Analysis of Passenger Delays:
developing a passenger delay metric

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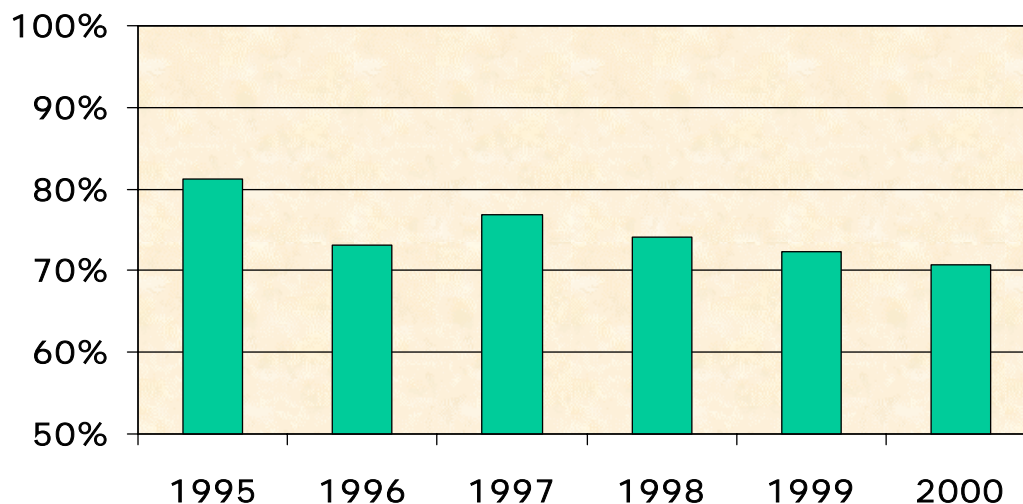*Collaborators: Dave Lovell, Avijit Mukherjee, Bargava Subramanian*

Flight Delays vs Passenger Delays (ref: Cindy Barnhart)

In 2000 and early 2001 there was a very substantial public outcry concerning air transportation delays but …
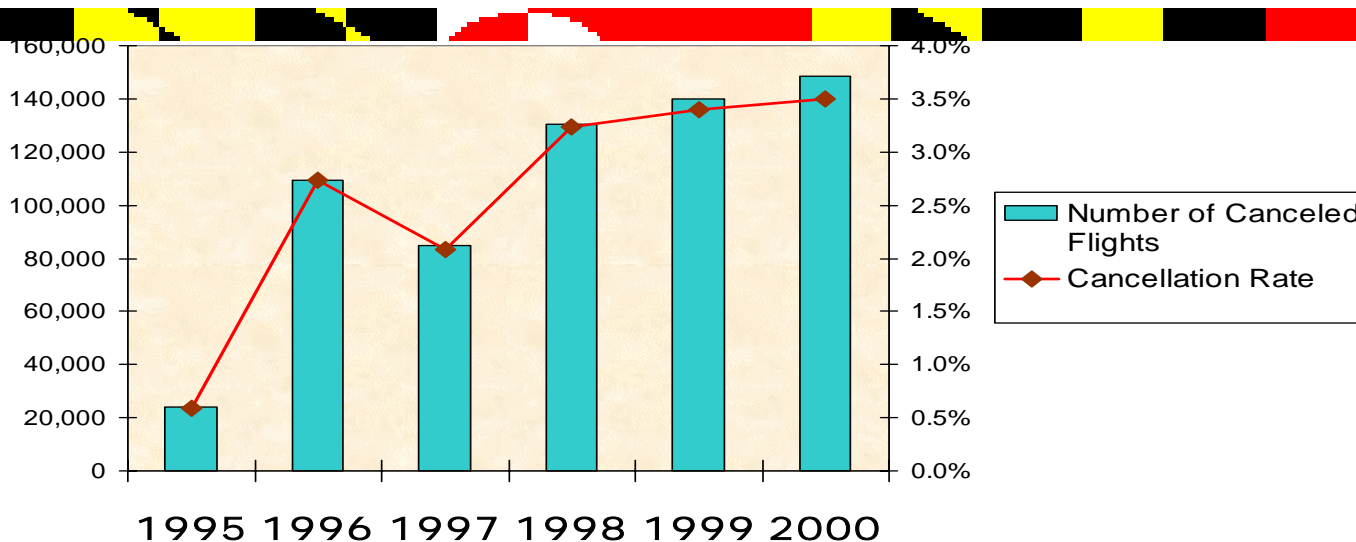
15 minute on-time performance:

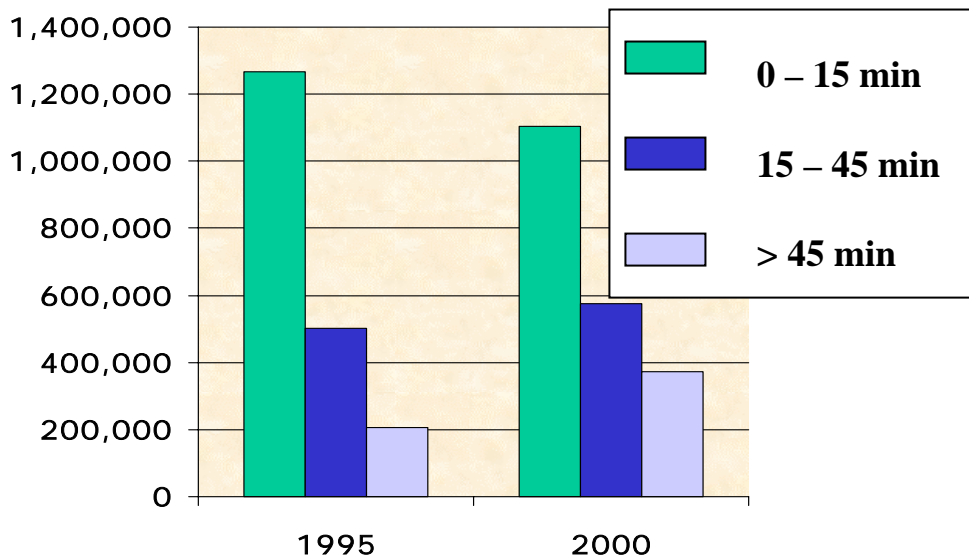**Things looked pretty good in 2000, why were passengers so upset???**

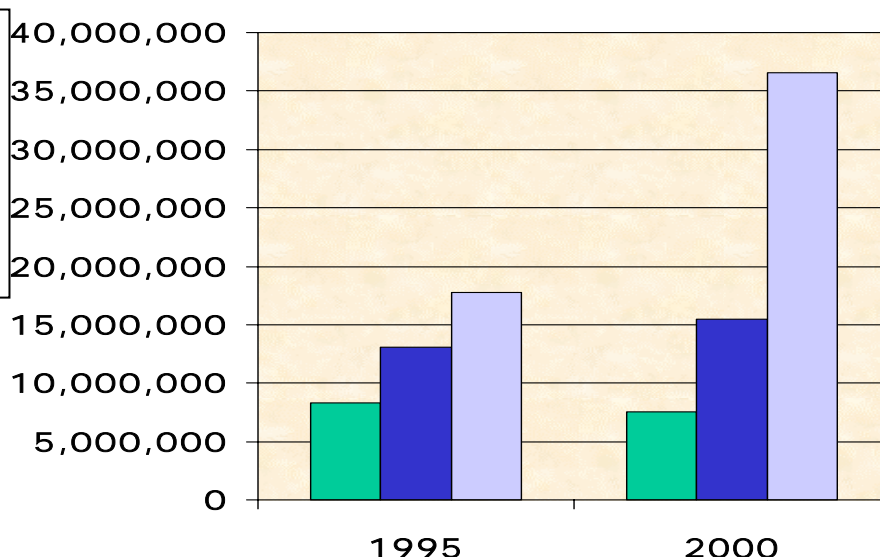# Flight Cancellation Rates and Delay Distribution:

Cancellation rates
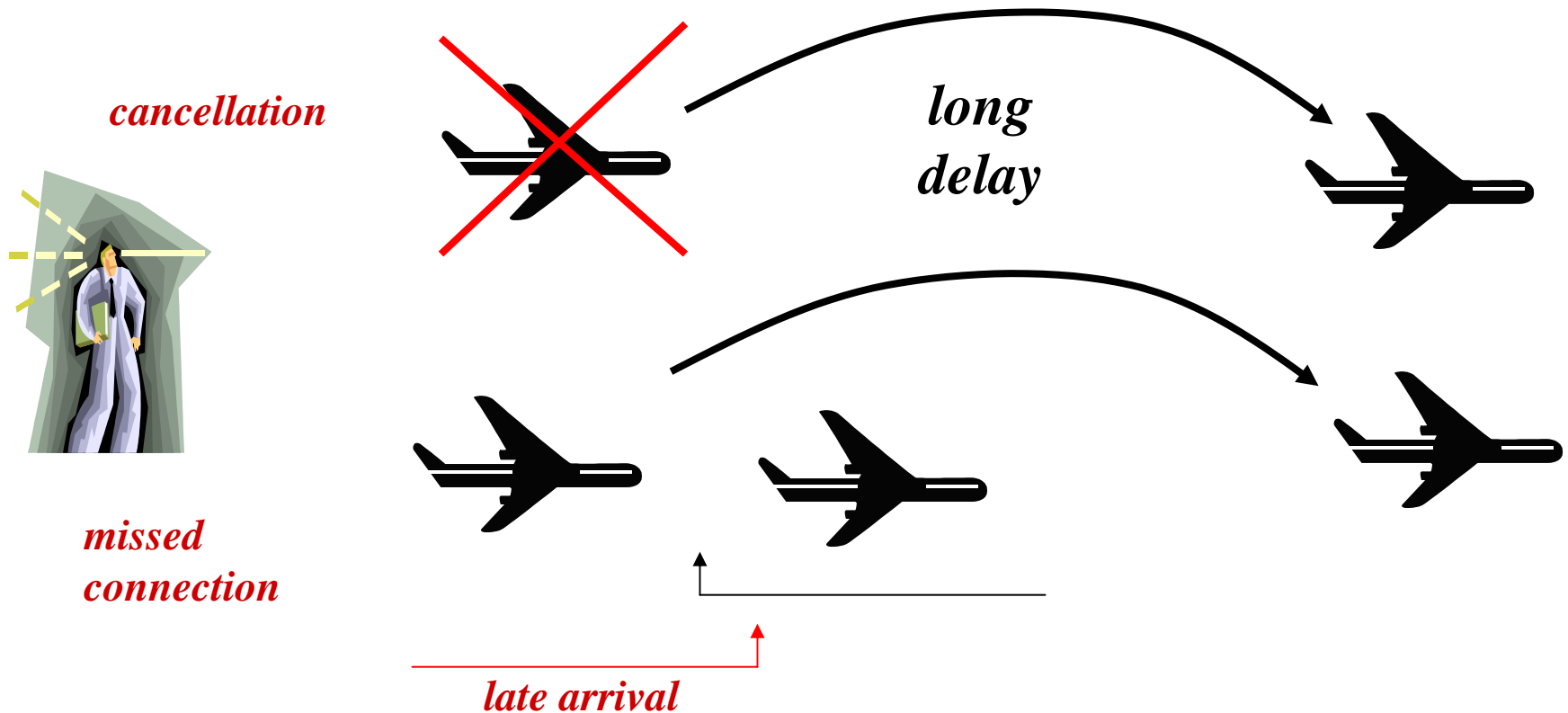

Num flight delayed
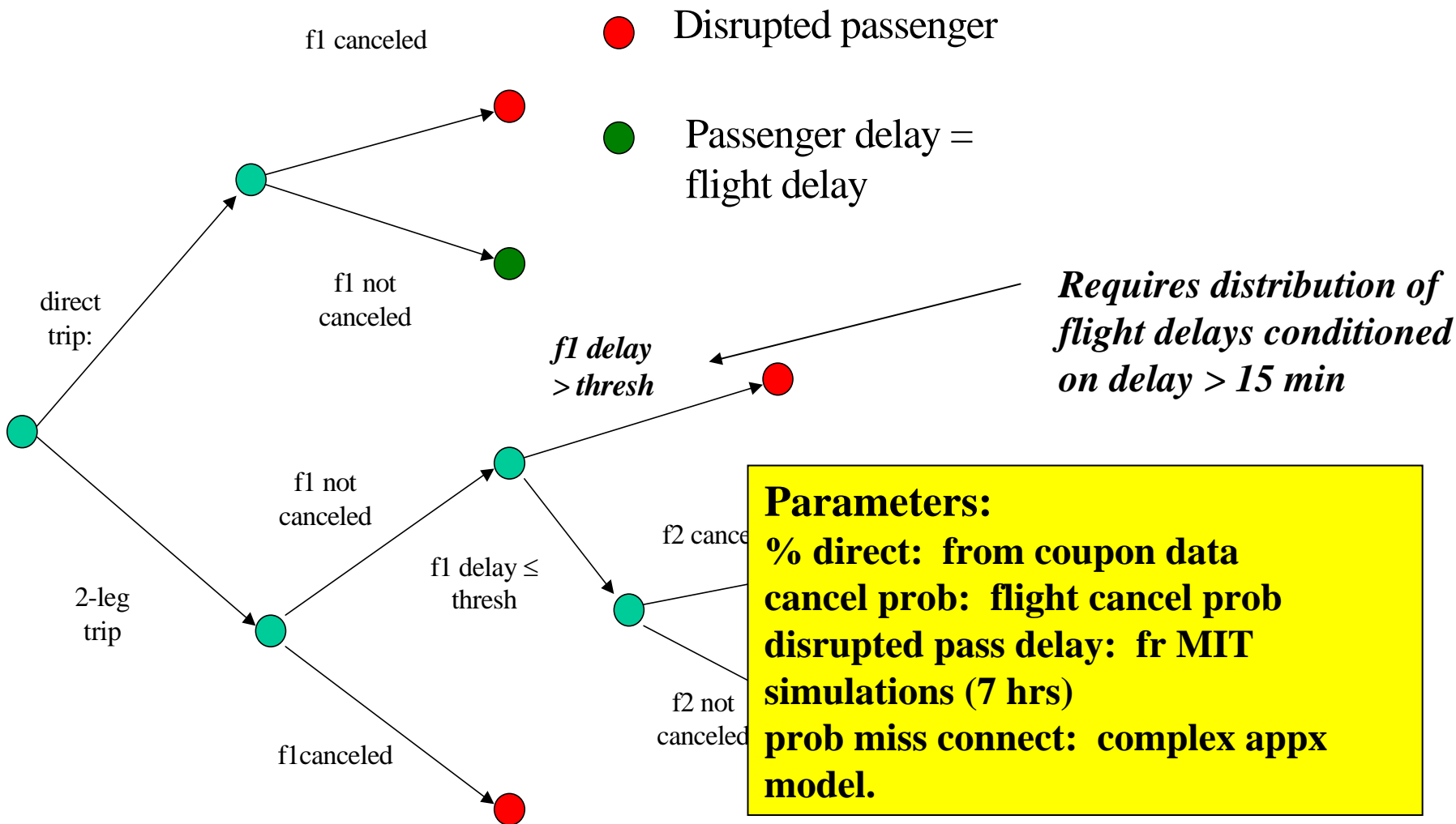

Total delay minutes

Why do cancellation rates and delay distributions have such an impact on customer satisfaction (and passenger delays)??

Ans: the disrupted passenger

cancellation

long delay

missed connection

late arrival

The average delay suffered by a disrupted passenger is substantial (ref: Barnhart & Bratu)

Sample Day	Av. Delay	% Delays	% Pax
Disrupted pax	7 hours	61%	4%
Non disrupted pax	14 minutes	39%	96%
All pax	28 minutes		
Flights	16 minutes		

Passenger Delay Model

Disrupted passenger

Passenger delay = flight delay

f1 canceled

f1 not canceled

direct trip:

2-leg trip

f1 not canceled

f1 delay ≤ thresh

f1 canceled

f1 delay > thresh

f2 canceled

f2 not canceled

Requires distribution of flight delays conditioned on delay > 15 min

Parameters:
% direct: from coupon data
cancel prob: flight cancel prob
disrupted pass delay: fr MIT simulations (7 hrs)
prob miss connect: complex appx model.

Average passenger delay =

A_1 (average flight delay)

+ A_2 (average flight delay)$^{(1 + e)}$

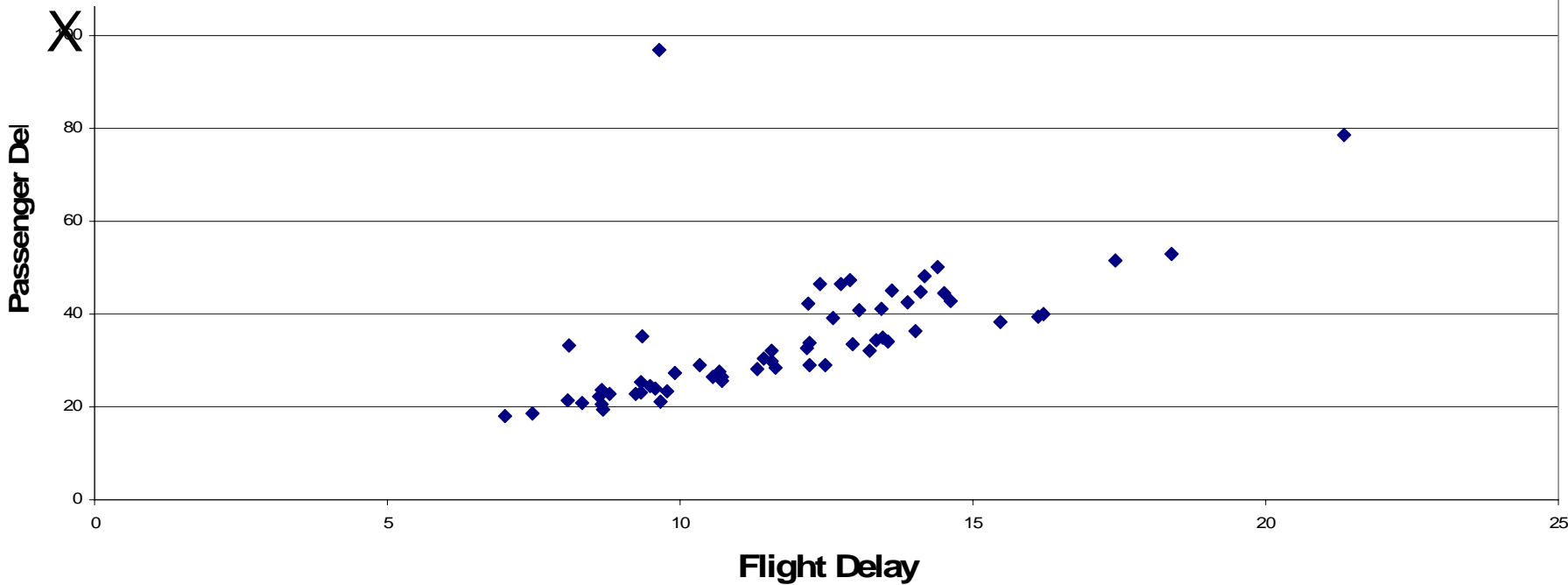+ A_3 (flight cancellation probability)

Daily average pax delay
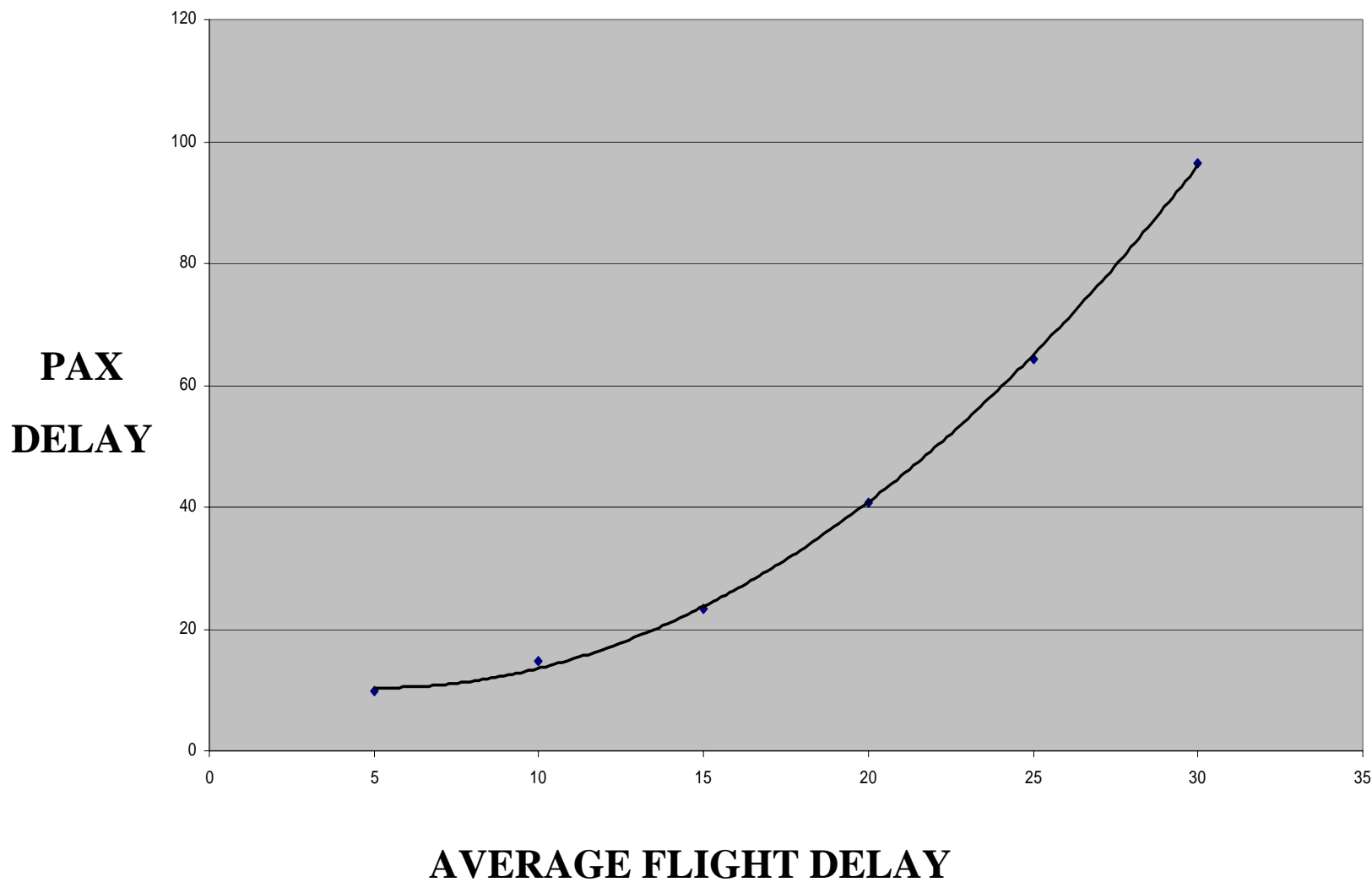
Monthly Average Pax Delay

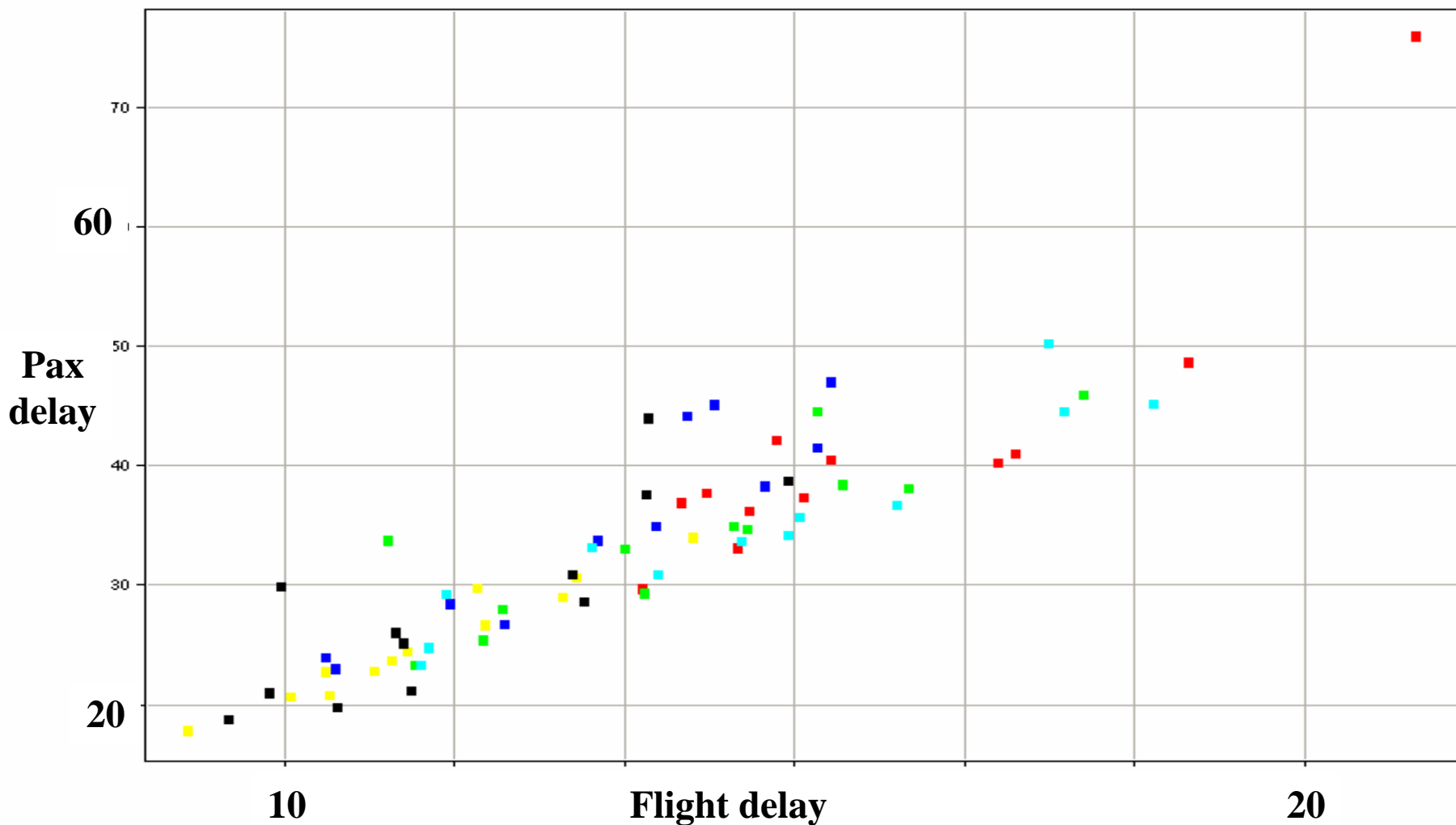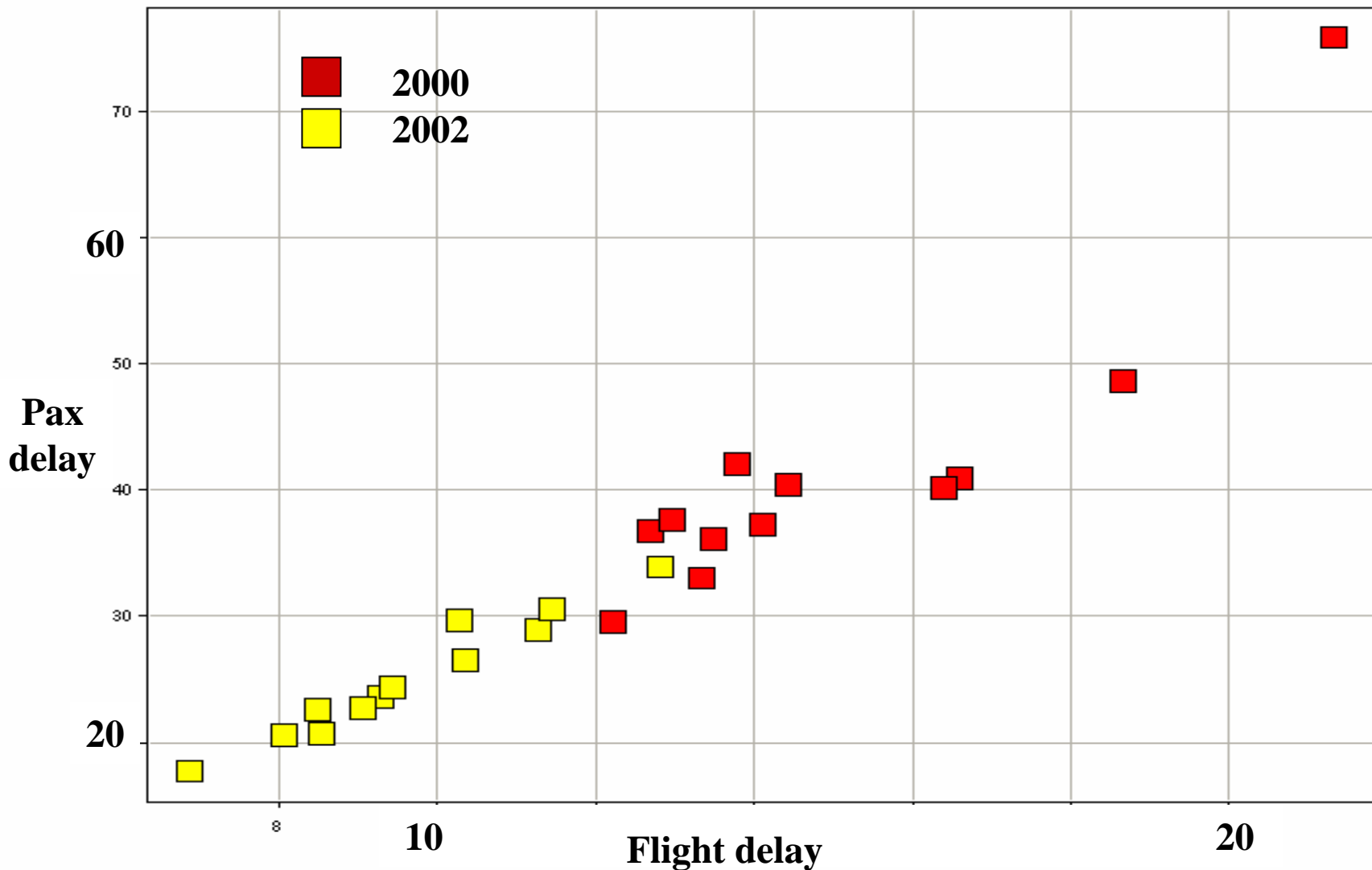passenger delay = .0525 X**2 + 2.165 X
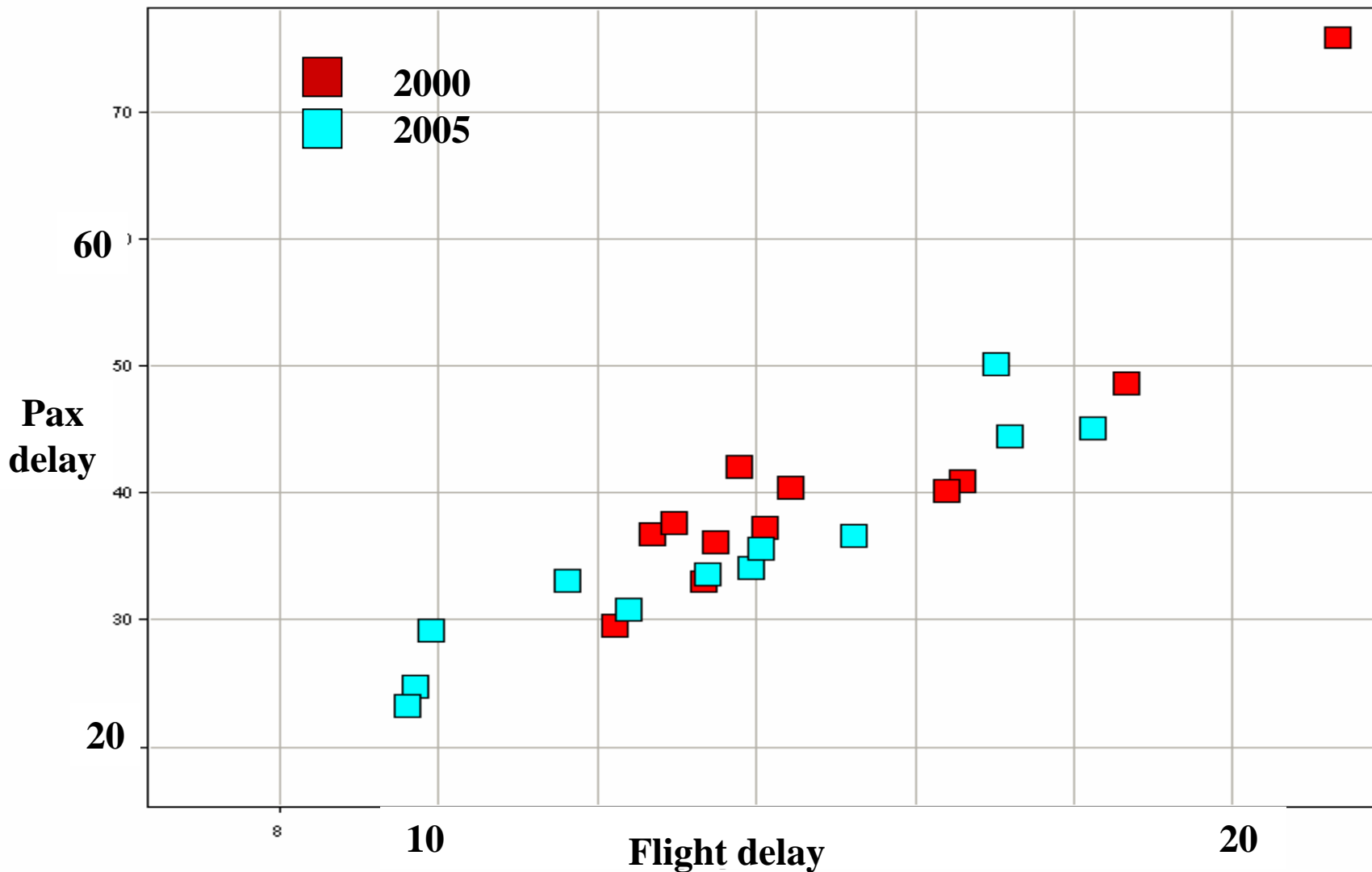
F-delay vs P-delay: 2000 → 2005

F-delay vs P-delay: 2000 vs 2005

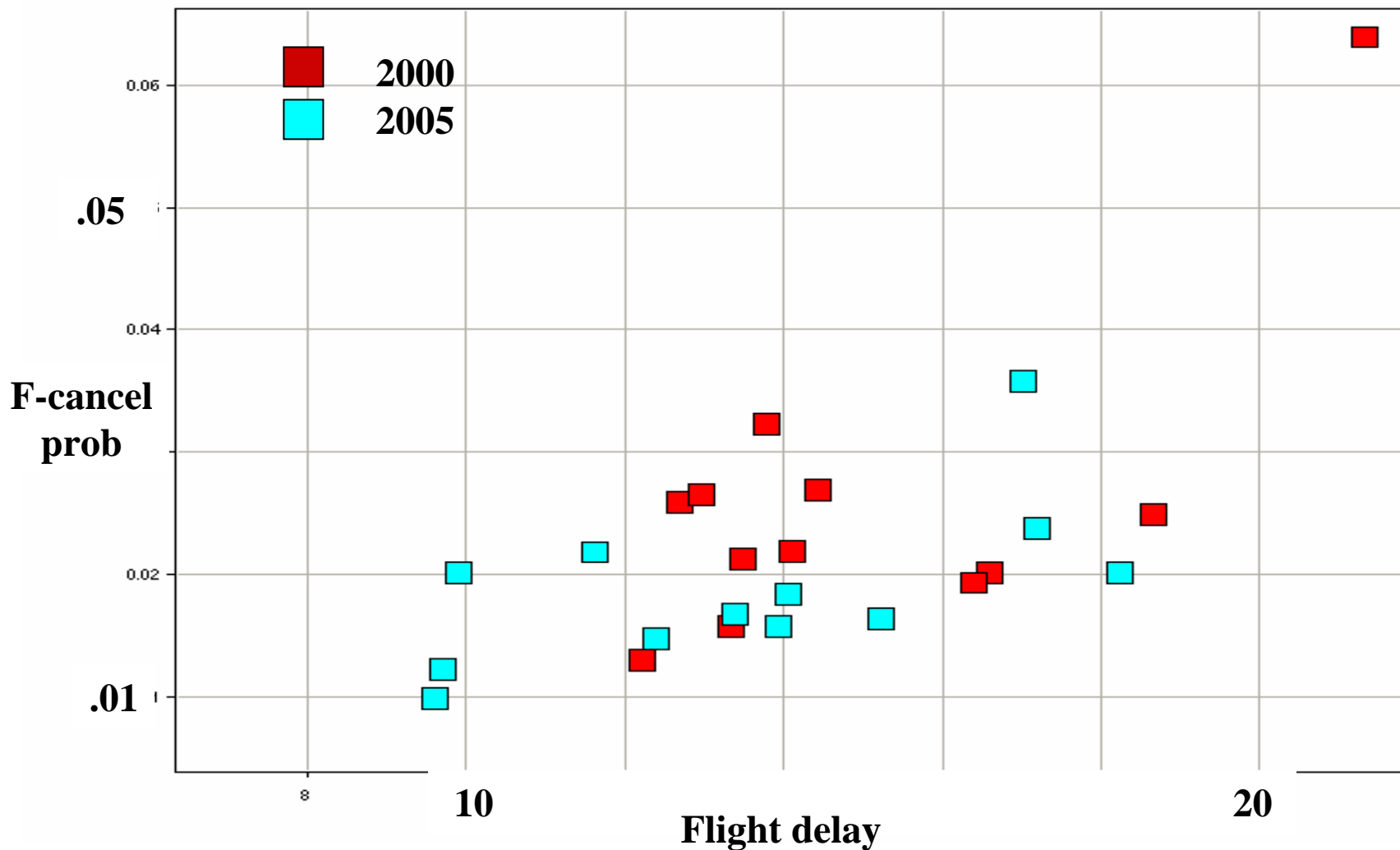# F-delay vs P-delay: 2000 vs 2005

F-delay vs F-cancel: 2000 vs 2005
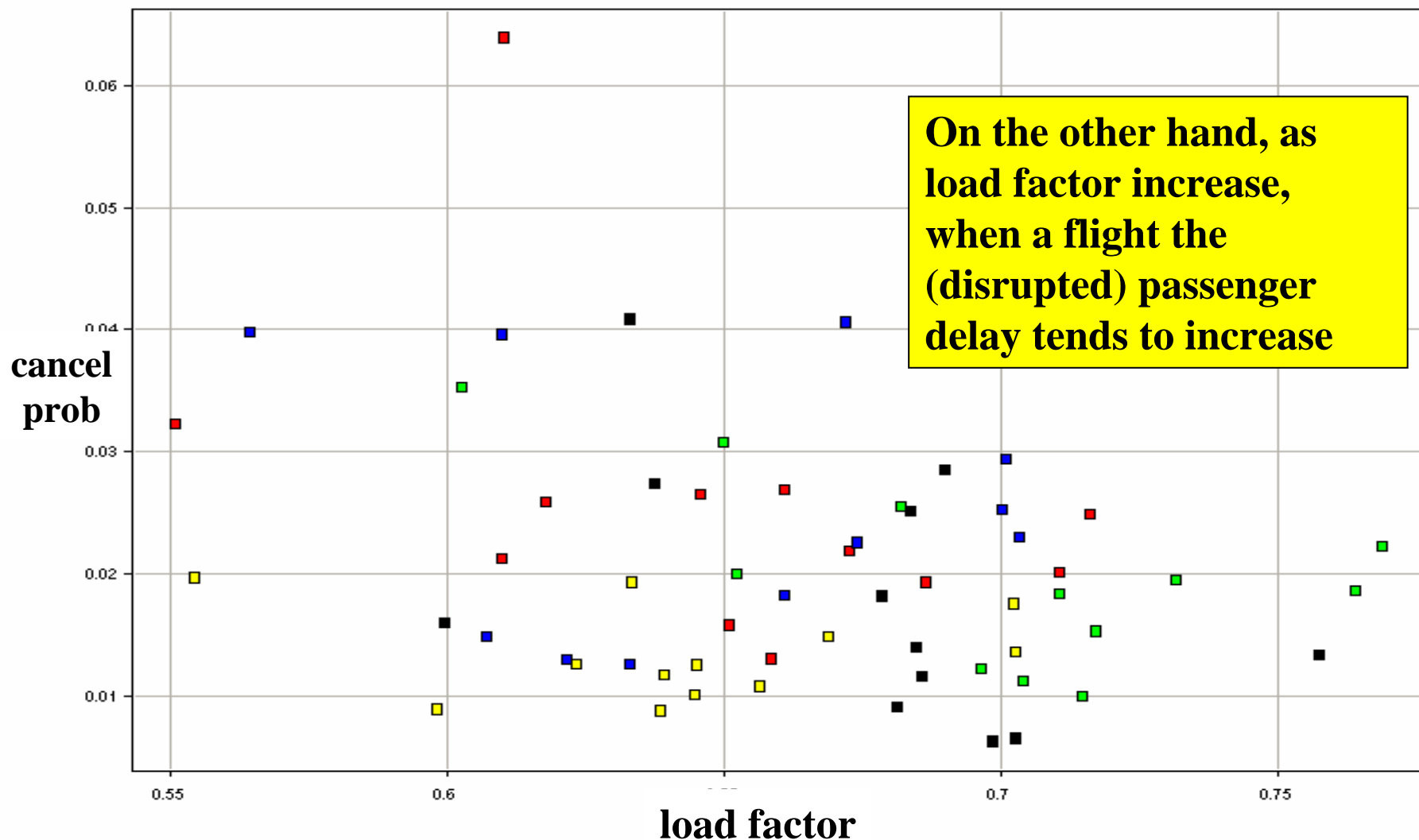
Comparison of Yearly Averages

	2000	2001	2002	2003	2004	2005
p-delay	41.47	32.10	25.11	28.32	33.95	34.99
f-delay	15.02	10.84	9.68	10.13	12.71	13.54
Ratio	2.76	2.96	2.60	2.80	2.67	2.58

2000 vs 2005

- 2005 flight delays approaching 2000 flight delays
- There seems to have been significantly less public outcry in 2005 than in 2000 … Why …
  - Lower passenger delays
    - Lower cancellation rates (such policies were announced by carriers)
    - More robust scheduling – de-peaking.
    - ???

Impact of load factor

On the other hand, as load factor increase, when a flight the (disrupted) passenger delay tends to increase

- Flight delays can underestimate passenger delays

- Airline policies can impact relationship between flight delays and passenger delays

- It can be useful to estimate passenger delays to better track the impact the NAS performance as experienced by the ultimate customers (the passengers) and to influence factors controllable by the airlines (and the FAA).

- Validation using MIT simulation (MEANS) and possible some actual performance data.
- Flight cancel prob → prob passenger is on a canceled flight.
- Further refinements to estimation of missed connection probability.
- Incorporation of other parameters: airline schedule padding, airline schedule robustness.
- Passenger delay distribution information.
- Simplified model suitable for metric calculation.