

# *World Airline Safety: Darker Days Ahead?*



*Arnold Barnett MIT*

# *Primary NEXTOR Safety Areas:*

- *Air Passenger Mortality Risk*
- *Runway Collision Hazards*
- *Midair Collision Hazards*
- *Positive Passenger Bag Match*

*How safe is it to fly?*

*Well, how should we  
**measure** aviation safety?*

*Given that a passenger's greatest fear is of being killed in a plane crash, there is **a natural interest** in statistics about the likelihood of that outcome.*

*A widely-used statistic:*

*Fatal accidents per  
billion passenger miles*

# *But:*

- *The generic term “fatal accident” blurs the distinction between a crash that kills one passenger out of 300 and another that kills 300 out of 300.*
- *Measuring activity by “passenger miles flown” misses the point that most accidents occur on takeoff/climb or descent/landing.*

What about *hull losses*  
*per 100,000 departures?*

*(This is a popular one.)*

# Consider two hull losses in 2005:

- *Air France, Airbus 340, Toronto*

*Passengers on board:*            **291**

*Passengers killed:*            **0**

- *Helios Airlines, Boeing 737, near Athens*

*Passengers on Board:*            **115**

*Passengers Killed:*            **115**

***No difference?***



*Why not use the simple  
ratio of “passengers killed  
to passengers carried?”*

*(There **is** a reason.)*

*Measure of Safety Performance  
Over a Past Period:*

*Death Risk Per  
Randomly Chosen Flight*

# Question:

*If a person chooses a flight at random from among those of interest (e.g. UK domestic jet flights over the period 1990-99), what is the probability that she will not survive it?*

*This **death risk per flight** statistic has conceptual advantages compared to the other statistics just discussed.*

# *What Conceptual Advantages?*

- *Ignores length and duration of flight, which are virtually unrelated to mortality risk*
- *Weights each crash by the **percentage** of passengers killed*
- *Easy to calculate and understand*

*Scheduled First-World Domestic Jet Services*

*Death Risk per Flight, 1990-99:*

*1 in 13 million*

*At a mortality risk of **1 in 13 million** per flight, a passenger who took one flight per day would on average travel for **36,000** years before dying in a plane crash.*

*But what about safety  
thus far in the new  
century, over 2000-2005?*

*(Funny you should ask.)*



***Accidental Death Risk Per Flight for  
Domestic Jet Services, 2000-2005***

---

*United States*                      **0** (!!)

*Rest of First World*                      **0** (!!)

***(More than 60 million flights performed)***

*But do these statistics  
reflect a **statistically  
significant improvement**  
compared to the 1990's?*

*Well...*

*There were **ten** fatal accidents on First World domestic jets over the period 1990-2005, **all of which** occurred over 1990-99.*

*The probability that such a lopsided split between 1990-99 and 2000-05 would arise by coincidence alone is about **1 in 500**.*

# *Accidental Death Risk per Flight on Various Types of Scheduled Passenger Jet Services, 1990-99 and 2000-05*

## *Death Risk per Flight:*

<u><i>Type of Service</i></u>	<u><i>1990-99</i></u>	<u><i>2000-05</i></u>
<i>First-World Domestic</i>	<i>1 in 13 million</i>	<i>Zero</i>
<i>First-World International</i>	<i>1 in 6 million</i>	<i>1 in 8 million</i>
<i>Between First-World and Developing World</i>	<i>1 in 1 million</i>	<i>1 in 1.5 million</i>
<i>Within Developing World</i>	<i>1 in 500,000</i>	<i>1 in 2 million</i>

*(A World of Improvement!)*

*Overall Death Risk per Jet Flight, 2000-05*

*First-World Carriers*

*1 in 13 million*

*Developing-World Carriers*

*1 in 1.5 million*

*Does this difference mean that, given a choice between flying a First World airline and a Developing World one, we should opt for the former?*

*Death Risk per Jet Flight **Between First World City and Developing World City** On Two Groups of Airlines, 2000-05*

*First-World Carrier* **1 in 1.5 million**

*Developing-World Carrier* **1 in 1.5 million**

*Thus, on the routes on which First and Developing World airlines compete, the difference in their safety records **withers away.***



*This outcome is consistent with a broader rule of thumb about scheduled jet passenger services:*

*When two jet carriers compete on a given route, very rarely is there a reason related to safety to prefer one to the other.*

*Of course:*

*We have not yet  
mentioned that  
Tuesday in September.*

# Role Reversal:

*Overall Death Risk per Scheduled US Domestic Jet Flight By Cause, for 1990-99 and 2000-05*

<u>Period</u>	<u>For Accidents</u>	<u>For Crime/Terrorism</u>	<u>Total</u>
<i>1990-99</i>	<i>1 in 11 million</i>	<i>0</i>	<i>1 in 11 million</i>
<i>2000-05</i>	<i>0</i>	<i>1 in 11million</i>	<i>1 in 11 million</i>

*Crime/Terrorism Was Also an  
Increasing Menace in the Developing World:*

*Death Risk per Third World Jet Flight, 2000-05*

*From Accidents*

*From Crime/Terrorism*

*Total*

*1 in 2 million*

*1 in 10 million*

***1 in 1.5 million***

*Wasn't 2005 considerably  
worse than the several years  
that preceded it?*

*Actually, no.*

# Annual Number of Full-Crash Equivalents

	<u>2000-04</u>	<u>2005</u>
<u>Accidents:</u>		
<i>First-World Domestic</i>	<u>0</u>	0
<i>First-World International</i>	0.38	0
<i>First ↔ Developing</i>	0.70	1.00
<i>Developing-World</i>	3.37	4.23
<u>Crime/Terrorism:</u>		
	1.40	0

*So, where are we?*