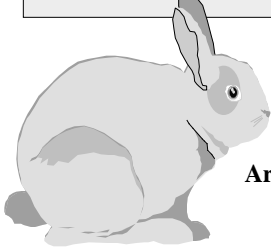


**Runway Collisions:  
Crying Wolf?**



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**Question:**

**How great a threat do runway accidents pose to domestic airport operations in the next two decades?**

**COE Viewpoint:**

**In assessing probabilities about future domestic runway collisions, it is appropriate to restrict attention to the US historical record.**

**However:**

**In estimating the consequences of a runway collision given that it occurs, it is appropriate to use full data about worldwide experience.**

**Mortality Rates in the Three Fatal Jet-to-Jet Runway Collisions Since 1970**

Location:	Percent Killed:		
	First Jet	Second Jet	Both Jets Combined
Tenerife	100(%)	76	88
Madrid	100	55	69
Detroit	21	0	4
Overall	(59)		(72)

**For future fatal US jet-to-jet runway accidents, a reasonable estimate of the average proportion killed is:**

- (A) 4%
- (B) 11%
- (C) 59%
- (D) 72%

**What do you think?**

**If there are  $N$  aircraft operations at a given airport in a given year, then:**

**To a first approximation, one might expect that the risk of a runway accident would vary with  $N^2$ .**

### **Why?**

- 1) The number of flights that could (theoretically) collide is  $(N^2-N)/2$ .
- 2) The Quadratic Model is conceptually attractive.
- 3)  $N^2$  is widely used in airspace collision-risk models.

**But, to the extent possible, it is desirable to go beyond merely stating conjectures, and to test hypotheses and “approximations” against empirical evidence.**

### **A most interesting data set**

**The 42 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 (night, sunrise/sunset).

**The  $N^2$ -hypothesis passed a Chi-squared test with flying colors.**

(The test was based on the spread of the 42 dangerous events across US airports.)

**Interestingly, the hypotheses that dangerous events varied across airports with either N or N<sup>3</sup> did not pass Chi-squared tests.**

### **Weather:**

**On a per-hour basis, haze and fog increase the risk of a runway accident by roughly a factor of 12.**

### **Airport Weather-Risk Factor F:**

$$F = 1 + 11*Q$$

Where Q = fraction of time haze/fog prevails at the airport

When Q = 0, F = 1; when Q = 1, F = 12.

When Q = 0.1, F = 2.2

### **Final Answer?**

**(Well, first approximation)**

- At towered US airports over the next two decades, we might expect something like **33** runway accidents, **5** of them jet-to-jet. (We are assuming recent accident patterns and projected air-traffic growth).
- The average death rate would be **59%** in the jet-to-jet accidents and **27%** in the others.

### **In other words:**

**No one is crying wolf.**

**The wolf is on the runway.**