Global Safety:

Successes and Challenges

FLIGHT SAFETY FOUNDATION

Jim Burin

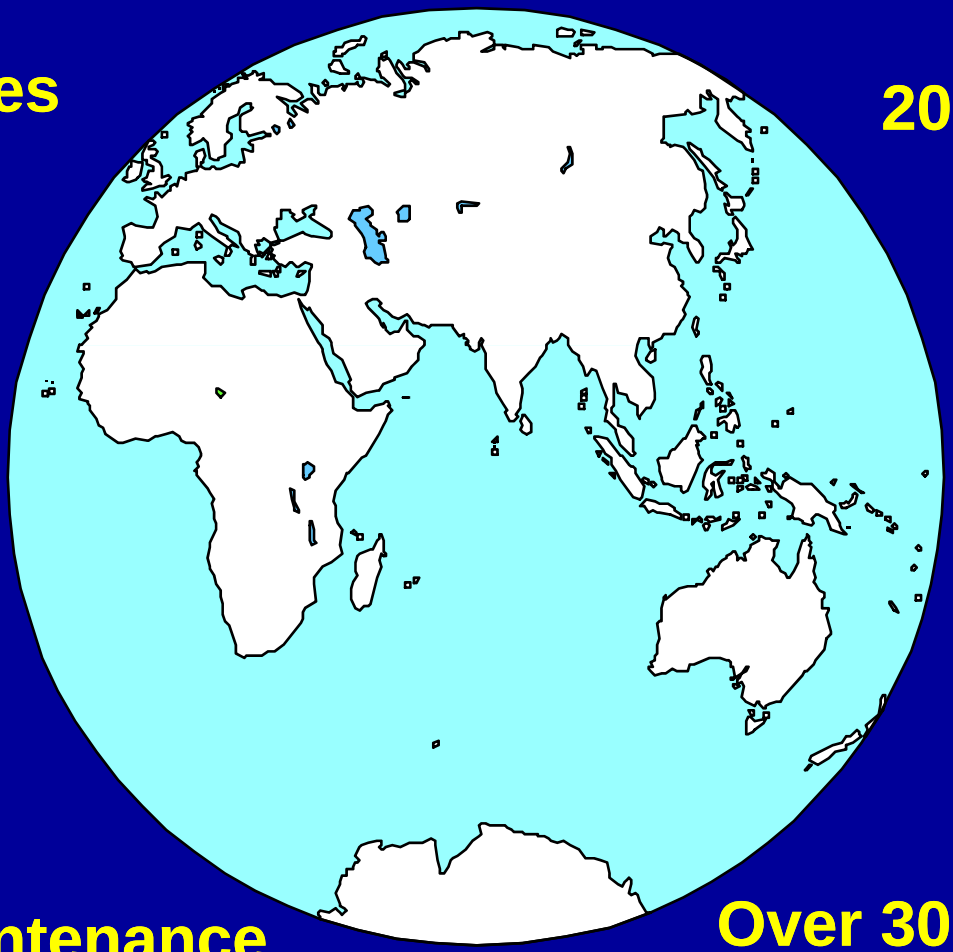
Director of Technical Programs

The Aviation System Is Complex

~800 airlines

200 languages

1,350+ major airports



200 countries

150,000+ flight crew

240,000+ maintenance personnel

Over 30,000 airplanes

Aviation Safety: Some Perspective

Worldwide:

- An airplane is landing approximately every two seconds somewhere in the world
- More than 3 million people fly each day
- In 2011, Over 1.6 billion people flew on over 29 million flights

Safety Responsibilities Are Shared

Safe Airplane + Safe Operation + Safe Infrastructure = Safe Air Travel

Manufacturers

- Safe airplane design
- Safety-enhancing technology development
- Flight and maintenance operations, recommendations, documents, training, and support
- Maintenance planning
- Safety-related analysis
- Safety initiatives

Operators

- Operations policy and procedures
- Airplane/pilot publications
- Approved maintenance program
- Maintenance, policy, and procedures
- Maintenance publications
- Safety program
- Training

Governments

- Aviation law
- Operations specification
- Rules and regulations
- Inspectors policy, procedures, and training
- Airline policy and procedures requirements
- Safety, health, environmental law, and regulations
- Navigation facilities/operations
- Airport facilities
- Departure en route, arrival, approach policy, and procedures
- Air traffic control services
- Safety-related analysis

Regional Perspective
Accident Rates Vary by Region of the World

Western-built transport hull loss accidents, by airline domicile, 2001 through 2010

Possible Reasons for Regional Accident Rate Differences

- Infrastructure
  - Air traffic control
  - Navigation aids
  - Airport equipment
  - Weather services
- Airline operations
  - Procedures
  - Training
  - Maintenance
  - Dispatch
- Regulatory oversight
  - Aviation law
  - Regulation
  - Personnel qualifications
  - Resource constraints

The Fleet - 2011

Type	Western Built	Eastern Built	Total
Turbojets	20,901	1,244	22,145
Turboprops	4,852	1,294	6,146
Business Jets			17,165

Source: Ascend

Major Accidents in 2010
Commercial Jets

Date	Operator	Aircraft	Location	Phase	Fatal
2 January	CAA	B-727	Kinshasa, DRC	Landing	0
24 January	Taban Air	TU-154	Mashhad, Iran	Landing	0
25 January	Ethiopian Airlines	B-737	Beirut, Lebanon	Climb	90
22 March	Avistar-TU	TU-204	Moscow, Russia	Approach	0
13 April	Merpati Airlines	B-737	Rendani, Indonesia	Landing	0
13 April	Aerounion	A-300	Monterrey, Mexico	Approach	5
5 May	Satena	EMB-145	Mitu, Colombia	Landing	0
12 May	Afriqiyah Airways	A-330	Tripoli, Libya	Approach	103
22 May	Air India Express	B-737	Mangalore, India	Landing	158
27 July	Lufthansa	MD-11F	Riyad, Saudi Arabia	Landing	0
28 July	Airblue	A-321	Islamabad, Pakistan	Approach	152
28 July	Mauritania Airways	B-737	Conakry, Guinea	Landing	0
16 August	Aires	B-737	San Andres, Colombia	Landing	2
24 August	Henan Airlines	EMB-190	Yichan, China	Approach	42
25 August	Passaredo Linhas Airways	EMB-145	Vitoria Conquista, Brazil	Approach	0
3 September	UPS	B-747	Dubai, UAE	Approach	2
24 September	Windjet	A-319	Palermo, Italy	Landing	0
28 November	Sun Way	IL-76	Karachi, Pakistan	Climb	8
4 December	Dagestan Airlines	TU-154	Moscow, Russia	Climb	2

Major Accidents
Commercial Jets
1 January 2011 to 31 December 2011

CFIT
LOC
Excursion

Date	Operator	Aircraft	Location	Phase	Fatal
1 Januray	Kolavia	TU-154	Surgut, Russia	Taxi	3
9 January	Iran Air	B-727	Orumiyeh, Iran	Landing	78
5 March	VASO	AN-148	Garbuzovo, Russia	Enroute	6
4 April	Gegorian Airways (UN)	CRJ-100	Kinshasa, DRC	Approach	32
18 May	Omega Air Refueling	B-707	Point Mugu, CA, USA	Takeoff	0
20 June	RusAir	TU-134	Petrozavodsk, Russia	Landing	45
6 July	Silk Way Airlines	IL - 76	Bagram, Afghanistan	Approach	9
8 July	Hewa Bora Airways	B-727	Kisangani, DRC	Landing	83
28 July	Asiana Airlines	B-747F	Jeju, South Korea	Enroute	2
30 July	Caribbean Airlines	B-737	Georgetown, Guyana	Landing	0
20 August	First Air	B-737	Resolute Bay, Canada	Approach	12
7 Sept	YAK Service	YAK-42	Yaroslavl, Russia	Takeoff	44
16 Sept	TAME	EMB-190	Quito, Ecuador	Landing	0
28 Dec	Kyrgyzstan	TU-134	Osh, Kyrgyzstan	Landing	0

Source: Ascend

Major Accidents
Commercial Jets
1 January 2012 to 21 May 2012

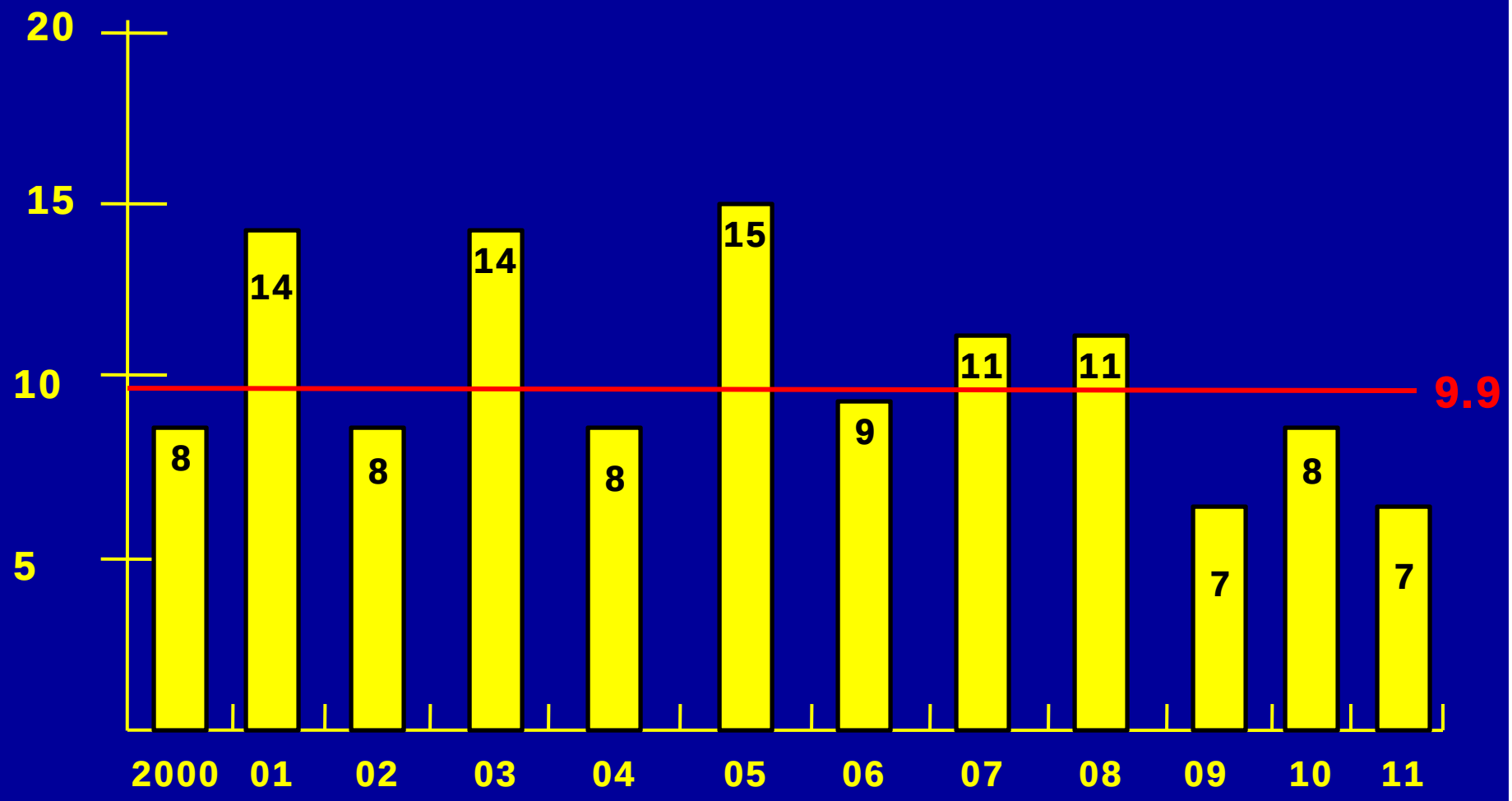
Date	Operator	Aircraft	Location	Phase	Fatal
20 April	Bhoja Airlines	B-737	Islamabad, Pakistan	Approach	127
9 April	Sukhoi	SU-95	Indonesia	Descent	44

Major Accidents
Business Jets
1 January 2011 to 31 December 2011

Date	Operator	Aircraft	Location	Phase	Fatal
6 January	Priester Aviation	Lear -35	Springfield, IL, USA	Landing	0
4 February	Sky Lounge	Hawker 900	Sulaymaniyah, Iraq	Climb	7
18 February	Escuela de Aviacion	Lear 24	Villasana, Mexico	Landing	2
28 March	Hong Fei General	Citation II	Missing - China	Enroute	3
5 May	Jorda LLC	HS-125	Loreto Bay, Mexico	Approach	0
25 May	Jet Suite Air	EMB Phenom	Sedona, AZ, USA	Landing	0
29 November	Wings over Africa	Gulfstream II	Huambo, Angola	Takeoff	0

Source: Ascend

Business Jet Major Accidents
2000 through 2011



Major Accidents

Commercial Turboprops (> 14 seats)

1 January 2011 to 31 December (page 1)

CFIT

Date	Operator	Aircraft	Location	Phase	Fatal
10 February	Flightline	Metro III	Cork, Ireland	Landing	6
12 February	Sabang Air Charter	CASA 212	Bintan, Indonesia	Enroute	5
14 February	African Air Services	LET - 410	Mont Biega, DRC	Enroute	2
14 February	Central American Airways	LET - 410	Cerro del Hula, Honduras	Enroute	14
4 March	Air Iceland	DHC-8	Godthab, Greenland	Landing	0
8 March	Desert Sand Leasing	DHC-6	Clayton County, GA, USA	Takeoff	2
21 March	Trans Air Congo	AN-12	Pointe Noire, Congo	Landing	9
1 April	Fugro Aviation Canada	CASA-212	Saskatoon, Canada	Apporach	1
7 May	Merpadi Nusantara	MA-60	Kaimana, Indonesia	Approach	25
18 May	SOL Lineas Areas	SAAB-340	Prahuaniyeu, Argentina	Enroute	22
6 June	Solenta Aviation	AN-26	Libreville, Gabon	Approach	0
11 July	Angara Airlines	AN-24	Strezheov, Russia	Approach	6
11 July	Trans Maldivian	DHC-6	Male, Maldives	Landing	)
13 July	Noar	LET - 410	Recife, Brazil	Approach	16
8 August	IrAero	AN-24	Blagoveshchensk, Russia	Landing	0
9 August	Avis Amur	AN-12	Omsukchan, Russia	Enroute	11

Source: Ascend

Major Accidents

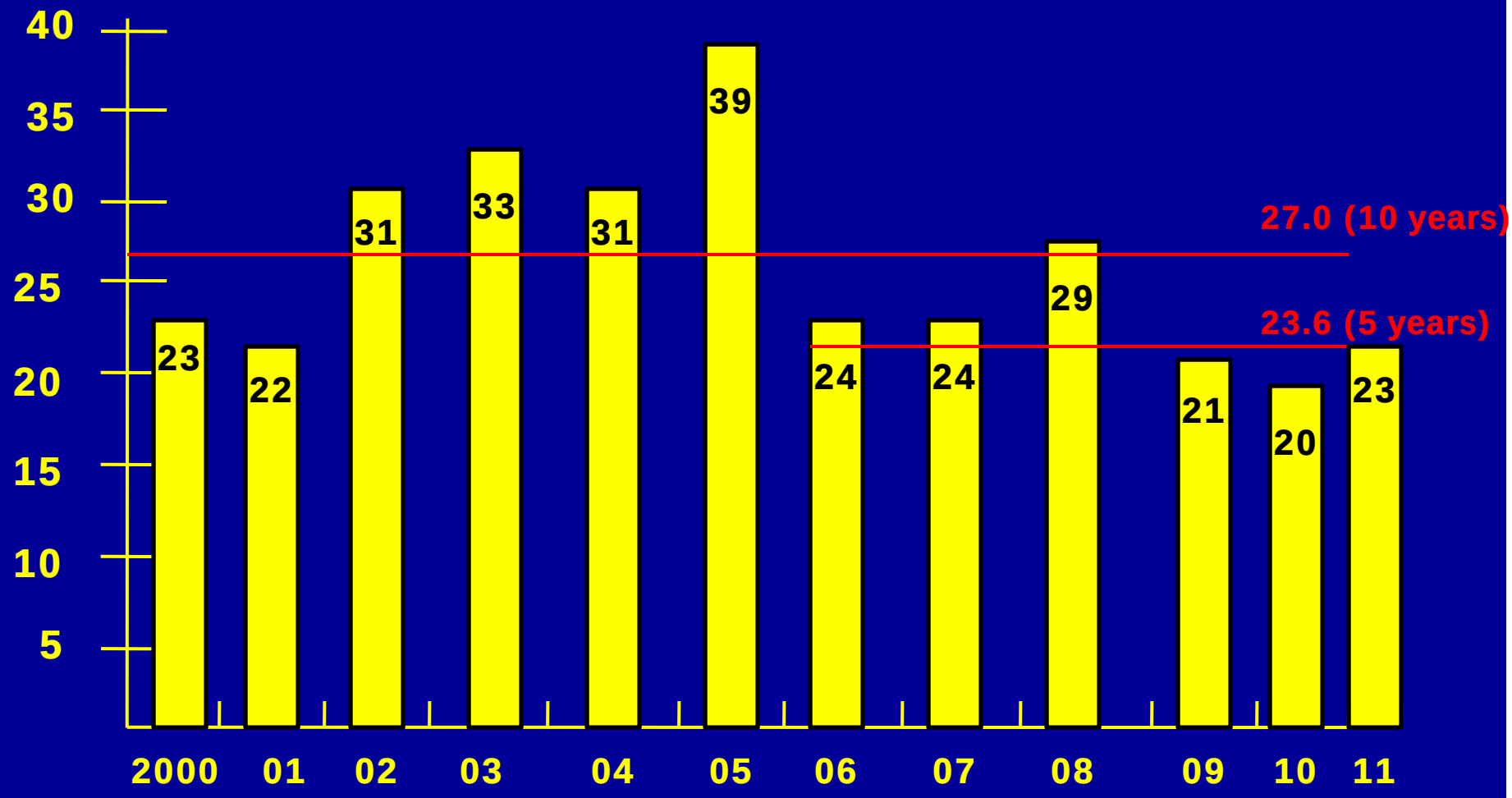
Commercial Turboprops (> 14 seats)

1 January 2011 to 31 December 2011 (cont.)

Date	Operator	Aircraft	Location	Phase	Fatal
6 September	Aerocon	Metro III	Trinidad, Bolivia	Approach	8
20 September	Salsa d'Haiti	Beech 99	Milot, Haiti	Enroute	3
22 September	Artic Sunwest Charters	DHC-6	Yellowknife, Canada	Approach	2
25 September	Buddah Air	Beech 1900	Kathmandu, Nepal	Approach	19
29 September	Nusantara Buana Air	CASA 212	Medan, Indonesia	Enroute	18
12 October	National Regional Transport	EMB-120	Port Gentil, Gabon	Landing	0
13 October	Airlines PNG	DHC-8	Madang, PNG	Approach	28

Source: Ascend

Commercial Turboprop Major Accidents
2000 through 2011



Major Accidents

Commercial Turboprops (> 14 seats)

1 January 2012 to 21 May 2012

Date	Operator	Aircraft	Location	Phase	Fatal
30 January	TRACEP	AN-28	Namoya, DRC	Enroute	3
2 April	Utair	ATR-72	Tyuman, Russia	Takeoff	31
9 April	Air Tanzania	DHC-8	Kigoma, Tanzania	Takeoff	0
28 April	Jubba Airways	AN-24	Galkayo, Somolia	Landing	0
14 May	Agni Air	DO -228	Jomsom, Nepal	Approach	15

Source: Ascend

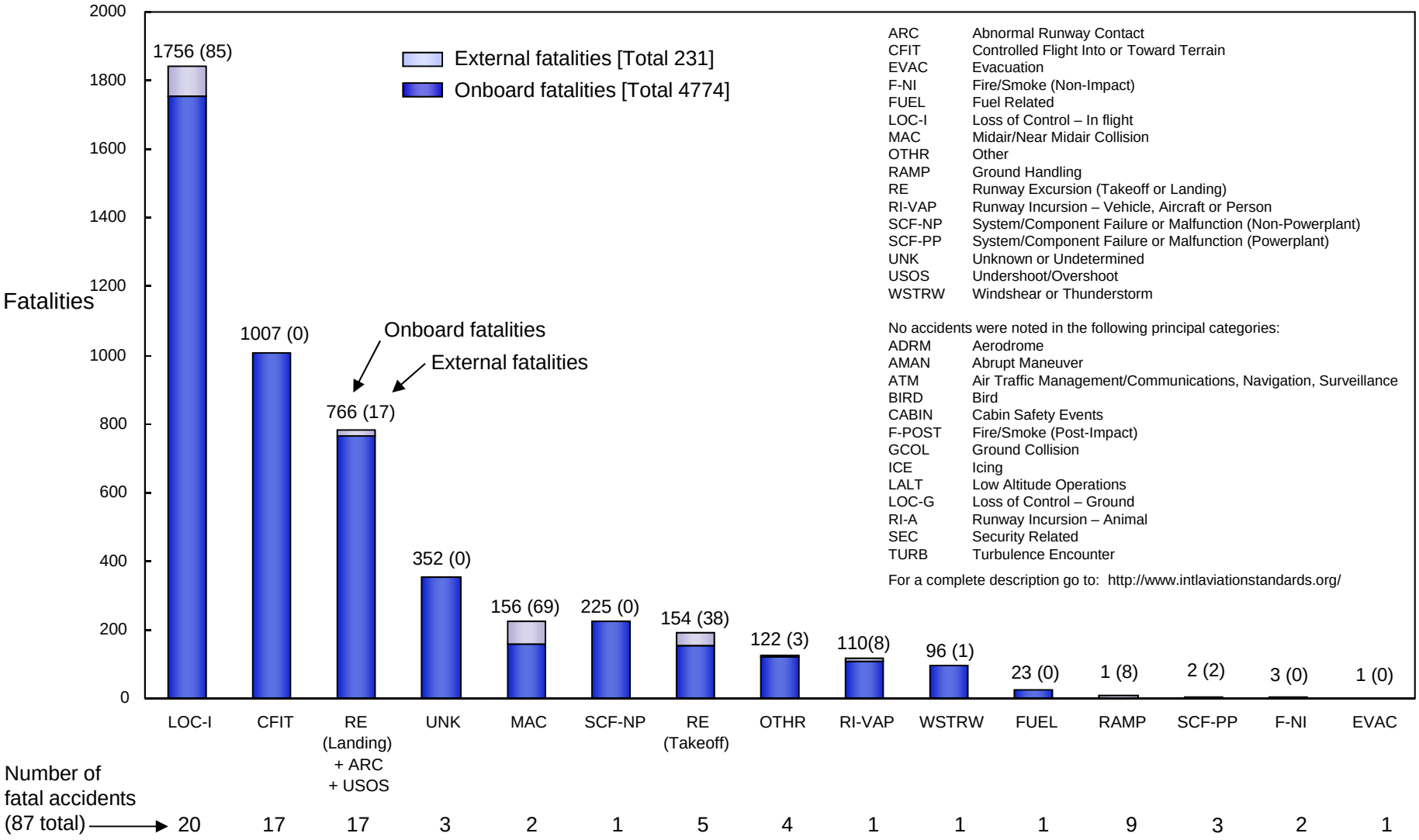
Flight Safety Foundation Top Safety Concerns

- **CFIT**
- **Approach and landing**
- **Loss of control**
- **Human Factors**

FLIGHT SAFETY FOUNDATION

Fatalities by CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories

Fatal Accidents – Worldwide Commercial Jet Fleet – 2001 Through 2010



ARC	Abnormal Runway Contact
CFIT	Controlled Flight Into or Toward Terrain
EVAC	Evacuation
F-NI	Fire/Smoke (Non-Impact)
FUEL	Fuel Related
LOC-I	Loss of Control – In flight
MAC	Midair/Near Midair Collision
OTHR	Other
RAMP	Ground Handling
RE	Runway Excursion (Takeoff or Landing)
RI-VAP	Runway Incursion – Vehicle, Aircraft or Person
SCF-NP	System/Component Failure or Malfunction (Non-Powerplant)
SCF-PP	System/Component Failure or Malfunction (Powerplant)
UNK	Unknown or Undetermined
USOS	Undershoot/Overshoot
WSTRW	Windshear or Thunderstorm

No accidents were noted in the following principal categories:

ADRM	Aerodrome
AMAN	Abrupt Maneuver
ATM	Air Traffic Management/Communications, Navigation, Surveillance
BIRD	Bird
CABIN	Cabin Safety Events
F-POST	Fire/Smoke (Post-Impact)
GCOL	Ground Collision
ICE	Icing
LALT	Low Altitude Operations
LOC-G	Loss of Control – Ground
RI-A	Runway Incursion – Animal
SEC	Security Related
TURB	Turbulence Encounter

For a complete description go to: http://www.intlaviationstandards.org/

Note: Principal categories as assigned by CAST.

Approach and Landing Major Accidents Commercial Jets

1 January 2011 through 31 December 2011

Date	Operator	Aircraft	Location	Phase	Fatal
9 January	Iran Air	B-727	Orumiyeh, Iran	Landing	78
4 April	Gegorian Airways (UN)	CRJ-100	Kinshasa, DRC	Approach	32
21 June	RusAir	TU-134	Petrozavodsk, Russia	Landing	45
6 July	Silk Way Airlines	IL - 76	Bagram, Afghanistan	Approach	9
8 July	Hewa Bora Airways	B-727	Kisangani, DRC	Landing	74
30 July	Caribbean Airlines	B-737	Georgetown, Guyana	Landing	0
20 August	First Air	B-737	Resolute Bay, Canada	Approach	12
16 Sept	TAME	EMB-190	Quito, Ecuador	Landing	0
28 Dec	Kyrgyzstan	TU-134	Osh, Kyrgyzstan	Landing	0

Source: Ascend and Aviation Safety Network

Controlled Flight into Terrain Major Accidents

Commercial Jets

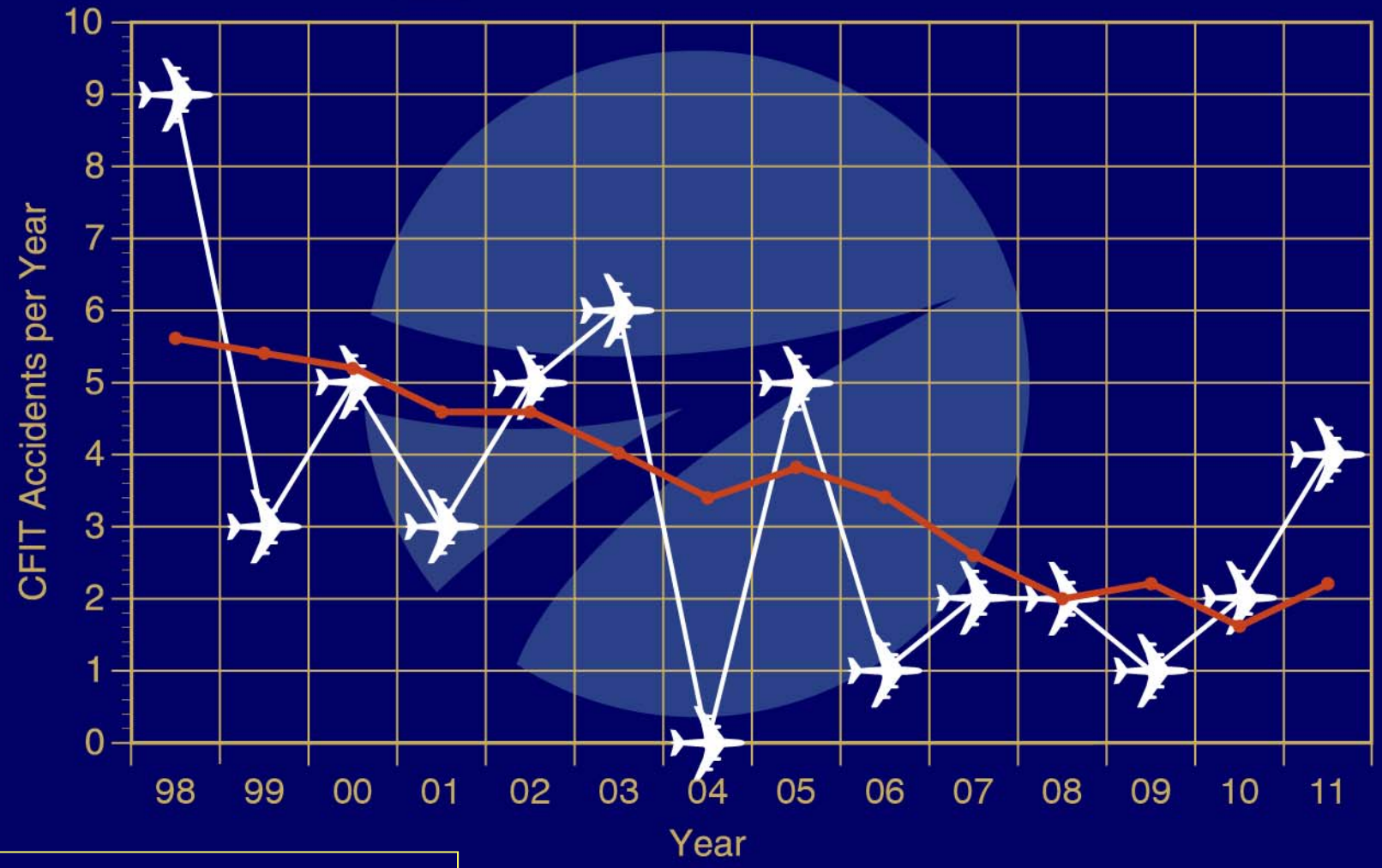
1 January 2011 though 31 December 2011

Date	Operator	Aircraft	Location	Phase	Fatal
21 June	RusAir	TU-134	Petrozavodsk, Russia	Landing	45
6 July	Silk Way Airlines	IL - 76	Bagram, Afghanistan	Approach	9
8 July	Hewa Bora Airways	B-727	Kisangani, DRC	Landing	74
20 August	First Air	B-737	Resolute Bay, Canada	Approach	12

Sources: Honeywell (Don Bateman), Ascend

CFIT

All Commercial Turbojets

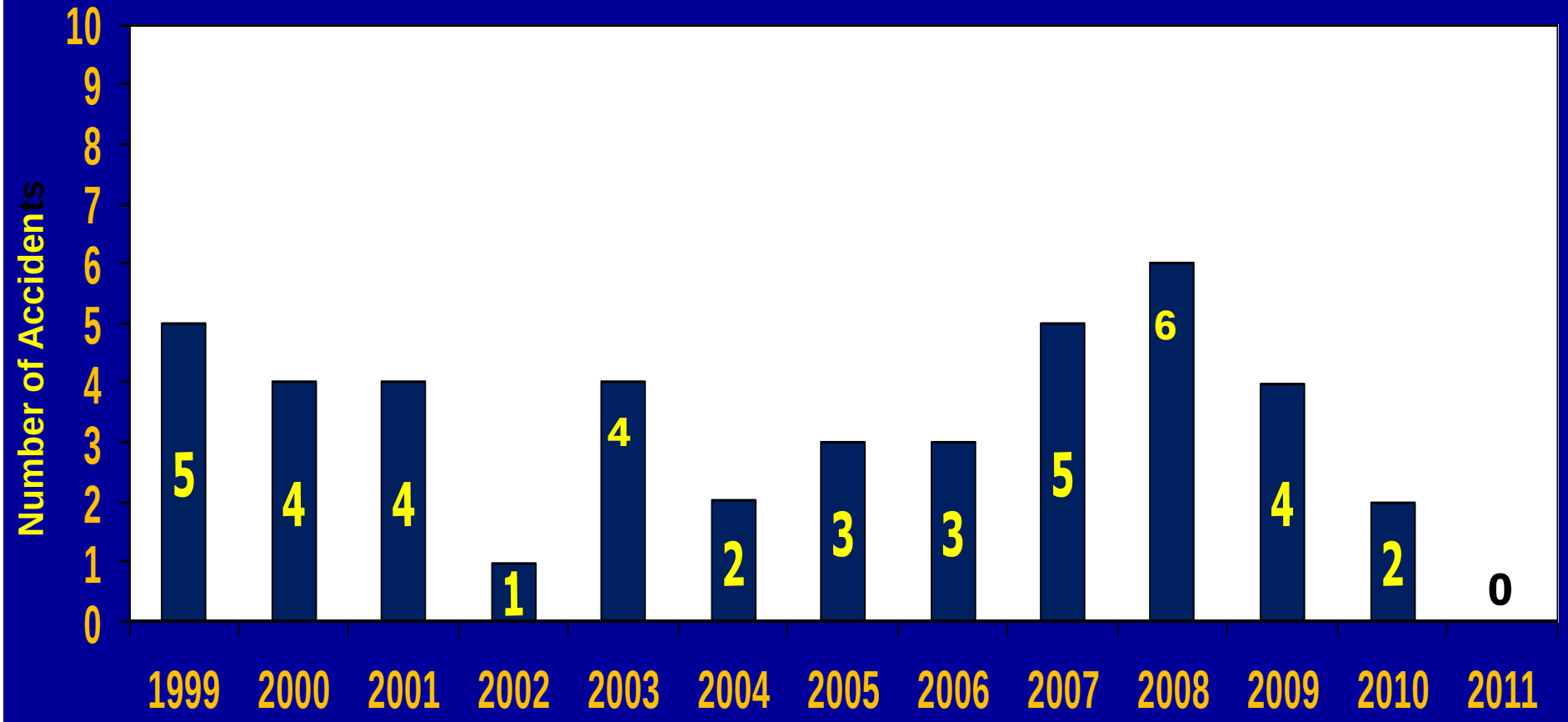


Loss of Control Major Accidents
Commercial Jets
1 January 2011 through 31 December 2011

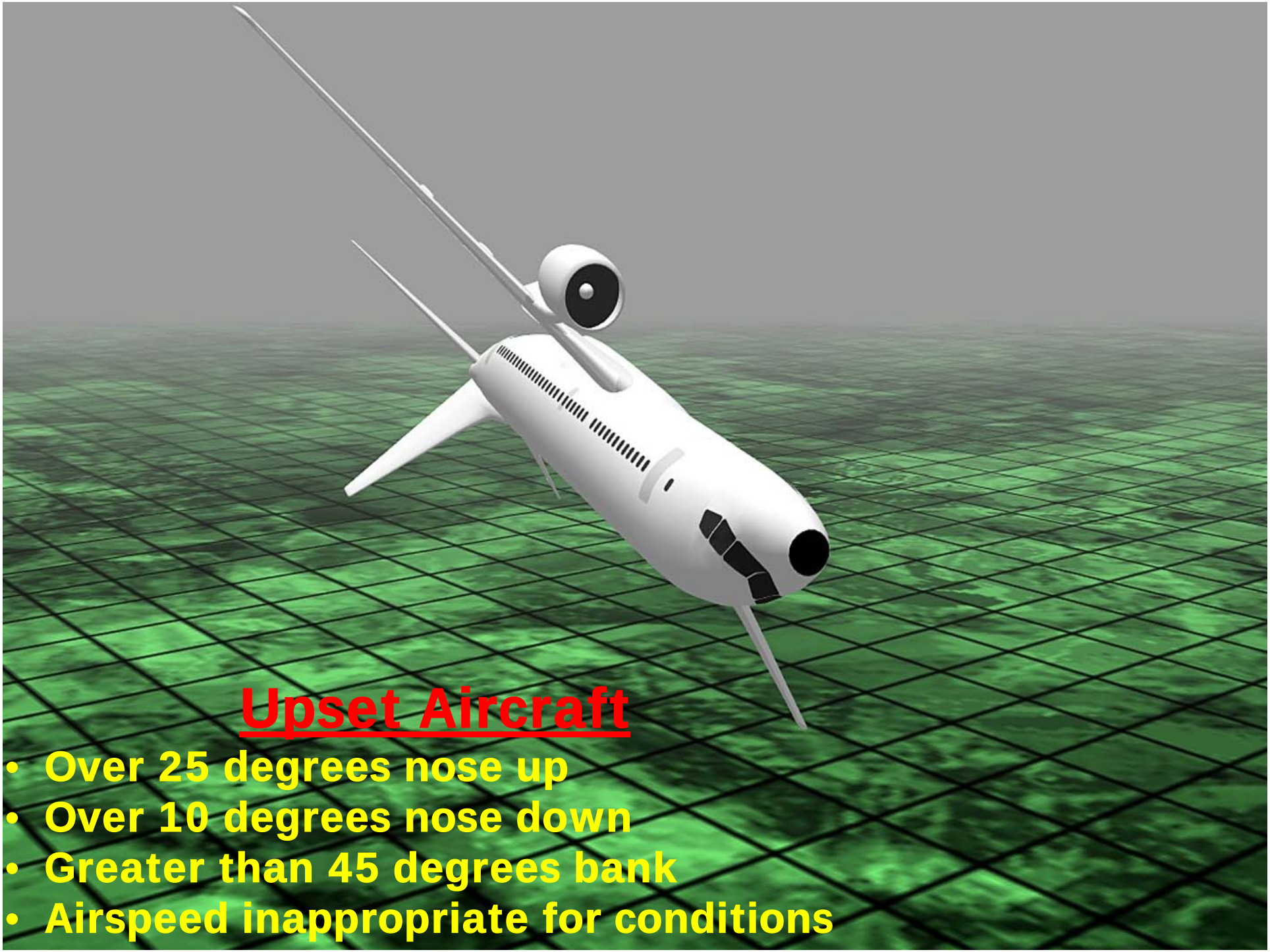
Date	Operator	Aircraft	Location	Phase	Fatal
No Loss of Control accidents in 2011					

Source: Ascend, Boeing

Loss of Control Major Accidents
Commercial Jets
1999 through 2011



Source: Ascend


Upset Aircraft
• Over 25 degrees nose up
• Over 10 degrees nose down
• Greater than 45 degrees bank
• Airspeed inappropriate for conditions

Some Upset Aircraft Observations

- No good visual references
  * IMC
  * Night
  * Over Water or lightless/featureless land

- Auto-Pilot involved (on or off ?)

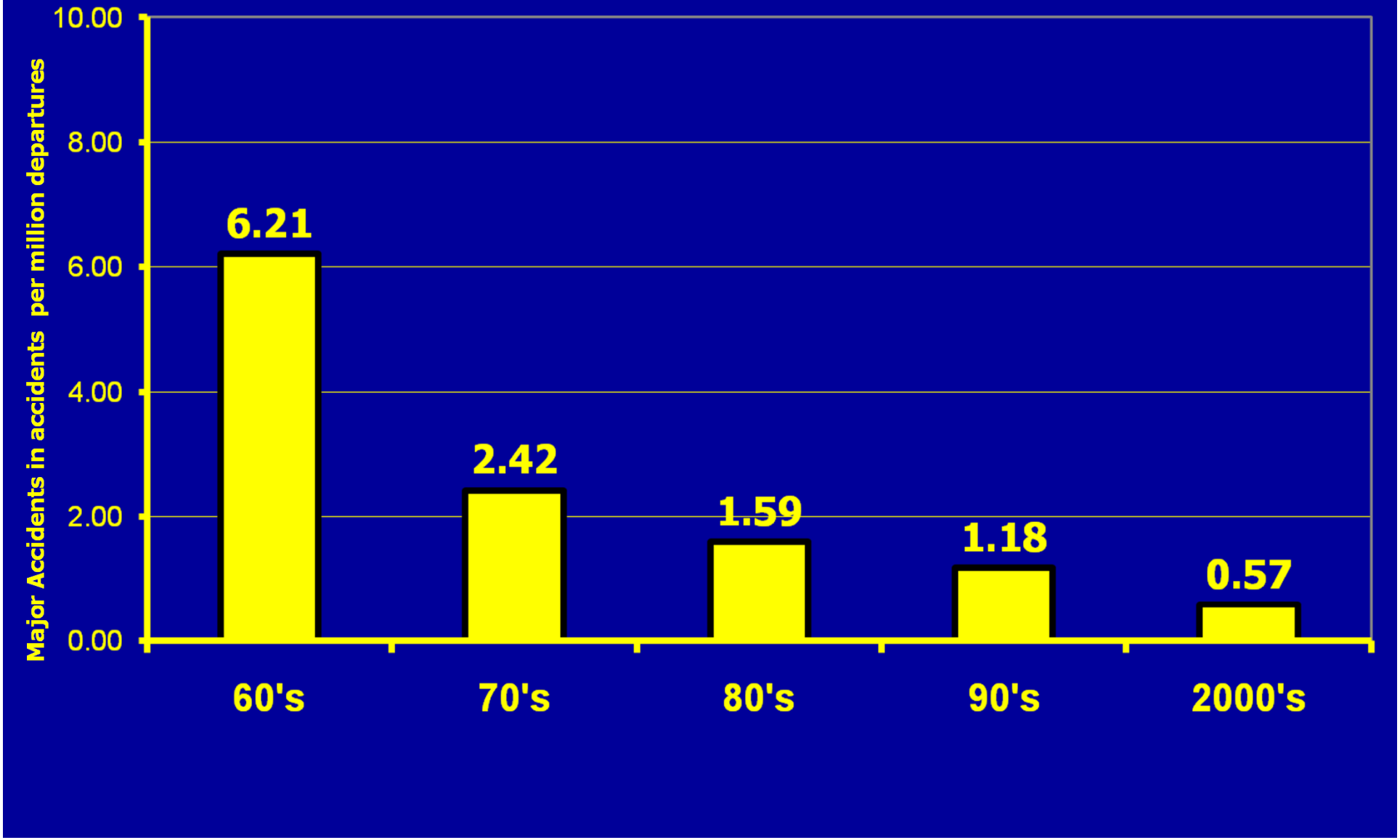
- Initial correction often in wrong direction

- The pilot not flying had better SA – but waited too long to correct the situation


Photo by Craig Murray
http://www.Airliners.net

Major Accidents by Decade

Worldwide Commercial Jets
1960 to 2009



Two Decades of Improvement

1990 – 1999 Major Accident Rate: 1.18

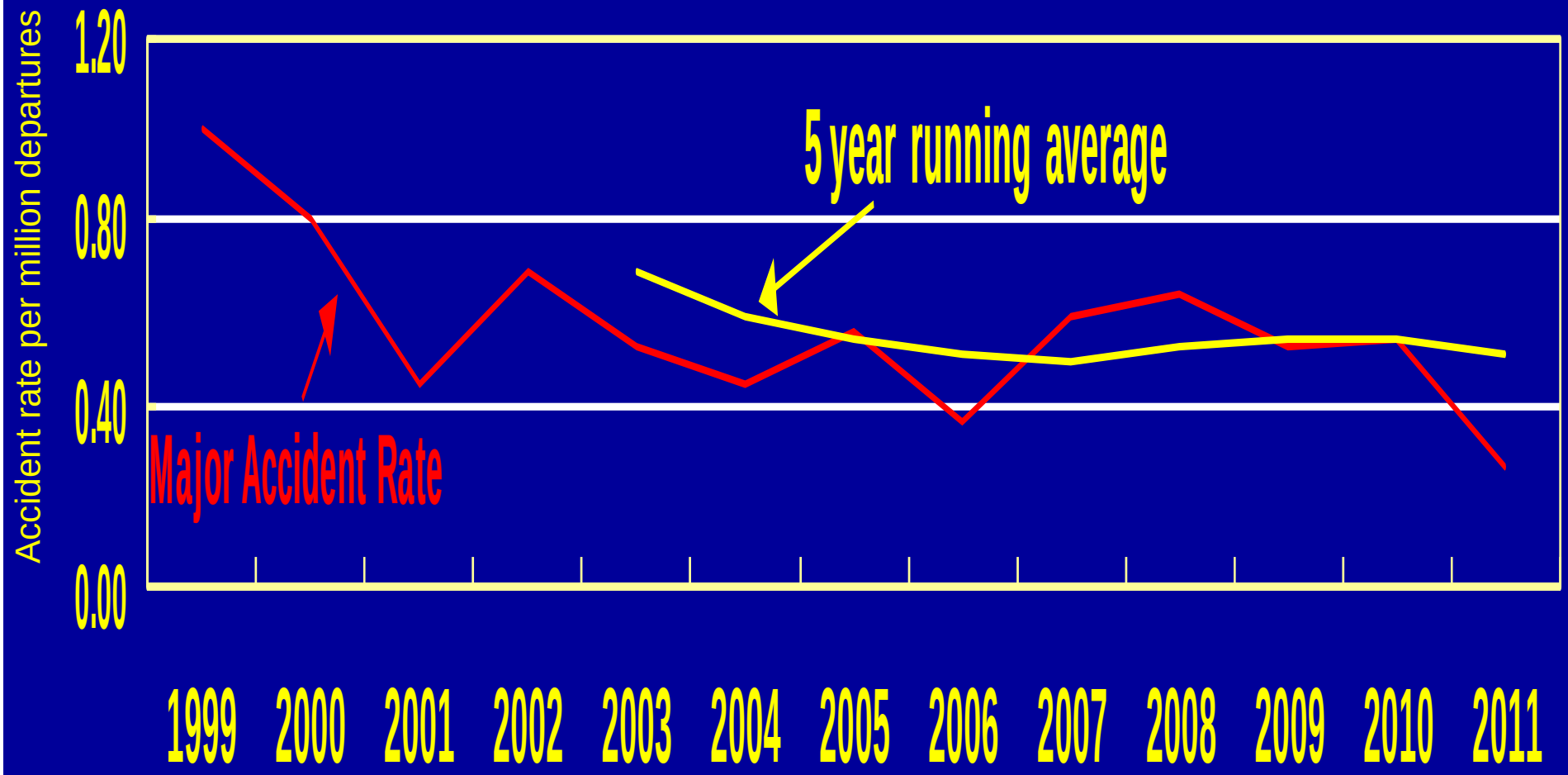
- 1990 – 1994 Major Accident Rate: 1.32
- 1995 – 1999 Major Accident Rate: 1.06

2000 – 2009 Major Accident Rate: .57

- 2000 – 2004 Major Accident Rate: .58
- 2005 – 2009 Major Accident Rate: .55

Major Accident Rate

Western-Built Commercial Jets*
1999 – 2011



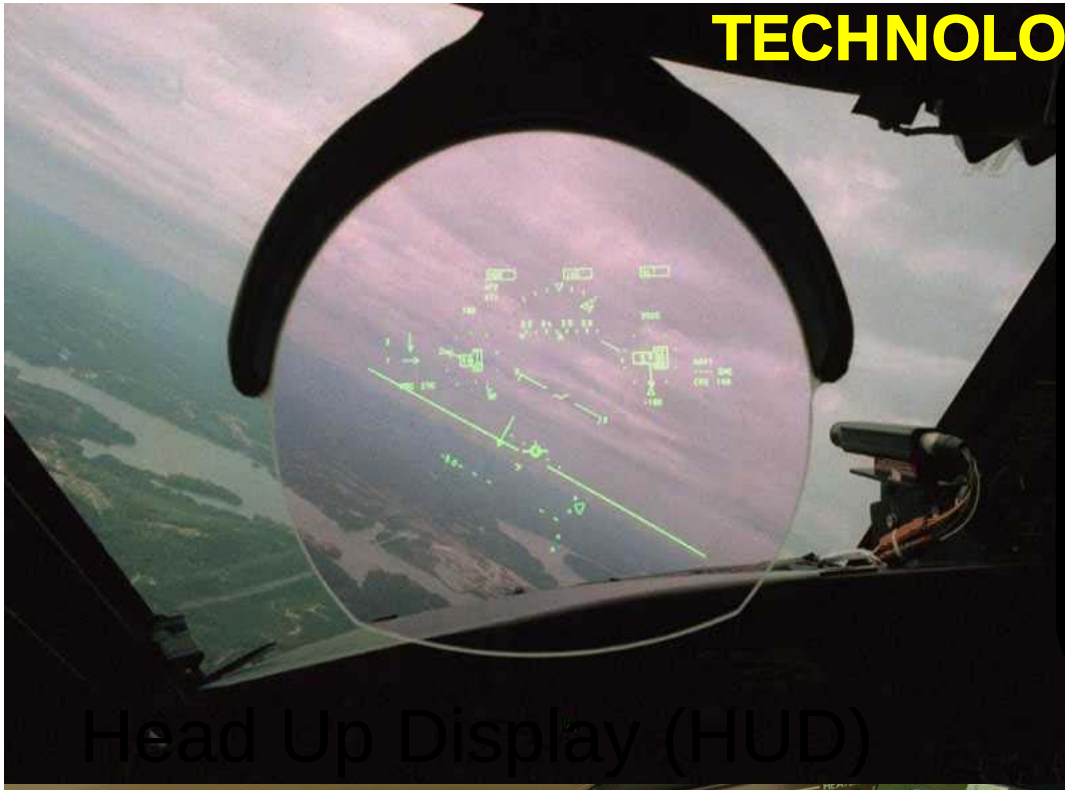
Source: Ascend

Safety Efforts are Data Driven

- Accident Data
- Incident Data
- Flight Data Monitoring
- Non-Punitive Reporting
- Line Observed Safety Audit
- Data Sharing

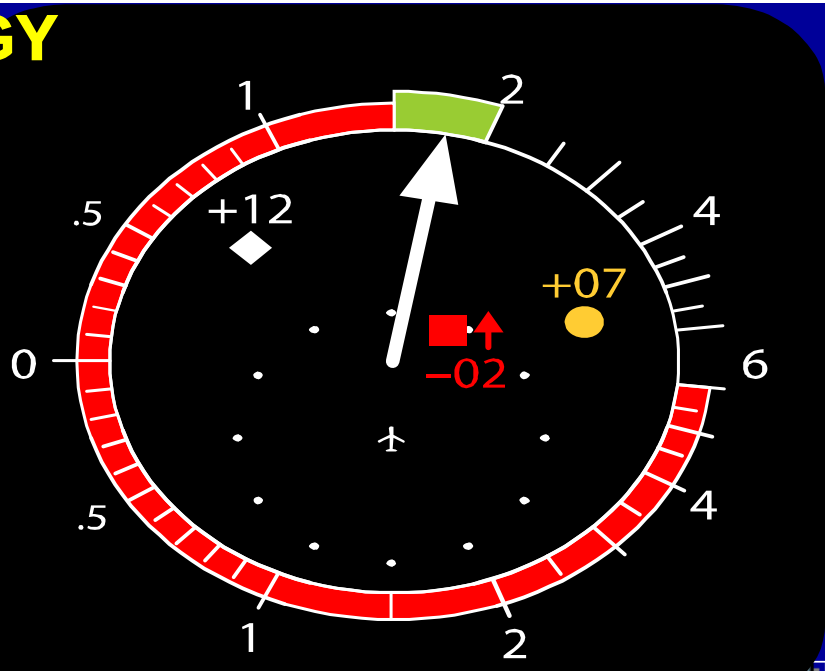
Africa 2003

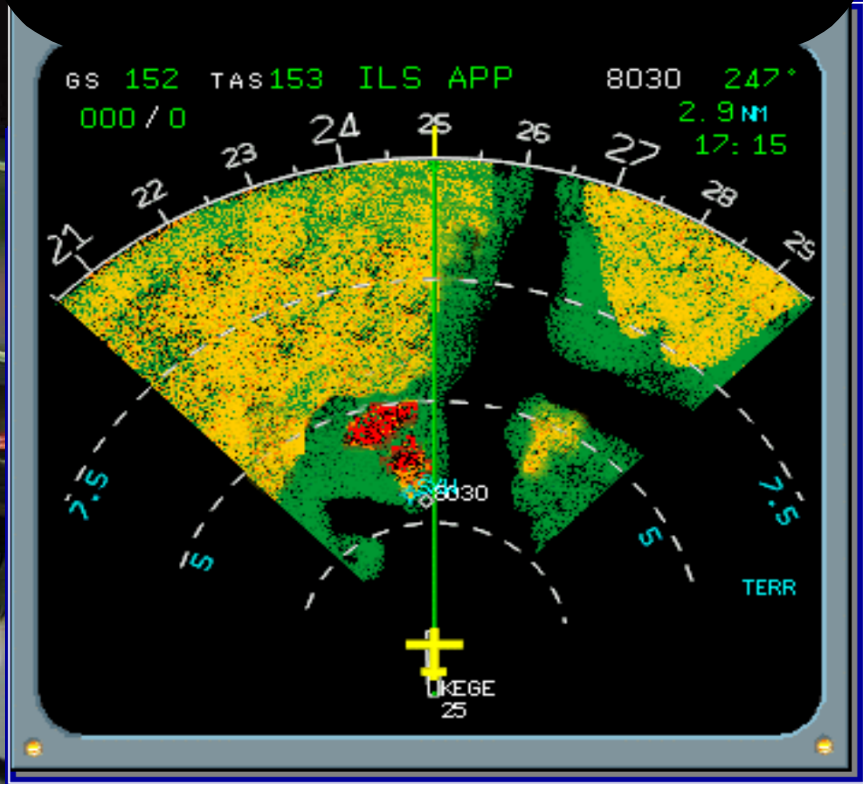
TECHNOLOGY



Head Up Display (HUD)

EFB





Government – Industry Cooperative Safety Efforts

- Commercial Aviation Safety Team (CAST)
- European Safety Strategy Initiative (ESSI)
- Regional Aviation Safety Groups (RASG)
- ICAO Cooperative Safety Efforts (COSCAP)

Challenges

- **Automation**
  - **Automation Knowldege / Interaction**
  - **Automation "Failures" ?**
    - **AA Cali Accident**
    - **THY Amsterdam Accident**
  - **Automation dilemma (more or less ?)**
    - **RVSM**
    - **RNP**

Challenges

- **Professionalism**
  - **Profession - What you do**
  - **Professionalism – How you do it**
  - **" You don't have to fly for a living to be an aviation professional" -** *Earl Weener, NTSB*
  - **" You don't have to be getting a paycheck to be a professional pilot" -** *Randy Babbit, FAA*
  - **" Being a professional has nothing to do with what you job is, and everything to do with how you do your job" -** *Jim Burin, FSF*

Safety Challenges

The alleviation of human error, whether design or intrinsically human, continues to be the most important problem facing aerospace safety

- Jerry Lederer
1952

Challenges

Approach and Landing accident Reduction

- **Excursions**
  - **Success in raising awareness**

Runway Safety Accident Data

1995 – 2010

	Number	(average)	
Incursions:	11	(.7/year)	1.0/year
Confusion:	6	(.3/year)	
Excursions:	650		40.6/Year

Challenges

Approach and Landing accident Reduction

- **Excursions**
  - Success in raising awareness
- **Go-arounds**
  - Decision
    - * LOSA: 4% unstable – 3% of them go-around
    - * Airbus: 3.5% unstable – 1.4% of the go-around

9 out of 10 unstable approaches continue to land

Safe Landing Guidelines

Safe Landing Guidelines

Note: The risk of an approach and landing accident is increased if any of the following guidelines is not met. If more than one guideline is not met, the overall risk is greatly increased

1. **Fly a stabilized approach**

2. **Height at threshold crossing is 50 feet**

3. **Speed at threshold crossing is not more than Vref + 10 knots indicated airspeed and not less than Vref**

4. **Tailwind is no more than 10 knots for a non-contaminated runway, no more than 0 knots for a contaminated runway**

Safe Landing Guidelines

5. Touchdown on runway centerline at the touchdown aim point

6. After touchdown, promptly transition to desired deceleration configuration:
   - Brakes
   - Spoilers/speed brakes
   - Thrust reversers

   Note: Once thrust reversers have been activated, a go-around is no longer an option

7. Speed is less than 80 knots with 2,000 feet of runway remaining

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(Note: Once thrust reversers have been activated, a go-around is no longer an option)

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Aviation Safety 2011

- Best year ever for Western built commercial jets
  - * Eastern built jets had second consecutive bad year
- Average year for commercial turboprops
  - * Eastern built turboprops had a bad year
- Better than average year for business jets
- CFIT continues to be a major killer – and it is happening to aircraft without TAWS installed
- There are many challenges out there
  - * Automation
  - * Professionalism
- Safe Landing Guidelines provide information for reducing landing risk

FSF Goal:
Make Aviation Safer by reducing the Risk of an Accident