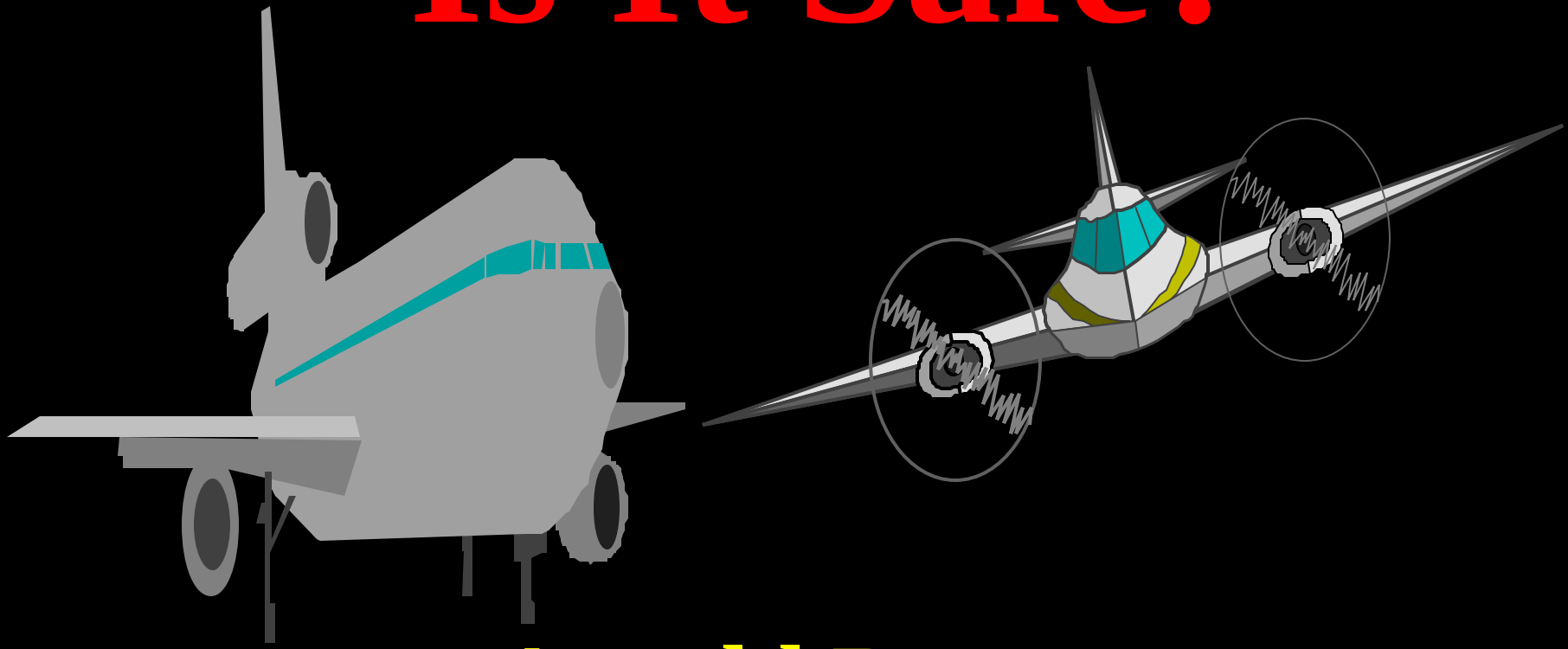
Is It Safe?



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Some Dangers that Might Be Tied to Airport/Airspace Congestion:

- **Runway Collisions**
- **Mid-air Collisions**
- **Thunderstorm Crashes**

Passenger Mortality Risk Arising from Runway Collisions, Scheduled First-World Jet Services Over 1990-99

Type of Service	Death Risk per Flight
US:	
Domestic	1 in 100 million
International	0
First World Outside US:	
Domestic	0
International	0

Question:

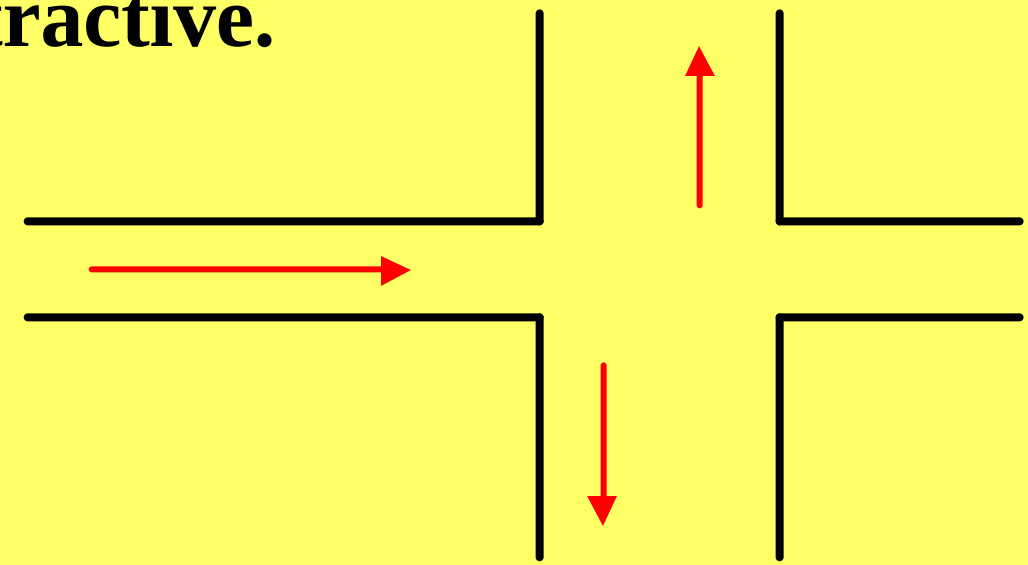
How might expected growth in US airport traffic affect the risk of fatal runway collisions?

To a first approximation, one might expect that an airport's risk of a fatal runway collision (FRC) would vary with the square of the annual number of operations.

Why?

1) The number of flights that could (theoretically) collide is $(N^2-N)/2$.

2) The Quadratic Model is conceptually attractive.



But, whenever possible, it is desirable to go beyond merely stating conjectures, and to test hypotheses and "approximations" against empirical evidence.

We were extremely fortunate in that a panel of experts (e.g. pilots, air-traffic controllers) had already studied in great detail all 292 runway incursions in the US in the year 1997.

A most interesting data set

The 40 US runway incursions in 1997 that:

(1) were judged by experts to have "extremely high" accident potential

and

(2) took place under known conditions of reduced visibility(e.g. night, sunrise/sunset).

If the quadratic (N^2) hypothesis were true, then airports with 500,000 operations per year would, on a per capita basis, suffer about four times the annual risk of a FRC than airports with 250,000 operations per year.

(Right?)

The N^2-hypothesis passed a statistical test with flying colors.

Most interestingly, the hypotheses that dangerous events varied across airports with either N or N^3 did not pass statistical tests.

This N^2-rule was part of a broader analysis which estimated that:

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

(Mid-range figure)

Two Ways To Reduce Runway Collision Risk:

- **New technology (and training)**

- **Greater Use of Secondary Airports**

(Under N^2-model, such displacement of traffic systematically improves safety.)

But will anyone really use secondary airports?

Some Origin-Destination Traffic Statistics for Greater Boston to Greater Washington, <u>Second Quarter, 2000:</u>

<u>Airports</u>	**<u>Daily Passengers</u>**
BOS↔DCA/IAD	**4075**
PVD/MHT↔BWI	**4119**

<u>Two New England Liberators</u>:

Paul Revere

Herb Kelleher

Passenger Mortality Risk Arising from Mid-Air Collisions, Scheduled First-World Jet Services Over 1990-99

Type of Service	Death Risk per Flight
US:	
Domestic	0
International	0
First World Outside US:	
Domestic	0
International	0

(Based on 100 million flights)

Against such a superb backdrop, air travelers may well have developed "zero tolerance" for mid-air collisions.

Innovations such as free-flight are not inherently dangerous, but they must be introduced with the greatest prudence. The public cannot be expected to tolerate mid-air collisions as we move down the learning curve.

Number of Fatal Thunderstorm Crashes at US Airports Among Passenger Planes:

1970's	**2**
1980's	**2**
1990's	**3**

A Solved Problem?

Landing During a Wind-Shear Alert:

- **Approximately 1% chance of encountering severe wind shear**

- **Approximately 2% chance of not being able to escape it despite appropriate maneuvers**

Thus, roughly 1 in 5000 chance of a crash.

Is 1 in 5000 an acceptable crash risk in an aviation system in which, otherwise, the mortality risk per flight is about 1 in 15 million?

(Continental Airlines thinks not.)

In the short run, what is the greatest threat that congestion poses to aviation safety?

One answer:

An atmosphere in which people are under subtle pressure to "keep things moving."

(E.g., Alaska #261 receives a last-minute message)

We have endlessly heard that last summer was "the worst summer ever" in terms of US delays and disruption.

A statistic about last summer we rarely hear:

Death risk per flight, US domestic air services:

0

Two Points to Remember:

(1) Some things are worth waiting for.

(2) Some strident people are worth ignoring.