NOISE AND OPERATIONAL CONSIDERATIONS FOR THE SAN DIEGO INTERNATIONAL AIRPORT PART 150 STUDY

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July 16, 2020

Executive Summary

Communities surrounding the San Diego International Airport (SAN) have raised significant concerns about aircraft noise since the completion of the Southern California Metroplex Project. Their concerns are being addressed as part of the Part 150 Study that has recently been commissioned by the Airport.

While it is very important to adequately address noise impacts to the communities caused by airport operations, it is equally as important to ensure the safety and efficiency of airport operations while providing as much relief as possible to the surrounding communities.

The Federal Aviation Administration (FAA) will not accept alternatives that minimize the effects of noise upon a community if it results in operational inefficiencies. Therefore, any solution must consider the effects on the operation as well as the effects on the surrounding communities.

This report, and supporting documentation, will provide a design alternative that we believe addresses the broader areas of concern on both sides of the issue, thereby providing a win-win scenario that we believe everyone can live with – recognizing of course, that there is no perfect solution that will make everyone happy.

In the first section of the report, we will address the concerns of the noise impacts to the communities surrounding the airport giving special attention to the Congressional Mandate (See Appendix 1) to consider noise dispersion in any new Performance Based Navigation (PBN) procedure designs. Consideration was given to disperse noise over the widest possible areas within the confines of criteria and without "moving" existing noise from one community to another. Operating within these parameters west of the SAN Airport is challenging as there is very little land area to work with to resolve noise impact issues. At the widest point of dispersion, the distance from centerline to centerline of the proposed flight tracks is only approximately 5½ miles along the shoreline. Given the confines of the space available to work with, dispersing noise over the impacted area becomes increasingly important as well as increasingly difficult. This is because from an observer's point of view on the ground, an aircraft flying ½ mile away is still perceived to be "overhead." Therefore, dispersion, what little is available, may not result in an audibly perceptible change in sound, although, technically, there will be a measurable difference.

In the second section of the report, we will address the operational concerns of the proposed designs. We will show how deploying the Equivalent Lateral Spacing Operations (ELSO) concept will allow for optimal airport efficiency while, at the same time, addressing noise issues. We will show that ELSO can be implemented without an increase in workload to the Air Traffic Controllers while maintaining FAA Safety Standards, remaining within prescribed TERPS Criteria, and operating within the guidelines of FAA Orders 7110.65 and 7210.3 as amended.

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Noise Considerations

The primary noise consideration for communities in proximity to the airport is the relationship between the thrust, the speed, and the orientation of the aircraft. This complex relationship ultimately determines the noise being generated by the aircraft and the three-dimensional (3-D) position of the aircraft, both as a function of time. Note that the noise being generated by the aircraft as a function of time will be henceforth referred to as the source noise trajectory, and the 3-D position of the aircraft as a function of time will be henceforth referred to as the flight trajectory. For all practical purposes, the source noise trajectory is a consequence of the flight trajectory that is specified, thus we will focus our discussion below on the flight trajectory.

Eliminating Differences between the Depicted and the Actual Ground Track

The desired flight trajectory for an aircraft is specified via a Standard Instrument Departure (SID) or via controller instructions. The Southern California Metroplex Project (SoCal Metroplex) has resulted in an increased used of SID's, as a way in principle to more closely control the path of aircraft. However, while a SID might appear on paper to specify a particular ground track (path over the ground), the way that SID is implemented within the Flight Management System (FMS) of the aircraft can have significant consequences in terms of the actual ground track and thus the noise that is observed on the ground. If the initial segment of a SID is specified using a VA/DF designation, the aircraft will turn directly to the second fix in the SID once it has achieved a specified altitude. Given the variation in climb performance of a fleet of aircraft, the point at which aircraft will turn from the extended runway centerline will also vary. Thus, instead of aircraft flying along the specified track over the ground, they could (as depicted in Fig. 1) be on a ground track that is anywhere within a triangle with vertices at: (1) the earliest point along the extended runway centerline where aircraft can attain the specified altitude; (2) the latest point along the extended runway centerline where aircraft can attain the specified altitude; and (3) the second fix in the SID. If, however, the SID is specified using a VI/CF designation, the aircraft will turn directly to the second fix in the SID only when is it in close proximity with the first fix in the SID. Thus, the actually path over the ground will be very close to the path that is depicted.

(See Fig. 1 on Page 9)

Noise Principle 1

With these considerations in mind, we believe that the first thing we can do for noise is to specify the SID's in terms of VI/CF legs, so that the ground tracks that are depicted are the ground tracks that are flown. This will thus enable full control of the position and noise being generated by aircraft as a function of time. And, once the difference between the depicted and actual paths has been eliminated, we can turn our attention to optimizing the trajectory.

Optimizing the Source Noise and Flight Trajectories

The noise that is observed at a specific location on the ground is a function of the distance between the aircraft and the observer, the elevation of the aircraft (the angle of the aircraft above the horizon as seen from the location of the observer), and the orientation of the aircraft relative to the observer.

Distance is the primary determinant of the noise that is observed at a given location. Specifically, the noise intensity (noise level per unit area) at a given location decreases with increasing distance between the source of the noise (in our case the aircraft) and the receiver of the noise, i.e., the observer on the ground. To an observer on the ground, a stationary source that only subtends part of the field of view may be considered to be a point source, i.e., the noise may be modeled as coming from a single point in space. Every time the distance between the source and the receiver is doubled, the noise at the location of the receiver will be decreased by a factor of 4, which in acoustic terms is referred to as a reduction of 6 decibels (dB). For a point source that is moving along a straight line, every time the distance between the source and the receiver is doubled, the noise at the location of the receiver will be halved, which in acoustic terms is referred to as a reduction of 3 decibels (dB). Thus, in the case of an aircraft that is moving through the air, the attenuation in noise as a function of distance will be approximately 3dB per doubling of the distance between the aircraft and observer.

Elevation has a significant effect on the observed noise level. Specifically, when noise is propagating at low angles, the rate at which the noise decreases per unit distance that it travels (the rate of attenuation) is greater than when the noise is propagating directly downwards. This is the result of ground attenuation due to the introduction of an impedance boundary, in this case the ground surface, into a given aircraft-to-receiver geometry. Specifically, sound propagation near the ground is affected by absorption and reflection of the sound waves by the ground. Sound can either leave a source and follow a straight path to a receiver or be reflected and/or absorbed by the ground. How the sound wave reacts with the ground is influenced by the ground impedance which relates pressure and speed. Interestingly, water is acoustically hard, i.e., it reflects sound more than dirt. Thus, maneuvers made just offshore could actually be more detrimental to residents near the coast than maneuvers made prior to the shoreline.

Orientation also has a significant effect on the observed noise level. The noise generated by jet engines has a number of discrete sources. These discrete sources include the fan, the compressor and turbine machinery, the combustor, and primary (jet) and secondary (fan) exhausts. These noise sources tend to be directional. The fan noise generally propagates forward, the machinery and combustor noise propagate perpendicularly, and the exhaust noise tends to propagate to the rear. Engine installation effects include shielding and reflections from aircraft structures, aerodynamic refraction of sound, and jet shielding due to closely spaced jet engine exhausts. When aircraft with tail-mounted engines are perpendicular to the receiver at low angles (8 to 20degrees), the farthest engine is completely shielded by the fuselage or the vertical stabilizer. With complete shielding of the farthest engine(s), the noise would be reduced (relative to the noise when the aircraft is directly overhead and at the same distance) by up to 3 dB for a two-engine aircraft and up to 4.8 dB for a three-engine aircraft in the limiting case of closely-spaced, co-linear engines. There may also be additional attenuation due to the scattering of the engine noise as it passes through the wing downwash and the wingtip vortices. At mid-range elevation angles (20 to 60 degrees), the farthest engine of aircraft with tail-mounted engines may be visible under the fuselage. As such, the aircraft with tail-mounted engines tend to show an increase (relative to the noise when the aircraft is directly overhead and at the same distance) of up to 2dB. This augmentation may be due to the combination of the incomplete shielding of the farthest engine and the reflection of the noise from the closest engine off the relatively flat horizontal and vertical stabilizers. For aircraft with wing-mounted engines, the tapered wing provides a fairly broad and flat surface from which to reflect the noise generated by the engine(s) on the side of the aircraft that is furthest from the observer. Noise from the engine(s) furthest from the observer may also reflect off the underside of the fuselage. These reflections, when combined with the fact that there is no shielding of the engine(s), may account for an increase (relative to the noise when the aircraft is directly overhead and at the same distance) of as much as 8dB at elevation angles below 60 degrees.

Noise Principle 2

Given the increasing dominance of aircraft with wing-mounted engines, it is thus more important than ever that aircraft maneuvers such as turn be conducted at the lowest possible altitude over ground, or after the aircraft is well offshore. Turns at intermediate locations will significantly increase the noise to the side of the depicted path over the ground.

Noise Summary

The principles described above have been incorporated in the operational discussion that follows and in the designs that will ultimately be presented at the end of this report. While it is impossible to say that the proposed solution will reduce the area of any given contour without having access to the input data that were used to develop the existing noise impact estimates, we believe that the proposed design will not have adverse impact on the communities closest to the airport.

Operational Considerations

Our approach to achieving noise benefits while simultaneously enabling operational benefits is to employ the use of ELSO – Equivalent Lateral Spacing Operations.

Equivalent Lateral Spacing Operations (ELSO)

The ELSO Standard was originally developed by the MITRE Corporation based upon a concept for reduced divergence departure separation created at Atlanta TRACON. (See Appendix 3)

The concept allowed for both parallel and successive departures to utilize reduced divergence to facilitate an additional departure path while taking into consideration the needs of the communities surrounding the ATL Airport. In this regard, we realized a win-win scenario whereby the airport achieved a departure capacity increase while the communities surrounding the airport had more say as to where the departure track was ultimately placed to minimize noise impact.

From the airport perspective, it was predicted that by adding one additional departure path that operations would increase by 8-13 departures per hour. After implementation of ELSO, it was determined that during departure pushes, ELSO equaled or exceeded expectations.

From the community perspective, having the option to have as little as 10-degrees divergence between departure routes allowed the community to specify a track that kept aircraft well south of the Woodward Academy and to pinpoint a bridge that they wanted the route to overfly. It truly was a win-win.

Of course, the SAN application will not involve parallel runways. But ELSO is designed to add efficiency for successive departures off of a single runway as well.

In the case of the San Diego communities, the ELSO designs recommended by ABCx2 will also give communities an opportunity to realize benefits from aircraft being dispersed over three tracks while at the same time removing aircraft from overflying some of the previously impacted populations north of the proposed ECHHO/MMOTO ground track.

From an ATC perspective, there is no more workload than when separating aircraft by 15-degrees or more. Once the appropriate RNAV SIDs are implemented, the Tower simply has to alternate SIDs via sequencing of airplanes for departure. Then aircraft can depart with minimum separation (1NM) except for when wake turbulence separation is required.

Controller training for ELSO, especially for a single runway operation, is minimal. The TRACON will be required to modify their video maps to depict the ELSO departure tracks. But other than that, there is very little impact to ATC operations to implement ELSO.

We believe that the ELSO designs provide the best option for an optimal solution for the airport, ATC, and the surrounding communities.

ELSO SID Construction

The SIDs are designed to the following specifications:

1. ZZOOO remains unchanged with a VA/DF initial leg construction resulting in a runway heading (275-degrees) departure to 520 feet MSL then direct to the JETTI waypoint.
2. The new CWARD/PADRZ SIDs are designed with a VI/CF initial leg construction. Initial heading is 275 degrees to 1.02NM from DER then intercept course 285-degrees to the WNFLD-NEW waypoint.
3. The new ECHHO/MMOTO SIDs are designed with a VI/CF initial leg construction. Initial heading is 275 degrees to 1.02NM from DER then intercept course 295-degrees to the LANDN-NEW waypoint.

NOTE- *See Appendix 2 for full design specifications – TARGETS Distribution Packages.*

ELSO Track Mile Comparison

The change in overall track miles for the proposed ELSO SID designs are negligible when compared to existing SID designs. (See Table 1 Below)

SAN RNAV SIDs - Track Mile Comparison

Procedure	Existing	ABCx2	Difference	Route – Runway to Common Fix
ECHHO	17.22	17.37	0.15	ECHHO
MMOTO	17.22	17.37	0.15	ECHHO
CWARD	33.13	33.17	0.04	GYWNN
PADRZ	33.13	33.17	0.04	GYWNN

Table 1 – Track Mile Comparison

The ZZOOO SID

ABCx2 reviewed the ZZOOO RNAV SID and we have proposed no changes to the existing SID. CAC, TAC, or other Community Groups have recommended that the JETTI waypoint on the ZZOOO SID be moved further offshore, which remains a possibility. For purposes of the recommendations herein the existing ZZOOO SID will serve as the baseline SID for ABCx2's recommendations.

The existing ZZOOO SID is constructed with a VA/DF initial leg combination from the DER. The ground track from the DER to JETTI waypoint is 275-degrees Magnetic. The other recommendations within this study will base ATC separation standards off of this baseline heading.

The CWARD/PADRZ SIDs

Both the CWARD and PADRZ RNAV SIDs utilize the same initial ground track, as currently published. The existing SIDs are constructed with the VA/DF leg combination from the DER. After aircraft reach an altitude of 520 feet MSL, they proceed direct to the WNFLD waypoint. Due to various aircraft types and performance, the time it takes to reach 520 feet MSL varies which results in aircraft flying anywhere within the blue shaded area as depicted in Fig. 1 below.

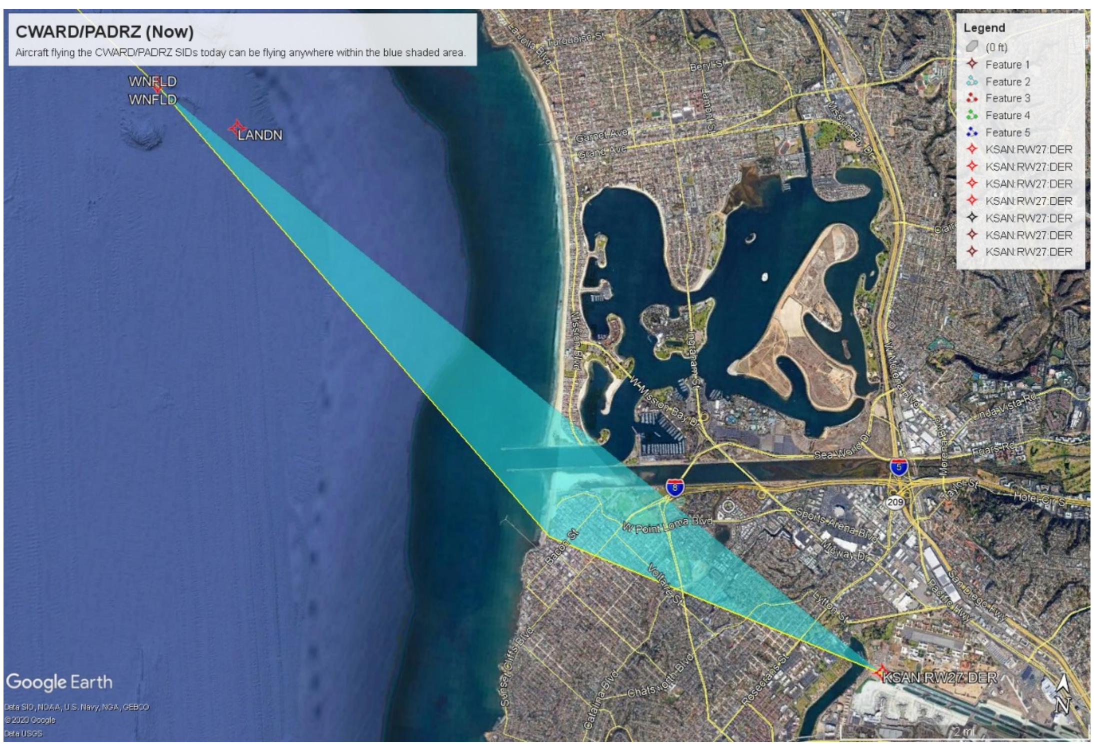


Fig. 1 – CWARD/PADRZ Possible Ground Track Splay Today

ABCx2 has reviewed the Part 150 Alternatives 2a and 2b. With only slight modification to the proposed SID construction, we concur that these alternatives represent a viable track for the future CWARD/PADRZ SIDs.

ABCx2 recommends that the initial leg combination be constructed as a VI/CF leg from the DER. This leg combination allows the use of ELSO rules for ATC separation and provides the necessary 10-degrees of divergence from the ZZOOO SID baseline track of 275-degrees resulting in a ground track of 285-degrees for the new CWARD/PADRZ SIDs.

The new track lies well within the current CWARD/PADRZ splay as depicted by the red line in Fig.2 below.

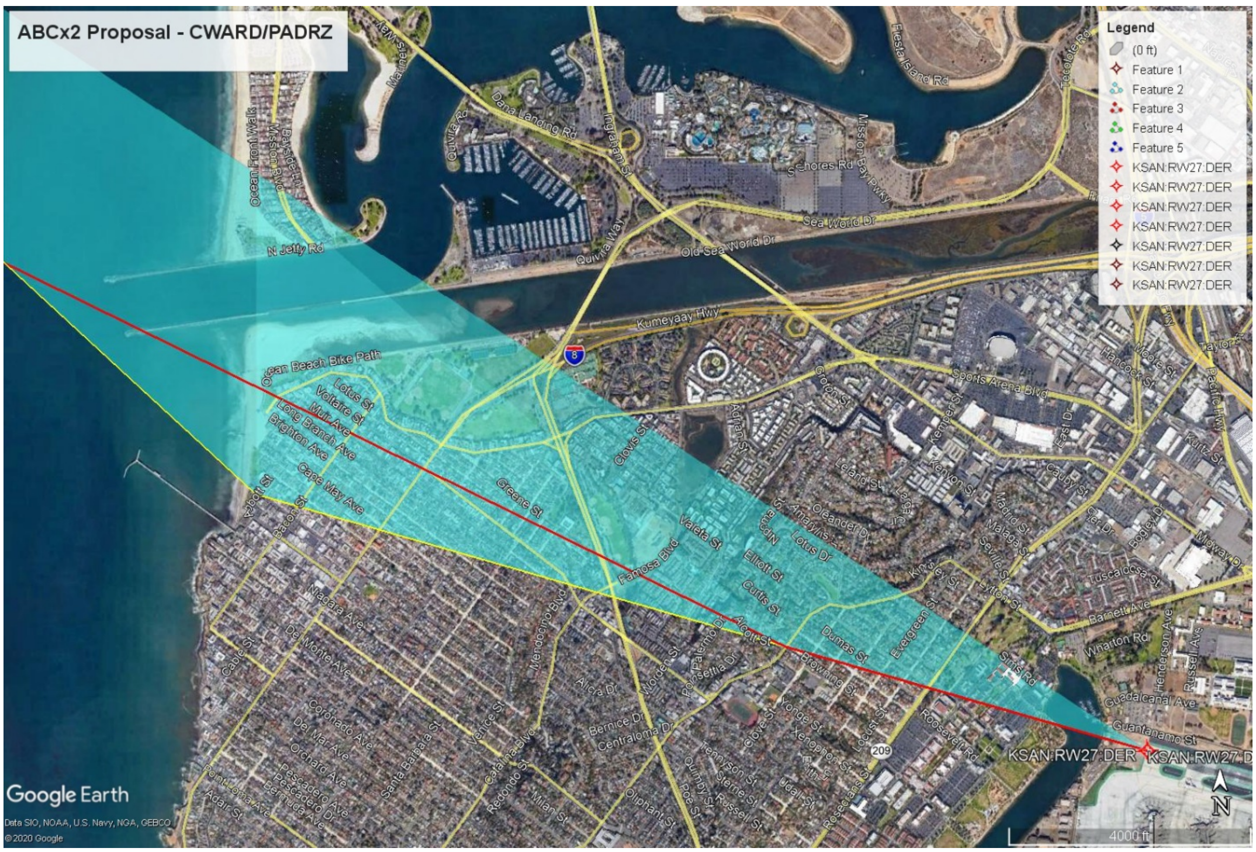


Fig. 2 – ABCx2 Proposal for CWARD/PADRZ Ground Track

Additional benefits of this ground track are that the flight track of aircraft offshore would be moved further from other noise sensitive areas as depicted in Fig. 3 below.

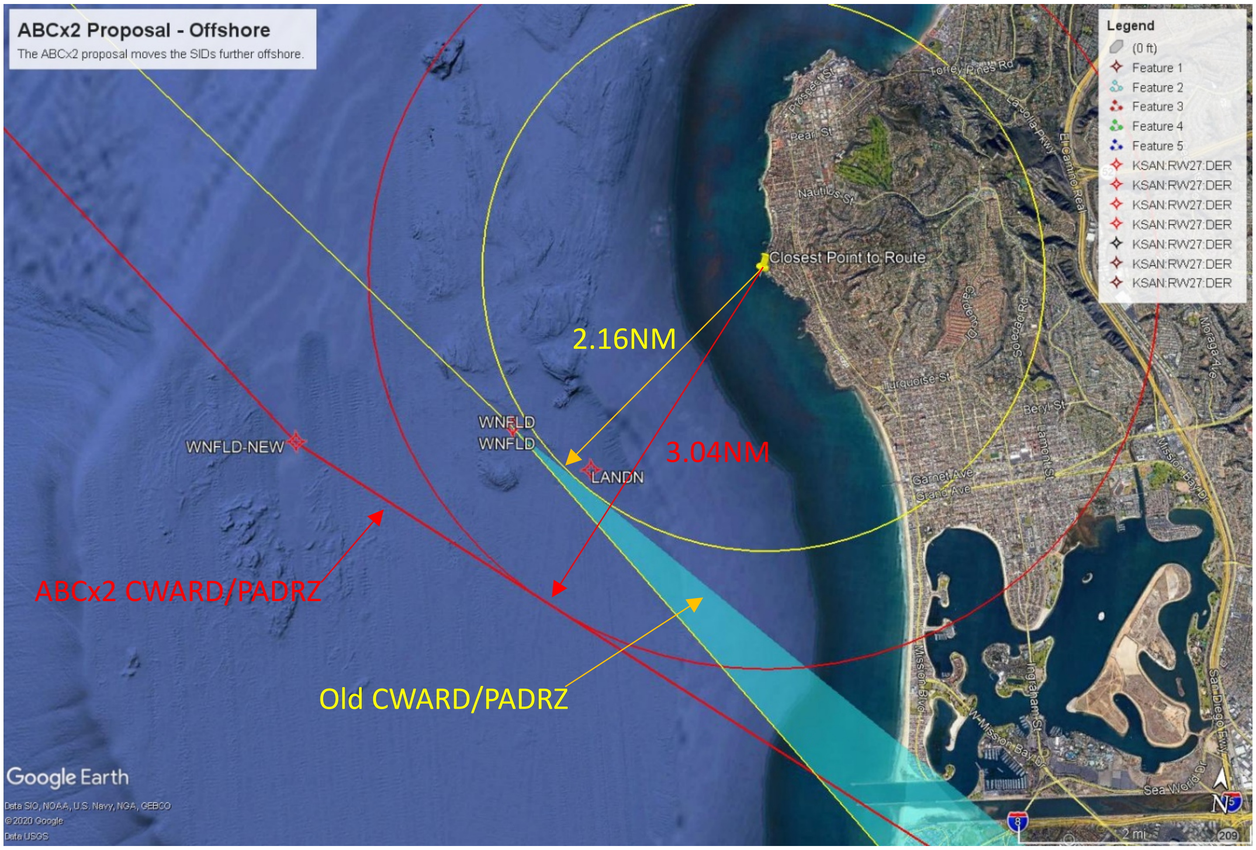


Fig. 3 – Offshore Benefits

The ECHHO/MMOTO SIDs

Both the ECHHO and MMOTO RNAV SIDs utilize the same initial ground track, as currently published. The existing SIDs are constructed with the VA/DF leg combination from the DER. After aircraft reach an altitude of 520 feet MSL, they proceed direct to the LANDN waypoint. Due to various aircraft types and performance, the time it takes to reach 520 feet MSL varies which results in aircraft flying anywhere within the yellow shaded area as depicted in Fig. 4 below.

Fig. 4 – ECHHO/MMOTO Possible Ground Track Splay Today

Although not specifically stated in the Part 150 documentation available to ABCx2, the Part 150-1c alternative could be a candidate for the ECHHO/MMOTO SIDs but for concerns about it being too far north and impacting new residences over South Mission Beach. Alternative 1c is depicted by the blue line within the yellow splay in Fig. 5 below.

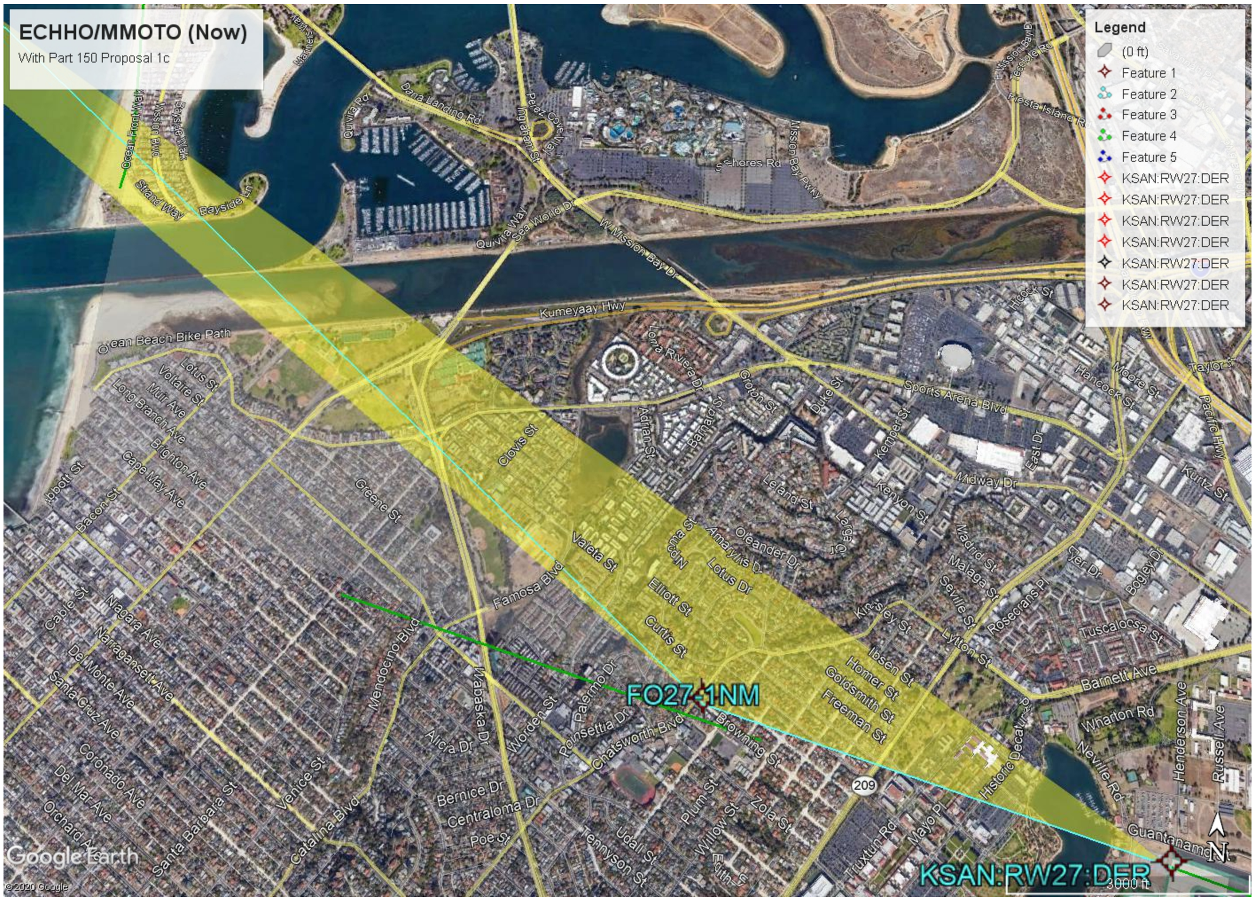


Fig. 5 – ECHHO/MMOTO SIDS Splay with Part 150 Alternative 1c (Blue Line)

Aircraft flying these SIDs are already proceeding at least this far north based upon analysis of the existing designs, which has been problematic from a noise perspective. Therefore, ABCx2 recommends that new ECHHO/MMOTO SIDs be designed south of the existing splay which will result in reducing impact to communities north of the inlet.

ABCx2 recommends that the initial leg combination be constructed as a VI/CF leg from the DER. This leg combination allows the use of ELSO rules for ATC separation and provides the necessary 10-degrees of divergence from the CWARD/PADRZ SID's new ABCx2 recommended track of 285-degrees, resulting in a ground track of 295-degrees for the new ECHHO/MMOTO SIDs. The new recommended track is depicted with the red line in Fig. 6 below.

Fig. 6 – ABCx2 Recommended ECHHO/MMOTO Ground Track (Red Line)

ABCx2 also evaluated the Part 150 Alternatives 1a and 1b as depicted by the southernmost blue line in Fig. 7 below. However, the location of Alternatives 1a/1b would not have allowed for the use of the ELSO separation standard and would have reduced the efficiency of the airport, something that we believe would cause the FAA to reject the proposal.

Fig. 7 – Part 150 Alternatives 1a/1b – (Southernmost blue line)

Additional benefits of the proposed ground track are that the flight track of aircraft offshore would be moved further from other noise sensitive areas as depicted in Fig. 8 below.

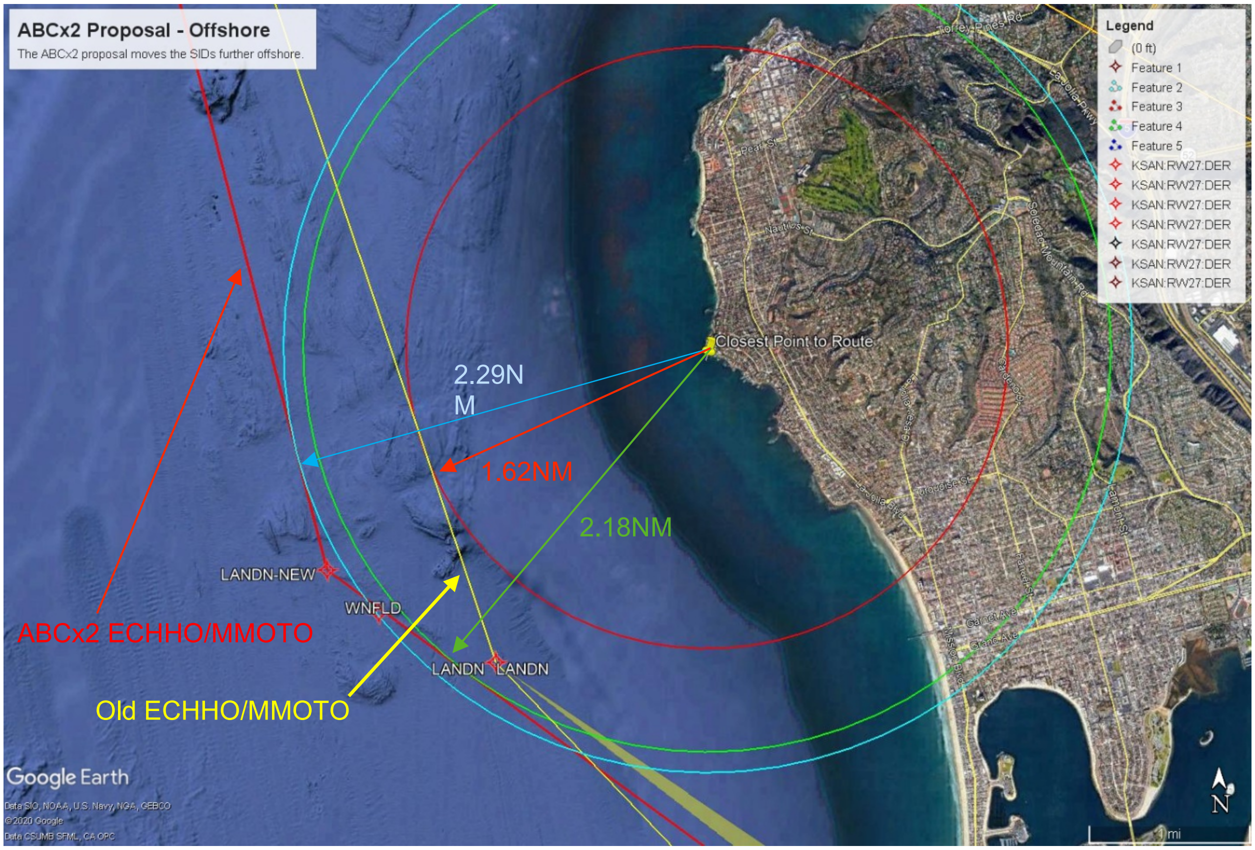


Fig. 8 – Offshore Benefits

Design Summary

When taken together, the three ELSO tracks proposed by ABCx2 promote operational efficiency at SAN, are well within the current splay of aircraft (See Fig. 9 below), disperse air traffic over and between all of the impacted communities (which addresses all communities' concerns), while simultaneously mitigating noise exposure both north and south of the Mission Bay Jetty inlet. This proposal provides three departure paths that are separated by 10-degrees (275 ZZOOO, 285 CWARD/PADRZ, 295 ECHHO/MMOTO) thereby optimizing the departure throughput of the airport without increasing controller workload. We believe this proposal provides a win-win scenario for both the local community residents and the FAA. We believe that this is the optimal solution for both noise and efficiency for west departures from the SAN Airport.

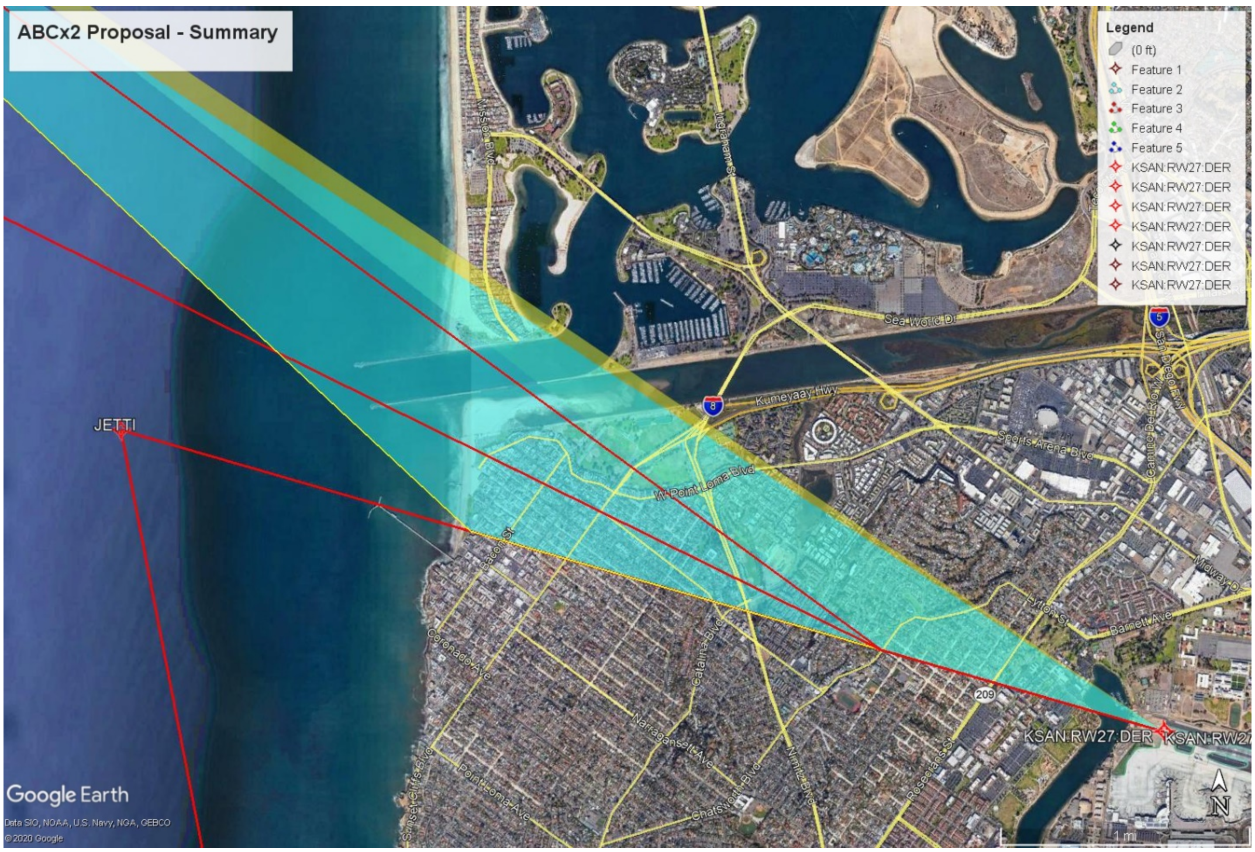


Fig. 9 – ABCx2 Proposed Tracks (Three tracks in red) within the current splay. Blue shaded area includes existing CWARD/PADRZ SIDs and yellow is the additional area covered by the existing ECHHO/MMOTO SIDs.

Glossary

ATC – Air Traffic Control

ATL – The Atlanta Hartsfield-Jackson International Airport

CAC – Community Advisory Committee

DER - Departure End of Runway

DME/DME/IRU - An RNAV system that utilizes multiple Distance Measuring Equipment sources as well as an internal Inertial Reference Unit for navigation

ELSO – Equivalent Lateral Spacing Operations – A special FAA separation standard whereby departing aircraft may diverge by as little as10-degrees as long as all aircraft participating are, and will remain, established on an RNAV SID until standard separation is achieved.

FAA – Federal Aviation Administration

GPS – Global Positioning System

MSL - Altitude above Mean Sea Level

RNAV – Area Navigation – Normally by use of GPS or DME/DME/IRU

SAN – The San Diego International Airport

SID - Standard Instrument Departure

TAC - Technical Advisory Committee

TRACON – Terminal Radar Approach Control

VA/DF - Vector or Heading to Altitude leg followed by a Direct to Fix leg

VI/CF - Vector or Heading to Intercept leg followed by a Course to Fix leg

Appendix 1 – FAA Reauthorization Act of 2018

FAA REAUTHORIZATION ACT OF 2018
SEC. 175. ADDRESSING COMMUNITY NOISE CONCERNS.

When proposing a new area navigation departure procedure, or amending an existing procedure that would direct aircraft between the surface and 6,000 feet above ground level over noise sensitive areas, the Administrator of the Federal Aviation Administration shall consider the feasibility of **dispersal headings or other lateral track variations** to address community noise concerns, if—

(1) the affected airport operator, in consultation with the affected community, submits a request to the Administrator for such a consideration;

(2) the airport operator's request would not, in the judgment of the Administrator, conflict with the safe and efficient operation of the national airspace system; and

(3) the effect of a modified departure procedure would not significantly increase noise over noise sensitive areas, as determined by the Administrator.

Appendix 2 – TARGETS Distribution Packages

NOTE- *The TARGETS Files are included herein by reference and will be distributed separately.*

CWARD2 2-ABCX2

Point Of Contact

Organization Name - ABCx2

POC's Name - James K Allerdice Jr

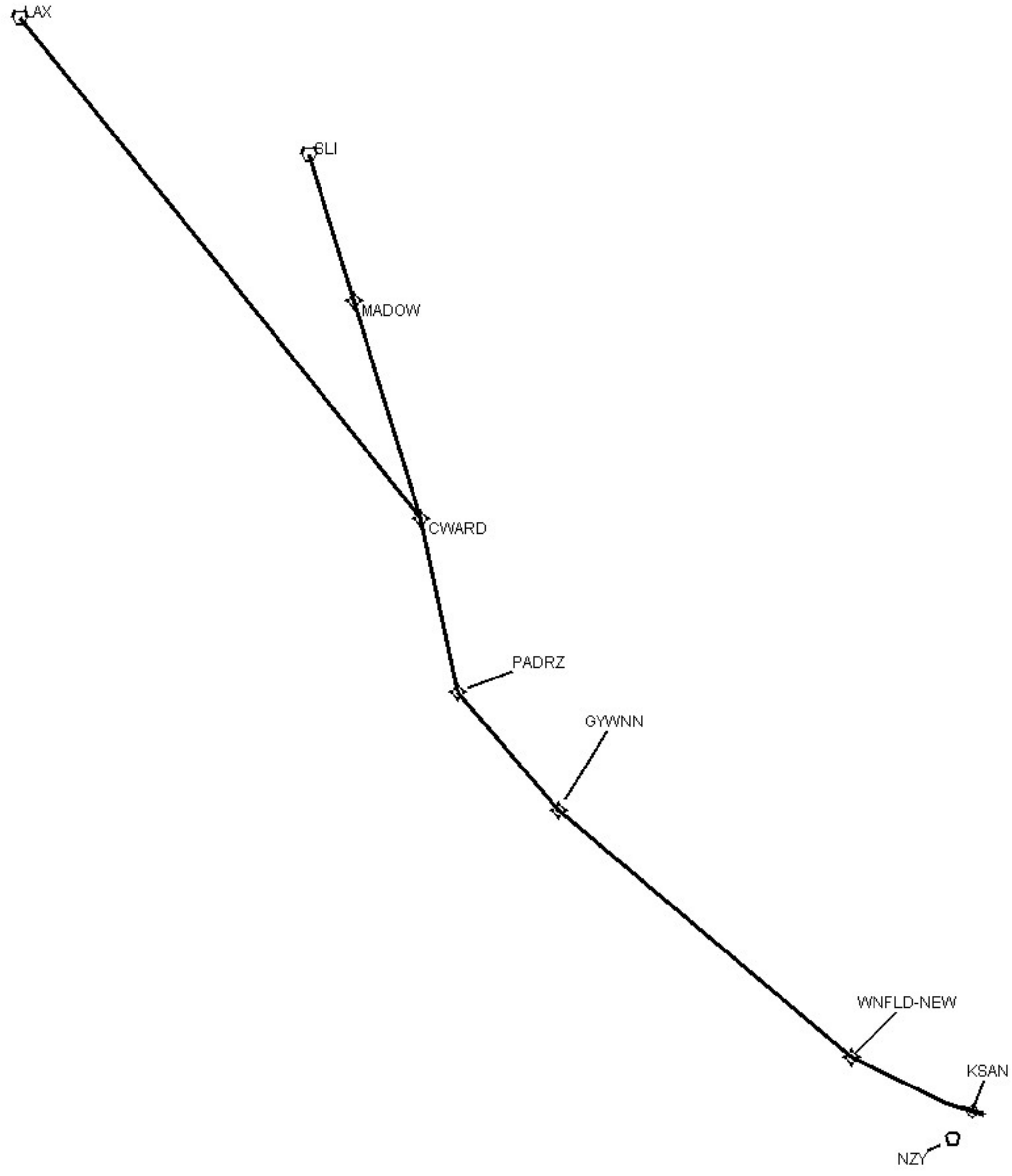
Telephone Number - 678-485-0852

FAX Number -

Email Address - j.allerdice@abcx2.com

TARGETS Distribution Package

Version:6.1.0
Date: Tue Jul 14 12:11:03 EDT 2020



CWARD2 2-ABCX2

Runway Transition Data - KSAN:RW27

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FUL L	DER RW27	N32 44 13.65	W117 12 15.68													
					VI	286.00	275.00	1.02								
	WNFLD-NEW WP	N32 47 35.42	W117 20 53.52	FB	CF	296.00	285.00	7.00								
CIFP:FUL L	GYWNN WP	N33 03 48.44	W117 43 45.23	FB	TF	310.17	299.17	25.14	+6000							

Common Route Data - GYWNN

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FUL L	GYWNN WP	N33 03 48.44	W117 43 45.23		IF				+6000							
CIFP:FUL L	PADRZ WP	N33 11 38.00	W117 51 43.00	FB	TF	319.47	308.47	10.28								
CIFP:FUL L	CWARD WP	N33 23 02.45	W117 54 33.38	FB	TF	348.20	337.20	11.63	-12000							

En Route Transition Data - LAX

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FUL L	CWARD WP	N33 23 02.45	W117 54 33.38		IF				-12000							
CIFP:FUL L	LAX VORTAC	N33 55 59.34	W118 25 55.25	FB	TF	321.62	310.62	42.04			3600	3600				

En Route Transition Data - SLI

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FUL L	CWARD WP	N33 23 02.45	W117 54 33.38		IF				-12000							
CIFP:FUL L	MADOW WP	N33 37 24.97	W117 59 47.04	FB	TF	343.08	332.08	15.00			2500	2500				
CIFP:FUL L	SLI VORTAC	N33 46 59.88	W118 03 17.13	FB	TF	343.03	332.03	10.00			2500	2500				

Point Data

DB	Point	Arc Center	Lat-Long (DMS.S)	Latitude (Deg)	Longitude (Deg)	Latitude (D°, M.mm')	Longitude (D°, M.mm')	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")
CIFP:FULL	CWARD WP		332302.45N-1175433.38W	N 33.3840139	W 117.9092722	N33 23.041	W117 54.556	N33 23 02.45	W117 54 33.38
CIFP:FULL	GYWNN WP		330348.44N-1174345.23W	N 33.0634556	W 117.7292306	N33 03.807	W117 43.754	N33 03 48.44	W117 43 45.23
CIFP:FULL	LAX VORTAC		335559.34N-1182555.25W	N 33.9331500	W 118.4320139	N33 55.989	W118 25.921	N33 55 59.34	W118 25 55.25
CIFP:FULL	MADOW WP		333724.97N-1175947.04W	N 33.6236028	W 117.9964000	N33 37.416	W117 59.784	N33 37 24.97	W117 59 47.04
NFDC	NZY TACAN		324209.13N-1171258.43W	N 32.7025361	W 117.2162306	N32 42.152	W117 12.974	N32 42 09.13	W117 12 58.43
CIFP:FULL	PADRZ WP		331138.00N-1175143.00W	N 33.1938889	W 117.8619444	N33 11.633	W117 51.717	N33 11 38.00	W117 51 43.00
CIFP:FULL	SLI VORTAC		334659.88N-1180317.13W	N 33.7833000	W 118.0547583	N33 46.998	W118 03.285	N33 46 59.88	W118 03 17.13
	WNFLD-NEW WP		324735.42N-1172053.52W	N 32.7931717	W 117.3482009	N32 47.590	W117 20.892	N32 47 35.42	W117 20 53.52

RS Results CWARD2 2-ABCX2

Last Evaluation: 14-Jul-2020 11:43:30
Reference Software Version: 2.5.0
Project Chart Date: 04/26/2018

Controlling Obstacles for RW27 Runway Evaluation

CG Controlling Obstacle

Name:	06-187045	
Obstacle Type:	UTILITY POLE	
Height (ft) AMSL:	241	
Location:	N32° 44' 16.06",W117° 13' 30.48"	
Accuracy Code (H/V (ft) AMSL):	4D (+250/+50)	
Applied Horizontal Accuracy (ft) AMSL:	250	
Applied Vertical Accuracy (ft) AMSL:	50	
	Original Values	**Adjusted Values**
Effective Height (ft) AMSL:	241	291
Primary Evaluation Point:	N32° 44' 16.06",W117° 13' 30.48"	N32° 44' 15.38",W117° 13' 27.66"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	6208.9	5958.9
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	-154.8	-89.6
Required Termination Altitude (ft) AMSL:	312	377.8
Required Climb Gradient (ft/NM):	289.5	368.7
OCS Altitude (ft) AMSL:	395.8	380.6
Minimum Aircraft Altitude (ft) AMSL:	515.8	495.7

En Route Controlling Obstacles

MOCA

Start Pt	End Pt	Name	Source	Obstacle Type	AC (H/V (ft))	Lat	Long	Height (ft)	Height (ft) AMSL	Mnts Area	Pri/Sec Area	ROC (ft)	Worst Case Veg Ht (ft)	Leg MOCA (ft)	Min OCA (ft)	TARGETS Instance Date	Man-Made Obstacle
CWARD	LAX	06-000413	DOF	TOWER	4D (+250/+50)	N33° 44' 46.00"	W118° 20' 07.00"	1543.00	1543.00	true	P	2000.00	0	3543	3543.00	Sun Jul 05 13:22:51 EDT 2020	false
CWARD	MADOW	06-000307	DOF	TOWER	4D (+250/+50)	N33° 37' 55.77"	W117° 56' 16.20"	425.00	425.00	true	P	2000.00	0	2425	2425.00	Sun Jul 05 13:22:50 EDT 2020	false
MADOW	SLI	06-000307	DOF	TOWER	4D (+250/+50)	N33° 37' 55.77"	W117° 56' 16.20"	425.00	425.00	true	P	2000.00	0	2425	2425.00	Sun Jul 05 13:22:50 EDT 2020	false

No MCA Obstacles

Runway Evaluation for RW27

LNAV Engagement CG (ft/NM):	-
LNAV Engagement Termination Altitude (ft):	-
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW27:GYWNN:LAX

Required Engagement Climb Gradient (ft/NM): 489.00

KSAN:RW27:GYWNN:LAX Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						221.00	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+6000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	28.81	10.28	2.84
TF	CWARD	FLY_BY	-12000.00			11036.46	26.56	11.63	5.67
TF	LAX	FLY_BY				19449.72		42.04	2.84

KSAN:RW27:GYWNN:LAX Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.27	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.27	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17
TF	PADRZ	FLY_BY	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17	2.84	11.04	12000.0	300.0	14.4	70.76	370.41	441.17
TF	CWARD	FLY_BY	2.84	11.04	12000.0	300.0	14.4	70.76	370.41	441.17	2.84	12.02	12000.0	300.0	13.28	70.76	370.41	441.17
TF	LAX	FLY_BY	2.84	12.02	12000.0	300.0	13.28	70.76	370.41	441.17	0.0		26726.1	300.0	0.0	99.92	476.63	552.68

KSAN:RW27:GYWNN:LAX Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:GYWNN:SLI

Required Engagement Climb Gradient (ft/NM): 489.00

KSAN:RW27:GYWNN:SLI Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						221.00	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+6000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	28.81	10.28	2.84
TF	CWARD	FLY_BY	-12000.00			11036.46	5.1	11.63	2.84
TF	MADOW	FLY_BY				14038.20	0.0	15.0	1.0
TF	SLI	FLY_BY				16039.74		10.0	1.0

KSAN:RW27:GYWNN:SLI Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.27	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.27	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17
TF	PADRZ	FLY_BY	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17	2.84	11.04	12000.0	300.0	14.4	70.76	370.41	441.17
TF	CWARD	FLY_BY	2.84	11.04	12000.0	300.0	14.4	70.76	370.41	441.17	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17
TF	MADOW	FLY_BY	0.0	32.42	12000.0	300.0	5.0	70.76	370.41	441.17	0.0		17253.58	300.0	0.0	81.16	403.91	485.07
TF	SLI	FLY_BY	0.0		17253.58	300.0	0.0	81.16	403.91	485.07	0.0		20756.93	300.0	0.0	88.1	428.77	493.34

KSAN:RW27:GYWNN:SLI Criteria Failures and Warnings

No failures.

Evaluation Input

Name:	RS Results CWARD2 2-ABCX2
Project:	La Jolla 20200708a
Last Evaluated:	14-Jul-2020 11:43:30
Evaluated Obstacles?:	true
Obstacle Database:	DOF (14.0nm query)
Evaluated Terrain?:	false
Evaluated Precipitous Terrain?:	false
Worst Case Vegetation Height (ft) AGL:	0
Converted 9I Accuracies to 4D?:	true
MVA Prior to the IF (ft) MSL:	-
Maximum Aircraft Category:	D

Airport

Name:	KSAN [CIFP:FULL]
Location:	N32° 44' 00.80",W117° 11' 22.80"
Elevation (ft):	17
Magnetic Variation (degs):	11 ()

AAO Exempt Airports

Name	Location	Elevation (ft)
KCRQ [NFDC]	N33° 07' 41.70",W117° 16' 48.30"	330.5
KLAX [NFDC]	N33° 56' 32.99",W118° 24' 28.98"	127.8
KLGB [NFDC]	N33° 49' 04.55",W118° 09' 06.81"	60.4
KMYF [NFDC]	N32° 48' 56.60",W117° 08' 22.40"	427.3
KNZY [NFDC]	N32° 41' 53.51",W117° 12' 47.20"	25.9
KONT [NFDC]	N34° 03' 21.60",W117° 36' 04.30"	944
KRNM [NFDC]	N33° 02' 21.00",W116° 54' 54.90"	1394.6
KSAN [CIFP:FULL]	N32° 44' 00.80",W117° 11' 22.80"	17
KSAN [NFDC]	N32° 44' 00.80",W117° 11' 22.80"	16.8
KSDM [NFDC]	N32° 34' 20.20",W116° 58' 48.60"	526.1
KSEE [NFDC]	N32° 49' 34.40",W116° 58' 20.80"	387.5
KSMO [NFDC]	N34° 00' 56.96",W118° 27' 04.70"	169.8
KSNA [NFDC]	N33° 40' 32.40",W117° 52' 05.60"	56.1

Runways

Name	Airport	Location	Elevation (ft)	TDZE (ft)	True Course (degs)	Survey?
RW09	KSAN [CIFP:FULL]	N32° 44' 10.92",W117° 12' 04.43"	16	16	106	NONE
RW27	KSAN [CIFP:FULL]	N32° 43' 52.94",W117° 10' 50.26"	15	15.5	286	NONE

Criteria Failures and Warnings

RDO70: [Waiver Required] In the leg from CWARD to MADOW, an MEA was not provided. An MEA must be established on each leg of an En route Transition.
RDO73: [Information] In the route beginning at RW27 and ending at LAX, the Fix GYWNN, has a Minimum Climb Gradient Calculation Altitude 6651.702151969075 that is greater than the Altitude Restriction 6000.0.
RDO70: [Waiver Required] In the leg from CWARD to LAX, an MEA was not provided. An MEA must be established on each leg of an En route Transition.
RDO70: [Waiver Required] In the leg from MADOW to SLI, an MEA was not provided. An MEA must be established on each leg of an En route Transition.
RDO73: [Information] In the route beginning at RW27 and ending at SLI, the Fix GYWNN, has a Minimum Climb Gradient Calculation Altitude 6651.702151969075 that is greater than the Altitude Restriction 6000.0.

Software Evaluation Failures, Warnings, and Notes

CEW19: KLGB does not have all the required runways to construct the AAO area.
CEW19: KMYF does not have all the required runways to construct the AAO area.
No terrain evaluation was performed.
In the leg from CWARD to MADOW the MEA was set to 2500.0 based on evaluated MOCA.
CEW19: KCRQ does not have all the required runways to construct the AAO area.
CEW19: KSMO does not have all the required runways to construct the AAO area.
CEW19: KSEE does not have all the required runways to construct the AAO area.
CEW19: KLAX does not have all the required runways to construct the AAO area.
RW27: Minimum VI segment leg was applied.
CEW19: KSDM does not have all the required runways to construct the AAO area.
CEW19: KRNM does not have all the required runways to construct the AAO area.
CEW19: KNZY does not have all the required runways to construct the AAO area.
In the leg from CWARD to LAX the MEA was set to 3600.0 based on evaluated MOCA.
CEW19: KONT does not have all the required runways to construct the AAO area.
CEW19: KSNA does not have all the required runways to construct the AAO area.
In the leg from MADOW to SLI the MEA was set to 2500.0 based on evaluated MOCA.

Obstacles Requiring Accuracy Code Verification

[06-000275 [DOF], 06-000308 [DOF], 06-001163 [DOF], 06-002237 [DOF], 06-002238 [DOF], 06-002499 [DOF], 06-006030 [DOF], 06-006032 [DOF], 06-006035 [DOF], 06-006036 [DOF], 06-006037 [DOF], 06-006045 [DOF], 06-006056 [DOF], 06-006245 [DOF], 06-006254 [DOF], 06-020050 [DOF], 06-020074 [DOF], 06-038543 [DOF], 06-229418 [DOF]]

Ignored Obstacles

None.

Procedure Notes

None.

Database Effective Dates

Database	Date
UddfObstacle	07/13/2017
Tiled IFPA	N/A
OEAAA	N/A
DOF	06/18/2020
NFDC	07/16/2020
IFP_OFFLINE	N/A
AVNII_OFFLINE	N/A
CIFP	06/18/2020

Notes:

1. **The only changes made in this SID were on the RWY 27 Runway Transition.**
2. **The intended use of this TARGETS Distribution Package is for evaluation purposes in the SAN Airport Part 150, July 2020, as an alternative design proposal.**

PADRZ2 2-ABCX2

Point Of Contact

Organization Name - ABCx2

POC's Name - James K Allerdice Jr

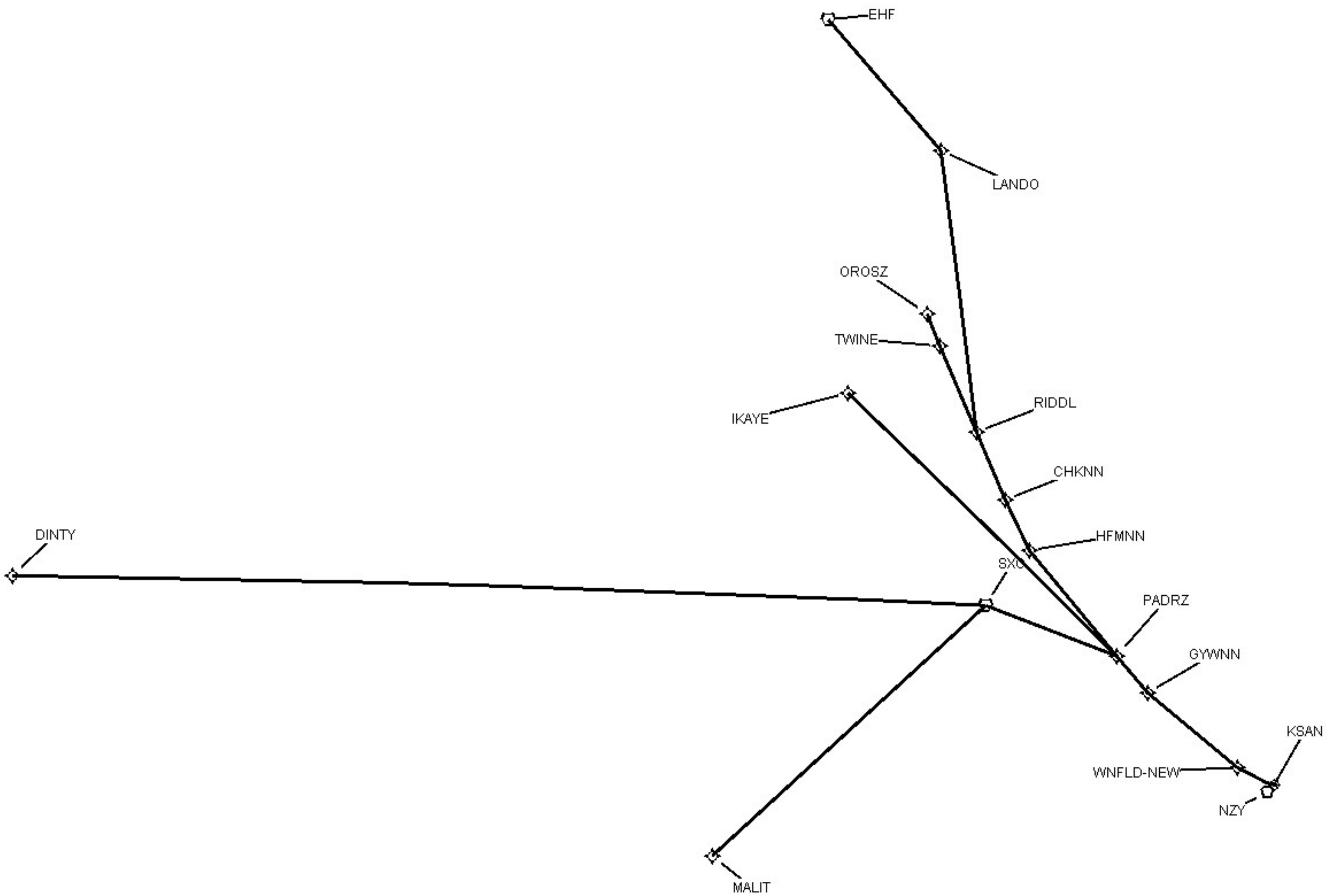
Telephone Number - 678-485-0852

FAX Number -

Email Address - j.allerdice@abcx2.com

TARGETS Distribution Package

Version:6.1.0
Date: Tue Jul 14 13:48:14 EDT 2020



PADRZ2 2-ABCX2

Runway Transition Data - KSAN:RW27

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	DER RW27	N32 44 13.65	W117 12 15.68													
					VI	286.00	275.00	1.02								
	WNFLD-NEW WP	N32 47 35.42	W117 20 53.52	FB	CF	296.00	285.00	7.00								
CIFP:FULL	GYWNN WP	N33 03 48.44	W117 43 45.23	FB	TF	310.17	299.17	25.14	+8000							
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00	FB	TF	319.47	308.47	10.28								

En Route Transition Data - CHKNN

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	HFMNN WP	N33 34 33.14	W118 14 10.12	FB	TF	320.69	309.69	29.61			2200	2200				
CIFP:FULL	CHKNN WP	N33 45 30.18	W118 20 12.29	FB	TF	335.28	324.28	12.04			3700	3600				

En Route Transition Data - DINTY

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	SXC VORTAC	N33 22 30.20	W118 25 11.68	FB	TF	291.29	280.29	30.09			4400	4200				
CIFP:FULL	DINTY WP	N33 28 58.49	W122 35 02.38	FB	TF	272.92	261.92	209.19			4400	4200				

En Route Transition Data - EHF

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	HFMNN WP	N33 34 33.14	W118 14 10.12	FB	TF	320.69	309.69	29.61			2200	2200				
CIFP:FULL	CHKNN WP	N33 45 30.18	W118 20 12.29	FB	TF	335.28	324.28	12.04			3700	3600				
CIFP:FULL	RIDDL WP	N34 00 07.30	W118 27 35.28	FB	TF	337.19	326.19	15.83			3700	3600				
CIFP:FULL	LANDO WP	N35 00 44.74	W118 36 58.94	FB	TF	352.73	341.73	61.02			10000	5600				
CIFP:FULL	EHF VORTAC	N35 29 04.40	W119 05 50.26	FB	TF	320.26	309.26	36.86			10000	5200				

En Route Transition Data - IKAYE

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	IKAYE WP	N34 08 35.00	W119 00 37.00	FB	TF	314.99	303.99	80.86			5200	3600				

En Route Transition Data - MALIT

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	SXC VORTAC	N33 22 30.20	W118 25 11.68	FB	TF	291.29	280.29	30.09			4400	4200				
CIFP:FULL	MALIT WP	N32 28 32.13	W119 35 28.25	FB	TF	228.00	217.00	80.00			4400	4200				

En Route Transition Data - OROSZ

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	PADRZ WP	N33 11 38.00	W117 51 43.00		IF											
CIFP:FULL	HFMNN WP	N33 34 33.14	W118 14 10.12	FB	TF	320.69	309.69	29.61			2200	2200				
CIFP:FULL	CHKNN WP	N33 45 30.18	W118 20 12.29	FB	TF	335.28	324.28	12.04			3700	3600				
CIFP:FULL	RIDDL WP	N34 00 07.30	W118 27 35.28	FB	TF	337.19	326.19	15.83			3700	3600				
CIFP:FULL	TWINE WP	N34 18 34.90	W118 36 59.32	FB	TF	337.10	326.10	20.01			6000	5600				
CIFP:FULL	OROSZ WP	N34 25 36.18	W118 40 27.01	FB	TF	337.78	326.78	7.57			6000	5600				

Point Data

DB	Point	Arc Center	Lat-Long (DMS.S)	Latitude (Deg)	Longitude (Deg)	Latitude (D°, M.mm')	Longitude (D°, M.mm')	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")
CIFP:FULL	CHKNN WP		334530.18N-1182012.29W	N 33.7583833	W 118.3367472	N33 45.503	W118 20.205	N33 45 30.18	W118 20 12.29
CIFP:FULL	DINTY WP		332858.49N-1223502.38W	N 33.4829139	W 122.5839944	N33 28.975	W122 35.040	N33 28 58.49	W122 35 02.38
CIFP:FULL	EHF VORTAC		352904.40N-1190550.26W	N 35.4845556	W 119.0972944	N35 29.073	W119 05.838	N35 29 04.40	W119 05 50.26
CIFP:FULL	GYWNN WP		330348.44N-1174345.23W	N 33.0634556	W 117.7292306	N33 03.807	W117 43.754	N33 03 48.44	W117 43 45.23
CIFP:FULL	HFMNN WP		333433.14N-1181410.12W	N 33.5758722	W 118.2361444	N33 34.552	W118 14.169	N33 34 33.14	W118 14 10.12
CIFP:FULL	IKAYE WP		340835.00N-1190037.00W	N 34.1430556	W 119.0102778	N34 08.583	W119 00.617	N34 08 35.00	W119 00 37.00
CIFP:FULL	LANDO WP		350044.74N-1183658.94W	N 35.0124278	W 118.6163722	N35 00.746	W118 36.982	N35 00 44.74	W118 36 58.94
CIFP:FULL	MALIT WP		322832.13N-1193528.25W	N 32.4755917	W 119.5911806	N32 28.536	W119 35.471	N32 28 32.13	W119 35 28.25
NFDC	NZY TACAN		324209.13N-1171258.43W	N 32.7025361	W 117.2162306	N32 42.152	W117 12.974	N32 42 09.13	W117 12 58.43
CIFP:FULL	OROSZ WP		342536.18N-1184027.01W	N 34.4267167	W 118.6741694	N34 25.603	W118 40.450	N34 25 36.18	W118 40 27.01
CIFP:FULL	PADRZ WP		331138.00N-1175143.00W	N 33.1938889	W 117.8619444	N33 11.633	W117 51.717	N33 11 38.00	W117 51 43.00
CIFP:FULL	RIDDL WP		340007.30N-1182735.28W	N 34.0020278	W 118.4598000	N34 00.122	W118 27.588	N34 00 07.30	W118 27 35.28
CIFP:FULL	SXC VORTAC		332230.20N-1182511.68W	N 33.3750556	W 118.4199111	N33 22.503	W118 25.195	N33 22 30.20	W118 25 11.68
CIFP:FULL	TWINE WP		341834.90N-1183659.32W	N 34.3096944	W 118.6164778	N34 18.582	W118 36.989	N34 18 34.90	W118 36 59.32
	WNFLD-NEW WP		324735.42N-1172053.52W	N 32.7931717	W 117.3482009	N32 47.590	W117 20.892	N32 47 35.42	W117 20 53.52

RS Results PADRZ2 2-ABCX2

Last Evaluation: 14-Jul-2020 13:44:18
Reference Software Version: 2.5.0
Project Chart Date: 04/26/2018

Controlling Obstacles for RW27 Runway Evaluation

CG Controlling Obstacle

Name:	06-187045	
Obstacle Type:	UTILITY POLE	
Height (ft) AMSL:	241	
Location:	N32° 44' 16.06",W117° 13' 30.48"	
Accuracy Code (H/V (ft) AMSL):	4D (+250/+50)	
Applied Horizontal Accuracy (ft) AMSL:	250	
Applied Vertical Accuracy (ft) AMSL:	50	
	Original Values	Adjusted Values
Effective Height (ft) AMSL:	241	291
Primary Evaluation Point:	N32° 44' 16.06",W117° 13' 30.48"	N32° 44' 15.38",W117° 13' 27.66"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	6208.9	5958.9
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	-154.9	-89.6
Required Termination Altitude (ft) AMSL:	312	377.8
Required Climb Gradient (ft/NM):	289.5	368.7
OCS Altitude (ft) AMSL:	395.9	380.6
Minimum Aircraft Altitude (ft) AMSL:	515.9	495.8

En Route Controlling Obstacles

MOCA

Start Pt	End Pt	Name	Source	Obstacle Type	AC (H/V (ft))	Lat	Long	Height (ft)	Height (ft) AMSL	Mnts Area	Pri/Sec Area	ROC (ft)	Worst Case Veg Ht (ft)	Leg MOCA (ft)	Min OCA (ft)	TARGETS Instance Date	Man-Made Obstacle
RIDDL	LANDO	06-020154	DOF	TOWER	2E (+50/+125)	N34° 19' 26.62"	W118° 34' 53.72"	3590.00	3590.00	true	P	2000.00	0	5590	5590.00	Sun Jul 05 13:29:30 EDT 2020	false
RIDDL	TWINE	06-020154	DOF	TOWER	2E (+50/+125)	N34° 19' 26.62"	W118° 34' 53.72"	3590.00	3590.00	true	P	2000.00	0	5590	5590.00	Sun Jul 05 13:29:30 EDT 2020	false
TWINE	OROSZ	06-020154	DOF	TOWER	2E (+50/+125)	N34° 19' 26.62"	W118° 34' 53.72"	3590.00	3590.00	true	P	2000.00	0	5590	5590.00	Sun Jul 05 13:29:30 EDT 2020	false
LANDO	EHF	06-165107	DOF	CATENARY	5E (+500/+125)	N35° 01' 40.25"	W118° 37' 32.27"	3174.00	3174.00	true	P	2000.00	0	5174	5174.00	Sun Jul 05 13:29:33 EDT 2020	false
PADRZ	SXC	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false
SXC	DINTY	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false
SXC	MALIT	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false
HFMNN	CHKNN	06-000413	DOF	TOWER	4D (+250/+50)	N33° 44' 46.00"	W118° 20' 07.00"	1543.00	1543.00	true	P	2000.00	0	3543	3543.00	Sun Jul 05 13:22:51 EDT 2020	false
CHKNN	RIDDL	06-000413	DOF	TOWER	4D (+250/+50)	N33° 44' 46.00"	W118° 20' 07.00"	1543.00	1543.00	true	P	2000.00	0	3543	3543.00	Sun Jul 05 13:22:51 EDT 2020	false
PADRZ	IKAYE	06-001864	DOF	TOWER	2A (+50/+3)	N34° 06' 30.00"	W119° 03' 52.00"	1524.00	1524.00	true	P	2000.00	0	3524	3524.00	Sun Jul 05 13:22:52 EDT 2020	false
PADRZ	HFMNN	NONE															

No MCA Obstacles

Runway Evaluation for RW27

LNAV Engagement CG (ft/NM):	-
LNAV Engagement Termination Altitude (ft):	-
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW27:CHKNN

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:CHKNN Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	1.29	10.28	1.0
TF	HFMNN	FLY_BY				14634.23	14.8	29.61	7.03
TF	CHKNN	FLY_BY				17043.21		12.04	7.03

KSAN:RW27:CHKNN Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69
TF	HFMNN	FLY_BY	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0
TF	CHKNN	FLY_BY	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0	0.0		32821.53	300.0	0.0	111.99	534.07	570.0

KSAN:RW27:CHKNN Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:DINTY

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:DINTY Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	28.11	10.28	3.55
TF	SXC	FLY_BY				14730.07	18.07	30.09	12.15
TF	DINTY	FLY_BY				41000.00		209.19	8.6

KSAN:RW27:DINTY Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	3.55	14.19	18227.75	300.0	14.05	83.09	410.6	493.69
TF	SXC	FLY_BY	3.55	14.19	18227.75	300.0	14.05	83.09	410.6	493.69	8.6	54.11	28770.66	300.0	5.0	103.97	494.84	570.0
TF	DINTY	FLY_BY	8.6	54.11	28770.66	300.0	5.0	103.97	494.84	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:DINTY Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:EHF

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:EHF Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	1.29	10.28	1.0
TF	HFMNN	FLY_BY				14634.23	14.8	29.61	7.03
TF	CHKNN	FLY_BY				17043.21	1.96	12.04	7.03
TF	RIDDL	FLY_BY				20212.87	15.61	15.83	7.42
TF	LANDO	FLY_BY				32431.67	32.39	61.02	23.13
TF	EHF	FLY_BY				39815.90		36.86	15.72

KSAN:RW27:EHF Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69
TF	HFMNN	FLY_BY	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0
TF	CHKNN	FLY_BY	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0	0.0	54.11	32821.53	300.0	5.0	111.99	534.07	570.0
TF	RIDDL	FLY_BY	0.0	54.11	32821.53	300.0	5.0	111.99	534.07	570.0	7.42	54.11	38372.95	300.0	5.0	122.98	595.68	570.0
TF	LANDO	FLY_BY	7.42	54.11	38372.95	300.0	5.0	122.98	595.68	570.0	15.72	54.11	41000.0	300.0	5.0	128.18	628.54	570.0
TF	EHF	FLY_BY	15.72	54.11	41000.0	300.0	5.0	128.18	628.54	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:EHF Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:IKAYE

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:IKAYE Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	4.41	10.28	1.0
TF	IKAYE	FLY_BY				24893.56		80.86	1.0

KSAN:RW27:IKAYE Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69
TF	IKAYE	FLY_BY	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:IKAYE Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:MALIT

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:MALIT Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	28.11	10.28	3.55
TF	SXC	FLY_BY				14730.07	62.98	30.09	23.55
TF	MALIT	FLY_BY				30747.52		80.0	20.0

KSAN:RW27:MALIT Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	3.55	14.19	18227.75	300.0	14.05	83.09	410.6	493.69
TF	SXC	FLY_BY	3.55	14.19	18227.75	300.0	14.05	83.09	410.6	493.69	20.0	32.65	28770.66	300.0	8.25	103.97	494.84	570.0
TF	MALIT	FLY_BY	20.0	32.65	28770.66	300.0	8.25	103.97	494.84	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:MALIT Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:OROSZ

Required Engagement Climb Gradient (ft/NM): 489.09

KSAN:RW27:OROSZ Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.96	10.08	1.02	1.02
CF	WNFLD-NEW	FLY_BY				1621.83	14.17	7.0	1.98
TF	GYWNN	FLY_BY	+8000.00			6651.70	9.5	25.14	1.72
TF	PADRZ	FLY_BY				8708.95	1.29	10.28	1.0
TF	HFMNN	FLY_BY				14634.23	14.8	29.61	7.03
TF	CHKNN	FLY_BY				17043.21	1.96	12.04	7.03
TF	RIDDL	FLY_BY				20212.87	0.02	15.83	1.0
TF	TWINE	FLY_BY				24219.32	0.77	20.01	1.0
TF	OROSZ	FLY_BY				25735.60		7.57	1.0

KSAN:RW27:OROSZ Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95
CF	WNFLD-NEW	FLY_BY	0.25	2.89	528.17	265.0	25.0	30.0	273.95	303.95	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75
TF	GYWNN	FLY_BY	1.72	13.85	4030.57	265.0	7.09	54.98	288.77	343.75	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58
TF	PADRZ	FLY_BY	0.0	35.64	14626.07	300.0	5.0	75.96	386.62	462.58	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69
TF	HFMNN	FLY_BY	0.0	40.6	18227.75	300.0	5.0	83.09	410.6	493.69	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0
TF	CHKNN	FLY_BY	7.03	54.11	28602.83	300.0	5.0	103.63	493.31	570.0	0.0	54.11	32821.53	300.0	5.0	111.99	534.07	570.0
TF	RIDDL	FLY_BY	0.0	54.11	32821.53	300.0	5.0	111.99	534.07	570.0	0.0		38372.95	300.0	0.0	122.98	595.68	570.0
TF	TWINE	FLY_BY	0.0		38372.95	300.0	0.0	122.98	595.68	570.0	0.0	54.11	41000.0	300.0	5.0	128.18	628.54	570.0
TF	OROSZ	FLY_BY	0.0	54.11	41000.0	300.0	5.0	128.18	628.54	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:OROSZ Criteria Failures and Warnings

No failures.

Evaluation Input

Name:	RS Results PADRZ2 2-ABCX2
Project:	La Jolla 20200708a
Last Evaluated:	14-Jul-2020 13:44:18
Evaluated Obstacles?:	true
Obstacle Database:	DOF (14.0nm query)
Evaluated Terrain?:	false
Evaluated Precipitous Terrain?:	false
Worst Case Vegetation Height (ft) AGL:	0
Converted 9I Accuracies to 4D?:	true
MVA Prior to the IF (ft) MSL:	-
Maximum Aircraft Category:	D

Airport

Name:	KSAN [CIFP:FULL]
Location:	N32° 44' 00.80",W117° 11' 22.80"
Elevation (ft):	17
Magnetic Variation (degs):	11 ()

AAO Exempt Airports

Name	Location	Elevation (ft)
KCRQ [NFDC]	N33° 07' 41.70",W117° 16' 48.30"	330.5
KLAX [NFDC]	N33° 56' 32.99",W118° 24' 28.98"	127.8
KLGB [NFDC]	N33° 49' 04.55",W118° 09' 06.81"	60.4
KMYF [NFDC]	N32° 48' 56.60",W117° 08' 22.40"	427.3
KNZY [NFDC]	N32° 41' 53.51",W117° 12' 47.20"	25.9
KONT [NFDC]	N34° 03' 21.60",W117° 36' 04.30"	944
KRNM [NFDC]	N33° 02' 21.00",W116° 54' 54.90"	1394.6
KSAN [CIFP:FULL]	N32° 44' 00.80",W117° 11' 22.80"	17
KSAN [NFDC]	N32° 44' 00.80",W117° 11' 22.80"	16.8
KSDM [NFDC]	N32° 34' 20.20",W116° 58' 48.60"	526.1
KSEE [NFDC]	N32° 49' 34.40",W116° 58' 20.80"	387.5
KSMO [NFDC]	N34° 00' 56.96",W118° 27' 04.70"	169.8
KSNA [NFDC]	N33° 40' 32.40",W117° 52' 05.60"	56.1

Runways

Name	Airport	Location	Elevation (ft)	TDZE (ft)	True Course (degs)	Survey?
RW09	KSAN [CIFP:FULL]	N32° 44' 10.92",W117° 12' 04.43"	16	16	106	NONE
RW27	KSAN [CIFP:FULL]	N32° 43' 52.94",W117° 10' 50.26"	15	15.5	286	NONE

Criteria Failures and Warnings

No failures.

Software Evaluation Failures, Warnings, and Notes

CEW19: KLGB does not have all the required runways to construct the AAO area.
CEW19: KMYF does not have all the required runways to construct the AAO area.
No terrain evaluation was performed.
CEW19: KCRQ does not have all the required runways to construct the AAO area.
CEW19: KSMO does not have all the required runways to construct the AAO area.
CEW19: KSEE does not have all the required runways to construct the AAO area.
CEW19: KLAX does not have all the required runways to construct the AAO area.
RW27: Minimum VI segment leg was applied.
CEW19: KSDM does not have all the required runways to construct the AAO area.
CEW19: KRNM does not have all the required runways to construct the AAO area.
CEW19: KNZY does not have all the required runways to construct the AAO area.
CEW19: KONT does not have all the required runways to construct the AAO area.
CEW19: KSNA does not have all the required runways to construct the AAO area.

Obstacles Requiring Accuracy Code Verification

[06-000242 [DOF], 06-000275 [DOF], 06-000315 [DOF], 06-000553 [DOF], 06-001163 [DOF], 06-001665 [DOF], 06-002013 [DOF], 06-002064 [DOF], 06-002237 [DOF], 06-002238 [DOF], 06-002499 [DOF], 06-006030 [DOF], 06-006036 [DOF], 06-006037 [DOF], 06-006045 [DOF], 06-006056 [DOF], 06-006067 [DOF], 06-006068 [DOF], 06-006086 [DOF], 06-006254 [DOF], 06-020050 [DOF], 06-020074 [DOF], 06-229418 [DOF]]

Ignored Obstacles

None.

Procedure Notes

None.

Database Effective Dates

Database	Date
UddfObstacle	07/13/2017
Tiled IFPA	N/A
OEAAA	N/A
DOF	06/18/2020
NFDC	07/16/2020
IFP_OFFLINE	N/A
AVNII_OFFLINE	N/A
CIFP	06/18/2020

Notes:

1. The only changes made in this SID were on the RWY 27 Runway Transition.

2. The intended use of this TARGETS Distribution Package is for evaluation purposes in the SAN Airport Part 150, July 2020, as an alternative design proposal.

ECHHO2-ABCX2

Point Of Contact

Organization Name - ABCx2

POC's Name - James K Allerdice Jr

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FAX Number -

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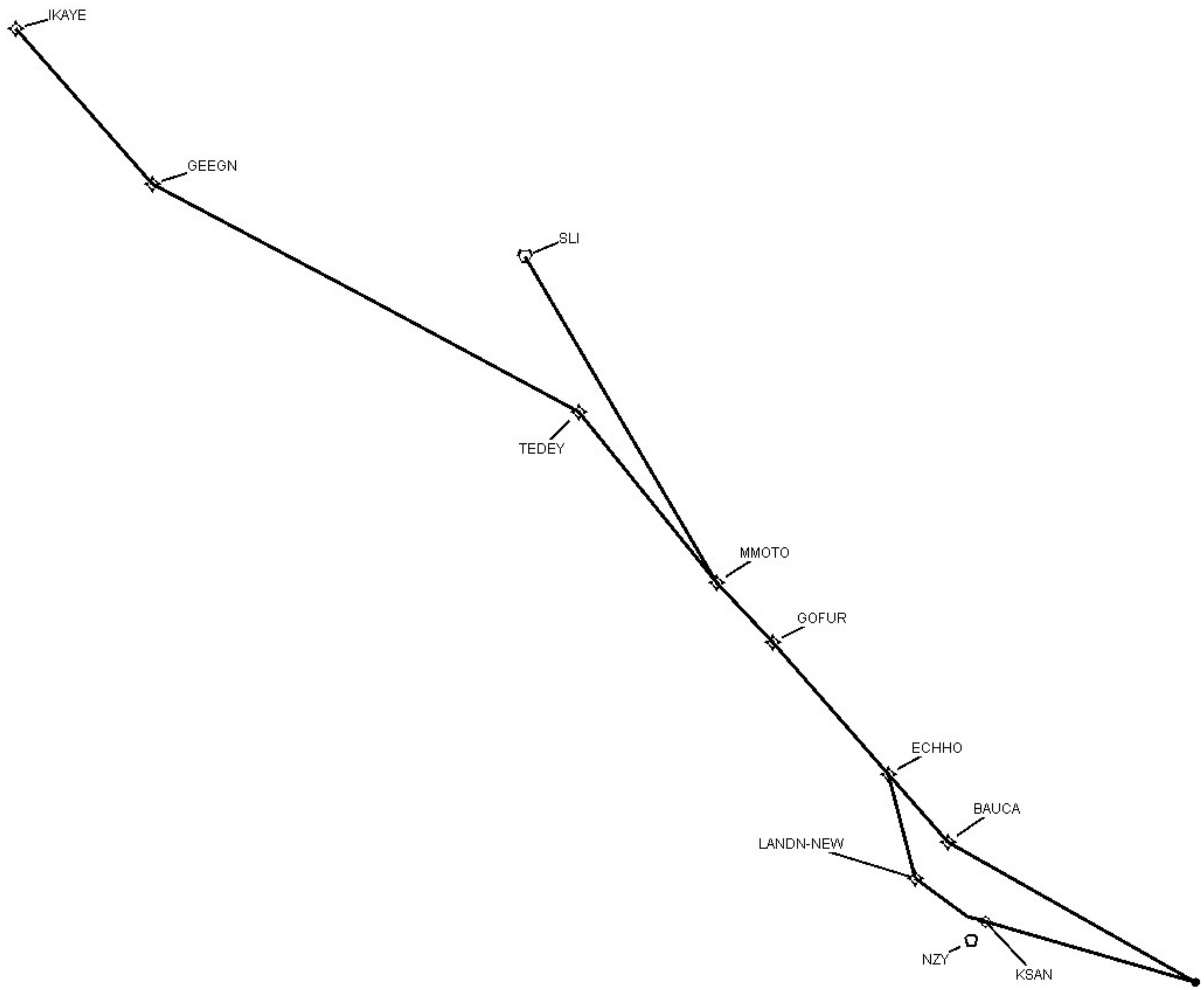
TARGETS Distribution Package

Version:6.1.0
Date: Tue Jul 14 12:22:00 EDT 2020



ECHHO2-ABCX2

Runway Transition Data - KSAN:RW09

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	DER RW09	N32 43 48.00	W117 10 29.89													
					VA	106.00	95.00	19.92	+4000							
CIFP:FULL	BAUCA WP	N32 51 36.76	W117 15 38.05	FB	DF			26.98								
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40	FB	TF	318.40	307.40	8.56								

Runway Transition Data - KSAN:RW27

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	DER RW27	N32 44 13.65	W117 12 15.68													
					VI	286.00	275.00	1.02								
	LANDN-NEW WP	N32 48 06.67	W117 19 17.32	FB	CF	306.00	295.00	6.11								
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40	FB	TF	345.23	334.23	10.23								

En Route Transition Data - IKAYE

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40		IF											
CIFP:FULL	GOFUR WP	N33 10 29.72	W117 35 26.14	FB	TF	318.69	307.69	16.59	+15000		2200	2200				
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94	FB	TF	317.12	306.12	7.74			2200	2200				
CIFP:FULL	TEDEY WP	N33 32 15.25	W117 57 14.80	FB	TF	321.06	310.06	20.66			2200	1300				
CIFP:FULL	GEEGN WP	N33 53 52.27	W118 45 08.16	FB	TF	298.60	287.60	45.40			3700	3600				
CIFP:FULL	IKAYE WP	N34 08 35.00	W119 00 37.00	FB	TF	318.85	307.85	19.53			5200	3600				

En Route Transition Data - SLI

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40		IF											
CIFP:FULL	GOFUR WP	N33 10 29.72	W117 35 26.14	FB	TF	318.69	307.69	16.59	+15000		2200	2200				
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94	FB	TF	317.12	306.12	7.74			2200	2200				
CIFP:FULL	SLI VORTAC	N33 46 59.88	W118 03 17.13	FB	TF	329.73	318.73	35.66			3000	2600				

Point Data

DB	Point	Arc Center	Lat-Long (DMS.S)	Latitude (Deg)	Longitude (Deg)	Latitude (D°, M.mm')	Longitude (D°, M.mm')	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")
CIFP:FULL	BAUCA WP		325136.76N-1171538.05W	N 32.8602111	W 117.2605694	N32 51.613	W117 15.634	N32 51 36.76	W117 15 38.05
CIFP:FULL	ECHHO WP		325801.44N-1172223.40W	N 32.9670667	W 117.3731667	N32 58.024	W117 22.390	N32 58 01.44	W117 22 23.40
CIFP:FULL	GEEGN WP		335352.27N-1184508.16W	N 33.8978528	W 118.7522667	N33 53.871	W118 45.136	N33 53 52.27	W118 45 08.16
CIFP:FULL	GOFUR WP		331029.72N-1173526.14W	N 33.1749222	W 117.5905944	N33 10.495	W117 35.436	N33 10 29.72	W117 35 26.14
CIFP:FULL	IKAYE WP		340835.00N-1190037.00W	N 34.1430556	W 119.0102778	N34 08.583	W119 00.617	N34 08 35.00	W119 00 37.00
	LANDN-NEW WP		324806.67N-1171917.32W	N 32.8018535	W 117.3214783	N32 48.111	W117 19.289	N32 48 06.67	W117 19 17.32
CIFP:FULL	MMOTO WP		331610.43N-1174142.94W	N 33.2695639	W 117.6952611	N33 16.174	W117 41.716	N33 16 10.43	W117 41 42.94
NFDC	NZY TACAN		324209.13N-1171258.43W	N 32.7025361	W 117.2162306	N32 42.152	W117 12.974	N32 42 09.13	W117 12 58.43
CIFP:FULL	SLI VORTAC		334659.88N-1180317.13W	N 33.7833000	W 118.0547583	N33 46.998	W118 03.285	N33 46 59.88	W118 03 17.13
CIFP:FULL	TEDEY WP		333215.25N-1175714.80W	N 33.5375694	W 117.9541111	N33 32.254	W117 57.247	N33 32 15.25	W117 57 14.80

RS Results 01 ECHHO2-ABCX2

Last Evaluation: 14-Jul-2020 12:17:33
Reference Software Version: 2.5.0
Project Chart Date: 04/26/2018

Controlling Obstacles for RW09 Runway Evaluation

CG Controlling Obstacle

Name:	06-000364	
Obstacle Type:	TOWER	
Height (ft) AMSL:	2713	
Location:	N32° 41' 47.22",W116° 56' 10.09"	
Accuracy Code (H/V (ft) AMSL):	5E (+500/+125)	
Applied Horizontal Accuracy (ft) AMSL:	500	
Applied Vertical Accuracy (ft) AMSL:	125	
	Original Values	Adjusted Values
Effective Height (ft) AMSL:	2713	2838
Primary Evaluation Point:	N32° 41' 47.22",W116° 56' 10.09"	N32° 41' 48.59",W116° 56' 15.71"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	73973	73473
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	847.1	984.5
Required Termination Altitude (ft) AMSL:	3565.1	3729.6
Required Climb Gradient (ft/NM):	291.6	307.2
OCS Altitude (ft) AMSL:	1865.9	1853.5
Minimum Aircraft Altitude (ft) AMSL:	2449.7	2433.3

Controlling Obstacles for RW27 Runway Evaluation

CG Controlling Obstacle

Name:	06-187045
Obstacle Type:	UTILITY POLE
Height (ft) AMSL:	241
Location:	N32° 44' 16.06",W117° 13' 30.48"
Accuracy Code (H/V (ft) AMSL):	4D (+250/+50)
Applied Horizontal Accuracy (ft) AMSL:	250
Applied Vertical Accuracy (ft) AMSL:	50

	Original Values	Adjusted Values
Effective Height (ft) AMSL:	241	291
Primary Evaluation Point:	N32° 44' 16.06",W117° 13' 30.48"	N32° 44' 15.38",W117° 13' 27.66"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	6208.9	5958.9
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	-155.3	-90
Required Termination Altitude (ft) AMSL:	312	377.8
Required Climb Gradient (ft/NM):	289.5	368.7
OCS Altitude (ft) AMSL:	396.3	381
Minimum Aircraft Altitude (ft) AMSL:	516.5	496.3

En Route Controlling Obstacles

MOCA

Start Pt	End Pt	Name	Source	Obstacle Type	AC (H/V (ft))	Lat	Long	Height (ft)	Height (ft) AMSL	Mnts Area	Pri/Sec Area	ROC (ft)	Worst Case Veg Ht (ft)	Leg MOCA (ft)	Min OCA (ft)	TARGETS Instance Date	Man-Made Obstacle
TEDEY	GEEGN	06-000413	DOF	TOWER	4D (+250/+50)	N33° 44' 46.00"	W118° 20' 07.00"	1543.00	1543.00	true	P	2000.00	0	3543	3543.00	Sun Jul 05 13:22:51 EDT 2020	false
GEEGN	IKAYE	06-001864	DOF	TOWER	2A (+50/+3)	N34° 06' 30.00"	W119° 03' 52.00"	1524.00	1524.00	true	P	2000.00	0	3524	3524.00	Sun Jul 05 13:22:52 EDT 2020	false
MMOTO	SLI	06-037689	DOF	BLDG	1A (+20/+3)	N33° 36' 59.40"	W117° 52' 15.16"	540.00	540.00	true	P	2000.00	0	2540	2540.00	Sun Jul 05 13:22:50 EDT 2020	false
MMOTO	TEDEY	06-147243	DOF	TOWER	1A (+20/+3)	N33° 37' 17.40"	W117° 54' 19.35"	143.00	143.00	true	S	1104.34	0	1248	1247.34	Sun Jul 05 13:22:50 EDT 2020	false
ECHHO	GOFUR	NONE															
GOFUR	MMOTO	NONE															

No MCA Obstacles

Runway Evaluation for RW09

LNAV Engagement CG (ft/NM):	200.0
LNAV Engagement Termination Altitude (ft):	4000.0
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW09:IKAYE

Required Engagement Climb Gradient (ft/NM): -

KSAN:RW09:IKAYE Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VA			+4000.00			4000.00	166.49	19.92	19.92
DF	BAUCA	FLY_BY				9397.66	42.61	26.98	0.0
TF	ECHHO	FLY_BY				11110.69	0.35	8.56	3.19
TF	GOFUR	FLY_BY	+15000.00			14430.05	1.45	16.59	1.0
TF	MMOTO	FLY_BY				15978.78	4.0	7.74	1.0
TF	TEDEY	FLY_BY				20113.49	22.32	20.66	10.68
TF	GEEGN	FLY_BY				29204.46	20.69	45.4	20.56
TF	IKAYE	FLY_BY				33115.42		19.53	9.88

KSAN:RW09:IKAYE Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VA					0.0	0.0					20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55
DF	BAUCA	FLY_BY	20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8
TF	ECHHO	FLY_BY	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86
TF	GOFUR	FLY_BY	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86	0.0	46.11	24057.39	300.0	5.0	94.63	454.31	526.15
TF	MMOTO	FLY_BY	0.0	46.11	24057.39	300.0	5.0	94.63	454.31	526.15	0.0	50.96	26769.0	300.0	5.0	100.0	477.0	553.11
TF	TEDEY	FLY_BY	0.0	50.96	26769.0	300.0	5.0	100.0	477.0	553.11	10.68	54.11	34009.02	300.0	5.0	114.34	546.43	570.0
TF	GEEGN	FLY_BY	10.68	54.11	34009.02	300.0	5.0	114.34	546.43	570.0	9.88	54.11	41000.0	300.0	5.0	128.18	628.54	570.0
TF	IKAYE	FLY_BY	9.88	54.11	41000.0	300.0	5.0	128.18	628.54	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW09:IKAYE Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at IKAYE, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.

Route Evaluation for KSAN:RW09:SLI

Required Engagement Climb Gradient (ft/NM): -

KSAN:RW09:SLI Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VA			+4000.00			4000.00	166.49	19.92	19.92
DF	BAUCA	FLY_BY				9397.66	42.61	26.98	0.0
TF	ECHHO	FLY_BY				11110.69	0.35	8.56	3.19
TF	GOFUR	FLY_BY	+15000.00			14430.05	1.45	16.59	1.0
TF	MMOTO	FLY_BY				15978.78	12.66	7.74	5.65
TF	SLI	FLY_BY				23117.79		35.66	5.65

KSAN:RW09:SLI Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VA					0.0	0.0					20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55
DF	BAUCA	FLY_BY	20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8
TF	ECHHO	FLY_BY	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86
TF	GOFUR	FLY_BY	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86	0.0	46.11	24057.39	300.0	5.0	94.63	454.31	526.15
TF	MMOTO	FLY_BY	0.0	46.11	24057.39	300.0	5.0	94.63	454.31	526.15	5.65	50.96	26769.0	300.0	5.0	100.0	477.0	553.11
TF	SLI	FLY_BY	5.65	50.96	26769.0	300.0	5.0	100.0	477.0	553.11	0.0		39270.31	300.0	0.0	124.76	606.62	570.0

KSAN:RW09:SLI Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at SLI, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.

Runway Evaluation for RW27

LNAV Engagement CG (ft/NM):	-
LNAV Engagement Termination Altitude (ft):	-
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW27:IKAYE

Required Engagement Climb Gradient (ft/NM): 489.59

KSAN:RW27:IKAYE Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.75	20.06	1.02	1.02
CF	LANDN-NEW	FLY_BY				1442.98	39.23	6.11	2.2
TF	ECHHO	FLY_BY				3489.68	26.51	10.23	3.74
TF	GOFUR	FLY_BY	+15000.00			6807.83	1.45	16.59	2.05
TF	MMOTO	FLY_BY				8356.00	4.0	7.74	1.0
TF	TEDEY	FLY_BY				12489.20	22.32	20.66	9.41
TF	GEEGN	FLY_BY				21576.86	20.69	45.4	19.29
TF	IKAYE	FLY_BY				25486.39		19.53	9.88

KSAN:RW27:IKAYE Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95
CF	LANDN-NEW	FLY_BY	0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91
TF	ECHHO	FLY_BY	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66
TF	GOFUR	FLY_BY	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71
TF	MMOTO	FLY_BY	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71	0.0	39.84	17710.44	300.0	5.0	82.07	407.03	489.09
TF	TEDEY	FLY_BY	0.0	39.84	17710.44	300.0	5.0	82.07	407.03	489.09	9.41	47.67	24947.32	300.0	5.0	96.4	461.58	535.0
TF	GEEGN	FLY_BY	9.41	47.67	24947.32	300.0	5.0	96.4	461.58	535.0	9.88	54.11	40862.79	300.0	5.0	127.91	626.76	570.0
TF	IKAYE	FLY_BY	9.88	54.11	40862.79	300.0	5.0	127.91	626.76	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:IKAYE Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:SLI

Required Engagement Climb Gradient (ft/NM): 489.59

KSAN:RW27:SLI Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.75	20.06	1.02	1.02
CF	LANDN-NEW	FLY_BY				1442.98	39.23	6.11	2.2
TF	ECHHO	FLY_BY				3489.68	26.51	10.23	3.74
TF	GOFUR	FLY_BY	+15000.00			6807.83	1.45	16.59	2.05
TF	MMOTO	FLY_BY				8356.00	12.66	7.74	3.49
TF	SLI	FLY_BY				15492.40		35.66	3.49

KSAN:RW27:SLI Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95
CF	LANDN-NEW	FLY_BY	0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91
TF	ECHHO	FLY_BY	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66
TF	GOFUR	FLY_BY	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71
TF	MMOTO	FLY_BY	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71	3.49	31.42	17710.44	300.0	6.33	82.07	407.03	489.09
TF	SLI	FLY_BY	3.49	31.42	17710.44	300.0	6.33	82.07	407.03	489.09	0.0		30206.33	300.0	0.0	106.81	508.24	570.0

KSAN:RW27:SLI Criteria Failures and Warnings

No failures.

Evaluation Input

Name:	RS Results 01 ECHHO2-ABCX2
Project:	La Jolla 20200708a
Last Evaluated:	14-Jul-2020 12:17:33
Evaluated Obstacles?:	true
Obstacle Database:	DOF (14.0nm query)
Evaluated Terrain?:	false
Evaluated Precipitous Terrain?:	false
Worst Case Vegetation Height (ft) AGL:	0
Converted 9I Accuracies to 4D?:	true
MVA Prior to the IF (ft) MSL:	-
Maximum Aircraft Category:	D

Airport

Name:	KSAN [CIFP:FULL]
Location:	N32° 44' 00.80",W117° 11' 22.80"
Elevation (ft):	17
Magnetic Variation (degs):	11 ()

AAO Exempt Airports

Name	Location	Elevation (ft)
KCRQ [NFDC]	N33° 07' 41.70",W117° 16' 48.30"	330.5
KLAX [NFDC]	N33° 56' 32.99",W118° 24' 28.98"	127.8
KLGB [NFDC]	N33° 49' 04.55",W118° 09' 06.81"	60.4
KMYF [NFDC]	N32° 48' 56.60",W117° 08' 22.40"	427.3
KNZY [NFDC]	N32° 41' 53.51",W117° 12' 47.20"	25.9
KONT [NFDC]	N34° 03' 21.60",W117° 36' 04.30"	944
KRNM [NFDC]	N33° 02' 21.00",W116° 54' 54.90"	1394.6
KSAN [CIFP:FULL]	N32° 44' 00.80",W117° 11' 22.80"	17
KSAN [NFDC]	N32° 44' 00.80",W117° 11' 22.80"	16.8
KSDM [NFDC]	N32° 34' 20.20",W116° 58' 48.60"	526.1
KSEE [NFDC]	N32° 49' 34.40",W116° 58' 20.80"	387.5
KSMO [NFDC]	N34° 00' 56.96",W118° 27' 04.70"	169.8
KSNA [NFDC]	N33° 40' 32.40",W117° 52' 05.60"	56.1

Runways

Name	Airport	Location	Elevation (ft)	TDZE (ft)	True Course (degs)	Survey?
RW09	KSAN [CIFP:FULL]	N32° 44' 10.92",W117° 12' 04.43"	16	16	106	NONE
RW27	KSAN [CIFP:FULL]	N32° 43' 52.94",W117° 10' 50.26"	15	15.5	286	NONE

Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at IKAYE, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.
RDO66: [Waiver Required] The OCS surface applied from RW09 is penetrated by obstacles/terrain.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at SLI, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.

Software Evaluation Failures, Warnings, and Notes

CEW19: KLGB does not have all the required runways to construct the AAO area.
CEW19: KMYF does not have all the required runways to construct the AAO area.
No terrain evaluation was performed.
CEW19: KCRQ does not have all the required runways to construct the AAO area.
CEW19: KSMO does not have all the required runways to construct the AAO area.
CEW19: KSEE does not have all the required runways to construct the AAO area.
CEW19: KLAX does not have all the required runways to construct the AAO area.
RW27: Minimum VI segment leg was applied.
CEW19: KSDM does not have all the required runways to construct the AAO area.
CEW19: KRNM does not have all the required runways to construct the AAO area.
CEW19: KNZY does not have all the required runways to construct the AAO area.
CEW19: KONT does not have all the required runways to construct the AAO area.
CEW19: KSNA does not have all the required runways to construct the AAO area.

Obstacles Requiring Accuracy Code Verification

[06-000275 [DOF], 06-000308 [DOF], 06-001163 [DOF], 06-001665 [DOF], 06-002013 [DOF], 06-002237 [DOF], 06-002238 [DOF], 06-002499 [DOF], 06-006007 [DOF], 06-006026 [DOF], 06-006030 [DOF], 06-006032 [DOF], 06-006035 [DOF], 06-006036 [DOF], 06-006037 [DOF], 06-006068 [DOF], 06-006245 [DOF], 06-006254 [DOF], 06-006276 [DOF], 06-020050 [DOF], 06-020074 [DOF], 06-038543 [DOF], 06-229418 [DOF], 06-229745 [DOF], MX-000628 [DOF], MX-000629 [DOF], MX-000630 [DOF], MX-000631 [DOF], MX-000632 [DOF], MX-000633 [DOF], MX-000634 [DOF], MX-000649 [DOF], MX-000650 [DOF]]

Ignored Obstacles

None.

Procedure Notes

None.

Database Effective Dates

Database	Date
UddfObstacle	07/13/2017
Tiled IFPA	N/A
OEAAA	N/A
DOF	06/18/2020
NFDC	07/16/2020
IFP_OFFLINE	N/A
AVNII_OFFLINE	N/A
CIFP	06/18/2020

Notes:

1. The only changes made in this SID were on the RWY 27 Runway Transition.

2. The intended use of this TARGETS Distribution Package is for evaluation purposes in the SAN Airport Part 150, July 2020, as an alternative design proposal.

MMOTO2-ABCX2

Point Of Contact

Organization Name - ABCx2

POC's Name - James K Allerdice Jr

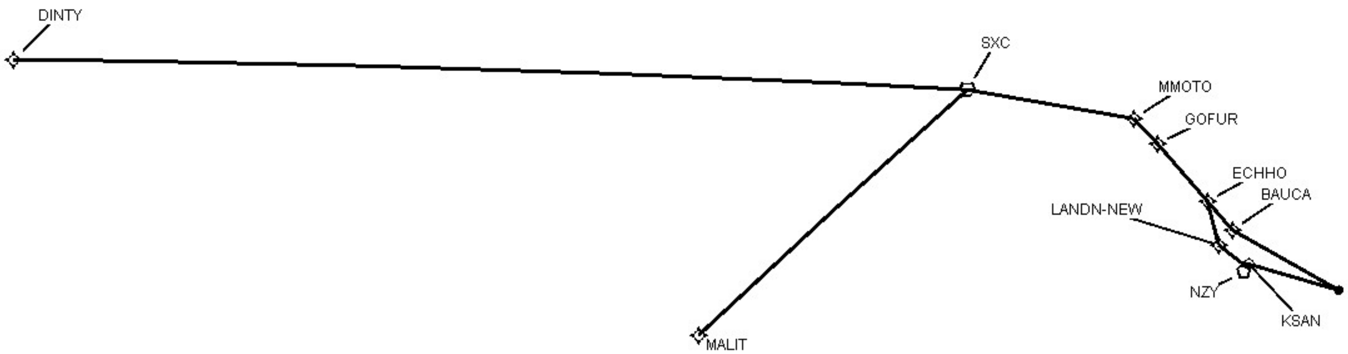
Telephone Number - 678-485-0852

FAX Number -

Email Address - j.allerdice@abcx2.com

TARGETS Distribution Package

Version:6.1.0
Date: Tue Jul 14 13:25:07 EDT 2020



MMOTO2-ABCX2

Runway Transition Data - KSAN:RW09

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	DER RW09	N32 43 48.00	W117 10 29.89													
					VA	106.00	95.00	19.92	+4000							
CIFP:FULL	BAUCA WP	N32 51 36.76	W117 15 38.05	FB	DF			26.98								
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40	FB	TF	318.40	307.40	8.56								
CIFP:FULL	GOFUR WP	N33 10 29.72	W117 35 26.14	FB	TF	318.69	307.69	16.59	+15000							
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94	FB	TF	317.12	306.12	7.74	-19000							

Runway Transition Data - KSAN:RW27

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	DER RW27	N32 44 13.65	W117 12 15.68													
					VI	286.00	275.00	1.02								
	LANDN-NEW WP	N32 48 06.67	W117 19 17.32	FB	CF	306.00	295.00	6.11								
CIFP:FULL	ECHHO WP	N32 58 01.44	W117 22 23.40	FB	TF	345.23	334.23	10.23								
CIFP:FULL	GOFUR WP	N33 10 29.72	W117 35 26.14	FB	TF	318.69	307.69	16.59	+15000							
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94	FB	TF	317.12	306.12	7.74	-19000							

En Route Transition Data - DINTY

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94		IF				-19000							
CIFP:FULL	SXC VORTAC	N33 22 30.20	W118 25 11.68	FB	TF	280.04	269.04	36.98			4200	4200				
CIFP:FULL	DINTY WP	N33 28 58.49	W122 35 02.38	FB	TF	272.92	261.92	209.19			4200	4200				

En Route Transition Data - MALIT

DB	End Point	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")	FO/ FB	Leg	TC	MC	Dist.	Altitude	Speed	MEA	MOCA	Turn Dir	Arc Center Lat (D° M' S.ss")	Arc Center Lon (D° M' S.ss")	Arc Radius (NM)
CIFP:FULL	MMOTO WP	N33 16 10.43	W117 41 42.94		IF				-19000							
CIFP:FULL	SXC VORTAC	N33 22 30.20	W118 25 11.68	FB	TF	280.04	269.04	36.98			4200	4200				
CIFP:FULL	MALIT WP	N32 28 32.13	W119 35 28.25	FB	TF	228.00	217.00	80.00			4200	4200				

Point Data

DB	Point	Arc Center	Lat-Long (DMS.S)	Latitude (Deg)	Longitude (Deg)	Latitude (D°, M.mm')	Longitude (D°, M.mm')	Latitude (D° M' S.ss")	Longitude (D° M' S.ss")
CIFP:FULL	BAUCA WP		325136.76N-1171538.05W	N 32.8602111	W 117.2605694	N32 51.613	W117 15.634	N32 51 36.76	W117 15 38.05
CIFP:FULL	DINTY WP		332858.49N-1223502.38W	N 33.4829139	W 122.5839944	N33 28.975	W122 35.040	N33 28 58.49	W122 35 02.38
CIFP:FULL	ECHHO WP		325801.44N-1172223.40W	N 32.9670667	W 117.3731667	N32 58.024	W117 22.390	N32 58 01.44	W117 22 23.40
CIFP:FULL	GOFUR WP		331029.72N-1173526.14W	N 33.1749222	W 117.5905944	N33 10.495	W117 35.436	N33 10 29.72	W117 35 26.14
	LANDN-NEW WP		324806.67N-1171917.32W	N 32.8018535	W 117.3214783	N32 48.111	W117 19.289	N32 48 06.67	W117 19 17.32
CIFP:FULL	MALIT WP		322832.13N-1193528.25W	N 32.4755917	W 119.5911806	N32 28.536	W119 35.471	N32 28 32.13	W119 35 28.25
CIFP:FULL	MMOTO WP		331610.43N-1174142.94W	N 33.2695639	W 117.6952611	N33 16.174	W117 41.716	N33 16 10.43	W117 41 42.94
NFDC	NZY TACAN		324209.13N-1171258.43W	N 32.7025361	W 117.2162306	N32 42.152	W117 12.974	N32 42 09.13	W117 12 58.43
CIFP:FULL	SXC VORTAC		332230.20N-1182511.68W	N 33.3750556	W 118.4199111	N33 22.503	W118 25.195	N33 22 30.20	W118 25 11.68

RS Results MMOTO2-ABCX2

Last Evaluation: 14-Jul-2020 13:20:20
Reference Software Version: 2.5.0
Project Chart Date: 04/26/2018

Controlling Obstacles for RW09 Runway Evaluation

CG Controlling Obstacle

Name:	06-000364	
Obstacle Type:	TOWER	
Height (ft) AMSL:	2713	
Location:	N32° 41' 47.22",W116° 56' 10.09"	
Accuracy Code (H/V (ft) AMSL):	5E (+500/+125)	
Applied Horizontal Accuracy (ft) AMSL:	500	
Applied Vertical Accuracy (ft) AMSL:	125	
	Original Values	Adjusted Values
Effective Height (ft) AMSL:	2713	2838
Primary Evaluation Point:	N32° 41' 47.22",W116° 56' 10.09"	N32° 41' 48.59",W116° 56' 15.71"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	73973	73473
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	847.1	984.5
Required Termination Altitude (ft) AMSL:	3565.1	3729.6
Required Climb Gradient (ft/NM):	291.6	307.2
OCS Altitude (ft) AMSL:	1865.9	1853.5
Minimum Aircraft Altitude (ft) AMSL:	2449.7	2433.3

Controlling Obstacles for RW27 Runway Evaluation

CG Controlling Obstacle

Name:	06-187045
Obstacle Type:	UTILITY POLE
Height (ft) AMSL:	241
Location:	N32° 44' 16.06",W117° 13' 30.48"
Accuracy Code (H/V (ft) AMSL):	4D (+250/+50)
Applied Horizontal Accuracy (ft) AMSL:	250
Applied Vertical Accuracy (ft) AMSL:	50

	Original Values	Adjusted Values
Effective Height (ft) AMSL:	241	291
Primary Evaluation Point:	N32° 44' 16.06",W117° 13' 30.48"	N32° 44' 15.38",W117° 13' 27.66"
Tieback Distance (ft):	0	0
Primary Evaluation Distance (ft):	6208.9	5958.9
Secondary Evaluation Distance (ft):	0	0
Level Surface ROC (ft):	2000	2000
Amount of Penetration (ft):	-155.3	-90
Required Termination Altitude (ft) AMSL:	312	377.8
Required Climb Gradient (ft/NM):	289.5	368.7
OCS Altitude (ft) AMSL:	396.3	381
Minimum Aircraft Altitude (ft) AMSL:	516.5	496.3

En Route Controlling Obstacles

MOCA

Start Pt	End Pt	Name	Source	Obstacle Type	AC (H/V (ft))	Lat	Long	Height (ft)	Height (ft) AMSL	Mnts Area	Pri/Sec Area	ROC (ft)	Worst Case Veg Ht (ft)	Leg MOCA (ft)	Min OCA (ft)	TARGETS Instance Date	Man-Made Obstacle
MMOTO	SXC	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false
SXC	DINTY	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false
SXC	MALIT	06-001930	DOF	TOWER	5E (+500/+125)	N33° 23' 12.00"	W118° 24' 03.00"	2137.00	2137.00	true	P	2000.00	0	4137	4137.00	Sun Jul 05 13:29:29 EDT 2020	false

No MCA Obstacles

Runway Evaluation for RW09

LNAV Engagement CG (ft/NM):	200.0
LNAV Engagement Termination Altitude (ft):	4000.0
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW09:DINTY

Required Engagement Climb Gradient (ft/NM): -

KSAN:RW09:DINTY Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VA			+4000.00			4000.00	166.49	19.92	19.92
DF	BAUCA	FLY_BY				9397.66	42.61	26.98	0.0
TF	ECHHO	FLY_BY				11110.69	0.35	8.56	3.19
TF	GOFUR	FLY_BY	+15000.00			14430.05	1.45	16.59	1.0
TF	MMOTO	FLY_BY	-19000.00			15978.78	37.03	7.74	3.64
TF	SXC	FLY_BY				23381.03	6.72	36.98	3.64
TF	DINTY	FLY_BY				41000.00		209.19	1.0

KSAN:RW09:DINTY Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VA					0.0	0.0					20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55
DF	BAUCA	FLY_BY	20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8
TF	ECHHO	FLY_BY	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86
TF	GOFUR	FLY_BY	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86	0.0	41.64	19000.0	300.0	5.0	84.62	416.03	500.0
TF	MMOTO	FLY_BY	0.0	41.64	19000.0	300.0	5.0	84.62	416.03	500.0	3.64	10.88	19000.0	300.0	18.51	84.62	416.03	500.0
TF	SXC	FLY_BY	3.64	10.88	19000.0	300.0	18.51	84.62	416.03	500.0	0.0	54.11	31957.53	300.0	5.0	110.28	525.33	570.0
TF	DINTY	FLY_BY	0.0	54.11	31957.53	300.0	5.0	110.28	525.33	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW09:DINTY Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at DINTY, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.

Route Evaluation for KSAN:RW09:MALIT

Required Engagement Climb Gradient (ft/NM): -

KSAN:RW09:MALIT Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VA			+4000.00			4000.00	166.49	19.92	19.92
DF	BAUCA	FLY_BY				9397.66	42.61	26.98	0.0
TF	ECHHO	FLY_BY				11110.69	0.35	8.56	3.19
TF	GOFUR	FLY_BY	+15000.00			14430.05	1.45	16.59	1.0
TF	MMOTO	FLY_BY	-19000.00			15978.78	37.03	7.74	3.64
TF	SXC	FLY_BY				23381.03	51.64	36.98	23.64
TF	MALIT	FLY_BY				39405.11		80.0	20.0

KSAN:RW09:MALIT Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VA					0.0	0.0					20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55
DF	BAUCA	FLY_BY	20.0	2.37	4000.0	265.0	25.0	54.92	288.63	343.55	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8
TF	ECHHO	FLY_BY	3.19	8.18	15247.45	300.0	21.31	77.19	390.61	467.8	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86
TF	GOFUR	FLY_BY	0.0	40.62	18246.19	300.0	5.0	83.13	410.73	493.86	0.0	41.64	19000.0	300.0	5.0	84.62	416.03	500.0
TF	MMOTO	FLY_BY	0.0	41.64	19000.0	300.0	5.0	84.62	416.03	500.0	3.64	10.88	19000.0	300.0	18.51	84.62	416.03	500.0
TF	SXC	FLY_BY	3.64	10.88	19000.0	300.0	18.51	84.62	416.03	500.0	20.0	41.34	31957.53	300.0	6.53	110.28	525.33	570.0
TF	MALIT	FLY_BY	20.0	41.34	31957.53	300.0	6.53	110.28	525.33	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW09:MALIT Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at MALIT, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.

Runway Evaluation for RW27

LNAV Engagement CG (ft/NM):	-
LNAV Engagement Termination Altitude (ft):	-
Obstacle Climb Gradient (ft/NM):	-
Obstacle CG Termination Altitude (ft):	-
Inhibit controlling obstacles within ICA Extended 3SM Area:	false

Route Evaluation for KSAN:RW27:DINTY

Required Engagement Climb Gradient (ft/NM): 489.59

KSAN:RW27:DINTY Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.75	20.06	1.02	1.02
CF	LANDN-NEW	FLY_BY				1442.98	39.23	6.11	2.2
TF	ECHHO	FLY_BY				3489.68	26.51	10.23	3.74
TF	GOFUR	FLY_BY	+15000.00			6807.83	1.45	16.59	2.05
TF	MMOTO	FLY_BY	-19000.00			8356.00	37.03	7.74	3.49
TF	SXC	FLY_BY				15755.55	6.72	36.98	3.49
TF	DINTY	FLY_BY				41000.00		209.19	1.0

KSAN:RW27:DINTY Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95
CF	LANDN-NEW	FLY_BY	0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91
TF	ECHHO	FLY_BY	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66
TF	GOFUR	FLY_BY	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71
TF	MMOTO	FLY_BY	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71	3.49	10.41	17710.44	300.0	18.51	82.07	407.03	489.09
TF	SXC	FLY_BY	3.49	10.41	17710.44	300.0	18.51	82.07	407.03	489.09	0.0	54.11	30667.17	300.0	5.0	107.72	512.66	570.0
TF	DINTY	FLY_BY	0.0	54.11	30667.17	300.0	5.0	107.72	512.66	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:DINTY Criteria Failures and Warnings

No failures.

Route Evaluation for KSAN:RW27:MALIT

Required Engagement Climb Gradient (ft/NM): 489.59

KSAN:RW27:MALIT Evaluation Results Part 1/2

Leg Tp	End Pt	Turn Tp	Alt Restr	Alt Restr 2	Spd Restr	Min CG Calc Alt	Turn Ang	Leg Length	Min Seg Length
VI						220.75	20.06	1.02	1.02
CF	LANDN-NEW	FLY_BY				1442.98	39.23	6.11	2.2
TF	ECHHO	FLY_BY				3489.68	26.51	10.23	3.74
TF	GOFUR	FLY_BY	+15000.00			6807.83	1.45	16.59	2.05
TF	MMOTO	FLY_BY	-19000.00			8356.00	37.03	7.74	3.49
TF	SXC	FLY_BY				15755.55	51.64	36.98	23.49
TF	MALIT	FLY_BY				31773.78		80.0	20.0

KSAN:RW27:MALIT Evaluation Results Part 2/2

Leg Tp	End Pt	Turn Tp	DTA1	DTA1 Turn Rad	DTA1 Turn Alt	DTA1 Turn Spd	DTA1 Bank Ang	DTA1 Tailwind	DTA1 True Airspd	DTA1 vGround	DTA2	DTA2 Turn Rad	DTA2 Turn Alt	DTA2 Turn Spd	DTA2 Bank Ang	DTA2 Tailwind	DTA2 True Airspd	DTA2 vGround
VI					0.0	0.0					0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95
CF	LANDN-NEW	FLY_BY	0.51	2.89	527.65	265.0	25.0	30.0	273.95	303.95	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91
TF	ECHHO	FLY_BY	1.69	4.75	3583.42	265.0	19.61	54.1	286.81	340.91	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66
TF	GOFUR	FLY_BY	2.05	8.68	8701.06	265.0	13.26	64.23	310.43	374.66	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71
TF	MMOTO	FLY_BY	0.0	36.12	15000.0	300.0	5.0	76.7	389.01	465.71	3.49	10.41	17710.44	300.0	18.51	82.07	407.03	489.09
TF	SXC	FLY_BY	3.49	10.41	17710.44	300.0	18.51	82.07	407.03	489.09	20.0	41.34	30667.17	300.0	6.53	107.72	512.66	570.0
TF	MALIT	FLY_BY	20.0	41.34	30667.17	300.0	6.53	107.72	512.66	570.0	0.0		41000.0	300.0	0.0	128.18	628.54	570.0

KSAN:RW27:MALIT Criteria Failures and Warnings

No failures.

Evaluation Input

Name:	RS Results MMOTO2-ABCX2
Project:	La Jolla 20200708a
Last Evaluated:	14-Jul-2020 13:20:20
Evaluated Obstacles?:	true
Obstacle Database:	DOF (14.0nm query)
Evaluated Terrain?:	false
Evaluated Precipitous Terrain?:	false
Worst Case Vegetation Height (ft) AGL:	0
Converted 9I Accuracies to 4D?:	true
MVA Prior to the IF (ft) MSL:	-
Maximum Aircraft Category:	D

Airport

Name:	KSAN [CIFP:FULL]
Location:	N32° 44' 00.80",W117° 11' 22.80"
Elevation (ft):	17
Magnetic Variation (degs):	11 ()

AAO Exempt Airports

Name	Location	Elevation (ft)
KCRQ [NFDC]	N33° 07' 41.70",W117° 16' 48.30"	330.5
KLAX [NFDC]	N33° 56' 32.99",W118° 24' 28.98"	127.8
KLGB [NFDC]	N33° 49' 04.55",W118° 09' 06.81"	60.4
KMYF [NFDC]	N32° 48' 56.60",W117° 08' 22.40"	427.3
KNZY [NFDC]	N32° 41' 53.51",W117° 12' 47.20"	25.9
KONT [NFDC]	N34° 03' 21.60",W117° 36' 04.30"	944
KRNM [NFDC]	N33° 02' 21.00",W116° 54' 54.90"	1394.6
KSAN [CIFP:FULL]	N32° 44' 00.80",W117° 11' 22.80"	17
KSAN [NFDC]	N32° 44' 00.80",W117° 11' 22.80"	16.8
KSDM [NFDC]	N32° 34' 20.20",W116° 58' 48.60"	526.1
KSEE [NFDC]	N32° 49' 34.40",W116° 58' 20.80"	387.5
KSMO [NFDC]	N34° 00' 56.96",W118° 27' 04.70"	169.8
KSNA [NFDC]	N33° 40' 32.40",W117° 52' 05.60"	56.1

Runways

Name	Airport	Location	Elevation (ft)	TDZE (ft)	True Course (degs)	Survey?
RW09	KSAN [CIFP:FULL]	N32° 44' 10.92",W117° 12' 04.43"	16	16	106	NONE
RW27	KSAN [CIFP:FULL]	N32° 43' 52.94",W117° 10' 50.26"	15	15.5	286	NONE

Criteria Failures and Warnings

RDO257: [Warning] In the route beginning at RW09, the Input Climb Gradient, 200.0 is equal to the Input Engagement Climb Gradient. Consolidate climb gradients into a single climb gradient of 200.0 ft/NM to 100000.0 feet.
RDO66: [Waiver Required] The OCS surface applied from RW09 is penetrated by obstacles/terrain.
RDO35: [Waiver Required] The VA/VI leg off of RW09 has a leg length of 19.924458820654678 NM that is in excess of the maximum ICA length: 10.0 NM.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at DINTY, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.
RDO55: [Waiver Required] In the route beginning at RW09 and ending at MALIT, the Engagement Altitude 4000.0 is not within 20 feet of the Airport Elevation plus 500 feet 517.0.
RDO70: [Waiver Required] In the leg from MMOTO to SXC, an MEA was not provided. An MEA must be established on each leg of an En route Transition.
RDO70: [Waiver Required] In the leg from SXC to DINTY, an MEA was not provided. An MEA must be established on each leg of an En route Transition.
RDO70: [Waiver Required] In the leg from SXC to MALIT, an MEA was not provided. An MEA must be established on each leg of an En route Transition.

Software Evaluation Failures, Warnings, and Notes

CEW19: KLGB does not have all the required runways to construct the AAO area.
CEW19: KMYF does not have all the required runways to construct the AAO area.
No terrain evaluation was performed.
CEW19: KCRQ does not have all the required runways to construct the AAO area.
In the leg from SXC to MALIT the MEA was set to 4200.0 based on evaluated MOCA.
CEW19: KSMO does not have all the required runways to construct the AAO area.
CEW19: KSEE does not have all the required runways to construct the AAO area.
CEW19: KLAX does not have all the required runways to construct the AAO area.
RW27: Minimum VI segment leg was applied.
In the leg from SXC to DINTY the MEA was set to 4200.0 based on evaluated MOCA.
CEW19: KSDM does not have all the required runways to construct the AAO area.
CEW19: KRNM does not have all the required runways to construct the AAO area.
CEW19: KNZY does not have all the required runways to construct the AAO area.
CEW19: KONT does not have all the required runways to construct the AAO area.
CEW19: KSNA does not have all the required runways to construct the AAO area.
In the leg from MMOTO to SXC the MEA was set to 4200.0 based on evaluated MOCA.

Obstacles Requiring Accuracy Code Verification

[06-000275 [DOF], 06-002237 [DOF], 06-002238 [DOF], 06-002499 [DOF], 06-006026 [DOF], 06-006276 [DOF], 06-020050 [DOF], 06-020074 [DOF], 06-229418 [DOF], 06-229745 [DOF], MX-000628 [DOF], MX-000629 [DOF], MX-000630 [DOF], MX-000631 [DOF], MX-000632 [DOF], MX-000633 [DOF], MX-000634 [DOF], MX-000649 [DOF], MX-000650 [DOF]]

Ignored Obstacles

None.

Procedure Notes

None.

Database Effective Dates

Database	Date
UddfObstacle	07/13/2017
Tiled IFPA	N/A
OEAAA	N/A
DOF	06/18/2020
NFDC	07/16/2020
IFP_OFFLINE	N/A
AVNII_OFFLINE	N/A
CIFP	06/18/2020

Notes:

1. **The only changes made in this SID were on the RWY 27 Runway Transition.**
2. **The intended use of this TARGETS Distribution Package is for evaluation purposes in the SAN Airport Part 150, July 2020, as an alternative design proposal.**

Appendix 3 – Equivalent Lateral Spacing Operations (ELSO) - Background Materials

DEVELOPMENT AND OPERATIONAL TRANSITION OF THE FIRST PBN-ENABLED DEPARTURE SEPARATION STANDARD

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Federal Aviation Administration, Washington, District of Columbia

Abstract

In 2014, the Federal Aviation Administration (FAA) prioritized Performance-Based Navigation (PBN) capabilities of its Next Generation Air Transportation System (NextGen) and committed to implementing high-priority innovations within the next three years. For 2015, the commitments include the issuance of a national standard for PBN-enabled Equivalent Lateral Spacing Operation (ELSO) departures and ELSO implementations at airports throughout the United States (US) National Airspace System (NAS). Beginning in 2011, flight validations of ELSO-based reduced-divergence procedures at The Hartsfield-Jackson Atlanta International Airport (KATL) demonstrated operational benefits and validated the ELSO concept for the development of the standard. The standard will enable the NAS-wide use of PBN departure procedures with a reduced minimum divergence of 10 degrees instead of the 15 degrees currently required to conduct simultaneous parallel and successive departure operations. This paper describes the process, from inception to integration into the NAS that pioneered the first PBN-enabled reduced separation standard for departures. Further work to identify candidate airports for application and activities supporting the harmonization of PBN-based separation standards in the global air transportation system are also discussed.

Introduction

Performance-Based Navigation (PBN) serves as a cornerstone for transforming the United States (US) National Airspace System (NAS) from a system that primarily relies on ground-based navigation and radar surveillance to a satellite-based system. To further capitalize on PBN-enabled capabilities and enable safe implementation of more closely spaced flight paths, the Federal Aviation Administration (FAA) committed to developing standards for reduced separation and divergence [1]. The commitments include the issuance of a standard for PBN-enabled Equivalent Lateral Spacing Operation (ELSO) departures and ELSO implementations at airports throughout the NAS [2]. The ELSO standard concept provides lateral spacing between reduced-divergence flight paths that is equivalent to the spacing observed in conventional departure operations at minimum divergence requirements of the currently applicable separation standard [3]. Applications of the reduced standard deliver benefits by providing PBN procedure design options to more effectively address terrain, obstacle, or airport noise sensitivity constraints and enable diverging operations to increase departure capacity, reduce departure delay, decrease fuel burn, and lessen aircraft emissions. This paper describes the process applied to successfully operationally transition ELSO as the first PBN-enabled departure separation standard into the NAS and harmonize its adoption in the global air transportation system.

Background

In 2003, the FAA unveiled its strategy for applying PBN capabilities with the publication of the *Roadmap for Performance-Based Navigation.* The roadmap paved the way for NAS-wide implementation of terminal Area Navigation (RNAV) Standard Instrument Departure (SID) and Standard Terminal Arrival (STAR) procedures [4]. Leveraging the on-board navigation capabilities of advanced flight automation systems that are currently available on the majority of commercial and corporate aircraft, RNAV procedures promised more efficient utilization of available runways and constrained terminal airspaces surrounding major U.S. airports.

Initial implementations of RNAV procedures that provided the most significant benefits included departure procedures at Dallas/Ft. Worth International Airport (KDFW) and The Hartsfield-Jackson Atlanta International Airport (KATL) [5]. At both airports, PBN-based improvements in navigation accuracy and precision enabled the designs of additional departure flight paths.

At KDFW, the designs implemented in 2005 offered two additional diverging departure procedure routes in both North and South airport operational configurations. For each primary departure runway, the designs applied conventional divergence with a minimum of 15 degrees between the initial route segments. A Certificate of Authorization or Waiver (COA or *waiver*) authorized conducting simultaneous PBN operations along initially parallel route segments from runways on both East and West airport complexes [6]. In Figure 1, green and red arrows illustrate the initial course angles that meet the minimum requirement of the conventional divergence standard (15 degrees). Red arrows denote the courses of initial procedure segments of the additional, PBN-enabled departure routes.

At KATL, noise impact considerations and resulting route design constraints limited the number of PBN departure routes to one additional departure route in both East and West operational configurations. Application of conventional

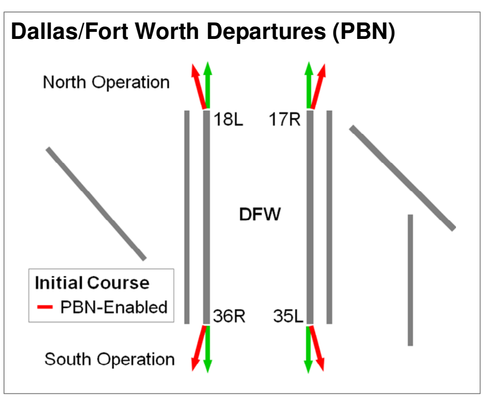

Figure 1. Initial Divergence of KDFW's PBN Procedures Implemented in 2005

divergence requiring course divergence of at least 15 degrees and the need to operate within established noise abatement corridors precluded designs of dual-diverging routes from Runway 08R and Runway 27R. The lack of divergence necessitated that these departures remain in-trail of each other and prevented full realization of the efficiency benefits associated with diverging operations at the airport. Furthermore, the use of the PBN-enabled dual-diverging departure routes from Runways 09L and 26L had to be discontinued during periods when the airport conducted Triple departure operations requiring Air Traffic Control (ATC) personnel to issue initial aircraft headings (radar vectors) to aircraft departing from some of the runways. The initial divergence angles of the departure tracks implemented in 2006 are illustrated in Figure 2. As before, red arrows denote initial courses of PBN-enabled additional departure routes.

The following sections review current requirements of the conventional 15-degree divergence standard and describe key steps in the development and implementation of a PBN-enabled reduced divergence standard.

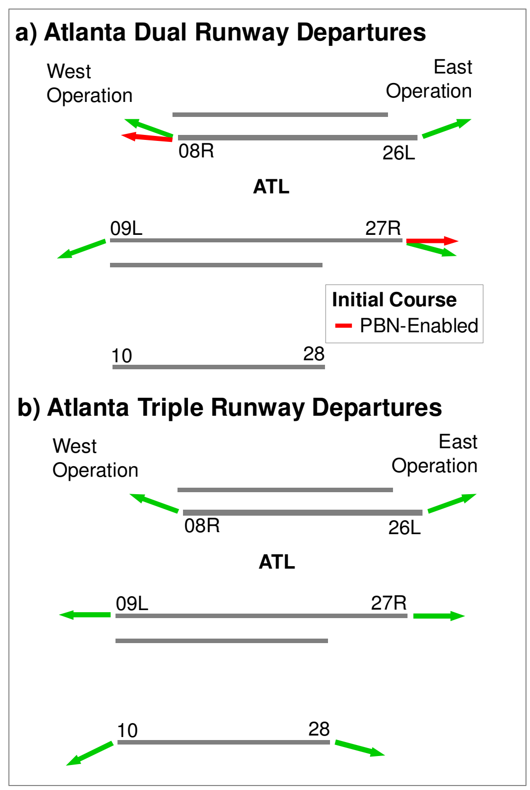

Figure 2. Initial Divergence of KATL's Dual and Triple Departure Tracks Implemented in 2006

Conventional Divergence Standard

A single 15-degree divergence requirement of the radar separation standard applies when conducting departure operations. This rule has been in place for the past 50 years. The standard currently applies equally to conventional departures that follow ATC-assigned aircraft headings (i.e., radar vectors) and PBN departures that proceed along designed procedure routes. FAA Order (FAAO) JO 7110.65 - Air Traffic Control and International Civil Aviation Organization (ICAO) Doc 4444 Procedures for Air Navigation – Air Traffic Management (PANS-ATM) define the requirements for conducting diverging departure operations [7,8].

There are three key rules pertaining to diverging departure operations from the same runway or parallel runways. In each of these cases, radar identification with the aircraft must be established within one mile of the takeoff runway end and courses must diverge by 15 degrees or more immediately after departure. Figure 3 illustrates minimum separation requirements for operations conducted in the radar environment. Figure 3a) refers to aircraft departing from the same runway and Figure 3b) refers to aircraft departing from the same airport or adjacent airports with parallel runways that are separated by less than 2,500 feet. In these cases, wake turbulence requirements must be applied longitudinally between aircraft departing the same or parallel runways. Figure 3c) refers to aircraft departing parallel runways that are spaced 2,500 feet or more apart. In this case, aircraft may depart independently and no wake turbulence requirements apply.

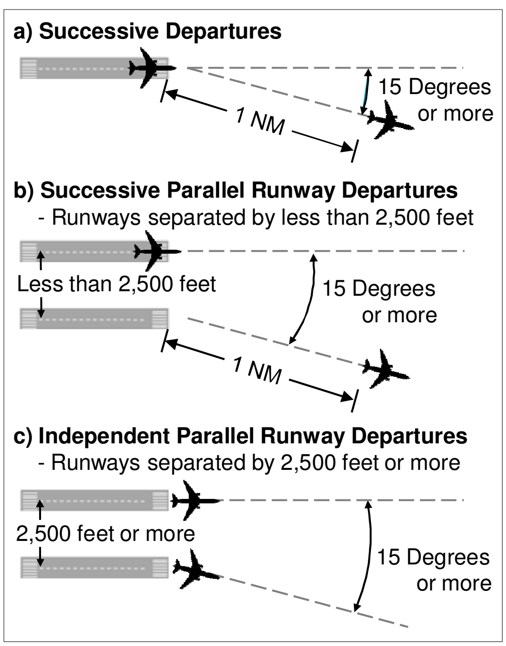

Figure 3. Applications of the Current 15-Degree Divergence Standard

Reduced Divergence Standard

In 2010, FAA Next Generation Air Transportation System (NextGen) strategy and mid-term implementation objectives included the goal of more effectively addressing terrain, obstacle, or airport noise sensitivity constraints and increase operational efficiencies. The strategy called for the development and adoption of a PBN-enabled reduced divergence standard to facilitate the design of multiple departure paths from each runway end [9,10]. With the initial goal of enabling diverging departure operations from all primary departure runways at KATL, the process adopted to reduce the divergence standard represents a multi-year effort across various FAA lines of business, and between the FAA and aviation industry. The various activities can be grouped in the following steps:

- Operational Need
- Concept Development
- Concept Application
- Technical Review
- Operational Transition
- Document Change
- NAS-Wide Application
- Global Harmonization

Key elements of each step are described in the following sections.

Operational Need

In 2008, the Atlanta Terminal Radar Approach Control (TRACON) Airspace and Procedures Office identified the need to overcome the design limitations described previously to fully realize the efficiency benefits of diverging departure operations (see Figure 2). The office proposed a plan to evolve the designs of KATL's PBN departure procedures to Atlanta's Capacity Enhancement Working Group (CEWG)[1]. Primary objectives of the evolution plan included the goals of increasing departure capacity and thus improving schedule integrity of airline hub operations at the airport [11]. To this end, the plan called for enabling air traffic controllers to conduct successive and/or simultaneous RNAV SID operations from dual/triple parallel runways with reduced divergence. The use of reduced divergence was necessary to provide additional departure paths within KATL's established noise abatement corridors and lessen the environmental impact on areas surrounding the airport. A secondary goal was to enhance operational safety by enabling consistent use of RNAV *off-the-ground* (OTG) operations, i.e., no longer requiring ATC issuance of initial radar vectors to departing aircraft when the airport conducted triple runway departure operations.

Initial Concept Development

In 2009, the FAA Performance Based Navigation Policy and Support Group (AJV-14) tasked The MITRE Corporation's Center for Advanced Aviation System Development (MITRE CAASD) to review the operational changes expected to result from KATL's evolution plan and estimate associated benefits to airline operators. The preliminary findings indicated potential annual benefits in the $10 to $20 million range [12]. The findings validated KATL's business case for reduced-divergence departure operations. Follow-on tasking included investigations of PBN-based options to advance the divergence standard with the initial goal of enabling reduced-divergence departure operations at the airport.

In 2010, the ELSO concept was proposed to enable departure operations along departure paths with reduced divergence and along initially parallel departure paths [3]. The concept provides lateral spacing between departure paths that is equivalent to or greater than the spacing of departure paths associated with conventional diverging departure operations based on minimum requirements of the currently applicable divergence standard. This comparative approach also suggested an equivalent or greater level of safety for ELSO departure operations.

The ELSO standard concept provides an analytic expression that describes the divergence angle as a function of three components that take into consideration observed navigational performance and runway layout characteristics [3]. Depending upon the runway layout geometry, diverging application of the ELSO standard typically supports reduced divergence angles of 5 to 10 degrees for RNAV 1 departure operations. As described in the *Document Change* section below, the standard eventually adopted for NAS-wide application solely capitalizes on PBN-enabled improvements in navigational performance. Figure 4 illustrates the PBN component of the ELSO concept.

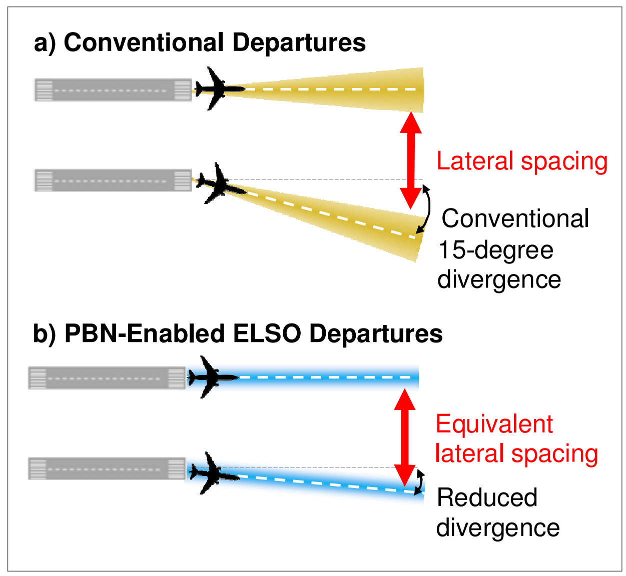

Figure 4. Diverging Application of the PBN Component of the ELSO Concept

Concept Application

To achieve the goals of its RNAV SID evolution plan, KATL sought approval for a waiver to apply reduced course divergence. The plan showed that application of reduced divergence enables dual-diverging operations from KATL's two primary departure runways and independent operations from its three widely-spaced parallel runways. The initial divergence angles of the departure routes are illustrated in Figure 5. Initial review of the route designs showed that the proposed divergence angles meet or exceed ELSO divergence requirements [3].

[1] A local workgroup comprised of representatives from the aviation industry, the local airport authority, and FAA.

In 2010, Atlanta TRACON convened a Safety Risk Management Panel (SRMP) to meet the Safety Management System (SMS) requirements for the proposed operational changes. The panel conducted a safety risk analysis in support of the proposed operations with reduced divergence. It identified and addressed safety risk management issues and mitigation actions pertaining to the proposed operational changes and developed a Safety Risk Management Document (SRMD) for FAA review and approval [13].

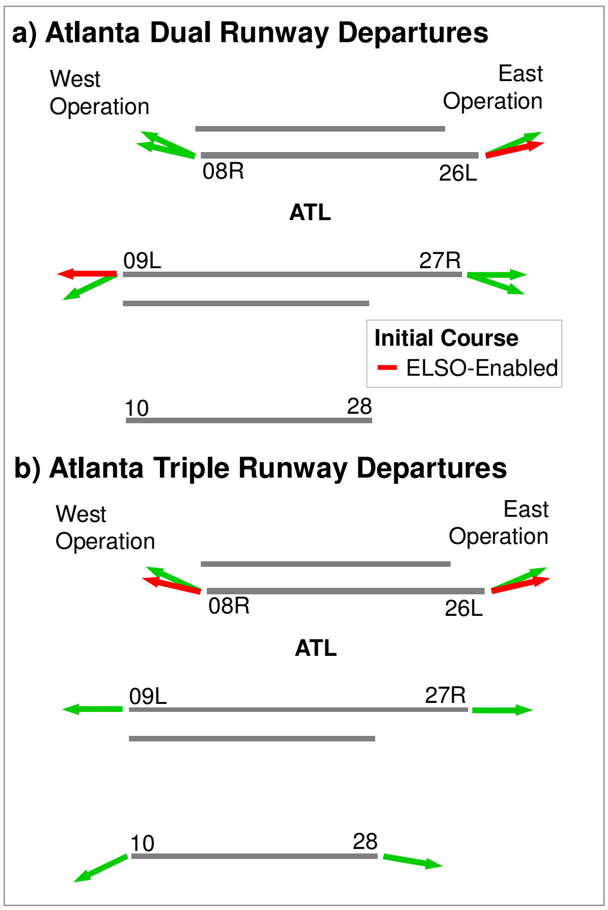

Figure 5. Initial Divergence of KATL's PBN Procedures Implemented in 2011

Technical Review

FAA technical review of the ELSO concept led by Flight Technologies and Procedures Division (AFS-400) commenced in 2011. It included AJV-14 as well as Terminal Safety and Operations Support (AJT-2) and focused on evaluating risks that may result from application of the concept at KATL. The initial review validated the comparative approach of the ELSO concept and the absence of negative impacts on risks associated with operations on reduced-divergence departure routes. Subsequent review by FAA RNAV and Required Navigation Performance (RNP) Group (AJR-37) determined the acceptability of ELSO departure operations from a safety aspect and facilitated the SMS process applicable to FAA's Air Traffic Organization (ATO) [14].

Operational Transition

Approval

On 22 August 2011, FAA Terminal Operations and Safety Support (AJS-22) approved Atlanta's waiver request for reduced course divergence and authorized Atlanta Tower and TRACON to conduct reduced-divergence continuous RNAV off-the-ground operations for successive departures and dual/triple simultaneous parallel departures by implementing NextGen RNAV ELSO procedures [15]. With an effective date of 20 October 2011, the waiver paved the way for operational demonstrations of reduced-divergence departure operations at KATL and served to validate the ELSO concept.

Implementation

On 20 October 2011, Atlanta implemented a set of sixteen NextGen RNAV ELSO departure procedures that provided additional departure paths within KATL's established noise abatement corridors. Various pre-implementation activities were carried out in close collaboration among Atlanta Tower, Atlanta TRACON, Atlanta Air Route Traffic Control Center (Center), airline operators, and surrounding communities. These activities implemented measures preempting possible operational issues for which the SRMP previously identified mitigation actions. Most importantly, they included controller and pilot training to ensure that aircraft navigate along the routes on which they were cleared to depart.

To facilitate the transition to reduced-divergence departure operations, Atlanta Tower temporarily opened an additional Ground control position. On initial call up, the controller staffing this *Meter* position verified that the assigned departure runway and initial navigational fix associated with the departure procedure were correctly loaded in the aircraft Flight Management System (FMS).

The phraseology in use by the Local controller when issuing takeoff clearances also specifies the name of the fix to which the departure is initially cleared. Use of this phraseology promotes final flight-crew verification of the procedure (initial fix) and requires read-back to ensure proper course guidance along the cleared route of flight [16]. Another measure requires the Local controller to monitor the departure either visually or by using a Certified Tower Radar Display (CTRD) to assure timely aircraft turn initiation before instructing the aircraft to contact Departure control.

Further monitoring of the flight's route conformance by Departure control was aided by additional markings on video map overlays developed for use by TRACON Automated Radar Terminal System Color Displays (ACD). These measures proved effective in assuring aircraft divergence and continue to be in use today.

Other measures were taken to accommodate non-participating aircraft, i.e., aircraft that lack the required PBN capability, or contingencies that preclude execution of the RNAV ELSO procedures (e.g., equipment outages, weather events). They included the development of runway-specific conventional procedures and revising the Letter of Agreement (LOA) between Atlanta Tower and TRACON to reflect the changes. The various implementation measures were taken in close consultation with the airlines operating at the airport to ensure flight crew awareness of the operational changes. They also included publications of a Letter to Airmen, Attention All Users Pages (AAUP) to pilots, as well as updates to flight crew check lists [17].

Validation

In 2012, the FAA tasked MITRE CAASD to assess the operational changes that are directly associated with the ELSO-enabled diverging departure operations. The assessment quantified associated annual operator benefits at nearly $20 million [18]. As stated previously, the RNAV ELSO procedure designs increased the number of departure routes from three routes to four routes (see Figure 5). In an East operation, the additional route permits diverging departure operations from Runway 08R. Figure 6 compares East operation radar tracks before and after implementation of the NextGen RNAV ELSO procedures and illustrates the reduced-divergence departure operations at the airport.

The waiver that enabled KATL to conduct RNAV ELSO departure operations initially required biannual review and renewal. In preparation for its first request for renewal in 2013, Atlanta TRACON personnel reviewed the safety data that were collected over a period of nearly two years by its ongoing safety monitoring program. The review established the effectiveness of the measures taken to mitigate possible operational issues. No operational errors were attributed to the reduction of departure divergence and the request for waiver renewal was granted.

The successful flight validations at KATL paved the way for policy changes to facilitate beneficial ELSO application throughout the NAS without the need for airport-specific reviews and authorizations.

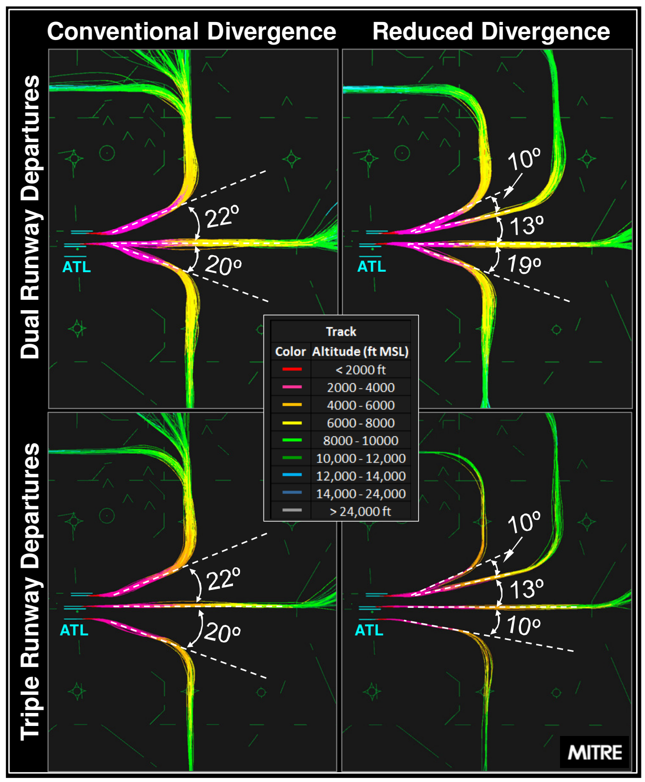

Figure 6. Radar Tracks Illustrating KATL's Reduced Divergence Departure Operations

Document Change

In 2012, FAA commenced a multi-phased initiative to update its Air Traffic Control Handbook, FAAO JO 7110.65. Update recommendations included changes to Section 5-8-3 (Successive or Simultaneous Departures) to enable NAS-wide application of the ELSO standard [19]. The FAA tasked MITRE CAASD to perform a NAS-wide survey of candidate implementation airports. The survey results suggested the potential for beneficial application of reduced-divergence departure operations at other airports and supported the decision to propose a national policy change [20].

In 2013, the FAA tasked MITRE CAASD to develop a single divergence requirement for uniform application throughout the NAS. The adoption of a single divergence requirement forgoes the complexities of leveraging runway layout characteristics and solely capitalizes on PBN-enabled improvements in navigational performance [21]. FAA technical review by AFS-400 determined a single reduced value of 10 degrees appropriate for all PBN (RNAV 1) departure operations and for achieving a level of safety equal to or better than that experienced by conventional departures using 15 degrees divergence [22]. A SRMP was convened in 2014 to analyze the hazards and unintended consequences of introducing the proposed NAS-wide change. The work of the panel centered on examining KATL's operational experience conducting reduced-divergence departure operations and found no evidence to suggest that the reduction of divergence to 10 degrees has introduced risk into the NAS [23].

In 2014, the FAA Terminal Procedures Office (AJV-822) initiated a Document Change Proposal (DCP) and drafted language to authorize a minimum of 10 degrees of course divergence between successive and simultaneous RNAV SID departures. Following a review and comment period, FAA Air Traffic Procedures (AJV-8) approved the document change for publication in FAAO JO 7110.65 with an effective date of 25 June 2015. Specifically, the change:

- Defines *immediately after departure* turn requirements as any turn that provides at least 15 degrees of divergence that begins no more than 2 miles from the departure end of the runway (DER)
- Defines the requirement that the only type SID that can be used for reduced divergence procedures are RNAV SIDs constructed with a specific lateral path that begins at the DER
- Authorizes 1 mile initial separation for aircraft departing the same runway or parallel runways separated by less than 2,500 feet provided both aircraft are flying an (appropriate) RNAV SID and their courses diverge by 10 degrees or more immediately after departure
- Authorizes simultaneous takeoffs between aircraft departing in the same direction from parallel runways if the centerlines are separated by at least 2,500 feet and courses diverge by 10 degrees or more when both aircraft are flying an (appropriate) RNAV SID.

NAS-Wide Application

The scheduled inclusion of the reduced divergence standard in FAAO JO 7110.65 permits PBN procedure implementations with reduced divergence at eligible locations throughout the NAS. Capitalizing on improved navigational precision of PBN operations, these reduced-divergence departure paths provide benefit by improving the ability of parallel and same runway operations to do the following: address terrain, obstacle, or noise sensitivity constraints; increase departure capacity or throughput during peak demand periods; reduce departure delay associated with taxi-out time; and reduce fuel burn and emissions. The new standard provides additional options for procedure designers as they seek to provide increased efficiency, safety, and environmentally friendly alternatives. The FAA plans to use the Metroplex [2] process along with single-site implementation to deploy the capability. Candidate sites are currently being examined for consideration [2].

Global Harmonization

The FAA's business is driven by four strategic priorities. One priority is advanced by initiatives to improve safety, air traffic efficiency, and environmental sustainability across the globe through an integrated, data driven approach that shapes global standards, enhances collaboration and harmonization, and better targets FAA resources and efforts. The

[2] FAA initiative which focuses on a systems approach to PBN implementation and airspace design in large metropolitan areas.

reduced divergence standard meets all of the requirements of this priority.

Beginning in 2011, the FAA introduced the reduced divergence standard concept to ICAO [24,25]. After initial review recommendation by ICAO's Separation and Airspace Safety Panel (SASP), ICAO's Air Navigation Commission (ANC) approved further work toward adopting a global reduced divergence standard.

In 2012, review of the theoretical assumptions and modeling of the concept by the Mathematician's Subgroup (MSG) of the SASP further supported ELSO-based reduced divergence requirements [26]. In 2013, the panel endorsed a proposal to draft an amendment proposal for PANS-ATM for the introduction of a global standard with a minimum requirement of 10-degree divergence for use by aircraft authorized to conduct terminal PBN (RNAV 1) operations [27,28]. The FAA is currently drafting the Circular and preparing the Impact Statement needed to support final ANC review of the reduced divergence standard and anticipates completion of the review process to enable publication in the next available edition of ICAO PANS-ATM.

Summary and Next Steps

The FAA is committed to capitalizing on PBN-enabled capabilities currently available on commercial and corporate aircraft operating in the NAS and enabling safe implementation of more closely spaced flight paths. In 2010, development of national standards for reduced separation and divergence commenced. The five-year process for the development, validation, NAS-wide integration, and global harmonization of a first PBN-enabled departure separation standard involved numerous lines of business within the FAA, aviation industry, and the international aviation community.

The new standard for reduced divergence enables the design of RNAV procedure paths with a minimum of 10 degrees of divergence instead of the 15 degrees currently required. Publication of the national standard for reduced divergence is scheduled for 25 June 2015 in FAAO JO 7110.65. Publication of the international standard in ICAO PANS-ATM is expected in 2018. The process applied to develop and integrate the reduced-divergence standard comprised eight steps that may serve as a framework for future advances in the development of aircraft separation standards that further leverage NextGen capabilities.

The goals of enhancing the efficiency with which departure operations are conducted at KATL and reducing the noise footprint of the airport provided a sustained local impetus toward the development and operational validation of the reduced divergence standard. The standard is based on the ELSO concept which provides lateral spacing between reduced-divergence flight paths that is equivalent to the spacing observed in conventional departure operations at minimum divergence requirements of the currently applicable separation standard. ELSO's comparative approach facilitated the SMS review and approval processes applicable to FAA ATO and ICAO SASP. The FAA Metroplex process currently serves to apply the standard in redesigns of departure procedures and to beneficially deploy reduced-divergence departure operations at airports throughout the NAS.

Further gains in NAS operational efficiencies of departure and arrival operations are expected to increasingly rely on developing advanced spacing concepts that capitalize on NextGen capabilities to evolve applicable separation standards. In the case of departures, further study currently investigates additional reductions in the required minimum divergence as well as enabling initially parallel departure paths. Capitalizing on Required Navigation Performance (RNP) technology to improve operational efficiencies of arrival operations, the Established-on-RNP (EoR) concept aims to safely guide aircraft to simultaneous parallel final approach paths without the requirement for vertical separation from aircraft on adjacent approaches. Flight trials to validate the EoR concept are currently conducted at Denver International Airport (KDEN).

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2015 Integrated Communications Navigation and Surveillance (ICNS) Conference

April 21-23, 2015

Center for Advanced Aviation System Development

Development and Operational Transition of the First PBN-Enabled Departure Separation Standard

Ralf H. Mayer, Dennis J. Zondervan, Brian M. Crow, James K. Allerdice, and H. Madison Walton

Integrated Communications Navigation and Surveillance (ICNS) Conference

Herndon, VA

21 April 2015

MITRE

F073-B15-007

Outline

- **Background**
  - Next Generation Air Transportation System (NextGen)
    - Opportunities for enabling more effective use of airspace and improving operational efficiencies
      - Leveraging Performance-Based Navigation (PBN) capabilities
- **Reduced Departure Divergence**
    - Development, operational transition, integration into the National Airspace System (NAS), and global harmonization
      - Key steps
- **Summary and Next Steps**

Background

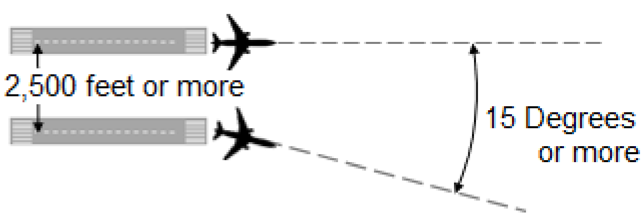
- **Next Generation Air Transportation System (NextGen)**
  - In 2003, Federal Aviation Administration (FAA) first unveiled its strategy for applying Performance Based Navigation (PBN) capabilities
  - FAA committed to developing PBN-enabled standards for reduced separation and divergence to further advance PBN capabilities
- **Reduced Departure Divergence**
  - Equivalent Lateral Spacing Operation (ELSO)
    - Concept developed in 2010
    - In operational use since 2011
      - The Hartsfield-Jackson Atlanta International Airport (KATL)
    - National reduced divergence standard
      - Development commenced in 2013

Current Departure Divergence

- **Same Runway**
  - Successive Departures

    - Diverging operations enable application of Same Runway Separation for improved departure efficiency

- **Parallel Runway**
  - Independent Departures



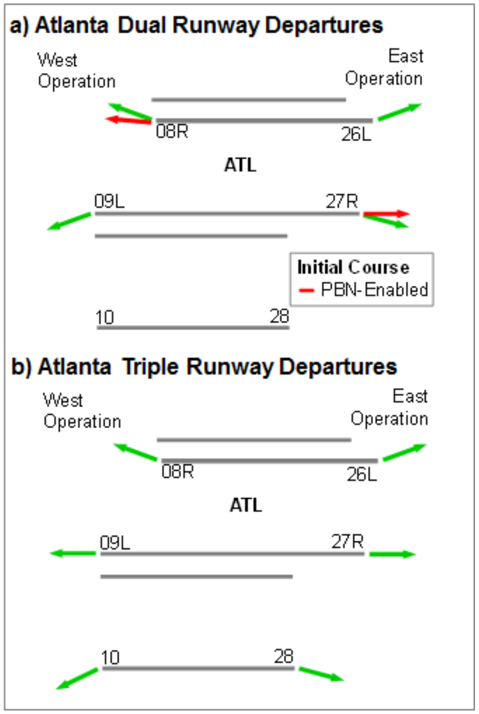
- **Key Requirements**
  - Courses must diverge by **15 degrees** or more immediately after departure
  - Radar environment and radar identification of aircraft within one mile of the departure runway

- **Applications**
  - Standard applies equally to:
    - Conventional departures (on radar vectors) and
    - PBN departures (e.g., on RNAV procedures)

Operational Need

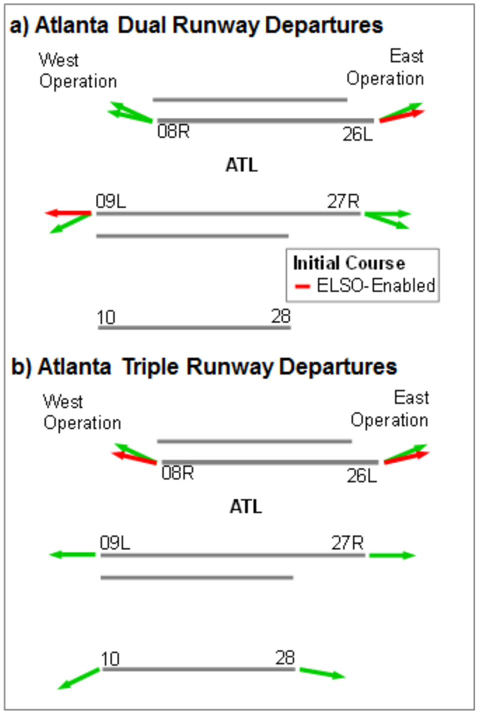
- **KATL PBN Departure Procedures**
  – Initial Procedure Courses

2006 Implementation



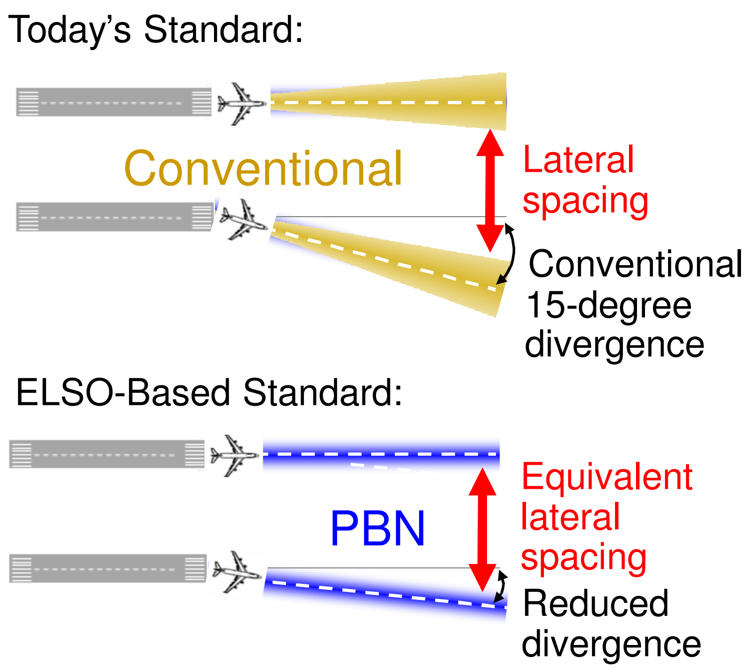
- In 2006, conventional divergence requirements and noise constraints limited the number of additional PBN-enabled departure routes
  – East or West Operations
  – Dual or Triple Departures
- In 2008, a proposal called for reduced departure divergence that enables additional departure paths
- Primary goals:
  – Increase efficiency and reduce departure delays
  – Lessen environmental impact

2008 Proposal



Concept Development

- **Equivalent Lateral Spacing Operation (ELSO)**
  – PBN Component



Benefits

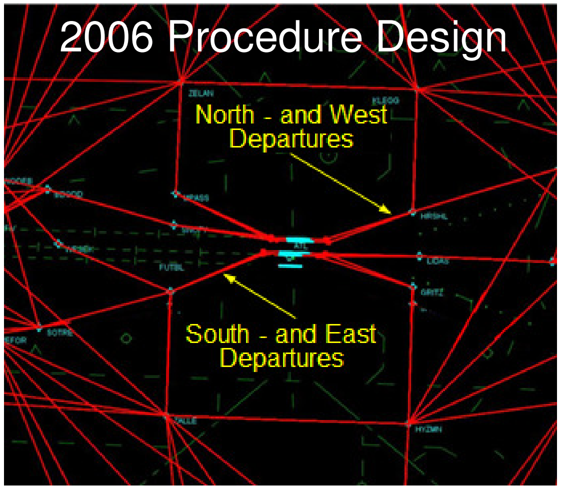
⇒ Additional RNAV SID procedure design options
- Improved ability to address terrain/obstacle and noise sensitivity constraints

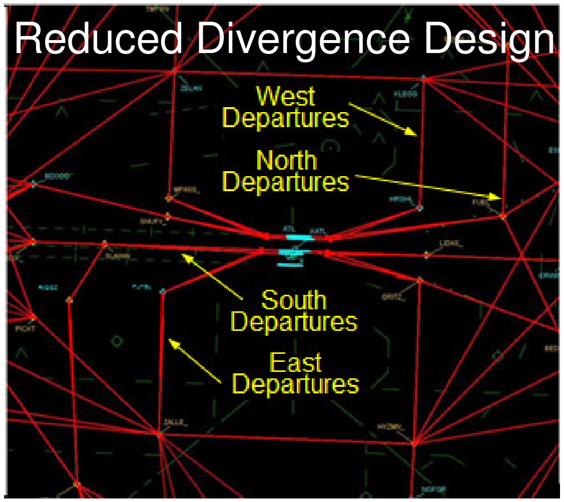
⇒ Increased departure efficiency if ELSO enables diverging departure operations
- Increased departure capacity
- Increased throughput during peak demand periods
- Reduced departure delay (taxi-out time)
- Reduced fuel burn and emissions

Concept Application and Review

- **Reduced Divergence Departure Operations**
  - KATL sought Air Traffic Organization (ATO) approval for an operational waiver
    - Safety Management System (SMS) review
      - Operational changes
    - Safety Risk Management Document (SRMD)
      - Risk mitigations

- **Technical Review**
  - Consistency of proposed divergence angles with ELSO divergence requirements
  - Validation of comparative approach of ELSO concept
  - Absence of negative impacts on risks associated with operations
  - Acceptability from a safety aspect





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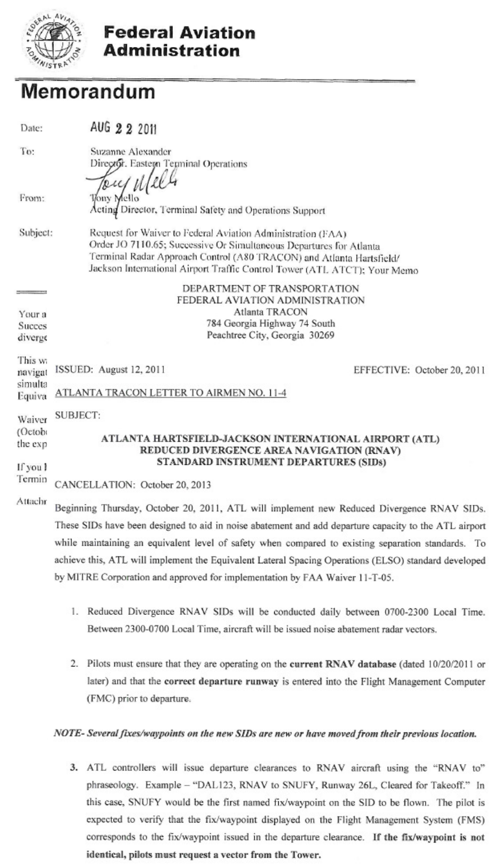
Operational Transition (1 of 2)

- **Waiver Approval (August 2011)**
  - Authorized Atlanta air traffic control (ATC) to conduct reduced-divergence continuous Area Navigation (RNAV) off-the-ground operations for successive departures and dual/triple simultaneous parallel departures
- **Procedure Implementation (October 2011)**
  - Key implementation activities included controller and pilot training to ensure proper runway use and procedure assignment verification
    - Including updated flight crew check lists
  - Use of "*RNAV to*" phraseology (takeoff clearance)
  - Conformance monitoring
    - Tower and Departure control
  - Procedures for accommodating non-participating aircraft
    - Updated Letter of Agreement (LoA) between Tower and Departure



Federal Aviation Administration

Memorandum

Date: AUG 22 2011

To: Suzanne Alexander
Director, Eastern Terminal Operations

From: Tony Mello
Acting Director, Terminal Safety and Operations Support

Subject: Request for Waiver to Federal Aviation Administration (FAA) Order JO 7110.65; Successive Or Simultaneous Departures for Atlanta Terminal Radar Approach Control (A80 TRACON) and Atlanta Hartsfield/Jackson International Airport Traffic Control Tower (ATL ATCT); Your Memo

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Atlanta TRACON
784 Georgia Highway 74 South
Peachtree City, Georgia 30269

ISSUED: August 12, 2011 EFFECTIVE: October 20, 2011

ATLANTA TRACON LETTER TO AIRMEN NO. 11-4

SUBJECT:

**ATLANTA HARTSFIELD-JACKSON INTERNATIONAL AIRPORT (ATL)
REDUCED DIVERGENCE AREA NAVIGATION (RNAV)
STANDARD INSTRUMENT DEPARTURES (SIDs)**

CANCELLATION: October 20, 2013

Beginning Thursday, October 20, 2011, ATL will implement new Reduced Divergence RNAV SIDs. These SIDs have been designed to aid in noise abatement and add departure capacity to the ATL airport while maintaining an equivalent level of safety when compared to existing separation standards. To achieve this, ATL will implement the Equivalent Lateral Spacing Operations (ELSO) standard developed by MITRE Corporation and approved for implementation by FAA Waiver 11-T-05.

1. Reduced Divergence RNAV SIDs will be conducted daily between 0700-2300 Local Time. Between 2300-0700 Local Time, aircraft will be issued noise abatement radar vectors.

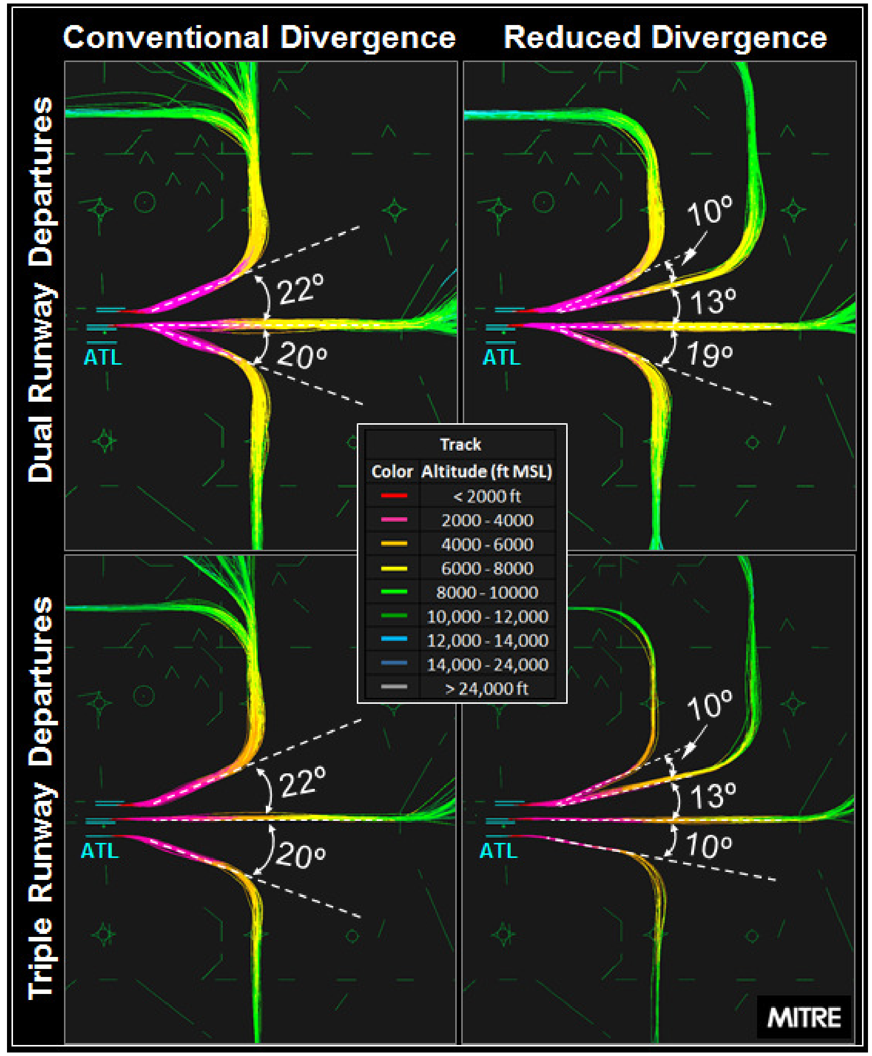
2. Pilots must ensure that they are operating on the **current RNAV database** (dated 10/20/2011 or later) and that the **correct departure runway** is entered into the Flight Management Computer (FMC) prior to departure.

NOTE- Several fixes/waypoints on the new SIDs are new or have moved from their previous location.

3. ATL controllers will issue departure clearances to RNAV aircraft using the "RNAV to" phraseology. Example – "DAL123, RNAV to SNUFY, Runway 26L, Cleared for Takeoff." In this case, SNUFY would be the first named fix/waypoint on the SID to be flown. The pilot is expected to verify that the fix/waypoint displayed on the Flight Management System (FMS) corresponds to the fix/waypoint issued in the departure clearance. **If the fix/waypoint is not identical, pilots must request a vector from the Tower.**

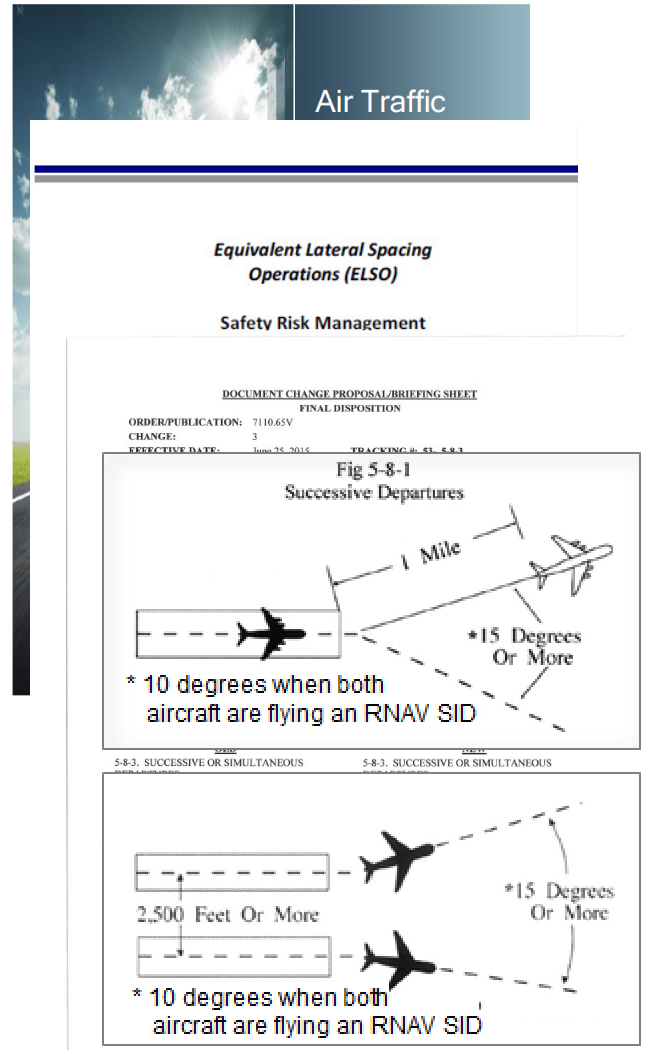
Operational Transition (2 of 2)

- **Operational Validation (2012)**
  - Benefits resulting from operational changes associated with reduced divergence departure operations
    - Annual operator benefit of nearly $ 20 million
- **Waiver Maintenance**
  - Ongoing safety monitoring program
  - Bi-annual renewal (2013)
    - No operational errors attributed to the reduction of departure divergence



Document Change

- **Divergence Standard**
  - In 2012, FAA commenced a multi-phased initiative to update *FAA JO 7110.65 Air Traffic Control*
    - Review of applicability throughout the NAS
    - Proposal for a national policy change
- **Document Change Proposal (DCP)**
  - In 2013, FAA adopted a single minimum reduced divergence angle of 10 degrees
    - Completed SMS review of operational changes (2014)
    - Developed draft language to change FAA JO 7110.65
      - Paragraph 5-8-3 Successive or Simultaneous Departures
  - Publication scheduled for 25 June 2015



NAS-Wide Application

- **Potential Application Benefits**
  - Improved procedure design flexibility
    - Facilitate addressing terrain, obstacle, or noise sensitivity constraints
    - Enable diverging departure operations
      - Increase departure efficiency
      - Reduce delays, fuel burn and emissions
- **Application Approach**
  - FAA Metroplex process
    - Ongoing initiative to re-design procedures and airspace in large metropolitan areas
  - Application under consideration at Fort Lauderdale-Hollywood International Airport (KFLL) and Miami International Airport (KMIA)

NextGEN

FAA NextGen eNews – April 2015

What's New in NextGen?

Another completed commitment involves Equivalent Lateral Spacing Operations (ELSO).

ELSO capitalizes on the increased navigational precision of Area Navigation (RNAV) departure operations. ELSO reduces the angle between departure routes from 15 degrees to as little as 10 degrees without the aircraft flying closer together.

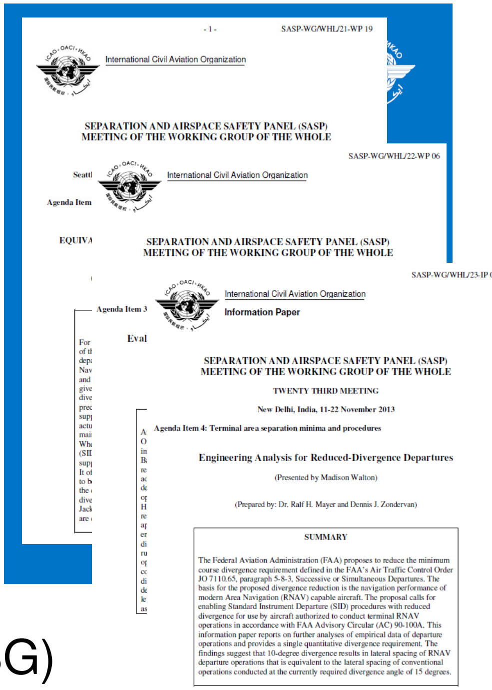
"By doing that, we are able to increase departure capacity flow so it makes the NAS (National Airspace System) more efficient," Creasap said.

The FAA approved change to the current standard and made it available for consideration in future Metroplex and single airport sites. It also will be incorporated into the air traffic control handbook, which is set to be released in June, Creasap said.

"Industry wanted us to get the work done so that it is well defined enough that we could actually use it in the Florida Metroplex," Gustin said. "We accomplished that, and Florida Metroplex is moving forward considering this ELSO technique."

Global Harmonization

- **International Civil Aviation Organization (ICAO)**
  - Enhance international collaboration and harmonization to shape global standards to:
    - Improve safety, air traffic efficiency, and environmental sustainability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International Civil Aviation Organization

SEPARATION AND AIRSPACE SAFETY PANEL (SASP)
MEETING OF THE WORKING GROUP OF THE WHOLE

SASP-WG/WHL/22-WP 06

International Civil Aviation Organization

SEPARATION AND AIRSPACE SAFETY PANEL (SASP)
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SASP-WG/WHL/23-IP 05

International Civil Aviation Organization

Information Paper

SEPARATION AND AIRSPACE SAFETY PANEL (SASP)
MEETING OF THE WORKING GROUP OF THE WHOLE

TWENTY THIRD MEETING

New Delhi, India, 11-22 November 2013

Agenda Item 4: Terminal area separation minima and procedures

Engineering Analysis for Reduced-Divergence Departures

(Presented by Madison Walton)

(Prepared by: Dr. Ralf H. Mayer and Dennis J. Zondervan)

SUMMARY

The Federal Aviation Administration (FAA) proposes to reduce the minimum course divergence requirement defined in the FAA's Air Traffic Control Order JO 7110.65, paragraph 5-8-3, Successive or Simultaneous Departures. The basis for the proposed divergence reduction is the navigation performance of modern Area Navigation (RNAV) capable aircraft. The proposal calls for enabling Standard Instrument Departure (SID) procedures with reduced divergence for use by aircraft authorized to conduct terminal RNAV operations in accordance with FAA Advisory Circular (AC) 90-100A. This information paper reports on further analyses of empirical data of departure operations and provides a single quantitative divergence requirement. The findings suggest that 10-degree divergence results in lateral spacing of RNAV departure operations that is equivalent to the lateral spacing of conventional operations conducted at the currently required divergence angle of 15 degrees.

- **Separation and Airspace Safety Panel (SASP)**
  - FAA introduced reduced divergence concept in 2011
    - Initial review approved work toward adopting a global reduced divergence standard
  - Concept reviewed by Mathematician's Subgroup (MSG)
    - MSG supported ELSO-based reduced divergence requirements (2012)
  - Panel endorsed proposal to draft amendment proposal for ICAO Doc 4444 Procedures for Air Navigation – Air Traffic Management (PANS-ATM) in 2013
    - 10-degree divergence for use by aircraft authorized to conduct terminal PBN procedure (RNAV 1) operations

Summary and Next Steps

- **FAA committed to capitalizing on PBN-enabled capabilities**
  - Enabling safe implementation of more closely-space flight paths
    - Reduced Departure Divergence
      - Process commenced in 2010 involving numerous lines of business within FAA, aviation industry, and international aviation community
      - New standard enables design of RNAV procedures with 10 degrees of divergence (instead of 15 degrees currently required)
      - FAA publication of new standard scheduled for 25 June 2015
      - ICAO adoption and publication expected in 2018
        - Circular and Impact Statement in preparation
- **Next Steps**
  - FAA system-wide implementation of reduced divergence procedures via the Metroplex process
  - Further study to investigate additional reductions in divergence requirements

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DEVELOPMENT AND OPERATIONAL TRANSITION OF THE FIRST PBN-ENABLED DEPARTURE SEPARATION STANDARD

COMPLETE LIST OF AUTHORS:
Ralf H. Mayer, Dennis J. Zondervan, Brian M. Crow, James K. Allerdice, Jr., H. Madison Walton, Jr.

IEEE PUBLICATION TITLE (Journal, Magazine, Conference, Book): 2015 ICNS Conference

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