212	302	227				
Improper Inflight Decisions or Planning		7	19	3		3		22			
Inadequate Preflight	17	31	36	16		8	8	58	182	12	
Mismanagement of Fuel		33	12					35		32	10
Fuel Exhaustion		28	55	22				88			33
Fuel Starvation	64	31									
Inadequate Maintenance, Inspection	29										
Improper Maintenance (Maint. Pers.)											
Engine Structure (Valve Assembly)											
Engine Structure (Cylinder Assembly)											
Engine Structure (Master and Connecting Rod)											
Ignition System (Magnetoes)											
Ignition System (Spark Plugs)											
Fuel System (Carburetor)											

SECTION III

NATURE AND SERIOUSNESS OF THE SECOND ACCIDENT TYPE INVOLVED

The purpose of Section III is to display graphically the relative seriousness of the type of accidents which followed engine failure. This was done by calculating the percentage of times that each second accident type resulted in fatal or serious injury to any occupant of the aircraft. The percentages are shown in Figures 1, 2, and 3 for all fixed-wing, single-engine fixed-wing, and multiengine fixed-wing aircraft, respectively. For example, as seen in Figure 1, of the 85 spin accidents which followed engine failure, 94.1% resulted in death or serious injury. The conclusion to be drawn from Figures 1, 2, and 3 is that a pilot who experiences an engine failure in his aircraft and is required to initiate a precautionary or forced landing should do everything possible to avoid a stall spin, stall spiral, stall, or uncontrolled collision with ground/water, because these accidents result in the highest percentage of deaths and serious injuries.

The Safety Board has previously examined and published guidelines relating to forced and precautionary landings.[5]

[5]National Transportation Safety Board, "Emergency Landing Techniques in Small Fixed-Wing Aircraft," NTSB-AAS-72-3.

Figure 1

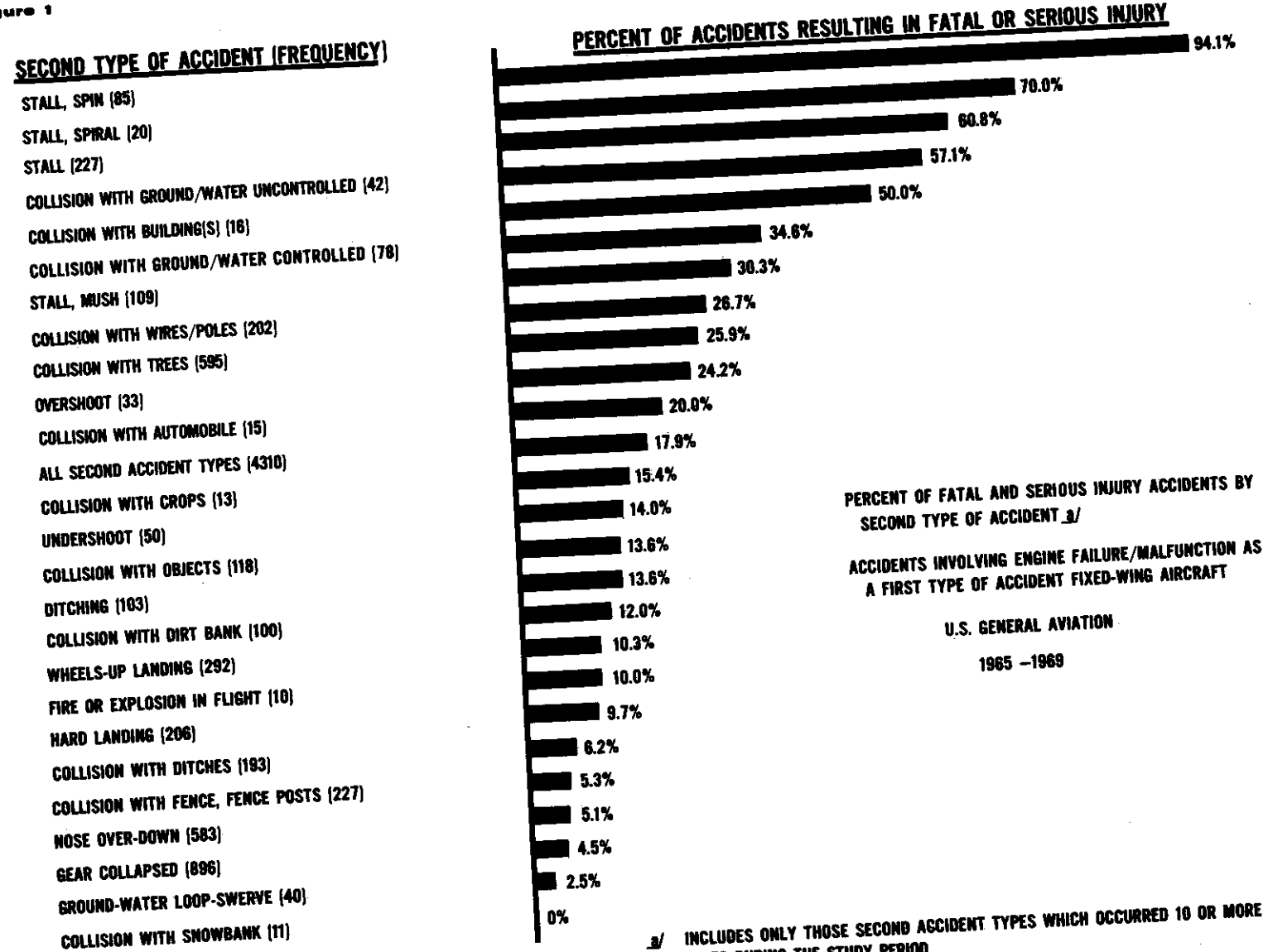

SECOND TYPE OF ACCIDENT (FREQUENCY)
STALL, SPIN (85)
STALL, SPIRAL (20)
STALL (227)
COLLISION WITH GROUND/WATER UNCONTROLLED (42)
COLLISION WITH BUILDING(S) (16)
COLLISION WITH GROUND/WATER CONTROLLED (78)
STALL, MUSH (109)
COLLISION WITH WIRES/POLES (202)
COLLISION WITH TREES (595)
OVERSHOOT (33)
COLLISION WITH AUTOMOBILE (15)
ALL SECOND ACCIDENT TYPES (4310)
COLLISION WITH CROPS (13)
UNDERSHOOT (50)
COLLISION WITH OBJECTS (118)
DITCHING (103)
COLLISION WITH DIRT BANK (100)
WHEELS-UP LANDING (292)
FIRE OR EXPLOSION IN FLIGHT (10)
HARD LANDING (206)
COLLISION WITH DITCHES (193)
COLLISION WITH FENCE, FENCE POSTS (227)
NOSE OVER-DOWN (583)
GEAR COLLAPSED (896)
GROUND-WATER LOOP-SWERVE (40)
COLLISION WITH SNOWBANK (11)
PERCENT OF ACCIDENTS RESULTING IN FATAL OR SERIOUS INJURY
94.1%
70.0%
60.8%
57.1%
50.0%
34.6%
30.3%
26.7%
25.9%
24.2%
20.0%
17.9%
15.4%
14.0%
13.6%
13.6%
12.0%
10.3%
10.0%
9.7%
6.2%
5.3%
5.1%
4.5%
2.5%
0%
PERCENT OF FATAL AND SERIOUS INJURY ACCIDENTS BY SECOND TYPE OF ACCIDENT a/
ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION AS A FIRST TYPE OF ACCIDENT FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 –1969
a/ INCLUDES ONLY THOSE SECOND ACCIDENT TYPES WHICH OCCURRED 10 OR MORE TIMES DURING THE STUDY PERIOD

Figure 2

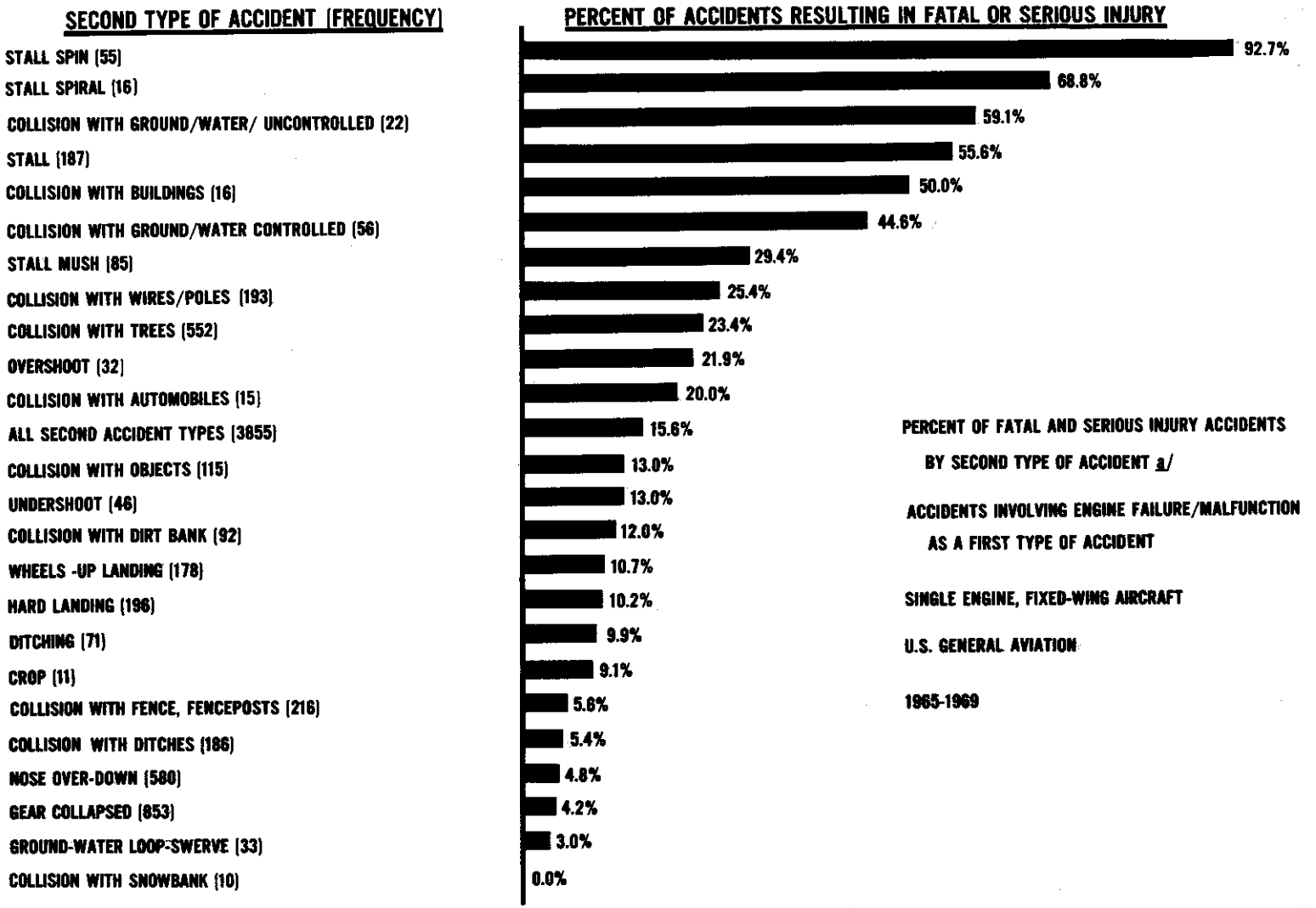
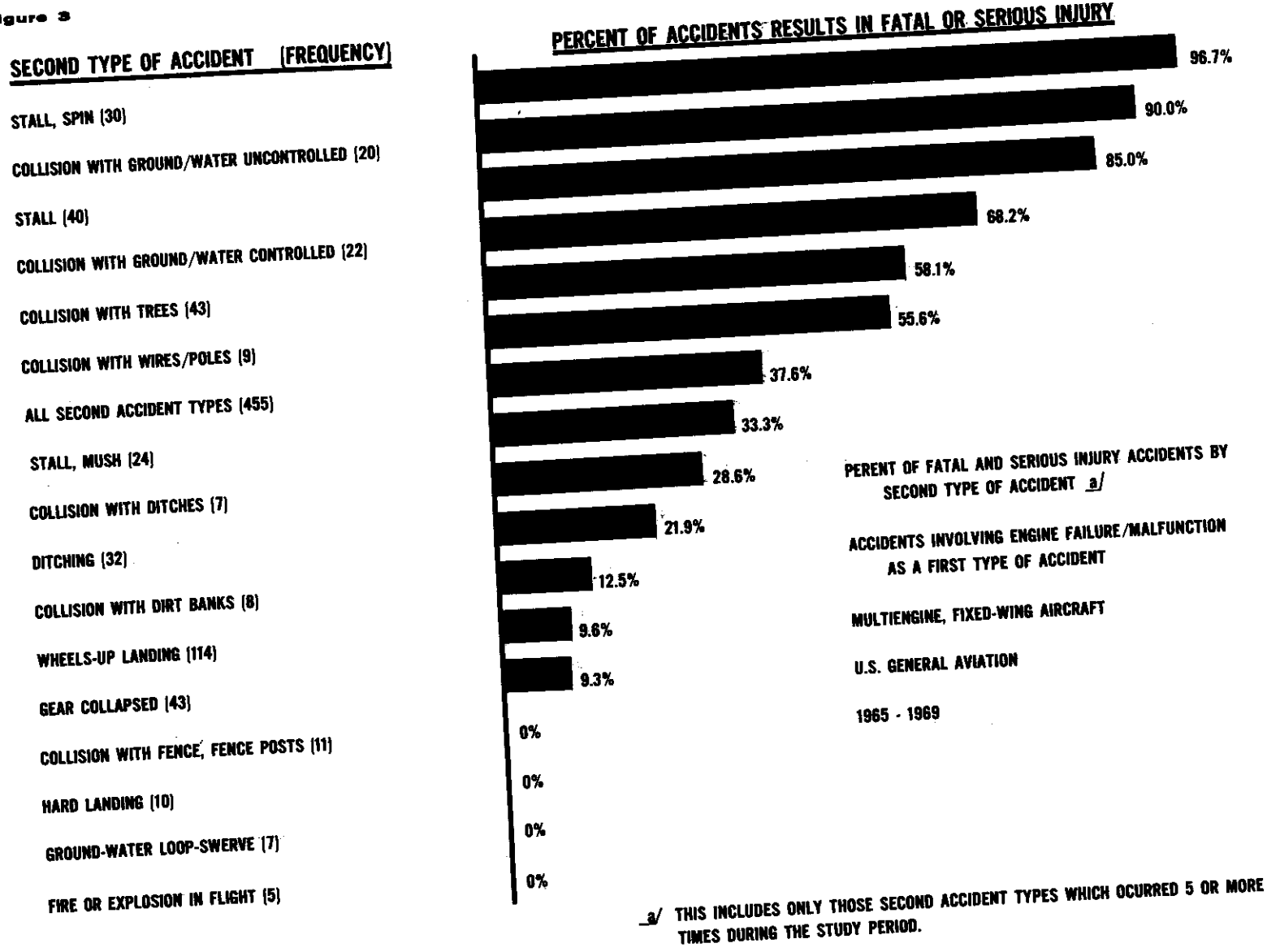

SECOND TYPE OF ACCIDENT (FREQUENCY)
STALL SPIN (55)
STALL SPIRAL (16)
COLLISION WITH GROUND/WATER/ UNCONTROLLED (22)
STALL (187)
COLLISION WITH BUILDINGS (16)
COLLISION WITH GROUND/WATER CONTROLLED (56)
STALL MUSH (85)
COLLISION WITH WIRES/POLES (193)
COLLISION WITH TREES (552)
OVERSHOOT (32)
COLLISION WITH AUTOMOBILES (15)
ALL SECOND ACCIDENT TYPES (3855)
COLLISION WITH OBJECTS (115)
UNDERSHOOT (46)
COLLISION WITH DIRT BANK (92)
WHEELS -UP LANDING (178)
HARD LANDING (196)
DITCHING (71)
CROP (11)
COLLISION WITH FENCE, FENCEPOSTS (216)
COLLISION WITH DITCHES (186)
NOSE OVER-DOWN (580)
GEAR COLLAPSED (853)
GROUND-WATER LOOP-SWERVE (33)
COLLISION WITH SNOWBANK (10)
PERCENT OF ACCIDENTS RESULTING IN FATAL OR SERIOUS INJURY
92.7%
68.8%
59.1%
55.6%
50.0%
44.6%
29.4%
25.4%
23.4%
21.9%
20.0%
15.6%
13.0%
13.0%
12.0%
10.7%
10.2%
9.9%
9.1%
5.6%
5.4%
4.8%
4.2%
3.0%
0.0%
PERCENT OF FATAL AND SERIOUS INJURY ACCIDENTS
BY SECOND TYPE OF ACCIDENT a/
ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION
AS A FIRST TYPE OF ACCIDENT
SINGLE ENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965-1969
a/ INCLUDES ONLY THOSE SECOND ACCIDENT TYPES WHICH OCCURRED 10 OR MORE TIMES
DURING THE STUDY PERIOD

Figure 3


SECOND TYPE OF ACCIDENT (FREQUENCY)
STALL, SPIN (30)
COLLISION WITH GROUND/WATER UNCONTROLLED (20)
STALL (40)
COLLISION WITH GROUND/WATER CONTROLLED (22)
COLLISION WITH TREES (43)
COLLISION WITH WIRES/POLES (9)
ALL SECOND ACCIDENT TYPES (455)
STALL, MUSH (24)
COLLISION WITH DITCHES (7)
DITCHING (32)
COLLISION WITH DIRT BANKS (8)
WHEELS-UP LANDING (114)
GEAR COLLAPSED (43)
COLLISION WITH FENCE, FENCE POSTS (11)
HARD LANDING (10)
GROUND-WATER LOOP-SWERVE (7)
FIRE OR EXPLOSION IN FLIGHT (5)
PERCENT OF ACCIDENTS RESULTS IN FATAL OR SERIOUS INJURY
96.7%
90.0%
85.0%
68.2%
58.1%
55.6%
37.6%
33.3%
28.6%
21.9%
12.5%
9.6%
9.3%
0%
0%
0%
0%
PERENT OF FATAL AND SERIOUS INJURY ACCIDENTS BY SECOND TYPE OF ACCIDENT a/
ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION AS A FIRST TYPE OF ACCIDENT
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969
a/ THIS INCLUDES ONLY THOSE SECOND ACCIDENT TYPES WHICH OCURRED 5 OR MORE TIMES DURING THE STUDY PERIOD.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

Louis M. Thayer, Member, was not present and did not participate in the adoption of this report.

November 29, 1972

APPENDIX A

FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION

TABLE A-1

APPENDIX A

ACCIDENTS, INJURIES
ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

	INJURIES						
	FATAL	SERIOUS	MINOR	NONE	UNKNOWN		TOTAL
PILOT	269	418	909	2714			4310
COPILOT	20	7	12	55			94
DUAL STUDENT	26	29	57	198			310
CHECK PILOT	2			7			9
FLIGHT ENGINEER				1			1
NAVIGATOR		1		2			3
CABIN ATTENDANT				10			10
EXTRA CREW	7	4	4	14			29
PASSENGERS	315	378	670	2501			3864
TOTAL	639	837	1652	5502		ABOARD	8630
* OTHER AIRCRAFT			1	2			3
OTHER GROUND	3	4	10	5			22
GRAND TOTAL	642	841	1663	5509			8655

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

* INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

TABLE A-2

ANALYTIC TABLE

KIND OF FLYING VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE
FAILURE OR MALFUNCTION AS
A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

KIND OF FLYING	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
INSTRUCTIONAL	62	251			313	313
DUAL	10	103			113	113
SOLO	3	7			10	10
CHECK					166	166
TRAINING	16	150				
NONCOMMERCIAL	410	1588			1998	1998
PLEASURE	22	189			211	211
PRACTICE	102	432			534	534
BUSINESS	15	30			45	45
CORPORATE/EXECUTIVE		4			4	4
AERIAL SURVEY						
COMPANY FLIGHT					3	3
OTHER	1	2				
COMMERCIAL					211	211
AERIAL APPLICATION	27	184			208	208
ASSOCIATED CROP CONTROL ACTIV	38	170			2	2
FIRE CONTROL	1	1			8	8
ASSOCIATED FIRE CONTROL ACTIV	1	7			6	6
AERIAL MAPPING/PHOTOGRAPHY	1	5			2	2
AERIAL ADVERTISING	1	1			7	7
POWER AND PIPELINE PATROL	1	6			2	2
FISH SPOTTING	1	1			127	127
AIR TAXI-PASSENGER OPERATIONS	37	90			41	41
AIR TAXI-CARGO OPERATIONS	16	25				
CONSTRUCTION WORK					1	1
SCHEDULED PASSENGER SERVICE						
SCHEDULED CARGO SERVICE	1					
NONSCHEDULED/CHARTER REVENUE						
NONSCHEDULED/CHARTER REVENUE						
MILITARY CONTRACT-PASSENGER					2	2
MILITARY CONTRACT-CARGO					2	2
CONTRACT/CHARTER-CARGO-DOMEST	1	1				
CONTRACT/CHARTER-PASSENGER-DO	1	1				
CONTRACT/CHARTER-CARGO-INTERN						

KIND OF FLYING	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
CONTRACT/CHARTER-PASSENGER-IN						
OTHER	3	7			10	10
UNKNOWN/NOT REPORTED						
MISCELLANEOUS						
EXPERIMENTATION		1			1	1
TEST	23	57			80	80
DEMONSTRATION	5	25			30	30
FERRY	30	100			130	130
SEARCH AND RESCUE	1	3			4	4
AIR SHOW/AIR RACING	3	7			10	10
PARACHUTE JUMP	2	10			12	12
PARACHUTE JUMP IN CONNECTION		1			1	1
TOWING GLIDERS		2			2	2
SEEDING CLOUDS	1				1	1
HUNTING						
POLICE PATROL		1			1	1
HIGHWAY TRAFFIC ADVISORY						
ALL OTHER PUBLIC FLYING		3			3	3
OTHER	2	3			5	5
UNKNOWN/NOT REPORTED	3	1			4	4
RECORDS	841	3469			4310	
ACCIDENTS	841	3469				4310

ANALYTIC TABLE

TABLE A-3

AIRPORT PROXIMITY BY INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
U. S. GENERAL AVIATION
1965 - 1969

AIRPORT PROXIMITY	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
ON AIRPORT	49	60	132	487	728	728
ON SEAPLANE BASE				1	1	1
ON HELIPORT						
ON BARGE/SHIP/PLATFORM						
IN TRAFFIC PATTERN	57	92	168	349	666	666
WITHIN 1/4 MILE	22	38	51	102	213	213
WITHIN 1/2 MILE	15	23	35	76	149	149
WITHIN 3/4 MILE	6	9	14	18	47	47
WITHIN 1 MILE	13	18	31	80	142	142
WITHIN 2 MILES	25	42	78	142	287	287
WITHIN 3 MILES	20	15	42	115	192	192
WITHIN 4 MILES	11	12	29	73	125	125
WITHIN 5 MILES	7	6	7	25	45	45
BEYOND 5 MILES	86	144	353	1092	1675	1675
UNKNOWN/NOT REPORTED	1	2	16	21	40	40
RECORDS	312	461	956	2581	4310	
ACCIDENTS	312	461	956	2581		4310

TABLE A-4

ANALYTIC TABLE

FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
U. S. GENERAL AVIATION
1965 - 1969

FIRST PHASE OF OPERATION	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS	PERCENT
	DEST	SUBST	MIN	NONE			
STATIC							
STARTING ENGINE/S							
IDLING ENGINE/S							
ENGINE RUNUP							
IDLING ROTORS							
PARKED-ENGINES NOT OPERATING							
OTHER							
TAXI							
TO TAKEOFF							
FROM LANDING							
OTHER							
GROUND TAXI TO TAKEOFF							
GROUND TAXI FROM LANDING							
GROUND TAXI, OTHER							
AERIAL TAXI TO TAKEOFF							
AERIAL TAXI TO/FROM LANDING							
AERIAL TAXI, OTHER							
TAKEOFF							
RUN	15		39		54	54	1.25
INITIAL CLIMB	240		818		1058	1058	24.55
VERTICAL							
RUNNING							
ABORTED			1		1	1	.02
ABORTED							
ABORTED							
OTHER							
INFLIGHT							
CLIMB TO CRUISE	23		86		109	109	2.53
NORMAL CRUISE	326		1404		1730	1730	40.14
DESCENDING	21		178		199	199	4.62
HOLDING	1		1		2	2	.05
HOVERING							
POWER-ON DESCENT							
AUTOROTATIVE DESCENT							
ACROBATICS	4		7		11	11	.26

TABLE A-4 CONTINUED

FIRST PHASE OF OPERATION	AIRCRAFT DAMAGE DEST	SUBST	MIN	NONE	RECORDS	ACCIDENTS	PERCENT
BUZZING	2	1			3	3	.07
UNCONTROLLED DESCENT		1			1	1	.02
EMERGENCY DESCENT							
LOW PASS	15	48			63	63	1.46
OTHER	23	63			86	86	2.00
EN ROUTE TO TREAT CROP	4	32			36	36	.84
EN ROUTE TO RELOADING AREA	2	15			17	17	.39
SURVEY FIELD/AREA		7			7	7	.16
STARTING SWATH RUN		15			15	15	.35
SWATH RUN	4	54			58	58	1.35
FLAREOUT FOR SWATH RUN		2			2	2	.05
PULLUP FROM SWATH RUN	6	31			37	37	.86
PROCEDURE TURNAROUND	20	78			98	98	2.27
CLEANUP SWATH		3			3	3	.07
MANEUVER TO AVOID OBSTRUCTION							
RETURN TO STRIP	2	13			15	15	.35
LANDING							
TRAFFIC PATTERN-CIRCLING	42	193			235	235	5.45
FINAL APPROACH	49	253			302	302	7.01
INITIAL APPROACH	4	6			10	10	.23
FINAL APPROACH	3	7			10	10	.23
LEVEL OFF/TOUCHDOWN		6			6	6	.14
ROLL		1			1	1	.02
ROLL-ON/RUN-ON							
POWER-ON LANDING							
POWER-OFF AUTOROTATIVE LANDIN							
GO-AROUND	26	105			131	131	3.04
MISSED APPROACH	4				4	4	.09
OTHER	3	1			4	4	.09
UNKNOWN/NOT REPORTED	2				2	2	.05
RECORDS	841	3469			4310		
ACCIDENTS	841	3469				4310	

TABLE A-5

ANALYTIC TABLE

SECOND ACCIDENT TYPE VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

TYPE OF ACCIDENT	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
GROUND-WATER LOOP-SWERVE		1	5	34	40	40
DRAGGED WINGTIP, POD, OR FLOA			2	2	4	4
WHEELS-UP LANDING	2	28	28	234	292	292
WHEELS-DOWN LANDING IN WATER				1	1	1
GEAR COLLAPSED	1	39	189	667	896	896
GEAR RETRACTED			1	3	4	4
HARD LANDING	2	18	54	132	206	206
NOSE OVER/DOWN	3	27	135	418	583	583
ROLL OVER						
OVERSHOOT	1	7	6	19	33	33
UNDERSHOOT	2	5	16	27	50	50
COLLISION WITH AIRCRAFT						
BOTH IN FLIGHT	1				1	1
ONE AIRBORNE						
BOTH ON GROUND			1		1	1
COLLISION WITH GROUND/WATER						
CONTROLLED	20	20	21	17	78	78
UNCONTROLLED	24	7	7	4	42	42
COLLIDED WITH						
WIRES/POLES	14	40	65	83	202	202
TREES	44	110	155	286	595	595
RESIDENCE/S	3	2	1	2	8	8
BUILDING/S	2	6	4	4	16	16
FENCE, FENCEPOSTS	1	11	43	172	227	227
ELECTRONIC TOWERS	1				1	1
RUNWAY OR APPROACH LIGHTS	1		1	1	3	3
AIRPORT HAZARD						
ANIMALS				2	2	2
CROP		2	3	8	13	13
FLAGMAN LOADER						
DITCHES	2	10	49	132	193	193
SNOWBANK				11	11	11
PARKED AIRCRAFT			2	2	4	4
AUTOMOBILE		3	5	7	15	15

E A-5 CONTINUED

ANALYTIC TABLE

YPE OF ACCIDENT	INJURY INDEX FATAL	SER	MIN	NONE	RECORDS	ACCIDENTS
IRTBANK	1	11	23	65	100	100
BJECT	4	12	23	79	118	118
IRD STRIKE						
TALL	88	50	46	43	227	227
PIN	64	17	4		85	85
PIRAL	10	4	3	3	20	20
USH	7	26	35	41	109	109
IRE OR EXPLOSION						
N FLIGHT	1		1	8	10	10
N GROUND			1	3	4	4
IRFRAME FAILURE						
N FLIGHT	2			1	3	3
N GROUND						
NGINE TEARAWAY						
NGINE FAILURE OR MALFUNCTION						
ROPELLER/ROTOR FAILURE						
ROPELLER		1		2	3	3
AIL ROTOR						
AIN ROTOR						
ROPELLER/ROTOR ACCIDENT TO P						
ET INTAKE/EXHAUST ACCIDENT T						
ROPELLER/JET/ROTOR BLAST						
URBULENCE						
AIL DAMAGE TO AIRCRAFT						
IGHTNING STRIKE						
VASIVE MANEUVER						
NCONTROLLED ALTITUDE DEVIATI						
ITCHING	11	3	26	63	103	103
ISSING AIRCRAFT NOT RECOVERE						
ISCELLANEOUS, OTHER			1	5	6	6
NDETERMINED		1			1	1
CORDS	312	461	956	2581	4310	
CIDENTS	312	461	956	2581		4310

TABLE A-6

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	163 52.41	14 4.50	166 53.38	2060 51.51	72 1.80	2067 51.69	2223 51.58	86 2.00	2233 51.81
PERSONNEL	38 12.22	6 1.93	44 14.15	398 9.95	32 .80	429 10.73	436 10.12	38 .88	473 10.97
AIRFRAME	1 .32	.00	1 .32	2 .05	.00	2 .05	3 .07	.00	3 .07
LANDING GEAR	.00	.00	.00	1 .03	1 .03	2 .05	1 .02	1 .02	2 .05
POWERPLANT	142 45.66	3 .96	144 46.30	1716 42.91	70 1.75	1779 44.49	1858 43.11	73 1.69	1923 44.62
SYSTEMS	.00	1 .32	1 .32	18 .45	1 .03	19 .48	18 .42	2 .05	20 .46
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .32	.00	1 .32	5 .13	5 .13	10 .25	6 .14	5 .12	11 .26
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	1 .03	1 .03	2 .05	1 .02	1 .02	2 .05
WEATHER	13 4.18	28 9.00	38 12.22	145 3.63	176 4.40	318 7.95	158 3.67	204 4.73	356 8.26
TERRAIN	.00	.00	.00	.00	1 .03	1 .03	.00	1 .02	1 .02
MISCELLANEOUS	10 3.22	.00	10 3.22	114 2.85	8 .20	122 3.05	124 2.88	8 .19	132 3.06
UNDETERMINED	4 1.29	.00	4 1.29	3 .08	.00	3 .08	7 .16	.00	7 .16

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

CAUSE/FACTOR TABLE

TABLE A-7

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND	7	1	8	25	5	30	32	6	38
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	3		3	8	1	9	11	1	12
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	8		8	82	11	93	90	11	101
BECAME LOST/DISORIENTED	10	1	11	29	4	33	39	5	44
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS				3		3	3		3
DELAYED IN INITIATING GO-AROUND				4	2	6	4	2	6
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				1		1	1		1
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				6		6	10		10
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	4		4	8		8	10		10
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	30	6	36	31	6	37
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	477		477	504		504
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	27		27	7		7	8		8
IMPROPER OPERATION OF FLIGHT CONTROLS	1		1	3		3	4		4
IMPROPER IFR OPERATION	1		1	106	7	113	120	7	127
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	14		14	1		1	1		1
IMPROPER COMPENSATION FOR WIND CONDITIONS				865	5	870	926	8	934
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	61	3	64	62		62	64		64
INADEQUATE SUPERVISION OF FLIGHT	2		2	29	25	54	33	31	64
LACK OF FAMILIARITY WITH AIRCRAFT	4	6	10	555	1	556	614	1	615
MISMANAGEMENT OF FUEL	59		59	31		31	35		35
EXERCISED POOR JUDGMENT	4		4	1	1	2	1	1	2
OPERATED CARELESSLY				3		3	3		3
SELECTED UNSUITABLE TERRAIN				3		3	4		4
IMPROPER STARTING PROCEDURES	1		1	1		1	1		1
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				14		14	14		14
SPONTANEOUS-IMPROPER ACTION				1		1	1		1
MISJUDGED DISTANCE, SPEED, AND ALTITUDE		1	1					1	1
MISJUDGED DISTANCE AND SPEED				1		1	1	1	1
MISJUDGED DISTANCE					1	1			1
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED SPEED	2		2				2		2
MISJUDGED ALTITUDE				1		1	1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
INCAPACITATION	6	1	7	3		3	9	1	10
PHYSICAL IMPAIRMENT	1		1	2		2	3		3
SPATIAL DISORIENTATION		1	1		1	1		2	3
PSYCHOLOGICAL CONDITION					3	3		3	3
MISUSED OR FAILED TO USE FLAPS					1	1		1	1
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	5		5	1		1	6		6
FAILED TO ABORT TAKEOFF				1		1	1		1
FAILED TO INITIATE GO-AROUND	1		1	12		12	13		13
DIRECT ENTRIES	224	14	238	2380	74	2454	2604	88	2692
SUBTOTAL				2		2	2		2
COPILOT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING									
DIRECT ENTRIES				5		5	5		5
SUBTOTAL				1		1	1		1
DUAL STUDENT				1		1	1		1
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
DELAYED IN INITIATING GO-AROUND									
FAILED TO EXTEND LANDING GEAR									

TABLE A-7 CONTINUED

CAUSE/FACTOR TABLE

DUAL STUDENT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				2		2	2		2
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				22		22	22		22
IMPROPER LEVEL OFF				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	5		5
LACK OF FAMILIARITY WITH AIRCRAFT					1	1		1	1
MISMANAGEMENT OF FUEL				11	1	12	11	1	12
SPONTANEOUS-IMPROPER ACTION				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				2		2	2		2
FAILED TO MAINTAIN DIRECTIONAL CONTROL				2		2	2		2
SUBTOTAL				49	2	51	49	2	51
CHECK PILOT									
INADEQUATE SUPERVISION OF FLIGHT	1		1	1		1	2		2
SUBTOTAL	1		1	1		1	2		2
** PERSONNEL **									
FLIGHT INSTRUCTOR									
INADEQUATE SUPERVISION OF FLIGHT				2	1	3	2	1	3
INADEQUATE TRAINING OF STUDENT				7	3	10	7	3	10
MAINTENANCE, SERVICING, INSPECTION	5		5	41		41	46		46
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	3		3	17	2	19	20	2	22
IMPROPER MAINTENANCE(OWNER PERSONNEL)				9	2	11	9	2	11
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)	1		1	23	2	25	24	2	26
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	2		2	9		9	11		11
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)		1	1	3		3	3	1	4
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)	25	4	29	262	12	274	287	16	303
INADEQUATE MAINTENANCE AND INSPECTION				2		2	2		2
OTHER	1		1				1		1
UNK/NR					1	1		1	1
OPERATIONAL SUPERVISORY PERSONNEL		1	1						
INADEQUATE FLIGHT TRAINING-PROCEDURES				1	1	2	1	1	2
INADEQUATE SUPERVISION OF FLIGHT CREW				1	1	2	1	1	2
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT	1		1						
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS					1	1	1	1	2
WEATHER PERSONNEL				1		1	1		1
INCORRECT WEATHER FORECAST				1		1	1		1
INCOMPLETE WEATHER REPORT	1		1		1	1	2	1	3
INADEQUATE/INCORRECT WEATHER BRIEFING	1		1						
TRAFFIC CONTROL PERSONNEL				1		1	1	1	2
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				1		1	1		1
AIRPORT SUPERVISORY PERSONNEL				1		1	1		1
IMPROPER MAINTENANCE-AIRPORT FACILITIES				2		2	2		2
FAILURE TO NOTIFY OF UNSAFE CONDITION				1	1	2	1	1	2
IMPROPER INSPECTION OF FACILITIES				1	1	2	1	1	2
OTHER					1	1		1	1
AIRWAYS FACILITIES PERSONNEL				1		1	1		1
PRODUCTION-DESIGN				5		5	6		6
SUBSTANDARD QUALITY CONTROL	1		1	7	2	9	8	2	10
INCORRECT FACTORY INSTALLATION	1		1	3	1	4	4	1	5
POOR/INADEQUATE DESIGN	1		1						
OTHER				4	1	5	4	1	5
MISCELLANEOUS-PERSONNEL				1		1	1		1
PASSENGER				5		5	6		6
OTHER				7	2	9	8	2	10
DIRECT ENTRIES				3	1	4	4	1	5
THIRD PILOT				1		1	1		1
FLIGHT ENGINEER				2		2	2		2
DISPATCHING									
SUBTOTAL	42	6	48	405	33	438	447	39	486
** AIRFRAME **									
WINGS									
BRACING WIRES, STRUTS	1		1				1		1
FUSELAGE				1		1	1		1
DOORS, DOOR FRAMES				1		1	1		1
WINDSHIELDS, WINDOWS, CANOPIES									

TABLE A-7 CONTINUED

CAUSE/FACTOR TABLE

AIRFRAME (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
LANDING GEAR				1		1	1		1
NORMAL RETRACTION/EXTENSION ASSEMBLY					1	1		1	1
LANDING GEAR WARNING AND INDICATING COMPONENTS									
FLIGHT CONTROL SURFACES	1		1				1		1
AILERON, SURFACES ATTACHMENTS									
SUBTOTAL	2		2	3	1	4	5	1	6
** POWERPLANT **									
ENGINE STRUCTURE				6		6	6		6
CRANKCASE	2		2	54	1	55	56	1	57
CRANKSHAFT	6		6	80		80	86		86
MASTER AND CONNECTING RODS	3	1	4	68		68	71	1	72
CYLINDER ASSEMBLY	6	1	7	62	1	63	68	2	70
PISTON, PISTON RINGS	6		6	123	1	124	129	1	130
VALVE ASSEMBLIES				14		14	14		14
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
MOUNT AND VIBRATION ISOLATORS	5		5	36		36	41		41
OTHER									
IGNITION SYSTEM	6	1	7	55	2	57	61	3	64
MAGNETOES	1		1	1		1	2		2
DISTRIBUTOR	8	1	9	41	3	44	49	4	53
SPARK PLUG				1		1	1		1
COILS				2		2	2		2
LOW TENSION WIRING				1		1	1		1
HIGH TENSION WIRING				7	1	8	7	1	8
IGNITION HARNESS, SHIELDING				3		3	3		3
SWITCHES	1		1	3		3	4		4
LEADS				2		2	2		2
OTHER									
FUEL SYSTEM				11	4	15	11	4	15
TANKS	3		3	29	2	31	32	2	34
LINES AND FITTINGS	4		4	21	2	23	25	2	27
SELECTOR VALVES	2		2	14	1	15	16	1	17
FILTERS, STRAINERS, SCREENS	2		2	2		2	4		4
PRIMING SYSTEM	10		10	91	1	92	101	1	102
CARBURETOR	6		6	21	1	22	27	1	28
PUMPS	4		4	12	1	13	16	1	17
FUEL INJECTION SYSTEM	1		1	39	8	47	40	8	48
VENTS, DRAINS, TANK CAPS				6		6	6		6
RAM AIR ASSEMBLY	1		1	6		6	7		7
OTHER									
LUBRICATING SYSTEM				18	1	19	18	1	19
LINES, HOSES, FITTINGS				2		2	2		2
VALVES				8		8	8		8
FILTERS, SCREENS				5		5	5		5
PUMP-PRESSURE				2		2	2		2
PUMPS-SCAVENGER				4		4	4		4
OIL COOLERS				1		1	1		1
MAGNETIC PLUGS				11		11	11		11
SEALS AND GASKETS				13	1	14	13	1	14
OTHER									
COOLING SYSTEM				1		1	1		1
BAFFLES				1		1	1		1
OTHER									
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES				1		1	1		1
HYDRAULIC PITCH CONTROL MECHANISM	1		1	2		2	3		3
OTHER									
EXHAUST SYSTEM				3		3	3		3
MANIFOLDS	1		1	14	1	15	15	1	16
MUFFLERS				1		1	1		1
GASKETS				6		6	6		6
STACKS				3		3	3		3
BAFFLES									
ENGINE ACCESSORIES				1		1	1		1
STARTERS				1		1	1		1
OTHER									
ENGINE CONTROLS-COCKPIT	1		1	28	1	29	29	1	30
THROTTLE-POWER LEVER ASSEMBLIES	1		1	16		16	17		17
MIXTURE CONTROL ASSEMBLIES									

TABLE A-7 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
INDUCTION AIR, PREHEAT CONTROLS									
OTHER				6		6	6		6
POWERPLANT-INSTRUMENTS				1		1	1		1
FUEL QUANTITY GAUGE									
MISCELLANEOUS		1	1	4	40	44	4	41	45
POWERPLANT FAILURE FOR UNDETERMINED REASONS									
BIRD INGESTION	70		70	762		762	832		832
FOREIGN OBJECT DAMAGE				2		2	2		2
COMPRESSOR STALLS				1		1	1		1
DETONATION				1		1	1		1
OTHER				6		6	6		6
DIRECT ENTRIES	1		1	1		1	2		2
REDUCTION GEAR ASSEMBLY	3		3	40	1	41	43	1	44
GEARS, ACCESSORY DRIVE									
OTHER				4		4	4		4
COMPRESSOR ASSEMBLY				1		1	1		1
OTHER									
COMBUSTION ASSEMBLY	1		1				1		1
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
OTHER									
SAFETY SYSTEM				1		1	1		1
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
OTHER									
PROPELLER SYSTEM				1		1	1		1
GOVERNOR									
CONSTANT SPEED DRIVE				1		1	1		1
GOVERNOR VALVE									
POWER LEVER				1		1	1		1
CABLE									
PROPELLER LEVER				1		1	1		1
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
TACHOMETER									
ENGINE INSTALLATION				1		1	1		1
SUBTOTAL	156	5	161	1790	74	1864	1946	79	2025
** SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES									
GENERATORS/ALTERNATORS				1	1	2	1	1	2
HYDRAULIC SYSTEM				2		2	2		2
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS									
CARBURETOR DE-ICING SYSTEM									
OTHER				15		15	15		15
AIR CONDITION, HEATING AND PRESSURIZATION				1		1	1		1
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM									
AUTO PILOT		1	1					1	1
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	19	1	20	19	2	21
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
COMPASS									
COMMUNICATIONS AND NAVIGATION EQUIPMENT				1		1	1		1
TRANSMITTERS AND/OR RECEIVERS									
VOR RECEIVERS				1	3	4	1	3	4
COMPASS RECEIVERS				1	3	4	1	3	4
	1		1	1		1	2		2

TABLE A-7 CONTINUED

CAUSE/FACTOR TABLE

INSTRUMENTS/EQUIPMENT AND ACCESSORIES (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
				1	1	2	1	1	2
OTHER				1		1	1		1
MISCELLANEOUS EQUIPMENT									
SPRAY, DUSTING EQUIPMENT	1		1	6	7	13	7	7	14
SUBTOTAL									
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES				1	1	2	1	1	2
AIRPORT CONDITIONS									
SNOW ON RUNWAY									
AIRWAYS FACILITIES				1	1	2	1	1	2
SUBTOTAL									
** WEATHER **									
	1	15	16	2	25	27	3	40	43
LOW CEILING		5	5	2	10	12	2	15	17
RAIN	1	5	6	3	15	18	4	20	24
FOG	2	5	7		8	8	2	13	15
SNOW	4	3	7	8	13	21	12	16	28
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	9	13	22	133	108	241	142	121	263
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING		1	1		9	9		10	10
UNFAVORABLE WIND CONDITIONS	1	1	2		1	1	1	2	3
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS	1		1	1		1	1		1
DOWNDRAFTS, UPDRAFTS					4	4		4	4
LOCAL WHIRLWIND		2	2		2	2		4	4
ADVERSE WINDS ALOFT		1	1		6	6		7	7
HIGH TEMPERATURE		2	2	1	5	6	1	7	8
OBSTRUCTIONS TO VISION		2	2		4	4		6	6
HIGH DENSITY ALTITUDE					1	1		1	1
THUNDERSTORM ACTIVITY									
OTHER	19	55	74	150	211	361	169	266	435
SUBTOTAL									
** TERRAIN **					1	1		1	1
					1	1		1	1
WET, SOFT GROUND									
SNOW-COVERED					2	2		2	2
SUBTOTAL									
** MISCELLANEOUS **									
				1		1	1		1
BIRD COLLISION				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				5	4	9	5	4	9
UNQUALIFIED PERSON OPERATED AIRCRAFT				1		1	1		1
SABOTAGE	9		9	102	4	106	111	4	115
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	4		4	3		3	7		7
UNDETERMINED	1		1	5		5	6		6
DIRECT ENTRIES	14		14	118	8	126	132	8	140
SUBTOTAL	459	81	540	4927	414	5341	5386	495	5881
GRAND TOTAL									
** MISCELLANEOUS ACTS, CONDITIONS **									
	16	1	17	397	6	403	413	7	420
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	1	1	2	4	11	15	5	12	17
CHECKLIST-FAILED TO USE	1		1				1		1
CREW COORDINATION-POOR		1	1	1	2	3	1	3	4
DISREGARD OF GOOD OPERATING PRACTICE	8	2	10	12	15	27	20	17	37
IMPROPER EMERGENCY PROCEDURES	1		1	1	2	3	1	2	3
FEATHERED WRONG ENGINE					1	1		1	1
INSTRUMENTS-MISREAD OR FAILED TO READ					2	2		2	2
SEAT BELT NOT FASTENED					5	5		5	5
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA	13	1	14	115	26	141	128	27	155
UNWARRANTED LOW FLYING									
INATTENTIVE TO FUEL SUPPLY									

TABLE A-7 CONTINUED

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
PREMATURE FLAP RETRACTION				1		1	1		1
POORLY PLANNED APPROACH				1	6	7	1	6	7
MISCALCULATED FUEL CONSUMPTION				70	17	87	73	19	92
JETTISONED LOAD					14	14		14	14
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	3	2	5		5	5		7	8
LANDED ON FOAMED RUNWAY					1	1	1	1	1
IMPROPERLY SECURED	1	2	3	38	3	41	42	3	45
BOGUS PART				3		3	3		3
ELECTRICAL FAILURE	4		4	4	3	7	4	3	7
ENGINE LOADED UP				113	17	130	115	17	132
FATIGUE FRACTURE				44	1	45	49	1	50
FUEL GRADE-IMPROPER	2		2	7		7	7		7
IMPROPER GRADE OIL-LUBRICATING SYSTEM	5		5	2		2	2		2
RPM-UNCONTROLLABLE-OVERSPEED					2	2		2	2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION					2	2		3	3
WRONG PART				1		1	1	1	2
IMPROPER ALIGNMENT/ADJUSTMENT		1	1	18	1	19	22	1	23
FAILURE OF TWO OR MORE ENGINES		1	1	27	61	88	35	70	105
SEPARATION IN FLIGHT	4		4	1	11	12	1	12	13
FIRE IN ENGINE	8	9	17	2	3	5	3	3	6
CORRODED/CORROSION		1	1	6	1	7	7	1	8
CONGESTED TRAFFIC-PATTERN	1		1	1		1	1	2	3
PILOT FATIGUE	1		1		3	3	1	3	4
FUEL EXHAUSTION		2	2	766		766	810	1	811
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	1		1	60	2	62	61	2	63
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	44	1	45	4		4	10	2	12
HYPOXIA	1		1		1	1		1	1
CARBON MONOXIDE POISONING	6	2	8					1	1
ICE-IN FUEL		1	1	10	2	12	11	2	13
ICE-ENGINE	1		1	5		5	6		6
ICE-CARBURETOR	1		1	333	7	340	349	7	356
ICE-PROPELLER	16		16	1		1	1		1
AIRFRAME ICE				5	4	9	5	4	9
ICE-WINDSHIELD				1		1	1		1
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	1	4	5		3	3	1	7	8
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1		1	10	1	11	11	1	12
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	4		4	54	2	56	58	2	60
OIL EXHAUSTION-PROPELLER SYSTEM				2		2	2		2
OIL CONTAMINATION				5		5	5		5
SIMULATED CONDITIONS	15	2	17	97	56	153	112	58	170
FUEL SIPHONING				3	1	4	3	1	4
WATER IN FUEL	7		7	184	5	189	191	5	196
AIRCRAFT CAME TO REST IN WATER		5	5		39	39		44	44
FROZEN, MOISTURE				4		4	4		4
MISSING	1	2	3	15	3	18	16	5	21
TOUCH AND GO LANDING		2	2		7	7		9	9
OVERLOAD FAILURE				1		1	1		1
MATERIAL FAILURE	18	1	19	465	11	476	483	12	495
FUEL STARVATION	73	2	75	758		758	831	2	833
OIL STARVATION	5		5	35	1	36	40	1	41
IMPROPER CLEARANCE-TOLERANCE	3		3	18	1	19	21	1	22
FUEL SELECTOR POSITIONED BETWEEN TANKS	8	2	10	30	5	35	38	7	45
FIRE OF UNDETERMINED ORIGIN				1		1	1		1
UNAPPROVED MODIFICATION		1	1	5	2	7	5	3	8
IMPROPER/INADEQUATE VENTING				5	3	8	5	3	8
ACTION, LACK OF				1		1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				5	3	8	5	3	8
LEAK/LEAKAGE	3		3	22	4	26	25	3	29
LOW FLUID LEVEL					2	2		4	4
ARCING	1		1	7		7	7		7
LOW COMPRESSION					4	4		5	5
DOWNWIND	5	1	6	24	3	27	29	4	33
CARBON DEPOSITS		1	1	1	1	2	1	1	3
LANDED IN CONSTRUCTION AREA	6		6	1		1	1		1
OVER TORQUED				27	3	30	33	3	36
UNDER TORQUED	3		3	3		3	3		3
LOOSE, PART/FITTING		1	1	5	1	6	8	1	9
BENT	1		1	11	2	13	11	3	14
BINDING				2	2	4	3	2	5
BURNED									
CHAFFED									

TABLE A-7 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
COLLAPSED				5	1	6	6	1	7
CROSSED	1		1				1		1
DETERIORATED	1		1				5	2	7
DISCONNECTED	1	1	2	4	1	5	13	2	15
EXCESSIVE		1	1	13	1	14	2	14	16
ERRATIC	1		1	5	14	19	2		2
FRICTION, EXCESSIVE				2		2	1		1
GROUNDED				1		1	5		5
HIGH VOLTAGE BREAKDOWN				5		5	1		1
IMPROPERLY INSTALLED				1		1	27	4	31
JAMMED	1	1	2	26	3	29	4		4
OBSTRUCTED				4		4	21	1	22
OPEN		1	1	21		21		1	1
OUT OF BALANCE					1	1	1	2	3
OVERHEATED				1	2	3	14	1	15
PINCHED				14	1	15	1		1
EXCESSIVE PRESSURE				1		1	4		4
PRESSURE TOO LOW				4		4	11	2	13
PRESSURE, NONE				11	2	13	9	2	11
SCORED	2	2	2	9	2	11	4		4
SHEARED	2	2	4	2		2	8		8
STICKING				6		6	8	2	10
STRIPPED				8	2	10	1		1
STUCK	1	1	2	1		1	11	3	14
EXCESSIVE TEMPERATURE	2	2	4	10	3	13	6	4	10
VIBRATION, EXCESSIVE				4	4	8	4		8
WARPED				4	4	8	1		1
ICE-INDUCTION	1	1	2	1		1	2		2
				1		1			

DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PWR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-THROTTLE CONTROL BINDING IN CABLE HOUSING.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-CAM REDUCTION GEAR FAILED.
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-ENGINES WOULDNT AIRSTART,REASON IS UNKNOWN
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.

TABLE A-7 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

CAUSE/FACTOR TABLE

MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWR PLT-DETONATION IN ALL CYLINDERS.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-OIL FILLER CAP MISSING.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-GASKET BLOWN NO 3 CYL.
PILOT-MISCALCULATED FUEL CONSUMPTION.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PILOT-DID NOT MONITOR REAR ENG INSTRUMENTS.
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PILOT-INADVERTENTLY TURNED ENG OFF.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

TABLE A-8

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	260 83.60	21 6.75	265 85.21	2403 60.09	90 2.25	2410 60.27	2663 61.79	111 2.58	2675 62.06
PERSONNEL	38 12.22	7 2.25	45 14.47	404 10.10	39 .98	443 11.08	442 10.26	46 1.07	488 11.32
AIRFRAME	1 .32	.00	1 .32	3 .08	1 .03	4 .10	4 .09	1 .02	5 .12
LANDING GEAR	.00	.00	.00	10 .25	4 .10	14 .35	10 .23	4 .09	14 .32
POWERPLANT	143 45.98	3 .96	145 46.62	1717 42.94	71 1.78	1781 44.54	1860 43.16	74 1.72	1926 44.69
SYSTEMS	.00	1 .32	1 .32	19 .48	2 .05	21 .53	19 .44	3 .07	22 .51
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .32	.00	1 .32	6 .15	5 .13	11 .28	7 .16	5 .12	12 .28
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	2 .64	2 .64	9 .23	25 .63	34 .85	9 .21	27 .63	36 .84
WEATHER	20 6.43	44 14.15	60 19.29	166 4.15	211 5.28	373 9.33	186 4.32	255 5.92	433 10.05
TERRAIN	14 4.50	23 7.40	37 11.90	309 7.73	532 13.30	841 21.03	323 7.49	555 12.88	878 20.37
MISCELLANEOUS	11 3.54	1 .32	12 3.86	144 3.60	11 .28	155 3.88	155 3.60	12 .28	167 3.87
UNDETERMINED	4 1.29	.00	4 1.29	3 .08	.00	3 .08	7 .16	.00	7 .16

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE A-9

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE

FIXED-WING AIRCRAFT

U. S. GENERAL AVIATION

1965 - 1969

CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 4310 TOTAL ACCIDENTS
INVOLVES 312 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	8	1	9	28	5	33	36	6	42
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	5		5	9	2	11	14	2	16
BECAME LOST/DISORIENTED	8	1	9	82	12	94	90	13	103
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	12	1	13	32	4	36	44	5	49
DELAYED ACTION IN ABORTING TAKEOFF				11		11	11		11
DELAYED IN INITIATING GO-AROUND				11	1	12	11	1	12
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1			6	2	8	7	2	9
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT	2		1	1		1	3		3
FAILED TO EXTEND LANDING GEAR			2	13		13	13		13
FAILED TO RETRACT LANDING GEAR				1		1	1		1
RETRACTED GEAR PREMATURELY				2		2	2		2
INADVERTENTLY RETRACTED GEAR				1		1	1		1
FAILED TO SEE AND AVOID OTHER AIRCRAFT	1		1				1		1
FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS	1		1				1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	129	1	130	22		22	23		23
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	207		207	336	1	337
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	2		2	12		12	14		14
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	29		29	35	7	42	37	7	44
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS				480		480	509		509
IMPROPER OPERATION OF FLIGHT CONTROLS	6		6	14		14	14		14
PREMATURE LIFT OFF				11		11	17		17
IMPROPER LEVEL OFF	2		2	5		5	5		5
IMPROPER IFR OPERATION	2		2	80		80	82		82
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	27		27	4		4	6		6
IMPROPER COMPENSATION FOR WIND CONDITIONS				123	7	130	150	7	157
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	64	4	68	2		2	2		2
INADEQUATE SUPERVISION OF FLIGHT	11		11	867	8	875	931	12	943
LACK OF FAMILIARITY WITH AIRCRAFT	8	9	17	91		91	102		102
MISMANAGEMENT OF FUEL	59		59	32	30	62	40	39	79
EXERCISED POOR JUDGMENT	7		7	556	1	557	615	1	616
OPERATED CARELESSLY				39		39	46		46
SELECTED UNSUITABLE TERRAIN	2		2	1	2	3	1	2	3
IMPROPER STARTING PROCEDURES	1		1	35		35	37		37
FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED				3		3	4		4
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				19		19	19		19
SPONTANEOUS-IMPROPER ACTION				1	1	2	1	1	2
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				18		18	18		18
MISJUDGED DISTANCE AND SPEED	1		1	9		9	10		10
MISJUDGED DISTANCE	2	1	3	44		44	46	1	47
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
MISJUDGED SPEED AND ALTITUDE	3		3	28	1	29	31	1	32
MISJUDGED SPEED	1		1	3		3	4		4
MISJUDGED ALTITUDE AND CLEARANCE				4		4	4		4
MISJUDGED ALTITUDE	1		1	3		3	4		4
MISJUDGED CLEARANCE	4		4	9		9	13		13
INADEQUATE TRAINING OF STUDENT				4		4	4		4
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
IMPROPER RECOVERY FROM BOUNCED LANDING				1		1	1		1
INCAPACITATION				4		4	4		4
PHYSICAL IMPAIRMENT				1		1	1		1
SPATIAL DISORIENTATION	8	1	9	4		4	12	1	13
PSYCHOLOGICAL CONDITION	3		3	4		4	7		7
MISUSED OR FAILED TO USE FLAPS		1	1		1	1		2	2
FAILED TO MAINTAIN DIRECTIONAL CONTROL	1		1	1	5	6	2	5	7
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	1		1	14		14	15		15
FAILED TO ABORT TAKEOFF		1	1	5	2	7	5	3	8
FAILED TO INITIATE GO-AROUND	6		6	14		14	20		20
DIRECT ENTRIES				2		2	2		2
	3		3	15		15	18		18

CAUSE/FACTOR TABLE

TABLE A-9 CONTINUED

PILOT IN COMMAND (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL	423	21	444	3025	91	3116	3448	112	3560
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				3		3	3		3
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				1		1	1		1
LACK OF FAMILIARITY WITH AIRCRAFT				1		1	1		1
CONTROL INTERFERENCE				1		1	1		1
DIRECT ENTRIES				8		8	8		8
SUBTOTAL									
DUAL STUDENT				1		1	1		1
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
DELAYED IN INITIATING GO-AROUND				4		4	4		4
FAILED TO EXTEND LANDING GEAR				2		2	2		2
INADVERTENTLY RETRACTED GEAR				2		2	3		3
FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS	1		1	2		2	26		26
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	12		12	14		14	22		22
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				22		22	1		1
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS				1		1	5		5
IMPROPER LEVEL OFF				5		5	1		1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING				1		1	5		5
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	2		2
INADEQUATE SUPERVISION OF FLIGHT				2		2	1	1	1
LACK OF FAMILIARITY WITH AIRCRAFT				11	1	12	11	1	12
MISMANAGEMENT OF FUEL				1	1	2	1	1	2
FAILURE TO RELINQUISH CONTROL				2		2	2		2
SPONTANEOUS-IMPROPER ACTION				2		2	2		2
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
MISJUDGED SPEED AND ALTITUDE				2		2	2		2
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS		1	1					1	1
MISUSED OR FAILED TO USE FLAPS				5		5	5		5
FAILED TO MAINTAIN DIRECTIONAL CONTROL				2		2	2		2
FAILED TO ABORT TAKEOFF	13	1	14	86	3	89	99	4	103
SUBTOTAL									
CHECK PILOT	1		1	5		5	6		6
INADEQUATE SUPERVISION OF FLIGHT	1		1	5		5	6		6
SUBTOTAL									
** PERSONNEL **									
FLIGHT INSTRUCTOR				2	1	3	2	1	3
INADEQUATE SUPERVISION OF FLIGHT				7	3	10	7	3	10
INADEQUATE TRAINING OF STUDENT				1		1	1		1
DIRECT ENTRIES									
MAINTENANCE, SERVICING, INSPECTION				41		41	46		46
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	5		5	17	2	19	20	2	22
IMPROPER MAINTENANCE(OWNER PERSONNEL)	3		3	9	2	11	9	2	11
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				23	2	25	24	2	26
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	1		1	9		9	11		11
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)	2		2	3		3	3	1	4
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)		1	1	265	13	278	290	17	307
INADEQUATE MAINTENANCE AND INSPECTION	25	4	29	2		2	2		2
OTHER							1		1
UNK/NR	1		1		1	1		1	1
OPERATIONAL SUPERVISORY PERSONNEL								1	1
INADEQUATE FLIGHT TRAINING-PROCEDURES		1	1	1	1	2	1	1	2
INADEQUATE SUPERVISION OF FLIGHT CREW				1	1	2	1	1	2
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT									
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS					1	1	1	1	2
WEATHER PERSONNEL				1		1	1		1
INCORRECT WEATHER FORECAST	1		1				1		1
INCOMPLETE WEATHER REPORT	1		1	1		1	1		1
INADEQUATE/INCORRECT WEATHER BRIEFING				1		1	1		1
TRAFFIC CONTROL PERSONNEL									
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION									

TABLE A-9 CONTINUED

CAUSE/FACTOR TABLE

PERSONNEL (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
ISSUED IMPROPER OR CONFLICTING INSTRUCTIONS									
AIRPORT SUPERVISORY PERSONNEL									
IMPROPER MAINTENANCE-AIRPORT FACILITIES		1	1						
FAILURE TO NOTIFY OF UNSAFE CONDITION									
IMPROPER INSPECTION OF FACILITIES									
OTHER				2	1	3	2	1	3
AIRWAYS FACILITIES PERSONNEL					1	1		1	1
PRODUCTION-DESIGN				1	1	2	1	1	2
SUBSTANDARD QUALITY CONTROL					1	1		1	1
INCORRECT FACTORY INSTALLATION								1	1
POOR/INADEQUATE DESIGN									
OTHER	1		1	1		1	1		1
MISCELLANEOUS-PERSONNEL	1		1	5		5	6		6
PILOT OF OTHER AIRCRAFT	1		1	7	2	9	8	2	10
PASSENGER				3	1	4	4	1	5
DRIVER OF VEHICLE				1	2	3	1	2	3
OTHER				5	2	7	5	2	7
DIRECT ENTRIES				1	1	2	1	1	2
THIRD PILOT				1	1	2	1	1	2
FLIGHT ENGINEER				2		2	2		2
DISPATCHING									
SUBTOTAL	42	7	49	412	40	452	454	47	501
** AIRFRAME **									
WINGS	1		1						
BRACING WIRES, STRUTS					1	1	1		1
OTHER				1		1		1	1
FUSELAGE				1		1	1		1
DOORS, DOOR FRAMES				5	1	6	5	1	6
WINDSHIELDS, WINDOWS, CANOPIES				2	1	3	2	1	3
LANDING GEAR				1	1	2	1	1	2
NORMAL RETRACTION/EXTENSION ASSEMBLY				1	2	3	1	2	3
EMERGENCY/EXTENSION ASSEMBLY				1		1	1		1
NOSEWHEEL ASSEMBLIES				1	2	3	1	2	3
BRAKING SYSTEM (NORMAL)				1	1	2	1	1	2
LANDING GEAR WARNING AND INDICATING COMPONENTS					1	1		1	1
GEAR LOCKING MECHANISM					1	1		1	1
DIRECT ENTRIES									
FLIGHT CONTROL SURFACES	1		1	1		1	1		1
AILERON, SURFACES ATTACHMENTS					1	1		1	1
HORIZONTAL STABILIZER, ATTACHMENTS					1	1		1	1
FLAP ASSEMBLIES									
SUBTOTAL	2		2	14	7	21	16	7	23
** POWERPLANT **									
ENGINE STRUCTURE	2		2	6		6	6		6
CRANKCASE	6		6	54	1	55	56	1	57
CRANKSHAFT	3	1	4	80		80	86		86
MASTER AND CONNECTING RODS	6	1	7	68		68	71	1	72
CYLINDER ASSEMBLY	6		6	62	1	63	68	2	70
PISTON, PISTON RINGS				123	1	124	129	1	130
VALVE ASSEMBLIES	5		5	14		14	14		14
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
MOUNT AND VIBRATION ISOLATORS	6	1	7	36		36	41		41
OTHER	1		1	55	2	57	61	3	64
IGNITION SYSTEM	8	1	9	1	1	2	2	1	3
MAGNETOES				41	3	44	49	4	53
DISTRIBUTOR				1		1	1		1
SPARK PLUG				2		2	2		2
COILS				1	1	2	1		1
LOW TENSION WIRING				7	1	8	7	1	8
HIGH TENSION WIRING	1		1	3		3	3		3
IGNITION HARNESS, SHIELDING				3		3	4		4
SWITCHES				2		2	2		2
LEADS				11	4	15	11	4	15
OTHER									
FUEL SYSTEM									
TANKS									

CAUSE/FACTOR TABLE

TABLE A-9 CONTINUED

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
LINES AND FITTINGS	3		3	30	2	32	33	2	35
SELECTOR VALVES	4		4	21	2	23	25	2	27
FILTERS, STRAINERS, SCREENS	2		2	14	1	15	16	1	17
PRIMING SYSTEM	2		2	2		2	4		4
CARBURETOR	10		10	91	1	92	101	1	102
PUMPS	6		6	21	1	22	27	1	28
FUEL INJECTION SYSTEM	4		4	12	1	13	16	1	17
VENTS, DRAINS, TANK CAPS	1		1	39	8	47	40	8	48
RAM AIR ASSEMBLY				6		6	6		6
OTHER	1		1	6		6	7		7
LUBRICATING SYSTEM				18	1	19	18	1	19
LINES, HOSES, FITTINGS				2		2	2		2
VALVES				8		8	8		8
FILTERS, SCREENS				5		5	5		5
PUMP-PRESSURE				2		2	2		2
PUMPS-SCAVENGER				4		4	4		4
OIL COOLERS				1		1	1		1
MAGNETIC PLUGS				11		11	11		11
SEALS AND GASKETS				13	1	14	13	1	14
OTHER				1		1	1		1
COOLING SYSTEM				1		1	1		1
BAFFLES									
OTHER				1		1	1		1
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES	1		1	3		3	4		4
HYDRAULIC PITCH CONTROL MECHANISM									
OTHER				3		3	3		3
EXHAUST SYSTEM	1		1	14	1	15	15	1	16
MANIFOLDS				1		1	1		1
MUFFLERS				6		6	6		6
GASKETS				3		3	3		3
STACKS									
BAFFLES							1		1
ENGINE ACCESSORIES	1		1	1		1	1		1
VACUUM PUMPS				1		1	1		1
STARTERS									
OTHER									
ENGINE CONTROLS-COCKPIT	1		1	28	1	29	29	1	30
THROTTLE-POWER LEVER ASSEMBLIES	1		1	16		16	17		17
MIXTURE CONTROL ASSEMBLIES				6		6	6		6
INDUCTION AIR, PREHEAT CONTROLS				1		1	1		1
OTHER									
POWERPLANT-INSTRUMENTS		1	1	4	40	44	4	41	45
FUEL QUANTITY GAUGE	70		70	762		762	832		832
MISCELLANEOUS				2		2	2		2
POWERPLANT FAILURE FOR UNDETERMINED REASONS				1		1	1		1
BIRD INGESTION				1		1	1		1
FOREIGN OBJECT DAMAGE				6		6	6		6
COMPRESSOR STALLS				1		1	2		2
DETONATION	1		1	1		1	2		2
OTHER	3		3	40	1	41	43	1	44
DIRECT ENTRIES				4		4	4		4
REDUCTION GEAR ASSEMBLY				1		1	1		1
GEARS, ACCESSORY DRIVE									
OTHER							1		1
COMPRESSOR ASSEMBLY	1		1						
OTHER									
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM				1		1	1		1
FUEL SYSTEM									
OTHER									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM				1		1	1		1
THRUST REVERSER									
OTHER				1		1	1		1
PROPELLER SYSTEM									
GOVERNOR									

TABLE 9 (CONTINUED)

CAUSE/FACTOR TABLE

APPENDIX A

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
CONSTANT SPEED DRIVE									
GOVERNOR VALVE									
POWER LEVER				1		1	1		1
CABLE				1		1	1		1
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
TACHOMETER				1		1	1		1
ENGINE INSTALLATION									
SUBTOTAL	157	5	162	1792	74	1866	1949	79	2028
** SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES									
GENERATORS/ALTERNATORS				1	1	2	1	1	2
HYDRAULIC SYSTEM				2		2	2		2
FLIGHT CONTROL SYSTEMS									
WING FLAP CONTROL SYSTEM (ELECTRICAL)									
WING FLAP CONTROL SYSTEM (HYDRAULIC)					1	1		1	1
ANTI-ICING, DE-ICING SYSTEMS				1		1	1		1
CARBURETOR DE-ICING SYSTEM									
OTHER				15		15	15		15
AIR CONDITION, HEATING AND PRESSURIZATION				1		1	1		1
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM									
AUTO PILOT		1	1					1	1
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	20	2	22	20	3	23
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
COMPASS				1		1	1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
TRANSMITTERS AND/OR RECEIVERS				1	3	4	1	3	4
VOR RECEIVERS				1	3	4	1	3	4
COMPASS RECEIVERS	1		1	1		1	2		2
OTHER				1	1	2	1	1	2
MISCELLANEOUS EQUIPMENT									
SPRAY, DUSTING EQUIPMENT				2		2	2		2
SUBTOTAL	1		1	7	7	14	8	7	15
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS									
WET RUNWAY					5	5		5	5
ICE/SLUSH ON RUNWAY					1	1		1	1
SNOW ON RUNWAY		1	1	5	4	9	5	5	10
SOFT SHOULDERS (RUNWAY)					3	3		3	3
HIGH VEGETATION		1	1		1	1		2	2
OTHER				4	11	15	4	11	15
AIRWAYS FACILITIES									
SUBTOTAL		2	2	9	25	34	9	27	36
** WEATHER **									
LOW CEILING	4	26	30	6	33	39	10	59	69
RAIN	1	7	8	3	11	14	4	18	22
FOG	5	11	16	7	21	28	12	32	44
SNOW	2	6	8		10	10	2	16	18
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	4	4	8	11	15	26	15	19	34
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	9	13	22	133	108	241	142	121	263
UNFAVORABLE WIND CONDITIONS	1	3	4	7	18	25	8	21	29
SUDDEN WINDSHIFT				1		1	1		1

TABLE A-9 CONTINUED

CAUSE/FACTOR TABLE

WEATHER (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
TURBULENCE IN FLIGHT, CLEAR AIR	1	1	2	1	1	1	1	2	1
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS	1	1	2	4	2	1	1	3	3
DOWNDRAFTS, UPDRAFTS				2		6	5		8
LOCAL WHIRLWIND					4	2	2		2
ADVERSE WINDS ALOFT		2	2		5	4		4	4
HIGH TEMPERATURE	1	1	2		6	5		7	7
OBSTRUCTIONS TO VISION	1	4	5	2	14	6	1	7	8
HIGH DENSITY ALTITUDE		2	2		6	16	3	18	21
THUNDERSTORM ACTIVITY		1	1		1	6		8	8
OTHER	30	82	112	177	255	432	207	337	544
SUBTOTAL									
** TERRAIN **		2	2	81	180	261	81	182	263
WET, SOFT GROUND				9	13	22	9	13	22
SNOW-COVERED				1	1	2	1	1	2
ICY		1	1	22	61	83	22	62	84
HIGH VEGETATION	1		1	9	4	13	10	4	14
HIDDEN OBSTRUCTIONS	3	9	12	112	197	309	115	206	321
ROUGH/UNEVEN		1	1	1	1	2	1	2	3
ROUGH WATER	9	12	21	59	56	115	68	68	136
HIGH OBSTRUCTIONS					1	1		1	1
LOOSE GRAVEL				13	14	27	13	14	27
SANDY	1		1	10	13	23	11	13	24
OTHER	14	25	39	317	541	858	331	566	897
SUBTOTAL									
** MISCELLANEOUS **		1	1	1		1	1		1
BIRD COLLISION				32	2	34	32	3	35
EVASIVE MANEUVER TO AVOID COLLISION				5	4	9	5	4	9
UNQUALIFIED PERSON OPERATED AIRCRAFT				1		1	1		1
SABOTAGE	9		9	103	5	108	112	5	117
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	4		4	3		3	7		7
UNDETERMINED	2		2	5		5	7		7
DIRECT ENTRIES	15	1	16	150	11	161	165	12	177
SUBTOTAL	698	145	843	6022	1056	7078	6720	1201	7921
GRAND TOTAL									
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER, OF/FAILED TO USE	16	2	18	397	6	403	413	8	421
CHECKLIST-FAILED TO USE	1	1	2	5	18	23	6	19	25
CREW COORDINATION-POOR	1		1		2	2	1	2	3
DISREGARD OF GOOD OPERATING PRACTICE		2	2	1	2	3	1	4	5
IMPROPER EMERGENCY PROCEDURES	27	4	31	47	22	69	74	26	100
FEATHERED WRONG ENGINE	1		1	1		1	2		2
INSTRUMENTS-MISREAD OR FAILED TO READ				2	2	4	2	2	4
SEAT BELT NOT FASTENED	1	1	2		2	2	1	3	4
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA				3	2	5	3	5	8
UNWARRANTED LOW FLYING	3		3	2	8	8	5	8	13
FAILED TO EXTEND THE LANDING FLAPS					1	10		1	1
FAILED TO USE ALL AVAILABLE RUNWAY		2	2		5	1		7	7
INATTENTIVE TO FUEL SUPPLY	13	1	14	115	26	5		27	155
FLEW INTO BLIND CANYON	1		1			141	128		1
PREMATURE FLAP RETRACTION				1			1		1
POORLY PLANNED APPROACH				10	16	1	1		1
MISCALCULATED FUEL CONSUMPTION	3	2	5	70	19	26	13	18	31
JETTISONED LOAD	3	2	5		21	89	73	21	94
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT		1	1		5	21		22	22
LANDED ON FOAMED RUNWAY		2	3		1	5	1	7	8
IMPROPERLY SECURED	1				3	1		1	1
BOGUS PART				38		41	42	3	45
ELECTRICAL FAILURE	4		4	3	5	3	3		3
ENGINE LOADED UP				5	5	10	5	5	10
FATIGUE FRACTURE				113	17	130	115	17	132
	2		2	44	1	45	49	1	50
	5		5						

TABLE A-9 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
FUEL GRADE-IMPROPER				7		7	7		7
HYDRAULIC FAILURE				1	1	2	1	1	2
IMPROPER GRADE OIL-LUBRICATING SYSTEM				2		2	2		2
RPM-UNCONTROLLABLE-OVERSPEED					2	2		2	2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION		1	1		4	4		5	5
WRONG PART		1	1	1		1	1	1	2
IMPROPER ALIGNMENT/ADJUSTMENT	4		4	18	2	20	22	2	24
FAILURE OF TWO OR MORE ENGINES	8	11	19	28	68	96	36	79	115
SEPARATION IN FLIGHT		2	2	1	13	14	1	15	16
FIRE IN ENGINE	1		1	4	8	12	5	8	13
ASYMETRICAL FLAPS				1		1	1		1
CORRODED/CORROSION	1		1	6	1	7	7	1	8
CONGESTED TRAFFIC-PATTERN		2	2	1	3	4	1	5	6
PILOT FATIGUE	1		1		3	3	1	3	4
FUEL EXHAUSTION	44	1	45	766		766	810	1	811
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	1		1	60	2	62	61	2	63
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	7	2	9	5		5	12	2	14
HYPOXIA					1	1		1	1
CARBON MONOXIDE POISONING		1	1					1	1
ICE-IN FUEL	1		1	10	2	12	11	2	13
ICE-ENGINE	1		1	5		5	6		6
ICE-CARBURETOR	16	1	17	333	7	340	349	8	357
ICE-PROPELLER				2		2	2		2
AIRFRAME ICE	3	1	4	9	6	15	12	7	19
ICE-WINDSHIELD				2	2	4	2	2	4
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	4	9	13	2	8	10	6	17	23
INTERFERENCE WITH FLIGHT CONTROLS				1		1	1		1
WHITEOUT					1	1		1	1
SUNGLARE		1	1		3	3		4	4
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1		1	10	1	11	11	1	12
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	4		4	54	2	56	58	2	60
OIL EXHAUSTION-PROPELLER SYSTEM				2		2	2		2
OIL CONTAMINATION				6		6	6		6
SIMULATED CONDITIONS	15	2	17	97	56	153	112	58	170
FUEL SIPHONING				3	1	4	3	1	4
WATER IN FUEL	7		7	184	5	189	191	5	196
AIRCRAFT CAME TO REST IN WATER		20	20		130	130		150	150
FROZEN, MOISTURE				4		4	4		4
MISSING	1	2	3	15	3	18	16	5	21
TOUCH AND GO LANDING		2	2		10	10		12	12
OVERLOAD FAILURE	1	1	2	3	806	809	4	807	811
MATERIAL FAILURE	18	1	19	467	11	478	485	12	497
FUEL STARVATION	73	2	75	758		758	831	2	833
OIL STARVATION	5		5	35	1	36	40	1	41
IMPROPER CLEARANCE-TOLERANCE	3		3	18	1	19	21	1	22
FUEL SELECTOR POSITIONED BETWEEN TANKS	8	2	10	31	5	36	39	7	46
FIRE OF UNDETERMINED ORIGIN				1		1	1		1
UNAPPROVED MODIFICATION		1	1	5	2	7	5	3	8
IMPROPER/INADEQUATE VENTING				5	3	8	5	3	8
ACTION, LACK OF					1	1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				6	3	9	6	3	9
LEAK/LEAKAGE	3		3	22	4	26	25	4	29
LOW FLUID LEVEL					2	2		2	2
CIRCUIT BREAKER POPPED				1	1	2	1	1	2
ARCING	1		1	7		7	1		1
LOW COMPRESSION					1	1	7		7
RUNWAY CLOSED				2		2	2	1	3
DOWNWIND				24	3	27	29	4	33
CARBON DEPOSITS		4	4	2	2	4	2	2	4
LANDED IN CONSTRUCTION AREA	5	1	6	1		1	1		1
OVER TORQUED				1		1	1		1
UNDER TORQUED	6		6	27	3	30	33	3	36
LOOSE, PART/FITTING				3		3	3		3
BENT	3		3	5	1	6	8	1	9
BINDING		1	1	11	2	13	11	3	14
BURNED	1		1	2	2	4	3	2	5
CHAFFED	1		1	5	1	6	6	1	7
COLLAPSED	1		1				1		1
CROSSED	1	1	2	4	1	5	5	2	7
DETERIORATED		1	1	13	1	14	13	2	15
DISCONNECTED									

CAUSE/FACTOR TABLE

TABLE A-9 CONTINUED

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
EXCESSIVE	1		1	5		5	6		6
ERRATIC				2	14	16	2	14	16
FRICTION, EXCESSIVE				1		1	1		1
GROUNDED				5		5	5		5
HIGH VOLTAGE BREAKDOWN				1		1	1		1
IMPROPERLY INSTALLED	1	1	2	26	3	29	27	4	31
JAMMED				4		4	4		4
OBSTRUCTED		1	1	21		21	21	1	22
OPEN					1	1		1	1
OUT OF BALANCE				1	2	3	1	2	3
OVERHEATED				14	1	15	14	1	15
PINCHED				1		1	1		1
EXCESSIVE PRESSURE				4		4	4		4
PRESSURE TOO LOW				12	3	15	12	3	15
PRESSURE, NONE				9	2	11	9	2	11
SCORED	2		2	2		2	4		4
SHEARED	2		2	6		6	8		8
STICKING				8	2	10	8	2	10
STRIPPED				1		1	1		1
STUCK	1		1	12	3	15	13	3	16
EXCESSIVE TEMPERATURE	2		2	4	4	8	6	4	10
VIBRATION, EXCESSIVE				4	4	8	4	4	8
WARPED				1		1	1		1
ICE-INDUCTION	1		1	1		1	2		2
INTENTIONAL GROUND-WATER LOOP-SWERVE				2	1	3	2	1	3
INTENTIONAL WHEELS UP	2		2	27	8	35	29	8	37

DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-DID NOT SEE WIRES IN TIME-EVASIVE ACT,N STAL
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PWR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-THROTTLE CONTROL BINDING IN CARLE HOUSING.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-CAM REDUCTION GEAR FAILED.
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PILOT-LIMITED EXPERIENCE
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
FLT INSTR-POORLY PLANNED FORCED LANDING
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-ENGINES WOULONT AIRSTART,REASON IS UNKNOWN

TABLE A-9 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWR PLT-DETONATION IN ALL CYLINDERS.
LDG GR-NOSE GEAR RETRACTED FOR UNDETERMINED REASON
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-OIL FILLER CAP MISSING.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PILOT-FAILED TO JETTISON LOAD.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-GASKET BLOWN NO 3 CYL.
PILOT-MISCALCULATED FUEL CONSUMPTION.
MISC-LOSS OF CONTROL FOR UNDETERMINED CAUSE.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PILOT-DID NOT MONITOR REAR ENG INSTRUMENTS.
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PILOT-INADVERTENTLY TURNED ENG OFF.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PILOT-LOSS OF CONTROL FOR UNDETERMINED REASON.
PILOT-LOSS OF CONTROL FOR UNDETERMINED CAUSE.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

TABLE A-10

CAUSE/FACTOR TABLE

FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS
INVOLVES 220 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	150 68.18	11 5.00	150 68.18	1977 63.94	66 2.13	1980 64.04	2127 64.22	77 2.32	2130 64.31
PERSONNEL	38 17.27	6 2.73	44 20.00	393 12.71	31 1.00	423 13.68	431 13.01	37 1.12	467 14.10
AIRFRAME	1 .45	.00	1 .45	1 .03	.00	1 .03	2 .06	.00	2 .06
LANDING GEAR	.00	.00	.00	1 .03	.00	1 .03	1 .03	.00	1 .03
POWERPLANT	72 32.73	3 1.36	74 33.64	950 30.72	68 2.20	1013 32.76	1022 30.86	71 2.14	1087 32.82
SYSTEMS	.00	1 .45	1 .45	16 .52	1 .03	17 .55	16 .48	2 .06	18 .54
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .45	.00	1 .45	5 .16	5 .16	10 .32	6 .18	5 .15	11 .33
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	1 .03	1 .03	2 .06	1 .03	1 .03	2 .06
WEATHER	12 5.45	20 9.09	30 13.64	143 4.62	161 5.21	301 9.73	155 4.68	181 5.46	331 9.99
TERRAIN	.00	.00	.00	.00	.00	.00	.00	.00	.00
MISCELLANEOUS	10 4.55	.00	10 4.55	114 3.69	8 .26	122 3.95	124 3.74	8 .24	132 3.99
UNDETERMINED	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE A-11

CAUSE/FACTOR TABLE

FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3312 TOTAL ACCIDENTS
INVOLVES 220 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	6	1	7	22	5	27	28	6	34
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	3		3	8	1	9	11	1	12
BECAME LOST/DISORIENTED	8		8	82	11	93	90	11	101
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	9		9	28	4	32	37	4	41
DELAYED IN INITIATING GO-AROUND				2		2	2		2
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				3	2	5	3	2	5
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	2		2	1		1	3		3
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	7		7	9		9
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	23	4	27	24	4	28
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	25		25	442		442	467		467
IMPROPER OPERATION OF FLIGHT CONTROLS				7		7	7		7
IMPROPER IFR OPERATION	1		1	3		3	4		4
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	13		13	104	7	111	117	7	124
IMPROPER COMPENSATION FOR WIND CONDITIONS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	61	1	62	861	5	866	922	6	928
INADEQUATE SUPERVISION OF FLIGHT				44		44	44		44
LACK OF FAMILIARITY WITH AIRCRAFT	4	6	10	28	22	50	32	28	60
MISMANAGEMENT OF FUEL	59		59	553	1	554	612	1	613
EXERCISED POOR JUDGMENT	2		2	17		17	19		19
OPERATED CARELESSLY				1	1	2	1	1	2
SELECTED UNSUITABLE TERRAIN				3		3	3		3
IMPROPER STARTING PROCEDURES	1		1	2		2	3		3
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				1		1	1		1
SPONTANEOUS-IMPROPER ACTION				12		12	12		12
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				1		1	1		1
MISJUDGED DISTANCE AND SPEED		1	1						
MISJUDGED DISTANCE AND ALTITUDE					1	1		1	1
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED SPEED				1		1	1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
INCAPACITATION				1		1	1		1
PHYSICAL IMPAIRMENT				1		1	1		1
SPATIAL DISORIENTATION				1		1	1		1
PSYCHOLOGICAL CONDITION	5	1	6	3		3	8	1	9
MISUSED OR FAILED TO USE FLAPS	1		1	2		2	3		3
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND		1	1		1	1		2	2
FAILED TO ABORT TAKEOFF					2	2		2	2
FAILED TO INITIATE GO-AROUND	3		3		1	1		1	1
DIRECT ENTRIES				1		1	4		4
SUBTOTAL	1		1	1		1	1		1
	207	11	218	11		11	12		12
COPILOT				2280	68	2348	2487	79	2566
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				1		1	1		1
DIRECT ENTRIES				1		1	1		1
SUBTOTAL				4		4	4		4
DUAL STUDENT									
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1

TABLE A-11 CONTINUED

CAUSE/FACTOR TABLE

DUAL STUDENT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				17		17	17		17
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	5		5
LACK OF FAMILIARITY WITH AIRCRAFT					1	1		1	1
MISMANAGEMENT OF FUEL				10	1	11	10	1	11
SPONTANEOUS-IMPROPER ACTION				1		1	1		1
SUBTOTAL				35	2	37	35	2	37
** PERSONNEL **									
FLIGHT INSTRUCTOR				2	1	3	2	1	3
INADEQUATE SUPERVISION OF FLIGHT				7	3	10	7	3	10
INADEQUATE TRAINING OF STUDENT									46
MAINTENANCE, SERVICING, INSPECTION				41		41	46		22
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	5		5	17	2	19	20	2	11
IMPROPER MAINTENANCE(OWNER PERSONNEL)	3		3	9	2	11	9	2	26
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				23	2	25	24	2	11
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	1		1	9		9	11		4
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)	2		2	3		3	3	1	300
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)		1	1	259	12	271	284	16	2
INADEQUATE MAINTENANCE AND INSPECTION	25	4	29	2		2	2		1
OTHER							1		
UNK/NR	1		1					1	1
OPERATIONAL SUPERVISORY PERSONNEL		1	1						1
INADEQUATE SUPERVISION OF FLIGHT CREW				1		1	1	1	2
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT				1	1	2	1		
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS							1	1	2
WEATHER PERSONNEL					1	1	1		1
INCORRECT WEATHER FORECAST	1		1				1		1
INCOMPLETE WEATHER REPORT	1		1	1		1			
INADEQUATE/INCORRECT WEATHER BRIEFING				1		1	1		1
TRAFFIC CONTROL PERSONNEL									
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				2		2	2		2
AIRPORT SUPERVISORY PERSONNEL					1	1		1	1
IMPROPER MAINTENANCE-AIRPORT FACILITIES				1	1	2	1	1	2
FAILURE TO NOTIFY OF UNSAFE CONDITION					1	1		1	1
IMPROPER INSPECTION OF FACILITIES									
OTHER									
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN				5		5	6		6
INCORRECT FACTORY INSTALLATION	1		1	6	2	8	7	2	9
POOR/INADEQUATE DESIGN	1		1	3	1	4	4	1	5
OTHER	1		1						
MISCELLANEOUS-PERSONNEL				4	1	5	4	1	5
PASSENGER				1		1	1		1
OTHER				2		2	2		2
DIRECT ENTRIES									
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	42	6	48	400	31	431	442	37	479
** AIRFRAME **									
WINGS							1		1
BRACING WIRES, STRUTS	1		1						
FUSELAGE				1		1	1		1
WINDSHIELDS, WINDOWS, CANOPIES				1		1	1		1
LANDING GEAR									1
NORMAL RETRACTION/EXTENSION ASSEMBLY	1		1						
FLIGHT CONTROL SURFACES							2		4
AILERON, SURFACES ATTACHMENTS	2		2	2		2			
SUBTOTAL									
** POWERPLANT **									
ENGINE STRUCTURE				6		6	6		6
CRANKCASE	2		2	54	1	55	56		56
CRANKSHAFT	6		6	80		80	86		86
MASTER AND CONNECTING RODS									

TABLE A-11 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
CYLINDER ASSEMBLY	3	1	4	67		67	70	1	71
PISTON, PISTON RINGS	6	1	7	62	1	63	68	2	70
VALVE ASSEMBLIES	6		6	123	1	124	129	1	130
BLOWER, IMPELLER ASSEMBLY				14		14	14		14
MOUNT AND VIBRATION ISOLATORS				1		1	1		1
OTHER	5		5	36		36	41		41
IGNITION SYSTEM									
MAGNETOES	6	1	7	55	1	56	61	2	63
DISTRIBUTOR	1		1	1		1	2		2
SPARK PLUG	8	1	9	41	3	44	49	4	53
COILS				1		1	1		1
LOW TENSION WIRING				2		2	2		2
HIGH TENSION WIRING				1		1	1		1
IGNITION HARNESS, SHIELDING				7	1	8	7	1	8
SWITCHES	1		1	3		3	3		3
LEADS				3		3	4		4
OTHER				2		2	2		2
FUEL SYSTEM									
TANKS	3		3	11	4	15	11	4	15
LINES AND FITTINGS	4		4	29	2	31	32	2	34
SELECTOR VALVES	2		2	21	2	23	25	2	27
FILTERS, STRAINERS, SCREENS	2		2	14	1	15	16	1	17
PRIMING SYSTEM	10		10	2		2	4		4
CARBURETOR	6		6	89	1	90	99	1	100
PUMPS	4		4	21		21	27		27
FUEL INJECTION SYSTEM	1		1	12	1	13	16	1	17
VENTS, DRAINS, TANK CAPS				38	8	46	39	8	47
RAM AIR ASSEMBLY	1		1	6		6	6		6
OTHER				6		6	7		7
LUBRICATING SYSTEM									
LINES, HOSES, FITTINGS				18	1	19	18	1	19
VALVES				2		2	2		2
FILTERS, SCREENS				8		8	8		8
PUMP-PRESSURE				5		5	5		5
PUMPS-SCAVENGER				2		2	2		2
OIL COOLERS				4		4	4		4
MAGNETIC PLUGS				1		1	1		1
SEALS AND GASKETS				11		11	11		11
OTHER				13	1	14	13	1	14
COOLING SYSTEM									
BAFFLES				1		1	1		1
OTHER				1		1	1		1
PROPELLER AND ACCESSORIES									
BLADES				1		1	1		1
HYDRAULIC PITCH CONTROL MECHANISM				1		1	1		1
OTHER				2		2	3		3
EXHAUST SYSTEM									
MANIFOLDS	1		1	3		3	3		3
MUFFLERS				14	1	15	15	1	16
GASKETS	1		1	1		1	1		1
STACKS				6		6	6		6
BAFFLES				3		3	3		3
ENGINE ACCESSORIES									
STARTERS				1		1	1		1
OTHER				1		1	1		1
ENGINE CONTROLS-COCKPIT									
THROTTLE-POWER LEVER ASSEMBLIES	1		1	28	1	29	29	1	30
MIXTURE CONTROL ASSEMBLIES	1		1	15		15	16		16
INDUCTION AIR, PREHEAT CONTROLS				6		6	6		6
OTHER				1		1	1		1
POWERPLANT-INSTRUMENTS									
FUEL QUANTITY GAUGE		1	1	4	40	44	4	41	45
MISCELLANEOUS									
BIRD INGESTION				2		2	2		2
FOREIGN OBJECT DAMAGE				1		1	1		1
COMPRESSOR STALLS				1		1	1		1
DETONATION				6		6	6		6
OTHER				1		1	1		1
DIRECT ENTRIES	1		1	40	1	41	42	1	43
REDUCTION GEAR ASSEMBLY	2		2						
GEARS, ACCESSORY DRIVE				4		4	4		4
OTHER				1		1	1		1

TABLE A-11 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
COMPRESSOR ASSEMBLY	1		1				1		1
OTHER									
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM				1		1	1		1
OTHER									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER				1		1	1		1
OTHER									
PROPELLER SYSTEM				1		1	1		1
GOVERNOR									
CONSTANT SPEED DRIVE				1		1	1		1
GOVERNOR VALVE									
POWER LEVER				1		1	1		1
CABLE									
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT				1		1	1		1
TACHOMETER									
ENGINE INSTALLATION									
SUBTOTAL	85	5	90	1023	72	1095	1108	77	1185
** SYSTEMS **									
ELECTRICAL SYSTEM					1	1		1	1
BATTERIES				1		1	1		1
GENERATORS/ALTERNATORS									
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS				14		14	14		14
CARBURETOR DE-ICING SYSTEM				1		1	1		1
OTHER									
AIR CONDITION, HEATING AND PRESSURIZATION		1	1					1	1
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM									
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	16	1	17	16	2	18
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS				1		1	1		1
COMPASS									
COMMUNICATIONS AND NAVIGATION EQUIPMENT				1	3	4	1	3	4
TRANSMITTERS AND/OR RECEIVERS				1	3	4	1	3	4
VOR RECEIVERS	1		1	1		1	2		2
COMPASS RECEIVERS				1	1	2	1	1	2
OTHER									
MISCELLANEOUS EQUIPMENT				1		1	1		1
SPRAY, DUSTING EQUIPMENT									
SUBTOTAL	1		1	6	7	13	7	7	14
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES				1	1	2	1	1	2
AIRPORT CONDITIONS									
SNOW ON RUNWAY									
AIRWAYS FACILITIES									
SUBTOTAL				1	1	2	1	1	2

TABLE A-11 CONTINUED

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
WEATHER (CONTINUED)									
** WEATHER **									
LOW CEILING	1	11	12	2	24	26	3	35	38
RAIN		4	4	2	9	11	2	13	15
FOG	1	3	4	3	15	18	4	18	22
SNOW	2	3	5		6	6	2	9	11
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	4	2	6	8	13	21	12	15	27
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	9	8	17	131	98	229	140	106	246
UNFAVORABLE WIND CONDITIONS		1	1		8	8		9	9
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS		1	1		1	1		2	2
LOCAL WHIRLWIND				1			1		1
ADVERSE WINDS ALOFT					4	4		4	4
HIGH TEMPERATURE		2	2					2	2
OBSTRUCTIONS TO VISION		1	1		6	6		7	7
HIGH DENSITY ALTITUDE		1	1	1	5	6	1	6	7
THUNDERSTORM ACTIVITY		1	1		4	4		5	5
OTHER					1	1		1	1
SUBTOTAL	17	38	55	148	194	342	165	232	397
** MISCELLANEOUS **									
BIRD COLLISION				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				1		1	1		1
UNQUALIFIED PERSON OPERATED AIRCRAFT				5	4	9	5	4	9
SABOTAGE				1		1	1		1
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	9		9	102	4	106	111	4	115
DIRECT ENTRIES	1		1	5		5	6		6
SUBTOTAL	10		10	115	8	123	125	8	133
GRAND TOTAL	364	61	425	4030	384	4414	4394	445	4839
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER, OF/FAILED TO USE	16		16	388	4	392	404	4	408
CHECKLIST-FAILED TO USE	1	1	2	4	10	14	5	11	16
CREW COORDINATION-POOR	1		1				1		1
DISREGARD OF GOOD OPERATING PRACTICE				1	1	2	1	1	2
IMPROPER EMERGENCY PROCEDURES	6	2	8	8	12	20	14	14	28
FEATHERED WRONG ENGINE	1		1		2	2	1		1
INSTRUMENTS-MISREAD OR FAILED TO READ					1	1		2	2
SEAT BELT NOT FASTENED					2	2		1	1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA					1	1		2	2
UNWARRANTED LOW FLYING					2	2		2	2
INATTENTIVE TO FUEL SUPPLY					4	4		4	4
POORLY PLANNED APPROACH	13	1	14	115	26	141	128	27	155
MISCALCULATED FUEL CONSUMPTION				1	6	7	1	6	7
JETTISONED LOAD	3	2	5	70	17	87	73	19	92
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT					8	8		8	8
IMPROPERLY SECURED	1	2	3		5	5	1	7	8
BOGUS PART	4		4	37	3	40	41	3	44
ELECTRICAL FAILURE				3		3	3		3
ENGINE LOADED UP				4	3	7	4	3	7
FATIGUE FRACTURE	1		1	96	14	110	97	14	111
FUEL GRADE-IMPROPER	5		5	44	1	45	49	1	50
IMPROPER GRADE OIL-LUBRICATING SYSTEM				7		7	7		7
RPM-UNCONTROLLABLE-OVERSPEED				2		2	2		2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION		1	1		2	2		2	2
WRONG PART		1	1		2	2		3	3
IMPROPER ALIGNMENT/ADJUSTMENT				1		1	1	1	2
FAILURE OF TWO OR MORE ENGINES	4		4	18	1	19	22	1	23
SEPARATION IN FLIGHT	7	8	15	21	53	74	28	61	89
FIRE IN ENGINE		1	1	1	11	12	1	12	13
CORRODED/CORROSION	1		1	2	2	4	3	2	5
CONGESTED TRAFFIC-PATTERN	1		1	6	1	7	7	1	8
PILOT FATIGUE		2	2	1		1	1	2	3
FUEL EXHAUSTION	1		1		3	3	1	3	4
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	44	1	45	766		766	810	1	811
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	1		1	60	2	62	61	2	63
CARBON MONOXIDE POISONING	5	2	7	4		4	9	2	11
		1	1					1	1

CAUSE/FACTOR TABLE

TABLE A-11 CONTINUED

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
ICE-IN FUEL	1		1	10	2	12	11	2	13
ICE-ENGINE	1		1	5		5	6		6
ICE-CARBURETOR	16		16	324	7	331	340	7	347
ICE-PROPELLER				1		1	1		1
AIRFRAME ICE				5	4	9	5	4	9
ICE-WINDSHIELD				1		1	1		1
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	1	3	4		2	2	1	5	6
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1		1	10	1	11	11	1	12
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	4		4	54	2	56	58	2	60
OIL EXHAUSTION-PROPELLER SYSTEM				2		2	2		2
OIL CONTAMINATION				5		5	5		5
FUEL SIPHONING				3	1	4	3	1	4
WATER IN FUEL	7		7	182	5	187	189	5	194
AIRCRAFT CAME TO REST IN WATER		4	4		19	19		23	23
FROZEN, MOISTURE				4		4	4		4
MISSING	1	2	3	14	3	17	15	5	20
TOUCH AND GO LANDING		1	1		5	5		6	6
OVERLOAD FAILURE				1		1	1		1
MATERIAL FAILURE	18	1	19	463	11	474	481	12	493
FUEL STARVATION	73	2	75	747		747	820	2	822
OIL STARVATION	5		5	35	1	36	40	1	41
IMPROPER CLEARANCE-TOLERANCE	3		3	18	1	19	21	1	22
FUEL SELECTOR POSITIONED BETWEEN TANKS	8	2	10	30	5	35	38	7	45
FIRE OF UNDETERMINED ORIGIN				1		1	1		1
UNAPPROVED MODIFICATION				5	2	7	5	2	7
IMPROPER/INADEQUATE VENTING				5	3	8	5	3	8
ACTION, LACK OF					1	1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				5	3	8	5	3	8
LEAK/LEAKAGE	3		3	22	4	26	25	4	29
LOW FLUID LEVEL					2	2		2	2
ARCING	1		1	7		7	7		7
LOW COMPRESSION		1	1		4	4	1	5	5
DOWNWIND	5	1	6	24	3	27	29	4	33
CARBON DEPOSITS				1		1	1		1
OVER TORQUED				1		1	1		1
UNDER TORQUED	6		6	27	3	30	33	3	36
LOOSE, PART/FITTING				3		3	3		3
BENT	3		3	5	1	6	8	1	9
BINDING		1	1	11	2	13	11	3	14
BURNED	1		1	2	2	4	3	2	5
CHAFFED	1		1	5	1	6	6	1	7
COLLAPSED	1		1				1		1
CROSSED	1	1	2	4	1	5	5	2	7
DETERIORATED		1	1	13	1	14	13	2	15
DISCONNECTED	1		1	5		5	6		6
EXCESSIVE				2	14	16	2	14	16
ERRATIC				1		1	1		1
FRICTION, EXCESSIVE				5		5	5		5
GROUNDED				1		1	1		1
HIGH VOLTAGE BREAKDOWN	1	1	2	26	3	29	27	4	31
IMPROPERLY INSTALLED				4		4	4		4
JAMMED		1	1	21		21	21	1	22
OBSTRUCTED					1	1	1	1	1
OPEN				1	2	3	2	1	3
OUT OF BALANCE				14	1	15	14	1	15
OVERHEATED				1		1	1		1
PINCHED				4		4	4		4
EXCESSIVE PRESSURE				11	1	12	11	1	12
PRESSURE TOO LOW				9	2	11	9	2	11
PRESSURE, NONE	2		2	2		2	2		2
SCORED	2		2	6		6	8		8
SHEARED				8	2	10	8	2	10
STICKING				1		1	1		1
STRIPPED	1		1	10	3	13	11	3	14
STUCK	2		2	4	4	8	6	4	10
EXCESSIVE TEMPERATURE				4	4	8	4	4	8
VIBRATION, EXCESSIVE				1		1	1		1
WARPED	1		1	1		1	1		1
ICE-INDUCTION							2		2

TABLE A-11 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

DIRECT ENTRY CAUSES

PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CAM REDUCTION GEAR FAILED.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-DETONATION IN ALL CYLINDERS.
PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PILOT-MISCALCULATED FUEL CONSUMPTION.
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-OIL FILLER CAP MISSING.
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-GASKET BLOWN NO 3 CYL.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PWR PLT-THROTTLE CONTROL BINDING IN CABLE HOUSING.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-INADVERTENTLY TURNED ENG OFF.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

APPENDIX B

SINGLE-ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION

TABLE B-2

ACCIDENTS, INJURIES
ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

	INJURIES					
	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
PILOT	176	351	848	2480		3855
COPILOT	11	1	4	13		29
DUAL STUDENT	15	24	52	176		267
CHECK PILOT	1			4		5
FLIGHT ENGINEER						
NAVIGATOR						
CABIN ATTENDANT				3		3
EXTRA CREW	2	3	3	6		14
PASSENGERS	170	268	566	1992		2996
TOTAL	375	647	1473	4674	ABOARD	7169
* OTHER AIRCRAFT			1	2		3
OTHER GROUND	1	2	9	3		15
G	376	649	1483	4679		7187

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

* INJURIES CARRIED OPPOSITE OTHER-AIRCRAFT ARE INJURIES OCCURRING IN AIRCRAFT THAT ARE NOT PART OF THIS SUBJECT TABULATION, BUT WERE PART OF THE TOTAL INJURIES INVOLVED IN COLLISIONS BETWEEN AIRCRAFT.

TABLE B-2

ANALYTIC TABLE

KIND OF FLYING VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

KIND OF FLYING	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
INSTRUCTIONAL					270	270
DUAL	46	224			113	113
SOLO	10	103			6	6
CHECK	1	5			166	166
TRAINING	16	150				
NONCOMMERCIAL					1898	1898
PLEASURE	361	1537			200	200
PRACTICE	19	181			429	429
BUSINESS	61	368			7	7
CORPORATE/EXECUTIVE	2	5			4	4
AERIAL SURVEY		4				
COMPANY FLIGHT					3	3
OTHER	1	2				
COMMERCIAL					210	210
AERIAL APPLICATION	27	183			205	205
ASSOCIATED CROP CONTROL ACTIV	36	169			1	1
FIRE CONTROL		1			4	4
ASSOCIATED FIRE CONTROL ACTIV		4			6	6
AERIAL MAPPING/PHOTOGRAPHY	1	5			2	2
AERIAL ADVERTISING	1	1			7	7
POWER AND PIPELINE PATROL	1	6			2	2
FISH SPOTTING	1	1			64	64
AIR TAXI-PASSENGER OPERATIONS	12	52			15	15
AIR TAXI-CARGO OPERATIONS	2	13				
CONSTRUCTION WORK						
SCHEDULED PASSENGER SERVICE						
SCHEDULED CARGO SERVICE						
NONSCHEDULED/CHARTER REVENUE						
NONSCHEDULED/CHARTER REVENUE						
MILITARY CONTRACT-PASSENGER						
MILITARY CONTRACT-CARGO						
CONTRACT/CHARTER-CARGO-DOMEST						
CONTRACT/CHARTER-PASSENGER-DO						
CONTRACT/CHARTER-CARGO-INTERN						

TABLE B-2 CONTINUED

ANALYTIC TABLE

KIND OF FLYING	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
CONTRACT/CHARTER-PASSENGER-IN						
OTHER						
UNKNOWN/NOT REPORTED	3	7			10	10
MISCELLANEOUS						
EXPERIMENTATION						
TEST		1			1	1
DEMONSTRATION	16	50			66	66
FERRY	5	14			19	19
SEARCH AND RESCUE	19	90			109	109
AIR SHOW/AIR RACING	1	3			4	4
PARACHUTE JUMP	2	7			9	9
PARACHUTE JUMP IN CONNECTION	2	10			12	12
TOWING GLIDERS		1			1	1
SEEDING CLOUDS		2			2	2
HUNTING						
POLICE PATROL						
HIGHWAY TRAFFIC ADVISORY		1			1	1
ALL OTHER PUBLIC FLYING						
OTHER		2			2	2
UNKNOWN/NOT REPORTED	2	3			5	5
	2				2	2
RECORDS	650	3205			3855	
ACCIDENTS	650	3205				3855

TABLE B-3

ANALYTIC TABLE

AIRPORT PROXIMITY VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

AIRPORT PROXIMITY	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
ON AIRPORT	34	48	114	391	587	587
ON SEAPLANE BASE				1	1	1
ON HELIPORT						
ON BARGE/SHIP/PLATFORM						
IN TRAFFIC PATTERN	35	76	158	317	586	586
WITHIN 1/4 MILE	18	32	48	98	196	196
WITHIN 1/2 MILE	12	19	31	73	135	135
WITHIN 3/4 MILE	4	8	13	17	42	42
WITHIN 1 MILE	9	15	29	76	129	129
WITHIN 2 MILES	16	33	68	129	246	246
WITHIN 3 MILES	9	14	41	107	171	171
WITHIN 4 MILES	6	12	28	72	118	118
WITHIN 5 MILES	3	6	7	24	40	40
BEYOND 5 MILES	62	129	335	1041	1567	1567
UNKNOWN/NOT REPORTED		1	16	20	37	37
RECORDS	208	393	888	2366	3855	
ACCIDENTS	208	393	888	2366		3855

TABLE B-4

ANALYTIC TABLE

FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

FIRST PHASE OF OPERATION	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
STATIC						
STARTING ENGINE/S						
IDLING ENGINE/S						
ENGINE RUNUP						
IDLING ROTORS						
PARKED-ENGINES NOT OPERATING						
OTHER						
TAXI						
TO TAKEOFF						
FROM LANDING						
OTHER						
GROUND TAXI TO TAKEOFF						
GROUND TAXI FROM LANDING						
GROUND TAXI, OTHER						
AERIAL TAXI TO TAKEOFF						
AERIAL TAXI TO/FROM LANDING						
AERIAL TAXI, OTHER						
TAKEOFF						
RUN	11			24	35	35
INITIAL CLIMB	185			736	921	921
VERTICAL						
RUNNING						
ABORTED				1	1	1
ABORTED						
ABORTED						
OTHER						
INFLIGHT						
CLIMB TO CRUISE	17			81	98	98
NORMAL CRUISE	255			1306	1561	1561
DESCENDING	18			169	187	187
HOLDING	1				1	1
HOVERING						
POWER-ON DESCENT						
AUTOROTATIVE DESCENT						

ANALYTIC TABLE

TABLE B-4 CONTINUED

FIRST PHASE OF OPERATION	AIRCRAFT DAMAGE DEST	SUBST	MIN	NONE	RECORDS	ACCIDENTS
ACROBATICS					11	11
BUZZING	4	7			3	3
UNCONTROLLED DESCENT	2	1			1	1
EMERGENCY DESCENT		1				
LOW PASS					62	62
OTHER	15	47			78	78
EN ROUTE TO TREAT CROP	18	60			36	36
EN ROUTE TO RELOADING AREA	4	32			16	16
SURVEY FIELD/AREA	2	14			7	7
STARTING SWATH RUN		7			15	15
SWATH RUN		15			58	58
FLAREOUT FOR SWATH RUN	4	54			2	2
PULLUP FROM SWATH RUN		2			36	36
PROCEDURE TURNAROUND	5	31			97	97
CLEANUP SWATH	19	78			3	3
MANEUVER TO AVOID OBSTRUCTION		3				
RETURN TO STRIP					15	15
LANDING	2	13				
TRAFFIC PATTERN-CIRCLING					217	217
FINAL APPROACH	35	182			262	262
INITIAL APPROACH	31	231			4	4
FINAL APPROACH	1	3			6	6
LEVEL OFF/TOUCHDOWN		6			4	4
ROLL		4				
ROLL-ON/RUN-ON						
POWER-ON LANDING						
POWER-OFF AUTOROTATIVE LANDIN						
GO-AROUND					113	113
MISSED APPROACH	17	96			1	1
OTHER	1				2	2
UNKNOWN/NOT REPORTED	1	1			2	2
	2					
RECORDS	650	3205			3855	
ACCIDENTS	650	3205				3855

TABLE B-5

ANALYTIC TABLE

SECOND ACCIDENT TYPE VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

TYPE OF ACCIDENT	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
GROUND-WATER LOOP-SWERVE						
DRAGGED WINGTIP, POD, OR FLOA		1	3	29	33	33
WHEELS-UP LANDING			2	2	4	4
WHEELS-DOWN LANDING IN WATER	1	18	18	141	178	178
GEAR COLLAPSED				1	1	1
GEAR RETRACTED	1	35	177	640	853	853
HARD LANDING			1	2	3	3
NOSE OVER/DOWN	2	18	51	125	196	196
ROLL OVER	1	27	134	418	580	580
OVERSHOOT						
UNDERSHOOT	1	6	6	19	32	32
COLLISION WITH AIRCRAFT	1	5	15	25	46	46
BOTH IN FLIGHT						
ONE AIRBORNE	1				1	1
BOTH ON GROUND						
COLLISION WITH GROUND/WATER			1		1	1
CONTROLLED						
UNCONTROLLED	13	12	17	14	56	56
COLLIDED WITH	9	4	5	4	22	22
WIRES/POLES						
TREES	13	36	63	81	193	193
RESIDENCE/S	34	95	146	277	552	552
BUILDING/S	1	2		2	5	5
FENCE, FENCEPOSTS	2	6	4	4	16	16
ELECTRONIC TOWERS	1	11	42	162	216	216
RUNWAY OR APPROACH LIGHTS	1				1	1
AIRPORT HAZARD	1		1	1	3	3
ANIMALS						
CROP				2	2	2
FLAGMAN LOADER		1	3	7	11	11
DITCHES						
SNOWBANK	2	8	47	129	186	186
PARKED AIRCRAFT				10	10	10
AUTOMOBILE			1	1	2	2
	3	5	7		15	15

ANALYTIC TABLE

TABLE B-5 CONTINUED

TYPE OF ACCIDENT	INJURY INDEX FATAL	SER	MIN	NONE	RECORDS	ACCIDENTS
DIRTBANK	1	10	21	60	92	92
OBJECT	3	12	21	79	115	115
BIRD STRIKE					187	187
STALL	62	42	43	40	55	55
SPIN	37	14	4		16	16
SPIRAL	7	4	3	2	85	85
MUSH	4	21	33	27		
FIRE OR EXPLOSION					5	5
IN FLIGHT	1		1	3	1	1
ON GROUND				1		
AIRFRAME FAILURE					1	1
IN FLIGHT	1					
ON GROUND						
ENGINE TEARAWAY						
ENGINE FAILURE OR MALFUNCTION					3	3
PROPELLER/ROTOR FAILURE		1		2		
PROPELLER						
TAIL ROTOR						
MAIN ROTOR						
PROPELLER/ROTOR ACCIDENT TO P						
JET INTAKE/EXHAUST ACCIDENT T						
PROPELLER/JET/ROTOR BLAST						
TURBULENCE						
HAIL DAMAGE TO AIRCRAFT						
LIGHTNING STRIKE						
EVASIVE MANEUVER						
UNCONTROLLED ALTITUDE DEVIATI					71	71
DITCHING	7		19	45		
MISSING AIRCRAFT NOT RECOVERE					4	4
MISCELLANEOUS, OTHER			1	3	2	2
UNDETERMINED		1		1		
RECORDS	208	393	888	2366	3855	
ACCIDENTS	208	393	888	2366		3855

TABLE B-6

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	112 53.85	11 5.29	114 54.81	1896 51.99	57 1.56	1900 52.10	2008 52.09	68 1.76	2014 52.24
PERSONNEL	29 13.94	3 1.44	32 15.38	374 10.26	29 .80	403 11.05	403 10.45	32 .83	435 11.28
AIRFRAME	1 .48	.00	1 .48	1 .03	.00	1 .03	2 .05	.00	2 .05
LANDING GEAR	.00	.00	.00	1 .03	.00	1 .03	1 .03	.00	1 .03
POWERPLANT	94 45.19	2 .96	96 46.15	1553 42.58	60 1.65	1607 44.06	1647 42.72	62 1.61	1703 44.18
SYSTEMS	.00	.00	.00	15 .41	1 .03	16 .44	15 .39	1 .03	16 .42
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	.00	.00	.00	3 .08	5 .14	8 .22	3 .08	5 .13	8 .21
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	1 .03	1 .03	2 .05	1 .03	1 .03	2 .05
WEATHER	7 3.37	17 8.17	22 10.58	134 3.67	157 4.30	288 7.90	141 3.66	174 4.51	310 8.04
TERRAIN	.00	.00	.00	.00	.00	.00	.00	.00	.00
MISCELLANEOUS	10 4.81	.00	10 4.81	112 3.07	6 .16	118 3.24	122 3.16	6 .16	128 3.32
UNDETERMINED	3 1.44	.00	3 1.44	.00	.00	.00	3 .08	.00	3 .08

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

CAUSE/FACTOR TABLE

TABLE B-7

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND	3	1	4	20	4	24	23	5	28
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	2		2	8	1	9	10	1	11
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	6		6	80	9	89	86	9	95
BECAME LOST/DISORIENTED	8	1	9	28	4	32	36	5	41
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS				3		3	3		3
DELAYED IN INITIATING GO-AROUND				2	1	3	2	1	3
DIVERTED *ATTENTION FROM OPERATION OF AIRCRAFT*				3		3	6		6
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	3		3	7		7	9		9
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	18	3	21	18	3	21
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC				454		454	469		469
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	15		15	6		6	7		7
IMPROPER OPERATION OF FLIGHT CONTROLS	1		1	1		1	1		1
IMPROPER IFR OPERATION				93	5	98	102	5	107
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	9		9	1		1	1		1
IMPROPER COMPENSATION FOR WIND CONDITIONS				803	4	807	848	6	854
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	45	2	47	51		51	51		51
INADEQUATE SUPERVISION OF FLIGHT				27	19	46	31	23	54
LACK OF FAMILIARITY WITH AIRCRAFT	4	4	8	500	1	501	541	1	542
MISMANAGEMENT OF FUEL	41		41	27		27	31		31
EXERCISED POOR JUDGMENT	4		4	1	1	2	1	1	2
OPERATED CARELESSLY				3		3	3		3
SELECTED UNSUITABLE TERRAIN				2		2	2		2
IMPROPER STARTING PROCEDURES				1		1	1		1
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				14		14	14		14
SPONTANEOUS-IMPROPER ACTION		1	1					1	1
MISJUDGED DISTANCE AND SPEED				1		1	1		1
MISJUDGED DISTANCE					1	1		1	1
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED SPEED	1		1				1		1
MISJUDGED ALTITUDE				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
INCAPACITATION	5	1	6	3		3	8	1	9
PHYSICAL IMPAIRMENT	1		1	1		1	2		2
SPATIAL DISORIENTATION		1	1		1	1		2	2
PSYCHOLOGICAL CONDITION					2	2		2	2
MISUSED OR FAILED TO USE FLAPS	4		4	1		1	5		5
FAILED TO ABORT TAKEOFF				1		1	1		1
FAILED TO INITIATE GO-AROUND	1		1	9		9	10		10
DIRECT ENTRIES									
SUBTOTAL	155	11	166	2173	56	2229	2328	67	2395
COPILOT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING									
SUBTOTAL				3		3	3		3
DUAL STUDENT				1		1	1		1
DELAYED IN INITIATING GO-AROUND				*1*		*1*	*1*		*1*
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				*21*		*21*	*21*		*21*
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				*1*		*1*	*1*		*1*
IMPROPER LEVEL OFF				5		5	5		5
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING					1	1		1	1
LACK OF FAMILIARITY WITH AIRCRAFT				11	1	12	11	1	12
MISMANAGEMENT OF FUEL				1		1	1		1
SPONTANEOUS-IMPROPER ACTION									

TABLE B-7 CONTINUED

CAUSE/FACTOR TABLE

DUAL STUDENT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
SUBTOTAL				42	2	44	42	2	44
** PERSONNEL **									
FLIGHT INSTRUCTOR									
INADEQUATE SUPERVISION OF FLIGHT				2	1	3	2	1	3
INADEQUATE TRAINING OF STUDENT				7	3	10	7	3	10
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	5		5	39		39	44		44
IMPROPER MAINTENANCE(OWNER PERSONNEL)	3		3	16	2	18	19	2	21
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				6	2	8	6	2	8
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	1		1	21	2	23	22	2	24
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)	2		2	9		9	11		11
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)		1	1	3		3	3	1	4
INADEQUATE MAINTENANCE AND INSPECTION	17	2	19	248	11	259	265	13	278
OTHER				2		2	2		2
UNK/NR	1		1				1		1
OPERATIONAL SUPERVISORY PERSONNEL									
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT				1		1	1		1
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS				1	1	2	1	1	2
WEATHER PERSONNEL									
INCORRECT WEATHER FORECAST	1		1		1	1	1	1	2
INADEQUATE/INCORRECT WEATHER BRIEFING				1		1	1		1
TRAFFIC CONTROL PERSONNEL									
AIRPORT SUPERVISORY PERSONNEL									
IMPROPER MAINTENANCE-AIRPORT FACILITIES				2		2	2		2
IMPROPER INSPECTION OF FACILITIES				1	1	2	1	1	2
OTHER					1	1		1	1
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN									
SUBSTANDARD QUALITY CONTROL				1		1	1		1
INCORRECT FACTORY INSTALLATION	1		1	5		5	6		6
POOR/INADEQUATE DESIGN				6	2	8	6	2	8
OTHER	1		1	3	1	4	4	1	5
MISCELLANEOUS-PERSONNEL									
PASSENGER				4	1	5	4	1	5
OTHER				1		1	1		1
DIRECT ENTRIES				2		2	2		2
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	32	3	35	381	29	410	413	32	445
** AIRFRAME **									
WINGS									
BRACING WIRES, STRUTS	1		1				1		1
FUSELAGE									
WINDSHIELDS, WINDOWS, CANOPIES				1		1	1		1
LANDING GEAR									
NORMAL RETRACTION/EXTENSION ASSEMBLY				1		1	1		1
FLIGHT CONTROL SURFACES									
AILERON, SURFACES ATTACHMENTS	1		1				1		1
SUBTOTAL	2		2	2		2	4		4
** POWERPLANT **									
ENGINE STRUCTURE									
CRANKCASE				4		4	4		4
CRANKSHAFT	2		2	53	1	54	55	1	56
MASTER AND CONNECTING RODS	3		3	72		72	75		75
CYLINDER ASSEMBLY	3	1	4	58		58	61	1	62
PISTON, PISTON RINGS	3	1	4	59	1	60	62	2	64
VALVE ASSEMBLIES	3		3	122	1	123	125	1	126
BLOWER, IMPELLER ASSEMBLY				13		13	13		13
MOUNT AND VIBRATION ISOLATORS				1		1	1		1
OTHER	5		5	31		31	36		36
IGNITION SYSTEM									

TABLE B-7 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
MAGNETOES	5		5	52	2	54	57	2	59
DISTRIBUTOR	1		1	1		1	2		2
SPARK PLUG	5	1	6	37	3	40	42	4	46
COILS				1		1	1		1
LOW TENSION WIRING				2		2	2		2
HIGH TENSION WIRING				1		1	1		1
IGNITION HARNESS, SHIELDING				6	1	7	6	1	7
SWITCHES				3		3	3		3
LEADS				3		3	3		3
OTHER				2		2	2		2
FUEL SYSTEM				9	4	13	9	4	13
TANKS	2		2	25	2	27	27	2	29
LINES AND FITTINGS	1		1	20	2	22	21	2	23
SELECTOR VALVES	2		2	13	1	14	15	1	16
FILTERS, STRAINERS, SCREENS	2		2	2		2	4		4
PRIMING SYSTEM	9		9	89	1	90	98	1	99
CARBURETOR	5		5	19		19	24		24
PUMPS				11		11	11		11
FUEL INJECTION SYSTEM				34	8	42	34	8	42
VENTS, DRAINS, TANK CAPS				5		5	5		5
RAM AIR ASSEMBLY	1		1	6		6	7		7
OTHER									
LUBRICATING SYSTEM				11		11	11		11
LINES, HOSES, FITTINGS				2		2	2		2
VALVES				8		8	8		8
FILTERS, SCREENS				5		5	5		5
PUMP-PRESSURE				2		2	2		2
PUMPS-SCAVENGER				4		4	4		4
OIL COOLERS				1		1	1		1
MAGNETIC PLUGS				10		10	10		10
SEALS AND GASKETS				10	1	11	10	1	11
OTHER									
COOLING SYSTEM				1		1	1		1
OTHER									
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES				1		1	1		1
HYDRAULIC PITCH CONTROL MECHANISM	1		1	1		1	2		2
OTHER									
EXHAUST SYSTEM				2		2	2		2
MANIFOLDS	1		1	14	1	15	15	1	16
MUFFLERS				1		1	1		1
GASKETS				5		5	5		5
STACKS				3		3	3		3
BAFFLES									
ENGINE ACCESSORIES				1		1	1		1
STARTERS				1		1	1		1
OTHER									
ENGINE CONTROLS-COCKPIT	1		1	27	1	28	28	1	29
THROTTLE-POWER LEVER ASSEMBLIES	1		1	15		15	16		16
MIXTURE CONTROL ASSEMBLIES				6		6	6		6
INDUCTION AIR, PREHEAT CONTROLS				1		1	1		1
OTHER									
POWERPLANT-INSTRUMENTS		1	1	4	33	37	4	34	38
FUEL QUANTITY GAUGE									
MISCELLANEOUS	45		45	677		677	722		722
POWERPLANT FAILURE FOR UNDETERMINED REASONS				1		1	1		1
BIRD INGESTION				1		1	1		1
FOREIGN OBJECT DAMAGE				1		1	1		1
COMPRESSOR STALLS				5		5	5		5
DETONATION							1		1
OTHER	1		1	36	1	37	37	1	38
DIRECT ENTRIES	1		1						
REDUCTION GEAR ASSEMBLY				3		3	3		3
GEARS, ACCESSORY DRIVE				1		1	1		1
OTHER									
COMPRESSOR ASSEMBLY									
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM				1		1	1		1
OTHER									

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
PROPELLER SYSTEM									
CONSTANT SPEED DRIVE									
POWER LEVER									
CABLE				1		1	1		1
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
TACHOMETER				1		1	1		1
ENGINE INSTALLATION									
SUBTOTAL	103	4	107	1619	64	1683	1722	68	1790
** SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES					1	1		1	1
GENERATORS/ALTERNATORS				1		1	1		1
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS									
CARBURETOR DE-ICING SYSTEM				14		14	14		14
AIR CONDITION, HEATING AND PRESSURIZATION									
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL				15	1	16	15	1	16
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
COMPASS				1		1	1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
TRANSMITTERS AND/OR RECEIVERS					3	3		3	3
VOR RECEIVERS				1	3	4	1	3	4
OTHER					1	1		1	1
MISCELLANEOUS EQUIPMENT									
SPRAY, DUSTING EQUIPMENT				1		1	1		1
SUBTOTAL				3	7	10	3	7	10
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS									
SNOW ON RUNWAY				1	1	2	1	1	2
AIRWAYS FACILITIES									
SUBTOTAL				1	1	2	1	1	2
** WEATHER **									
LOW CEILING		7	7	1	22	23	1	29	30
RAIN		4	4	1	9	10	1	13	14
FOG		2	2	2	13	15	2	15	17
SNOW	1	1	2		7	7	1	8	9
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	2	3	4	8	12	5	10	15
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	7	9	16	126	100	226	133	109	242
UNFAVORABLE WIND CONDITIONS		1	1		8	8		9	9
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS		1	1		1	1		2	2
LOCAL WHIRLWIND				1		1	1		1
ADVERSE WINDS ALOFT					4	4		4	4
HIGH TEMPERATURE		1	1		2	2		3	3
OBSTRUCTIONS TO VISION					6	6		6	6

WEATHER (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
HIGH DENSITY ALTITUDE		2	2	1	3	4	1	5	6
THUNDERSTORM ACTIVITY					4	4		4	4
OTHER					1	1		1	1
SUBTOTAL	9	30	39	136	188	324	145	218	363
** MISCELLANEOUS **									
BIRD COLLISION				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				1		1	1		1
UNQUALIFIED PERSON OPERATED AIRCRAFT				5	3	8	5	3	8
SABOTAGE				1		1	1		1
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	9		9	100	3	103	109	3	112
UNDETERMINED	3		3				3		3
DIRECT ENTRIES	1		1	5		5	6		6
SUBTOTAL	13		13	113	6	119	126	6	132
GRAND TOTAL	314	48	362	4488	354	4842	4802	402	5204
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER, OF/FAILED TO USE	12	1	13	379	6	385	391	7	398
CHECKLIST-FAILED TO USE				2	5	7	2	5	7
DISREGARD OF GOOD OPERATING PRACTICE		1	1	1		1	1	1	2
IMPROPER EMERGENCY PROCEDURES	2		2	5	8	13	7	8	15
INSTRUMENTS-MISREAD OR FAILED TO READ					1	1		1	1
SEAT BELT NOT FASTENED					1	1		1	1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA					2	2		2	2
UNWARRANTED LOW FLYING					5	5		5	5
INATTENTIVE TO FUEL SUPPLY	9	1	10	107	22	129	116	23	139
POORLY PLANNED APPROACH				1	4	5	1	4	5
MISCALCULATED FUEL CONSUMPTION	2	2	4	66	15	81	68	17	85
JETTISONED LOAD					13	13		13	13
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT		2	2		5	5		7	7
LANDED ON FOAMED RUNWAY					1	1		1	1
IMPROPERLY SECURED	2		2	32	3	35	34	3	37
BOGUS PART				3		3	3		3
ELECTRICAL FAILURE				3	3	6	3	3	6
ENGINE LOADED UP	1		1	109	17	126	110	17	127
FATIGUE FRACTURE	2		2	43	1	44	45	1	46
FUEL GRADE-IMPROPER				6		6	6		6
IMPROPER GRADE OIL-LUBRICATING SYSTEM				2		2	2		2
RPM-UNCONTROLLABLE-OVERSPEED					2	2		2	2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION		1	1		2	2		3	3
WRONG PART				1		1	1		1
IMPROPER ALIGNMENT/ADJUSTMENT	3		3	16	1	17	19	1	20
SEPARATION IN FLIGHT		1	1	1	11	12	1	12	13
FIRE IN ENGINE				2	1	3	2	1	3
CORRODED/CORROSION	1		1	6	1	7	7	1	8
CONGESTED TRAFFIC-PATTERN		2	2	1		1	1	2	3
PILOT FATIGUE					2	2		2	2
FUEL EXHAUSTION	34	1	35	724		724	758	1	759
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	1		1	55	2	57	56	2	58
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	6	2	8	4		4	10	2	12
HYPOXIA					1	1		1	1
ICE-IN FUEL				9	2	11	9	2	11
ICE-ENGINE				1		1	1		1
ICE-CARBURETOR	12		12	316	7	323	328	7	335
ICE-PROPELLER				1		1	1		1
AIRFRAME ICE				2	3	5	2	3	5
ICE-WINDSHIELD				1		1	1		1
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	1	2	3		1	1	1	3	4
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM				9	1	10	9	1	10
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	3		3	53	2	55	56	2	58
OIL EXHAUSTION-PROPELLER SYSTEM				2		2	2		2
OIL CONTAMINATION				4		4	4		4
SIMULATED CONDITIONS	6	1	7	65	50	115	71	51	122
FUEL SIPHONING				3	1	4	3	1	4
WATER IN FUEL	5		5	171	5	176	176	5	181

TABLE B-7 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
AIRCRAFT CAME TO REST IN WATER		3	3		33	33		36	36
FROZEN, MOISTURE				4		4	4		4
MISSING	1	2	3	14	3	17	15	5	20
TOUCH AND GO LANDING		1	1		7	7		8	8
OVERLOAD FAILURE				1		1	1		1
MATERIAL FAILURE	10		10	422	11	433	432	11	443
FUEL STARVATION	51	2	53	701		701	752	2	754
OIL STARVATION	2		2	33	1	34	35	1	36
IMPROPER CLEARANCE-TOLERANCE	3		3	17		17	20		20
FUEL SELECTOR POSITIONED BETWEEN TANKS	8	1	9	28	4	32	36	5	41
FIRE OF UNDETERMINED ORIGIN				1		1	1		1
UNAPPROVED MODIFICATION		1	1	5	2	7	5	3	8
IMPROPER/INADEQUATE VENTING				4	3	7	4	3	7
ACTION, LACK OF					1	1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				5	3	8	5	3	8
LEAK/LEAKAGE	2		2	20	3	23	22	3	25
LOW FLUID LEVEL					2	2		2	2
ARCING	1		1				1		1
LOW COMPRESSION				6		6	6		6
DOWNWIND		1	1		4	4		5	5
CARBON DEPOSITS	3	1	4	22	3	25	25	4	29
LANDED IN CONSTRUCTION AREA					1	1		1	1
OVER TORQUED				1		1	1		1
UNDER TORQUED				1		1	1		1
LOOSE, PART/FITTING	4		4	26	3	29	30	3	33
BENT				3		3	3		3
BINDING	2		2	5	1	6	7	1	8
BURNED				11	2	13	11	2	13
CHAFFED				2	2	4	2	2	4
COLLAPSED	1		1	4	1	5	5	1	6
CROSSED	1		1				1		1
DETERIORATED	1	1	2	2		2	3	1	4
DISCONNECTED		1	1	13		13	13	1	14
EXCESSIVE	1		1	5		5	6		6
ERRATIC				2	11	13	2	11	13
FRICTION, EXCESSIVE				1		1	1		1
GROUNDED				5		5	5		5
IMPROPERLY INSTALLED		1	1	24	3	27	24	4	28
JAMMED				3		3	3		3
OBSTRUCTED		1	1	19		19	19	1	20
OPEN					1	1		1	1
OUT OF BALANCE				1	2	3	1	2	3
OVERHEATED				13	1	14	13	1	14
EXCESSIVE PRESSURE				3		3	3		3
PRESSURE TOO LOW				10	2	12	10	2	12
PRESSURE, NONE				5	2	7	5	2	7
SCORED	1		1	2		2	3		3
SHEARED	2		2	5		5	7		7
STICKING				8	2	10	8	2	10
STRIPPED				1		1	1		1
STUCK				10	3	13	10	3	13
EXCESSIVE TEMPERATURE	1		1	3	4	7	4	4	8
VIBRATION, EXCESSIVE				2	3	5	2	3	5
WARPED				1		1	1		1

DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.

TABLE B-7 CONTINUED

CAUSE/FACTOR TABLE

DIRECT ENTRY CAUSES (CONTINUED)

PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PWR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-THROTTLE CONTROL BINDING IN CABLE HOUSING.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-CAM REDUCTION GEAR FAILED.
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWR PLT-DETONATION IN ALL CYLINDERS.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-OIL FILLER CAP MISSING.
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-GASKET BLOWN NO 3 CYL.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PILOT-INADVERTENTLY TURNED ENG OFF.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 ~ 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	171 82.21	15 7.21	173 83.17	2163 59.31	72 1.97	2169 59.47	2334 60.54	87 2.26	2342 60.75
PERSONNEL	29 13.94	3 1.44	32 15.38	377 10.34	33 .90	411 11.27	406 10.53	36 .93	443 11.49
AIRFRAME	1 .48	.00	1 .48	1 .03	1 .03	2 .05	2 .05	1 .03	3 .08
LANDING GEAR	.00	.00	.00	5 .14	.00	5 .14	5 .13	.00	5 .13
POWERPLANT	94 45.19	2 .96	96 46.15	1553 42.58	61 1.67	1608 44.09	1647 42.72	63 1.63	1704 44.20
SYSTEMS	.00	.00	.00	16 .44	2 .05	18 .49	16 .42	2 .05	18 .47
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	.00	.00	.00	4 .11	5 .14	9 .25	4 .10	5 .13	9 .23
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	1 .48	1 .48	8 .22	21 .58	29 .80	8 .21	22 .57	30 .78
WEATHER	11 5.29	25 12.02	33 15.87	149 4.09	183 5.02	328 8.99	160 4.15	208 5.40	361 9.36
TERRAIN	12 5.77	16 7.69	28 13.46	301 8.25	517 14.18	818 22.43	313 8.12	533 13.83	846 21.95
MISCELLANEOUS	11 5.29	.00	11 5.29	141 3.87	8 .22	149 4.09	152 3.94	8 .21	160 4.15
UNDETERMINED	3 1.44	.00	3 1.44	.00	.00	.00	3 .08	.00	3 .08

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

CAUSE/FACTOR TABLE

TABLE B-9

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
SINGLE ENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 3855 TOTAL ACCIDENTS
INVOLVES 208 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND	3	1	4	21	4	25	24	5	29
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	2		2	9	2	11	11	2	13
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	6		6	80	10	90	86	10	96
BECAME LOST/DISORIENTED	9	1	10	31	4	35	40	5	45
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS				8		8	8		8
DELAYED ACTION IN ABORTING TAKEOFF				11	1	12	11	1	12
DELAYED IN INITIATING GO-AROUND				3	1	4	3	1	4
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1		1				1		1
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				4		4	4		4
FAILED TO EXTEND LANDING GEAR				1		1	1		1
FAILED TO RETRACT LANDING GEAR				1		1	1		1
RETRACTED GEAR PREMATURELY				1		1	1		1
INADVERTENTLY RETRACTED GEAR	1		1				1		1
FAILED TO SEE AND AVOID OTHER AIRCRAFT	1		1	21		21	22		22
FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS	85	1	86	167		167	252	1	253
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	2		2	8		8	10		10
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	1		1	19	3	22	20	3	23
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	15		15	456		456	471		471
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				12		12	12		12
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS	3		3	10		10	13		13
IMPROPER OPERATION OF FLIGHT CONTROLS	2		2	78		78	80		80
IMPROPER LEVEL OFF				1		1	1		1
IMPROPER IFR OPERATION	14		14	104	5	109	118	5	123
IMPROPER IN-FLIGHT DECISIONS OR PLANNING				2		2	2		2
IMPROPER COMPENSATION FOR WIND CONDITIONS	46	2	48	804	6	810	850	8	858
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	3		3	75		75	78		78
INADEQUATE SUPERVISION OF FLIGHT	7	6	13	28	23	51	35	29	64
LACK OF FAMILIARITY WITH AIRCRAFT	41		41	501	1	502	542	1	543
MISMANAGEMENT OF FUEL	5		5	32		32	37		37
EXERCISED POOR JUDGMENT				1	2	3	1	2	3
OPERATED CARELESSLY	2		2	34		34	36		36
SELECTED UNSUITABLE TERRAIN				2		2	2		2
IMPROPER STARTING PROCEDURES				8		8	8		8
FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED				1	1	2	1	1	2
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				16		16	16		16
SPONTANEOUS-IMPROPER ACTION				7		7	8		8
MISJUDGED DISTANCE, SPEED, AND ALTITUDE	1		1	41		41	43	1	44
MISJUDGED DISTANCE AND SPEED	2	1	3	1		1	1		1
MISJUDGED DISTANCE				25	1	26	27	1	28
MISJUDGED DISTANCE AND ALTITUDE	2		2	2		2	3		3
MISJUDGED SPEED AND ALTITUDE	1		1	4		4	4		4
MISJUDGED SPEED				3		3	3		3
MISJUDGED ALTITUDE AND CLEARANCE	3		3	9		9	12		12
MISJUDGED ALTITUDE				4		4	4		4
MISJUDGED CLEARANCE				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				4		4	4		4
IMPROPER RECOVERY FROM BOUNCED LANDING				1		1	1		1
INCAPACITATION	7	1	8	4		4	11	1	12
PHYSICAL IMPAIRMENT	2		2	3		3	5		5
SPATIAL DISORIENTATION		1	1		1	1		2	2
PSYCHOLOGICAL CONDITION				1	4	5	1	4	5
MISUSED OR FAILED TO USE FLAPS				8		8	8		8
FAILED TO MAINTAIN DIRECTIONAL CONTROL				5	1	6	5	1	6
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND	4		4	8		8	12		12
FAILED TO ABORT TAKEOFF				2		2	2		2
FAILED TO INITIATE GO-AROUND	3		3	12		12	15		15
DIRECT ENTRIES									
SUBTOTAL	274	14	288	2695	70	2765	2969	84	3053

TABLE B-9 CONTINUED

CAUSE/FACTOR TABLE

COPILOT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				1		1	1		1
SUBTOTAL									
DUAL STUDENT				3		3	3		3
DELAYED IN INITIATING GO-AROUND									
FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1		1	2		2	3		3
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	4		4	13		13	17		17
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS				21		21	21		21
IMPROPER LEVEL OFF				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	5		5
INADEQUATE SUPERVISION OF FLIGHT				5		5	5		5
LACK OF FAMILIARITY WITH AIRCRAFT				1		1	1		1
MISMANAGEMENT OF FUEL					1	1			1
FAILURE TO RELINQUISH CONTROL				11	1	12	11	1	12
SPONTANEOUS-IMPROPER ACTION				1	1	2	1	1	2
MISJUDGED DISTANCE AND ALTITUDE				2		2	2		2
MISJUDGED SPEED AND ALTITUDE				2		2	2		2
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
MISUSED OR FAILED TO USE FLAPS				1		1	1		1
FAILED TO ABORT TAKEOFF		1	1						
SUBTOTAL				1		1	1	1	1
** PERSONNEL **	5	1	6	68	3	71	73	4	77
FLIGHT INSTRUCTOR									
INADEQUATE SUPERVISION OF FLIGHT				2	1	3	2	1	3
INADEQUATE TRAINING OF STUDENT				7	3	10	7	3	10
DIRECT ENTRIES				1		1	1		1
MAINTENANCE, SERVICING, INSPECTION	5		5	39		39	44		44
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	3		3	16	2	18	19	2	21
IMPROPER MAINTENANCE(OWNER PERSONNEL)				6	2	8	6	2	8
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)	1		1	21	2	23	22	2	24
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	2		2	9		9	11		11
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)		1	1	3		3	3	1	4
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)	17	2	19	248	11	259	265	13	278
INADEQUATE MAINTENANCE AND INSPECTION				2		2	2		2
OTHER	1		1				1		1
UNK/NR				1		1	1		1
OPERATIONAL SUPERVISORY PERSONNEL				1	1	2	1	1	2
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT	1		1	1		1	1		1
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS					1	1		1	2
WEATHER PERSONNEL				1		1	1		1
INCORRECT WEATHER FORECAST				1		1	1		1
INADEQUATE/INCORRECT WEATHER BRIEFING	1		1		1	1		1	2
TRAFFIC CONTROL PERSONNEL				1		1	1	1	2
AIRPORT SUPERVISORY PERSONNEL				1		1	1		1
IMPROPER MAINTENANCE-AIRPORT FACILITIES									
IMPROPER INSPECTION OF FACILITIES									
OTHER				2	1	3	2	1	3
RWAYS FACILITIES PERSONNEL				1	1	2	1	1	2
ODUCTION-DESIGN					1	1		1	1
SUBSTANDARD QUALITY CONTROL									
INCORRECT FACTORY INSTALLATION									
POOR/INADEQUATE DESIGN				1		1	1		1
OTHER	1		1	5		5	6		6
SCELLANEOUS-PERSONNEL				6	2	8	6	2	8
PILOT OF OTHER AIRCRAFT	1		1	3	1	4	4	1	5
PASSENGER									
DRIVER OF VEHICLE				1	1	2	1	1	2
OTHER				5	2	7	5	2	7
DIRECT ENTRIES				1	1	2	1	1	2
RD PILOT				1		1	1		1
GHT ENGINEER				2		2	2		2
PATCHING									

TABLE B-9 CONTINUED

CAUSE/FACTOR TABLE

PERSONNEL (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL	32	3	35	385	33	418	417	36	453
** AIRFRAME **									
WINGS	1		1		1	1	1	1	1 1
BRACING WIRES, STRUTS				1		1	1		1
OTHER				2		2	2		2
FUSELAGE				1		1	1		1
WINDSHIELDS, WINDOWS, CANOPIES				1		1	1		1
LANDING GEAR				1		1	1		1
NORMAL RETRACTION/EXTENSION ASSEMBLY				1		1	1		1
NOSEWHEEL ASSEMBLIES				1		1	1		1
BRAKING SYSTEM (NORMAL)							1		1
DIRECT ENTRIES	1		1		1	1		1	1
FLIGHT CONTROL SURFACES									
AILERON, SURFACES ATTACHMENTS									
HORIZONTAL STABILIZER, ATTACHMENTS	2		2	6	2	8	8	2	10
SUBTOTAL									
** POWERPLANT **									
ENGINE STRUCTURE				4		4	4		4
CRANKCASE	2		2	53	1	54	55	1	56
CRANKSHAFT	3		3	72		72	75		75
MASTER AND CONNECTING RODS	3	1	4	58		58	61	1	62
CYLINDER ASSEMBLY	3	1	4	59	1	60	62	2	64
PISTON, PISTON RINGS	3		3	122	1	123	125	1	126
VALVE ASSEMBLIES				13		13	13		13
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
MOUNT AND VIBRATION ISOLATORS	5		5	31		31	36		36
OTHER				52	2	54	57	2	59
IGNITION SYSTEM	5		5	1		1	2		2
MAGNETOES	1		1	37	3	40	42	4	46
DISTRIBUTOR	5	1	6	1		1	1		1
SPARK PLUG				2		2	2		2
COILS				1		1	1		1
LOW TENSION WIRING				6	1	7	6	1	7
HIGH TENSION WIRING				3		3	3		3
IGNITION HARNESS, SHIELDING				3		3	3		3
SWITCHES				2		2	2		2
LEADS									
OTHER				9	4	13	9	4	13
FUEL SYSTEM	2		2	25	2	27	27	2	29
TANKS	1		1	20	2	22	21	2	23
LINES AND FITTINGS	2		2	13	1	14	15	1	16
SELECTOR VALVES	2		2	2		2	4		4
FILTERS, STRAINERS, SCREENS	9		9	89	1	90	98	1	99
PRIMING SYSTEM	5		5	19		19	24		24
CARBURETOR				11		11	11		11
PUMPS				34	8	42	34	8	42
FUEL INJECTION SYSTEM				5		5	5		5
VENTS, DRAINS, TANK CAPS				6		6	7		7
RAM AIR ASSEMBLY	1		1						
OTHER				11		11	11		11
LUBRICATING SYSTEM				2		2	2		2
LINES, HOSES, FITTINGS				8		8	8		8
VALVES				5		5	5		5
FILTERS, SCREENS				2		2	2		2
PUMP-PRESSURE				4		4	4		4
PUMPS-SCAVENGER				1		1	1		1
OIL COOLERS				10		10	10		10
MAGNETIC PLUGS				10	1	11	10	1	11
SEALS AND GASKETS									
OTHER				1		1	1		1
COOLING SYSTEM									
OTHER				1		1	1		1
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES				1		1	2		2
HYDRAULIC PITCH CONTROL MECHANISM	1		1						
OTHER				2		2	2		2
EXHAUST SYSTEM									
MANIFOLDS									

TABLE B-9 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
MUFFLERS									
GASKETS	1		1	14	1	15	15	1	16
STACKS				1		1	1		1
BAFFLES				5		5	5		5
ENGINE ACCESSORIES				3		3	3		3
STARTERS									
OTHER				1		1	1		1
ENGINE CONTROLS-COCKPIT				1		1	1		1
THROTTLE-POWER LEVER ASSEMBLIES									
MIXTURE CONTROL ASSEMBLIES	1		1	27	1	28	28	1	29
INDUCTION AIR, PREHEAT CONTROLS	1		1	15		15	16		16
OTHER				6		6	6		6
POWERPLANT-INSTRUMENTS				1		1	1		1
FUEL QUANTITY GAUGE									
MISCELLANEOUS		1	1	4	33	37	4	34	38
POWERPLANT FAILURE FOR UNDETERMINED REASONS	45		45	677		677	722		722
BIRD INGESTION				1		1	1		1
FOREIGN OBJECT DAMAGE				1		1	1		1
COMPRESSOR STALLS				1		1	1		1
DETONATION				5		5	5		5
OTHER	1		1				1		1
DIRECT ENTRIES	1		1	36	1	37	37	1	38
REDUCTION GEAR ASSEMBLY				3		3	3		3
GEARS, ACCESSORY DRIVE				1		1	1		1
OTHER									
COMPRESSOR ASSEMBLY									
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
OTHER				1		1	1		1
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
PROPELLER SYSTEM									
CONSTANT SPEED DRIVE									
POWER LEVER									
CABLE									
PROPELLER LEVER				1		1	1		1
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
TACHOMETER									
ENGINE INSTALLATION				1		1	1		1
SUBTOTAL	103	4	107	1619	64	1683	1722	68	1790
SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES									
GENERATORS/ALTERNATORS					1	1		1	1
HYDRAULIC SYSTEM				1		1	1		1
LIGHT CONTROL SYSTEMS									
WING FLAP CONTROL SYSTEM (ELECTRICAL)									
WING FLAP CONTROL SYSTEM (HYDRAULIC)					1	1		1	1
ANTI-ICING, DE-ICING SYSTEMS				1		1	1		1
CARBURETOR DE-ICING SYSTEM									
AIR CONDITION, HEATING AND PRESSURIZATION				14		14	14		14
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
DEICER SYSTEMS									
SUBTOTAL				16	2	18	16	2	18
INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									

TABLE B-9 CONTINUED

CAUSE/FACTOR TABLE

INSTRUMENTS/EQUIPMENT AND ACCESSORIES (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
FLIGHT AND NAVIGATION INSTRUMENTS				1		1	1		1
COMPASS					3	3		3	3
COMMUNICATIONS AND NAVIGATION EQUIPMENT				1	3	4	1	3	4
TRANSMITTERS AND/OR RECEIVERS					1	1		1	1
VOR RECEIVERS									
OTHER				2		2	2		2
MISCELLANEOUS EQUIPMENT									
SPRAY, DUSTING EQUIPMENT				4	7	11	4	7	11
SUBTOTAL									
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES					5	5		5	5
AIRPORT CONDITIONS					1	1		1	1
WET RUNWAY				5	3	8	5	3	8
ICE/SLUSH ON RUNWAY					3	3		3	3
SNOW ON RUNWAY					1	1		2	2
SOFT SHOULDERS (RUNWAY)		1	1	3	8	11	3	8	11
HIGH VEGETATION									
OTHER									
AIRWAYS FACILITIES		1	1	8	21	29	8	22	30
SUBTOTAL									
** WEATHER **	2	13	15	3	29	32	5	42	47
LOW CEILING	1	5	6	1	10	11	2	15	17
RAIN	4	5	9	4	19	23	8	24	32
FOG	1	2	3		8	8	1	10	11
SNOW	1	2	3	4	9	13	5	11	16
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	7	9	16	126	100	226	133	109	242
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING		3	3	7	15	22	7	18	25
UNFAVORABLE WIND CONDITIONS				1		1	1		1
SUDDEN WINDSHIFT				1		1	1		1
TURBULENCE IN FLIGHT, CLEAR AIR					1	1		2	2
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS		1	1	4	2	6	4	2	6
DOWNDRAFTS, UPDRAFTS				2		2	2		2
LOCAL WHIRLWIND					4	4		4	4
ADVERSE WINDS ALOFT					4	4		5	5
HIGH TEMPERATURE		1	1		6	6	1	6	7
OBSTRUCTIONS TO VISION	1		1		6	6	1	11	12
HIGH DENSITY ALTITUDE		3	3	1	8	9		6	6
THUNDERSTORM ACTIVITY					6	6		1	1
OTHER					1	1			
SUBTOTAL	17	44	61	154	222	376	171	266	437
** TERRAIN **		2	2	77	176	253	77	178	255
WET, SOFT GROUND				8	12	20	8	12	20
SNOW-COVERED				1	1	2	1	1	2
ICY				22	61	83	22	61	83
HIGH VEGETATION				9	4	13	10	4	14
HIDDEN OBSTRUCTIONS	1		1	110	189	299	111	194	305
ROUGH/UNEVEN	1	5	6	1	1	2	1	2	3
ROUGH WATER		1	1	58	53	111	67	62	129
HIGH OBSTRUCTIONS	9	9	18		1	1		1	1
LOOSE GRAVEL				13	14	27	13	14	27
SANDY	1		1	10	13	23	11	13	24
OTHER									
SUBTOTAL	12	17	29	309	525	834	321	542	863
** MISCELLANEOUS **				1		1	1		1
BIRD COLLISION				32	2	34	32	2	34
EVASIVE MANEUVER TO AVOID COLLISION				5	3	8	5	3	8
UNQUALIFIED PERSON OPERATED AIRCRAFT				1		1	1		1
SABOTAGE	9		9	100	3	103	109	3	112
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	3		3				3		3
UNDETERMINED									

TABLE B-9 CONTINUED

MISCELLANEOUS (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
DIRECT ENTRIES	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL	2		2	5		5	7		7
GRAND TOTAL	14		14	144	8	152	158	8	166
** MISCELLANEOUS ACTS, CONDITIONS **	459	84	543	5411	957	6368	5870	1041	6911
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE									
CHECKLIST-FAILED TO USE	12	1	13	379	6	385	391	7	398
DISREGARD OF GOOD OPERATING PRACTICE				2	9	11	2	9	11
IMPROPER EMERGENCY PROCEDURES		1	1	1		1	1	1	2
INSTRUMENTS-MISREAD OR FAILED TO READ	2	1	3	12	8	20	14	9	23
SEAT BELT NOT FASTENED					1	1		1	1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA	1	1	2		2	2	1	3	4
UNWARRANTED LOW FLYING				3	4	7	3	4	7
FAILED TO EXTEND THE LANDING FLAPS	2		2	2	8	10	4	8	12
FAILED TO USE ALL AVAILABLE RUNWAY		2	2		1	1		1	1
INATTENTIVE TO FUEL SUPPLY	9	1	10	107	3	3		5	5
PLEW INTO BLIND CANYON	1		1		22	129	116	23	139
POORLY PLANNED APPROACH	3	1	4	6			1		1
MISCALCULATED FUEL CONSUMPTION	2	2	4	66	14	20	9	15	24
JETTISONED LOAD					17	83	68	19	87
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT		2	2		19	19		19	19
LANDED ON FOAMED RUNWAY					5	5		7	7
IMPROPERLY SECURED	2		2	32	1	1		1	1
BOGUS PART				3	3	35	34	3	37
ELECTRICAL FAILURE				4		3	3		3
ENGINE LOADED UP	1		1	109	4	8	4	4	8
FATIGUE FRACTURE	2		2	43	17	126	110	17	127
FUEL GRADE-IMPROPER				6	1	44	45	1	46
IMPROPER GRADE OIL-LUBRICATING SYSTEM				2		6	6		6
RPM-UNCONTROLLABLE-OVERSPEED						2	2		2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION		1	1		2	2		2	2
WRONG PART					4	4		5	5
IMPROPER ALIGNMENT/ADJUSTMENT	3		3	1		1	1		1
SEPARATION IN FLIGHT		2	2	16	2	18	19	2	21
FIRE IN ENGINE				1	13	14	1	15	16
CORRODED/CORROSION	1			3	2	5	3	2	5
CONGESTED TRAFFIC-PATTERN		2	1	6	1	7	7	1	8
PILOT FATIGUE			2	1	2	3	1	4	5
FUEL EXHAUSTION	34	1	35	724	2	2		2	2
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	1		1	55	2	724	758	1	759
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	7	2	9	5		57	56	2	58
HYPOXIA					1	5	12	2	14
ICE-IN FUEL				9	2	1		1	1
ICE-ENGINE	12		12	1		11	9	2	11
ICE-CARBURETOR				316	7	1	1		1
ICE-PROPELLER	1		1	1		323	328	7	335
AIRFRAME ICE				2	4	1	1		1
ICE-WINDSHIELD	2	3	5	1	1	6	3	4	7
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG				2	4	2	1	1	2
INTERFERENCE WITH FLIGHT CONTROLS				1		6	4	7	11
WHITEOUT		1	1	2	1	1	1		1
DAZZLE				1	1	1		1	1
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	3		3	9	3	3		4	4
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM				53	1	10	9	1	10
OIL EXHAUSTION-PROPELLER SYSTEM		3	3	2	2	55	56	2	58
OIL CONTAMINATION				4		2	2		2
SIMULATED CONDITIONS	6	1	7	65	50	4	4		4
FUEL SIPHONING				3	1	115	71	51	122
WATER IN FUEL	5		5	171	5	4	3	1	4
AIRCRAFT CAME TO REST IN WATER		14	14		104	176	176	5	181
FROZEN, MOISTURE				4		104		118	118
MISSING	1	2	3	14	3	4	4		4
TOUCH AND GO LANDING		1	1		9	17	15	5	20
OVERLOAD FAILURE	1	1	2	2	771	9		10	10
MATERIAL FAILURE	10		10	424	11	773	3	772	775
FUEL STARVATION	51	2	53	701		435	434	11	445
OIL STARVATION	2		2	33	1	701	752	2	754
						34	35	1	36

CAUSE/FACTOR TABLE

TABLE B-9CONTINUED

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
IMPROPER CLEARANCE-TOLERANCE				17		17	20		20
FUEL SELECTOR POSITIONED BETWEEN TANKS	3		3	29	4	33	37	5	42
FIRE OF UNDETERMINED ORIGIN	8	1	9	1		1	1		1
UNAPPROVED MODIFICATION		1	1	5	2	7	5	3	8
IMPROPER/INADEQUATE VENTING				4	3	7	4	3	7
ACTION, LACK OF					1	1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				6	3	9	6	3	9
LEAK/LEAKAGE	2		2	20	3	23	22	3	25
LOW FLUID LEVEL					2	2		2	2
CIRCUIT BREAKER POPPED					1	1		1	1
ARCING	1		1				1		1
LOW COMPRESSION				6		6	6		6
RUNWAY CLOSED					1	1		1	1
DOWNWIND		4	4	2	30	32	2	34	36
CARBON DEPOSITS	3	1	4	22	3	25	25	4	29
LANDED IN CONSTRUCTION AREA				2	2	4	2	2	4
OVER TORQUED				1		1	1		1
UNDER TORQUED				1		1	1		1
LOOSE, PART/FITTING	4		4	26	3	29	30	3	33
BENT				3		3	3		3
BINDING	2		2	5	1	6	7	1	8
BURNED				11	2	13	11	2	13
CHAFFED				2	2	4	2	2	4
COLLAPSED	1		1	4	1	5	5	1	6
CROSSED	1		1				1		1
DETERIORATED	1	1	2	2		2	3	1	4
DISCONNECTED		1	1	13		13	13	1	14
EXCESSIVE	1		1	5		5	6		6
ERRATIC				2	11	13	2	11	13
FRICTION, EXCESSIVE				1		1	1		1
GROUNDED				5		5	5		5
IMPROPERLY INSTALLED		1	1	24	3	27	24	4	28
JAMMED				3		3	3		3
OBSTRUCTED		1	1	19		19	19		19
OPEN					1	1		1	1
OUT OF BALANCE				1	2	3	1	2	3
OVERHEATED				13	1	14	13	1	14
EXCESSIVE PRESSURE				3		3	3		3
PRESSURE TOO LOW				10	2	12	10	2	12
PRESSURE, NONE				5	2	7	5	2	7
SCORED	1		1	2		2	3		3
SHEARED	2		2	5		5	7		7
STICKING				8	2	10	8	2	10
STRIPPED				1		1	1		1
STUCK				10	3	13	10	3	13
EXCESSIVE TEMPERATURE	1		1	3	4	7	4	4	8
VIBRATION, EXCESSIVE				2	3	5	2	3	5
WARPED				1		1	1		1
INTENTIONAL GROUND-WATER LOOP-SWERVE				2	1	3	2	1	3
INTENTIONAL WHEELS UP	1		1	16	2	18	17	2	19

DIRECT ENTRY CAUSES

PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-DID NOT SEE WIRES IN TIME-EVASIVE ACT,N STAL
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-CARB.FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.

TABLE B-9 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PWR PLT-ACELERATOR PUMP JAMMED BY DUST COVER.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-THROTTLE CONTROL BINDING IN CABLE HOUSING.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-CAM REDUCTION GEAR FAILED.
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PILOT-LIMITED EXPERIENCE
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
FLT INSTR-PODRLY PLANNED FORCED LANDING
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWR PLT-DETONATION IN ALL CYLINDERS.
LDG GR-NOSE GEAR RETRACTED FOR UNDETERMINED REASON
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-OIL FILLER CAP MISSING.
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PILOT-FAILED TO JETTISON LOAD.
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-GASKET BLOWN NO 3 CYL.
MISC-LOSS OF CONTROL FOR UNDETERMINED CAUSE.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PILOT-INADVERTENTLY TURNED ENG OFF.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PILOT-LOSS OF CONTROL FOR UNDETERMINED REASON.
PILOT-LOSS OF CONTROL FOR UNDETERMINED CAUSE.
PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

TABLE B-10

CAUSE/FACTOR TABLE

SINGLE ENGINE FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3015 TOTAL ACCIDENTS
INVOLVES 153 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	104 67.97	9 5.88	104 67.97	1836 64.15	54 1.89	1838 64.22	1940 64.34	63 2.09	1942 64.41
PERSONNEL	29 18.95	3 1.96	32 20.92	369 12.89	29 1.01	398 13.91	398 13.20	32 1.06	430 14.26
AIRFRAME	1 .65	.00	1 .65	1 .03	.00	1 .03	2 .07	.00	2 .07
LANDING GEAR	.00	.00	.00	1 .03	.00	1 .03	1 .03	.00	1 .03
POWERPLANT	49 32.03	2 1.31	51 33.33	872 30.47	59 2.06	926 32.35	921 30.55	61 2.02	977 32.40
SYSTEMS	.00	.00	.00	14 .49	1 .03	15 .52	14 .46	1 .03	15 .50
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	.00	.00	.00	3 .10	5 .17	8 .28	3 .10	5 .17	8 .27
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	1 .03	1 .03	2 .07	1 .03	1 .03	2 .07
WEATHER	7 4.58	13 8.50	18 11.76	132 4.61	142 4.96	271 9.47	139 4.61	155 5.14	289 9.59
TERRAIN	.00	.00	.00	.00	.00	.00	.00	.00	.00
MISCELLANEOUS	10 6.54	.00	10 6.54	112 3.91	6 .21	118 4.12	122 4.05	6 .20	128 4.25
UNDETERMINED	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT
OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

[illegible] RELATED FACTOR IN THE SAME CAUSAL [illegible] FOR THAT CATEGORY

TABLE B-11

CAUSE/FACTOR TABLE

SINGLE ENGINE FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 3015 TOTAL ACCIDENTS
INVOLVES 153 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	2	1	3	18	4	22	20	5	25
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	2		2	8	1	9	10	1	11
BECAME LOST/DISORIENTED	6		6	80	9	89	86	9	95
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	8		8	27	4	31	35	4	39
DELAYED IN INITIATING GO-AROUND				2		2	2		2
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				2	1	3	2	1	3
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	2		2	6		6	2		2
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT	2		2	15	2	17	8	2	8
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	14		14	422		422	436		436
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				6		6	6		6
IMPROPER OPERATION OF FLIGHT CONTROLS	9		9	1		1	1		1
IMPROPER IFR OPERATION				93	5	98	102	5	107
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	45	1	46	1		1	1		1
IMPROPER COMPENSATION FOR WIND CONDITIONS				800	4	804	845	5	850
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	4	4	8	41		41	41		41
INADEQUATE SUPERVISION OF FLIGHT	41		41	27	18	45	31	22	53
LACK OF FAMILIARITY WITH AIRCRAFT	2		2	499	1	500	540	1	541
MISMANAGEMENT OF FUEL				17		17	19		19
EXERCISED POOR JUDGMENT				1	1	2	1	1	2
OPERATED CARELESSLY				3		3	3		3
SELECTED UNSUITABLE TERRAIN				2		2	2		2
IMPROPER STARTING PROCEDURES				1		1	1		1
INITIATED FLIGHT IN ADVERSE WEATHER CONDITIONS				12		12	12		12
SPONTANEOUS-IMPROPER ACTION		1	1		1	1		1	1
MISJUDGED DISTANCE AND SPEED				1		1	1	1	1
MISJUDGED DISTANCE AND ALTITUDE				1		1	1		1
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED SPEED				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
INCAPACITATION				1		1	1		1
PHYSICAL IMPAIRMENT				1		1	1		1
SPATIAL DISORIENTATION				1		1	1		1
PSYCHOLOGICAL CONDITION	4	1	5	3		3	7	1	8
MISUSED OR FAILED TO USE FLAPS	1		1	1		1	2		2
FAILED TO ABORT TAKEOFF		1	1		1	1		2	2
FAILED TO INITIATE GO-AROUND	2		2	1	1	2	1		1
DIRECT ENTRIES	1		1	1		1	3		3
SUBTOTAL	145	9	154	9		9	10		10
PILOT				2103	53	2156	2248	62	2310
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				1		1	1		1
SUBTOTAL				3		3	3		3
L STUDENT									
AILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
MPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				16		16	16		16
NADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING				5		5	5		5
ACK OF FAMILIARITY WITH AIRCRAFT					1	1		1	1
SMANAGEMENT OF FUEL				10	1	11	10	1	11
PONTANEOUS-IMPROPER ACTION				1		1	1		1

TABLE B-11 CONTINUED

CAUSE/FACTOR TABLE

DUAL STUDENT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL				33	2	35	33	2	35
** PERSONNEL **									
FLIGHT INSTRUCTOR				2	1	3	2	1	3
INADEQUATE SUPERVISION OF FLIGHT				7	3	10	7	3	10
INADEQUATE TRAINING OF STUDENT									
MAINTENANCE, SERVICING, INSPECTION				39		39	44		44
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)	5		5	16	2	18	19	2	21
IMPROPER MAINTENANCE(OWNER PERSONNEL)	3		3	6	2	8	6	2	8
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)	1		1	21	2	23	22	2	24
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)	2		2	9		9	11		11
INADEQUATE INSPECTION OF AIRCRAFT(MAINTENANCE PERSONNEL)		1	1	3		3	3	1	4
INADEQUATE INSPECTION OF ACFT(OWNER-PILOT PERSONNEL)	17	2	19	245	11	256	262	13	275
INADEQUATE MAINTENANCE AND INSPECTION				2		2	2		2
OTHER	1		1				1		1
UNK/NR									
OPERATIONAL SUPERVISORY PERSONNEL				1		1	1		
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT				1	1	2	1	1	
DEFICIENCY, COMPANY MAINTAINED EQMT, SERV, REGULATIONS									
WEATHER PERSONNEL	1		1		1	1	1	1	
INCORRECT WEATHER FORECAST				1		1	1		
INADEQUATE/INCORRECT WEATHER BRIEFING									
TRAFFIC CONTROL PERSONNEL									
AIRPORT SUPERVISORY PERSONNEL				2		2	2		
IMPROPER MAINTENANCE-AIRPORT FACILITIES				1	1	2	1	1	
IMPROPER INSPECTION OF FACILITIES					1	1		1	
OTHER									
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN	1		1	5		5	6		
INCORRECT FACTORY INSTALLATION				5	2	7	5	2	
POOR/INADEQUATE DESIGN	1		1	3	1	4	4	1	
OTHER									
MISCELLANEOUS-PERSONNEL				4	1	5	4	1	
PASSENGER				1		1	1		
OTHER				2		2	2		
DIRECT ENTRIES									
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	32	3	35	376	29	405	408	32	
** AIRFRAME **									
WINGS	1		1				1		
BRACING WIRES, STRUTS				1		1	1		
FUSELAGE									
WINDSHIELDS, WINDOWS, CANOPIES				1		1	1		
LANDING GEAR									
NORMAL RETRACTION/EXTENSION ASSEMBLY							1		
FLIGHT CONTROL SURFACES	1		1						
AILERON, SURFACES ATTACHMENTS									
SUBTOTAL	2		2	2		2	4		
** POWERPLANT **									
ENGINE STRUCTURE				4		4	4		
CRANKCASE	2		2	53	1	54	55	1	
CRANKSHAFT	3		3	72		72	75		
MASTER AND CONNECTING RODS	3	1	4	58		58	61	1	
CYLINDER ASSEMBLY	3	1	4	59	1	60	62	2	
PISTON, PISTON RINGS	3		3	122	1	123	125	1	
VALVE ASSEMBLIES				13		13	13		
BLOWER, IMPELLER ASSEMBLY				1		1	1		
MOUNT AND VIBRATION ISOLATORS	5		5	31		31	36		
OTHER									
IGNITION SYSTEM	5		5	52	1	53	57	1	
MAGNETOES	1		1	1		1	2		
DISTRIBUTOR	5	1	6	37	3	40	42	4	
SPARK PLUG				1		1	1		
COILS									

TABLE B-11 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
LOW TENSION WIRING				2		2	2		2
HIGH TENSION WIRING				1		1	1		1
IGNITION HARNESS, SHIELDING				6	1	7	6	1	7
SWITCHES				3		3	3		3
LEADS				3		3	3		3
OTHER				2		2	2		2
FUEL SYSTEM				9	4	13	9	4	13
TANKS	2		2	25	2	27	27	2	29
LINES AND FITTINGS	1		1	20	2	22	21	2	23
SELECTOR VALVES	2		2	13	1	14	15	1	16
FILTERS, STRAINERS, SCREENS	2		2	2		2	4		4
PRIMING SYSTEM	9		9	87	1	88	96	1	97
CARBURETOR	5		5	19		19	24		24
PUMPS				11		11	11		11
FUEL INJECTION SYSTEM				33	8	41	33	8	41
VENTS, DRAINS, TANK CAPS				5		5	5		5
RAM AIR ASSEMBLY				6		6	7		7
OTHER									
LUBRICATING SYSTEM				11		11	11		11
LINES, HOSES, FITTINGS	1		1	2		2	2		2
VALVES				8		8	8		8
FILTERS, SCREENS				5		5	5		5
PUMP-PRESSURE				2		2	2		2
PUMPS-SCAVENGER				4		4	4		4
OIL COOLERS				1		1	1		1
MAGNETIC PLUGS				10		10	10		10
SEALS AND GASKETS				10	1	11	10	1	11
OTHER									
COOLING SYSTEM				1		1	1		1
OTHER									
PROPELLER AND ACCESSORIES				1		1	1		1
BLADES				1		1	1		1
HYDRAULIC PITCH CONTROL MECHANISM				1		1	1		1
OTHER				2		2	2		2
EXHAUST SYSTEM	1		1	14	1	15	15	1	16
MANIFOLDS				1		1	1		1
MUFFLERS				5		5	5		5
GASKETS				3		3	3		3
STACKS	1		1						
BAFFLES				1		1	1		1
ENGINE ACCESSORIES				1		1	1		1
STARTERS	1		1	27	1	28	28	1	29
OTHER	1		1	14		14	15		15
ENGINE CONTROLS-COCKPIT				6		6	6		6
THROTTLE-POWER LEVER ASSEMBLIES				1		1	1		1
MIXTURE CONTROL ASSEMBLIES		1	1	4	33	37	4	34	38
INDUCTION AIR, PREHEAT CONTROLS				1		1	1		1
OTHER				1		1	1		1
POWERPLANT-INSTRUMENTS				1		1	1		1
FUEL QUANTITY GAUGE				5		5	5		5
MISCELLANEOUS	1		1	36	1	37	37	1	38
BIRD INGESTION	1		1						
FOREIGN OBJECT DAMAGE				3		3	3		3
COMPRESSOR STALLS				1		1	1		1
DETONATION									
OTHER									
DIRECT ENTRIES									
REDUCTION GEAR ASSEMBLY									
GEARS, ACCESSORY DRIVE									
OTHER									
COMPRESSOR ASSEMBLY									
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
OTHER									
FUEL SYSTEM									
UTILITY SYSTEM									
IGNITION SYSTEM									
TACHOMETER				1		1	1		1
AIR BLEED									
EXHAUST SYSTEM									

TABLE B-11 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
THRUST REVERSER									
PROPELLER SYSTEM									
CONSTANT SPEED DRIVE									
POWER LEVER				1		1	1		1
CABLE									
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT				1		1	1		1
TACHOMETER									
ENGINE INSTALLATION									
SUBTOTAL	58	4	62	938	63	1001	996	67	1063
** SYSTEMS **									
ELECTRICAL SYSTEM					1	1		1	1
BATTERIES				1		1	1		1
GENERATORS/ALTERNATORS									
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS				13		13	13		13
CARBURETOR DE-ICING SYSTEM									
AIR CONDITION, HEATING AND PRESSURIZATION									
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL				14	1	15	14	1	15
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS				1		1	1		
COMPASS									
COMMUNICATIONS AND NAVIGATION EQUIPMENT					3	3		3	
TRANSMITTERS AND/OR RECEIVERS				1	3	4	1	3	
VOR RECEIVERS					1	1		1	
OTHER									
MISCELLANEOUS EQUIPMENT				1		1	1		
SPRAY, DUSTING EQUIPMENT									
SUBTOTAL				3	7	10	3	7	
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS				1	1	2	1	1	
SNOW ON RUNWAY									
AIRWAYS FACILITIES									
SUBTOTAL				1	1	2	1	1	
** WEATHER **									
LOW CEILING		6	6	1	21	22	1	27	
RAIN		4	4	1	8	9	1	12	
FOG		2	2	2	13	15	2	15	
SNOW	1	1	2		5	5	1	6	
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	1	2	4	8	12	5	9	
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	7	5	12	124	90	214	131	95	
UNFAVORABLE WIND CONDITIONS		1	1		7	7		8	
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS		1	1		1	1		2	
LOCAL WHIRLWIND				1		1	1		
ADVERSE WINDS ALOFT					4	4		4	
HIGH TEMPERATURE		1	1					1	
OBSTRUCTIONS TO VISION					6	6		6	
HIGH DENSITY ALTITUDE		1	1	1	3	4	1	4	
THUNDERSTORM ACTIVITY					4	4		4	
OTHER					1	1		1	

TABLE B-11 CONTINUED

CAUSE/FACTOR TABLE

WEATHER (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SUBTOTAL									
** MISCELLANEOUS **	9	23	32	134	171	305	143	194	337
BIRD COLLISION				1		1	1		1
EVASIVE MANEUVER TO AVOID COLLISION				1		1	1		1
UNQUALIFIED PERSON OPERATED AIRCRAFT				5	3	8	5	3	8
SABOTAGE				1		1	1		1
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS	9		9	100	3	103	109	3	112
DIRECT ENTRIES	1		1	5		5	6		6
SUBTOTAL	10		10	113	6	119	123	6	129
GRAND TOTAL	256	39	295	3720	333	4053	3976	372	4348
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	12		12	370	4	374	382	4	386
CHECKLIST-FAILED TO USE				2	5	7	2	5	7
DISREGARD OF GOOD OPERATING PRACTICE	2		2	1		1	1		1
IMPROPER EMERGENCY PROCEDURES				5	7	12	7	7	14
INSTRUMENTS-MISREAD OR FAILED TO READ					1	1		1	1
SEAT BELT NOT FASTENED					1	1		1	1
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA					2	2		2	2
UNWARRANTED LOW FLYING	9	1	10		4	4		4	4
INATTENTIVE TO FUEL SUPPLY				107	22	129	116	23	139
POORLY PLANNED APPROACH	2	2	4	1	4	5	1	4	5
MISCALCULATED FUEL CONSUMPTION				66	15	81	68	17	85
JETTISONED LOAD		2	2		8	8		8	8
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	2		2		5	5		7	7
IMPROPERLY SECURED				31	3	34	33	3	36
BOGUS PART				3		3	3		3
ELECTRICAL FAILURE				3	3	6	3	3	6
ENGINE LOADED UP	2		2	92	14	106	92	14	106
FATIGUE FRACTURE				43	1	44	45	1	46
FUEL GRADE-IMPROPER				6		6	6		6
IMPROPER GRADE OIL-LUBRICATING SYSTEM				2		2	2		2
RPM-UNCONTROLLABLE-OVERSPEED		1	1		2	2		2	2
WINDSHIELD, DIRTY, FOGGY, ETC-RESTRICTED VISION					2	2		3	3
WRONG PART	3		3	1		1	1		1
IMPROPER ALIGNMENT/ADJUSTMENT		1	1	16	1	17	19	1	20
SEPARATION IN FLIGHT				1	11	12	1	12	13
FIRE IN ENGINE	1		1	2		2	2		2
CORRODED/CORROSION		2	2	6	1	7	7	1	8
CONGESTED TRAFFIC-PATTERN	34	1	35	1	2	3	1	2	3
PILOT FATIGUE	1		1	724		724	758	1	759
FUEL EXHAUSTION	5	2	7	55	2	57	56	2	58
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL				4		4	9	2	11
ALCOHOLIC IMPAIRMENT OF EFFICIENCY AND JUDGMENT	12		12	9	2	11	9	2	11
ICE-IN FUEL				1		1	1		1
ICE-ENGINE				307	7	314	319	7	326
ICE-CARBURETOR				1		1	1		1
ICE-PROPELLER	1	2	3	2	3	5	2	3	5
AIRFRAME ICE				1		1	1		1
ICE-WINDSHIELD					1	1	1		1
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	3		3	9	1	10	9	1	10
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM				53	2	55	56	2	58
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM				2		2	2		2
OIL EXHAUSTION-PROPELLER SYSTEM				4		4	4		4
OIL CONTAMINATION	5		5	3	1	4	3	1	4
FUEL SIPHONING		2	2	169	5	174	174	5	179
WATER IN FUEL					15	15		17	17
AIRCRAFT CAME TO REST IN WATER	1	2	3	4		4	4		4
FROZEN, MOISTURE				13	3	16	14	5	19
MISSING	10		10	1	5	5		5	5
TOUCH AND GO LANDING	51	2	53	421	11	432	431	11	442
OVERLOAD FAILURE	2		2	690	1	690	741	2	743
MATERIAL FAILURE	3		3	33		34	35	1	36
FUEL STARVATION				17		17	20		20
OIL STARVATION									
IMPROPER CLEARANCE-TOLERANCE									

TABLE B-11 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
FUEL SELECTOR POSITIONED BETWEEN TANKS	8	1	9	28	4	32	36	5	41
FIRE OF UNDETERMINED ORIGIN				1		1	1		1
UNAPPROVED MODIFICATION				5	2	7	5	2	7
IMPROPER/INADEQUATE VENTING				4	3	7	4	3	7
ACTION, LACK OF					1	1		1	1
POOR WELD				2		2	2		2
PREVIOUS DAMAGE				5	3	8	5	3	8
LEAK/LEAKAGE	2		2	20	3	23	22	3	25
LOW FLUID LEVEL					2	2		2	2
ARCING	1		1				1		1
LOW COMPRESSION				6		6	6		6
DOWNWIND		1	1		4	4		5	5
CARBON DEPOSITS	3	1	4	22	3	25	25	4	29
OVER TORQUED				1		1	1		1
UNDER TORQUED				1		1	1		1
LOOSE, PART/FITTING	4		4	26	3	29	30	3	33
BENT				3		3	3		3
BINDING	2		2	5	1	6	7	1	8
BURNED				11	2	13	11	2	13
CHAFFED				2	2	4	2	2	4
COLLAPSED	1		1	4	1	5	5	1	6
CROSSED	1		1				1		1
DETERIORATED	1	1	2	2		2	3	1	4
DISCONNECTED		1	1	13		13	13	1	14
EXCESSIVE	1		1	5		5	6		6
ERRATIC				2	11	13	2	11	13
FRICTION, EXCESSIVE				1		1	1		1
GROUNDED				5		5	5		5
IMPROPERLY INSTALLED		1	1	24	3	27	24	4	28
JAMMED				3		3	3		3
OBSTRUCTED		1	1	19		19	19	1	20
OPEN					1	1		1	1
OUT OF BALANCE				1	2	3	1	2	3
OVERHEATED				13	1	14	13	1	14
EXCESSIVE PRESSURE				3		3	3		3
PRESSURE TOO LOW				10	1	11	10	1	11
PRESSURE, NONE				5	2	7	5	2	7
SCORED	1		1	2		2	3		3
SHEARED	2		2	5		5	7		7
STICKING				8	2	10	8	2	10
STRIPPED				1		1	1		1
STUCK				10	3	13	10	3	13
EXCESSIVE TEMPERATURE	1		1	3	4	7	4	4	8
VIBRATION, EXCESSIVE				2	3	5	2	3	5
WARPED				1		1	1		1

DIRECT ENTRY CAUSES

PWR PLT-FUEL EXHAUSTION FOR UNK CAUSE.
PILOT-INCAPACITATION CAUSED BY DRUGS
PWR PLT-SEAL ON OIL FILTER IMPROPERLY INSTALLED.
PWR PLT-FUEL PRESSURE DROPPED TO ZERO,CAUSE UNDTMD
PWR PLT-EXCESSIVE FUEL CONSUMPTION-CAUSE UNDTRMND.
PWR PLT-MATERIAL FAILURE,CAM REDUCTION GEAR ASSEMB
PWR PLT-CAM REDUCTION GEAR FAILED.
PILOT-INADVERTENTLY TURNED OFF FUEL.
PILOT-IMPROPERLY EXECUTED EMERGENCY LANDING
PWR PLT-NO GASKET,NO.3 CYLINDER ROCKER BOX COVER.
PWR PLT-EXCESSIVE FUEL CONSUMPTION,CAUSE UNDETERMN
PILOT-POSITIONED MIXTURE CONTROL TO IDLE-CUT-OFF.
PWR PLT-THROTTLE HOUSING BROKE FORWARD OF FIREWALL
PWR PLT-FUEL SIPHONED OUT FROM DEFORMED TANK VENT.
PWR PLT-SLUSH ENTERED CARBURETOR AIR INTAKE SCOOP.
PWR PLT-CARB INGESTED WATER,AIR SCREEN SATURATED.
PWR PLT-DETONATION IN ALL CYLINDERS.
PWR PLT-CARB,FLOAT IMPROPERLY INSTALLED,STICKING.
PWR PLT-ACCELERATOR PUMP JAMMED BY DUST COVER.
PWR PLT-FATIGUE FAILURE OF NUMBER 1 CYLINDER.
MISC-DESCENT WAS TOO STEEP PRECLUDING FUEL FLOW

TABLE B-11 CONTINUED

DIRECT ENTRY CAUSES (CONTINUED)

PILOT-INADVERTENTLY ACTUATED MIXTURE CONTROL
PWR PLT-EXCESSIVE FUEL CONSUMPTION CAUSE NOT DTRMD
PWR PLT-IMPROPER CARBURETOR INSTALLED.
PWR PLT-OIL FILLER CAP MISSING.
PWR PLT-CAMSHAFT DRIVE GEAR BOLTS FAILED.
PWR PLT-ENG ROUGH,CAUSE UNDETERMINED.
PERSONNEL-IMPROPERLY SECURED OIL FILLER CAP.
PWR PLT-GASKET BLOWN NO 3 CYL.
MISC-WATER CONTAMINATED FUEL SOURCE
PWR PLT-ENGINE CRANKCASE BREATHER PLUGGED BY ICE
MISC-FUEL SELECTOR MOVED OFF FULL OPEN POSITION
MISC-CARBURETOR HEAT CONTROL BRACKET FAILED
PWR PLT-FATIGUE FAILURE OF CARB HEAT CONTROL.
PWR PLT-THROTTLE CONTROL BINDING IN CARLE HOUSING.
PILOT-LEG STRUCK AND TURNED FUEL SELECTR VALVE OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-LEFT CRANKSHAFT IDLER GEAR CAP SCREW FAILD
PERSONNEL-TRI-PACER OWNERS HANDBOOK INADEQUATE.
PWR PLT-RE-INGESTION OF EXHAUST GAS
PWR PLT-PUSH ROD SOCKETS NOT INSTALLED.
PWR PLT-BOTH MAIN FUEL CAPS LOOSE,FUEL SYPHONING
MISC-WATER FROZE IN FUEL SELECTOR BLOCKING FLOW
PILOT-ATTEMPTED FLIGHT WITH AUTOMOBILE FUEL.
PWR PLT-EXCESSIVE CARBON DEPOSITS ON SPARK PLUGS.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PWR PLT-IMPROPER FUEL GAUGE INSTALLED.
PWR PLT-FUEL STARVATION FOR UNDETERMINED REASON
PWR PLT-FUEL STRAVATION FOR AN UNDETERMINED REASON
PILOT-ACFT ON AUTOPILOT,PLT ASLEEP.
PILOT-INADVERTENTLY TURNED MAGNETO SWITCH OFF
PWR PLT-CARBURETOR NEEDLE VALVE STUCK.
PWR PLT-INTAKE MANIFOLD CRACKED.
PWP PLT-IMPROPERLY RIGGED MIXTURE CONTROL.
PWR PLT-OIL STARVATION FOR UNDETERMINED REASON
PILOT-INADVERTENTLY TURNED ENG OFF.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

APPENDIX C

MULTIENGINE FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION

TABLE 3

ACCIDENTS, INJURIES
ENGINE FAILURE OR MALFUNCTION
AS A FIRST ACCIDENT TYPE
MULITIENGINE, FIXED-WING AIRCRAFT
U. S. GENERAL AVIATION
1965 - 1969

	INJURIES					
	FATAL	SERIOUS	MINOR	NONE	UNKNOWN	TOTAL
PILOT	93	67	61	234		455
COPILOT	9	6	8	42		65
DUAL STUDENT	11	5	5	22		43
CHECK PILOT	1			3		4
FLIGHT ENGINEER				1		1
NAVIGATOR		1		2		3
CABIN ATTENDANT				7		7
EXTRA CREW	5	1	1	8		15
PASSENGERS	145	110	104	509		868
TOTAL	264	190	179	828	ABOARD	1461
OTHER AIRCRAFT						
OTHER GROUND	2	2	1	2		7
GRAND TOTAL	266	192	180	830		1468

INVOLVES
INVOLVES 455 TOTAL ACCIDENTS
104 FATAL ACCIDENTS

TABLE C-2

ANALYTIC TABLE

KIND OF FLYING VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969

KIND OF FLYING	AIRCRAFT DAMAGE DEST	SUBST	MIN	NONE	RECORDS	ACCIDENTS
INSTRUCTIONAL						
DUAL	16	27			43	43
SOLO						
CHECK	2	2			4	4
TRAINING						
NONCOMMERCIAL						
PLEASURE	49	51			100	100
PRACTICE	3	8			11	11
BUSINESS	41	64			105	105
CORPORATE/EXECUTIVE	13	25			38	38
AERIAL SURVEY						
COMPANY FLIGHT						
OTHER						
COMMERCIAL						
AERIAL APPLICATION		1			1	1
ASSOCIATED CROP CONTROL ACTIV	2	1			3	3
FIRE CONTROL	1				1	1
ASSOCIATED FIRE CONTROL ACTIV	1	3			4	4
AERIAL MAPPING/PHOTOGRAPHY						
AERIAL ADVERTISING						
POWER AND PIPELINE PATROL						
FISH SPOTTING						
AIR TAXI-PASSENGER OPERATIONS	25	38			63	63
AIR TAXI-CARGO OPERATIONS	14	12			26	26
CONSTRUCTION WORK						
SCHEDULED PASSENGER SERVICE						
SCHEDULED CARGO SERVICE	1				1	
NONSCHEDULED/CHARTER REVENUE						
NONSCHEDULED/CHARTER REVENUE						
MILITARY CONTRACT-PASSENGER						
MILITARY CONTRACT-CARGO						
CONTRACT/CHARTER-CARGO-DOMEST	1	1			2	
CONTRACT/CHARTER-PASSENGER-DO	1	1			2	
CONTRACT/CHARTER-CARGO-INTERN						

TABLE C-2 CONTINUED

ANALYTIC TABLE

KIND OF FLYING	AIRCRAFT DAMAGE DEST	SUBST	MIN	NONE	RECORDS	ACCIDENTS
CONTRACT/CHARTER-PASSENGER-IN						
OTHER						
UNKNOWN/NOT REPORTED						
MISCELLANEOUS						
EXPERIMENTATION						
TEST	7	7			14	14
DEMONSTRATION		11			11	11
FERRY	11	10			21	21
SEARCH AND RESCUE						
AIR SHOW/AIR RACING	1				1	1
PARACHUTE JUMP						
PARACHUTE JUMP IN CONNECTION						
TOWING GLIDERS						
SEEDING CLOUDS	1				1	1
HUNTING						
POLICE PATROL						
HIGHWAY TRAFFIC ADVISORY						
ALL OTHER PUBLIC FLYING		1			1	1
OTHER						
UNKNOWN/NOT REPORTED	1	1			2	2
RECORDS	191	264			455	
ACCIDENTS	191	264				455

AIRPORT PROXIMITY VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969

AIRPORT PROXIMITY	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
ON AIRPORT	15	12	18	96	141	141
ON SEAPLANE BASE						
ON HELIPORT						
ON BARGE/SHIP/PLATFORM						
IN TRAFFIC PATTERN	22	16	10	32	80	80
WITHIN 1/4 MILE	4	6	3	4	17	17
WITHIN 1/2 MILE	3	4	4	3	14	14
WITHIN 3/4 MILE	2	1	1	1	5	5
WITHIN 1 MILE	4	3	2	4	13	13
WITHIN 2 MILES	9	9	10	13	41	41
WITHIN 3 MILES	11	1	1	8	21	21
WITHIN 4 MILES	5		1	1	7	7
WITHIN 5 MILES	4			1	5	5
BEYOND 5 MILES	24	15	18	51	108	108
UNKNOWN/NOT REPORTED	1	1		1	3	
RECORDS	104	68	68	215	455	
ACCIDENTS	104	68	68	215		4

TABLE C-4

ANALYTIC TABLE

FIRST PHASE OF OPERATION VS AIRCRAFT DAMAGE
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969

FIRST PHASE OF OPERATION	AIRCRAFT DAMAGE				RECORDS	ACCIDENTS
	DEST	SUBST	MIN	NONE		
STATIC						
STARTING ENGINE/S						
IDLING ENGINE/S						
ENGINE RUNUP						
IDLING ROTORS						
PARKED-ENGINES NOT OPERATING						
OTHER						
TAXI						
TO TAKEOFF						
FROM LANDING						
OTHER						
GROUND TAXI TO TAKEOFF						
GROUND TAXI FROM LANDING						
GROUND TAXI, OTHER						
AERIAL TAXI TO TAKEOFF						
AERIAL TAXI TO/FROM LANDING						
AERIAL TAXI, OTHER						
TAKEOFF						
RUN						
INITIAL CLIMB	4		15			
VERTICAL	55		82		19	19
RUNNING					137	137
ABORTED						
BORTED						
BORTED						
THER						
NFLIGHT						
LIMB TO CRUISE						
RMAL CRUISE	6		5			
SCENDING	71		98		11	11
LDING	3		9		169	169
VERING			1		12	12
ER-ON DESCENT					1	1
OROTATIVE DESCENT						

TABLE C-4 CONTINUED

ANALYTIC TABLE

			RECORDS	ACCIDENTS
ACROBATICS				
BUZZING				
UNCONTROLLED DESCENT				
EMERGENCY DESCENT				
LOW PASS		1	1	1
OTHER	5	3	8	8
EN ROUTE TO TREAT CROP				
EN ROUTE TO RELOADING AREA		1	1	1
SURVEY FIELD/AREA				
STARTING SWATH RUN				
SWATH RUN				
FLAREOUT FOR SWATH RUN				
PULLUP FROM SWATH RUN	1		1	1
PROCEDURE TURNAROUND	1		1	1
CLEANUP SWATH				
MANEUVER TO AVOID OBSTRUCTION				
RETURN TO STRIP				
LANDING				
TRAFFIC PATTERN-CIRCLING	7	11	18	18
FINAL APPROACH	18	22	40	40
INITIAL APPROACH	3	3	6	6
FINAL APPROACH	3	1	4	4
LEVEL OFF/TOUCHDOWN		2	2	2
ROLL		1	1	1
ROLL-ON/RUN-ON				
POWER-ON LANDING				
POWER-OFF AUTOROTATIVE LANDIN				
GO-AROUND	9	9	18	1
MISSED APPROACH	3		3	
OTHER	2		2	
UNKNOWN/NOT REPORTED				
RECORDS	191	264	455	
ACCIDENTS	191	264		

TABLE C-5

ANALYTIC TABLE

SECOND ACCIDENT TYPE VS INJURY INDEX
ACCIDENTS INVOLVING ENGINE FAILURE
OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969

TYPE OF ACCIDENT	INJURY INDEX				RECORDS	ACCIDENTS
	FATAL	SER	MIN	NONE		
GROUND-WATER LOOP-SWERVE			2	5	7	7
DRAGGED WINGTIP, POD, OR FLOA	1	10	10	93	114	114
WHEELS-UP LANDING		4	12	27	43	43
WHEELS-DOWN LANDING IN WATER				1	1	1
GEAR COLLAPSED			3	7	10	10
GEAR RETRACTED	2		1		3	3
HARD LANDING		1				
NOSE OVER/DOWN	1		1	2	1	1
ROLL OVER					4	4
OVERSHOOT						
UNDERSHOOT						
COLLISION WITH AIRCRAFT						
BOTH IN FLIGHT						
ONE AIRBORNE						
BOTH ON GROUND						
COLLISION WITH GROUND/WATER						
CONTROLLED						
UNCONTROLLED	7	8	4	3	22	22
COLLIDED WITH	15	3	2		20	20
WIRES/POLES						
TREES	1	4	2	2	9	9
RESIDENCE/S	10	15	9	9	43	43
BUILDING/S	2		1		3	3
FENCE, FENCEPOSTS						
ELECTRONIC TOWERS			1	10	11	11
RUNWAY OR APPROACH LIGHTS						
AIRPORT HAZARD						
ANIMALS						
CROP						
FLAGMAN LOADER	1			1	2	2
DITCHES						
SNOWBANK	2	2	3		7	7
PARKED AIRCRAFT				1	1	1
AUTOMOBILE		1	1		2	2

TYPE OF ACCIDENT	INJURY INDEX FATAL	SER	MIN	NONE	RECORDS	ACCIDENTS
DIRTBANK		1	2	5	8	8
OBJECT	1		2		3	3
BIRD STRIKE						
STALL	26	8	3	3	40	40
SPIN	27	3			30	30
SPIRAL	3			1	4	4
MUSH	3	5	2	14	24	24
FIRE OR EXPLOSION						
IN FLIGHT				5	5	5
ON GROUND			1	2	3	3
AIRFRAME FAILURE						
IN FLIGHT	1			1	2	2
ON GROUND						
ENGINE TEARAWAY						
ENGINE FAILURE OR MALFUNCTION						
PROPELLER/ROTOR FAILURE						
PROPELLER						
TAIL ROTOR						
MAIN ROTOR						
PROPELLER/ROTOR ACCIDENT TO P						
JET INTAKE/EXHAUST ACCIDENT T						
PROPELLER/JET/ROTOR BLAST						
TURBULENCE						
HAIL DAMAGE TO AIRCRAFT						
LIGHTNING STRIKE						
EVASIVE MANEUVER						
UNCONTROLLED ALTITUDE DEVIATI						
DITCHING	4	3	7	18	32	32
MISSING AIRCRAFT NOT RECOVERE						
MISCELLANEOUS, OTHER				1	1	1
UNDETERMINED						
RECORDS	104	68	68	215	455	
ACCIDENTS	104	68	68	215		455

TABLE C-6

CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 455 TOTAL ACCIDENTS
INVOLVES 104 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	51 49.51	3 2.91	52 50.49	164 46.59	15 4.26	167 47.44	215 47.25	18 3.96	219 48.13
PERSONNEL	9 8.74	3 2.91	12 11.65	24 6.82	3 .85	26 7.39	33 7.25	6 1.32	38 8.35
AIRFRAME	.00	.00	.00	1 .28	.00	1 .28	1 .22	.00	1 .22
LANDING GEAR	.00	.00	.00	.00	1 .28	1 .28	.00	1 .22	1 .22
POWERPLANT	48 46.60	1 .97	48 46.60	163 46.31	10 2.84	172 48.86	211 46.37	11 2.42	220 48.35
SYSTEMS	.00	1 .97	1 .97	3 .85	.00	3 .85	3 .66	1 .22	4 .88
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .97	.00	1 .97	2 .57	.00	2 .57	3 .66	.00	3 .66
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	.00	.00	.00	.00	.00	.00
WEATHER	6 5.83	11 10.68	16 15.53	11 3.13	19 5.40	30 8.52	17 3.74	30 6.59	46 10.11
TERRAIN	.00	.00	.00	.00	1 .28	1 .28	.00	1 .22	1 .22
MISCELLANEOUS	.00	.00	.00	2 .57	2 .57	4 1.14	2 .44	2 .44	4 .88
UNDETERMINED	1 .97	.00	1 .97	3 .85	.00	3 .85	4 .88	.00	4 .88

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE C-7 CAUSE/FACTOR TABLE

ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE

MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST ACCIDENT TYPE ONLY

INVOLVES 455 TOTAL ACCIDENTS
INVOLVES 104 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	4		4	5	1	6	9	1	10
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1		1				1		1
BECAME LOST/DISORIENTED	2		2	2	2	4	4	2	6
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	2		2	1		1	3		3
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				2	1	3	2	1	3
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	1		1	3		3	4		4
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT				1		1	1		1
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	12	3	15	13	3	16
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	12		12	23		23	35		35
IMPROPER OPERATION OF FLIGHT CONTROLS				1		1	1		1
IMPROPER IFR OPERATION	1		1	2		2	3		3
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	5		5	13	2	15	18	2	20
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	16	1	17	62	1	63	78	2	80
INADEQUATE SUPERVISION OF FLIGHT	2		2	11		11	13		13
LACK OF FAMILIARITY WITH AIRCRAFT		2	2	2	6	8	2	8	10
MISMANAGEMENT OF FUEL	18		18	55		55	73		73
EXERCISED POOR JUDGMENT				4		4	4		4
IMPROPER STARTING PROCEDURES	1		1	1		1	2		2
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				1		1	1		1
MISJUDGED ALTITUDE	1		1				1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
PHYSICAL IMPAIRMENT	1		1				1		1
SPATIAL DISORIENTATION				1		1	1		1
MISUSED OR FAILED TO USE FLAPS					1	1		1	1
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND					1	1		1	1
FAILED TO ABORT TAKEOFF	1		1				1		1
DIRECT ENTRIES				3		3	3		3
SUBTOTAL	69	3	72	207	18	225	276	21	297
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
DIRECT ENTRIES				1		1	1		1
SUBTOTAL				2		2	2		2
DUAL STUDENT									
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
FAILED TO EXTEND LANDING GEAR				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
FAILED TO MAINTAIN DIRECTIONAL CONTROL				2		2	2		2
SUBTOTAL				7		7	7		7
CHECK PILOT									
INADEQUATE SUPERVISION OF FLIGHT				1		1	1		1
SUBTOTAL				1		1	1		1
** PERSONNEL **									
FLIGHT INSTRUCTOR									
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)				2		2	2		2

PERSONNEL (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
IMPROPER MAINTENANCE(OWNER PERSONNEL)				1		1	1		1
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				3		3	3		3
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)				2		2	2		2
INADEQUATE MAINTENANCE AND INSPECTION	8	2	10	14	1	15	22	3	25
OPERATIONAL SUPERVISORY PERSONNEL									
INADEQUATE FLIGHT TRAINING-PROCEDURES					1	1		1	1
INADEQUATE SUPERVISION OF FLIGHT CREW		1	1					1	1
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT					1	1		1	1
WEATHER PERSONNEL									
INCOMPLETE WEATHER REPORT	1		1				1		1
TRAFFIC CONTROL PERSONNEL									
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				1		1	1		1
AIRPORT SUPERVISORY PERSONNEL									
FAILURE TO NOTIFY OF UNSAFE CONDITION					1	1		1	1
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN									
POOR/INADEQUATE DESIGN	1		1	1		1	2		2
MISCELLANEOUS-PERSONNEL									
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	10	3	13	24	4	28	34	7	41
** AIRFRAME **									
WINGS									
FUSELAGE									
DOORS, DOOR FRAMES				1		1	1		1
LANDING GEAR									
LANDING GEAR WARNING AND INDICATING COMPONENTS					1	1		1	1
FLIGHT CONTROL SURFACES									
SUBTOTAL				1	1	2	1	1	2
** POWERPLANT **									
ENGINE STRUCTURE									
CRANKCASE				2		2	2		2
CRANKSHAFT				1		1	1		1
MASTER AND CONNECTING RODS	3		3	8		8	11		11
CYLINDER ASSEMBLY				10		10	10		10
PISTON, PISTON RINGS	3		3	3		3	6		6
VALVE ASSEMBLIES	3		3	1		1	4		4
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
OTHER				5		5	5		5
IGNITION SYSTEM									
MAGNETOES	1	1	2	3		3	4	1	5
SPARK PLUG	3		3	4		4	7		7
IGNITION HARNESS, SHIELDING				1		1	1		1
LEADS	1		1				1		1
FUEL SYSTEM									
TANKS				2		2	2		2
LINES AND FITTINGS	1		1	4		4	5		5
SELECTOR VALVES	3		3	1		1	4		4
FILTERS, STRAINERS, SCREENS				1		1	1		1
CARBURETOR	1		1	2		2	3		3
PUMPS	1		1	2	1	3	3	1	4
FUEL INJECTION SYSTEM	4		4	1	1	2	5	1	6
VENTS, DRAINS, TANK CAPS	1		1	5		5	6		6
RAM AIR ASSEMBLY				1		1	1		1
LUBRICATING SYSTEM									
LINES, HOSES, FITTINGS				7	1	8	7	1	8
SEALS AND GASKETS				1		1	1		1
OTHER				3		3	3		3
COOLING SYSTEM									
BAFFLES				1		1	1		1
PROPELLER AND ACCESSORIES									
OTHER				1		1	1		1
EXHAUST SYSTEM									
MANIFOLDS				1		1	1		1
STACKS				1		1	1		1

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
ENGINE ACCESSORIES									
ENGINE CONTROLS-COCKPIT				1		1	1		1
THROTTLE-POWER LEVER ASSEMBLIES				1		1	1		1
MIXTURE CONTROL ASSEMBLIES									
POWERPLANT-INSTRUMENTS					7	7		7	7
FUEL QUANTITY GAUGE									
MISCELLANEOUS				85		85	110		110
POWERPLANT FAILURE FOR UNDETERMINED REASONS	25		25	1		1	1		1
BIRD INGESTION				1		1	1		1
DETONATION				1		1	1		1
OTHER									
DIRECT ENTRIES	2		2	4		4	6		6
REDUCTION GEAR ASSEMBLY				1		1	1		1
GEARS, ACCESSORY DRIVE									
COMPRESSOR ASSEMBLY									
OTHER	1		1				1		1
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
OTHER				1		1	1		1
PROPELLER SYSTEM				1		1	1		1
GOVERNOR									
CONSTANT SPEED DRIVE				1		1	1		1
GOVERNOR VALVE									
POWER LEVER									
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
ENGINE INSTALLATION									
SUBTOTAL	53	1	54	171	10	181	224	11	235
** SYSTEMS **									
ELECTRICAL SYSTEM				1		1	1		1
BATTERIES				1		1	1		1
GENERATORS/ALTERNATORS									
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS				1		1	1		
CARBURETOR DE-ICING SYSTEM				1		1	1		
OTHER									
AIR CONDITION, HEATING AND PRESSURIZATION		1	1					1	
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM									
AUTO PILOT									
FIRE WARNING SYSTEM									
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	4		4	4	1	
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS									
COMMUNICATIONS AND NAVIGATION EQUIPMENT				1		1	1		
TRANSMITTERS AND/OR RECEIVERS				1		1	2		
COMPASS RECEIVERS	1		1	1		1	1		
OTHER									
MISCELLANEOUS EQUIPMENT									
SUBTOTAL	1		1	3		3	4		

TABLE C-7 CONTINUED

WEATHER (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** WEATHER **									
LOW CEILING									
RAIN									
FOG	1	8	9	1	3	4	2	11	13
SNOW		1	1	1	1	2	1	2	3
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	3	4	1	2	3	2	5	7
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	1	4	5		1	1	1	5	6
UNFAVORABLE WIND CONDITIONS	3	1	4	4	5	9	7	6	13
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS	2	4	6	7	8	15	9	12	21
DOWNDRAFTS, UPDRAFTS					1	1		1	1
HIGH TEMPERATURE	1		1				1		1
OBSTRUCTIONS TO VISION	1		1				1		1
HIGH DENSITY ALTITUDE		1	1					1	1
THUNDERSTORM ACTIVITY		1	1					1	1
SUBTOTAL		2	2		2	2		2	2
** TERRAIN **	10	25	35	14	23	37	24	48	72
WET, SOFT GROUND									
SNOW-COVERED									
SUBTOTAL					1	1		1	1
** MISCELLANEOUS **					1	1		1	1
UNQUALIFIED PERSON OPERATED AIRCRAFT					2	2		2	2
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS									
UNDETERMINED					1	1		1	1
SUBTOTAL	1		1	2	1	3	2	1	3
	1		1	3		3	4		4
GRAND TOTAL	144	33	177	439	60	499	583	93	676
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	4		4	18		18	22		22
CHECKLIST-FAILED TO USE	1	1	2	2	6	8	3	7	10
CREW COORDINATION-POOR	1		1				1		1
DISREGARD OF GOOD OPERATING PRACTICE					2	2		2	2
IMPROPER EMERGENCY PROCEDURES	6	2	8	7	7	14	13	9	22
FEATHERED WRONG ENGINE	1		1				1		1
INSTRUMENTS-MISREAD OR FAILED TO READ				1	1	2	1	1	2
INATTENTIVE TO FUEL SUPPLY	4		4	8	4	12	12	4	16
PREMATURE FLAP RETRACTION				1		1	1		1
POORLY PLANNED APPROACH	1		1	4	2	6	5	2	7
MISCALCULATED FUEL CONSUMPTION					2	2		2	2
JETTISONED LOAD					1	1		1	1
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	1		1	6		6	8		8
IMPROPERLY SECURED	2		2	1		1	1		1
ELECTRICAL FAILURE				4		4	5		5
ENGINE LOADED UP	1		1	1		1	4		4
FATIGUE FRACTURE	3		3	1		1	1		1
FUEL GRADE-IMPROPER		1	1	2	61	63	3	1	4
WRONG PART	1	9	10	27	2	29	35	70	105
IMPROPER ALIGNMENT/ADJUSTMENT	1		1		1	1	1	2	3
FAILURE OF TWO OR MORE ENGINES	10		10	42		42	52		52
FIRE IN ENGINE		1	1	5		5	5		5
PILOT FATIGUE	1		1	1		1	2	1	3
FUEL EXHAUSTION	1		1	4		4	5		5
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL	4		4	17		17	21		21
CARBON MONOXIDE POISONING		2	2	3	1	4	3	1	4
ICE-IN FUEL	1		1		2	2		4	4
ICE-ENGINE	1		1	1		1	2		2
ICE-CARBURETOR				1		1	2		2
AIRFRAME ICE				1		1	2		2
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG							1		1
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM									
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM									
OIL CONTAMINATION									

TABLE C-7 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
SIMULATED CONDITIONS	9	1	10	32	6	38	41	7	48
WATER IN FUEL	2		2	13		13	15		15
AIRCRAFT CAME TO REST IN WATER		2	2		6	6		8	8
MISSING				1		1	1		1
TOUCH AND GO LANDING		1	1					1	1
MATERIAL FAILURE	8	1	9	43		43	51	1	52
FUEL STARVATION	22		22	57		57	79		79
OIL STARVATION	3		3	2		2	5		5
IMPROPER CLEARANCE-TOLERANCE				1	1	2	1	1	2
FUEL SELECTOR POSITIONED BETWEEN TANKS		1	1	2	1	3	2	2	4
IMPROPER/INADEQUATE VENTING				1		1	1		1
LEAK/LEAKAGE	1		1	2	1	3	3	1	4
LOW COMPRESSION				1		1	1		1
CARBON DEPOSITS	2		2	2		2	4		4
LOOSE, PART/FITTING	2		2	1		1	3		3
BINDING	1		1				1		1
BURNED		1	1					1	1
CHAFFED	1		1				1		1
COLLAPSED				1		1	1		1
DETERIORATED				2	1	3	2	1	3
DISCONNECTED					1	1		1	1
ERRATIC					3	3		3	3
HIGH VOLTAGE BREAKDOWN				1		1	1		1
IMPROPERLY INSTALLED	1		1	2		2	3		3
JAMMED				1		1	1		1
OBSTRUCTED				2		2	2		2
OVERHEATED				1		1	1		1
PINCHED				1		1	1		1
EXCESSIVE PRESSURE				1		1	1		1
PRESSURE TOO LOW				1		1	1		1
PRESSURE, NONE				4		4	4		4
SCORED	1		1				1		1
SHEARED				1		1	1		1
STUCK	1		1				1		1
EXCESSIVE TEMPERATURE	1		1	1		1	2		2
VIBRATION, EXCESSIVE				2	1	3	2	1	3
ICE-INDUCTION	1		1	1		1	2		2

DIRECT ENTRY CAUSES

PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-ENGINES WOULDNT AIRSTART.REASON IS UNKNOWN
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PILOT-MISCALCULATED FUEL CONSUMPTION.
PILOT-DID NOT MONITOR REAR ENG INSTRUMENTS.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES
ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 455 TOTAL ACCIDENTS
INVOLVES 104 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	89 86.41	6 5.83	92 89.32	240 68.18	18 5.11	241 68.47	329 72.31	24 5.27	333 73.19
PERSONNEL	9 8.74	4 3.88	13 12.62	27 7.67	6 1.70	32 9.09	36 7.91	10 2.20	45 9.89
AIRFRAME	.00	.00	.00	2 .57	.00	2 .57	2 .44	.00	2 .44
LANDING GEAR	.00	.00	.00	5 1.42	4 1.14	9 2.56	5 1.10	4 .88	9 1.98
POWERPLANT	49 47.57	1 .97	49 47.57	164 46.59	10 2.84	173 49.15	213 46.81	11 2.42	222 48.79
SYSTEMS	.00	1 .97	1 .97	3 .85	.00	3 .85	3 .66	1 .22	4 .88
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 .97	.00	1 .97	2 .57	.00	2 .57	3 .66	.00	3 .66
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	1 .97	1 .97	1 .28	4 1.14	5 1.42	1 .22	5 1.10	6 1.32
WEATHER	9 8.74	19 18.45	27 26.21	17 4.83	28 7.95	45 12.78	26 5.71	47 10.33	72 15.82
TERRAIN	2 1.94	7 6.80	9 8.74	8 2.27	15 4.26	23 6.53	10 2.20	22 4.84	32 7.03
MISCELLANEOUS	.00	1 .97	1 .97	3 .85	3 .85	6 1.70	3 .66	4 .88	7 1.54
UNDETERMINED	1 .97	.00	1 .97	3 .85	.00	3 .85	4 .88	.00	4 .88

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* IF AN ACCIDENT INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CATEGORY, THE ACCIDENT IS REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES
ACCIDENTS INVOLVING ENGINE FAILURE OR MALFUNCTION AS A FIRST ACCIDENT TYPE
MULTIENGINE, FIXED-WING AIRCRAFT
U.S. GENERAL AVIATION
1965 - 1969
CAUSES DISPLAYED RELATE TO FIRST AND SECOND ACCIDENT TYPES

INVOLVES 455 TOTAL ACCIDENTS
INVOLVES 104 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	5		5	7	1	8	12	1	13
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	3		3				3		3
BECAME LOST/DISORIENTED	2	1	3	2	2	4	4	3	7
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	3		3	1		1	4		4
DELAYED ACTION IN ABORTING TAKEOFF				3		3	3		3
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT	1		1	3	1	4	4	1	5
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT	1		1	1		1	2		2
FAILED TO EXTEND LANDING GEAR				9		9	9		9
RETRACTED GEAR PREMATURELY				1		1	1		1
FAILED TO SEE AND AVOID OBJECTS OR OBSTRUCTIONS				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	44		44	40		40	84		84
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT				4		4	4		4
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	16	4	20	17	4	21
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	14		14	24		24	38		38
IMPROPER OPERATION OF BRAKES AND/OR FLIGHT CONTROLS				2		2	2		2
IMPROPER OPERATION OF FLIGHT CONTROLS	3		3	1		1	4		4
PREMATURE LIFT OFF				5		5	5		5
IMPROPER LEVEL OFF				2		2	2		2
IMPROPER IFR OPERATION	2		2	3		3	5		5
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	13		13	19	2	21	32	2	34
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	18	2	20	63	2	65	81	4	85
INADEQUATE SUPERVISION OF FLIGHT	8		8	16		16	24		24
LACK OF FAMILIARITY WITH AIRCRAFT	1	3	4	4	7	11	5	10	15
MISMANAGEMENT OF FUEL	18		18	55		55	73		73
EXERCISED POOR JUDGMENT	2		2	7		7	9		9
SELECTED UNSUITABLE TERRAIN				1		1	1		1
IMPROPER STARTING PROCEDURES	1		1	1		1	2		2
FAILED TO ASSURE THE GEAR WAS DOWN AND LOCKED				11		11	11		11
SPONTANEOUS-IMPROPER ACTION				2		2	2		2
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				2		2	2		2
MISJUDGED DISTANCE AND SPEED				3		3	3		3
MISJUDGED DISTANCE AND ALTITUDE	1		1	3		3	4		4
MISJUDGED SPEED AND ALTITUDE				1		1	1		1
MISJUDGED ALTITUDE AND CLEARANCE	1		1				1		1
MISJUDGED ALTITUDE	1		1				1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
PHYSICAL IMPAIRMENT	1		1				1		1
SPATIAL DISORIENTATION	1		1	1		1	2		2
MISUSED OR FAILED TO USE FLAPS	1		1		1	1	1	1	2
FAILED TO MAINTAIN DIRECTIONAL CONTROL	1		1	6		6	7		7
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND		1	1		1	1		2	2
FAILED TO ABORT TAKEOFF	2		2	6		6	8		8
DIRECT ENTRIES				3		3	3		3
SUBTOTAL	149	7	156	330	21	351	479	28	507
COPILOT									
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				2		2	2		2
LACK OF FAMILIARITY WITH AIRCRAFT				1		1	1		1
CONTROL INTERFERENCE				1		1	1		1
DIRECT ENTRIES				1		1	1		1
SUBTOTAL				5		5	5		5
DUAL STUDENT									
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
FAILED TO EXTEND LANDING GEAR				4		4	4		4

TABLE C-9 CONTINUED

DUAL STUDENT (CONTINUED)

CAUSE/FACTOR TABLE

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
INADVERTENTLY RETRACTED GEAR				2		2	2		2
FAILED TO OBTAIN/MAINTAIN FLYING SPEED	8		8	1		1	9		9
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
IMPROPER IN-FLIGHT DECISIONS OR PLANNING				1		1	1		1
INADEQUATE SUPERVISION OF FLIGHT				1		1	1		1
MISUNDERSTANDING OF ORDERS OR INSTRUCTIONS				1		1	1		1
FAILED TO MAINTAIN DIRECTIONAL CONTROL				5		5	5		5
FAILED TO ABORT TAKEOFF				1		1	1		1
SUBTOTAL	8		8	18		18	26		26
CHECK PILOT				3		3	3		3
INADEQUATE SUPERVISION OF FLIGHT				3		3	3		3
SUBTOTAL									
** PERSONNEL **									
FLIGHT INSTRUCTOR									
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)				2		2	2		2
IMPROPER MAINTENANCE(OWNER PERSONNEL)				1		1	1		1
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				3		3	3		3
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)				2		2	2		2
INADEQUATE MAINTENANCE AND INSPECTION	8	2	10	17	2	19	25	4	29
OPERATIONAL SUPERVISORY PERSONNEL					1	1		1	1
INADEQUATE FLIGHT TRAINING-PROCEDURES		1	1					1	1
INADEQUATE SUPERVISION OF FLIGHT CREW					1	1		1	1
FAILURE TO PROVIDE ADEQ DIRECTIVES, MANUALS, EQUIPMENT									
WEATHER PERSONNEL									
INCOMPLETE WEATHER REPORT									
TRAFFIC CONTROL PERSONNEL	1		1				1		1
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION									
ISSUED IMPROPER OR CONFLICTING INSTRUCTIONS				1		1	1		1
AIRPORT SUPERVISORY PERSONNEL									
FAILURE TO NOTIFY OF UNSAFE CONDITION		1	1					1	1
AIRWAYS FACILITIES PERSONNEL					1	1		1	1
PRODUCTION-DESIGN									
POOR/INADEQUATE DESIGN									
MISCELLANEOUS-PERSONNEL	1		1	1		1	2		2
PILOT OF OTHER AIRCRAFT									
OTHER					1	1		1	1
THIRD PILOT					1	1		1	1
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL									
** AIRFRAME **	10	4	14	27	7	34	37	11	48
WINGS									
FUSELAGE									
DOORS, DOOR FRAMES									
LANDING GEAR				1		1	1		1
NORMAL RETRACTION/EXTENSION ASSEMBLY									
EMERGENCY/EXTENSION ASSEMBLY				3	1	4	3	1	4
NOSEWHEEL ASSEMBLIES				2	1	3	2	1	3
LANDING GEAR WARNING AND INDICATING COMPONENTS					1	1		1	1
GEAR LOCKING MECHANISM					2	2		2	2
FLIGHT CONTROL SURFACES				1		1	1		1
FLAP ASSEMBLIES									
SUBTOTAL				1		1	1		1
** POWERPLANT **				8	5	13	8	5	13
ENGINE STRUCTURE									
CRANKCASE									
CRANKSHAFT									
MASTER AND CONNECTING RODS				2		2	2		2
CYLINDER ASSEMBLY	3		3	1		1	1		1
				8		8	11		11
				10		10	10		10

POWERPLANT (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
PISTON, PISTON RINGS	3		3	3		3	6		6
VALVE ASSEMBLIES	3		3	1		1	4		4
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
OTHER				5		5	5		5
IGNITION SYSTEM									
MAGNETOES	1	1	2	3		3	4	1	5
SPARK PLUG	3		3	4		4	7		7
IGNITION HARNESS, SHIELDING				1		1	1		1
LEADS	1		1				1		1
FUEL SYSTEM									
TANKS				2		2	2		2
LINES AND FITTINGS	1		1	5		5	6		6
SELECTOR VALVES	3		3	1		1	4		4
FILTERS, STRAINERS, SCREENS				1		1	1		1
CARBURETOR	1		1	2		2	3		3
PUMPS	1		1	2	1	3	3	1	4
FUEL INJECTION SYSTEM	4		4	1	1	2	5	1	6
VENTS, DRAINS, TANK CAPS	1		1	5		5	6		6
RAM AIR ASSEMBLY				1		1	1		1
LUBRICATING SYSTEM									
LINES, HOSES, FITTINGS				7	1	8	7	1	8
SEALS AND GASKETS				1		1	1		1
OTHER				3		3	3		3
COOLING SYSTEM									
BAFFLES				1		1	1		1
PROPELLER AND ACCESSORIES									
OTHER				2		2	2		2
EXHAUST SYSTEM									
MANIFOLDS				1		1	1		1
STACKS				1		1	1		1
ENGINE ACCESSORIES									
VACUUM PUMPS	1		1				1		1
ENGINE CONTROLS-COCKPIT									
THROTTLE-POWER LEVER ASSEMBLIES				1		1	1		1
MIXTURE CONTROL ASSEMBLIES				1		1	1		1
POWERPLANT-INSTRUMENTS									
FUEL QUANTITY GAUGE					7	7		7	7
MISCELLANEOUS									
POWERPLANT FAILURE FOR UNDETERMINED REASONS	25		25	85		85	110		110
BIRD INGESTION				1		1	1		1
DETONATION				1		1	1		1
OTHER				1		1	1		1
DIRECT ENTRIES	2		2	4		4	6		6
REDUCTION GEAR ASSEMBLY									
GEARS, ACCESSORY DRIVE				1		1	1		1
COMPRESSOR ASSEMBLY									
OTHER	1		1				1		1
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
OTHER				1		1	1		1
PROPELLER SYSTEM									
GOVERNOR				1		1	1		1
CONSTANT SPEED DRIVE									
GOVERNOR VALVE				1		1	1		1
POWER LEVER									
PROPELLER LEVER									
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
ENGINE INSTALLATION									
SUBTOTAL	54	1	55	173	10	183	227	11	

TABLE C-9 CONTINUED

CAUSE/FACTOR TABLE

SYSTEMS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** SYSTEMS **									
ELECTRICAL SYSTEM									
BATTERIES									
GENERATORS/ALTERNATORS									
HYDRAULIC SYSTEM				1		1	1		1
FLIGHT CONTROL SYSTEMS				1		1	1		1
ANTI-ICING, DE-ICING SYSTEMS									
CARBURETOR DE-ICING SYSTEM									
OTHER									
AIR CONDITION, HEATING AND PRESSURIZATION				1		1	1		1
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM				1		1	1		1
AUTO PILOT									
FIRE WARNING SYSTEM		1	1					1	1
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL		1	1	4		4	4	1	5
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **									
FLIGHT AND NAVIGATION INSTRUMENTS				1		1	1		1
COMMUNICATIONS AND NAVIGATION EQUIPMENT				1		1	2		2
TRANSMITTERS AND/OR RECEIVERS				1		1	1		1
COMPASS RECEIVERS									
OTHER									
MISCELLANEOUS EQUIPMENT	1		1						
SUBTOTAL	1		1	3		3	4		4
** AIRPORTS/AIRWAYS/FACILITIES **									
AIRPORT FACILITIES									
AIRPORT CONDITIONS									
SNOW ON RUNWAY									
OTHER									
AIRWAYS FACILITIES		1	1						
SUBTOTAL		1	1	1	3	4	1	3	4
** WEATHER **									
LOW CEILING		1	1	1	4	5	1	5	6
RAIN									
FOG	2	13	15	3	4	7	5	17	22
SNOW		2	2	2	1	3	2	3	5
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	6	7	3	2	5	4	8	12
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	1	4	5		2	2	1	6	7
UNFAVORABLE WIND CONDITIONS	3	2	5	7	6	13	10	8	18
TURBULENCE, ASSOCIATED W/CLOUDS, THUNDERSTORMS	2	4	6	7	8	15	9	12	21
DOWNDRAFTS, UPDRAFTS	1		1		3	3	1	3	4
HIGH TEMPERATURE	1		1				1		1
OBSTRUCTIONS TO VISION		1	1		1	1	1	1	2
HIGH DENSITY ALTITUDE		1	1					2	2
THUNDERSTORM ACTIVITY	1	1	2	1	6	7	2	1	3
OTHER		2	2					7	9
SUBTOTAL	13	38	51	23	33	56	36	71	107
** TERRAIN **									
WET, SOFT GROUND				4	4	8	4	4	8
SNOW-COVERED		1	1	1	1	2	1	1	2
HIGH VEGETATION	2	4	6	2	8	10	4	1	5
ROUGH/UNEVEN		3	3	1	3	4	1	12	16
HIGH OBSTRUCTIONS								6	7
SUBTOTAL	2	8	10	8	16	24	10	24	34
** MISCELLANEOUS **									
EVASIVE MANEUVER TO AVOID COLLISION		1	1					1	1

MISCELLANEOUS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
UNQUALIFIED PERSON OPERATED AIRCRAFT					1	1		1	1
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS				3	2	5	3	2	5
UNDETERMINED	1		1	3		3	4		4
SUBTOTAL	1	1	2	6	3	9	7	4	11
GRAND TOTAL	238	61	299	609	99	708	847	160	1007
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	4	1	5	18		18	22	1	23
CHECKLIST-FAILED TO USE	1	1	2	3	9	12	4	10	14
CREW COORDINATION-POOR	1		1		2	2	1	2	3
DISREGARD OF GOOD OPERATING PRACTICE		1	1		2	2		3	3
IMPROPER EMERGENCY PROCEDURES	25	3	28	35	14	49	60	17	77
FEATHERED WRONG ENGINE	1		1	1		1	2		2
INSTRUMENTS-MISREAD OR FAILED TO READ				2	1	3	2	1	3
NOT ALLIGNED WITH RUNWAY/INTENDED LANDING AREA					1	1		1	1
UNWARRANTED LOW FLYING	1		1				1		1
FAILED TO USE ALL AVAILABLE RUNWAY					2	2		2	2
INATTENTIVE TO FUEL SUPPLY	4		4	8	4	12	12	4	16
PREMATURE FLAP RETRACTION				1		1	1		1
POORLY PLANNED APPROACH		1	1	4	2	6	4	3	7
MISCALCULATED FUEL CONSUMPTION	1		1	4	2	6	5	2	7
JETTISONED LOAD		1	1		2	2		3	3
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	1		1				1		1
IMPROPERLY SECURED	2		2	6		6	8		8
ELECTRICAL FAILURE				1	1	2	1	1	2
ENGINE LOADED UP	1		1	4		4	5		5
FATIGUE FRACTURE	3		3	1		1	4		4
FUEL GRADE-IMPROPER				1		1	1		1
HYDRAULIC FAILURE				1	1	2	1	1	2
WRONG PART		1	1					1	1
IMPROPER ALIGNMENT/ADJUSTMENT	1		1	2		2	3		3
FAILURE OF TWO OR MORE ENGINES	8	11	19	28	68	96	36	79	115
FIRE IN ENGINE	1		1	1	6	7	2	6	8
ASYMETRICAL FLAPS				1		1	1		1
CONGESTED TRAFFIC-PATTERN					1	1		1	1
PILOT FATIGUE	1		1		1	1	1	1	2
FUEL EXHAUSTION	10		10	42		42	52		52
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL				5		5	5		5
CARBON MONOXIDE POISONING		1	1					1	1
ICE-IN FUEL	1		1	1		1	2		2
ICE-ENGINE	1		1	4		4	5		5
ICE-CARBURETOR	4	1	5	17		17	21	1	22
ICE-PROPELLER				1		1	1		1
AIRFRAME ICE	2	1	3	7	2	9	9	3	12
ICE-WINDSHIELD				1	1	2	1	1	2
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG	2	6	8		4	4	2	10	12
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1		1	1		1	2		2
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	1		1	1		1	2		2
OIL CONTAMINATION				2		2	2		2
SIMULATED CONDITIONS	9	1	10	32	6	38	41	7	48
WATER IN FUEL	2		2	13		13	15		15
AIRCRAFT CAME TO REST IN WATER		6	6		26	26		32	32
MISSING				1		1	1		
TOUCH AND GO LANDING		1	1		1	1		2	
OVERLOAD FAILURE				1	35	36	1	35	36
MATERIAL FAILURE	8	1	9	43		43	51	1	52
FUEL STARVATION	22		22	57		57	79		79
OIL STARVATION	3		3	2		2	5		
IMPROPER CLEARANCE-TOLERANCE				1	1	2	1	1	
FUEL SELECTOR POSITIONED BETWEEN TANKS		1	1	2	1	3	2	2	
IMPROPER/INADEQUATE VENTING				1		1	1		
LEAK/LEAKAGE	1		1	2	1	3	3	1	
CIRCUIT BREAKER POPPED				1		1	1		
LOW COMPRESSION				1		1	1		
DOWNWIND					2	2		2	
CARBON DEPOSITS	2		2	2		2	4		
LOOSE, PART/FITTING	2		2	1		1	3		

TABLE C-9 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
BINDING							1		1
BURNED	1		1					1	1
CHAFFED		1	1				1		1
COLLAPSED	1		1	1		1	1		1
DETERIORATED				2	1	3	2	1	3
DISCONNECTED					1	1		1	1
ERRATIC					3	3		3	3
HIGH VOLTAGE BREAKDOWN				1		1	1		1
IMPROPERLY INSTALLED	1		1	2		2	3		3
JAMMED				1		1	1		1
OBSTRUCTED				2		2	2		2
OVERHEATED				1		1	1		1
PINCHED				1		1	1		1
EXCESSIVE PRESSURE				1		1	1		1
PRESSURE TOO LOW				1		1	1		1
PRESSURE, NONE				2	1	3	2	1	3
SCORED				4		4	4		4
SHEARED	1		1				1		1
STUCK	1		1	1		1	1		1
EXCESSIVE TEMPERATURE	1		1	2		2	3		3
VIBRATION, EXCESSIVE				1		1	2		2
ICE-INDUCTION	1		1	2	1	3	2	1	3
INTENTIONAL WHEELS UP	1		1	1		1	2		2
				11	6	17	12	6	18

DIRECT ENTRY CAUSES

PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.
PWR PLT-ENGINES WOULDNT AIRSTART.REASON IS UNKNOWN
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PILOT-MISCALCULATED FUEL CONSUMPTION.
PILOT-DID NOT MONITOR REAR ENG INSTRUMENTS.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

MULTIENGINE FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 297 TOTAL ACCIDENTS
INVOLVES 67 FATAL ACCIDENTS

BROAD CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*	CAUSE	FACTOR	TOTAL*
PILOT	46 68.66	2 2.99	46 68.66	141 61.30	12 5.22	142 61.74	187 62.96	14 4.71	188 63.30
PERSONNEL	9 13.43	3 4.48	12 17.91	24 10.43	2 .87	25 10.87	33 11.11	5 1.68	37 12.46
AIRFRAME	.00	.00	.00	.00	.00	.00	.00	.00	.00
LANDING GEAR	.00	.00	.00	.00	.00	.00	.00	.00	.00
POWERPLANT	23 34.33	1 1.49	23 34.33	78 33.91	9 3.91	87 37.83	101 34.01	10 3.37	110 37.04
SYSTEMS	.00	1 1.49	1 1.49	2 .87	.00	2 .87	2 .67	1 .34	3 1.01
INSTRUMENTS/EQUIPMENT AND ACCESSORIES	1 1.49	.00	1 1.49	2 .87	.00	2 .87	3 1.01	.00	3 1.01
ROTORCRAFT	.00	.00	.00	.00	.00	.00	.00	.00	.00
AIRPORTS/AIRWAYS/FACILITIES	.00	.00	.00	.00	.00	.00	.00	.00	.00
WEATHER	5 7.46	7 10.45	12 17.91	11 4.78	19 8.26	30 13.04	16 5.39	26 8.75	42 14.14
TERRAIN	.00	.00	.00	.00	.00	.00	.00	.00	.00
MISCELLANEOUS	.00	.00	.00	2 .87	2 .87	4 1.74	2 .67	2 .67	4 1.35
UNDETERMINED	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE FIGURES OPPOSITE EACH CAUSAL CATEGORY REPRESENT THE NUMBER AND PERCENT OF ACCIDENTS IN WHICH THAT PARTICULAR CAUSAL CATEGORY WAS ASSIGNED

* INCLUDES BOTH A CAUSE AND RELATED FACTOR IN THE SAME CAUSAL CATEGORY REPRESENTED ONCE UNDER THE TOTAL FOR THAT CATEGORY

TABLE C-11

CAUSE/FACTOR TABLE

APPENDIX C

MULTIENGINE FIXED-WING AIRCRAFT
ENGINE FAILURE AS FIRST ACCIDENT TYPE ONLY
U. S. GENERAL AVIATION
1965 - 1969

EXCLUDES ACCIDENTS WITH CAUSE UNDETERMINED,
HOMEBUILT AND EXPERIMENTAL AIRCRAFT,
AND ACCIDENTS INVOLVING SIMULATED ENGINE FAILURES

INVOLVES 297 TOTAL ACCIDENTS
INVOLVES 67 FATAL ACCIDENTS

DETAILED CAUSE/FACTOR	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** PILOT **									
PILOT IN COMMAND									
ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT	4		4	4	1	5	8	1	9
ATTEMPTED OPERATION BEYOND EXPERIENCE/ABILITY LEVEL	1		1				1		1
BECAME LOST/DISORIENTED	2		2	2	2	4	4	2	6
CONTINUED VFR FLIGHT INTO ADVERSE WEATHER CONDITIONS	1		1	1		1	2		2
DIVERTED ATTENTION FROM OPERATION OF AIRCRAFT				1	1	2	1	1	2
EXCEEDED DESIGN STRESS LIMITS OF AIRCRAFT				1		1	1		1
FAILED TO OBTAIN/MAINTAIN FLYING SPEED				1		1	1		1
FAILED TO USE OR INCORRECTLY USED MISC EQUIPMENT				1		1	1		1
FAILED TO FOLLOW APPROVED PROCEDURES, DIRECTIVES ETC	1		1	8	2	10	9	2	11
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS	11		11	20		20	31		31
IMPROPER OPERATION OF FLIGHT CONTROLS				1		1	1		1
IMPROPER IFR OPERATION	1		1	2		2	3		3
IMPROPER IN-FLIGHT DECISIONS OR PLANNING	4		4	11	2	13	15	2	17
INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING	16		16	61	1	62	77	1	78
INADEQUATE SUPERVISION OF FLIGHT				3		3	3		3
LACK OF FAMILIARITY WITH AIRCRAFT		2	2	1	4	5	1	6	7
MISMANAGEMENT OF FUEL	18		18	54		54	72		72
IMPROPER STARTING PROCEDURES	1		1				1		1
MISJUDGED DISTANCE, SPEED, AND ALTITUDE				1		1	1		1
INADEQUATE TRAINING OF STUDENT				1		1	1		1
PHYSICAL IMPAIRMENT	1		1				1		1
SPATIAL DISORIENTATION				1		1	1		1
MISUSED OR FAILED TO USE FLAPS					1	1	1	1	1
SELECTED WRONG RUNWAY RELATIVE TO EXISTING WIND					1	1		1	1
FAILED TO ABORT TAKEOFF	1		1				1		1
DIRECT ENTRIES				2		2	2		2
SUBTOTAL	62	2	64	177	15	192	239	17	256
COPILOT									
DIRECT ENTRIES				1		1	1		1
SUBTOTAL				1		1	1		1
DUAL STUDENT									
DELAYED ACTION IN ABORTING TAKEOFF				1		1	1		1
IMPROPER OPERATION OF POWERPLANT + POWERPLANT CONTROLS				1		1	1		1
SUBTOTAL				1		1	1		1
** PERSONNEL **				2		2	2		2
FLIGHT INSTRUCTOR									
MAINTENANCE, SERVICING, INSPECTION									
IMPROPER MAINTENANCE(MAINTENANCE PERSONNEL)				2		2	2		2
IMPROPER MAINTENANCE(OWNER PERSONNEL)				1		1	1		1
IMPROPERLY SERVICED AIRCRAFT(GROUND CREW)				3		3	3		3
IMPROPERLY SERVICED AIRCRAFT(OWNER-PILOT)				2		2	2		2
INADEQUATE MAINTENANCE AND INSPECTION									
OPERATIONAL SUPERVISORY PERSONNEL	8	2	10	14	1	15	22	3	25
INADEQUATE SUPERVISION OF FLIGHT CREW									
WEATHER PERSONNEL		1	1					1	1
INCOMPLETE WEATHER REPORT									
TRAFFIC CONTROL PERSONNEL	1		1				1		1
FAILURE TO ADVISE OF UNSAFE AIRPORT CONDITION				1		1	1		1

TABLE C-11 CONTINUED

CAUSE/FACTOR TABLE

PERSONNEL (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
AIRPORT SUPERVISORY PERSONNEL									
FAILURE TO NOTIFY OF UNSAFE CONDITION					1	1		1	1
AIRWAYS FACILITIES PERSONNEL									
PRODUCTION-DESIGN									
POOR/INADEQUATE DESIGN	1		1	1		1	2		2
MISCELLANEOUS-PERSONNEL									
THIRD PILOT									
FLIGHT ENGINEER									
DISPATCHING									
SUBTOTAL	10	3	13	24	2	26	34	5	39
** POWERPLANT **									
ENGINE STRUCTURE									
CRANKCASE				2		2	2		2
CRANKSHAFT				1		1	1		1
MASTER AND CONNECTING RODS	3		3	8		8	11		11
CYLINDER ASSEMBLY				9		9	9		9
PISTON, PISTON RINGS	3		3	3		3	6		6
VALVE ASSEMBLIES	3		3	1		1	4		4
BLOWER, IMPELLER ASSEMBLY				1		1	1		1
OTHER				5		5	5		5
IGNITION SYSTEM									
MAGNETOES	1	1	2	3		3	4	1	5
SPARK PLUG	3		3	4		4	7		7
IGNITION HARNESS, SHIELDING				1		1	1		1
LEADS	1		1				1		1
FUEL SYSTEM									
TANKS				2		2	2		2
LINES AND FITTINGS	1		1	4		4	5		5
SELECTOR VALVES	3		3	1		1	4		4
FILTERS, STRAINERS, SCREENS				1		1	1		1
CARBURETOR	1		1	2		2	3		3
PUMPS	1		1	2		2	3		3
FUEL INJECTION SYSTEM	4		4	1	1	2	5	1	6
VENTS, DRAINS, TANK CAPS	1		1	5		5	6		6
RAM AIR ASSEMBLY				1		1	1		1
LUBRICATING SYSTEM									
LINES, HOSES, FITTINGS				7	1	8	7	1	8
SEALS AND GASKETS				1		1	1		1
OTHER				3		3	3		3
COOLING SYSTEM									
BAFFLES				1		1	1		1
PROPELLER AND ACCESSORIES									
OTHER				1		1	1		1
EXHAUST SYSTEM									
MANIFOLDS				1		1	1		1
STACKS				1		1	1		1
ENGINE ACCESSORIES									
ENGINE CONTROLS-COCKPIT									
THROTTLE-POWER LEVER ASSEMBLIES				1		1	1		1
MIXTURE CONTROL ASSEMBLIES				1		1	1		1
POWERPLANT-INSTRUMENTS									
FUEL QUANTITY GAUGE					7	7		7	7
MISCELLANEOUS									
BIRD INGESTION				1		1	1		1
DETONATION				1		1	1		1
OTHER				1		1	1		1
DIRECT ENTRIES	1		1	4		4	5		5
REDUCTION GEAR ASSEMBLY									
GEARS, ACCESSORY DRIVE				1		1	1		1
COMPRESSOR ASSEMBLY									
OTHER	1		1				1		1
COMBUSTION ASSEMBLY									
TURBINE ASSEMBLY									
ACCESSORY DRIVE ASSEMBLY									
LUBRICATING SYSTEM									
FUEL SYSTEM									
SAFETY SYSTEM									
IGNITION SYSTEM									
TORQUEMETER									

TABLE C-11 CONTINUED

CAUSE/FACTOR TABLE

POWERPLANT (CONTINUED)	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
AIR BLEED									
EXHAUST SYSTEM									
THRUST REVERSER									
OTHER									
PROPELLER SYSTEM									
GOVERNOR				1		1	1		1
CONSTANT SPEED DRIVE									
GOVERNOR VALVE				1		1	1		1
POWER LEVER									
PROPELLER LEVER				1		1	1		1
REVERSE THRUST LEVER									
ENGINE INDICATING EQUIPMENT									
ENGINE INSTALLATION									
SUBTOTAL									
** SYSTEMS **	27	1	28	85	9	94	112	10	122
ELECTRICAL SYSTEM									
HYDRAULIC SYSTEM									
FLIGHT CONTROL SYSTEMS									
ANTI-ICING, DE-ICING SYSTEMS									
CARBURETOR DE-ICING SYSTEM									
OTHER									
AIR CONDITION, HEATING AND PRESSURIZATION				1		1	1		1
CABIN TEMP CONTROL AND TEMP INDICATING SYSTEM				1		1	1		1
AUTO PILOT		1	1						
FIRE WARNING SYSTEM								1	1
FIRE EXTINGUISHER SYSTEM									
OXYGEN SYSTEM									
OTHER SYSTEMS									
SUBTOTAL									
** INSTRUMENTS/EQUIPMENT AND ACCESSORIES **		1	1	2		2	2	1	3
FLIGHT AND NAVIGATION INSTRUMENTS									
COMMUNICATIONS AND NAVIGATION EQUIPMENT									
TRANSMITTERS AND/OR RECEIVERS									
COMPASS RECEIVERS									
OTHER				1		1	1		1
MISCELLANEOUS EQUIPMENT	1		1	1		1	2		2
				1		1	1		1
SUBTOTAL									
** WEATHER **	1		1	3		3	4		4
LOW CEILING									
RAIN	1	5	6	1	3	4	2	8	10
FOG				1	1	2	1	1	2
SNOW	1	1	2	1	2	3	2	3	5
ICING CONDITIONS-INCLUDES SLEET, FREEZING RAIN, ETC	1	2	3		1	1	1	3	4
CONDITIONS CONDUCIVE TO CARB/INDUCTION SYSTEM ICING	3	1	4	4	5	9	7	6	13
UNFAVORABLE WIND CONDITIONS	2	3	5	7	8	15	9	11	20
HIGH TEMPERATURE		1	1		1	1		1	1
OBSTRUCTIONS TO VISION		1	1					1	1
HIGH DENSITY ALTITUDE		1	1		2	2		1	1
THUNDERSTORM ACTIVITY								2	2
SUBTOTAL		1	1					1	1
** MISCELLANEOUS **	8	15	23	14	23	37	22	38	60
UNQUALIFIED PERSON OPERATED AIRCRAFT									
FOREIGN MATERIAL AFFECTING NORMAL OPERATIONS					1	1		1	1
SUBTOTAL				2	1	3	2	1	3
GRAND TOTAL				2	2	4	2	2	4
	108	22	130	310	51	361	418	73	491

TABLE C-11 CONTINUED

CAUSE/FACTOR TABLE

MISCELLANEOUS ACTS, CONDITIONS (CONTINUED)

	FATAL ACCIDENTS			NONFATAL ACCIDENTS			ALL ACCIDENTS		
	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL	CAUSE	FACTOR	TOTAL
** MISCELLANEOUS ACTS, CONDITIONS **									
ANTI-ICING/DEICING EQUIP-IMPROPER OPER. OF/FAILED TO USE	4		4	18		18	22		22
CHECKLIST-FAILED TO USE	1	1	2	2	5	7	3	6	9
CREW COORDINATION-POOR	1		1				1		1
DISREGARD OF GOOD OPERATING PRACTICE					1	1		1	1
IMPROPER EMERGENCY PROCEDURES	4	2	6	3	5	8	7	7	14
FEATHERED WRONG ENGINE	1		1				1		1
INSTRUMENTS-MISREAD OR FAILED TO READ					1	1		1	1
INATTENTIVE TO FUEL SUPPLY	4		4	8	4	12	12	4	16
POORLY PLANNED APPROACH					2	2		2	2
MISCALCULATED FUEL CONSUMPTION	1		1	4	2	6	5	2	7
STOLEN OR UNAUTHORIZED USE OF AIRCRAFT	1		1				1		1
IMPROPERLY SECURED	2		2	6		6	8		8
ELECTRICAL FAILURE				1		1	1		1
ENGINE LOADED UP	1		1	4		4	5		5
FATIGUE FRACTURE	3		3	1		1	4		4
FUEL GRADE-IMPROPER				1		1	1		1
WRONG PART		1	1					1	1
IMPROPER ALIGNMENT/ADJUSTMENT	1		1	2		2	3		3
FAILURE OF TWO OR MORE ENGINES	7	8	15	21	53	74	28	61	89
FIRE IN ENGINE	1		1		2	2	1	2	3
PILOT FATIGUE	1		1		1	1	1	1	2
FUEL EXHAUSTION	10		10	42		42	52		52
FUEL CONTAMINATION-EXCLUSIVE OF WATER IN FUEL				5		5	5		5
CARBON MONOXIDE POISONING		1	1					1	1
ICE-IN FUEL	1		1	1		1	2		2
ICE-ENGINE	1		1	4		4	5		5
ICE-CARBURETOR	4		4	17		17	21		21
AIRFRAME ICE				3	1	4	3	1	4
IMPROPERLY LOADED AIRCRAFT-WEIGHT-AND/OR CG		1	1		1	1		2	2
LACK OF LUBRICATION-SPECIFIC PART, NOT SYSTEM	1		1	1		1	2		2
OIL EXHAUSTION-ENGINE LUBRICATION SYSTEM	1		1	1		1	2		2
OIL CONTAMINATION				1		1	1		1
WATER IN FUEL	2		2	13		13	15		15
AIRCRAFT CAME TO REST IN WATER		2	2		4	4		6	6
MISSING				1		1	1		1
TOUCH AND GO LANDING		1	1					1	1
MATERIAL FAILURE	8	1	9	42		42	50	1	51
FUEL STARVATION	22		22	57		57	79		79
OIL STARVATION	3		3	2		2	5		5
IMPROPER CLEARANCE-TOLERANCE				1	1	2	1	1	2
FUEL SELECTOR POSITIONED BETWEEN TANKS		1	1	2	1	3	2	2	4
IMPROPER/INADEQUATE VENTING				1		1	1		1
LEAK/LEAKAGE	1		1	2	1	3	3	1	4
LOW COMPRESSION				1		1	1		1
CARBON DEPOSITS	2		2	2		2	4		4
LOOSE, PART/FITTING	2		2	1		1	3		3
BINDING	1		1				1		1
BURNED		1	1					1	1
CHAFFED	1		1				1		1
COLLAPSED				1		1	1		1
DETERIORATED				2	1	3	2	1	3
DISCONNECTED					1	1		1	1
ERRATIC					3	3		3	3
HIGH VOLTAGE BREAKDOWN				1		1	1		1
IMPROPERLY INSTALLED	1		1	2		2	3		3
JAMMED				1		1	1		1
OBSTRUCTED				2		2	2		2
OVERHEATED				1		1	1		1
PINCHED				1		1	1		1
EXCESSIVE PRESSURE				1		1	1		1
PRESSURE TOO LOW				1		1	1		1
PRESSURE, NONE				4		4	4		4
SCORED	1		1				1		1
SHEARED				1		1	1		1
STUCK	1		1				1		1
EXCESSIVE TEMPERATURE	1		1	1		1	2		2
VIBRATION, EXCESSIVE				2	1	3	2	1	3
ICE-INDUCTION	1		1	1		1	2		2

DIRECT ENTRY CAUSES

PWR PLT-LEFT ENGINE COUNTERWEIGHT ATTACHMENT FAILD
COPILOT-INADVERTENTLY MOVD PWR LVRS TO CUTOFF.
PWR PLT-FUEL STARVATION FOR UNDETERMINED CAUSE.
PILOT-MISCALCULATED FUEL CONSUMPTION.
PWR PLT-PARTIAL PWR LOSS FRONT ENGINE CAUSE UNKNOW
PWR PLT-RIGHT ENG. AIR FILTER BOX BLOCKED BY SNOW.
PILOT-TOOK OFF WITH TURBO SUPERCHARGERS FULL BOOST
PWR PLT-UNWANTED FEATHER NO 1 PROP UNDET REASON.

DIRECT ENTRY CAUSES ARE CARRIED UNDER THEIR APPROPRIATE CAUSAL CATEGORIES AND ARE INCLUDED IN THE TOTALS

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