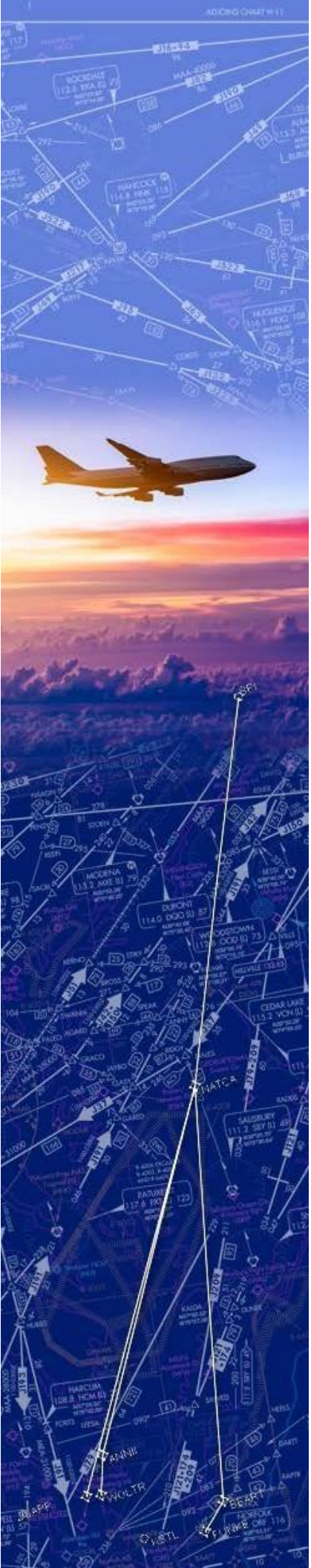


Federal Aviation Administration

Phoenix West Flow RNAV SID
Post-Implementation Assessment Report

BY

FEDERAL AVIATION ADMINISTRATION

April 2015

Table of Contents

List of Figures

1 Background and Overview

On September 18, 2014, the Federal Aviation Administration (FAA) implemented nine new Area Navigation (RNAV) Standard Instrument Departures (SIDs) at Phoenix Sky Harbor International Airport (KPHX) which have flow-dependent transitions designed to ensure repeatable, predictable flight paths. The purpose and need of the project was to improve the predictability of flight routes in the greater Phoenix airspace. The safety and efficiency of the National Airspace System (NAS) are enhanced by decreasing communication requirements between controllers and pilots and providing more direct routings that are not dependent on ground base navigational aids. The departure procedures attempt to maintain unrestricted climbs as much as possible, while providing procedural de-confliction where practical from other SID and Standard Terminal Arrival Routes (STAR).

Prior to January 2015, to implement RNAV procedures, the FAA utilized the 18-step process described in FAA Order 7100.9, *Standard Terminal Arrival Program and Procedures*. The development of these SIDs began March 2012, in accordance with the requirements of that order. On April 3, 2014, FAA Order 7100.41, *Performance Based Navigation Implementation (PBN) Process*, superseded FAA Order 7100.9. The post-implementation monitoring and evaluation guidance contained in FAA Order 7100.41 was applied during this post-implementation assessment. During this final phase, the operation of the procedures and/or routes is assessed to ensure they perform as expected and meet the goals finalized during the development phase. Post-implementation activities also involve collecting and analyzing data to ensure that safe and efficient procedures were developed.

On December 19, 2014, the FAA completed a post-implementation assessment which included an analysis of all RNAV SID procedures. The assessment determined the procedures performed as expected and met the goals identified in the development phase.

In response to concerns conveyed by the Phoenix City Manager, FAA Administrator Michael P. Huerta stated, "We are committed to partnering with the airport and airlines to explore other potential adjustments to the procedures to better manage noise issues." The FAA convened a PBN Working Group (Workgroup) to explore potential adjustments to the new air traffic procedures implemented at KPHX (See Attachment A, Huerta letter to Phoenix City Manager Ed Zuercher). Any potential adjustment would be subject to a subsequent environmental review of the final procedure design prior to implementation.

2 Scoping

NATCA and FAA (The Parties) recognize that having a consistent and collaborative approach to information sharing, consensus building, and formulation of agreements would allow the overall process to move forward more effectively and efficiently while addressing the interests of all concerned (See Attachment B: Post-Implementation Scoping Letter).

The Parties agreed to form a Workgroup comprised of:

1) One National Air Traffic Controllers Association (NATCA) Co-Lead, identified by NATCA National Airspace Representative
2) One FAA Management Co-Lead, identified by Director for Airspace Services
3) Two NATCA Points of Contacts (POC), one each from Phoenix TRACON (P50) and Phoenix Tower (PHX)
4) Two FAA Management POCs, one each from P50 and PHX
5) Western Service Center (WSC) PBN Operations Support Group Representatives, one each from FAA Management and NATCA
6) One FAA AeroNav Products (AJV-3) Representative
7) One FAA Environmental Specialist
8) One Lead Operator designated by Airlines For America (A4A)

Additional support will be provided as requested by the Co-Leads:

1) One MITRE Analyst
2) One ATAC Analyst
3) One CSSI Documentation Specialist

The Workgroup shall:

1) Assess and examine the Phoenix PBN SIDs with initial turns to the northwest, specifically the LALUZ, MAYSA, SNOBL, and YOTES RNAV SIDs, focusing on the initial segments to the TWSND waypoint, when KPHX is departing in a west configuration.
2) Assess and examine the IZZZO RNAV SID, focusing on the initial segment to the KEENS waypoint, when KPHX is departing in a west configuration.
3) Assess and examine the Phoenix PBN SIDs with initial turns to the southwest, specifically the BNYRD, FTHLS, JUDTH and KATMN RNAV SIDs, focusing on the initial segments to the DAVZZ waypoint, when KPHX is departing in a west configuration.
4) Consider comments from the City of Phoenix Aviation Department, the Phoenix Mayor's Office, and the Phoenix City Council.
5) Propose modifications that would maintain and/or enhance safety, improve operational efficiency, and ensure procedural conformance with the intended flight paths.

Figure 2-1 depicts the overview of the project area.

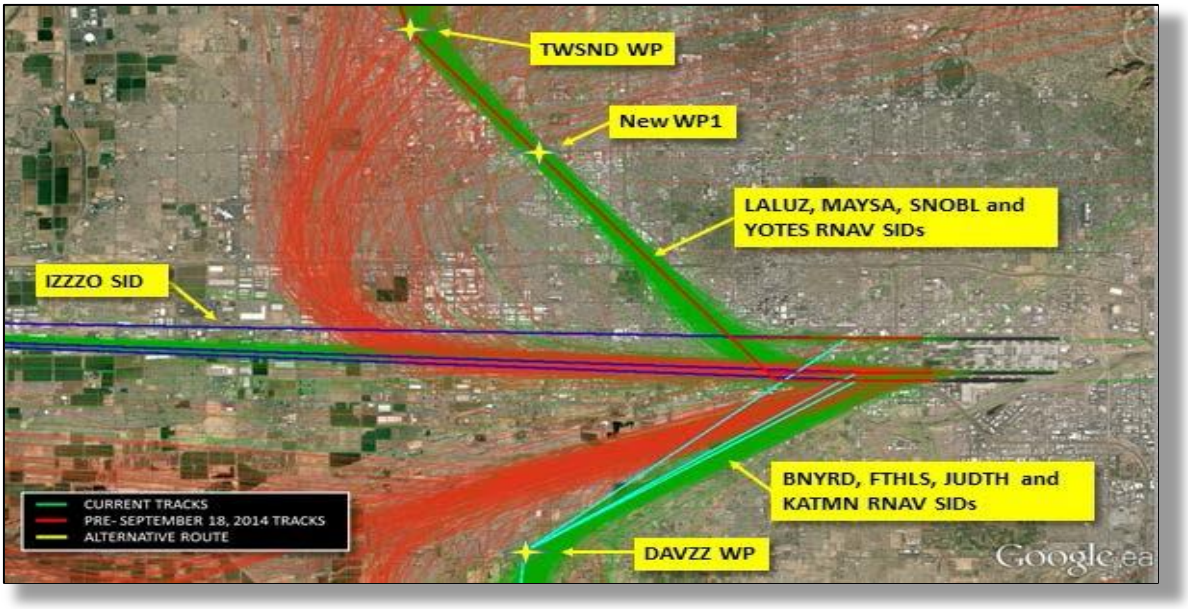


Figure 2-1 Overall View of Project Area 1

3 Post Implementation Findings

3.1 Air Traffic Control (ATC) Findings

ATC reported the following benefits for the September 18, 2014 departure procedure implementation:

- Safety and efficiency are improved with immediate course divergence due to repeatable, predictable flight paths
- Provides lateral separation between successive west configuration departures
- Maintains increased departure throughput during peak traffic periods with a third departure course
- Reduces ground controller task complexity by simplifying departure gate balancing
- PBN procedures enhance safety by reducing frequency congestion
- Reduces potential conflicts

3.2 Industry Findings

Industry reported the following benefits and data for the September 18, 2014 departure procedure implementation:

- Reduced an average 3.5 nautical miles (NM) per flight for all configurations
- KPHX averages 588 departures per day of these daily departures, approximately 500 flights utilize the new procedures in all configurations
- Approximately 1,750 flight miles have been eliminated per day

- Over 15,000 metric ton reduction in CO_2 emissions are realized annually
- Approximately $3.6 million in fuel savings[1] are realized annually
- Reverting to pre-September 18, 2014 routings, industry reported the following data for west configurations:
    - LALUZ, YOTES, SNOBL, and MAYSA RNAV SIDs
        - Adds approximately 410 NM per day based on 117 flights
        - Equates to over 374,000 gallons of fuel and over 3,515 metric tons of CO_2 per year
    - IZZZO RNAV SID
        - Adds approximately 38 NM per day based on 54 flights
        - Equates to over 34,600 gallons of fuel and 325 metric tons of CO_2 per year
    - FTHLS, BNYRD, JUD TH, and KATMN RNAV SIDs
        - Adds approximately 59 NM per day based on 66 flights
        - Equates to over 53,000 gallons of fuel and 498 metric tons of CO_2 per year
        - Reversion to the previous procedures would reintroduce in excess of 4,300 metric tons of CO_2 emissions annually into the Phoenix metropolitan area's environment

4 Implementation Assessment of KPHX Northwest, West, and Southwest SIDs

4.1 Assessment of the Northwest RNAV SIDs: LALUZ, YOTES, SNOBL, and MAYSA

As directed by the scoping document, the Workgroup assessed the LALUZ, MAYSA, SNOBL, and YOTES RNAV SIDs. The Workgroup's task was to create and assess potential adjustments which maintain and/or enhance safety, improve operational efficiency, and ensure procedural conformance with the intended flight paths. Focusing on the initial segments to the TWSND waypoint on the SIDs when KPHX is departing in a west configuration, the following potential adjustments were considered:

[1] Source fuel cost : HTTP://www.transtats.bts.gov/fuel.asp, based on fuel costs of $2.30 per gallon

4.1.1 Alternative NW1: No Action

Description:

- No change to September 18, 2014 west flow departure procedures

Considerations:

- Other alternatives identified by the Workgroup enhanced safety and efficiency, which met the goals of the original project

Decision:

The Workgroup identified other alternatives which were aligned with the purpose and need of the project and were able to produce gains in efficiency and safety.

4.1.2 Alternative NW2: Add RNAV Waypoint (New WP1) and Speed and Altitude Restrictions to Northwest SIDs: LALUZ, YOTES, SNOBL, and MAYSA

Description:

- Add RNAV waypoint on the LALUZ, YOTES, SNOBL, and MAYSA SIDs, in the vicinity of Grand Avenue and Indian School Road, which would keep flight tracks within the Grand Avenue Corridor (industrial corridor as defined by the City of Phoenix)
- Add altitude restriction (at-or-above 4,000 feet Mean Sea Level [MSL]) at New WP1
- Add altitude restriction (at-or-above 5,000 feet MSL) at TWSND waypoint (WP)
- Add speed restriction (at-or-below 230 knots) at New WP1 and TWSND WP
- No change in the lateral path to ensure alignment with the purpose and need of the project

Considerations:

- Speed and altitude restrictions at New WP1 and TWSND WPs would increase aircraft rates of climb resulting in aircraft being higher at any given point along the procedure than experienced today. Consistent departure speed assignments would ensure predictable and repeatable flight paths eliminating over takes and conflictions. Currently northwest departures are climbed to 8,000 feet MSL these new restrictions would allow SIDs to have an unrestricted climb to FL210.
- Speed and altitude restrictions also de-conflict KPHX departures from KPHX northwest arrivals. Airspace constraints and mountainous terrain limit the TRACON's ability to utilize lateral separation making vertical separation essential.
- Due to military airspace constraints and mountainous terrain, turboprop and turbojet departure courses must be merged within five to seven NM from departure end of the runway. With a steeper climb profile, safety is enhanced due to the expeditious application of vertical separation between Phoenix turbojet departures initially assigned 8,000 feet MSL and turboprop departures initially assigned 5,000 feet MSL.

- The speed and altitude restrictions in this alternative help eliminate interactions between KPHX turboprop departures and low attitude satellite and military operations. Satellite and military operations are conducted outside Class B airspace and concentrated at-or- below 6,000 feet MSL. The higher altitude for KPHX turboprop departures would retain the aircraft within Class B airspace providing an enhanced level of safety.
- Maintains equivalent level of airport throughput by retaining current immediate departure course divergence. Without the initial departure separation provided by immediate course divergence, departures from parallel runways would become dependent. Other forms of separation would have to be employed, in this case lateral separation. This would increase controller task complexity, inhibit airport departure rates, and fail to ensure an equivalent level of safety.
- During the two week traffic sampling (September 19, 2014 to October 3, 2014) approximately seven percent of northwest departures were below the proposed 4,000 foot MSL altitude restriction placed at New WP1. The Phoenix Subject Matter Experts (SME) noted the percentage increases dramatically during hot summer months. The climb restrictions would eliminate this summer month increase and increase aircraft conformance.

Decision:

The Workgroup decided to recommend this potential adjustment as the preferred alternative for the northwest SIDs, subject to further review including environmental analysis.

This alternative does not increase miles flown as there is no change in the lateral path. Therefore, there is no loss of efficiency, no increase in fuel burn and no increase CO_2 emissions. Not modifying the lateral path of the procedures, the current level of safety is maintained.

Crossing altitudes and speed restrictions at New WP1 and TWSND waypoints would increase departure rates of climb, resulting in steeper climb profiles. Today, without restrictions approximately seven percent[2] of departures operate at shallow climb rates as illustrated by the red tracks in Figure 4.1.2-1. The Phoenix Subject Matter Experts (SME) noted the percentage increases dramatically during hot summer months. The steeper profiles created by the proposed restrictions would eliminate aircraft flight paths below 4,000 feet MSL in the vicinity of New WP1 as illustrated in Figure 4.1.2-2. Additional benefits would be realized in that all departures would be at higher altitudes at any given point on the procedure. Figure 4.1.2-3 illustrates an overhead view of the restrictions associated with New WP1 and TWSND waypoints.

Turboprop departures are typically assigned radar vectors and routed east of the subject RNAV departure course. Vertical separation between turbojet and turboprop departures must be attained prior to merging them onto a common departure routes. The differing performance characteristics of these aircraft increases controller task complexity. Higher climb rates

[2] Percentage from a PDARS sampling of departure track data from 09/19/2014 through 10/03/2014

achieved by adding altitude and speed restrictions at New WP1 and TWSND waypoints would provide vertical separation sooner. This would reduce controller task complexity, reduce miles flown and reduce fuel burn and CO_2 emissions while increasing the level of safety Satellite and military operations are conducted outside Class B airspace and concentrated at-or-below 6,000 feet. The higher altitude for KPHX turboprop departures would retain them within Class B airspace providing an enhanced level of safety.

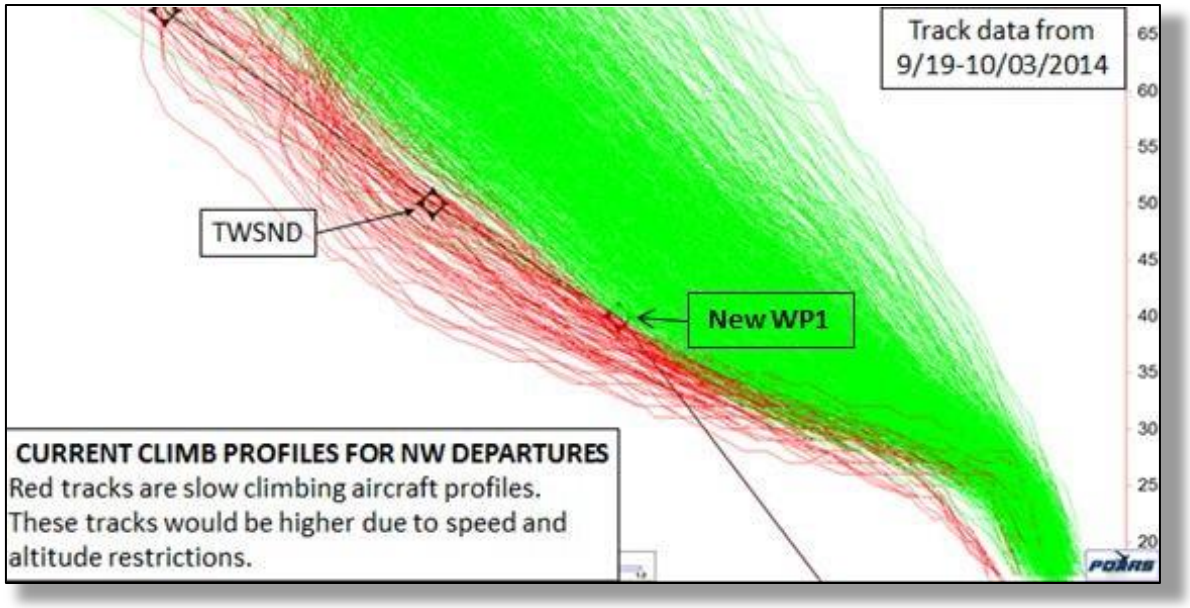


Figure 4.1.2-1. Historical Climb Profiles of PHX Northwest SIDs (Elevation View)

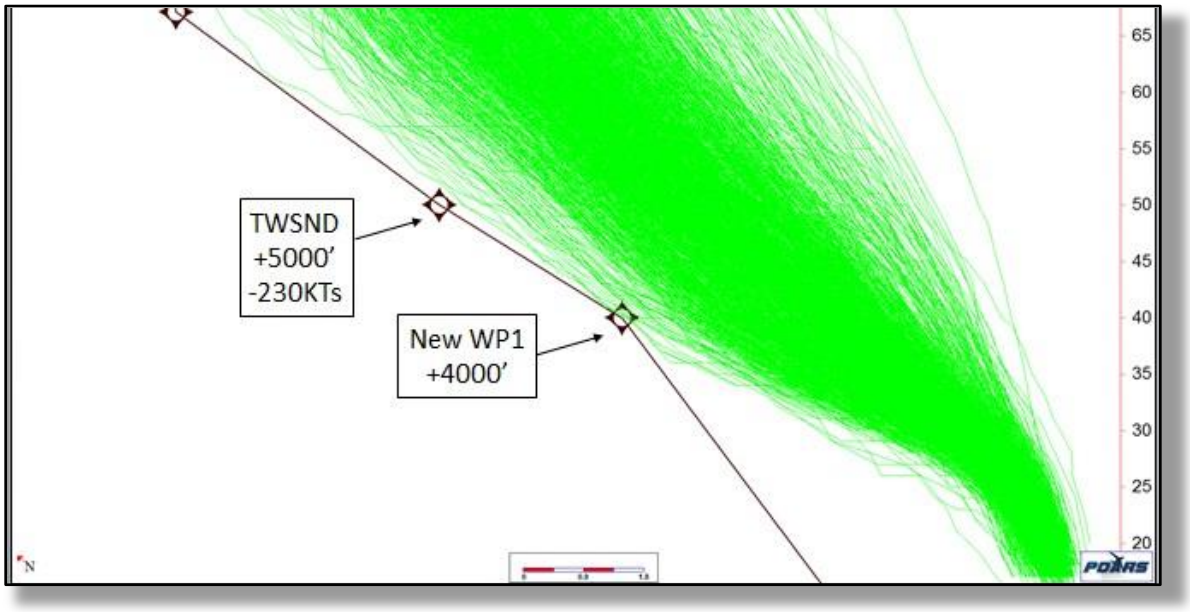


Figure 4.1.2-2. Northwest SIDs Amended Flight Tracks with Altitude Restrictions

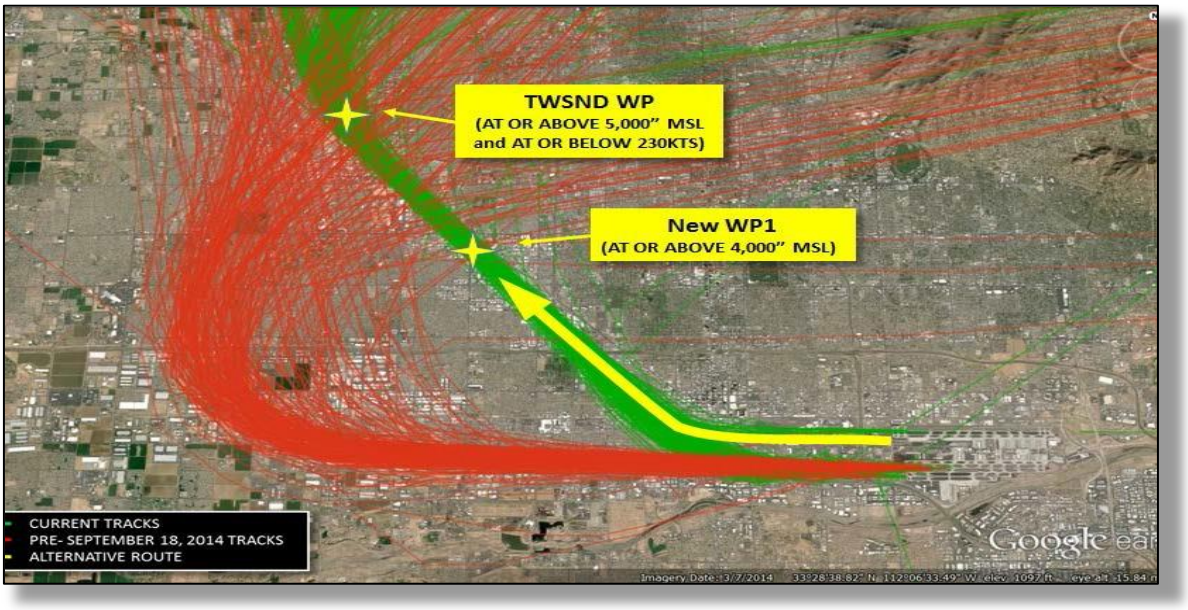


Figure 4.1.2-3. Northwest SIDs Proposed Amended Procedure(s)

4.1.3 Alternative NW3: Revert to Pre-September 18, 2014 Non-RNAV Routings

Description:

- Revert to Pre-September 18, 2014 published Non-RNAV departure procedures

Considerations:

- FAA Administrator Huerta letter to Phoenix City Manager Ed Zuercher, dated January 22, 2015
- Reroutes flight tracks away from the industrial corridor
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures
- With repeatable and predictable flight paths modifications would eliminate overtakes and conflicting departure paths
- Reverting to the September 18, 2014 northwest departures would not maintain an equivalent level of airport throughput. Eliminating the current immediate departure course divergence would create a dependency with the IZZZO RNAV SID. The pre-September 18,2014 northwest SIDs and the IZZZO SID both have initial runway heading legs, creating the dependency. This dependency would require other forms of separation, in this case lateral separation. This would increase controller task complexity, inhibit airport departure rates, and fail to ensure an equivalent level of safety.

Decision:

Reverting to the pre-September 18, 2014 flight tracks would reduce efficiency and safety, and would not align with the purpose and need of the project. Approximately 3.29 nautical flying miles are added with this alternative. On a west departure configuration, approximately 351,000 additional gallons of fuel would be burned annually. This would also result in an additional 3,300 metric tons of CO_2 introduced annually into the environment. This alternative would also route flights away from a designated industrial corridor. (See Figure 4.1.3-1. Northwest SIDs with No Performance Based Navigation [Radar Vectoring])

The lack of PBN procedures is contrary to the Congressional mandate to implement Next Generation Air Transportation System (NextGen) procedures. Reversion to radar vectoring would: increase controller task complexity, create the potential for airport throughput reductions, and fail to maintain an equivalent level of safety.

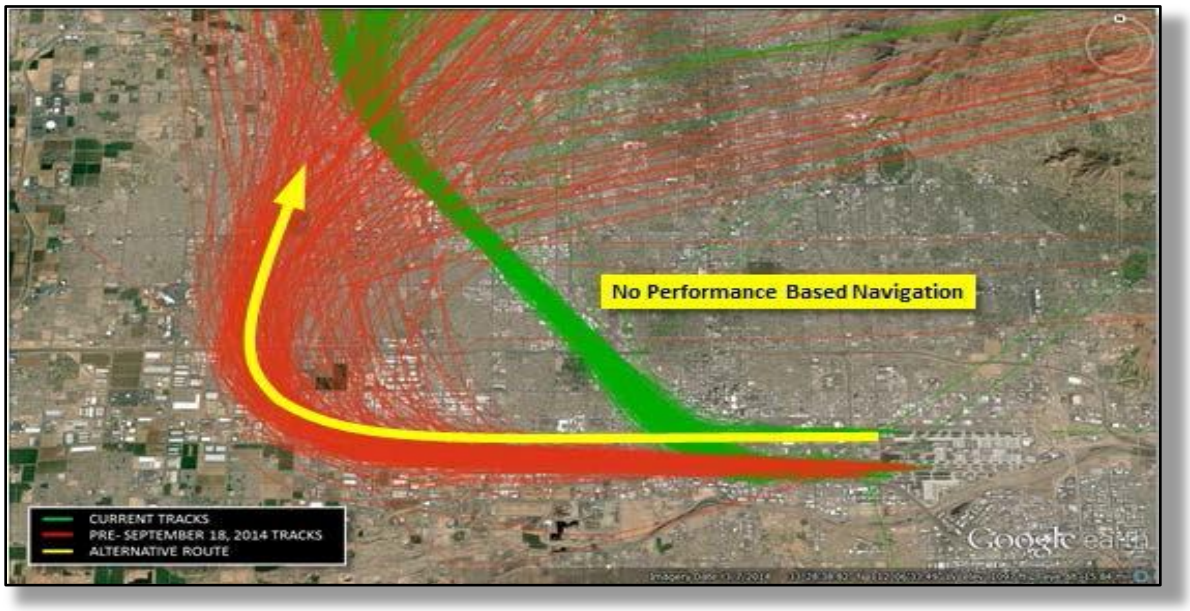


Figure 4.1.3-1. Northwest SIDs with No Performance Based Navigation (Radar Vectoring)

4.1.4 Alternative NW4: Revert to Pre-September 18, 2014 Using PBN RNAV Routings

Description:

- Revert to Pre-September 18, 2014 flight paths incorporating RNAV procedures

Considerations:

- Reroutes flight tracks away from the industrial corridor
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures

Decision:

Reverting to the pre-September 18, 2014 flight tracks would reduce efficiency and safety and would not align with the purpose and need of the project. Approximately 1.85 nautical flying miles are added with this alternative. On a west departure configuration, approximately 197,500 additional gallons of fuel would be burned annually. This would also result in an additional 1,850 metric tons of CO_2 introduced annually into the environment. This alternative would also route flights away from a designated industrial corridor. (See Figure 4.1.4-1. Northwest SIDs Using Performance Based Navigation)

This alternative also introduces the potential for reducing airport throughput and failing to maintain an equivalent level of safety. The extended initial departure tracks following the runway heading(s) create an undesirable and inefficient dependency between parallel runway departures. Simultaneous departures from the parallel runways would be adversely impacted as lateral separation would not be attained immediately after departure as is provided by the Workgroups recommended alternative. Any reduction in efficiency does not align with the purpose and need of this project.

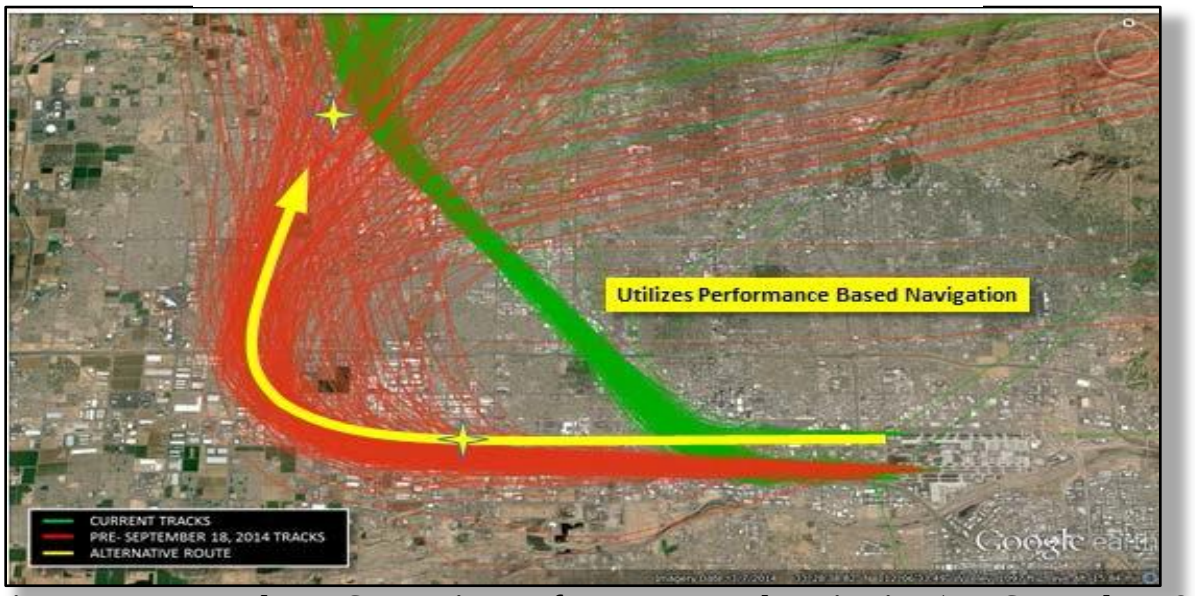


Figure 4.1.4-1. Northwest SIDs Using Performance Based Navigation (Pre-September 18, 2014 Flight Tracks)

4.1.5 Alternative NW5: Immediate Turn Direct TWNSD Waypoint

Description:

- Immediate right turn from runway direct TWNSD WP on the LALUZ, YOTES, SNOBL, and MAYSA SIDs

Considerations:

- Increases efficiency and reduces controller task complexity
- Dispersal of flight tracks over residential areas

Decision:

This alternative would realize an increase in efficiency by reducing miles flown on the route by 1.40 NM. The reduction correlates to an annual miles flown savings of approximately 17,000 NM. It reduces annual fuel burn by approximately 42,500 gallons and reducing annual carbon emissions by 399 metric tons. This alternative maintains an equivalent level of safety.

However, this alternative would route flights away from the Grand Avenue industrial corridor and move flight paths to the east, closer to, or directly over sensitive residential areas. The expected noise impact does not align with the purpose and need of this project. (See Figure 4.1.5-1. Northwest SIDs with Immediate Turn Direct to TWSND waypoint)

Figure 4.1.5-1. Northwest SIDs with Immediate Turn Direct to TWSND Waypoint

4.1.6 Alternative NW6: Add RNAV Waypoint to Extend Upwind Leg

Description:

- Add RNAV WP 1.3 NM west of the current tracks on the LALUZ, YOTES, SNOBL, and MAYSA SIDs to relocate turn point to the west

Considerations:

- Aircraft would fly runway heading for 1.3 NM further than the current procedure, prior to starting northwest turn to TWSND WP, routing flights away from the industrial corridor and over residential areas
- KPHX SMEs relayed that elimination of course divergence creates loss of efficiency due to reduced departure throughput

Decision:

Reverting to the pre-September 18, 2014 flight tracks using PBN procedures would also reduce efficiency and safety and would not align with the purpose and need of the project. Approximately 0.66 nautical flying miles are added to each departure with this alternative. Approximately 70,400 additional gallons of fuel would be burned and an additional 660 metric tons of CO_2 would be introduced annually into the environment. This alternative would also route flights away from a designated industrial corridor.

This alternative also introduces the likely potential for reducing airport throughput and failing to maintain an equivalent level of safety. The extended initial departure tracks following the runway heading(s) create an undesirable and inefficient dependency between parallel runway departures. Simultaneous departures from the parallel runways would be adversely impacted as lateral separation would not be attained immediately after departure as is provided by the Workgroups recommended alternative. (See Figure 4.1.6-1. Northwest SIDs with Extended Upwind Leg)

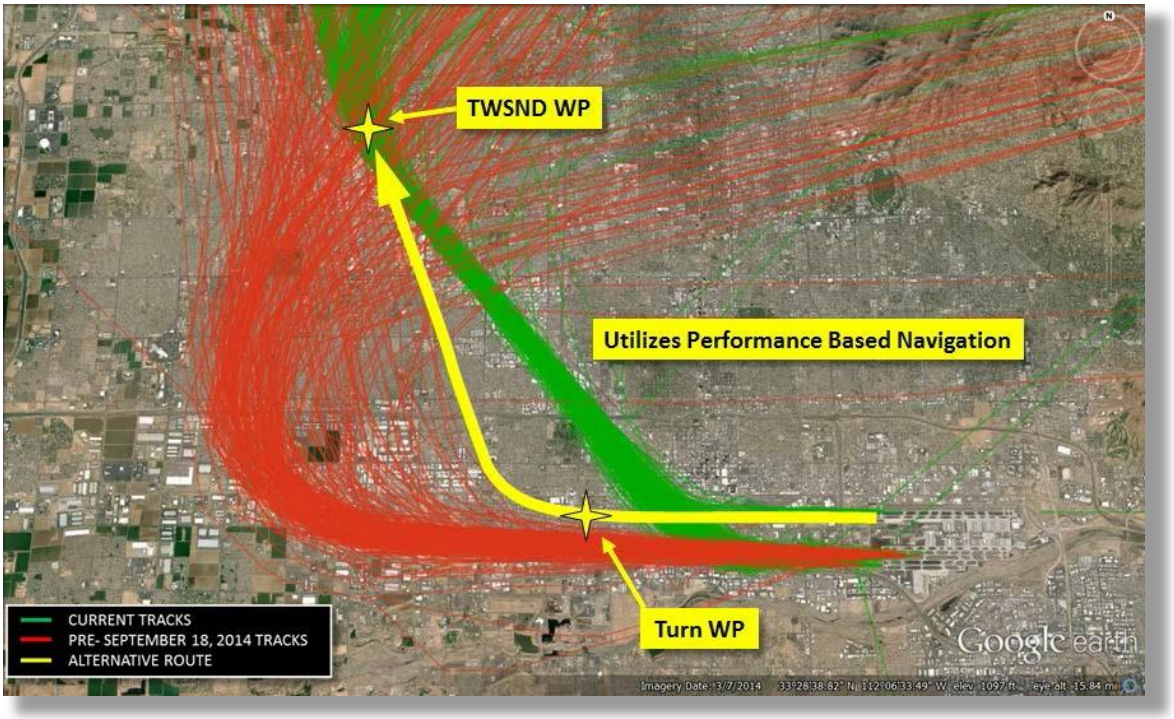


Figure 4.1.6-1. Northwest SIDs with Extended Upwind Leg

4.1.7 Alternative NW7: Add Radius to Fix (RF) Leg

Description:

- An RF leg departure procedure as proposed by Industry

Considerations:

- Increased flight path precision
- Fleet equipage limitations
- Criteria not supported for public procedures

Decision:

Although there are benefits to RF segments as they increase flight path repeatability and predictability, there is currently no criterion for their implementation in public instrument departure procedures. (See Figure 4.1.7-1. Northwest SIDs with RF Leg [RF Leg Would Tighten Turn Track Width]). Several aircraft types are unable to fly RF legs for departures; therefore aircraft would be on multiple SIDs and would increase ATC task complexity.

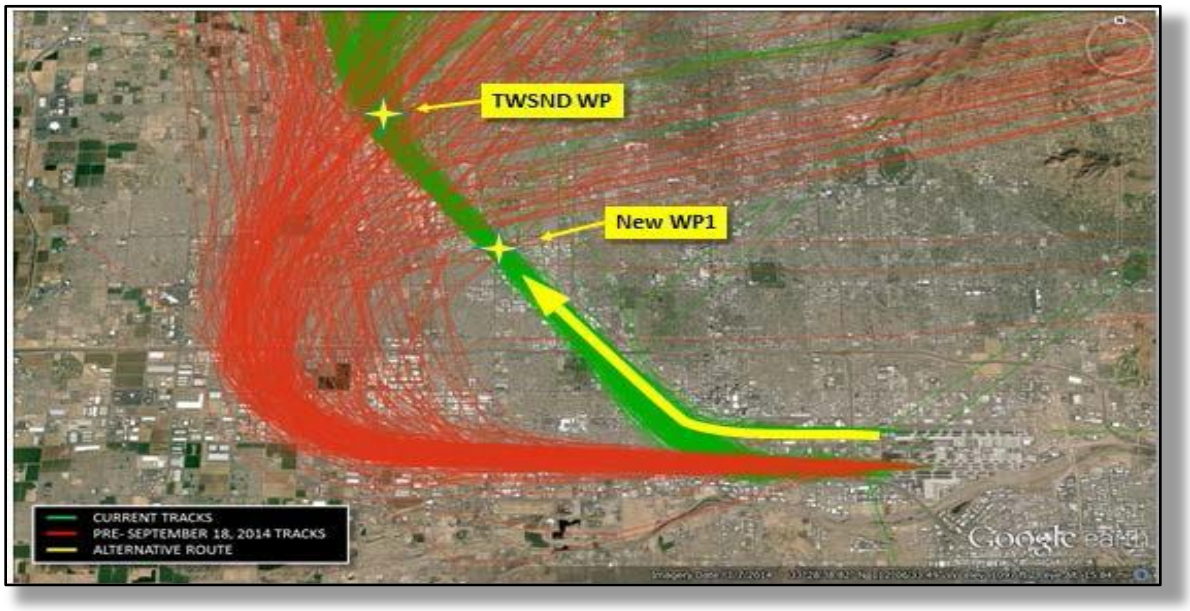


Figure 4.1.7-1. Northwest SIDs with RF Leg (RF Leg Would Tighten Turn Track Width)

4.2 Assessment of the West RNAV SID: IZZZO

As directed by the scoping document, the Workgroup assessed the IZZZO RNAV SID. The Workgroup's task was to create and assess potential adjustments which would maintain and/or enhance safety, improve operational efficiency, and ensure procedural conformance with the intended flight paths. Focusing on the SID when KPHX is departing in a west configuration, the following modifications were considered:

4.2.1 Alternative W1: No Action

Description:

- No change to September 18, 2014 west flow departure procedures

Considerations:

- No change to September 18, 2014 west flow departure procedures
- No Turboprop departures on this procedure
- Without turboprop traffic, turbojets would climb without restrictions

Decision:

The Workgroup decided to recommend this potential adjustment alternative for the west SID, subject to further review including environmental analysis.

There were no impacting issues requiring modifications identified on this route. This alternative does not increase miles flown as there is no change in the lateral path. Therefore, there is no loss of efficiency, no increase in fuel burn and no increase CO_2 emissions. Not modifying the lateral path of the procedures, the current level of safety is maintained.

4.2.2 Alternative W2: Add Speed and Altitude Restriction Waypoint

Description:

- Add speed and altitude restriction to IZZZO RNAV SID

Considerations:

- No benefits to safety or efficiency identified
- No Turboprop departures on this procedure
- Without turboprop traffic, turbojets climb unrestricted

Decision:

Without turboprop departures on the route, turbojet aircraft are able to climb unrestricted. This eliminates the need for a waypoint crossing restriction. There were no additional issues requiring design modification. Without a change to the lateral path there is no increase to miles flown. Therefore, there is no loss of efficiency, no increase in fuel burn and no increase CO_2 emissions. Not modifying the lateral path of the procedure, the current level of safety is maintained. This alternative did not increase current level of efficiency or safety. Figure 4.2.2-1 depicts the current west RNAV SID with a proposed altitude and speed restriction waypoint.

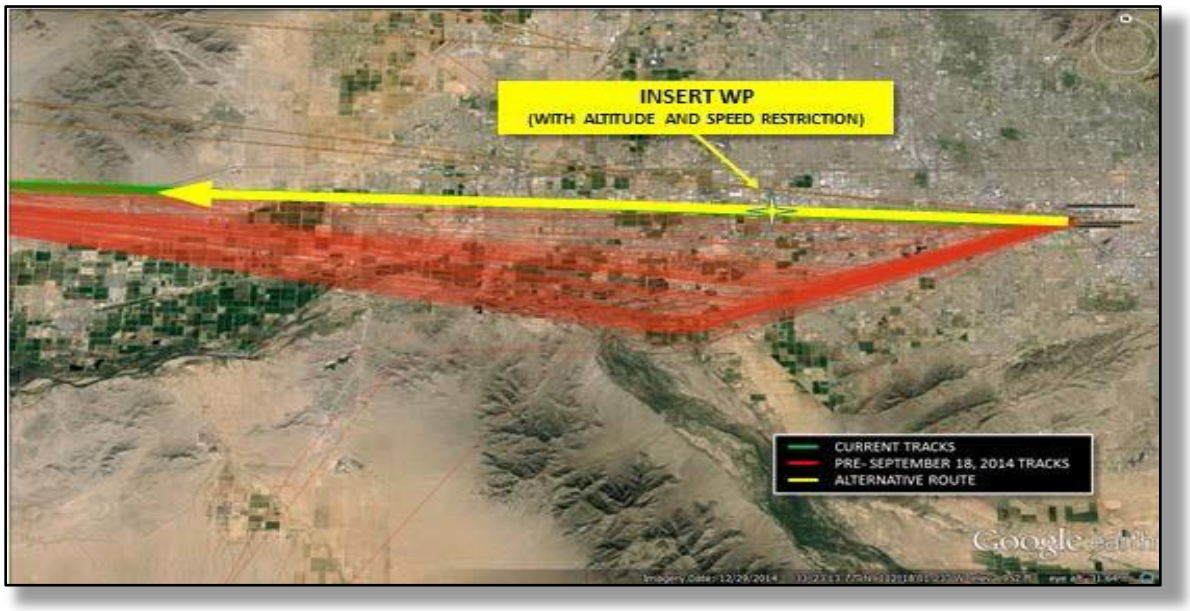


Figure 4.2.2-1. Current West RNAV SID with Proposed Altitude/Speed Restriction Waypoint

4.3 Assessment of Southwest RNAV SIDs: BNYRD, FTHLS, JUDTH, and KATMN

As directed by the scoping document, the Workgroup assessed the BNYRD, FTHLS, JUDTH, and KATMN RNAV SIDs. The Workgroup's task was to create and assess potential adjustments which would maintain and/or enhance safety, improve operational efficiency, and ensure procedural conformance with the intended flight paths. Focusing on the initial segments to the DAVZZ waypoint on the SIDs when KPHX is departing in a west configuration, the following modifications were considered:

4.3.1 Alternative SW1: No Action

Description

- No change to September 18, 2014 west flow departure procedures

Considerations:

- Other alternatives identified by the Workgroup enhanced safety and efficiency, which met the goals of the original project

Decision:

The Workgroup identified other alternatives which were aligned with the purpose and need of the project and were able to produce gains in efficiency and safety.

4.3.2 Alternative SW2: Add Speed and Altitude Restriction to Southwest SIDs: BNYRD, FTHLS, JUDTH, and KATMN

Description:

- Add altitude restriction (at-or-above 4,000 feet MSL) at DAVZZ WP
- Add speed restriction (at-or-below 230 knots) at DAVZZ WP
- No change in the lateral path to ensure alignment with the purpose and need of the project

Considerations:

- Speed and altitude restrictions at DAVZZ WP would increase aircraft rates of climb resulting in aircraft being higher at any given point along the procedure than experienced today. Consistent departure speed assignments would ensure predictable and repeatable flight paths eliminating over takes and conflictions.
- Speed and altitude restrictions also de-conflict KPHX departures from KPHX southwest arrivals. Airspace constraints and mountainous terrain limit the TRACON's ability to utilize lateral separation making vertical separation essential.
- With a steeper climb profile, safety is enhanced due to the expeditious application of vertical separation between Phoenix turbojet departures initially assigned 8,000 feet MSL and turboprop departures initially assigned 5,000 feet MSL.

- The speed and altitude restrictions in this alternative help eliminate interactions between KPHX turboprop departures and low attitude satellite and military operations. Satellite and military operations are conducted outside Class B airspace and concentrated at-or- below 6,000 feet MSL. The higher altitude for KPHX turboprop departures would retain them within Class B airspace providing an enhanced level of safety.
- During the two week traffic sampling (September 19, 2014 to October 3, 2014) approximately 15 percent[3] of southwest departures were below the proposed 4,000 foot MSL altitude restriction placed at DAVZZ. The Phoenix Subject Matter Experts (SME) noted the percentage increases dramatically during hot summer months. The climb restrictions would eliminate this summer month increase and increase aircraft conformance.

Decision:

The Workgroup decided to recommend this potential adjustment as the preferred alternative for the southwest SIDs, subject to further review including environmental analysis.

This alternative does not increase miles flown as there is no change in the lateral path. Therefore, there is no loss of efficiency, no increase in fuel burn and no increase in CO_2 emissions. By not modifying the lateral path of the procedures, the current level of safety is maintained.

Speed and altitude restrictions also de-conflict KPHX departures from KPHX southwest arrivals on the HYDRR RNAV STAR. By reducing the length of departure level offs and the vertical interactions with the HYDRR RNAV STAR, the Phoenix SMEs noted that the current procedures has reduced annual Traffic Collision Avoidance System (TCAS) events. Reverting to the Pre-September 2014 procedures with extended track mile interaction between arrival and departure routes could increase TCAS events.

Crossing altitude and speed restriction at DAVZZ WP would increase departure rates of climb, resulting in steeper climb profiles. Today, without restrictions approximately 15 percent of departures operate at shallow climb rates as illustrated by the red tracks in Figure 4.3.2-1. The Phoenix SMEs noted the percentage increases dramatically during hot summer months. The steeper profiles created by the proposed restrictions would eliminate aircraft flight paths below 4,000 feet MSL in the vicinity of DAVZZ WP as illustrated in Figure 4.3.2-2. Additional benefits would be realized in that all departures would be at higher altitudes at any given point on the procedure and interaction with increased Minimum Vectoring Altitudes (MVA) would be reduced. Figure 4.3.2-3 illustrates an overhead view of the restrictions associated with DAVZZ WP.

Turboprop departures are typically assigned 5,000 feet MSL with turbojet aircraft assigned 8,000 feet MSL with additional miles in trail. Vertical separation between turbojet and turboprop departures must be attained prior to merging them onto a common departure routes. The differing performance characteristics of these aircraft increases controller task complexity. Higher climb rates achieved by adding altitude and speed restrictions at DAVZZ WP would

[3] Percentage from a PDARS sampling of departure track data from 09/19/2014 through 10/03/2014

provide vertical separation sooner. This would allow departures to be turned on course sooner than is experienced today. This would reduce controller task complexity, reduce miles flown and related fuel burn and CO_2 emissions, and increase the level of safety.

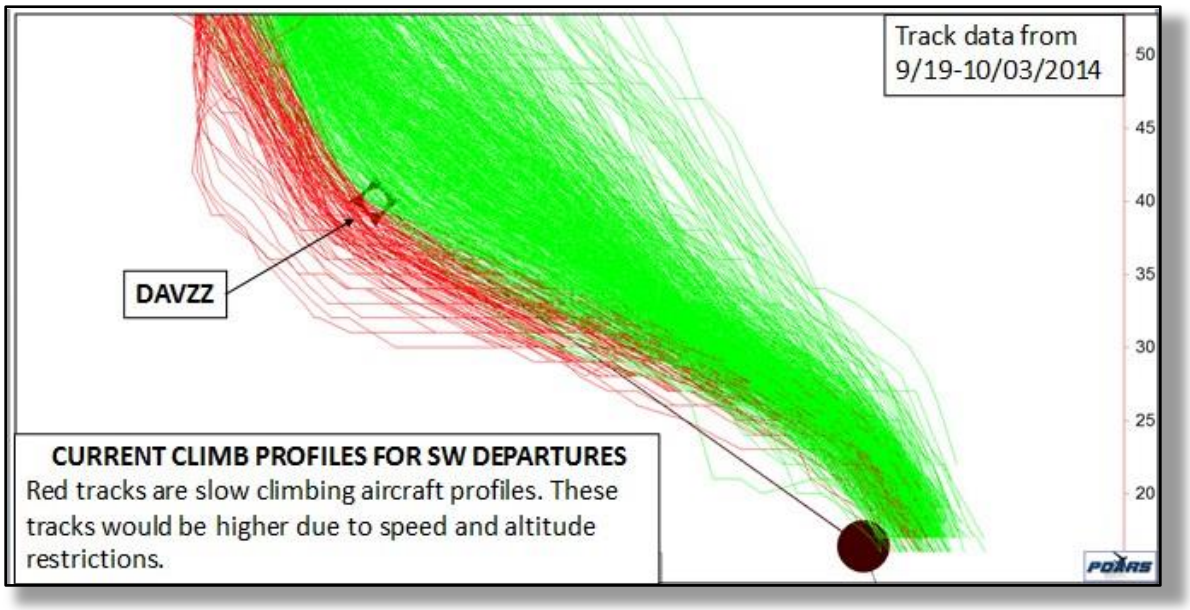


Figure 4.3.2-1. Historical Climb Profiles of PHX Southwest SIDs

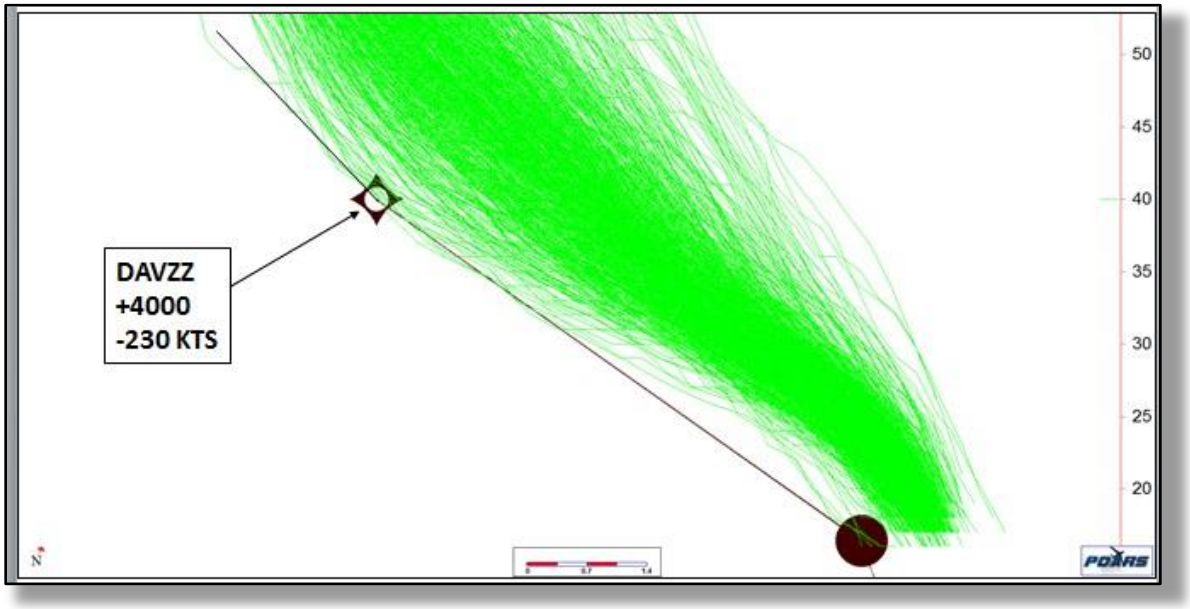


Figure 4.3.2-2. Southwest SIDs Amended Flight Tracks with Altitude Restrictions (Elevation View)

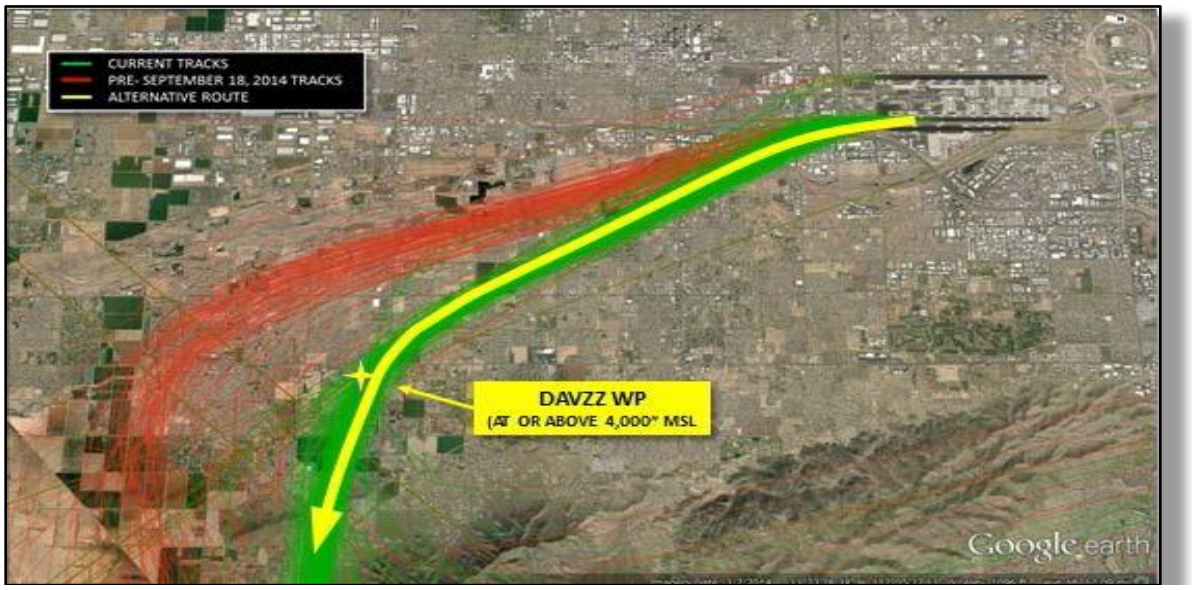


Figure 4.3.2-3. Southwest SIDs Proposed Amended Procedure(s)

4.3.3 Alternative SW3: Revert to Pre-September 18, 2014 Non-RNAV Routings

Description

- Revert to Pre-September 18, 2014 published non-RNAV departure procedures

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures

Decision:

Reverting to the pre-September 18, 2014 flight tracks would reduce efficiency, safety and not align with the purpose and need of the project. An average of 2.2 NM is added to each departure's route by this alternative. Approximately 132,000 additional gallons of fuel would be burned annually. This would also result in an additional 1,200 metric tons of CO_2 introduced annually into the environment.

The lack of PBN procedures and reverting to radar vectoring would increase controller task complexity, and create the potential for reducing airport throughput and failing to maintain an equivalent level of safety. Figure 4.3.3-1 depicts Pre-September 2014 traffic in red.

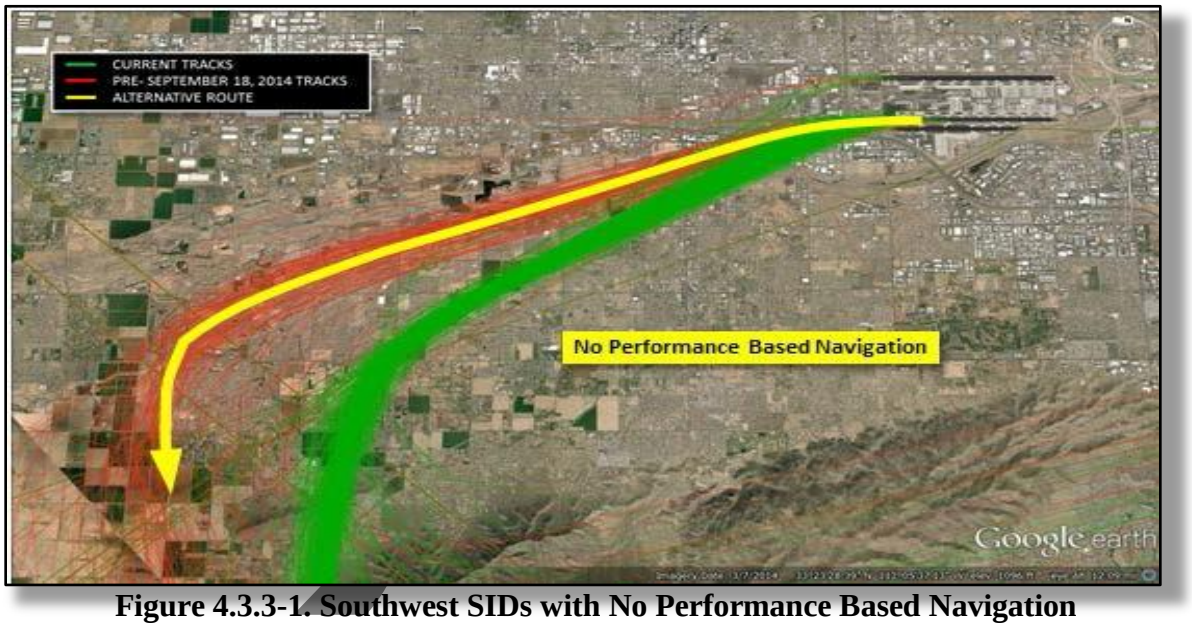


Figure 4.3.3-1. Southwest SIDs with No Performance Based Navigation (Radar Vectoring)

4.3.4 Alternative SW4: Relocate DAVZZ Waypoint

Description

- Explore lateral adjustments to DAVZZ WP to enhance the safety and efficiency of the procedures

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures

Decision:

Moving DAVZZ WP to the west, as depicted in Figure 4.3.4-1, extends the point at which departures continue their turns to the south and east and would reduce efficiency and safety and would not align with the purpose and need of the project. The efficiency reduction is due to the addition of 0.36 nautical flying miles to each departure's route. Approximately 8,650 miles would be added to annual departure flights, resulting in approximately 21,600 additional gallons of fuel to be burned and an additional 203 metric tons of CO_2 to be introduced annually into the environment. This alternative would also route flights away from a designated industrial corridor.

This alternative also introduces the likely potential for reducing airport throughput and failing to maintain an equivalent level of safety. The extended initial departure track caused by the western relocation of DAVZZ may eliminate lateral separation needed to simultaneously depart southwest and west departure SID flights.

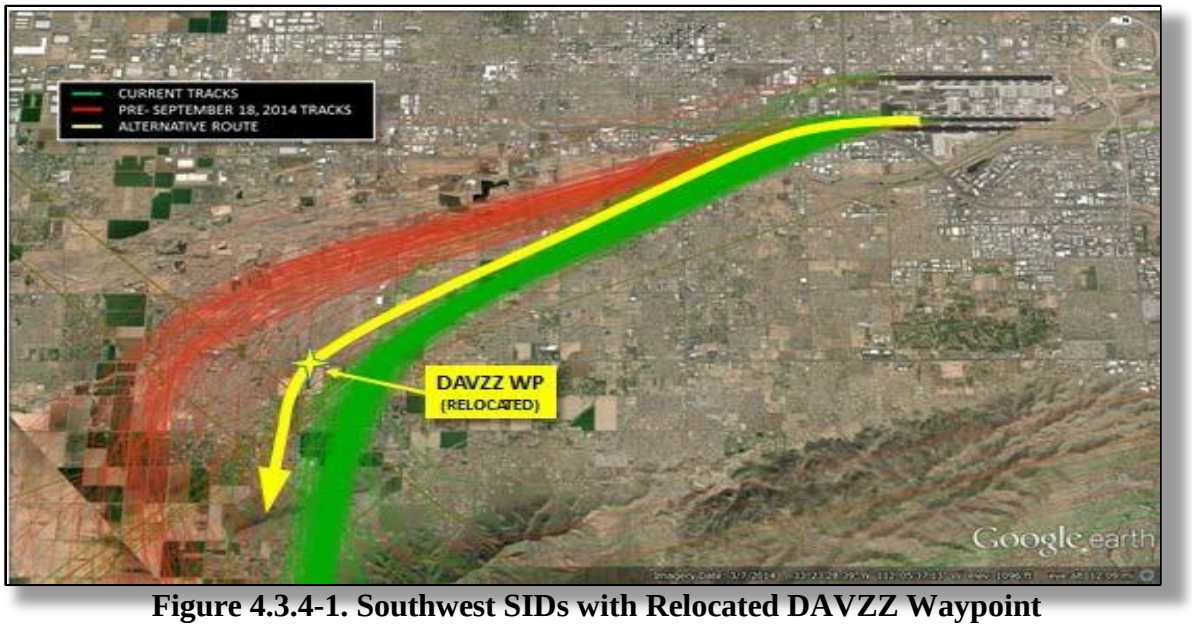


Figure 4.3.4-1. Southwest SIDs with Relocated DAVZZ Waypoint

4.3.5 Alternative SW5: Runway Heading to Intercept Course to DAVZZ Waypoint

Description

- Explore alternate RNAV criteria for heading to intercept course to DAVZZ WP

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015
- Elimination of immediate course divergence creates loss of efficiency due to reduced departure throughput
- Higher altitude potentially decreases noise levels

Decision:

Requiring departures to extend their initial segment on runway heading to join an RNAV course to DAVZZ WP would create a dependency with departures utilizing the IZZZO SID. A loss of efficiency would also be realized, as 0.20 nautical flying miles are added to each departure's route. Approximately 4,800 miles would be added to annual departure flights. Due to the additional miles flown, approximately 12,000 additional gallons of fuel would be burned and an additional 112 metric tons of CO_2 would be introduced annually into the environment.

This alternative also introduces the likely potential for reducing airport throughput and failing to maintain an equivalent level of safety. The extended runway heading departure track, required by design criteria to intercept and fly a course to DAVZZ WP, would eliminate the immediate lateral separation between departures from parallel runways needed to simultaneously depart Runways 26, 25R and 25L. Figure 4.3.5-1 depicts the "Course-To-Fix" routing in yellow.

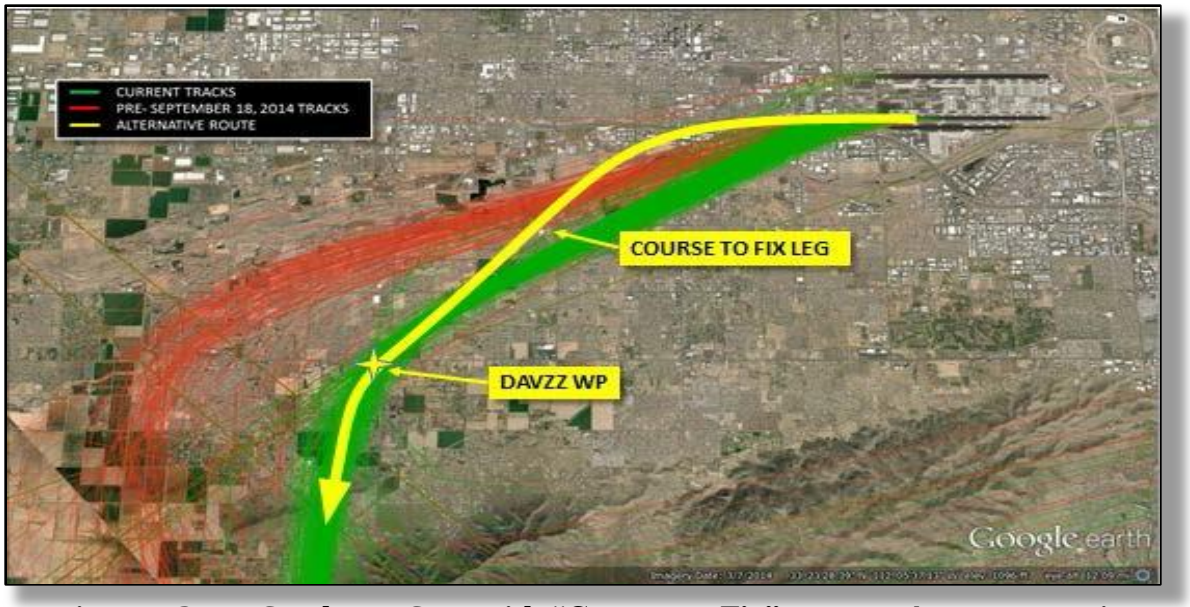


Figure 4.3.5-1. Southwest SIDs with "Course-To-Fix" Leg to DAVZZ Waypoint

5 Post-Implementation Workgroup Recommendations

The Workgroup created and evaluated multiple potential adjustment alternatives for possible procedure amendments, subject to additional environmental review, that aligned with the purpose and need of the post September 18, 2014 project. Subsections 5.1 and 5.3 delineates the selection methodology for the Northwest and Southwest SIDs procedure amendments.

The No Action alternative was selected for the West SID. Subsection 5.2 delineates the selection methodology for the West SID.

5.1 Northwest RNAV SIDs Procedure Amendments

The Workgroup created and evaluated seven alternative procedure amendments to the current KPHX northwest SIDs. After examining all potential adjustment alternatives, the Workgroup selected Alternative NW2 as the preferred procedure amendment, subject to further review including environmental analysis. Alternative NW2 adds an RNAV waypoint (New WP1) to the LALUZ, YOTES, SNOBL, and MAYSA SIDs in the vicinity of the intersection of Grand Avenue and Indian School Road, with altitude and speed restrictions. New WP1 would be restricted at-or-above 4,000 feet MSL and TWNSD WP would be restricted at-or-above 5,000 feet MSL and 230 knots. Using these restrictions, aircraft rates of climb would increase and aircraft altitudes would generally be higher than current procedures. The higher altitudes potentially decrease noise levels. Alternative NW2 also enhances the level of safety by increasing vertical separation between Phoenix turbojet and turboprop departures, as well as satellite airport operations, while maintaining an equivalent level of efficiency. Additionally Industry partners simulated the procedures and identified the best climb rates for all aircraft. The lateral path of Alternative NW2 remains unchanged.

5.2 West RNAV SID Proposed Procedure Amendments

The Workgroup considered two alternative procedure amendments for the West RNAV SID. After examining all alternatives, the Workgroup selected Alternative W1 (No Action) as the preferred solution. This No Action alternative does not increase miles flown as there is no change in the lateral path. Therefore, there is no loss of efficiency, no increase in fuel burn and no increase CO_2 emissions. Not modifying the lateral path of the procedures, the current level of safety is maintained.

5.3 Southwest RNAV SIDs Proposed Procedure Amendment

The Workgroup created and evaluated five alternative procedure amendments to the current KPHX southwest SIDs. After examining the alternatives the Workgroup selected Alternative SW2 as the proposed procedure amendment, subject to further review including environmental analysis. Alternative SW2 incorporates an altitude restriction, at-or-above 4,000 feet MSL and speed restriction, 230 knots at DAVZZ WP. Using these restrictions, aircraft rates of climb would increase and aircraft altitudes would be higher than current procedures. The higher altitude potentially decreases noise levels. Alternative SW2 also enhances the level of safety by increasing vertical separation between Phoenix turbojet and turboprop departures, as well as satellite airport operations, while maintaining an equivalent level of efficiency. Additionally,

Industry partners simulated the procedures and identified the best climb rates for all aircraft. The lateral path of Alternative SW2 remains unchanged.

6 Environmental Overview

6.1 Background

As documented in the Categorical Exclusion (CATEX) Declaration dated September 12, 2013, the FAA determined that the nine RNAV SID procedures, and the five RNAV STARS for KPHX were categorically excluded from further environmental review as per the FAA Order 1050.1E, *Environmental Impacts: Policies and Procedure*, the FAA Modernization and Reform Act of 2012, Section 213 (c)(l) and Memo FAA Order 1050.1E, Change 1, Guidance Memo #5 dated December 6, 2012, *Guidance for Implementation of the Categorical Exclusion in Section 213(c)(l) of the FAA Modernization and Reform Act of 2012*.

Subsequent to implementation of the procedures, the FAA was made aware that communities around the airport had concerns about the noise generated by some of the new procedures. The FAA committed to exploring potential adjustments to the September 18, 2014, procedures to help manage noise issues associated with the new procedures.

The departure procedures being assessed are:

- Northwest SIDs (LALUZ, YOTES, SNOBL, MAYSA)
- West SID (IZZZO)
- Southwest SIDs (FTHLS, BNYRD, JUDTH, KATMN)

The assessment process includes analyzing post implementation data and identifying possible procedure adjustments to ensure that aircraft are flying newly published procedures as intended. Adjustments would be subject to environmental review.

6.2 Investigation

The post implementation assessment identified alternatives for amendments to the west flow RNAV departure procedures. The proposed procedural amendments take into account the following operational assumptions:

- No change in the number of operations utilizing the west flow SIDs
- No change in fleet mix
- No change in runway use
- No change to night time operations

This post-implementation assessment is intended to make modifications and adjustments that align with the purpose and need of the original project.

FAA also conducted an initial environmental screening of the potential adjustment alternatives. The alternatives were evaluated by analyzing and comparing the results from the original environmental analysis to the potential environmental effects for each of the proposed procedural amendments. The comparison analysis indicated there were likely no extraordinary circumstances for two of the proposed procedural amendments, and that these

alternatives would likely not result in a significant environmental effect in accordance with FAA Order 1050.1E. Additionally, the comparison analysis was completed for the resource impact categories as defined in FAA Order 1050.1E. However, implementation of any proposed adjustment alternatives would require further review, including the appropriate environmental review under NEPA.

The proposed alternatives that align with the purpose and need of the original project are identified as:

- Alternative NW2: An addition of an RNAV waypoint and speed and altitude restrictions on the northwest SIDs (LALUZ, YOTES, SNOBL, MAYSA)
- Alternative SW2: An addition of a speed and altitude restriction on the southwest SIDs (FTHLS, BNYRD, JUDTH, KATMN)

In order to determine the extent of the potential noise impact, the *Guidance for Screening Air Traffic Actions* (Screening Guidance) was applied to help determine the need for a detailed noise analysis of the proposed procedural amendments. The Screening Guidance provides a solid and repeatable approach to noise screening within the regulatory framework of FAA Order 1050.1E.

6.3 Alternative NW2 Environmental Review

Alternative NW2 is an addition of an RNAV waypoint on the northwest departure SIDs with an altitude and speed restriction (LALUZ, YOTES, SNOBL, MAYSA). Changes in the location of a fix could potentially result in a change in noise impacts.

The Screening Guidance Lateral Movement Test was used to determine the potential for noise impacts related to the proposed procedural amendment. The Lateral Movement Test is applied to determine if the lateral movement of a route resulting from adding, removing, or changing the location of a fix is enough to cause a change in Day/Night Average Sound Level (DNL) exceeding the noise screening thresholds. The test can be used for both jet and/or propeller traffic, and also in cases where the location change is accompanied by an increase in altitude or a decrease in the number of operations.

The following data for the existing and proposed procedural amendments were evaluated for application of the Lateral Movement Test:

- Geographic coordinates of the fixes that define the route or procedure. This information is used to determine the greatest lateral displacement of the proposed route from the existing route in thousands of feet MSL.
- Lowest altitude specified in Above Ground Level (AGL) flown along the changed portion of the route or procedure
- Presence of noise sensitive receptors near the changed portion of the route

The Lateral Movement Test noise screening results indicated that the proposed amendments would not change the noise impact determination associated with the current published northwest RNAV departure procedures. However, implementation of the proposed amendments would require further review, including the appropriate environmental review under NEPA.

6.4 Alternative SW2 Environmental Review

Alternative SW2 is the addition of a speed and altitude restriction to southwest SIDs (FTHLS, BNYRD, JUDTH, KATMN).

The Screening Guidance Altitude/Operations Test was used to determine the potential for noise impacts related to the proposed procedural amendment. The Altitude/ Operations Test is used to screen for potential noise impacts resulting from a single change in altitude on a route or procedure, or simultaneous change in number of operations and altitude. This test applies to both jet and/or propeller traffic. The Altitude/Operations Test was applied to determine if changes in the number of operations or altitudes or both are enough to cause a change in DNL exceeding the noise screening thresholds. There is no expected change in the number of operations for Alternative SW2. Therefore, only the change in altitude was evaluated as per the Screening Guidance.

The following data for the existing and proposed altitude change were evaluated for application of the Altitude/Operations Test:

- Lowest existing altitude specified in AGL typically flown at the location of the largest altitude decrease
- Lowest proposed altitude in AGL expected to be flown along the route or procedure
- Presence of noise sensitive receptors near the changed portion of the route

The Altitude/Operations Test noise screening results indicated that the proposed amendments would not change the noise impact determination associated with the current published southwest RNAV departure procedures. However, implementation of the proposed amendments would require further review, including the appropriate environmental review under NEPA.

6.5 Findings

The noise screening results indicated that the proposed amendments would not change the noise impact determination associated with the current published northwest and southwest RNAV departure procedures. The noise screening results indicate a potential for decreasing noise due to higher altitudes associated with the proposed amendments. Additionally, there is no change to the impact determination for any of the other resource impact categories per FAA Order 1050.1E as analyzed in the CATEX determination dated September 12, 2013. However, implementation of the proposed amendments would require further review, including the appropriate environmental review under NEPA.

7 Summary

The Workgroup was tasked to perform a post-implementation assessment of procedures published September 18, 2014. The Workgroup created and evaluated 14 potential adjustment alternative designs and developed procedural amendments for the northwest and southwest KPHX SIDs. These amendments meet the purpose and need of the original project by enhancing safety and efficiency. The Workgroup performed a noise screening evaluation which indicated a potential for decreasing noise and did not identify additional environmental impacts. The Workgroup recommends FAA initiate activities to implement these procedural amendments subject to the appropriate environmental review of the final procedure design.

Attachment A: Huerta Letter to Phoenix City Manager Ed Zuercher

U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

January 22, 2015

Mr. Ed Zuercher
City Manager, City of Phoenix
200 West Washington Street
Phoenix, AZ 85003

Dear Mr. Zuercher:

Thank you for your December 23, 2014, letter about the new air traffic procedures that the Federal Aviation Administration (FAA) implemented for Phoenix Sky Harbor International Airport last September.

We are working with airports, airlines, and communities all over the country to modernize the National Airspace System by taking full advantage of emerging technologies and aircraft navigation capabilities to improve safety and efficiency. The recently implemented Performance Based Navigation (PBN) procedures in Phoenix make a safe system even safer by automatically keeping arrival routes and departure routes separated from one another. Airlines program the procedures into their flight computers, and planes fly the routes automatically. This decreases communications between controllers and pilots, which reduces the chances for miscommunications. It also creates more predictable flight paths and provides more direct routings. An ancillary benefit is a reduction in fuel burned and associated CO_2 emissions.

We recognize communities around the airport have concerns about the noise generated by some of the new procedures. After becoming aware of this issue, the FAA quickly took steps to ensure aircraft remained for a greater distance on the charted departure routes, which are designed to fly over an industrial area instead of residential communities to the east. We're continuing to work with aircraft operators to ensure the procedures are being flown as intended. FAA representatives also attended two public meetings to receive input from residents and elected officials.

We are committed to partnering with the airport and airlines to explore other potential adjustments to the procedures to better manage noise issues. We will reconvene our Performance Based Navigation Working Group in February. As I told Mayor Stanton and Congressman Gallego when I met with them on Wednesday, January 21, the City of Phoenix is an important player in this process and we want city representatives to be part of this process.

Although we are committed to exploring possible adjustments to the new procedures, we cannot revert to the procedures that were in use before September 18, 2014. Making changes is not as

simple as turning one procedure off and turning another one on, and designing and developing possible adjustments will not be a simple or quick process.

The new arrival procedures are interdependent with the new departure procedures. Making changes to one would have a domino effect, requiring changes to others. Adjustments to the new procedures must be designed, subjected to a rigorous safety analysis, flight-checked, and charted. Air traffic control and aircraft automation systems must be updated, and air traffic control personnel must be retrained on any changes. We also must conduct the environmental reviews that further changes may require.

As we pursue improvements in safety and efficiency of the National Airspace System for the flying public, we remain committed to working with communities to manage noise issues associated with these changes. We will work closely with the Phoenix Department of Aviation and airlines to explore potential adjustments to the new procedures, and we will keep the community and Congress informed about our efforts.

If we can be of further assistance, please contact me or Molly Harris, Acting Assistant Administrator for Government and Industry Affairs.

Sincerely,

Michael P. Huerta
Administrator

Attachment B: Scoping Document

Scoping Document
for
Post-Implementation Assessment

PURPOSE: Post-implementation analysis is a standard part of Performance Based Navigation (PBN) implementation activities, and includes a review of post-implementation data and any necessary design adjustments to ensure that aircraft are flying newly published procedures as intended.

PROCESS: The Parties recognize that having a consistent and collaborative approach to information sharing, consensus building, and formulation of agreements will allow the overall process to move forward more effectively and efficiently while addressing the interests of all concerned.

1. The Parties agree to form a Workgroup comprising of:

   1 NATCA Co-Lead, identified by NATCA National Airspace Representative
   1 Management Co-Lead, identified by Director for Airspace Services
   2 NATCA POCs (1 each from P50 and PHX)
   2 Management POCs (1 each from P50 and PHX)
   2 WSC PBN Co-Leads (1 each from Management and NATCA)
   1 AJV-3 Representative
   1 FAA Environmental Specialist
   1 Lead Operator (designated by A4A)

   The following subject matter experts will support the team as requested by the Co-Leads:

   1 MITRE analyst
   1 ATAC analyst
   1 CSSI documentation specialist

2. The Workgroup may establish sub-groups to address specific issues as identified by the Workgroup. If a sub-group(s) is unable to reach an agreement by consensus on any portion of the project, that matter will be elevated to the Workgroup for resolution by consensus.

3. The Workgroup and any established sub-groups shall make every effort to reach an agreement through consensus. For the purpose of this document, consensus is defined as the voluntary agreement of all representatives of the Workgroup. If the Workgroup members are unable to reach an agreement on any portion of the project, that matter will be elevated to the Workgroup Co-Leads. Should the Co-Leads fail to reach agreement, the matter will be elevated to the signatories of this document for a collaborative resolution. If the signatories are unable to reach agreement, either Party may pursue whatever course of action is available to them under the CBA, Federal Service Labor/Management Relations Statute and all applicable laws, rules, and regulations.

4. NATCA representatives on the Workgroup and sub-groups shall be in a duty status for all Workgroup and sub-group activities. Additionally, they shall be afforded a reasonable amount of duty time in order to travel for Workgroup-related duties and to communicate with NATCA regarding the status of any Workgroup initiatives.

Scoping Document
for
Post-Implementation Assessment

5. NATCA designated Workgroup and sub-group members will be provided access to the same information as any other Workgroup member.
6. All agreements reached by the Workgroup shall be reduced to writing.

SCOPE: The Workgroup shall:

1. Assess and examine the Phoenix PBN Standard Instrument Departures (SID) with initial turns to the northwest, specifically the LALUZ, MAYSA, SNOBL, and YOTES RNAV SIDs, focusing on the initial segments to the TWSND waypoint, when Phoenix is departing in a west configuration.
2. Assess and examine the Phoenix PBN SIDs with initial turns to the southwest, specifically the BNYRD, FTHLS, JUDTH and KATMN RNAV SIDs, focusing on the initial segments to the DAVSS waypoint, when Phoenix is departing in a west configuration.
3. Assess and examine the Phoenix PBN SID with an initial runway heading, specifically the IZZZO RNAV SID, focusing on the initial segments to the KEENS waypoint, when Phoenix is departing in a west configuration.
4. Analyze feedback from the City of Phoenix Aviation Department, the Phoenix Mayor's Office, and the Phoenix City Council.
5. Propose modifications that will maintain and/or enhance safety, improve operational efficiency, and ensure procedural conformance with the intended flight paths.
6. Produce and deliver the following to Jim Davis and Elizabeth Ray:
   a. Within two weeks of execution of this Scoping Document, a summary of meeting minutes reflecting initial findings.
   b. Within three weeks of execution of this Scoping Document, a summary of meeting minutes reflecting the work completed during Week 2.
   c. Within four weeks of execution of this Scoping Document, a summary of meeting minutes reflecting the work completed during Week 3 and a final design package, if applicable.
7. The Workgroup shall conclude its work no later than March 11, 2015.

Date: 2/9/2015

James D. Davis
Jim Davis
NATCA National Airspace Representative

Edie Parish
Edie Parish
Director, Mission Support Services, AJV-1

Attachment C: Cost/Benefit Calculations

Procedure	Workgroup Alternative Identifier	Departure Runway	Mileage to TWSND WP	Delta from Workgroup Recommended Proposal	Annual Cost/(Benefit)	
					Gallons	Metric Tons (CO_2)
LALUZ, YOTES, SNOBL, MAYSA (117 Flights per Day)	NW1	26	9.6	0.0	0	0
		25R	10.0	0.0	0	0
		25L	10.1	0.0	0	0
	NW2 (Recommended)	26	9.6	0.0	0.0	0
		25R	10.0	0.0	0.0	0
		25L	10.1	0.0	0.0	0
	NW3	26	12.9	3.2	341,640	3,263
		25R	13.6	3.3	351,249	3,354
		25L	13.7	3.3	352,316	3,365
	NW4	26	12.9	1.8	194,308	1,856
		25R	13.6	1.9	197,511	1,886
		25L	13.7	1.9	198,578	1,896
	NW5	26	9.2	(0.4)	(40,570)	(387)
		25R	9.7	(0.4)	(42,705)	(408)
		25L	9.8	(0.4)	(43,773)	(418)
	NW6	26	10.2	0.7	69,396	663
		25R	10.6	0.7	70,463	673
		25L	10.7	0.7	71,531	683
	NW7	26	9.6	N/A	N/A	N/A
		25R	10.0	N/A	N/A	N/A
		25L	10.1	N/A	N/A	N/A

Procedure	Workgroup Alternative Identifier	Departure Runway	Mileage to KEENS WP	Delta from Workgroup Recommended Proposal	Annual Cost/(Benefit)	
					Gallons	Metric Tons (CO_2)
IZZZO (54 Flights per Day)	W1 (Recommended)	26	28.7	0.0	0	0
		25R	28.8	0.0	0	0
		25L	28.8	0.0	0	0
	W2	26	28.7	0.0	0	0
		25R	28.8	0.0	0	0
		25L	28.8	0.0	0	0

Procedure	Workgroup Alternative Identifier	Departure Runway	Mileage to VANZZ WP	Delta from Workgroup Recommended Proposal	Annual Cost/(Benefit)	
					Gallons	Metric Tons (CO_2)
BNYRD, FTHLS, JUDTH, KATMN (66 Flights per Day)	SW1	26	10.1	0.0	0	0
		25R	9.8	0.0	0	0
		25L	10.0	0.0	0	0
	SW2 (Recommended)	26	10.1	0.0	0	0
		25R	9.8	0.0	0	0
		25L	10.0	0.0	0	0
	SW3	26	11.6	2.2	134,904	1,288
		25R	11.4	2.2	132,495	1,265
		25L	11.6	2.2	131,291	1,254
	SW4	26	10.4	0.4	22,283	213
		25R	10.1	0.4	21,681	207
		25L	10.3	0.4	21,079	201
	SW5	26	10.2	0.2	12,647	121
		25R	10.2	0.2	12,045	115
		25L	10.4	0.2	11,443	109

All figures are approximate

= Indicates Workgroup Recommended Alternative (Baseline for Comparisons)

Appendix A: Data, Tools and Guidance

The following tools were employed by the Phoenix RNAV SID Post-Implementation Workgroup in the process of studying the Phoenix Procedures:

- Performance Data Analysis and Reporting System (PDARS)
    - Historical traffic flow analysis using merged datasets to analyze multi-facility operations
    - Customized reports to measure performance and air traffic operations (i.e., fix loading, hourly breakdowns, origin-destination counts, etc.)
    - Graphical replays to understand and visualize air traffic operations
- Terminal Area Route Generation Evaluation and Traffic Simulation (TARGETS)
    - Comparison of pre and post track data of actual flown routes to proposed routes
    - Procedure design work
- Air Traffic Airspace Lab (ATALAB) National Offload Program (NOP) data queries
    - Quantification of traffic demand over time for specific segments of airspace
- Guidance for Screening Air Traffic Actions (December 2012)

Appendix B: Post Analysis Environmental Review Details

4.1.1 Alternative NW1: No Action

Description:

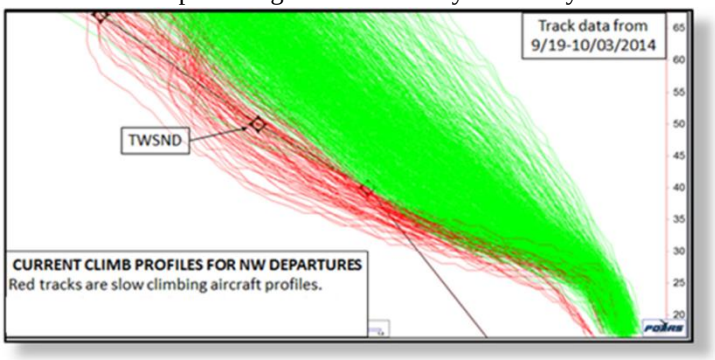
- No change to September 18, 2014 west flow departure procedures.

Considerations:

- Other alternatives identified enhanced safety and efficiency, which align with the goals of the original project.

Decision:

- The Workgroup identified other alternatives which were aligned with the purpose and need of the original project and were able to produce gains in efficiency and safety.



4.1.1 Environmental Review

Noise Analysis:

- No change in noise exposure.

4.1.2 Alternative NW2: Add Waypoint and Speed and Altitude Restrictions to Northwest SIDs: LALUZ, YOTES, SNOBL, and MAYSA

Description:

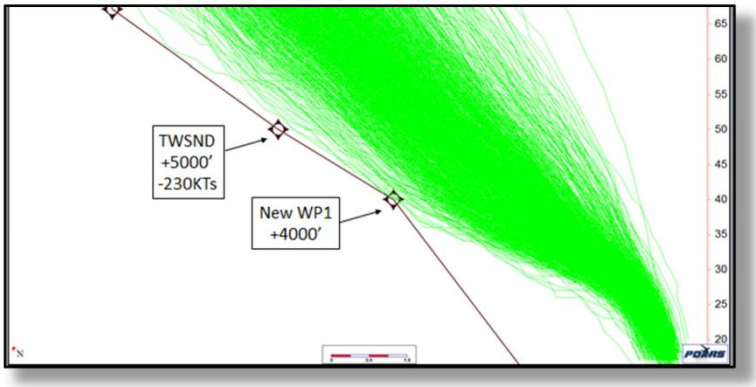
- Add RNAV waypoint on the LALUZ, YOTES, SNOBL, and MAYSA SIDs in the vicinity of Grand Avenue and Indian School Road, as well as altitude and speed restrictions. No change in the lateral path.

Considerations:

- Using this restriction, aircraft rates of climb will increase
- Aircraft will be higher than current procedure.
- Proposed waypoint (New WP1) assigns an at or above 4,000 feet MSL altitude restriction.
- Add similar speed and altitude restrictions at TWNSD waypoint (230 knot speed restriction and at or above 5,000 feet MSL altitude restriction).
- Potential decrease noise levels due to higher altitude.

Decision:

- Workgroup selected this alternative for the northwest SIDs.



4.1.2 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Above 3,000 feet AGL" was applied to evaluate the proposed New WP1 location and altitude, as well as the altitude restriction for the existing TWNSD waypoint location.
- The LAT noise screening tool data indicated that the proposed altitude for NEW WP1 would support up to a 3,000 feet lateral displacement from the existing route at the proposed geographical location for New WP1.
- Evaluation of land use within a radius of 3,000 feet from the geographic location of New WP1 indicated the presence of noise sensitive receptors to the northeast.
- The Workgroup determined that a lateral displacement of 3,000 feet on either side of the existing route would not substantially improve efficiency and/or safety of the existing procedure.

Findings:

- The LAT noise screening tool data indicated that Alternative NW2 would not likely cause a change in the Day Night Average Sound Level (DNL) exceeding the noise screening thresholds.
- Given that the route is not expected to be laterally displaced, the LAT noise screening data indicated that the proposed 4,000 feet AGL altitude for New WP1 would not result in extraordinary circumstances.

4.1.3 Alternative NW3: Revert to Pre-September 18, 2014 Non-RNAV Routings

Description:

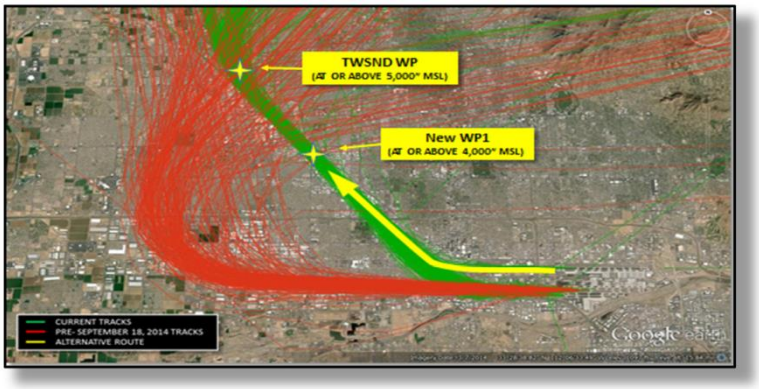
- Revert to Pre-September 18, 2014 published Non-RNAV departure procedures.

Considerations:

- Reroutes flight tracks away from the industrial corridor.
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures.

Decision:

Reverting to the pre-September 18, 2014 flight tracks would reduce efficiency and safety, and would not align with the purpose and need of the original project.



4.1.3 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately six nautical miles from the existing procedure initial turn to the northwest.
- Evaluation of land use in the vicinity of the proposed initial turn to the northwest indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative NW3 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed initial turn to the northwest indicated the potential for extraordinary circumstances.
- The LAT noise screening tool data indicated that Alternative NW3 failed the LAT; as the potential exists for extraordinary circumstances according to FAA Order 1050.1E.
-

4.1.4 Alternative NW4: Revert to Pre-September 18, 2014 Using RNAV Routings

Description:

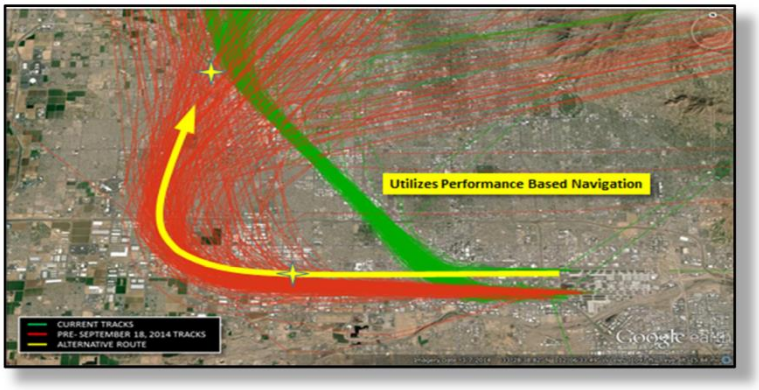
- Revert to Pre-September 18, 2014 flight paths incorporating RNAV procedures.

Considerations:

- Reroutes flight tracks away from the industrial corridor.
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures.

Decision:

- Alternative would reduce efficiency and safety and will not align with the purpose and need of the original project.



4.1.4 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately six nautical miles from the existing procedure initial turn to the northwest.
- Evaluation of land use in the vicinity of the proposed initial turn to the northwest indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative NW4 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed initial turn to the northwest indicated the potential for extraordinary circumstances.
- Alternative NW4 would be considered a distinct federal action due to the displacement of the proposed lateral track exceeding the parameters of the LAT associated with the changes in altitude.

4.1.5 Alternative NW5: Immediate Turn Direct TWNSD Waypoint

Description:

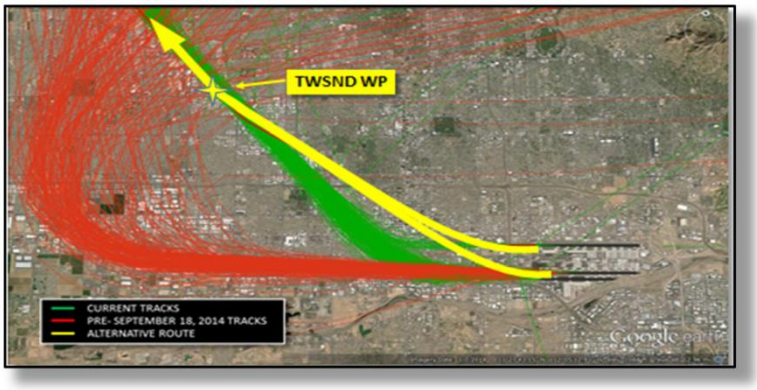
- Immediate right turn from departure end of runway direct TWNSD waypoint on the LALUZ, YOTES, SNOBL, and MAYSA SIDs.

Considerations:

- Increases efficiency and reduces controller task complexity.
- Dispersal of flight tracks over residential areas.

Decision:

- Alternative has potential environmental concerns.



4.1.5 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately one nautical mile from the immediate turn from the runway end to the existing procedure initial turn to the northwest.
- Evaluation of land use in the vicinity of the proposed initial turn to the northwest indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative NW5 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed immediate turn to the northwest indicated the potential for extraordinary circumstances.
- Alternative NW5 would be considered a distinct federal action due to the displacement of the proposed lateral track exceeding the parameters of the LAT associated with the changes in altitude.

4.1.6 Alternative NW6: Add RNAV Waypoint to Extend Upwind Leg

Description:

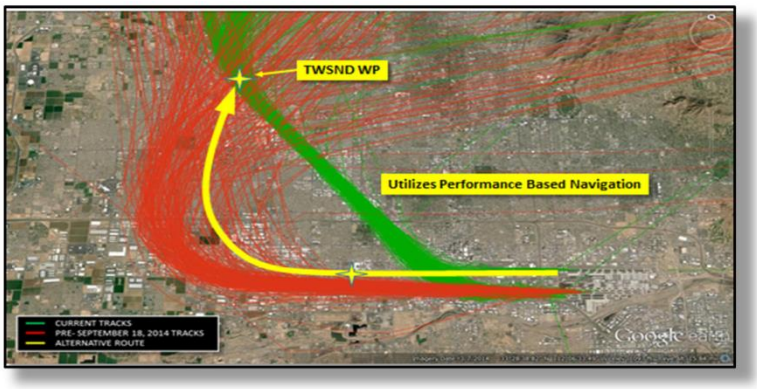
- Add RNAV waypoint two miles west of the current tracks on the LALUZ, YOTES, SNOBL, and MAYSA SIDs to relocate turn point to the west.

Considerations:

- Aircraft will fly runway heading for 1.3NM prior to starting northwest turn to TWSND waypoint, routing flights away from the industrial corridor and over residential areas.
- Elimination of course divergence creates loss of efficiency due to reduced departure throughput.t

Decision:

- Alternative would reduce efficiency and safety.



4.1.6 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the proposed route lateral displacement of approximately two nautical miles from the existing procedure initial turn to the northwest.
- Evaluation of land use in the vicinity of the proposed initial turn to the northwest indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative NW6 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed waypoint and subsequent turn to the northwest indicated the potential for extraordinary circumstances.
- Alternative NW6 would be considered a distinct federal action due to the displacement of the proposed lateral track exceeding the parameters of the LAT associated with the changes in altitude.

4.1.7 Alternative NW7: Add Radius to Fix (RF) Leg

Description:

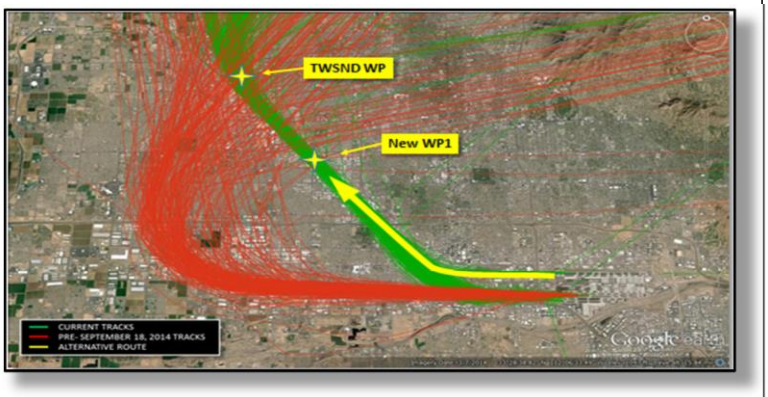
- Add an RF leg departure procedure.

Considerations:

- Increased flight path precision.
- Fleet equipage limitations.
- Criteria not supported for public procedures.

Decision:

- Alternative does not meet criteria for public instrument departure procedures.



4.1.7 Environmental Review

Noise Analysis:

- The noise screening tools and techniques to evaluate potential changes in noise impacts associated with the change in a route or procedure were not applied to Alternative NW7 as the alternative does not meet criteria for a public procedure per FAA Order 8260.46E, "*Departure Procedure Program*" and FAA order 8260.58, *" United States Standard for Performance Based Navigation Instrument Procedure Design".*

4.2.1 Alternative W1: No Action

Description:

- No change to September 18, 2014 west flow departure procedures.

Considerations:

- No change to September 18, 2014 west flow departure procedures.

Decision:

- No Action Alternative was selected.

4.2.1 Environmental Review

Noise Analysis:

- No change in noise exposure.

4.2.2 Alternative W2: Add Speed and Altitude Restriction

Description:

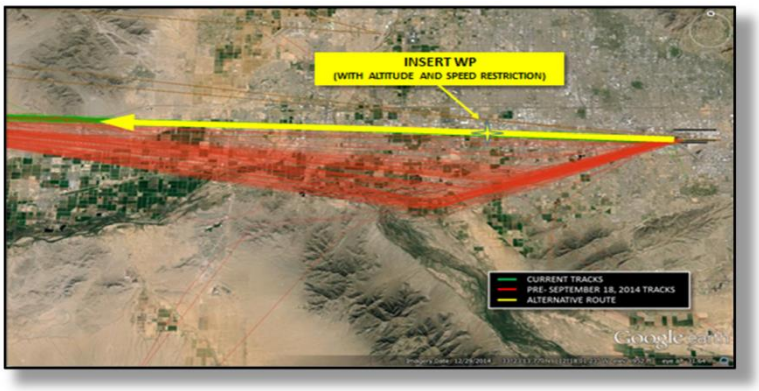
- Add speed and altitude restriction to IZZZO RNAV SID.

Considerations:

- No benefits to safety or efficiency identified.

Decision:

- Turbojet aircraft are able to climb unrestricted and eliminates the need for a waypoint crossing restriction.



4.2.2 Environmental Review

Noise Analysis:

- The Altitude/Operations Test (A/O) was used to screen for potential noise impacts resulting from a single change in altitude on a route or procedure.
- The Alternative W2 would result in an increase in aircraft altitude at the location of the speed and altitude restriction.
- The number of departure operation is not expected to increase as a result of the Alternative W2.

Findings:

- The A/O noise screening tool data indicated that Alternative W2 would not cause a change in the DNL exceeding the noise screening thresholds.
- Given that there is no expected lateral displacement of the west flow RNAV SIDs, evaluation of land use along the ground track of the Alternative W2 indicated the speed and altitude restriction would not result in extraordinary circumstances above 3,000 feet AGL.
- The Workgroup determined that Alternative W2 would not substantially improve efficiency and/or safety of the existing procedure; therefore Alternative W2 is not recommended.

4.3.1 Alternative SW1: No Action

Description:

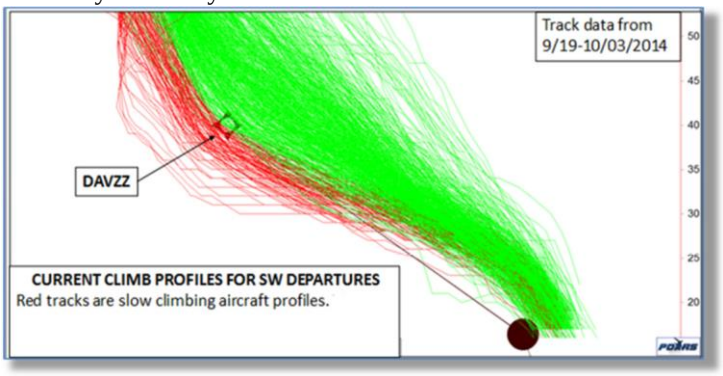
- No change to September 18, 2014 west flow departure procedures.

Considerations:

- Other alternatives identified by the Workgroup enhanced safety and efficiency, which met the goals of the original project.

Decision:

The Workgroup identified other alternatives which were aligned with the purpose and need of the project and were able to produce gains in efficiency and safety.



4.3.1 Environmental Review

Noise Analysis:

- No change in noise exposure.

4.3.2 Alternative SW2: Add Speed and Altitude Restriction to Southwest SIDs: BNYRD, FTHLS, JUDTH, and KATMN

Description:

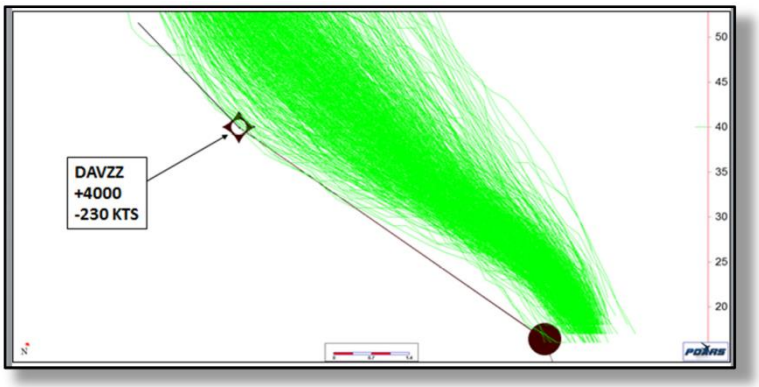
- Add speed and altitude restriction to southwest SIDs. No change in the lateral path.

Considerations:

- Retains direct-to-fix legs required for immediate divergence off runway.
- Waypoint assigns at-or-above 4,000 feet MSL altitude restriction.
- Waypoint assigns at-or-below 230 knots speed restriction.
- Aircraft rates of climb will increase. Aircraft will be higher than current procedure.
- Enhances level of safety by increasing vertical separation from Phoenix turboprop departures and satellite airport operations.
- Potential decrease noise levels due to higher altitude.

Decision:

- Workgroup selected this alternative for the southwest SIDs.



4.3.2 Environmental Review

Noise Analysis:

- The Altitude/Operations Test (A/O) was used to screen for potential noise impacts resulting from a single change in altitude on a route or procedure.
- Given that the number of operations associated with the southwest SIDs is not expected to increase, the A/O noise screening tool data indicated that the Alternative SW2 would support a speed and altitude restriction.

Findings:

- The A/O noise screening tool data indicated that Alternative SW2 would not cause a change in the DNL exceeding the noise screening thresholds.
- Given that there is no expected lateral displacement of the southwest RNAV SIDs, evaluation of land use along the ground track of the Alternative SW2 indicated the speed and altitude restriction would not result in extraordinary circumstances above 3,000 feet AGL.

4.3.3 Alternative SW3: Revert to Pre-September 18, 2014 Non-RNAV Routings

Description:

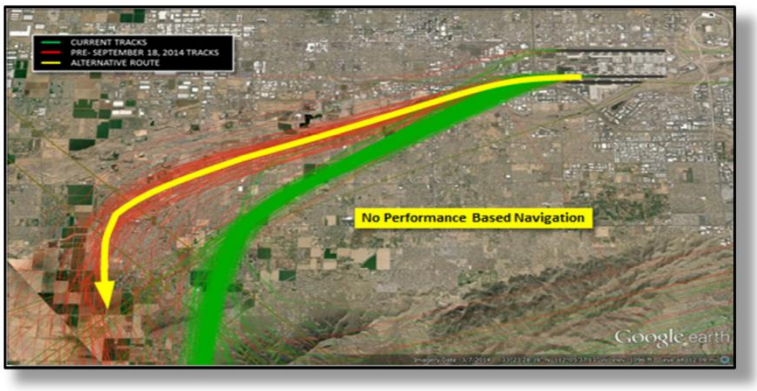
- Revert to Pre-September 18, 2014 published non-RNAV departure procedures.

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015.
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures.

Decision:

- Alternative would reduce efficiency and safety and will not align with the purpose and need of the project.



4.3.3 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately 1.3 nautical miles from the existing procedure.
- Evaluation of land use along the ground track of the proposed procedure indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative SW3 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- Alternative SW3 would be considered a distinct federal action due to the displacement of the proposed lateral track exceeding the parameters of the LAT associated with the changes in altitude.

4.3.4 Alternative SW4: Move DAVZZ Waypoint

Description:

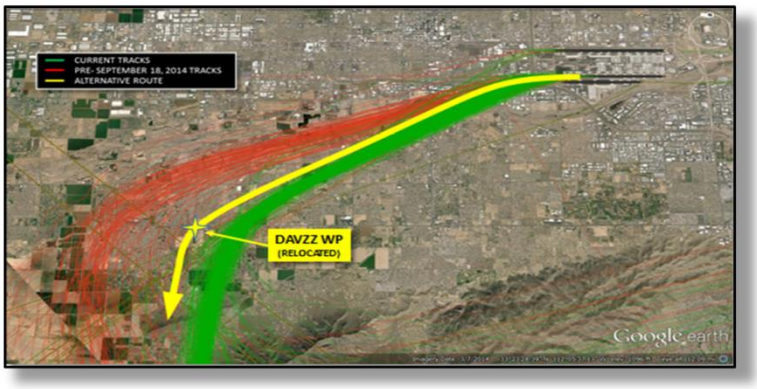
- Explore lateral adjustments to DAVZZ waypoint to enhance the safety and efficiency of the procedures.

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015.
- Eliminates efficiency and safety enhancements realized by the September 18, 2014 published procedures.

Decision:

- Alternative would reduce efficiency and safety and will not align with the purpose and need of the project.



4.3.4 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Above 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately 0.3 nautical miles from the existing procedure.
- Evaluation of land use along the ground track of the proposed procedure indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative SW4 would potentially cause a change in the DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed waypoint indicated the potential for extraordinary circumstances.
- The LAT noise screening tool data indicated that Alternative SW4 failed the LAT; as the potential exists for extraordinary circumstances according to FAA Order 1050.1E.

4.3.5 Alternative SW5: Runway Heading to Intercept Course to DAVZZ Waypoint

Description:

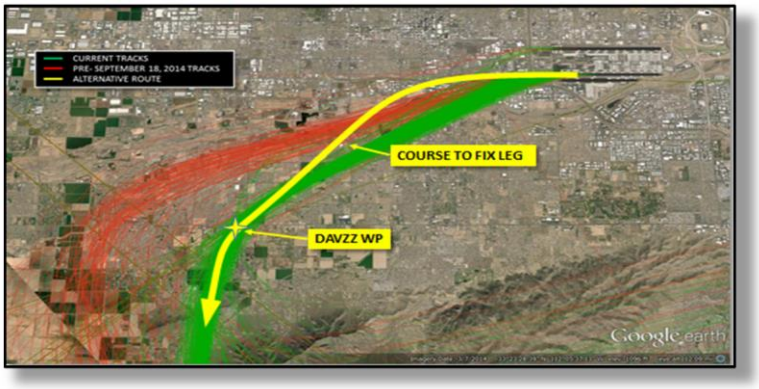
- Explore alternate RNAV criteria for heading to intercept course to DAVZZ waypoint.

Considerations:

- Letter to Manager, City of Phoenix, from Administrator Huerta dated January 22, 2015.
- Elimination of immediate course divergence creates loss of efficiency due to reduced departure throughput.
- Higher altitude potentially decreases noise levels.

Decision:

- Alternative would reduce efficiency and safety and will not align with the purpose and need of the project.



4.3.5 Environmental Review

Noise Analysis:

- The Lateral Movement Test (LAT) for actions "Under 3,000 feet AGL" was applied to evaluate the propose route lateral displacement of approximately 1.3 nautical miles from the existing procedure.
- Evaluation of land use along the ground track of the proposed procedure indicated the presence of noise sensitive receptors.

Findings:

- The LAT noise screening tool data indicated that Alternative SW5 would potentially cause a change DNL exceeding the noise screening thresholds.
- The presence of noise sensitive receptors in the vicinity of the proposed waypoint indicated the potential for extraordinary circumstances.
- The LAT noise screening tool data indicated that Alternative SW5 failed the LAT; as the potential exists for extraordinary circumstances according to FAA Order 1050.1E.