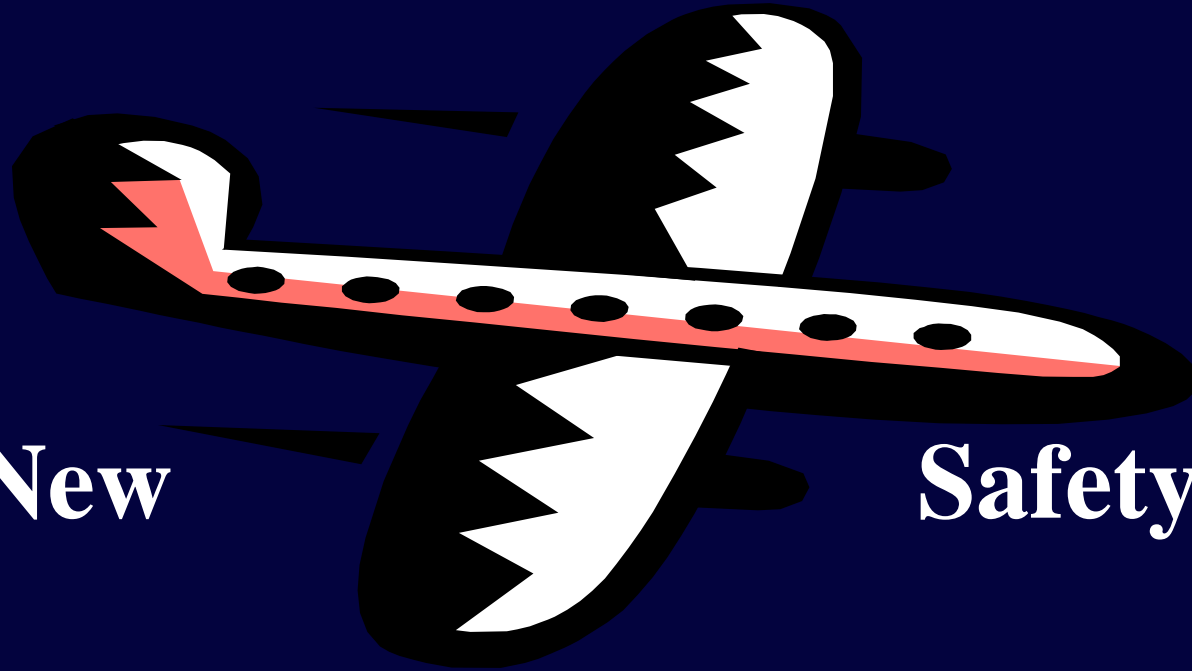


# *The Mother Metric?*



**FAA's New**

**Safety Index**

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**MIT**

**FAA has set a performance target to “implement by FY 2006 a *single, comprehensive index* that provides a meaningful measure of the safety performance of the US civil aviation system.”**

**Let's consider now  
some general suggestions  
relevant to this endeavor.**

**(1) When the safety index is reported, it should be accompanied by reports about its *individual components*.**

(2) The indicator should  
strive to *exude simplicity*.

**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. US domestic jet flights over the period 1990-99), what is the probability that he will **not** survive it?

This **death risk per flight** statistic is simple, and has conceptual advantages compared to some other safety indicators.



# 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 with readily-available data

# 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.

(3) In places where calculations can be done in two or more equally plausible ways, there is a strong case for *sensitivity analysis*.

*Let's consider a specific question:*

\_\_\_ Are some major US jet carriers *systematically safer* than others?

**To investigate this issue, we consider NTSB data about accidents and serious incidents over the 20-year span **1983-2002**.**

**(There were about **500** such events.)**

We focus on *domestic*  
passenger jet services, and the  
seven largest US carriers:

**AA, CO, DL, NW, UA, US, WN**

In total, these seven carriers suffered **6.40** full-crash equivalents (**FCE's**) caused by accidents over the 20-year period, out of **83 million flights**.

(In computing FCE's, we weight each plane crash by the **proportion** of those on board who perished in the accident.)



*Accident-caused Full-crash Equivalents  
for the seven carriers, 1983-2002*

<u>Airline</u>	<u>Proportionate Share</u>	<u>Actual FCE's</u>
AA	1.05	0.08
CO	0.58	0.34
DL	1.24	0.97
NW	0.70	1.17
UA	1.01	1.39
US	1.02	2.46
WN	0.82	0

These variations between proportionate shares and actual FCE's can *easily be explained as chance fluctuations* associated with rare events.

For another perspective on the “equal safety” question, we use a technique for evaluating baseball players that was described in the book Moneyball.

Under a “just desserts” principle, we assigned to each airline the *20-year average mortality rate* for each dangerous event it encountered (e.g. for each in-flight loss of control).

*“Luck Adjusted” Full-Crash Equivalents for  
Seven Carriers, 1983-2002 (Accidents Only)*

<u>Airline</u>	<u>Proportionate Share</u>	<u>“Just Desserts” Share</u>
AA	1.05	1.34
CO	0.58	0.88
DL	1.24	1.34
NW	0.70	0.65
UA	1.01	0.96
US	1.02	0.89
WN	0.82	0.35

The “just desserts” scores--*based on hundred of events*-- are far closer to the equal-safety FCE shares than were the actual scores based on very few events. **However**, they depend on a questionable axiom.

Neither of these analyses is ideal. But, *taken together*, they offer greater insight than either one on its own. That outcome illustrates the *value of sensitivity analysis*.

**(4) No indicator is perfect.**

*(“The best is the enemy of the good.”)*



# A Tentative Thought for the Composite Index:

For a *randomly-chosen person living in the US* and a *randomly-chosen US flight* over the period of interest, what is the probability that the person dies because of a mishap involving the flight?