Safety Hazards in Civil Aviation Operations

Congreso Internacional de Medicina Aeroespacial

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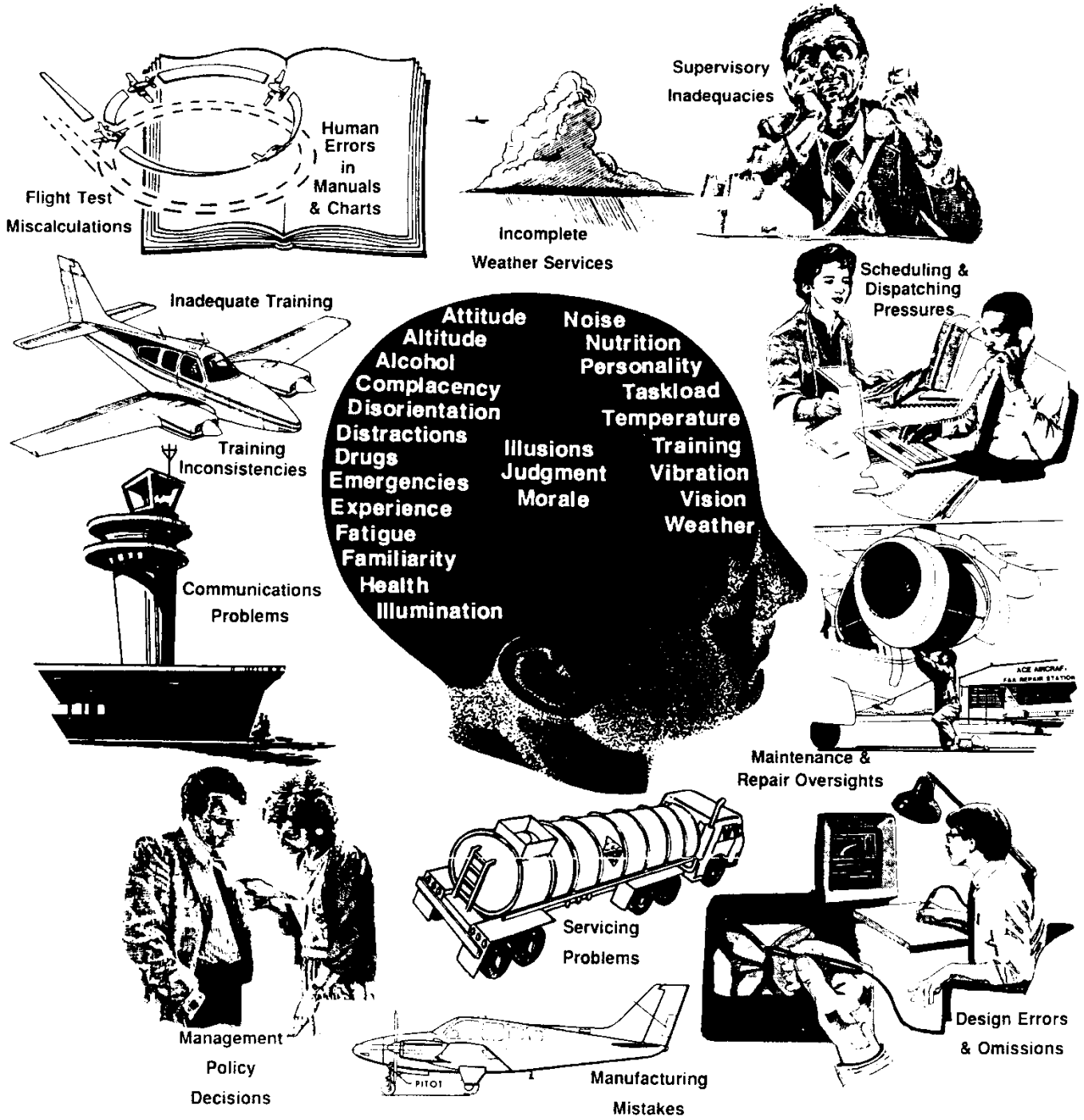
HUMAN FACTORS
(ICAO Definition)

"Human Factors is about people; it is about people in their working and living environments, and it is about their relationship with equipment, procedures and the environment. Just as important, it is about their relationship with other people. Its twin objectives can be seen as safety and efficiency."

Why Human Factors are Important?

- The majority of all aviation accidents are due to human factors (not necessarily pilot error)
- Most aviation accidents and incidents due to human factors are preventable
- ICAO has recommended that all pilots receive training in human factors

The Weak Link is the *Human Being*


Human Errors in Manuals & Charts
Flight Test Miscalculations
Supervisory Inadequacies
Incomplete Weather Services
Inadequate Training
Scheduling & Dispatching Pressures
Training Inconsistencies
Attitude
Altitude
Alcohol
Complacency
Disorientation
Distractions
Drugs
Emergencies
Experience
Fatigue
Familiarity
Health
Illumination
Noise
Nutrition
Personality
Taskload
Temperature
Illusions
Judgment
Morale
Training
Vibration
Vision
Weather
Communications Problems
Maintenance & Repair Oversights
Servicing Problems
Management Policy Decisions
Design Errors & Omissions
Manufacturing Mistakes
PITOT

Risk Management

Risk Management is the Process of:

+ *Identifying Hazards*
+ *Assessing Risks*
+ *Making a Decision*
+ *Implementing the Decision*
+ *Monitoring the Results*

RISK MANAGEMENT

Perception vs Reality

"People are disturbed, not by things, but by their view of them"
Epictetus


RISK MANAGEMENT
Perception vs Reality
Understanding Risks is Important


Including All Potential Risks!!!

PSYCHOLOGICAL FACTORS INFLUENCING RISK PERCEPTION

- *Level of Trust*
- *Potential Benefit vs Harm*
- *Control vs Lack of Control*
- *Individual Choice*
- *Natural vs Human-Made*
- *Catastrophic vs Chronic*
- *Certainty vs Uncertainty*
- *Me vs Them*
- *Familiar vs New*
- *Children vs Adults*
- *Equity vs Inequity*
- *Level of Awareness*


There I Fixed It


BIC SICILIA


DANGER
FLAMMABLE
GAS


TADANO


TOYOTA

STUPIDITY IS

ignoring the laws of gravity

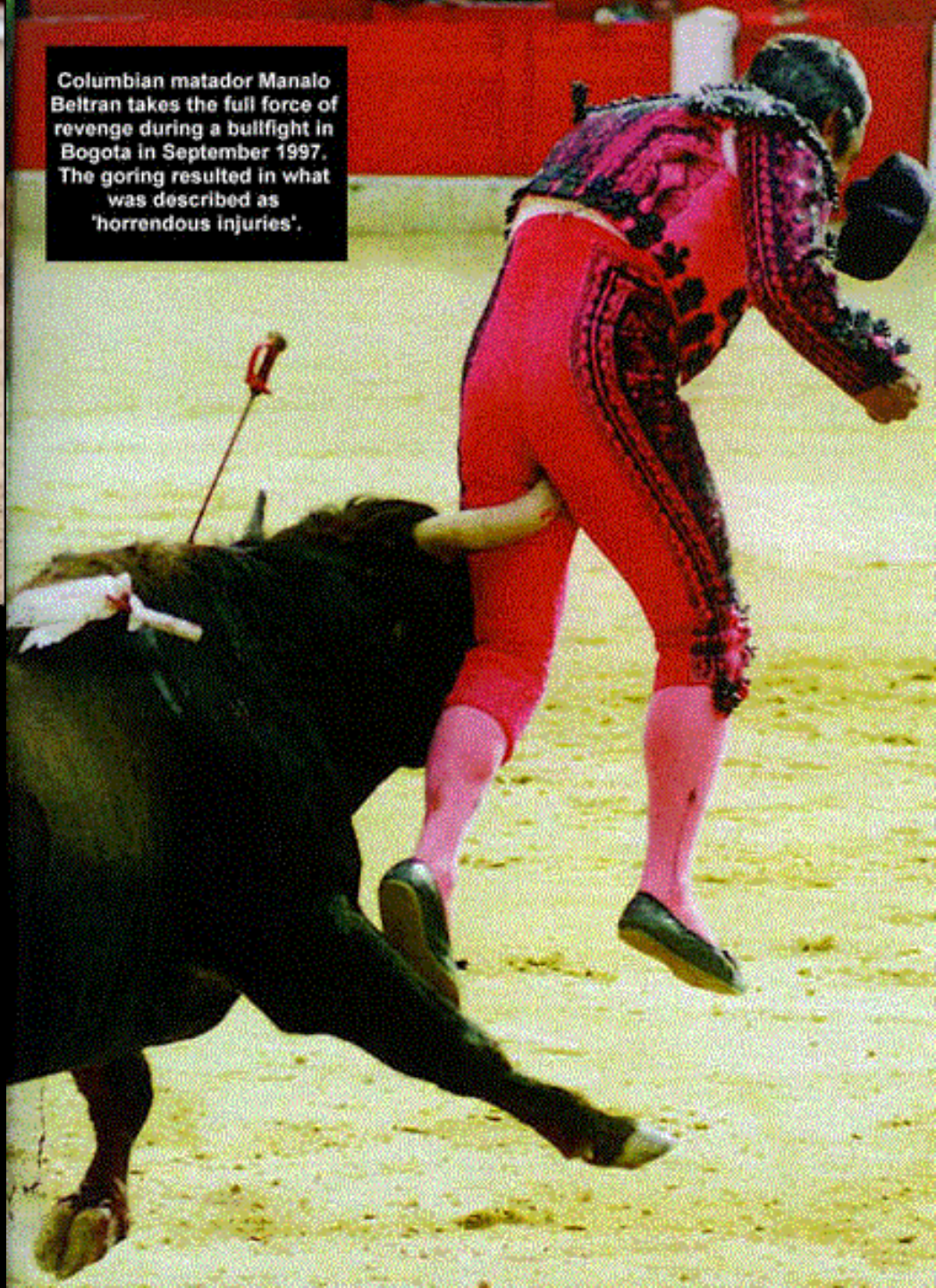

POLIZEI
BERLIN


WHACKED
OUT
SPORTS.COM

Skill and Experience
may not be Enough to
Prevent an Accident

Using Personal Protective
Equipment is Always
a Great Idea!!!

Always be prepared to deal with the unexpected!

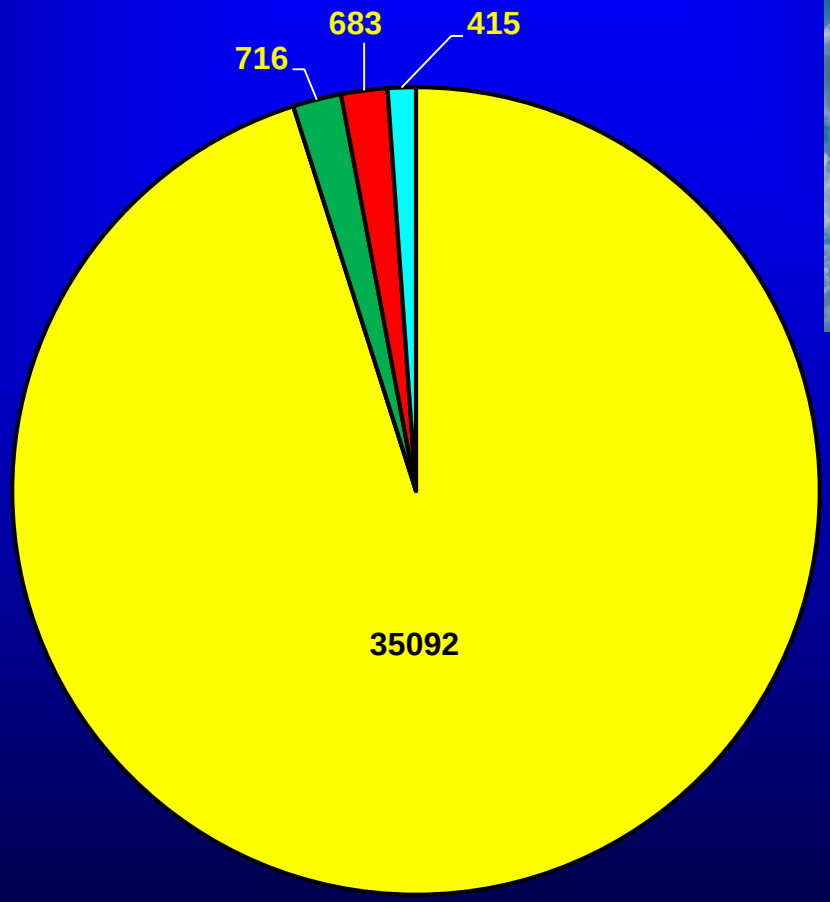


Columbian matador Manalo Beltran takes the full force of revenge during a bullfight in Bogota in September 1997. The goring resulted in what was described as 'horrendous injuries'.


COUNT

Aviation Safety:
Putting Risks in Perspective

U.S. Fatalities by Mode of Transportation (36,918 in 2016)



U.S. Aviation Accidents by Type of Operation (2015)

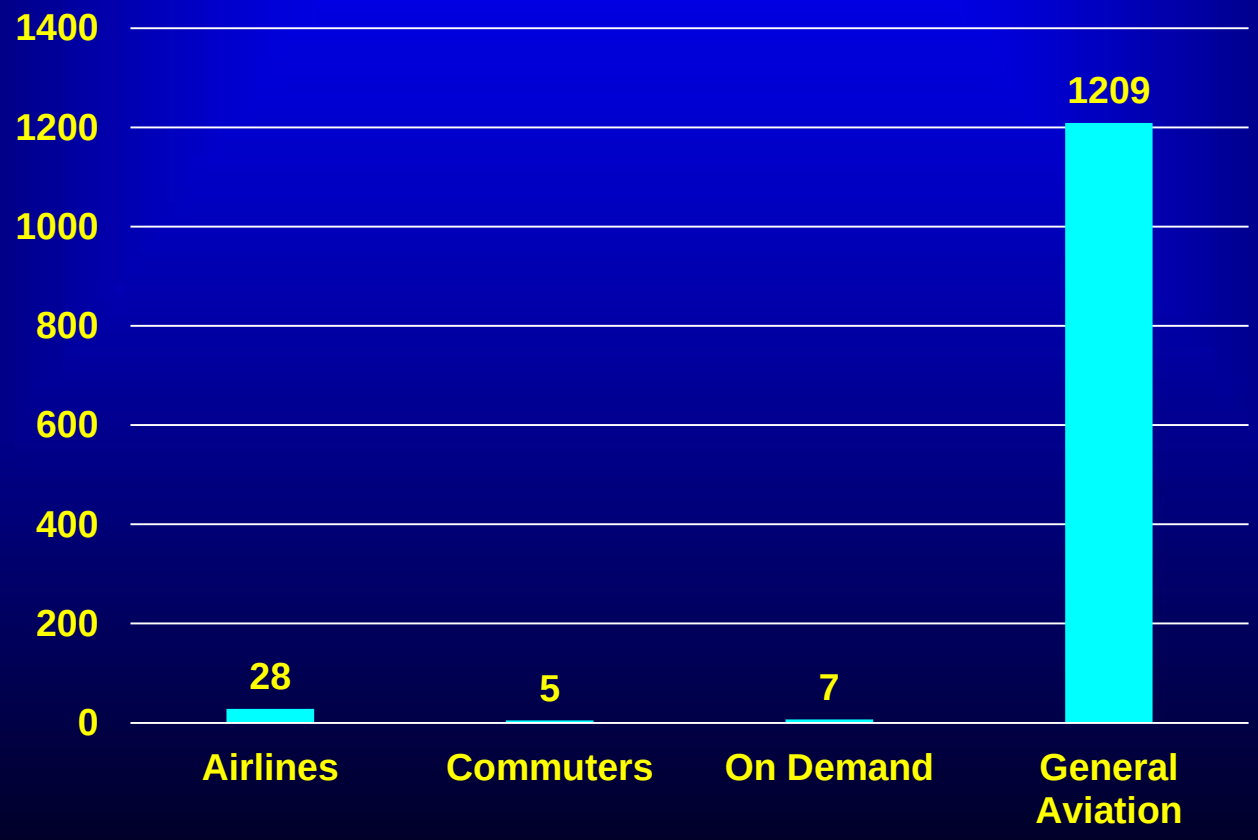


Table 10. Accidents, Fatalities, and Rates, 1995 through 2014,

General Aviation

	Accidents		Fatalities			Accidents per 100,000 Flight Hours	
Year	All	Fatal	Total	Aboard	Flight Hours	All	Fatal
1995	2,056	412	734	727	24,906,000	8.21	1.63
1996	1,908	361	636	619	24,881,000	7.65	1.45
1997	1,840	350	631	625	25,591,000	7.17	1.36
1998	1,902	364	624	618	25,518,000	7.43	1.41
1999	1,905	340	621	615	29,246,000	6.50	1.16
2000	1,837	345	596	585	27,838,000	6.57	1.21
2001	1,727	325	562	558	25,431,000	6.78	1.27
2002	1,716	345	581	575	25,545,000	6.69	1.33
2003	1,741	352	633	630	25,998,000	6.68	1.34
2004	1,619	314	559	559	24,888,000	6.49	1.26
2005	1,671	321	563	558	23,168,000	7.20	1.38
2006	1,523	308	706	547	23,963,000	6.35	1.28
2007	1,654	288	496	491	23,819,000	6.94	1.20
2008	1,568	277	496	487	22,805,000	6.87	1.21
2009	1,480	275	479	470	20,862,000	7.08	1.32
2010	1,440	271	458	455	21,688,000	6.63	1.24
2011	1,470	269	452	441	-	-	-
2012	1,470	272	437	437	20,881,000	7.04	1.30
2013	1,224	222	391	386	19,492,000	6.26	1.12
2014	1,221	253	419	410	18,103,000	6.74	1.40

Notes 2014 data are preliminary.

An average of 3.3 accidents per day

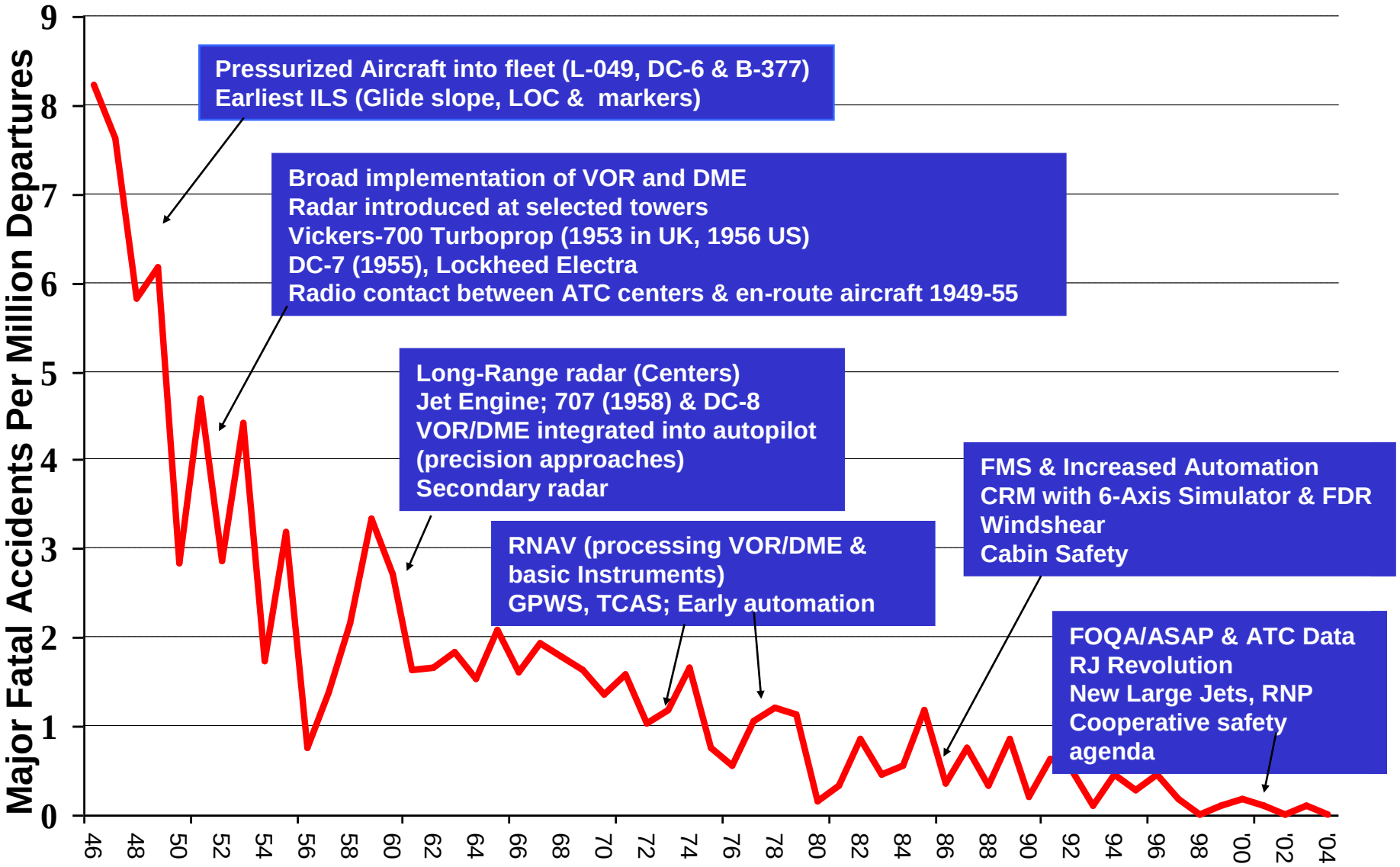
Driving the distance of a typical nonstop flight (~1,157 km or 719 miles) is 65 times as risky as flying on the 10 major U.S. airlines

For flying to become as risky as driving, disastrous airline accidents on the scale of those of 911 would have to occur about once a month

During October, November and December of 2001 highway traffic increased by 5.3% and fatal accidents rose by 8%

“Safer Driving”

Factors That Led To Breakthroughs in Major Fatal Accident Rates Since 1946

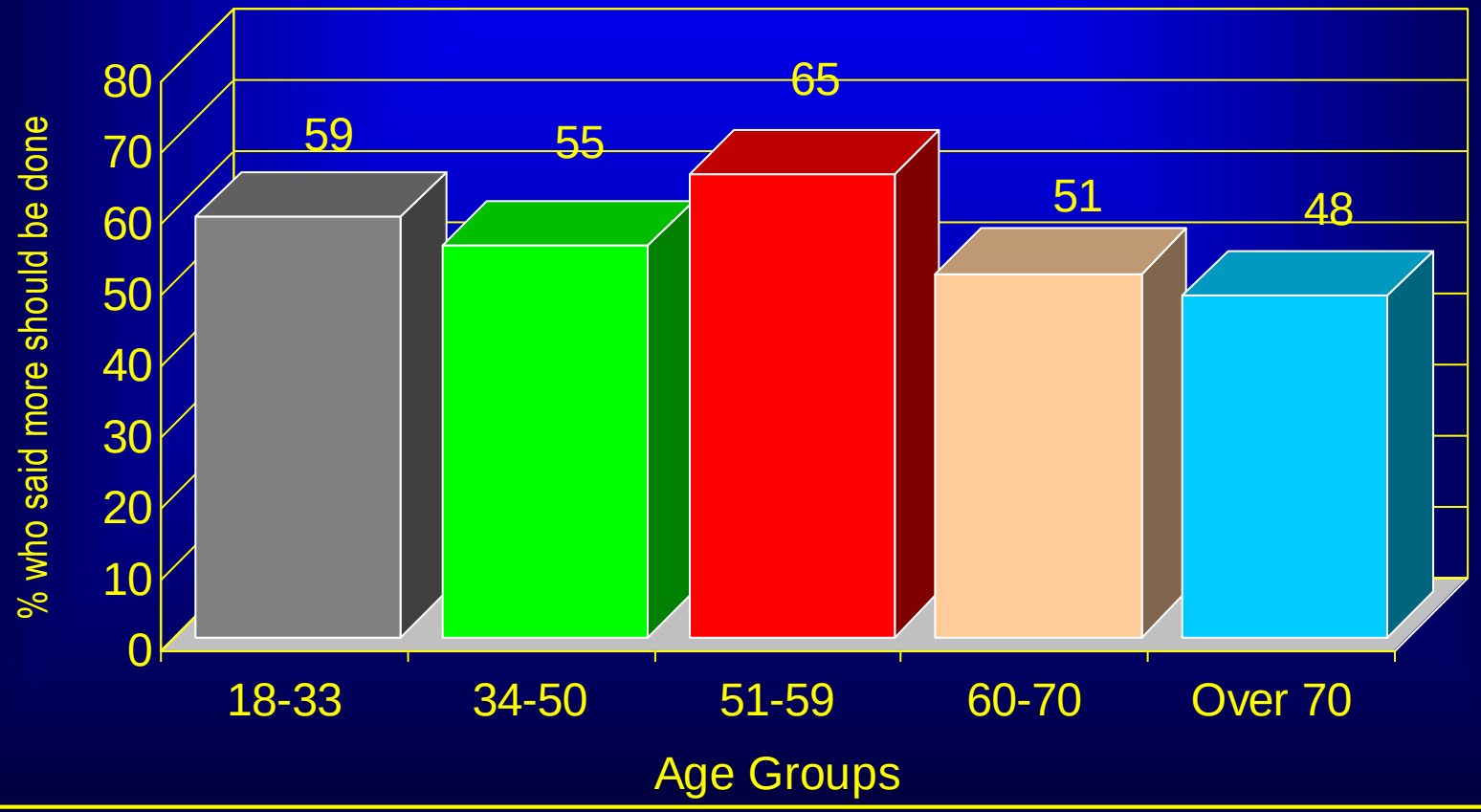


"Major" accidents include destroyed aircraft , both fatal and non-fatal, and non-destroyed aircraft with multiple fatalities. Rate for 2004 is pro-rated based on data through September.

Public Perception about Aviation Safety is a Problem

Public Opinion About Aviation Safety
(Fox News)

55% of adults said the government is NOT doing enough to make air travel as safe as possible



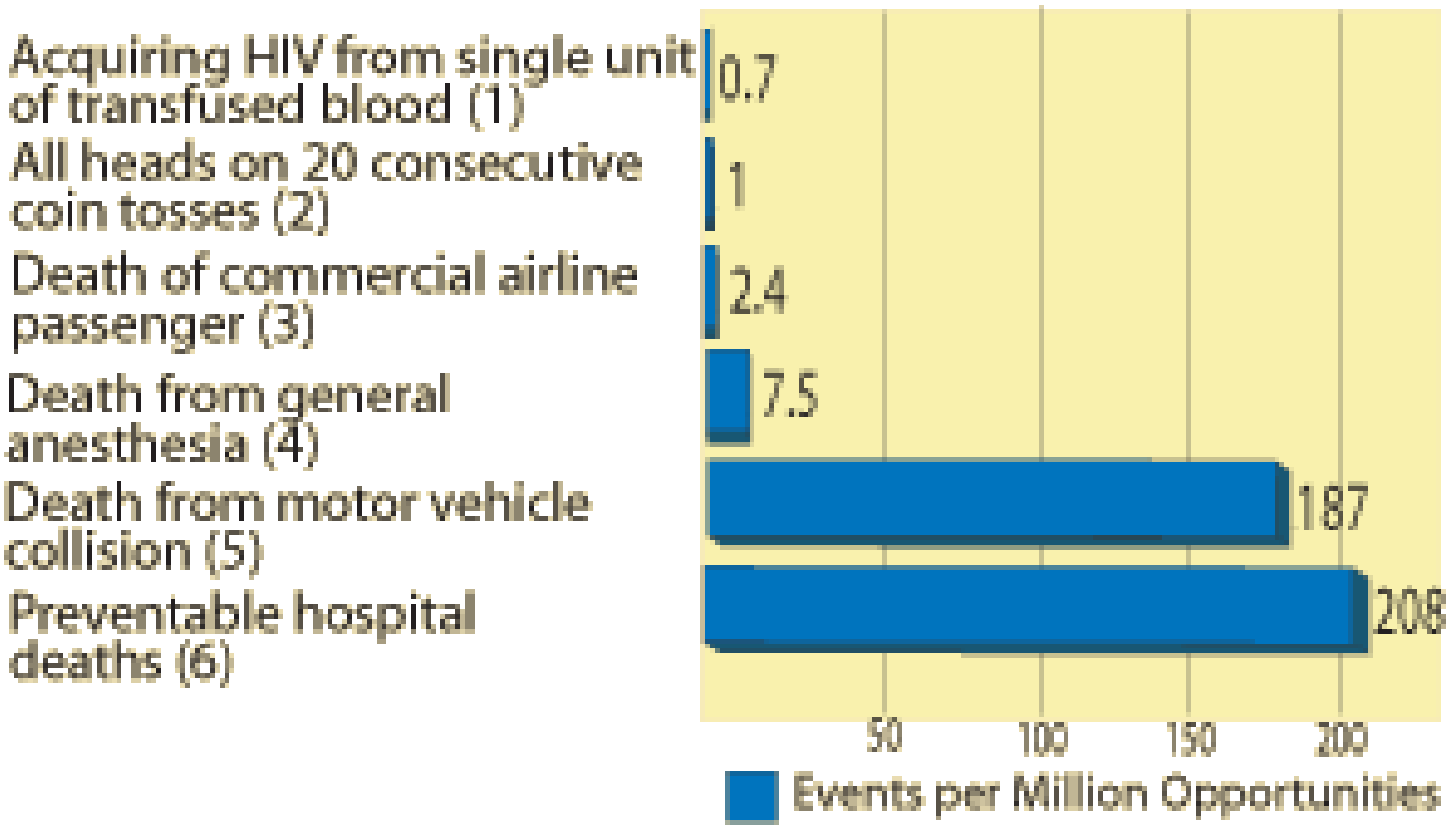
Top 10 Airline Safety Questions (AirSafe.com)

- Is flying safer or less safe today than 10-20 years ago?
- Where is the safest place to sit on an airplane?
- Which is the safest airline to fly?
- Which aircraft model is the safest to fly?
- What kind of emergency am I most likely to face?
- How should I prepare to face this situation?
- How often do airlines crash?
- If the plane crashes, don't most people die?
- Who decides on what changes are made for safety?
- Who investigates airline accidents?

Heart Disease	1-in-5
Cancer	1-in-7
Stroke	1-in-23
Accidental Injury	1-in-36
Motor Vehicle Accident	1-in-100
Intentional Self-harm (suicide)	1-in-121
Falling Down	1-in-246
Assault by Firearm	1-in-325
Fire or Smoke	1-in-1,116
Natural Forces (heat, cold, storms, quakes, etc.)	1-in-3,357
Electrocution	1-in-5,000
Drowning	1-in-8,942
Air Travel Accident	1-in-20,000
Flood* (included also in Natural Forces above)	1-in-30,000
Legal Execution	1-in-58,618
Tornado (included also in Natural Forces above)	1-in-60,000
Lightning Strike (included also in Natural Forces above)	1-in-83,930
Snake, Bee or other Venomous Bite or Sting	1-in-100,000
Earthquake (included also in Natural Forces above)	1-in-131,890
Dog Attack	1-in-147,717
Asteroid Impact	1-in-200,000**
Tsunami	1-in-500,000
Fireworks Discharge	1-in-615,488

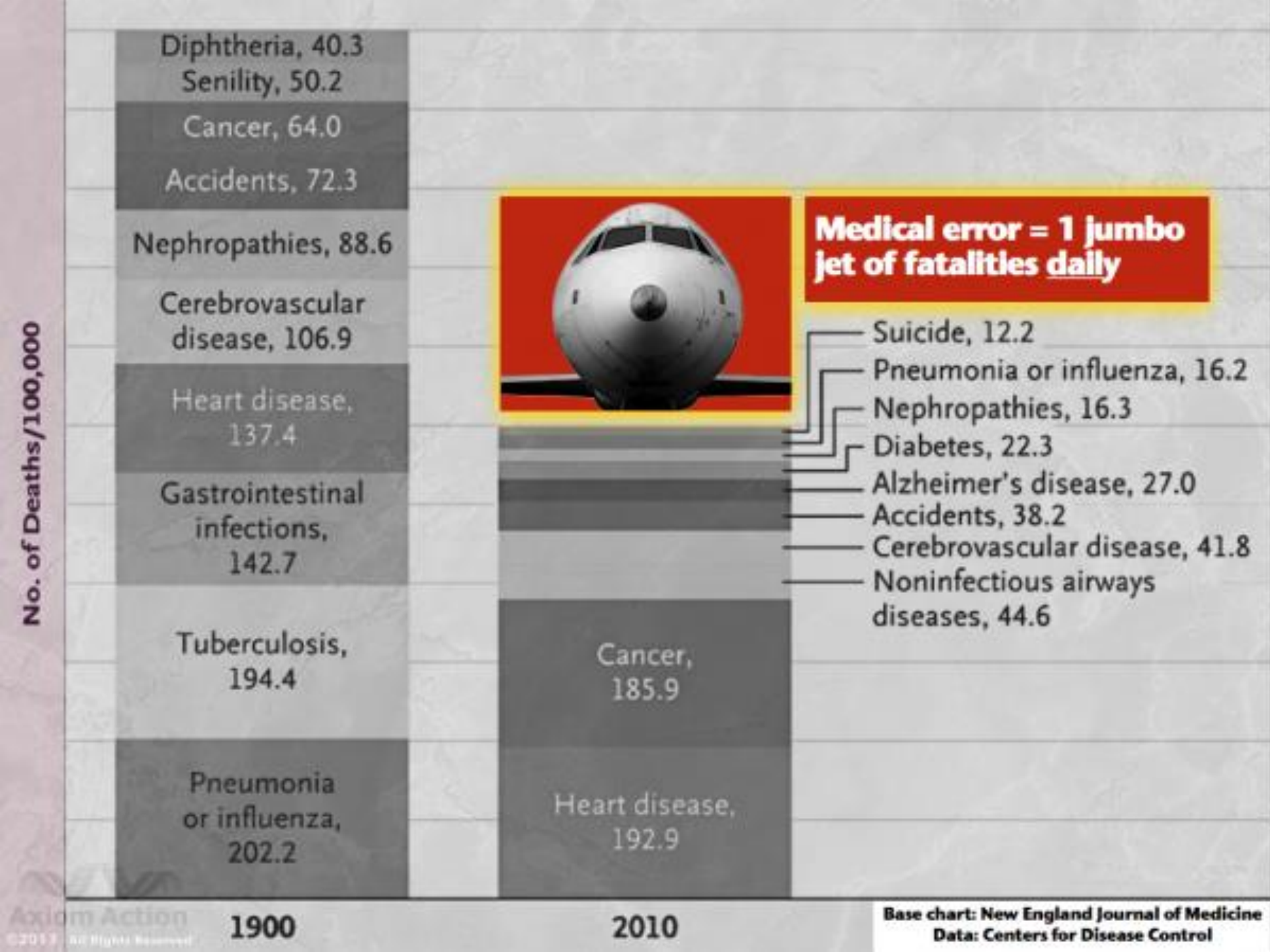
** Perhaps 1-in-500,000

SOURCES: National Center for Health Statistics, CDC; American Cancer Society; National Safety Council; International Federation of Red Cross and Red Crescent Societies; World Health Organization; USGS; Clark Chapman, SwRI; David Morrison, NASA; Michael Paine, Planetary Society Australian Volunteers



"The world is a dangerous place to live, not because the people who are evil, but because of the **people who don't do anything about it**"

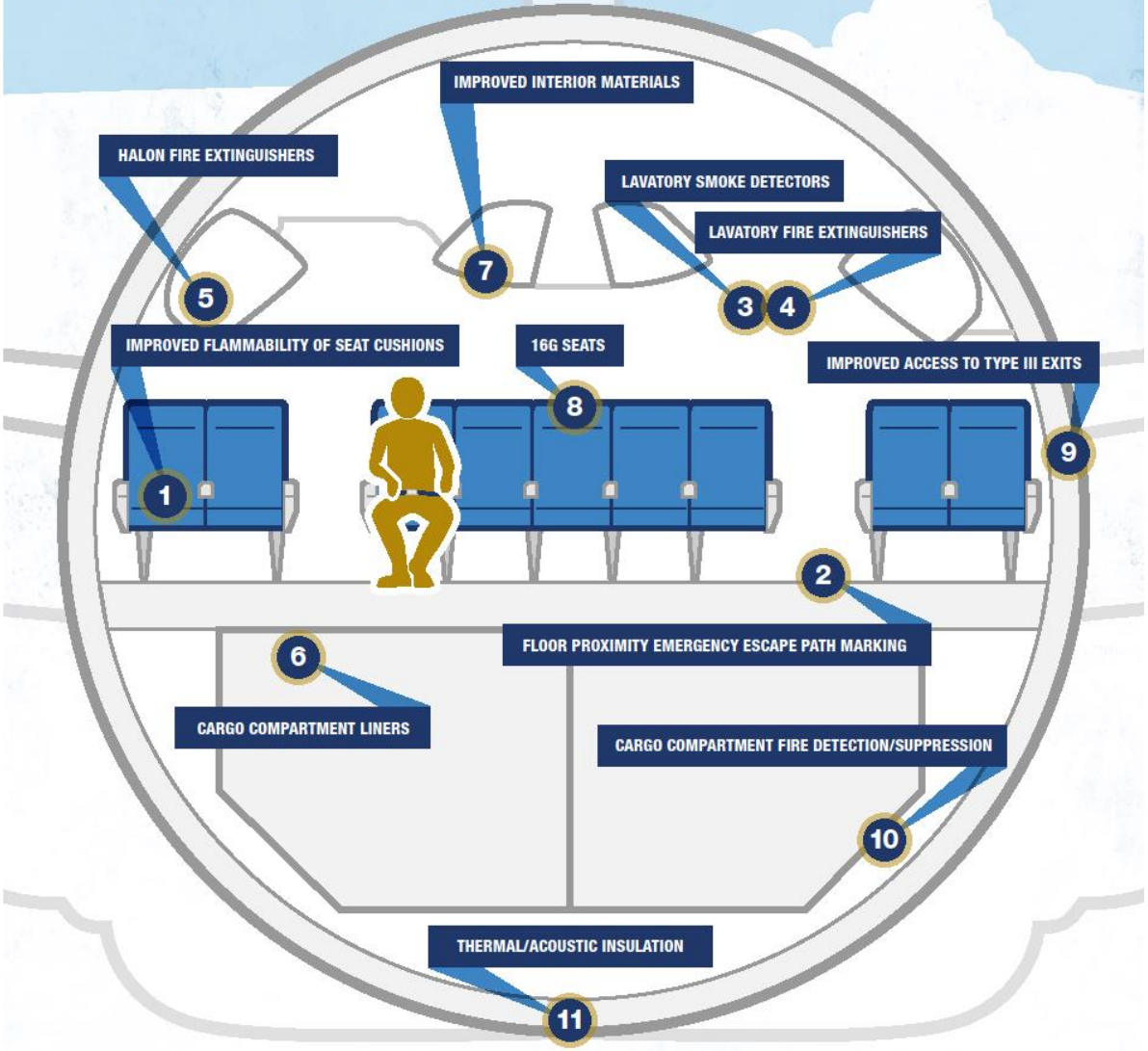
Einstein



Flying is the Safest Mode of Public Transportation

FAA Fact Sheet:
Improvements to Aircraft Survivability

The FAA research and upgrades to aircraft over the years have significantly increased the likelihood of passengers surviving an aviation accident.




FLIGHT
zh
aw
TECHNORAMA

Is Aviation Risk Free?

NTSB MOST WANTED

Transportation Safety Improvements

"... a program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives."

1. Improve Safety of Emergency Medical Services Flights
2. Improve Runway Safety
3. Reduce Dangers to Aircraft Flying in Icing Conditions
4. Improve Crew Resource Management for Part 135 Ops
5. Require Crash-Worthy Image Recorders in Cockpits
6. Reduce Accidents and Incidents Cause by Human Fatigue
7. Improve Oversight of Pilot Proficiency

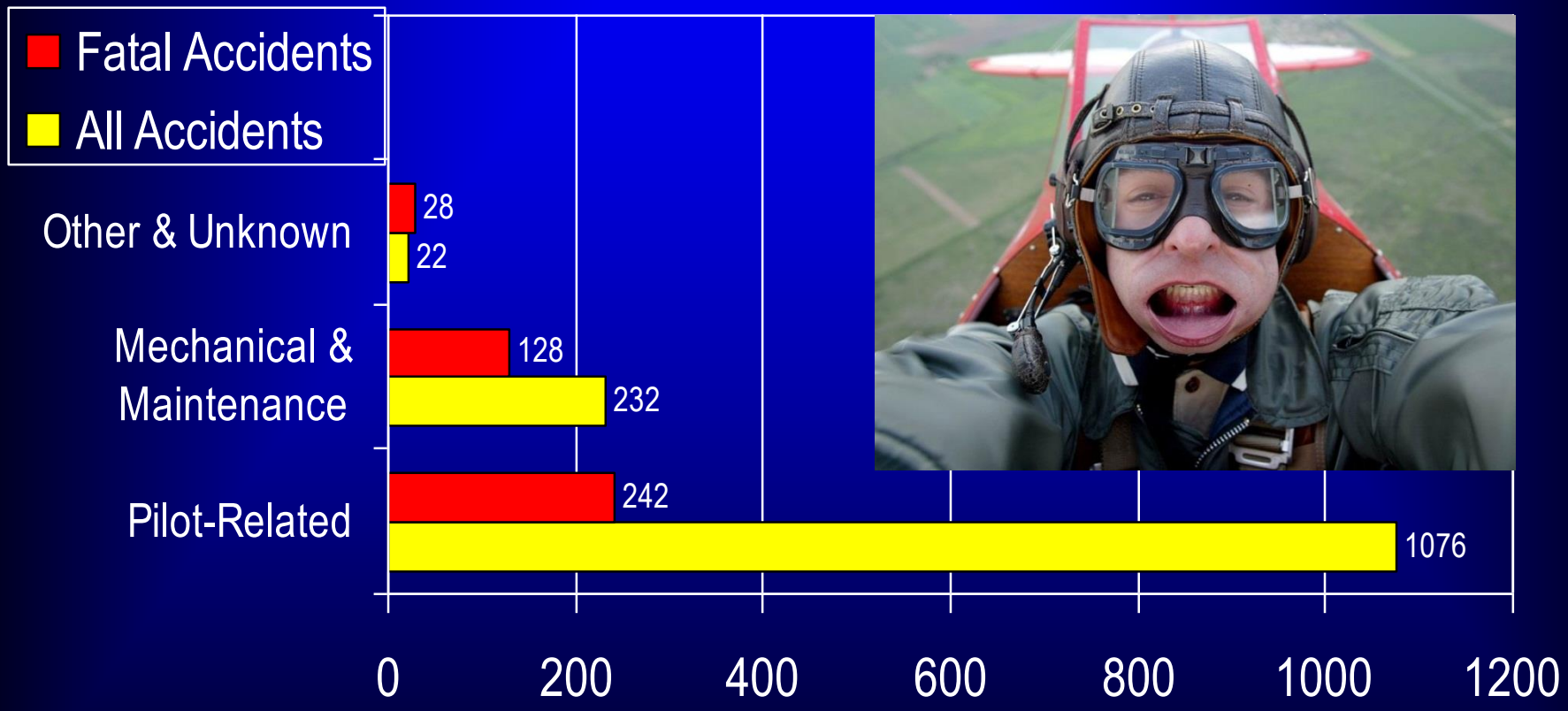
13 Hazards on Take-Off

(AirDisaster.com)

Ground vehicles
Landing aircraft
Slush/water on runway
Bad visibility
Crosswind
Tire damage
Bird strike
High climb angle
Low climb angle
Midair collision
Engine failure
Bad weather
System failure

Accident Causes in General Aviation

(1,436 Accidents {292 fatal} - 2005)

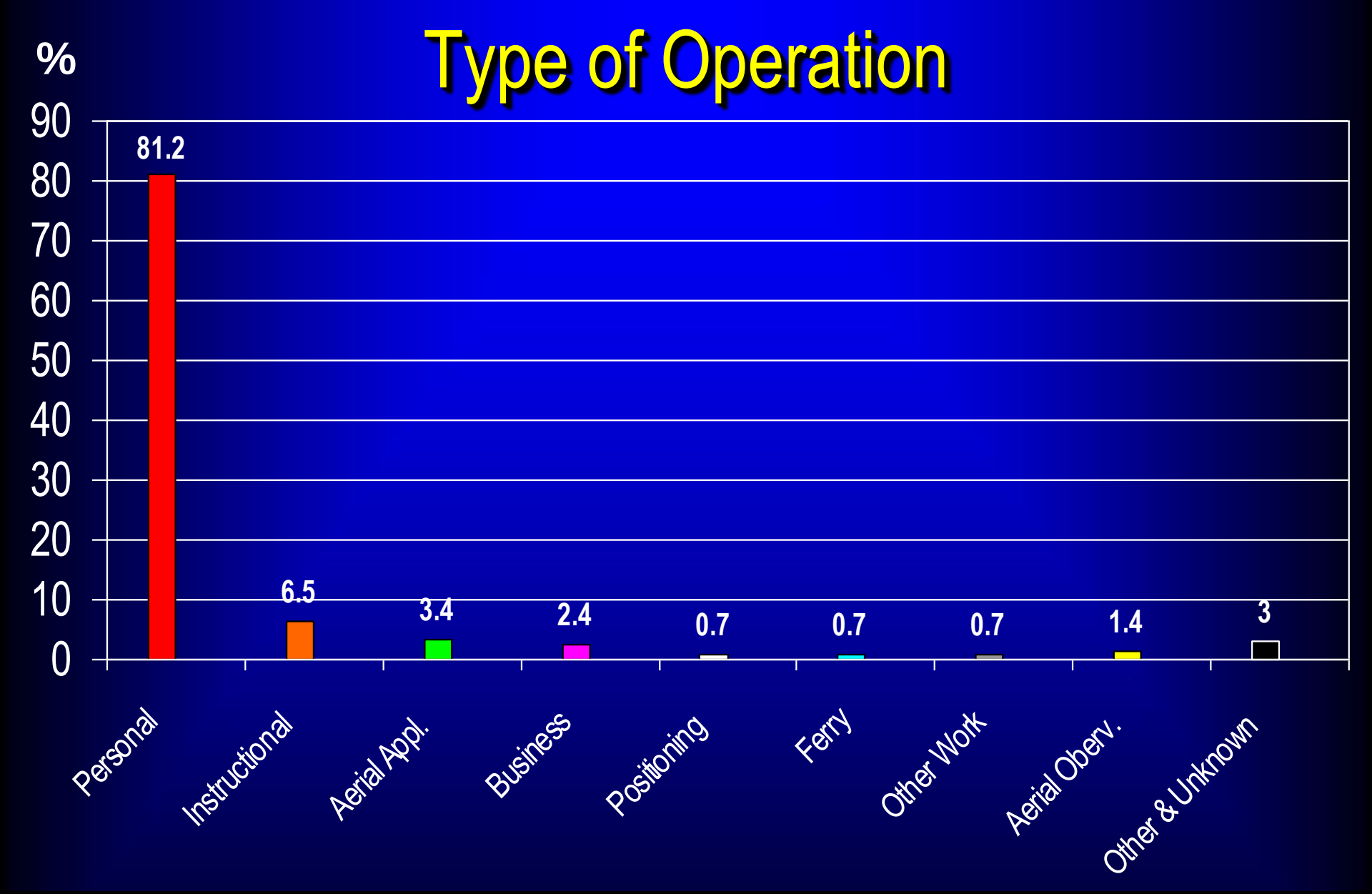


Pilot-Related Accident Categories

500
450
400
350
300
250
200
150
100
50
0

Preflight-Taxi
Takeoff-Climb
Fuel Mgt.
Weather
Cruise
Descent- Approach
Go Around
Maneuvering
Landing
Other

Type of Operation



GOOD RULE OF THUMB

"Always leave yourself an OUT or WIGGLE ROOM to deal with the unexpected"


AMERICAN
AVIATION
LEARN TO
FLY HERE!


AMERICAN
AVIATION
LEARN TO
FLY HERE!


NO HUNTING
NO TRESPASSING
TED CHAMBERLIN
SHERIFF'S LINE DO NOT CROSS


VISITOR-PARKING
FLORENCE AVIATION


LiveLeak
AP
19:38:42
L 07-22-07

September 22, 2007
Pilot took off from Fort Lauderdale and lost power during initial ascent
Performed an emergency landing on a highway
Hit a warehouse on the side of the road
The twin-engine Beechcraft disintegrated around the pilot
He fractured his left leg, left arm and nose but survived


BIG-BOYS.COM


www.eBaumsWorld.com


Tuesday
New York City
www.capitalnews2.com


N2649J


PLAY

Wildlife Risks

Table 1. Number of reported wildlife strikes to civil aircraft by wildlife group, USA, 1990–2011 (see Figures 1 and 2).

Year	Birds	Bats	Terrestrial mammals[1]	Reptiles[1]	Total strikes	Strikes with damage
1990	1,748	4	52	0	1,804	372
1991	2,266	3	54	0	2,323	401
1992	2,360	2	73	1	2,436	368
1993	2,409	6	67	0	2,482	399
1994	2,472	2	82	1	2,557	464
1995	2,679	5	84	8	2,776	500
1996	2,856	1	91	3	2,951	505
1997	3,353	1	95	14	3,463	582
1998	3,691	3	111	7	3,812	588
1999	5,022	7	96	1	5,126	706
2000	5,870	16	124	3	6,013	765
2001	5,676	8	140	8	5,832	650
2002	6,104	19	119	15	6,257	675
2003	5,886	20	127	5	6,038	635
2004	6,411	27	129	6	6,573	628
2005	7,092	27	132	7	7,258	609
2006	7,053	49	142	10	7,254	599
2007	7,538	53	175	7	7,773	571
2008	7,417	46	183	5	7,651	528
2009	9,229	67	232	10	9,538	607
2010	9,546	113	247	11	9,917	598
2011	9,730	139	199	15	10,083	541
Total	**116,408**	**618**	**2,754**	**137**	**119,917**	**12,291**

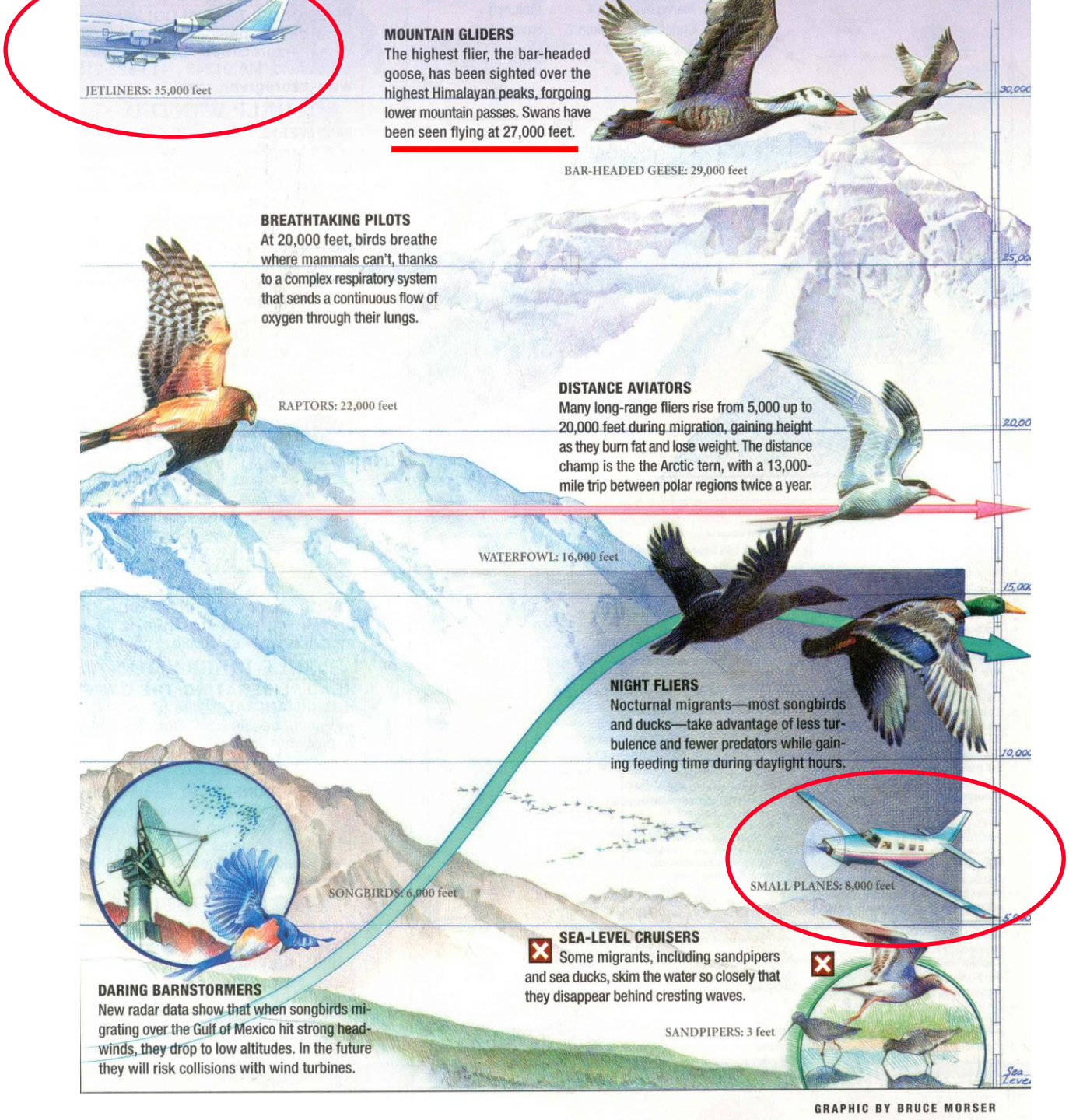
[1] For terrestrial mammals and reptiles, species with body masses <1 kilogram (2.2 pounds) are excluded from database (Dolbeer et al. 2005).

1990 - 2011

- Total of 119,917 wildlife strikes (116,408 with birds)
- Birds were involved in 97.1% of the strikes
- Number of strikes reported annually increased over 5-fold
- Strikes were reported from 1,714 USA airports
- Pilots had to dump fuel (~13,700 gal of jet fuel per dump) in 46 cases
- Strikes occurring above 500 feet were more likely to cause damage
- Record altitude for a reported bird strike was 31,300 feet
- 12,291 aircraft were damaged
- 57 aircraft were destroyed

Since 1988

- Over 250 people killed worldwide



GRAPHIC BY BRUCE MORSER

Table 9. Reported phase of flight at time of occurrence of wildlife strikes with civil aircraft, USA, 1990–2011[1].

Phase of flight	Birds		Terrestrial mammals	
	22- year total	% of total known	22- year total	% of total known
Parked	55	<1	2	<1
Taxi	289	<1	38	2
Take-off Run	15,473	19	559	32
Climb	14,545	18	35[2]	2
En Route	2,084	3	0	0
Descent	2,838	3	0	0
Approach	32,887	40	121[2]	7
Landing Roll	13,940	17	993	57
Total known	**82,111**	**100**	**1,748**	**100**
Unknown	**34,297**		**1,006**	
Total	**116,408**		**2,754**	


Germania
flygermania.de
D-AD


TAC


US AIRWAYS


NYC POLICE

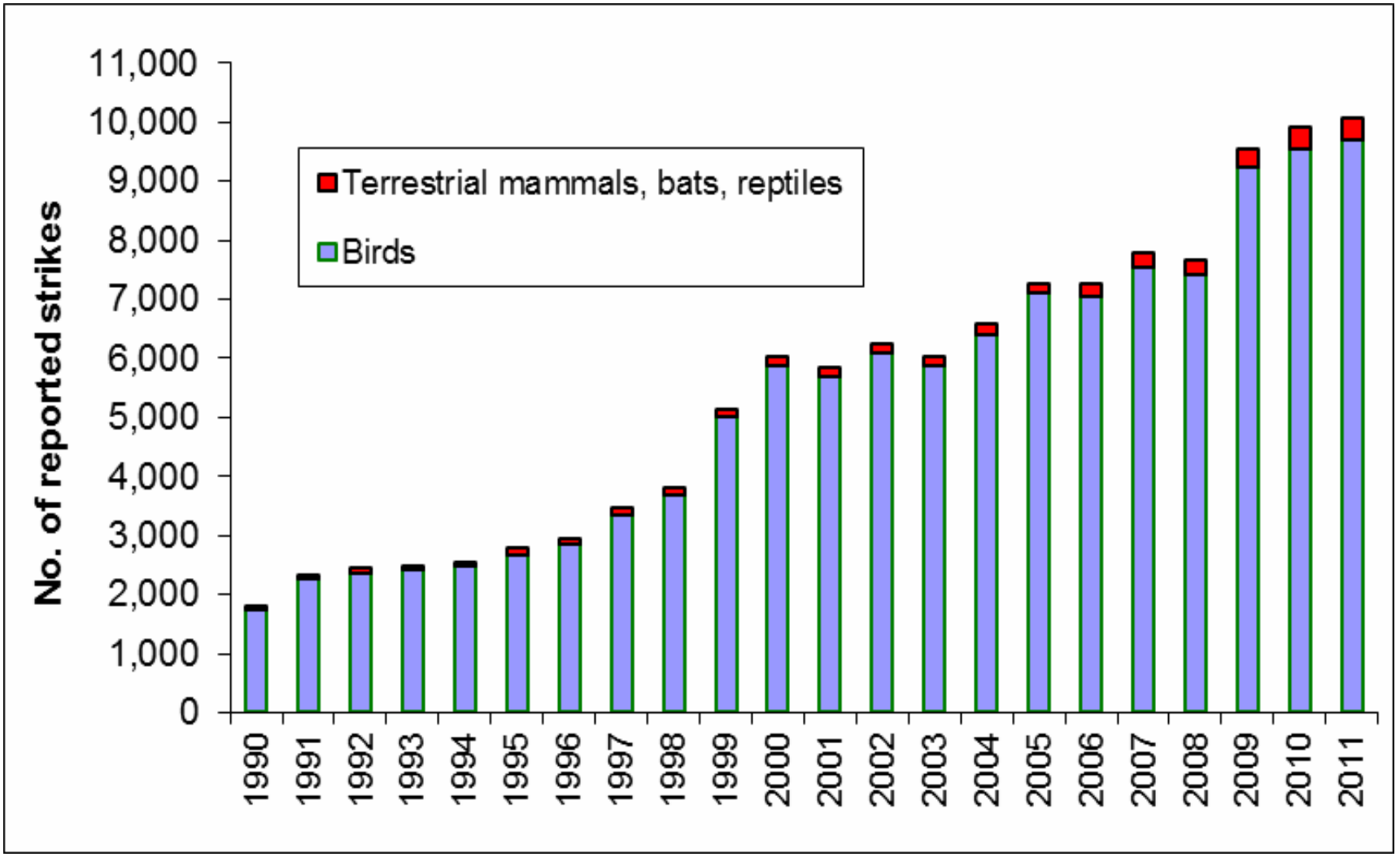
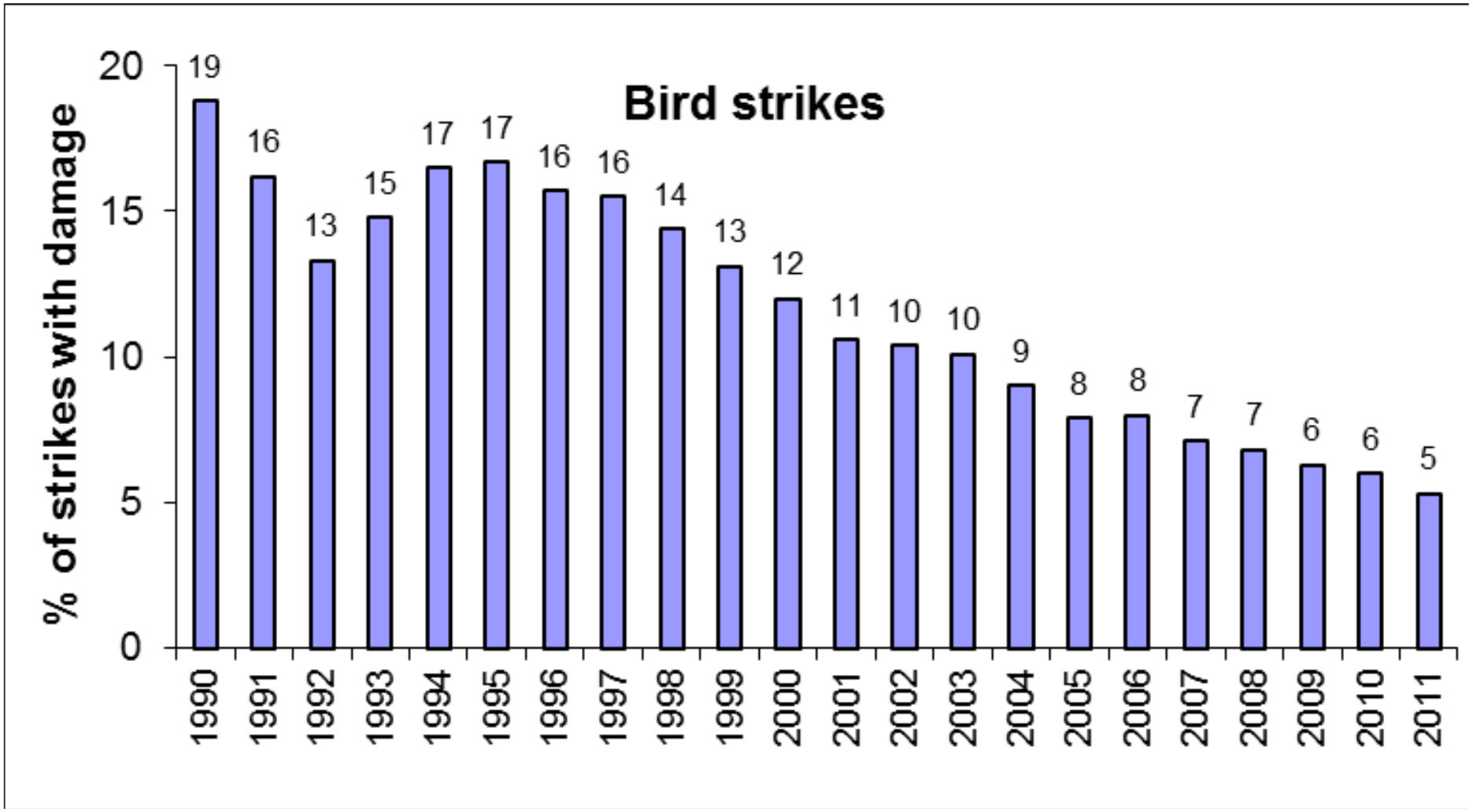


Figure 1. Number of reported wildlife strikes with civil aircraft, USA, 1990–2011. The 119,917 strikes involved birds (116,408), terrestrial mammals (2,754), bats (618), and reptiles (137, see Table 1).


Bird strikes
% of strikes with damage
0
5
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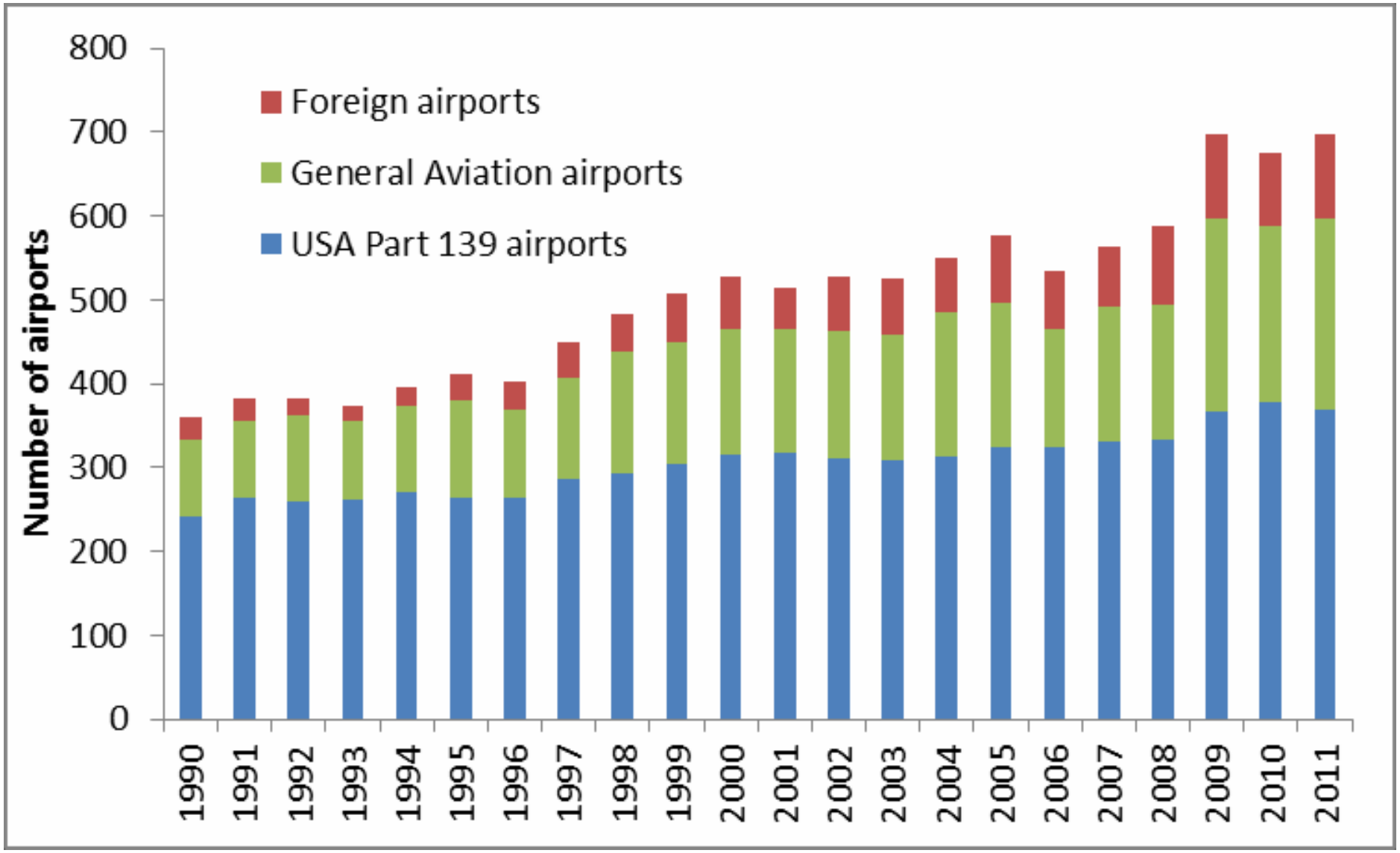
Number of airports
800
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400
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100
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Foreign airports
General Aviation airports
USA Part 139 airports
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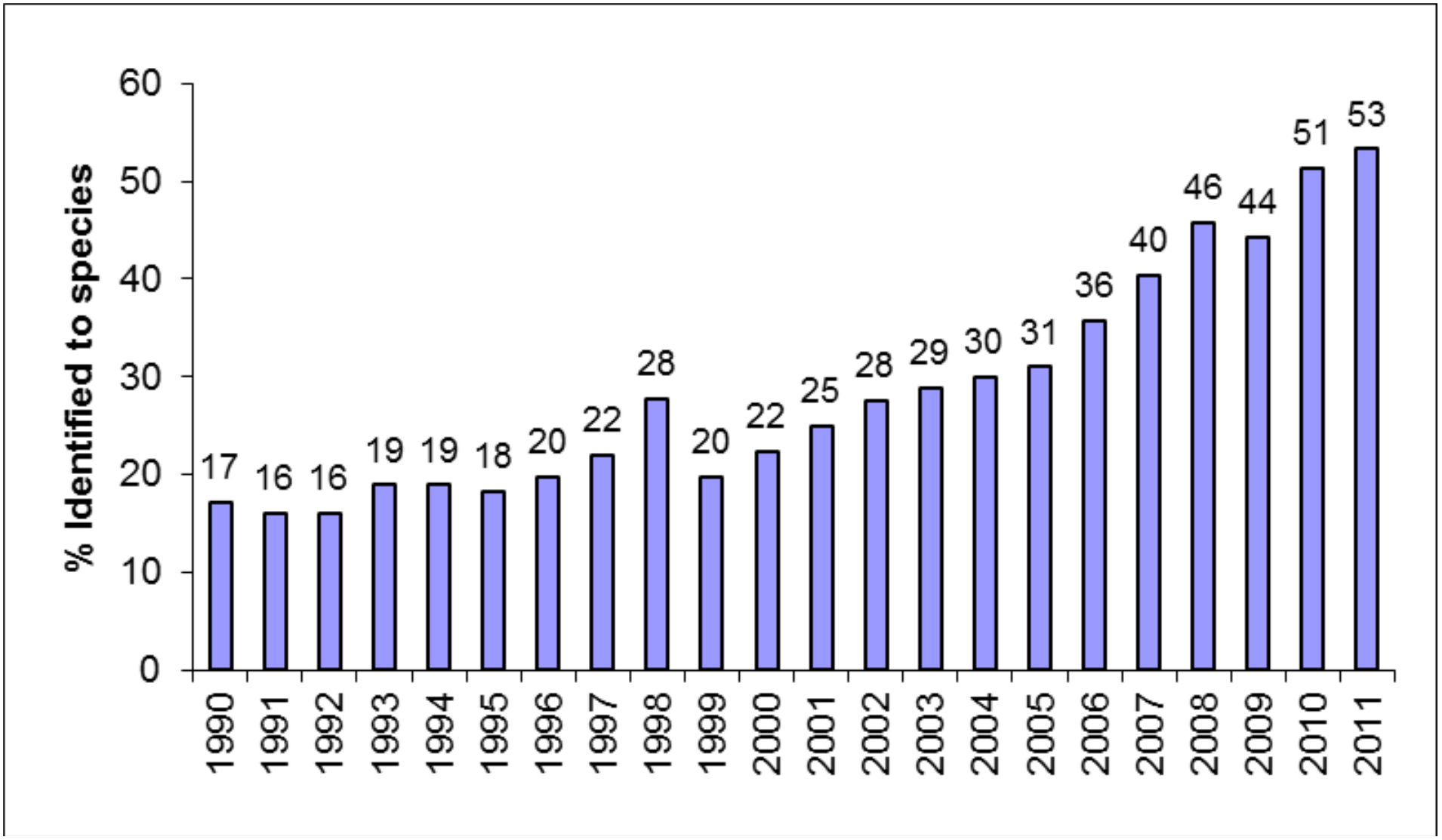


About 90% of all bird strikes in the U.S. are by species Federally protected under the Migratory Bird Treaty Act

Breeding population of white pelicans has increased over 6 fold in North America, 1990-2010

BBS Population Index

70
60
50
40
30
20
10
0

1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010

Graph by R. A. Dolbeer, Data from North American Breeding Bird Survey

Canada Goose population in North America, 1970-2010 (resident and migratory)

(Graph by R. A. Dolbeer with data from U.S. Fish and Wildlife Service)


23 2:23 PM


Windshield wiper blade
thrown into fuselage
MESABA
AIRLINE
Goose impaled
in fuselage
(see closeup)

The cooperative FAA/USDA APHIS WS National Wildlife Research Center (NWRC) continues its efforts to improve wildlife management techniques and practices on and near airports including:

- *Alternatives to habitat management to reduce attraction to hazardous species*
- *Techniques for controlling species by restricting access to attractive features like storm water ponds*
- *Technologies for harassing and deterring hazardous species*
- *Evaluation of avian radar systems for detecting and tracking birds on or near airports*
- *Aircraft-mounted alternating pulse lights to enhance aircraft detection and deter wildlife strikes*

Aircraft Birdstrike Avoidance Radar

Bird Cannon

The Avian Infrasound Non-lethal Denial System uses a passive infrasound detector that listens for an approaching flock of birds and activates subwoofer speakers that generate high-intensity but low-frequency sound (below the range of human hearing)

The system can be used as a non-lethal avian active denial system at commercial aviation facilities in areas that have high concentrations of birds that pose a threat to aircraft from bird-strikes and/or aircraft/facility damage, communication towers, energy wind-driven windmills and harbors and shipyards


WARNING
THIS IS AN ACTIVE
GATOR CROSSING AREA
STAY ON PATH AND
HOLD CHILDREN
BY THE HAND
N929CC


6WA

JFK Flights Delayed by 30 minutes (6/29/11)
150 diamondback terrapins turtles crossing one runway

The FAA recorded 18 collisions between civil aircraft and diamondback terrapins from 1990 to 2007


Fairfax Media

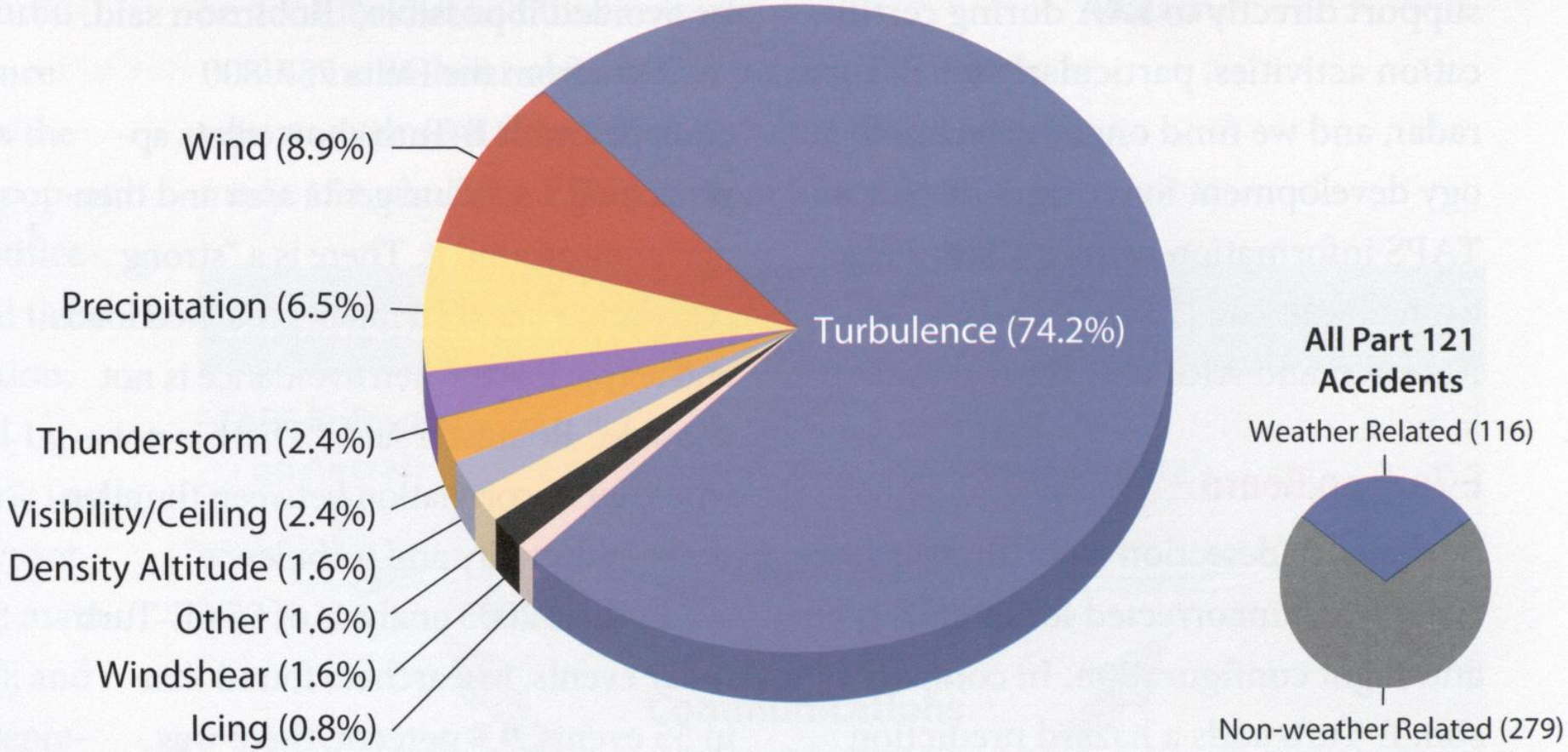
Stowaway mouse grounds flight from Sweden to Chicago (08/18/11)

Stowaway mouse grounds flight from Nepal to Bangkok (09/05/11)

Thousands of bees on a plane wing - as crews were getting ready to fuel the plane - delay flight at Pittsburg airport (06/08/12)

Weather Risks

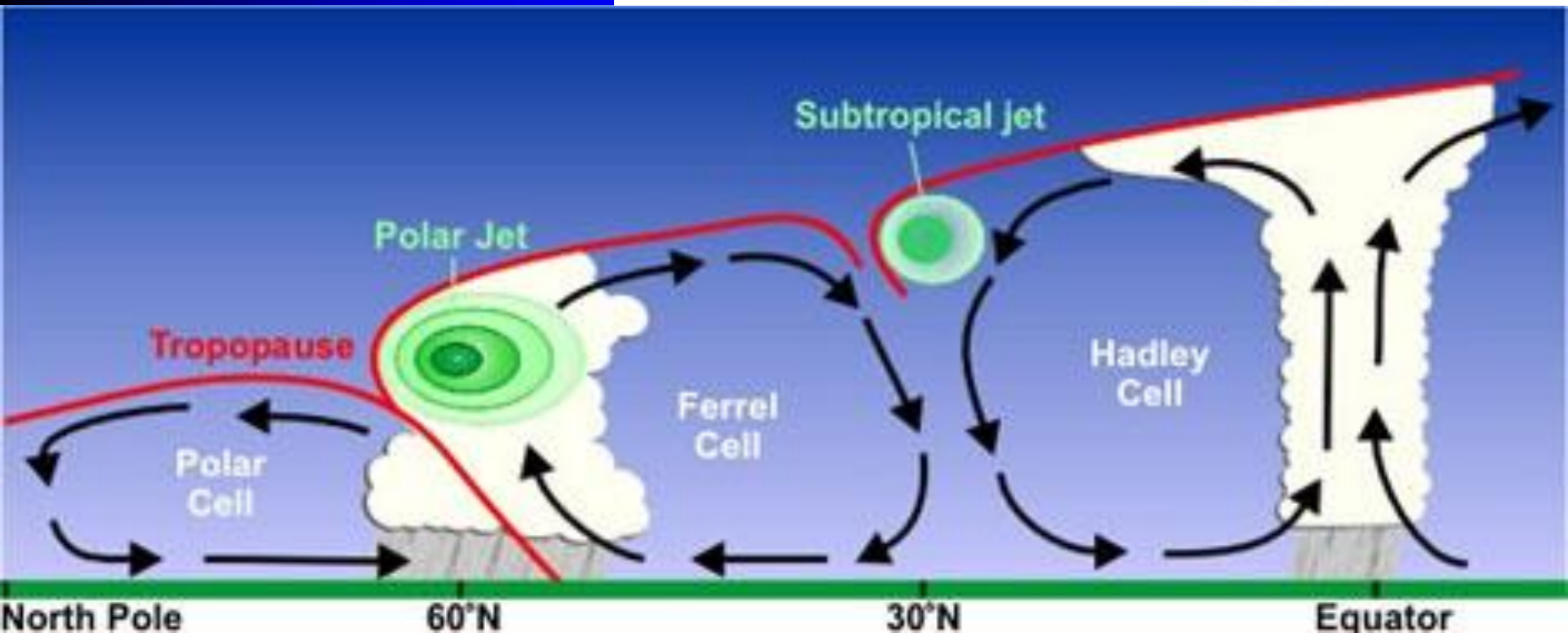
U.S. FARs Part 121 Weather-Related Accidents by Weather Condition, 1994–2003



FARs = U.S. Federal Aviation Regulations

Source: National Aviation Safety Data Analysis Center, U.S. Federal Aviation Administration

Inflight Turbulence



CLEAR AIR TURBULENCE

- Turbulence not associated with clouds and cannot be seen visually
- Caused by Jet Streams, mountainous terrain and proximity to cumulonimbus cells
- Can cause structural damage, physical injury to occupants and impair crew performance

Each year 58 passengers are injured during flight because of turbulence

198 turbulence incidents (1980-04)

2/3 occurred above 30K ft

266 serious injuries

3 fatalities

Short-Wave UV LASER-based Turbulence Detector

Demonstration of LIDAR-based CAT Detection (DELICAT)

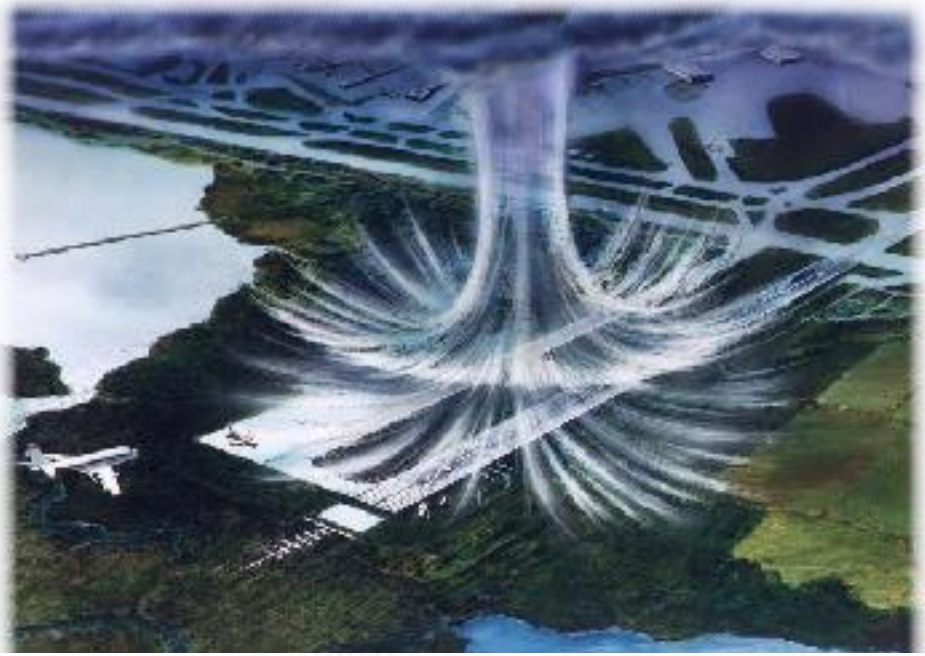
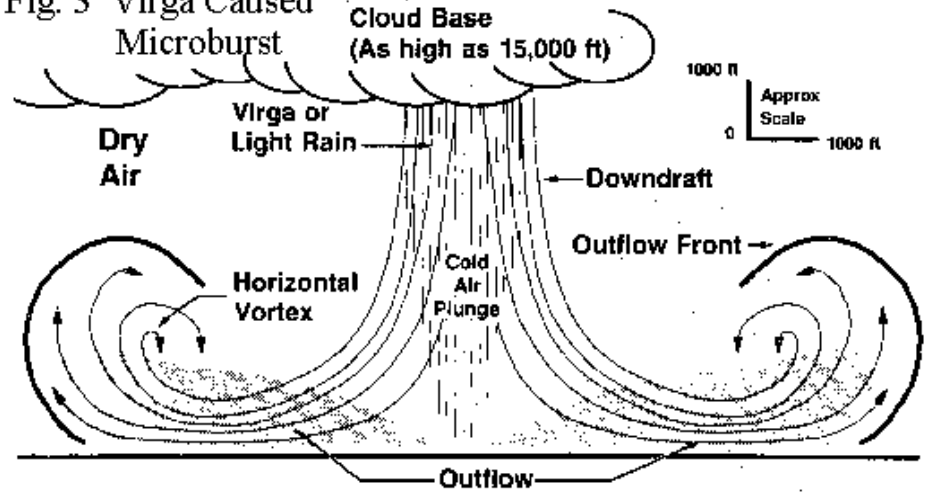


Fig. 3 Virga Caused Microburst



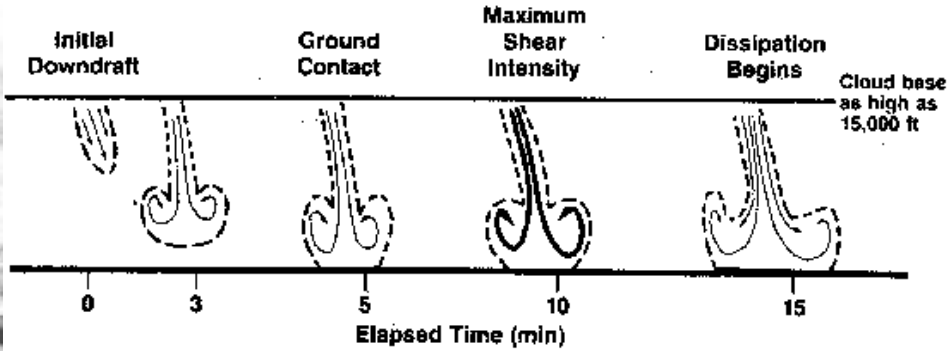


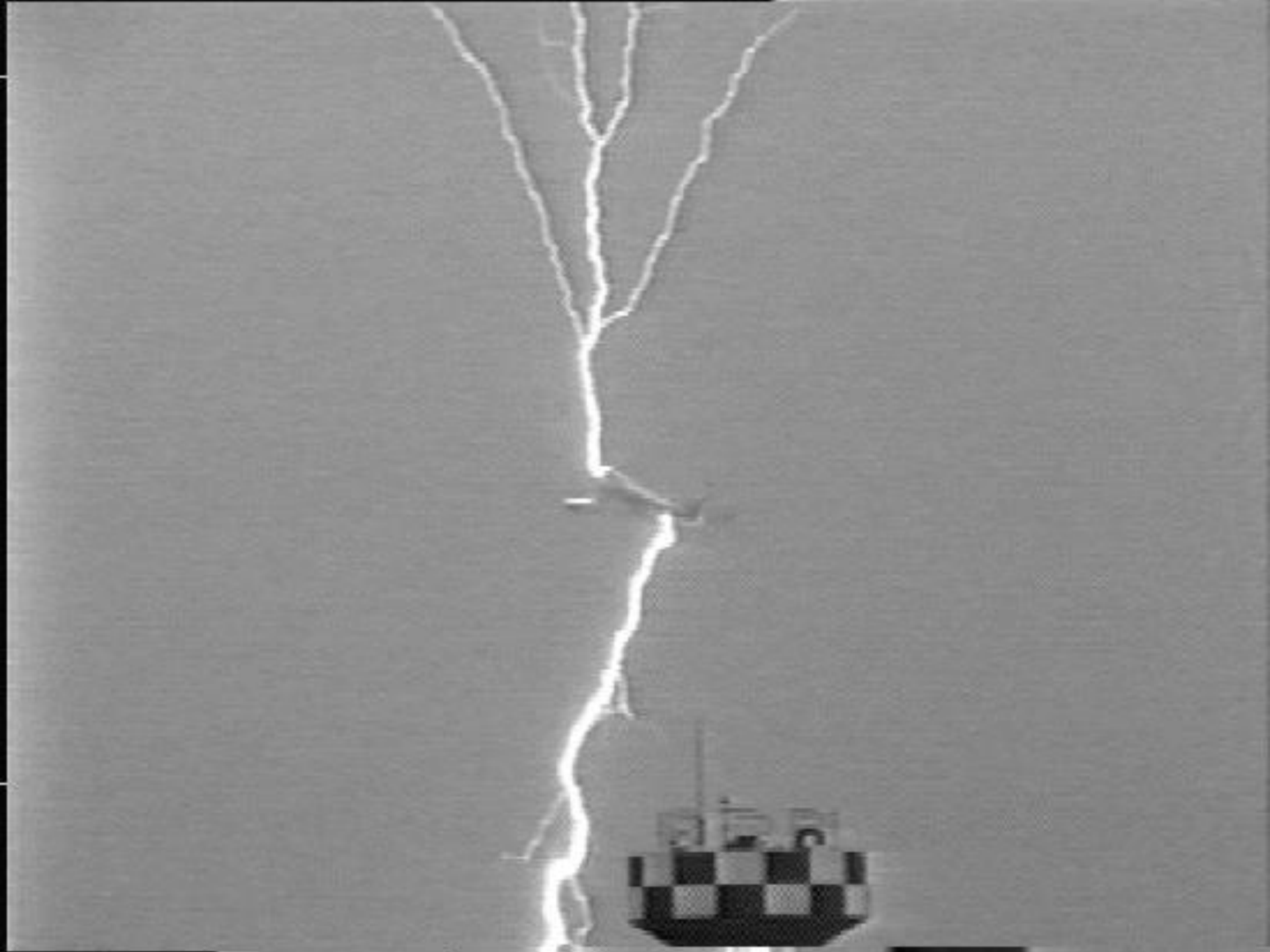
Fig. 4 Lifecycle of a typical Microburst.

Types of Injuries:

- *Abrasions*
- *Contusions*
- *Spinal & Rib Fractures*
- *Head Trauma*

235 passengers & 20 crew

- *2 passengers died*
- *149 passengers injured*
  - *53 serious*
  - *96 minor*
- *7 crew injured*




PLATAFORMA P8
12.May 2011 12:36:56

NTSB

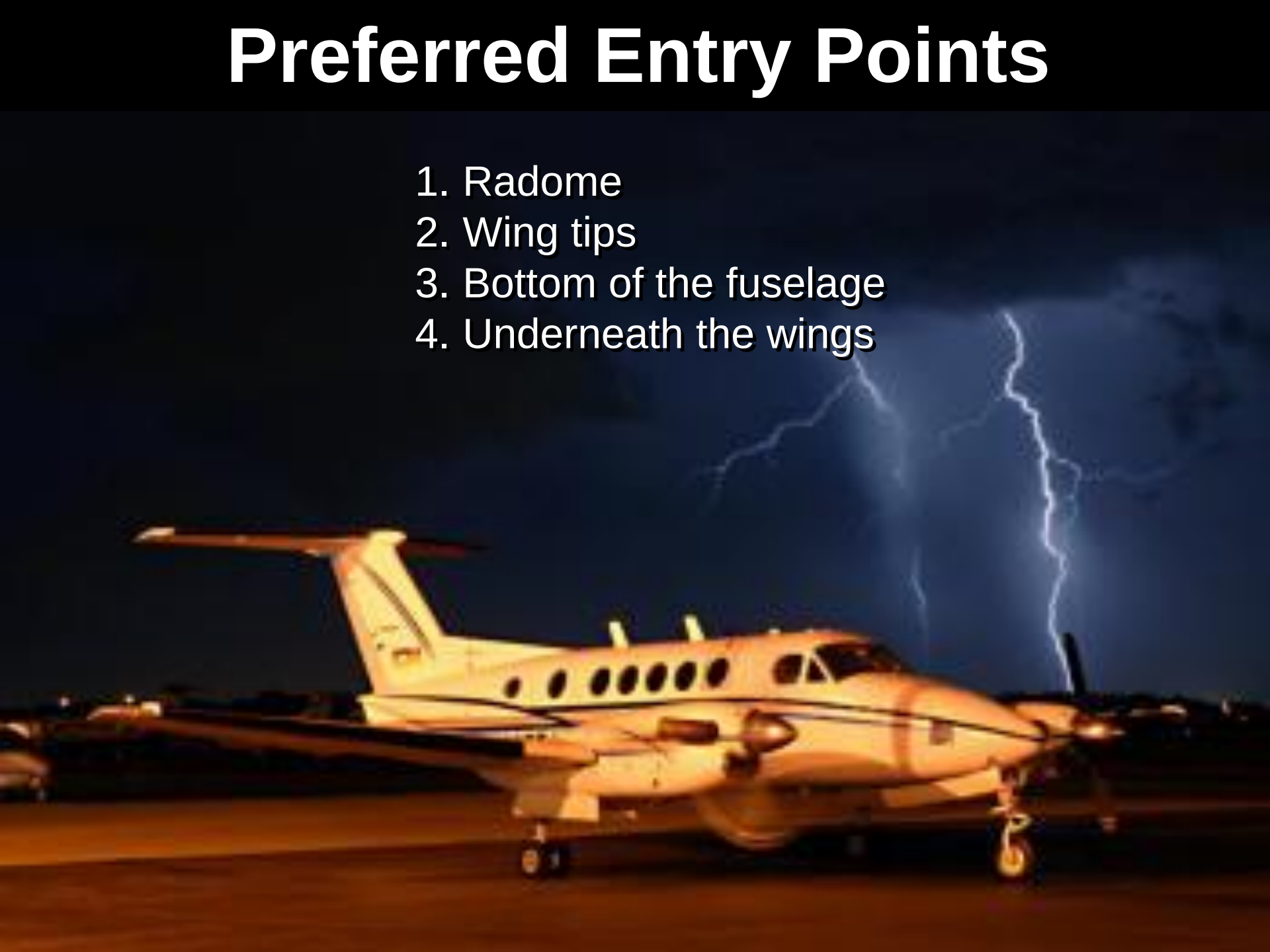
- Between 01/01/62 and 04/30/2010
- Lightning was a contributing factor in 58 aviation accidents
- Only 41 involved actual strikes and 68% landed safely
- There were 202 fatalities and 46 injuries

Effects of Lightning on an Aircraft Surface

- Burning or melting at strike points
- Increase in temperature
- Residual magnetism
- Acoustic shock effects
- Arcing at hinges, joints and bonding points
- Ignition of fuel vapors

- 1/3 to 1/2 of all strikes result in at least minor damage to the aircraft

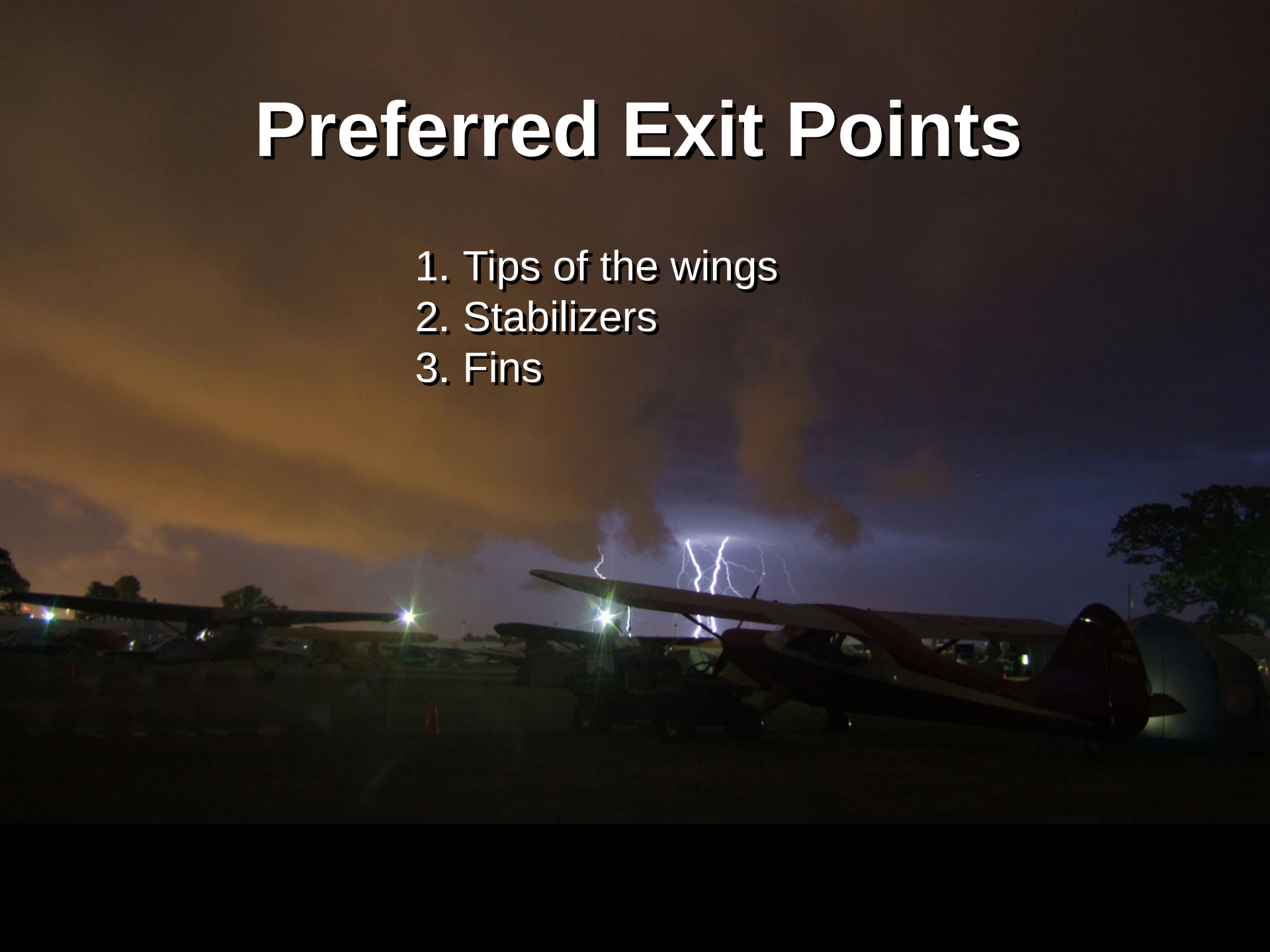
Preferred Entry Points



1. Radome
2. Wing tips
3. Bottom of the fuselage
4. Underneath the wings

Preferred Exit Points

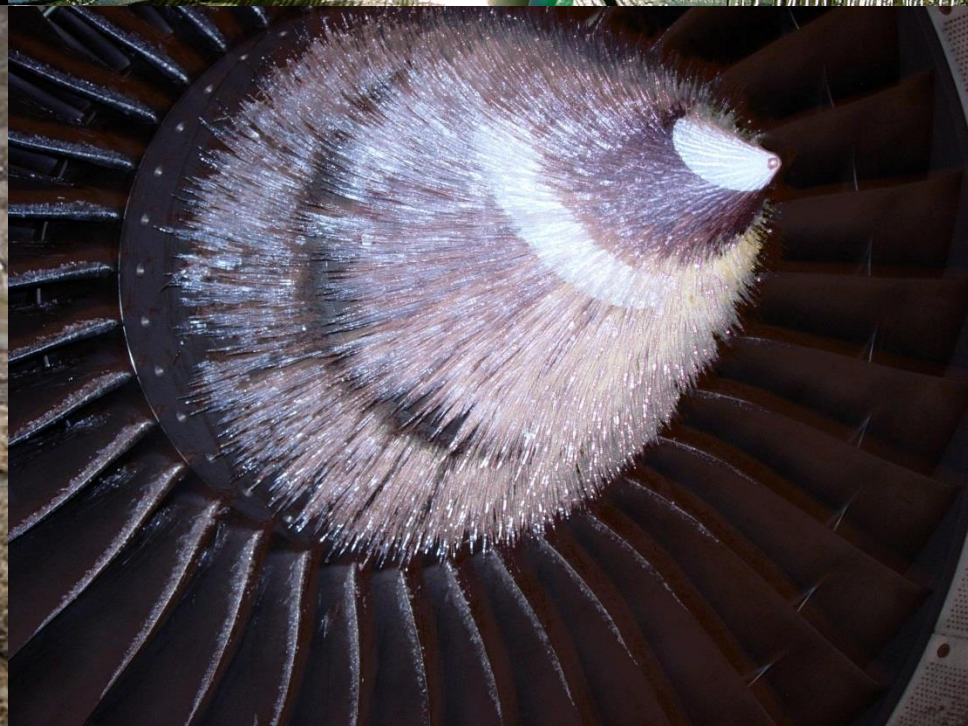
1. Tips of the wings
2. Stabilizers
3. Fins



Lightning Protection Systems

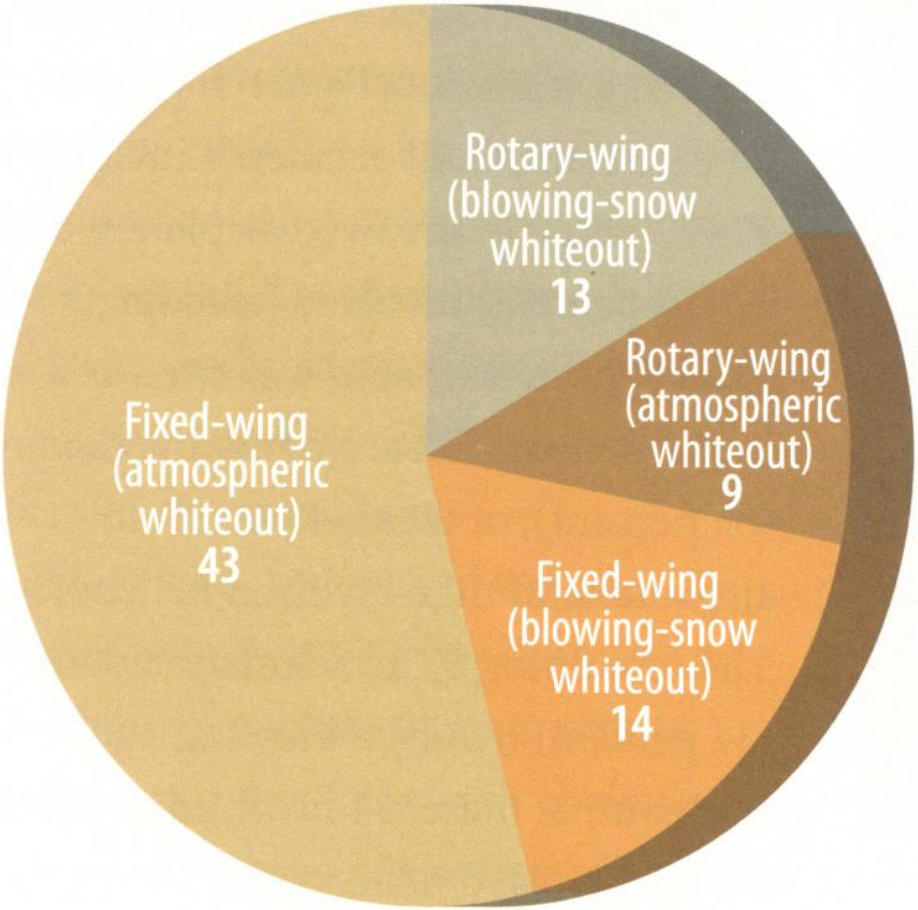
1. Airframe and Structure
2. Fuel System
3. Electrical and Electronic


CESSNA 152 II



A research team from Harvard University has developed a new super-hydrophobic surface called Slippery Liquid Infused Porous Surfaces (SLIPS) for metal surfaces that will keep them free of ice and frost

Whiteout-Related U.S. Civil Aircraft Events*



*Accidents and incidents from 1978–Oct. 20, 2006

Source: U.S. National Transportation Safety Board


JetPhotos.Net - Image Copyright © Stefan


JetPhotos.Net - Image Copyright © Stefan


737-300

Bangladesh (October 2004)

F-28
Rainy weather
Ran off runway

Chicago (December 2005)

B-737
Snowing
Thrust reverse failed - ran off runway
Six-year-old boy died

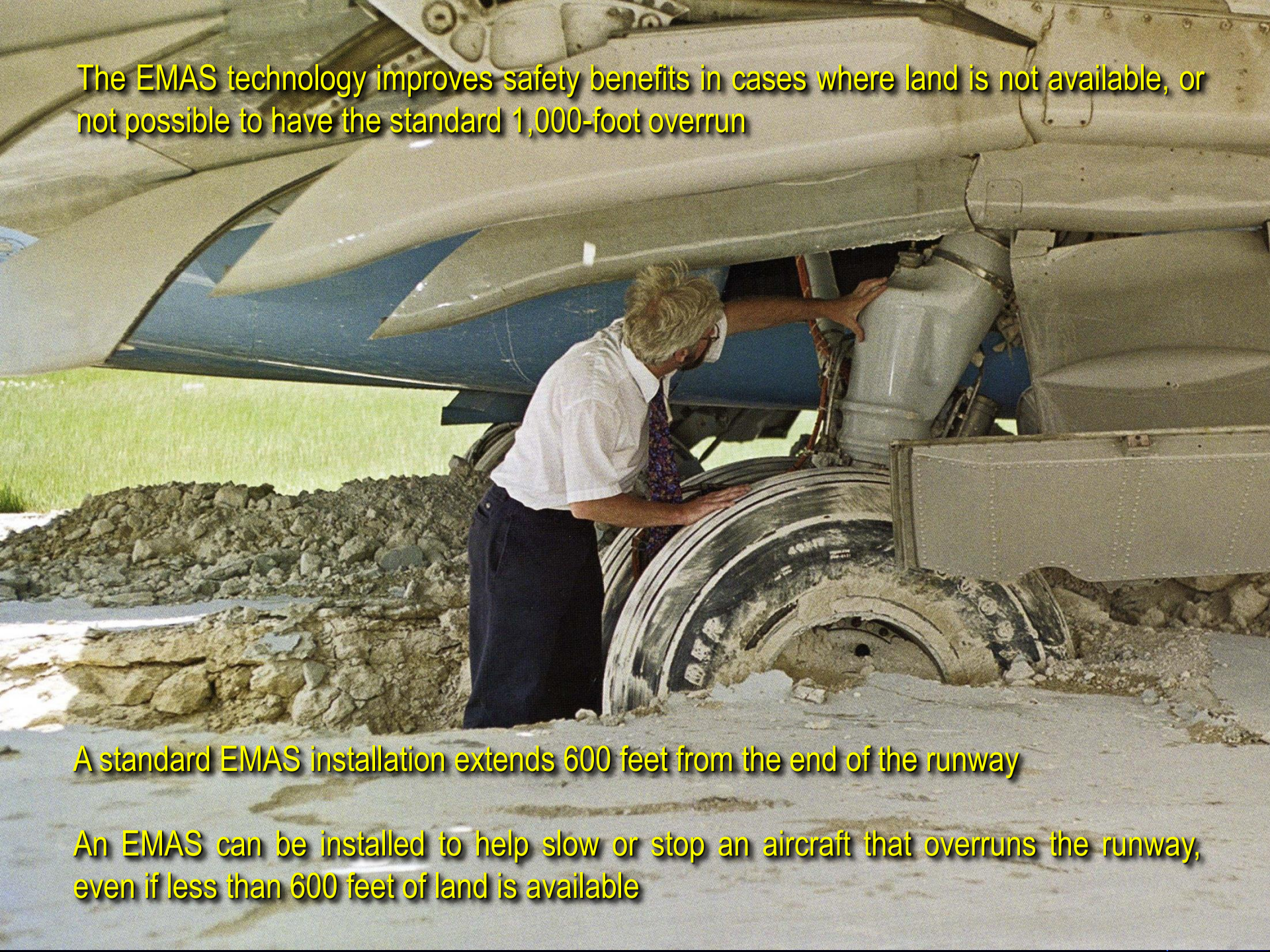
Engineered Materials Arresting System (EMAS)

~$8.5 million per site

69 runway ends at 45 airports in the US, with plans to install 5 new systems at 4 additional U.S. airports

To date, there have been eight incidents where EMAS has safely stopped eight overrunning aircraft with a total of 235 crew and passengers aboard those flights

Date	Crew and Passengers	Incident
May 1999	30	A Saab 340 commuter aircraft overran the runway at JFK
May 2003	3	A Gemini Cargo MD-11 overran the runway at JFK
January 2005	3	A Boeing 747 overran the runway at JFK
July 2006	5	A Mystere Falcon 900 overran the runway at Greenville Downtown Airport in South Carolina
July 2008	145	An Airbus A320 overran the runway at ORD
January 2010	34	A Bombardier CRJ-200 regional jet overran the runway at Yeager Airport in Charleston, WVA
October 2010	10	A G-4 Gulfstream overran the runway at Teterboro Airport in Teterboro, NJ
November 2011	5	A Cessna Citation II overran the runway at Key West International Airport in Key West, FL



The EMAS technology improves safety benefits in cases where land is not available, or not possible to have the standard 1,000-foot overrun

A standard EMAS installation extends 600 feet from the end of the runway

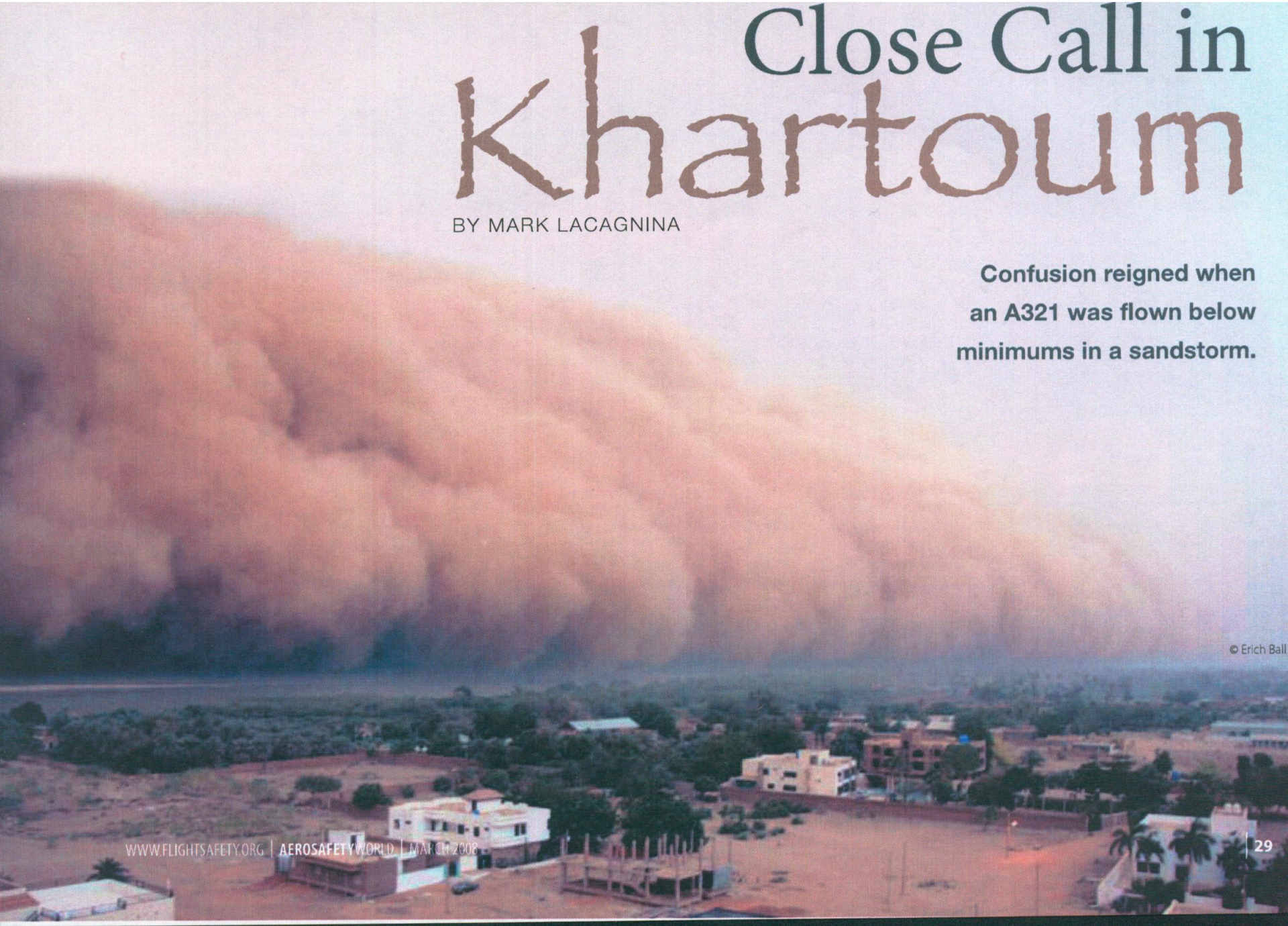
An EMAS can be installed to help slow or stop an aircraft that overruns the runway, even if less than 600 feet of land is available


Courtesy Hollywood Park

Close Call in Khartoum

BY MARK LACAGNINA

Confusion reigned when an A321 was flown below minimums in a sandstorm.



© Erich Ball


Dust storm in Phoenix

Air Force Staff Sgt. Thomas Jenkins recently developed a formula to increase dust storm forecast accuracy from about 10 percent to 80 percent

Clear Communications are Very Important to Manage Risks and Prevent Accidents


HK


N86926


ORACLE
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HONDA
HONDA
G-SIID
OAKLEY
www.roadangel-direct.com
ROAD ANGEL

Accident Causes in General Aviation

- Action or inaction of the pilot:
  83% of all accidents
- Bad weather:
  24% of all accidents
- Power plant or controls:
  22% of all accidents
- Terrain or runway conditions:
  25% of all accidents
- Object (tree, wires, etc.):
  14% of all accidents

Most Prevalent First Occurrences

- *Loss of control in-flight*
- *Total loss of engine power (non-mechanical)*
- Loss of control on the ground
- In-flight collision with object
- Partial loss of engine power (mechanical)
- Bad weather in-flight
- In-flight collision with terrain/water
- Airframe/component/system failure/malfunction
- Hard landing


S5-DHO
SKYHAWK II
Photo Copyright Jernej Verbovsek
AIRLINERS.NET

Vienna (July 2000)

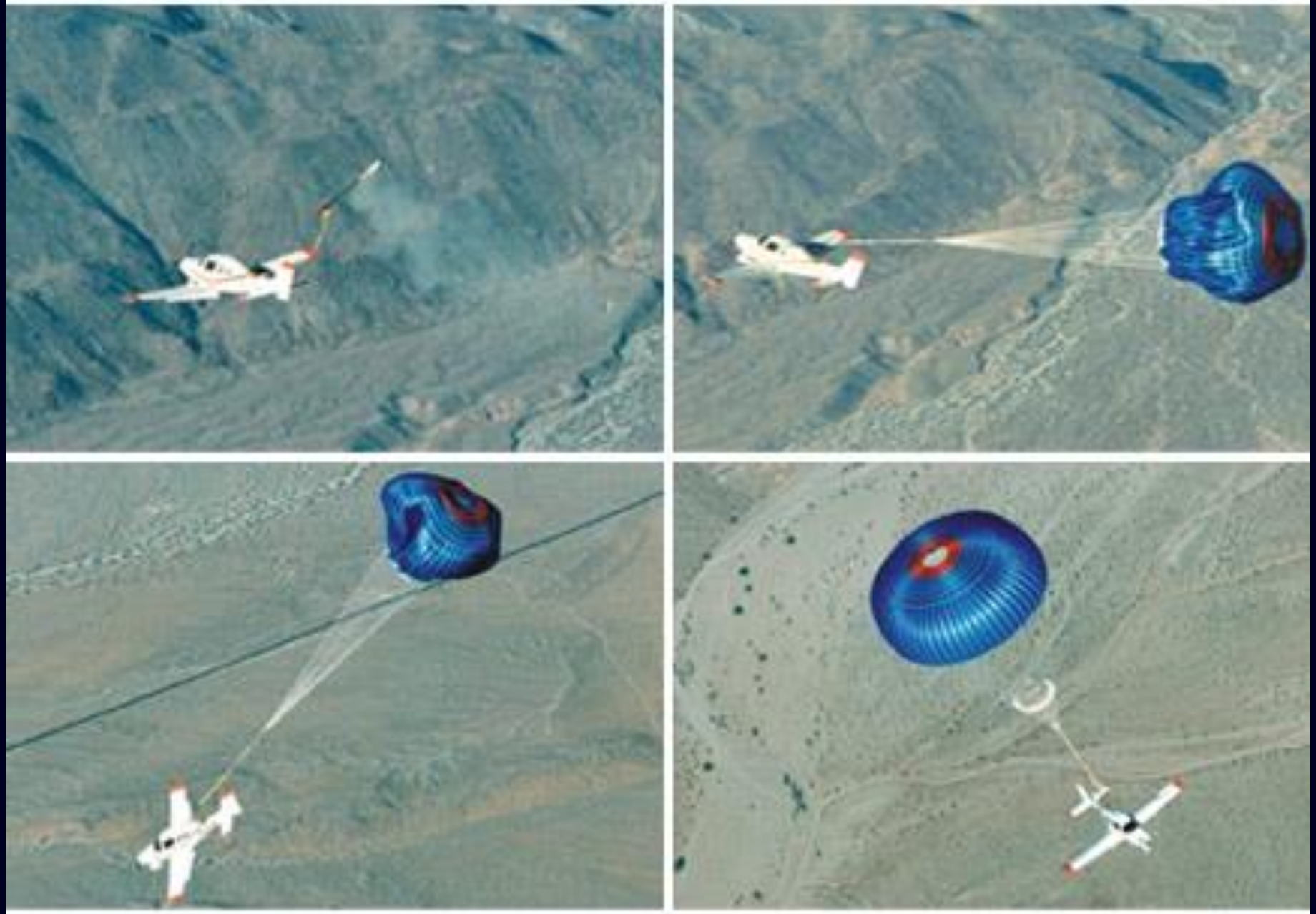
A-310
Landing gear did not retract
Flew to alternate airport
Ran out of fuel

Flight from Chicago to Japan
Sgt. Bachleda noticed fuel leak
Flight Diverted to San Francisco


WWW.STILEPROIECT.COM

Ryc. 2. Fazy katapultowania z samolotu Su-22, z wykorzystaniem fotela K-36DM:
A – zrzut osłony kabiny, uruchomienie zespolonego mechanizmu odpalającego,
B – wymuszony ruch fotela z pilotem,
C, D – wznoszący ustabilizowany ruch fotela z pilotem,
E – wierzchołek toru ruchu fotela z pilotem,
F – opadanie fotela z pilotem do chwili uruchomienia mechanizmów otwierających spadochron główny,
G – odstrzelenie zagłówka i oddzielenie się pilota od fotela,
H – początek rozwijania się spadochronu głównego,
I – rozwinięcie się spadochronu głównego oraz zapasu awaryjnego

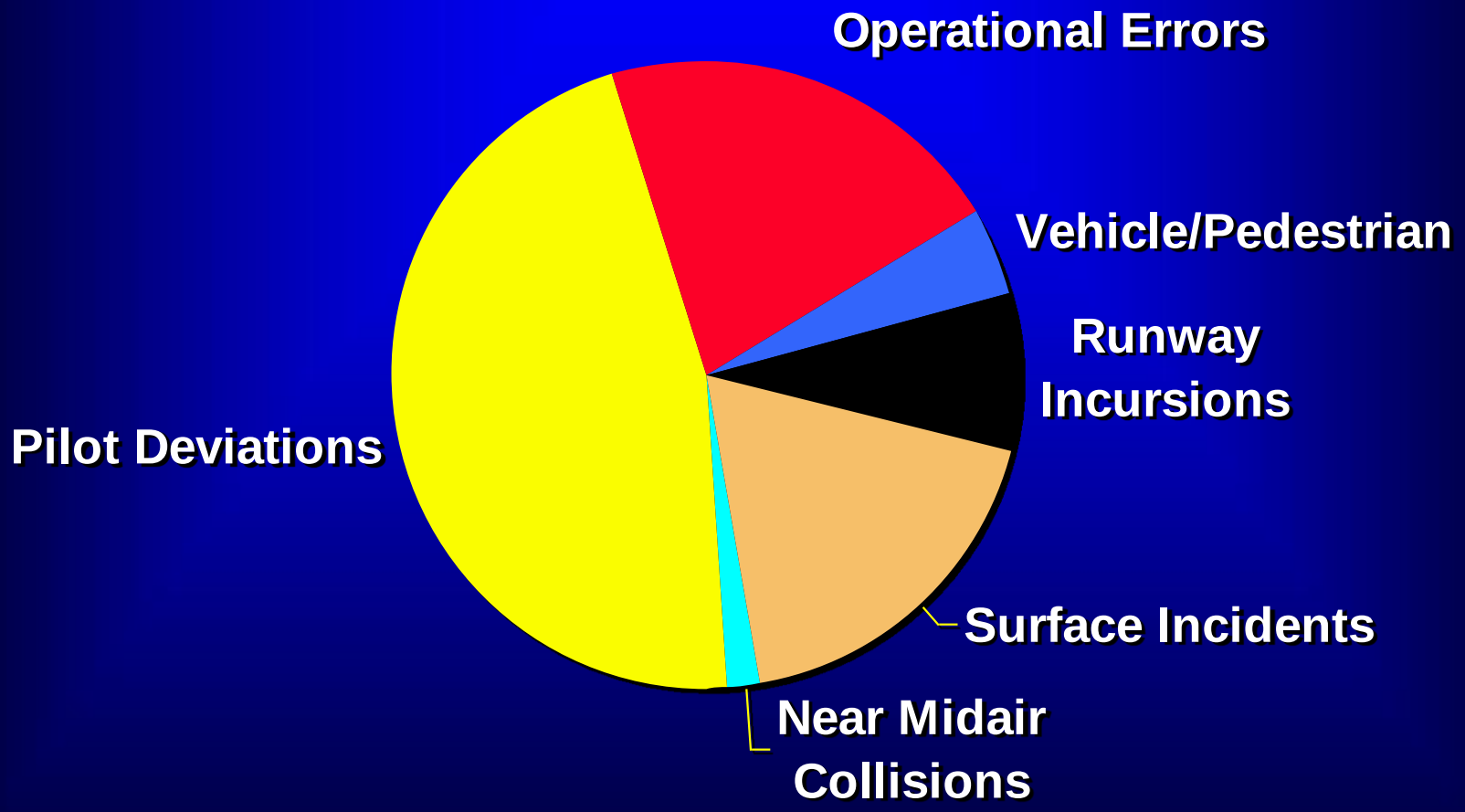
Rys. Krzysztof Białkowski




N200SR

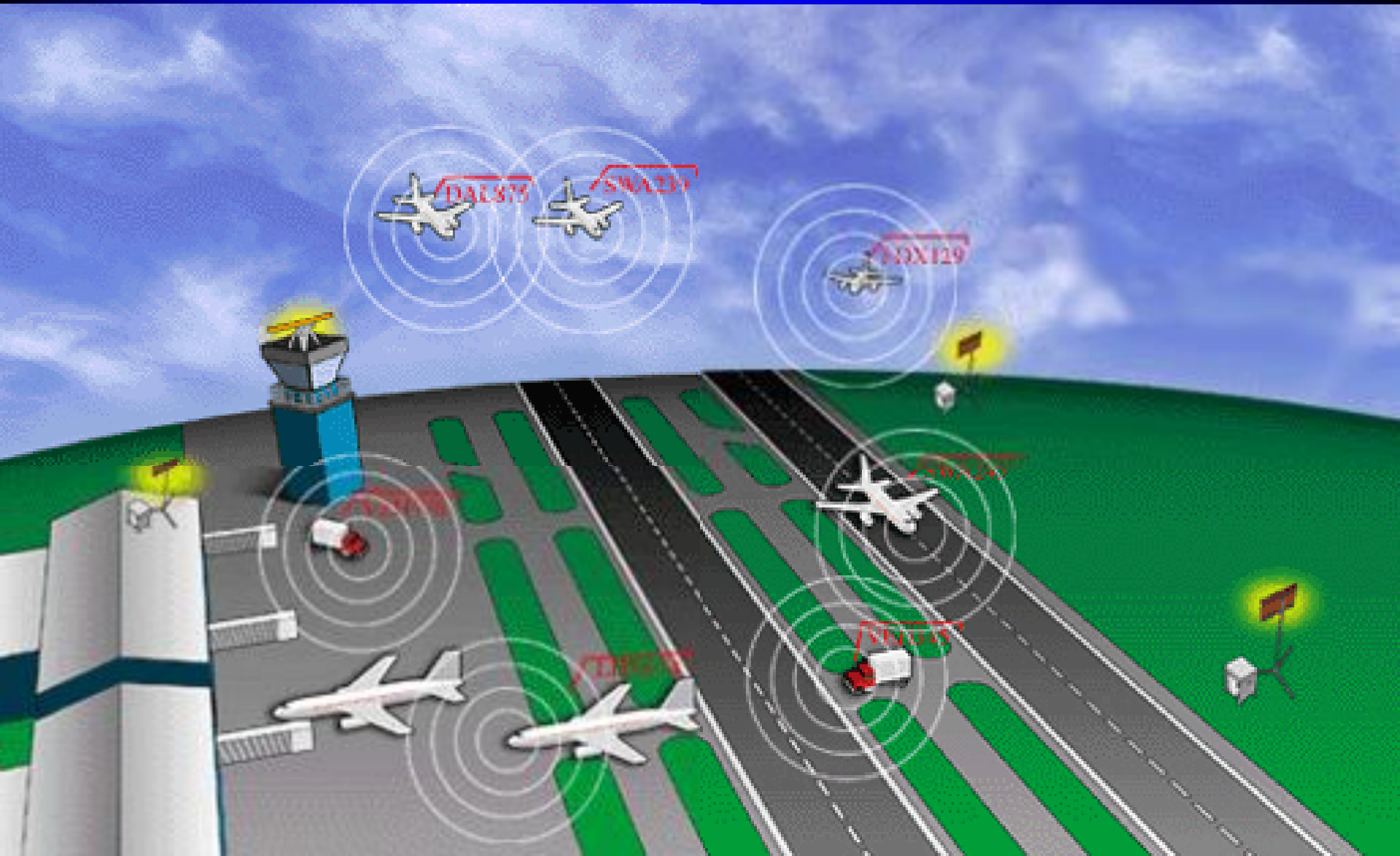

nwa
NORTHWEST AIRLINES

U.S. Aviation Incidents
6,229

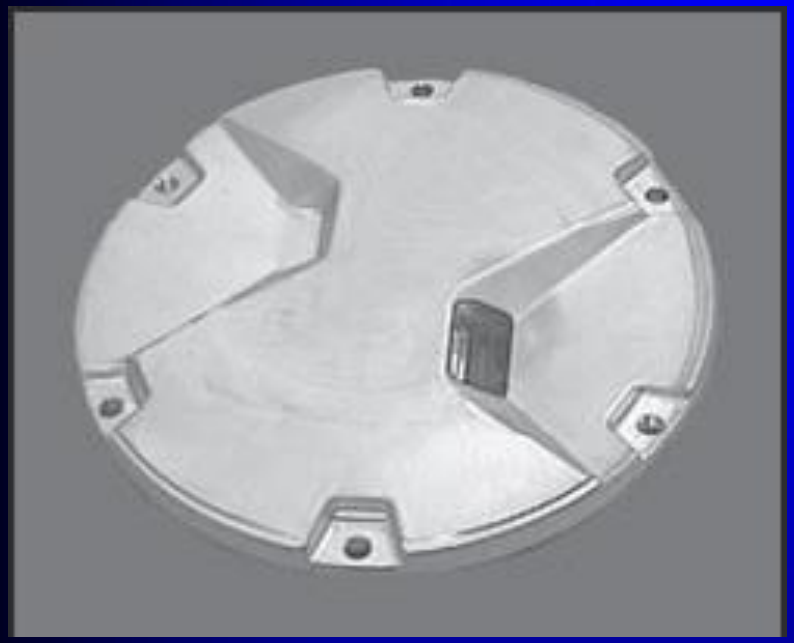


Ground Collision Risks

Airport Surface Detection Equipment Model-X (ASDE-X)



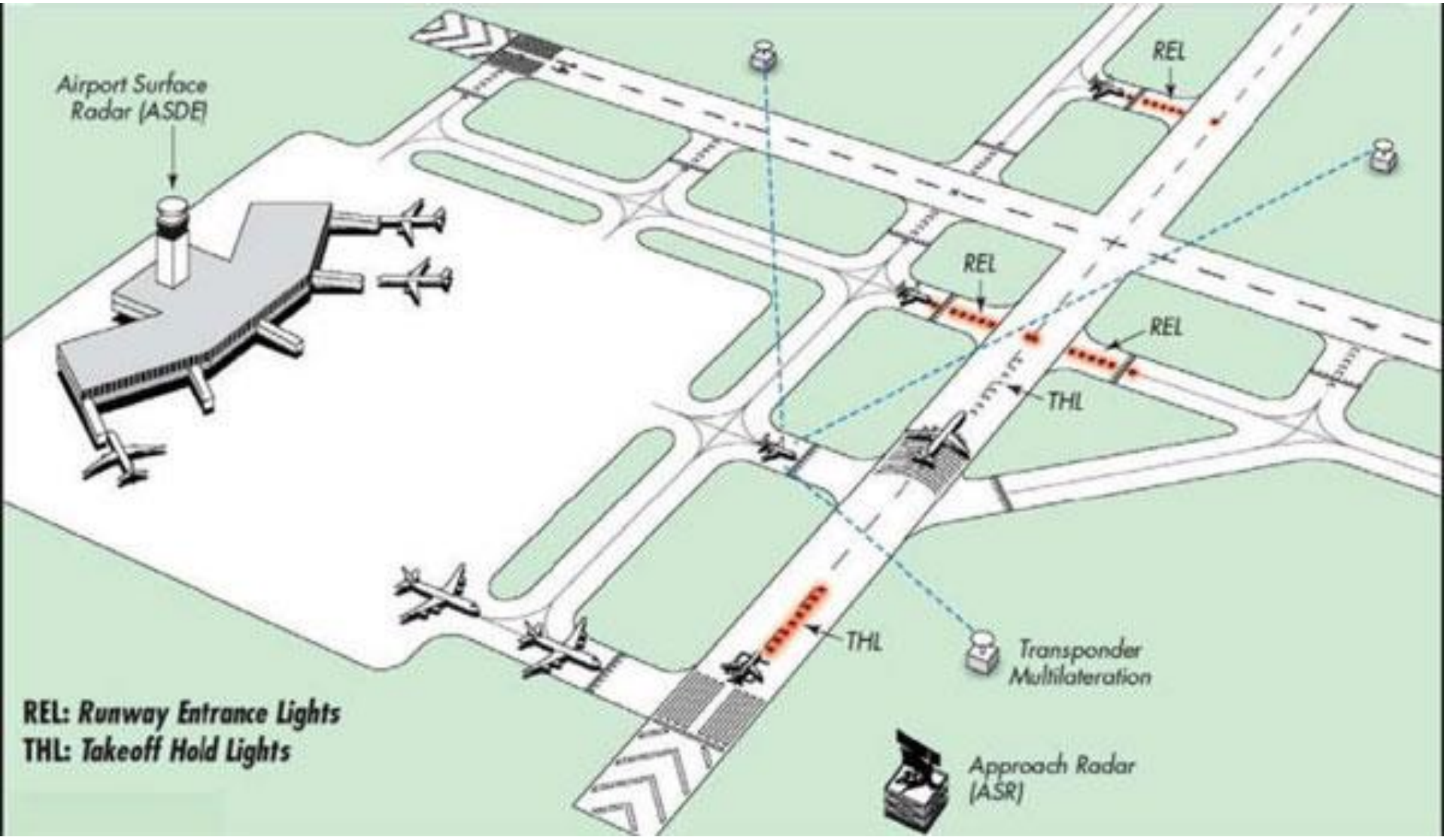
Runway Status Lights



Being tested at: LAX, DFW and San Diego

Will be available in:
Atlanta, Baltimore, Boston, Charlotte, Chicago, Denver, Detroit, Dulles, Ft. Lauderdale, Houston Intl, JFK, La Guardia, Las Vegas, Minneapolis, Newark, Orlando Philadelphia, Phoenix and Seattle

- Runway Entrance Lights (REL)
- Take-Off Hold Lights (THL)
- Runway Intersection Lights (RIL)
- Final Approach Runway Occupancy Signal (FAROS)


Airport Surface Radar (ASDE)
REL
REL
REL
THL
THL
Transponder Multilateration
Approach Radar (ASR)
REL: Runway Entrance Lights
THL: Takeoff Hold Lights

Vehicle Strikes Airplane


Airplane Strikes Vehicle

Airplane Strikes Structure

Memphis (October 2002)

Avro RJ-85
Lost braking
Strikes jet bridge

Minneapolis (May 2005)

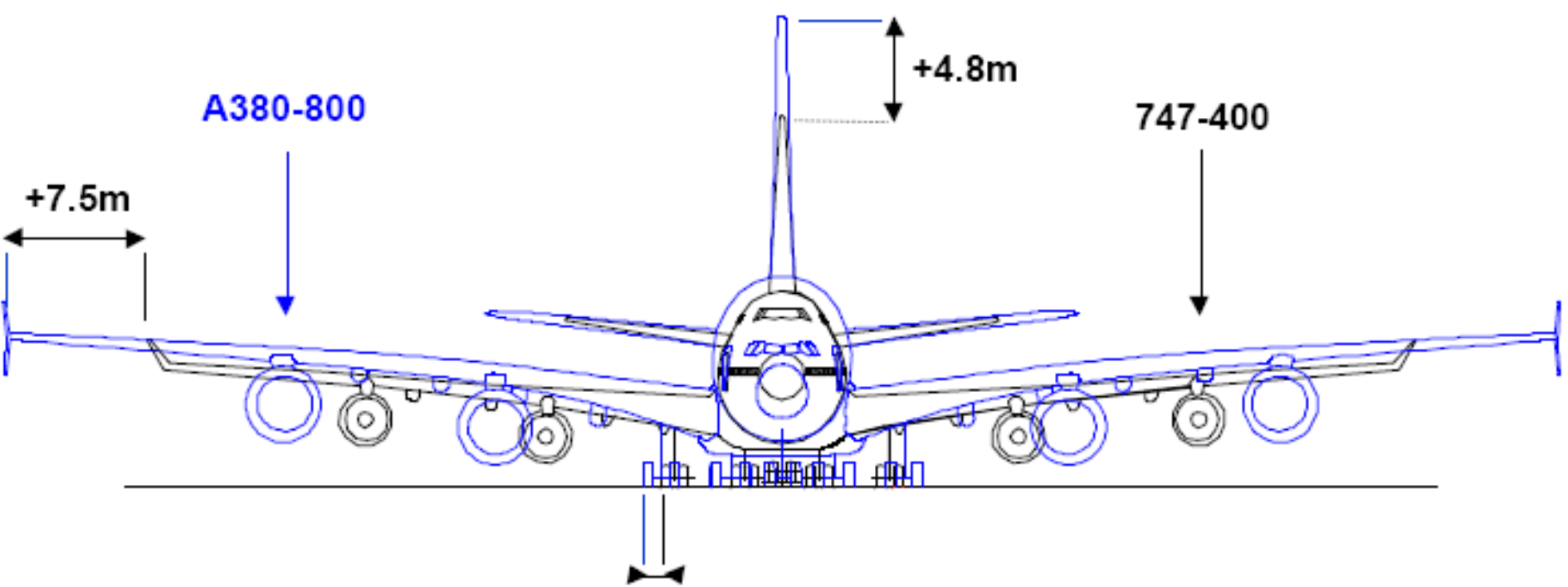
DC-9

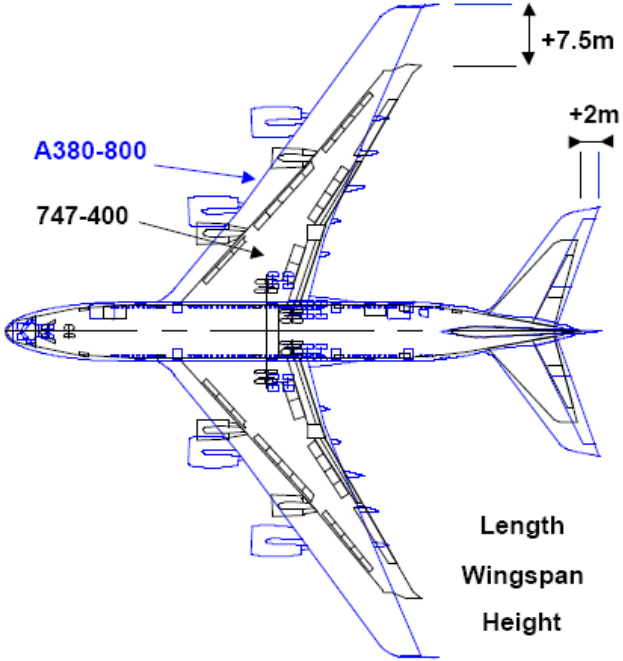
Lost steering & braking

Other plane was backing off the gate

Pilot and co-pilot seriously injured


PHRA NAKHON





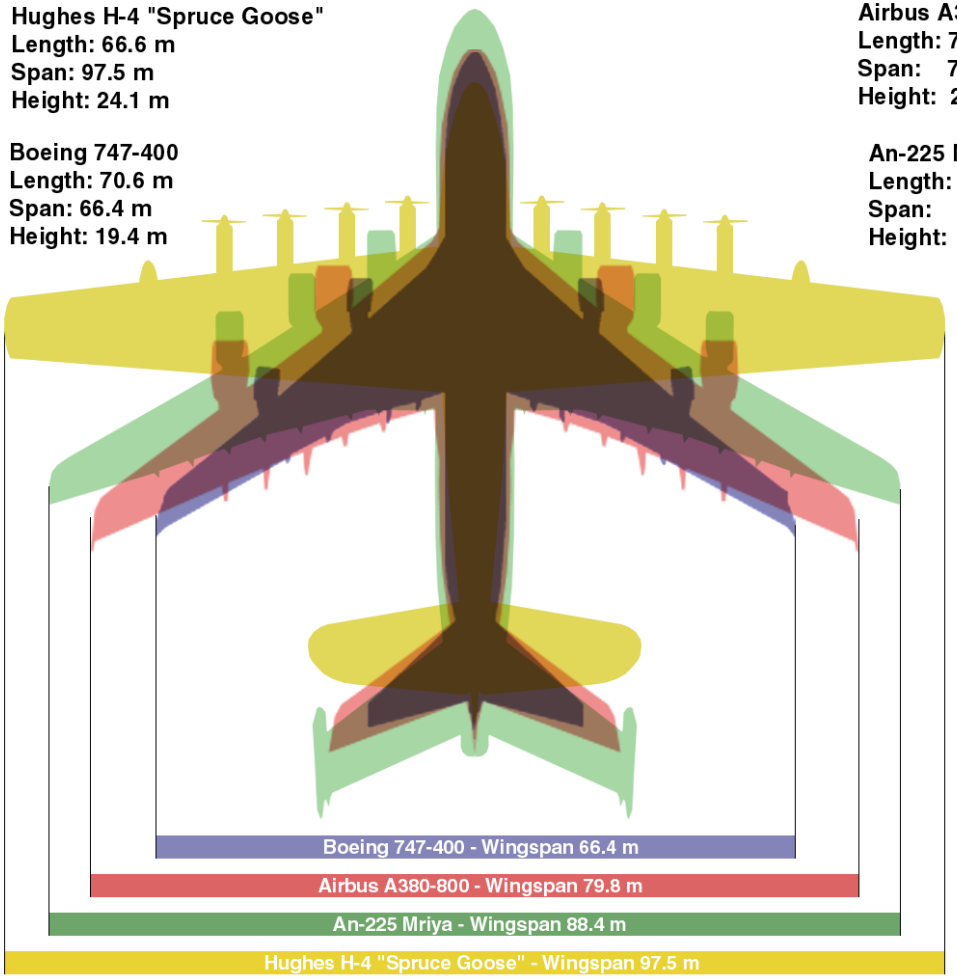
	A380-800	747-400
Length	72.7m (239ft)	70.7m (232ft)
Wingspan	79.6m (261ft)	64.5m (212ft)
Height	24.1m (79ft)	19.3m (63ft)

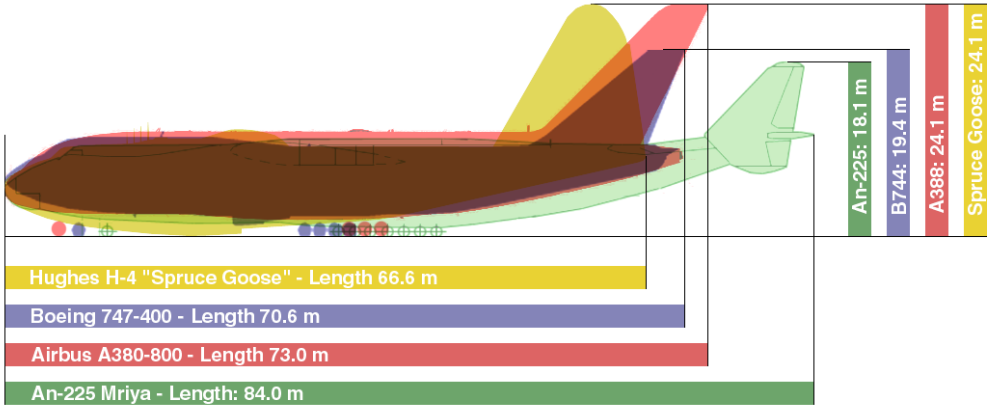
Hughes H-4 "Spruce Goose"
Length: 66.6 m
Span: 97.5 m
Height: 24.1 m

Boeing 747-400
Length: 70.6 m
Span: 66.4 m
Height: 19.4 m

Airbus A380-800
Length: 73.0 m
Span: 79.8 m
Height: 24.1 m

An-225 Mriya
Length: 84.0 m
Span: 88.4 m
Height: 18.1 m





A-380 Hits CRJ 700 at Kennedy Airport

(April 12, 2011)

June 19, 2011 Le Bourget Airport

On Large airplanes such as the B-747, 757, 767, 777, MD-10 and 11, and A-340 and 380 the pilot cannot see the airplane's wingtips from the cockpit

The NTSB has recommended the installation of wingtip cameras to prevent ground collisions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VH-KBZ


CARAVAN I
FALK
SKYHAWK II


LiveLeak

Ramp Accidents and Incidents

(IATA Estimates)

27,000 per year worldwide

243,000 people are injured every year

The cost is US$10 billion per year


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Airport/Airstrip Risks


P2-SIG
P2-SIG


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FALCON
N48823


N4882

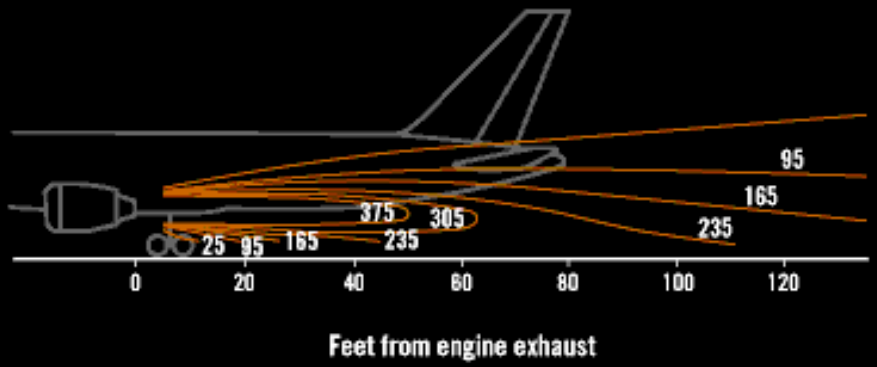
Ground Operations

Ground Operations

Risks

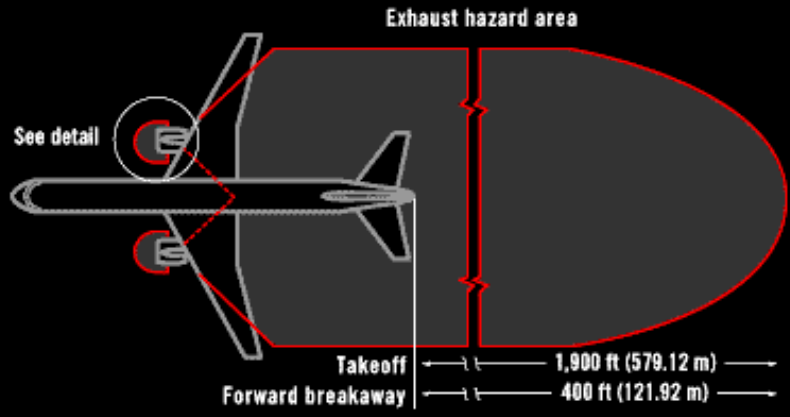

ft Engines
GE
BOEING
115B
© D. Verhelst

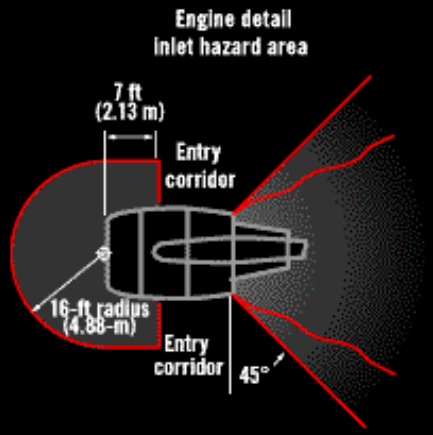
FIGURE 1. MAXIMUM TAKEOFF THRUST ENGINE EXHAUST WAKE



The jet wake streamlines repesent velocities from 375 mi/h for the inside streamline to 25 mi/h for the outside streamline. Each successive streamline represents a velocity change of 70 mi/h.

FIGURE 4. TAKEOFF THRUST POWER HAZARD AREAS





WARNING If surface wind is reported greater than 25 kn, increase distance of inlet boundary by 20 percent.

If ramp surfaces are slippery, additional precautions such as cleaning the ramp will be necessary to provide personnel safety.

Ground personnel must stand clear of these hazard zones and maintain communication with flight-deck personnel during engine running.

LATEST INCIDENT: May 11, 2009 – JAL 747 in LAX ingested a luggage container


70 F 17 077


02-20-91 F 71
03:41:08 20


hosted On
Live
+3
10:14:37:25
00:04:24:03

El Paso, Texas (January 2006)

Congo (October 2005)


CALSTAR


73
30


10-16-00 63
14:48:47 26

Aircraft Design

Aircraft Design

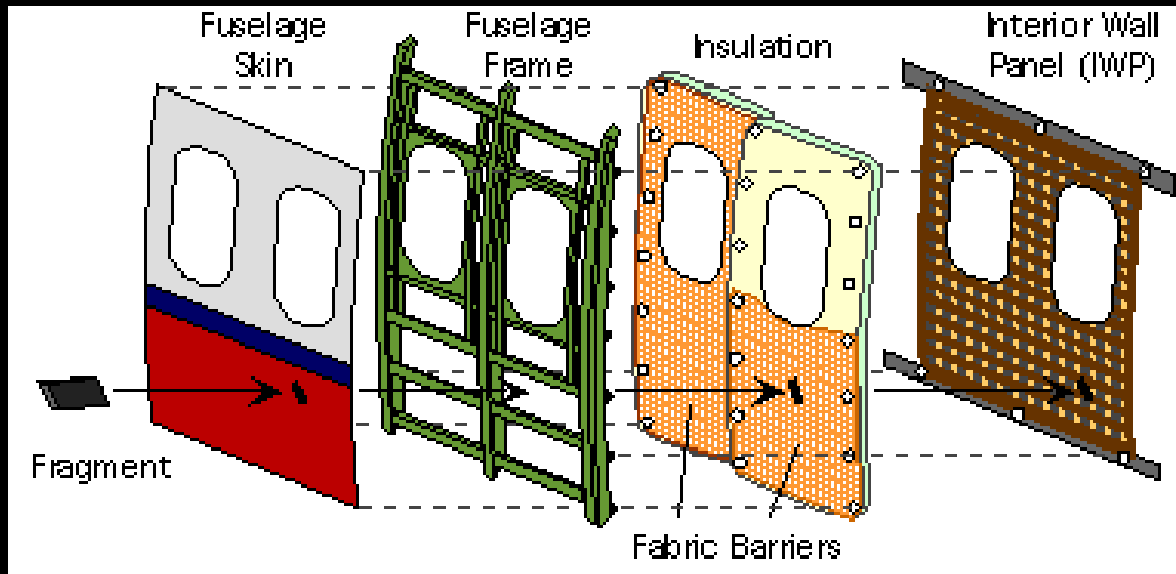
Risks


SOUTHWEST
N632SW


TWITPIC @BluestMuse


Spirit of Australia

Maintenance-Related Risks


Fuselage Skin
Fuselage Frame
Insulation
Interior Wall Panel (IWP)
Fragment
Fabric Barriers

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AIR
21


QANTAS
Spirit of Australia

Aloha Airlines B737-222
April 28, 1988

The NTSB determines that the probable cause of this accident was the failure of the Aloha Airlines maintenance program to detect the presence of significant disbonding and fatigue damage which ultimately led to failure of the lap joint at S-10L and the separation of the fuselage upper lobe.

Ada-Boi Critical Care
Boise, Idaho, USA
July 2, 2007

Twin Engine Piper
22,000 ft
Window Failure
Injured Flight Nurse

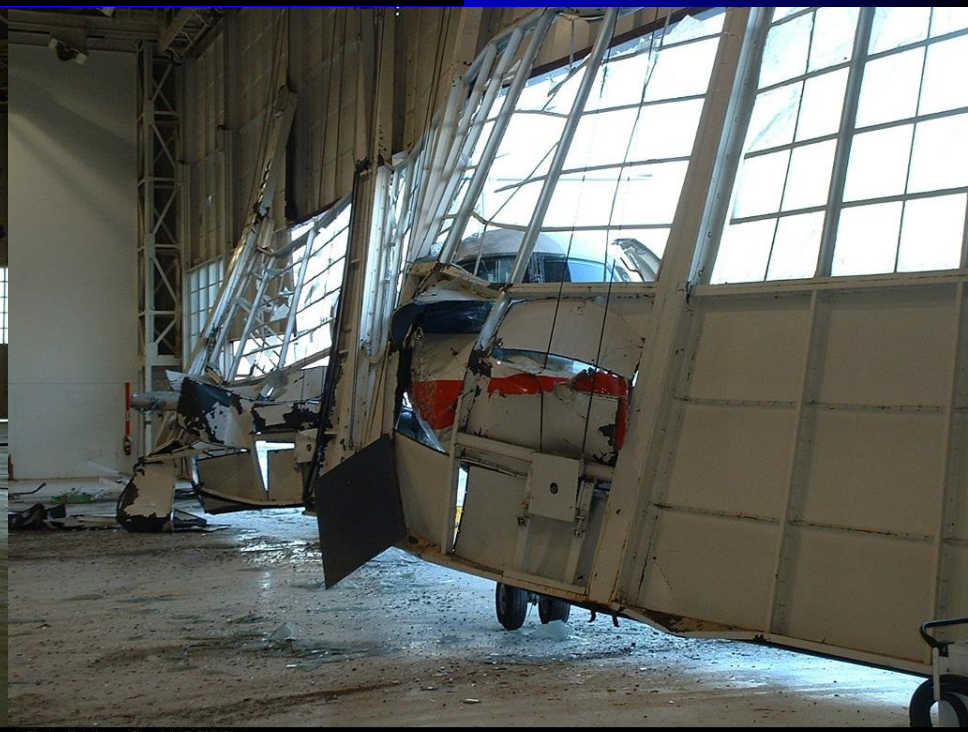
Causes of Pressurization Failure Events

Cause	Number	Percentage
Control problem	228	44.1%
Door problem	62	12.0%
System failure	42	8.1%
Outflow valve problem	28	5.4%
Operator error	16	3.1%
Window failure	14	2.7%
Maintenance error	11	2.1%
Air leak	2	0.4%
Seal problem	2	0.4%
Structural problem	2	0.4%
Engine failure	1	0.2%
Not specified	109	21.1%
Total	**517**	**100.0%**

Source: Australian Transport Safety Bureau


ETIHAD


ETIHAD



Ramp Accidents and Incidents

(IATA Estimates)

27,000 per year worldwide

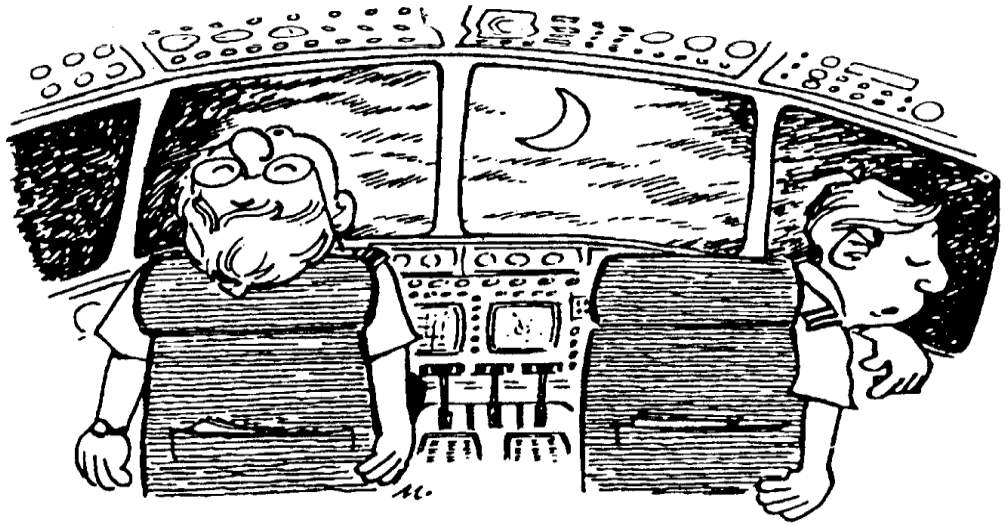
243,000 people are injured every year

The cost is US$10 billion per year

Pilot Fatigue

Pilot Fatigue

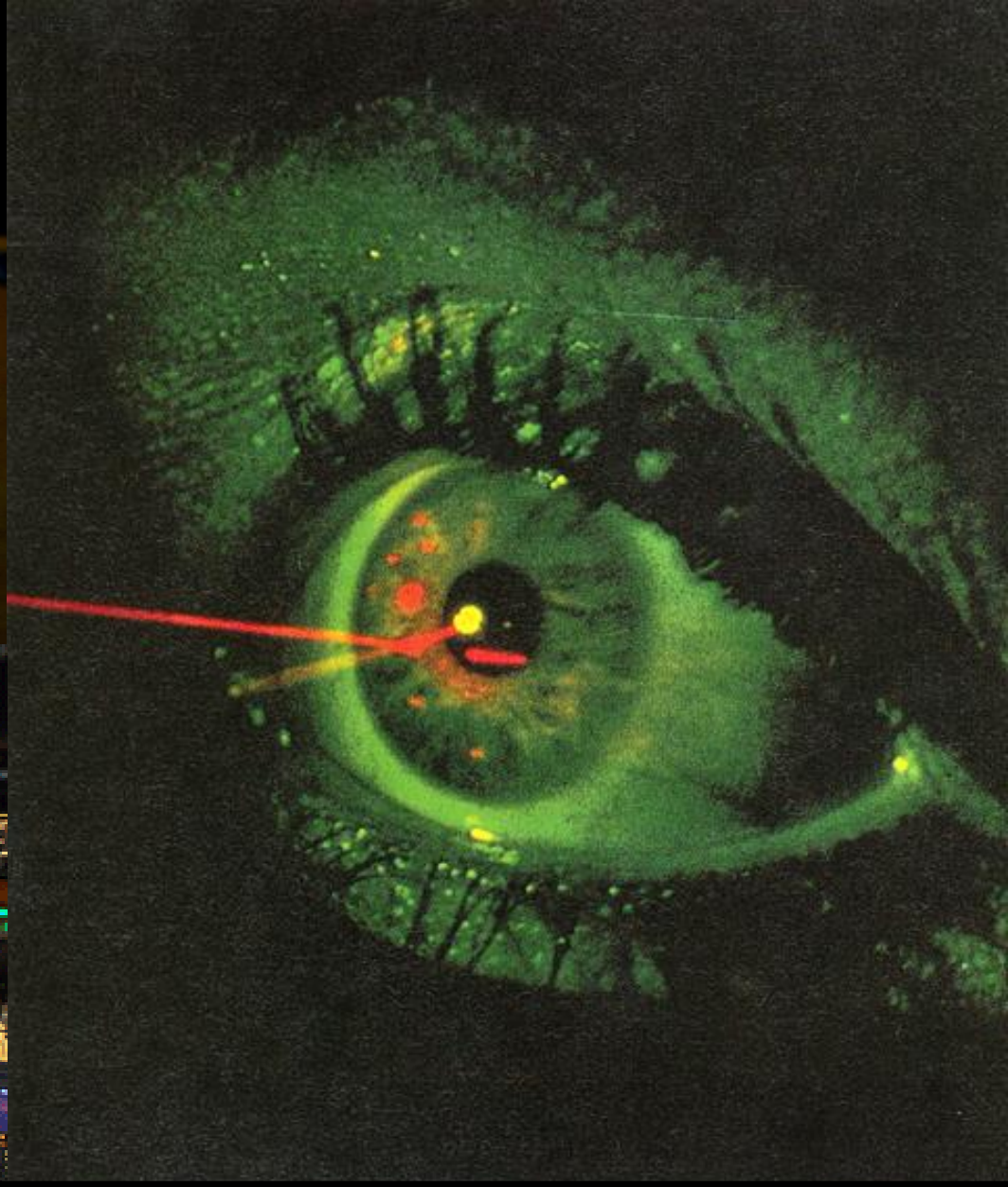
Risks



Constantly vigilant for any system malfunction the Captain scans the overhead panel as the co-pilot checks the window heat system with his forehead — at 03:00 pilots can't be too careful.....


DRIVECAM

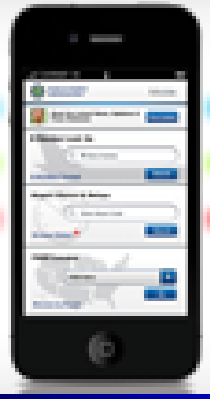
Laser Exposure Risks




13x
Increase in laser incidents
384
590
913
1527
2836
3591
3482
2006
2007
2008
2009
2010
2011
2012
2013 - 3960
2014 - 3894

A 19 year old North Hollywood man was sentenced to 2.5 years in prison for aiming a LASER pointer at a commercial aircraft

Defense attorneys are seeking 2 years of probation and community service



Report a laser incident
on your mobile device

Go

In cooperation with federal, state and local law enforcement agencies, FAA needs everyone's help in reporting laser incidents

If you are the victim of a laser incident or you witness a laser incident, please report it to FAA

www.faa.gov/aircraft/safety/report/laserinfo/

Spatial Disorientation

Spatial Disorientation

Risks

Your eyes can fool you


LiveLeak


01.07.2006

Safety and Survivability Issues in Civil Aviation

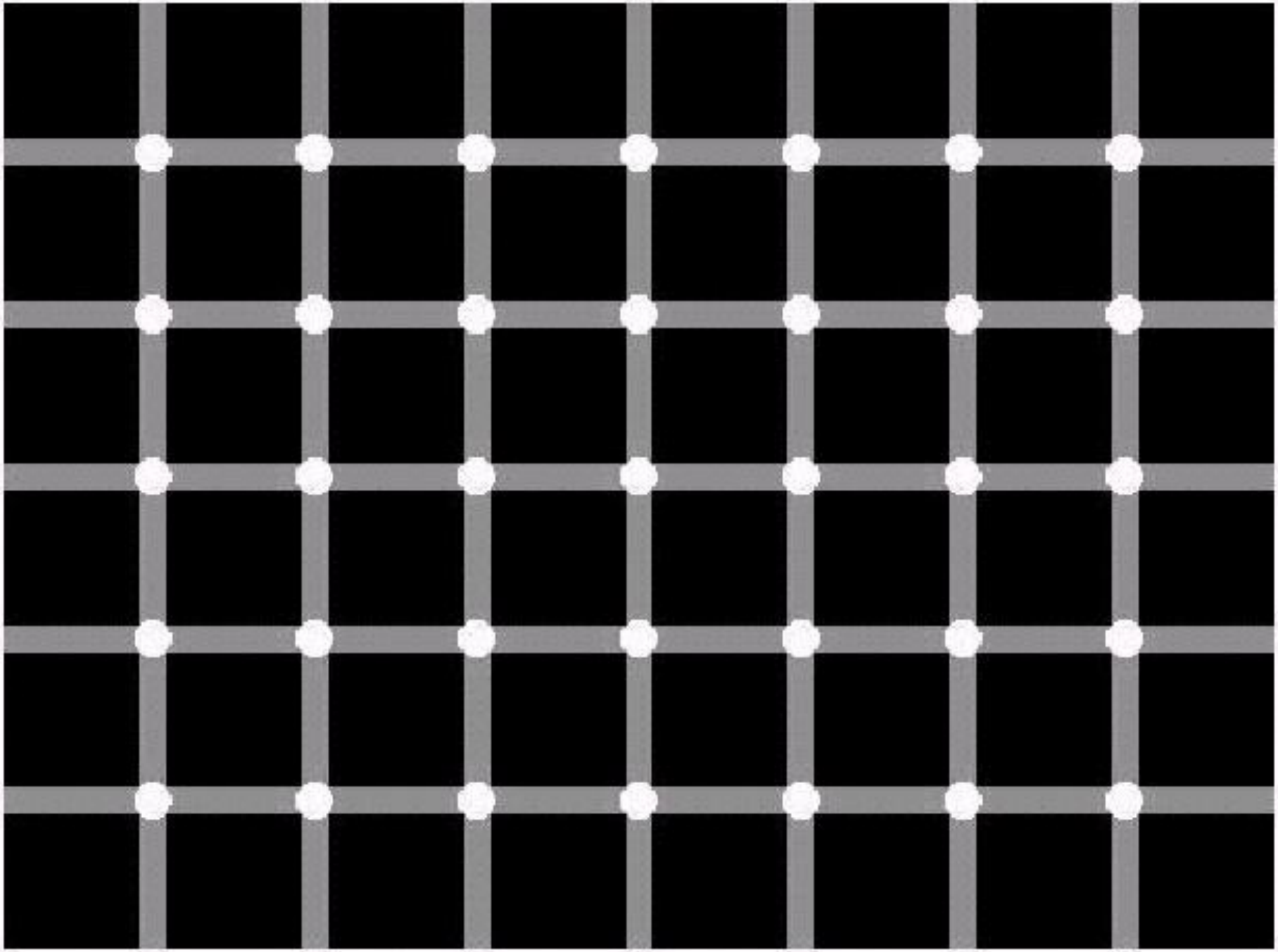
Safety and Survivability Issues in Civil Aviation


143

This red and grey paint scheme was documented from an old plastic model kit. This model was built and painted by Jerry Caudle.


opet
opet


01.07.2006



Optical.exe


106
901

The graveyard spiral

A loss of instruments and spatial disorientation may have been critical factors that caused a plane carrying 10 men associated with the Oklahoma State University basketball program to crash on Jan. 27, 2001. Investigators think the last 96 seconds of the flight amounted to a "graveyard spiral."

1. At about 5:35 p.m. Mountain Standard Time, the plane was traveling southeast at 23,200 feet.

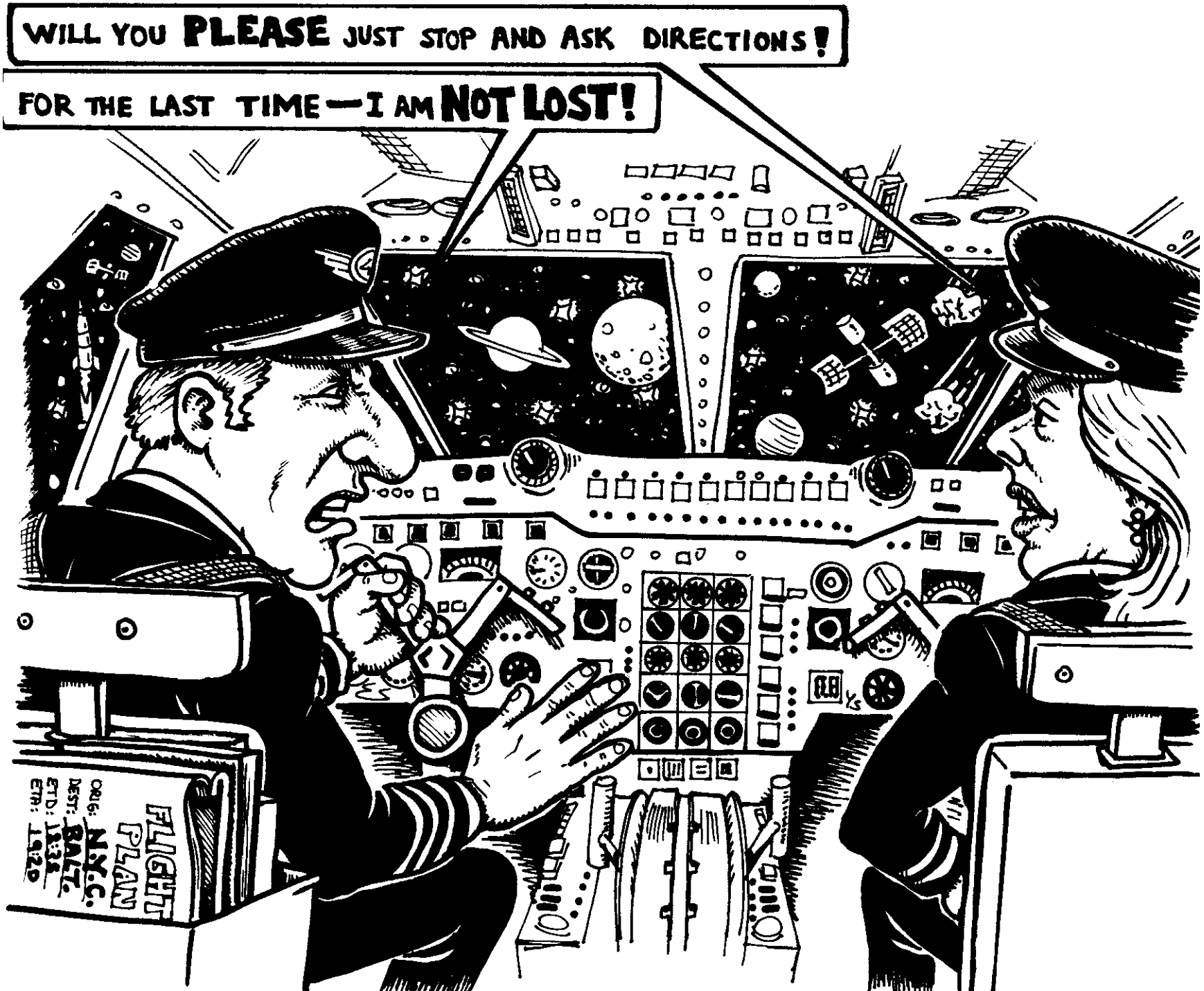
2. At 5:36 p.m., the plane was banking to the right and began diving slightly at more than 200 mph.

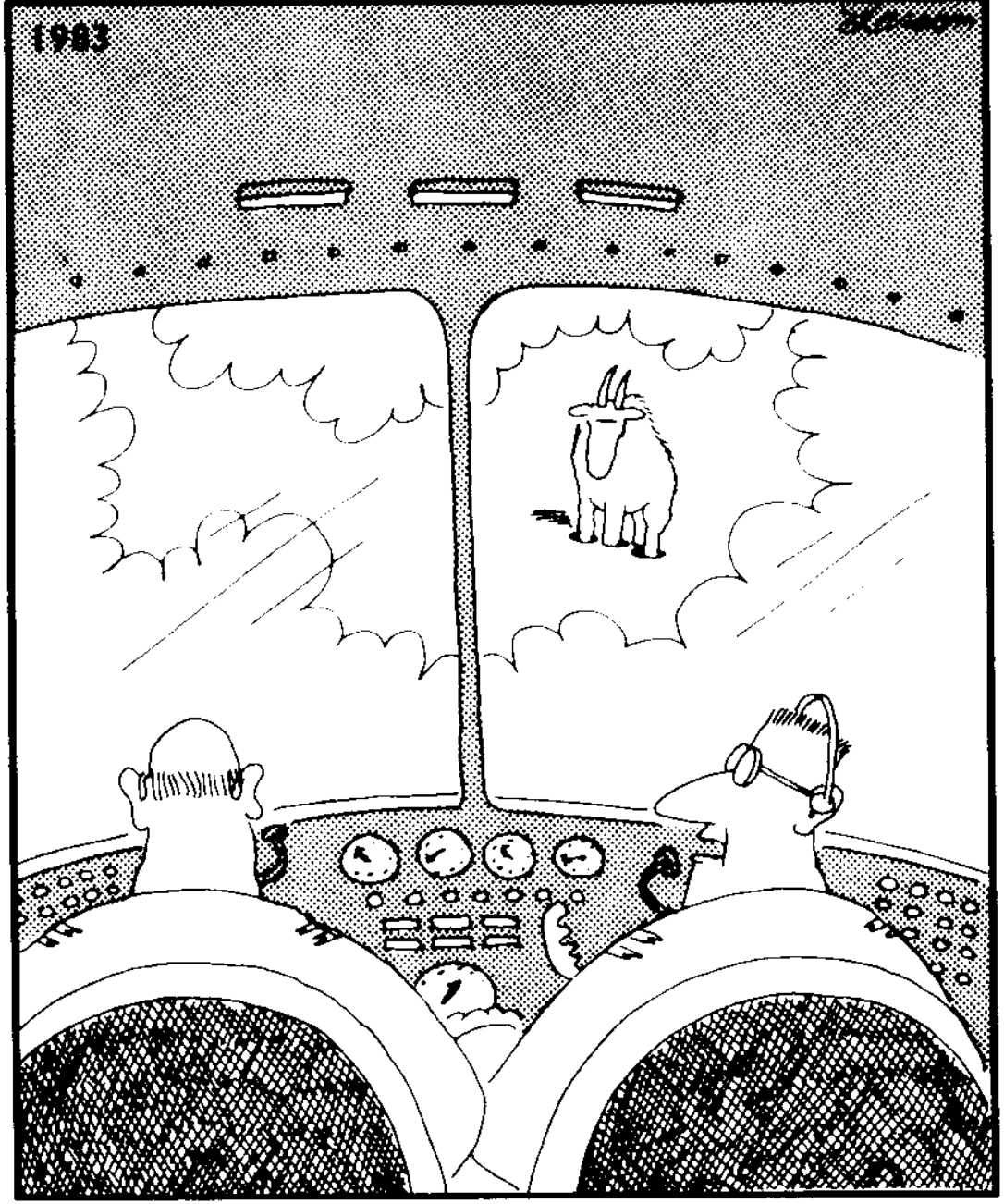
3. Thirty seconds later, the plane was circling north, dropping 6,000 feet. Its dive and bank were getting steeper and speeds exceeded 250 mph.

4. By 5:37, the plane was nose-down at an 80-degree angle and banking sharply south with speeds exceeding 350 mph.

5. The pilot begins to pull out of the dive as the plane nears the ground, but stress on the tail and right wing causes an in-flight break-up and crash, killing everyone aboard.

SOURCE: National Transportation Safety Board


WILL YOU PLEASE JUST STOP AND ASK DIRECTIONS!
FOR THE LAST TIME—I AM NOT LOST!
FLIGHT PLAN
ORIG: N.Y.C.
DEST: BALT.
ETD: 1:31
ETA: 1:20



"Say … what's a mountain goat doing
way up here in a cloud bank?"


EXPLAIN
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MEXLUB


MEXLUB
MEXLUB

Spatial Disorientation Training


CIVIL AEROMEDICAL

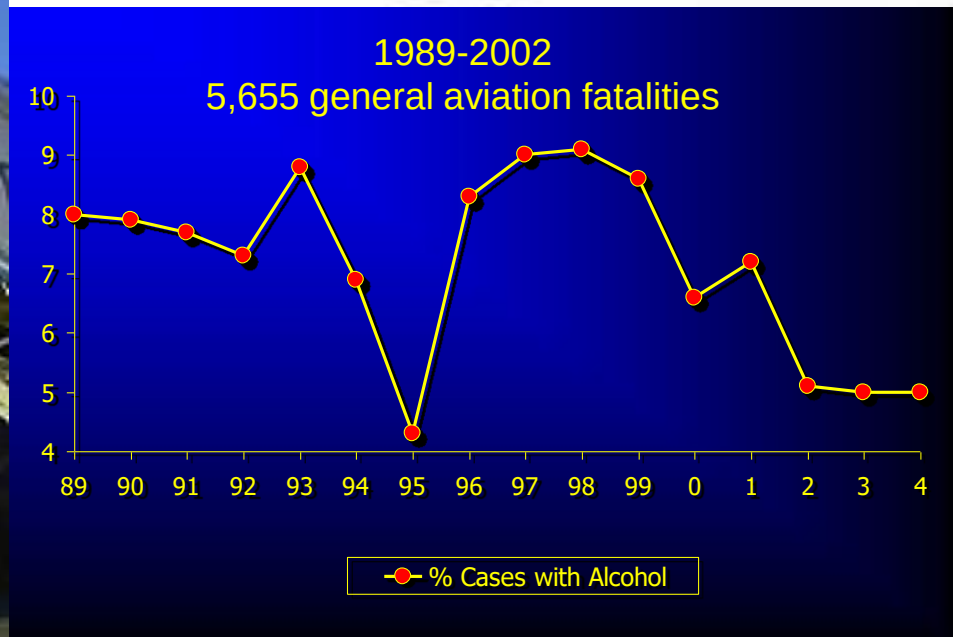
Advanced Spatial Disorientation Training


Helo


Helo


Rx


DON'T
DRINK
AND FLY


1989-2002
5,655 general aviation fatalities
10
9
8
7
6
5
4
89 90 91 92 93 94 95 96 97 98 99 0 1 2 3 4
% Cases with Alcohol

Alcohol Consumption Impairs Judgment

Inflight Collision Risks

Vertical Separation Minima or Minimum (RVSM)

The standard vertical separation required between aircraft flying at levels between FL290 (29K ft) and FL410 (41K ft) was reduced from 2,000 feet to 1,000 feet in 2005

B-727
vs
Cessna 172

DC-9
vs
Piper

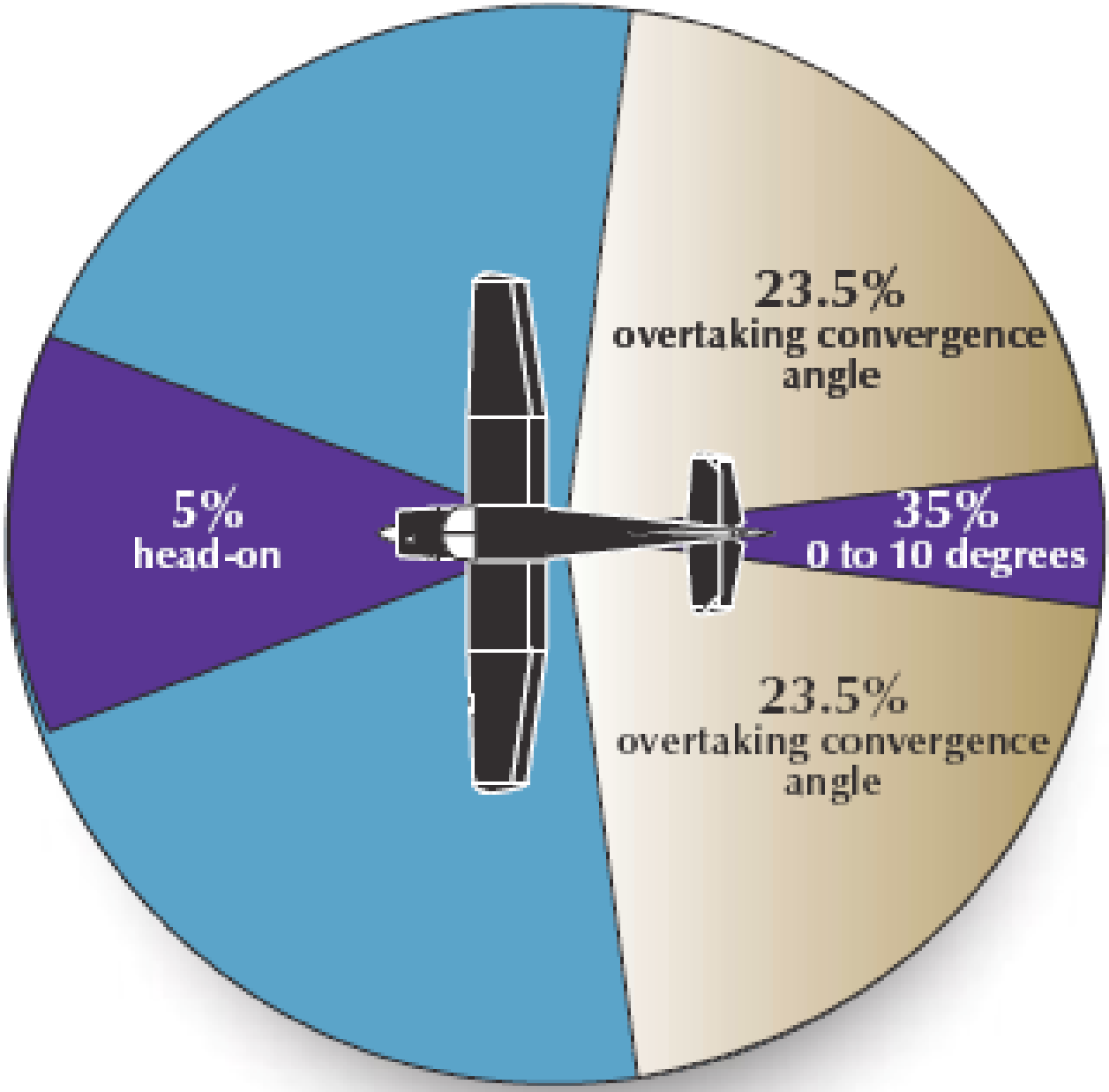


Figure 2. Note: Percentages are based on a study of 105 MACs. Some of the angles were unreported.

New FAA Midair Incident Reporting Standards Implemented

Minimum horizontal separation during flight changed from 5 miles to 4.5 miles

Aircraft flying at the same altitude must maintain a 4.5 mile separation


N7505B


USAF
USAF
USAF
USAF


USAF
UNITED STATES AIR FORCE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Wake Turbulence

Radar Separation Minima During Approach and Departure

Preceeding aircraft	Succeeding aircraft	Wake turbulence radar separation minima
A380-800/ non-A380-800 HEAVY	A380-800	Not required*
A380-800	Non-A380-800 HEAVY	11.1 km (6.0 NM)
A380-800	MEDIUM	13 km (7.0 NM)
A380-800	LIGHT	14.8 km (8.0 NM)

Horizontal and Vertical Spacing En-route

Piper 18 Flipped by Air Force 2


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MyFoxTampaBay.com


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Geographic Disorientation

A Boeing 747 “Dreamlifter” takes off 11/21/2013, the day after it mistakenly landed at Col. James Jabara Airport in Wichita, Kansas, about 8 miles (13 kilometers) north of its intended destination, the McConnell Air Force Base

A Southwest Airlines Boeing 737 with 129 people on board bound for Branson, Mo., mistakenly landed at M. Graham Clark Downtown Airport several miles from its destination

The pilot and 1st officer were removed from flying duties

Geographic Disorientation: Approaching and Landing at the Wrong Airport

Antunano MJ, Mohler SR, Gosbee JW.
Aviation Space Environmental Medicine Journal
1989, Volume 60, Number 10

Between 1982 and 1987

- 75 Air Carrier Cases
- 16 General Aviation Cases

Types of Occurrences

- Becoming lost during flight
- Intruding inadvertently into unauthorized air space
- Selecting a wrong airway
- Landing on the wrong runway
- Approaching the wrong airport

TABLE VII. AIRPORTS THAT HAVE BEEN MISIDENTIFIED BY AIR CARRIER PILOTS, JANUARY 1982 TO DECEMBER 1987.

Intended Airport	Wrong Airport
Albany County, NY	Schenectady, NY
Allen C. Thompson, Jackson, MS	Hawkins, Jackson, MS
Allen C. Thompson, Jackson, MS	Campbell County, TN*
Allentown-Bethlehem-Easton, PA	Queen City, PA
Bradley Airport, MA	Westover Air Force Base, MA
Blue Grass, Lexington, KY	Frankfort Capital City, KY
Buffalo International, NY	Niagara Falls International, NY
Bush Field, Augusta, GA	Daniel Field, Augusta, GA
Cedar Rapids Municipal, IA	Iowa City Municipal, IA
Columbus International, OH	Don Scott Airport, OH
Columbus Rickenbacker AFB, OH	Bolton Field, Columbus, OH
Columbia Regional, MO	Fulton Municipal, MO
Corpus Christi Intl., TX	Cabaniss Navy Field, TX
Dayton Cox International, OH	Wright Patterson AFB, OH
Deadhorse, AK	Prudhoe Bay, AK
El Paso International, TX	Biggs Army Air Field, TX
Farmington Municipal, NM	Aztec Municipal, NM*
Greenville Spartanburg, SC	Greenville Downtown, SC
Hobby Airport, Houston, TX	Ellington Air Force Base, TX*
Huntsville-Madison, AL	Redstone Army Air Field, AL
Indianapolis International, IN	Eagle Creek, Indianapolis, IN
Kearney Municipal, NE	Hall County, Grand Island, NE
Kileen Municipal, Austin, TX	Gray Army Air Field, TX
Los Angeles International, CA	Hawthorne Municipal, CA
Las Americas, FO	San Isidro Air Base, FO******
McChord, Seattle, WA	Gray Army Air Field, Seattle, WA
Memphis International, TN	Olive Branch Municipal, MS
Miami International, FL	Ft. Lauderdale International, FL
Miami International, FL	Opa Locka, Miami, FL
Mid-Continent, Wichita, KS	McConnel Air Force Base, KS
Muskegon County, Chicago, MI	Grand Haven Mem. Airpark, MI
Myrtle Beach Air Force Base, SC	North Myrtle Beach, SC
Nashville Metropolitan, TN	Smyrna Airport, TN******
Newark International, NJ	Linden Airport, NJ***
Oakland International, CA	Alameda Naval Air Station, CA
Ontario International, CA	Los Angeles International, CA
Port-Au-Prince, Haiti	Bowen Field (Military), Haiti
Providence, Green State, RI	Quonset State, RI
Rapid City Regional, SD	Ellsworth Air Force Base, SD
Redmond Roberts Field, OR	Prineville, OR
San Diego Intl. Lindbergh, CA	North Island, NAS, CA
San Juan Intl., Puerto Rico	Isla Grande, Puerto Rico*
Santa Ana, Orange County, CA	El Toro (Marine), Los Angeles, CA
Savannah Municipal, GA	Hunter Army Air Field, GA
Seattle-Tacoma International, WA	Boeing Field Seattle Intl., WA
Sheridan County, WY	Buffalo Municipal, WY
Standiford Field, Louisville, KY	Bowman Field, KY
Stewart Airport, Newburgh, NY	Dutchess County, NY*
Southwest Florida Regional, FL	Page Field, Ft. Myers, FL****
Tampa International, FL	McDill Air Force Base, FL
Will Rogers, Oklahoma City, OK	Wiley Post, Oklahoma City, OK

* Indicates those airports that have been misidentified more than once. The number of asterisks indicates the number of incidents reported in those locations.

Geological Risks

- In the last 20 years +80 commercial planes
- Abrasion damages forward-facing surfaces
- 1,500 known volcanoes (600 active)
- ~ 15 major explosive eruptions per year
- Ash can reach 30-40K ft altitudes
- Ash can circle the earth within weeks

Consequences of Airborne Ash from Volcanic Eruption in Iceland

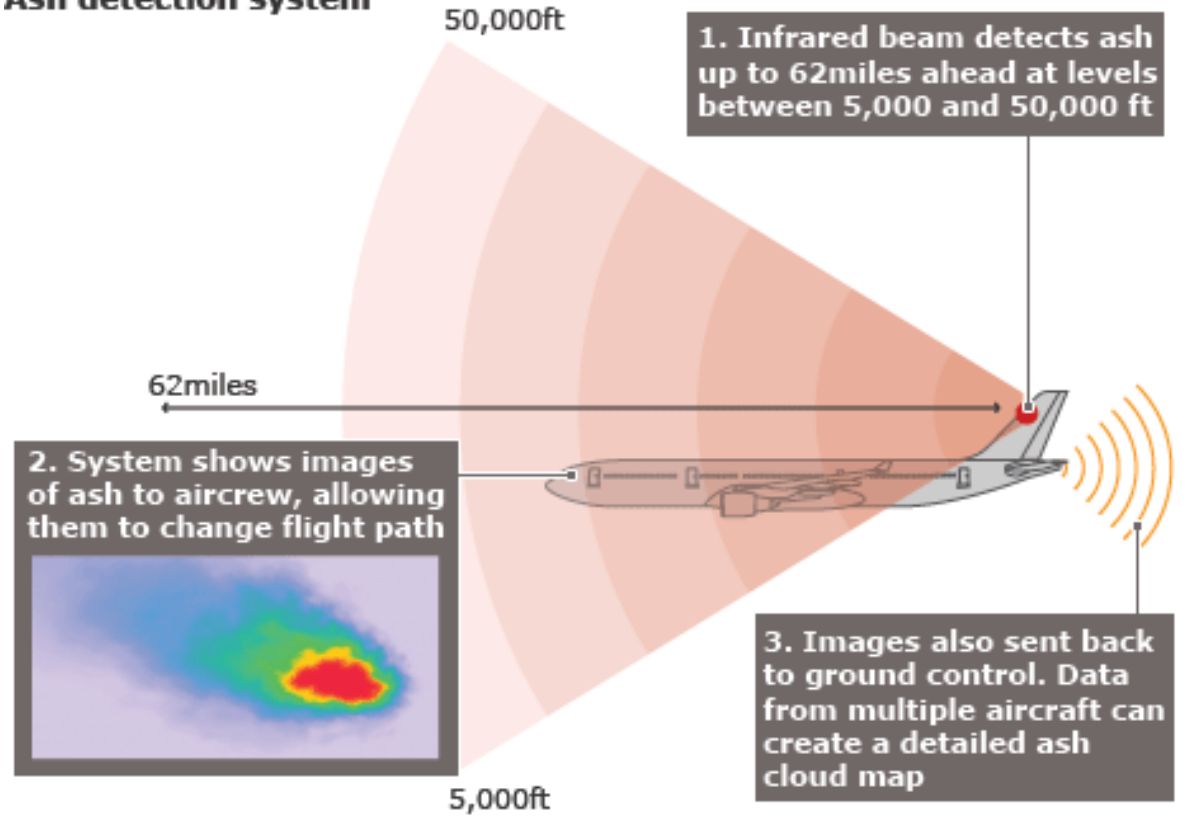
- Most of Northern Europe airspace was closed and had a global impact
- Airlines lost an average of 200 million Euros per day
- More than 7 million passengers were affected
- Airbus tested an A380 and A340-600 flying through the ash cloud (40 other test flights across Europe)
- The scale of the crisis was greater than September 11

Are Volcanic Eruptions Increasing?

Using the Smithsonian Volcano Research database the trends point to increased volcanism in the next 30 years:

2035 between 70 and 97 volcano eruptions
2030 between 68 and 92 volcano eruptions
2025 between 67 and 88 volcano eruptions
2020 between 66 and 84 volcano eruptions
2015 between 64 and 78 volcano eruptions
2010 between 63 and 74 volcano eruptions

Ash detection system



Not to scale

Source: EasyJet

EasyJet is looking to equip some of its aircraft with the AVOID volcanic ash detection system by the end of 2014

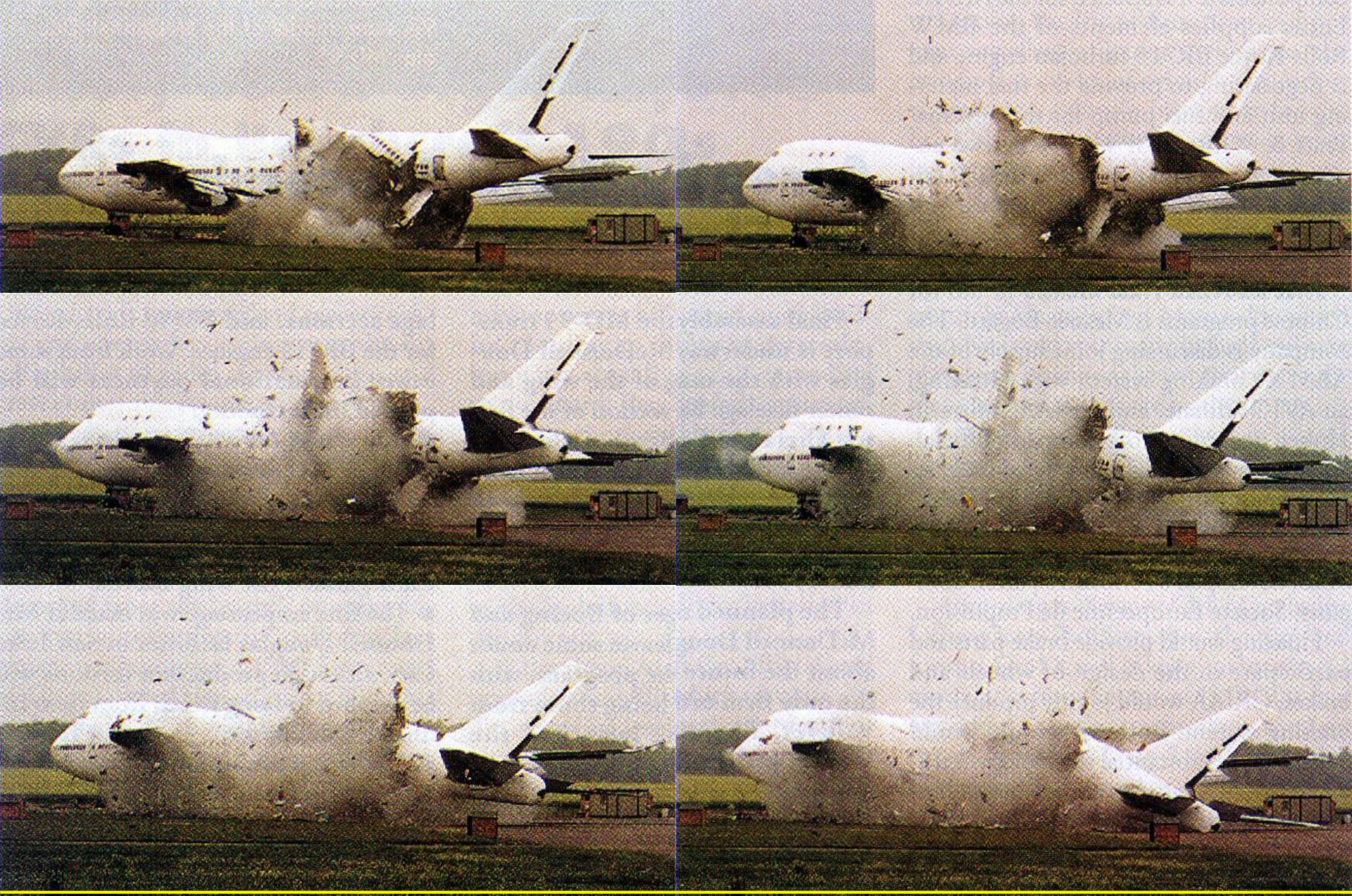
Security-Related Risks


International Conference On
DISRUPTIVE
AIRLINE
PASSENGERS

USA Cases

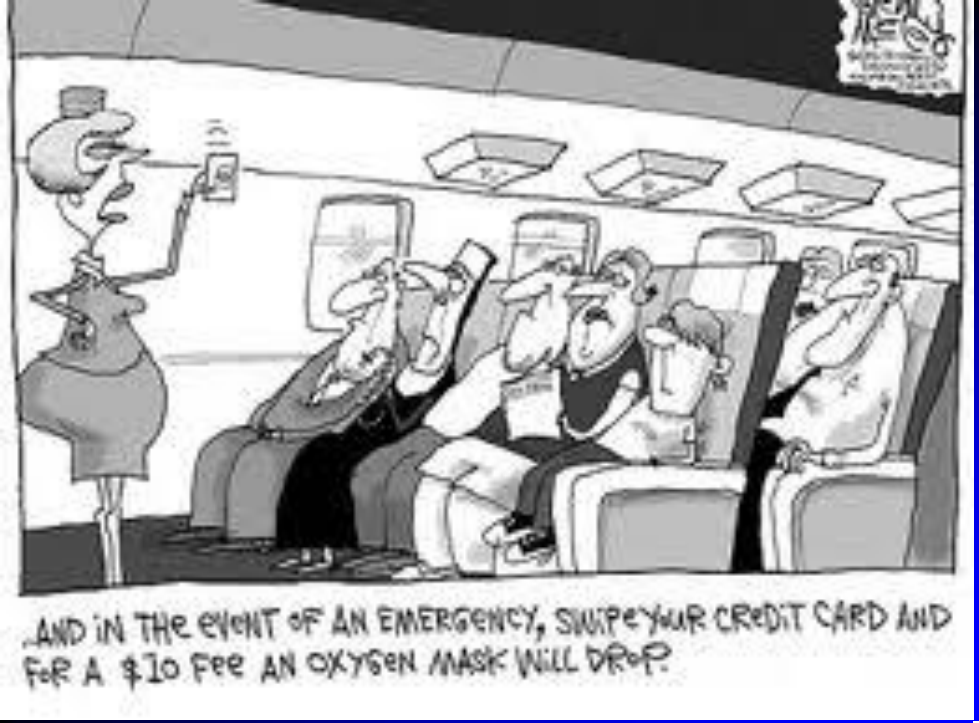
Year	Total
1995	146
1996	184
1997	235
1998	200
1999	226
2000	227
2001	300
2002	306
2003	302
2004	330
2005	226
2006	156
2007	176
2008	134
2009	176
2010	149
2011	140
2012	129
2013	41 as of June 30, 2013

- *No person may assault, threaten, intimidate, or interfere with a crewmember performing duties aboard an aircraft"*
- *FAA can propose up to $25K per violation*
- *One incident may result in multiple violations*




AKC 6361 BA
WORLD CARGO
BRITISH AIRWAYS

Secret FAA Airworthiness Directive is Issued in March 2011 to Disable Chemical Oxygen Generators in Aircraft Lavatories – Directive is Reversed in June 2012


..AND IN THE EVENT OF AN EMERGENCY, SWIPE YOUR CREDIT CARD AND FOR A $10 FEE AN OXYGEN MASK WILL DROP.


...AND, IN THE EVENT OF AN EMERGENCY, PULL GENTLY ON THE MASK, PUT THREE QUARTERS IN THE METER, AND OXYGEN WILL FLOW AUTOMATICALLY.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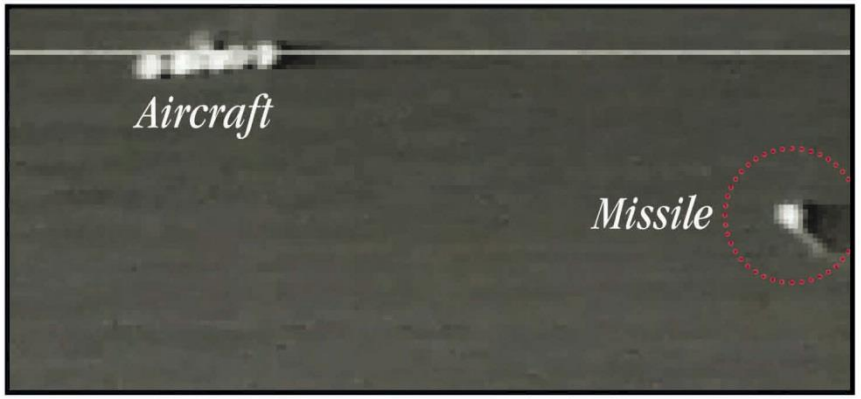
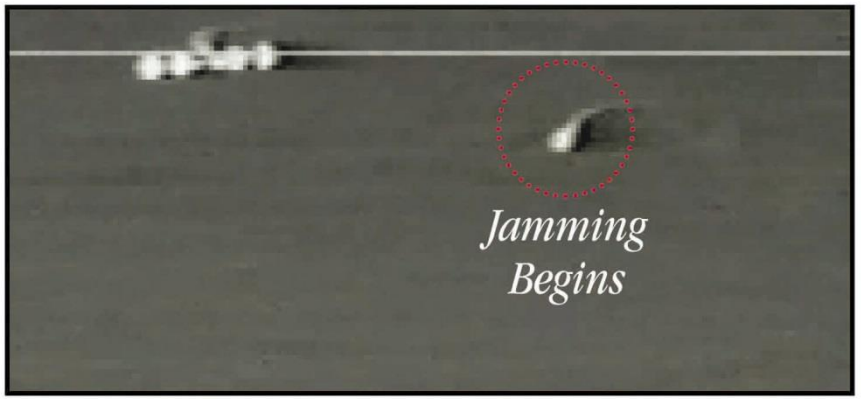
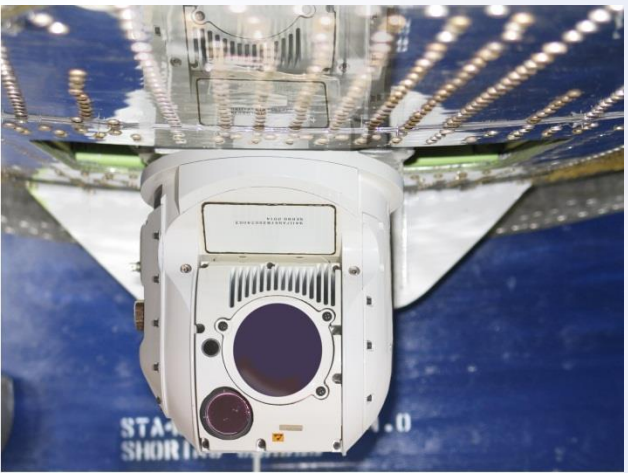
Guardian System







JETEYE System

"YOU COFFEE, TEA OR...


STAR TREK