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An Application of CICCT Accident Categories to Aviation Accidents in 1988-2004

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July 2007

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Introduction and Methods

Introduction

As NASA begins a new program to address issues in aviation safety, it is beneficial to look back at the accidents of the past several years, to categorize those accidents by type and to look for changes in the types of accidents that have occurred. It is important to understand past mistakes, and in this time of limited resources, it is equally important not to focus on the prevention of accidents that already have been eliminated.

Data Selection

The National Transportation Safety Board is an independent Federal agency that investigates every civil aviation accident in the United States and significant accidents in the other modes of transportation, conducts special investigations and safety studies, and issues safety recommendations to prevent future accidents. The information the NTSB investigators collect during their investigations of these aviation events resides in the NTSB Aviation Accident and Incident Data System. A copy of this database in Microsoft Access format was obtained from the Aviation Safety Information Analysis and Sharing (ASIAS) department of the FAA's Office of Aviation Safety in September 2006.

The NTSB database includes events involving a wide variety of aircraft (airplanes, helicopters, hot air balloons, gliders, ultralight, etc.) conducted under various Federal Aviation Regulations (Part 91: General Aviation, Part 121: Commercial Air Carriers, Part 129: Foreign Air Carriers, Part 135: Commuters and On-Demand Air Taxis, Part 137: Agricultural Operations, etc.). In addition, the NTSB considers events to be either an accident or an incident, under the following definitions:

Accident - an occurrence associated with the operation of an aircraft, which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage

Incident - an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations

This report will focus on 26,117 accidents involving 26,435 US airplanes that occurred between January 1, 1988 and December 31, 2004. Events involving military or foreign aircraft are included only if they also involve a US non-military aircraft.

The results are presented in four major sections, one for each of the general categories of aviation that are considered here. The large, commercial air carriers fly under the regulations of FAR Part 121, while Part 135 regulates both the smaller commuter airlines (Scheduled) and the on-demand air taxi system (Non-Scheduled). Part 91 fixed wing aircraft are more commonly referred to as General Aviation. Table 1 shows both the number of events and the number of aircraft involved in these events during the 17 years examined here. Some events involve aircraft from two different categories (e.g., a Part 121 and a Part 91), and these events will be reported in both categories. For simplicity, and because there are relatively few multiple aircraft events within each general category, for the remainder of this report each aircraft will be counted as a separate event.

Table 1. Number of Events and Aircraft per Flight Category

Category	Number of Events	Number of Aircraft
Part 121 (Large Air Carriers)	618	630
Part 135 Scheduled	212	217
Part 135 Non-Scheduled	1094	1115
Part 91 (General Aviation)	24,193	24,473

All Part 121 and Part 135 events are included in this analysis, regardless of whether the investigation is in a preliminary stage or finalized, and whether or not the event occurred within the United States. For Part 91, events involving home built or experimental aircraft are excluded from the analysis unless the event also included another aircraft that otherwise would have been included.

Report Content

All of the accidents included this report have been assigned accident categories based upon the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Some categories were added to this taxonomy for non-transport accidents, and details on all categories can be found in Appendix A. The assignment of categories was performed by means of a computer program, based on the occurrence codes and causal factor codes in the NTSB database. During the assignment process, many of the more complicated accidents were reviewed by the author, and all of the fatal accidents for Part 121 and Scheduled Part 135 were reviewed by other Aviation Safety program assessment staff. One CICTT specification was not followed; this was with regard to the coding of loss of control when control was not possible due to a system/component failure/malfunction. The CICTT taxonomy states that the loss of control should not be considered as a separate category in these cases. However, this analysis retained the loss of control category in all circumstances, regardless of malfunctions, in order to capture all of the loss of control that followed system/component failure/malfunction or other circumstances (incapacitation, weather) that might have rendered the aircraft uncontrollable.

The main focus of this report is on the CICTT accident category, but information is included on the type and number of injuries; the level of damage to the aircraft; and the phase of flight. Data for total flight hours per year were obtained from tables published by the NTSB, which they based on data from the FAA.

In 1997, the NTSB developed a classification system in order to combine injury and aircraft damage into one rating of accident severity. The classification was developed for Part 121 aircraft only, but has been expanded in this report to apply to all aircraft. When multiple aircraft were involved in the accident, the most severe injury and damage was used to classify the accident. The definitions for these classifications are as follows:

Major: the aircraft was destroyed
OR there were multiple fatalities
OR there was one fatality and the aircraft was substantially damaged

Serious: there was one fatality without substantial aircraft damage
OR there was at least one serious injury and the aircraft was substantially damaged

Injury: no fatalities but at least one serious injury
(with less than substantial damage to the aircraft)

Damage: no fatalities or serious injuries, but the aircraft was substantially damaged

Toward the end of each of the four main sections of this report is a table presenting information on the events that preceded the various categories loss of control (In-flight, Takeoff, Approach/Landing). The accidents were divided into 5 groups, which are defined below:

1. Primary LOC: No specific occurrence preceded the loss of control.

2. LOC secondary to system/component failure/malfunction: The prior occurrence also may have included some other event (examples below), but in each of these accidents, loss of control was secondary to a failure/malfunction. In some of these events, it may have been possible for the flight crew to maintain control, but in others the loss of control was unavoidable.

3. LOC secondary to power loss or fire: In these events, loss of control was secondary to a non-mechanical loss of engine power or a fire/explosion that was not linked to a system/component failure/malfunction.

4. LOC secondary to low altitude operations: In these accidents, the control was lost in conjunction with some type of low level maneuvering (aerobatics, aerial application, banner towing, evasive maneuvers to avoid a collision, sightseeing, scud running, etc.).

5. LOC secondary to severe weather: In these events the loss of control was secondary to an encounter with severe weather – icing, turbulence, thunderstorm or windshear – or to inadequate ice/frost/snow removal prior to takeoff.

6. LOC secondary to other events: The other events might include pilot incapacitation, bird strikes or inadequate preflight inspections that resulted in open doors, gust locks that were not removed, or compromised pitot systems.

Statistical Methods

This report is primarily one of data presentation, rather than data analysis. Most tables consist of raw counts, percentages and rates adjusted for total flight hours. The denominator used for various percentages is defined in the text associated with each table. A trend analysis was performed with the CICTT categories. For categories with occurrences greater than 10% (20% for Part 135-S) of the total events (6 for Part 121, 4 for Part 135-S, 11 for Part 135-NS and 200 for Part 91) the rate of occurrences per one million flight hours was calculated for each year, and a linear regression line was fit to those data. The rate of occurrence of a CICTT category is said to show a (decreasing or increasing) trend when the slope of that regression line is judged to be not equal to zero (using a nominal p-value of 0.05). All calculations and analyses were performed using release 8.02 of the SAS System (SAS Institute, Inc. of Cary, North Carolina, copyright 2001).

Part 121 – Commercial Air Carriers

Injuries and Aircraft Damage by Year

As shown in Table 2 below, there were a total of 630 accidents involving Part 121 aircraft during the years 1988-2004. After adjusting for total flight hours, it is clear that while the number of reported events has increased modestly during these years, the number and percentage of fatal events has fallen steadily. If not for the four fatal events on September 11, 2001, the decrease would be even more striking.

Table 2. Total Accidents and Fatal Accidents by Total Flight Hours per Year

Year	Total Events	Fatal Events	Fatal Events out of Total	Total Estim. Flight Hours	Events per million FH	Fatal per mil FH
1988	30	3	10.0%	11,140,548	2.693	0.269
1989	28	11	39.3%	11,274,543	2.483	0.976
1990	25	7	28.0%	12,150,116	2.058	0.576
1991	27	4	14.8%	11,780,610	2.292	0.340
1992	18	4	22.2%	12,359,715	1.456	0.324
1993	23	1	4.3%	12,706,206	1.810	0.079
1994	23	4	17.4%	13,124,315	1.752	0.305
1995	37	3	8.1%	13,505,257	2.740	0.222
1996	39	5	12.8%	13,746,112	2.837	0.364
1997	49	4	8.2%	15,838,109	3.094	0.253
1998	50	1	2.0%	16,816,555	2.973	0.059
1999	52	2	3.8%	17,555,208	2.962	0.114
2000	56	3	5.4%	18,299,257	3.060	0.164
2001	48	6	12.5%	17,814,191	2.694	0.337
2002	41	0	0.0%	17,290,198	2.371	0.000
2003	54	2	3.7%	17,467,700	3.091	0.114
2004	30	2	6.7%	18,882,503	1.589	0.106
1988-2004	630	62	9.8%	251,751,143	2.502	0.246

Figure 1 shows both the total accidents and fatal accidents each year, adjusted for total flight hours. The bars represent fatal events using the scale of the left axis. The connected diamonds represent total events according to the right axis.

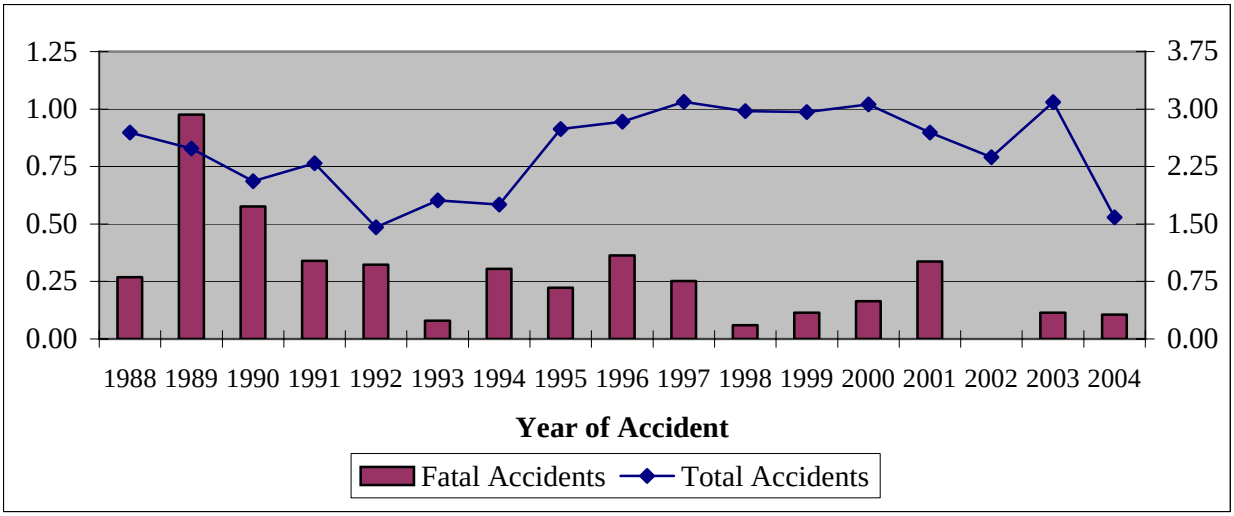

Figure 1. Fatal and Total Accidents per Million Flight Hours.

Table 3 shows the most severe injury in each event by year. All percentages are based on the total events for that year. Forty-five percent of the accidents included a severe injury, while there were no injuries in 36% of the accidents. The percentage of events with no injuries has increased generally over time.

Table 3. Most Severe Injury by Year of Accident

Year	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
1988	30	3 (10.0%)	16 (53.3%)	4 (13.3%)	7 (23.3%)
1989	28	11 (39.3%)	6 (21.4%)	5 (17.9%)	6 (21.4%)
1990	25	7 (28.0%)	11 (44.0%)	1 (4.0%)	6 (24.0%)
1991	27	4 (14.8%)	11 (40.7%)	3 (11.1%)	9 (33.3%)
1992	18	4 (22.2%)	12 (66.7%)	0 (0.0%)	2 (11.1%)
1993	23	1 (4.3%)	14 (60.9%)	2 (8.7%)	6 (26.1%)
1994	23	4 (17.4%)	12 (52.2%)	3 (13.0%)	4 (17.4%)
1995	37	3 (8.1%)	16 (43.2%)	1 (2.7%)	17 (45.9%)
1996	39	5 (12.8%)	18 (46.2%)	6 (15.4%)	10 (25.6%)
1997	49	4 (8.2%)	25 (51.0%)	7 (14.3%)	13 (26.5%)
1998	50	1 (2.0%)	23 (46.0%)	7 (14.0%)	19 (38.0%)
1999	52	2 (3.8%)	21 (40.4%)	1 (1.9%)	28 (53.8%)
2000	56	3 (5.4%)	22 (39.3%)	7 (12.5%)	24 (42.9%)
2001	48	6 (12.5%)	19 (39.6%)	6 (12.5%)	17 (35.4%)
2002	41	0 (0.0%)	16 (39.0%)	1 (2.4%)	24 (58.5%)
2003	54	2 (3.7%)	26 (48.1%)	3 (5.6%)	23 (42.6%)
2004	30	2 (6.7%)	17 (56.7%)	2 (6.7%)	9 (30.0%)
1988-2004	630	62 (9.8%)	285 (45.2%)	59 (9.4%)	224 (35.6%)

Table 4 shows the number of persons killed or injured in these events. In the first column (Aircraft), the first number is the number of aircraft/events with an injury of that type, and the number in parentheses is the percentage out of the total number of accident aircraft. In the second column (Persons), the first number is the number of persons with an injury of that type, and the number in parentheses is the percentage out of the total number of that category of persons (aboard, crew, passengers, ground, or total) involved in these accidents. The total number of persons involved is defined to be the number of persons on board plus persons on the ground with injuries. The term "Ground" also includes persons on other aircraft, for those events which involved a Part 121 aircraft and a non-Part 121 aircraft. The ground injuries on September 11, 2001 are not included in these totals. In the third column (Averages) the average number of persons with an injury of that type was calculated in two ways: based on the number of events with an injury of that type, and based on the total number of accident aircraft (630).

Table 4. Total Number of Injuries

Specific Type of Injury	Aircraft	Persons	Averages
Total Persons Aboard	630 (100.0%)	55584 (100.0%)	88.23 (88.23)
Total Persons Involved	630 (100.0%)	55795 (100.0%)	88.56 (88.56)
Total Persons Injured	406 (64.4%)	4578 (8.2%)	11.28 (7.27)
Fatal Injury Aboard	45 (7.1%)	2060 (3.7%)	45.78 (3.27)
Crew Fatal Injury	37 (5.9%)	163 (4.4%)	4.41 (0.26)
Passengers Fatal Injury	33 (5.2%)	1897 (3.7%)	57.48 (3.01)
Ground Fatal Injury	22 (3.5%)	105 (49.8%)	4.77 (0.17)
Total Fatal Injuries	62 (9.8%)	2165 (3.9%)	34.92 (3.44)
Serious Injury Aboard	275 (43.7%)	539 (1.0%)	1.96 (0.86)
Crew Serious Injury	170 (27.0%)	206 (5.6%)	1.21 (0.33)
Passengers Serious Injury	122 (19.4%)	333 (0.6%)	2.73 (0.53)
Ground Serious Injury	30 (4.8%)	80 (37.9%)	2.67 (0.13)
Total Serious Injury	305 (48.4%)	619 (1.1%)	2.03 (0.98)
Minor Injury Aboard	182 (28.9%)	1768 (3.2%)	9.71 (2.81)
Crew Minor Injury	107 (17.0%)	236 (6.4%)	2.21 (0.37)
Passengers Minor Injury	135 (21.4%)	1532 (3.0%)	11.35 (2.43)
Ground Minor Injury	12 (1.9%)	26 (12.3%)	2.17 (0.04)
Total Minor Injury	190 (30.2%)	1794 (3.2%)	9.44 (2.85)
Not Injured Aboard	591 (93.8%)	51217 (92.1%)	86.66 (81.30)
Crew Not Injured	582 (92.4%)	3081 (83.6%)	5.29 (4.89)
Passengers Not Injured	520 (82.5%)	48136 (92.8%)	92.57 (76.41)

Only 33 of the 62 fatal events included passenger fatalities (53%), and in 17 of the fatal events, no persons on board the Part 121 aircraft were killed. In three of these 17 events, passengers and crew on

board another aircraft were killed, in one event, the aircraft overran the runway and crashed into a residential area, in another a pedestrian on the runway was struck by the aircraft, and the remaining twelve fatal injuries were to ground personnel.

Ninety-two percent of all persons on board the Part 121 aircraft sustained no injuries in these 630 accidents. In the 406 accidents with injuries, an average of 11 persons per event were killed or injured, while the average across all 630 accidents is just over 7 persons killed or injured per accident. When an event included at least one fatality, an average of 35 persons died. In contrast, there was an average of 2 persons seriously injured, when the event included any serious injuries. When the event included any minor injuries, 9 persons on average sustained minor injuries.

Three hundred thirty-six (53.4%) of the Part 121 aircraft involved in these events were destroyed or suffered substantial damage (see Table 5), while 38% had no damage at all. All percentages are based on the total events for that year.

Table 5. Aircraft Damage by Year of Accident

Year	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
1988	30	3 (10.0%)	13 (43.3%)	0 (0.0%)	14 (46.7%)
1989	28	7 (25.0%)	11 (39.3%)	0 (0.0%)	10 (35.7%)
1990	25	3 (12.0%)	8 (32.0%)	4 (16.0%)	10 (40.0%)
1991	27	5 (18.5%)	10 (37.0%)	3 (11.1%)	9 (33.3%)
1992	18	3 (16.7%)	3 (16.7%)	1 (5.6%)	11 (61.1%)
1993	23	1 (4.3%)	8 (34.8%)	3 (13.0%)	11 (47.8%)
1994	23	3 (13.0%)	8 (34.8%)	3 (13.0%)	9 (39.1%)
1995	37	3 (8.1%)	18 (48.6%)	2 (5.4%)	14 (37.8%)
1996	39	5 (12.8%)	14 (35.9%)	7 (17.9%)	13 (33.3%)
1997	49	2 (4.1%)	20 (40.8%)	6 (12.2%)	21 (42.9%)
1998	50	0 (0.0%)	28 (56.0%)	7 (14.0%)	15 (30.0%)
1999	52	2 (3.8%)	28 (53.8%)	4 (7.7%)	18 (34.6%)
2000	56	3 (5.4%)	31 (55.4%)	5 (8.9%)	17 (30.4%)
2001	48	5 (10.4%)	21 (43.8%)	3 (6.3%)	19 (39.6%)
2002	41	1 (2.4%)	25 (61.0%)	2 (4.9%)	13 (31.7%)
2003	54	2 (3.7%)	27 (50.0%)	2 (3.7%)	23 (42.6%)
2004	30	4 (13.3%)	11 (36.7%)	0 (0.0%)	15 (50.0%)
1988-2004	630	52 (8.3%)	284 (45.1%)	52 (8.3%)	242 (38.4%)

Table 6 shows the distribution of the NTSB severity classification. All percentages are based on the total events for that year. Slightly less than 15% of the accidents were considered either major or serious. The

percentage of events in these two categories has decreased over time, and the percentage of accidents in the "damage" category has increased.

Table 6. Accident Severity Classification by Year of Accident

Year	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
1988	30	4 (13.3%)	2 (6.7%)	13 (43.3%)	11 (36.7%)
1989	28	8 (28.6%)	4 (14.3%)	6 (21.4%)	10 (35.7%)
1990	25	5 (20.0%)	3 (12.0%)	10 (40.0%)	7 (28.0%)
1991	27	5 (18.5%)	2 (7.4%)	10 (37.0%)	10 (37.0%)
1992	18	3 (16.7%)	3 (16.7%)	10 (55.6%)	2 (11.1%)
1993	23	1 (4.3%)	2 (8.7%)	12 (52.2%)	8 (34.8%)
1994	23	4 (17.4%)	0 (0.0%)	12 (52.2%)	7 (30.4%)
1995	37	3 (8.1%)	2 (5.4%)	14 (37.8%)	18 (48.6%)
1996	39	6 (15.4%)	0 (0.0%)	18 (46.2%)	15 (38.5%)
1997	49	2 (4.1%)	4 (8.2%)	24 (49.0%)	19 (38.8%)
1998	50	0 (0.0%)	3 (6.0%)	21 (42.0%)	26 (52.0%)
1999	52	2 (3.8%)	2 (3.8%)	20 (38.5%)	28 (53.8%)
2000	56	3 (5.4%)	3 (5.4%)	20 (35.7%)	30 (53.6%)
2001	48	5 (10.4%)	1 (2.1%)	19 (39.6%)	23 (47.9%)
2002	41	1 (2.4%)	1 (2.4%)	14 (34.1%)	25 (61.0%)
2003	54	2 (3.7%)	3 (5.6%)	24 (44.4%)	25 (46.3%)
2004	30	4 (13.3%)	0 (0.0%)	15 (50.0%)	11 (36.7%)
1988-2004	630	58 (9.2%)	35 (5.6%)	262 (41.6%)	275 (43.7%)

Injuries and Aircraft Damage by CICTT Accident Category

Figure 2 and Table 7 present the breakdown of CICTT accident categories in the 1988-2004 accidents. The first column of Table 7 lists the category abbreviation with an explanation of the abbreviation. Refer to Appendix A for a more detailed explanation of these categories. The second column lists the number of accidents in this category (with a percentage based on the total number of accidents, rather than the total number of category assignments). The third column lists the number of fatal injuries in all the accidents for that category, with a percentage out of the number of persons involved in those accidents (see column 5) and the fourth column shows the total number of injuries of any type in those accidents (again, with a percentage based on column 5). As before, the number of persons involved in the accident is defined to be the number of persons on board plus persons on the ground with injuries.

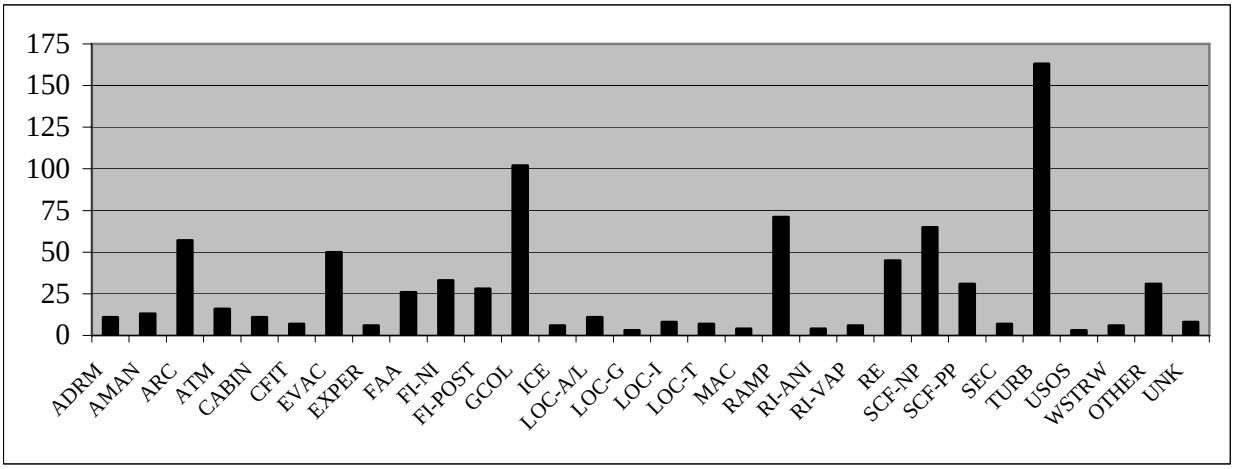

Figure 2. CICTT Accident Categories for Part 121 data from 1988-2004.

The most common event categories are turbulence (26% of events), ground collision (16%), ground handling (11%) and non-powerplant system/component failure/malfunction (10%). The combined incidence of system/component failure/malfunction (powerplant and non-powerplant) ranks as third most common (15.2%). The categories with fatal injuries to more than half of all those persons involved in the accident are CFIT (78%), security-related events (73%), LOC-I (72%), post-impact fire (52%) and LOC-A/L (52%). The categories with any type of injury to more than half of all those persons involved in the accident are LOC-Takeoff (92%), post-impact fire (86%), CFIT (81%), LOC-A/L (84%), LOC-I (74%) and security-related events (74%).

Table 8 shows the most severe injury distribution in each CICTT accident category. All percentages in Tables 8 through 10 are based on the total events for that category. The categories most likely to have a fatal injury are LOC-Takeoff (100%), RI-VAP (100%), LOC-A/L (82%), post-impact fire (71%), Security (71%), Icing (67%), LOC-I (63%), FAA (58%) and CFIT (57%). The categories most likely to have no injuries are abnormal runway contact (79%), ground collision (78%), RI-Animal (75%), LOC-Ground (67%), undershoot/overshoot (67%), Windshear/Thunderstorm (67%), aerodrome (64%) and powerplant system/component failure/malfunction (61%).

Table 7. CICTT accident categories

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
ADRM (Aerodrome)	11 (1.7%)	0 (0.0%)	70 (8.2%)	852
AMAN (Abrupt Maneuver)	13 (2.1%)	265 (20.9%)	282 (22.2%)	1269
ARC (Abnormal Runway Contact)	57 (9.0%)	0 (0.0%)	65 (1.4%)	4504
ATM (Air Traffic Management)	16 (2.5%)	224 (12.2%)	357 (19.4%)	1840
CABIN (Cabin Safety)	11 (1.7%)	1 (0.1%)	11 (0.6%)	1746
CFIT (Controlled Flight Into or Toward Terrain)	7 (1.1%)	321 (77.9%)	335 (81.3%)	412
EVAC (Evacuation)	50 (7.9%)	3 (0.1%)	440 (7.5%)	5893
EXPER (Experience/Training Issues)	6 (1.0%)	0 (0.0%)	10 (4.0%)	252
FAA (Inadequate FAA Oversight)	26 (4.1%)	400 (19.3%)	698 (33.6%)	2076
FI-NI (Fire/Smoke – Non-Impact)	33 (5.2%)	380 (17.4%)	630 (28.8%)	2187
FI-POST (Fire – Post Impact)	28 (4.4%)	726 (51.6%)	1208 (85.8%)	1408
GCOL (Ground Collision)	102 (16.2%)	0 (0.0%)	85 (1.3%)	6420
ICE (Icing)	6 (1.0%)	99 (37.8%)	120 (45.8%)	262
LOC-A/L (Loss of Control – Approach/Landing)	11 (1.7%)	319 (51.5%)	519 (83.7%)	620
LOC-G (Loss of Control – Ground)	3 (0.5%)	0 (0.0%)	2 (1.3%)	149
LOC-I (Loss of Control – In Flight)	8 (1.3%)	761 (72.4%)	780 (74.2%)	1051
LOC-T (Loss of Control – Takeoff)	7 (1.1%)	106 (38.7%)	253 (92.3%)	274
MAC (Mid Air Collision or Lack of Separation)	4 (0.6%)	0 (0.0%)	3 (1.0%)	293
RAMP (Ground Handling)	71 (11.3%)	42 (0.7%)	120 (2.1%)	5647
RE (Runway Excursion)	45 (7.1%)	19 (0.5%)	367 (10.1%)	3642
RI-ANI (Runway Incursion – Animal)	4 (0.6%)	0 (0.0%)	1 (1.5%)	65
RI-VAP (Runway Incursion – Vehicle or Aircraft or Person)	6 (1.0%)	46 (7.2%)	113 (17.6%)	642
SCF-NP (System/Component Fail/Malf (Non-Powerplant)	65 (10.3%)	553 (8.6%)	925 (14.4%)	6417
SCF-PP (System/Component Fail/Malf (Powerplant)	31 (4.9%)	117 (5.9%)	372 (18.8%)	1977
SEC (Security)	7 (1.1%)	535 (72.6%)	545 (73.9%)	737
TURB (Turbulence)	163 (25.9%)	2 (0.0%)	836 (4.3%)	19380
USOS (Undershoot/Overshoot)	3 (0.5%)	0 (0.0%)	23 (17.8%)	129
WSTRW (Windshear/Thunderstorm)	6 (1.0%)	48 (12.7%)	178 (47.0%)	379
OTHER (Other)	31 (4.9%)	259 (19.3%)	280 (20.9%)	1339
UNK (Unknown/Not Reported)	8 (1.3%)	0 (0.0%)	9 (1.1%)	816
Total	630 (100.0%)	2060 (3.7%)	4578 (8.2%)	55,795

Table 8. Most Severe Injury by CICTT accident category

CICTT category	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
ADRM	11	0 (0.0%)	2 (18.2%)	2 (18.2%)	7 (63.6%)
AMAN	13	1 (7.7%)	9 (69.2%)	0 (0.0%)	3 (23.1%)
ARC	57	0 (0.0%)	2 (3.5%)	10 (17.5%)	45 (78.9%)
ATM	16	6 (37.5%)	2 (12.5%)	4 (25.0%)	4 (25.0%)
CABIN	11	1 (9.1%)	10 (90.9%)	0 (0.0%)	0 (0.0%)
CFIT	7	4 (57.1%)	2 (28.6%)	1 (14.3%)	0 (0.0%)
EVAC	50	2 (4.0%)	32 (64.0%)	14 (28.0%)	2 (4.0%)
EXPER	6	0 (0.0%)	1 (16.7%)	2 (33.3%)	3 (50.0%)
FAA	26	15 (57.7%)	3 (11.5%)	4 (15.4%)	4 (15.4%)
FI-NI	33	5 (15.2%)	10 (30.3%)	6 (18.2%)	12 (36.4%)
FI-POST	28	20 (71.4%)	2 (7.1%)	6 (21.4%)	0 (0.0%)
GCOL	102	0 (0.0%)	9 (8.8%)	13 (12.7%)	80 (78.4%)
ICE	6	4 (66.7%)	0 (0.0%)	0 (0.0%)	2 (33.3%)
LOC-A/L	11	9 (81.8%)	1 (9.1%)	1 (9.1%)	0 (0.0%)
LOC-G	3	0 (0.0%)	0 (0.0%)	1 (33.3%)	2 (66.7%)
LOC-I	8	5 (62.5%)	2 (25.0%)	0 (0.0%)	1 (12.5%)
LOC-T	7	7 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
MAC	4	0 (0.0%)	2 (50.0%)	1 (25.0%)	1 (25.0%)
RAMP	71	17 (23.9%)	37 (52.1%)	3 (4.2%)	14 (19.7%)
RE	45	3 (6.7%)	9 (20.0%)	17 (37.8%)	16 (35.6%)
RI-ANI	4	0 (0.0%)	1 (25.0%)	0 (0.0%)	3 (75.0%)
RI-VAP	6	6 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
SCF-NP	65	11 (16.9%)	18 (27.7%)	12 (18.5%)	24 (36.9%)
SCF-PP	31	3 (9.7%)	6 (19.4%)	3 (9.7%)	19 (61.3%)
SEC	7	5 (71.4%)	2 (28.6%)	0 (0.0%)	0 (0.0%)
TURB	163	2 (1.2%)	159 (97.5%)	1 (0.6%)	1 (0.6%)
USOS	3	0 (0.0%)	0 (0.0%)	1 (33.3%)	2 (66.7%)
WSTRW	6	2 (33.3%)	0 (0.0%)	0 (0.0%)	4 (66.7%)
OTHER	31	4 (12.9%)	3 (9.7%)	5 (16.1%)	19 (61.3%)
UNK	8	0 (0.0%)	2 (25.0%)	0 (0.0%)	6 (75.0%)
Total	630	62 (9.8%)	285 (45.2%)	59 (9.4%)	224 (35.6%)

Table 9 shows the distribution of aircraft damage in each CICTT accident category. The categories most likely to result in aircraft destruction are LOC-Takeoff (100%), LOC-A/L (91%), post-impact fire (89%), CFIT (86%), Security (71%), icing (67%), and LOC-I (63%). The categories most likely to result in no aircraft damage are cabin safety events (100%), turbulence (91%), mid-air collisions (75%), abrupt maneuvers (69%) and ground handling events (59%).

Table 9. Aircraft Damage by CICTT accident category

CICTT Category	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
ADRM	11	0 (0.0%)	11 (100.%)	0 (0.0%)	0 (0.0%)
AMAN	13	1 (7.7%)	3 (23.1%)	0 (0.0%)	9 (69.2%)
ARC	57	3 (5.3%)	54 (94.7%)	0 (0.0%)	0 (0.0%)
ATM	16	5 (31.3%)	8 (50.0%)	1 (6.3%)	2 (12.5%)
CABIN	11	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (100.%)
CFIT	7	6 (85.7%)	1 (14.3%)	0 (0.0%)	0 (0.0%)
EVAC	50	4 (8.0%)	15 (30.0%)	12 (24.0%)	19 (38.0%)
EXPER	6	1 (16.7%)	5 (83.3%)	0 (0.0%)	0 (0.0%)
FAA	26	11 (42.3%)	13 (50.0%)	0 (0.0%)	2 (7.7%)
FI-NI	33	9 (27.3%)	16 (48.5%)	4 (12.1%)	4 (12.1%)
FI-POST	28	25 (89.3%)	3 (10.7%)	0 (0.0%)	0 (0.0%)
GCOL	102	0 (0.0%)	87 (85.3%)	14 (13.7%)	1 (1.0%)
ICE	6	4 (66.7%)	2 (33.3%)	0 (0.0%)	0 (0.0%)
LOC-A/L	11	10 (90.9%)	1 (9.1%)	0 (0.0%)	0 (0.0%)
LOC-G	3	0 (0.0%)	3 (100.%)	0 (0.0%)	0 (0.0%)
LOC-I	8	5 (62.5%)	1 (12.5%)	2 (25.0%)	0 (0.0%)
LOC-T	7	7 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
MAC	4	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)
RAMP	71	4 (5.6%)	16 (22.5%)	9 (12.7%)	42 (59.2%)
RE	45	10 (22.2%)	34 (75.6%)	1 (2.2%)	0 (0.0%)
RI-ANI	4	0 (0.0%)	4 (100.%)	0 (0.0%)	0 (0.0%)
RI-VAP	6	2 (33.3%)	3 (50.0%)	1 (16.7%)	0 (0.0%)
SCF-NP	65	9 (13.8%)	39 (60.0%)	6 (9.2%)	11 (16.9%)
SCF-PP	31	4 (12.9%)	24 (77.4%)	1 (3.2%)	2 (6.5%)
SEC	7	5 (71.4%)	0 (0.0%)	1 (14.3%)	1 (14.3%)
TURB	163	0 (0.0%)	3 (1.8%)	12 (7.4%)	148 (90.8%)
USOS	3	0 (0.0%)	3 (100.%)	0 (0.0%)	0 (0.0%)
WSTRW	6	2 (33.3%)	4 (66.7%)	0 (0.0%)	0 (0.0%)
OTHER	31	3 (9.7%)	25 (80.6%)	1 (3.2%)	2 (6.5%)
UNK	8	0 (0.0%)	6 (75.0%)	0 (0.0%)	2 (25.0%)
Total	630	52 (8.3%)	284 (45.1%)	52 (8.3%)	242 (38.4%)

Table 10 shows the severity classification in each CICTT accident category. The categories most likely to include “major” accidents are LOC-Takeoff (100%), LOC-A/L (91%), post-impact fire (89%), CFIT (86%), RI-VAP (83%), security related events (71%), icing (67%), LOC-I (63%) and FAA oversight (58%). The categories with less than 10% of the accidents either “Major” or “Serious” are LOC–Ground

(0%), mid-air collision (0%), undershoot/overshoot (0%), turbulence (2%), ground collision (5%), abnormal runway contact (7%), abrupt maneuvers (8%), cabin safety (9%) and evacuation (9%).

Table 10. Accident Severity Classification by CICTT Accident Category

CICTT Category	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
ADRM	11	0 (0.0%)	2 (18.2%)	0 (0.0%)	9 (81.8%)
AMAN	13	1 (7.7%)	0 (0.0%)	9 (69.2%)	3 (23.1%)
ARC	57	3 (5.3%)	1 (1.8%)	0 (0.0%)	53 (93.0%)
ATM	16	7 (43.8%)	0 (0.0%)	2 (12.5%)	7 (43.8%)
CABIN	11	0 (0.0%)	1 (9.1%)	10 (90.9%)	0 (0.0%)
CFIT	7	6 (85.7%)	0 (0.0%)	0 (0.0%)	1 (14.3%)
EVAC	50	5 (10.0%)	3 (6.0%)	30 (60.0%)	12 (24.0%)
EXPER	6	1 (16.7%)	0 (0.0%)	0 (0.0%)	5 (83.3%)
FAA	26	15 (57.7%)	1 (3.8%)	2 (7.7%)	8 (30.8%)
FI-NI	33	9 (27.3%)	1 (3.0%)	8 (24.2%)	15 (45.5%)
FI-POST	28	25 (89.3%)	0 (0.0%)	0 (0.0%)	3 (10.7%)
GCOL	102	0 (0.0%)	5 (4.9%)	4 (3.9%)	93 (91.2%)
ICE	6	4 (66.7%)	0 (0.0%)	0 (0.0%)	2 (33.3%)
LOC-A/L	11	10 (90.9%)	0 (0.0%)	0 (0.0%)	1 (9.1%)
LOC-G	3	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100.%)
LOC-I	8	5 (62.5%)	0 (0.0%)	2 (25.0%)	1 (12.5%)
LOC-T	7	7 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
MAC	4	0 (0.0%)	0 (0.0%)	2 (50.0%)	2 (50.0%)
RAMP	71	4 (5.6%)	14 (19.7%)	37 (52.1%)	16 (22.5%)
RE	45	10 (22.2%)	5 (11.1%)	1 (2.2%)	29 (64.4%)
RI-ANI	4	0 (0.0%)	1 (25.0%)	0 (0.0%)	3 (75.0%)
RI-VAP	6	5 (83.3%)	1 (16.7%)	0 (0.0%)	0 (0.0%)
SCF-NP	65	11 (16.9%)	2 (3.1%)	16 (24.6%)	36 (55.4%)
SCF-PP	31	5 (16.1%)	2 (6.5%)	3 (9.7%)	21 (67.7%)
SEC	7	5 (71.4%)	0 (0.0%)	2 (28.6%)	0 (0.0%)
TURB	163	0 (0.0%)	3 (1.8%)	158 (96.9%)	2 (1.2%)
USOS	3	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100.%)
WSTRW	6	2 (33.3%)	0 (0.0%)	0 (0.0%)	4 (66.7%)
OTHER	31	3 (9.7%)	2 (6.5%)	2 (6.5%)	24 (77.4%)
UNK	8	0 (0.0%)	0 (0.0%)	2 (25.0%)	6 (75.0%)
Total	630	58 (9.2%)	35 (5.6%)	262 (41.6%)	275 (43.7%)

Trends over time in CICTT Accident Categories

The CICTT categories found to show a significant trend are shown in Figure 3 through Figure 10 below. The estimated regression line is included on each chart. Accidents categorized by abrupt maneuvers, ground collisions and turbulence encounters have increased, but cabin events, accidents attributed to ATM errors or inadequate FAA oversight, post-impact fires and Loss of Control (Approach/Landing) events have decreased.

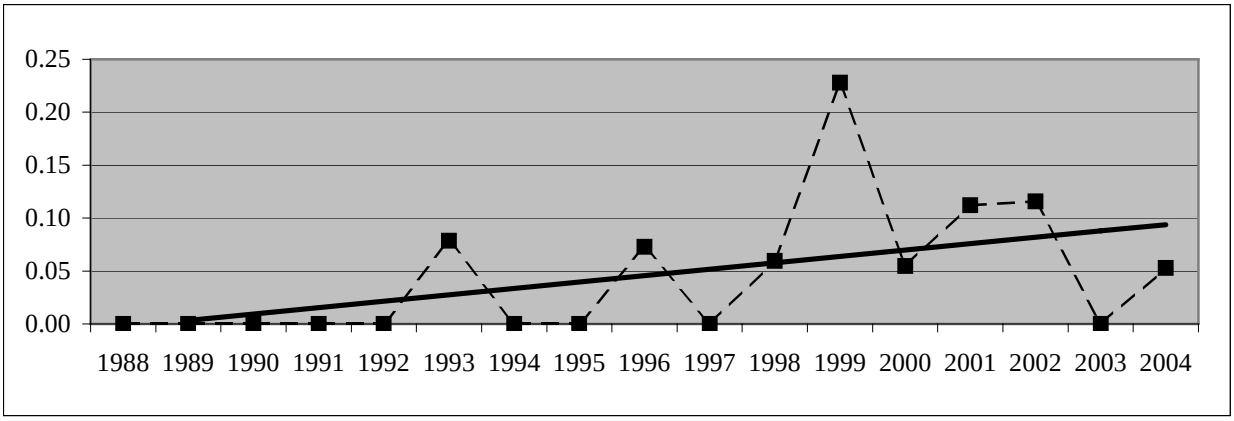

Figure 3. Rate of Abrupt Maneuvers (per million flight hours).

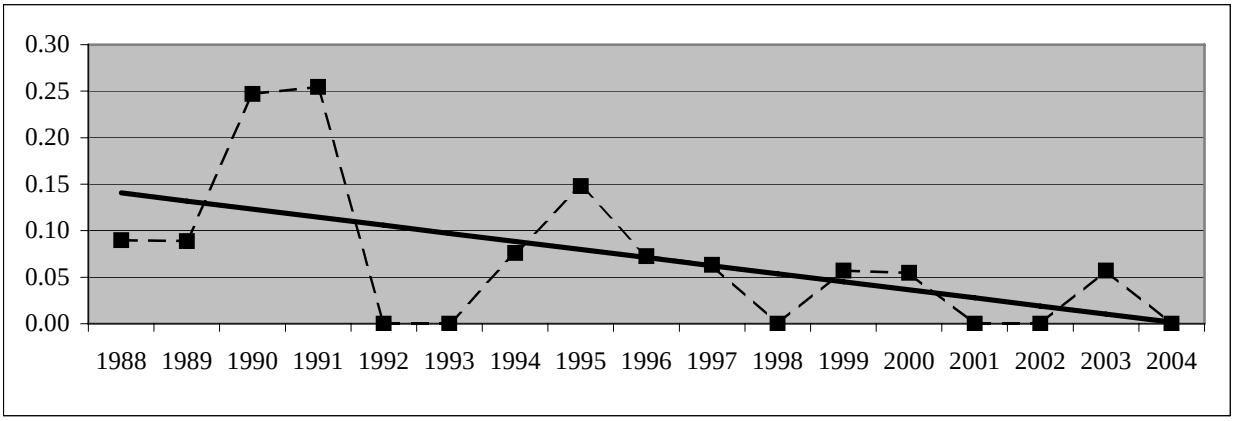

Figure 4. Rate of ATM Accidents (per million flight hours).

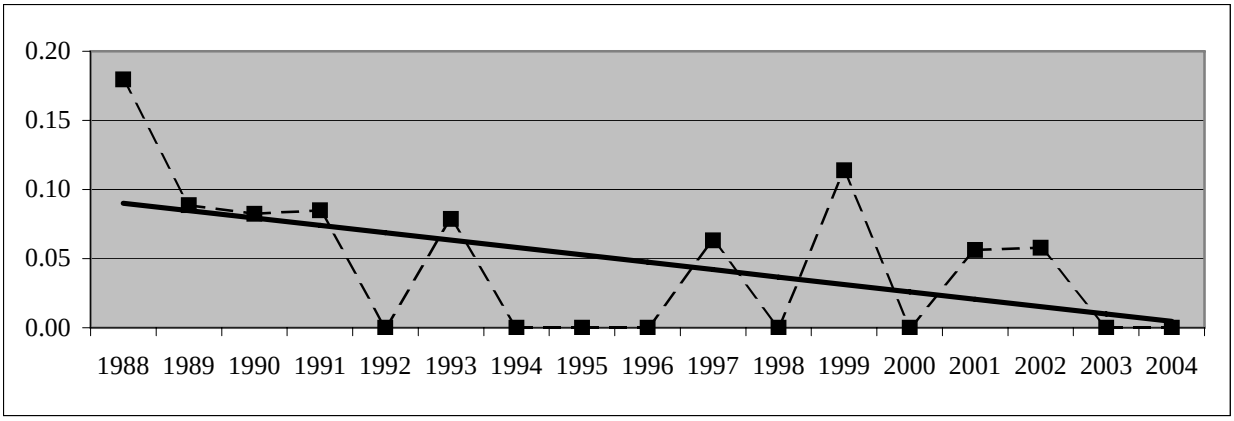

Figure 5. Rate of Cabin Accidents (per million flight hours).

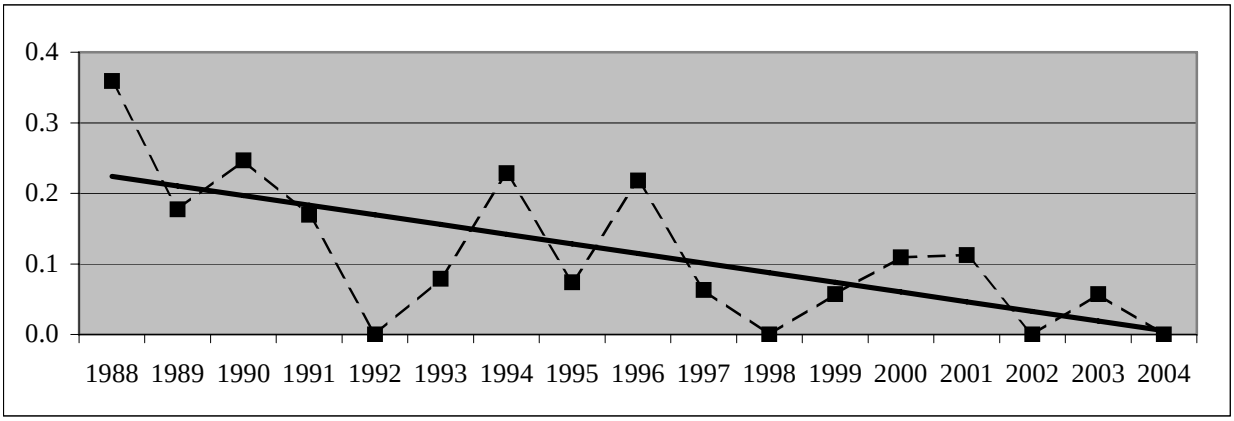

Figure 6. Rate of FAA Oversight Accidents (per million flight hours).

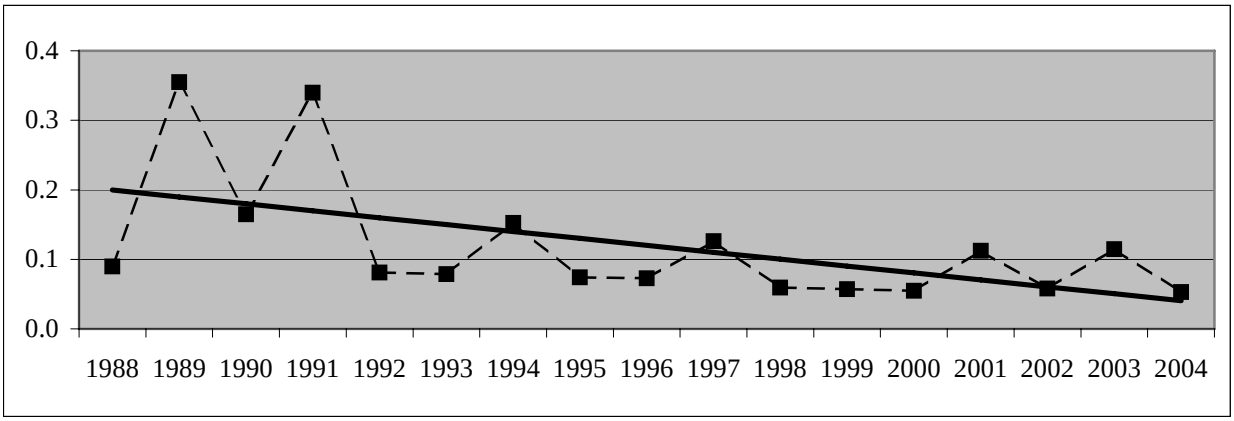

Figure 7. Rate of Post Impact Fires (per million flight hours).

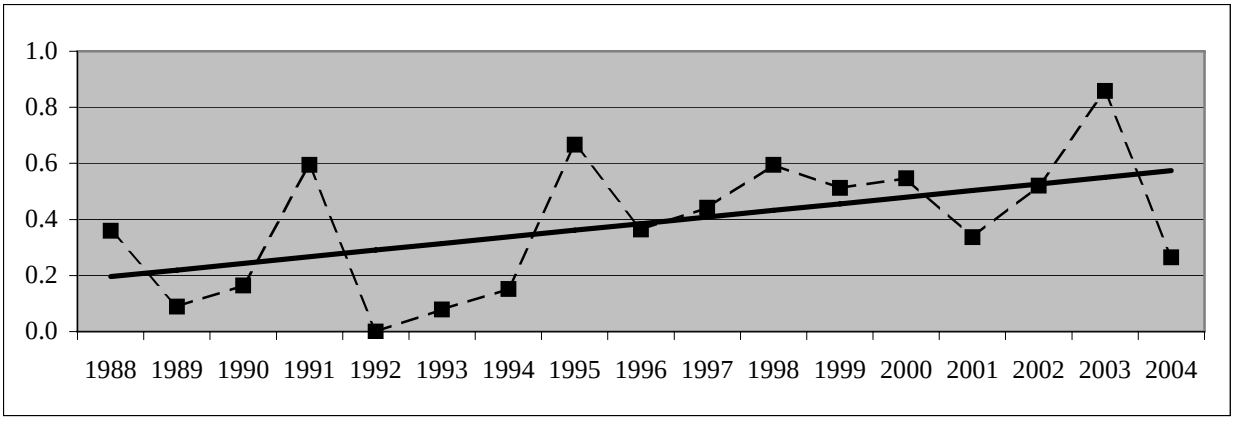

Figure 8. Rate of Ground Collisions (per million flight hours).

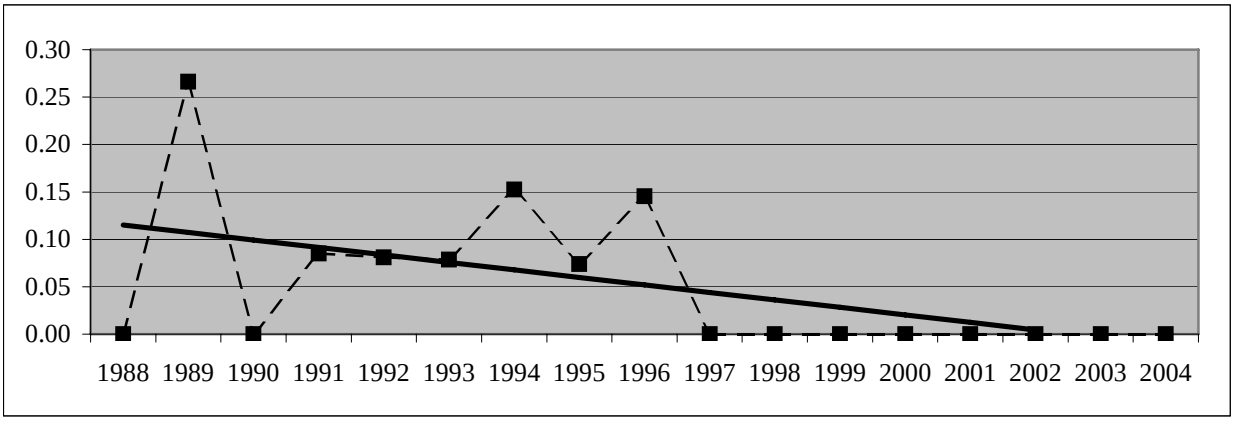

Figure 9. Rate of Loss of Control -- Approach/Landing (per million flight hours).

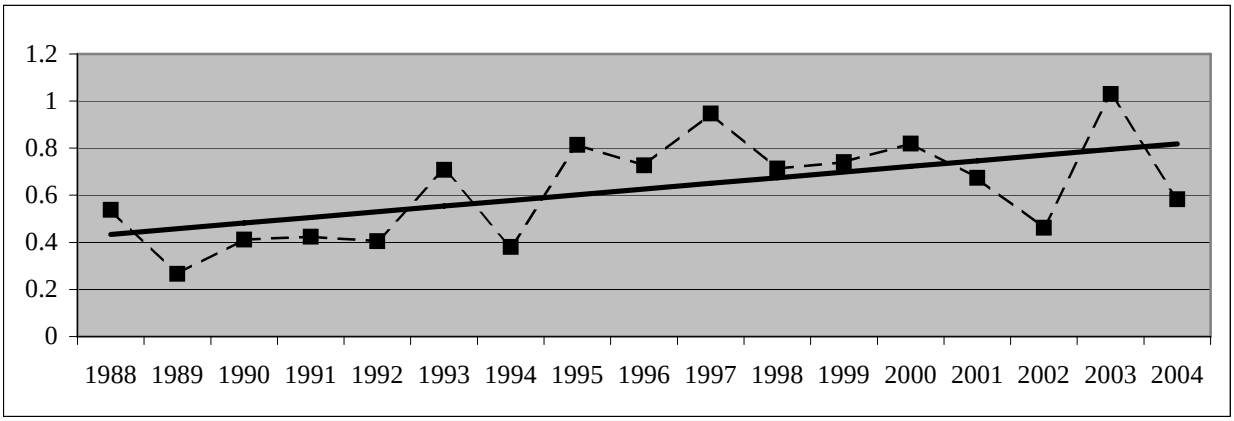

Figure 10. Rate of Turbulence Encounters (per million flight hours).

Figures 11 through 14 show the relative constancy (lack of trend) of rates among the four remaining most common or most often fatal CICTT categories.

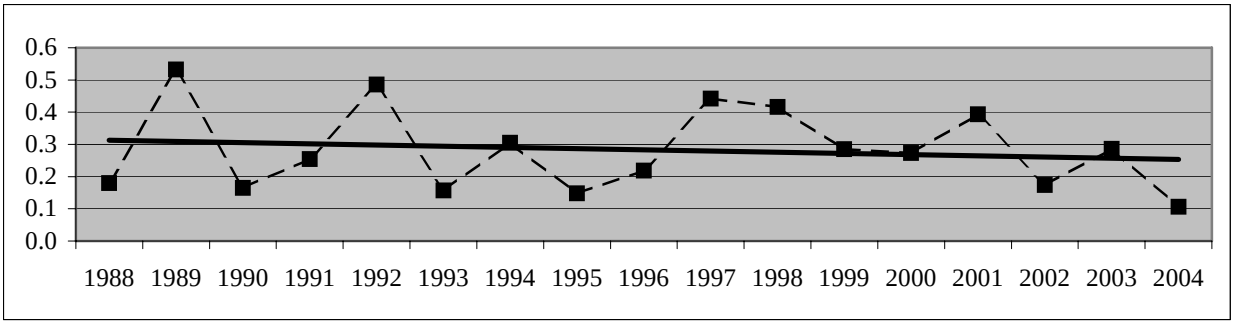

Figure 11. Rate of Ground Handling Events (per million flight hours).

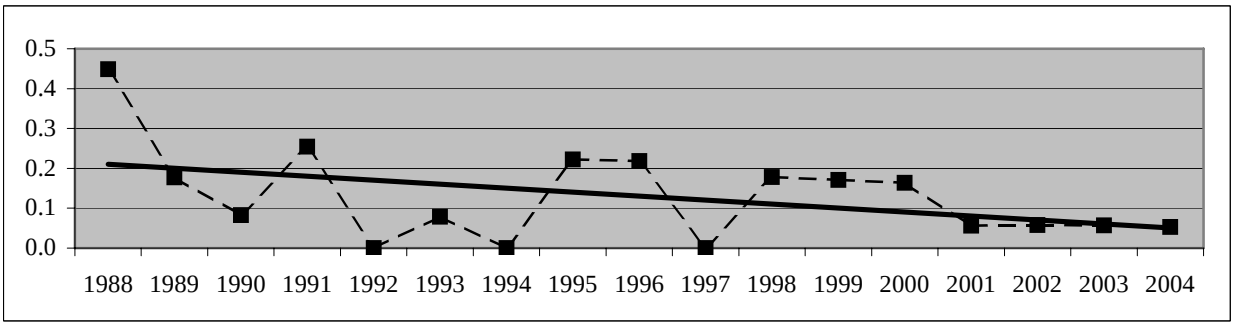

Figure 12. Rate of Non-Powerplant System/Component Failure/Malfunction (per million flight hours).

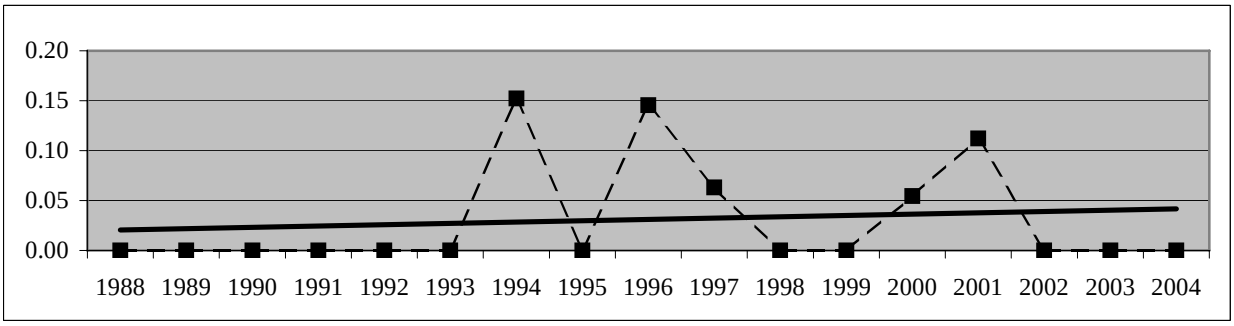

Figure 13. Rate of Loss of Control -- In Flight (per million flight hours).

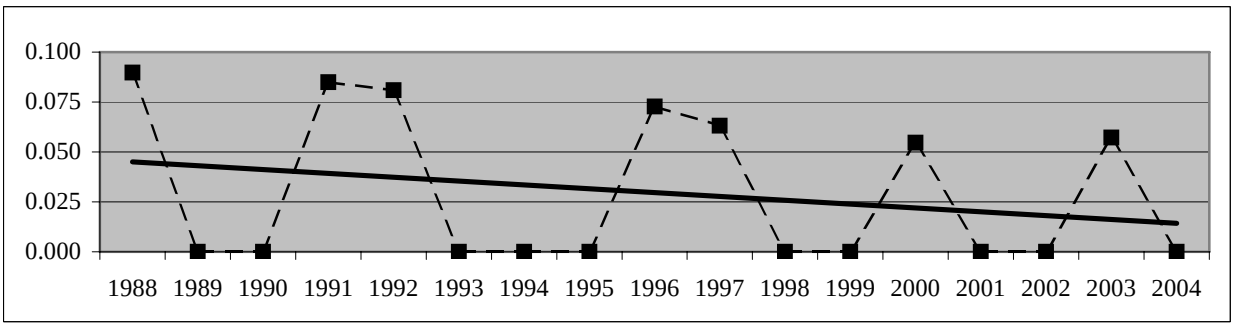

Figure14. Rate of Loss of Control -- Takeoff (per million flight hours).

Additional Miscellaneous Information

Table 11 presents the distribution of events by phase of flight. All percentages are based on the total events for that year. Slightly more than one-third (37%) of all accidents occurred during en route phases of flight, while slightly less than one-third (30%) occurred during standing or taxi phases.

Table 11. Phase of Flight for Initiating Occurrence

Year	Total Events	Standing or Taxi	Takeoff	En Route **	Approach or Landing	Unknown/ No Report
1988	30	6 (20.0%)	4 (13.3%)	12 (40.0%)	3 (10.0%)	5 (16.7%)
1989	28	8 (28.6%)	3 (10.7%)	12 (42.9%)	5 (17.9%)	0 (0.0%)
1990	25	8 (32.0%)	6 (24.0%)	7 (28.0%)	3 (12.0%)	1 (4.0%)
1991	27	10 (37.0%)	4 (14.8%)	7 (25.9%)	6 (22.2%)	0 (0.0%)
1992	18	8 (44.4%)	2 (11.1%)	5 (27.8%)	2 (11.1%)	1 (5.6%)
1993	23	3 (13.0%)	0 (0.0%)	10 (43.5%)	10 (43.5%)	0 (0.0%)
1994	23	5 (21.7%)	2 (8.7%)	10 (43.5%)	5 (21.7%)	1 (4.3%)
1995	37	13 (35.1%)	3 (8.1%)	15 (40.5%)	6 (16.2%)	0 (0.0%)
1996	39	11 (28.2%)	6 (15.4%)	14 (35.9%)	8 (20.5%)	0 (0.0%)
1997	49	16 (32.7%)	5 (10.2%)	20 (40.8%)	7 (14.3%)	1 (2.0%)
1998	50	19 (38.0%)	4 (8.0%)	14 (28.0%)	13 (26.0%)	0 (0.0%)
1999	52	14 (26.9%)	1 (1.9%)	22 (42.3%)	14 (26.9%)	1 (1.9%)
2000	56	13 (23.2%)	9 (16.1%)	21 (37.5%)	13 (23.2%)	0 (0.0%)
2001	48	13 (27.1%)	3 (6.3%)	21 (43.8%)	11 (22.9%)	0 (0.0%)
2002	41	13 (31.7%)	5 (12.2%)	11 (26.8%)	12 (29.3%)	0 (0.0%)
2003	54	22 (40.7%)	3 (5.6%)	19 (35.2%)	10 (18.5%)	0 (0.0%)
2004	30	7 (23.3%)	1 (3.3%)	13 (43.3%)	9 (30.0%)	0 (0.0%)
1988-2004	630	189 (30.0%)	61 (9.7%)	233 (37.0%)	137 (21.7%)	10 (1.6%)

** En route includes climb, cruise, descent and maneuvering flight

For the 93 accidents classified as either SCF-PP or SCF-NP, Table 12 provides information on the specific system or component involved in the failure or malfunction. Two accidents had malfunctions of both the landing gear and another system; one had an engine failure and structural malfunction. The “total events” percentage is based on the total number of accidents (630), while the percentages associated with number of injuries are based on the number of persons involved with all the accidents with a malfunction of that type. Failures or malfunctions were most common in the engine and landing gear. Malfunctions of a flight control system or surface occurred in only 1.7% of the accidents, but 50% of the persons involved with those flights were injured, and 98% of those injuries were fatal. Two of the five “other” systems related to galley furnishings, one was the APU, one was the air conditioning pack and the other (which included the fatality) was the pressurization system.

Table 12. Specific System/Component Failures/Malfunctions

Component or System Affected	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
Electrical System	3 (0.5%)	0 (0.0%)	28 (9.2%)	306
Engine	28 (4.4%)	117 (6.0%)	371 (19.1%)	1945
Flight Control System/Surfaces	11 (1.7%)	534 (49.5%)	542 (50.2%)	1079
Fuel System	2 (0.3%)	0 (0.0%)	3 (4.5%)	66
Hydraulic System	10 (1.6%)	0 (0.0%)	68 (8.1%)	837
Instrumentation/Communications/ Navigation	5 (0.8%)	4 (0.5%)	25 (3.3%)	748
Landing Gear	24 (3.8%)	0 (0.0%)	129 (5.9%)	2170
Lubricating System	1 (0.2%)	0 (0.0%)	5 (17.2%)	29
Propeller	3 (0.5%)	0 (0.0%)	1 (3.1%)	32
Structures	6 (1.0%)	14 (1.4%)	116 (11.4%)	1017
Other Systems	5 (0.8%)	1 (0.2%)	30 (5.7%)	524
Total	630 (100.0%)	2165 (3.9%)	4578 (8.2%)	55,795

Among Part 121 accidents during 1988-2004, there were 8 events with in-flight loss of control, 7 loss of control during takeoff climb, and 11 loss of control during approach or landing (also see Table 7). As shown in Table 13 below, between 38% and 64% of these events were precipitated by a system/component failure/malfunction, an in-flight fire, or a loss of engine power. Between 18% and 29% followed encounters with severe weather. The one in-flight loss of control that is considered to be secondary to other events is the Belle Harbor, New York crash in which the pilot inappropriately manipulated the rudder controls, leading to an overload failure of the vertical stabilizer. Because the failure was caused by the actions of the pilot, this event is not grouped with other system/component failures/malfunctions. The landing LOC secondary to other events involved inadequate preflight (open baggage door) and the subsequent failure to make a successful precautionary landing after takeoff.

Table 13. Prior Occurrences for Loss of Control

	In Flight Loss of Control	Takeoff Loss of Control	Approach/Landing Loss of Control
Primary LOC	2 (25.0%)	2 (28.6%)	1 (9.1%)
LOC secondary to system/comp failure/malf	1 (12.5%)	2 (28.6%)	6 (54.5%)
LOC secondary to fire or engine power loss	2 (25.0%)	1 (14.3%)	1 (9.1%)
LOC secondary to severe weather	2 (25.0%)	2 (28.6%)	2 (18.2%)
LOC secondary to other events	1 (12.5%)	0 (0.0%)	1 (9.1%)
Total	8 (100.%)	7 (100.%)	11 (100.%)

Part 135 Scheduled – Commuter Operations

Injuries and Aircraft Damage by Year

As shown in Table 14 below, there were a total of 217 accidents involving Part 135-Scheduled aircraft during the years 1988-2004. In March 1997 there was a change in the federal regulations defining the requirements for Part 121 versus Part 135 operations. As a result, Part 121 regulations were applied to more commuter operations, thus lowering both the number of flights and the total flight hours for Part 135. As a result, the rates of total accidents and fatal accidents jump dramatically when adjusted for total flight hours. However, following a peak in both total accidents and fatal accidents in 1999, rates have decreased steadily and now are approaching pre-1997 levels.

Table 14. Total Accidents and Fatal Accidents by Total Flight Hours per Year

Year	Total Events	Fatal Events	Fatal Events out of Total	Total Estim. Flight Hours	Events per million FH	Fatal per mil FH
1988	18	2	11.1%	2,092,689	8.601	0.956
1989	20	5	25.0%	2,240,555	8.926	2.232
1990	15	3	20.0%	2,341,760	6.405	1.281
1991	23	8	34.8%	2,291,581	10.037	3.491
1992	23	7	30.4%	2,335,349	9.849	2.997
1993	16	4	25.0%	2,638,347	6.064	1.516
1994	10	3	30.0%	2,784,129	3.592	1.078
1995	12	2	16.7%	2,627,866	4.566	0.761
1996	11	1	9.1%	2,756,755	3.990	0.363
1997	16	5	31.3%	982,764	16.281	5.088
1998	8	0	0.0%	353,670	22.620	0.000
1999	13	5	38.5%	342,731	37.931	14.589
2000	12	1	8.3%	369,535	32.473	2.706
2001	7	2	28.6%	300,432	23.300	6.657
2002	7	0	0.0%	273,559	25.589	0.000
2003	2	1	50.0%	319,206	6.266	3.133
2004	4	0	0.0%	302,218	13.235	0.000
1988-2004	217	49	22.6%	25,353,146	8.559	1.933

Figure 15 shows both the total accidents and fatal accidents each year, adjusted for total flight hours. The bars represent fatal events using the scale of the left axis. The connected diamonds represent total events according to the right axis.

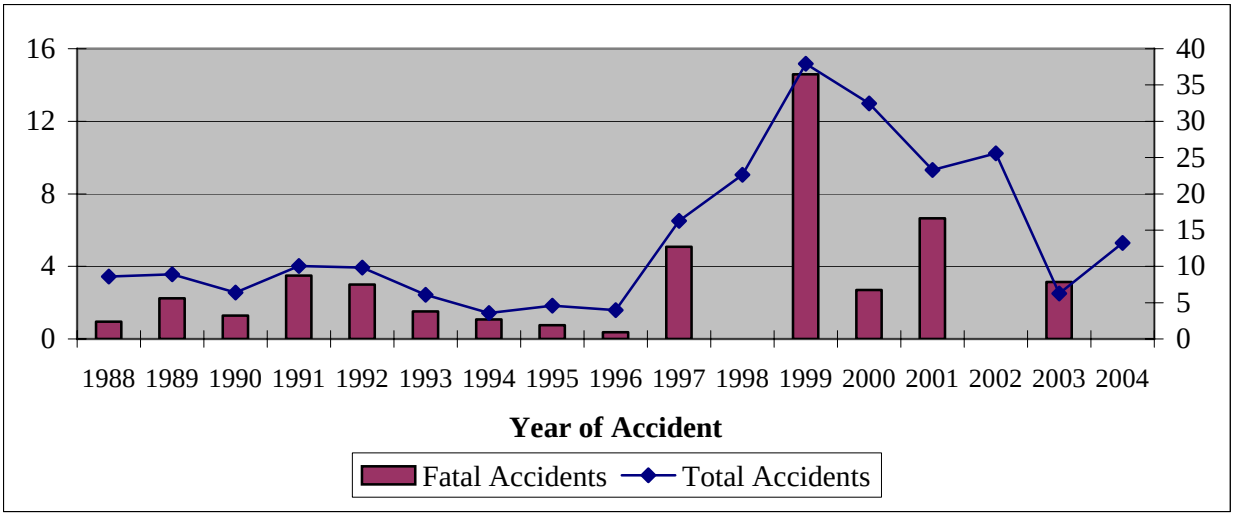

Figure 15. Fatal and Total Accidents per Million Flight Hours.

Table 15 shows the most severe injury in each event by year. All percentages are based on the total events for that year. Thirty-three percent of the accidents included a serious or fatal injury, while there were no injuries in 54% of the accidents.

Table 15. Most Severe Injury by Year of Accident

Year	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
1988	18	2 (11.1%)	2 (11.1%)	2 (11.1%)	12 (66.7%)
1989	20	5 (25.0%)	2 (10.0%)	3 (15.0%)	10 (50.0%)
1990	15	3 (20.0%)	2 (13.3%)	0 (0.0%)	10 (66.7%)
1991	23	8 (34.8%)	3 (13.0%)	3 (13.0%)	9 (39.1%)
1992	23	7 (30.4%)	1 (4.3%)	3 (13.0%)	12 (52.2%)
1993	16	4 (25.0%)	2 (12.5%)	2 (12.5%)	8 (50.0%)
1994	10	3 (30.0%)	1 (10.0%)	1 (10.0%)	5 (50.0%)
1995	12	2 (16.7%)	2 (16.7%)	0 (0.0%)	8 (66.7%)
1996	11	1 (9.1%)	1 (9.1%)	5 (45.5%)	4 (36.4%)
1997	16	5 (31.3%)	1 (6.3%)	3 (18.8%)	7 (43.8%)
1998	8	0 (0.0%)	2 (25.0%)	1 (12.5%)	5 (62.5%)
1999	13	5 (38.5%)	0 (0.0%)	1 (7.7%)	7 (53.8%)
2000	12	1 (8.3%)	1 (8.3%)	2 (16.7%)	8 (66.7%)
2001	7	2 (28.6%)	2 (28.6%)	0 (0.0%)	3 (42.9%)
2002	7	0 (0.0%)	0 (0.0%)	1 (14.3%)	6 (85.7%)
2003	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
2004	4	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100%)
1988-2004	217	49 (22.6%)	23 (10.6%)	27 (12.4%)	118 (54.4%)

Table 16 shows the number of persons killed or injured in these events. In the first column (Aircraft), the first number is the number of aircraft/events with an injury of that type, and the number in parentheses is the percentage out of the total number of accident aircraft. In the second column (Persons), the first number is the number of persons with an injury of that type, and the number in parentheses is the percentage out of the total number of that category of persons (aboard, crew, passengers, ground, or total) involved in these accidents. The total number of persons involved is defined to be the number of persons on board plus persons on the ground with injuries. The term "Ground" also includes persons on other aircraft, for those events which involved a Part 135-Scheduled aircraft and a non-Part 135-S aircraft. In the third column (Averages) the average number of persons with an injury of that type was calculated in two ways: based on the number of aircraft with an injury of that type, and based on the total number of accident aircraft (217).

Table 16. Total Number of Injuries

Specific Type of Injury	Aircraft	Persons	Averages
Total Persons Aboard	217 (100.0%)	1576 (100.0%)	7.26 (7.26)
Total Persons Involved	217 (100.0%)	1640 (100.0%)	7.56 (7.56)
Total Persons Injured	99 (45.6%)	573 (34.9%)	5.79 (2.64)
Fatal Injury Aboard	47 (21.7%)	301 (19.1%)	6.40 (1.39)
Crew Fatal Injury	43 (19.8%)	60 (19.2%)	1.40 (0.28)
Passengers Fatal Injury	40 (18.4%)	241 (19.1%)	6.03 (1.11)
Ground Fatal Injury	4 (1.8%)	27 (42.2%)	6.75 (0.12)
Total Fatal Injuries	49 (22.6%)	328 (20.0%)	6.69 (1.51)
Serious Injury Aboard	30 (13.8%)	86 (5.5%)	2.87 (0.40)
Crew Serious Injury	18 (8.3%)	20 (6.4%)	1.11 (0.09)
Passengers Serious Injury	28 (12.9%)	66 (5.2%)	2.36 (0.30)
Ground Serious Injury	4 (1.8%)	16 (25.0%)	4.00 (0.07)
Total Serious Injury	34 (15.7%)	102 (6.2%)	3.00 (0.47)
Minor Injury Aboard	41 (18.9%)	122 (7.7%)	2.98 (0.56)
Crew Minor Injury	16 (7.4%)	16 (5.1%)	1.00 (0.07)
Passengers Minor Injury	34 (15.7%)	106 (8.4%)	3.12 (0.49)
Ground Minor Injury	5 (2.3%)	21 (32.8%)	4.20 (0.10)
Total Minor Injury	46 (21.2%)	143 (8.7%)	3.11 (0.66)
Not Injured Aboard	163 (75.1%)	1067 (67.7%)	6.55 (4.92)
Crew Not Injured	152 (70.0%)	217 (69.3%)	1.43 (1.00)
Passengers Not Injured	140 (64.5%)	850 (67.3%)	6.07 (3.92)

Forty of the 49 fatal events included passenger fatalities (82%), and in 2 of the fatal events, no persons on board the Part 135-S aircraft were killed. In one of these accidents, persons on board a Part 91 flight were killed after a mid-air collision, and in the other, an airport employee walked into the propeller arc.

Sixty-eight percent of all persons on board the Part 135-S aircraft sustained no injuries in these 217 accidents. In the 99 accidents with injuries, an average of 6 persons per event were killed or injured, while the average across all 217 accidents is less than 3 persons killed or injured per accident. When an event included at least one fatality, an average of 7 persons died. In contrast, there was an average of 3 persons seriously injured, when the event included any serious injuries. When the event included any minor injuries, 3 persons on average sustained minor injuries.

Two hundred eight (96%) of the Part 135-S aircraft involved in these events were destroyed or suffered substantial damage (see Table 17), while 4% had minor or no damage. All percentages are based on the total events for that year.

Table 17. Aircraft Damage by Year of Accident

Year	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
1988	18	3 (16.7%)	14 (77.8%)	1 (5.6%)	0 (0.0%)
1989	20	5 (25.0%)	14 (70.0%)	0 (0.0%)	1 (5.0%)
1990	15	2 (13.3%)	12 (80.0%)	1 (6.7%)	0 (0.0%)
1991	23	9 (39.1%)	13 (56.5%)	0 (0.0%)	1 (4.3%)
1992	23	7 (30.4%)	16 (69.6%)	0 (0.0%)	0 (0.0%)
1993	16	4 (25.0%)	10 (62.5%)	0 (0.0%)	2 (12.5%)
1994	10	3 (30.0%)	6 (60.0%)	1 (10.0%)	0 (0.0%)
1995	12	3 (25.0%)	9 (75.0%)	0 (0.0%)	0 (0.0%)
1996	11	1 (9.1%)	10 (90.9%)	0 (0.0%)	0 (0.0%)
1997	16	5 (31.3%)	11 (68.8%)	0 (0.0%)	0 (0.0%)
1998	8	0 (0.0%)	8 (100%)	0 (0.0%)	0 (0.0%)
1999	13	4 (30.8%)	9 (69.2%)	0 (0.0%)	0 (0.0%)
2000	12	1 (8.3%)	11 (91.7%)	0 (0.0%)	0 (0.0%)
2001	7	2 (28.6%)	5 (71.4%)	0 (0.0%)	0 (0.0%)
2002	7	0 (0.0%)	6 (85.7%)	0 (0.0%)	1 (14.3%)
2003	2	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)
2004	4	0 (0.0%)	4 (100%)	0 (0.0%)	0 (0.0%)
1988-2004	217	49 (22.6%)	159 (73.3%)	3 (1.4%)	6 (2.8%)

Table 18 shows the distribution of the NTSB severity classification. All percentages are based on the total events for that year. Thirty percent of the accidents were considered either major or serious, while 66% were classified as “damage” accidents.

Table 18. Accident Severity Classification by Year of Accident

Year	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
1988	18	3 (16.7%)	0 (0.0%)	1 (5.6%)	14 (77.8%)
1989	20	5 (25.0%)	1 (5.0%)	1 (5.0%)	13 (65.0%)
1990	15	3 (20.0%)	1 (6.7%)	1 (6.7%)	10 (66.7%)
1991	23	9 (39.1%)	1 (4.3%)	1 (4.3%)	12 (52.2%)
1992	23	7 (30.4%)	1 (4.3%)	0 (0.0%)	15 (65.2%)
1993	16	4 (25.0%)	2 (12.5%)	1 (6.3%)	9 (56.3%)
1994	10	3 (30.0%)	0 (0.0%)	1 (10.0%)	6 (60.0%)
1995	12	3 (25.0%)	1 (8.3%)	0 (0.0%)	8 (66.7%)
1996	11	1 (9.1%)	1 (9.1%)	0 (0.0%)	9 (81.8%)
1997	16	5 (31.3%)	1 (6.3%)	0 (0.0%)	10 (62.5%)
1998	8	0 (0.0%)	2 (25.0%)	0 (0.0%)	6 (75.0%)
1999	13	5 (38.5%)	0 (0.0%)	0 (0.0%)	8 (61.5%)
2000	12	1 (8.3%)	1 (8.3%)	0 (0.0%)	10 (83.3%)
2001	7	3 (42.9%)	1 (14.3%)	0 (0.0%)	3 (42.9%)
2002	7	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (100%)
2003	2	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)
2004	4	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100%)
1988-2004	217	53 (24.4%)	13 (6.0%)	7 (3.2%)	144 (66.4%)

Injuries and Aircraft Damage by CICTT Accident Category

Figure 16 and Table 19 present the breakdown of CICTT accident categories in the 1988-2004 accidents. The first column of Table 19 lists the category abbreviation with an explanation of the abbreviation. Refer to Appendix A for a more detailed explanation of these categories. The second column lists the number of accidents in this category (with a percentage out of the total number of accidents, not the total number of category assignments). The third column lists the number of fatal injuries in all the accidents for that category, with a percentage out of the number of persons involved in those accidents (see column 5) and the fourth column shows the total number of injuries of any type in those accidents (again, with a percentage based on column 5).

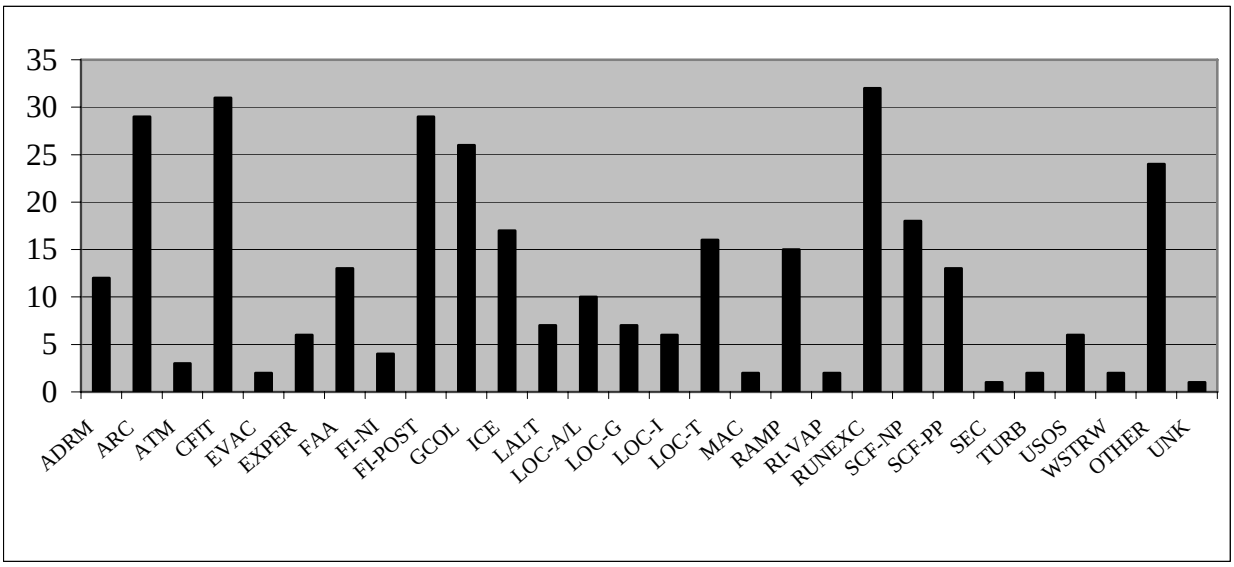

Figure 16. CICTT Accident Categories in Scheduled Part 135 data from 1988-2004.

The most common categories are runway excursion (15% of events), CFIT (14%), post-impact fire (14%), abnormal runway contact (13%), and ground collision (12%). The categories with fatal injuries to more than half of all those persons involved in the accident are windshear/thunderstorm (88%), LOC-A/L (82%), post-impact fire (66%), FAA oversight (66%), RI-VAP (62%), CFIT (57%), LOC-T (52%) and ATM (52%). The categories with any type of injury to more than two-thirds of all those persons involved in the accident are windshear/thunderstorm (100%), RI-VAP (100%), ATM (96%), post-impact fire (95%), FAA oversight (95%), LOC-A/L (94%), CFIT (89%), LALT (79%), LOC-I (67%), LOC-T (67%) and turbulence (67%).

Table 19. CICTT accident categories

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
ADRM (Aerodrome)	12 (5.5%)	0 (0.0%)	1 (1.0%)	103
ARC (Abnormal Runway Contact)	29 (13.4%)	5 (1.9%)	42 (15.8%)	265
ATM (Air Traffic Management)	3 (1.4%)	40 (51.9%)	74 (96.1%)	77
CFIT (Controlled Flight Into or Toward Terrain)	31 (14.3%)	94 (56.6%)	148 (89.2%)	166
EVAC (Evacuation)	2 (0.9%)	2 (14.3%)	9 (64.3%)	14
EXPER (Experience/Training Issues)	6 (2.8%)	6 (10.9%)	12 (21.8%)	55
FAA (Inadequate FAA Oversight)	13 (6.0%)	167 (65.7%)	241 (94.9%)	254
FI-NI (Fire/Smoke – Non-Impact)	4 (1.8%)	0 (0.0%)	1 (5.3%)	19
FI-POST (Fire – Post Impact)	29 (13.4%)	232 (66.1%)	335 (95.4%)	351
GCOL (Ground Collision)	26 (12.0%)	0 (0.0%)	9 (3.7%)	244
ICE (Icing)	17 (7.8%)	53 (30.1%)	85 (48.3%)	176
LALT(Low Altitude Operations)	7 (3.2%)	6 (25.0%)	19 (79.2%)	24
LOC-A/L (Loss of Control – A/L)	10 (4.6%)	101 (82.1%)	115 (93.5%)	123
LOC-G (Loss of Control – Ground)	7 (3.2%)	0 (0.0%)	1 (2.4%)	41
LOC-I (Loss of Control – In Flight)	6 (2.8%)	18 (34.6%)	35 (67.3%)	52
LOC-T (Loss of Control – Takeoff)	16 (7.4%)	42 (51.9%)	54 (66.7%)	81
MAC (Mid Air Coll or Lack of Sep)	2 (0.9%)	2 (10.5%)	7 (36.8%)	19
RAMP (Ground Handling)	15 (6.9%)	15 (13.2%)	24 (21.1%)	114
RE (Runway Excursion)	32 (14.7%)	0 (0.0%)	38 (11.8%)	323
RI-VAP (Runway Incursion – Vehicle or Aircraft or Person)	2 (0.9%)	48 (61.5%)	78 (100.%)	78
SCF-NP (System/Component Failure or Malfunction -- Non-Powerplant)	18 (8.3%)	19 (13.5%)	33 (23.4%)	141
SCF-PP (System/Component Failure or Malfunction -- Powerplant)	13 (6.0%)	33 (19.8%)	87 (52.1%)	167
SEC (Security)	1 (0.5%)	0 (0.0%)	1 (20.0%)	5
TURB (Turbulence)	2 (0.9%)	3 (50.0%)	4 (66.7%)	6
USOS (Undershoot/Overshoot)	6 (2.8%)	0 (0.0%)	0 (0.0%)	23
WSTRW (Windshear/Thunderstorm)	2 (0.9%)	15 (88.2%)	17 (100.%)	17
OTHER (Other)	24 (11.1%)	35 (23.2%)	73 (48.3%)	151
UNK (Unknown/Not Reported)	1 (0.5%)	5 (100.%)	5 (100.%)	5
Total	217 (100.%)	328 (20.0%)	573 (34.9%)	1640

Table 20 shows the distribution of most severe injury in each CICTT accident category. All percentages in Tables 3.7 through 3.9 are based on the total events for that category. The categories most likely to include a fatal injury are windshear/thunderstorm (100%), RI-VAP (100%), post-impact fire (86%), FAA oversight (85%), LOC-A/L (80%), LOC-I (67%), ATM (67%) and CFIT (61%). The categories most

likely to have no injuries are undershoot/overshoot (100%), aerodrome (92%), LOC-Ground (86%), abnormal runway contact (79%), ground collision (77%), non-impact fire (75%), runway excursion (69%) and non-powerplant system/component failure/malfunction (67%).

Table 20. Most Severe Injury by CICTT accident category

CICTT category	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
ADRM	12	0 (0.0%)	0 (0.0%)	1 (8.3%)	11 (91.7%)
ARC	29	1 (3.4%)	3 (10.3%)	2 (6.9%)	23 (79.3%)
ATM	3	2 (66.7%)	0 (0.0%)	1 (33.3%)	0 (0.0%)
CFIT	31	19 (61.3%)	6 (19.4%)	4 (12.9%)	2 (6.5%)
EVAC	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
EXPER	6	2 (33.3%)	0 (0.0%)	2 (33.3%)	2 (33.3%)
FAA	13	11 (84.6%)	1 (7.7%)	1 (7.7%)	0 (0.0%)
FI-NI	4	0 (0.0%)	1 (25.0%)	0 (0.0%)	3 (75.0%)
FI-POST	29	25 (86.2%)	3 (10.3%)	0 (0.0%)	1 (3.4%)
GCOL	26	0 (0.0%)	1 (3.8%)	5 (19.2%)	20 (76.9%)
ICE	17	4 (23.5%)	1 (5.9%)	3 (17.6%)	9 (52.9%)
LALT	7	3 (42.9%)	2 (28.6%)	0 (0.0%)	2 (28.6%)
LOC-A/L	10	8 (80.0%)	0 (0.0%)	0 (0.0%)	2 (20.0%)
LOC-G	7	0 (0.0%)	0 (0.0%)	1 (14.3%)	6 (85.7%)
LOC-I	6	4 (66.7%)	1 (16.7%)	1 (16.7%)	0 (0.0%)
LOC-T	16	7 (43.8%)	1 (6.3%)	2 (12.5%)	6 (37.5%)
MAC	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
RAMP	15	4 (26.7%)	5 (33.3%)	1 (6.7%)	5 (33.3%)
RE	32	0 (0.0%)	2 (6.3%)	8 (25.0%)	22 (68.8%)
RI-VAP	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
SCF-NP	18	2 (11.1%)	2 (11.1%)	2 (11.1%)	12 (66.7%)
SCF-PP	13	3 (23.1%)	1 (7.7%)	4 (30.8%)	5 (38.5%)
SEC	1	0 (0.0%)	0 (0.0%)	1 (100.%)	0 (0.0%)
TURB	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
USOS	6	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (100.%)
WSTRW	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
OTHER	24	5 (20.8%)	0 (0.0%)	3 (12.5%)	16 (66.7%)
UNK	1	1 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	217	49 (22.6%)	23 (10.6%)	27 (12.4%)	118 (54.4%)

Table 21 shows the distribution of aircraft damage in each CICTT accident category. The categories most likely to result in aircraft destruction are windshear/thunderstorm (100%), RI-VAP (100%), post-impact

fire (97%), FAA oversight (92%), LOC-A/L (80%), CFIT (68%), LOC-I (67%) and ATM (67%). The only events with less than substantial damage were in the categories of evacuation, non-impact fire, ground collision, ground handling, non-powerplant system/component failure/malfunction and turbulence.

Table 21. Aircraft Damage by CICTT accident category

CICTT Category	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
ADRM	12	0 (0.0%)	12 (100.%)	0 (0.0%)	0 (0.0%)
ARC	29	2 (6.9%)	27 (93.1%)	0 (0.0%)	0 (0.0%)
ATM	3	2 (66.7%)	1 (33.3%)	0 (0.0%)	0 (0.0%)
CFIT	31	21 (67.7%)	10 (32.3%)	0 (0.0%)	0 (0.0%)
EVAC	2	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)
EXPER	6	2 (33.3%)	4 (66.7%)	0 (0.0%)	0 (0.0%)
FAA	13	12 (92.3%)	1 (7.7%)	0 (0.0%)	0 (0.0%)
FI-NI	4	0 (0.0%)	3 (75.0%)	1 (25.0%)	0 (0.0%)
FI-POST	29	28 (96.6%)	1 (3.4%)	0 (0.0%)	0 (0.0%)
GCOL	26	0 (0.0%)	25 (96.2%)	0 (0.0%)	1 (3.8%)
ICE	17	6 (35.3%)	11 (64.7%)	0 (0.0%)	0 (0.0%)
LALT	7	3 (42.9%)	4 (57.1%)	0 (0.0%)	0 (0.0%)
LOC-A/L	10	8 (80.0%)	2 (20.0%)	0 (0.0%)	0 (0.0%)
LOC-G	7	0 (0.0%)	7 (100.%)	0 (0.0%)	0 (0.0%)
LOC-I	6	4 (66.7%)	2 (33.3%)	0 (0.0%)	0 (0.0%)
LOC-T	16	7 (43.8%)	9 (56.3%)	0 (0.0%)	0 (0.0%)
MAC	2	0 (0.0%)	2 (100.%)	0 (0.0%)	0 (0.0%)
RAMP	15	2 (13.3%)	8 (53.3%)	1 (6.7%)	4 (26.7%)
RUNEXC	32	0 (0.0%)	32 (100.%)	0 (0.0%)	0 (0.0%)
RI-VAP	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
SCF-NP	18	2 (11.1%)	15 (83.3%)	1 (5.6%)	0 (0.0%)
SCF-PP	13	3 (23.1%)	10 (76.9%)	0 (0.0%)	0 (0.0%)
SEC	1	0 (0.0%)	1 (100.%)	0 (0.0%)	0 (0.0%)
TURB	2	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)
USOS	6	0 (0.0%)	6 (100.%)	0 (0.0%)	0 (0.0%)
WSTRW	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
OTHER	24	5 (20.8%)	19 (79.2%)	0 (0.0%)	0 (0.0%)
UNK	1	1 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	217	49 (22.6%)	159 (73.3%)	3 (1.4%)	6 (2.8%)

Table 22 shows the severity classification in each CICTT accident category. The categories most likely to include “major” accidents are windshear/thunderstorm (100%), RI-VAP (100%), post-impact fire (97%),

FAA oversight (92%), LOC-A/L (80%), CFIT (68%), ATM (67%) and LOC-I (67%). The categories with less than 10% of the accidents either "Major" or "Serious" are aerodrome (0%), non-impact fire (0%), Loss of Control – Ground (0%), security (0%), undershoot/overshoot (0%), ground collision (4%) and runway excursion (6%).

Table 22. Accident Severity Classification by CICTT Accident Category

CICTT Category	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
ADRM	12	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (100.%)
ARC	29	2 (6.9%)	2 (7.1%)	0 (0.0%)	25 (86.2%)
ATM	3	2 (66.7%)	2 (6.9%)	0 (0.0%)	1 (33.3%)
CFIT	31	21 (67.7%)	4 (12.9%)	0 (0.0%)	6 (19.4%)
EVAC	2	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)
EXPER	6	2 (33.3%)	0 (0.0%)	0 (0.0%)	4 (66.7%)
FAA	13	12 (92.3%)	0 (0.0%)	0 (0.0%)	1 (7.7%)
FI-NI	4	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)
FI-POST	29	28 (96.6%)	0 (0.0%)	0 (0.0%)	1 (3.4%)
GCOL	26	0 (0.0%)	1 (3.8%)	0 (0.0%)	25 (96.2%)
ICE	17	6 (35.3%)	0 (0.0%)	0 (0.0%)	11 (64.7%)
LALT	7	3 (42.9%)	2 (28.6%)	0 (0.0%)	2 (28.6%)
LOC-A/L	10	8 (80.0%)	0 (0.0%)	0 (0.0%)	2 (20.0%)
LOC-G	7	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (100.%)
LOC-I	6	4 (66.7%)	1 (16.7%)	0 (0.0%)	1 (16.7%)
LOC-T	16	9 (56.3%)	0 (0.0%)	0 (0.0%)	7 (43.8%)
MAC	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
RAMP	15	3 (20.0%)	2 (13.3%)	4 (26.7%)	6 (40.0%)
RUNEXC	32	0 (0.0%)	2 (6.3%)	0 (0.0%)	30 (93.8%)
RI-VAP	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
SCF-NP	18	2 (11.1%)	1 (5.6%)	1 (5.6%)	14 (77.8%)
SCF-PP	13	4 (30.8%)	0 (0.0%)	0 (0.0%)	9 (69.2%)
SEC	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.%)
TURB	2	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)
USOS	6	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (100.%)
WSTRW	2	2 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
OTHER	24	5 (20.8%)	0 (0.0%)	0 (0.0%)	19 (79.2%)
UNK	1	1 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	53 (24.4%)	13 (6.0%)	7 (3.2%)	144 (66.4%)	53 (24.4%)

Trends over time in CICTT Accident Categories

The only CICTT category found to show a significant trend over time was Abnormal Runway Contact (see Figure 17 below). The estimated regression line displaying the increase in the rate of these accidents is included on the chart.

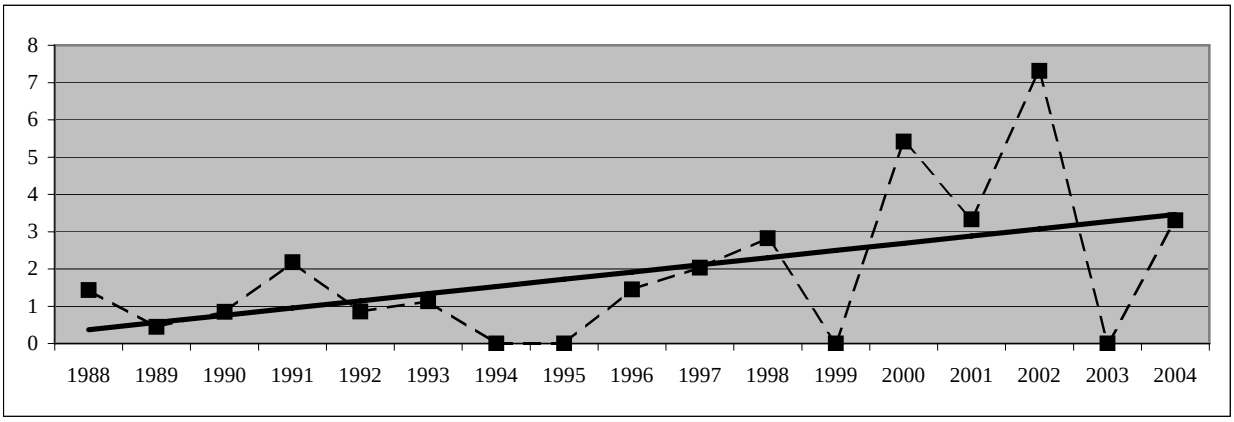

Figure 17. Rate of Abnormal Runway Contact (per million flight hours).

Figures 18 through 23 show the relative constancy (lack of trend) of rates among the six remaining most common or most often fatal CICTT categories.

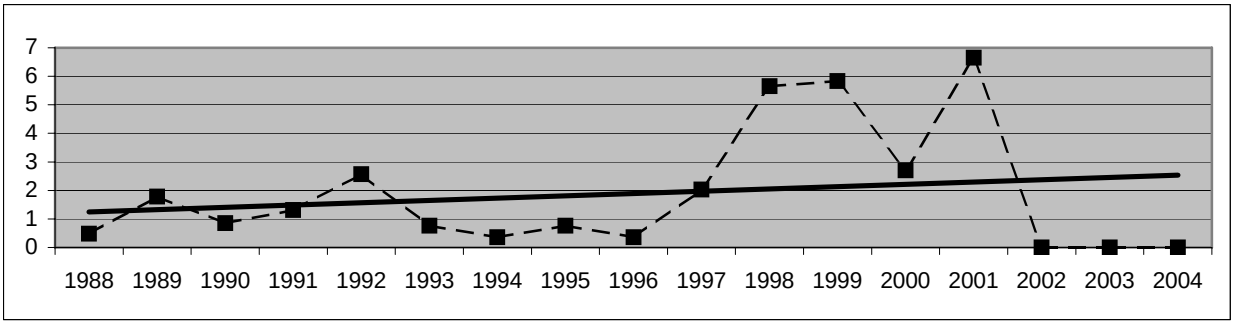

Figure 18. Rate of CFIT (per million flight hours).

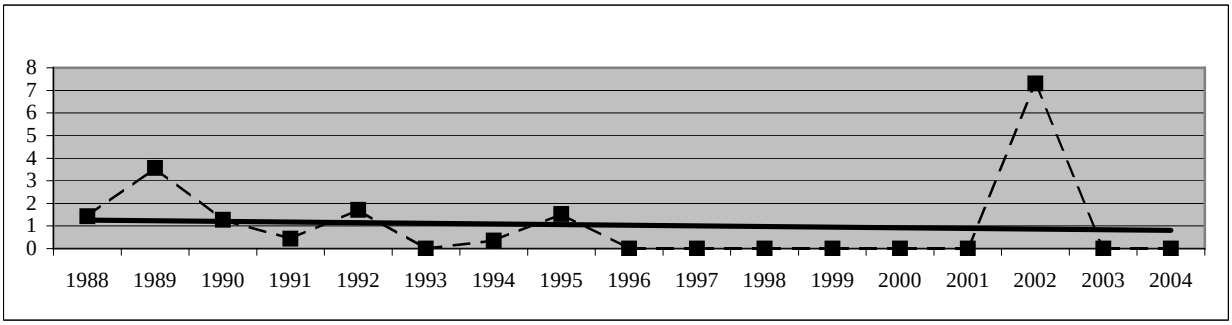

Figure 19. Rate of Ground Collisions (per million flight hours).

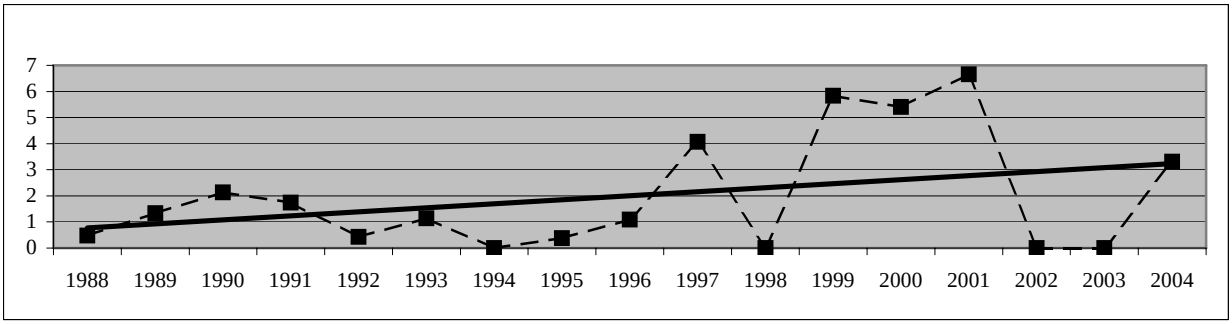

Figure 20. Rate of Runway Excursions (per million flight hours).

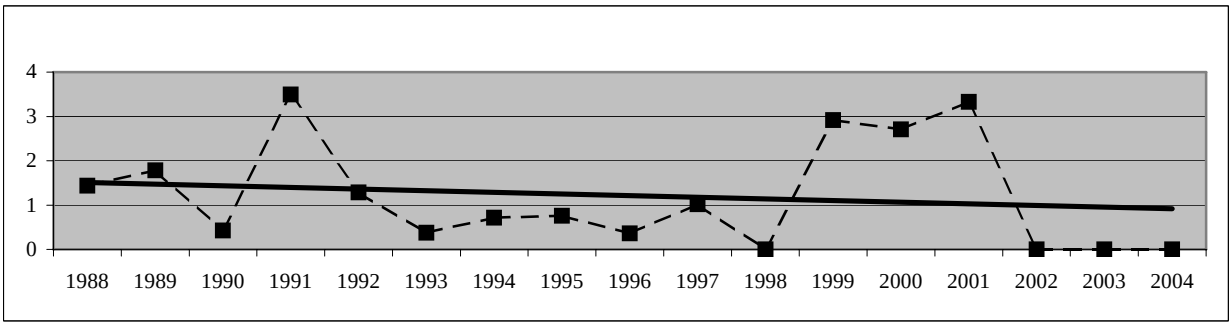

Figure 21. Rate of Post-Impact Fires (per million flight hours).

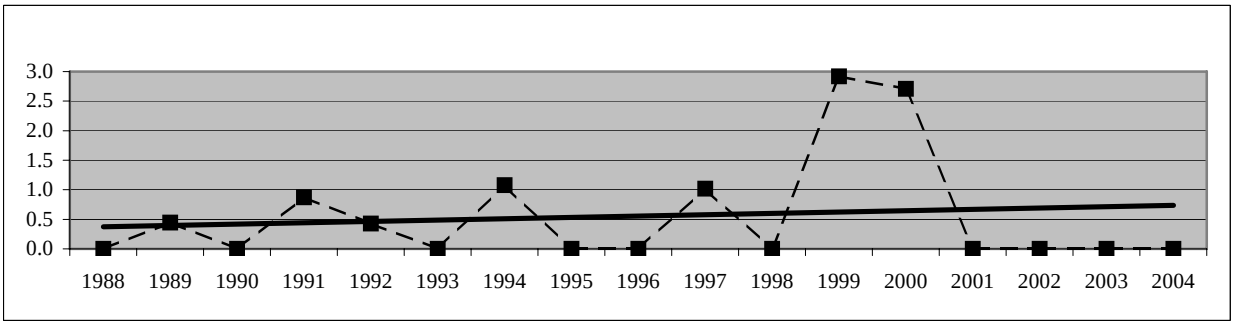

Figure 22. Rate of Loss of Control -- Approach/Landing (per million flight hours).

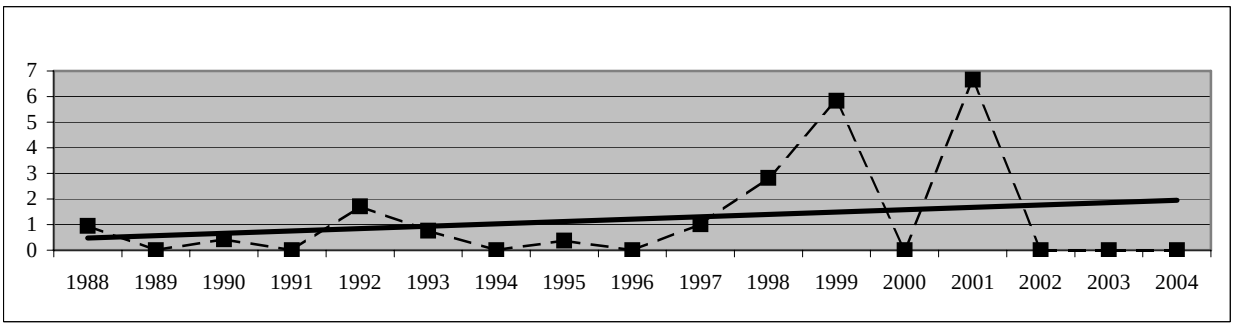

Figure 23. Rate of Loss of Control -- Takeoff (per million flight hours).

Additional Miscellaneous Information

Table 23 presents the distribution of events by phase of flight. All percentages are based on the total events for that year. Approximately 34% all accidents occurred during the Approach or Landing phases of flight, while 29% occurred en route.

Table 23. Phase of Flight for Initiating Occurrence

Year	Total Events	Standing or Taxi	Takeoff	En Route **	Approach or Landing	Unknown/ No Report
1988	18	6 (33.3%)	3 (16.7%)	4 (22.2%)	5 (27.8%)	0 (0.0%)
1989	20	10 (50.0%)	1 (5.0%)	5 (25.0%)	4 (20.0%)	0 (0.0%)
1990	15	3 (20.0%)	1 (6.7%)	4 (26.7%)	7 (46.7%)	0 (0.0%)
1991	23	3 (13.0%)	4 (17.4%)	8 (34.8%)	7 (30.4%)	1 (4.3%)
1992	23	4 (17.4%)	4 (17.4%)	5 (21.7%)	10 (43.5%)	0 (0.0%)
1993	16	3 (18.8%)	6 (37.5%)	3 (18.8%)	4 (25.0%)	0 (0.0%)
1994	10	1 (10.0%)	1 (10.0%)	2 (20.0%)	6 (60.0%)	0 (0.0%)
1995	12	4 (33.3%)	3 (25.0%)	4 (33.3%)	1 (8.3%)	0 (0.0%)
1996	11	0 (0.0%)	3 (27.3%)	4 (36.4%)	4 (36.4%)	0 (0.0%)
1997	16	0 (0.0%)	3 (18.8%)	5 (31.3%)	8 (50.0%)	0 (0.0%)
1998	8	0 (0.0%)	1 (12.5%)	4 (50.0%)	3 (37.5%)	0 (0.0%)
1999	13	0 (0.0%)	4 (30.8%)	7 (53.8%)	2 (15.4%)	0 (0.0%)
2000	12	0 (0.0%)	2 (16.7%)	4 (33.3%)	6 (50.0%)	0 (0.0%)
2001	7	0 (0.0%)	5 (71.4%)	1 (14.3%)	1 (14.3%)	0 (0.0%)
2002	7	2 (28.6%)	1 (14.3%)	1 (14.3%)	3 (42.9%)	0 (0.0%)
2003	2	0 (0.0%)	0 (0.0%)	2 (100.%)	0 (0.0%)	0 (0.0%)
2004	4	0 (0.0%)	1 (25.0%)	0 (0.0%)	3 (75.0%)	0 (0.0%)
1988-2004	217	36 (16.6%)	43 (19.8%)	63 (29.0%)	74 (34.1%)	1 (0.5%)

** En route includes climb, cruise, descent and maneuvering flight

For the 31 accidents classified as either SCF-PP or SCF-NP, Table 24 provides information on the specific system or component involved in the failure or malfunction. The “total events” percentage is based on the total number of accidents (217), while the percentages associated with number of injuries are based on the number of persons involved with all the accidents with a malfunction of that type. Failures or malfunctions were most common in the engine and landing gear. Malfunctions of a flight control system or surface occurred in only 1.4% of the accidents, but 88% of the persons involved with those flights were fatally injured. Similarly, propeller failures/malfunctions accounted for only 1.4% of accidents, but 79% of the persons involved were injured, and nearly half of the injuries were fatal.

Table 24. Specific System/Component Failures/Malfunctions

Component or System Affected	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
Engine	10 (4.6%)	2 (2.4%)	22 (25.9%)	85
Flight Control System/Surfaces	3 (1.4%)	14 (87.5%)	14 (87.5%)	16
Fuel System	1 (0.5%)	0 (0.0%)	5 (100.%)	5
Hydraulic System	2 (0.9%)	0 (0.0%)	0 (0.0%)	39
Landing Gear	10 (4.6%)	5 (7.6%)	11 (16.7%)	66
Propeller	3 (1.4%)	31 (37.8%)	65 (79.3%)	82
Structures	1 (0.5%)	0 (0.0%)	1 (25.0%)	4
Other (False Stall Warning)	1 (0.5%)	0 (0.0%)	2 (18.2%)	11
Total	217 (100.0%)	328 (20.0%)	573 (34.9%)	1640

Among Scheduled Part 135 accidents during 1988-2004, there were 6 events with in-flight loss of control, 16 with loss of control during takeoff climb, and 10 with loss of control during approach or landing (also see Table 19). As shown in Table 25 below, between 6% and 17% of these events were precipitated by a system/component failure/malfunction. Between 33% and 44% of the loss of control were considered primary LOC, with no prior occurrences, and between 33% and 44% followed encounters with severe weather. The LOC due to other events during takeoff involved an open door, and the LOC during approach/landing involved a failure to extend the landing gear, with a stall during the aborted landing.

Table 25. Prior occurrences for Loss of Control

	In Flight Loss of Control	Takeoff Loss of Control	Approach/Landing Loss of Control
Primary LOC	2 (33.3%)	7 (43.8%)	4 (40.0%)
LOC secondary to system/comp failure/malf	1 (16.7%)	1 (6.3%)	1 (10.0%)
LOC secondary to fire or engine power loss	0 (0.0%)	0 (0.0%)	0 (0.0%)
LOC secondary to low altitude maneuvering	1 (16.7%)	0 (0.0%)	0 (0.0%)
LOC secondary to severe weather	2 (33.3%)	7 (43.8%)	4 (40.0%)
LOC secondary to other events	0 (0.0%)	1 (6.3%)	1 (10.0%)
Total	6 (100.%)	16 (100.%)	10 (100.%)

Part 135 Non-Scheduled – On-Demand Operations

Injuries and Aircraft Damage by Year

As shown in Table 26 below, there were a total of 1115 accidents involving Part 135-Non-Scheduled aircraft during the years 1988-2004. Following a peak in both total accidents and fatal accidents in 1990, rates have decreased steadily to less than half of the 1990 rates.

Table 26. Total Accidents and Fatal Accidents by Total Flight Hours per Year

Year	Total Events	Fatal Events	Fatal Events out of Total	Total Estim. Flight Hours	Events per million FH	Fatal per mil FH
1988	86	23	26.7%	2,632,000	32.675	8.739
1989	88	18	20.5%	3,020,000	29.139	5.960
1990	86	25	29.1%	2,249,000	38.239	11.116
1991	69	22	31.9%	2,241,000	30.790	9.817
1992	60	19	31.7%	2,844,000	21.097	6.681
1993	55	14	25.5%	2,324,000	23.666	6.024
1994	69	20	29.0%	2,465,000	27.992	8.114
1995	66	21	31.8%	2,486,000	26.549	8.447
1996	80	24	30.0%	3,220,000	24.845	7.453
1997	74	12	16.2%	3,098,000	23.886	3.873
1998	66	13	19.7%	3,802,000	17.359	3.419
1999	59	10	16.9%	3,204,000	18.414	3.121
2000	63	19	30.2%	3,930,000	16.031	4.835
2001	54	15	27.8%	2,997,000	18.018	5.005
2002	47	15	31.9%	2,911,000	16.146	5.153
2003	48	8	16.3%	2,927,000	16.399	2.733
2004	45	15	33.3%	3,238,000	13.897	4.632
1988-2004	1115	293	26.3%	49,588,000	22.485	5.909

Figure 24 shows both the total accidents and fatal accidents each year, adjusted for total flight hours. The bars represent fatal events using the scale of the left axis. The connected diamonds represent total events according to the right axis.

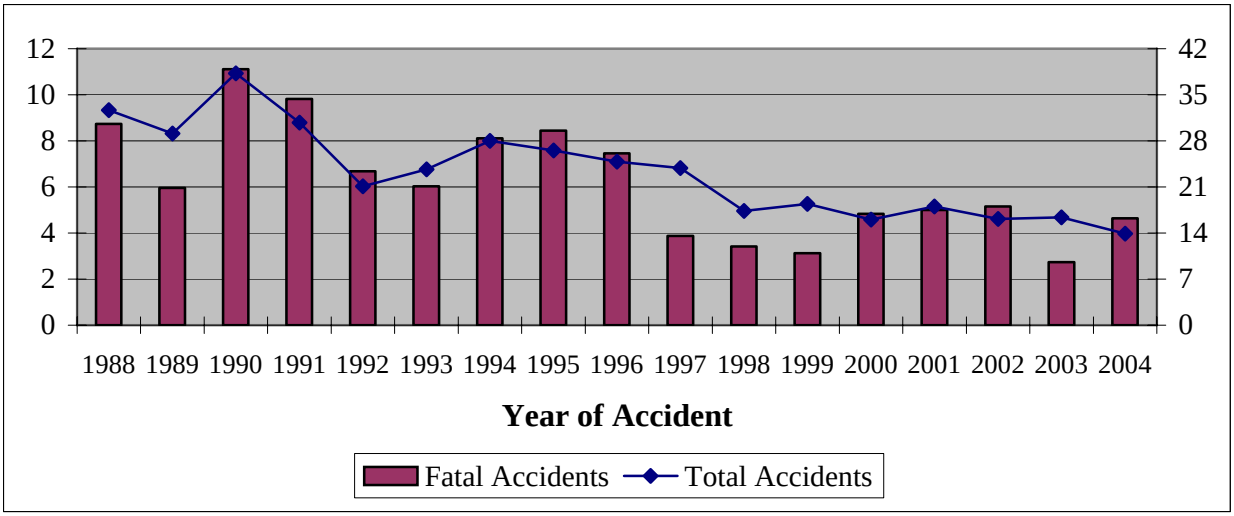

Figure 24. Fatal and Total Accidents per Million Flight Hours.

Table 27 shows the most severe injury in each event by year. All percentages are based on the total events for that year. Thirty-five percent of the accidents included a severe or fatal injury, while there were no injuries in 53% of the accidents.

Table 27. Most Severe Injury by Year of Accident

Year	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
1988	86	23 (26.7%)	9 (10.5%)	9 (10.5%)	45 (52.3%)
1989	88	18 (20.5%)	8 (9.1%)	10 (11.4%)	52 (59.1%)
1990	86	25 (29.1%)	9 (10.5%)	8 (9.3%)	44 (51.2%)
1991	69	22 (31.9%)	7 (10.1%)	5 (7.2%)	35 (50.7%)
1992	60	19 (31.7%)	5 (8.3%)	3 (5.0%)	33 (55.0%)
1993	55	14 (25.5%)	5 (9.1%)	10 (18.2%)	26 (47.3%)
1994	69	20 (29.0%)	5 (7.2%)	9 (13.0%)	35 (50.7%)
1995	66	21 (31.8%)	4 (6.1%)	6 (9.1%)	35 (53.0%)
1996	80	24 (30.0%)	10 (12.5%)	9 (11.3%)	37 (46.3%)
1997	74	12 (16.2%)	11 (14.9%)	12 (16.2%)	39 (52.7%)
1998	66	13 (19.7%)	3 (4.5%)	14 (21.2%)	36 (54.5%)
1999	59	10 (16.9%)	6 (10.2%)	10 (16.9%)	33 (55.9%)
2000	63	19 (30.2%)	2 (3.2%)	9 (14.3%)	33 (52.4%)
2001	54	15 (27.8%)	4 (7.4%)	3 (5.6%)	32 (59.3%)
2002	47	15 (31.9%)	2 (4.3%)	2 (4.3%)	28 (59.6%)
2003	48	8 (16.7%)	3 (6.3%)	10 (20.8%)	27 (56.3%)
2004	45	15 (33.3%)	5 (11.1%)	2 (4.4%)	23 (51.1%)
1988-2004	1115	293 (26.3%)	98 (8.8%)	131 (11.7%)	593 (53.2%)

Table 28 shows the number of persons killed or injured in these events. In the first column (Aircraft), the first number is the number of aircraft/events with an injury of that type, and the number in parentheses is the percentage out of the total number of accident aircraft. In the second column (Persons), the first number is the number of persons with an injury of that type, and the number in parentheses is the percentage out of the total number of that category of persons (aboard, crew, passengers, ground, or total) involved in these accidents. The total number of persons involved is defined to be the number of persons on board plus persons on the ground with injuries. The term "Ground" also includes persons on other aircraft, for those events which involved a Part 135-Non-Scheduled aircraft and a non-Part 135-NS aircraft. In the third column (Averages) the average number of persons with an injury of that type was calculated in two ways: based on the number of aircraft with an injury of that type, and based on the total number of accident aircraft (1115).

Table 28. Total Number of Injuries

Specific Type of Injury	Aircraft	Persons	Averages
Total Persons Aboard	1115 (100.0%)	3299 (100.0%)	2.96 (2.96)
Total Persons Involved	1115 (100.0%)	3334 (100.0%)	2.99 (2.99)
Total Persons Injured	522 (46.8%)	1275 (38.2%)	2.44 (1.14)
Fatal Injury Aboard	289 (25.9%)	682 (20.7%)	2.36 (0.61)
Crew Fatal Injury	274 (24.6%)	316 (24.3%)	1.15 (0.28)
Passengers Fatal Injury	114 (10.2%)	366 (18.3%)	3.21 (0.33)
Ground Fatal Injury	10 (0.9%)	16 (45.7%)	1.60 (0.01)
Total Fatal Injuries	293 (26.3%)	698 (20.9%)	2.38 (0.63)
Serious Injury Aboard	131 (11.7%)	222 (6.7%)	1.69 (0.20)
Crew Serious Injury	81 (7.3%)	88 (6.8%)	1.09 (0.08)
Passengers Serious Injury	80 (7.2%)	134 (6.7%)	1.68 (0.12)
Ground Serious Injury	7 (0.6%)	7 (20.0%)	1.00 (0.01)
Total Serious Injury	138 (12.4%)	229 (6.9%)	1.66 (0.21)
Minor Injury Aboard	182 (16.3%)	336 (10.2%)	1.85 (0.30)
Crew Minor Injury	119 (10.7%)	134 (10.3%)	1.13 (0.12)
Passengers Minor Injury	105 (9.4%)	202 (10.1%)	1.92 (0.18)
Ground Minor Injury	4 (0.4%)	12 (34.3%)	3.00 (0.01)
Total Minor Injury	188 (16.9%)	348 (10.4%)	1.85 (0.31)
Not Injured Aboard	685 (61.4%)	2059 (62.4%)	3.01 (1.85)
Crew Not Injured	652 (58.5%)	762 (58.6%)	1.17 (0.68)
Passengers Not Injured	401 (36.0%)	1297 (64.9%)	3.23 (1.16)

One hundred fourteen of the 293 fatal events included passenger fatalities (39%), and in 4 of the fatal events, no persons on board the Part 135-NS aircraft were killed. In two of these accidents, persons on board a Part 91 flight were killed after a mid-air collision; in one accident the aircraft struck an

automobile during an emergency landing and the driver of the automobile was killed; and in the remaining accident, a person on the ground walked into a rotating propeller.

Sixty-two percent of all persons on board the Part 135-NS aircraft sustained no injuries in these 1115 accidents. In the 522 accidents with injuries, an average of 2.4 persons per event were killed or injured, while the average across all 1115 accidents is 1.1 person killed or injured per accident. On average, about 2 persons received fatal (2.4), serious (1.7) or minor (1.9) injuries when an event included at least one fatal, serious or minor injury, respectively.

Ninety-eight percent (1095) of the Part 135-NS aircraft involved in these events were destroyed or suffered substantial damage (see Table 29), while 2% had minor or no damage. All percentages are based on the total events for that year.

Table 29. Aircraft Damage by Year of Accident

Year	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
1988	86	29 (33.7%)	56 (65.1%)	1 (1.2%)	0 (0.0%)
1989	88	22 (25.0%)	66 (75.0%)	0 (0.0%)	0 (0.0%)
1990	86	33 (38.4%)	52 (60.5%)	1 (1.2%)	0 (0.0%)
1991	69	23 (33.3%)	42 (60.9%)	2 (2.9%)	2 (2.9%)
1992	60	20 (33.3%)	39 (65.0%)	1 (1.7%)	0 (0.0%)
1993	55	19 (34.5%)	36 (65.5%)	0 (0.0%)	0 (0.0%)
1994	69	19 (27.5%)	49 (71.0%)	0 (0.0%)	1 (1.4%)
1995	66	18 (27.3%)	47 (71.2%)	1 (1.5%)	0 (0.0%)
1996	80	31 (38.8%)	47 (58.8%)	0 (0.0%)	2 (2.5%)
1997	74	18 (24.3%)	54 (73.0%)	1 (1.4%)	1 (1.4%)
1998	66	15 (22.7%)	51 (77.3%)	0 (0.0%)	0 (0.0%)
1999	59	10 (16.9%)	47 (79.7%)	2 (3.4%)	0 (0.0%)
2000	63	17 (27.0%)	45 (71.4%)	1 (1.6%)	0 (0.0%)
2001	54	15 (27.8%)	39 (72.2%)	0 (0.0%)	0 (0.0%)
2002	47	14 (29.8%)	30 (63.8%)	2 (4.3%)	1 (2.1%)
2003	48	7 (14.6%)	40 (83.3%)	1 (2.0%)	0 (0.0%)
2004	45	17 (37.8%)	28 (62.2%)	0 (0.0%)	0 (0.0%)
1988-2004	1115	327 (29.3%)	768 (68.9%)	13 (1.2%)	7 (0.6%)

Table 30 shows the distribution of the NTSB severity classification. All percentages are based on the total events for that year. Thirty-eight percent of the accidents were considered either major or serious, while 62% were classified as “damage” accidents.

Table 30. Accident Severity Classification by Year of Accident

Year	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
1988	86	30 (34.9%)	5 (5.8%)	0 (0.0%)	51 (59.3%)
1989	88	23 (26.1%)	5 (5.7%)	0 (0.0%)	60 (68.2%)
1990	86	35 (40.7%)	4 (4.7%)	0 (0.0%)	47 (54.7%)
1991	69	24 (34.8%)	4 (5.8%)	2 (2.9%)	39 (56.5%)
1992	60	23 (38.3%)	3 (5.0%)	0 (0.0%)	34 (56.7%)
1993	55	19 (34.5%)	2 (3.6%)	0 (0.0%)	34 (61.8%)
1994	69	22 (31.9%)	3 (4.3%)	1 (1.4%)	43 (62.3%)
1995	66	23 (34.8%)	4 (6.1%)	0 (0.0%)	39 (59.1%)
1996	80	32 (40.0%)	2 (2.5%)	2 (2.5%)	44 (55.0%)
1997	74	19 (25.7%)	8 (10.8%)	1 (1.4%)	46 (62.2%)
1998	66	16 (24.2%)	3 (4.5%)	0 (0.0%)	47 (71.2%)
1999	59	11 (18.6%)	4 (6.8%)	1 (1.7%)	43 (72.9%)
2000	63	20 (31.7%)	1 (1.6%)	0 (0.0%)	42 (66.7%)
2001	54	16 (29.6%)	4 (7.4%)	0 (0.0%)	34 (63.0%)
2002	47	18 (38.3%)	1 (2.1%)	0 (0.0%)	28 (59.6%)
2003	48	11 (22.9%)	2 (4.2%)	0 (0.0%)	35 (72.9%)
2004	45	18 (40.0%)	4 (8.9%)	0 (0.0%)	23 (51.1%)
1988-2004	1115	360 (32.3%)	59 (5.3%)	7 (0.6%)	689 (61.8%)

Injuries and Aircraft Damage by CICTT Accident Category

Figure 25 and Table 31 present the breakdown of CICTT accident categories in the 1988-2004 accidents. The first column in Table 31 lists the category abbreviation with an explanation of the abbreviation. Refer to Appendix A for a more detailed explanation of these categories. The second column lists the number of accidents in this category (with a percentage out of the total number of accidents, not the total number of category assignments). The third column lists the number of fatal injuries in all the accidents for that category, with a percentage out of the number of persons involved in those accidents (see column 5) and the fourth column shows the total number of injuries of any type (again, with a percentage based on column 5).

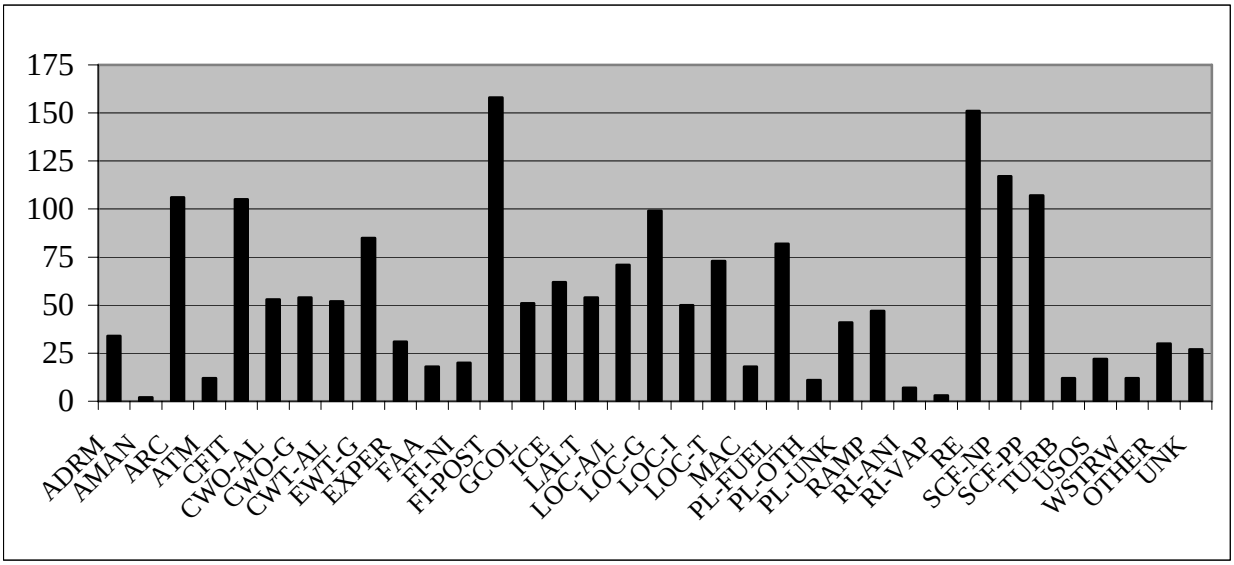

Figure 25. CICTT Accident Categories in Non-Scheduled Part 135 data from 1988-2004.

Table 31. CICTT accident categories

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
ADRM (Aerodrome)	34 (3.0%)	0 (0.0%)	9 (8.4%)	107
AMAN (Abrupt Maneuver)	2 (0.2%)	1 (50.0%)	2 (100.%)	2
ARC (Abnormal Runway Contact)	106 (9.5%)	11 (3.5%)	48 (15.4%)	311
ATM (Air Traffic Management)	12 (1.1%)	1 (4.0%)	8 (32.0%)	25
CFIT (Controlled Flight Into or Toward Terrain)	105 (9.4%)	180 (67.9%)	235 (88.7%)	265
CWO-A/L (Collision with Object – Approach/Landing)	53 (4.8%)	35 (26.7%)	97 (74.0%)	131
CWO-G (Coll with Object – Ground)	54 (4.8%)	12 (7.5%)	46 (28.9%)	159
(continued on next page)				

Table 31. Concluded

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
CWT-AL (Collision with Terrain – Approach/Landing)	52 (4.7%)	32 (17.2%)	97 (52.2%)	186
EWT-G (Encounter with Terrain – On Ground)	85 (7.6%)	1 (0.4%)	55 (21.8%)	252
EXPER (Experience/Training Issues)	31 (2.8%)	41 (46.6%)	71 (80.7%)	88
FAA (Inadequate FAA oversight)	18 (1.6%)	53 (55.2%)	73 (76.0%)	96
FI-NI (Fire/Smoke – Non-Impact)	20 (1.8%)	16 (22.5%)	38 (53.5%)	71
FI-POST (Fire – Post Impact)	158 (14.2%)	320 (71.3%)	410 (91.3%)	449
GCOL (Ground Collision)	51 (4.6%)	1 (0.6%)	15 (9.1%)	164
ICE (Icing)	62 (5.6%)	33 (22.9%)	73 (50.7%)	144
LALT (Low Altitude Operations)	54 (4.8%)	98 (57.3%)	135 (78.9%)	171
LOC-A/L (Loss of Control – A/L)	71 (6.4%)	108 (59.3%)	144 (79.1%)	182
LOC-G (Loss of Control – Ground)	99 (8.9%)	0 (0.0%)	40 (14.4%)	278
LOC-I (Loss of Control – In Flight)	50 (4.5%)	88 (80.0%)	93 (84.5%)	110
LOC-T (Loss of Control – Takeoff)	73 (6.5%)	66 (30.6%)	119 (55.1%)	216
MAC (Mid Air Coll or Lack of Sep)	18 (1.6%)	27 (28.4%)	33 (34.7%)	95
PL-FUEL (Loss of Engine Power – Fuel Related)	82 (7.4%)	29 (13.5%)	94 (43.7%)	215
PL-OTH (Loss of Engine Power – Other Reasons)	11 (1.0%)	4 (8.3%)	19 (39.6%)	48
PL-UNK (Loss of Engine Power – Unknown Reasons)	41 (3.7%)	15 (14.9%)	43 (42.6%)	101
RAMP (Ground Handling)	47 (4.2%)	31 (18.6%)	77 (46.1%)	167
RE (Runway Excursion)	151 (13.5%)	9 (1.7%)	69 (12.8%)	537
RI-ANI (Runway Incursion – Animal)	7 (0.6%)	0 (0.0%)	0 (0.0%)	30
RI-VAP (Runway Incursion – Vehicle or Aircraft or Person)	3 (0.3%)	0 (0.0%)	1 (16.7%)	6
SCF-NP (System/Component Failure or Malfunction (Non-Powerplant)	117 (10.5%)	35 (10.3%)	58 (17.0%)	341
SCF-PP (System/Component Failure or Malfunction (Powerplant)	107 (9.6%)	67 (20.8%)	172 (53.4%)	322
TURB (Turbulence)	12 (1.1%)	15 (45.5%)	18 (54.5%)	33
USOS (Undershoot/Overshoot)	22 (2.0%)	1 (0.9%)	32 (29.9%)	107
WSTRW (Windshear/Thunderstorm)	12 (1.1%)	15 (55.6%)	17 (63.0%)	27
OTHER (Other)	30 (2.7%)	32 (43.8%)	35 (47.9%)	73
UNK (Unknown/Not Reported)	27 (2.4%)	53 (58.9%)	60 (66.7%)	90
Total	1115 (100%)	682 (20.7%)	1275 (38.%)	3334

The most common categories are post-impact fire (14%), runway excursion (13.5% of events), non-powerplant system/component failure/malfunction (10.5%), powerplant system/component failure/malfunction (10%), abnormal runway contact (9%), CFIT (9%) and LOC-ground (9%). The categories with fatal injuries to more than half of all those persons involved in the accident are LOC-I (80%), post-impact fire (71%), CFIT (68%), LOC-A/L (59%), LALT (57%), windshear/thunderstorm (56%) and FAA oversight (55%). The categories with any type of injury to more than two-thirds of all those persons involved in the accident are abrupt maneuvers (100%), post-impact fire (91%), CFIT (89%), LOC-I (85%), CWO-AL (84%), experience/training (81%), LOC-A/L (79%), LALT (79%) and FAA oversight (76%).

Table 32 shows the most severe injury distribution in each CICTT accident category. All percentages in Tables 32 through 34 are based on the total events for that category. The categories most likely to have a fatal injury are LOC-I (92%), post-impact fire (77%), CFIT (70%), windshear/thunderstorm (67%), LOC-A/L (65%), LALT (63%) and FAA oversight (61%). The categories most likely to result in no injuries are RI-Animal (100%), abnormal runway contact (87%), aerodrome (85%), ground collision (82%), non-powerplant system/component failure/malfunction (80%), runway excursion (80%), LOC-Ground (80%), encounter with terrain on ground/water (68%) and undershoot/overshoot (64%).

Table 33 shows the distribution of aircraft damage in each CICTT accident category. The categories most likely to result in aircraft destruction are post-impact fire (86%), LOC-I (86%), CFIT (75%), turbulence (67%) and windshear/thunderstorm (67%). The only events with less than substantial damage were in the categories of ATM, ground collision, LOC-G, MAC and ground handling.

Table 34 shows the severity classification in each CICTT accident category. The categories most likely to include “major” accidents are LOC-I (94%), post-impact fire (89%), CFIT (78%), LOC-A/L (69%), LALT (67%), turbulence (67%) and windshear/thunderstorm (67%). The categories with less than 10% of the accidents either “Major” or “Serious” are RI-ANI (0%), RI-VAP (0%), ground collision (4%), Loss of Control – Ground (5%), aerodrome (6%) and abnormal runway contact (9%).

Table 32. Most Severe Injury by CICTT accident category

CICTT category	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
ADRM	34	0 (0.0%)	2 (5.9%)	3 (8.8%)	29 (85.3%)
AMAN	2	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)
ARC	106	2 (1.9%)	6 (5.7%)	6 (5.7%)	92 (86.8%)
ATM	12	1 (8.3%)	1 (8.3%)	3 (25.0%)	7 (58.3%)
CFIT	105	73 (69.5%)	18 (17.1%)	5 (4.8%)	9 (8.6%)
CWO-AL	53	17 (32.1%)	7 (13.2%)	17 (32.1%)	12 (22.6%)
CWO-G	54	5 (9.3%)	7 (13.0%)	10 (18.5%)	32 (59.3%)
CWT-AL	52	17 (32.7%)	7 (13.5%)	11 (21.2%)	17 (32.7%)
EWT-G	85	1 (1.2%)	10 (11.8%)	16 (18.8%)	58 (68.2%)
EXPER	31	18 (58.1%)	4 (12.9%)	3 (9.7%)	6 (19.4%)
FAA	18	11 (61.1%)	1 (5.6%)	3 (16.7%)	3 (16.7%)
FI-NI	20	8 (40.0%)	1 (5.0%)	1 (5.0%)	10 (50.0%)
FI-POST	158	122 (77.2%)	15 (9.5%)	11 (7.0%)	10 (6.3%)
GCOL	51	1 (2.0%)	2 (3.9%)	6 (11.8%)	42 (82.4%)
ICE	62	25 (40.3%)	7 (11.3%)	10 (16.1%)	20 (32.3%)
LALT	54	34 (63.0%)	6 (11.1%)	3 (5.6%)	11 (20.4%)
LOC-A/L	71	46 (64.8%)	7 (9.9%)	8 (11.3%)	10 (14.1%)
LOC-G	99	0 (0.0%)	5 (5.1%)	15 (15.2%)	79 (79.8%)
LOC-I	50	46 (92.0%)	0 (0.0%)	1 (2.0%)	3 (6.0%)
LOC-T	73	30 (41.1%)	5 (6.8%)	12 (16.4%)	26 (35.6%)
MAC	18	8 (44.4%)	0 (0.0%)	1 (5.6%)	9 (50.0%)
PL-FUEL	82	11 (13.4%)	14 (17.1%)	19 (23.2%)	38 (46.3%)
PL-OTH	11	4 (36.4%)	1 (9.1%)	2 (18.2%)	4 (36.4%)
PL-UNK	41	5 (12.2%)	3 (7.3%)	11 (26.8%)	22 (53.7%)
RAMP	47	15 (31.9%)	10 (21.3%)	4 (8.5%)	18 (38.3%)
RE	151	2 (1.3%)	12 (7.9%)	16 (10.6%)	121 (80.1%)
RI-ANI	7	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (100.%)
RI-VAP	3	0 (0.0%)	0 (0.0%)	1 (33.3%)	2 (66.7%)
SCF-NP	117	16 (13.7%)	4 (3.4%)	3 (2.6%)	94 (80.3%)
SCF-PP	107	29 (27.1%)	14 (13.1%)	24 (22.4%)	40 (37.4%)
TURB	12	7 (58.3%)	1 (8.3%)	0 (0.0%)	4 (33.3%)
USOS	22	1 (4.5%)	3 (13.6%)	4 (18.2%)	14 (63.6%)
WSTRW	12	8 (66.7%)	0 (0.0%)	2 (16.7%)	2 (16.7%)
OTHER	30	19 (63.3%)	0 (0.0%)	1 (3.3%)	10 (33.3%)
UNK	27	16 (59.3%)	1 (3.7%)	3 (11.1%)	7 (25.9%)
Total	1115	293 (26.3%)	98 (8.8%)	131 (11.7%)	593 (53.2%)

Table 33. Aircraft Damage by CICTT accident category

CICTT Category	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
ADRM	34	1 (2.9%)	33 (97.1%)	0 (0.0%)	0 (0.0%)
AMAN	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
ARC	106	6 (5.7%)	100 (94.3%)	0 (0.0%)	0 (0.0%)
ATM	12	1 (8.3%)	10 (83.3%)	1 (8.3%)	0 (0.0%)
CFIT	105	79 (75.2%)	26 (24.8%)	0 (0.0%)	0 (0.0%)
CWO-AL	53	26 (49.1%)	27 (50.9%)	0 (0.0%)	0 (0.0%)
CWO-G	54	8 (14.8%)	46 (85.2%)	0 (0.0%)	0 (0.0%)
CWT-AL	52	24 (46.2%)	28 (53.8%)	0 (0.0%)	0 (0.0%)
EWT-G	85	9 (10.6%)	76 (89.4%)	0 (0.0%)	0 (0.0%)
EXPER	31	18 (58.1%)	13 (41.9%)	0 (0.0%)	0 (0.0%)
FAA	18	11 (61.1%)	7 (38.9%)	0 (0.0%)	0 (0.0%)
FI-NI	20	8 (40.0%)	12 (60.0%)	0 (0.0%)	0 (0.0%)
FI-POST	158	136 (86.1%)	22 (13.9%)	0 (0.0%)	0 (0.0%)
GCOL	51	2 (3.9%)	42 (82.4%)	5 (9.8%)	2 (3.9%)
ICE	62	29 (46.8%)	33 (53.2%)	0 (0.0%)	0 (0.0%)
LALT	54	29 (53.7%)	25 (46.3%)	0 (0.0%)	0 (0.0%)
LOC-A/L	71	42 (59.2%)	29 (40.8%)	0 (0.0%)	0 (0.0%)
LOC-G	99	1 (1.0%)	97 (98.0%)	0 (0.0%)	1 (1.0%)
LOC-I	50	43 (86.0%)	7 (14.0%)	0 (0.0%)	0 (0.0%)
LOC-T	73	36 (49.3%)	37 (50.7%)	0 (0.0%)	0 (0.0%)
MAC	18	6 (33.3%)	7 (38.9%)	4 (22.2%)	1 (5.6%)
PL-FUEL	82	21 (25.6%)	61 (74.4%)	0 (0.0%)	0 (0.0%)
PL-OTH	11	6 (54.5%)	5 (45.5%)	0 (0.0%)	0 (0.0%)
PL-UNK	41	12 (29.3%)	29 (70.7%)	0 (0.0%)	0 (0.0%)
RAMP	47	13 (27.7%)	27 (57.4%)	3 (6.4%)	4 (8.5%)
RUNEXC	151	7 (4.6%)	144 (95.4%)	0 (0.0%)	0 (0.0%)
RI-ANI	7	0 (0.0%)	7 (100.%)	0 (0.0%)	0 (0.0%)
RI-VAP	3	0 (0.0%)	3 (100.%)	0 (0.0%)	0 (0.0%)
SCF-NP	117	17 (14.5%)	100 (85.5%)	0 (0.0%)	0 (0.0%)
SCF-PP	107	35 (32.7%)	72 (67.3%)	0 (0.0%)	0 (0.0%)
TURB	12	8 (66.7%)	4 (33.3%)	0 (0.0%)	0 (0.0%)
USOS	22	3 (13.6%)	19 (86.4%)	0 (0.0%)	0 (0.0%)
WSTRW	12	8 (66.7%)	4 (33.3%)	0 (0.0%)	0 (0.0%)
OTHER	30	18 (60.0%)	11 (36.7%)	1 (3.2%)	0 (0.0%)
UNK	27	15 (55.6%)	12 (44.4%)	0 (0.0%)	0 (0.0%)
Total	1115	327 (29.3%)	768 (68.9%)	13 (1.2%)	7 (0.6%)

Table 34. Accident Severity Classification by CICTT Accident Category

CICTT Category	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
ADRM	34	1 (2.9%)	1 (2.9%)	0 (0.0%)	32 (94.1%)
AMAN	2	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)
ARC	106	6 (5.7%)	3 (2.8%)	0 (0.0%)	97 (91.5%)
ATM	12	1 (8.3%)	1 (8.3%)	0 (0.0%)	10 (83.3%)
CFIT	105	82 (78.1%)	9 (8.6%)	0 (0.0%)	14 (13.3%)
CWO-AL	53	27 (50.9%)	3 (5.7%)	0 (0.0%)	23 (43.4%)
CWO-G	54	9 (16.7%)	4 (7.4%)	0 (0.0%)	41 (75.9%)
CWT-AL	52	27 (51.9%)	2 (3.8%)	0 (0.0%)	23 (44.2%)
EWT-G	85	9 (10.6%)	6 (7.1%)	0 (0.0%)	70 (82.4%)
EXPER	31	19 (61.3%)	3 (9.7%)	0 (0.0%)	9 (29.0%)
FAA	18	11 (61.1%)	1 (5.6%)	0 (0.0%)	6 (33.3%)
FI-NI	20	10 (50.0%)	1 (5.0%)	0 (0.0%)	9 (45.0%)
FI-POST	158	140 (88.6%)	4 (2.5%)	0 (0.0%)	14 (8.9%)
GCOL	51	2 (3.9%)	0 (0.0%)	2 (3.9%)	47 (92.2%)
ICE	62	32 (51.6%)	4 (6.5%)	0 (0.0%)	26 (41.9%)
LALT	54	36 (66.7%)	4 (7.4%)	0 (0.0%)	14 (25.9%)
LOC-A/L	71	49 (69.0%)	5 (7.0%)	0 (0.0%)	17 (23.9%)
LOC-G	99	1 (1.0%)	4 (4.0%)	1 (1.0%)	93 (93.9%)
LOC-I	50	47 (94.0%)	0 (0.0%)	0 (0.0%)	3 (6.0%)
LOC-T	73	38 (52.1%)	4 (5.5%)	0 (0.0%)	31 (42.5%)
MAC	18	8 (44.4%)	0 (0.0%)	0 (0.0%)	10 (55.6%)
PL-FUEL	82	23 (28.0%)	10 (12.2%)	0 (0.0%)	49 (59.8%)
PL-OTH	11	6 (54.5%)	0 (0.0%)	0 (0.0%)	5 (45.5%)
PL-UNK	41	12 (29.3%)	0 (0.0%)	0 (0.0%)	29 (70.7%)
RAMP	47	15 (31.9%)	5 (10.6%)	5 (10.6%)	22 (46.8%)
RE	151	7 (4.6%)	9 (6.0%)	0 (0.0%)	135 (89.4%)
RI-ANI	7	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (100.%)
RI-VAP	3	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100.%)
SCF-NP	117	17 (14.5%)	3 (2.6%)	0 (0.0%)	97 (82.9%)
SCF-PP	107	40 (37.4%)	9 (8.4%)	0 (0.0%)	58 (54.2%)
TURB	12	8 (66.7%)	0 (0.0%)	0 (0.0%)	4 (33.3%)
USOS	22	3 (13.6%)	2 (9.1%)	0 (0.0%)	17 (77.3%)
WSTRW	12	8 (66.7%)	0 (0.0%)	0 (0.0%)	4 (33.3%)
OTHER	30	19 (63.3%)	1 (3.3%)	0 (0.0%)	10 (33.3%)
UNK	27	18 (66.7%)	1 (3.7%)	0 (0.0%)	8 (29.6%)
Total	1115	360 (32.3%)	59 (5.3%)	7 (0.6%)	689 (61.8%)

Trends over time in CICTT Accident Categories

The CICTT categories found to show a significant trend are shown in Figure 26 through Figure 38. below. The estimated regression line is included on each chart. Rates of accidents categorized as Abnormal Runway Contact, CFIT, Collisions with Object (Approach/Landing), Experience or Training Issues, Post-Impact Fires, Low Altitude Operations, LOC (Ground), LOC (In Flight), LOC (Takeoff), Runway Excursions, Non-Powerplant System/Component Failure/Malfunction and Powerplant System/Component Failure/Malfunction have all decreased.

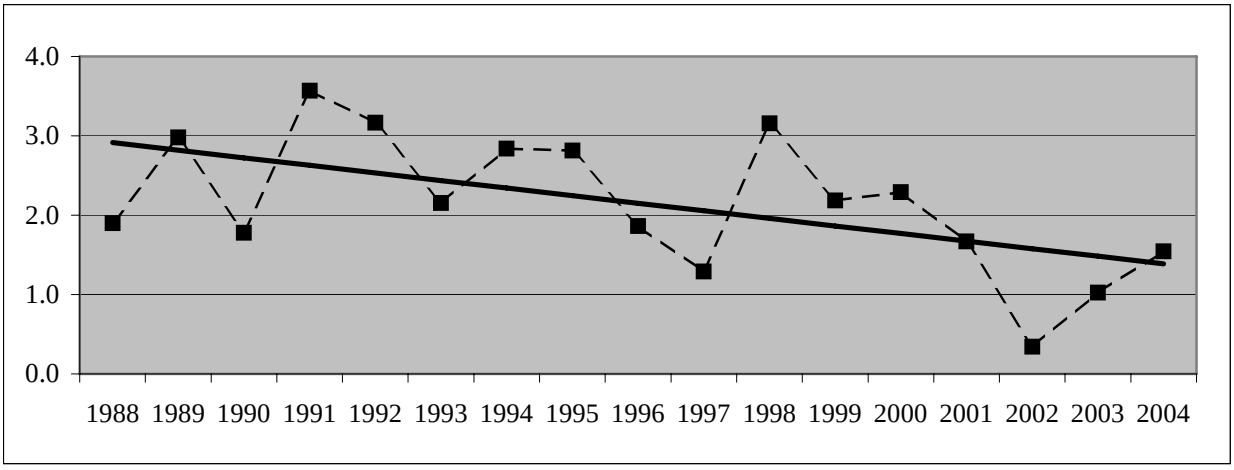

Figure 26. Rate of Abnormal Runway Contact (per million flight hours).

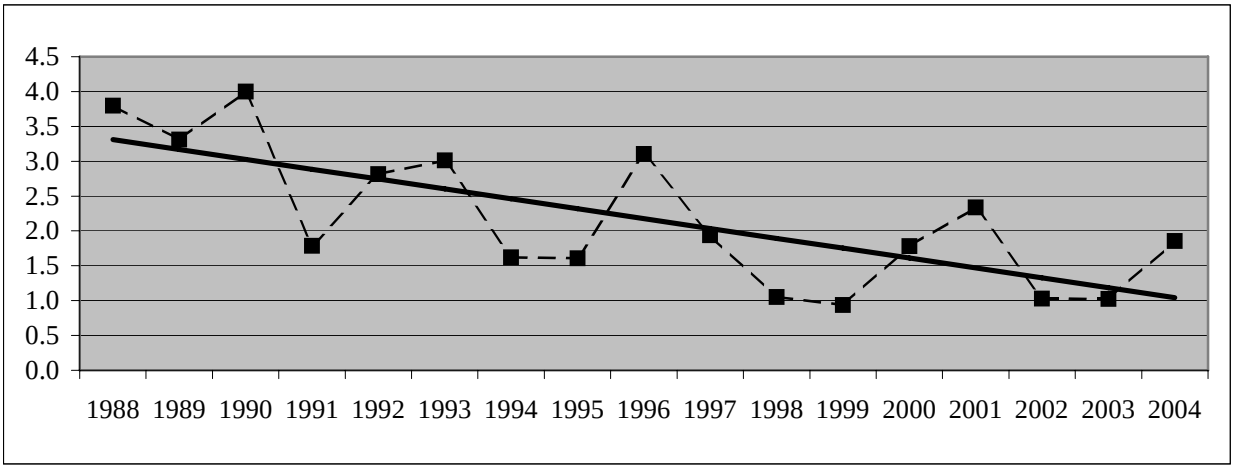

Figure 27. Rate of CFIT (per million flight hours).

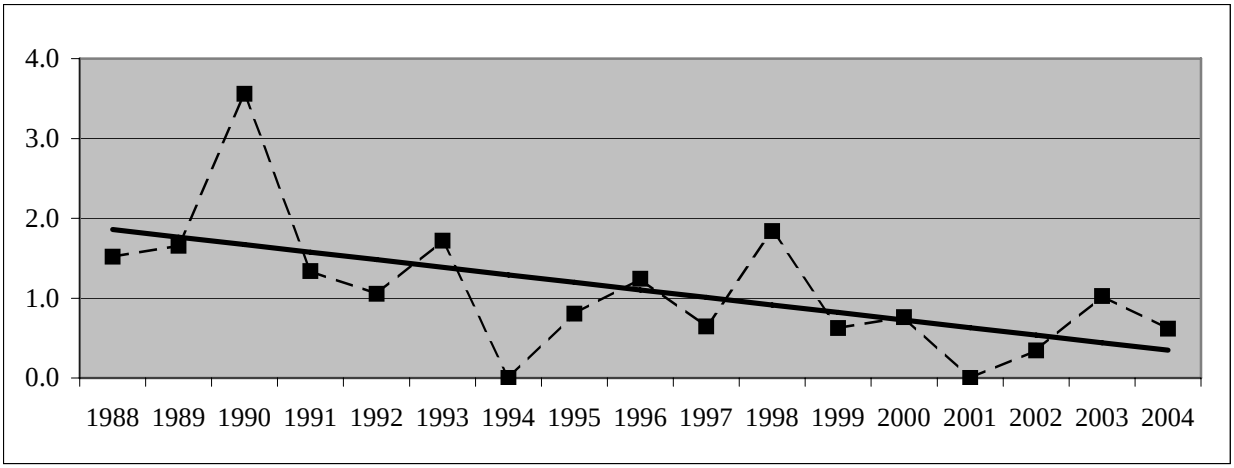

Figure 28 Rate of Collision with Object -- Approach/Landing (per million flight hours).

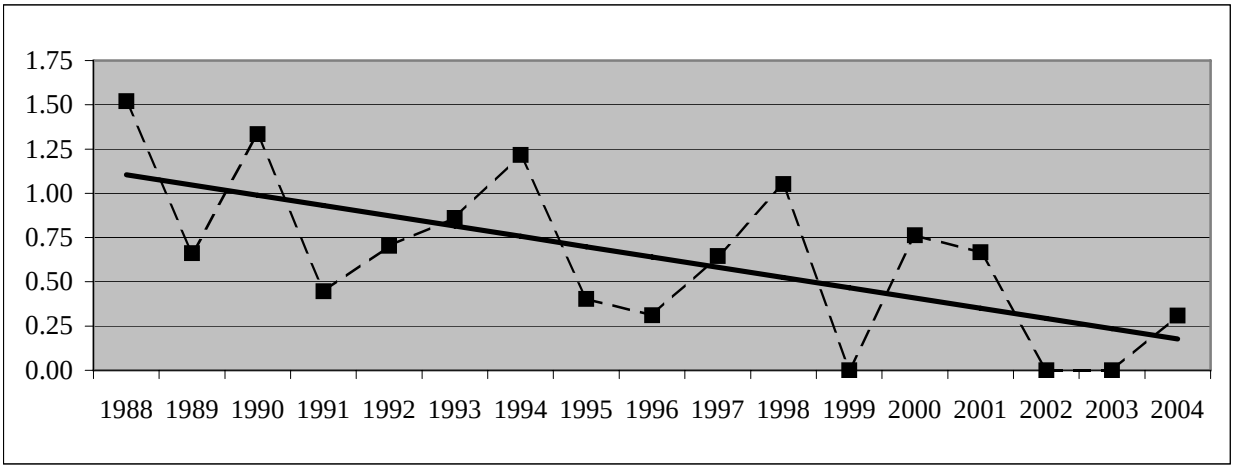

Figure 29. Rate of Experience/Training Issues (per million flight hours).

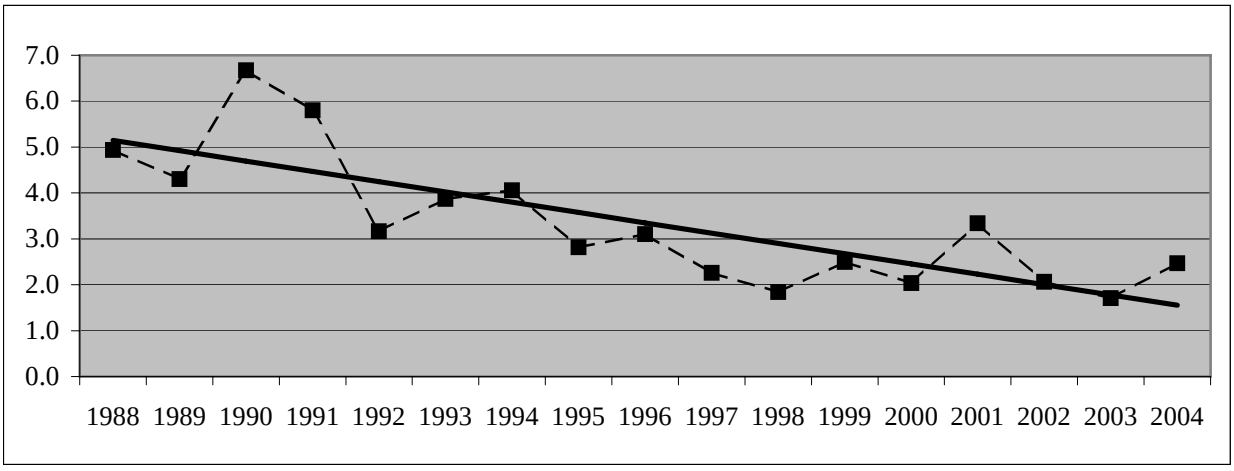

Figure 30. Rate of Post-Impact Fires (per million flight hours).

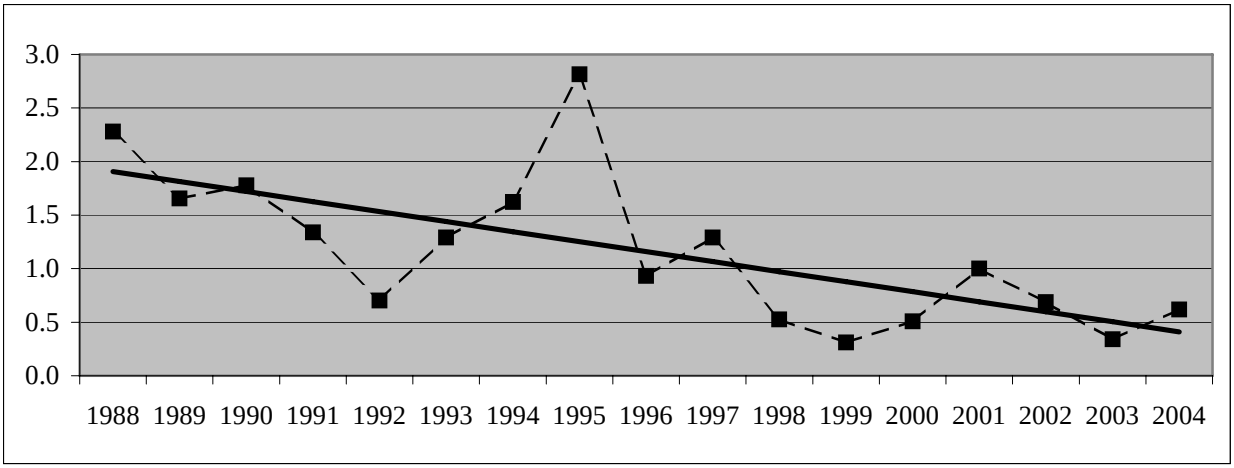

Figure 31. Rate of Low Altitude Operations (per million flight hours).

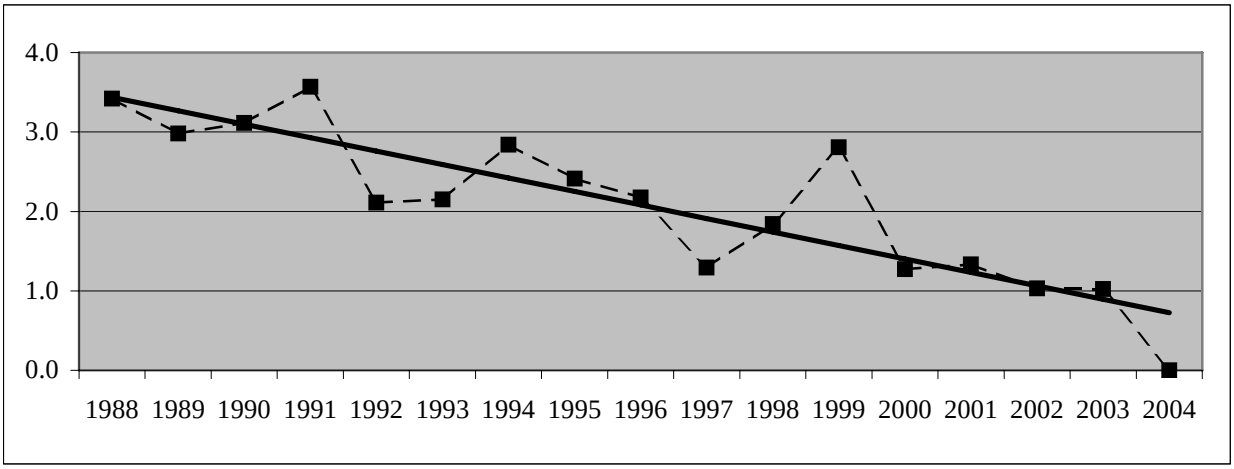

Figure 32. Rate of Loss of Control -- Ground (per million flight hours).

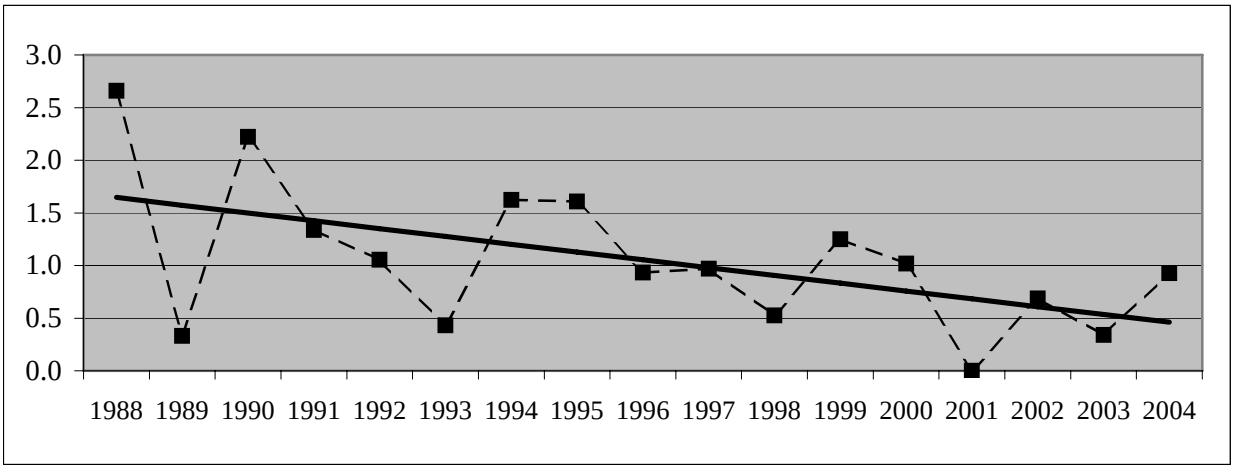

Figure 33. Rate of Loss of Control -- In Flight (per million flight hours).

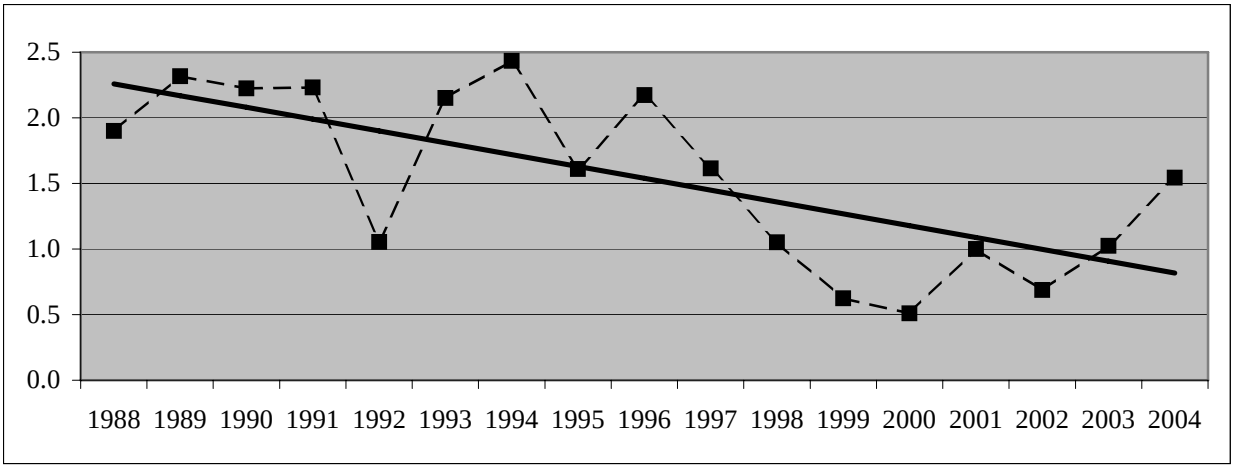

Figure 34. Rate of Loss of Control -- Takeoff (per million flight hours).

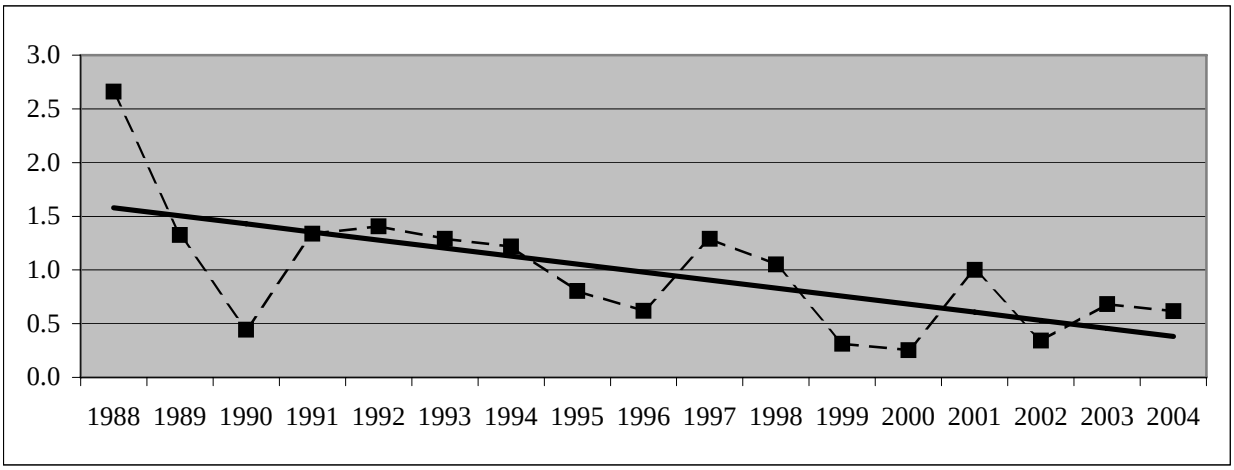

Figure 35. Rate of Ground Handling Accidents (per million flight hours).

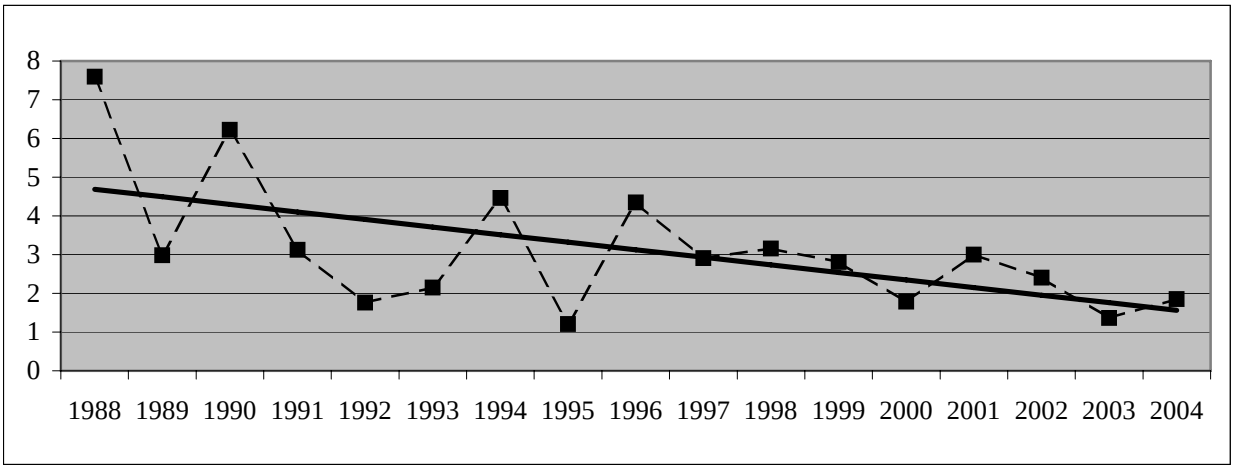

Figure 36. Rate of Runway Excursions (per million flight hours).

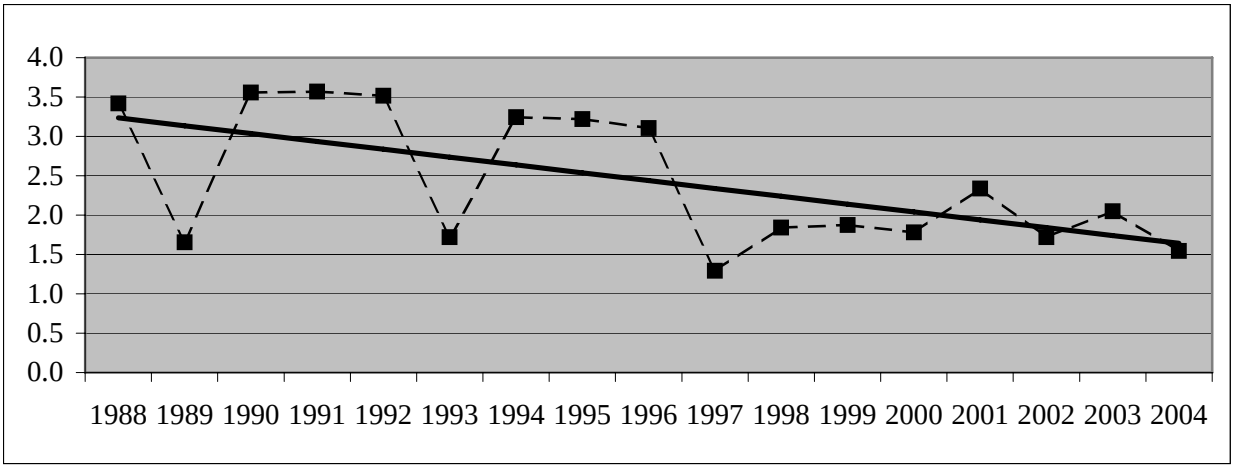

Figure 37. Rate of Non-Powerplant System/Component Failure/Malfunction (per million flight hours).

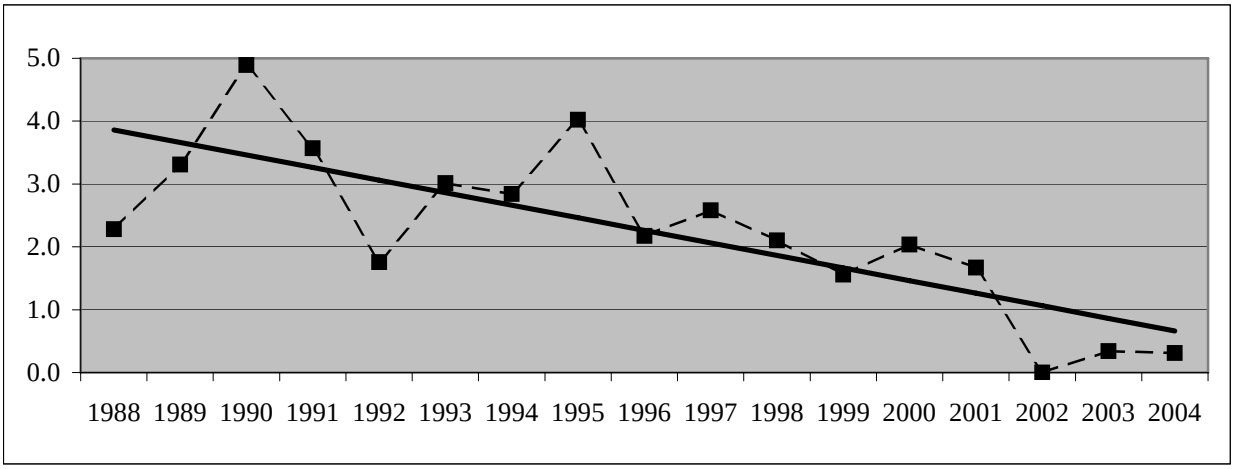

Figure 38. Rate of Powerplant System/Component Failure/Malfunction (per million flight hours).

Figures 39 through 41 show the relative constancy (lack of trend) of rates among the three remaining most common or "major" CICTT categories.

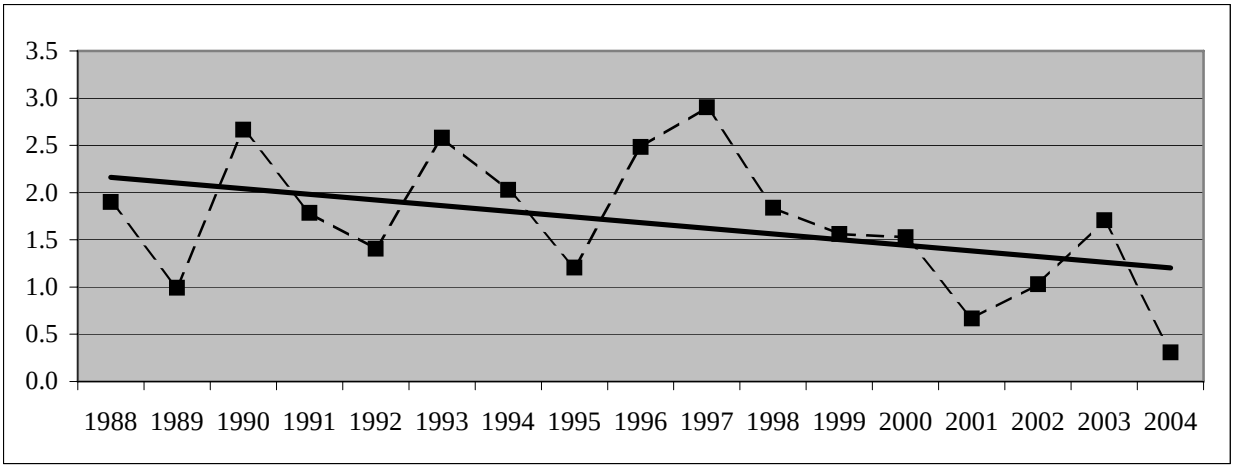

Figure 39. Rate of Fuel Related Power Loss (per million flight hours).

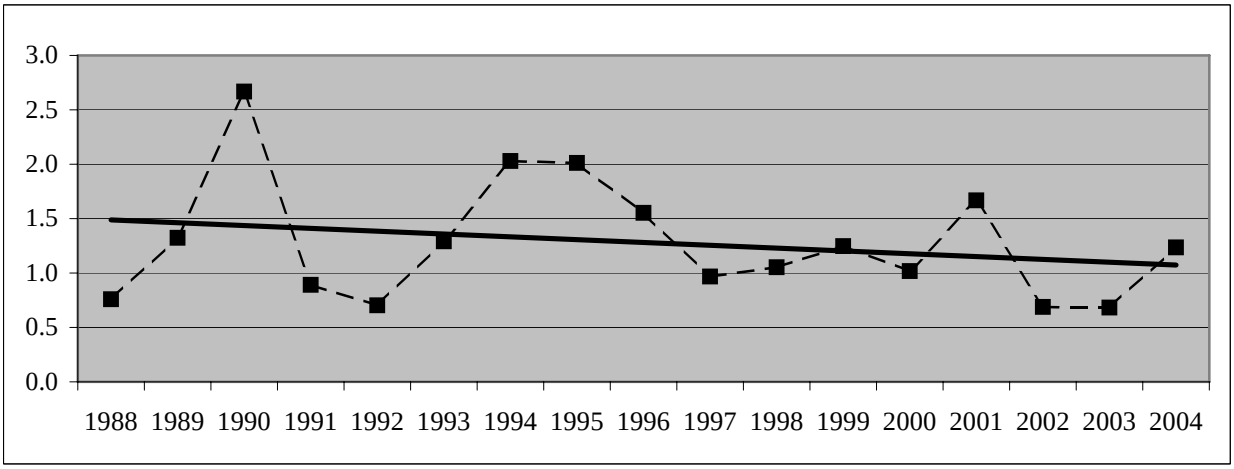

Figure 40. Rate of Icing Encounters (per million flight hours).

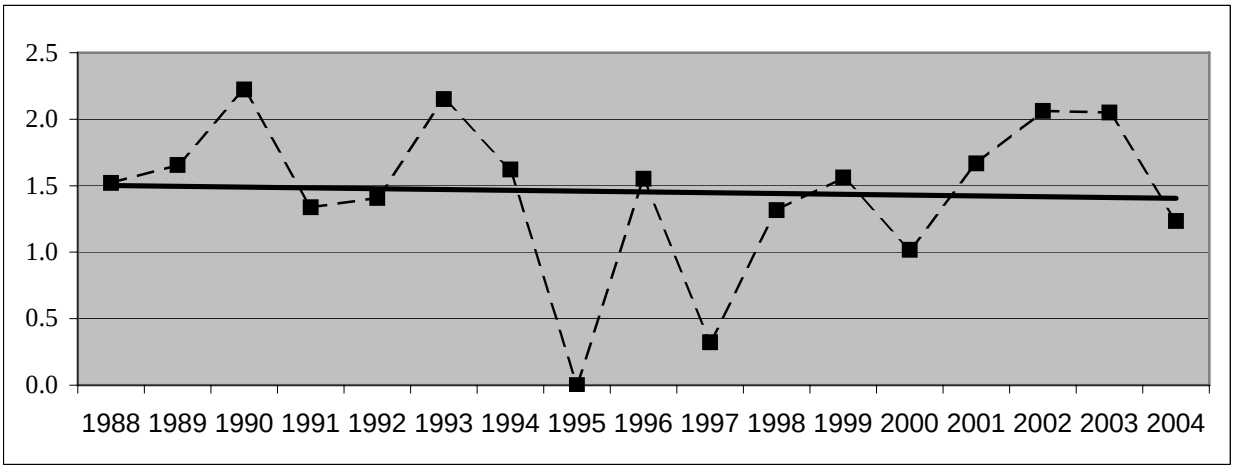

Figure 41. Rate of Loss of Control -- Approach/Landing (per million flight hours).

Additional Miscellaneous Information

Table 35 presents the distribution of events by phase of flight. All percentages are based on the total events for that year. Less than one-third (29%) of all accidents occurred during en route phases of flight, while nearly 39% occurred during approach and landing.

Table 35. Phase of Flight for Initiating Occurrence

Year	Total Events	Standing or Taxi	Takeoff	En Route **	Approach or Landing	Unknown/ No Report
1988	86	4 (4.7%)	22 (25.6%)	20 (23.3%)	37 (43.0%)	3 (3.5%)
1989	88	6 (6.8%)	14 (15.9%)	22 (25.0%)	40 (45.5%)	6 (6.8%)
1990	86	5 (5.8%)	21 (24.4%)	31 (36.0%)	28 (32.6%)	1 (1.2%)
1991	69	5 (7.2%)	16 (23.2%)	22 (31.9%)	23 (33.3%)	3 (4.3%)
1992	60	2 (3.3%)	12 (20.0%)	22 (36.7%)	24 (40.0%)	0 (0.0%)
1993	55	2 (3.6%)	14 (25.5%)	19 (34.5%)	20 (36.4%)	0 (0.0%)
1994	69	9 (13.0%)	14 (20.3%)	20 (29.0%)	25 (36.2%)	1 (1.4%)
1995	66	6 (9.1%)	20 (30.3%)	23 (34.8%)	16 (24.2%)	1 (1.5%)
1996	80	4 (5.0%)	18 (22.5%)	21 (26.3%)	34 (42.5%)	3 (3.8%)
1997	74	6 (8.1%)	15 (20.3%)	26 (35.1%)	26 (35.1%)	1 (1.4%)
1998	66	4 (6.1%)	19 (28.8%)	18 (27.3%)	24 (36.4%)	1 (1.5%)
1999	59	6 (10.2%)	11 (18.6%)	15 (25.4%)	27 (45.8%)	0 (0.0%)
2000	63	4 (6.3%)	10 (15.9%)	24 (38.1%)	25 (39.7%)	0 (0.0%)
2001	54	2 (3.7%)	12 (22.2%)	17 (31.5%)	22 (40.7%)	1 (1.9%)
2002	47	9 (19.1%)	7 (14.9%)	13 (27.7%)	17 (36.2%)	1 (2.1%)
2003	48	8 (16.7%)	9 (18.8%)	7 (14.6%)	23 (47.9%)	1 (2.1%)
2004	45	1 (2.2%)	13 (28.9%)	8 (17.8%)	21 (46.7%)	2 (4.4%)
1988-2004	1115	83 (7.4%)	247 (22.2%)	328 (29.4%)	432 (38.7%)	25 (2.2%)

** En route includes climb, cruise, descent and maneuvering flight

For the 223 accidents classified as either SCF-PP or SCF-NP, Table 36 provides information on the specific system or component involved in the failure or malfunction. In one event there was a fuel system malfunction in one engine, and an unrelated compressor malfunction in the other engine. Lubricating system malfunctions contributed to engine failure in 10 events. The “total events” column percentage is based on the total number of accidents (1115), while the percentages associated with number of injuries are based on the number of persons involved with all the accidents with a malfunction of that type. Failures or malfunctions were most common in the engine and landing gear. Only malfunctions of the hydraulic system or landing gear resulted in no fatal injuries. The four “other” systems were anti-ice/de-ice, pressurization and two vacuum systems.

Table 36. Specific System/Component Failures/Malfunctions

Component or System Affected	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
Electrical System	10 (0.9%)	4 (13.8%)	9 (31.0%)	29
Engine	97 (8.7%)	64 (21.4%)	166 (55.6%)	299
Flight Control System/Surfaces	9 (0.8%)	2 (6.7%)	2 (6.7%)	30
Fuel System	11 (1.0%)	16 (38.1%)	24 (57.1%)	42
Hydraulic System	8 (0.7%)	0 (0.0%)	2 (8.0%)	25
Landing Gear	67 (6.0%)	0 (0.0%)	4 (2.1%)	192
Lubricating System	10 (0.9%)	6 (15.4%)	22 (56.4%)	39
Propeller	10 (0.9%)	3 (13.0%)	6 (26.1%)	23
Structures	8 (0.7%)	3 (23.1%)	7 (53.8%)	13
Other Systems	4 (0.4%)	10 (100.%)	10 (100.%)	10
Total	1115 (100.%)	698 (20.9%)	1275 (38.2%)	3334

Among Non-Scheduled Part 135 accidents during 1988-2004, there were 50 events with in-flight loss of control, 73 with loss of control on takeoff climb, and 71 with loss of control during approach or landing (also see Table 31). As shown in Table 37 below, between 16% and 24% of these events were precipitated by a system/component failure/malfunction, an in-flight fire or a loss of engine power. Between 17% and 33% followed encounters with severe weather. Twenty-eight percent of the in-flight loss of control occurred while operating at low altitude. One of the two in-flight LOC due to other events followed pilot incapacitation and the other had an in-flight break-up due to excessive airspeed. The takeoff LOC due to other events involved an open door. One of the approach/landing LOC due to other events involved an inadequate preflight (engine cowl plugs not removed) and the other followed pilot incapacitation.

Table 37. Prior occurrences for Loss of Control

	In Flight Loss of Control	Takeoff Loss of Control	Approach/Landing Loss of Control
Primary LOC	12 (24.0%)	46 (63.0%)	29 (40.8%)
LOC secondary to system/comp failure/malf	6 (12.0%)	11 (15.1%)	8 (11.3%)
LOC secondary to fire or engine power loss	2 (4.0%)	2 (2.7%)	9 (12.7%)
LOC secondary to low altitude maneuvering	14 (28.0%)	0 (0.0%)	0 (0.0%)
LOC secondary to severe weather	14 (28.0%)	13 (17.8%)	23 (32.4%)
LOC secondary to other events	2 (4.0%)	1 (1.4%)	2 (2.8%)
Total	50 (100.%)	73 (100.%)	71 (100.%)

Part 91 – General Aviation

Injuries and Aircraft Damage by Year

As shown in Table 38 below, there were a total of 24473 accidents involving Part 91 aircraft during the years 1988-2004. The percentage of the total events that involved at least one fatality has remained right around 20% through these years. However, the flight hour adjusted rates of both total and fatal events have decreased by about 25%.

Table 38. Total Accidents and Fatal Accidents by Total Flight Hours per Year

Year	Total Events	Fatal Events	Fatal Events out of Total	Total Estim. Flight Hours	Events per million FH	Fatal per mil FH
1988	1866	381	20.4%	27,446,000	67.988	13.882
1989	1738	339	19.5%	27,920,000	62.249	12.142
1990	1676	345	20.6%	28,510,000	58.786	12.101
1991	1680	339	20.2%	27,678,000	60.698	12.248
1992	1560	347	22.2%	24,780,000	62.954	14.003
1993	1530	305	19.9%	22,796,000	67.117	13.380
1994	1447	298	20.6%	22,235,000	65.078	13.402
1995	1513	299	19.8%	24,906,000	60.748	12.005
1996	1384	256	18.5%	24,881,000	55.625	10.289
1997	1373	259	18.9%	25,591,000	53.652	10.121
1998	1352	268	19.8%	25,518,000	52.982	10.502
1999	1371	232	16.9%	29,246,000	46.878	7.933
2000	1266	242	19.1%	27,838,000	45.477	8.693
2001	1207	215	17.8%	25,431,000	47.462	8.454
2002	1178	232	19.7%	25,545,000	46.115	9.082
2003	1208	242	20.0%	25,998,000	46.465	9.308
2004	1124	219	19.5%	24,888,000	45.162	8.799
1988-2004	24473	4818	19.7%	441,207,000	55.468	10.920

Figure 42 shows both the total accidents and fatal accidents each year, adjusted for total flight hours. The bars represent fatal events using the scale of the left axis. The connected diamonds represent total events according to the right axis.

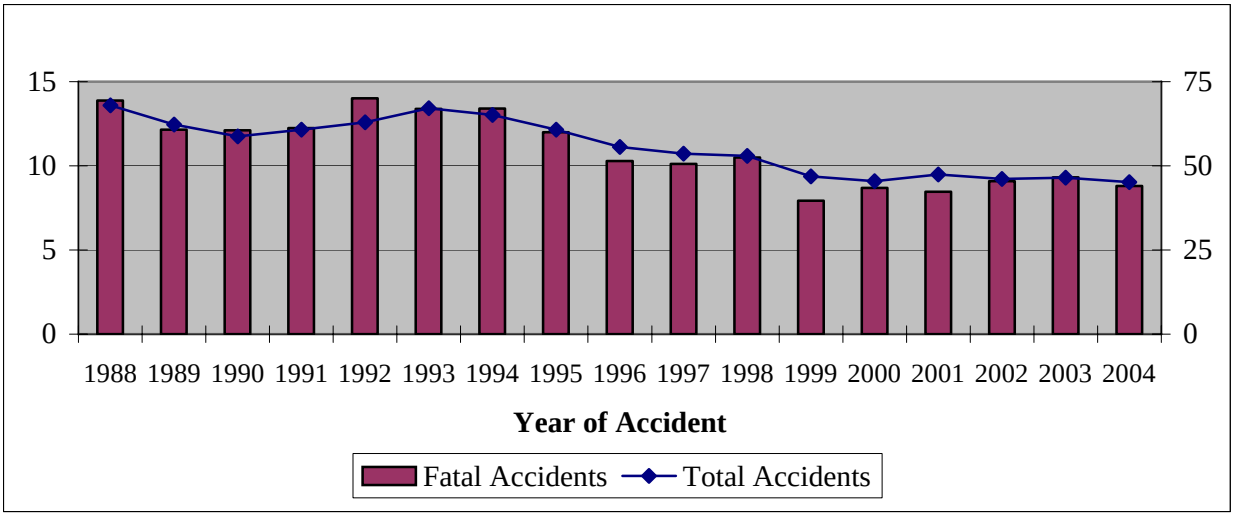

Figure 42. Fatal and Total Accidents per Million Flight Hours.

Table 39 shows the most severe injury in each event by year. All percentages are based on the total events for that year. Thirty percent of the accidents included a severe or fatal injury, while there were no injuries in 55% of the accidents.

Table 39. Most Severe Injury by Year of Accident

Year	Tot Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
1988	1866	381 (20.4%)	199 (10.7%)	306 (16.4%)	980 (52.5%)
1989	1738	339 (19.5%)	155 (8.9%)	271 (15.6%)	973 (56.0%)
1990	1676	345 (20.6%)	153 (9.1%)	237 (14.1%)	941 (56.1%)
1991	1680	339 (20.2%)	177 (10.5%)	267 (15.9%)	897 (53.4%)
1992	1560	347 (22.2%)	141 (9.0%)	245 (15.7%)	827 (53.0%)
1993	1530	305 (19.9%)	148 (9.7%)	254 (16.6%)	823 (53.8%)
1994	1447	298 (20.6%)	169 (11.7%)	215 (14.9%)	765 (52.9%)
1995	1513	299 (19.8%)	168 (11.1%)	221 (14.6%)	825 (54.5%)
1996	1384	256 (18.5%)	135 (9.8%)	200 (14.5%)	793 (57.3%)
1997	1373	259 (18.9%)	126 (9.2%)	205 (14.9%)	783 (57.0%)
1998	1352	268 (19.8%)	117 (8.7%)	216 (16.0%)	751 (55.5%)
1999	1371	232 (16.9%)	116 (8.5%)	212 (15.5%)	811 (59.2%)
2000	1266	242 (19.1%)	114 (9.0%)	197 (15.6%)	713 (56.3%)
2001	1207	215 (17.8%)	121 (10.0%)	159 (13.2%)	712 (59.0%)
2002	1178	232 (19.7%)	108 (9.2%)	158 (13.4%)	680 (57.7%)
2003	1208	242 (20.0%)	113 (9.4%)	178 (14.7%)	675 (55.9%)
2004	1124	219 (19.5%)	96 (8.5%)	155 (13.8%)	654 (58.2%)
1988-2004	24473	4818 (19.7%)	2356 (9.6%)	3696 (15.1%)	13603 (55.6%)

Table 40 shows the number of persons killed or injured in these events. In the first column (Aircraft), the first number is the number of aircraft/events with an injury of the specified type, and the number in parentheses is a percentage based on the total number of accident aircraft. In the second column (Persons), the first number is the number of persons with an injury of that type, and the number in parentheses is the percentage out of the total number of that category of persons (aboard, crew, passengers, ground, or total) involved in these accidents. The total number of persons involved is defined to be the number of persons on board plus persons on the ground with injuries. The term "Ground" also includes persons on other aircraft, for those events which involved a Part 91 aircraft and a non-Part 91 aircraft. In the third column (Averages) the average number of persons with an injury of that type was calculated in two ways: based on the number of aircraft with an injury of that type, and based on the total number of accident aircraft (24473).

Table 40. Total Number of Injuries

Specific Type of Injury	Aircraft	Persons	Averages
Total Persons Aboard	24471 (100.0%)	47343 (100.0%)	1.93 (1.93)
Total Persons Involved	24473 (100.0%)	47617 (100.0%)	1.95 (1.95)
Total Persons Injured	10870 (44.4%)	20404 (42.9%)	1.88 (0.83)
Fatal Injury Aboard	4753 (19.4%)	9075 (19.2%)	1.91 (0.37)
Crew Fatal Injury	4517 (18.5%)	5029 (18.2%)	1.11 (0.21)
Passengers Fatal Injury	2407 (9.8%)	4046 (20.5%)	1.68 (0.17)
Ground Fatal Injury	44 (0.2%)	71 (25.9%)	1.61 (0.00)
Total Fatal Injuries	4818 (19.7%)	9146 (19.2%)	1.90 (0.37)
Serious Injury Aboard	2904 (11.9%)	4159 (8.8%)	1.43 (0.17)
Crew Serious Injury	2222 (9.1%)	2356 (8.5%)	1.06 (0.10)
Passengers Serious Injury	1379 (5.6%)	1803 (9.1%)	1.31 (0.07)
Ground Serious Injury	46 (0.2%)	51 (18.6%)	1.11 (0.00)
Total Serious Injury	2962 (12.1%)	4210 (8.8%)	1.42 (0.17)
Minor Injury Aboard	4582 (18.7%)	6896 (14.6%)	1.51 (0.28)
Crew Minor Injury	3653 (14.9%)	3895 (14.1%)	1.07 (0.16)
Passengers Minor Injury	2197 (9.0%)	3001 (15.2%)	1.37 (0.12)
Ground Minor Injury	72 (0.3%)	152 (55.5%)	2.11 (0.01)
Total Minor Injury	4648 (19.0%)	7048 (14.8%)	1.52 (0.29)
Not Injured Aboard	14989 (61.3%)	27213 (57.5%)	1.82 (1.11)
Crew Not Injured	14471 (59.1%)	16332 (59.1%)	1.13 (0.67)
Passengers Not Injured	6566 (26.8%)	10881 (55.1%)	1.66 (0.44)

2407 of the 4818 fatal events included passenger fatalities (50%), and in 65 of the fatal events, no persons on board the Part 91 aircraft were killed. In 44 of these accidents, persons on board an aircraft other than the Part 91 flights contained in this report (these other aircraft could include gliders being towed, home

built or experimental aircraft, or helicopters that were also flying under Part 91 regulations) were killed after a mid-air collision. In thirteen accidents, persons on the ground (or in the water) were struck and killed by the aircraft; some of these were in ground/water vehicles. One accident involved a skydiver from a different aircraft; and in the 7 remaining accidents, a person on the ground walked into a rotating propeller.

Fifty-eight percent of all persons on board the Part 91 aircraft sustained no injuries in these 24473 accidents. In the 10870 accidents with injuries, an average of 1.9 persons per event were killed or injured, while the average across all 24473 accidents is less than 1 person killed or injured per accident. When an event included at least one fatality, an average of 1.9 persons died. Similarly, there was an average of 1.4 persons seriously injured, when the event included any serious injuries. When the event included any minor injuries, 1.5 persons on average sustained minor injuries.

Ninety-nine percent (24260) of the Part 91 aircraft involved in these events were destroyed or suffered substantial damage (see Table 41), while 1% had minor or no damage. All percentages are based on the total events for that year.

Table 41. Aircraft Damage by Year of Accident

Year	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
1988	1866	528 (28.3%)	1323 (70.9%)	9 (0.5%)	6 (0.3%)
1989	1738	455 (26.2%)	1269 (73.0%)	11 (0.6%)	3 (0.2%)
1990	1676	437 (26.1%)	1230 (73.4%)	6 (0.4%)	3 (0.2%)
1991	1680	431 (25.7%)	1229 (73.2%)	12 (0.7%)	8 (0.5%)
1992	1560	407 (26.1%)	1143 (73.3%)	5 (0.3%)	5 (0.3%)
1993	1530	392 (25.6%)	1126 (73.6%)	7 (0.5%)	5 (0.3%)
1994	1447	362 (25.0%)	1065 (73.6%)	10 (0.7%)	10 (0.7%)
1995	1513	402 (26.6%)	1093 (72.2%)	10 (0.7%)	8 (0.5%)
1996	1384	318 (23.0%)	1053 (76.1%)	10 (0.7%)	3 (0.2%)
1997	1373	337 (24.5%)	1028 (74.9%)	6 (0.4%)	2 (0.1%)
1998	1352	313 (23.2%)	1029 (76.1%)	5 (0.4%)	5 (0.4%)
1999	1371	266 (19.4%)	1093 (79.7%)	9 (0.7%)	3 (0.2%)
2000	1266	237 (18.7%)	1013 (80.0%)	12 (0.9%)	4 (0.3%)
2001	1207	233 (19.3%)	962 (79.7%)	8 (0.7%)	4 (0.3%)
2002	1178	226 (19.2%)	945 (80.2%)	2 (0.2%)	5 (0.4%)
2003	1208	229 (19.0%)	967 (80.0%)	7 (0.6%)	5 (0.4%)
2004	1124	186 (16.5%)	933 (83.0%)	4 (0.4%)	1 (0.1%)
1988-2004	24473	5759 (23.5%)	18501 (75.6%)	133 (0.5%)	80 (0.3%)

Table 42 shows the distribution of the NTSB severity classification. All percentages are based on the total events for that year. Thirty-three percent of the accidents were considered either major or serious,

while 67% were classified as “damage” accidents. Accidents in which people are injured but the aircraft is not damaged are very rare (0.3%) in Part 91.

Table 42. Accident Severity Classification by Year of Accident

Year	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
1988	1866	571 (30.6%)	117 (6.3%)	3 (0.2%)	1175 (63.0%)
1989	1738	494 (28.4%)	90 (5.2%)	3 (0.2%)	1151 (66.2%)
1990	1676	472 (28.2%)	88 (5.3%)	3 (0.2%)	1113 (66.4%)
1991	1680	470 (28.0%)	105 (6.3%)	6 (0.4%)	1099 (65.4%)
1992	1560	454 (29.1%)	101 (6.5%)	2 (0.1%)	1003 (64.3%)
1993	1530	428 (28.0%)	96 (6.3%)	4 (0.3%)	1002 (65.5%)
1994	1447	402 (27.8%)	107 (7.4%)	11 (0.8%)	927 (64.1%)
1995	1513	430 (28.4%)	101 (6.7%)	6 (0.4%)	976 (64.5%)
1996	1384	365 (26.4%)	93 (6.7%)	4 (0.3%)	922 (66.6%)
1997	1373	374 (27.2%)	85 (6.2%)	1 (0.1%)	913 (66.5%)
1998	1352	360 (26.6%)	83 (6.1%)	4 (0.3%)	905 (66.9%)
1999	1371	300 (21.9%)	86 (6.3%)	2 (0.1%)	983 (71.7%)
2000	1266	280 (22.1%)	102 (8.1%)	3 (0.2%)	881 (69.6%)
2001	1207	270 (22.4%)	89 (7.4%)	4 (0.3%)	844 (69.9%)
2002	1178	273 (23.2%)	90 (7.6%)	4 (0.3%)	811 (68.8%)
2003	1208	288 (23.8%)	92 (7.6%)	6 (0.5%)	822 (68.0%)
2004	1124	256 (22.8%)	80 (7.1%)	3 (0.3%)	785 (69.8%)
1988-2004	24473	6487 (26.5%)	1605 (6.6%)	69 (0.3%)	16312 (66.7%)

Injuries and Aircraft Damage by CICTT Accident Category

Figure 43 and Table 43 present the breakdown of CICTT accident categories in the 1988-2004 accidents. The first column in Table 43 lists the category abbreviation with an explanation of the abbreviation. Refer to Appendix A for a more detailed explanation of these categories. The second column lists the number of accidents in this category (with a percentage based on the total number of accidents, not the total number of category assignments). The third column lists the number of fatal injuries in all the accidents for that category, with a percentage out of the number of persons involved in those accidents (see column 5) and the fourth column shows the total number of injuries of any type in those accidents (again, with a percentage based on column 5).

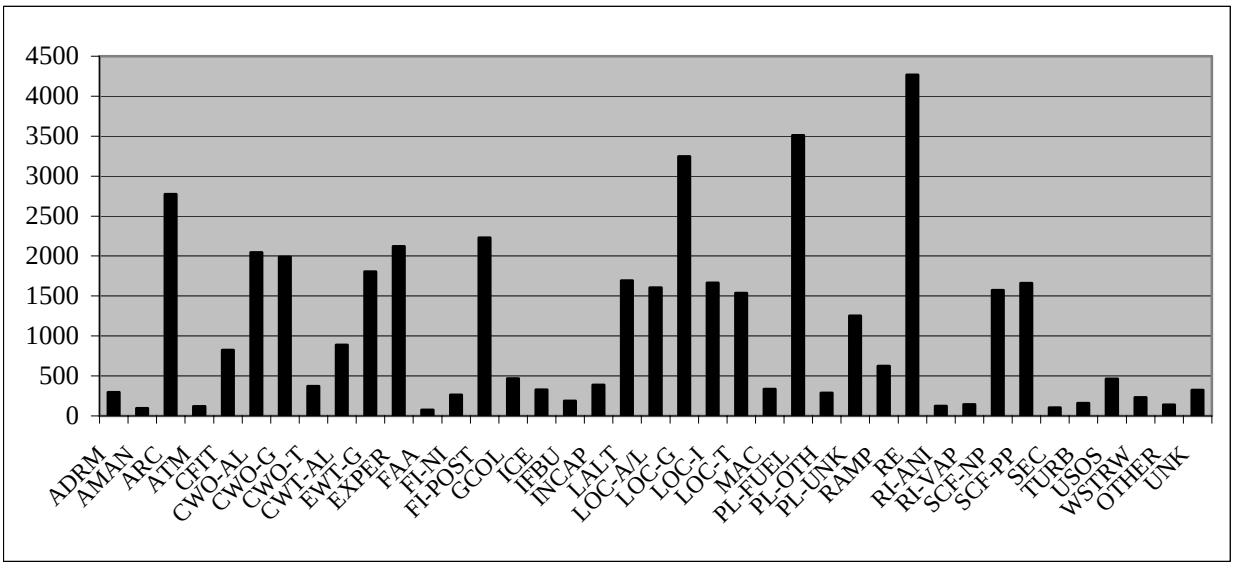

Figure 43. CICTT Accident Categories in Part 91 data from 1988-2004.

The most common categories are runway excursion (17% of events), fuel related loss of engine power (14%), LOC-ground (13%), abnormal runway contact (11%), post-impact fire (9%), Experience/Training (9%), CWO-AL (8%) and CWO-Ground (8%). The categories with fatal injuries to more than half of all those persons involved in the accident are IFBU (99%), LOC-I (78%), CFIT (74%), INCAP (72%), post-impact fire (68%), ATM (64%), LALT (55%) and MAC (52%). The categories with any type of injury to more than two-thirds of all those persons involved in the accident are IFBU (100%), CFIT (93%), INCAP (93%), LOC-I (93%), post-impact fire (91%), LALT (83%), ATM (73%), LOC-A/L (71%), FAA oversight (71%) and LOC-T (67%).

Table 43. CICTT accident categories

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
ADRM (Aerodrome)	296 (1.2%)	14 (2.3%)	82 (13.6%)	604
AMAN (Abrupt Maneuver)	98 (0.4%)	58 (33.5%)	96 (55.5%)	173
ARC (Abnormal Runway Contact)	2774 (11.3%)	69 (1.3%)	766 (14.5%)	5269
ATM (Air Traffic Management)	121 (0.5%)	161 (64.1%)	182 (72.5%)	251
CFIT (Controlled Flight Into or Toward Terrain)	824 (3.4%)	1337 (73.8%)	1683 (92.9%)	1811
CWO-AL (Coll with Object – A/L)	2044 (8.4%)	484 (12.4%)	2429 (62.3%)	3897
CWO-G (Coll with Object – Ground)	1990 (8.1%)	61 (1.6%)	775 (20.9%)	3705
CWO-T (Coll with Object – Takeoff)	373 (1.5%)	160 (18.5%)	484 (56.0%)	864
CWT-AL (Coll with Terrain – A/L)	887 (3.6%)	237 (13.4%)	1036 (58.4%)	1773
EWT-G (Encounter with Terrain – On Ground)	1806 (7.4%)	28 (0.8%)	1011 (29.9%)	3385
EXPER (Experience/Training Issues)	2122 (8.7%)	1375 (34.6%)	2149 (54.1%)	3972
FAA (Inadequate FAA Oversight)	76 (0.3%)	90 (49.2%)	129 (70.5%)	183
FI-NI (Fire/Smoke – Non-Impact)	265 (1.1%)	100 (18.1%)	194 (35.1%)	553
FI-POST (Fire – Post Impact)	2229 (9.1%)	3452 (67.5%)	4646 (90.8%)	5114
GCOL (Ground Collision)	469 (1.9%)	9 (1.1%)	110 (13.0%)	849
ICE (Icing)	329 (1.3%)	322 (40.8%)	505 (64.0%)	789
IFBU(In Flight Break Up)	187 (0.8%)	442 (98.9%)	447 (100.%)	447
INCAP(Pilot Incapacitation /Severe Impairment)	388 (1.6%)	473 (71.8%)	613 (93.0%)	659
LALT(Low Altitude Operations)	1694 (6.9%)	1747 (54.5%)	2648 (82.6%)	3207
LOC-A/L (Loss of Control – A/L)	1605 (6.6%)	1184 (37.0%)	2284 (71.3%)	3203
LOC-G (Loss of Control – Ground)	3246 (13.3%)	18 (0.3%)	697 (13.1%)	5322
LOC-I (Loss of Control – In Flight)	1666 (6.8%)	2606 (78.2%)	3093 (92.8%)	3333
LOC-T (Loss of Control – Takeoff)	1537 (6.3%)	1074 (30.8%)	2353 (67.4%)	3490
MAC (Mid Air Coll or Lack of Sep)	336 (1.4%)	318 (52.0%)	396 (64.7%)	612
PL-FUEL (Loss of Engine Power – Fuel Related)	3513 (14.4%)	557 (8.6%)	3096 (47.9%)	6460
PL-OTH (Loss of Engine Power – Other Reasons)	288 (1.2%)	50 (8.3%)	268 (44.5%)	602
PL-UNK (Loss of Engine Power – Unknown Reasons)	1255 (5.1%)	330 (13.5%)	1210 (49.4%)	2448
RAMP (Ground Handling)	623 (2.5%)	557 (33.4%)	1058 (63.4%)	1668
RE (Runway Excursion)	4266 (17.4%)	72 (0.9%)	1202 (14.9%)	8086
RI-ANI (Runway Incursion – Animal)	125 (0.5%)	0 (0.0%)	33 (13.1%)	251
RI-VAP (Runway Incursion – Vehicle or Aircraft or Person)	146 (0.6%)	32 (11.7%)	90 (33.0%)	273
(Continued on next table)				

Table 43. CICTT accident categories (Concluded)

CICTT category	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
SCF-NP (System/Component Failure or Malfunction (Non-Powerplant)	1575 (6.4%)	364 (11.1%)	871 (26.7%)	3265
SCF-PP (System/Component Failure or Malfunction (Powerplant)	1661 (6.8%)	485 (13.7%)	1598 (45.3%)	3531
SEC (Security)	103 (0.4%)	67 (47.2%)	92 (64.8%)	142
TURB (Turbulence)	162 (0.7%)	108 (32.7%)	174 (52.7%)	330
USOS (Undershoot/Overshoot)	466 (1.9%)	22 (2.3%)	220 (22.8%)	964
WSTRW (Windshear/Thunderstorm)	233 (1.0%)	245 (43.1%)	361 (63.4%)	569
OTHER (Other)	142 (0.6%)	66 (18.1%)	118 (32.4%)	364
UNK (Unknown/Not Reported)	323 (1.3%)	445 (57.5%)	558 (72.1%)	774
Total	24473 (100.%)	9146 (19.2%)	20404 (42.9%)	47617

Table 44 shows the most severe injury distribution in each CICTT accident category. All percentages in Tables 44 through 46 are based on the total events for that category. The categories most likely to have at least one fatal injury are IFBU (100%), CFIT (77%), LOC-I (81%), INCAP (76%), post-impact fire (73%), ATM (62%), MAC (62%) and LALT (60%). The categories most likely to result in no injuries are LOC-Ground (85%), aerodrome (84%), ground collision (84%), RI-Animal (85%), runway excursion (83%), abnormal runway contact (83%), CWO-G (77%), undershoot/overshoot (73%) and non-powerplant system/component failure/malfunction (71%).

Table 45 shows the distribution of aircraft damage in each CICTT accident category. The categories most likely to result in aircraft destruction are IFBU (100%), post-impact fire (90%), LOC-I (78%), CFIT (77%), INCAP (68%) and LALT (61%). The categories most likely to result in less than substantial damage were ground collision (12%), ground handling (11%), RI-VAP (10%), MAC (10%), ATM (5%), and turbulence (4%).

Table 46 shows the severity classification in each CICTT accident category. The categories most likely to include “major” accidents are IFBU (100%), post-impact fire (92%), LOC-I (86%), CFIT (84%), INCAP (80%), LALT (70%), MAC (67%), security (65%) and ATM (64%). The categories with less than 10% of the accidents either “Major” or “Serious” are LOC-Ground (5%), RI-ANI (6%), ground collision (6%), aerodrome (7%), runway excursion (7%) and abnormal runway contact (10%).

Table 44. Most Severe Injury by CICTT accident category

CICTT category	Total Events	Fatal Injury	Serious Injury	Minor Injury	No Injury
ADRM	296	6 (2.0%)	10 (3.4%)	32 (10.8%)	248 (83.8%)
AMAN	98	36 (36.7%)	11 (11.2%)	12 (12.2%)	39 (39.8%)
ARC	2774	43 (1.6%)	137 (4.9%)	299 (10.8%)	2295 (82.7%)
ATM	121	75 (62.0%)	5 (4.1%)	5 (4.1%)	36 (29.8%)
CFIT	824	637 (77.3%)	69 (8.4%)	65 (7.9%)	53 (6.4%)
CWO-AL	2044	295 (14.4%)	446 (21.8%)	581 (28.4%)	722 (35.3%)
CWO-G	1990	31 (1.6%)	110 (5.5%)	322 (16.2%)	1527 (76.7%)
CWO-T	373	76 (20.4%)	57 (15.3%)	83 (22.3%)	157 (42.1%)
CWT-AL	887	132 (14.9%)	173 (19.5%)	245 (27.6%)	337 (38.0%)
EWT-G	1806	21 (1.2%)	179 (9.9%)	422 (23.4%)	1184 (65.6%)
EXPER	2122	668 (31.5%)	168 (7.9%)	232 (10.9%)	1054 (49.7%)
FAA	76	41 (53.9%)	9 (11.8%)	4 (5.3%)	22 (28.9%)
FI-NI	265	48 (18.1%)	24 (9.1%)	30 (11.3%)	163 (61.5%)
FI-POST	2229	1624 (72.9%)	239 (10.7%)	177 (7.9%)	189 (8.5%)
GCOL	469	6 (1.3%)	19 (4.1%)	54 (11.5%)	390 (83.2%)
ICE	329	144 (43.8%)	42 (12.8%)	30 (9.1%)	113 (34.3%)
IFBU	187	187 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
INCAP	388	295 (76.0%)	44 (11.3%)	26 (6.7%)	23 (5.9%)
LALT	1694	1008 (59.5%)	245 (14.5%)	189 (11.2%)	252 (14.9%)
LOC-A/L	1605	605 (37.7%)	280 (17.4%)	291 (18.1%)	429 (26.7%)
LOC-G	3246	15 (0.5%)	79 (2.4%)	396 (12.2%)	2756 (84.9%)
LOC-I	1666	1342 (80.6%)	127 (7.6%)	107 (6.4%)	90 (5.4%)
LOC-T	1537	517 (33.6%)	281 (18.3%)	258 (16.8%)	481 (31.3%)
MAC	336	207 (61.6%)	18 (5.4%)	29 (8.6%)	82 (24.4%)
PL-FUEL	3513	323 (9.2%)	578 (16.5%)	867 (24.7%)	1745 (49.7%)
PL-OTH	288	29 (10.1%)	47 (16.3%)	71 (24.7%)	141 (49.0%)
PL-UNK	1255	175 (13.9%)	177 (14.1%)	299 (23.8%)	604 (48.1%)
RAMP	623	231 (37.1%)	124 (19.9%)	81 (13.0%)	187 (30.0%)
RE	4266	43 (1.0%)	165 (3.9%)	514 (12.0%)	3544 (83.1%)
RI-ANI	125	0 (0.0%)	3 (2.4%)	16 (12.8%)	106 (84.8%)
RI-VAP	146	17 (11.6%)	14 (9.6%)	23 (15.8%)	92 (63.0%)
SCF-NP	1575	186 (11.8%)	97 (6.2%)	172 (10.9%)	1120 (71.1%)
SCF-PP	1661	233 (14.0%)	199 (12.0%)	388 (23.4%)	841 (50.6%)
SEC	103	59 (57.3%)	8 (7.8%)	7 (6.8%)	29 (28.2%)
TURB	162	50 (30.9%)	19 (11.7%)	22 (13.6%)	71 (43.8%)
USOS	466	8 (1.7%)	40 (8.6%)	77 (16.5%)	341 (73.2%)
WSTRW	233	108 (46.4%)	19 (8.2%)	31 (13.3%)	75 (32.2%)
OTHER	142	44 (31.0%)	16 (11.3%)	16 (11.3%)	66 (46.5%)
UNK	323	215 (66.6%)	17 (5.3%)	13 (4.0%)	78 (24.1%)
Total	24473	4818 (19.7%)	2356 (9.6%)	3696 (15.1%)	13603 (55.6%)

Table 45. Aircraft Damage by CICTT accident category

CICTT Category	Total Events	Destroyed	Substantial Damage	Minor Damage	No Damage
ADRM	296	14 (4.7%)	282 (95.3%)	0 (0.0%)	0 (0.0%)
AMAN	98	37 (37.8%)	61 (62.2%)	0 (0.0%)	0 (0.0%)
ARC	2774	137 (4.9%)	2637 (95.1%)	0 (0.0%)	0 (0.0%)
ATM	121	69 (57.0%)	46 (38.0%)	6 (5.0%)	0 (0.0%)
CFIT	824	630 (76.5%)	194 (23.5%)	0 (0.0%)	0 (0.0%)
CWO-AL	2044	518 (25.3%)	1525 (74.6%)	1 (0.0%)	0 (0.0%)
CWO-G	1990	135 (6.8%)	1853 (93.1%)	2 (0.1%)	0 (0.0%)
CWO-T	373	107 (28.7%)	266 (71.3%)	0 (0.0%)	0 (0.0%)
CWT-AL	887	238 (26.8%)	647 (72.9%)	2 (0.2%)	0 (0.0%)
EWT-G	1806	97 (5.4%)	1707 (94.5%)	1 (0.1%)	1 (0.1%)
EXPER	2122	710 (33.5%)	1405 (66.2%)	5 (0.2%)	2 (0.1%)
FAA	76	44 (57.9%)	32 (42.1%)	0 (0.0%)	0 (0.0%)
FI-NI	265	136 (51.3%)	129 (48.7%)	0 (0.0%)	0 (0.0%)
FI-POST	2229	2001 (89.8%)	228 (10.2%)	0 (0.0%)	0 (0.0%)
GCOL	469	10 (2.1%)	403 (85.9%)	53 (11.3%)	3 (0.6%)
ICE	329	159 (48.3%)	170 (51.7%)	0 (0.0%)	0 (0.0%)
IFBU	187	187 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
INCAP	388	264 (68.0%)	121 (31.2%)	1 (0.3%)	2 (0.5%)
LALT	1694	1039 (61.3%)	654 (38.6%)	1 (0.1%)	1 (0.1%)
LOC-A/L	1605	664 (41.4%)	940 (58.6%)	0 (0.0%)	2 (0.1%)
LOC-G	3246	71 (2.2%)	3175 (97.8%)	0 (0.0%)	0 (0.0%)
LOC-I	1666	1305 (78.3%)	359 (21.5%)	2 (0.1%)	0 (0.0%)
LOC-T	1537	603 (39.2%)	932 (60.6%)	0 (0.0%)	1 (0.1%)
MAC	336	178 (53.0%)	124 (36.9%)	32 (9.5%)	2 (0.6%)
PL-FUEL	3513	548 (15.6%)	2965 (84.4%)	0 (0.0%)	0 (0.0%)
PL-OTH	288	53 (18.4%)	235 (81.6%)	0 (0.0%)	0 (0.0%)
PL-UNK	1255	291 (23.2%)	962 (76.7%)	1 (0.1%)	1 (0.1%)
RAMP	623	233 (37.4%)	319 (51.2%)	18 (2.9%)	53 (8.5%)
RE	4266	166 (3.9%)	4100 (96.1%)	0 (0.0%)	0 (0.0%)
RI-ANI	125	6 (4.8%)	119 (95.2%)	0 (0.0%)	0 (0.0%)
RI-VAP	146	23 (15.8%)	108 (74.0%)	13 (8.9%)	2 (1.4%)
SCF-NP	1575	237 (15.0%)	1336 (84.8%)	2 (0.1%)	0 (0.0%)
SCF-PP	1661	352 (21.2%)	1305 (78.6%)	4 (0.2%)	0 (0.0%)
SEC	103	61 (59.2%)	39 (37.9%)	0 (0.0%)	3 (2.9%)
TURB	162	59 (36.4%)	96 (59.3%)	0 (0.0%)	7 (4.3%)
USOS	466	35 (7.5%)	431 (92.5%)	0 (0.0%)	0 (0.0%)
WSTRW	233	118 (50.6%)	115 (49.4%)	0 (0.0%)	0 (0.0%)
OTHER	142	40 (28.2%)	93 (65.5%)	6 (4.2%)	3 (2.1%)
UNK	323	216 (66.9%)	105 (32.5%)	0 (0.0%)	2 (0.6%)
Total	24473	5759 (23.5%)	18501 (75.6%)	133 (0.5%)	80 (0.3%)

Table 46. Accident Severity Classification by CICTT Accident Category

CICTT Category	Total Events	Major Accident	Serious Accident	Injury Accident	Damage Accident
ADRM	296	14 (4.7%)	8 (2.7%)	0 (0.0%)	274 (92.6%)
AMAN	98	45 (45.9%)	4 (4.1%)	0 (0.0%)	49 (50.0%)
ARC	2774	156 (5.6%)	108 (3.9%)	0 (0.0%)	2510 (90.5%)
ATM	121	77 (63.6%)	4 (3.3%)	0 (0.0%)	40 (33.1%)
CFIT	824	689 (83.6%)	36 (4.4%)	0 (0.0%)	99 (12.0%)
CWO-AL	2044	601 (29.4%)	302 (14.8%)	1 (0.0%)	1140 (55.8%)
CWO-G	1990	142 (7.1%)	73 (3.7%)	1 (0.1%)	1774 (89.1%)
CWO-T	373	121 (32.4%)	41 (11.0%)	0 (0.0%)	211 (56.6%)
CWT-AL	887	277 (31.2%)	131 (14.8%)	1 (0.1%)	478 (53.9%)
EWT-G	1806	104 (5.8%)	141 (7.8%)	2 (0.1%)	1559 (86.3%)
EXPER	2122	778 (36.7%)	101 (4.8%)	4 (0.2%)	1239 (58.4%)
FAA	76	46 (60.5%)	6 (7.9%)	0 (0.0%)	24 (31.6%)
FI-NI	265	138 (52.1%)	7 (2.6%)	0 (0.0%)	120 (45.3%)
FI-POST	2229	2054 (92.1%)	52 (2.3%)	0 (0.0%)	123 (5.5%)
GCOL	469	16 (3.4%)	12 (2.6%)	4 (0.9%)	437 (93.2%)
ICE	329	172 (52.3%)	23 (7.0%)	0 (0.0%)	134 (40.7%)
IFBU	187	187 (100.%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
INCAP	388	309 (79.6%)	34 (8.8%)	0 (0.0%)	45 (11.6%)
LALT	1694	1191 (70.3%)	135 (8.0%)	0 (0.0%)	368 (21.7%)
LOC-A/L	1605	769 (47.9%)	185 (11.5%)	0 (0.0%)	651 (40.6%)
LOC-G	3246	81 (2.5%)	67 (2.1%)	0 (0.0%)	3098 (95.4%)
LOC-I	1666	1428 (85.7%)	70 (4.2%)	2 (0.1%)	166 (10.0%)
LOC-T	1537	693 (45.1%)	179 (11.6%)	2 (0.1%)	663 (43.1%)
MAC	336	226 (67.3%)	8 (2.4%)	0 (0.0%)	102 (30.4%)
PL-FUEL	3513	641 (18.2%)	431 (12.3%)	0 (0.0%)	2441 (69.5%)
PL-OTH	288	55 (19.1%)	35 (12.2%)	0 (0.0%)	198 (68.8%)
PL-UNK	1255	335 (26.7%)	119 (9.5%)	2 (0.2%)	799 (63.7%)
RAMP	623	262 (42.1%)	75 (12.0%)	43 (6.9%)	243 (39.0%)
RE	4266	179 (4.2%)	135 (3.2%)	0 (0.0%)	3952 (92.6%)
RI-ANI	125	6 (4.8%)	1 (0.8%)	0 (0.0%)	118 (94.4%)
RI-VAP	146	36 (24.7%)	8 (5.5%)	1 (0.7%)	101 (69.2%)
SCF-NP	1575	259 (16.4%)	66 (4.2%)	2 (0.1%)	1248 (79.2%)
SCF-PP	1661	393 (23.7%)	135 (8.1%)	2 (0.1%)	1131 (68.1%)
SEC	103	67 (65.0%)	6 (5.8%)	0 (0.0%)	30 (29.1%)
TURB	162	63 (38.9%)	7 (4.3%)	7 (4.3%)	85 (52.5%)
USOS	466	38 (8.2%)	29 (6.2%)	0 (0.0%)	399 (85.6%)
WSTRW	233	124 (53.2%)	10 (4.3%)	0 (0.0%)	99 (42.5%)
OTHER	142	50 (35.2%)	14 (9.9%)	3 (2.1%)	75 (52.8%)
UNK	323	235 (72.8%)	13 (4.0%)	0 (0.0%)	75 (23.2%)
Total	24473	6487 (26.5%)	1605 (6.6%)	69 (0.3%)	16312 (66.7%)

Trends over time in CICTT Accident Categories

The CICTT categories found to show a significant trend are shown in Figure 44 through Figure 61 below. The estimated regression line is included on each chart. Runway Incursions involving animals have increased. Accidents categorized as Abnormal Runway Contact, CFIT, Experience/Training Issues, Post-Impact Fires, Ground Collisions, Icing, Low Altitude Operations, LOC-A/L, LOC-G, LOC-T, LOC-I, Mid-Air Collisions, Fuel Related Loss of Engine Power, Non-Powerplant System/Component Failure/Malfunction, Powerplant System/Component Failure/Malfunction, Undershoot/Overshoot and Windshear/Thunderstorm have decreased. As seen in Figure 61, although the general trend is for a decreasing rate of encounters with Windshear or Thunderstorm, since 1997 these rates are actually increasing.

Other categories which are not presented graphically but which also display a decreasing trend include Aerodrome, Collision with Object (Approach/Landing), Collision with Object (Takeoff), Encounter with Terrain (Ground), Ground Handling, In-Flight Break-Up, Incapacitation, Loss of Engine Power for Other Reasons and Security.

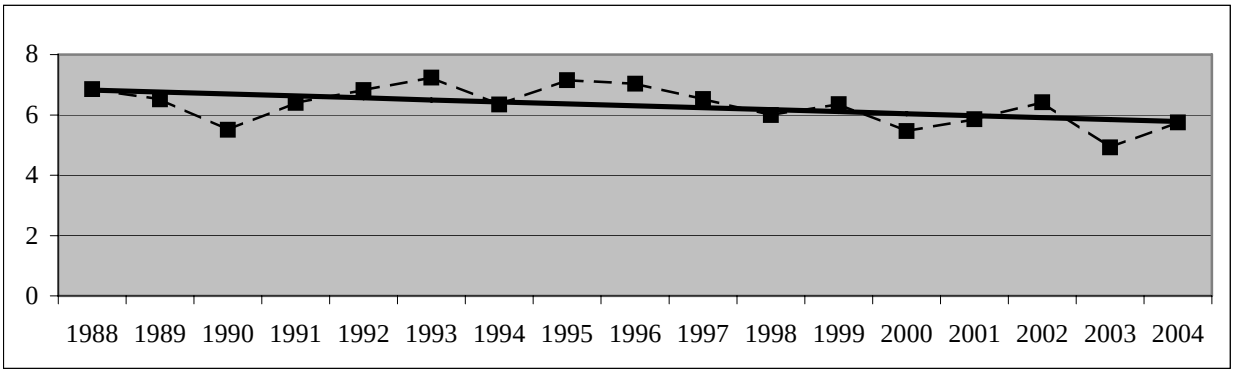

Figure 44. Rate of Abnormal Runway Contact (per million flight hours).

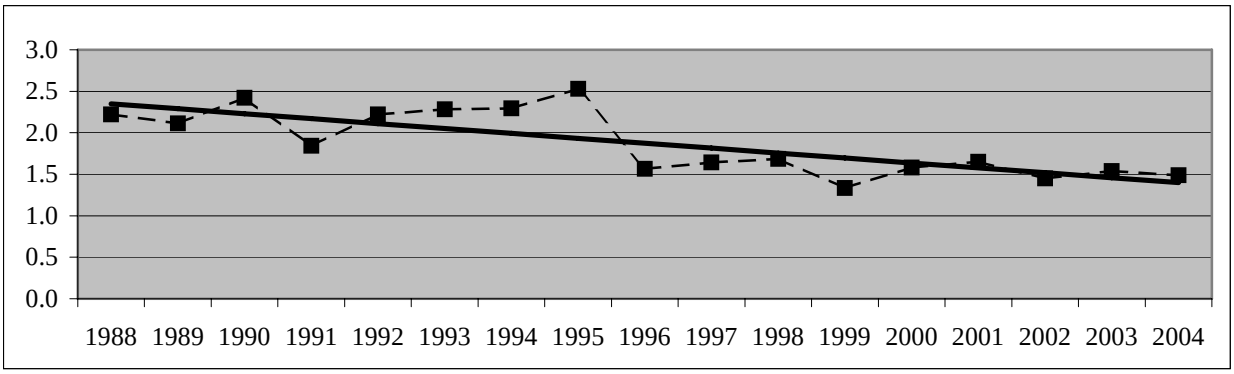

Figure 45. Rate of CFIT (per million flight hours).

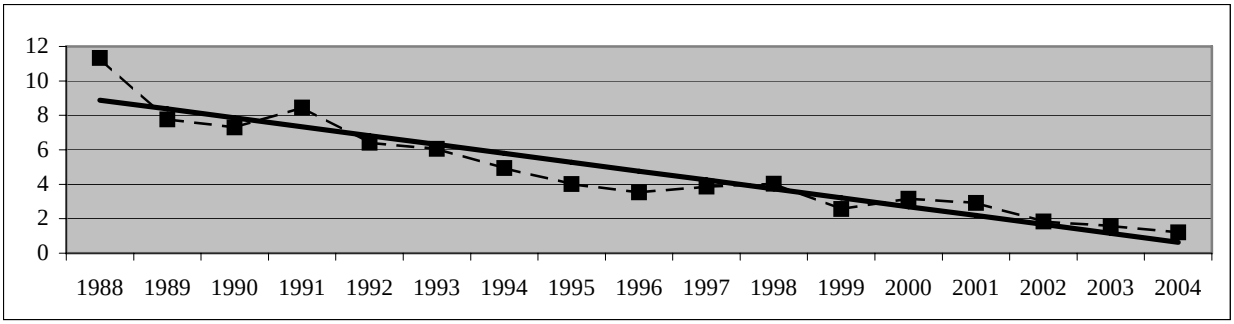

Figure 46. Rate of Experience/Training Issues (per million flight hours).

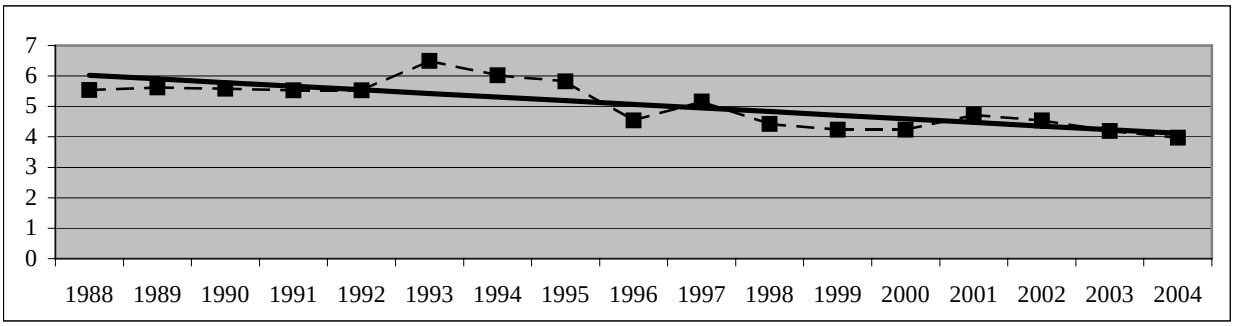

Figure 47. Rate of Post-Impact Fires (per million flight hours).

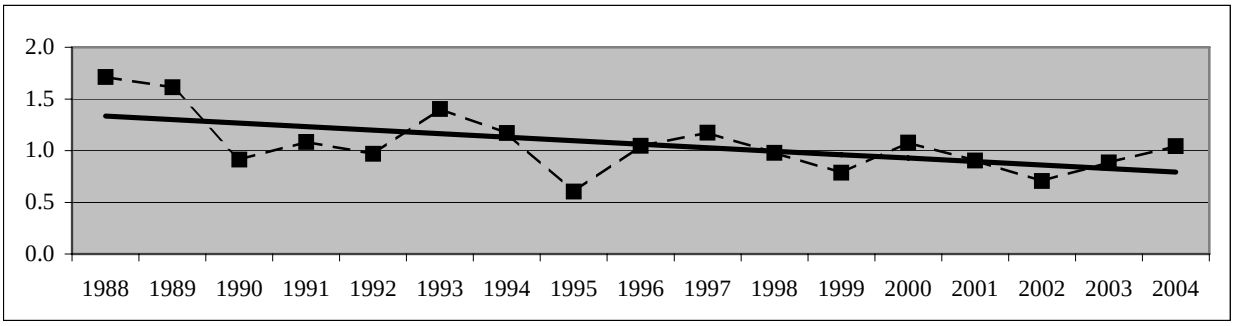

Figure 48. Rate of Ground Collisions (per million flight hours).

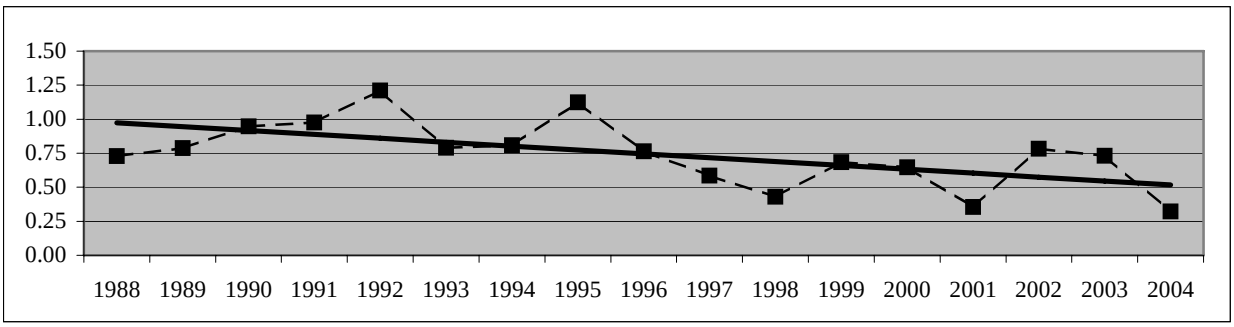

Figure 49. Rate of Icing Accidents (per million flight hours).

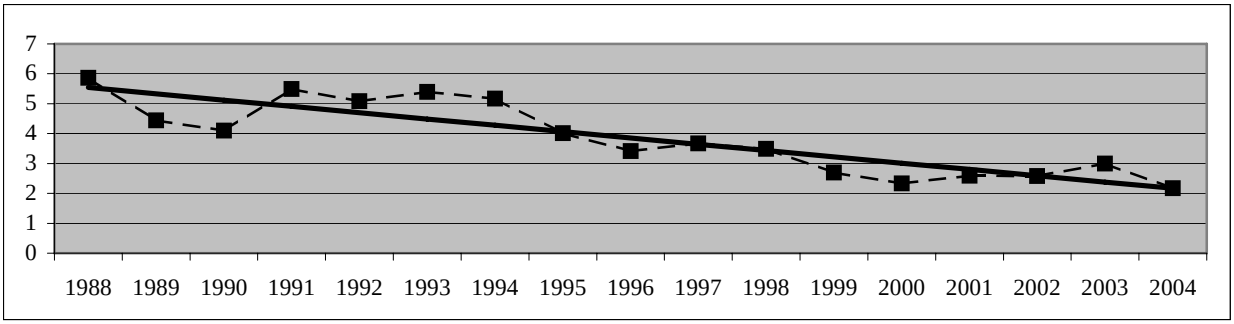

Figure 50. Rate of Low Altitude Operations (per million flight hours).

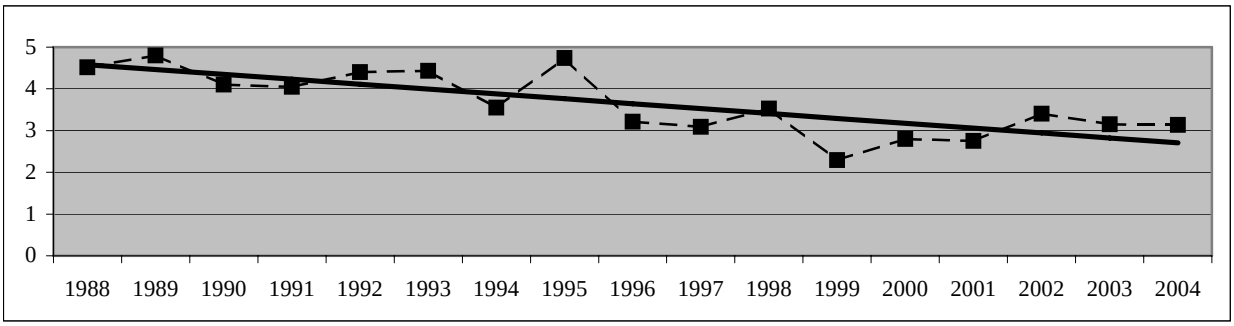

Figure 51. Rate of Loss of Control -- Approach/Landing (per million flight hours).

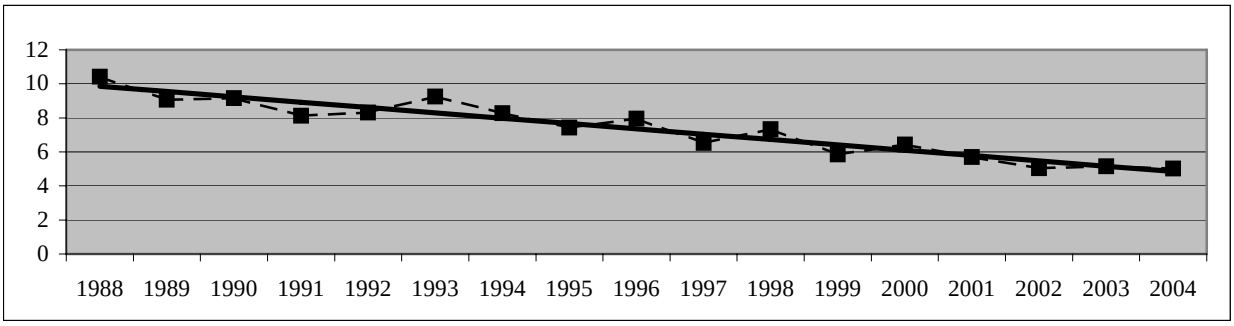

Figure 52. Rate of Loss of Control -- Ground (per million flight hours).

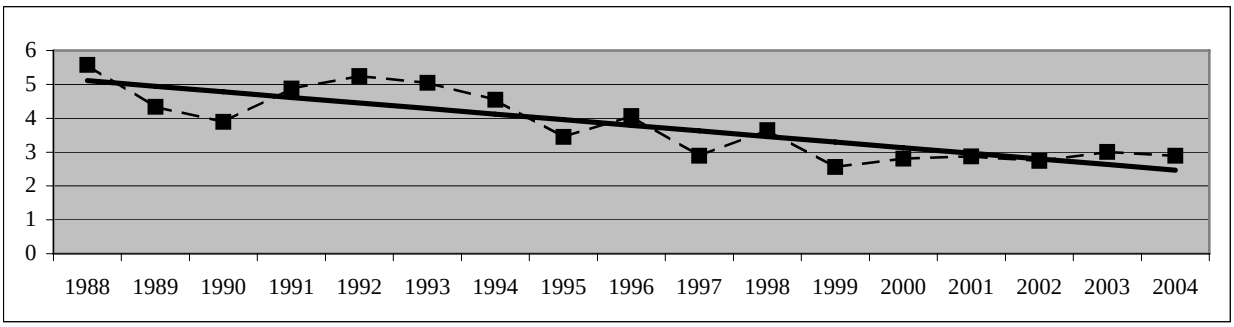

Figure 53. Rate of Loss of Control -- In Flight (per million flight hours).

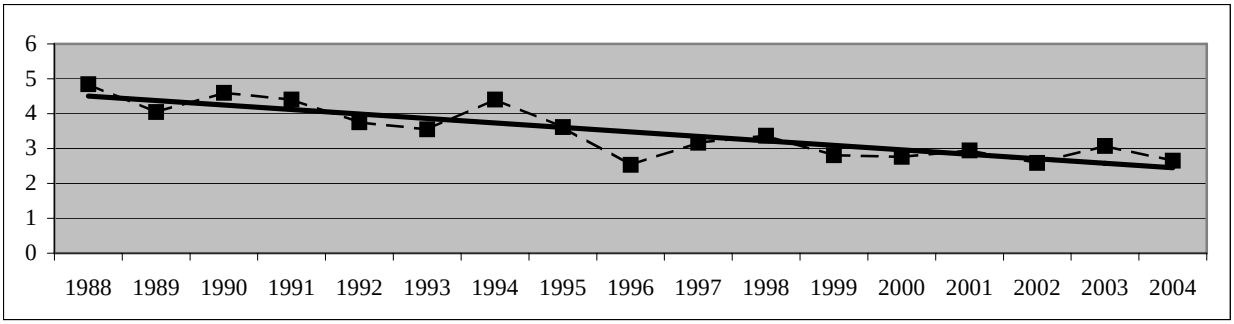

Figure 54. Rate of Loss of Control -- Takeoff (per million flight hours).

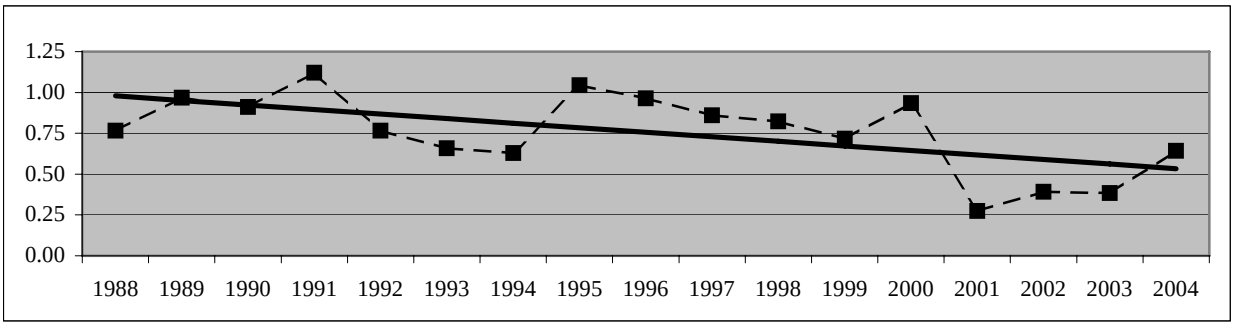

Figure 55. Rate of Mid-Air Collisions (per million flight hours).

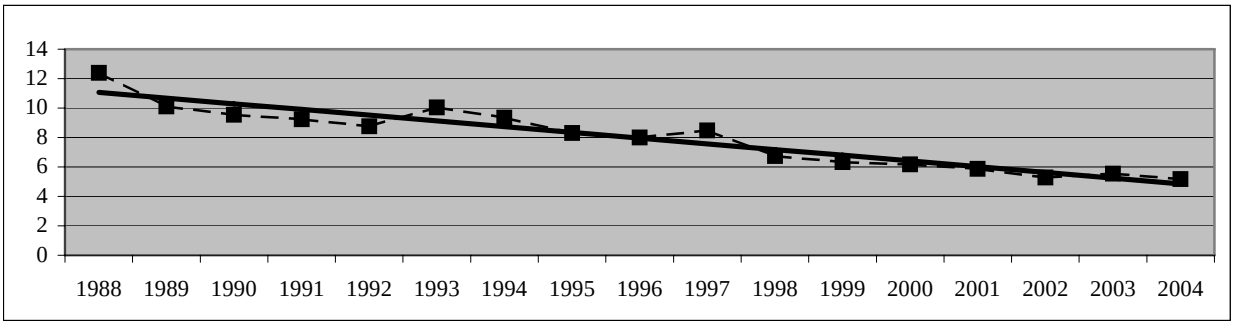

Figure 56. Rate of Fuel Related Engine Power Loss (per million flight hours).

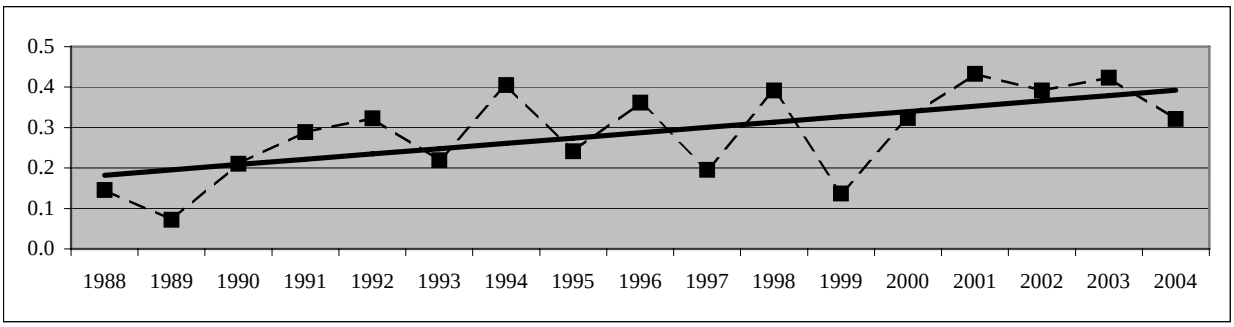

Figure 57. Rate of Runway Incursion --Animal (per million flight hours).

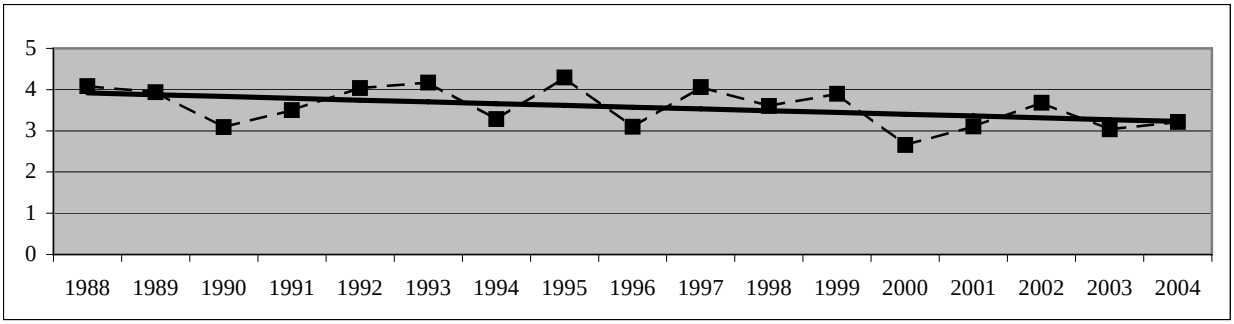

Figure 58. Rate of Non-Powerplant System/Component Failure/Malfunction (per million flight hours).

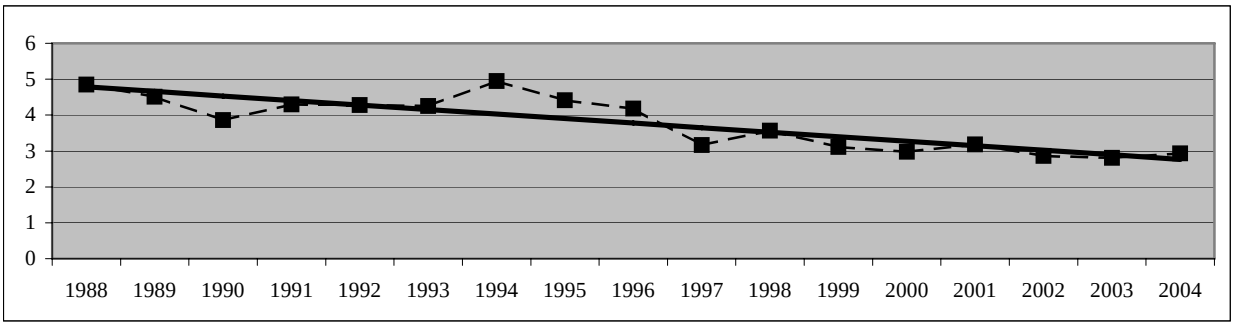

Figure 59. Rate of Powerplant System/Component Failure/Malfunction (per million flight hours).

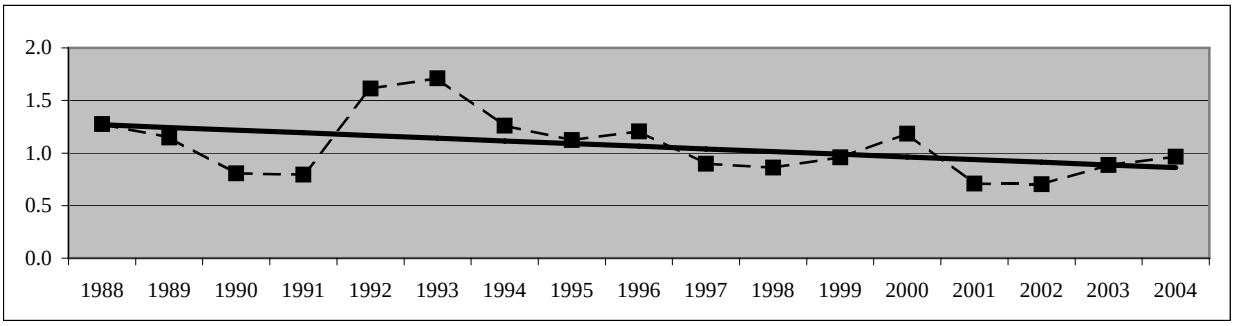

Figure 60. Rate of Undershoot/Overshoot (per million flight hours).

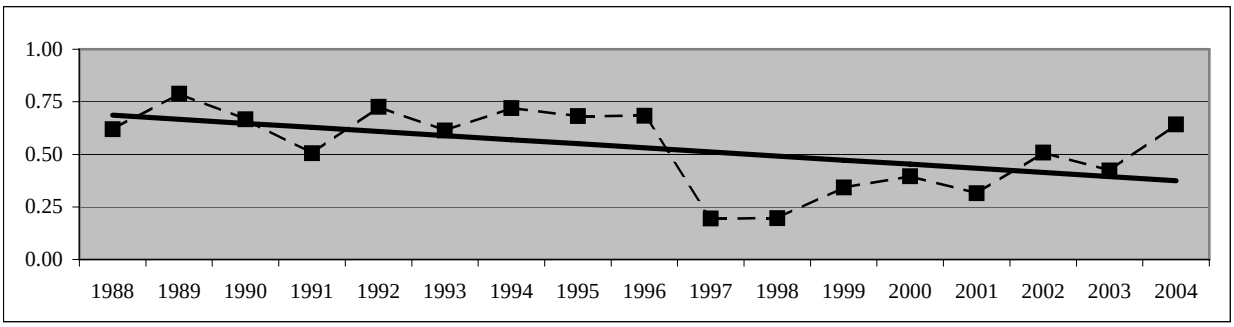

Figure 61. Rate of Windshear/Thunderstorm (per million flight hours).

Figures 62 through 64 show the relative constancy (lack of trend) of rates among the three remaining most common or most often fatal CICTT categories.

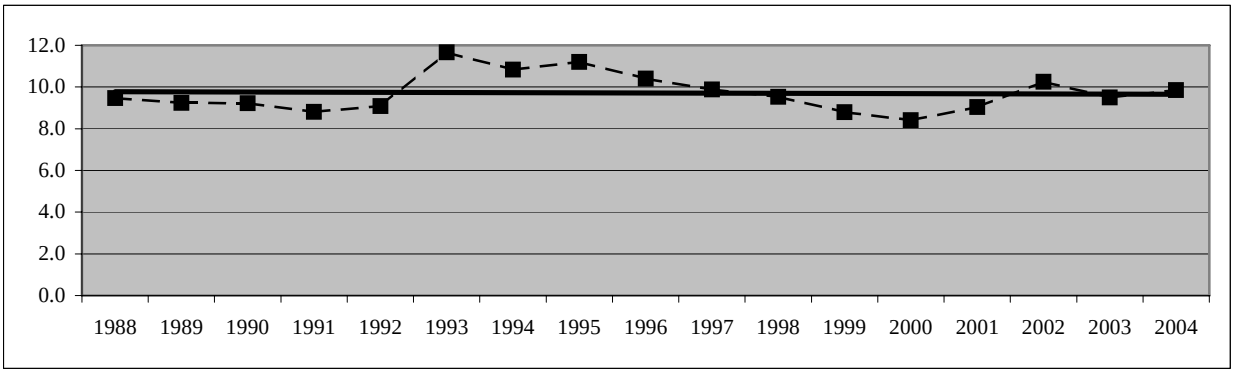

Figure 62. Rate of Runway Excursions (per million flight hours).

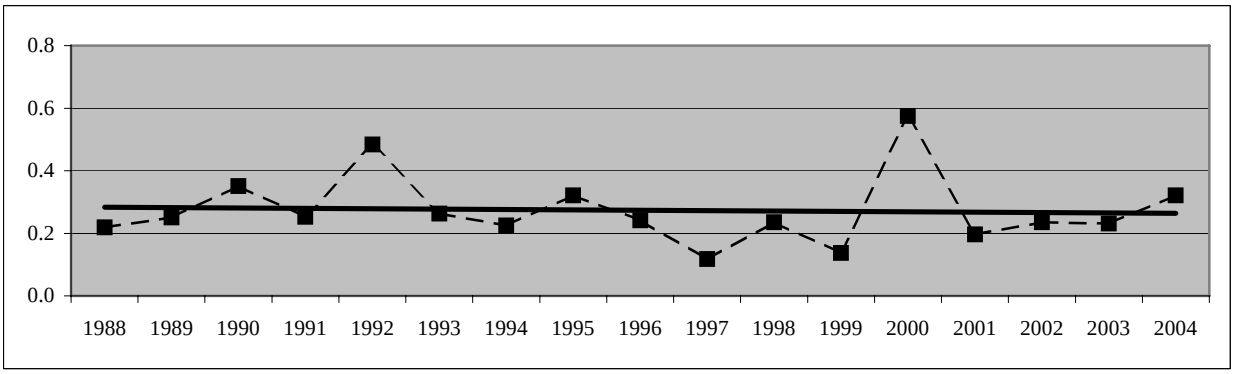

Figure 63. Rate of ATM Events (per million flight hours).

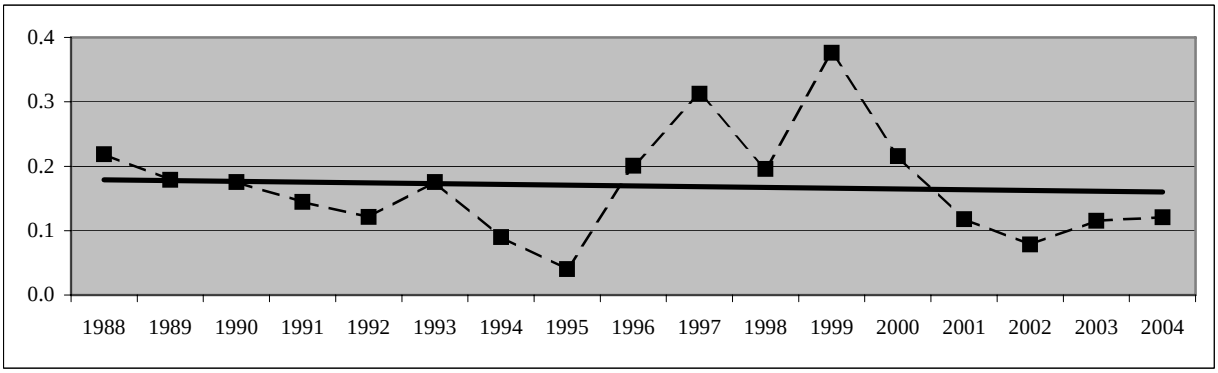

Figure 64. Rate of FAA Oversight Events (per million flight hours).

Additional Miscellaneous Information

Table 47 presents the distribution of events by phase of flight. All percentages are based on the total events for that year. Thirty-one percent of all accidents occurred during en route phases of flight, while 42% occurred during Approach or Landing.

Table 47. Phase of Flight for Initiating Occurrence

Year	Total Events	Standing or Taxi	Takeoff	En Route **	Approach or Landing	Unknown/ No Report
1988	1866	88 (4.7%)	369 (19.8%)	641 (34.4%)	734 (39.3%)	34 (1.8%)
1989	1738	73 (4.2%)	372 (21.4%)	555 (31.9%)	709 (40.8%)	29 (1.7%)
1990	1676	68 (4.1%)	359 (21.4%)	515 (30.7%)	699 (41.7%)	35 (2.1%)
1991	1680	60 (3.6%)	378 (22.5%)	581 (34.6%)	632 (37.6%)	29 (1.7%)
1992	1560	41 (2.6%)	308 (19.7%)	531 (34.0%)	633 (40.6%)	47 (3.0%)
1993	1530	64 (4.2%)	297 (19.4%)	508 (33.2%)	625 (40.8%)	36 (2.4%)
1994	1447	60 (4.1%)	324 (22.4%)	467 (32.3%)	576 (39.8%)	20 (1.4%)
1995	1513	58 (3.8%)	328 (21.7%)	487 (32.2%)	618 (40.8%)	22 (1.5%)
1996	1384	59 (4.3%)	239 (17.3%)	436 (31.5%)	628 (45.4%)	22 (1.6%)
1997	1373	61 (4.4%)	283 (20.6%)	427 (31.1%)	585 (42.6%)	17 (1.2%)
1998	1352	61 (4.5%)	285 (21.1%)	400 (29.6%)	585 (43.3%)	21 (1.6%)
1999	1371	59 (4.3%)	278 (20.3%)	399 (29.1%)	621 (45.3%)	14 (1.0%)
2000	1266	55 (4.3%)	274 (21.6%)	364 (28.8%)	563 (44.5%)	10 (0.8%)
2001	1207	62 (5.1%)	251 (20.8%)	349 (28.9%)	529 (43.8%)	16 (1.3%)
2002	1178	51 (4.3%)	232 (19.7%)	333 (28.3%)	554 (47.0%)	8 (0.7%)
2003	1208	44 (3.6%)	251 (20.8%)	343 (28.4%)	559 (46.3%)	11 (0.9%)
2004	1124	50 (4.4%)	221 (19.7%)	310 (27.6%)	538 (47.9%)	5 (0.4%)
1988-2004	24473	1014 (4.1%)	5049 (20.6%)	7646 (31.2%)	10388 (42.4%)	376 (1.5%)

** En route includes climb, cruise, descent and maneuvering flight

For the 3228 accidents classified as either SCF-PP or SCF-NP, Table 48 provides information on the specific system or component involved in the failure or malfunction. Multiple malfunctions were noted in 202 accidents. The “total events” percentage is based on the total number of accidents (24473), while the percentages associated with number of injuries are based on the number of persons involved with all the accidents with a malfunction of that type. Failures or malfunctions were most common in the engine and landing gear. Malfunctions of instrumentation, communications or navigation occurred in only 0.2% of the accidents, but 75% of the persons involved with those flights were injured, and 60% of those injuries were fatal. The “other” systems were anti-ice/de-ice (4), cockpit heater (1), fire warning system (1), landing lights (5), oxygen system (2), pressurization system (1) and vacuum system (20).

Table 48. Specific System/Component Failures/Malfunctions

Component or System Affected	Total Events	Number of Fatal Injuries	Number of Injuries	Persons Involved
Electrical System	152 (0.6%)	31 (10.2%)	112 (36.7%)	305
Engine	1555 (6.4%)	444 (13.5%)	1494 (45.6%)	3278
Flight Control System/Surfaces	168 (0.7%)	49 (16.0%)	112 (36.5%)	307
Fuel System	315 (1.3%)	100 (15.5%)	309 (47.8%)	647
Hydraulic System	65 (0.3%)	0 (0.0%)	9 (6.2%)	145
Instrumentation/Communications/ Navigation	39 (0.2%)	47 (45.2%)	78 (75.0%)	104
Landing Gear	707 (2.9%)	3 (0.2%)	90 (6.0%)	1497
Lubricating System	213 (0.9%)	34 (8.3%)	181 (44.1%)	410
Propeller	101 (0.4%)	36 (14.9%)	93 (38.4%)	242
Structures	81 (0.3%)	69 (48.3%)	90 (62.9%)	143
Other Systems	34 (0.1%)	63 (64.3%)	67 (68.4%)	98
Total	24473 (100.%)	9146 (19.2%)	20404 (42.9%)	47617

Among Part 91 accidents during 1988-2004, there were 1666 events with in-flight loss of control, 1537 with loss of control on takeoff climb, and 1605 with loss of control during approach or landing (also see Table 43). As shown in Table 49 below, between 10% and 30% of these events were precipitated by a system/component failure/malfunction, an in-flight fire or a loss of engine power. Between 5% and 13% followed an encounter with severe weather. Thirty-eight percent of the in-flight loss of control occurred while operating at low altitude. Sixty-six of the 89 in-flight LOC due to other events followed pilot incapacitation, 17 had a structural failure due to exceeding the design stress limits, 5 followed bird strikes and the final involved an inadequate preflight (open door). Forty-two of the 58 takeoff LOC due to other events involved an inadequate preflight (doors not secured, gust locks not removed, pitot tubes not cleared), seven followed pilot incapacitation, seven followed abrupt maneuvering and the final two takeoff LOC followed a propeller strike shortly after lift-off. Nineteen of the 58 landing LOC due to other events followed pilot incapacitation, 14 involved inadequate preflights (open doors, fuel/oil caps and pitot systems), 13 involved evasive maneuvers, 7 followed failures to extend the landing gear and the other 5 involved problems with banner towing equipment.

Table 49. Prior occurrences for Loss of Control

	In Flight Loss of Control	Takeoff Loss of Control	Approach/Landing Loss of Control
Primary LOC	573 (34.4%)	1166 (75.9%)	948 (59.1%)
LOC secondary to system/comp failure/malf	121 (7.3%)	113 (7.4%)	167 (10.4%)
LOC secondary to fire or engine power loss	49 (2.9%)	126 (8.2%)	323 (20.1%)
LOC secondary to low altitude maneuvering	625 (37.5%)	0 (0.0%)	0 (0.0%)
LOC secondary to severe weather	209 (12.5%)	74 (4.8%)	109 (6.8%)
LOC secondary to other events	89 (5.3%)	58 (3.8%)	58 (3.6%)
Total	1666 (100.%)	1537 (100.%)	1605 (100.%)

Summary

Part 121 – Commercial Air Carriers

During the years 1988-2004, there were a total of 630 accidents involving Part 121 aircraft. The number of accidents has increased modestly during these years, but the number of fatal events has fallen steadily. Ten percent of all accidents included at least one fatality, and 45% included a severe injury. The percentage of events with no injuries has increased generally over time. On average, 88 persons were on board these accident flights, but only 7% of them were injured in any way during these accidents. Fifty-three percent of the Part 121 aircraft involved in these events were destroyed (8%) or suffered substantial damage (45%), while 38% had no damage at all. According to the NTSB severity classification, approximately 15% of the accidents were considered either major (9%) or serious (6%). The percentage of events in these two categories has decreased over time, and the percentage of accidents in the "damage" category has increased, while the percentage of accidents in the "injury" category has remained relatively constant.

Each accident was assigned one or more accident categories based on the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Among Part 121 accidents, the most common categories are turbulence (26% of events), ground collision (16%), ground handling (11%) and non-powerplant system/component failure/malfunction (10%). The combined incidence of system/component failure/malfunction (powerplant and non-powerplant) ranks as third most common (15.2%). The categories with fatal injuries to more than half of all those persons involved in the accident are CFIT (78%), security-related events (73%), LOC-I (72%), post-impact fire (52%) and LOC-A/L (52%). The categories most likely to have at least one fatal injury are LOC-Takeoff (100%), RI-VAP (100%), LOC-A/L (82%), post-impact fire (71%), security (71%), Icing (67%), LOC-I (63%), FAA oversight (58%) and CFIT (57%). These same categories are also most likely to be classified as "major" accidents, and with the exception of RI-VAP, these categories are also the most likely to result in aircraft destruction. The categories most likely to include no injuries are abnormal runway contact (79%), ground collision (78%), RI-Animal (75%), LOC-Ground (67%), undershoot/overshoot (67%), windshear/thunderstorm (67%), aerodrome (64%) and powerplant system/component failure/malfunction (61%).

The CICTT categories found to show a significant trend over time are abrupt maneuvers, ground collisions and turbulence encounters (all increasing), cabin events, ATM events, FAA oversight events, loss of control -- approach/landing events and post-impact fires (all decreasing). These findings may explain the decrease in fatal events despite the increase in total events, since those events of decreasing incidence were more likely to be fatal, while those of increasing incidence were among the least likely to include a fatality.

Just over one-third (36%) of all accidents occurred during en route (climb, cruise, descent or maneuvering) phases of flight, and 30% occurred while the aircraft was standing or taxiing. System/component failures/malfunctions were most common in the engine and landing gear, but malfunctions of a flight control system or surface, while occurring in only 1.7% of the accidents, were most likely to result in fatal injuries. Between 38% and 64% of the three types of loss of control events (takeoff, in-flight, approach/landing) were precipitated by a system/component failure/malfunction, an in-flight fire, or a loss of engine power. Between 18% and 29% followed encounters with severe weather.

Part 135 Scheduled – Commuter Operations

During the years 1988-2004, there were a total of 217 accidents involving Part 135-Scheduled aircraft. Nearly 70% of these accidents occurred prior to 1997, when a change in the federal regulations resulted in more flights being conducted under Part 121 regulations rather than Part 135. Total flight hours for Scheduled Part 135 dropped in 1997 and again in 1998, and as a result, the rates of accidents and fatal accidents jumped dramatically when adjusted for total flight hours. However, following a peak in both total accidents and fatal accidents in 1999, rates have decreased steadily, and are approaching pre-1997 levels. Thirty-four percent of the accidents included a serious (11%) or fatal (23%) injury, while there were no injuries in 54% of the accidents. On average, 7 persons were on board the flights, and 35% of them were injured in some way. Ninety-six percent of the Part 135-S aircraft involved in these accidents were destroyed (23%) or suffered substantial damage (73%), while only 4% had minor or no damage. Thirty-one percent of the accidents were considered either major (25%) or serious (6%) according to the NTSB severity classification, while 66% were classified as "damage" accidents and only 3% were "injury" accidents.

Each accident was assigned one or more accident categories based on the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Among Scheduled Part 135 accidents, the most common categories are runway excursion (15% of events), CFIT (14%), post-impact fire (14%), abnormal runway contact (13%), and ground collision (12%). The categories with fatal injuries to more than half of all those persons involved in the accident are windshear/thunderstorm (88%), LOC-A/L (82%), post-impact fire (66%), FAA oversight (66%), RI-VAP (62%), CFIT (57%), LOC-T (52%) and ATM (52%). The categories most likely to have no injuries are undershoot/overshoot (100%), aerodrome (92%), LOC-Ground (86%), abnormal runway contact (79%), ground collision (77%), non-impact fire (75%), runway excursion (69%) and non-powerplant system/component failure/malfunction (67%). The categories most likely to result in aircraft destruction are windshear/thunderstorm (100%), RI-VAP (100%), post-impact fire (97%), FAA oversight (92%), LOC-A/L (80%), CFIT (68%), LOC-I (67%) and ATM (67%). These same categories are most likely to include "major" accidents. Abnormal runway contact was the only CICTT category found to show a significant trend over time; the rate of this type of accident has increased.

Approximately 34% of all accidents occurred during the approach or landing phases of flight, while 29% occurred en route (climb, cruise, descent or maneuvering phases). System/component failures or malfunctions were most common in the engine and landing gear. Although malfunctions of a flight control system or surface occurred in only 1.4% of the accidents, 88% of the persons involved with those flights were fatally injured. Similarly, propeller failures/malfunctions accounted for 1.4% of accidents, but 79% of the persons involved were injured, and nearly half of those injuries were fatal. Between 6% and 17% of the three types of loss of control events (takeoff, in-flight, approach/landing) were precipitated by a system/component failure/malfunction. Between 33% and 44% of the loss of control were considered primary LOC, with no prior occurrences, and between 33 and 44% followed encounters with severe weather.

Part 135 Non-Scheduled – On-Demand Operations

During the years 1988-2004, there were a total of 1115 accidents involving Part 135-Non-Scheduled aircraft. Following a peak in both total accidents and fatal accidents in 1990, rates have decreased steadily to less than half of the 1990 rates. Thirty-five percent of the accidents included a serious (9%) or fatal (26%) injury, while there were no injuries in 53% of the accidents. Approximately 38% of the people on board the aircraft were injured in some way. Ninety-eight percent of the Part 135-NS aircraft involved in these events were destroyed (29%) or suffered substantial damage (69%), while 2% had minor or no damage. Thirty-seven percent of the accidents were considered either major (32%) or serious (5%) according to the NTSB severity classification, while 62% were classified as "damage" accidents.

Each accident was assigned one or more accident categories based on the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Among Non-Scheduled Part 135 accidents, the most common categories are post-impact fire (14%), runway excursion (13.5% of events), non-powerplant system/component failure/malfunction (10.5%), powerplant system/component failure/malfunction (10%), abnormal runway contact (9%), CFIT (9%) and LOC-ground (9%). The categories with fatal injuries to more than half of all those persons involved in the accident are LOC-I (80%), post-impact fire (71%), CFIT (68%), LOC-A/L (59%), LALT (57%), windshear/thunderstorm (56%) and FAA oversight (55%). The categories most likely to result in aircraft destruction are post-impact fire (86%), LOC-I (86%), CFIT (75%), turbulence (67%) and windshear/thunderstorm (67%) and the categories most likely to include "major" accidents are LOC-I (94%), post-impact fire (89%), CFIT (78%), LOC-A/L (69%), LALT (67%), turbulence (67%) and windshear/thunderstorm (67%). The categories most likely to result in no injuries are RI-Animal (100%), abnormal runway contact (87%), aerodrome (85%), ground collision (82%), non-powerplant system/component failure/malfunction (80%), runway excursion (80%), LOC-Ground (80%), EWT-G (68%) and undershoot/overshoot (64%).

The CICTT categories found to show a significant decreasing trend are abnormal runway contact, CFIT, collision with object -- approach/landing, experience or training issues, post-impact fires, low altitude operations, LOC--Ground, LOC--In Flight, LOC--Takeoff, runway excursions, non-powerplant system/component failure/malfunction and powerplant system/component failure/malfunction.

Less than one-third (29%) of all accidents occurred during en route (climb, cruise, descent or maneuvering) phases of flight, while nearly 39% occurred during approach and landing. System/component failures or malfunctions were most common in the engine and landing gear. Only malfunctions of the hydraulic system or landing gear resulted in no fatal injuries. Between 16% and 24% of the three types of loss of control events (takeoff, in-flight, approach/landing) were precipitated by a system/component failure/malfunction, an in-flight fire or a loss of engine power. Between 17% and 33% followed encounters with severe weather. Twenty-eight percent of the in-flight loss of control occurred while operating at low altitude.

Part 91 – General Aviation

During the years 1988-2004, there were a total of 24473 accidents involving Part 91 aircraft. The percentage of the total events that involved at least one fatality has remained right around 20% through these years. However, the flight hour adjusted rates of both total and fatal events have decreased by about

25%. Thirty percent of the accidents included a serious (10%) or fatal (20%) injury, while there were no injuries in 56% of the accidents. On average, two people were on board each flight, and 43% of all the persons on board were injured in some way. Ninety-nine percent of the Part 91 aircraft involved in these events were destroyed (23%) or suffered substantial damage (76%), while 1% had minor or no damage. Thirty-three percent of the accidents were considered either major (26%) or serious (7%) according to the NTSB severity classification, while 67% were classified as "damage" accidents.

Each accident was assigned one or more accident categories based on the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Among Part 91 accidents, the most common categories are runway excursion (17% of events), fuel related loss of engine power (14%), LOC-ground (13%), abnormal runway contact (11%), post-impact fire (9%), experience/training (9%), CWO-A/L (8%) and CWO-Ground (8%). The categories with fatal injuries to more than half of all those persons involved in the accident are IFBU (99%), LOC-I (78%), CFIT (74%), INCAP (72%), post-impact fire (68%), ATM (64%), LALT (55%) and MAC (52%). These categories are also most likely to result in aircraft destruction, and most likely to be classified as "major" accidents. The categories most likely to result in no injuries are LOC-Ground (85%), aerodrome (84%), ground collision (84%), RI-Animal (85%), runway excursion (83%), abnormal runway contact (83%), CWO-G (77%), undershoot/overshoot (73%) and non-powerplant system/component failure/malfunction (71%).

The CICTT categories found to show a significant decreasing trend are abnormal runway contact, aerodrome, CFIT, collision with object (approach/landing), collision with object (takeoff), encounter with terrain (ground), experience/training issues, post-impact fires, ground collisions, ground handling, icing, in-flight break-up, incapacitation, low altitude operations, LOC-A/L, LOC-G, LOC-T, LOC-I, mid-air collisions, fuel related loss of engine power, loss of engine power for other reasons, non-powerplant system/component failure/malfunction, powerplant system/component failure/malfunction, security, undershoot/overshoot and windshear/thunderstorm. In addition, runway incursions involving animals have increased significantly. Although the general trend is for a decreasing rate of encounters with windshear or thunderstorm, since 1997 these rates are actually increasing.

Thirty-one percent of all accidents occurred during en route (climb, cruise, descent or maneuvering) phases of flight, while 42% occurred during approach or landing. System/component failures or malfunctions were most common in the engine and landing gear. Malfunctions of instrumentation, communications or navigation occurred in only 0.1% of the accidents, but 75% of the persons involved with those flights were injured, and more than half of those injuries were fatal. Between 10% and 30% of the three types of loss of control events (takeoff, in-flight, approach/landing) were precipitated by a system/component failure/malfunction, an in-flight fire or a loss of engine power. Between 5% and 13% followed an encounter with severe weather. Thirty-eight percent of the in-flight loss of control occurred while operating at low altitude.

Conclusion

Historically, approximately 10% of Part 121 accidents include a fatality, and about 8% of the persons on board the aircraft are injured. Only 8% of the aircraft are destroyed, and another 45% suffer substantial damage. Three types of accidents (Turbulence Encounters, Ground Collisions and System/Component Failures/Malfunctions) account for 57% of the accidents and 73% of all injuries, but only 33% of all fatal injuries. Two other accident types (CFIT and LOC-I) combine for 53% of all fatal injuries and 24% of all injuries, but only 2% of all accidents. Clearly this raises a dilemma with regard to focus: whether to work to prevent accidents which occur with less frequency, but which, when they do occur, claim a large percentage of lives, or to work to prevent accidents which occur more frequently, and for which the incidence is increasing, but which result in fewer fatal injuries.

Among Scheduled Part 135 accidents, more than 20% include a fatality, with 35% of involved persons injured, and 23% of the aircraft are destroyed. The only accident category showing a definite trend over time was abnormal runway contact (ARC), which is increasing in incidence. ARC, together with runway excursion and ground collision, accounts for 40% of accidents, but only 16% of injuries and less than 2% of fatalities. In contrast, the CFIT, loss of control during approach/landing and runway incursion categories combine for 20% of accidents and 74% of all fatalities. Part 121 accidents occurred almost 3 times as often as Part 135-S accidents, and had nearly 8 times the number of injuries.

One fourth of Non-Scheduled Part 135 accidents include a fatality, and 38% of persons involved are injured. Twenty-nine percent of the aircraft are destroyed, and another 69% are substantially damaged. However, both total events and fatal events have declined through the years, and no category of accidents shows an increasing trend. The categories of abnormal runway contact, LOC on ground, runway excursion and system/component failure/malfunction together account for 52% of accidents, but only 31% of injuries and less than 18% of fatalities. In contrast, the CFIT, loss of control during approach/landing and loss of control in flight categories combine for 20% of accidents and 55% of all fatalities.

About 20% of Part 91 accidents include a fatality and 43% of persons on-board are injured. Nearly all the aircraft are destroyed or damaged substantially. Runway incursions involving animals have increased over the years. Although the general trend is for a decreasing rate of encounters with windshear or thunderstorm, since 1997 these rates are actually increasing. The rates of many other accident categories have declined through the years. The four accident categories of runway excursion, fuel related loss of engine power, loss of control on ground and abnormal runway contact combine for 56% of accidents but only 8% of fatalities, whereas CFIT and loss of control in flight together account for only 10% of accidents but 43% of all fatalities.

Appendix A

Aviation Accident Categories

The CAST/ICAO Common Taxonomy Team (CICTT) was jointly chartered by the International Civil Aviation Organization (ICAO) and the Commercial Aviation Safety Team (CAST), and was charged with developing common taxonomies and definitions for aviation accident and incident reporting systems (for additional information see http://www.intlaviationstandards.org/). The occurrence categories are listed below, with brief descriptions of each. The information is taken from a document dated February 2006.

CICTT Categories

Abnormal Runway Contact (ARC): Any takeoff or landing involving abnormal contact with the runway or landing surface. Included are hard/heavy landings, long/fast landings, crabbed landings, nose wheel first touchdowns, tail strikes, wing/nacelle strikes and gear up landings.

Abrupt Maneuver (AMAN): The intentional abrupt maneuvering of the aircraft (in flight or on ground) by the flight crew to avoid a collision with terrain, objects, weather or other aircraft.

Aerodrome (ADRM): Occurrences involved aerodrome design, service or functionality issues. The aerodrome includes runways, taxiways, ramp areas, parking areas, buildings and structures, lighting, signage Crash/Fire/Rescue (CFR) services.

ATM/CNS (ATM): Occurrences involving air traffic management (ATM) or communication, navigation or surveillance (CNS) service issues.

Cabin Safety Events (CABIN): Includes significant events in the passenger cabin, related to carry-one baggage, supplemental oxygen, missing/non-operational emergency equipment, the inadvertent deployment of emergency equipment, and the medical emergency (not caused by turbulence encounters) of persons other than the flight crew or medical evacuation patients.

Controlled flight into or toward terrain (CFIT): In flight collision or near collision with terrain, water or obstacle without indication of loss of control. Excludes intentional low altitude operations, intentional flight into terrain and runway undershoot/overshoot.

Evacuation (EVAC): Occurrences including one or more of the following: and unnecessary evacuation was performed, person(s) were injured during the evacuation, evacuation equipment failed to perform as required, or the evacuation was a factor in the outcome.

Fire/Smoke Non-Impact (FI-NI): Fire or smoke in the aircraft (in flight or on ground) which was not the result of an impact.

Fire/Smoke Impact (FI-POST): Fire or smoke resulting from impact.

Fuel Related (FUEL): One or more powerplants experienced reduced or no power output due to fuel exhaustion (no usable fuel on board), fuel starvation (usable fuel is not available to the engine), fuel contamination (by water, sand, dirt, bugs) or wrong fuel, or carburetor and/or induction icing.

Ground Handling (RAMP): Occurrences during (or as a result of) ground operations, including preflight configuration errors that lead to subsequent events (such as improperly latched doors, pitot tube contamination, or weight/balance issues).

Ground Collision (GCOL): Collision with an aircraft, person, animal, ground vehicle, building, etc., while taxiing to or from the runway in use.

Icing (ICE): The accumulation of snow, ice, freezing rain or frost on aircraft surfaces to the extent that aircraft control or performance is adversely affected.

Loss of Control – Ground (LOC-G): Loss of aircraft control while the aircraft is on the ground, which may result from a contaminated runway, evasive action due to a runway incursion, or the failure or malfunction of a system or component.

Loss of Control – In flight (LOC-I): Loss of aircraft control while in flight; may occur in Instrument Meteorological Conditions (IMC) or Visual Meteorological Conditions (VMC).

Low Altitude Operations (LALT): Collision or near collision with terrain/objects/obstacles while intentionally operating near the surface (excludes landing and takeoff phases). Includes aerobatics, sight seeing, aerial photography, aerial application, scud running, and flying in close proximity to mountains or box canyons where the aircraft aerodynamic capability is not sufficient to avoid impact.

Airprox/TCAS Alert/Loss of Separation/Near Mid-Air Collision/Mid-Air Collision (MAC): Airprox, TCAS alerts and loss of separation, as well as near collisions or collisions between aircraft in flight.

Other (OTHER): Any occurrence not covered under another category.

Runway Excursion (RE): A veer off the side or overrun off the end of the runway.

Runway Incursion – Animal (RI-A): Collision with, risk of collision with, or evasive action taken by an aircraft to avoid an animal (other than birds) on the runway in use.

Runway Incursion – Vehicle, Aircraft or Person (RI-VAP): The incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for takeoffs or landings.

Security Related (SEC): Criminal or security related acts such as hijacking, aircraft theft, flight control interference, sabotage or suicide.

System/Component Failure or Malfunction – Non-powerplant (SCF-NP): Failure or malfunction of an aircraft system or component other than the powerplant.

System/Component Failure or Malfunction – Powerplant (SCF-PP): Failure or malfunction of an aircraft system or component related to the powerplant.

Turbulence Encounter (TURB): In flight encounter with turbulence; includes clear-air or cloud turbulence, mountain wave and wake vortex.

Undershoot/Overshoot (USOS): A touchdown off the runway surface but in close proximity to the runway. Excludes off-airport emergency landings.

Unknown or Undetermined (UNK): Insufficient information exists to categorize the accident; includes missing aircraft.

Windshear or Thunderstorm (WSTRW): Flight into windshear or thunderstorm; includes hail and heavy rain.

Additional Categories

Many of the following categories were added in order to completely capture the event sequence. An emergency landing is required in most cases of System/Component Failure/Malfunction and Loss of Engine Power, and may be performed after an encounter with adverse weather; this landing often is not without further incident. Control of the aircraft may be lost, hard or bounced landings may occur, terrain unsuitable for a proper landing may be encountered, the aircraft may collide with power lines, fences or ground vehicles during an off-airport landing, the aircraft may be unable to avoid rising terrain due to degraded performance. The single category of "Loss of Engine Power" is not sufficient to explain why the aircraft was destroyed.

Several categories (collisions with terrain or objects and loss of control) were further subdivided by general phase of flight (ground, takeoff, in flight, approach/landing) because either the root cause or the consequences of the occurrence differ by phase of flight.

Collision with Object – Approach/Landing (CWO-AL): A collision with an object or obstacle occurred during the approach to land, during flare, or during a go-around/missed approach. CFIT is not an appropriate category in these cases for one of two reasons: a system/component failure/malfunction or non-mechanical loss of engine power necessitated the landing, or the pilot was distracted by some other circumstance.

Collision with Object – Ground (CWO-G): A collision with an object or obstacle occurred on the ground away from an airport environment.

Collision with Object – Takeoff (CWO-T): A collision with an object or obstacle occurred during takeoff climb, usually as a result of an insufficient climb rate.

Collision with Terrain – Approach/Landing (CWT-AL): A collision with terrain occurred during the approach to land or during a go-around/missed approach. CFIT is not an appropriate category in these cases for one of two reasons: a system/component failure/malfunction or non-mechanical loss of engine power necessitated the landing, or the pilot did not maintain sufficient altitude above high vegetation. This code was also used in cases where the pilot "ditched" the aircraft in water.

Encounter with Terrain – Ground (EWT-G): An encounter with terrain occurred on the ground away from an airport environment, causing damage to the aircraft.

Experience/Training Issues (EXPER): The cause of the accident was attributable, at least in part, to a lack of experience (in the specific aircraft or in general) or inadequate training (in the specific aircraft, in the procedure being performed, or in general). This category includes flight by non-licensed pilots.

Inadequate FAA Oversight (FAA): The cause of the accident was attributable, at least in part, to inadequate oversight or communications by the Federal Aviation Administration, and the NTSB accident report included the appropriate codes for this causation.

In Flight Break Up (IFBU): Separation of multiple surfaces of the aircraft, resulting either from loss of control or from forces associated with severe weather.

Pilot Incapacitation or Severe Impairment (INCAP): Pilot became incapacitated (due to illness or fatigue) or severely impaired (due to illness, alcohol or illegal drugs). Does not include minor impairment caused by fatigue or the use of unapproved prescription medications.

Loss of Control – Approach/Landing (LOC-A/L): The loss of control occurred during approach to land, during flare, or during a go-around/missed approach.

Loss of Control – Takeoff (LOC-T): The loss of control occurred during takeoff climb.

Loss of Engine Power – Fuel Related (PL-FUEL): Loss of engine power due to fuel exhaustion (no usable fuel on board), fuel starvation (usable fuel is not available to the engine), fuel contamination (by water, sand, dirt, bugs) or wrong fuel, or carburetor and/or induction icing (see FUEL above).

Loss of Engine Power – Other Reasons (PL-OTHER): Loss of engine power due to other non-mechanical reasons. Reasons include foreign object damage (e.g. bird strikes), ice ingestion, improper simulated engine out procedures, other improper procedures.

Loss of Engine Power – Unknown Reasons (PL-UNK): Loss of engine power occurred but the exact cause was undetermined.

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14. ABSTRACT

Interventions or technologies developed to improve aviation safety often focus on specific causes or accident categories. Evaluation of the potential effectiveness of those interventions is dependent upon mapping the historical aviation accidents into those same accident categories. To that end, the United States civil aviation accidents occurring between 1988 and 2004 (n=26,117) were assigned accident categories based upon the taxonomy developed by the CAST/ICAO Common Taxonomy Team (CICTT). Results are presented separately for four main categories of flight rules: Part 121 (large commercial air carriers), Scheduled Part 135 (commuter airlines), Non-Scheduled Part 135 (on-demand air taxi) and Part 91 (general aviation). Injuries and aircraft damage are summarized by year and by accident category.

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Accident category; Accident rate; Commercial Aviation; General Aviation

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