SILICON VALLEY'S AIRPORT

SJC

Downtown Airspace and Development Capacity Study

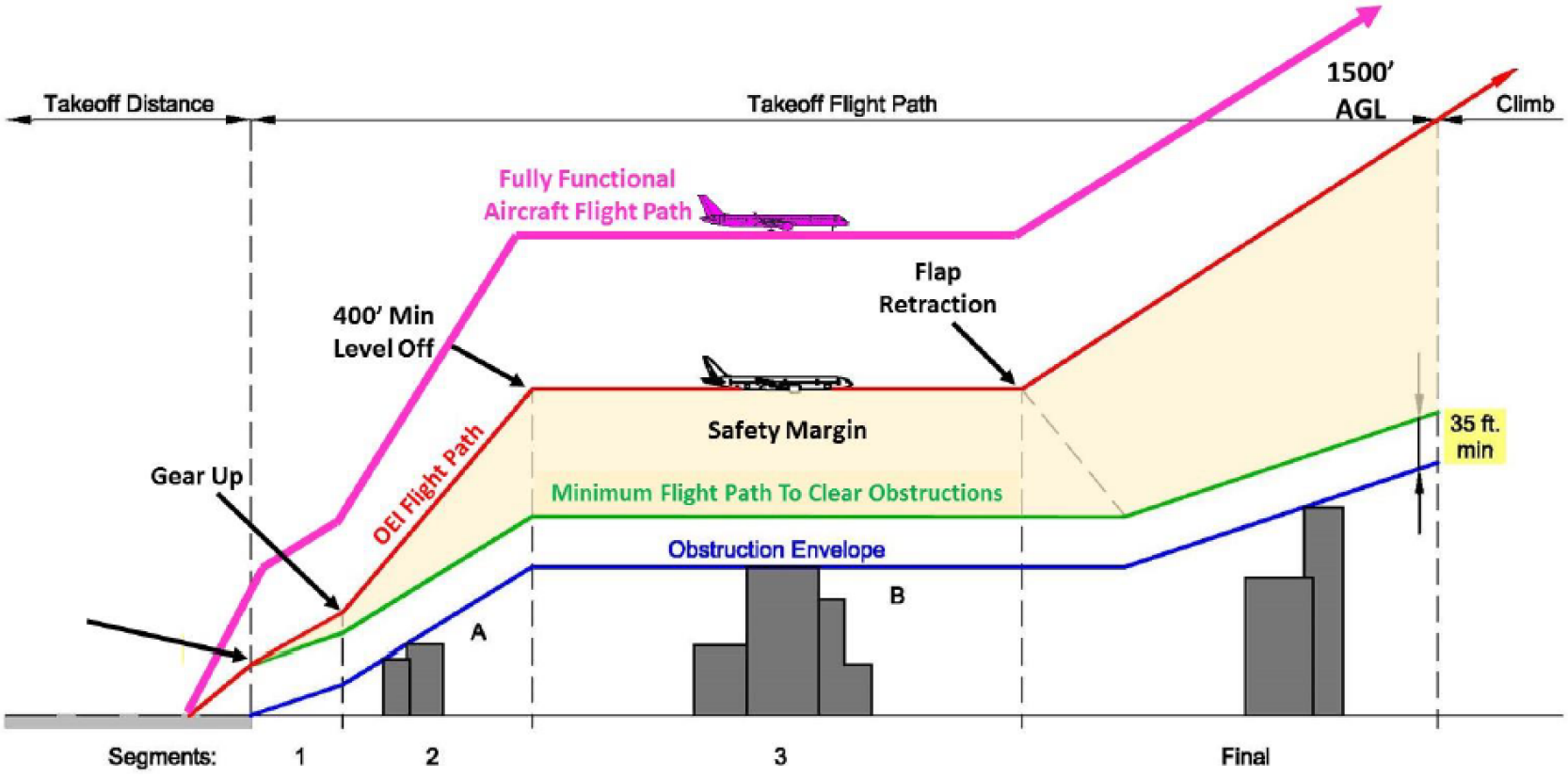
Community and Economic Development Committee

January 28, 2019

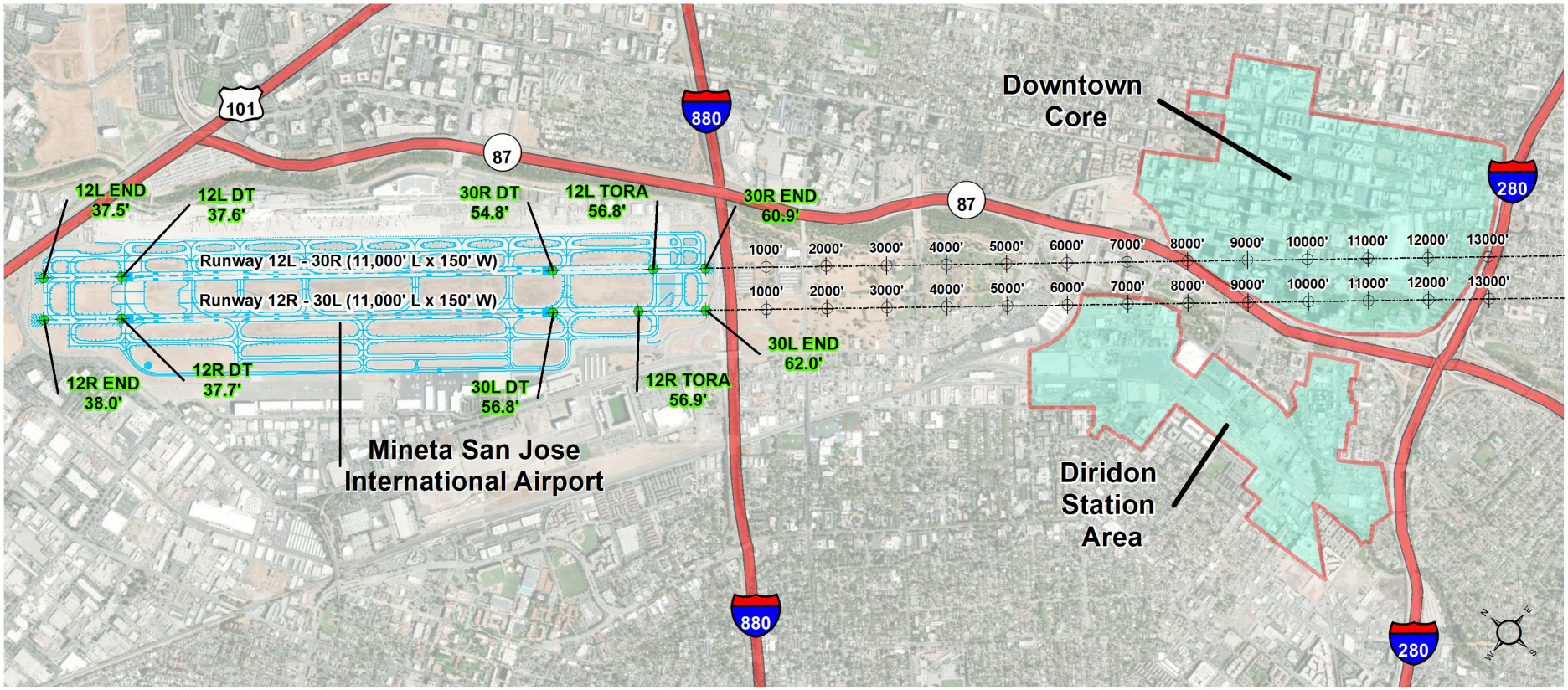
The Challenge

- Downtown and Airport are two of San Jose's economic priorities
- FAA protects airspace invisible "surfaces" known as Part 77 and FAA/TERPS
- Part 77 and FAA/TERPs do not consider specific airline emergency procedures known as one-engine inoperative (OEI)
- OEI study last conducted in 2007, established Straight-out and West Corridor OEI protection

What is One Engine Inoperative?



Study Evaluation Area



Project Steering Committee

Community Representatives

Teresa Alvarado – SPUR

Scott Knies – San Jose Downtown Association

Matt Mahood – Silicon Valley Organization

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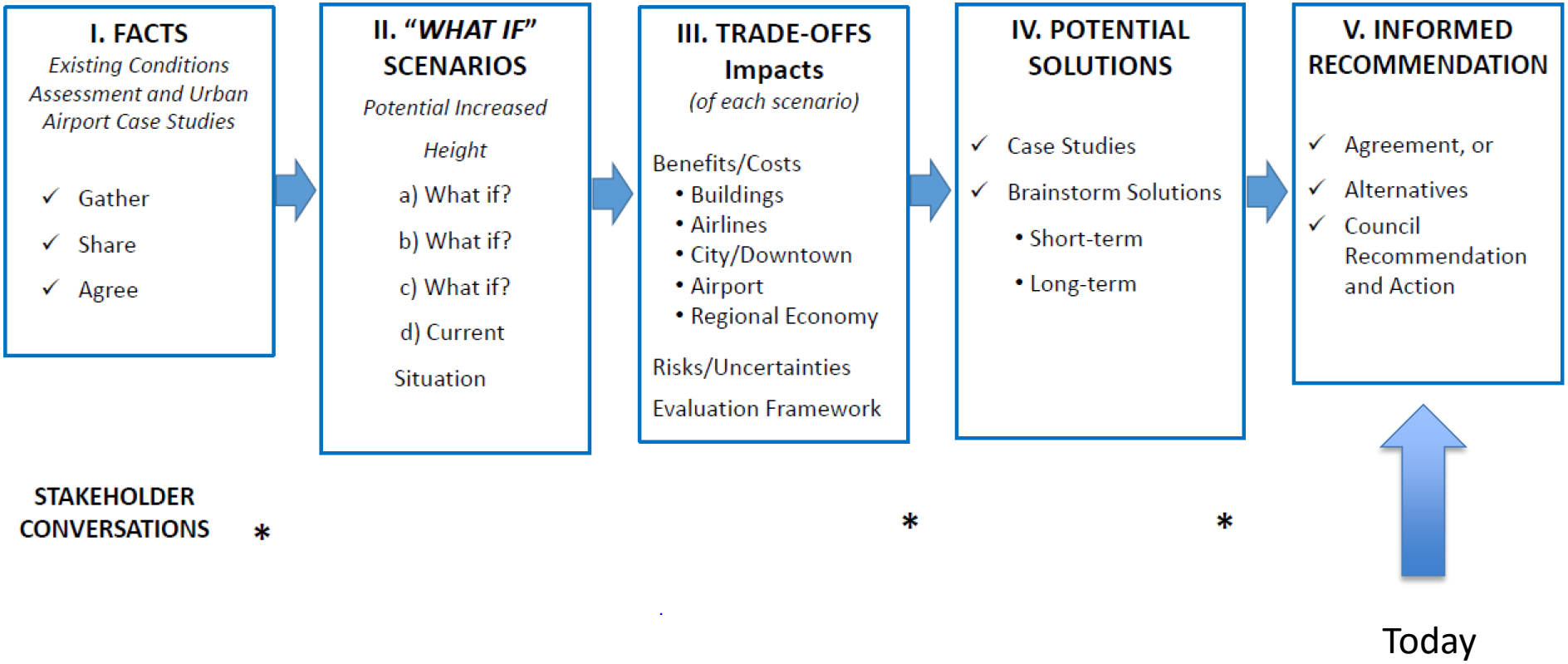
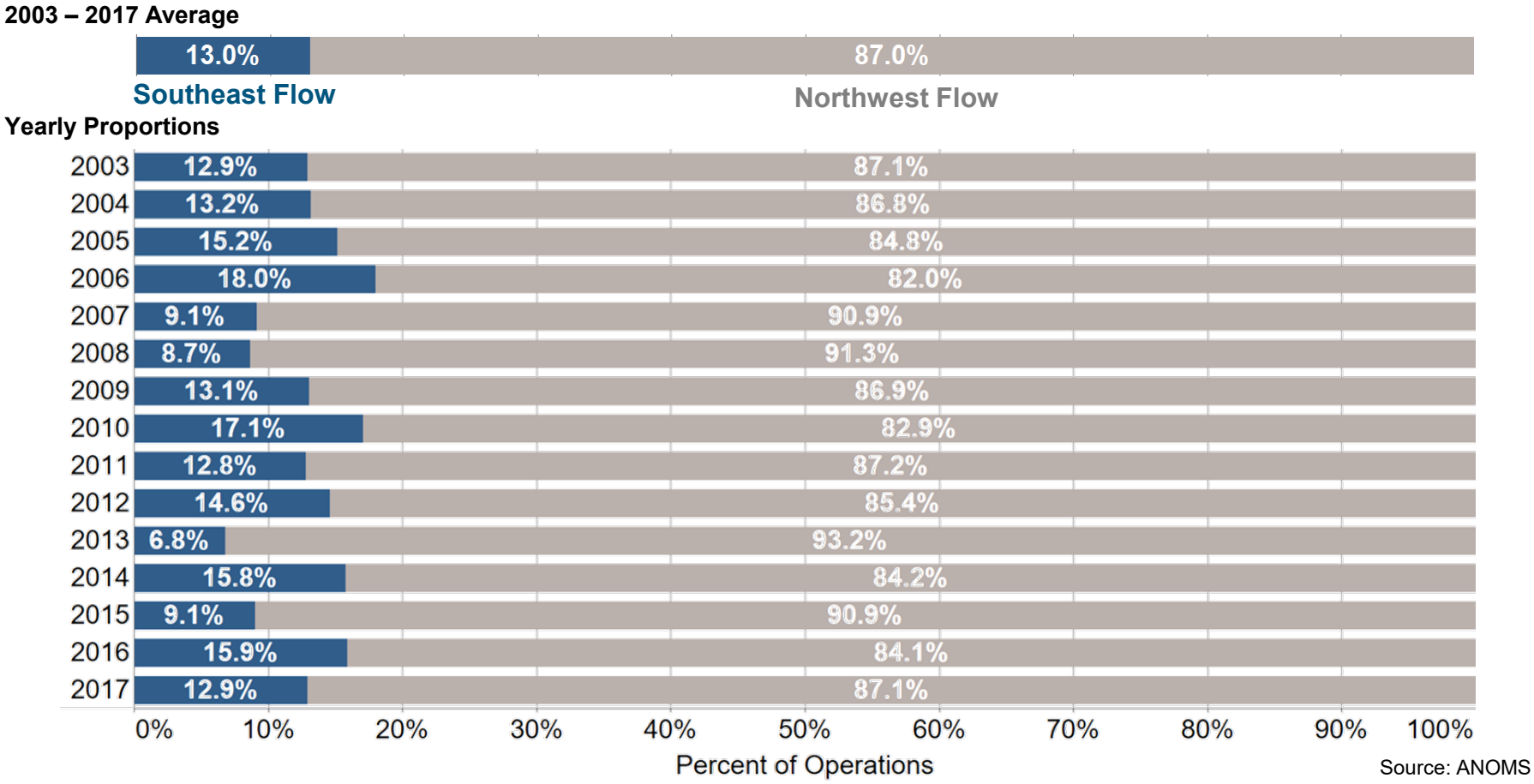
Consultants

Landrum and Brown and Jones, Lang, and LaSalle

Collaborative Process



South Flow Departures



Source: ANOMS

“What If” Scenario Assessment

Airspace Protection Scenarios

Four Airspace Scenarios

- **Scenario 4**: No OEI protection, FAA/TERPS only
- **Scenario 7**: Straight-out OEI protection only
- **Scenario 10**: Straight-out OEI with West OEI Corridor alternatives
- **Scenario 9**: No OEI, increased FAA/TERPS Height Only

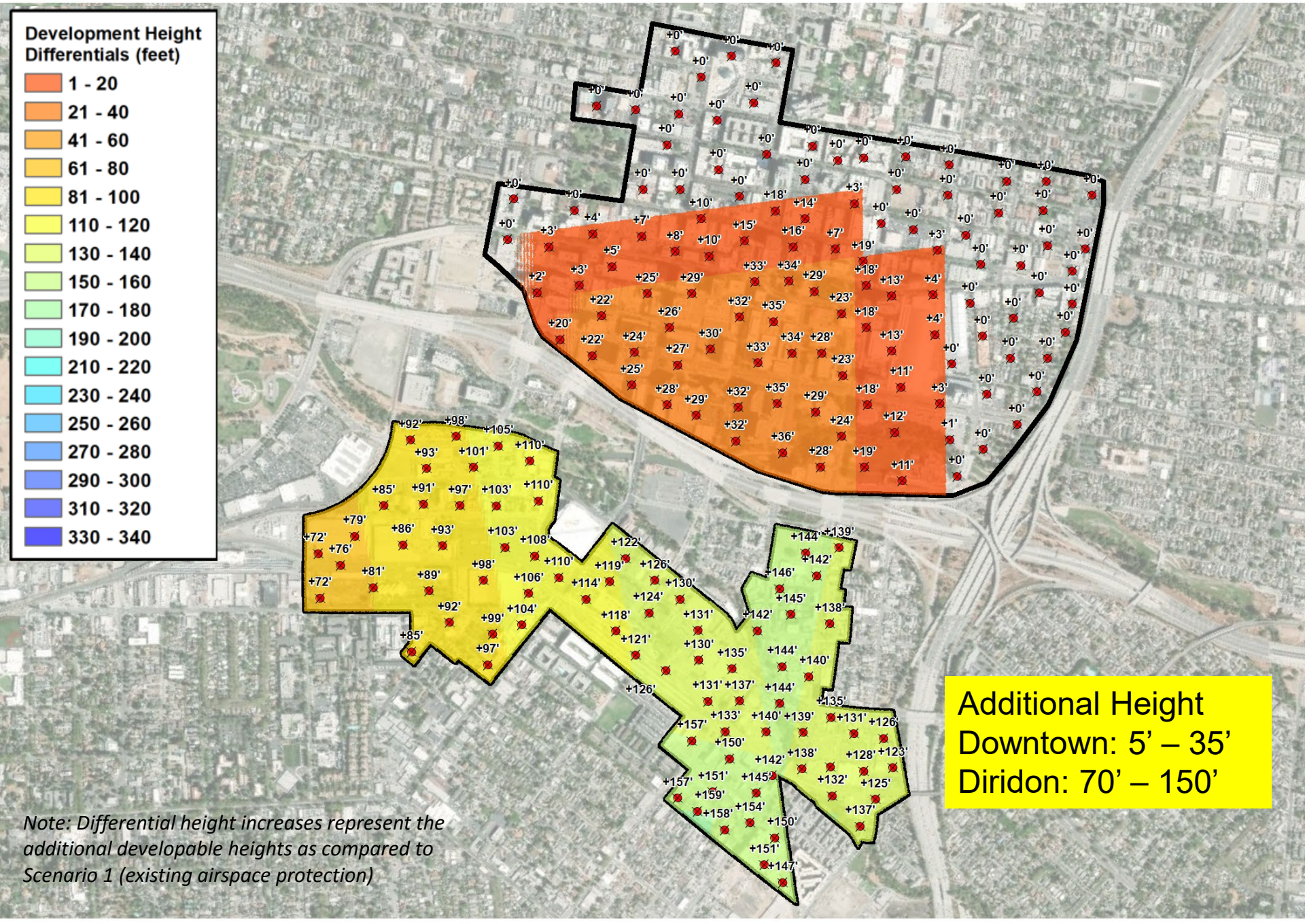
Selected Aircrafts

- Boeing 737-800
- Airbus 321-NEO (Original was Airbus 320-200)
- Boeing 787-9
- Boeing 777-300ER

Airline Response to Obstacles

- Request another runway (wind, weather, air traffic permitting)
- Off-load passengers and/or cargo (weight penalty)
- Make a refueling stop
- Cancel current day's flight
- Change aircraft
- Change OEI procedure
- Cancel air service if payload loss affects financial viability

SCENARIO 4 – NO OEI – FAA/TERPS ONLY



Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

Transcontinental Weight Penalty Assessment

New York - JFK Winter (63° F)		A320-200 (150 seats/2,384 lbs. cargo)		B737-800 (175 seats/1,604 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	1,067	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	106	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	8	2,384	-	583

New York - JFK Summer (81.3° F)		A320-200 (150 seats/2,384 lbs. cargo)		B737-800 (175 seats/1,138 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	3	2,384	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	1,378	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	13	2,384	3	860

Hawaii Weight Penalty Assessment

Hawaii - HNL Winter (63° F)		A321 NEO (189 seats/18,481 lbs.)		B737-800 (173 seats[1]/No Cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	-	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	-	**2,537**	**3**	-

Hawaii - HNL Summer (81.3° F)		A321 NEO (189 seats/21,658 lbs.)		B737-800 (175 seats/1,599 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	**593**	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	-	**3,565**	**1**	**1,599**

Notes:

1. **HNL is fuel capacity limited in Feb to 173 PAX and no cargo (i.e., not a takeoff weight limitation) for the B737-800.**

Europe Weight Penalty Assessment

Frankfurt - FRA Winter (68° F)		B787-9 (290 seats/26,198 lbs. cargo)		B777-300ER (370 seats/62,240 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	21,580	-	4,400
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	15,338	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	10,000	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	9,349	-	-
	Opt 10C: 129' - 240' AGL	-	14,096	-	-
	Opt 10D: 146' - 260' AGL	-	19,282	-	2,027
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	29	26,198	-	11,735

Frankfurt - FRA Summer (81.3° F)		B787-9 (290 seats/23,514 lbs. cargo)		B777-300ER (370 seats/62,240 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	2	22,911	-	7,811
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	16,407	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	4,217	-	-
	Opt 10B: 115' - 224' AGL	-	9,353	-	-
	Opt 10C: 129' - 240' AGL	-	14,270	-	-
	Opt 10D: 146' - 260' AGL	-	19,612	-	3,876
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	41	23,514	-	15,397

Asia Weight Penalty Assessment

Beijing - PEK Winter (68° F)		B787-9 (290 seats/10,853 lbs. cargo)		B777-300ER (370 seats/56,089 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	51	10,853	-	19,278
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	25	10,853	-	11,801
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	4,534	-	5,479
	Opt 10B: 115' - 224' AGL	-	9,408	-	6,673
	Opt 10C: 129' - 240' AGL	13	10,853	-	10,537
	Opt 10D: 146' - 260' AGL	34	10,853	-	16,929
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	93	10,853	-	26,672

Beijing - PEK Summer (81.3° F)		B787-9 (290 seats/9,542 lbs. cargo)		B777-300ER (370 seats/55,588 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	56	9,542	-	20,597
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	30	9,542	-	13,268
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	3,933	-	5,293
	Opt 10B: 115' - 224' AGL	-	8,725	-	10,223
	Opt 10C: 129' - 240' AGL	15	9,542	-	11,020
	Opt 10D: 146' - 260' AGL	36	9,542	-	17,545
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	95	9,542	-	28,076

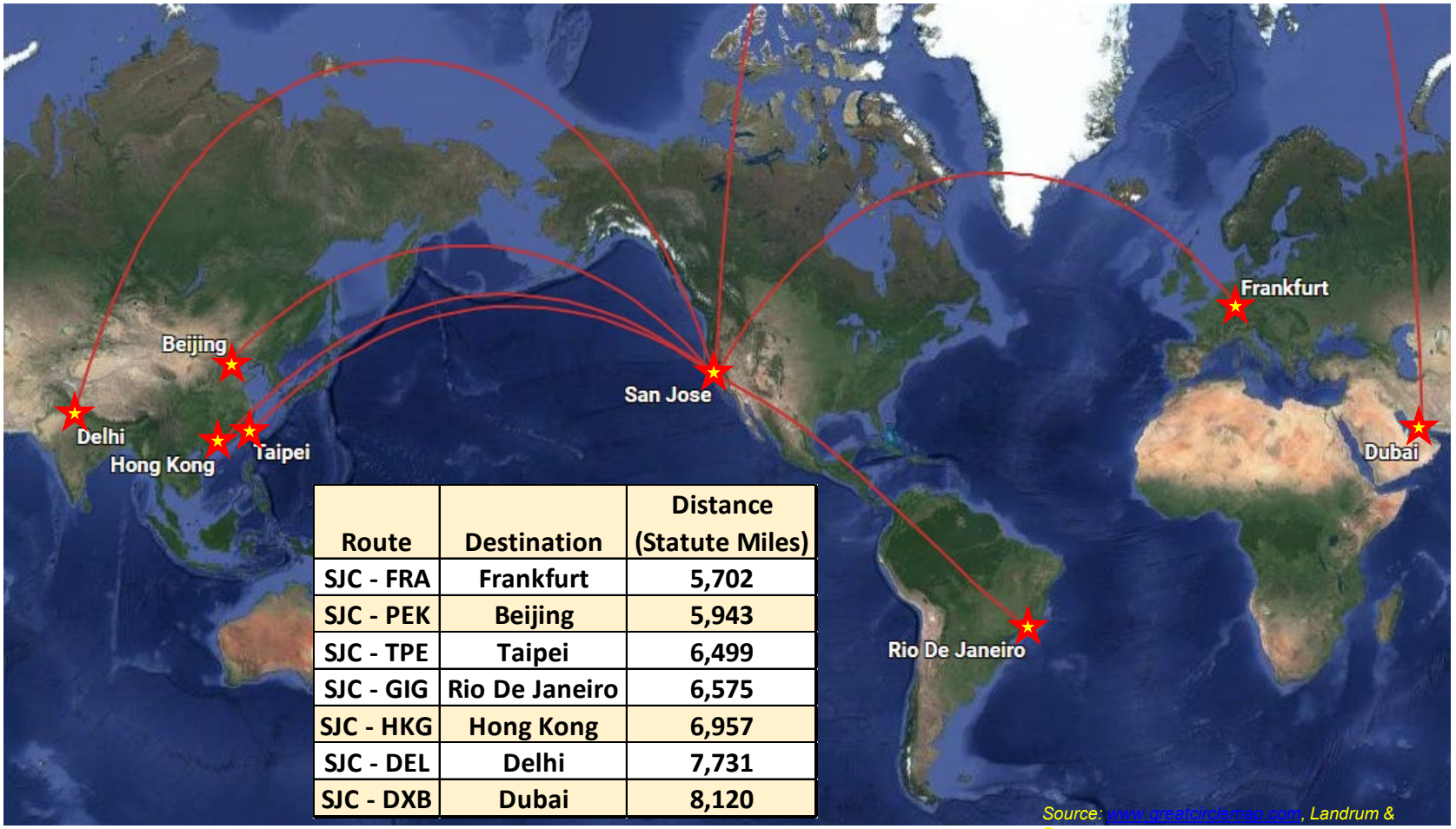
Weight Penalty Assessment
Additional Domestic Markets

Anchorage - ANC Summer (81.3° F)		A320 (150 seats/1,379 lbs. cargo)		B737-800 (175 seats/7,100 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	-	-	-
Boston - BOS Summer (81.3° F)		**A320 (150 seats/0 lbs. cargo)**		**B737-800 (175 seats/0 lbs. cargo)**	
		PAX Penalty	**Cargo Penalty (lbs.)**	**PAX Penalty**	**Cargo Penalty (lbs.)**
Scenario 1	Existing airspace protection	7	-	1	-
Scenario 4	TERPS Only	23		1	-
Miami - MIA Summer (81.3° F)		**A320 (150 seats/0 lbs. cargo)**		**B737-800 (175 seats/0 lbs. cargo)**	
		PAX Penalty	**Cargo Penalty (lbs.)**	**PAX Penalty**	**Cargo Penalty (lbs.)**
Scenario 1	Existing airspace protection	1	-	3	-
Scenario 4	TERPS Only	17		3	-

Note - 1 and 3 Pax penalties as being due to Max Structural Takeoff Weight limits (and not related to the obstacles or runway length.)

Assessment of Existing Straight-Out OEI vs TERPS only for Additional Markets

Aircraft Evaluated:
A330-200
A350-900
B777-300
B787-9



Route	Destination	Distance (Statute Miles)
SJC - FRA	Frankfurt	5,702
SJC - PEK	Beijing	5,943
SJC - TPE	Taipei	6,499
SJC - GIG	Rio De Janeiro	6,575
SJC - HKG	Hong Kong	6,957
SJC - DEL	Delhi	7,731
SJC - DXB	Dubai	8,120

Source: www.greatcirclemap.com, Landrum & Brown

WEIGHT PENALTY ASSESSMENT
GIG, TPE, HKG, DEL & DXB

	A330-200		A350-900		B777-300ER		B787-9	
Rio de Janeiro - GIG **Summer (81.3° F)** 6,575 miles	(284 seats/39,344 lbs cargo)		(325 seats/37,963 lbs cargo)		(370 seats/48,211 lbs cargo)		(290 seats/7,144 lbs cargo)	
	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)
Existing Straight Out OEI*							51	
West OEI Corridor								
TERPS Only		20,072		23,528		18,975	60	7,144
Taipei - TPE **Summer (81.3° F)** 6,499 miles	A330-200 (284 seats/28,577 lbs cargo)		A350-900 (325 seats/27,582 lbs cargo)		B777-300ER (370 seats/35,569 lbs cargo)		B787-9 (290 seats/0 lbs cargo)	
	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)
Existing Straight Out OEI*							89	
West OEI Corridor							12	
TERPS Only		1,976		23,195		18,742	96	
Hong Kong - HKG **Summer (81.3° F)** 6,957 miles	A330-200 (284 seats/18,283 lbs cargo)		A350-900 (325 seats/27,182 lbs cargo)		B777-300ER (370 seats/20,785 lbs cargo)		B787-9 (290 seats/0 lbs cargo)	
	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)
Existing Straight Out OEI*			15				128	
West OEI Corridor							51	
TERPS Only	5	18,283	23	17,182		17,980	134	
Delhi - DEL **Summer (81.3° F)** 7,731 miles	A330-200 (284 seats/5,014 lbs cargo)		A350-900 (325 seats/3,132 lbs cargo)		B777-300ER (370 seats/106 lbs cargo)		B787-9 (290 seats/0 lbs cargo)	
	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)
Existing Straight Out OEI*	48		69		62		178	
West OEI Corridor							103	
TERPS Only	55	5,014	77	3,132	72	106	184	
Dubai - DXB **Summer (81.3° F)** 8,120 miles	A330-200 (284 seats/3,537 lbs cargo)		A350-900 (325 seats/2,688 lbs cargo)		B777-300ER (370 seats/1,828 lbs cargo)		B787-9 (290 seats/0 lbs cargo)	
	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)	PAX Penalty	Cargo Penalty (lbs)
Existing Straight Out OEI*	57		71		62		184	
West OEI Corridor							107	
TERPS Only	65	3,537	79	2,688	72	1,828	191	

*Existing Straight Out OEI calculations use different cargo capacity numbers than West OEI and TERPS Only.

Airline Responses

The following airlines participated in the aircraft performance assessment for the various airspace scenarios presented.

Responded	No Response
AeroMexico	Air Canada/Jazz
Air China	California Pacific
Alaska	Frontier
American	Lufthansa
ANA	UPS
British Airways	Jet Blue
Delta	
FedEx	
Hainan Airways	
Hawaiian	
Southwest	
United	
Volaris	

Airline Aircraft Performance Analysis Results

- ANA
  - Evaluated B787-8 (max 169 PAX configuration)
  - No PAX penalty impacts in Scenarios 1, 4, 7 and 10, however cargo impact.
  - Scenario 9 results in PAX penalties between 30-37 PAX in summer temperatures (92º F), including additional cargo penalties.

- British Airways
  - Scenarios 4 and 7 have no impact to current operations.
  - Scenario 9 results in greatest impact when operating on Runways 12L/12R.
  - Scenario 10 has no impact on 12L when departing straight-out, however a payload and engine impact for 12R when making a right course correction.

- Hainan Airways
  - For B787-8/9, Scenario 4 obstacles result in significant reduction in cargo and PAX payload (50+ PAX for a maximum capacity B787-9) due to loss of the West Corridor.

Airline Aircraft Performance Analysis Results

- Alaska, American, Aeromexico, Delta, Southwest, and Volaris
  - No penalties for operations below 92º F.
- Hawaiian (Aircraft - A321 NEO)
  - HNL, OGG, or KOA has no passenger penalties, some cargo penalties.
  - LIH has minimal passenger penalties and some cargo penalties.
- Federal Express
  - Cargo penalties in most scenarios; however, will cube out before weight out.
- United
  - Significant PAX and cargo penalties for B737-900ER operation in Scenarios 1, 4, 7 and 9.
  - Minor PAX and cargo penalties in Scenario 4 for B737-800, moderate PAX and cargo penalties in Scenario 9 for B737-800.

Annual Direct Airline Impacts During Southflow Operations

- Scenario 4 results in a potential airline loss of $802,000 the first year buildings are constructed to FAA/TERPS.

- Impact is primarily to Asian markets.

- Potential loss could grow to approximately $1.2 M in 2032 and $1.5 M in 2038 as market, costs, and load factors grow over time.

- Community Air Service Support Fund mechanism to offset these potential Airline economic losses.

Development Impact

Downtown Core

- Significant density already available.
- Any increase in height restrictions due to adjustments in air space protection scenarios will not have an aggregate impact until far into the future.
- Specific development sites may achieve some additional height – 5'-35'.

Diridon Station Area

- Increase in height restrictions could result in 8.6M net new square footage of development.
- Analysis focused on underutilized and vacant APNs larger than .2 acres.
- Upon complete buildout, $4.4B in construction value and $5.5M in annual property tax to CSJ.

Recommendations

1. Accept a completed Downtown Airspace and Development Capacity Study, with selection of Scenario 4.

2. Direct the Administration to explore the feasibility of establishing a community-funded Air Service Support Fund.

3. Direct the Administration to consider potential refinements to the development review process.

4. Direct the Administration to initiate amendments, as determined applicable, to the General Plan and other key policy documents to incorporate the above recommendations.

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Downtown Airspace and Development Capacity Study

QUESTIONS & DISCUSSION