Small Data Yields Big Results

ICAO Business Class Symposium

ICAO Headquarters, Montréal

14 – 16 October, 2014

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Big Data Drum Beat

"The use of Big Data is becoming a crucial way for leading companies to outperform their peers."

McGuire, Manylka, and Chul

"… the march of quantification, made possible by enormous new sources of data, will sweep through academia, business and government. There is no area that is going to be untouched."

Gary King, Harvard

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Big Data Reality

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Gartner Hype Cycle

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Voices from the Trough

*“Big Data is Bulls**t.”*

Harper Reed, Obama 2012 CTO

“There are a lot of small data problems that occur in big data. They don’t disappear because you’ve got lots of the stuff. They get worse.”

David Spiegelhalter, Cambridge University

In some cases I believe its (big data’s) application can be …. like using a flame thrower to light a candle when all you need is a match.

Steve Sherlock, Pablow AP

“Big Data has arrived, but big insights have not.”

Tim Harford, Financial Times

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Go forth and “do” big data!

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Bigger is Harder

- Data sets can be expensive
- Cleaning - missing data, outliers, duplicates
- Blending, harmonizing, “munging”, structured and unstructured data
- Political and organizational barriers
- Talent is scarce and in high demand
- Infrastructure costs – the cloud can be really expensive

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Our experience with Big Data

2012 Predictive Analytics project

- Goal – reliably predict individual flight disruptions 24 hours in advance
- Results – delays could be predicted
- Hurdles to get to production were big
- ROI looked low

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Path to the Plateau of Productivity

- Start small
- Use proven platforms and tools
- Practice exploratory data analysis (EDA)
- Focus on a specific question or issue
- Examples

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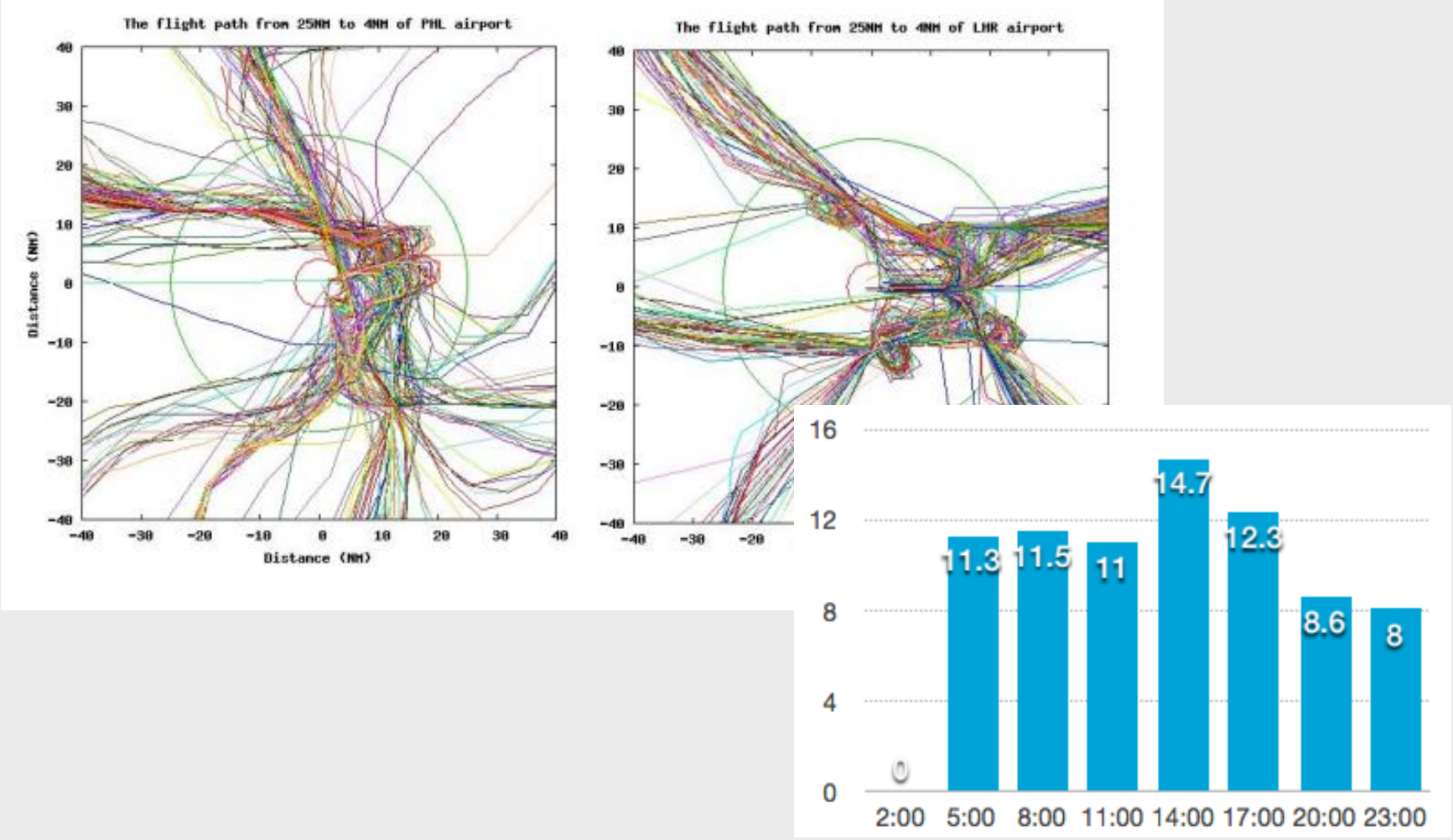
Examples and Case Studies - ICAO

Measurement of Airport Congestion (PHI, LHR)



Open ADS-B data from FlightStats, AWS, Google Map Engine

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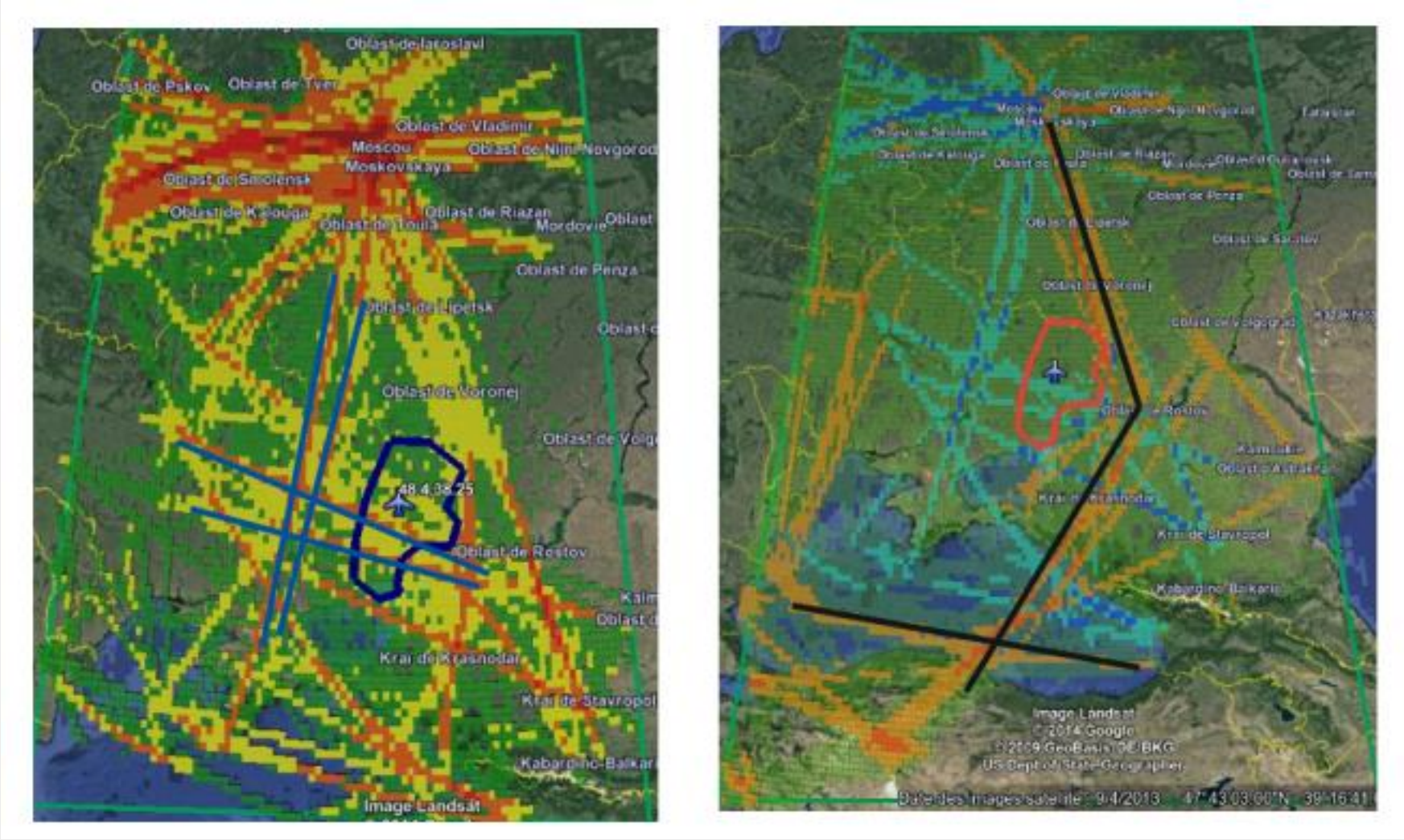
Examples and Case Studies - ICAO

Crisis Zone Monitoring Program



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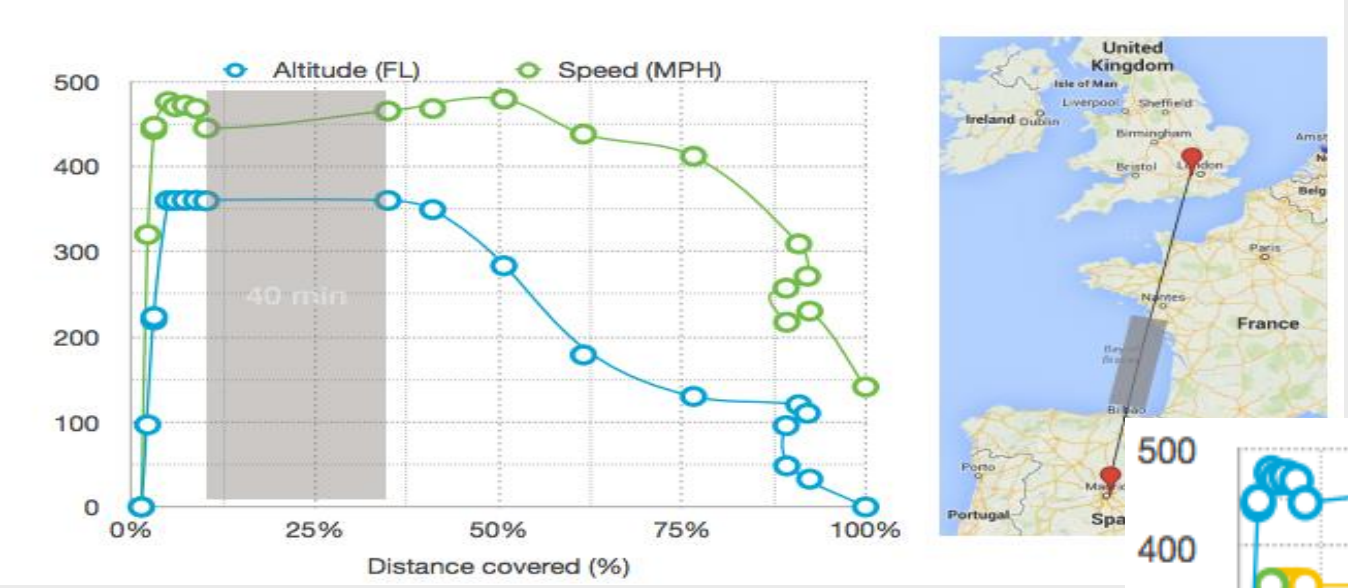
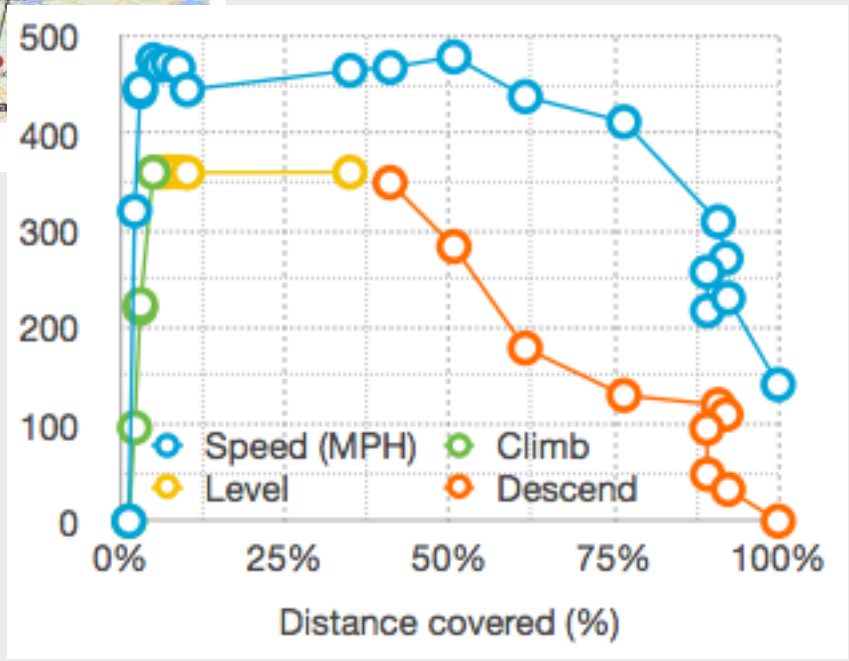
Examples – Exploratory Data Analysis at ICAO

ICAO Fuel Consumption Study





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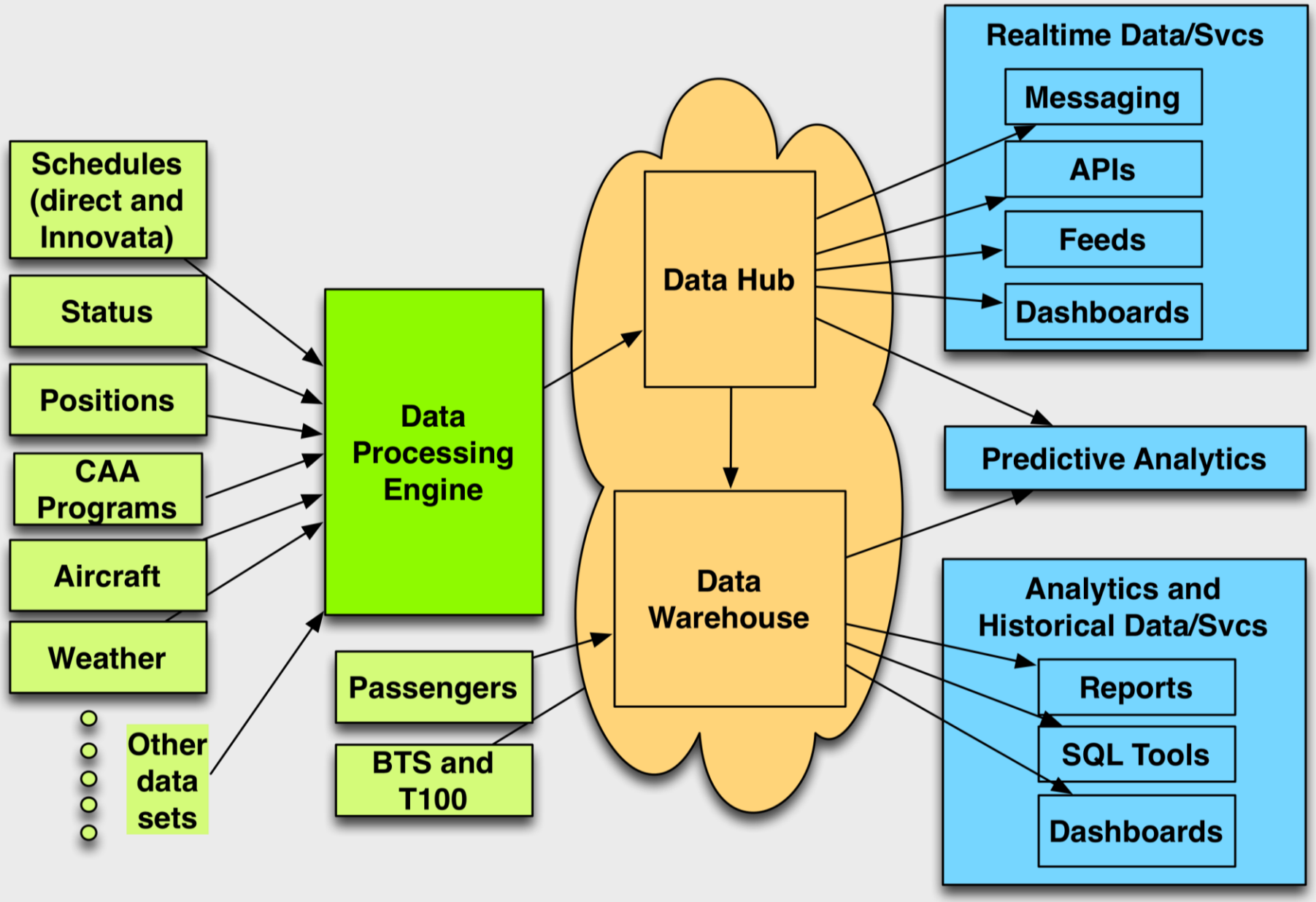
FlightStats Data and Analytics Infrastructure



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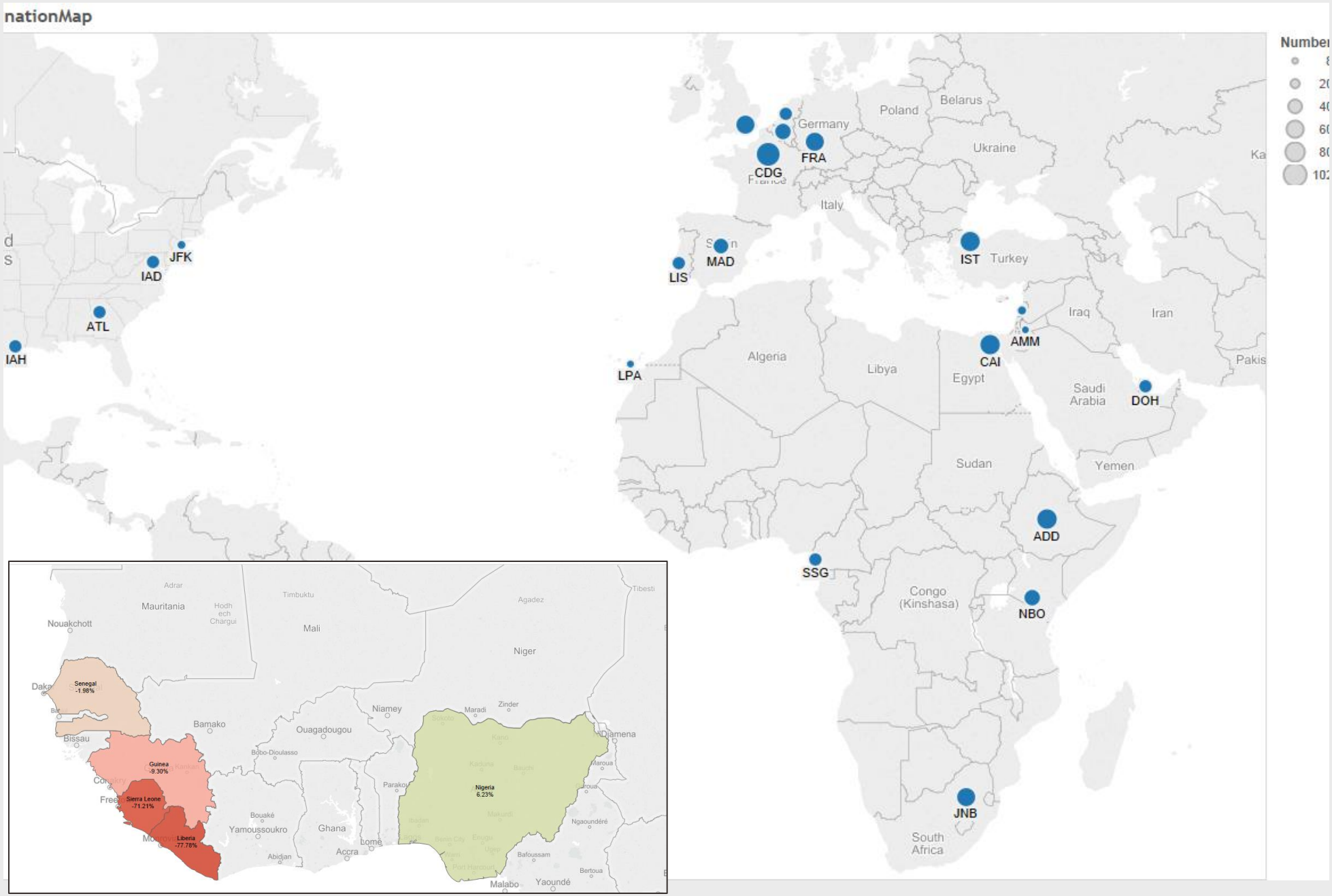
Tracking Ebola



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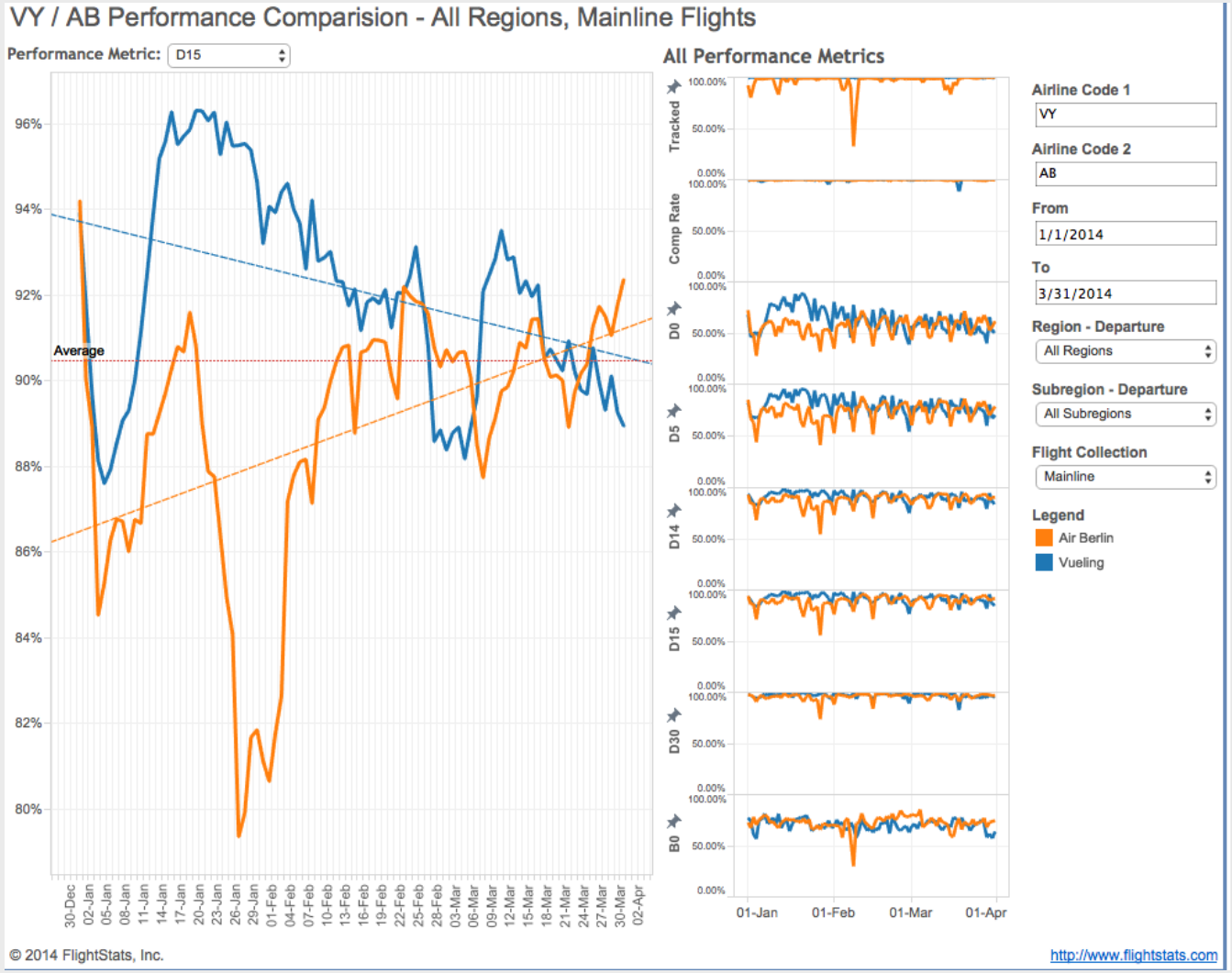
Examples and Case Studies

OTP benchmarking and competitive comparison



FlightStats data warehouse, AWS, Amazon Redshift, Tableau

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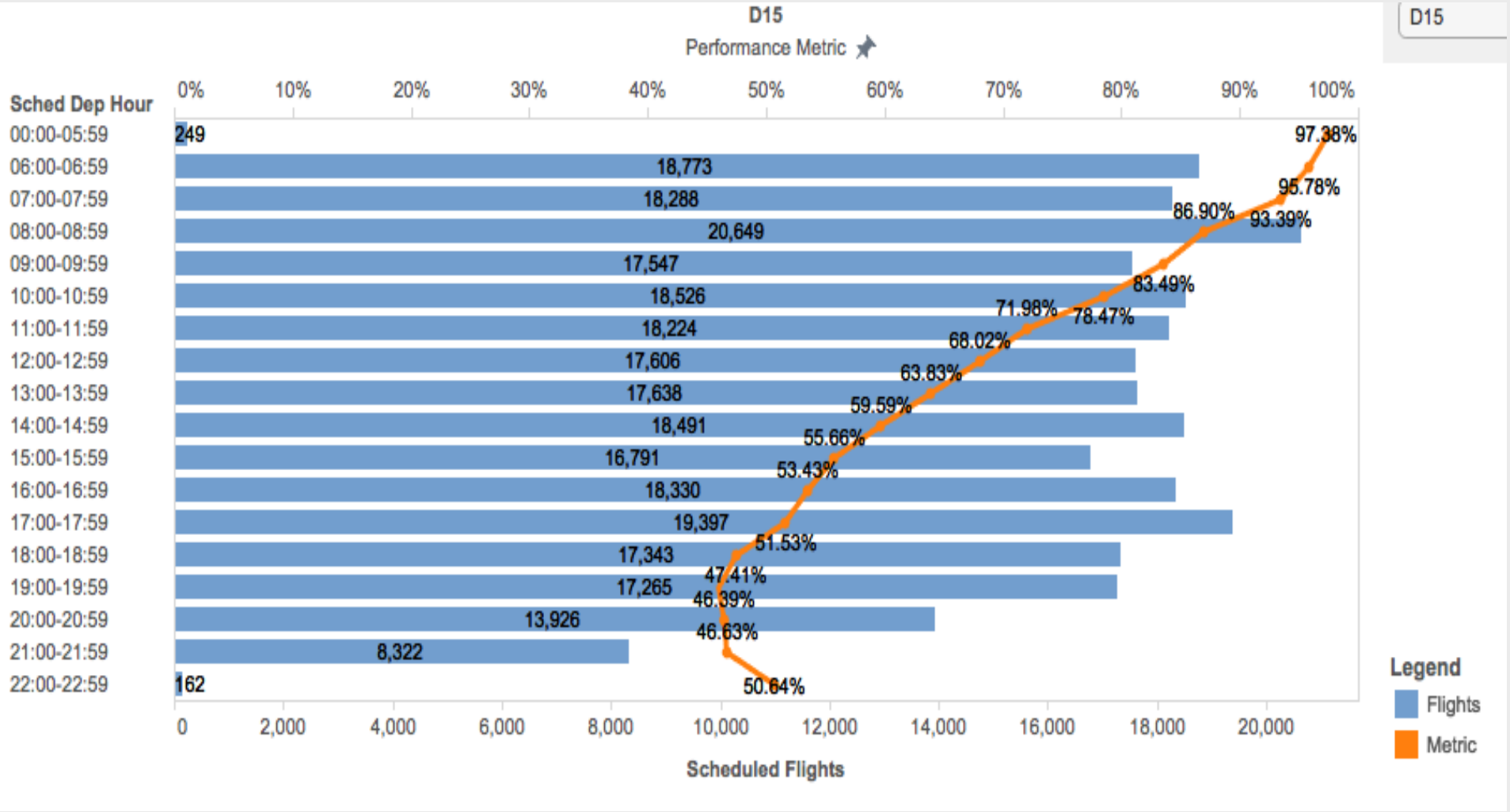
Examples and Case Studies

Airline Delay Analysis



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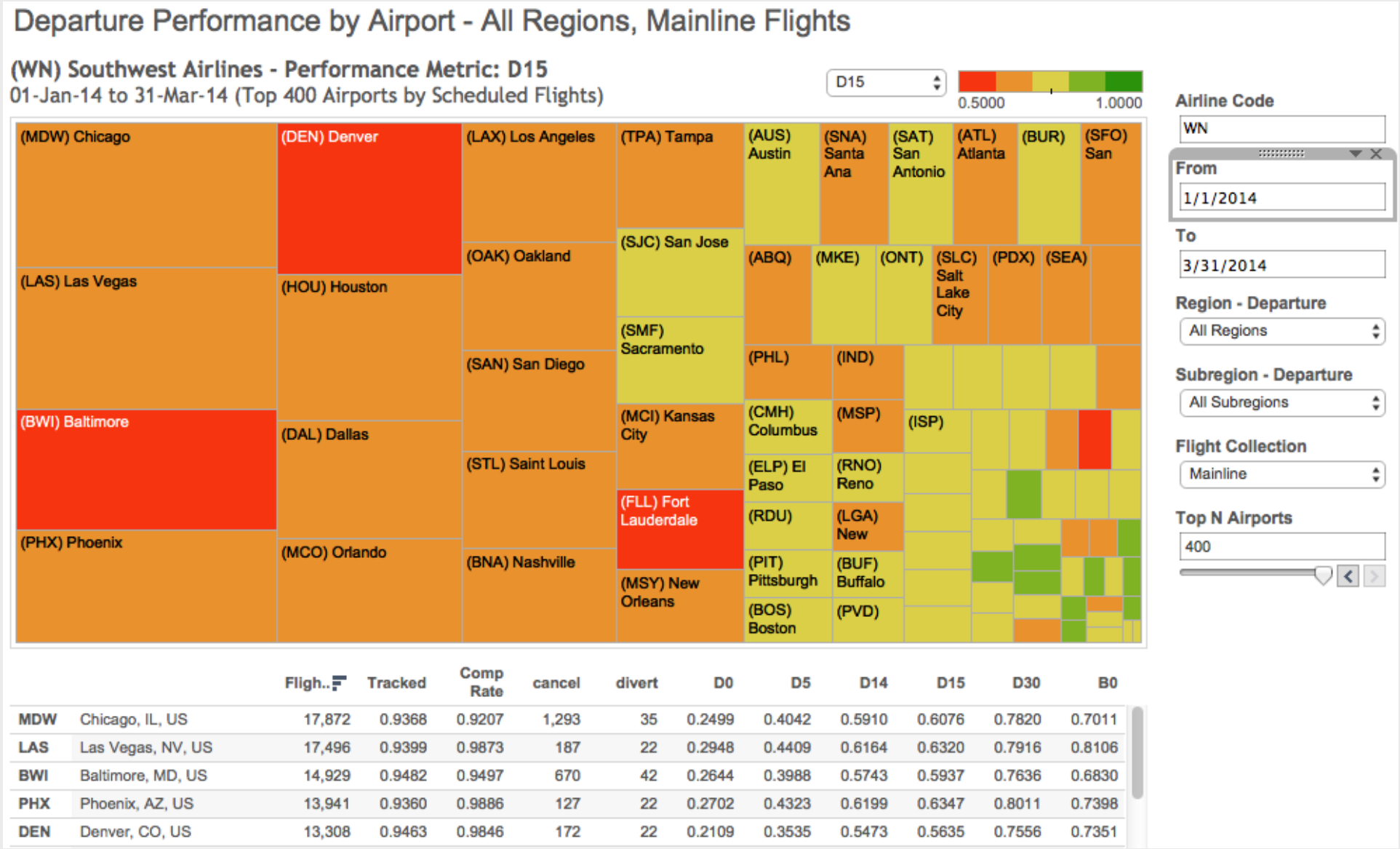
Examples – Airline departure performance



		Fligh..	Tracked	Comp Rate	cancel	divert	D0	D5	D14	D15	D30	B0
MDW	Chicago, IL, US	17,872	0.9368	0.9207	1,293	35	0.2499	0.4042	0.5910	0.6076	0.7820	0.7011
LAS	Las Vegas, NV, US	17,496	0.9399	0.9873	187	22	0.2948	0.4409	0.6164	0.6320	0.7916	0.8106
BWI	Baltimore, MD, US	14,929	0.9482	0.9497	670	42	0.2644	0.3988	0.5743	0.5937	0.7636	0.6830
PHX	Phoenix, AZ, US	13,941	0.9360	0.9886	127	22	0.2702	0.4323	0.6199	0.6347	0.8011	0.7398
DEN	Denver, CO, US	13,308	0.9463	0.9846	172	22	0.2109	0.3535	0.5473	0.5635	0.7556	0.7351

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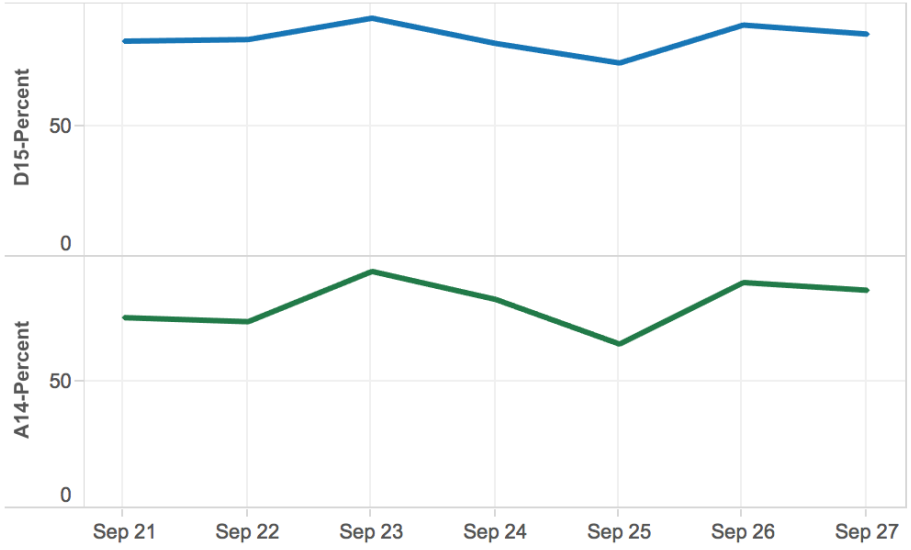
Examples – JFK route performance

Outbound Route Performance

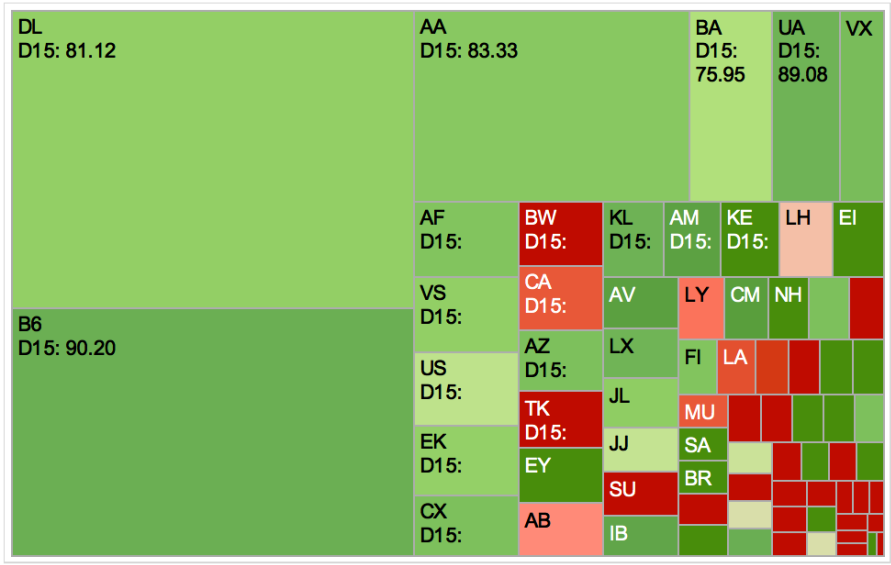
Airport Code: JFK

Date Range: Previous week

D15 & A14 Performance - All



Market Share & D15



Detailed Performance (Click to filter by airline)

Airline Code	Carrier Short Name	Route	Flights	Seats	Market%	Tracked	Cov%	Cancel	CF%	D15%	A14%	B0%	Avg. Dep Delay	Avg. Arr Delay
DL	Delta Air Lines	JFK -> ACC	7	1,477	0.23%	7	100.00	0	100.00	57.14	85.71	85.71	9.43	-6.86
		JFK -> AMS	7	1,477	0.23%	7	100.00	0	100.00	71.43	57.14	42.86	14.00	6.71
		JFK -> ATH	7	2,086	0.33%	7	100.00	0	100.00	57.14	71.43	85.71	29.29	13.86
		JFK -> AUA	7	1,204	0.19%	7	100.00	0	100.00	100.00	100.00	85.71	-3.14	-7.29
		JFK -> AUS	11	1,892	0.30%	11	100.00	0	100.00	90.91	81.82	90.91	1.91	-13.09
		JFK -> BCN	7	2,086	0.33%	7	100.00	0	100.00	71.43	85.71	57.14	4.86	4.71
		JFK -> BDA	5	800	0.13%	5	100.00	0	100.00	100.00	100.00	40.00	-7.20	-7.00
		JFK -> BNA	7	532	0.08%	7	100.00	0	100.00	71.43	71.43	57.14	5.14	-0.14
		JFK -> BOS	41	4,236	0.67%	41	100.00	0	100.00	87.80	85.37	68.29	1.49	-2.68
		JFK -> BUF	25	1,848	0.29%	25	100.00	0	100.00	76.00	68.00	60.00	6.92	5.68
		JFK -> BWI	19	950	0.15%	19	100.00	0	100.00	84.21	78.95	78.95	6.32	-5.95

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Examples – SFO Gate Utilization

Gate Utilization

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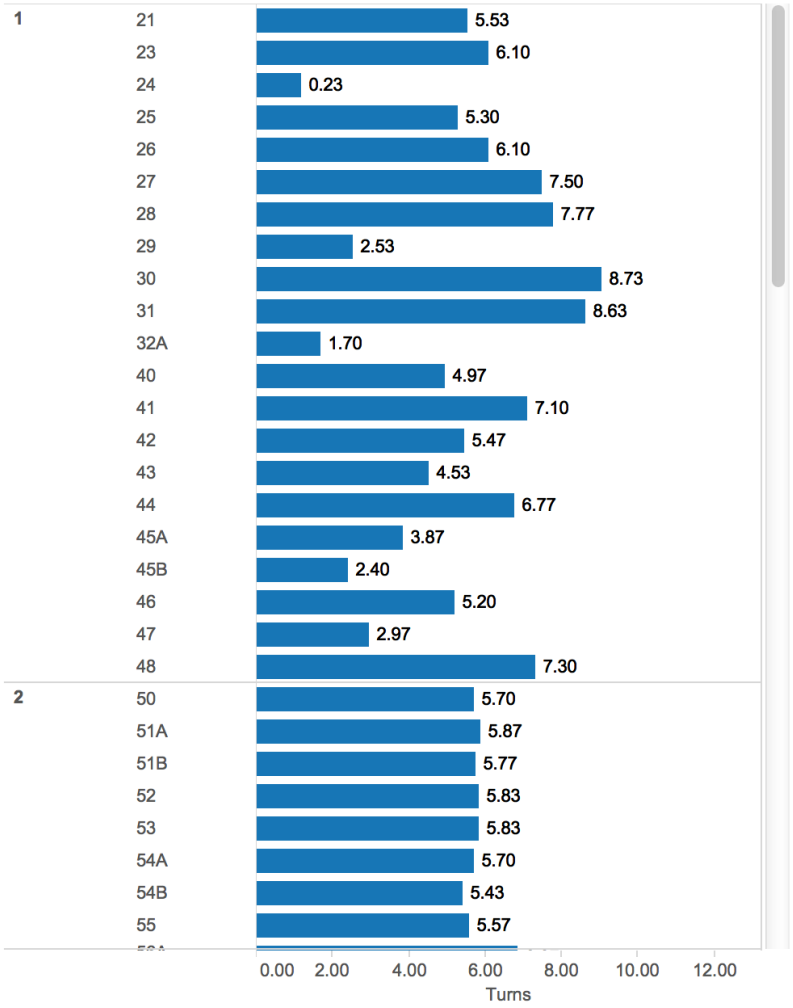
Airport Code: SFO

Departure Date: Last 30 days

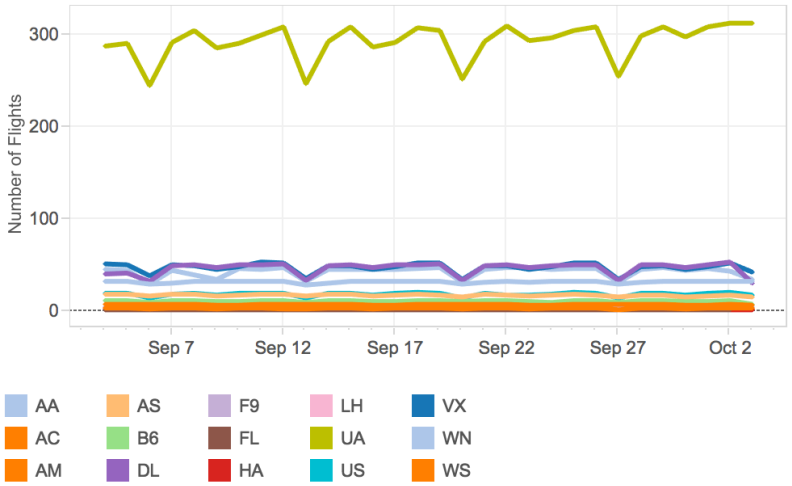
Utilization by Terminal & Gate



Airline Turn Summary (Click to filter by airline)

Marketing Airline	Carrier Short Name	Flights	Avg Daily Turns
UA	United Airlines	8,804	293.47
VX	Virgin America	1,413	47.10
DL	Delta Air Lines	1,381	46.03
WN	Southwest Airlines	1,236	41.20
AA	American Airlines	940	31.33
US	US Airways	539	17.97
AS	Alaska Airlines	507	16.90
B6	JetBlue Airways	310	10.33
AC	Air Canada	201	6.70
F9	Frontier Airlines	136	4.53
AM	Aeromexico	80	2.67
WS	WestJet	60	2.00
HA	Hawaiian Airlines	30	1.00
FL	AirTran	29	0.97

Daily Flights At Selected Terminal & Gates



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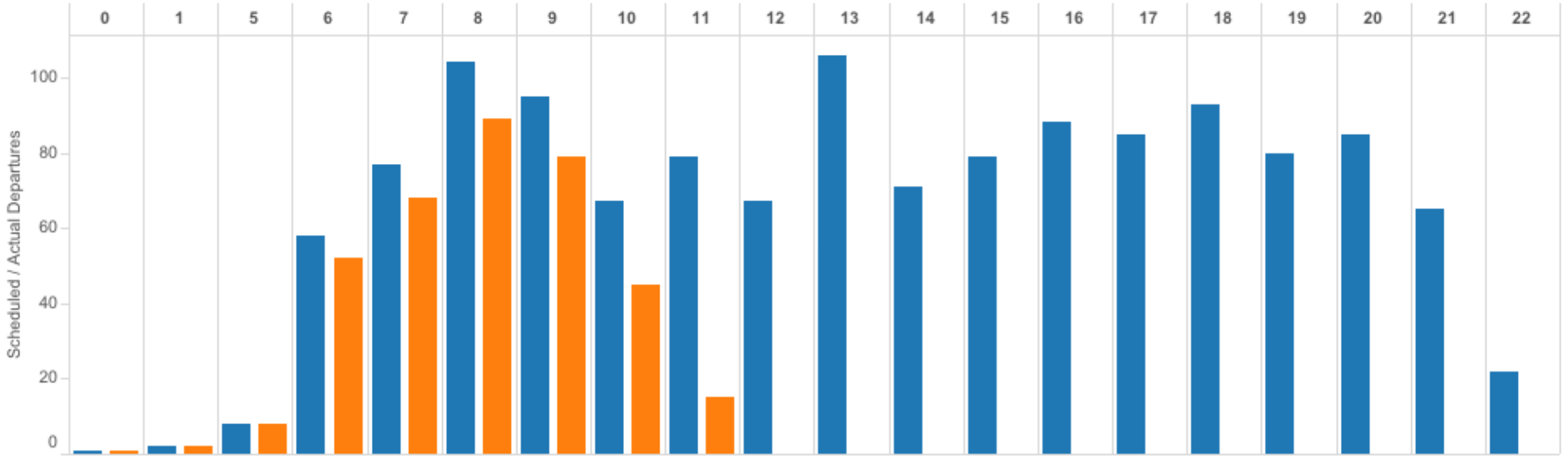
Examples – Real Time Dashboards

Today | ORD

Measure Names: Flights, Actual Departures

Hourly Departures



Detailed Airline Performance

Airline Code	Carrier Short N..	Flights	Seats	Market%	Tracked	Cov%	Cancel	CF%	D0%	D5%	D15%	D30%
UA	United Airlines	669	57,064	43.57%	151	22.57	41	72.85	41.82	54.55	66.36	82.73
AA	American Airlines	479	46,206	35.28%	120	25.05	50	58.33	32.86	45.71	70.00	84.29
DL	Delta Air Lines	57	5,657	4.32%	14	24.56	2	85.71	50.00	66.67	75.00	83.33
NK	Spirit Airlines	25	4,120	3.15%	8	32.00	4	50.00	50.00	50.00	50.00	50.00
US	US Airways	21	3,721	2.84%	5	23.81	0	100.00	60.00	60.00	100.00	100.00
AC	Air Canada	11	803	0.61%	2	18.18	0	100.00	50.00	50.00	50.00	100.00
3E	Air Choice One	8	88	0.07%	0	0.00	0					
B6	JetBlue Airways	7	850	0.65%	1	14.29	0	100.00	100.00	100.00	100.00	100.00
AS	Alaska Airlines	5	800	0.61%	0	0.00	0					
VX	Virgin America	5	745	0.57%	0	0.00	0					
AM	Aeromexico	4	618	0.47%	2	50.00	0	100.00	0.00	0.00	100.00	100.00
LH	Lufthansa	4	889	0.68%	0	0.00	0					

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In closing

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Thank you

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