



# An Analysis of Historical Aviation Accident Data



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# Outline

Safety's Role in the FAA

Uses of Historical Data

Assumptions

Accident Rates Trends

Accidents by Categories

Weather Accidents

Accidents by Phase of Flight

Day/Night Accidents

Preventative Safety Programs



# Safety

- **Safety** is the FAA's primary mission
- **FAA's GOAL** - Achieve the lowest possible accident rate and constantly improve safety.
- Set the bar for aviation safety around the world- Have done for almost a half century.



# Safety- (Continued)

- Develop new technology to increase safety
- Improve FAA's risk management practices
  - collecting and analyzing data to identify problems and prevent accidents from occurring
- Improve runway safety
- Continue to partner with industry to reduce the commercial accident rate



# Claim

Use Historical Accident  
Statistics To help FAA  
Achieve its Goal...



# Historical Data

- Historical accident statistics can be used
  - to predict future accident rates for various alternatives
  - to evaluate the effect of a safety program by comparing data before and after program implementation
  - to identify safety risks so that the return on investment is maximized



# Historical Data (continued)

- Historical accident data
  - Can help derive the pool of safety benefits
  - Can help establish the effectiveness of new programs



# Inputs and Assumptions

- Used the NTSB data base and included
  - All accidents in or before 2001
  - “Airplanes” and “helicopters”
  - FAR Parts 91, 135 and 121
- Built categories of accidents using a combination of NTSB “Cause-Factor” codes, “Subject Modifiers,” and selected keywords in brief reports





# Examples of NTSB Cause-Factor Codes

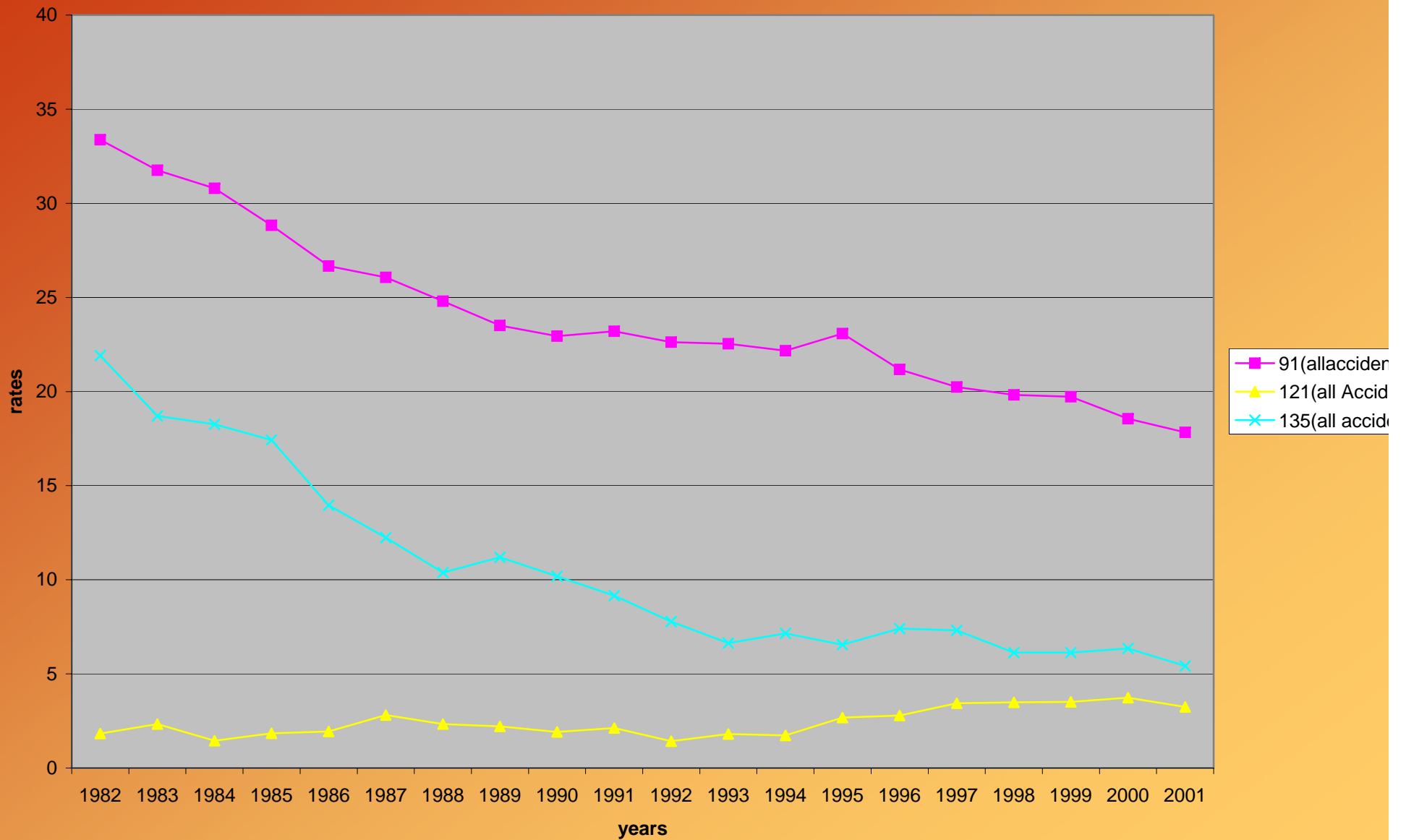
Cause Code

OCC_DESC	CountOfEVENT_ID
ABRUPT MANEUVER	309
AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION	3822
ALTITUDE DEVIATION, UNCONTROLLED	155
CARGO SHIFT	12
COLLISION BETWEEN AIRCRAFT (OTHER THAN MIDAIR)	192
COMPLETE GEAR COLLAPSED	372
DECOMPRESSION	23
DITCHING	537
DRAGGED WING, ROTOR, POD, FLOAT OR TAIL/SKID	681
ENGINE TEARAWAY	13
EXPLOSION	27
FIRE	908
FIRE/EXPLOSION	119
FORCED LANDING	12940
GEAR COLLAPSED	1044
GEAR NOT EXTENDED	230
GEAR NOT RETRACTED	11
GEAR RETRACTION ON GROUND	25
HARD LANDING	4279

# of accidents  
effected  
by that cause

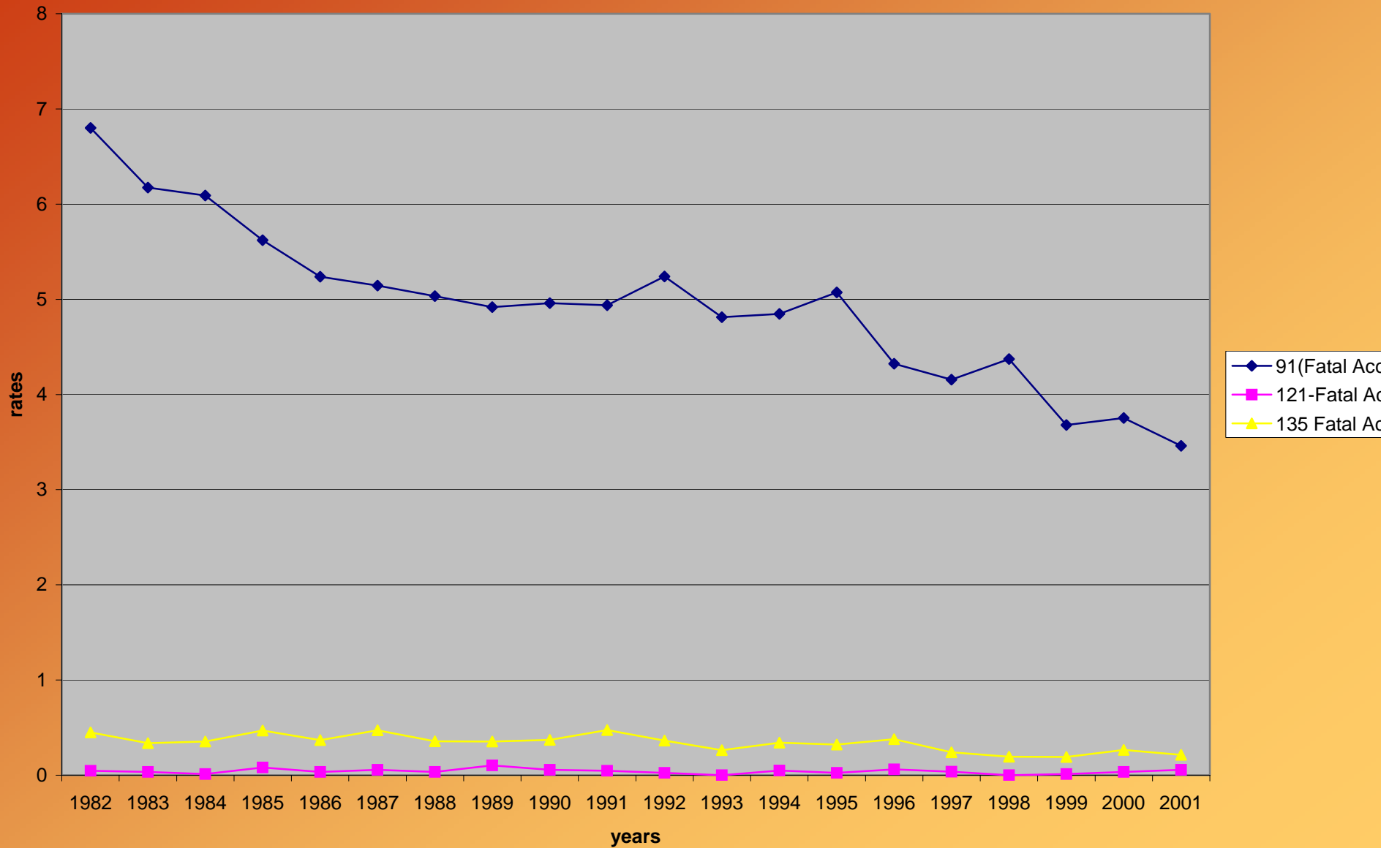


# Accident Rates per Million Flights



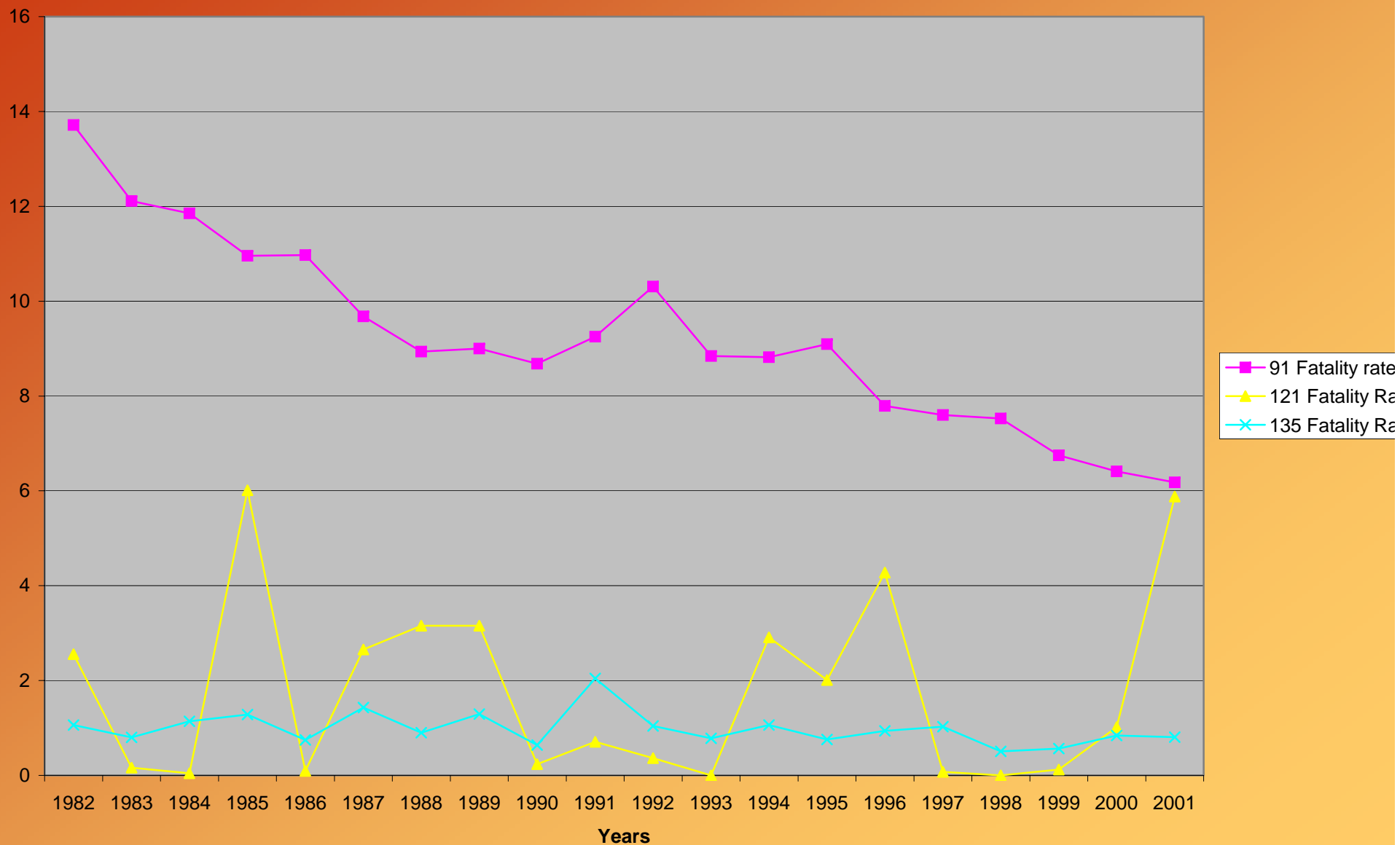


# Fatal Accident Rates per Million Flights



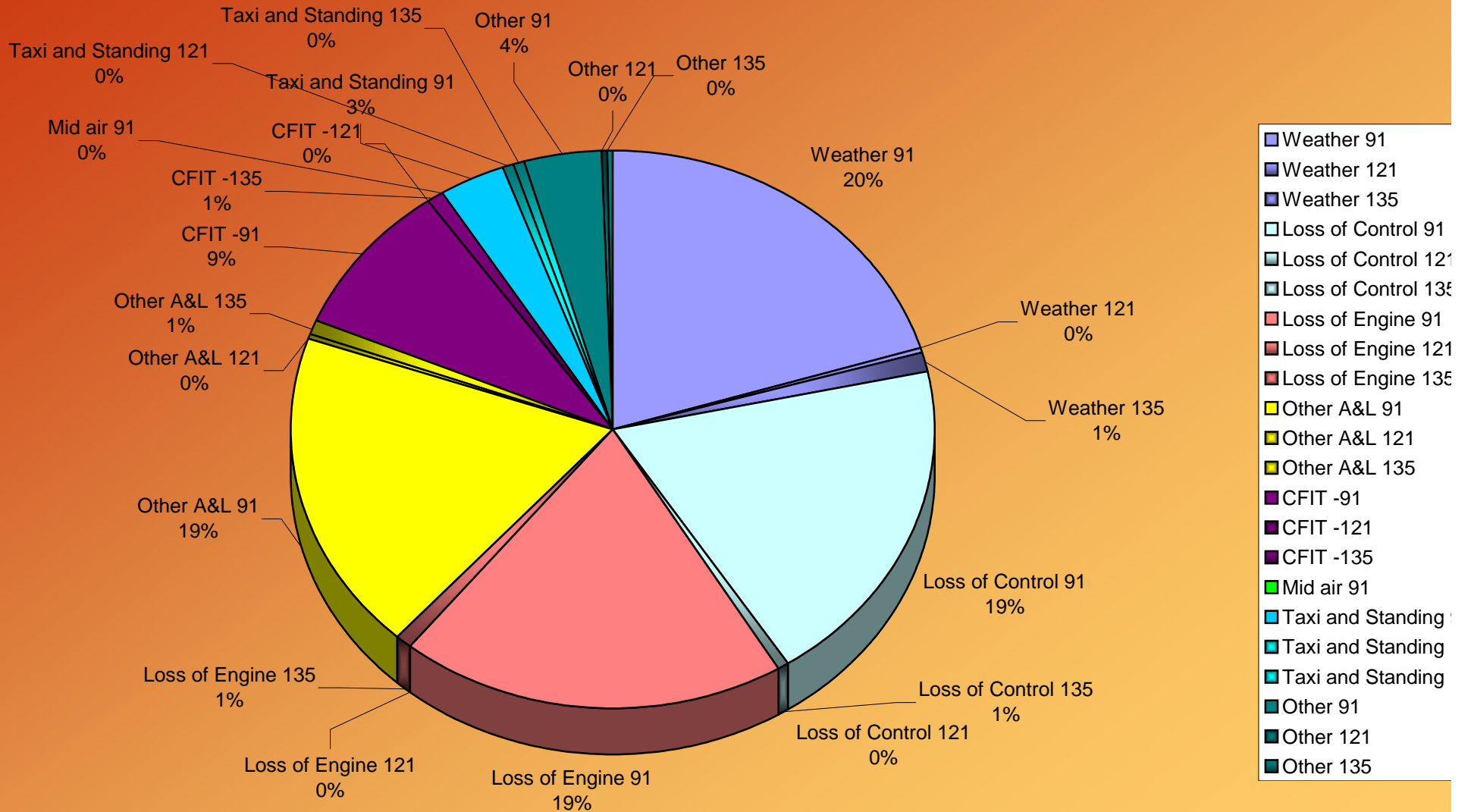


# Fatality Rates per Million Flights



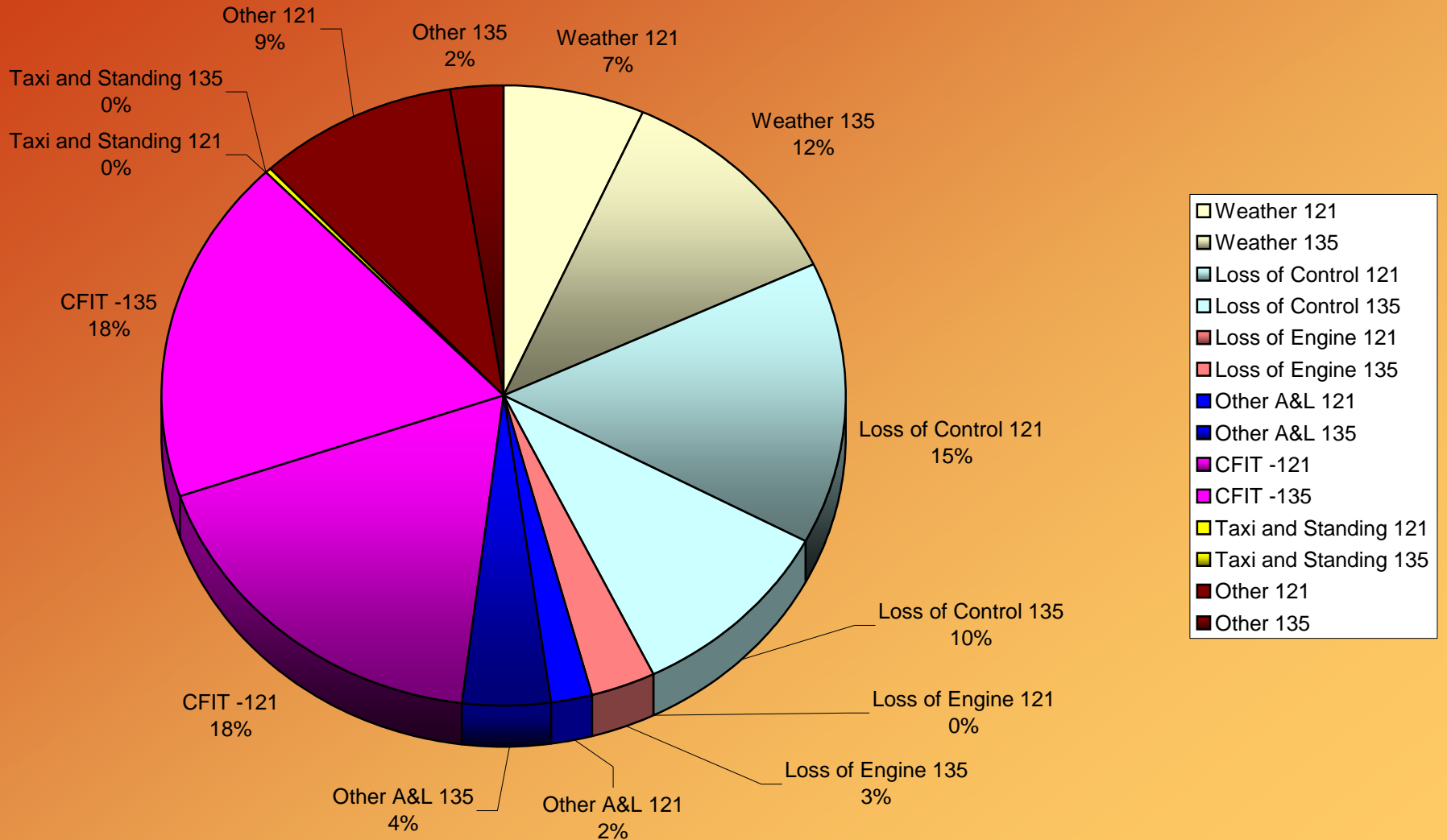


# Various Categories of Accidents





# Fatality Counts By Category - Part 121&135





# Preventive Safety Programs

- Commercial Aviation Safety Team (CAST) addressing CFIT and Approach and Landing (A&L) accidents
  - TAWS
  - Precision like approaches
  - Pilot and controller training
- Capstone in AK
  - Reduce weather and CFIT accidents in AK



# Preventive Safety Programs (continued)

- System Approach for Safety Oversight (SASO)
  - Increase the effectiveness of surveillance to reduce maintenance related accidents
- Aviation Safety Knowledge Management Environment (ASKME)
  - Increase the effectiveness of oversight during aircraft's certification process to reduce related accidents.
- Various weather programs
- ASDEX and ASDE-3
  - Surface Safety





# Different Weather Categories

The categorization (part 1):

DENSITY ALTITUDE	
	HIGH DENSITY ALTITUDE
	TEMPERATURE EXTREMES
	NO THERMAL LIFT (gliders/sailplanes)
	THERMAL LIFT (gliders/sailplanes)
	TEMPERATURE, HIGH
	TEMPERATURE, LOW
	TEMPERATURE INVERSION
ICING	
	CARBURETOR ICING CONDITIONS
	ICING CONDITIONS
	ICE FOG
PRECIPITATION	
	RAIN
	SNOW
	WHITEOUT
	DRIZZLE
	FREEZING RAIN
	PRECIPITATION STATIC CONDITIONS



# Different Weather Categories (continued)

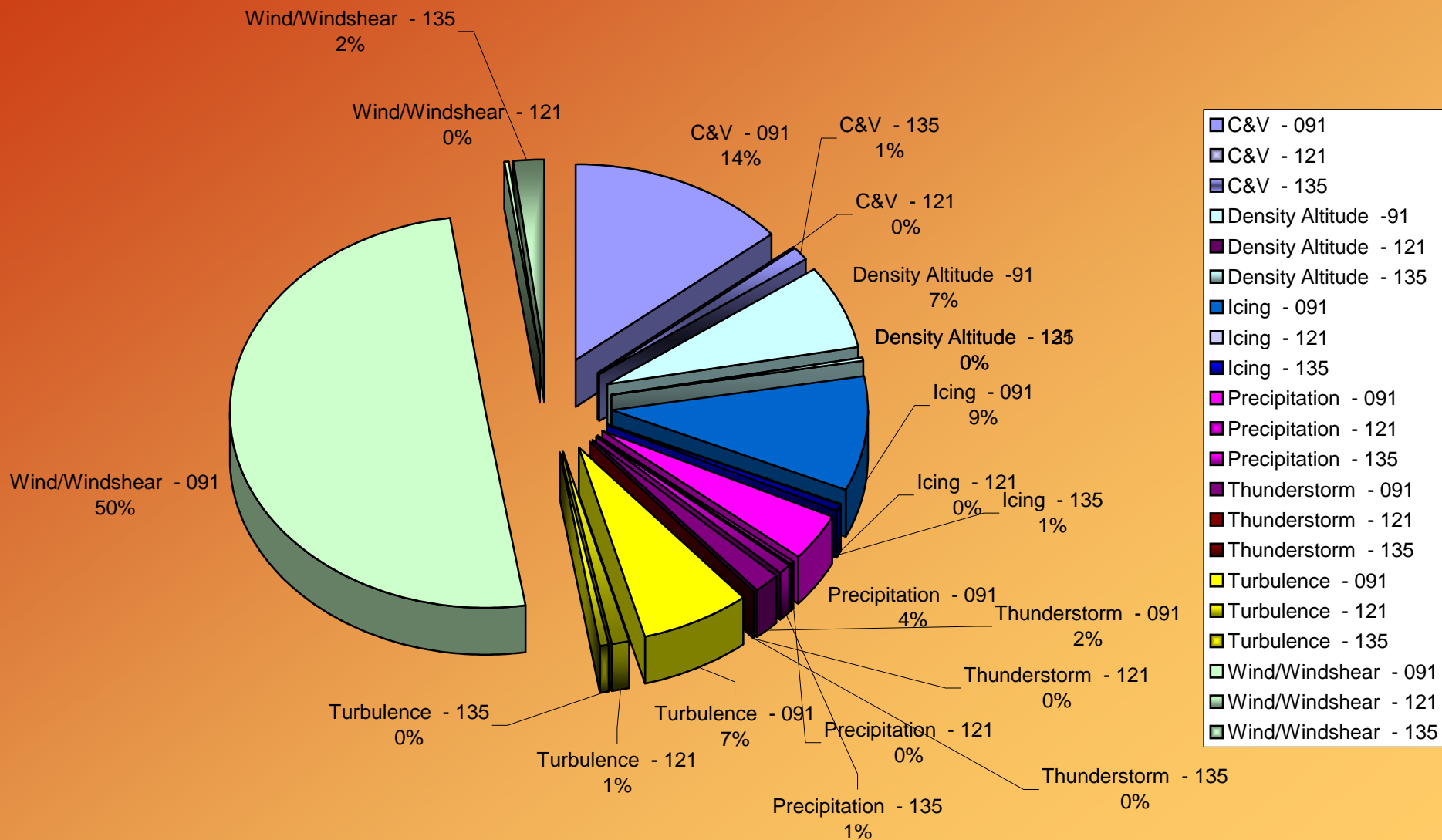
## The categorization (part 2):

TURBULENCE	
	DOWNDRAFT
	MOUNTAIN WAVE
	TURBULENCE
	TURBULENCE, CLEAR AIR
	TURBULENCE IN CLOUDS
	TURBULENCE (Thunderstorms)
	UPDRAFT
	TURBULENCE TERRAIN INDUCED
VISIBILITY/CEILING	
	VISIBILITY/RVR
	CLOUDS
	FOG
	HAZE/SMOKE
	LOW CEILING
	OBSCURATION
	SAND/DUST STORM
	VOLCANIC ASH
	SUNGLARE

WIND/WINDSHEAR	
	CROSSWIND
	GUSTS
	HIGH WIND
	HURRICANE
	TAILWIND
	UNFAVORABLE WIND
	DUST DEVIL/WHIRLWIND
	SUDDEN WINDSHIFT
	VARIABLE WIND
	WINDSHEAR

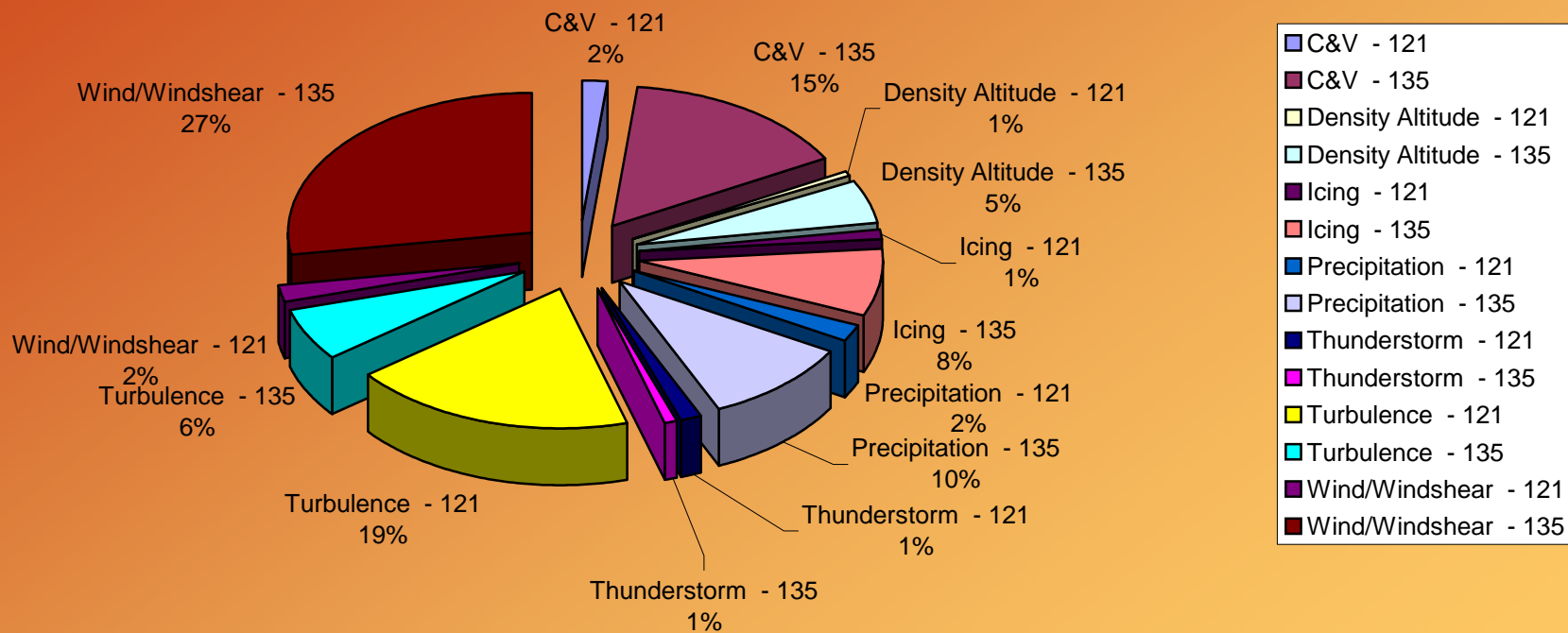


# Weather Accidents 1982-2001



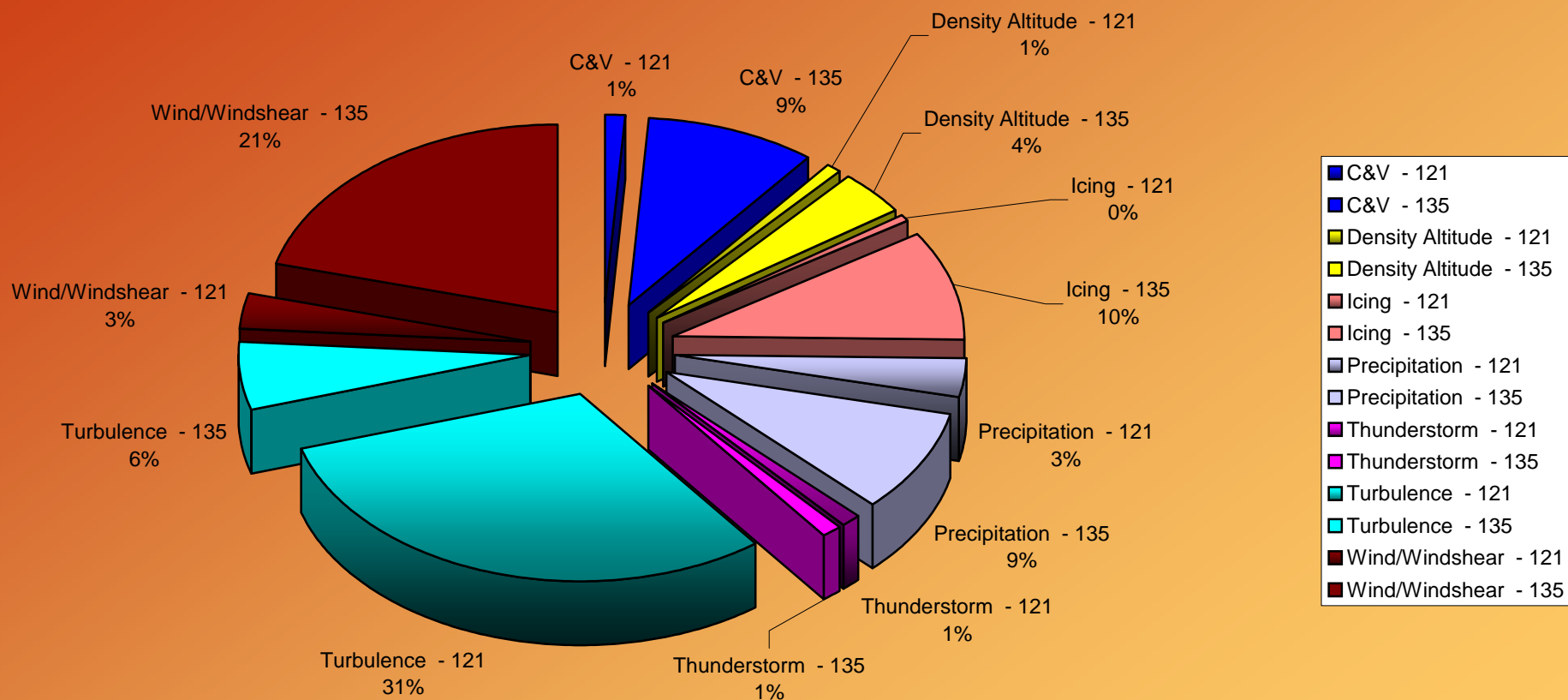


# Weather Accidents 121&135





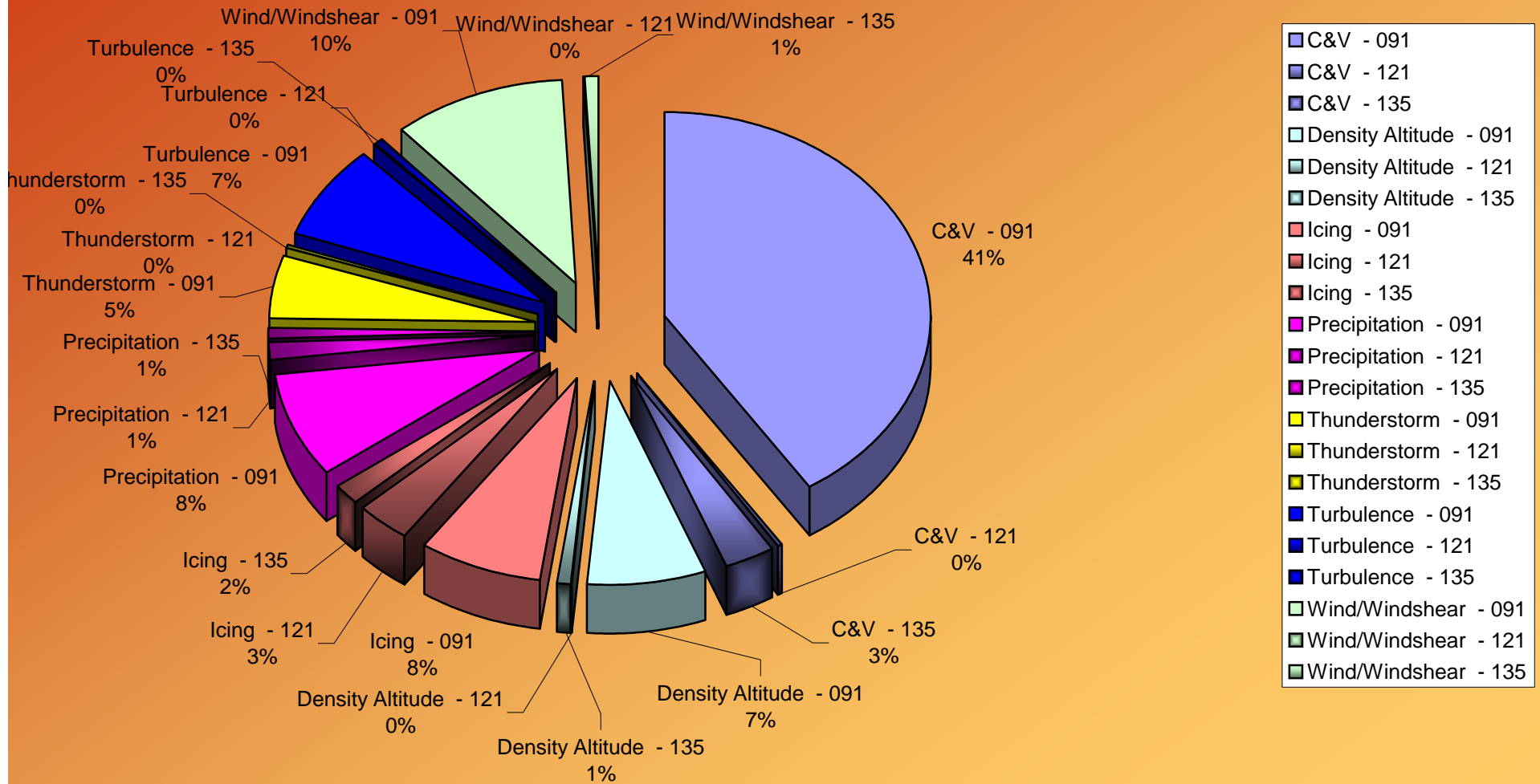
# Recent Weather Accidents 121&135 1996-2001



- C&V - 121
- C&V - 135
- Density Altitude - 121
- Density Altitude - 135
- Icing - 121
- Icing - 135
- Precipitation - 121
- Precipitation - 135
- Thunderstorm - 121
- Thunderstorm - 135
- Turbulence - 121
- Turbulence - 135
- Wind/Windshear - 121
- Wind/Windshear - 135



# Weather Accident Fatalities





# Weather Accidents

- Accidents with more than 1 causal factor are divided up equally among all causal factors.
- Observations
  - For part 121, turbulence has caused the most number of accidents, but very few fatal injuries.
  - A larger percentage of Ceiling and Visibility accidents are fatal compared to other categories



# Some Preventive Measures for Weather Accidents

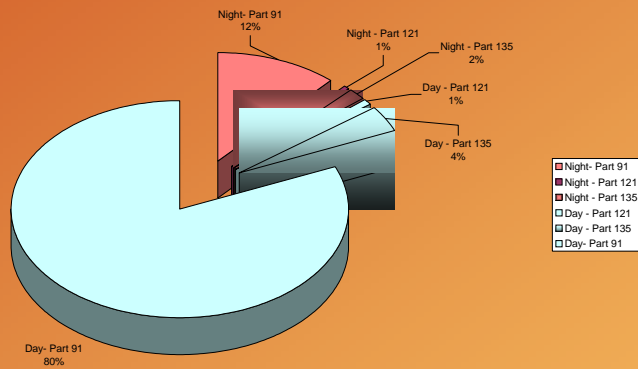
- Ground Based
  - Low-Level Windshear Alert System (LLWAS), Terminal Doppler Weather Radar (TDWR) and Weather Surveillance Radar (WSR)
  - Integrated Terminal Weather System (ITWS)
  - Medium Intensity Airport Weather System (MIAWS)
  - Weather and Radar Processors (WARP)
  - Corridor Integrated Weather System (CIWS)
- Training Programs
- Airborne Systems
  - Low-Altitude Windshear System Equipment Requirements.



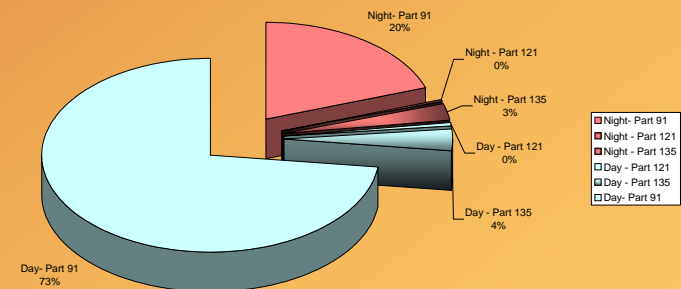


# Day/Night Accidents

## All Accidents

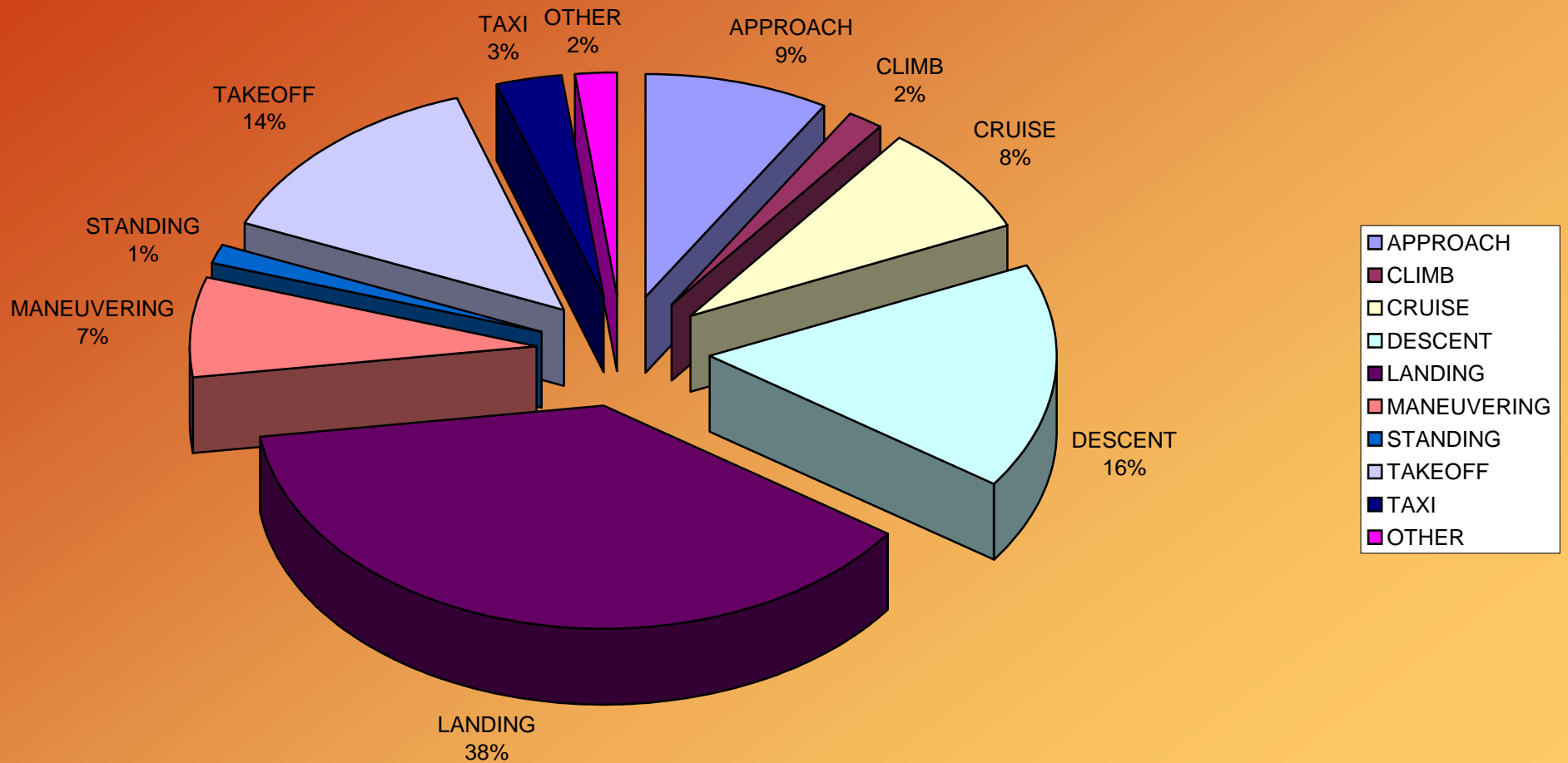


## Fatal Accidents



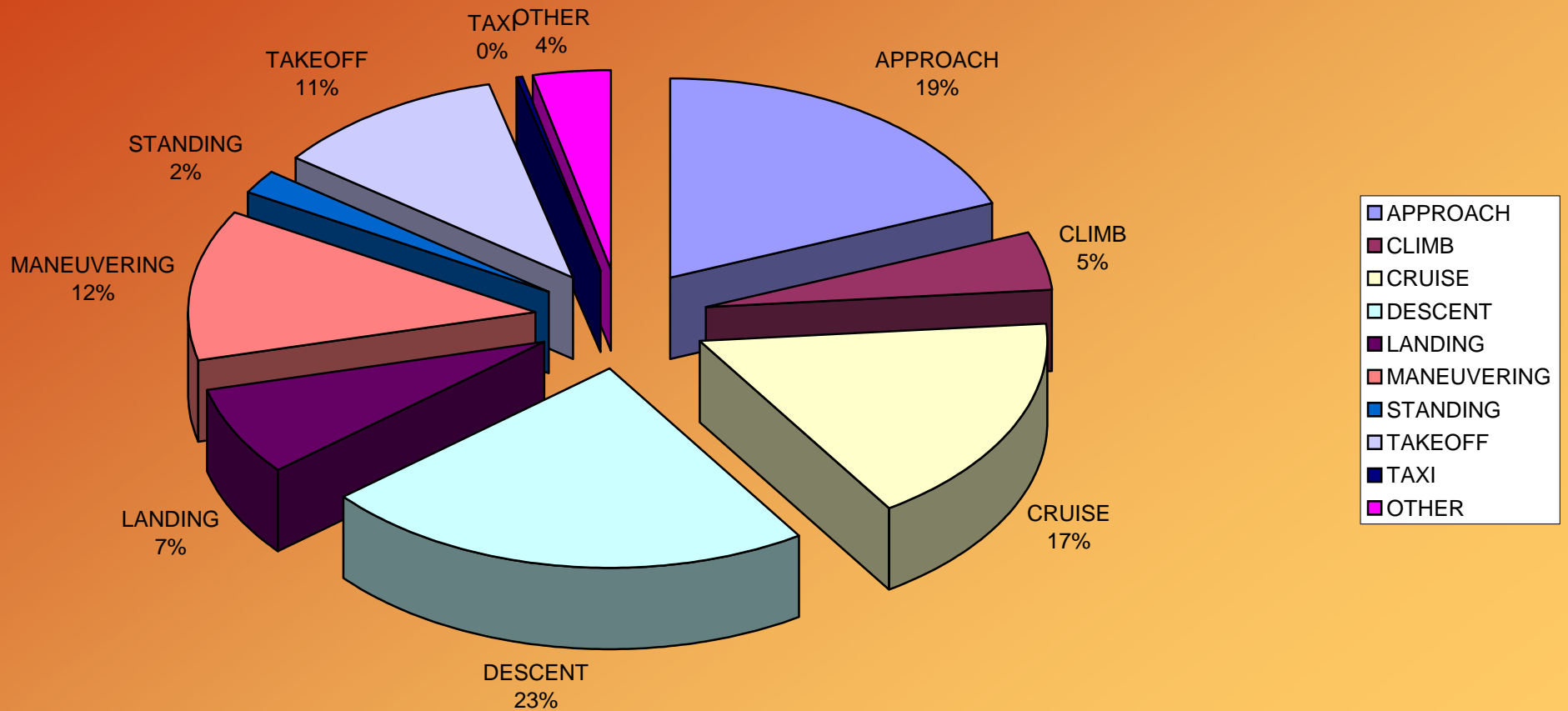


# All Accidents By Phase of Flight





# Fatal Accidents By Phase of Flight - Part 121&135





# Observations

- Most accidents happen during daylight however, the rate of **fatal** accidents is greater in the absence of daylight.
- Approach, Landing, and Descent are the most dangerous phases of flight.



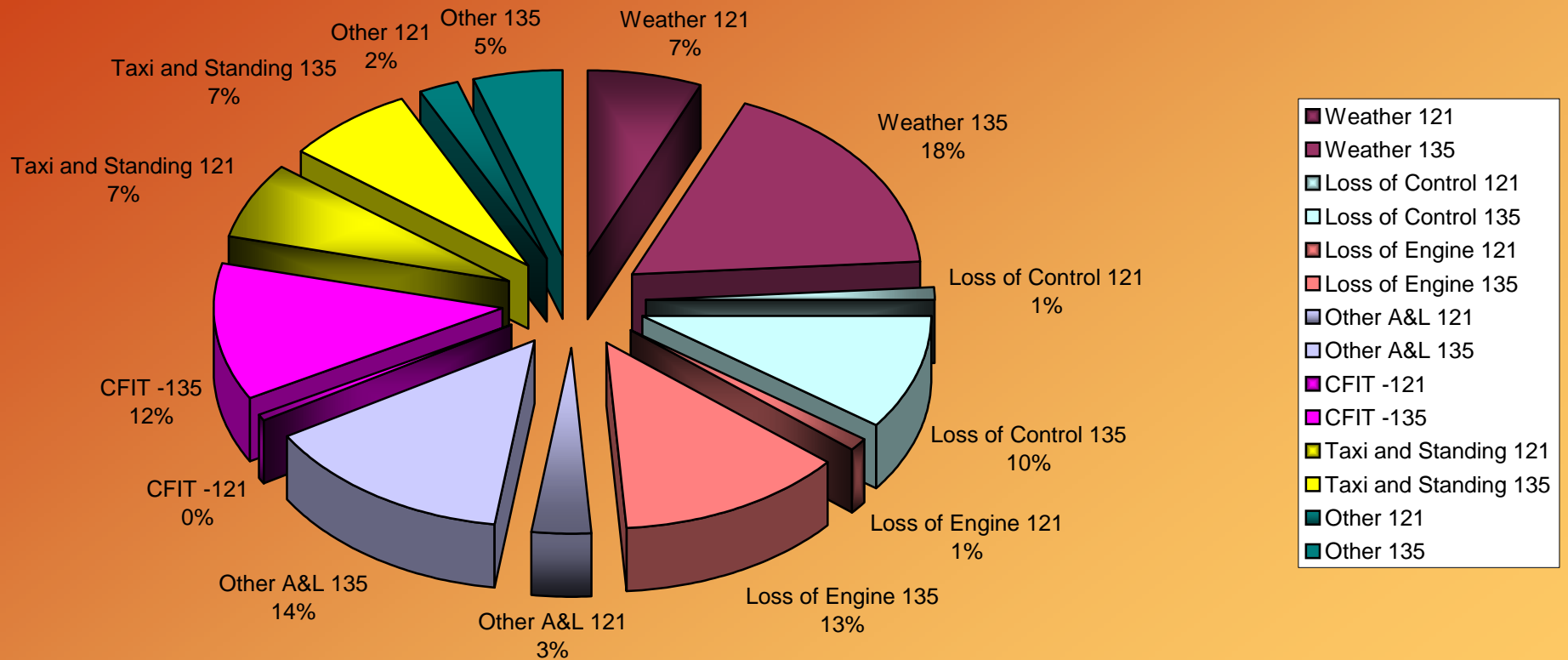
# Summary

Through the analyses of historical accident data, such findings can contribute to efforts in preventive safety in order to reduce aviation accidents.

**BACK UP SLIDES**

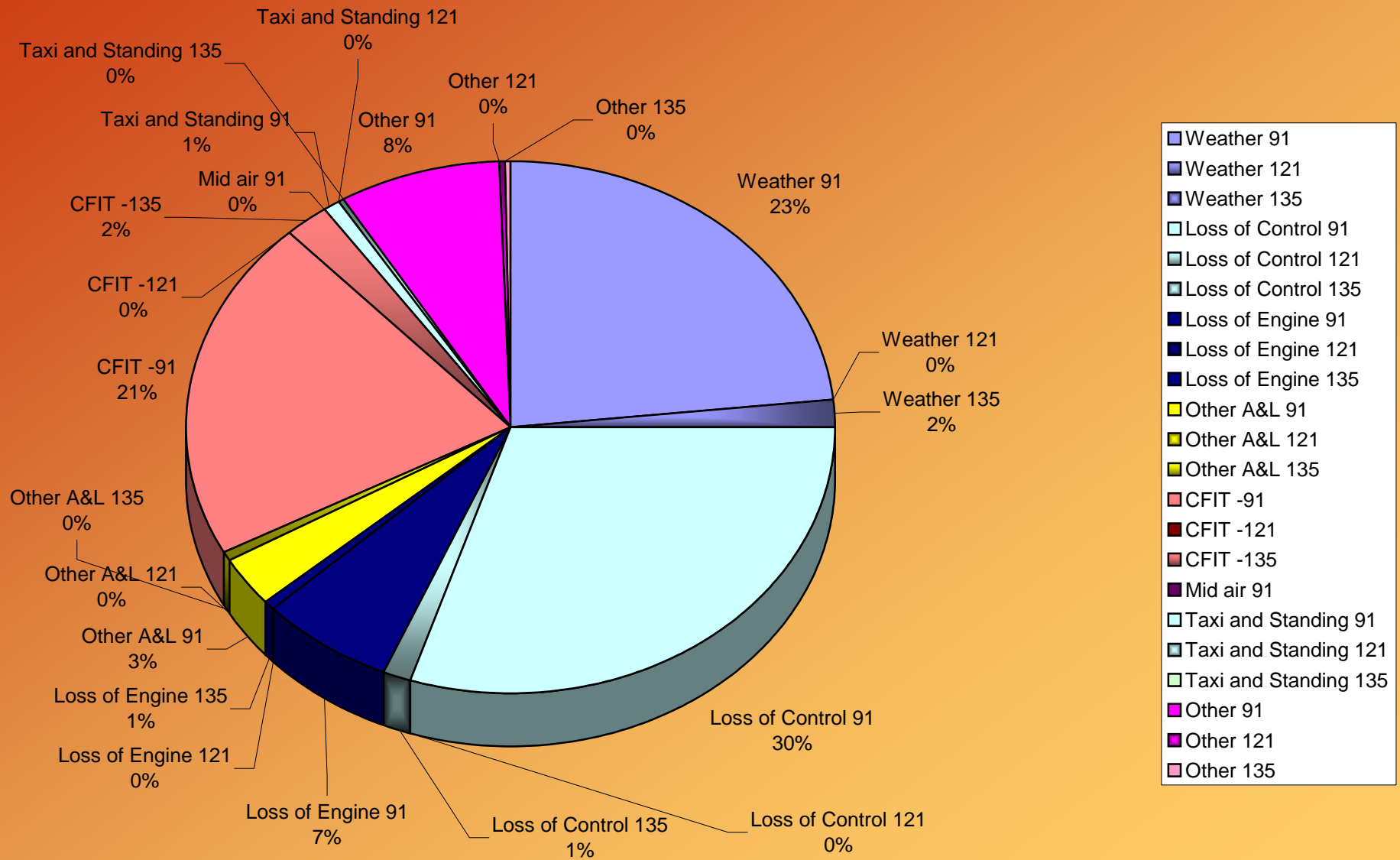


# Various Categories of Accidents – Part 121&135





# Various Categories of Fatal Accidents

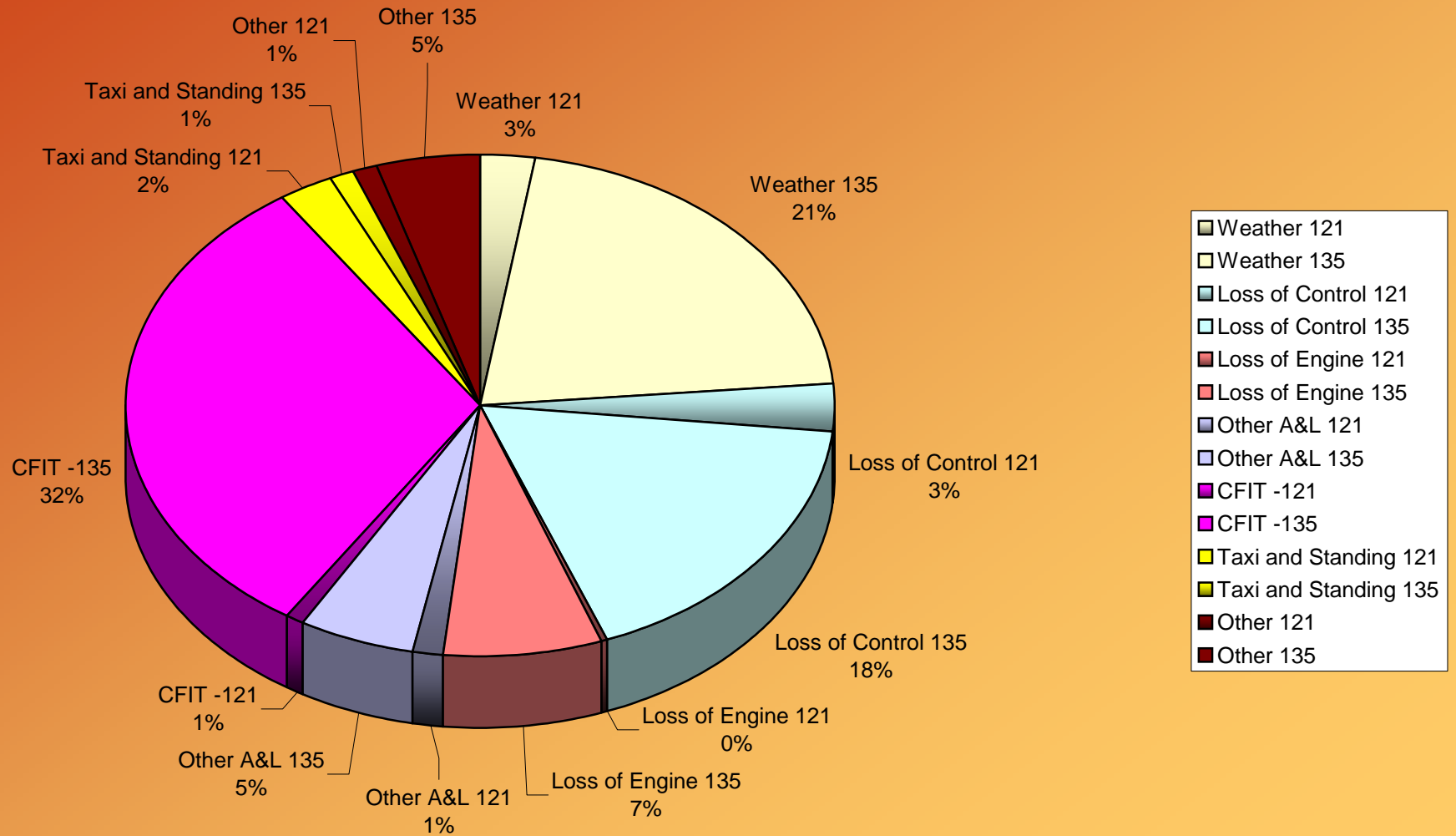






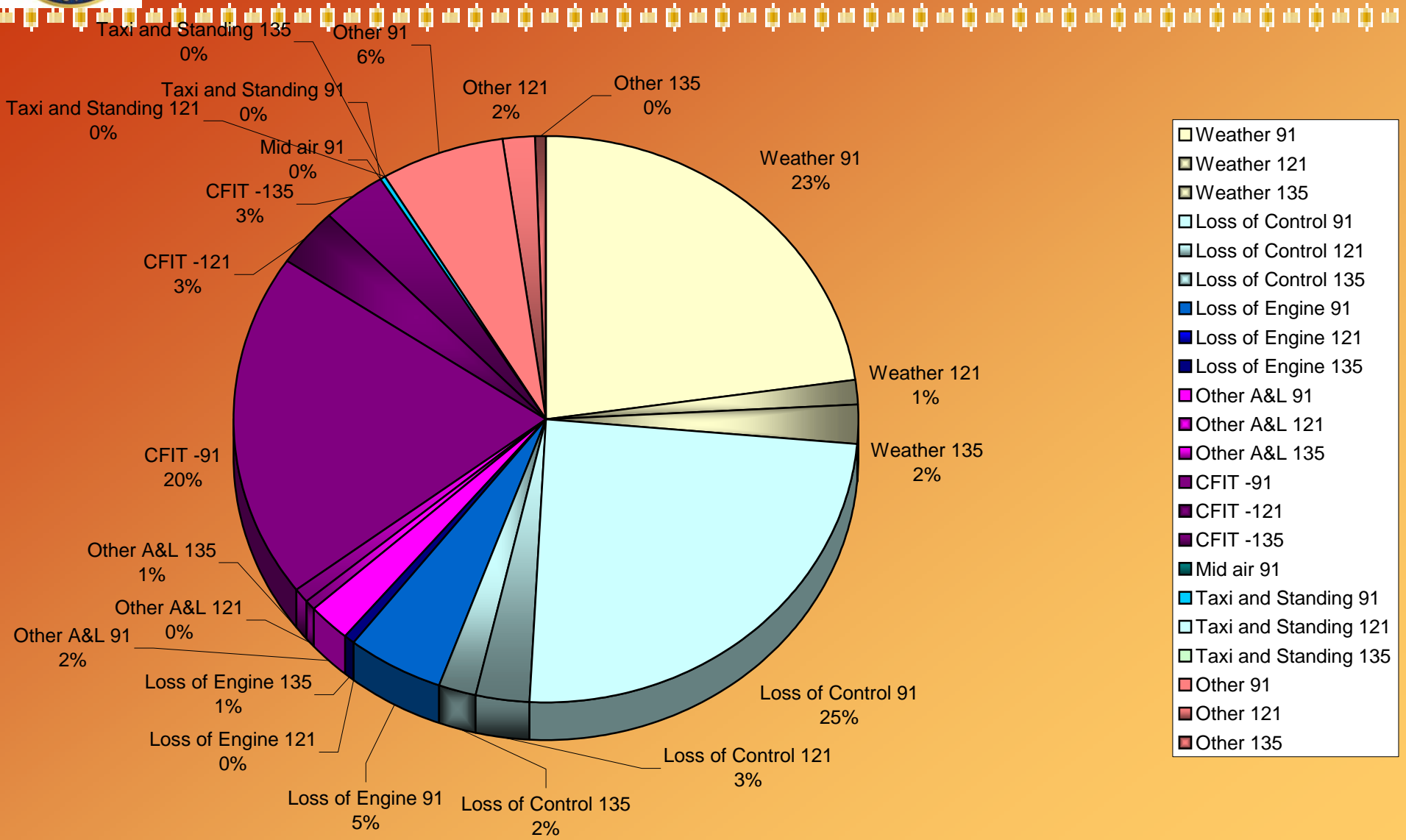
# Categories of Fatal Accidents - Part 121&135

All Categories-FATAL Accidents



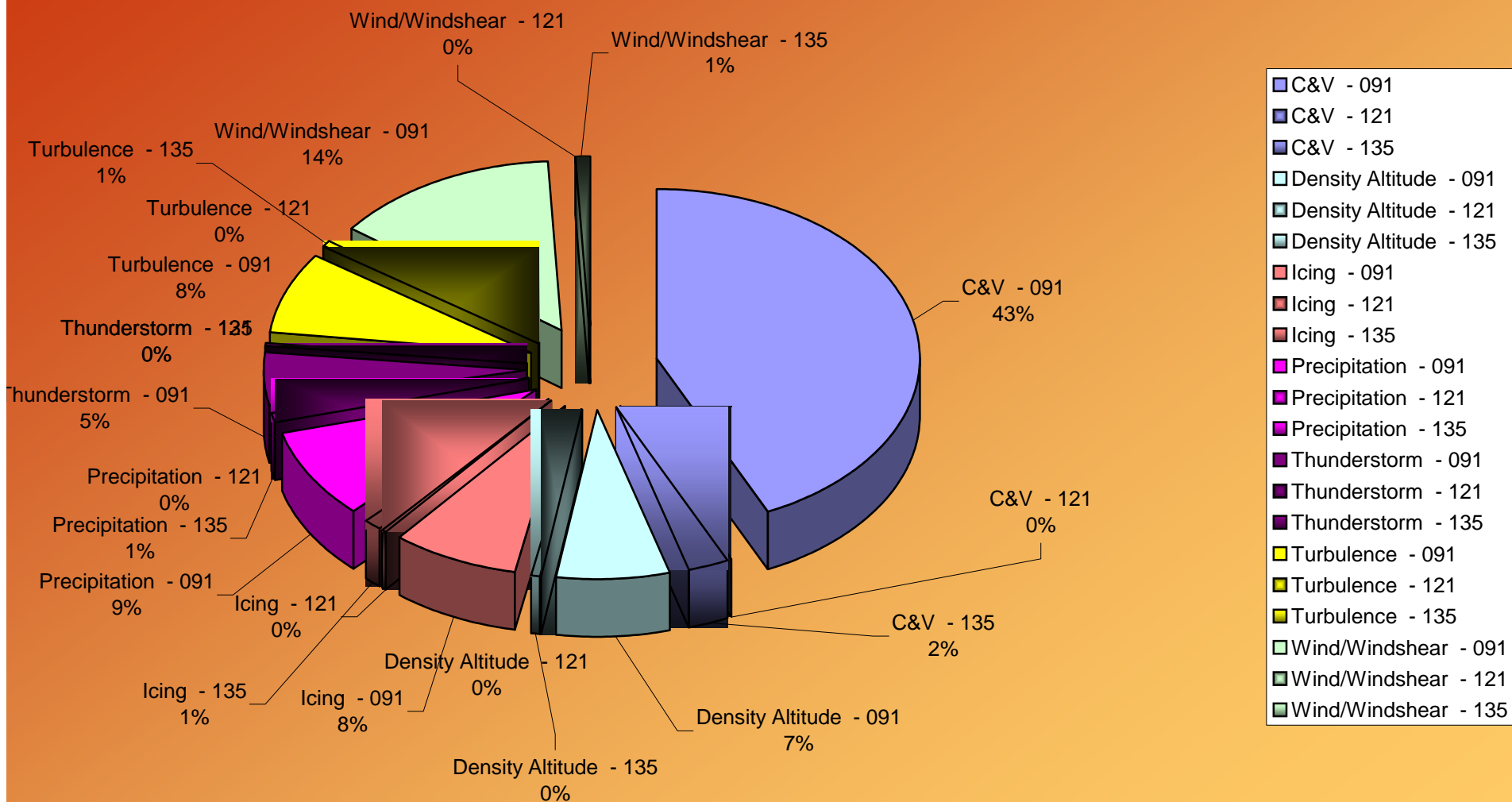


# Fatality Counts for All Accident Categories





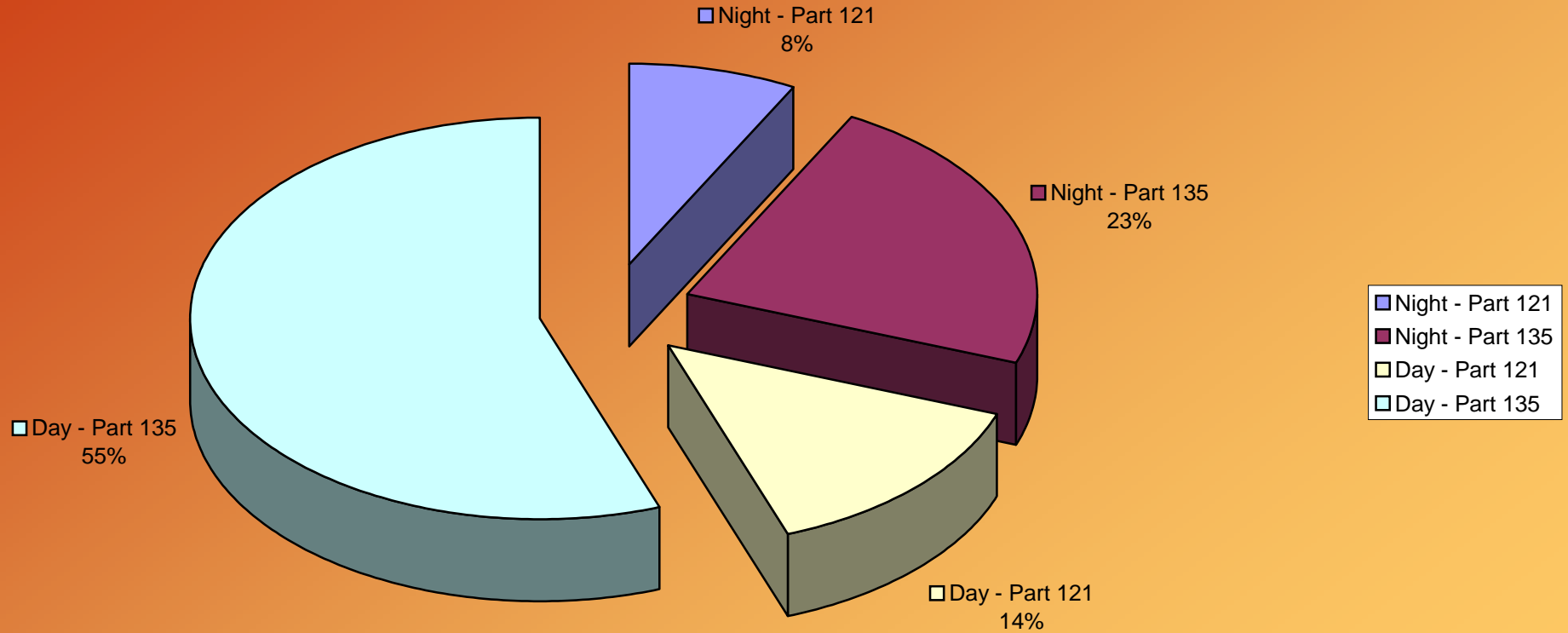
# Fatal Weather Accidents



- C&V - 091
- C&V - 121
- C&V - 135
- Density Altitude - 091
- Density Altitude - 121
- Density Altitude - 135
- Icing - 091
- Icing - 121
- Icing - 135
- Precipitation - 091
- Precipitation - 121
- Precipitation - 135
- Thunderstorm - 091
- Thunderstorm - 121
- Thunderstorm - 135
- Turbulence - 091
- Turbulence - 121
- Turbulence - 135
- Wind/Windshear - 091
- Wind/Windshear - 121
- Wind/Windshear - 135

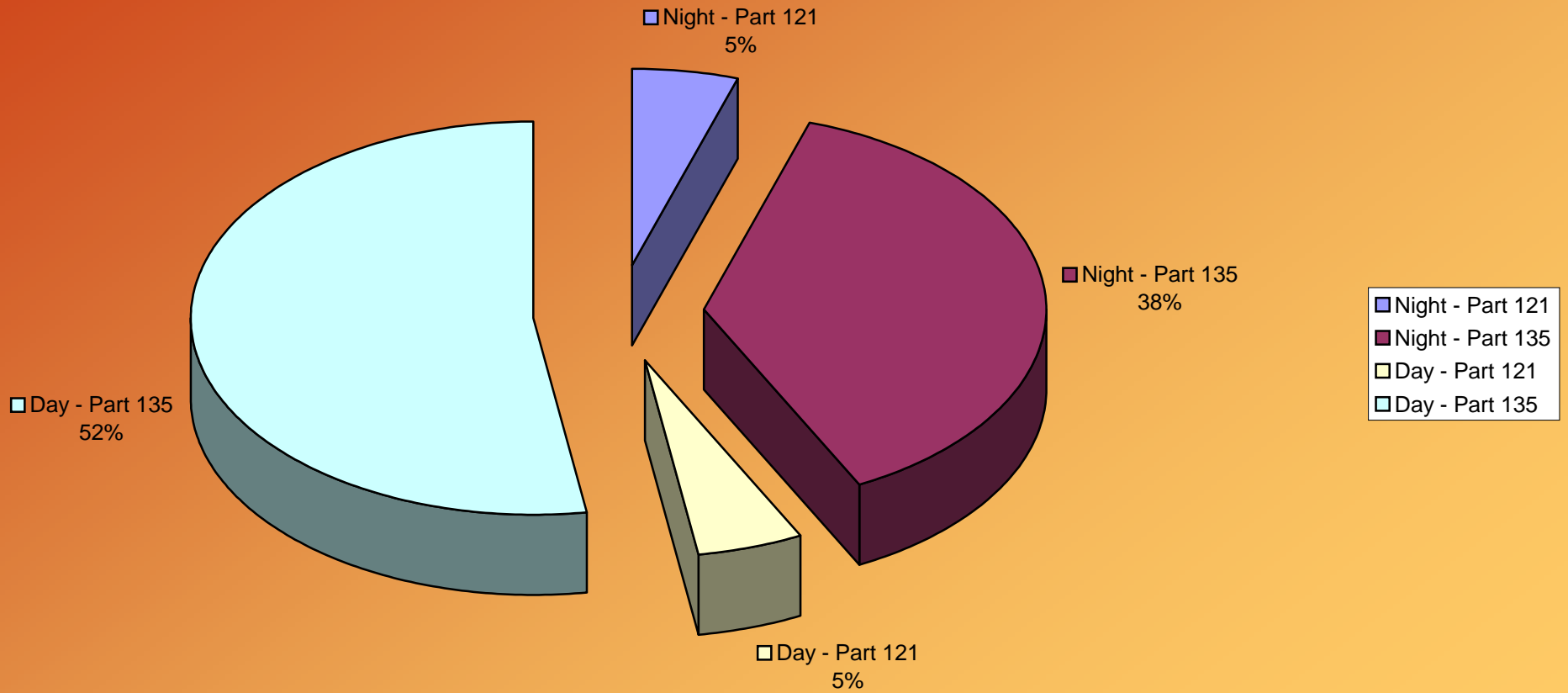


# All Day/Night Accidents – Part 121&135



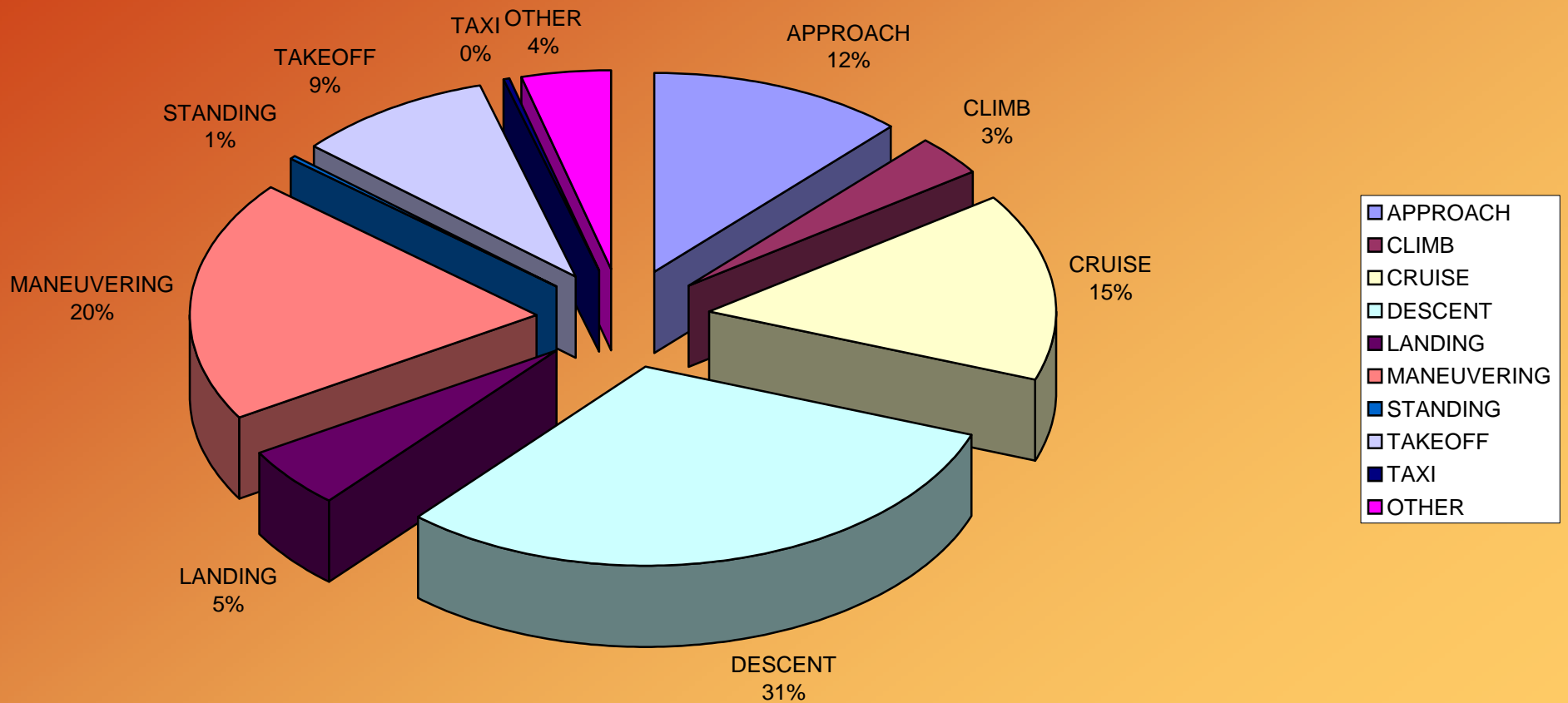


# Fatal Day/Night Accidents – Part 121&135



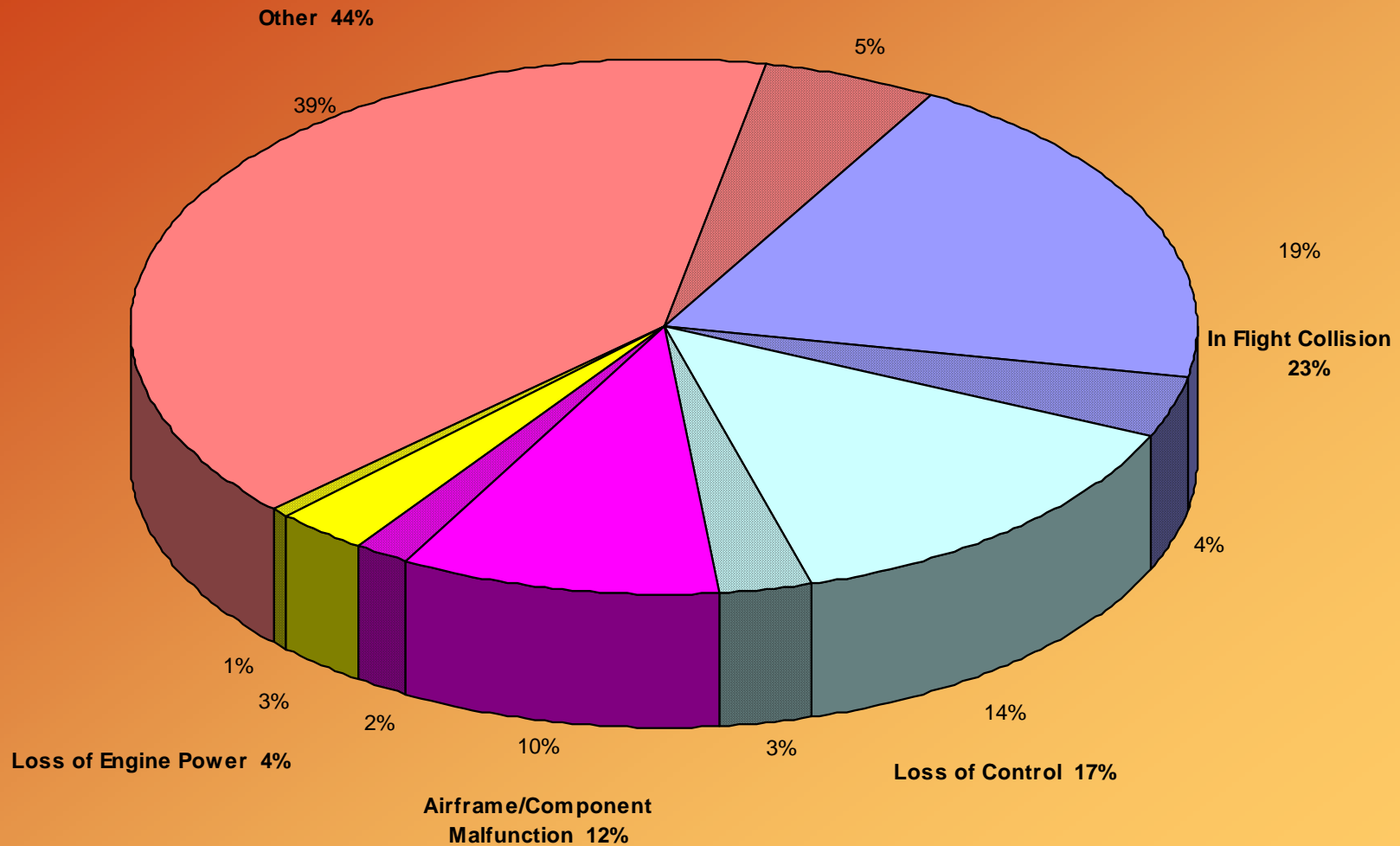


# Fatal Accidents By Phase of Flight





# SASO'S Contribution to Part 121 Accident Avoidance



# Accidents by Category

	All Accidents	Fatal Accident	Fatality Counts
Weather 91	9616	1847	4080.75
Weather 121	202	15.5	217.25
Weather 135	541.5	125.5	383.5
Loss of Control 91	9111	2380	4380
Loss of Control 121	33	17	487
Loss of Control 135	313	104	327
Loss of Engine 91	9161	533	909
Loss of Engine 121	31	2	6
Loss of Engine 135	396	43	94
Other A&L 91	8936	236	419
Other A&L 121	103	8	70
Other A&L 135	444	32	138
CFIT -91	4157	1658	3533
CFIT -121	12	5	585
CFIT -135	374	186	599
Mid air 91	36	0	0
Taxi and Standing 91	1652	64	55
Taxi and Standing 121	208	14	4
Taxi and Standing 135	222	8	8
Other 91	1953	645	1121
Other 121	66	6	313
Other 135	159	28	80
<b>Sum</b>	<b>47726.5</b>	<b>7957</b>	<b>17809.5</b>
<b>Sum 121&amp;135</b>	<b>3104.5</b>	<b>594</b>	<b>3311.75</b>



# Weather

Weather All accidents	091	121	135	PUBU	Grand Total	
C&V	1423.547619	11.64		114.7285714	4.666666667	1555.081746
Density Altitude	712.0833333	3.833		37.7	1.5	755.1166667
Icing	967.7857143	7.333		58.05	1	1034.169048
Precipitation	409.9452381	14.78		73.81190476	1.333333333	499.868254
Thunderstorm		176.85	9.917	7.926190476	0	194.6928571
Turbulence	696.8190476	139.3		45.82142857	2	883.9460317
Wind/Windshear	5214.969048	15.19		203.4619048	3.5	5437.125397
Grand Total		9602	202	541.5	14	10360

Sum of TOT_FATALITY	FLTCNDCT_CODE					
wx_CODE	091	121	135	PUBU	Grand Total	
C&V	1905.295238		10.66666667	140.8571429	11.33333333	2068.152381
Density Altitude	337.8833333		0.666666667	32.66666667	3.5	374.7166667
Icing	358.0333333		148	83.6		589.6333333
Precipitation	388.0119048		55.25	41.24047619	3.666666667	488.1690476
Thunderstorm	233.1333333			22.86666667		256
Turbulence	348.55		2	19.42380952		369.9738095
Wind/Windshear	489.8428571		0.666666667	42.8452381	1.5	534.8547619
Grand Total	4060.75		217.25	383.5	20	4681.5

# Weather- Continued

Weather after 1996	091	121	135	PUBU	Grand Total
C&V	252.8333333	2.333333333	19.83333333	3.5	278.5
Density Altitude	150.8333333	2	7.833333333	1	161.6666667
Icing	214.1666667	1	20.33333333	1	236.5
Precipitation	61.91666667	6.5	19	0.5	87.91666667
Thunderstorm	35	2.5	2	0	39.5
Turbulence	129.5	64.5	12.16666667	1	207.1666667
Wind/Windshear	1357.75	6.166666667	43.83333333	2	1409.75
Grand Total	2202	85	125	9	2421

## Phase of Flight

	All Accident	Fatal Accidents	121&135 only
APPROACH	3767.405	1070.738095	116.53333333
CLIMB	747.8833	291.43333333	29.36666667
CRUISE	3525.348	1366.17381	107.8166667
DESCENT	7122.35	2744.509524	143.78333333
LANDING	16534.18	427.6928571	43.31666667
MANEUVERING	3155.217	1753.1	77.15
STANDING	579.7333	44.83333333	11
TAKEOFF	5905.824	814.7238095	68.5
TAXI	1427.917	13.66666667	1.66666667
OTHER	807.1429	373.1285714	21.86666667

## Day/night

	Fatal Accidents	All Accidents	Fatal Accidents	All Accidents
Night- Part 91	1531	3992	19.77%	11.60%
Night - Part 121	28	192	0.36%	0.56%
Night - Part 135	212	556	2.74%	1.62%
Day - Part 121	28	342	0.36%	0.99%
Day - Part 135	295	1365	3.81%	3.97%
Day- Part 91	5650	27967	72.96%	81.27%

## Accidents

### Annual Average

	91	121	135
All accident	2065.85	32.2	116.8
Fatal Accident	424.5	3.45	29.2
Fatality counts	794	152.55	84.65

# Accidents

	All Accidents	Fatal Accident	Fatality Counts
Weather 91	9616	1847	4080.75
Weather 121	202	15.5	217.25
Weather 135	541.5	125.5	383.5
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