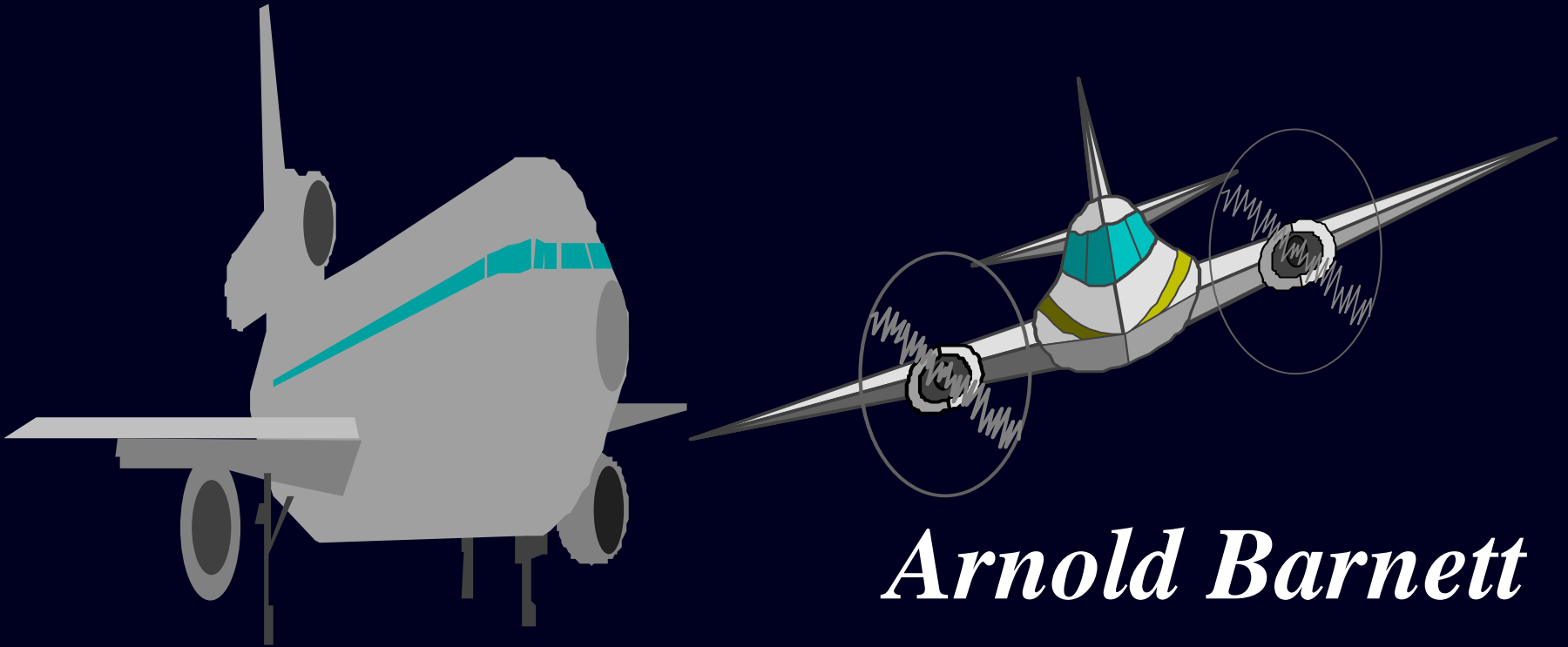# *Are You Afraid To Fly?*

Arnold Barnett
MIT

To put the question in a more neutral way:

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.*

But which statistics are the most informative?

We restrict our attention here to scheduled passenger jet flights.

"NTSB studies show that, from 1993 through 1996, scheduled US carriers averaged only 0.2 fatal accidents per 100,000 flight hours, less than half the fatal accidents rate for the four-year period a decade earlier.

--Wall Street Journal

Two problems with the statistic <u>fatal accidents per 100,000 flight hours:</u>

*The **numerator** and the **denominator!***

- *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 "flying hours" misses the point that most accidents occur on landing or takeoff.*

Among the 15 Accidental US Domestic Jet Crashes Over 1987-2006:

• **93%** *of them (all but one) were caused during takeoff/climb or descent/landing.*

• *The average (intended) sector length on ill-fated flights was* **626** *miles, as compared to an average of 750 miles for all domestic jet flights over 1987-2006.*

FAA's Primary Yardstick for System Safety:

Fatal Accidents per Million Domestic Departures

(This was the statistic that was supposed to drop by 80% between 1994-96 and 2005-07.)

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 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 he 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*

First-World Domestic Jet Services

Death Risk per Flight, 1990-99:

1 in 13 million

At this level of risk, a citizen is **2.5 times as likely to win the jackpot in the Mass Millions lottery** *as to perish on her next flight.*

(This comparison brought **scant comfort** *to nervous air travelers.)*

*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.*

Accidental Death Risk per Flight, First-World Jet Domestic Passenger Services, 1960-2006

Period	Death Risk per Flight
1960-69	1 in 1 million
1970-79	1 in 3 million
1980-89	1 in 4 million
1990-99	1 in 13 million
2000-06	1 in 70 million

*The **statistical significance** of this pattern of "continuous improvement" is beyond question, as is the **discontinuous jump** from the 1990's to 2000-06.*

Accidental Death Risk per Flight, Developing-World Jet Passenger Services, 1960-2005

Period	*Death Risk per Flight*
1960-69	*1 in 100,000*
1970-79	*1 in 200,000*
1980-89	*1 in 400,000*
1990-99	*1 in 500,000*
2000-06	*1 in 2 million*

Fatal Accidents on First-World Passenger Jets Are on the *Verge of Extinction*

But:
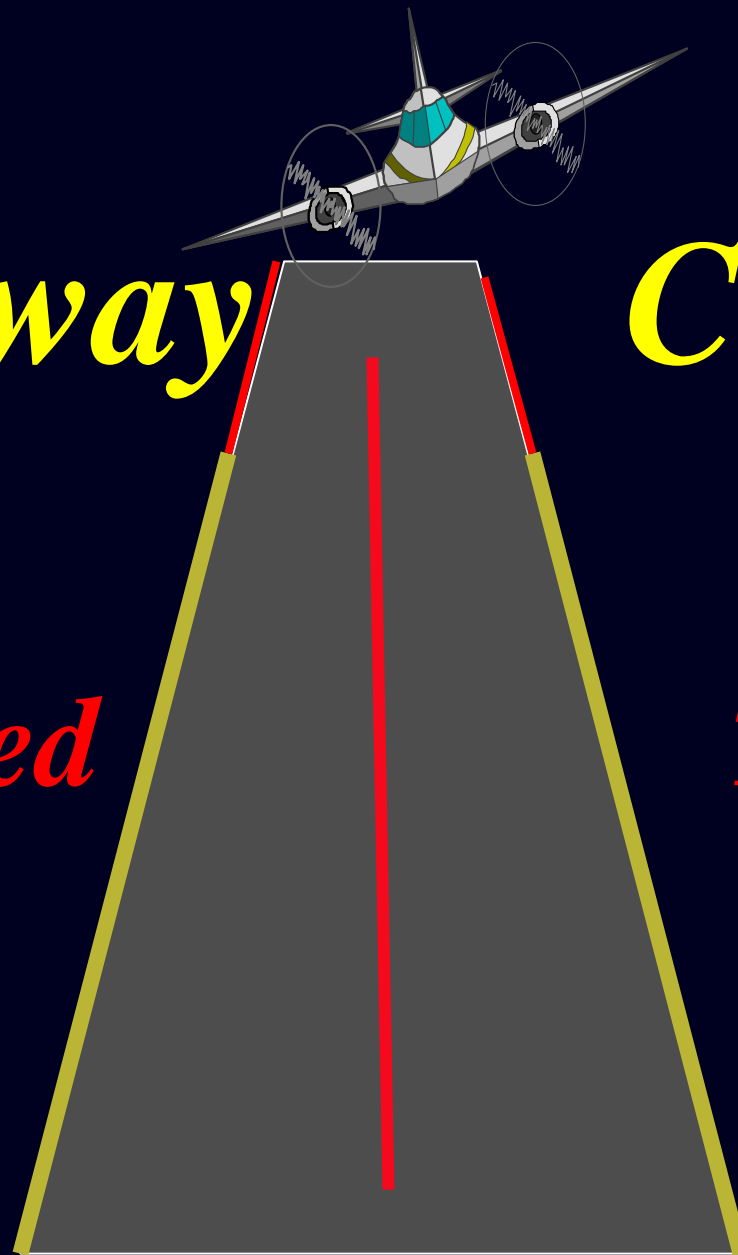
Many a near-extinct species has staged a massive comeback.

Runway Collisions:

Poised   To Return?

FAA asked the speaker to help investigate:

How might expected growth in US airport traffic affect the risk of fatal runway collisions?

*Both physical reasoning and data analysis **suggest strongly** that the risk of a runway collision varies with the **square of traffic levels.***

This quadratic effect contributed to the forecast that:

US runway collisions over the next two decades could cause **700-800** deaths and **200** serious injuries.

(Mid-range figure)

Changes in air traffic control in both Europe and the US could bring increased risk of midair collisions.

*But *potential* problems do not have to turn into actual ones.*

*Upset by the projections about runway collisions, FAA determined that **25 mid-sized airports** should receive new state-of-the-art ground radars.*

*It described this outcome as a **"joint FAA/MIT decision."***

Moreover, the revised geometry of direct routings could act to reduce the risk of mid-air collisions.

NOW

SOON
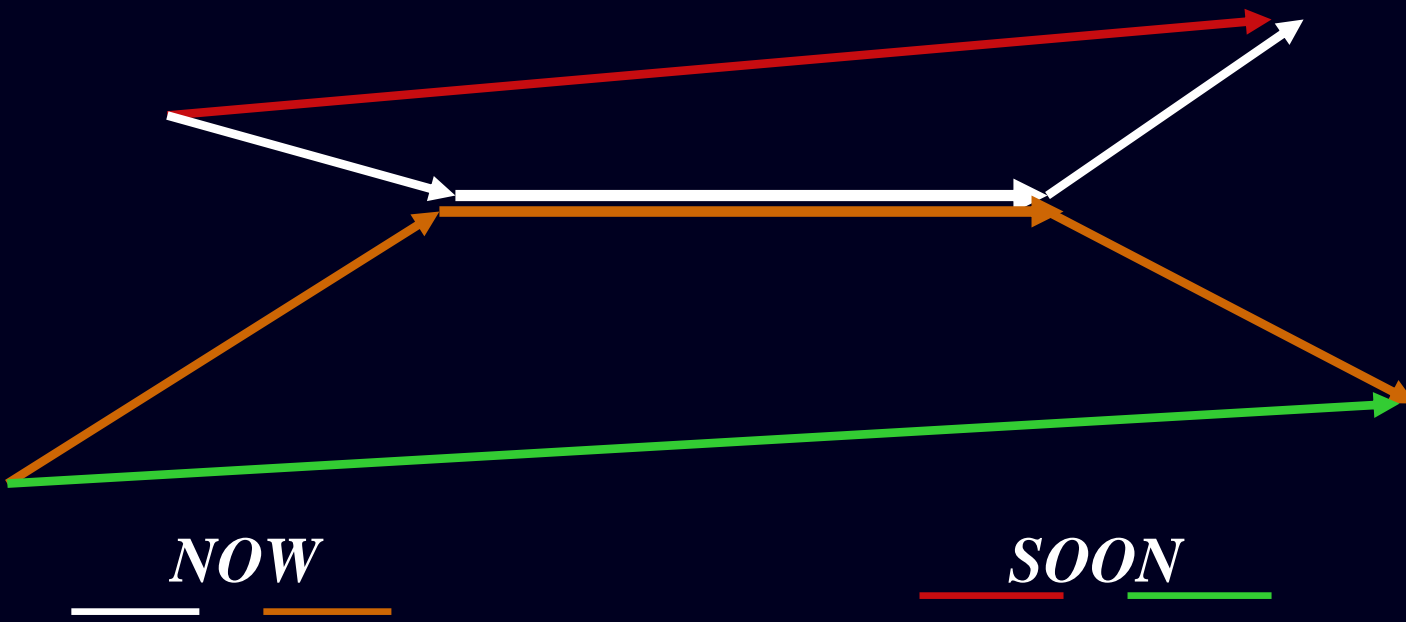
But there is always the issue of airline security.

The 9/11 Commission suggested a certain impatience with recent aviation-security measures when it described them as "fighting the last war."

(Page 391)

Perhaps this viewpoint makes some sense, but we should note that:

- *More US civilians were killed by terrorists during air journeys than during any other activity.*

- *On a per-hour basis, the terrorism death risk during air journeys was 600 times higher than at other times.*

And these statistics are all based on the 35-year period prior to 9/11!

Since 9/11, we have seen:

- *The Shoe Bomber's 2001 attempt to destroy a transAtlantic jet*

- *The 2002 shootout at LAX that left several dead and injured*

- *The simultaneous destruction in 2004 of two Russian jets*

- *The 2006 plot to destroy ten transAtlantic jets with liquid explosives*

- *The 2007 firebombing at Glasgow airport.*

Instead of more accessible targets such as subways and commuter trains, hotels and tourist destinations, last summer's plot to bomb more than 10 US airliners was aimed at perhaps the most internationally hardened target since 9/11: commercial aviation.

--Bruce Hoffman (RAND)

The terrorist fascination with aviation **long preceded 9/11 and has evidently persisted since then.** *There is perhaps nothing wrong with "fighting the last war"* **when it resembles to one before that and the one before that,** *and when we* **lost the last war disastrously.**

So what happens now?

--Evita Peron