

AGIFORS ANNUAL SYMPOSIUM 2014

Updating airline cancellation costs and customer disruption

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Summary of findings

Cost per Cancelled Flight Segment (USD 2014)	Controllable Events (e.g. maintenance, crew)	Uncontrollable Events (e.g. weather, airspace)
Regional Jets Including CRJ, ERJ aircraft	\$2,750 per flight	\$1,050 per flight
Legacy Narrowbodies Boeing 737 and Airbus 320 families by legacy airlines	\$15,650 per flight	\$4,930 per flight
LCC Narrowbodies Boeing 737 and Airbus 320 families by LCC/ULCC airlines	\$19,240 per flight	\$710 per flight
Small Widebodies Boeing 767/787 and Airbus 330 on 8-hr international routes	\$29,690 per flight	\$6,770 per flight
Large Widebodies Boeing 777/747 and Airbus 340 on 12-hr international routes	\$42,890 per flight	\$13,140 per flight
Average Cost Based on weighted average of events across U.S. fleets	\$5,770 average per cancelled flight segment	

Start with two simple questions:

How much does it cost an airline to cancel a flight?

It's a difficult question to answer, but a relevant metric:

- Airline cost/benefit analysis
- Passenger handling and re-accommodation
- Regulatory policy

Every airline has different input costs and customer policies.

But can we create generalized metrics that are useful?

What is the impact of cancellations on passengers?

- Additional travel time due to extended re-accommodation?
- Differences between business and leisure traffic?
- Differences between LCCs and legacy airlines?
- Have merged networks improved passenger re-accommodation options?

We examine cancellation costs in the U.S. market and focus on what has changed since 2007

Higher Fuel Cost

*\$1.84 to \$3.00 - savings
from not operating flights*

Higher Load Factors

*From 79% to 83% - few
empty seats to re-accom*

Larger Aircraft

*69 → 82 avg passengers
per flight; more per event*

Limited Interline

*Preference for online
re-accommodation*

Labor Changes

*Higher wages, different
ability to reschedule*

Merged Networks

*More routings possible to
recover a/c, crews, pax*

**Focused on re-active cancellations – not why cancellation
decisions occur, just on how much it costs when they do**

More focus on the cancellation *decision* versus cost!

Author(s)	Cancellation cost	Comments
American Airlines (2014)	\$1,765 per flight	Announced \$60 million cost for 34,000 weather cancellations during 1Q14
Hansen, Xiong (2009)	\$5,517 per flight	Based on equivalent delay minutes (one cancellation = 165.9 delay min) and \$30 per minute delay cost
Metron (2006)	\$6,000 per flight	Unpublished NAS performance report – airlines protested as too low
Shavell (1998)	\$16,926 per flight	Based on aggregated airline reports in 1998 to ASQP/DOT of \$858 million divided by 74,000 cancelled flights
Sridar (2007)	\$18,000 per flight	Based on equivalent delay minutes (one cancellation = 600 mins) and \$30 per minute delay cost

There's a wide variation – we need to build estimates ground-up

Let's start with a baseline scenario and build from there:

- **Reactive cancellations** before gate departure
True cancellations (not 12-24 hour delays)
- When the decision occurs is relevant
- Cost of a cancellation decision (primary & downstream)

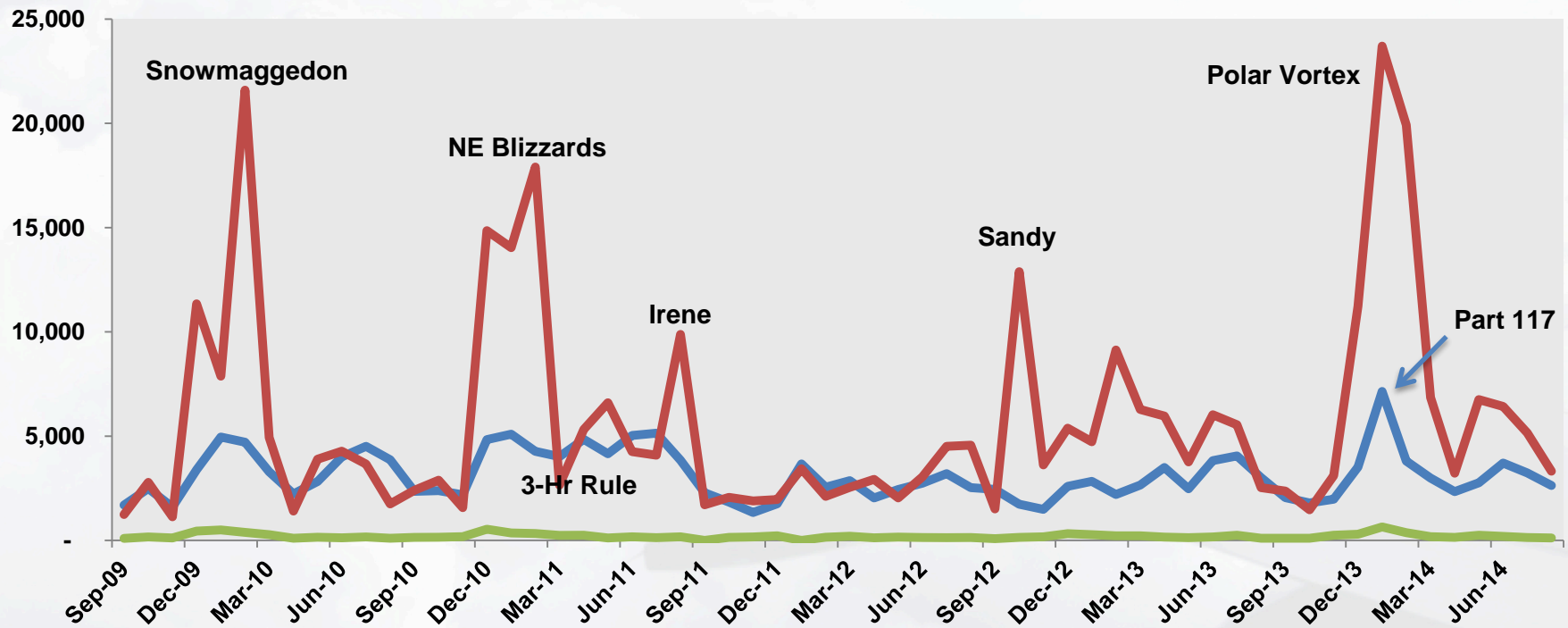
Many factors we need to consider for cost estimates:

- Controllable (crew, mx.) vs. uncontrollable (weather, NAS)
- Route profile (short, medium & long-haul)
- Aircraft type (small CRJ through widebody)
- Airline type (regional, major & LCC)

In the United States, carrier-controllable cancellations exhibit low variability (moved significantly only by regulatory changes) while uncontrollable cancellations vary by season and winter severity.

Reported US flight cancellations by month (DOT Part 234)

— Controllable — Uncontrollable — Diverted



Material differences in cancellation rates by aircraft category, and differences in the *reasons* as well.

<i>Reported Flights</i>	Cancelled as % of Scheduled	Controllable (Carrier)	Uncontrollable (Wx, NAS, TSA)	Cancelled at Diversion Apt
Turboprop	2.9%	33.5%	66.5%	2.1%
Regional jet	2.6%	31.0%	69.0%	1.9%
Narrowbody	1.0%	41.8%	58.2%	3.3%
Widebody	1.0%	57.2%	42.8%	1.6%

Source: DOT Part 234 ASQP from reporting carriers, September 2009 through August 2014, domestic flights only. Controllable cancellations coded "A" and uncontrollable cancellations coded "B", "C" or "D".

What are relevant costs

Incremental costs (new, out of pocket)

Allocable Costs (wasted expenses)

Cost Offsets (real benefits)

Opportunity costs (forfeit by carrier)

- **Crew** salaries & benefits, per diem awaiting rescheduling, transportation costs, hotel costs – direct and buffers
- **Maintenance** cost to prepare aircraft, labor and materials, allocation of indirect maintenance to that flight
- **Catering and passenger services** including perishable food, catering preparation & loading, bonding, etc.
- **Airport and handling** including above- and below-wing, terminal fees, reservations center
- **Aircraft parking** awaiting new flight
- **Aircraft ownership** (debatable!)
- **Ticket refunds and interline fees** for pax that cancel or re-book on OA (plus merchant fees, GDS fees, etc.)
- **Passenger re-accommodation** incl. hotels, meals, transportation (depends on cancellation causes)
- **Displaced revenue** from accommodating impacted pax and consuming open inventory
- **Offsets:**
 - **Fuel burn** – huge impact
 - **Landing & airport fees**

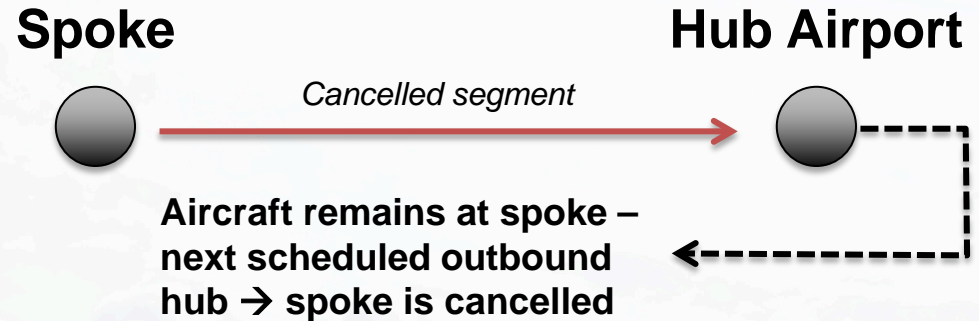
Ground-up cancellation cost model for five aircraft types based on DOT data and real-world aircraft utilization

1. Five aircraft families/roles modeled (regional jet, mainline narrowbody, LCC narrowbody, small widebody and large widebody)
2. Use DOT Form 41 and OEM costs per hour, aggregated by category (e.g. B737NG/A320/717/MD80 aggregated into single group)
3. Review how airlines schedule the aircraft – average block hours, stage lengths, configurations/loads/yields, staffing and utilization
 - Fare and yield data – use DOT DB1B ticket data
 - Utilization, configuration, etc. – OAG flight schedules for Oct 2014
4. Calculate operating costs for cancelled segments (including offsets for saved expenses) and follow-on impact assuming 1:1 inverse
5. Roll up direct (out-of-pocket), indirect and opportunity costs

We model cancellation decisions that impact two flight segments
Only the first segment cancelled is re-active – the follow-on is pro-active

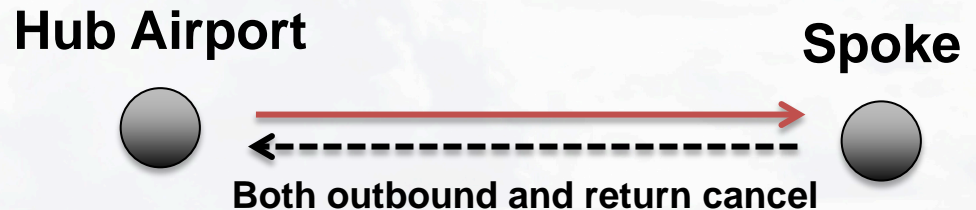
Option 1

Aircraft cancels
at spoke airport



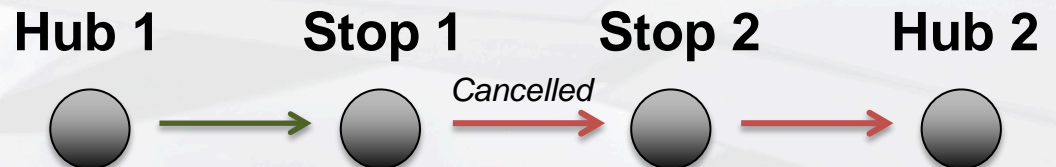
Option 2

Aircraft cancels
at hub airport



Option 3

Aircraft cancels during
multi-stop routing



Keep it simple – rough order of magnitude cost once a decision to cancel has been made

Average costs across aircraft groups – grouping labor contracts, aircraft vintages, maintenance programs, etc.

The resulting cost model is a foundation to customize unique labor, aircraft, crew contracts and customer service standards for each airline

Regional Jets

- 1.6 hr stage length
- 50 seats (All Y)
- CRJ/ERJ aircraft
- Business/leisure mix

Narrowbody - Legacy

- 2.5 hr stage length
- 150 seats (8F/142Y)
- 737/320 aircraft
- Business/leisure mix

Narrowbody - LCC

- 2.5 hr stage length
- 168 seats (All Y)
- 737/320 aircraft
- Leisure traffic

Widebody – Med-Haul

- 8 hr stage length
- 240 seats (40C/220Y)
- 767/787/330 aircraft
- Business/leisure mix

Widebody – Long-Haul

- 12 hr stage length
- 280 seats (56C/224Y)
- 777/747 aircraft
- Business/leisure mix

Inputs: DOT Form 41

	Regional Jet Families	Narrowbody Families	Small Widebodies	Large Widebodies
Aircraft ownership	\$380	\$630	\$790	\$1,070
Crew	\$380	\$680	\$1,010	\$1,240
Maintenance	\$540	\$790	\$1,140	\$1,600
Direct cost	\$370	\$610	\$830	\$1,160
Indirect cost	\$160	\$190	\$310	\$440
Fuel expense (\$)	\$1,370	\$2,690	\$4,990	\$7,620
Fuel gallons/hour	460 gals/hr	910 gals/hr	1,690 gals/hr	2,550 gals/hr
Direct Operating Cost/Hr	\$2,670	\$4,790	\$7,930	\$11,530

Sourced from DOT Form 41 Schedule P-5.2 Reports for 2Q14 (bts.gov)

Total direct operating costs divided by airborne hours

Regional jets include Embraer and Bombardier CRJ/ERJ families (fuel cost based on gal/hr)

Narrowbody families include Boeing 737, Airbus 319/320/321 and McDonnell-Douglas 717/MD80/90

Small widebodies include Airbus A330, Boeing 767 and Boeing 787 families

Large widebodies include Boeing 777 and 747 families

How often airlines fly a route (and with what equipment) is relevant for operational recovery (aircraft positioning) and passenger re-accommodation in empty seats

<i>Daily flights by route by aircraft type scheduled</i>	Specific Equipment on Route		All Equipment on Route	
	Daily Flights	Daily Seats	Daily Flights	Daily Seats
Regional Jets	2.9 flights	176 seats	3.7	276
Narrowbodies	2.4 flights	344 seats	2.9	399
Small Widebodies	1.1 flights	257 seats	2.5	485
Large Widebodies	1.1 flights	320 seats	1.7	423

Source: OAG Schedules for week ending October 7, 2014 for US-domiciled carriers

Regional jets include 100/200/700/705/900, ERJ includes 135/140/145, EMJ includes 170/175/190

Narrowbodies include 737 classic and NG families, A319/320/321, and MD-80/90/717 families

Small widebodies include A330, B767, B787; large widebodies include B777, B747, A340

Reactive cancellation = crew has reported for duty or is extremely unlikely to be reassigned to alternate flying within duty window

We interviewed airlines and reviewed labor contracts – most have right to reassign crews, but rarely happens with limited-scale cancellation events

- DOT Reported pilot cost per flight hour by aircraft type
- Add cabin crew based on staffing and \$30-\$60 hourly wages
- Add augmentation for short-haul and long-haul international flights
- Add buffer for duty time and transportation
- Assume one crew for every two cancelled flights must overnight (hotel + per diem provided for each cancelled crewmember)

Aircraft type	Regional Jet	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Crew pay per event	\$820	\$2,330	\$2,410	\$16,760	\$31,720
Lodging/per diem	\$450	\$1,200	\$1,050	\$3,410	\$4,200

Reactive cancellation = time-limited aircraft maintenance performed (ETOPS, daily, etc.) but substantial variable cost is avoided as well

- Start with Form 41 labor and materials cost per flight hour by aircraft type
- Isolate direct (variable, flight-hour based) and indirect + burden components
- Allocate 25% of direct maintenance cost per flight hour to the cancelled flight
- Allocate 75% of indirect maintenance cost to the cancelled flight
- Why 25/75? Significant savings from not operating the flight segment, but there's still real cost related to direct expenses and fixed/amortization

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Direct CPH, allocated	\$90	\$150	\$150	\$250	\$350
Indirect CPH, allocated	\$120	\$140	\$140	\$250	\$360
Average stage length	97 min	150 min	150 min	480 min	720 min
Mx cost per cancellation	\$350	\$730	\$730	\$3,970	\$8,430

Airport-related services already performed at time of cancellation

- Catering and aircraft servicing – contracted and delivered (or non-cancellable)
- Airport-related variable costs and reservations/customer service (check-in, baggage check and re-claim, gate/hold area usage, etc.)
- Above-wing and below-wing servicing expense and related overtime
- Aircraft parking awaiting next departure (based on next scheduled departure)

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Catering/pax, Y cabin	\$0.50	\$0.50	\$0.25	\$15	\$30
Catering/pax, F/C cabins	N/A	\$15	N/A	\$40	\$100
Total catering & services	\$70	\$280	\$90	\$4,920	\$12,670
Airport-related costs	\$400	\$1,220	\$1,480	\$1,980	\$2,320
Staffing & overtime	\$120	\$360	\$440	\$590	\$700
Airport parking	\$90	\$140	\$140	\$1,260	\$1,560
Catering/station per flight	\$680	\$2,010	\$2,150	\$8,750	\$17,250

Reactive cancellation = savings from not flying (maintenance, fuel, landing and navigation/overflight fees)

- Fuel matters a lot at \$3.00 per gallon
- We account for maintenance savings earlier
- Assumed landing fees of \$2 per thousand MTOW
- Assumed navigation fees of \$1,000/\$3,000 for small/large widebodies

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Fuel burn per block hour	440	866	875	1,609	2,422
Fuel cost per trip (\$3/gal)	\$2,130	\$6,490	\$6,560	\$38,610	\$87,200
Landing fees	\$110	\$350	\$350	\$1,070	\$1,310
Overflight fees	N/A	N/A	N/A	\$1,000	\$3,000
Total offsets	\$2,240	\$6,840	\$6,910	\$40,680	\$91,510

Sources: Form 41 (Fuel Burn per Hour) adjusted 95% FH/BH, 2Q14 fuel expense per gallon;
landing fees based on airport average of PANYNJ 2014; overflight fees estimated based on masFlight routing data

What's important for commercial costs related to cancellations?

- Controllable/uncontrollable – what customer service obligations?
- Ticket refunds – cash out-of-pocket and associated transaction fees?
- Empty seats – time to re-accommodate, and revenue displaced?

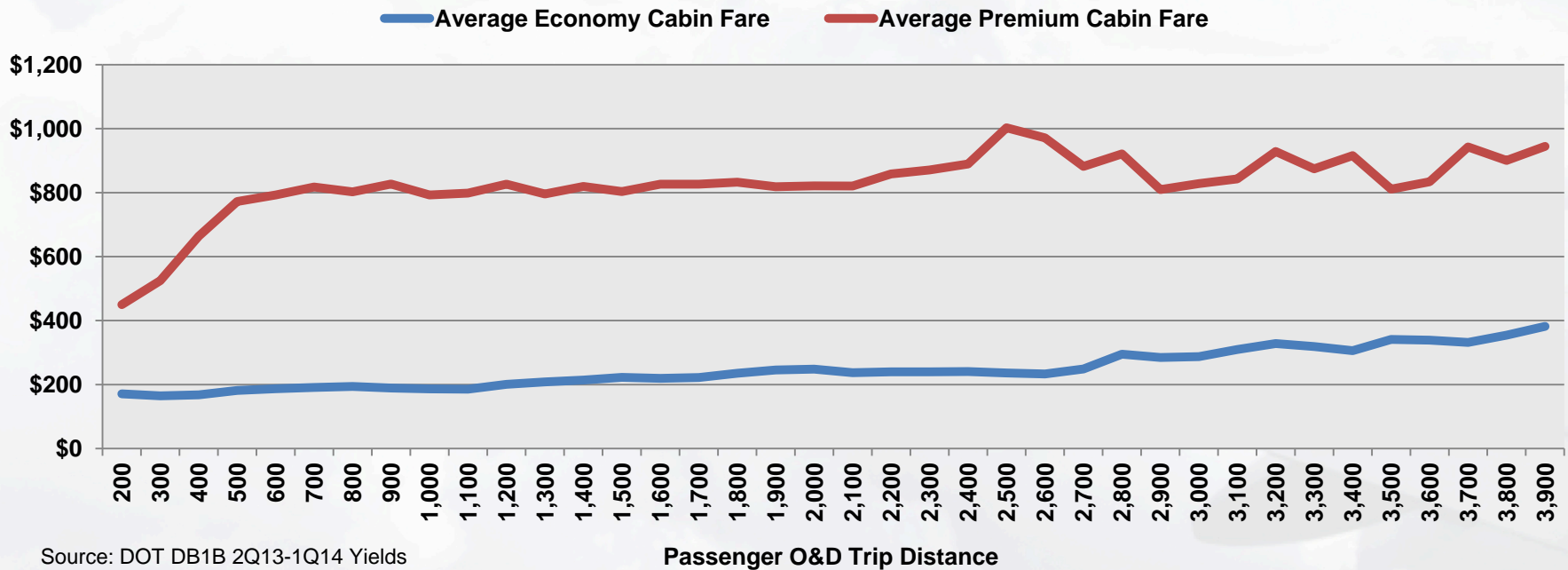
Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Configuration	50Y	8F/142Y	168Y	40C/200Y	56C/224Y
Premium Load Factor	N/A	95%	N/A	95%	95%
Premium Passengers	0	8	0	38	53
Economy Load Factor	80%	80%	88%	80%	80%
Economy Passengers	40	122	148	160	179
Blended Load Factor	80%	81%	88%	83%	83%
Empty Seats per Flight	10	20	20	42	48

Sources: configurations based on OAG schedules by aircraft category, October 2014;
load factors based on domestic T-100 enplanement data for 2013

Refund considerations include:

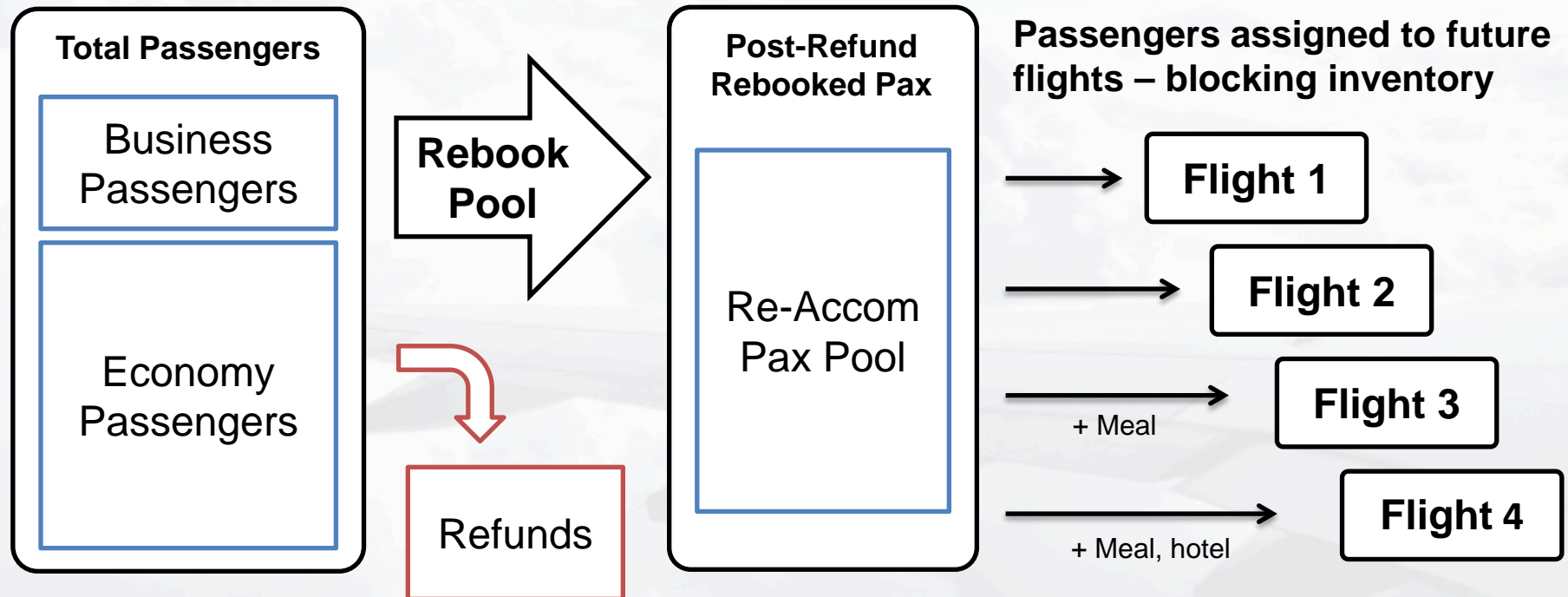
- What percent on business vs. leisure (business refund rate higher)
- What percent away from home (assume they don't refund)
- What fare they paid (O&D fare matters, not segment fare)
- Transaction fees (credit card refund, GDS, loyalty points/goodwill)

Average Fare Paid (Based on DB1B Domestic Yields)



What's important for commercial costs related to cancellations?

- Controllable/uncontrollable – what customer service obligations?
- Ticket refunds – cash out of pocket and associated transaction fees?
- Empty seats – time to re-accommodate, and revenue displaced?



Refund rate is based on originating passengers only, and differential refund rates for business (or business-like) and economy passengers

- Assume 50/50 split of O&D traffic
- Originating passengers – 30% of business and 20% of leisure get refund
- En-route passengers – all seek re-protection + hotel/OA options
- 6% transaction fees (credit card, agency/GDS and frequent flyer incentives)

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Average net premium fare	N/A	\$827	N/A	\$834	\$2,000
Average net economy fare	\$168	\$189	\$150	\$339	\$550
Paid passengers	40	122	148	198	232
Refunded tickets	6	17	17	27	32
Refunds + fees processed	\$1,070	\$5,440	\$2,700	\$13,380	\$32,490

For controllable cancellations – and some uncontrollable events, in each airline’s discretion – hotel and meal costs apply

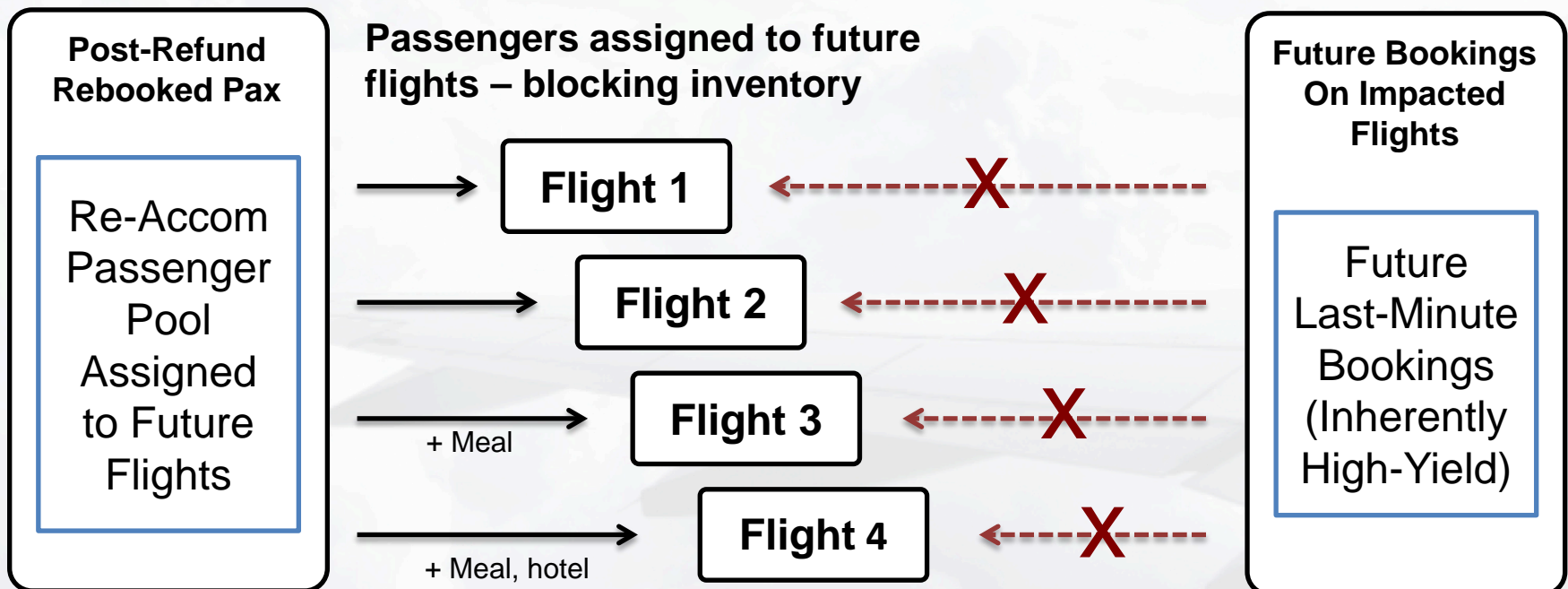
- Calculate available seats within next 24 and 48 hour windows
- Apply estimated load factors (route averages) to calculate available seats
- Allocate passengers to flights – count how many taken next 24, 48 hrs
- Assume that 75% of re-accommodated passengers need hotel rooms

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Re-protected passengers	34	100	131	140	156
Re-accommodated w/in 24h	34	75	48	85	72
Re-accommodated w/in 48h	0	25	83	55	84
Per diem and incidentals	\$430	\$1,950	\$3,900	\$3,280	\$4,250
Hotel rooms	\$1,280	\$8,780	\$14,630	\$19,650	\$25,500

Model: Revenue spill

In high load factor environment, inventory consumption from passenger re-accommodation is a material consideration

- Small number of high yield booking opportunities are lost
- Less relevant for LCCs and highly relevant for transatlantic routes with last-minute business bookings in premium cabins



Extended re-accommodation times → future bookings are displaced by rebooked passengers and blocked inventory

- Calculate occupied seats within next 48 hours (blocked inventory matters)
- Estimate last-minute (within 72 hours) revenue across categories
- Incorporate savings from processing fees, etc. – net revenue matters

Aircraft type	RJs	Narrowbody		Small WB	Large WB
Route type	Express	Mainline	LCC	Short Int'l	Long Int'l
Premium seats occupied		5		31	44
Displaced premium revenue		\$830		\$7,760	\$26,400
Economy seats occupied	34	100	131	140	156
Displaced economy revenue	\$570	\$3,670	\$1,970	\$12,500	\$34,980
Offset taxes and processing	(\$80)	(\$550)	(\$300)	(\$1,880)	(\$5,250)
Net displaced revenue	\$490	\$3,120	\$1,670	\$10,620	\$29,730

What about the follow-on flight segment?

- It's a **proactive** cancellation (advance decision) versus reactive
- Some cost items are avoided (crew accommodation, catering, airport handling, etc.) since the airline has time to notify vendors, re-plan
- If it's an uncontrollable cancellation where the airline isn't liable (or chooses not to pay) then the offsets in the second segment can exceed the out of pocket cost – net result, savings from not flying
- In the model, each cancellation **decision = two flight segments** so we want the average of first and second impacted segments.

Summary: Controllable events

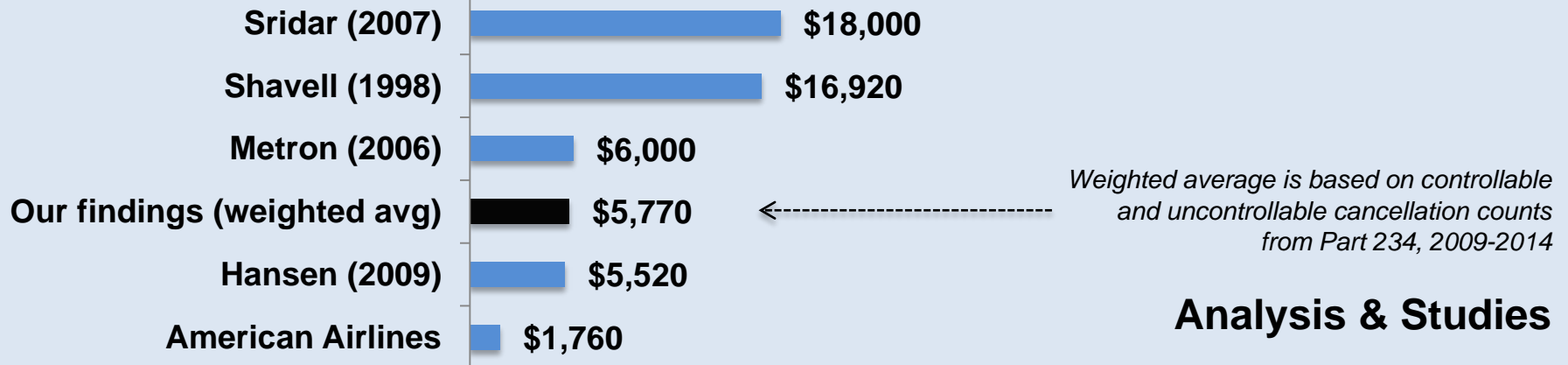
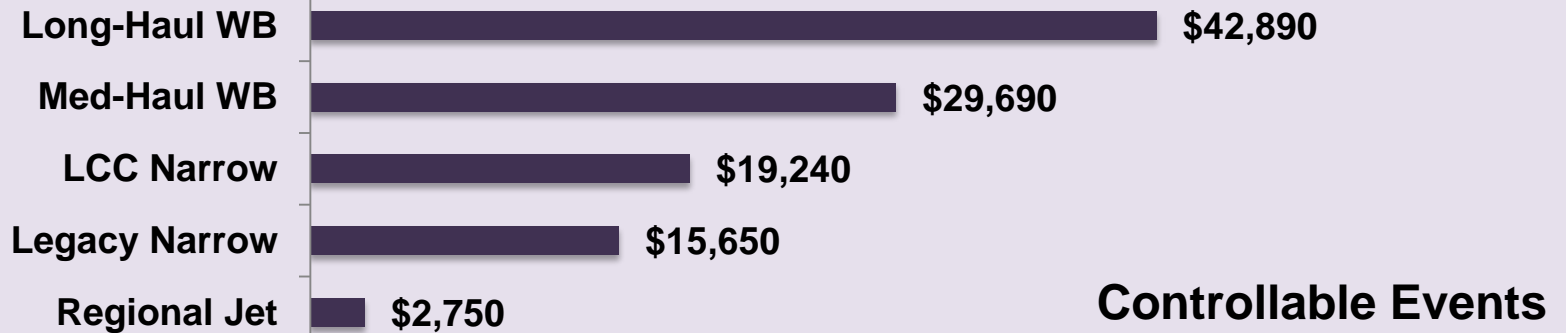
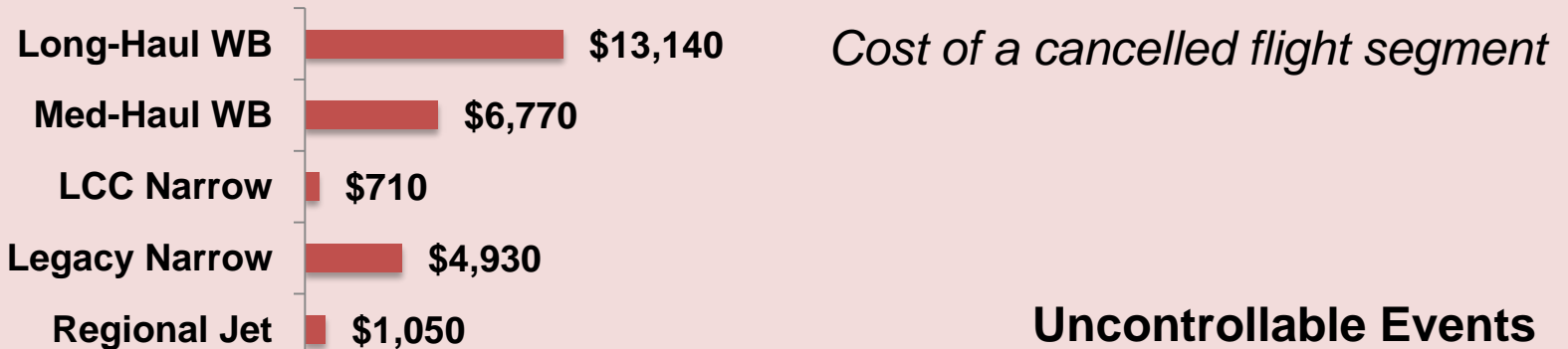
For controllables, segment cost from \$2,750 to \$43,000

	<u>Regional Jets</u>	<u>Legacy Narrow</u>	<u>LCC Narrow</u>	<u>Med-Haul Widebody</u>	<u>Long-Haul Widebody</u>
<i>Cancelled flight segment</i>					
Base incremental costs	2,300	6,260	6,350	32,900	61,600
Net offsets (fuel, landing fees)	(2,240)	(6,840)	(6,910)	(40,680)	(91,510)
Total operating cost impact	60	(580)	(570)	(7,790)	(29,910)
Commercial/revenue cost	3,260	17,830	21,400	43,560	83,520
Cancellation cost, cancelled segment	\$3,320	\$17,250	\$20,840	\$35,770	\$53,610
<i>Follow-on segment cancellation</i>					
Follow-on segment incremental cost	1,170	3,060	3,140	20,730	40,150
Follow-on segment offsets	(2,240)	(6,840)	(6,910)	(40,680)	(91,510)
Commercial/revenue, follow-on	3,260	17,830	21,400	43,560	83,520
Cancellation cost, follow-on segment	\$2,180	\$14,050	\$17,630	\$23,610	\$32,160
Total direct cancellation cost	\$5,500	\$31,300	\$38,470	\$59,380	\$85,770
Average cost per flight segment	\$2,750	\$15,650	\$19,240	\$29,690	\$42,890

For uncontrollables, segment cost from \$710 to \$13,140 Primary difference is passenger re-accommodation

	<u>Regional Jets</u>	<u>Legacy Narrow</u>	<u>LCC Narrow</u>	<u>Med-Haul Widebody</u>	<u>Long-Haul Widebody</u>
<i>Cancelled flight segment</i>					
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Total operating cost impact	60	(580)	(570)	(7,790)	(29,910)
Commercial/revenue cost	1,560	7,110	2,880	20,630	53,770
Cancellation cost, cancelled segment	\$1,620	\$6,530	\$2,310	\$12,850	\$23,860
<i>Follow-on segment cancellation</i>					
Follow-on segment incremental cost	1,170	3,060	3,140	20,730	40,150
Follow-on segment offsets	(2,240)	(6,840)	(6,910)	(40,680)	(91,510)
Commercial/revenue, follow-on	1,560	7,110	2,880	20,630	53,770
Cancellation cost, follow-on segment	\$480	\$3,320	(\$890)	\$680	\$2,410
Direct cancellation cost	\$2,100	\$9,850	\$1,420	\$13,530	\$26,270
Average cost per flight segment	\$1,050	\$4,930	\$710	\$6,770	\$13,140

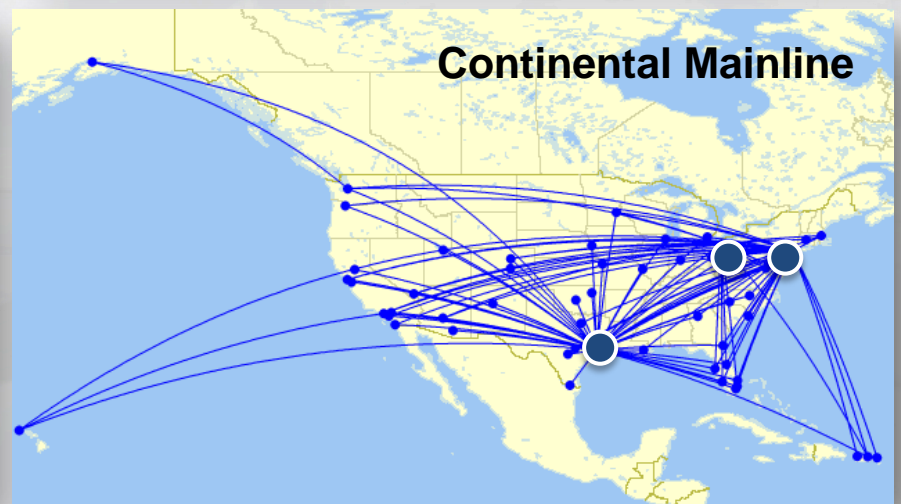
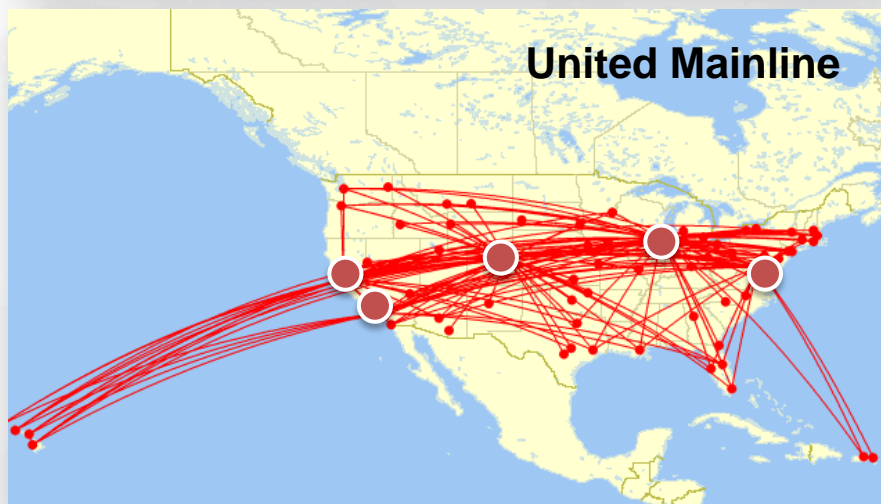
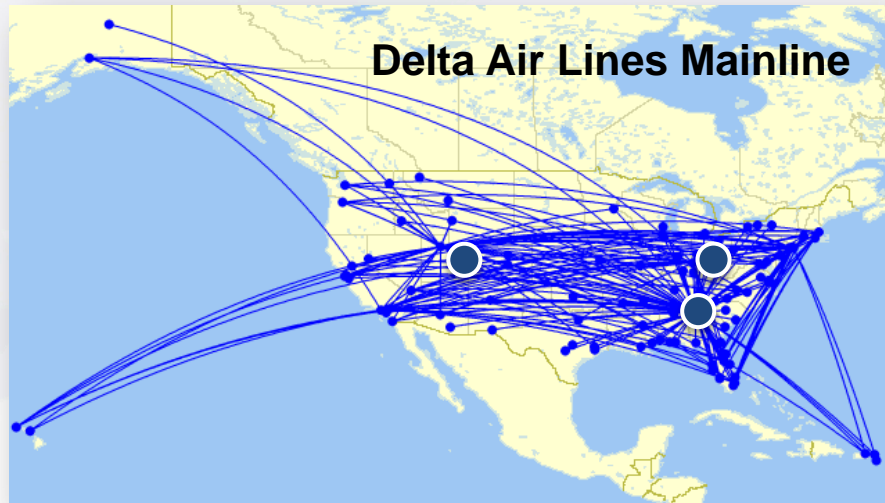
Summary: Cost per segment



- **Wide variation** between RJs and widebodies, business models
 - LCCs – leisure booking curves, low fares mean revenue displacement and commercial costs are lower than full-service
 - The more business/premium customers on the aircraft, the more commercial and operational exposure the cancellation brings
- **Fuel cost per gallon** – because fuel is a primary offset, higher fuel prices mean cancellations are “cheaper”
- **Load factors** – passenger re-accommodation takes longer, particularly for low-cost carriers. Strong encouragement to delay versus cancel
- **Top-down academic studies** were in the ballpark based on reported airline results – and our findings align with AA's 1Q14 metrics
- **Our model** creates a foundation for thinking about cost, benefits

Finally, let's look at the customer's perspective.

Pre-Merger Route Networks



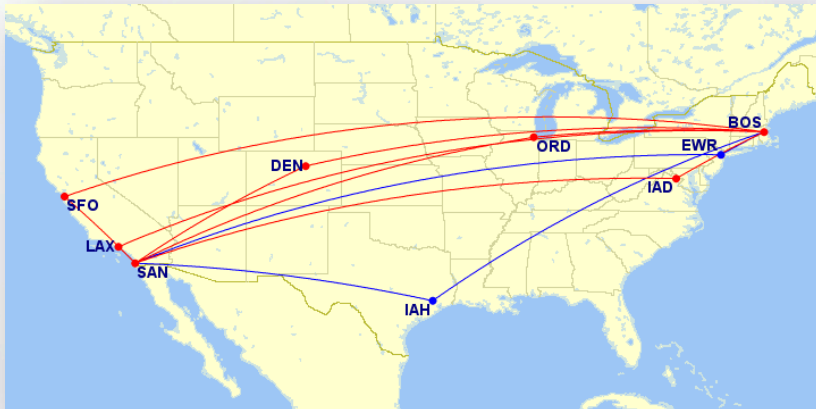
Example: PMCO/PMUA BOS-SAN

Boston (BOS)-San Diego (SAN) 1/28/2008 – Pre-merger UA and CO

#	Times	Routing	Flights	Equip
1	06:00-11:57	BOS-EWR-SAN	CO1117/1626	735/738
2	06:50-13:37	BOS-IAH-SAN	CO683/738	733/738
3	07:30-16:39	BOS-EWR-SAN	CO1121/1726	735/738
4	08:30-16:39	BOS-EWR-SAN	CO1123/1726	735/738
5	09:30-16:39	BOS-EWR-SAN	CO1125/1726	735/738
6	09:45-15:59	BOS-IAH-SAN	CO324/409	733/738
7	11:45-20:18	BOS-EWR-SAN	CO1129/1426	735/738
8	12:55-20:18	BOS-EWR-SAN	CO1177/1426	735/738
9	13:10-19:34	BOS-IAH-SAN	CO1083/1689	738/738
10	14:00-20:18	BOS-EWR-SAN	CO1189/1426	735/738
11	16:25-22:26	BOS-IAH-SAN	CO383/1547	733/739

#	Times	Routing	Flights	Equip
1	05:45-12:12	BOS-ORD-SAN	UA525/421	733/752
2	06:00-11:04	BOS-IAD-SAN	UA201/229	752/319
3	06:10-13:02	BOS-SFO-SAN	UA171/501	752/733
4	07:05-12:12	BOS-ORD-SAN	UA527/421	320/752
5	07:52-16:26	BOS-DEN-SAN	UA339/1185	752/735
6	08:00-13:55	BOS-LAX-SAN	UA163/5414	752/EM2
7	08:00-14:27	BOS-ORD-SAN	UA1019/477	733/752
8	08:00-15:10	BOS-IAD-SAN	UA427/231	752/752
9	08:07-15:11	BOS-SFO-SAN	UA173/852	752/733
10	09:00-14:27	BOS-ORD-SAN	UA881/477	752/752
11	09:50-15:10	BOS-IAD-SAN	UA897/231	319/752
12	09:55-16:26	BOS-DEN-SAN	UA591/1185	752/735
13	10:40-17:37	BOS-ORD-SAN	UA533/679	319/752
14	12:00-17:37	BOS-ORD-SAN	UA535/679	319/752
15	12:32-20:35	BOS-IAD-SAN	UA7806/919	ER4/752
16	13:00-19:06	BOS-DEN-SAN	UA779/329	752/733
17	14:00-20:35	BOS-IAD-SAN	UA823/919	733/752
18	14:28-22:20	BOS-ORD-SAN	UA537/717	319/319
19	14:51-21:47	BOS-SFO-SAN	UA181/785	752/320
20	16:00-22:20	BOS-ORD-SAN	UA541/717	319/319
21	16:49-21:59	BOS-DEN-SAN	UA465/1227	752/319
22	17:00-22:20	BOS-ORD-SAN	UA543/717	733/319
23	17:54-23:47	BOS-SFO-SAN	UA179/1164	752/735
24	18:05-23:20	BOS-LAX-SAN	UA167/6411	752/CR7

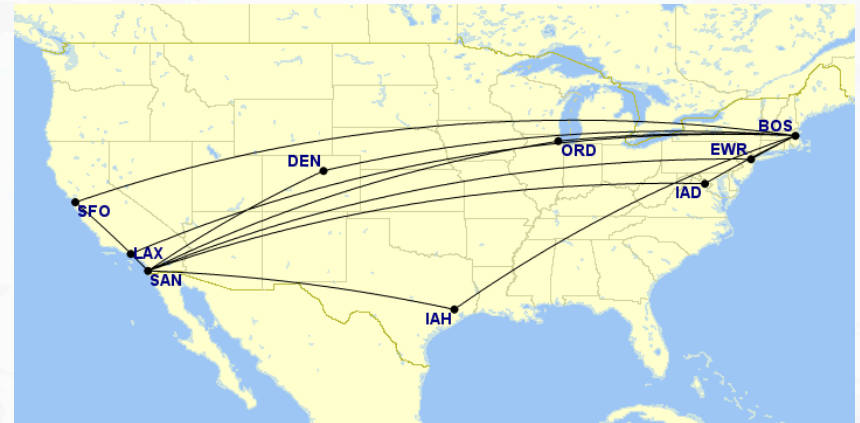
CO over EWR/IAH; UA over ORD/IAD/DEN/SFO/LAX



Example: Post-merger UA BOS-SAN

Boston (BOS)-San Diego (SAN) 1/27/2014 – Rationalized UA/CO

#	Times	Routing	Flights	Equip
1	05:40-10:43	BOS-IAD-SAN	UA282/229	319/752
2	05:55-14:15	BOS-IAH-SAN	UA1098/1657	73G/739
3	06:00-12:48	BOS-SFO-SAN	UA433/500	752/319
4	06:04-12:24	BOS-EWR-SAN	UA220/1626	319/738
5	06:45-12:22	BOS-ORD-SAN	UA359/1134	752/738
6	07:00-14:15	BOS-IAH-SAN	UA401/1657	320/739
7	07:37-12:38	BOS-DEN-SAN	UA1451/1567	738/738
8	08:10-14:26	BOS-SFO-SAN	UA297/1452	752/73G
9	09:05-14:28	BOS-ORD-SAN	UA521/1168	319/738
10	09:12-17:20	BOS-IAH-SAN	UA1410/1547	73G/739
11	09:45-16:59	BOS-IAD-SAN	UA285/1165	752/738
12	10:34-18:00	BOS-EWR-SAN	UA761/1200	320/738
13	11:12-17:13	BOS-SFO-SAN	UA1131/5266	739/CRJ
14	11:20-18:00	BOS-EWR-SAN	UA1686/1200	738/738
15	12:36-19:07	BOS-IAH-SAN	UA676/1689	319/739
16	12:49-20:23	BOS-ORD-SAN	UA271/1453	752/739
17	13:58-20:37	BOS-IAD-SAN	UA1566/240	73G/752
18	14:16-21:23	BOS-EWR-SAN	UA279/1212	319/738
19	14:29-20:23	BOS-ORD-SAN	UA3737/1453	CR7/739
20	15:35-00:10	BOS-SFO-SAN	UA1523/1118	738/739
21	15:39-20:58	BOS-DEN-SAN	UA1476/1579	739/739
22	16:48-22:39	BOS-IAH-SAN	UA1644/700	739/319
23	17:35-00:10	BOS-SFO-SAN	UA1265/1118	738/739
24	18:01-23:49	BOS-LAX-SAN	UA743/5611	752/CRJ



Routings	sUA	sCO	Merged
IAD	5		3
DEN	4		2
EWR		7	4
IAH		4	5
LAX	2		1
ORD	9		4
SFO	4		5
Total	24	11	24

Available routings BOS-XXX-SAN (masFlight/OAG)

Can we measure the positive impact of mergers on available routings
(It's about the scope of routings offered to the customer)

Rationalization eliminates duplicative frequencies over redundant hubs
(Hub closures such as CLE, CVG, MEM - not all O&D pairs benefit!)

Reviewed the top 500 O&D markets in the United States (YE 1Q14) and
measured the change in offered routings (nonstop/one-stop) 2008 vs 2014

<i>Post-merger network</i>	United	Delta
City pairs with service from 2008 through 2014	1,282	1,375
Routings increased from 2008 to 2014	865	959
Routings equal or decrease from 2008 to 2014	417	416
50% or more routings increase	545	461
50% or more routings decrease	32	27

How much does it cost an airline to cancel a flight?

- Up to \$40K, but on average \$6K. It used to cost more, but fuel offsets.
- LCCs have different risks than legacies with business traffic

Can a single cancellation metric apply on industry-wide scale?

- No – the differences between controllable and uncontrollable, small regional jets versus long-haul widebodies drive extreme variation.

Is this finding different from prior academic studies?

- No – but the mean is deceptive when applied to airline decision making.

Have mergers helped passenger re-accommodation?

- Number of routings between major city pairs has gone up.
- Some losers – particularly around closed hubs, rationalized routes
- Many winners – cities w/multiple airports, new hub-to-hub connections
- Mitigates negative impact from higher load factors and fewer seats



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Appendix – Modeled Aircraft

	Regional Jet	Typical Narrowbody		Small WB	Large WB
Aircraft	CRJ-200, ERJ-145	B737 Series, A320 Series, 717/MD-80 Series		B767/B787/ A330	B777/B747/ A340
Stage length (mi)	400	900	900	3,600	6,000
Block hours	1.6	2.5	2.5	8.0	12.0
Seating by cabin	50Y	8F/142Y	168Y	40C/200Y	56C/224Y
Average Y fare	\$168	\$189	\$150	\$339	\$550
Y Load Factor	80%	80%	88%	80%	80%
Average C fare	N/A	\$827	N/A	\$834	\$2,000
C Load Factor	N/A	95%	N/A	95%	95%
Fuel gal per hr	440	866	875	1,609	2,422
Flight deck per hr	\$376	\$684	\$684	\$1,012	\$1,238
Cabin crew per hr	\$30	\$91	\$120	\$600	\$720
Mx cost per hr	\$537	\$793	\$793	\$1,141	\$1,602
Aircraft MTOW	53K	174K	174K	534K	656K

Shavell, *The Effects of Schedule Disruptions on the Economics of Airline Operations*, MITRE 15 April 2000

Hansen and Xiong, *Value of Flight Cancellation and Cancellation Decision Modeling*. Transportation Research Record, No. 2106 (2009)

Sridar. *Relationship between weather, traffic and delay based on empirical methods*. NEXTOR 2007

Cramer and Irrgang, *Disruption Costing Methodology*. AGIFORS 2007

Cook and Tanner, *Modeling the airline costs of delay propagation, a European perspective*. AGIFORS 2011

M2P Consulting, *The Costs of Delays and Cancellations*. AGIFORS 2006