Using Novel Aircraft Performance Engineering Methods to Optimize Runway Length

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Penn State Airports Conference - 2016

Goals For This Morning's Presentation

- Background on Aircraft Performance Engineering and Runway Length Assessment
- Difference Between Current Methods For Runway Length Assessment and Aircraft Performance Engineering Methods
- Novel Approaches to Runway Length Assessments used at Various Airports and what they achieved

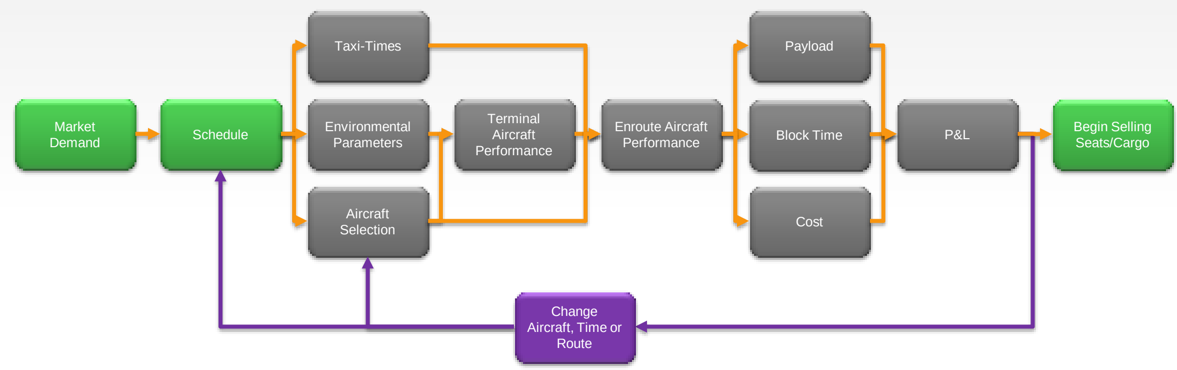
What is Aircraft Performance Engineering

- The science and profession of operating, testing, and improving airplanes
- It has several synonymous professional titles including: Flight Operations Engineering, Operations Engineering and Operations Planning
- When applied to the design, manufacture and test of aircraft in the United States it is governed by FAR Part 23/25 and results in
  - Airport Planning Manuals (APM)
  - Aircraft Operations Manuals (AFM, AOM, POH, MEL, QRH)
  - Software to calculate aircraft flight operations data (CAFM, SCAP)
- When applied to the operation of aircraft in the United States it is regulated under FAR 23/25/91/91-K/121/125/135 and results in
  - One Engine Inoperative Procedures (SDPs, EOSIDs, SMAPs, EOMAP)
  - PBN Procedures (RNP, RNP-AR)
- ***The group of people who are behind every request to build longer runways, remove more obstacles and never, ever close a runway***

The Goal of Aircraft Performance Engineering

How much stuff can a plane safely fly with?	Takeoff, Landing, Weight and Balance, Aircraft Certification
How far can the plane go once all the stuff is onboard?	Climb, Cruise, Descent, Routing, Terrain, Hazardous Areas, Forecasting, APM, ECM
How much will it cost to get there with most of the stuff?	Noise, Emissions, Cost Index, Airspace Charges, Landing Fees, Into Plane Costs
Do I need to find another plane, modify the plane or fly it in a different way?	Aircraft Substitutions, Wingtip Improvements, Engine and Avionics Improvements, Flight Profile Changes
What are the risks associated with my choices?	FARs, Advisory Circulars, ICAO Annexes, OpSpecs, Notices, SMS, ATOS, IS-BAO, IOSA

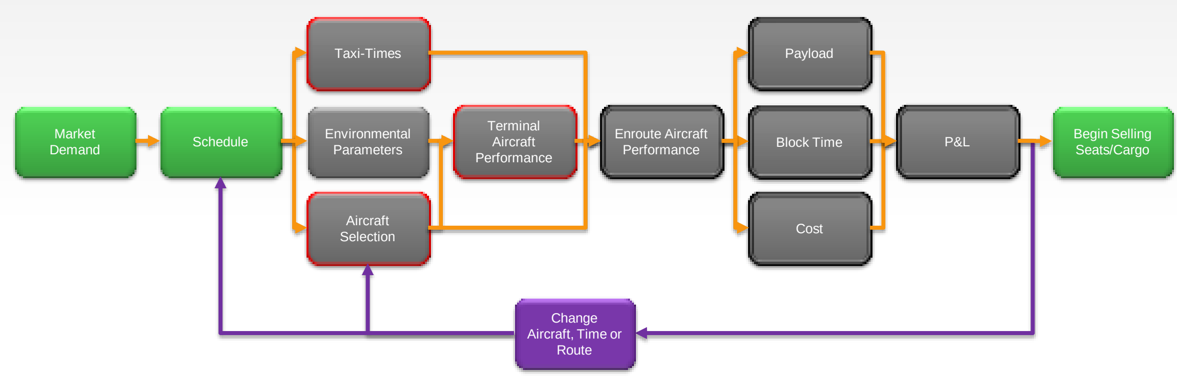
Aircraft Performance Engineering At a Scheduled Operator



Legend

- Non-Aircraft Performance Decisions
- Aircraft Performance Engineering
- Team Decision

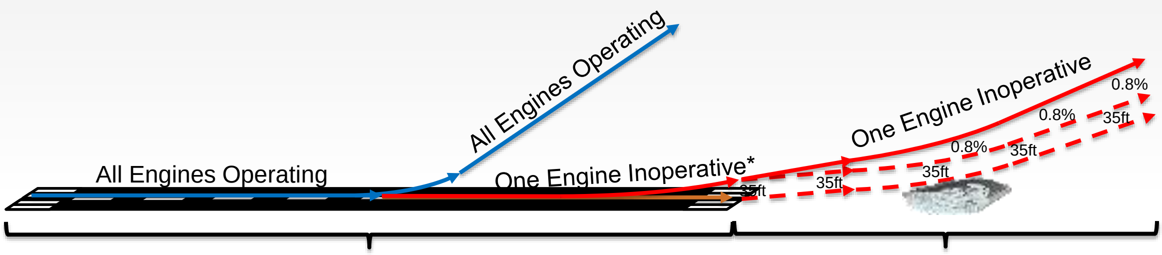
Aircraft Performance Engineering and The Effects of Runway Length



Legend

- Operator Decisions
- Factors Independent of Runway Length
- Factors Directly Influenced by Runway Length
- Factors Indirectly Influenced by Runway Length
- Solutions Available to Operators

Aircraft Performance Engineering View of Runway Length



- Basic profile view of the possible paths which relate to FAR 121.189 compliance
- 1st and 2nd segments of a 4 segment one engine inoperative takeoff flight path are depicted
- All engines operating flight path is shown for reference, but is not considered a part of the obstacle limited takeoff weight computation
- Flight paths are not linear, even though certain older aircraft will treat the clearance of obstacles using linear references

*All Engines Operating and One-Engine Inoperative considered for stop calculation

Runway Length Determination with Aircraft Performance Engineering

Historical Environmental Data Analysis

Geospatial Deconfliction

Performance Calculations

Regulatory Basis

Runway Length Determination with Aircraft Performance Engineering

Historical Environmental Data Analysis

- Hourly Observations By Month
  - Temperature/Pressure/Winds
  - Runway Surface Conditions/Anti-Icing
  - Ceiling and Visibility

Geospatial Deconfliction

Performance Calculations

Regulatory Basis

Historical Environmental Data Analysis

85% Temperatures (C°)

Local Time	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	7.7	6.8	11.0	11.6	16.1	20.0	24.8	24.8	22.9	16.6	12.6	7.0
100	7.3	6.6	10.6	11.1	15.2	19.2	24.1	23.2	23.1	16.1	12.6	7.0
200	7.5	6.5	10.2	10.8	14.7	18.9	25.0	23.0	22.9	16.1	12.2	6.8
300	7.7	6.8	10.0	10.3	14.2	18.2	24.1	23.0	22.4	15.5	12.1	6.7
400	7.4	6.4	9.8	10.0	13.6	17.7	23.6	22.9	21.9	15.2	12.4	6.8
500	7.2	6.2	9.8	9.8	13.2	17.5	22.2	20.8	21.2	15.0	12.0	6.3
600	6.9	6.0	9.7	9.4	12.7	16.5	22.6	20.4	18.9	14.5	11.8	6.4
700	6.9	5.8	9.3	9.0	13.5	18.8	23.2	19.7	17.7	14.3	11.5	6.2
800	7.1	5.9	9.0	10.5	15.5	20.7	26.3	22.7	18.3	13.9	11.2	6.2
900	7.1	5.5	10.8	12.6	18.2	23.7	30.5	24.0	22.2	16.2	11.5	6.3
1000	7.7	7.1	12.6	14.7	20.3	26.0	31.1	29.1	25.3	19.1	13.2	7.1
1100	8.5	8.7	14.4	16.7	21.6	28.2	34.8	31.1	27.5	21.7	14.9	8.8
1200	10.2	10.2	16.0	17.9	23.0	29.9	34.3	32.9	29.0	23.8	16.5	9.4
1300	11.0	11.1	17.4	19.2	24.0	30.1	34.7	33.5	31.1	24.5	17.2	10.1
1400	11.8	12.0	18.1	20.0	25.0	30.3	35.6	35.0	31.7	25.3	17.8	10.8
1500	11.7	12.2	18.2	20.6	25.0	31.1	36.2	36.1	32.5	25.8	18.1	10.5
1600	11.2	12.4	18.5	20.4	25.4	31.1	36.3	34.7	32.9	25.9	17.8	9.9
1700	10.3	11.6	18.1	20.2	25.1	32.2	36.7	33.5	33.2	24.8	16.9	8.9
1800	8.8	10.8	17.4	19.7	24.9	30.7	35.1	34.1	31.5	23.6	15.3	7.9
1900	8.3	9.1	15.8	18.8	23.7	30.3	33.9	31.4	29.2	20.8	14.4	7.6
2000	7.9	7.9	13.7	16.8	21.9	28.1	32.8	31.4	26.6	18.9	13.7	7.3
2100	7.9	7.5	12.7	14.9	19.5	25.9	29.8	30.7	23.5	18.0	13.2	7.0
2200	8.0	7.0	11.6	13.5	17.7	22.5	28.7	28.7	21.7	17.5	13.1	7.1
2300	7.7	7.0	11.3	12.5	16.4	21.2	24.9	26.1	21.1	16.7	12.8	7.1

65% Pressure (inHg)

Local Time	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	29.76	29.75	29.75	29.73	29.83	29.86	29.99	29.97	29.94	29.85	29.79	29.75
100	29.77	29.74	29.75	29.72	29.83	29.86	29.99	29.97	29.93	29.85	29.78	29.75
200	29.75	29.75	29.75	29.72	29.82	29.86	29.99	29.97	29.93	29.84	29.78	29.75
300	29.75	29.74	29.74	29.71	29.82	29.86	29.99	29.96	29.93	29.85	29.78	29.74
400	29.76	29.74	29.73	29.71	29.81	29.86	29.99	29.97	29.93	29.84	29.78	29.75
500	29.76	29.73	29.73	29.72	29.82	29.86	29.99	29.97	29.93	29.85	29.78	29.74
600	29.74	29.73	29.74	29.71	29.83	29.87	30.00	29.98	29.94	29.85	29.78	29.73
700	29.75	29.74	29.73	29.72	29.83	29.87	30.01	29.99	29.94	29.85	29.77	29.74
800	29.75	29.74	29.75	29.73	29.83	29.87	30.02	30.00	29.95	29.86	29.77	29.75
900	29.76	29.75	29.75	29.73	29.83	29.87	30.02	30.00	29.95	29.87	29.78	29.75
1000	29.76	29.75	29.74	29.73	29.83	29.87	30.01	30.00	29.95	29.87	29.79	29.76
1100	29.77	29.75	29.73	29.72	29.82	29.87	30.00	29.99	29.95	29.87	29.79	29.77
1200	29.77	29.75	29.73	29.72	29.81	29.86	29.99	29.97	29.93	29.86	29.78	29.76
1300	29.75	29.74	29.72	29.71	29.80	29.84	29.98	29.96	29.92	29.85	29.76	29.74
1400	29.73	29.72	29.70	29.69	29.80	29.83	29.97	29.94	29.90	29.83	29.75	29.73
1500	29.73	29.71	29.70	29.69	29.80	29.82	29.96	29.93	29.89	29.82	29.75	29.72
1600	29.73	29.70	29.70	29.69	29.78	29.82	29.94	29.92	29.88	29.82	29.75	29.74
1700	29.74	29.71	29.70	29.68	29.78	29.81	29.94	29.91	29.89	29.82	29.76	29.74
1800	29.76	29.72	29.72	29.70	29.78	29.81	29.93	29.92	29.89	29.82	29.76	29.75
1900	29.75	29.73	29.72	29.69	29.78	29.82	29.94	29.92	29.90	29.83	29.77	29.75
2000	29.76	29.74	29.73	29.70	29.80	29.83	29.95	29.93	29.91	29.84	29.78	29.76
2100	29.76	29.74	29.75	29.71	29.81	29.84	29.96	29.95	29.92	29.84	29.78	29.75
2200	29.76	29.75	29.75	29.73	29.83	29.86	29.99	29.97	29.93	29.85	29.78	29.76
2300	29.77	29.75	29.75	29.73	29.83	29.87	29.99	29.97	29.94	29.85	29.79	29.76

Likelihood of Using Runway 04

Local Time	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	20.69%	16.60%	15.05%	10.37%	5.00%	5.95%	2.73%	5.68%	6.35%	11.58%	16.60%	16.02%
100	16.44%	11.86%	12.73%	10.11%	4.17%	4.89%	3.10%	3.47%	6.48%	9.96%	13.67%	16.60%
200	16.89%	13.60%	15.30%	10.28%	4.55%	4.69%	3.16%	5.93%	4.92%	10.94%	16.92%	14.73%
300	20.98%	12.94%	13.38%	10.39%	5.54%	2.68%	2.78%	5.18%	6.37%	9.16%	15.97%	14.62%
400	14.83%	12.20%	14.75%	9.29%	2.82%	4.48%	2.79%	1.15%	4.42%	11.03%	14.62%	11.37%
500	13.01%	10.36%	14.84%	8.10%	5.28%	3.70%	1.18%	1.15%	4.02%	11.32%	13.03%	14.34%
600	16.33%	13.15%	12.64%	6.86%	4.91%	3.33%	1.19%	1.89%	4.78%	10.90%	12.02%	13.90%
700	16.55%	10.67%	14.04%	8.24%	3.83%	4.09%	2.36%	2.28%	3.60%	8.30%	12.45%	14.01%
800	16.38%	11.86%	12.90%	7.17%	6.38%	4.06%	2.02%	2.67%	2.43%	8.68%	9.92%	13.18%
900	14.33%	16.41%	15.00%	16.01%	9.15%	6.27%	2.39%	2.65%	7.14%	9.85%	11.11%	15.63%
1000	20.00%	14.00%	18.25%	16.61%	10.45%	10.26%	6.67%	4.96%	8.06%	12.93%	14.34%	14.56%
1100	22.90%	18.58%	23.86%	19.43%	16.61%	13.77%	7.42%	8.43%	8.66%	14.56%	16.54%	21.01%
1200	24.16%	19.69%	26.15%	28.87%	18.82%	14.80%	10.24%	7.72%	12.94%	15.85%	16.67%	19.23%
1300	20.20%	19.07%	27.08%	30.18%	25.26%	17.20%	12.84%	10.31%	16.47%	20.61%	16.99%	21.43%
1400	21.58%	20.91%	30.04%	30.85%	21.60%	19.71%	21.09%	18.85%	15.18%	21.64%	21.26%	21.54%
1500	17.94%	21.57%	29.39%	32.14%	23.16%	21.09%	18.25%	19.39%	16.67%	20.52%	22.31%	23.26%
1600	19.46%	20.78%	33.21%	30.94%	26.13%	21.74%	20.93%	17.44%	19.12%	24.63%	22.35%	19.62%
1700	21.21%	21.26%	34.05%	31.90%	26.55%	23.72%	22.66%	19.23%	17.72%	21.72%	22.69%	20.08%
1800	18.47%	16.87%	25.00%	28.15%	22.99%	21.27%	21.86%	19.12%	13.88%	16.73%	17.53%	14.74%
1900	14.63%	16.13%	24.64%	27.44%	24.65%	19.49%	21.09%	13.57%	10.76%	15.66%	18.60%	13.15%
2000	20.07%	16.54%	19.00%	15.36%	13.79%	17.34%	15.63%	5.06%	6.43%	11.29%	19.77%	15.04%
2100	22.07%	16.53%	14.07%	13.26%	9.47%	9.33%	6.64%	5.08%	4.78%	11.16%	13.67%	14.90%
2200	18.39%	13.52%	17.08%	15.58%	4.93%	8.99%	3.98%	4.26%	5.76%	9.13%	17.19%	13.39%
2300	19.46%	15.54%	13.21%	9.82%	5.30%	10.82%	3.19%	4.03%	7.20%	9.69%	17.62%	16.00%

Runway Length Determination with Aircraft Performance Engineering

Historical Environmental Data Analysis

Geospatial Deconfliction

- Determining which data is “right”
  - NFDC/AIRNAV 2.0/eNASR/5010/AFD/eALP/3rd Party
  - DDOF/TPSS/NOAA/DVOF/LOW Close-In/DSM

Performance Calculations

Regulatory Basis

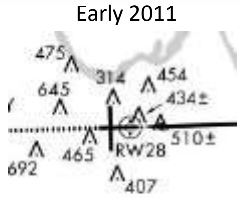
Geospatial Deconfliction

2010

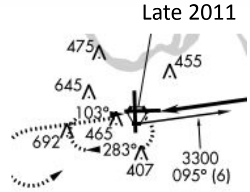
Early 2011

Late 2011

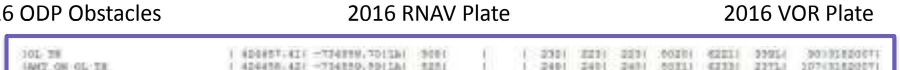
2016 ODP Obstacles



2016 RNAV Plate



2016 VOR Plate



UDDF Was Still Controlling For Aircraft Performance

Runway Length Determination with Aircraft Performance Engineering

Historical Environmental Data Analysis

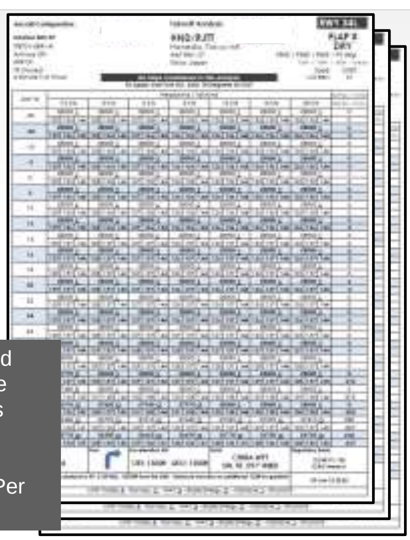
Geospatial Deconfliction

Performance Calculations

- Simulation and emulation of aircraft performance
  - Declared distances and alignment
  - Slope and elevation
  - Special procedure optimization
  - Aircraft configuration optimization

Regulatory Basis

Performance Calculations



Computerized Performance Calculations

Millions of Combination Per Runway

Special One Engine Inoperative and All Engines Operating Procedures Are Computer Calculated

Runway Length Determination with Aircraft Performance Engineering

Historical Environmental Data Analysis

Geospatial Deconfliction

Performance Calculations

Regulatory Basis

- Understand the differences between regulatory basis and foreign/domestic operators
  - Landing distance requirements
  - Obstacle clearance
  - Obstacle detection
  - Declared distance requirements
  - Passenger/baggage weights

Regulatory Basis

Aircraft Category	Operating Rule			
	Part 91 (except Fractional Operations)	Part 91 Fractional Operations	Part 121	Part 135
Large Transport: Reciprocating engine powered	§ 91.605	§ 91.605	§ 121.175 - § 121.187	§ 135.365 - § 135.377
Large Transport: Turbine engine powered	§ 91.605	§ 91.1037	§ 121.189 - § 121.197	§ 135.379 - § 135.387
Large Nontransport	§ 91.103	§ 91.103	§ 121.199- § 121.205	§ 135.389 - § 135.395
Small Transport	§ 91.605	§ 91.605	Same as for Large Transport	§ 135.397
Commuter	§ 91.103	§ 91.103	Same as for Large Transport	§ 135.398
Small Nontransport	§ 91.103	§ 91.103	§ 121.189 – § 121.197 (See Paragraph 4-XXX)	§ 135.399

Declared Distances Are Encouraged

No requirement to ensure obstacle clearance

Declared Distances Must Be Considered

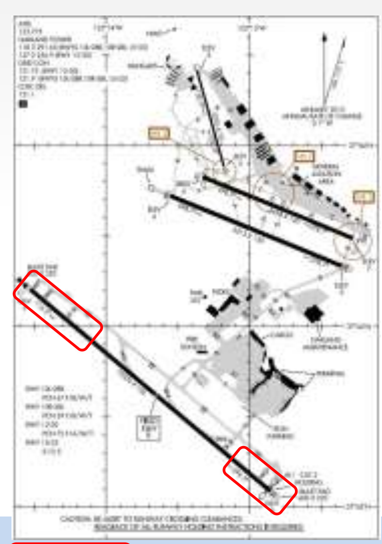
Special rules for takeoff minimums

Examples of Conventional Analysis vs Aircraft Performance Engineering

- Oakland, CA (OAK/KOAK) Rwy 12/30 RSA Compliance
  - Operator Feedback vs Aircraft Performance
- Los Angeles, CA (LAX/KLAX) Rwy 06R/24L RSA Compliance
  - Observed Performance vs Aircraft Performance
- San Francisco, CA (SFO/KSFO) Rwys 01L/19R and 01R/19L RSA Compliance
  - Airport Planning Manuals vs Aircraft Performance
- Regional Airport in the Eastern US Master Plan Update
  - AC-150-5325-4B vs Aircraft Performance

Oakland, CA (OAK/KOAK) 12/30 RSA Improvements

- Operators were asked to indicate how much runway they needed during a Runway Safety Area compliance project on the primary runway
- Answers came in a variety of formats with seemingly contradictory results
  - Chief Pilots provided minimum runway lengths necessary to operate of between 5,000ft up to 7,000ft (without any distinction as to whether it was for takeoff or landing)
  - Station managers coordinated with their aircraft performance engineering groups and got answers back ranging from 6,500ft up to 10,000ft
  - Some aircraft performance engineering departments responded with answers for wet conditions only, because no specific environmental assumptions or times of year had been established as a pre-condition
  - Many operators did not respond because the project was over 6 months away
- Result:
  - The airport planning and design teams were unable to converge on a single answer that would satisfy both the hub operators like Southwest Airlines without disabling the FedEx sort center, international and Hawaii operations



Work Area

Oakland, CA (OAK/KOAK) 12/30 RSA Improvements

- We used Aircraft Performance Engineering to help the airport make a better determination:
  - Create an hourly/monthly historical environmental analysis that was equivalent to how the operators would consider the airport for their scheduled flights
  - Perform a geospatial deconfliction to understand what operators were “seeing” and convert the old NOAA and DDOF obstacles along with the TPSS/AGIS submission and eALP updates into a common view based on domestic and international obstacle detection areas
  - Create payload range assessments using aircraft performance manuals and software for operators that were unable to deliver detailed responses and identify the critical aircraft by hour, by month
- Result:
  - A phased construction of the runway was created to maintain FedEx, European and Hawaii operations that would have otherwise not been able to operate
  - The geospatial deconfliction revealed that certain obstacles should be removed prior to implementation of the shortened runway lengths, which would have been limited MD-11 takeoffs by 10klbs – 20klbs

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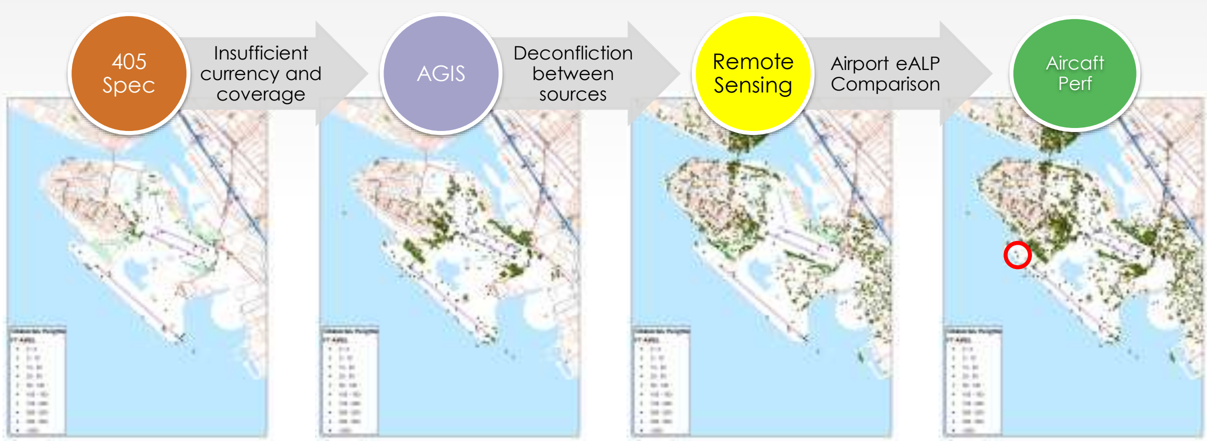
March 22, 2016

Oakland Geospatial Deconfliction Example



Obstacle impacting MD-11 takeoffs

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March 22, 2016

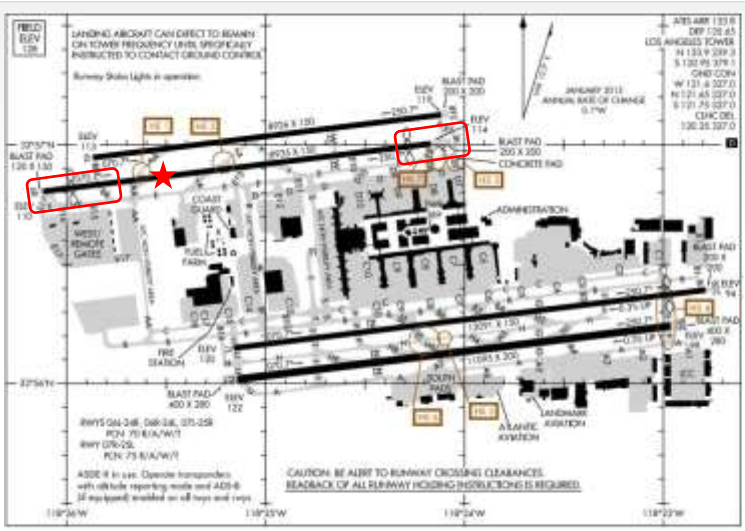
Los Angeles, CA (LAX/KLAX) 06R/24L RSA Improvements

- Airport needed to make RSA improvements to the third longest runway at the airport ahead of longer range masterplans that involved potential decoupling of the runways
- Airport had observed that the current runway was frequently used by 747s, A340 and A380 following cross field taxiway reconstruction and the opening of the new Tom Brady International Terminal
- Airport and tower representatives had also observed that most aircraft lifted off thousands of feet prior to the end of the runway and hypothesized that some reduction in the TODA/TORA/ASDA could be utilized to achieve RSA compliance instead of adding additional runway
- The airport received information from the planning process that relocating the thresholds would have no impacts on aircraft performance because the “length” (and not the position) had always been sufficient but they weren’t getting a lot of operator feedback to justify this feedback or the other reduced length hypothesis
- Result:
  - The airport planning and design teams wanted to understand how changes to the runway would impact widebody operations on trans-pacific and trans-Atlantic operations if the runway were unbalanced and new obstruction surveys were considered

Los Angeles, CA (LAX/KLAX) 06R/24L RSA Improvements

Work Area

★ Observed Liftoff Point for A380 on 24L



Construction is currently in progress, hence the shorter length on 06R/24L

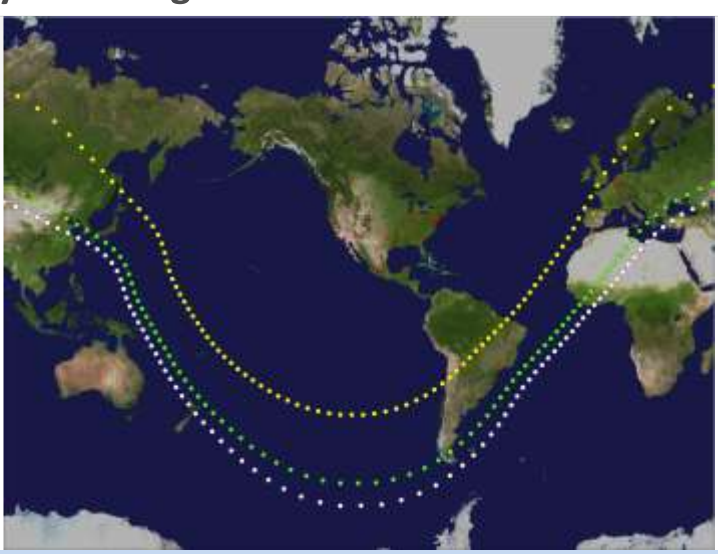
Los Angeles, CA (LAX/KLAX) 06R/24L RSA Improvements

- We used Aircraft Performance Engineering to help the airport make a better determination
  - Performing a geospatial deconfliction on the new AC-150-5300-18B collected dataset revealed that there were a number of obstacles that the airport was preparing to distribute to the TPSS, but these obstacles were not yet "known" to air carriers
  - Additional obstacles were detected that had not been captured by the -18B process along city owned streets surrounding the airport
  - The hypothesized position of the runway, combined with the new obstacle data set, would have prevented A340s and 747s from using the runway in the future for Trans-Pacific and Middle Eastern Operations
  - SCAP based aircraft performance calculations, for unbalanced field lengths and obstacle clearance, were used to simulate and emulate the impacted payload range options to find a more optimal RSA compliant solution
- Result
  - Aircraft operators were effectively forewarned of the upcoming updates to the obstacle situation at the airport, and agreed with the aircraft performance engineering assessments that had been used in the lead up to the construction
  - This ensured that the design of the runway, and its reconstruction, could occur on schedule with an enhanced taxiway layout and improved payload range performance for current and future operators off of the same physical pavement length

Los Angeles, CA (LAX/KLAX) 06R/24L RSA Improvements 747-400 Payload Range

○ Range Before Obstacles and RSA Compliance

● Range That Would Have Resulted From Current Methods

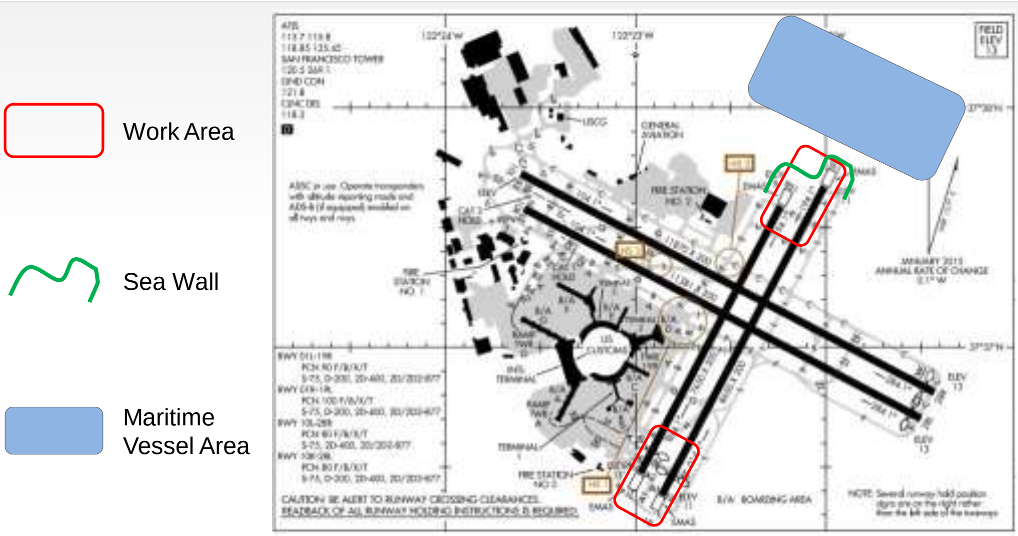


● Range That Resulted From Aircraft Performance Engineering

San Francisco, CA (SFO/KSFO) 01L/19R and 01R/19L RSA Improvements

- Consultant team was considering the total or partial closure of the primary departure runways to accommodate RSA improvements
- Many different stakeholders were offering different opinions about whether the runways should be closed or remain open, at partially available lengths, to permit the lowest possible chance of delays
- Airport planning manuals had suggested that the existing runway lengths were not sufficient for wide body operations, but the airport had observed that a significant number of domestic and international wide body operations use the runways on a daily basis
- Hub operator fleets at the airport, with similar equipment, had different opinions about runway length needs based on different interpretations of obstacle clearance and aircraft performance optimization for their Airbus fleet
- Result
  - The airport sought out aircraft performance engineering to perform a detailed runway length assessment in response to the hub operators concerns

San Francisco, CA (SFO/KSFO) 01L/19R and 01R/19L RSA Improvements



San Francisco, CA (SFO/KSFO) 01L/19R and 01R/19L RSA Improvements

- We used Aircraft Performance Engineering to determine the optimal runway lengths:
  - Optimized aircraft performance calculations were used to model several options based on different constructability criteria
  - The results of the analysis were used to create a flight by flight, hour by hour, breakdown of the existing schedule that could be used with TAAM and SIMMOD that indicate which flights would be able to use the runways and which would need to utilize the 10/28s
  - Geospatial deconfliction and a regulatory analysis revealed that different obstacle determination methods were being considered for one engine inoperative clearance relative to the sea wall and ships that transit the departure path
- Result
  - The airport consultant team, empowered by the Aircraft Performance Engineering derived SIMMOD analysis was able to show that several design options existed that could accommodate 85% of scheduled flights

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San Francisco, CA (SFO/KSFO) 01L/19R and 01R/19L RSA Improvements

Current methods available for estimating runway length showed that the runways would be unsuitable for use during construction

✓ **Aircraft Performance Engineering was able to show different runway length options that could accommodate over 90% of traffic**

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Regional Airport In the Eastern US Masterplan Update

- A regional airport in the Eastern US was completing an update to the master plan to accommodate longer range business jet operations off of the primary runway
- Current methods for estimating runway length taken from AC-150-5325-4B led to the conclusion that the runway needed to be extended from 5500ft to a new length of 7000ft
- Significant slope (>0.5%), obstruction removal, RSA and RPZ issues led to an open question about how best to achieve the extension
  - Extend the runway but use declared distances
  - Relocate the runway and avoid declared distances
- Result
  - The planning team decided to use aircraft performance engineering to determine whether the use of declared distances, or relocating the runway would be a better option

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Regional Airport In the Eastern US Masterplan Update

- We used Aircraft Performance Engineering to evaluate the best options to achieve the extension:
  - A length of haul study indicated that the target market for the extension should be West Coast operations and not Trans Atlantic (no plan for customs at the airport)
  - The target aircraft identified in the study were being operated under several different operating rules
  - Aircraft flight manuals (AFMs) and detailed historical environmental analysis (monthly/hourly) were used to determine the runway lengths needed with and without obstacles
  - By changing the liftoff end elevations through different relocation scenarios, the optimal runway length with obstacle clearance was found to be in the range of 6200ft and 6400ft with a 0.1% reduction in slope
- Results
  - A new location for the runway was identified that maintained 6400ft of runway, but relocated it to a position where all business jet operators would benefit from the extension

Aircraft Type	Aircraft Performance Engineering Runway Length Without Obstacles	Aircraft Performance Engineering Runway Length With Obstacles
Hawker 800XP To SFO	7,090 ft	8,600 ft
Hawker 800XP Relocated Rwy	6,440 ft	6,440 ft
Challenger 300 To SFO	6,290 ft	7,600 ft
Challenger 300 Relocated Rwy	6,200 ft	6,200 ft

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Summary of Novel Aircraft Performance Engineering Methods for Runway Length

Aircraft Performance Method	Key Elements	Benefits	Conventional Analysis Method	Risks
Historical Environmental Data Analysis	Monthly/Hourly environmental data	**Precise, schedule level determinations** **Same methods as the operators**	Average Daily Maximum Temperature Historical Wind Assessment	Imprecise assessment that does not match aircraft scheduling Runway lengths will be longer than optimal
Geospatial Deconfliction	Resolve past, current and future discrepancies for runway and obstacle data	**Cost effective optimization** **Re-usable set of data for aircraft operators to consider**	Surveying ALP Updates	Expensive, especially when not required for the project. Results will not reveal how the operator "sees" the airport
Airport Performance Calculations	Computerized Aircraft Performance Calculations from the Operator and Aircraft Manufacturer	**Same answers as the operator** **Optimal runway lengths** **Reduced operator feedback time**	Airport Planning Manuals AC-150-5325-4B Observations and Experience	Runway lengths are not optimizable Obstacle and slope accountability is impossible
Regulatory Basis	Direct application of different regulatory basis to runway length analysis	**Reduced operator feedback time** **Optimal runway lengths for international operators and business jet operators**	Operator Feedback	Significant time with operator feedback is required to cover all regulatory basis

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Need Additional Insight On Aircraft Performance Engineering?

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