Federal Aviation Administration

Design Team Technical Report

Las Vegas Metroplex

Updated May 29, 2020

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1.0 Executive Summary

This document is an updated version of the Design Team Technical Report for the Las Vegas Metroplex, dated November 8, 2019, which was included as Appendix G to the Draft Environmental Assessment (EA) for the Las Vegas (LAS) Metroplex project. The Federal Aviation Administration (FAA) LAS Metroplex project Design and Implementation (D&I) Team for the project designed 24 proposed new Performance Based Navigation (PBN) procedures. These procedures include nine Standard Instrument Departures (SIDs), ten Standard Terminal Arrivals (STARs), and five Required Navigation Performance (RNP) procedures for the Las Vegas McCarran International Airport (KLAS), Henderson Executive Airport (KHND) and North Las Vegas Airport (KVGT). To provide continuity with the 24 proposed PBN procedures, four conventional STARs were created and two conventional SIDs were amended. Four Area Navigation (RNAV) Global Positioning System (GPS) approaches and three Instrument Landing System (ILS) approach procedures were amended. To facilitate movement of aircraft transitioning airspace, five new T-Routes and one new Q-Route were designed. Two additional Q-Routes were amended. Contingent on a Finding of No Significant Impact (FONSI) at the completion of the EA process, the procedures and routes (except for the new and amended Q-Routes[1]) are planned for publication no later than November 5, 2020.

There are a total of 45 proposed changes in the Las Vegas Metroplex. The presentation of these changes differs between the EA and the D&I Technical Report. However, both documents refer to the same 45 proposed changes. The following sections of this document describe in detail the impetus for this project and the process used to design the proposed procedures. Also included are the airports to be served by these procedures, the names of the procedures, the details about how these procedures were refined and who participated in their development.

2.0 The FAA Metroplex Program

The FAA Metroplex Program, formerly Optimization of Airspace and Procedures in the Metroplex, was developed in direct response to the RTCA's Task Force 5 Final Report on Mid-Term NextGen Implementation which addressed the quality, timeliness, and scope of metroplex solutions. The Metroplex Program is a systematic, integrated and expedited approach to implementing PBN procedures and associated airspace changes.

3.0 Overview of the Las Vegas Metroplex Study and D&I Process

The LAS Metroplex Study Team was the twelfth collaborative Metroplex team deployed, and it was active from May 2015 to September 2015. The Study Team Final Report from November 20, 2015 served as the foundation for the D&I Team's scope of work. The LAS Design Phase was initiated in January 2017 and continued through May 2019. Additional refinement of designs has occurred during the Evaluation Phase of the project (see section 6.0). The D&I Team focused on finalizing the Study Team's conceptual designs to address identified operational and efficiency issues through the application of PBN procedures and associated airspace changes within the Metroplex, with the goal of creating designs that support both FAA and Industry needs. The D&I Team consisted of participants from the FAA Air Traffic Control (ATC) facilities, the National

[1] The FAA is conducting a separate environmental review process for the proposed new and amended Q-Routes, which have utility independent of the Las Vegas Metroplex project.

Air Traffic Controllers Association (NATCA), ATC subject matter experts (SMEs), Industry, the FAA's Western Service Center, other FAA lines of business such as PBN Policy and Support and Flight Procedures, MITRE Center for Advanced Aviation System Development, and various support contractors. The original Proposed Final Design milestone was completed on May 25, 2019.

4.0 Scope and Process

The LAS Metroplex consists of airspace delegated to the McCarran International Airport Traffic Control Tower (LAS ATCT), Las Vegas Terminal Radar Approach Control Facility (L30), and Los Angeles Air Route Traffic Control Center (ZLA ARTCC). The D&I Team focused on aircraft operations at the Las Vegas McCarran International Airport, Henderson Executive Airport and North Las Vegas Airport. Table 1 below lists the airports served by procedures proposed by this project:

Airport ID	Airport Name
KLAS	McCarran International Airport
KHND	Henderson Executive Airport
KVGT	North Las Vegas Airport

Table 1: Airports Served by LAS Metroplex Proposed Procedures

5.0 Proposed Solutions

The D&I Team worked together with Industry in balancing diverse aircraft-type profiles and increased efficiency. The Team consulted with surrounding facilities when the proposed designs would affect their operations or airspace. Proposed Final Design (PFDs) Packages and associated Change Control Sheets are contained in Attachment 1. Table 2 below lists the Final Design Packages. Table 3 below lists the number of procedures per airport designed for this project.

Procedure Name	Procedure Type	Airport (s)	Action
GIDGT	RNAV SID	KLAS	Create
JOHKR	RNAV SID	KLAS	Create
LOHLA	RNAV SID	KLAS	Create
NIITZ	RNAV SID	KLAS	Create
RADYR	RNAV SID	KLAS	Create
RASLR	RNAV SID	KLAS	Create
RATPK	RNAV SID	KLAS	Create
CHOWW	RNAV STAR	KLAS	Create
COKTL	RNAV STAR	KLAS	Create
JAYSN	RNAV STAR	KLAS	Create
RKSTR	RNAV STAR	KLAS	Create
RNDRZ	RNAV STAR	KLAS	Create
OYODA	RNAV SID	KHND	Create
SCAMR	RNAV SID	KHND	Create
BOEGY	RNAV STAR	KHND	Create
GAMES	RNAV STAR	KHND and KLAS	Create
NTNDO	RNAV STAR	KHND and KVGT	Create
FLCHR	RNAV STAR	KVGT	Create
WYLND	RNAV STAR	KVGT	Create
BLAID	CONVENTIONAL STAR	KLAS	Create
LARKK[2]	CONVENTIONAL STAR	KLAS	Create
HOOVER	CONVENTIONAL SID	KLAS	Up-number
ISHEE	CONVENTIONAL STAR	KLAS	Create
MCCARRAN	CONVENTIONAL SID	KLAS	Up-number
PUMLE	CONVENTIONAL STAR	KLAS and KHND	Create
RNAV (RNP) Z RWY 08R	RNP AR approach	KLAS	Create
RNAV (RNP) Z RWY 19L	RNP AR approach	KLAS	Create
RNAV (RNP) Z RWY 19R	RNP AR approach	KLAS	Create
RNAV (RNP) Z RWY 26L	RNP AR approach	KLAS	Create
RNAV (RNP) Z RWY 26R	RNP AR approach	KLAS	Create
RNAV (GPS) Y RWY 01R	GPS approach	KLAS	Amend
RNAV (GPS) Y RWY 19L	GPS approach	KLAS	Amend
RNAV (GPS) Y RWY 19R	GPS approach	KLAS	Amend
RNAV (GPS) RWY 12R	GPS approach	KVGT	Amend
ILS or LOC RWY 26L	ILS approach	KLAS	Amend
ILS or LOC RWY 26R	ILS approach	KLAS	Amend
ILS or LOC RWY 01L	ILS approach	KLAS	Amend
T338	T-Route	N/A	Create
T357	T-Route	N/A	Create
T359	T-Route	N/A	Create
T361	T-Route	N/A	Create
T363	T-Route	N/A	Create
Q13	Q-Route	N/A	Amend
Q15	Q-Route	N/A	Amend
Q174	Q-Route	N/A	Create

Table 2: LAS Metroplex Proposed Final Designs

[2] The proposed LARKK STAR replaces the proposed GRMMA STAR, which was listed in the November 18, 2019 version of this document (included as Appendix G to the Draft EA). This change is described in Section 6.0 of this document and a Design Package describing the LARKK STAR is included in Attachment 1.

Procedure Type	KLAS	KHND	KVGT	Totals
RNAV SIDs New	7	2	0	9
RNAV STARs New	5	3	2	10
Standard Instrument Approach Procedures (SIAPs) New	5	0		5
SIAP Amendments	6	0	1	7
T-Routes New				5
Q-Routes New				1
Q-Route Amendments				2
Conventional SIDS Amended	2	0	0	2
Conventional STARs New	4	0	0	4
Totals	**29**	**5**	**3**	**45**[3]

Table 3: Procedures Developed by Airport

Table 4 lists the proposed new RNAV SIDs and STARs, the existing procedure that would be replaced, and the airport(s) served. Table 5 lists the proposed new conventional procedures, the existing conventional procedures that would be replaced, and the airport(s) served.

New RNAV Procedure	Replaced Procedure	Airport(s) Served
KLAS COKTL STAR	KLAS SUNST STAR	KLAS
KLAS RNDRZ STAR	KLAS KEPEC STAR	KLAS
KLAS RKSTR STAR	KLAS TYSSN STAR	KLAS
KLAS CHOWW STAR	KLAS SITEE STAR	KLAS
KLAS JAYSN STAR	NEW PROCEDURE	KLAS
KLAS JOHKR SID	KLAS SHEAD SID	KLAS
KLAS RADYR SID	KLAS BOACH SID	KLAS
KLAS RASLR SID	KLAS PRFUM SID	KLAS
KLAS NIITZ SID	KLAS COWBY SID	KLAS
KLAS GIDGT SID	KLAS TRALR SID	KLAS
KLAS RATPK SID	KLAS STAAV SID	KLAS
KLAS LOHLA SID	NEW PROCEDURE	KLAS
KVGT FLCHR STAR	NEW PROCEDURE	KVGT
KVGT WYLND STAR	NEW PROCEDURE	KVGT
KHND GAMES STAR	KHND ADDEL STAR	KHND, KLAS
KHND OYODA SID	KHND PALLY SID	KHND
KHND NTNDO STAR	KHND JOMIX and KHND KNGMN STARs	KHND, KVGT
KHND SCAMR SID	KHND ACSIN and KHND FLAMZ SIDs	KHND
KHND BOEGY STAR	KHND NOOTN STAR	KHND

Table 4: Proposed New Metroplex RNAV SIDs and STARs

New Conventional Procedure	Replaced Procedure	Airport(s) Served
KLAS BLAID STAR	KLAS LUXOR STAR	KLAS
KLAS LARKK STAR	KLAS CLARR STAR	KLAS
KLAS ISHEE STAR	KLAS KADDY STAR	KLAS
KLAS PUMLE STAR	KLAS FUZZY STAR	KLAS, KHND
KLAS MCCARRAN SIX SID	KLAS MCCARRAN FIVE SID	KLAS
KLAS HOOVER SEVEN SID	KLAS HOOVER SIX and KLAS LASVEGAS FIVE SIDs	KLAS

Table 5: Proposed New Metroplex Conventional Procedure

[3] The Q-Routes and T-Routes are not included in the airport totals because they are not airport-specific.

5.1 Las Vegas McCarran Procedures

There are 29 procedures proposed for KLAS, including seven RNAV SIDs, five RNAV STARs and five Required Navigation Performance Authorization Required (RNP AR) Approaches. Six SIAPs and two conventional SIDs were amended and four conventional STARs were proposed.

The KLAS RNAV SIDs are RNAV-off-the-ground. The RNAV STARs to KLAS contain Optimized Profile Descents (OPDs) and all connect to approach procedures.

Amendments to existing KLAS SIAPs; three Instrument Landing System (ILS) and three Global Positioning System (GPS) approaches at KLAS are proposed to optimize designs, connect to the KLAS STARs and align them with the proposed RNP AR approaches.

The new and amended conventional SIDs and STARs were proposed to provide continuity with lateral routes of PBN procedures and to allow accommodation of conventional arrivals and departures in new airspace boundary designs. Tables 6 and 7 below list the proposed procedures serving KLAS.

PROCEDURE NAME
KLAS GIDGT RNAV SID
KLAS JOHKR RNAV SID
KLAS LOHLA RNAV SID
KLAS NIITZ RNAV SID
KLAS RADYR RNAV SID
KLAS RASLR RNAV SID
KLAS RATPK RNAV SID
KLAS CHOWW RNAV STAR
KLAS COKTL RNAV STAR
KLAS JAYSN RNAV STAR
KLAS RKSTR RNAV STAR
KLAS RNDRZ RNAV STAR

Table 6: KLAS Proposed SIDs and STARs

PROCEDURE NAME
RNAV (RNP) Z RWY 08R
RNAV (RNP) Z RWY 19L
RNAV (RNP) Z RWY 19R
RNAV (RNP) Z RWY 26L
RNAV (RNP) Z RWY 26R
ILS or LOC RWY 01L
ILS or LOC RWY 26L
ILS or LOC RWY 26R
RNAV (GPS) Y RWY 01R
RNAV (GPS) Y RWY 19L
RNAV (GPS) Y RWY 19R

Table 7: KLAS RNP Approaches and Existing SIAP Amendments

5.2 Henderson Executive Airport Procedures

There are five procedures proposed for KHND, including two RNAV SIDs and three RNAV STARs. The KHND RNAV SIDs are RNAV-off-the-ground. The RNAV STARs to KHND were designed to minimize interactions with KLAS procedures.

The KHND GAMES STAR will serve both KHND and KLAS. It will be available for propeller and jet aircraft landing KHND and for propeller aircraft only landing at KLAS. This was done to facilitate the sequencing of jet arrival traffic into KLAS.

The NTNDO STAR will serve both KHND and KVGT.

Table 8 below lists the proposed procedures serving KHND.

Procedure Name
OYODA (RNAV) SID
SCAMR (RNAV) SID
BOEGY (RNAV) STAR
GAMES (RNAV) STAR
NTNDO (RNAV) STAR

Table 8: KHND Proposed SIDs and STARs

5.3 North Las Vegas Airport Procedures

There are four procedures proposed for KVGT, including three new RNAV STARs and one amended RNAV GPS approach. The RNAV STARs to KVGT were designed to minimize interactions with KLAS procedures. Table 9 below lists the proposed procedures serving KVGT.

Procedure Name
NTNDO (RNAV) STAR
FLCHR (RNAV) STAR
WYLND (RNAV) STAR
RNAV (GPS) RWY 12R

Table 9: KVGT Proposed STARs and SIAP Amendment

6.0 Procedure Refinement

The D&I Team utilized several workgroups, which included representatives from industry, FAA Air Traffic Control (ATC) facilities, the National Air Traffic Controllers Association (NATCA), ATC subject matter experts (SMEs), the FAA's Western Service Center, other FAA lines of business such as PBN Policy and Support and Flight Procedures and various support contractors. The workgroups systematically developed and refined PBN procedures and airspace designs that met the intent of the Study Team. For each individual proposed concept, the D&I Team went through a design process considering alternative lateral and vertical paths, various speed and altitude restrictions, alternative leg types, different segregation options, aircraft performance, terrain and various charting considerations. Numerous tools were utilized to support the refinement including industry flight simulations, Integrated Simulation (I-SIM), Human-In-The-Loop (HITL) and other simulations, flyability, and criteria checks.

The D&I Team also considered public comments received during community engagement activities in April 2019. The Team conducted workshops in Las Vegas, Henderson and North Las Vegas. The workshops presented preliminary designs to the community and input concerning proposed procedures was solicited. The D&I Team received 156 comments, which were reviewed individually. The D&I Team reviewed the following to determine whether design changes to address community comments could be accomplished consistent with applicable design criteria and without adversely affecting safety or efficiency:

- KLAS RATPK SID (Runway 08 Transition)
    - Due to safety and efficiency concerns, the preliminary design for this procedure was not changed in response to community input. However, as a result of community input:
        - L30 and the LAS ATCT agreed to generally limit use of the Runway 08 Transition to times when aircraft are landing on Runway 19.

        - The original intention was to utilize the Runway 08 Transition at all times when aircraft are departing Runway 08.
        - This represents a 48% decrease in intended use of the Runway 08 Transition.
- KLAS Runway 26 L/R Downwind
    - Due to design criteria issues (maximum bank angle), the design for this procedure was not changed in response to the community input.
- KLAS JOHKR, NIITZ, RADYR and RASLR SIDs (Runway 26 transitions)
    - Due to safety and efficiency concerns, the designs for these procedures were not changed in response to the community input.
- KLAS Approach Procedures to Runways 01 L/R
    - The Metroplex Project does not include any lateral or vertical changes to the existing KLAS Runway 01 arrivals over urban areas. Therefore the FAA was unable to make any changes to the proposed procedures in response to the community input.
- KLAS JOHKR, NIITZ, RADYR, RASLR SIDS (Runway 19 transitions)
    - Due to safety and efficiency concerns, the designs for these procedures were not changed in response to the community input.
- KLAS GIDGT and RATPK SIDs (Runway 26 transitions)
    - Due to safety and efficiency concerns, the designs for these procedures were not changed in response to the community input.

Design proposals were documented and signed by affected FAA and NATCA stakeholders. The remainder of the Design Phase focused on the refinement of the proposed designs, ensuring consistency with applicable guidance documents, including, but not limited to:

- FAA Order JO 7100.41: Performance Based Navigation Implementation Process
- FAA Order 8260.3: United States Standard for Terminal Instrument Procedures (TERPS)
- FAA Order 8260.46: Departure Procedure Program
- FAA Order 8260.58: United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design

The D&I Team considered additional public comments received on the proposed designs during the comment period on the Draft EA, which was released November 18, 2019. Public workshops on the Draft EA were held at five locations in the Las Vegas Valley. At the request of the Clark County Department of Aviation (CCDOA), workshops near the communities of Summerlin, NV and Southern Highlands, NV were added to the three previous locations of the April 2019 public workshops. These two additional communities had submitted the largest number of comments following the previous workshops.

The FAA received 140 comment submissions, including from the CCDOA, during an extended public comment period on the Draft EA. Specific Las Vegas area procedure comments concerned:

- KHND NTNDO Arrival
    - Comments concerned impact the procedure could have on the town of Searchlight, NV and a commercial Unmanned Aircraft System (drone) operation near the

Searchlight Airport (K1L3). The FAA conducted a review of existing air traffic near the airport and determined the existing JOMIX arrival routes KHND and KVGT arrivals over the same area as the proposed NTNDO arrival procedure. Therefore, no change was made to the proposed procedure.

- KLAS RATPK "Loop" Departure Procedure
    - This procedure was reviewed after the April 2019 public workshops. Due to safety concerns, no change was made to the proposed procedure; however, L30 and the LAS ATCT agreed to use this procedure only when aircraft are landing on Runway 19 and taking off of Runway 08.
- KLAS RWY 08 Departures
    - Comment requested KLAS RWY 08 departures be moved outside of historical tracks. Due to safety concerns, no change was made to the proposed procedure.
- KLAS RWY 19 Right Turn
    - Several comments were received requesting extension of the runway heading before turning west. The FAA reviewed an alternative design (moving the procedure south to Blue Diamond Road), but was unable to resolve the design criteria issues encountered. Due to safety and efficiency concerns, no change was made to the proposed procedure.
- KLAS RWY 19 L/R RNAV (RNP) Z
    - The comment requested a change to raise the Decision Altitude for the approaches to avoid "restricting of the city's ability to expand." Raising the Decision Altitude would cause the approach procedure to extend further north encroaching on Nellis Air Force Base traffic and airspace. This request could not be accommodated due to safety concerns. Therefore, no change was made to the proposed procedure.
- KLAS RWY 19 Straight Out (JOHKR, NIITZ, RASLR and RADYR SIDs)
    - Comments centered on departure traffic being added to existing arrival traffic landing on KLAS RWY 01. The procedures were designed to mitigate concerns with KLAS RWY 19 departure flight paths converging eight miles southwest of the airport with KLAS RWY 26 departures. Currently, controllers vector RWY 19 departures away from this confliction. The design of the proposed procedures delays, or in many instances eliminates the convergence by proceduralizing the actions taken by controllers. Due to safety and efficiency concerns, no changes were made to the proposed procedures.
- KLAS RWY 26 DOWNWIND
    - Comments concerned the shift south for COKTL and RNDRZ arrivals to KLAS RWY 26. After the April 2019 workshops, the D&I Team examined moving the lateral route closer to the existing approach, but determined that any movement north for the downwind portion of the approach would exceed maximum allowed bank angle for the procedure. Due to design criteria, the Team was unable to amend the designs of the LAS Runway 26 downwind approach.
- Support for proposed changes
    - Two comments were received in favor of one or more of the proposed Metroplex changes and the workshops held for Community Engagement.

During the Evaluation Phase (which began in May 2019), the Team has made additional refinements to the proposed procedures to address quality control and safety issues. These

refinements included waypoint name changes, minimal adjustment of altitudes or lateral paths, and other minor changes. The following is a summary of the changes made (Change Control Sheets describing these changes are included in Attachment 1):

- KLAS RATPK SID – After a review of the Proposed Final Design for the KLAS RATPK SID with Nellis Air Traffic Control Facility (NATCF), it was determined that the waypoint JENFR needed to move .55 miles to the southwest in order to remain within a designated airspace shelf controlled by the Las Vegas TRACON (L30) and to share the same lateral path as the proposed GIDGT departure procedure. This change occurred outside of any urban areas. This move will reduce potential coordination between L30 and NATCF.
- KLAS RKSTR STAR – A new waypoint (WP1263/at or above 24,000 feet) was added 23.59 miles north of ELLDA on the ELLDA transition of the KLAS RKSTR STAR. This fix does not change the lateral track of the transition, but will serve as a holding fix (left turns/10 mile legs) if necessary. ZAYNE was removed from the procedure.
- KLAS RKSTR STAR – The JJEAN waypoint name was changed to FEREL on the Runways 19L/R transitions of the RKSTR STAR.
- KLAS CHOWW STAR – In order to meet design criteria and to increase efficiency, the Team removed the speed (210 knots) at NNEON. FOOOF (at or above 7,000 feet) was moved 2.5 nautical miles to the southwest on the same lateral path and a speed of 220 knots was added.
- KLAS CHOWW and RKSTR STARs RWY26R – FLYES was moved approximately 2 miles to the east abeam of PRINO at Industry request in order to reduce complexity.
- KLAS COKTL STAR and KLAS JAYSN STAR – The Team determined that removal of the altitude restriction (at or above 9,000 feet) at BAUMM would allow the procedure to pass criteria from BAUMM to ROAMN and BAUMM to YAGGR.
- KLAS RKSTR STAR – In order to meet design criteria and to increase efficiency, the Team removed the speed (210 knots) at NNEON. FOOOF (at or above 7,000 feet) was moved 2.5 nautical miles to the southwest on the same lateral path and a speed of 220 knots was added.
- KHND SCAMR SID – The original Design Package stated that the SCAMR would replace the KHND ACSIN SID. It will replace both the KHND ACSIN and FLAMZ SIDs.
- KLAS RADYR SID and KHND OYODA SID – The name of waypoint BLACK has been changed to BLAQQ.
- KLAS CHOWW STAR – The MNCIN waypoint was added 33 nautical miles southwest of GGAPP to allow ZLC a waypoint to rejoin the procedure after sequencing. There was no change to the lateral or vertical path of the procedure. This change was outside of the General Study Area in the EA.
- KLAS CHOWW STAR - The altitude restriction at TATUU was changed to meet criteria from an altitude range of 9,400 to 10,500 feet to an altitude range of 9,500 to 10,500 feet, raising the bottom altitude by 100 feet
- KLAS RKSTR and CHOWW STARs – Removed the altitude restriction at JAIDE which was at or below 13,000 feet. The restriction is not required operationally and removal allows this segment of the procedure to meet criteria and aircraft to cross JAIDE at higher altitudes.
- KLAS LOHLA RNAV SID – The LOHLA waypoint altitude was changed from 13,300 to 13,400 for terrain.

- KLAS BLAID STAR – Criteria dictated a move of the BLAID waypoint 3.85 miles to the southwest. This change occurred outside of any urban areas. The altitude restriction at BLAID remains at 12,000 feet. Prior to the BLAID intersection, arrivals will be radar vectored to the appropriate runway and follow a similar path as the runway transitions on the KLAS CHOWW RNAV STAR. This is the same path that was modeled for the EA.
- KLAS RADYR SID and KHND OYODA SID - Due to the RADYR waypoint being moved to align with the GFS radial, the course and distance between RADYR and DOYYL waypoints changed. This change required moving the DOYLL waypoint to pass criteria on the KLAS RADYR SID, BOJAC transition. This change occurred outside of any urban areas.
- KLAS GRMMA STAR was amended to the KLAS LARKK STAR (reflected in Tables 2 and 5 above). This change was required to eliminate a dead reckoning leg on the GRMMA STAR. The route no longer overflies the GRMMA waypoint. Abeam the GRMMA waypoint the lateral track moved .83 nautical miles west. Because the procedure no longer overflies the GRMMA waypoint, a new name for the procedure had to be chosen. Prior to the LARKK intersection, arrivals will be radar vectored to the appropriate runway and follow a similar path as the runway transitions on the proposed KLAS RNDRZ RNAV STAR. This is the same path that was modeled for the EA.
- KLAS RNAV (GPS) Y RWY 01R approach – Waypoint and altitude restriction changes were made to allow an additional entry point at BUHLL to connect the approach to the KLAS RNAV RNDRZ and CHOWW RNAV STARs. The proposed approach waypoints are: CAKNU (at or above 7,000 feet) or BUHLL (at 7,000 feet/no greater than 210 knots) will serve as initial approach fixes, FEBET (at or above 6,000 feet) as an intermediate fix, KIBSE (at 5,100 feet) as PFAF fix, GALNE (at or above 3,900 feet) as a step down fix, MOLME (at or above 3,500 feet).
- KLAS RADYR SID – The BLAQQ waypoint was removed from all transitions except the BLAQQ transition. This was done to eliminate possible confusion on the chart of the proposed procedure. The BLAQQ transition will be charted offset from other transitions. The lateral and vertical paths were not changed.
- KHND OYODA SID – The BLAQQ waypoint was removed from all transitions except the BLAQQ transition. This was done to eliminate possible confusion on the chart of the proposed procedure. The BLAQQ transition will be charted offset from other transitions. The lateral and vertical paths were not changed.
- KLAS CHOWW STAR – For Class B containment, an altitude restriction of at or above 8,500 feet was added to the FELAA waypoint. The lateral path was not changed.
- KLAS RKSTR STAR – For Class B containment, an altitude restriction of at or above 8,500 feet was added to the FELAA waypoint. The lateral path was not changed.
- KLAS RNAV (RNP) Z RWY 19R – To meet criteria, the glide path angle was increased to 3.5 degrees which resulted in an altitude restriction change at KIVEY to at or above 5,400 feet; MOBBB waypoint moved .19 NM east and an altitude restriction changed to at or above 4,200 feet; GMBIL waypoint to moved .76 NM west; HIRLR waypoint moved .14 NM northwest; and CEGIL waypoint moved .32 NM north.
- KLAS RNAV (GPS) Y RWY 19R – To match the glide path angle of the KLAS RNAV (RNP) Z 19R and the Visual Glide Slope Indicator, the approach was amended to a 3.5 degree glide path. New waypoint WP42_ created 2.24 NM north of HAMIG; JOGMU waypoint moved 1.01 NM west and the name changed to MOZOS; RANVE waypoint

moved 1.39 NM southwest and named PFAFR. WP42_ and PFAFR will be renamed again during the production process.

- KLAS RNAV (GPS) Y RWY 19L – Because fixes are shared with the KLAS (RNAV) GPS Y RWY 19R approach, this approach was amended also. However, the glide path angle on the approach to RWY 19L will remain at 3.0 degrees. The change required HAMIG waypoint to move 2.37 NM north and the name changed to STORA; JOGMU waypoint moved 1.02 NM west and the name changed to MOZOS; RAVNE waypoint moved 1.25 NM southwest and the name changed to DIRDE.
- KHND NTNDO STAR – The altitude restriction at KONNG would be changed from at 11,000 feet to at or above 10,000 to accommodate the crossing restriction of propeller driven and jet aircraft. Jet aircraft would cross KONNG at 11,000 feet and propeller driven aircraft would cross KONNG at 10,000 feet. Changing the altitude restriction at KONNG necessitates a change in the minimum enroute altitude (MEA) from BYSEN to KONNG and from TETRS to KONNG from 11,000 to 10,000. Additionally, the MEAs from TNP to JOTNU and from JOTNU to ZELMA would be raised from 13,000 to 15,000 to ensure navigational aid reception on the procedure. The NTNDO STAR is proposed to serve KHND and KVGT.
- KLAS BLAID STAR – The proposed KLAS BLAID STAR MLF and DVC transitions failed flight inspection due to navigational aid reception. The MLF transition is now proposed to route via MLF, direct HOLDM, direct AALAN, then as previously proposed. The DVC transition was eliminated with a new proposed transition via PGA, direct HOLDM, and direct AALAN then as previously proposed.
- KLAS HOOVER SID – The proposed KLAS HOOVER SID, DRK and MOSBI transitions failed flight inspections due to navigational aid reception. The DRK transition is now proposed to route via NIITZ, WP926, WP930, WP927, KIDDR, and then DRK. The MOSBI transition was deleted. A BAVPE transition is now proposed, routing via NIITZ, WP926, WP930, and then BAVPE.

7.0 Publication Dates

Contingent on a Finding of No Significant Impact (FONSI) at the end of the EA process, the D&I Team developed and coordinated a plan to publish the proposed Metroplex procedures no later than November 5, 2020. Implementation of proposed procedures would include modification and cancellation of some existing SID's and STAR's. The cancellation of some procedures would be delayed 56 days to provide contingency planning. Table 10 shows the procedures that would be cancelled.

Procedure	Airport	Proposed Cancellation Date
ACSIN 6 RNAV SID	KHND	11/05/20
ADDEL1 RNAV STAR	KHND	12/31/20
BOACH 8 RNAV SID	KLAS	12/31/20
CLARR 3 CONVENTIONAL STAR	KLAS, KHND, KVGT	11/05/20
COWBY 8 RNAV SID	KLAS	12/31/20
FLAMZ 6 RNAV SID	KHND	11/05/20
FUZZY 8 CONVENTIONAL STAR	KLAS, KVGT	11/05/20
JOMIX 1 RNAV STAR	KHND	12/31/20
KADDY 3 CONVENTIONAL STAR	KLAS, KVGT	11/05/20
KEPEC 6 CONVENTIONAL STAR	KLAS	11/05/20
KNGMN 2 RNAV STAR	KHND	11/05/20
LAS VEGAS 5 CONVENTIONAL SID	KLAS	11/05/20
LUXOR 2 CONVENTIONAL STAR	KLAS, KVGT	11/05/20
NOOTN 2 RNAV STAR	KHND	12/31/20
PALLY 6 RNAV SID	KHND	11/05/20
PRFUM 4 RNAV SID	KLAS	12/31/20
SHEAD 1 RNAV SID	KLAS	12/31/20
SITEE 4 RNAV STAR	KLAS	12/31/20
STAAV 8 RNAV SID	KLAS	12/31/20
SUNST 4 RNAV STAR	KLAS	12/31/20
TRALR 9 RNAV SID	KLAS	12/31/20
TYSSN 5 RNAV STAR	KLAS	12/31/20

Table 10: Proposed LAS Metroplex Procedure Cancellations

_____ _____

Bradley R. Mayhugh Date
FAA Metroplex Lead

Chris Thomas Date
NATCA Metroplex Lead

LAS Metroplex OYODA Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
2/11/2020	The Metroplex Team discovered that the waypoint name PALIS was not available. Waypoint PALIS changed to RFUSE. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS OYODA Change Sheet

Las Vegas Metroplex KLAS OYODA SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/20/20	The Team reviewed OYODA SID for human factor issue. The waypoint BLAQQ is not on all transitions, which could result in some flightcrew confusion. Discussed removing BLAQQ from all transitions except the BLAQQ transition. Chart will show half circle around BLAQQ for other transitions. Also discussed moving BLAQQ west 1.9 miles southwest and removing from a line DOYLL to RADYR Removed BLAQQ from LVELL and BLH transitions. Only left on BLAQQ transition. 2/20/20 update. BLAQQ has been removed from all transitions except the BLAQQ transition. Charting will indicate an The BLAQQ transition offset from the other transitions that fly over BLAQQ but do not contain BLAQQ in the route of flight. Lateral routes remain the same. No change to map.	LAS Master TARGETs File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Original Signed

Bradley R Mayhugh

FAA Metroplex Co-Lead

3-12-2020

Date

NATCA Metroplex Co-Lead

3/12/2020

Date

KLAS OYODA Change Sheet

Las Vegas Metroplex KLAS OYODA SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
1/16/20	Email from Russell Roslewski (Aeronautical Information Specialist (TERPS): *Bob,* *With RADYR, being moved slightly to align with the GFS radial, the course and distance to DOYYL changed, forcing a slight movement of DOYLL to clear leg length errors on the KLAS RADYR SID, BOJAC transition.* *DOYYL had to move 0.01 nm south. New coordinates: 350711.04N/1152111.64W* *This affects the OYODA and RADYR SIDs, but not significantly.* *I suspect this relocation will not be an issue for ATC, but please let me know if it is.* Email from Walt Alexis (Walt Alexis, LA District Airspace and Procedures Support Specialist): *According to TARGETS, DOYYL is moving 43 feet. This will have no impact on ZLA.* DOYLE is outside of L30 airspace. DOYLE lateral movement imperceptible in TARGETS graphic.	LAS Master TARGETs File	

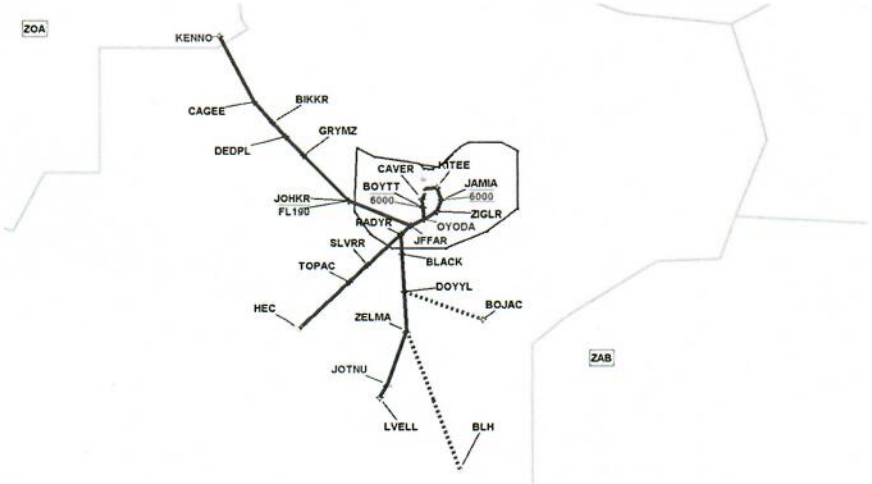

Figure 1. KHND OYODA SID

LAS OYODA Change Sheet

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Myhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

LAS Metroplex OYODA Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
11/21/19	The Metroplex Team discovered that the waypoint name BLACK was not available. Waypoint BLACK changed to BLAQQ. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

LAS Metroplex OYODA Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
11/19/19	The Metroplex Team discovered that the waypoint name BLACK was not available. Waypoint BLACK changed to BLAKK. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KHND OYODA (PALLY) SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Henderson Executive Airport (KHND) departures to northwest/south/southwest destinations will use a new flight path procedure called the OYODA (pronounced “Oh-Yo-da”) SID. The OYODA SID will replace the current PALLY (pronounced “Pal-lee”) RNAV SID.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The OYODA SID is developed around advanced navigation concepts, which will provide climbs that are more continuous.

This procedure is not anticipated to change runway usage. The OYODA SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new OYODA SID addresses KHND. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KHND OYODA (PALLY) SID

Name of Change and Airport(s)	Change Classification
Henderson Executive Airport (KHND) OYODA Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 16, 17, 35, 37, 39, 53, 60 **Oakland ARTCC (ZOA) Sectors: 33, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: CYN, DAG, GNT, FNL, SAT, LAK** **KHND**	**McCarran International Airport (KLAS) RADYR SID** **Q13 Amendment** **Q15 Amendment**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **HITLS results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

Study Team Issues and Solutions

Issues

Stakeholders requested procedures for the Las Vegas satellite airports, which provide predictable, repeatable course guidance and reduce dependencies between operations at neighboring airports. The MST designed conceptual Standard Terminal Arrival Routes (STARs) and SIDs for KHND and North Las Vegas Airport (KVGT).

Las Vegas OAPM Design Package
KHND OYODA (PALLY) SID

MST Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design efficient Runway 17R and Runway 35L departure procedures. The MST created four conceptual RNAV SIDs (KHND E SID, KHND NE SID, KHND SE SID, and KHND SW/NW SID) (See Figure 1). Mountainous terrain near the KHND airport was a primary concern in developing these procedures.

To provide common en route transitions, the KHND SIDs follow conceptual KLAS SIDs. L30 and ZLA expressed concerns about mountainous terrain for Runway 35L departure procedures and gaps in surveillance coverage on the KHND SW/NW SID.

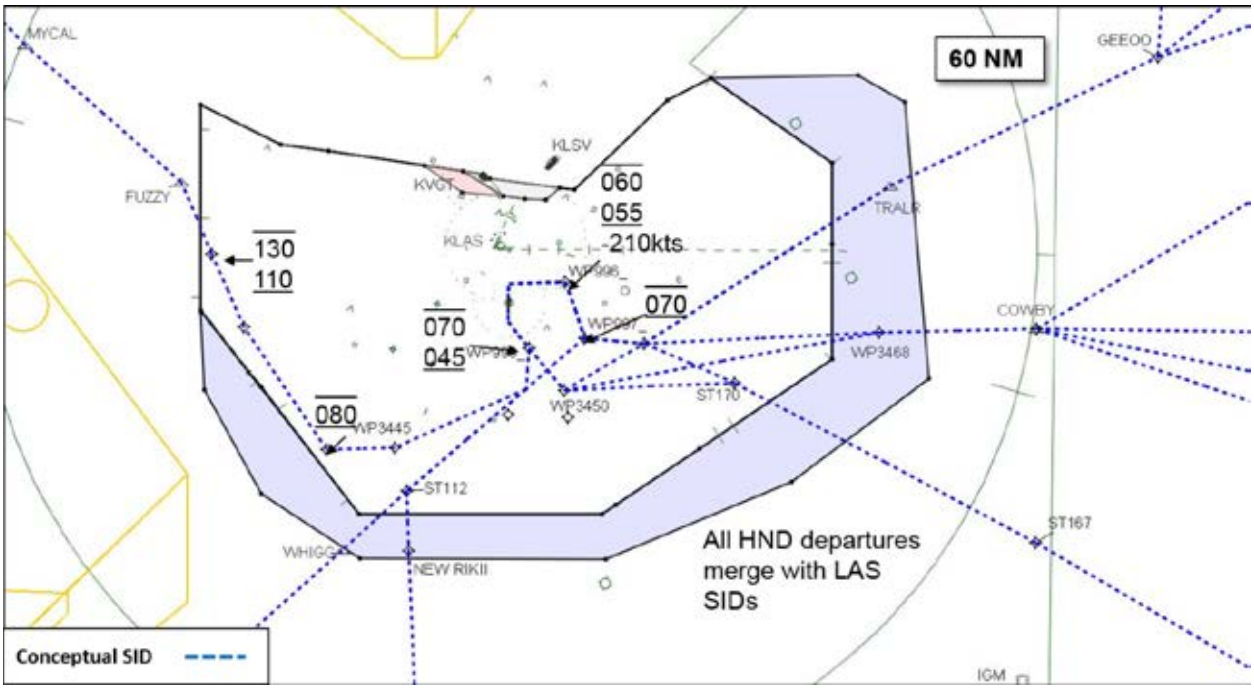

Figure 1: MST KHND Conceptual SIDs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations.

The D&I Team decided to design two SIDs (OYODA and SCAMR) in order to reduce ATC complexity and chart clutter caused by too many transitions.

The top altitude of the OYODA SID is 060 to segregate from KLAS procedures.

Las Vegas OAPM Design Package
KHND OYODA (PALLY) SID

The KHND OYODA SID is depicted in Figure 2.

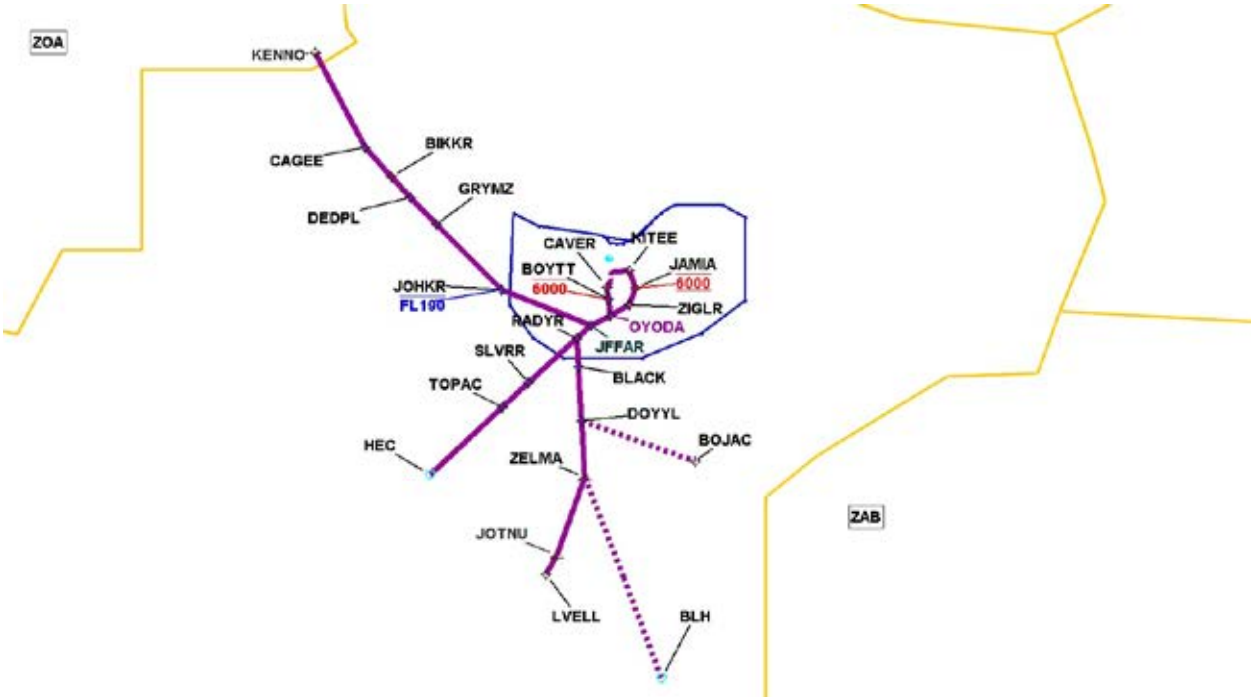

Figure 2: KHND OYODA SID - Proposed Final Design

Runway Transitions

KHND Runway 17R Transition (VICF leg for terrain avoidance)

- CAVER (existing waypoint/provides terrain avoidance)
- BOYTT (at or below 060 to segregate from KLAS RKSTR and CHOWW STARs and KLAS NIITZ and RASLR SIDs/provides terrain avoidance)
- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)

KHND Runway 35L Transition (VICF leg to segregate from KLAS traffic)

- KITEE (existing waypoint/provides terrain avoidance and utilized for segregation from KLAS final to Runways 26L/R and departures off Runways 08L/R)
- JAMIA (at 060 to segregate from KLAS JOHKR, RATPK and RADYR SIDs, and from KLAS COKTL, RNDRZ and CHOWW STARs)
- ZIGLR (provides terrain avoidance)
- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)

En Route Transitions

Las Vegas OAPM Design Package

KHND OYODA (PALLY) SID

BLACK Transition

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)
- BLACK (placement is to segregate from KLAS arrivals over WHIGG and to tie into Los Angeles International Airport [KLAX] arrivals)

Blythe (BLH) Transition (ATC assigned only transition for weather avoidance)

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)
- BLACK (placement is to segregate from KLAS arrivals over WHIGG)
- DOYYL (provides continuity with BOJAC transition)
- ZELMA (existing waypoint to avoid Military Operation Areas [MOAs])
- BLH (existing ground-based navigational aid [VORTAC]/used as a tie-in point for weather reroutes to southeastern destinations)

BOJAC Transition (ATC assigned only transition for weather avoidance)

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)
- DOYYL (provides ATC flexibility for sequencing)
- BOJAC (used as a tie-in point for weather reroutes to southeastern destinations)

Hector (HEC) Transition

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)
- SLVRR (provides continuity with SLVRR transition)
- TOPAC (waypoint placement for crossing restriction to segregate from KHND NTNDO STAR)
- HEC (existing VORTAC/used for aircraft destined to the west of Los Angeles and to avoid restricted airspace)

KENNO Transition:

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)

Las Vegas OAPM Design Package
KHND OYODA (PALLY) SID

- JOHKR (placement is to tie in to KLAS procedure)
- GRYMZ (placement is to segregate from Special Use Airspace [SUA], Q13/15 Amend, and KHND GAMES STAR)
- DEDPL (to be used, if necessary, to segregate from Nellis Air Traffic Control Facility [NATCF] LEE Sector [A7 shelf] and to segregate from SUA, Q13/15 Amend, and KHND GAMES STAR)
- BIKKR (ties in to Q Route structure and segregates from KHND GAMES STAR)
- CAGEE (at or above 100 for terrain/placement is to segregate from SUA, Q13/15 Amend, and KHND GAMES STAR)
- KENNO (SID termination waypoint/placement is to segregate from SUA, Q13/15 Amend, and KHND GAMES STAR)

LVELL Transition

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)
- BLACK (placement is to segregate from KLAS arrivals over WHIGG)
- DOYYL (provides continuity with BOJAC transition)
- ZELMA (existing waypoint to avoid MOAs)
- JOTNU (existing waypoint to avoid MOAs)
- LVELL (existing waypoint to join San Diego area, Los Angeles area, Mexico and other western/southwestern destinations)

SLVRR Transition

- OYODA (placement provides a common transition point for both runways and is a coordination waypoint for L30 CYN and DAG sectors)
- JFFAR (placement is for design criteria/provides terrain avoidance)
- RADYR (placement is to tie in to KLAS procedure)SLVRR (transition for Los Angeles area airports, excluding KLAX)

Additional Design Considerations

- The KHND OYODA SID concept was validated by the D&I Team via Human in the Loop Simulation (HITLS)
- Spectrum analysis will be required for the proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

Las Vegas OAPM Design Package
KHND OYODA (PALLY) SID

The OYODA SID affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 10, 16, 17, 35, 37, 39, 53, 60
- ZOA Sectors: 33, 46
- L30 Sectors: CYN, DAG, GNT, FNL, SAT, LAK
- KHND

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/ L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- LAS/L30/HND LOA
- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- L30 SOP
- ERAM and STARS automation changes (ADRS, ADAR, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures
    - TARGETS Distribution Package
    - Flight Simulator Worksheet
    - RNAV Pro analysis results (may be completed during Evaluation Phase)
    - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

Las Vegas OAPM Design Package

KHND SCAMR SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Henderson Executive Airport (KHND) departures to eastern destinations will use a new flight path procedure called the SCAMR (pronounced “Scam-mer”) RNAV SID. The SCAMR SID will replace the current ACSIN (pronounced “Ack-sin”) and FLAMZ (pronounced "Flames") RNAV SID.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The SCAMR SID is developed around advanced navigation concepts, which will provide climbs that are more continuous.

This procedure is not anticipated to change runway usage. The SCAMR SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new SCAMR SID addresses KHND. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KHND SCAMR SID

Name of Change and Airport(s)	Change Classification
Henderson Executive Airport (KHND) SCAMR Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 8, 35, 36, 53, 54, 55 **Salt Lake City ARTCC (ZLC) Sectors: 33, 34, 44, 46** **Denver ARTCC (ZDV) Sectors: 23, 24, 36, 68** **Albuquerque ARTCC (ZAB) Sectors: 37, 43, 45, 67, 92** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: CYN, DAG, MED, LAK** **Nellis Air Traffic Control Facility (NATCF)** **KHND**	**McCarran International Airport (KLAS) RASLR, RATPK, NIITZ and GIDGT SIDs**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

Study Team Issues and Solutions

Issues

Stakeholders requested procedures for the Las Vegas satellite airports, which provide predictable, repeatable course guidance and reduce dependencies between operations at neighboring airports. The MST designed conceptual Standard Terminal Arrival Routes (STARs) and SIDs for KHND and North Las Vegas Airport (KVGT).

Las Vegas OAPM Design Package
KHND SCAMR SID

MST Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design efficient Runway 17R and Runway 35L departure procedures. The MST created four conceptual RNAV SIDs (KHND E SID, KHND NE SID, KHND SE SID, and KHND SW/NW SID) (See Figure 1). Mountainous terrain near the KHND airport was a primary concern in developing these procedures.

To provide common en route transitions, the KHND SIDs follow conceptual KLAS SIDs. L30 and ZLA expressed concerns about mountainous terrain for Runway 35L departure procedures and gaps in surveillance coverage on the KHND SW/NW SID.

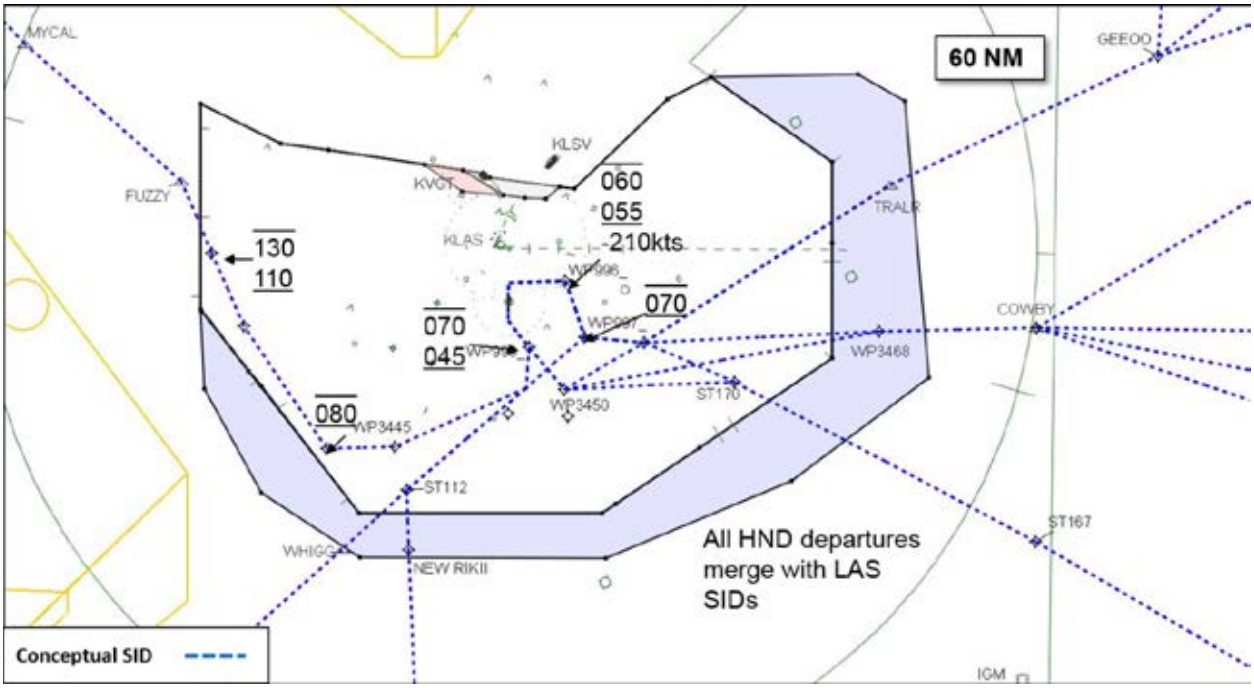

Figure 1: MST KHND Conceptual SIDs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations.

The D&I Team decided to design two SIDs (SCAMR and OYODA) in order to reduce ATC complexity and chart clutter caused by too many transitions.

The top altitude of the SCAMR SID is 060 to segregate from KLAS procedures.

Las Vegas OAPM Design Package
KHND SCAMR SID

The KHND SCAMR SID is depicted in Figure 2.

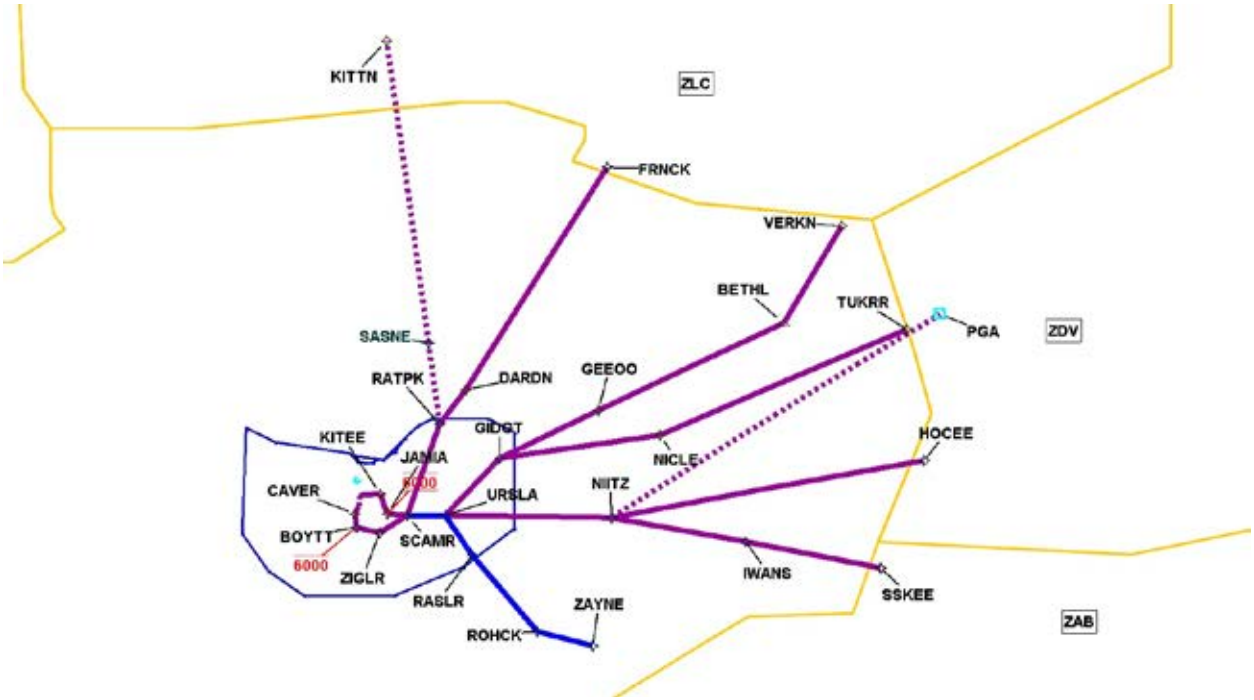

Figure 2: KHND SCAMR SID - Proposed Final Design

Runway Transitions

KHND Runway 17R Transition (VICF leg)

- CAVER (existing waypoint/provides terrain avoidance)
- BOYTT (at or below 060 to segregate from KLAS RKSTR and CHOWW STARs and KLAS NIITZ and RASLR SIDs/provides terrain avoidance)
- ZIGLR (provides terrain avoidance)
- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)

KHND Runway 35L Transition (VICF leg)

- KITEE (existing waypoint/provides terrain avoidance and utilized for segregation from KLAS final to Runways 26L/R and departures off Runways 08L/R)
- JAMIA (at 060 to segregate from KLAS JOHKR, RADYR and RATPK SIDs, and from KLAS COKTL, RNDRZ and CHOWW STARs)
- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint L30)

En Route Transitions

Las Vegas OAPM Design Package
KHND SCAMR SID

FRNCK Transition (for aircraft transitioning to ZLC)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- RATPK (joins same lateral tracks as the KLAS RATPK SID)
- DARDN (joins same lateral tracks as the KLAS RATPK SID)
- FRNCK (joins same lateral tracks as the KLAS RATPK SID)

HOCEE Transition (for aircraft transitioning to ZDV)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- NIITZ (coordination waypoint)
- HOCEE (joins same lateral tracks as the KLAS NIITZ SID)

IWANS Transition (for aircraft transitioning to Phoenix Sky Harbor Airport (KPHX) and Phoenix Terminal satellite airports):

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- NIITZ (coordination waypoint)
- IWANS (joins same lateral tracks as the KLAS NIITZ SID)

KITTN Transition (ATC assigned only/utilized to reduce track miles when Special Use Airspace (SUA) is not in use)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- RATPK (joins same lateral tracks as the KLAS RATPK SID)
- SASNE (joins same lateral tracks as the KLAS RATPK SID)
- KITTN (joins same lateral tracks as the KLAS RATPK SID)

PGA Transition (ATC assigned only/utilized for weather avoidance for aircraft transitioning to the Northeast)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- NIITZ (coordination waypoint)
- PGA (closely aligns with the KLAS NIITZ SID, TUKKR transition lateral track)

Las Vegas OAPM Design Package

KHND SCAMR SID

SSKEE Transition (for aircraft transitioning to ZAB airspace)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- NIITZ (coordination waypoint)
- IWANS (joins same lateral tracks as the KLAS NIITZ SID)
- SSKEE (joins same lateral tracks as the KLAS NIITZ SID)

TUKRR Transition (for aircraft transitioning to ZDV)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- GIDGT (coordination waypoint for L30)
- NICLE (joins same lateral tracks as the KLAS GIDGT SID)
- TUKRR (joins same lateral tracks as the KLAS GIDGT SID)

VERKN Transition (for aircraft transitioning to ZLC)

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- GIDGT (coordination waypoint for L30)
- GEEOO (joins same lateral tracks as the KLAS GIDGT SID)
- BETHL (joins same lateral tracks as the KLAS GIDGT SID)
- VERKN (joins same lateral tracks as the KLAS GIDGT SID)

ZAYNE Transition (for aircraft transitioning to KPHX

- SCAMR (placement provides a common transition point for both runways and is a coordination waypoint for L30)
- URSLA (segregates from KLAS CHOWW and RKSTR STARs/serves as transition point to join same lateral tracks as the KLAS GIDGT, NIITZ and RASLR SIDs)
- RASLR (coordination waypoint for L30)
- ROHCK (joins same lateral tracks as the KLAS RASLR SID)
- ZAYNE (joins same lateral tracks as the KLAS RASLR SID)

Additional Design Considerations

- The KHND SCAMR SID concept was validated by the D&I Team via Human in the Loop Simulation (HITLS)
- Spectrum analysis will be required for the proposed airspace changes associated with the proposed SID

Las Vegas OAPM Design Package
KHND SCAMR SID

- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The SCAMR SID affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 8, 35, 36, 53, 54, 55
- ZLC Sectors: 33, 34, 44, 46
- ZDV Sectors: 23, 24, 36, 68
- ZAB Sectors: 37, 43, 45, 67, 92
- L30 Sectors: CYN, DAG, MED, LAK
- NATCF
- KHND

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/ L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZLC LOA
- ZLA/ZDV LOA
- ZLA/ZAB LOA
- L30/LAS/HND LOA
- ZLA Standard Operating Procedures (SOP)
- ZLC SOP
- ZDV SOP
- ZAB SOP
- L30 SOP
- HND SOP
- VGT SOP
- ERAM and STARS automation changes (ADRS, ADAR, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)

- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

Las Vegas Metroplex KLAS GIDGT SID Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
1/29/20	The fix JETTG as currently documented causes a turn in the segment from GEEZY to GIDGT and will not properly evaluate. Using a proposed new location of N360846.76 W1142826.72 moved the fix location 23 feet north and puts the fix on centerline and allows the build to evaluate with no errors. It changes the departure instructions from- TAKEOFF RWY 8L/R: CLIMB ON HEADING 078.93 TO 2682, THEN DIRECT AYVUH, CROSS AYVUH AT OR ABOVE 6000, THEN ON TRACK 079.33 TO MLVIN, THEN ON TRACK 064.45 TO CROSS GEEZY AT OR ABOVE 12000, THEN ON TRACK 064.93 TO CROSS JETTG AT OR BELOW 14000, THEN ON TRACK 064.73 TO GIDGT, THENCE... To- TAKEOFF RWY 8L/R: CLIMB ON HEADING 078.93 TO 2682, THEN DIRECT AYVUH, CROSS AYVUH AT OR ABOVE 6000, THEN ON TRACK 079.33 TO MLVIN, THEN ON TRACK 064.45 TO CROSS GEEZY AT OR ABOVE 12000, THEN ON TRACK 064.73 TO CROSS JETTG AT OR BELOW 14000, THEN ON TRACK 064.75 TO GIDGT, THENCE... JETTG is a new fix that is only used by the GIDGT RNAV SID, so moving this fix will have no effects on another procedure.	LAS Master TARGETs File	

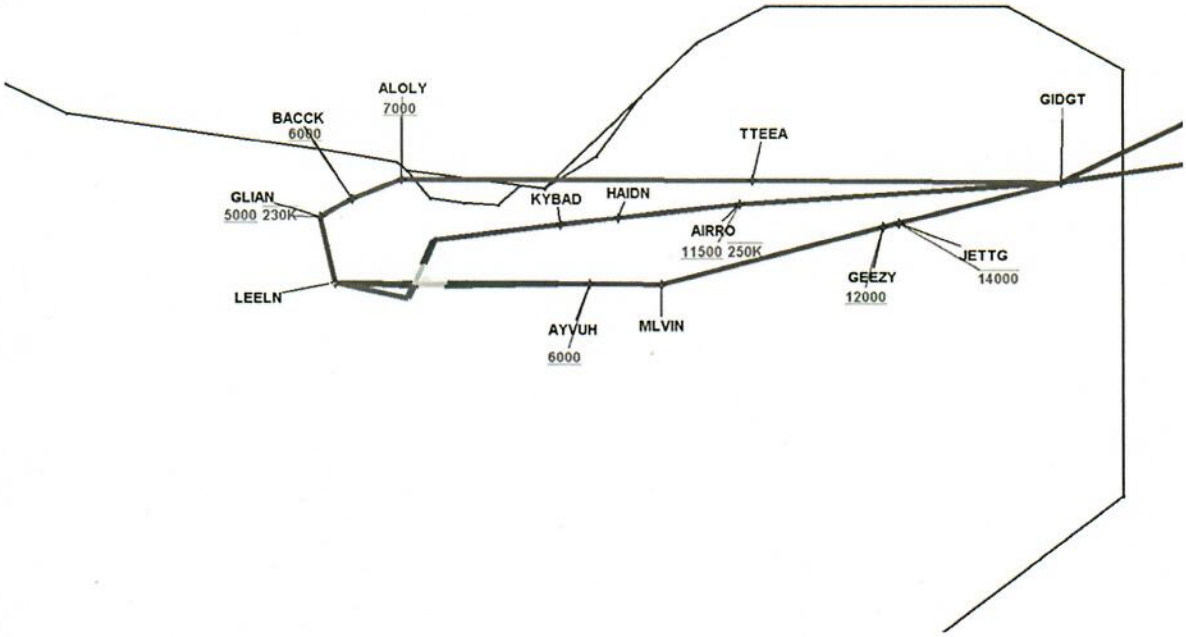

Figure 1. Original Proposed Final Design Procedure

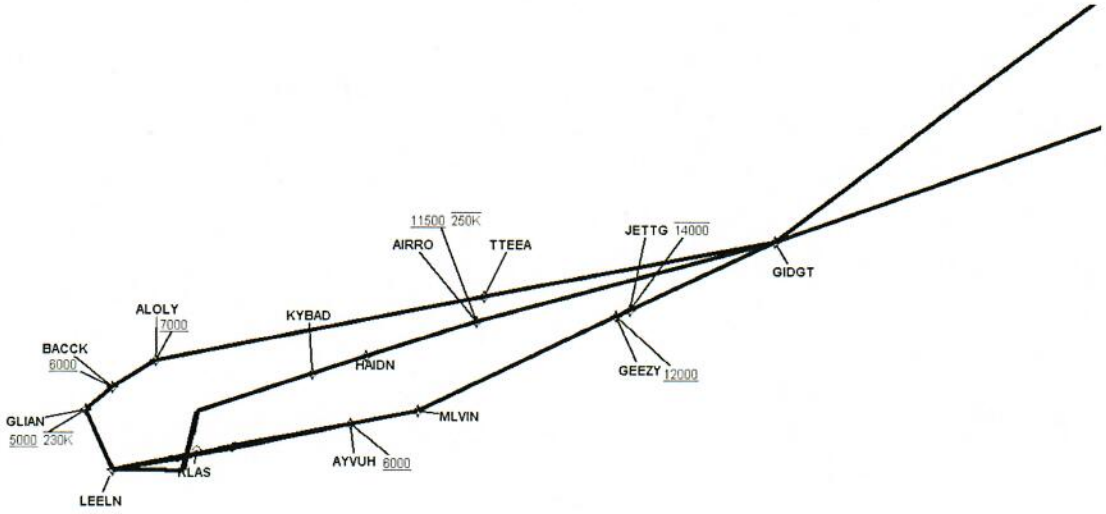

Figure 2. Revised Proposed Final Design Procedure

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

Date

NATCA Metroplex Co-Lead

2/11/2020

Date

Las Vegas OAPM Design Package

KLAS GIDGT SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to east/northeast destinations will use a new flight path procedure called the GIDGT (pronounced "GID-jet") RNAV SID. The GIDGT SID will replace the current STAAV (pronounced "Stahv") and TRALR (pronounced "Tray-ler") RNAV SIDs.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The GIDGT SID is developed around advanced navigation concepts, which will provide climbs that are more continuous.

The Las Vegas Design and Implementation (D&I) Team reviewed potential safety issues associated with the existing TRALR (Runways 19/26) and STAAV (Runway 26) SIDs that converge at the TRALR waypoint. These two SIDs depart the airport in separate directions and then join at the same point northeast of the airport. The convergence of these two SIDs at TRALR creates sequencing and separation issues for controllers, resulting in increased complexity and implementation of flow control management for departures. Flow management requires extensive ground movements in order to reroute Runway 19 departures over to Runway 26. The redirection of aircraft from one runway to another requires the crossing of two active runways and movement over several taxiways. The reassignment of takeoff runway enforces a more orderly and controllable flow after departure.

The GIDGT SID includes a right turn immediately after departure from Runway 19, allowing earlier and more efficient sequencing with Runway 26 departures. Safety will increase with the elimination of active runway and taxiway crossings. The intended use of the GIDGT SID departing Runway 19 is for general aviation aircraft parked on the west side of the airport.

The GIDGT SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new GIDGT SID addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS GIDGT SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) GIDGT Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.2	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 54, 55 **Salt Lake City ARTCC (ZLC) Sectors: 34, 46** **Denver ARTCC (ZDV) Sectors: 23, 24, 68** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: MED** **LAS Positions: LC1, LC2, LC3, GCE, GCW, CD** **KLAS**	**KLAS NIITZ and RATPK SIDs** **KLAS CHOWW Standard Terminal Arrival Route (STAR)** **Henderson Executive Airport (KHND) SCAMR SID** **KHND BOEGY STAR** **North Las Vegas Airport (KVGT) WYLND STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

Study Team Issues and Solutions

Issues

Currently, the TRALR SID is available for all configurations with Runways 26L/R and 19L/R traffic merging close to the airport over ROPPR, increasing ATC task complexity. Stakeholders identified an issue with confusion between filed routes and assigned routes, and requested a new SID that mimics the right turn on the STAAV SID. ZLA identified that the TRALR SID's MLF transition conflicts with the LAS GRNPA STAR. The TRALR SID has inefficient initial departure routes and altitudes. ZLA requested that all conceptual designs merge with Southern California Metroplex designs and have Q-Route connectivity.

Las Vegas OAPM Design Package

KLAS GIDGT SID

MST Recommendation

- The MST reduced lateral track miles by reviewing historical flight track data and designing more direct routes, and created an RNAV SID (KLAS NE2 SID) usable for all configurations that connects to the proposed Southern California Metroplex procedures.
- The KLAS NE2 SID was designed with runway transitions for all configurations and simplifies departure flows with two en route transitions, one ending at the proposed Southern California Metroplex waypoint VERKN (BCE area) and the other at WP7458 (replaces DVC transition). Both transitions join Southern California Metroplex proposed Q-Routes.
- The KLAS NE2 SID segregates Runways 19L/R departure routes from ROPPR and optimizes lateral paths and vertical profiles. To eliminate the confusion between filed routes and assigned routes, the conceptual procedure mimics the initial path of the Runways 25L/R transition of the KLAS NE1 SID. The KLAS NE2 SID en route transitions minimize the conflictions with the conceptual KLAS NE STAR.
- During procedure design, the MST looked at multiple options to replace the current TRALR SID. The options included various altitude constraints, realignment of runway transitions, and simplifying en route transitions. The KLAS NE2 SID has two en route transitions over the BCE and DVC areas. During the Second Outreach, ZLA requested that the two en route transitions be moved to points more in line with proposed Southern California Metroplex designed routes.
- The KLAS NE2 SID was designed to be available for all configurations and is not reliant on ground-based navigation. The KLAS NE2 SID provides transitions for runways and simplifies departure flows with two en route transitions, one over VERKN (BCE) and a transition over WP7458 (DVC). The proposed SID utilizes lower altitudes with reduced climb gradients.

The current TRALR SID and MST-proposed KLAS NE2 SID are depicted in Figures 1 and 2.

Las Vegas OAPM Design Package
KLAS GIDGT SID

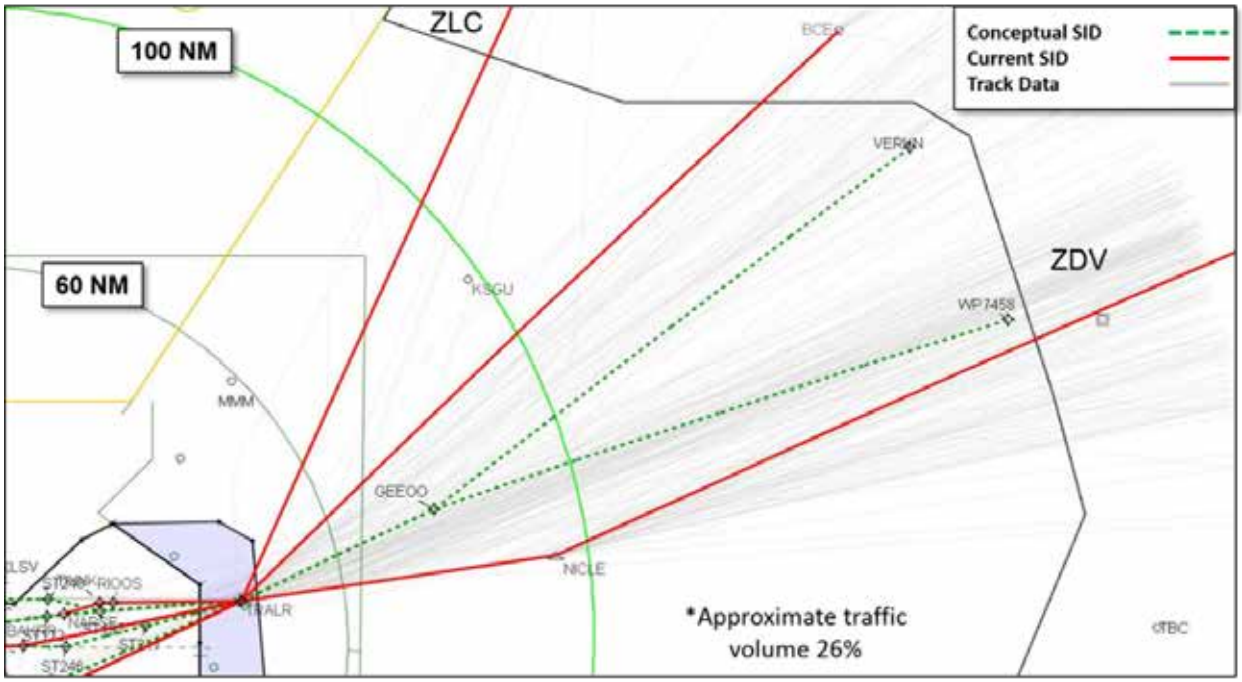

Figure 1: TRALR SID and KLAS NE2 SID – En Route View

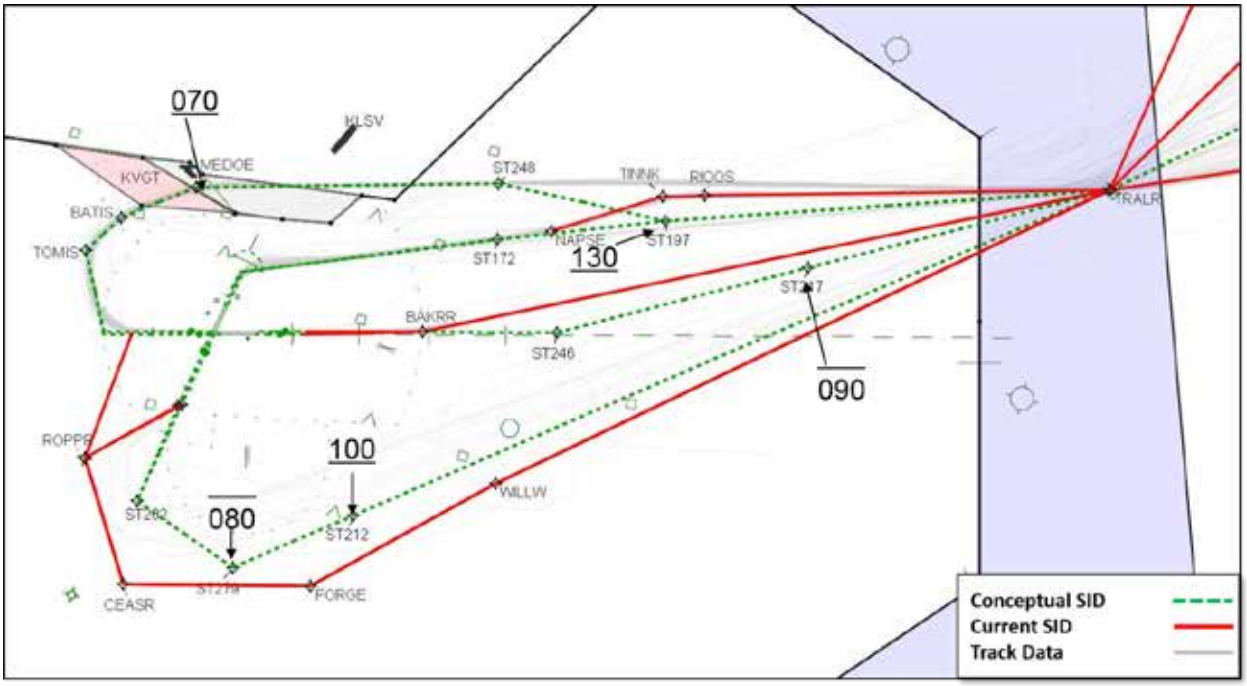

Figure 2: TRALR SID and KLAS NE2 SID - Terminal View

Las Vegas OAPM Design Package
KLAS GIDGT SID

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations.

The D&I Team reviewed potential safety issues associated with the existing TRALR (Runways 19/26) and STAAV (Runway 26) SIDs that converge at the TRALR waypoint. These two SIDs depart the airport in separate directions, and then join at the same point northeast of the airport. The convergence of these two SIDs at TRALR creates sequencing and separation issues for controllers, resulting in increased complexity and implementation of flow control management for departures. Flow management requires extensive ground movements in order to reroute Runway 19 departures over to Runway 26. The redirection of aircraft from one runway to another requires the crossing of two active runways and movement over several taxiways. The reassignment of takeoff runway enforces a more orderly and controllable flow after departure.

The GIDGT SID includes a right turn immediately after departure from Runway 19, allowing earlier and more efficient sequencing with Runway 26 departures. Safety will increase with the elimination of active runway and taxiway crossings. The intended use of the GIDGT SID departing Runway 19 is for general aviation aircraft parked on the west side of the airport.

The D&I Team amended the MST proposal, providing departure guidance from all runways at KLAS.

The KLAS GIDGT SID's Proposed Final Design (PFD) is depicted in Figures 3 and 4.

Runway Transitions

Runways 01L/R Transitions (VICF legs)

- KYBAD (common waypoint for eastbound departures)
- HAIDN (placement provides segregation from KLAS Runway 26 final)
- AIRRO (at or above 115/less than 250 knots/ facilitates the climb gradient and provides segregation from the KLAS CHOWW STAR)
- GIDGT (coordination waypoint)

Runways 08L/R Transitions (VADF legs)

- AYVUH (at or above 060/provides terrain avoidance)
- MLVIN (placement provides segregation from the KLAS Runway 19 arrival route)
- GEEZY (at or above 120/provides segregation from the KLAS RKSTR STAR)
- JETTG (at or below 140/provides segregation from the KLAS CHOWW STAR)
- GIDGT (coordination waypoint)

Las Vegas OAPM Design Package

KLAS GIDGT SID

Runways 19L/R Transitions (VICF legs)

- LEELN (existing waypoint on the current Runway 26 procedure/added to Runway 19 L/R transitions)
- GLIAN (at or above 050/less than 230 knots/ ensures climb gradient for Nellis Air Traffic Control Facility [NATCF] airspace and KVGT)
- BACCK (at or above 060/ensures climb gradient for NATCF airspace and KVGT)
- ALOLY (at or above 070/provides NATCF airspace integrity)
- TTEEA (placement provides possible restriction waypoint for segregation from the KLAS CHOWW STAR)
- GIDGT (coordination waypoint)

Runways 26L/R Transitions (VICF legs)

- LEELN (existing waypoint)
- GLIAN (at or above 050/less than 230 knots/ensures climb gradient for NATCF airspace and KVGT)
- BACCK (at or above 060/ensures climb gradient for NATCF airspace and KVGT)
- ALOLY (at or above 070/provides NATCF airspace integrity)
- TTEEA (placement provides possible restriction waypoint for segregation from the KLAS CHOWW STAR)
- GIDGT (coordination waypoint)

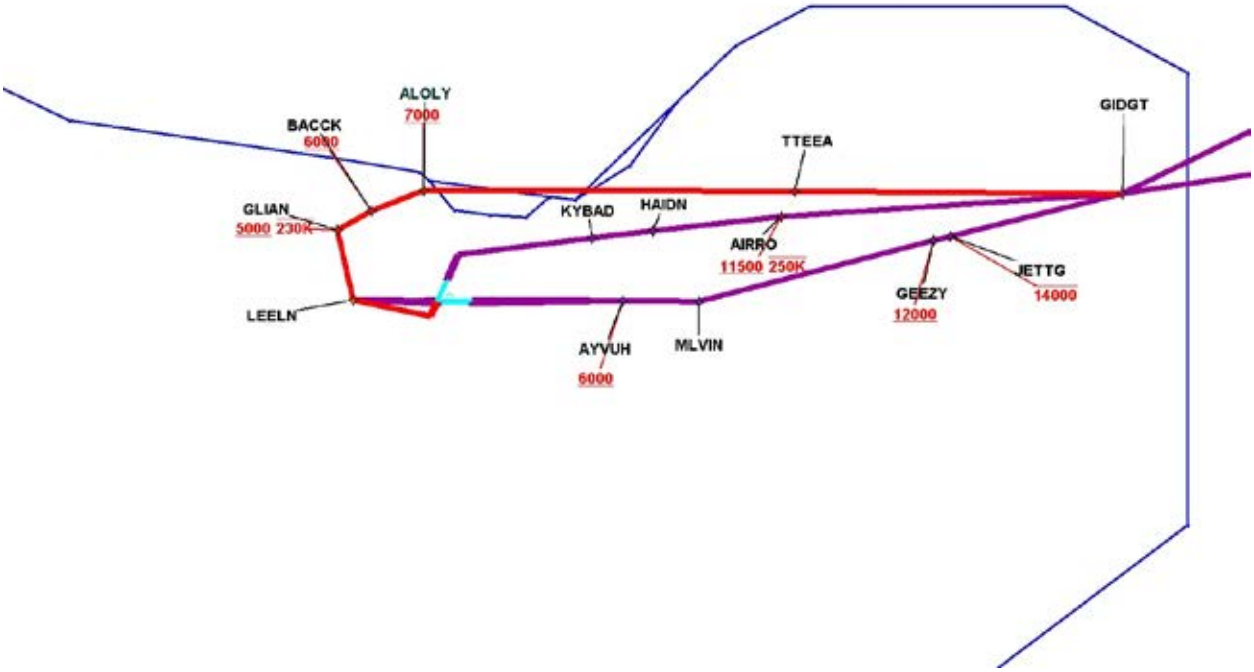

Figure 3: KLAS GIDGT SID's PFD - Terminal View

Las Vegas OAPM Design Package
KLAS GIDGT SID

En Route Transitions

The D&I Team considered the MST recommendation of one SID with three en route transitions however chose to design two separate SIDs (KLAS GIDGT and RATPK) to facilitate segregation from the KLAS CHOWW STAR.

TUKRR Transition (to ZLC)

- GIDGT (coordination waypoint)
- NICLE (existing waypoint/provides segregation from the KLAS GIDGT SID's VERKN Transition)
- TUKRR (located in ZDV airspace/used as a coordination and termination waypoint)

VERKN Transition (to ZLC)

- GIDGT (coordination waypoint)
- GEEOO (provides segregation from the KLAS CHOWW STAR)
- BETHL (provides segregation from the KLAS CHOWW STAR)
- VERKN (placement provides a coordination waypoint clear of CHOWW to return on course/provides connectivity with Q Route structure)

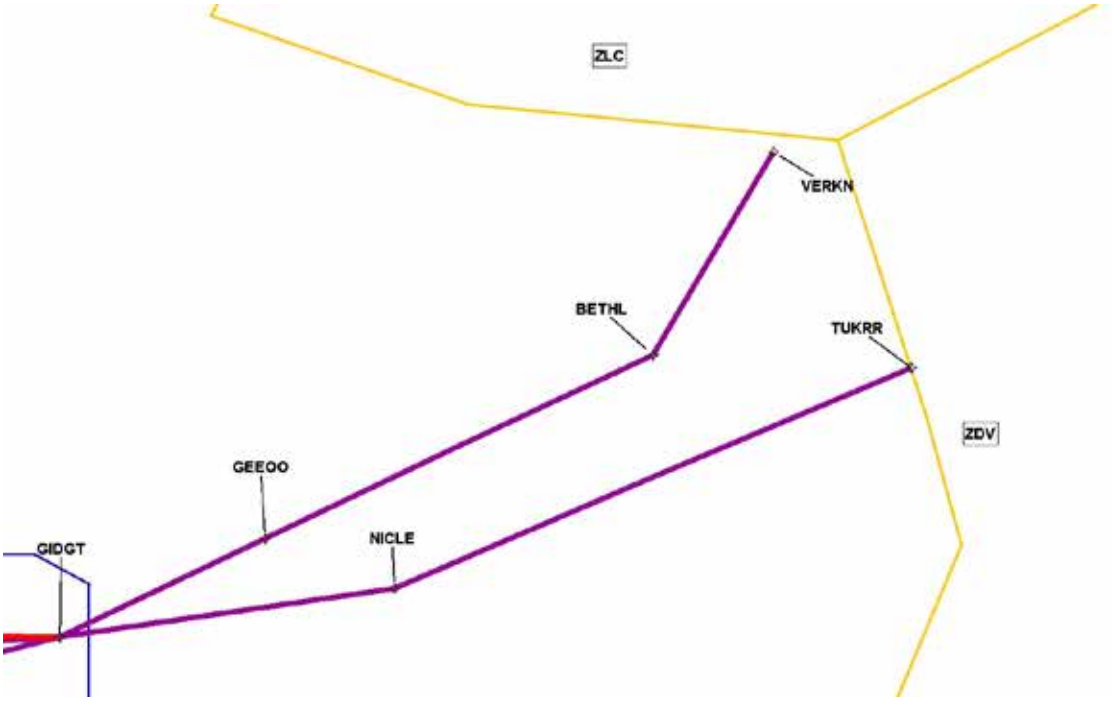

Figure 4: KLAS GIDGT SID's PFD - En Route View

Las Vegas OAPM Design Package

KLAS GIDGT SID

Additional Design Considerations

- The KLAS GIDGT SID concept was validated by the D&I Team via Human in the Loop Simulation (HITLS)
- Spectrum analysis will be required for the proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The GIDGT SID affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 54, 55
- ZLC Sectors: 34, 46
- ZDV Sectors: 23, 24, 68
- L30 Sectors: MED
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZLC LOA
- ZLA/ZDV LOA
- L30/LAS LOA
- ZLA Standard Operating Procedures (SOP)
- ZLC SOP
- ZDV SOP
- L30 SOP
- LAS SOP
- VGT SOP

- ERAM and STARs automation changes (ADAR, ADRS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 4/23/19
Bradley R. Mayhugh — Date
LAS FAA Lead

Chris Thomas 4/23/19
Chris Thomas — Date
LAS NATCA Lead

4/23/19
Sarah Fletcher — Date
ZLA Facility POC

5/2/19
Martin Ramirez — Date
ZLA NATCA POC

Anita Engelmann 4/25/19
Anita Engelmann — Date
TWAB Representative

23 Apr 19
Dan Hauptman — Date
L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

Las Vegas OAPM Design Package

KLAS JOHKR SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to northwestern destinations will use a new flight path called the JOHKR (pronounced "JOKE-her") RNAV SID. The JOKHR SID will replace the current SHEAD (pronounced "SH-head") RNAV SID.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The JOHKR SID is developed around advanced navigation concepts, which will provide climbs that are more continuous.

The JOHKR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of ten-degree divergent headings between successive departures will improve efficiency and reduce complexity.

This procedure is not anticipated to change runway usage. The JOHKR SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The JOHKR SID addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS JOHKR SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) JOHKR Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.6	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 16 **Oakland ARTCC (ZOA) Sectors: 33, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED** **LAS Positions: LC1, LC2, LC3, GCE, GCW, CD** **KLAS**	**Henderson Executive Airport (KHND) GAMES Standard Terminal Arrival Route (STAR)** **KLAS RADYR SID** **KLAS RNDRZ and COKTL STARs** **KHND OYODA SID** **KHND NTNDO STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendations

Issues

Currently, the SHEAD SID is available for all configurations with Runways 26L/R and 19L/R traffic merging close to the airport over ROPPR increasing ATC task complexity. Stakeholders agree that there are inefficiencies in the design of the SHEAD SID. There are numerous interactions between arrival and departure flows to the northwest within terminal airspace creating level segments. Traffic on the SHEAD SID typically experiences approximately five NM of level flight at 7,000 and 9,000 feet and five to ten NM at 11,000 feet. In the en route environment, the current Q-Route structure in ZLA Sector 16 does not provide necessary connectivity. ZLA Sector 16 is a very narrow volume of airspace confined on the east and west by several Special Use Airspace areas (SUAs).

The SHEAD SID requires a sharp turn at the SHEAD waypoint. The route is minimally segregated from the SHOSHONE SUA at this turn and some aircraft have difficulty with course guidance and possible incursion into the SUA. These deviations require ATC to coordinate with the Department of Defense (DoD) thus increasing controller task complexity and workload.

MST Recommendations

Based on feedback from the facilities the MST reversed flows in the northwest corridor. The MST created an RNAV SID (KLAS NW SID) usable for all configurations. The KLAS NW SID provides connectivity to the current Q-Route structure (Q162/Q13 at TUMBE) and incorporates altitude and speed restrictions to reduce pilot/controller task complexity.

Reversing the arrival and departure flows in the northwest corridor provides aircraft on the KLAS NW SID an unrestricted climb by removing all interaction with the northwest arrival traffic. By moving the departure route to the north and east, the sharp turn at SHEAD has been removed.

The MST recommendation is depicted in Figures 1 and 2.

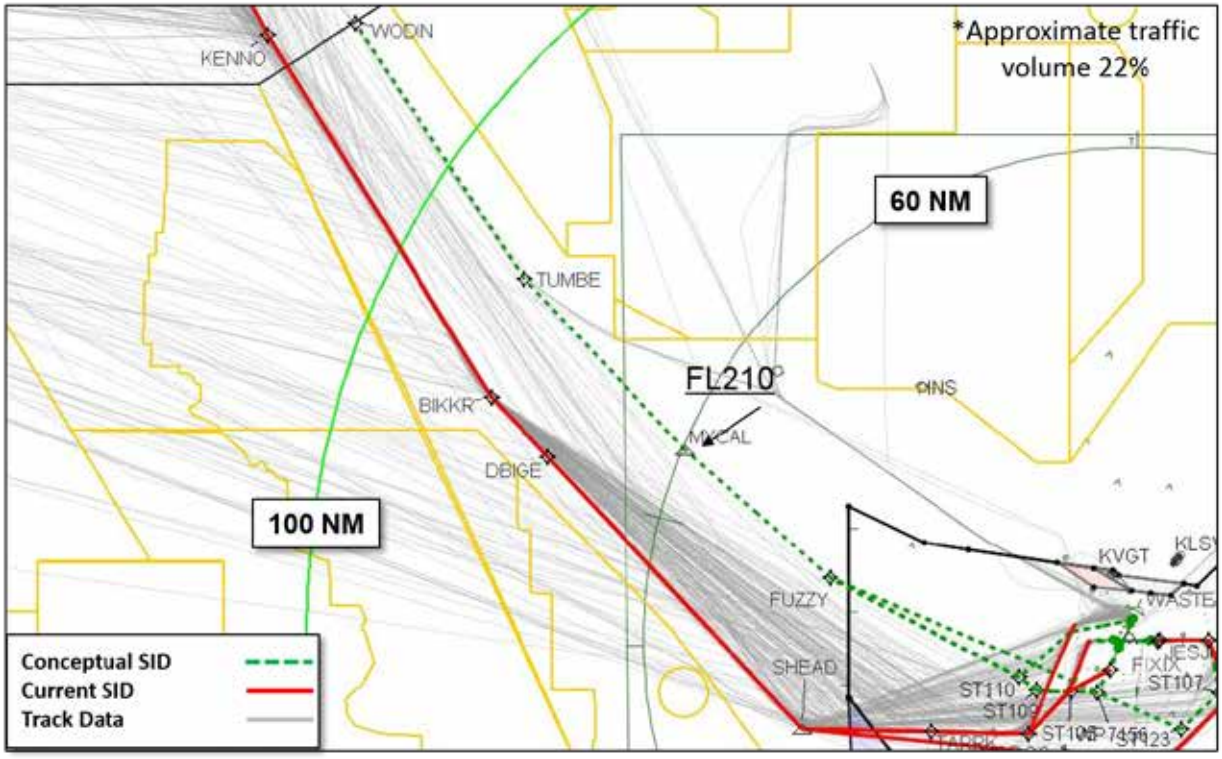

Figure 1: SHEAD SID and KLAS NW SID - En Route View

Las Vegas OAPM Design Package

KLAS JOHKR SID

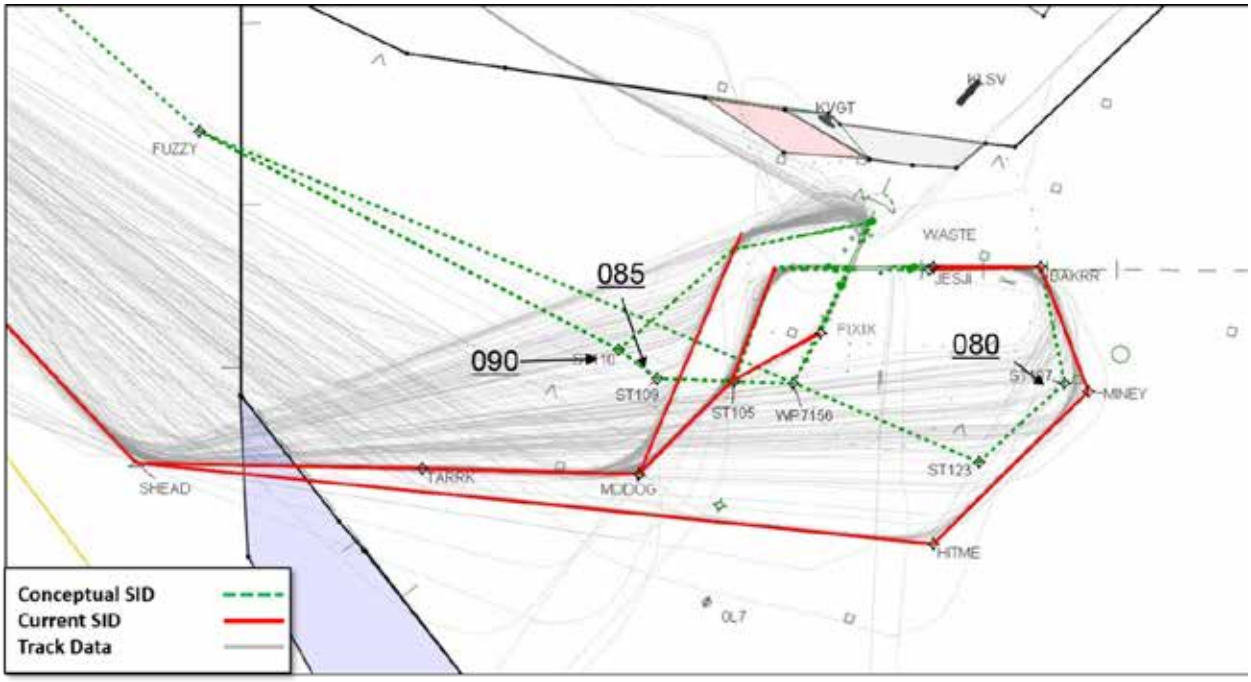

Figure 2: SHEAD SID and KLAS NW SID - Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations. The MST recommended a reversal of the arrival and departure traffic flows to the northwest.

The D&I Team utilized human in the loop simulations using I-SIM to test the conceptual designs of the MST. After analysis of the simulations and discussion with Industry partners, the D&I Team decided to omit the MST proposal and redesign the SHEAD SID without reversing the arrival and departure flows. Rationale for this decision is provided in the next section.

The JOHKR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of ten-degree divergent headings between successive departures will improve efficiency and reduce complexity.

The KLAS JOHKR SID's PFD is depicted in Figures 3 and 4.

Runway Transitions

Runways 01L/R Transitions (VADF legs)

- BESSY (at or above 050/for criteria)
- HRRLY (placement provides segregation from off load arrivals to Runway 26L/R)

Las Vegas OAPM Design Package

KLAS JOHKR SID

- KWYYN (provides segregation from the KLAS COKTL STAR)
- RAWKK (at or above 130/provides segregation from the KLAS COKTL STAR)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

- FLAAR (at or above 060/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for design criteria)
- VMPRE (provides segregation from the KLAS CHOWW and RKSTR STARs)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

Runway 08R Transition (VADF leg)

- SCAAR (placed to mirror VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for design criteria)
- VMPRE (provides segregation from the KLAS CHOWW and RKSTR STARs)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

Runways 19L/R Transitions (VADF legs)

- DEREW (at or below 070/provides segregation from the KLAS COKTL and RNDRZ STARs)
- CARNG (provides consistency with KLAS RASLR and NIITZ SIDs)
- GBLIN (required for design criteria)
- MGNTO (provides segregation from KLAS RNDRZ STAR)
- KRUGR (at or below 110/provides segregation from the KLAS RNDRZ STAR)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

Runway 26L Transition (VADF leg)

- SILTT (placed to mirror VICF leg utilized on the Runway 26R transition)
- RUDDY (at or above 040/required for design criteria and provides terrain avoidance)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- MGNTO (provides segregation from the KLAS RNDRZ STAR)
- KRUGR (at or below 110/provides segregation from the KLAS RNDRZ STAR)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

Las Vegas OAPM Design Package

KLAS JOHKR SID

Runway 26R Transition (VICF leg)

- RUDDY (at or above 040/required for design criteria and provides terrain avoidance)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- MGNTO (provides segregation from the KLAS RNDRZ STAR)
- KRUGR (at or below 110/provides segregation from the KLAS RNDRZ STAR)
- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)

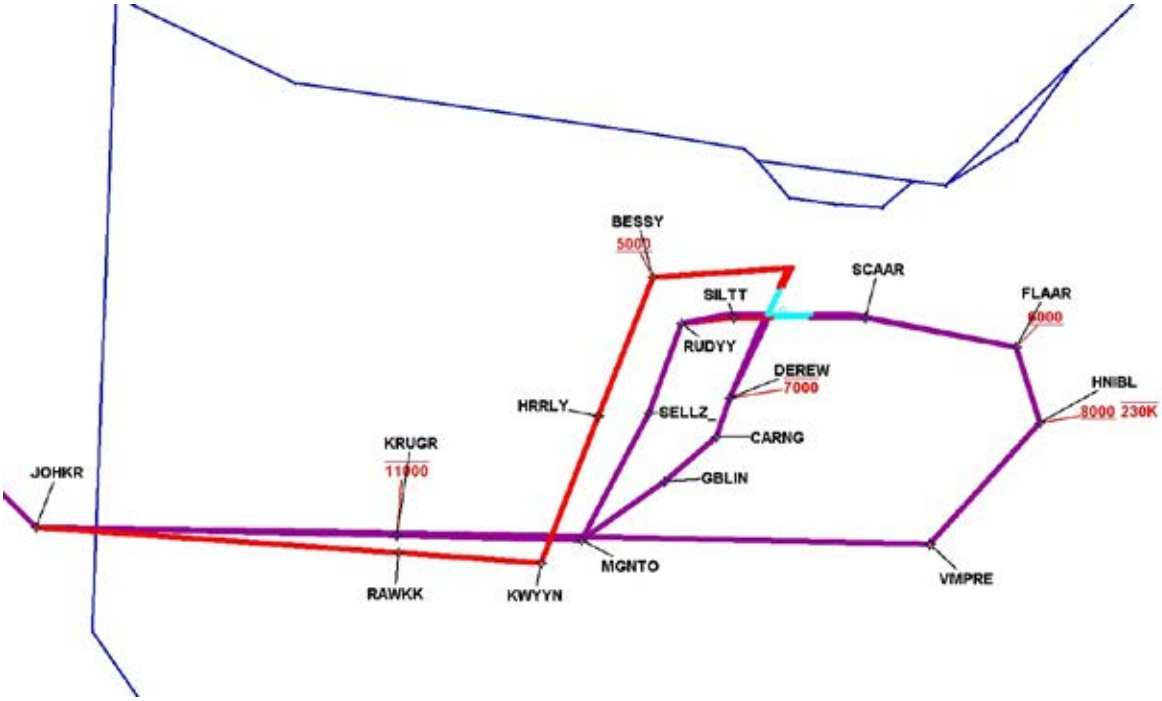

Figure 3: KLAS JOHKR SID's PFD - Terminal View

En Route Transitions

KEENO Transition

- JOHKR (placement provides a coordination waypoint with ZLA and segregation from the KHND GAMES STAR)
- GRYMZ (provides segregation from SUA, Q13/15 and the KHND GAMES STAR)
- DEDPL (placement provides ability to issue altitude restriction(s), if necessary to segregate from the Nellis Air Traffic Control Facility's [NATCF] LEE Sector (A7 shelf) and/or to segregate from SUA, Q13/15, and the KHND GAMES STAR)
- BIKKR (provides Q Route connectivity and can be used when Joshua Control Facility [JCF] airspace is not active)
- CAGEE (provides segregation from SUA, Q13/15 and the KHND GAMES STAR)

- KENNO (SID termination waypoint/placement provides segregation from SUA, Q13/15 and the KHND GAMES STAR)

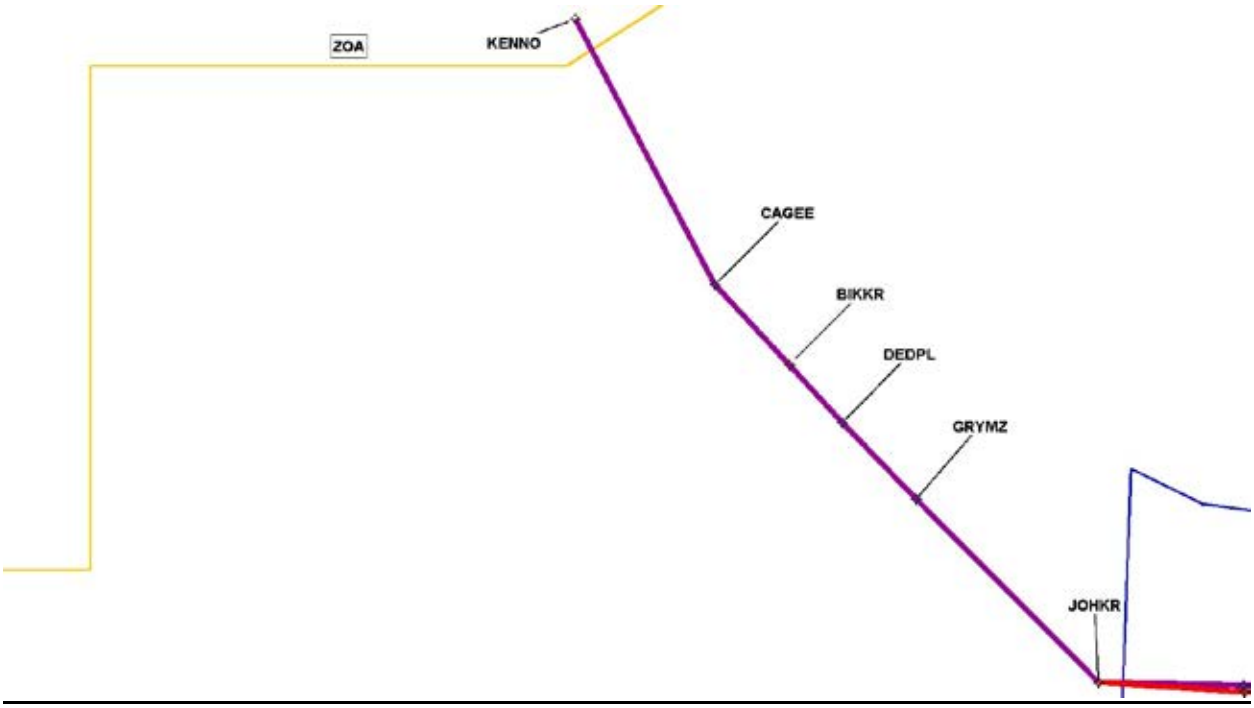

Figure 4: KLAS JOHKR SID's PFD - En Route View

MST Recommendation and D&I Team Design Differences

The MST recommended a reversal of the arrival and departure traffic flows to the northwest. The D&I Team utilized human in the loop simulations using I-SIM to test the conceptual designs of the MST. After analysis of the simulations and discussion with Industry partners, the D&I Team decided to omit the MST proposal and redesign the SHEAD SID without reversing the arrival and departure flows. The following are the reasons the team decided against the reversal of traffic flows:

- Terrain to the west of the airport rises faster than aircraft are able to climb
  - Aircraft would have difficulty meeting an excessive climb gradient to 10,000 feet, especially on Configuration 3. If an aircraft was unable to meet the altitude restrictions and was below the Minimum Vectoring Altitude (MVA), L30 would have no options to mitigate the situation
  - Eliminates L30's ability to turn departures for sequencing due to departures remaining below the MVA longer
  - L30 would have reduced ability to allow aircraft to deviate if weather were to impact the area
- Department of Energy (DoE) flights (JANET Flights) are in conflict with proposed northwest departures

Las Vegas OAPM Design Package

KLAS JOHKR SID

- KHND departure routes are excessively long, especially in configurations 2 and 4, and in conflict with traffic in L30 Sectors FNL, LAK and GNT
- ZLA Sector 16 would have no room to maneuver aircraft for sequencing. Departures in proposal would be lower and could not be vectored to the west to climb (conflicted with descending arrival traffic) nor could they be vectored to the east (SUA)
- Fewer track miles on departures would not allow aircraft to climb above NATCF A7 shelf
- Inability to provide direct routings due to interactions with arrival traffic

Additional Design Considerations

- The KLAS JOHKR SID concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for the proposed airspace changes associated with the proposed SID

The JOHKR SID affects the following facility area(s) as indicated:

- ZLA Sectors: 16
- ZOA Sectors: 33, 46
- L30 Sectors: DAG, MED
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- ZLA/ L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- L30/LAS LOA
- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- L30 SOP
- LAS SOP
- ERAM and STARS automation changes (ADAR, ADRS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)

Las Vegas OAPM Design Package
KLAS JOHKR SID

- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
    - TARGETS distribution package
    - Flight Simulator worksheet
    - RNAV Pro analysis results
    - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 4/23/19
Bradley R. Mayhugh — Date
LAS FAA Lead

Chris Thomas 4/23/19
Chris Thomas — Date
LAS NATCA Lead

4/23/19
Sarah Fletcher — Date
ZLA Facility POC

5/2/19
Martin Ramirez — Date
ZLA NATCA POC

Anita Engelmann 4/25/19
Anita Engelmann — Date
TWAB Representative

23 Apr 19
Dan Hauptman — Date
L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

Las Vegas Metroplex KLAS LOHLA SID Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
12/4/2019	After submission of the procedure to Flight Standards in Oklahoma City, the Team was notified that due to differing databases, Flight Procedures changed the altitude restriction at the LOHLA waypoint from 13,300 to 13,400 for terrain.	LAS Master TARGETs File	

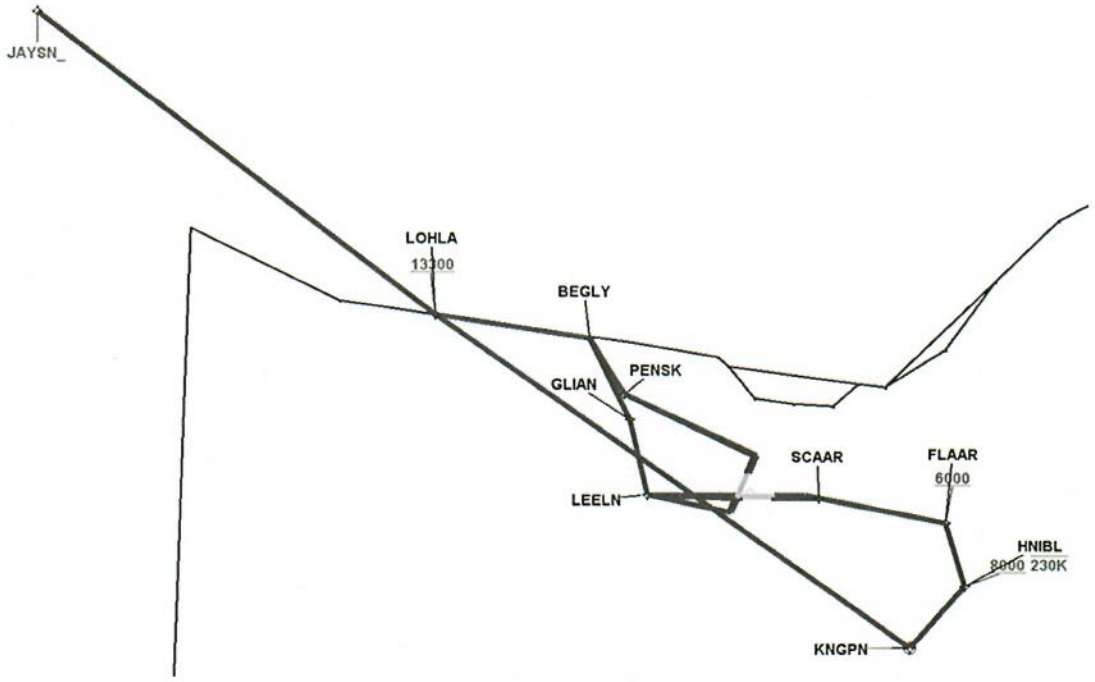

Figure 1. Original Proposed Final Design LOHLA SID

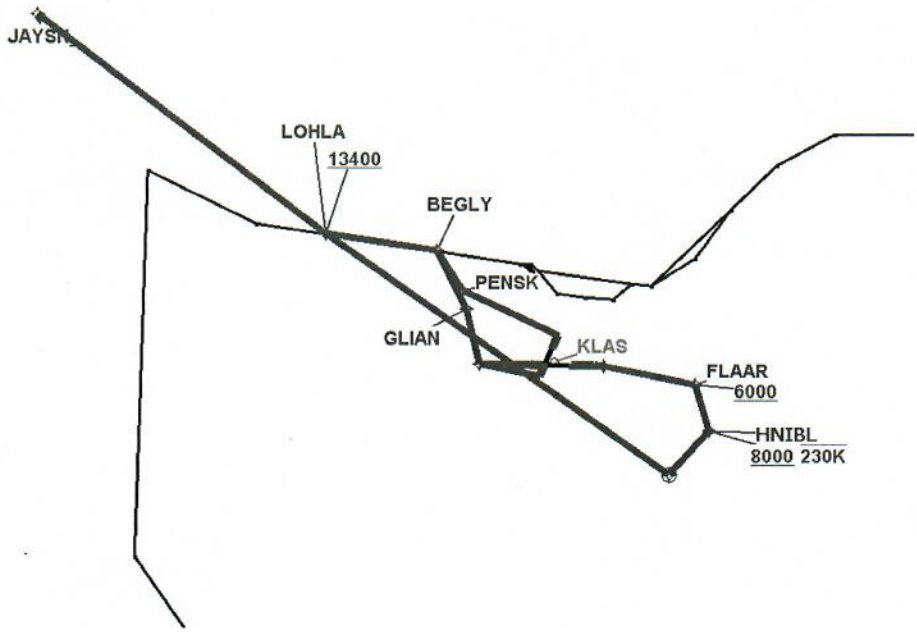

Figure 2. Revised Proposed Final Design LOHLA SID

LOHLA SID 12/4/2019

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

Date

NATCA Metroplex Co-Lead

2/11/2020

Date

Las Vegas OAPM Design Package

KLAS LOHLA SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure to serve the Tonopah Nevada Airport (KTNX) which account for up to four percent of the daily flights to/from McCarran International Airport (KLAS) utilizing modern technologies.

Aircraft departing to the northwest from KLAS to KTNX are currently directed via a historically developed routing that interferes with other traffic flows. These aircraft will use a new flight path called the LOHLA (pronounced “Low-lah”) RNAV SID. The LOHLA SID is developed around advanced navigation concepts, which will provide climbs that are more continuous.

This procedure is not anticipated to change runway usage. The LOHLA SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new LOHLA SID addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS LOHLA SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) LOHLA Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED **LAS Positions: CD, LC1, LC2, LC3, GCE, GCW** **KLAS** **KTNX** **Nellis Air Traffic Control Facility (NATCF)**	**KLAS RASLR, NIITZ, JOHKR, RATPK, RADYR and GIDGT SIDs**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The Las Vegas Metroplex Study Team (MST) did not address KLAS departures destined for Tonopah, NV (KTNX). The Las Vegas Design and Implementation Team (D&I Team) identified a need for efficient departure and arrival procedures to serve this airport which account for up to 4% of the daily flights to/from KLAS.

To protect from other traffic patterns and to address inefficiencies, the new procedure includes altitude restrictions reducing interactions with other traffic flows and allowing for less interrupted and more continuous climbs.

Study Team Recommendation

There was no specific recommendation from the MST for the development of a SID for aircraft departing KLAS to KTNX.

Proposed Final Design

Las Vegas OAPM Design Package

KLAS LOHLA SID

The LOHLA SID was designed to allow connectivity from all KLAS runways. Lateral and vertical paths were designed to provide repeatable and predictable routing, reducing interactions with other traffic flows wherever possible.

The D&I Team worked closely with the NATCF to design a KLAS departure procedure that would not interfere with Nellis Air Force Base (KLSV) departures to the west and still meet the objectives of the project.

The KLAS LOHLA SID's Proposed Final Design (PFD) is depicted in Figure 1.

Runways 01L/R Transitions (VICF legs)

- PENSK (mitigates conflictions with KLSV westbound departures/allows NATCF Controllers more time to resolve conflicts/provides segregation from North Las Vegas Airport (KVGT) departures)
- BEGLY (coordination waypoint with NATCF)
- LOHLA (at or above 133/provides terrain clearance/begins common route)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

- FLAAR (at or above 060/provides segregation from the Henderson Executive Airport (KHND) OYODA and SCAMR SIDs and the KLAS CHOWW STAR)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for design criteria)
- KNGPN (provides segregation from the KLAS CHOWW STAR)
- LOHLA (at or above 133/provides terrain clearance/begins common route)

Runway 08R Transition (VADF leg)

- SCAAR (placed to mirror VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for design criteria)
- KNGPN (provides segregation from the KLAS CHOWW STAR)
- LOHLA (at or above 133/provides terrain clearance/begins common route)

Runways 19L/R Transitions (VICF departure legs)

- LEELN (existing waypoint/ allows aircraft to depart northwest under Instrument Flight Rules [IFR] as opposed to Visual Flight Rules [VFR] over the mountainous terrain)
- GLIAN (provides continuity with other Metroplex KLAS SIDs)
- BEGLY (coordination waypoint with NATCF)
- LOHLA (at or above 133/provides terrain clearance/begins common route)

Runways 26L/R Transitions (VADF departure leg)

- LEELN (existing waypoint/allows aircraft to depart northwest under IFR as opposed to VFR over the mountainous terrain)
- GLIAN (provides continuity with other Metroplex KLAS SIDs)
- BEGLY (coordination waypoint with NATCF)
- LOHLA (at or above 133/provides terrain clearance/begins common route)

En Route Transitions

JAYSN_ Transition

- LOHLA (at or above 133/provides terrain clearance/begins common route)
- JAYSN_ (SID termination point)

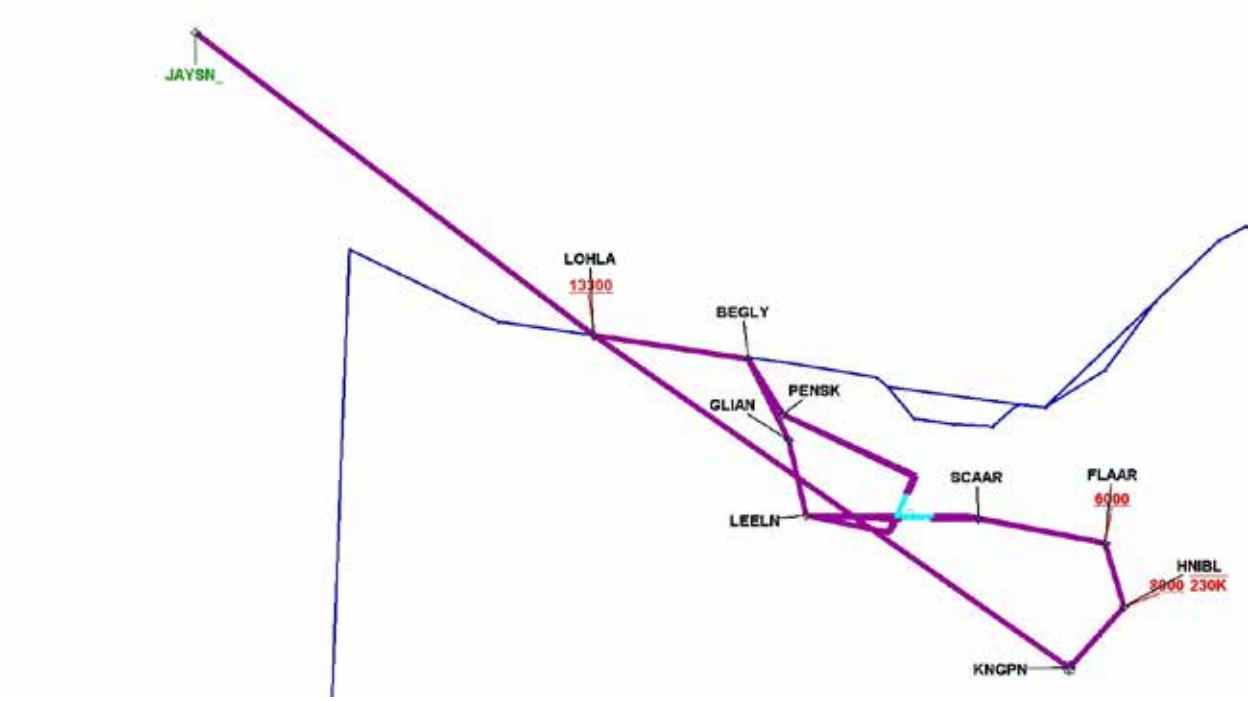

Figure 1: Proposed KLAS LOHLA SID

Additional Design Considerations

A VADF departure leg was examined by the D&I Team for the Runways 01L and 01R transitions, but due to conflictions with KLSV westbound departures, the route was adjusted further to the west to allow NATCF controllers more time to resolve any conflicts that may exist.

- The KLAS LOHLA SID concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for the proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage

- The following chart notes will be included with this procedure:
  - For turbojet aircraft only
  - ATC assigned only

The LOHLA SID affects the following facility area(s) as indicated:

-
- L30 TRACON Sectors: DAG, MED
- LAS Positions: CD, LC1, LC2, LC3, GCE, GCW
- KLAS
- KTNX
- NATCF

Implementation Dependencies

This procedure will be implemented in conjunction with other SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- L30 sector boundary maps and video maps
- L30/LAS Letter of Agreement LOA
- LAS/NATCF LOA
- L30 Standard Operation Procedures (SOP)
- LAS SOP
- STARS automation changes (ADRS, ADAR, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh 4/23/19			4/23/19
Bradley R Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	
Anita Engelmann 4/25/19			23 Apr 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	
Chris Iwanski 4-23-19		Available via electronic signature	
Chris Iwanski	Date		Date
LAS NATCA POC		Nellis Air Traffic Control Facility	

Las Vegas OAPM Design Package

KLAS NIITZ SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to eastern destinations will use a new flight path called the NIITZ (pronounced "Nights") RNAV SID. The NIITZ SID will replace the current COWBY (pronounced "COW-boy") RNAV SID.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The NIITZ SID was developed around advanced navigation concepts, which will provide climbs that are more continuous.

The NIITZ SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of 10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

This procedure is not anticipated to change runway usage. The NIITZ SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The NIITZ SID addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS NIITZ SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) NIITZ Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 8, 35, 36, 54, 55 Albuquerque ARTCC (ZAB) Sectors: 45, 67 Denver ARTCC (ZDV) Sectors: 23, 24, 36 Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD KLAS	**KLAS RASLR and GIDGT SIDs KLAS RKSTR Standard Terminal Arrival Route (STAR) Henderson Executive Airport (KHND) SCAMR SID**
Associated Data Files	
TARGETS output packages Flight Simulator worksheet RNAV Pro analysis results Human in the Loop Simulations (HITLS) results	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendations

Issues

Currently the COWBY SID is available for all configurations; however, aircraft departing Runways 19L/R and Runways 26L/R have an inefficient initial altitude constraint and merge close to the airport over ROPPR, increasing ATC task complexity.

Las Vegas OAPM Design Package

KLAS NIITZ SID

The COWBY SID is not segregated from the TYSSN STAR. The COWBY SID lacks connectivity with the proposed Phoenix Metroplex procedures. L30 and ZLA requested that a weather mitigation route be developed for aircraft departing LAS to the northeast when the TRALR SID is not usable.

Study Team Recommendations

The MST developed an RNAV SID (KLAS SE1 SID) usable in all configurations, which optimizes lateral paths and connects to the proposed Phoenix Metroplex procedures. The KLAS SE1 SID incorporates altitude and speed restrictions to reduce pilot/controller task complexity and increase efficiencies. The KLAS SE1 SID was segregated from conceptual STARs. The MST created an ATC assigned transition to the northeast to be used whenever the KLAS NE2 SID is unavailable.

The MST recommendation is depicted in Figures 1 and 2.

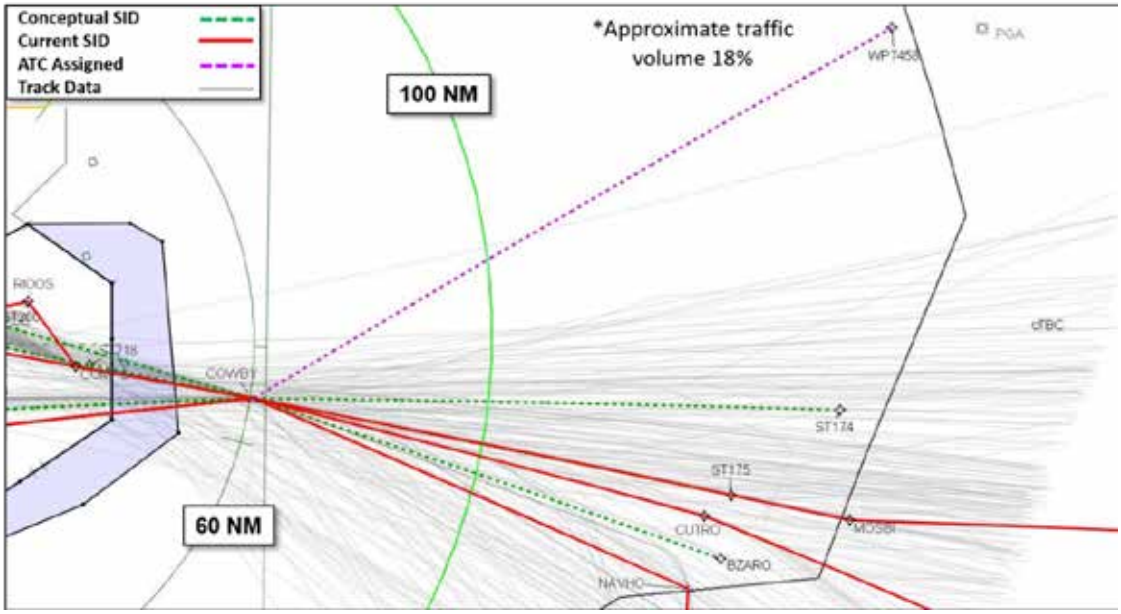

Figure 1: COWBY SID and KLAS SE1 SID - En Route View

Las Vegas OAPM Design Package

KLAS NIITZ SID

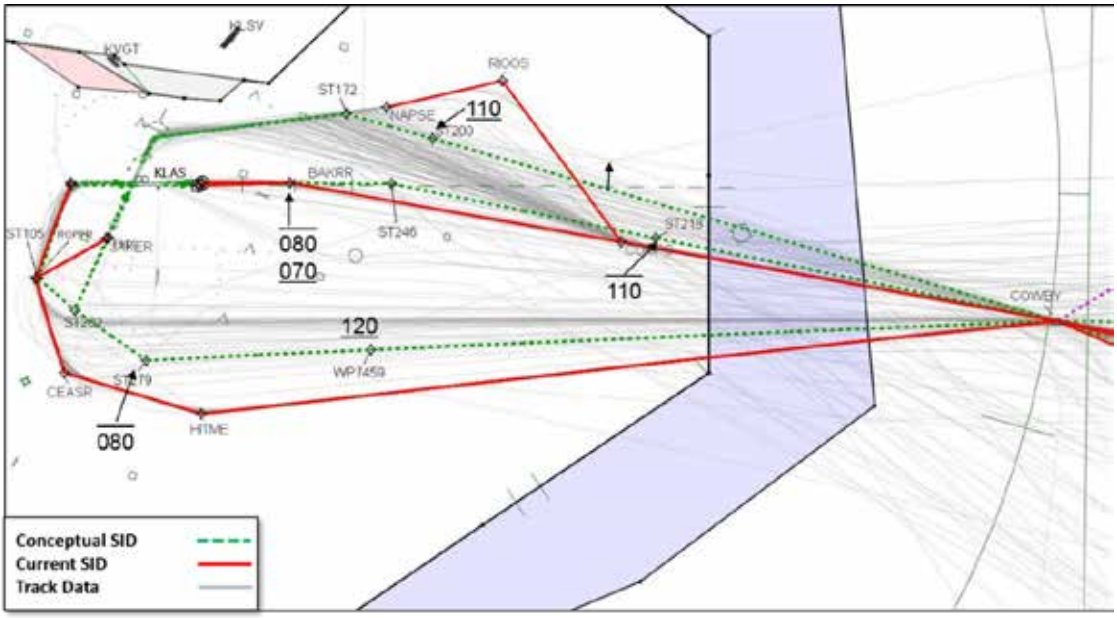

Figure 2: COWBY SID and KLAS SE1 SID - Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations. The D&I Team amended the MST proposal to provide connectivity from all runways at KLAS.

The NIITZ SID was designed to take advantage of reduced separation requirements between successive Runway 08 departures. The use of ten-degree divergent headings between successive departures will improve efficiency and reduce complexity.

The KLAS NIITZ SID's PFD is depicted in Figures 3 and 4.

Runway Transitions

Runways 01L/R Transitions (VICF legs)

- KYBAD (provides connectivity and continuity of east departures)
- HAIDN (provides segregation from KLAS Runway 26 final)
- OLBLU (at or above 100/less than 250 knots/ facilitates the climb gradient and provides segregation from the KLAS CHOWW STAR)
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for aircraft flyability)

Las Vegas OAPM Design Package

KLAS NIITZ SID

- GOLIE (provides segregation from the KLAS GIDGT SID)
- DBLII (at or below 130/provides segregation from the KLAS CHOWW STAR)
- GLDYN (at or above 120/provides segregation from the KLAS RKSTR STAR)
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Runway 08R Transition (VADF departure leg)

- SCAAR (located to mirror VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for aircraft flyability)
- GOLIE (provides segregation from the KLAS GIDGT SID)
- DBLII (at or below 130/provides segregation from the KLAS CHOWW STAR)
- GLDYN (at or above 120/provides segregation from the KLAS RKSTR STAR))
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Runways 19L/R Transitions (VADF legs)

- DEREW (at or below 070/provides segregation from the KLAS COKTL and BASIC STARs)
- CARNG (for design criteria/consolidates KLAS JOHKR, NIITZ, and RASLR SIDs)
- TTONE (at or above 070/provides segregation from KHND traffic)
- VIVVS (at or above 090/provides segregation from KHND traffic)
- SGFRD (at or above 170/provides segregation from the KLAS RKSTR STAR)
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Runway 26L Transition (VADF leg)

- SILTT (placed to mirror VICF leg utilized on the Runway 26R transition)
- RUDDY (at or above 040/provides terrain avoidance/for design criteria and aircraft flyability)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- TTONE (at or above 070/provides segregation from KHND traffic)
- VIVVS (at or above 090/provides segregation from KHND traffic)
- SGFRD (at or above 170/provides segregation from the KLAS RKSTR STAR)
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Runway 26R Transition (VICF leg)

- RUDDY (at or above 040/provides terrain avoidance/for design criteria and aircraft flyability)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- TTONE (at or above 070/provides segregation from KHND traffic)
- VIVVS (at or above 090/provides segregation from KHND traffic)
- SGFRD (at or above 170/provides segregation from the KLAS RKSTR STAR)
- NIITZ (coordination waypoint/beginning point for four en route transitions)

Las Vegas OAPM Design Package
KLAS NIITZ SID

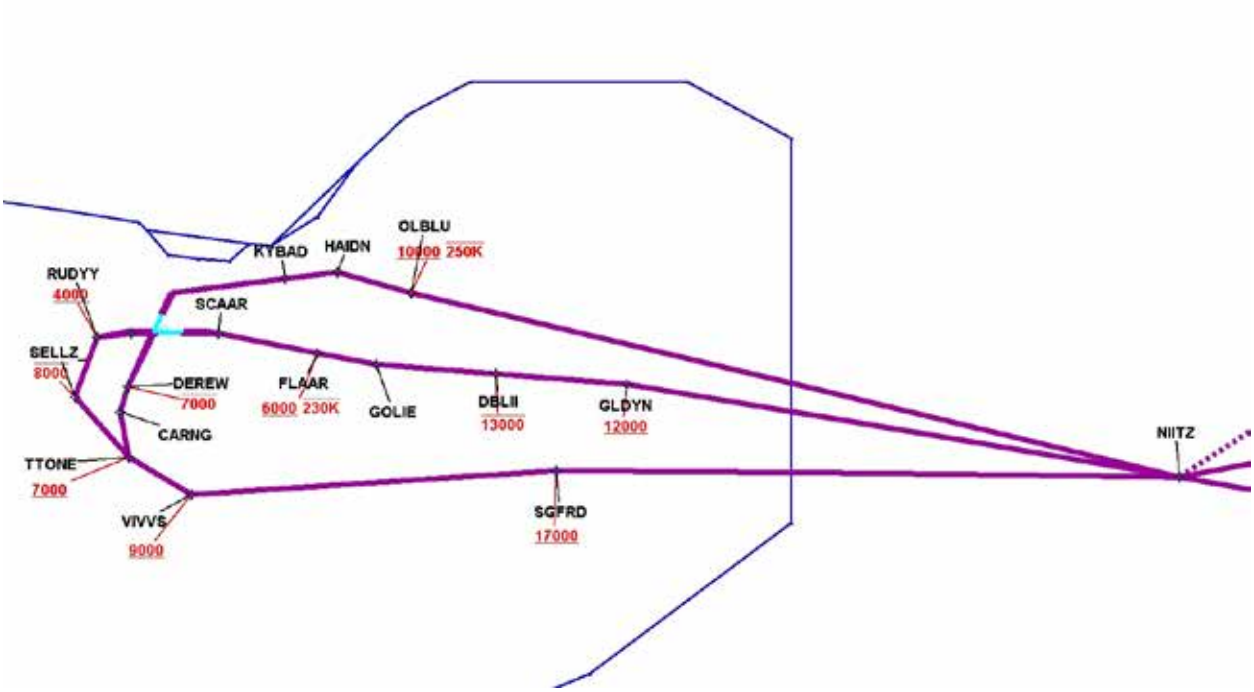

Figure 3: KLAS NIITZ SID's PFD - Terminal View

En Route Transitions

HOCEE Transition (to ZDV)

- NIITZ (placement provides avoidance of points of interest identified by the National Parks Service [NPS]/D&I Team examined several options and placed waypoint as far south as possible without interfering with the KLAS RKSTR STAR)
- HOCEE (coordination waypoint in ZDV airspace/SID termination point/ NPS had concerns with the waypoint location, but few options existed to change this location due to KLAS and Phoenix Sky Harbor International Airport [KPHX] arrival traffic)

IWANS Transition (to ZAB)

- NIITZ (placement provides avoidance of points of interest identified by the NPS/D&I Team examined several options and placed waypoint as far south as possible without interfering with the KLAS RKSTR STAR)
- IWANS (transition waypoint for the Phoenix Terminal area)

SSKEE Transition (to ZAB)

- NIITZ (placement provides avoidance of points of interest identified by the NPS/D&I Team examined several options and placed waypoint as far south as possible without interfering with the KLAS RKSTR STAR)
- IWANS (transition waypoint for Phoenix Terminal area)

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- SSKEE (coordination waypoint in ZAB airspace/SID termination point)

TUKRR Transition (ATC assigned only for weather avoidance to ZDV)

- NIITZ (placement provides avoidance of points of interest identified by the NPS/D&I Team examined several options and placed waypoint as far south as possible without interfering with the KLAS RKSTR STAR)
- TUKRR (coordination waypoint in ZDV airspace/SID termination point /NPS had concerns of the waypoint location- mitigated by the route being used only during KLAS severe weather events, with minimal traffic)

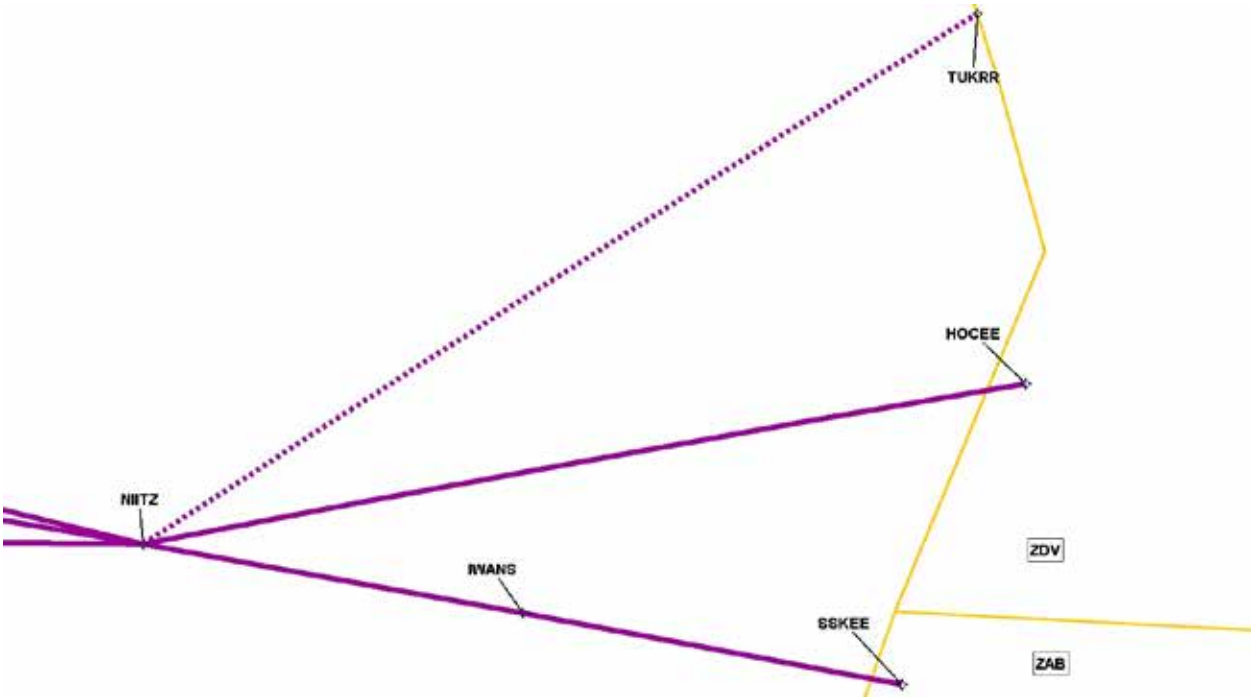

Figure 4 KLAS NIITZ SID's PFD - En Route View

Additional Design Considerations

- The KLAS NIITZ SID concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only
        - TUKKR transition ATC assigned only

The NIITZ SID affects the following facility area(s) as indicated:

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KLAS NIITZ SID

- ZLA Sectors: 7, 8, 35, 36, 54, 55
- ZAB Sectors: 45, 67
- ZDV Sectors: 23, 24, 36
- L30 Sectors: DAG, MED
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and North Las Vegas Airport (KVGT).

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZAB LOA
- ZLA/ZDV LOA
- L30/LAS LOA
- ZLA Standard Operating Procedures (SOP)
- ZAB SOP
- ZDV SOP
- L30 SOP
- LAS SOP
- ERAM and STARS automation changes (ADAR, ADRS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package

Las Vegas OAPM Design Package

KLAS NIITZ SID

- Flight Simulator worksheet
- RNAV Pro analysis results
- HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 4/23/19
Bradley R. Mayhugh — Date
LAS FAA Lead

Chris Thomas 4/23/19
Chris Thomas — Date
LAS NATCA Lead

4/23/19
Sarah Fletcher — Date
ZLA Facility POC

5/2/19
Martin Ramirez — Date
ZLA NATCA POC

Anita Engelmann 4/25/19
Anita Engelmann — Date
TWAB Representative

23 Apr 19
Dan Hauptman — Date
L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

LAS Metroplex RADYR Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
2/11/2020	The Metroplex Team discovered that the waypoint name PALIS was not available. Waypoint PALIS changed to RFUSE. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS RADYR Change Sheet

Las Vegas Metroplex KLAS RADYR SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/20/20	The Team reviewed RAYDR SID for human factor issue. The waypoint BLAQQ is not on all transitions, which could result in some flightcrew confusion. Discussed removing BLAQQ from all transitions except the BLAQQ transition. Chart will show half circle around BLAQQ for other transitions. Also discussed moving BLAQQ west 1.9 miles southwest and removing from a line DOYLL to RADYR Removed BLAQQ from LVELL and BLH transitions. Only left on BLAQQ transition. 2/20/20 update. BLAQQ has been removed from all transitions except the BLAQQ transition. Charting will indicate an The BLAQQ transition offset from the other transitions that fly over BLAQQ but do not contain BLAQQ in the route of flight. Lateral routes remain the same. No change to map.	LAS Master TARGETs File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Original Signed

Bradley R Mayhugh

FAA Metroplex Co-Lead

3-12-2020

Date

NATCA Metroplex Co-Lead

3/12/2020

Date

KLAS RADYR Change Sheet

Las Vegas Metroplex KLAS RADYR SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
1/16/20	Email from Russell Roslewski (Aeronautical Information Specialist (TERPS): *Bob,* *With RADYR, being moved slightly to align with the GFS radial, the course and distance to DOYYL changed, forcing a slight movement of DOYLL to clear leg length errors on the KLAS RADYR SID, BOJAC transition.* *DOYYL had to move 0.01 nm south. New coordinates: 350711.04N/1152111.64W* *This affects the OYODA and RADYR SIDs, but not significantly.* *I suspect this relocation will not be an issue for ATC, but please let me know if it is.* Email from Walt Alexis (Walt Alexis, LA District Airspace and Procedures Support Specialist): *According to TARGETS, DOYYL is moving 43 feet. This will have no impact on ZLA.* DOYLE is outside of L30 airspace. DOYLE lateral movement imperceptible in TARGETS graphic.	LAS Master TARGETs File	

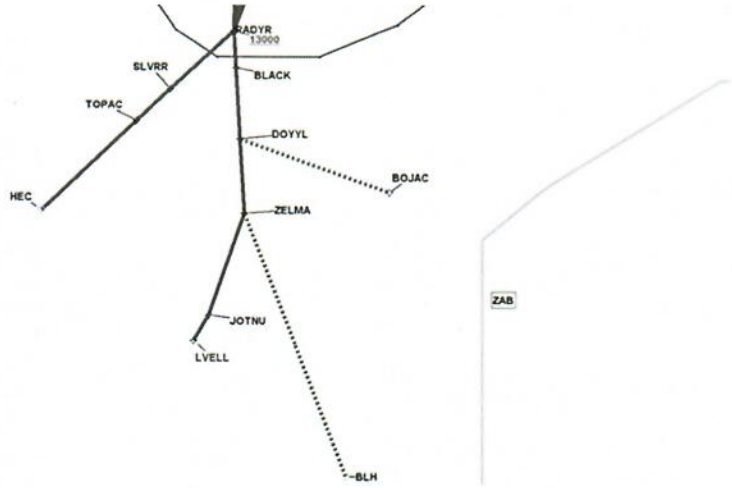

Figure 1. KLAS RADYR SID

AS RADYR Change Sheet

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

LAS Metroplex RADYR Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
11/21/19	The Metroplex Team discovered that the waypoint name BLACK was not available. Waypoint BLACK changed to BLAQQ. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

LAS Metroplex RADYR Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
11/19/19	The Metroplex Team discovered that the waypoint name BLACK was not available. Waypoint BLACK changed to BLAKK. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KLAS RADYR SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to south/southwest destinations will use a new flight path procedure called the KLAS RADYR (pronounced "ray-der") RNAV SID. The RADYR SID will replace the current BOACH (pronounced "bōCH") RNAV SID.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The RADYR SID is developed around advanced navigation concepts, which will provide more climbs that are continuous.

In a review of existing procedures by the Las Vegas Metroplex Design and Implementation Team (D&I Team), the merging of aircraft from KLAS Runways 19 and 26 on the BOACH SID shortly after departure was of particular concern. The opportunity for conflict occurring between aircraft while still below altitudes that allow controllers to stop their climb or turn aircraft was a safety issue. The BOACH SID, Runway 19 transition, routes aircraft via an unnecessary turn west, directly into the path of Runway 26 departures. While providing no operational benefit, the routing causes increased complexity and can add additional radio instructions during a critical phase of flight. The D&I Team elected to reduce this complexity by integrating two runway transitions further south.

The RADYR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of 10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

This procedure is not anticipated to change runway usage. The RADYR SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The RADYR SID addresses KLAS; however, other procedures are being proposed that will serve additional nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS RADYR SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) RADYR Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.5	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 17, 35, 36, 37, 39, 53, 60 **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED** **Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD**	**KLAS RASLR and JOHKR SIDs** **KLAS BASIC Standard Terminal Arrival Route (STAR)** **Henderson Executive Airport (KHND) NTNDO STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendations

Issues

Stakeholders agree that there are inefficiencies in the current design of the BOACH SID. Runways 19L/R and 26L/R departure traffic merge close to the airport over ROPPR with inefficient vertical profiles increasing ATC task complexity.

Facilities requested the MST to ensure that the conceptual design merges with Southern California Metroplex designs, have Q-Route connectivity, and provide a weather mitigation route.

Las Vegas OAPM Design Package
KLAS RADYR SID

Study Team Recommendations

The MST created an RNAV SID (KLAS SW SID) usable for all configurations which reduces flight track miles and connects to the proposed Southern California Metroplex procedures. The KLAS SW SID was designed with transitions for all runways and simplifies departure flows with connectivity to the proposed Southern California Metroplex.

The KLAS SW SID segregates Runways 19L/R departure routes from ROPPR and optimizes lateral paths and vertical profiles. A southeast bound weather mitigation transition was designed as an ATC assigned route.
The MST recommendation is depicted in Figures 1 and 2.

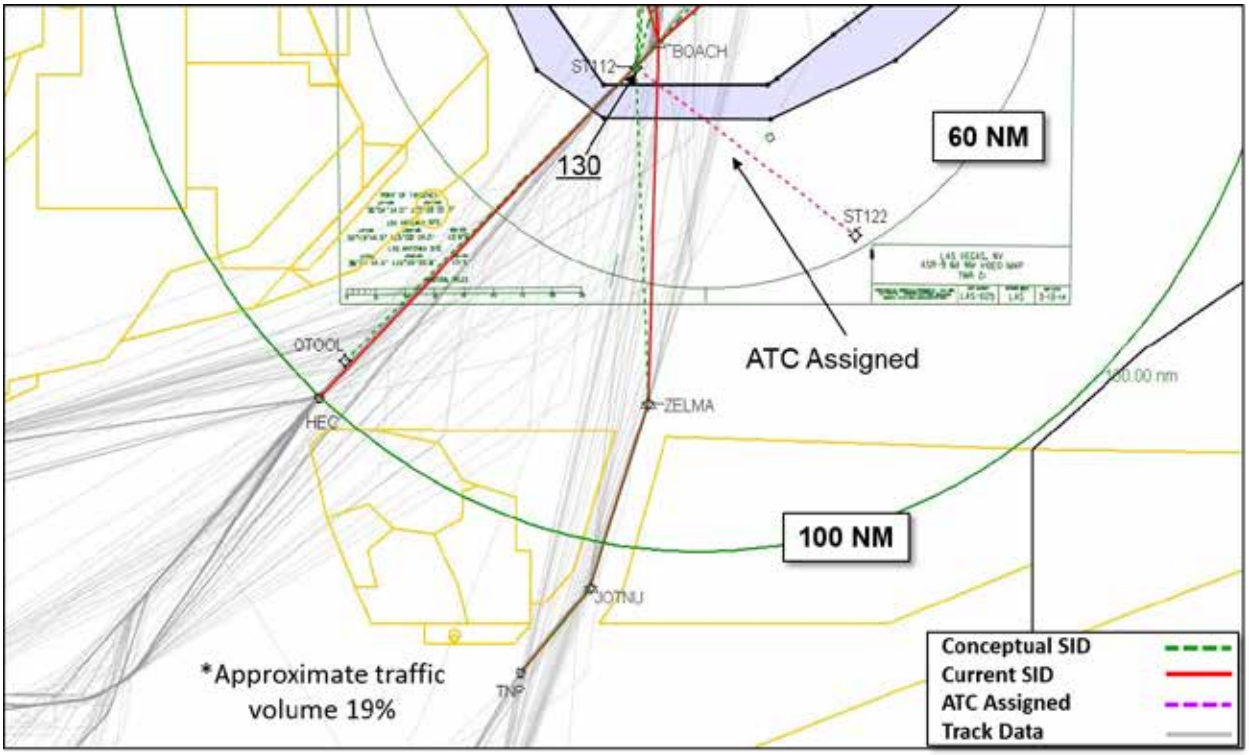

Figure 1: BOACH SID and KLAS SW SID - En Route View

Las Vegas OAPM Design Package

KLAS RADYR SID

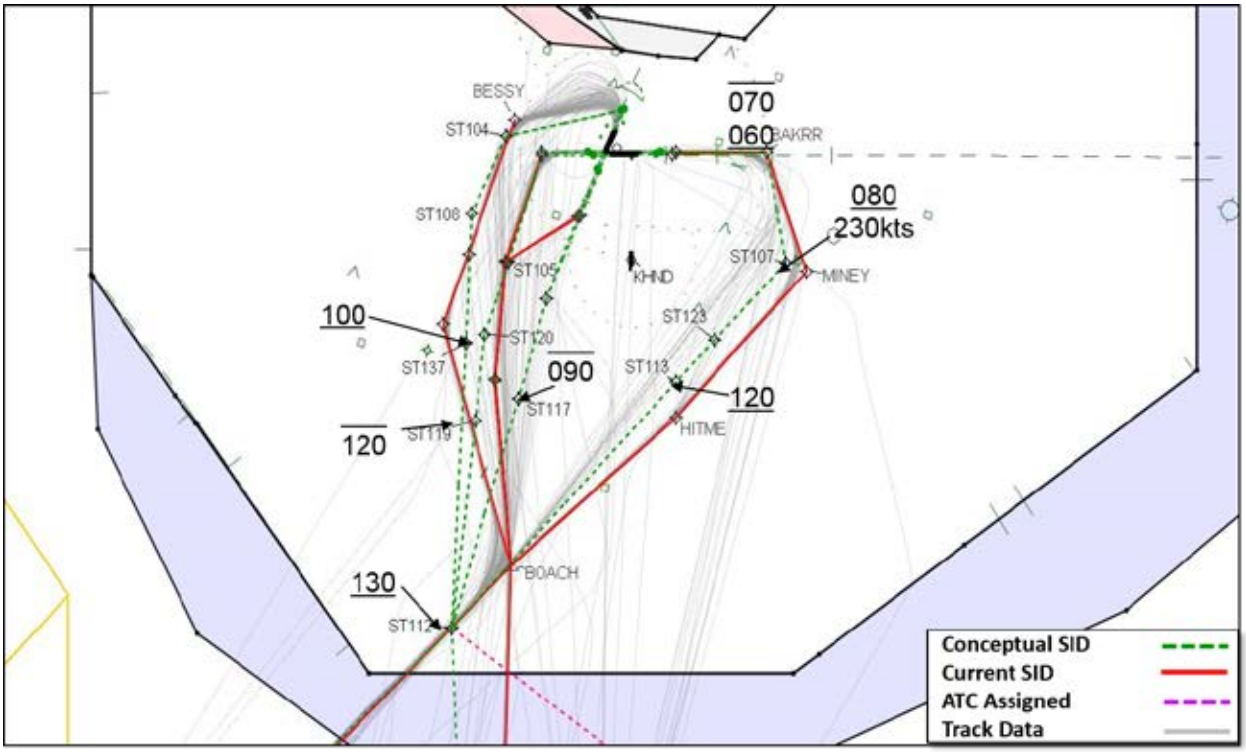

Figure 2: BOACH SID and KLAS SW SID - Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations.

In a review of existing procedures by the D&I Team, the merging of aircraft from KLAS Runways 19 and 26 on the BOACH SID shortly after departure was of particular concern. The opportunity for conflict occurring between aircraft while still below altitudes that allow controllers to stop their climb or turn aircraft was a safety issue. The BOACH SID's Runway 19 transition routes aircraft via an unnecessary turn west, directly into the path of Runway 26 departures. While providing no operational benefit, the routing causes increased complexity and can add additional radio instructions during a critical phase of flight. The D&I Team elected to reduce this complexity by integrating two runway transitions further south.

The RADYR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of 10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

The D&I Team made an additional amendment to the MST proposal, providing departure guidance from all runways at KLAS.

Las Vegas OAPM Design Package

KLAS RADYR SID

The KLAS RADYR SID's PFD is depicted in Figures 3 and 4.

Runway Transitions

Runways 01LR Transitions (VADF legs)

- BESSY (at or above 050/no greater than 230 knots/for design criteria)
- HRRLY (provides segregation from off load arrivals to runway 26)
- GRUDN (at or above 100/provides segregation from the KLAS RNDRZ and COKTL STARs)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

- FLAAR (at or above 060/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for aircraft flyability)
- VMPRE (/provides segregation from the KLAS CHOWW STAR)
- FLABB (at or above 130/provides segregation from the KLAS RKSTR and CHOWW STARs/ for airspace integrity)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

Runway 08R Transition (VADF leg)

- SCAAR (placed to mirror the VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for aircraft flyability)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction is for aircraft flyability)
- VMPRE (provides segregation from the KLAS CHOWW STAR)
- FLABB (at or above 130/provides segregation from the KLAS RKSTR and CHOWW STARs/ for airspace integrity)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

Runways 19L/R Transition (VADF legs)

- DEREW (at or below 070/provides segregation from the KLAS COKTL and RNDRZ STARs)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

Runway 26L Transition (VADF leg)

- SILTT (placed to mirror the VICF leg utilized on the Runway 26R transition)
- RUDDY (at or above 040/for design criteria)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

Las Vegas OAPM Design Package
KLAS RADYR SID

Runway 26R Transition (VICF leg utilized for 10-degree divergence with successive departures)

- RUDDY (at or above 040/for design criteria)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)

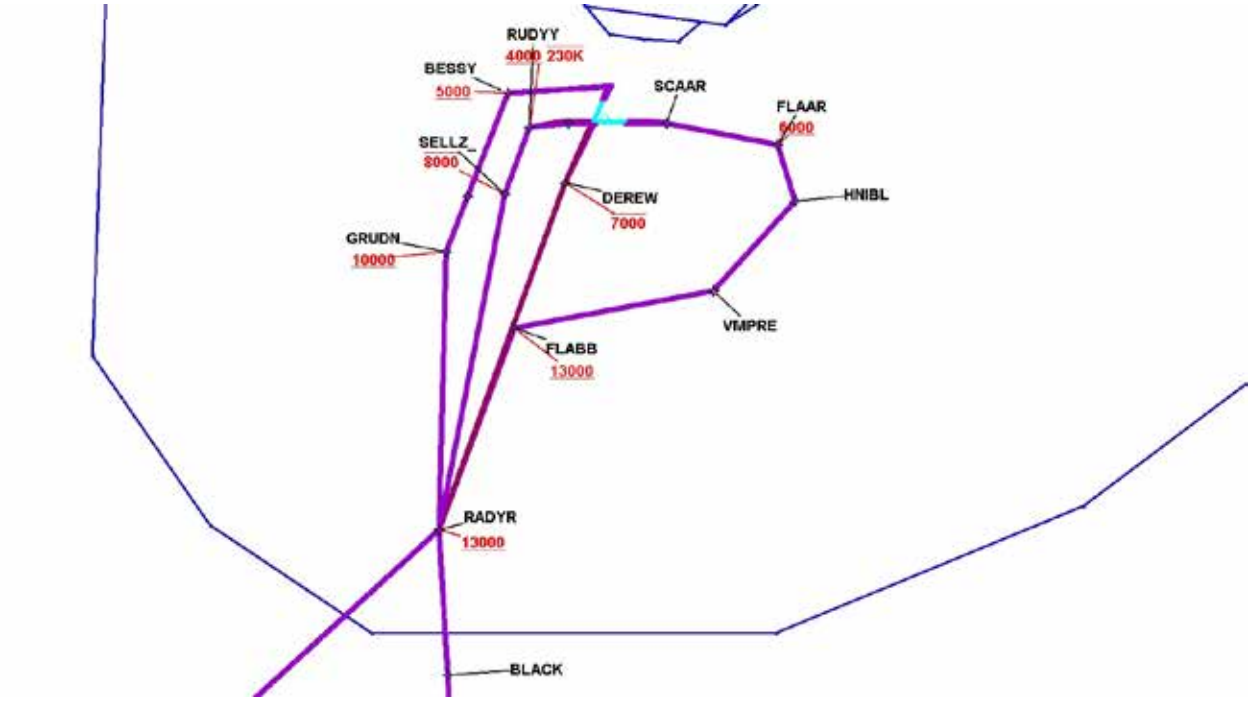

Figure 3: KLAS RADYR SID's PFD - Terminal View

En Route Transitions

BLACK Transition

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG))
- BLACK (provides segregation from KLAS arrivals over WHIGG/ tie-in point for Los Angeles International Airport [KLAX] arrivals)

Blythe (BLH) Transition (ATC assigned only transition for weather avoidance)

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)
- BLACK (provides segregation from KLAS arrivals over WHIGG)
- DOYYL (provides continuity with BOJAC transition)
- ZELMA (existing waypoint/provides avoidance of Military Operation Areas [MOAs])
- BLH (existing ground-based navigational aid [VORTAC]/used as a tie-in point for weather reroutes to southeastern destinations)

BOJAC Transition (ATC assigned only transition for weather avoidance)

Las Vegas OAPM Design Package

KLAS RADYR SID

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)
- DOYYL (provides ATC flexibility for sequencing)
- BOJAC (used as a tie-in point for weather reroutes for southeastern destinations)

Hector (HEC) Transition

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)
- SLVRR (provides continuity with SLVRR transition)
- TOPAC (waypoint placement for crossing restriction to segregate from KHND NTNDO STAR)
- HEC (existing VORTAC/used for aircraft destined to the west of Los Angeles and to avoid restricted airspace)

LVELL Transition

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)
- BLACK (provides segregation from KLAS arrivals over WHIGG)
- DOYYL (provides continuity with BOJAC transition)
- ZELMA (existing waypoint/provides avoidance of MOAs)
- JOTNU (existing waypoint/provides avoidance of MOAs))
- LVELL (existing waypoint/used to join San Diego area, Los Angeles area, Mexico and other western/southwestern destinations)

SLVRR Transition

- RADYR (at or above 130/provides segregation from prop arrivals over WHIGG)
- SLVRR (transition point for Los Angeles area airports, excluding KLAX)

Las Vegas OAPM Design Package

KLAS RADYR SID

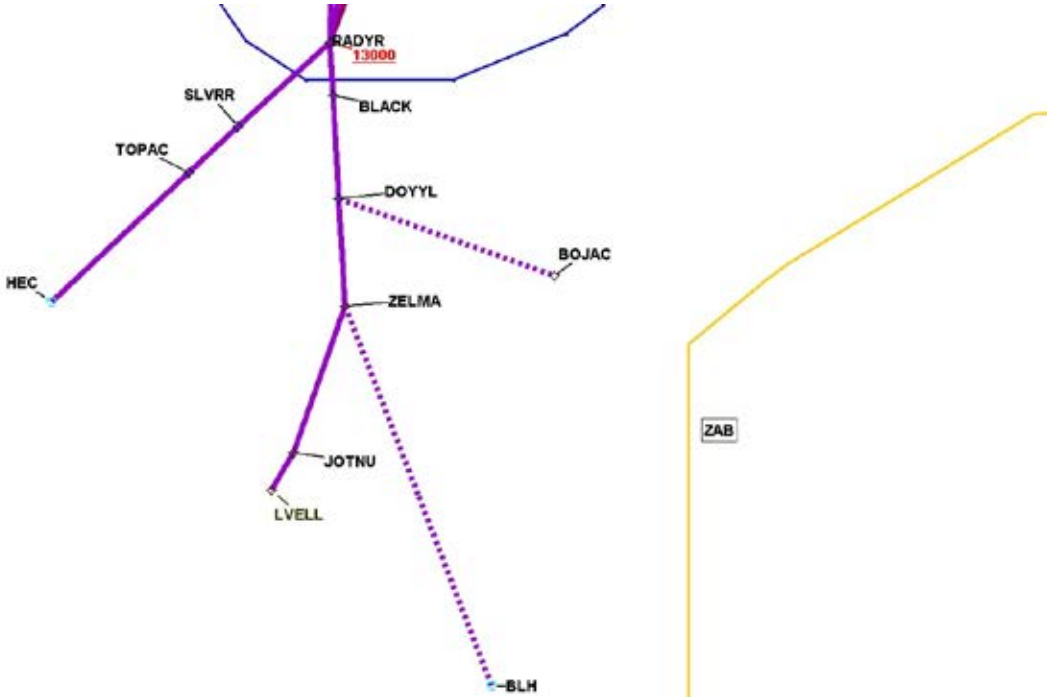

Figure 4: KLAS RADYR SID's PFD - En Route View

Additional Design Considerations

- The KLAS RADYR SID concept was validated via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The RADYR SID affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 10, 17, 35, 36, 37, 39, 53, 60
- L30 Sectors: DAG, MED
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND, KVGT and KLSV.

Las Vegas OAPM Design Package
KLAS RADYR SID

Document changes/modifications include:

- Departure SID filings with airline dispatchers
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- L30 Facility Operations and Administration Order 7210.3
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- L30/LAS LOA
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- L30 SOP
- LAS SOP
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- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

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TWAB Representative

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L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

Las Vegas OAPM Design Package

KLAS RASLR SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to southeastern destinations will use a new flight path procedure called the RASLR (pronounced "RAS-ler") RNAV SID. The RASLR SID will replace the current PRFUM (pronounced "PER-fume") RNAV SID. Additionally, current procedures do not provide routing from all the runways utilized at KLAS.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The RASLR SID was developed around advanced navigation concepts, which will provide climbs that are more continuous. The new RASLR RNAV SID will also provide connectivity from all KLAS runways.

The RASLR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of 10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

This procedure is not anticipated to change runway usage. The RASLR SID will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The RASLR SID addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KLAS RASLR SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) RASLR Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.4	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 8, 35, 36, 53 **Albuquerque ARTCC (ZAB) Sectors: 37, 43, 92** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED** **Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD** **KLAS**	**KLAS RADYR and NIITZ SIDs** **KLAS RKSTR STAR** **Henderson Executive Airport (KHND) NTNDO Standard Terminal Arrival Route (STAR)**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulations (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendations

Issues

Currently, the PRFUM SID is available in Configuration 1 only. Stakeholders requested availability of the PRFUM SID for all configurations. Aircraft departing Runways 19L/R and Runways 26L/R have an inefficient initial altitude constraint and merge close to the airport over ROPPR, increasing ATC task complexity.

Las Vegas OAPM Design Package

KLAS RASLR SID

The PRFUM SID conflicts with the KLAS TYSSN STAR at KADDY and does not align with the proposed Phoenix Metroplex procedures.

Study Team Recommendations

The MST created the KLAS SE2 SID, which is usable for all configurations and connects to the proposed Phoenix Metroplex procedures. The KLAS SE2 SID incorporates altitude and speed constraints to reduce pilot/controller task complexity and increases efficiencies. The KLAS SE2 SID was designed to be deconflicted from conceptual STARs.

The MST recommendation is depicted in Figures 1 and 2.

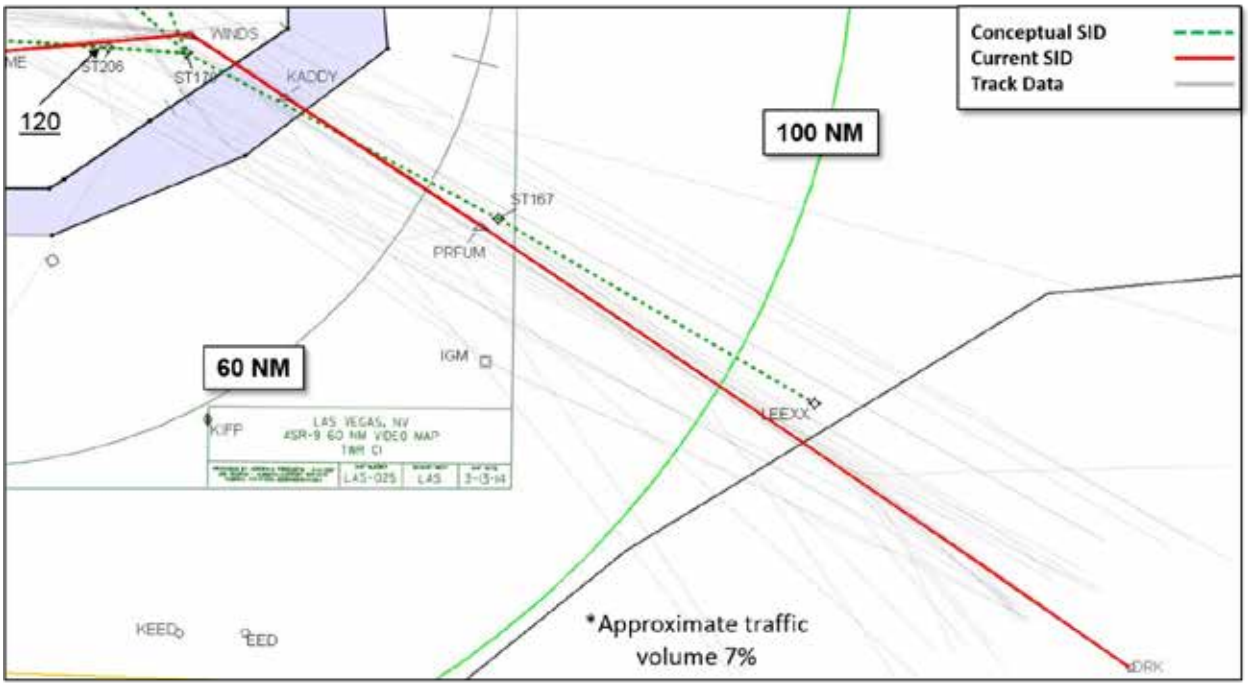


Figure 1: PRFUM SID and KLAS SE2 SID - En Route View

Las Vegas OAPM Design Package
KLAS RASLR SID

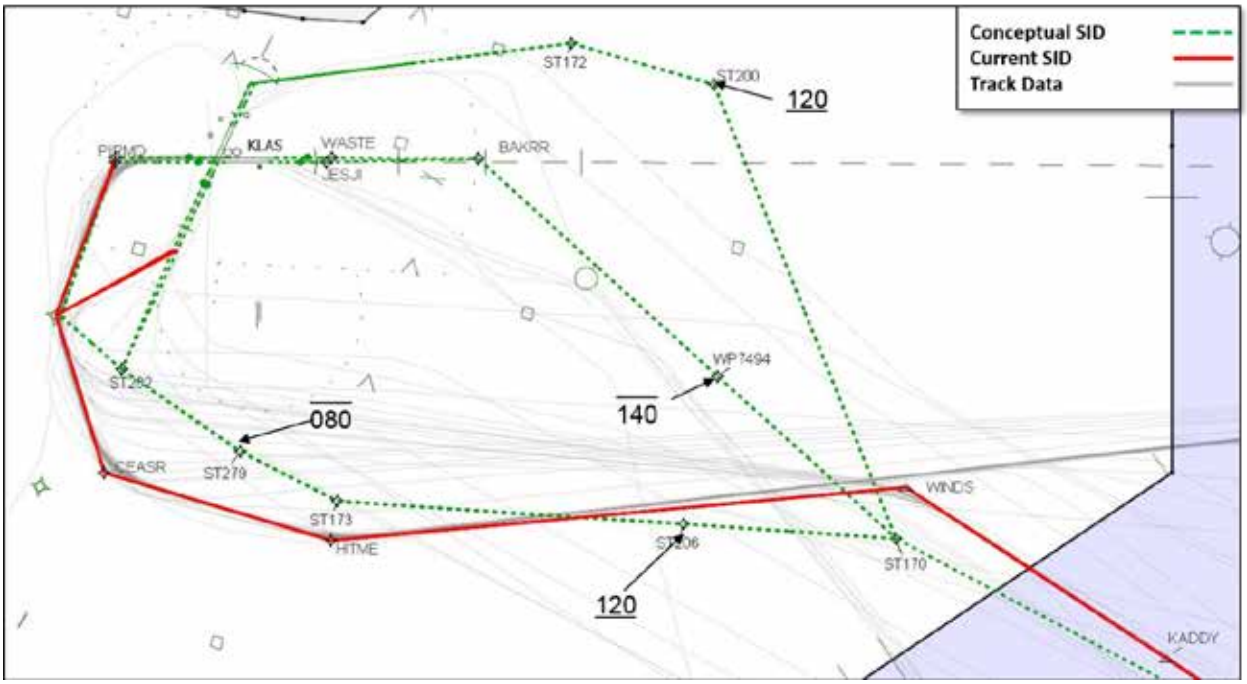


Figure 2: PRFUM SID and KLAS SE2 SID - Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations. The D&I Team amended the MST proposal to the following design, providing departure guidance from all runways at KLAS.

The RASLR SID was designed to take advantage of reduced separation requirements between successive Runway 08 or Runway 26 departures. The use of t10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

The KLAS RASLR SID's PFD is depicted in Figure 3.

Runway Transitions

Runways 01L/R Transitions (VICF legs)

- KYBAD (common waypoint for eastbound departures)
- HAIDN (provides segregation from KLAS Runway 26 final)
- OLBLU (at or above 100/less than 250 knots/facilitates the climb gradient/provides segregation from the KLAS CHOWW STAR)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

Las Vegas OAPM Design Package

KLAS RASLR SID

- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for aircraft flyability)
- ROODE (at or above 080/provides segregation from KHND traffic)
- JADWI (at or below 120/provides segregation from the KLAS RKSTR STAR)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

Runway 08R Transition (VADF leg)

- SCAAR (placed to mirror VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for aircraft flyability)
- ROODE (at or above 080/provides segregation from KHND traffic)
- JADWI (at or below 120/provides segregation from the KLAS RKSTR STAR)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

Runways 19L/R Transitions (VADF legs)

- DEREW (at or below 070/provides segregation from the KLAS COKTL and RNDRZ STARs)
- CARNG (for design criteria/consolidates KLAS JOHKR, NIITZ, and RASLR SIDs)
- TTONE (at or above 070/provides segregation from KHND traffic)
- VIVVS (at or above 090/provides segregation from KHND traffic)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

Runway 26L Transition (VADF leg)

- SILTT (placed to mirror VICF leg utilized on the Runway 26R transition)
- RUDDY (at or above 040/no greater than 230 knots/provides terrain avoidance/for design criteria and aircraft flyability)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- TTONE (at or above 070/provides segregation from KHND traffic)
- VIVVS (at or above 090/provides segregation from KHND traffic)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

Runway 26R Transition (VICF leg)

- RUDDY (at or above 040/no greater than 230 knots/provides terrain avoidance/for design criteria and aircraft flyability)
- SELLZ (at or below 080/provides segregation from the KLAS COKTL and RNDRZ STARs)
- TTONE (at or above 070/provides from KHND traffic)
- VIVVS (at or above 090/provides from KHND traffic)
- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)

En Route Transitions

ZAYNE Transition

KLAS RASLR (PRFUM) SID

Las Vegas OAPM Design Package

KLAS RASLR SID

- RASLR (at or above 130/provides segregation from the KLAS RKSTR STAR)
- ROHCK (provides segregation from the KLAS RKSTR STAR's ELLDA transition)
- ZAYNE (allows ZLA to issue routing "direct WOTRO" for Phoenix Sky Harbor International Airport [KPHX] arrivals, "direct KIDDR" for Phoenix area satellite airports, and "direct DRK" for aircraft filed over DRK)

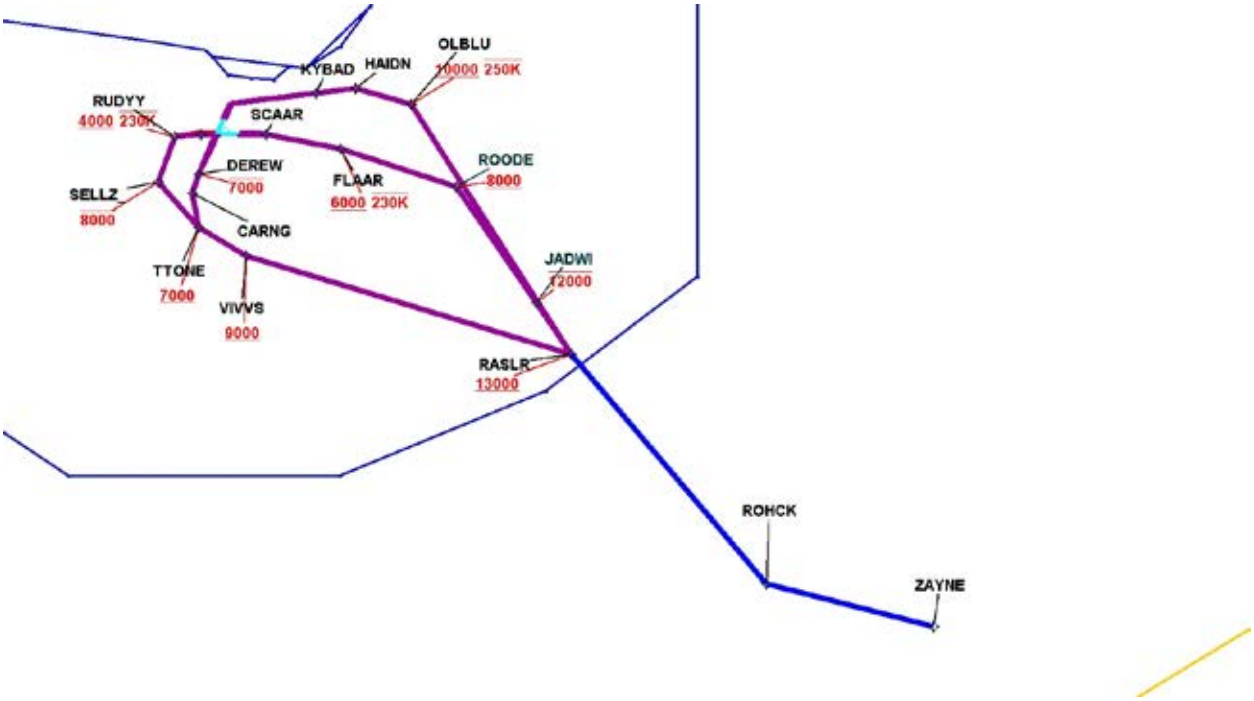


Figure 33: KLAS RASLR SID's PFD -

Additional Design Considerations

- The KLAS RASLR SID concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The RASLR SID affects the following facility area(s) as indicated:

-
- ZLA Sectors: 8, 35, 36, 53
- ZAB Sectors: 37, 43, 92
- L30 Sectors: DAG, MED

Las Vegas OAPM Design Package

KLAS RASLR SID

- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and North Las Vegas Airport (KVGT).

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZAB LOA
- L30/LAS LOA
- ZLA Standard Operating Procedures (SOP)
- ZAB SOP
- L30 SOP
- LAS SOP
- ERAM and STARS automation changes (ADRS, ADAR, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 4/23/19
Bradley R. Mayhugh — Date
LAS FAA Lead

Chris Thomas 4/23/19
Chris Thomas — Date
LAS NATCA Lead

4/23/19
Sarah Fletcher — Date
ZLA Facility POC

5/2/19
Martin Ramirez — Date
ZLA NATCA POC

Anita Engelmann 4/25/19
Anita Engelmann — Date
TWAB Representative

23 Apr 19
Dan Hauptman — Date
L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

Las Vegas Metroplex KLAS RATPK SID Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
4/30/2019	After a review of the Proposed Final Design for the KLAS RATPK SID with Nellis Air Traffic Control Facility (NATCF), it was determined that the waypoint JENFR needed to move .55 miles to the southwest in order to remain within a designated airspace shelf controlled by the Las Vegas TRACON (L30). This move will reduce potential coordination between L30 and NATCF.	LAS Master TARGETs File	

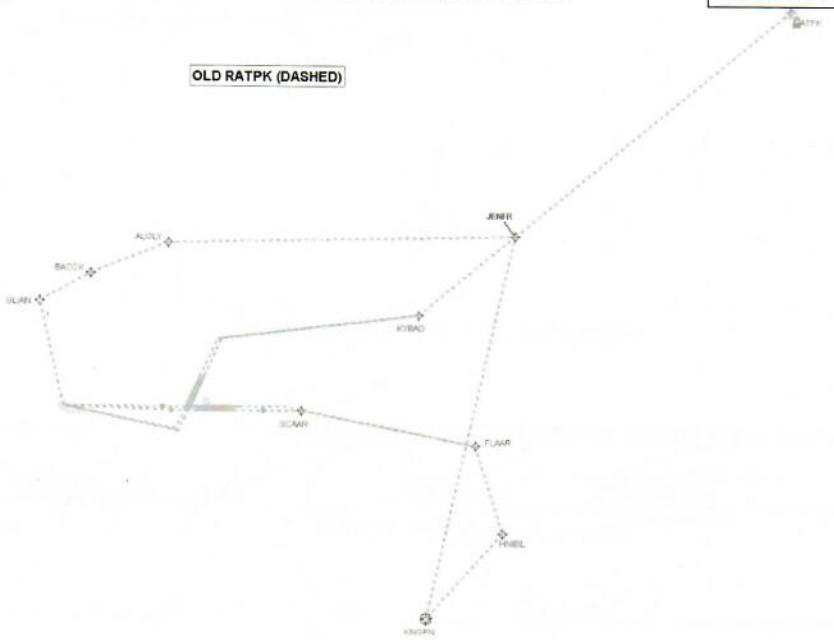


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

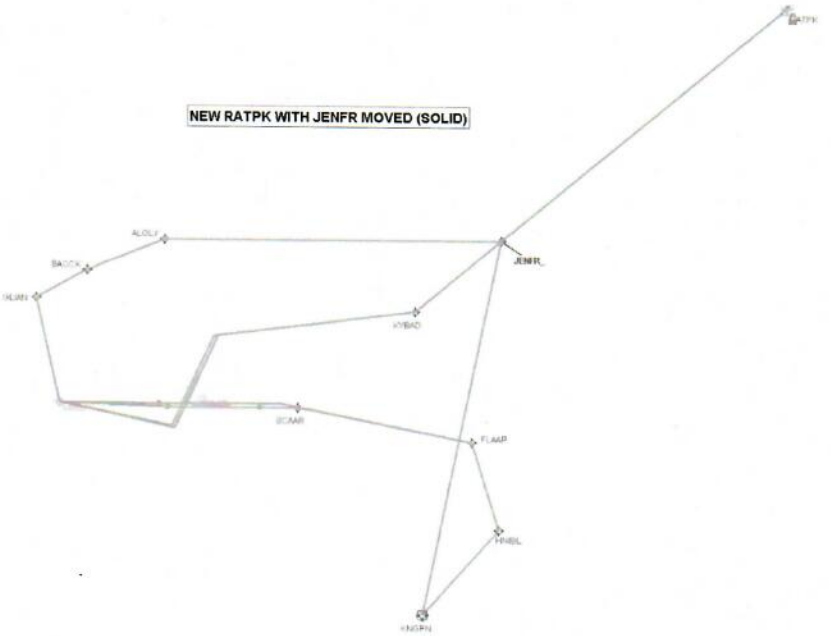


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

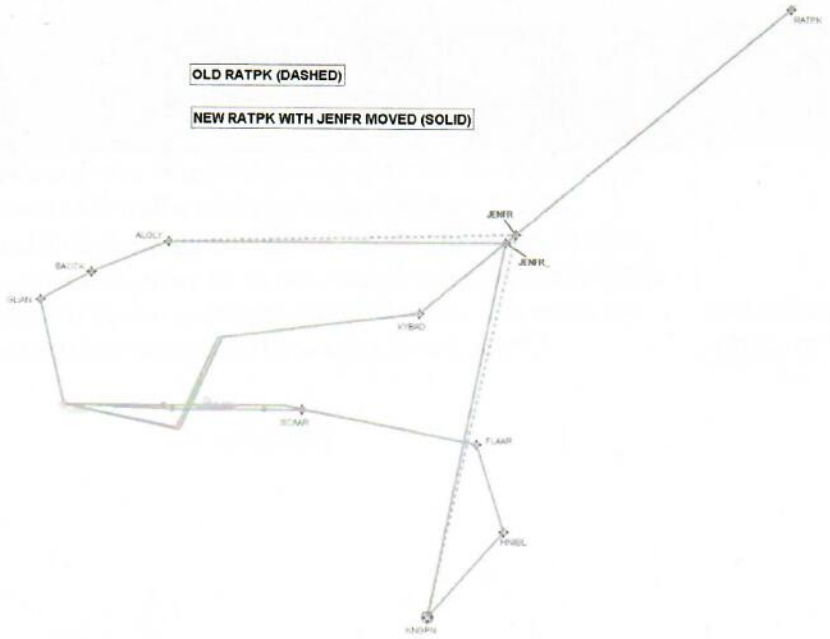


Figure 3. Original and Revised Overlaid

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

Date

NATCA Metroplex Co-Lead

2/11/2020

Date

Las Vegas OAPM Design Package

KLAS RATPK SID

An Area Navigation (RNAV) Standard Instrument Departure (SID) is a procedure that serves as a lateral path for aircraft departing from an airport. RNAV SIDs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Las Vegas McCarran International Airport (KLAS) departures to north/northeast destinations will use a new flight path procedure called the RATPK (pronounced "RAT-pack") RNAV SID. The RATPK SID will replace the current STAAV (pronounced "Stahv") and TRALR (pronounced "Tray-ler") SIDs.

The Las Vegas Metroplex Study Team (MST) identified the need for an efficient departure procedure that utilizes modern technologies. The RATPK SID is developed around advanced navigation concepts which will provide more continuous climbs.

The Las Vegas Design and Implementation Team (D&I Team) reviewed potential safety issues with the existing TRALR (Runways 19/26) and STAAV (Runway 26) SIDs that converge at the TRALR waypoint. These two SIDs depart the airport in separate directions, then join at the same point northeast of the airport. The convergence of these two SIDs at TRALR creates sequencing and separation issues for controllers, resulting in increased complexity and implementation of flow control management for departures. Flow management requires extensive ground movements in order to reroute Runway 19 departures over to Runway 26. The redirection of aircraft from one runway to another requires the crossing of two active runways and movement over several taxiways. The reassignment of takeoff runway enforces a more orderly and controllable flow after departure.

The RATPK SID includes a right turn immediately after departure from Runway 19, allowing earlier and more efficient sequencing with Runway 26 departures. Safety will increase with the elimination of active runway and taxiway crossings. The intended use of the RATPK SID departing Runway 19 is for general aviation aircraft parked on the west side of the airport.

The RATPK SID was designed to take advantage of reduced separation requirements between successive Runway 08 departures. The use of 10-degree divergent headings between successive departures will improve efficiency and reduce complexity.

The RATPK SID will increase flight path predictability and will decrease controller/pilot workload and task complexity which will enhance safety.

The new RATPK SID addresses KLAS; however, other procedures are being proposed that will serve additional nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas valley.

KLAS RATPK (STAAV) SID

Las Vegas OAPM Design Package

KLAS RATPK SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) RATPK Area Navigation (RNAV) Standard Instrument Departure (SID)	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.2.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 54, 55 **Salt Lake City ARTCC (ZLC) Sectors: 33, 44, 45, 47** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: MED, DAG** **Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD** **KLAS** **Nellis Air Traffic Control Facility (NATCF)**	**KLAS GIDGT SID** **KLAS CHOWW Standard Terminal Arrival Route (STAR)** **Henderson Executive Airport (KHND) BOEGY STAR** **North Las Vegas Airport (KVGT) WYLND STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop (HITLS)results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendations

Issues

The STAAV SID is available in configuration 1 for Runways 26L/R only. Stakeholders request that the STAAV SID be available for all configurations. Departures assigned the TRALR SID's MLF transition turn into the path of arrivals. Facilities requested that the MST merge conceptual designs with Southern California Metroplex procedures and provide Q-Route connectivity.

Las Vegas OAPM Design Package
KLAS RATPK SID

Stakeholders reported the current procedure has high climb gradients and several aircraft types have trouble meeting the restrictions at the STAAV and FOLDD waypoints. The NATCF identified a lack of a northbound transition through the Nellis Special Use Airspace (SUA), when the airspace is available for joint use.

Study Team Recommendations

The MST created an RNAV SID (KLAS NE1 SID) usable for all configurations, which reduces flight track miles, and connects to the proposed Southern California Metroplex procedures. The KLAS NE1 SID was designed to add transitions off all runways and simplify departure flows with two en route transitions. One transition ends at the proposed Southern California Metroplex waypoint WINEN. The MST designed an ATC assigned transition over CRITO that traverses the Nellis SUA when the airspace is open for joint use.

The KLAS NE1 SID incorporates lower altitude restrictions which reduce climb gradients. This procedure allows jet aircraft to meet conceptual altitudes, reducing pilot/controller task complexity and increase efficiencies. The MST designed the KLAS NE1 SID to be deconflicted from conceptual STARs.

The MST recommendation is depicted in Figures 1 and 2.

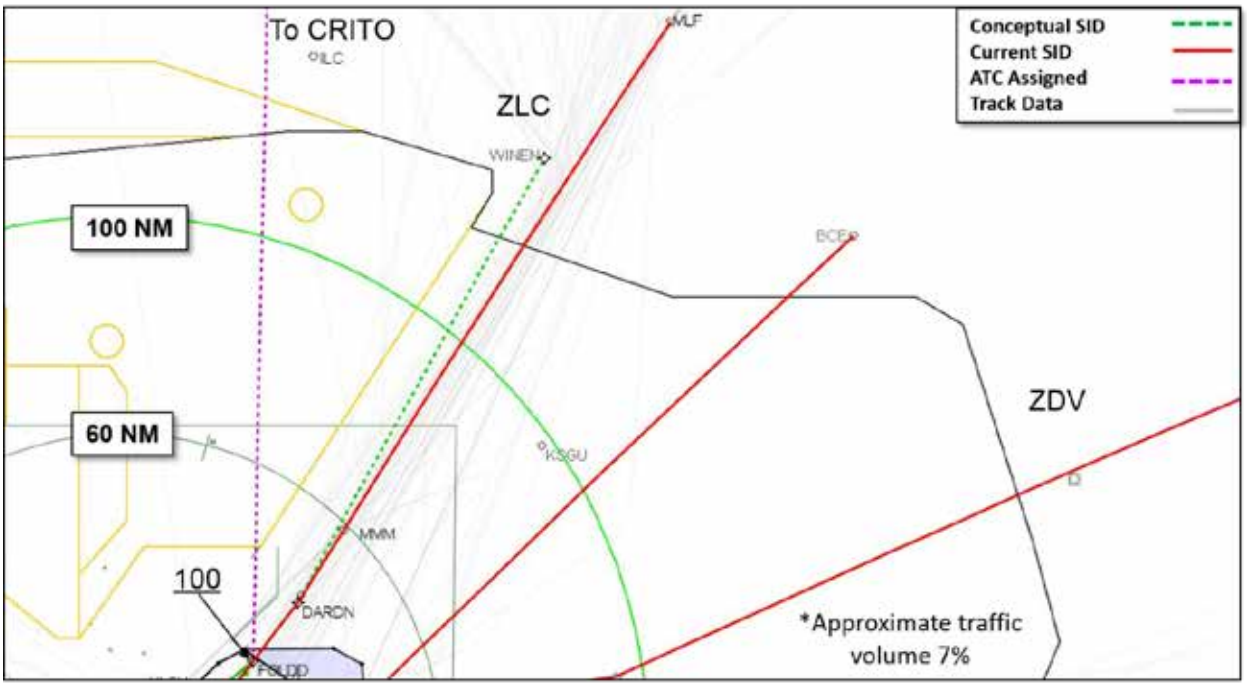


Figure 1: STAAV SID and KLAS NE1 SID - En Route View

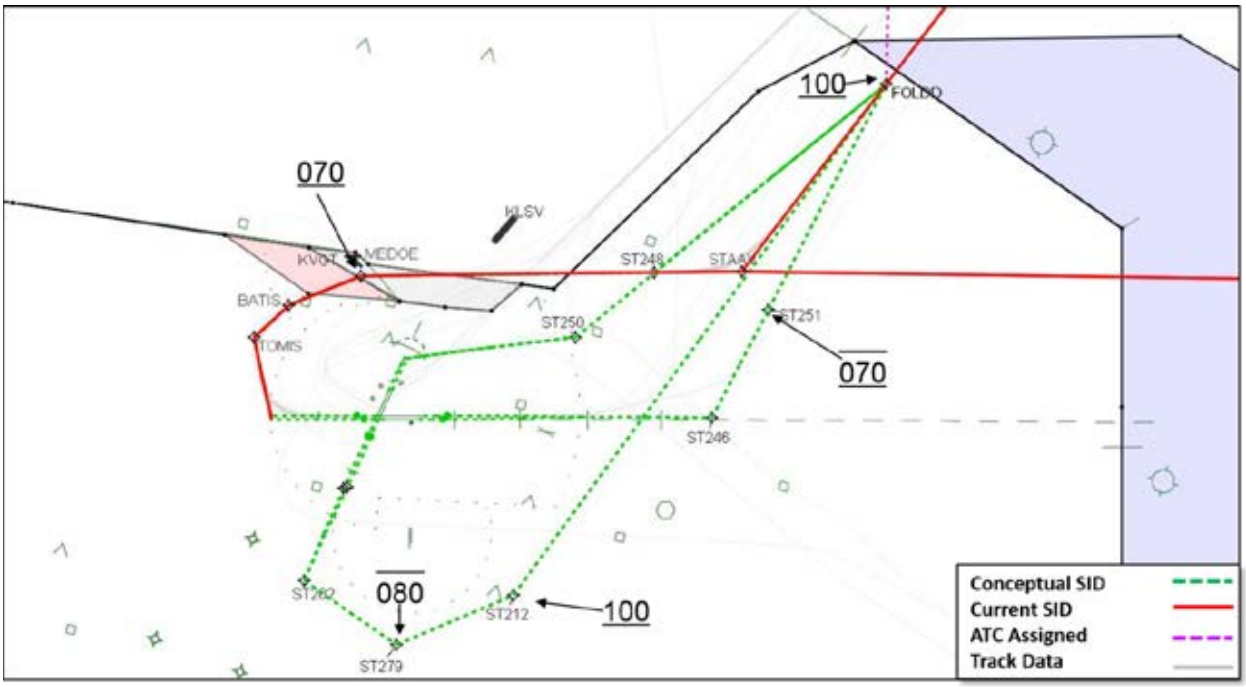


Figure 2: STAAV SID and KLAS NE1 SID - Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendations.

The D&I Team reviewed potential safety issues with existing TRALR (Runways 19/26) and STAAV (Runway 26) SIDs that converge at the TRALR waypoint. These two SIDs depart the airport in separate directions, and then join at the same point northeast of the airport. The convergence of these two SIDs at TRALR creates sequencing and separation issues for controllers, resulting in increased complexity and implementation of flow control management for departures. Flow management requires extensive ground movements in order to reroute Runway 19 departures over to Runway 26. The redirection of aircraft from one runway to another requires the crossing of two active runways and movement over several taxiways. The reassignment of takeoff runway enforces a more orderly and controllable flow after departure.

The RATPK SID includes a right turn immediately after departure from Runway 19, allowing earlier and more efficient sequencing with Runway 26 departures. Safety will increase with the elimination of active runway and taxiway crossings. The intended use of the RATPK SID departing Runway 19 is for general aviation aircraft parked on the west side of the airport.

Las Vegas OAPM Design Package

KLAS RATPK SID

The D&I Team additionally amended the MST proposal with a right turn "loop" that was created for the Runway 08 departure transitions to allow for aircraft to climb and to segregate from the KLAS CHOWW STAR, KHND BOEGY STAR and KVGT WYLND STAR. The alternative without a "loop" procedure on the departure was to leave aircraft at low altitudes for extended periods.

The KLAS RATPK SID's PFD is depicted in Figures 3 and 4.

Runway Transitions

Runways 01L/R Transitions (VICF legs)

- KYBAD (at or above 060/allow aircraft to get above the minimum vectoring altitude [MVA]/protects from VFR aircraft eastbound from NATCF)
- JNFER (placed to rejoin RATPK routing to northeast/common point for other runway transitions)
- RATPK (coordination waypoint with ZLA)

Runway 08L Transition (VICF leg utilized for 10-degree divergence with successive departures)

- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for design criteria)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/ speed restriction for design criteria)
- KNGPN (provides segregation from the KLAS CHOWW and RKSTR STARs)
- JENFR (placed to rejoin RATPK routing to northeast/common point for other runway transitions)
- RATPK (coordination waypoint with ZLA)

Runway 08R Transitions (VADF leg)

- SCAAR (placed to mirror VICF leg utilized on the Runway 08L transition)
- FLAAR (at or above 060/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/speed restriction for design criteria)
- HNIBL (at or above 080/less than 230 knots/provides segregation from the KHND OYODA and SCAMR SIDs and the KLAS CHOWW STAR/ speed restriction for design criteria)
- KNGPN (provides segregation from the KLAS CHOWW and RKSTR STARs)
- JENFR (placed to rejoin RATPK routing to northeast/common point for other runway transitions)
- RATPK (coordination waypoint with ZLA)

Runways 19L/R Transitions (VICF legs)

- LEELN (existing waypoint on the current Runway 26 procedure/added to Runways 19 L/R transitions)

KLAS RATPK (STAAV) SID

- GLIAN (at or above 050/ensures climb gradient for NATCF airspace and VGT)
- BACCK (at or above 060/less than 230 knots/ensures climb gradient for NATCF airspace and VGT /speed restriction for design criteria)
- ALOLY (at or above 070/provides NATCF airspace integrity)
- JENFR (placed to rejoin RATPK routing to northeast/common point for other runway transitions)
- RATPK (coordination waypoint with ZLA)

Runways 26L/R Transitions (VADF legs)

- LEELN (existing waypoint)
- GLIAN (at or above 050/ensures climb gradient for NATCF airspace and VGT)
- BACCK (at or above 060/less than 230 knots/ensures climb gradient for NATCF airspace and VGT /speed restriction for design criteria)
- ALOLY (at or above 070/provides NATCF airspace integrity)
- JENFR (placed to rejoin RATPK routing to northeast/common point for other runway transitions)
- RATPK (coordination waypoint with ZLA)

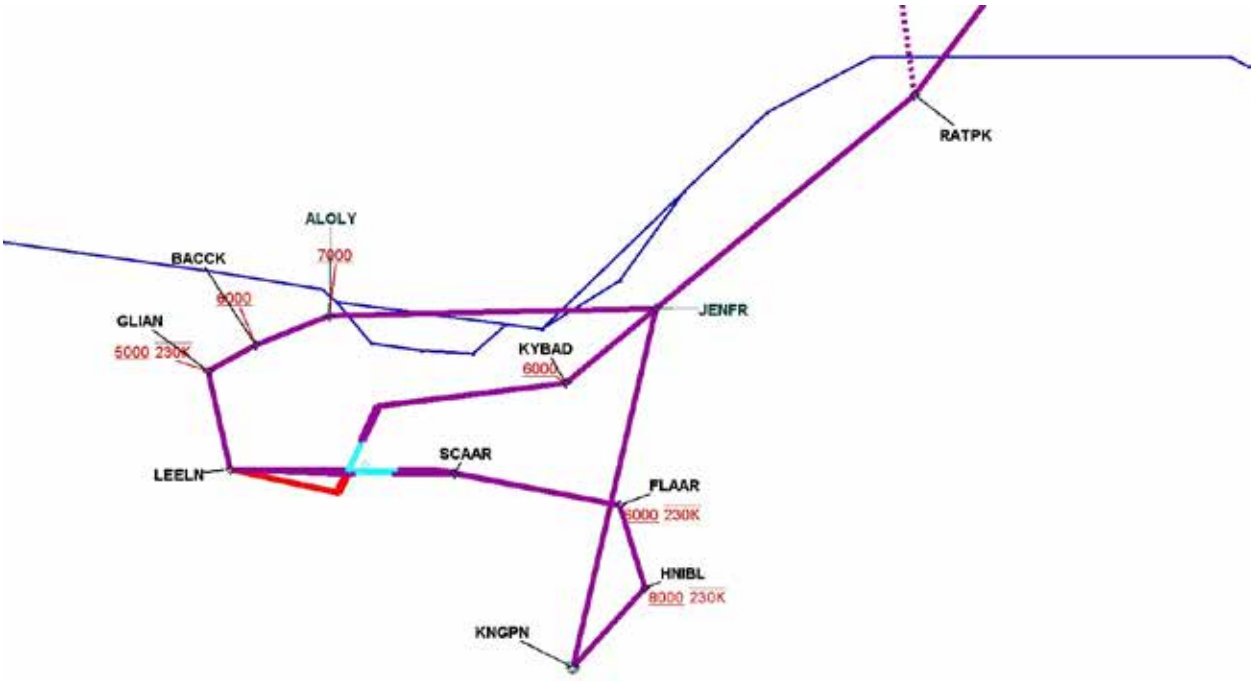


Figure 3: KLAS RATPK SID's PFD - Terminal View

En route Transitions

Las Vegas OAPM Design Package

KLAS RATPK SID

The MST proposed four transitions for this SID, but the D&I team chose to design two northern transitions for this SID and added the other 2 transitions to the newly designed KLAS GIDGT SID to facilitate the segregation from the KLAS CHOWW STAR.

FRNCK Transition (to ZLC)

- RATPK (coordination waypoint with ZLA)
- DARDN (provides segregation from NATCF airspace and the KLAS CHOWW STAR)
- FRNCK (coordination waypoint inside ZLC airspace)

KITTN Transition (ATC assigned only to reduce track miles when SUA is not in use)

- RATPK (coordination waypoint with ZLA)
- SANSE (at or below FL190/for design criteria)
- KITTN (existing waypoint on Q164 in ZOA airspace)

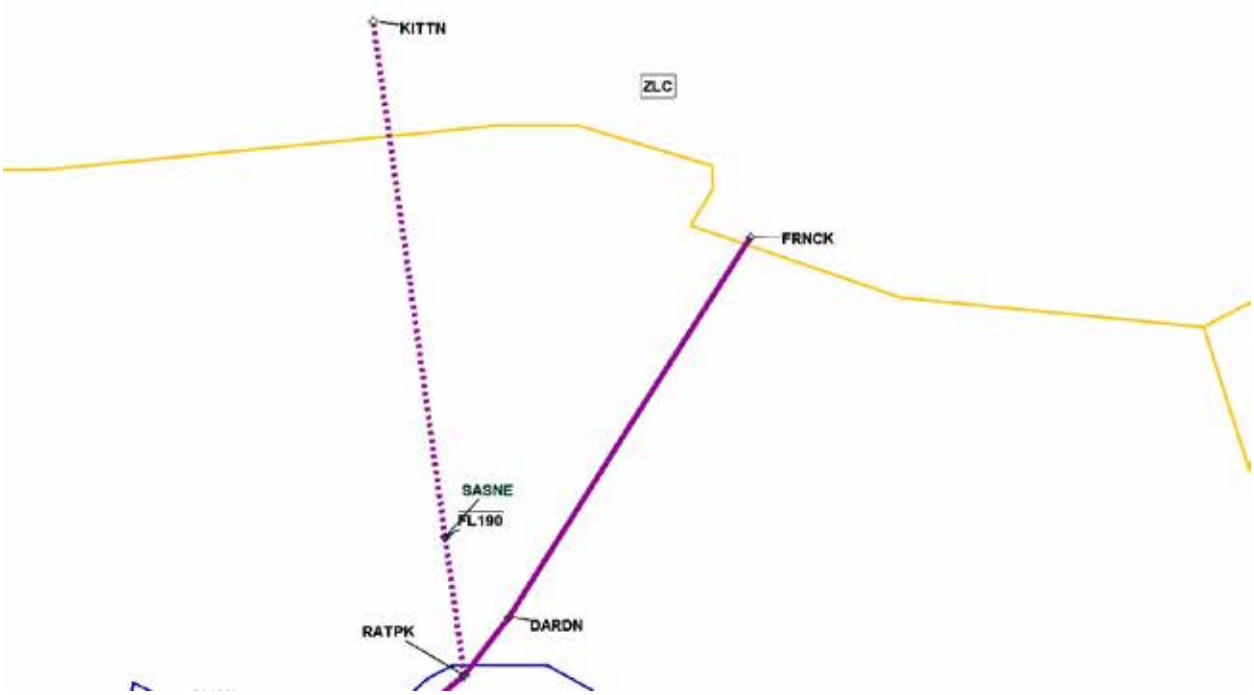


Figure 4: KLAS RATPK SID's PFD - En Route View

Additional Design Considerations

- The KLAS RATPK SID concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed SID
- This procedure will be used by RNAV-equipped turbojet aircraft only
    - The following chart notes will be included with this procedure:

Las Vegas OAPM Design Package
KLAS RATPK SID

- § For turbojet aircraft only

The RATPK SID affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 54, 55
- ZLC Sectors: 33, 44, 45, 47
- L30 Sectors: MED, DAG
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- NATCF
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed for KLAS, KHND and KVGT.

Document changes/modifications include:

- Departure SID filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZLC LOA
- L30/LAS LOA
- ZLA Standard Operating Procedures (SOP)
- ZLC SOP
- L30 SOP
- LAS SOP
- VGT SOP
- ERAM and STARS automation changes (ADRS, ADAR, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- NAS Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- En Route Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

KLAS RATPK (STAAV) SID

Las Vegas OAPM Design Package
KLAS RATPK SID

- Terminal Procedures
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results (may be completed during Evaluation Phase)
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 4/23/19
Bradley R. Mayhugh — Date
LAS FAA Lead

Chris Thomas 4/23/19
Chris Thomas — Date
LAS NATCA Lead

4/23/19
Sarah Fletcher — Date
ZLA Facility POC

5/2/19
Martin Ramirez — Date
ZLA NATCA POC

Anita Engelmann 4/25/19
Anita Engelmann — Date
TWAB Representative

23 Apr 19
Dan Hauptman — Date
L30 NATCA POC

Available via electronic signature

Date

Nellis Air Traffic Control Facility

LAS Metroplex KHND BOEGY SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
6/5/2019	The Proposed Final Design description of the KHND BOEGY STAR was reviewed. References to segregation from the KLAS BOEGY STAR were removed. No map depicted. Editorial change only	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mybaugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KHND BOEGY STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Henderson Executive Airport (KHND) arrivals from eastern/northeastern origins will use a new flight path procedure called the BOEGY (pronounced “Bow-gey”) RNAV STAR. The BOEGY STAR will replace the current NOOTN (pronounced “New-ton”) RNAV STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current KHND arrival procedures cause aircraft to level off for extended periods and require close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing the complexity of operations.

The BOEGY STAR will allow descents that are more continuous at reduced power. In air traffic control terms, this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage. The BOEGY STAR will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new BOEGY STAR addresses KHND. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KHND BOEGY STAR

[NL1]

Name of Change and Airport(s)	Change Classification
Henderson Executive Airport (KHND) BOEGY Area Navigation (RNAV) Standard Terminal Arrival Route (STAR)	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 8, 35, 36, 54, 55 **Denver ARTCC (ZDV) Sectors: 23, 24, 36, 68** **Salt Lake City ARTCC (ZLC) Sectors: 33, 34, 44, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: LAK, MED, CYN, DAG** **KHND** **North Las Vegas Airport (KVGT)**	**KVGT WYLND STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

KHND arrivals from the east and northeast interact with the busiest arrival streams into McCarran International Airport (KLAS). Current arrival procedures are inefficient and create task complexity for L30 and ZLA. The entry point into L30's airspace for the current KHND northeast STAR requires coordination between ZLA Sectors 7 and 8.

Las Vegas OAPM Design Package
KHND BOEGY STAR

Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design efficient arrival procedures for KHND. The MST created three conceptual RNAV STARs (KHND NE STAR, KHND NW STAR, and KHND S STAR).

The KHND NE STAR has two en route transitions that merge prior to terminal airspace and enter L30 south of KLAS Runways 26L/R extended centerline. The procedure continues to HAKID, the initial waypoint on the RNAV (GPS) B approach. This conceptual STAR is procedurally de-conflicted from KLAS arrivals. The waypoints and restrictions are depicted in Figure 1.

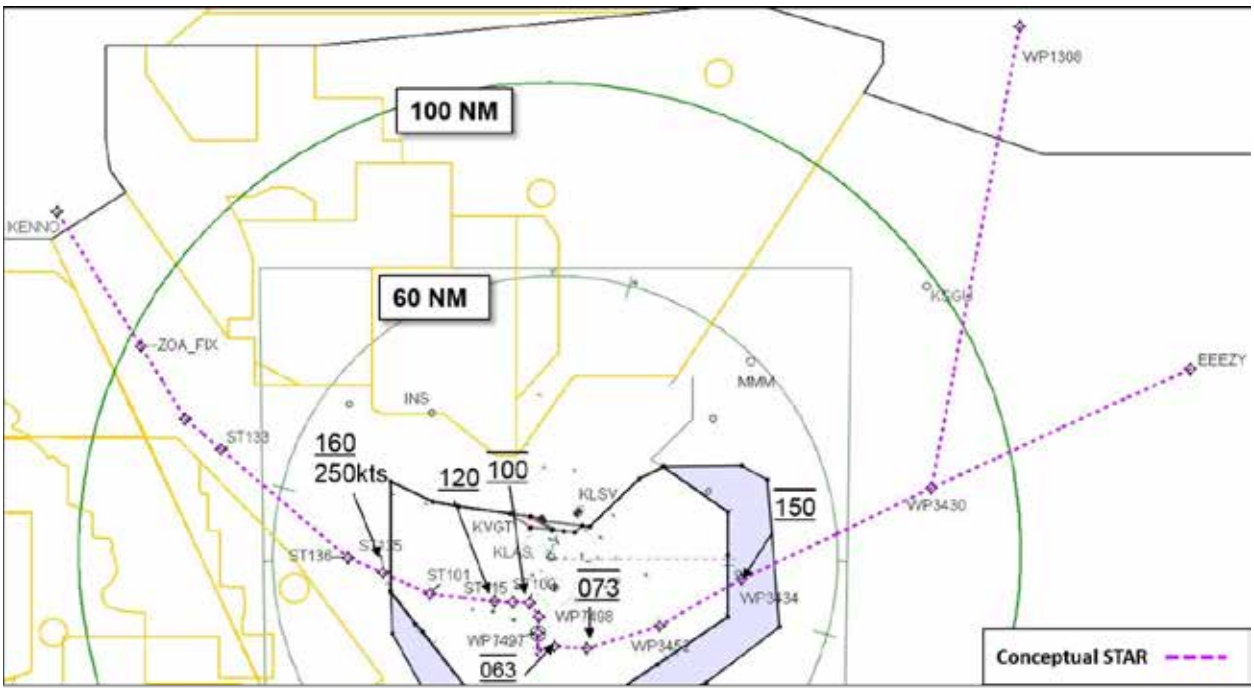


Figure 1: KHND NE and NW MST Conceptual STAR Designs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST concept as the basis for the initial design proposal, considering both the issues and the recommendation. The D&I Team developed three en route transitions for KHND arrivals from the east/northeast. The KHND BOEGY STAR's PFD is depicted in Figure 2.

En Route Transitions

EEEZY Transition (from ZDV)

- EEEZY (existing waypoint/used for aircraft arriving from the northeast)
- PAHRR (provides a sequencing point with SHAYM transition)

- BOEGY (at 150/250 knots/provides segregation from KLAS arrival and departure traffic/serves as a coordination waypoint/provides continuity with new T-routes/allows sequencing with TOADD transition)

SHAYM Transition (from ZLC)

- SHAYM (for aircraft arriving from northern airports)
- PAHRR (provides a sequencing point with EEEZY transition)
- BOEGY (at 150/250 knots/provides segregation from KLAS arrival and departure traffic/serves as a coordination waypoint/provides continuity with new T-routes/allows sequencing with TOADD transition)

TOADD Transition (from ZDV)

- TOADD (existing waypoint in ZDV airspace/coordination waypoint)
- BOEGY (at 150/250 knots/provides segregation from KLAS arrival and departure traffic/serves as a coordination waypoint/provides continuity with new T-routes/allows sequencing with EEEZY and SHAYM transitions)

Common Route (after BOEGY, regardless of active runway)

- PUTTT (at 070/provides terrain avoidance/provides segregation from KLAS arrival and departure traffic)
- KGRDN (at 060/provides terrain avoidance/allows for approach vectors to appropriate runway)

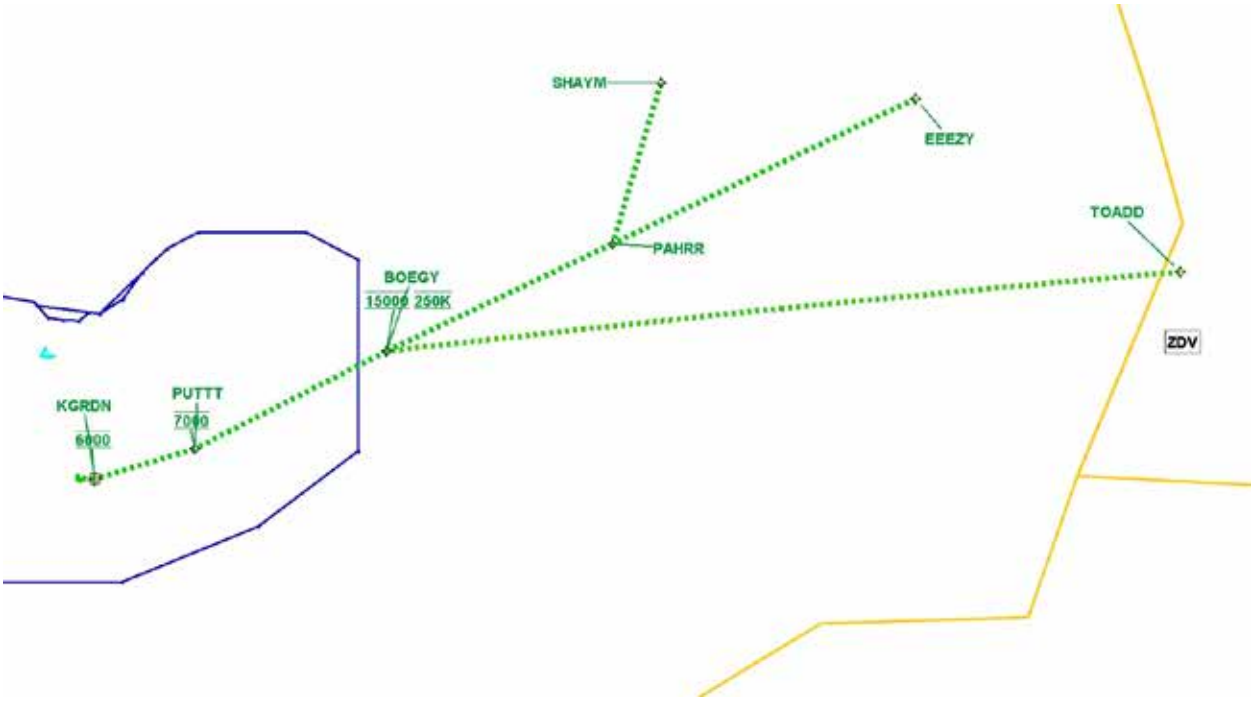


Figure 2: KHND BOEGY STAR – PFD

Additional Design Considerations

- The KHND BOEGY STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - No chart notes will be included with this procedure

The BOEGY STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 8, 35, 36, 54, 55
- ZDV Sectors: 23, 24, 36, 68
- ZLC Sectors: 33, 34, 44, 46
- L30 Sectors: LAK, MED, CYN, DAG
- KHND

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KHND and KVGT.

Document changes/modifications include:

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZDV LOA
- ZLA/ZLC LOA
- ZLA Standard Operating Procedures (SOP)
- ZDV SOP
- ZLC SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
    - TARGETS distribution package
    - Flight Simulator worksheet
    - RNAV Pro analysis results
    - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

Las Vegas OAPM Design Package

KHND GAMES STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Henderson Executive Airport (KHND) arrivals from northwestern origins will use a new flight path procedure called the GAMES (pronounced "Games") RNAV STAR. The GAMES STAR will replace the current ADDEL (pronounced "Aa-dell") RNAV STAR serving both turbojet and turboprop aircraft. The GAMES STAR will also serve McCarran International Airport (KLAS) turboprop arrivals from the northwest that currently utilize the KLAS FUZZY STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current KHND arrival procedures cause aircraft to level off for extended periods and require close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing the complexity of operations.

The GAMES STAR serves KHND arrivals from the northwest. Las Vegas Valley arrivals from and departures to the northwest require routing through a nineteen mile wide corridor formed by military restricted airspace to the northeast and southwest. The narrow corridor supports one KLAS departure procedure and three KLAS and satellite airport departure/arrival routes. The design is further complicated by interactions closer to the airport with aircraft assigned the KLAS JOHKR Standard Instrument Departure (SID). In an area where terrain is a factor, JOHKR departure aircraft are accomplishing climbs to altitude while GAMES arrival aircraft are descending.

The GAMES STAR will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage. The GAMES STAR will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new GAMES STAR addresses KHND and KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the Las Vegas Valley.

Las Vegas OAPM Design Package

KHND GAMES STAR

Name of Change and Airport(s)	Change Classification
Henderson Executive Airport (KHND) **McCarran international Airport (KLAS)** **GAMES Area Navigation (RNAV) Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 16 **Oakland ARTCC (ZOA) Sectors: 33, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, GNT, CYN** **Nellis Air Traffic Control Facility (NATCF) Sectors: LEE (A7 Shelf)** **KHND** **KLAS**	**KHND OYODA Standard Instrument Departure (SID)** **Q13 Amendment** **Q15 Amendment**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders reported that due to the close proximity of KHND and KLAS, current procedures for arrivals into KLAS create delays for KHND departures.

Recommendation

Las Vegas OAPM Design Package
KHND GAMES STAR

The MST worked extensively with the National Business Aviation Association (NBAA) to design efficient arrival procedures for KHND. The MST created three conceptual RNAV STARs (KHND NE STAR, KHND NW STAR, and KHND S STAR).

The KHND NW STAR follows the KLAS NW STAR through the northwest corridor and diverges at ST100. The waypoints and restrictions are depicted in Figure 1.

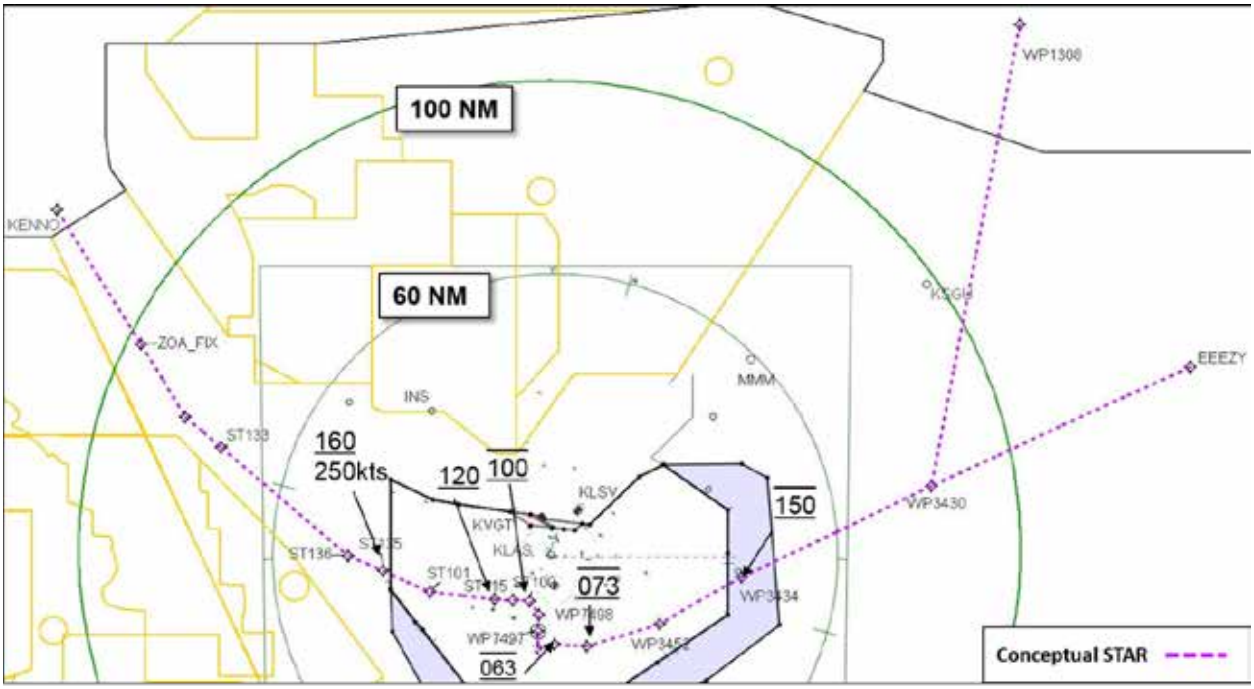


Figure 1: KHND NW and NE MST Conceptual STAR Designs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST concept as the basis for the initial design proposal, considering both the issues and the recommendation.

The GAMES STAR serves KHND arrivals from the northwest. Las Vegas Valley arrivals from and departures to the northwest require routing through a nineteen mile wide corridor formed by military restricted airspace to the northeast and southwest. The narrow corridor supports one KLAS departure procedure and three KLAS and satellite airport departure/arrival routes. The design is further complicated by interactions closer to the airport with aircraft assigned the KLAS JOHKR Standard Instrument Departure (SID). In an area where terrain is also a factor, JOHKR departure aircraft are accomplishing climbs to altitude while GAMES arrival aircraft are descending.

The GAMES STAR will serve turbojet and turboprop aircraft landing at KHND and turboprop aircraft landing at KLAS.

Las Vegas OAPM Design Package
KHND GAMES STAR

The KHND GAMES STAR's PFD is depicted in Figure 2.

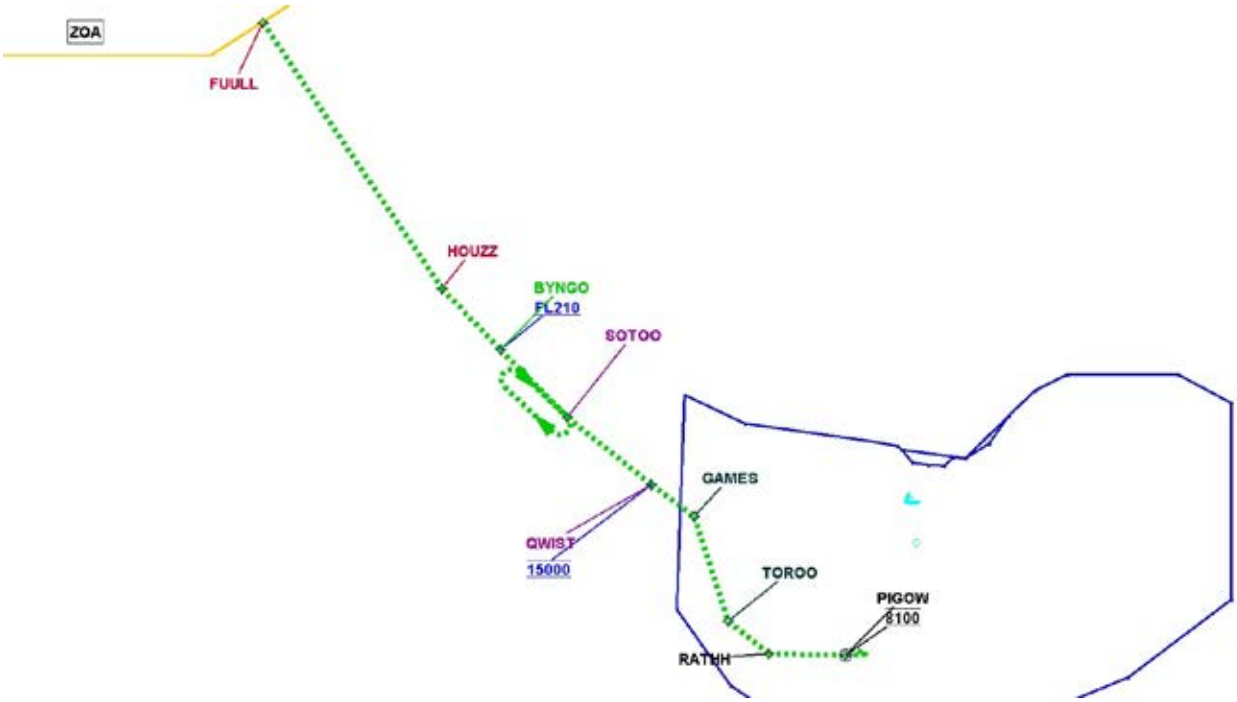
En Route Transition

FUULL Transition

- FUULL (coordination waypoint with ZOA/provides segregation from KLAS JOHKR SID and KLAS COKTL STAR)
- HOUZZ (provides segregation from KLAS JOHKR SID and KLAS COKTL STAR)
- BYNGO (at or above FL210/provides airspace integrity from NATCF's A7 shelf/provides segregation from KLAS JOHKR SID and KLAS COKTL STAR)
- SOTOO (provides alignment with the new Q13 and/or Q15 routes/provides segregation from KLAS JOHKR SID and KLAS COKTL STAR/provides a published standard holding pattern)
- QWIST (at 150/ensures KHND arrival traffic is below KLAS arrival/departure traffic)
- GAMES (provides segregation from KLAS JOHKR SID and KLAS COKTL STAR)

Common Route (allows radar vectors to all runways)

- GAMES (provides segregation from KLAS JOHKR SID and KLAS COKTL STAR)
- TOROO (parallels KLAS COKTL STAR)
- RATHH (provides lateral distance from KLAS COKTL STAR)
- PIGOW (at 081/FM leg towards KHND)



KHND GAMES (ADDEL) STAR

Figure 2: KHND GAMES STAR - PFD

Additional Design Considerations

- The KHND GAMES STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft landing KHND and turboprop aircraft landing KLAS, and is not anticipated to change runway usage

The GAMES STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 16
- ZOA) Sectors: 33, 46
- L30 Sectors: DAG, GNT, CYN
- NATCF
- KHND
- KLAS

Implementation Dependencies

The procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS and KHND.

Document changes/modifications include:

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- L30/HND LOA
- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- Standard Instrument Approach Procedures (SIAP)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

LAS Metroplex NTNDO STAR Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
4/3/2020	The Team, in consultation with ZLA and L30, changed the restriction at KONNG from at 110 and at 250 knots to at or above 100 and at or below 250 knots. This change will accommodate lower crossing restrictions for propeller driven aircraft as set out in the L30/ZLA new Letter of Agreement. The L30/ZLA LOA has been negotiated and upon implementation, propeller driven aircraft will cross KONNG at 10,000 feet and jet aircraft will cross KONNG at 11,000 feet and 250 knots. The at or above 10,000-foot and at or below 250 knot restriction accommodates both of the crossing restrictions that will be assigned by ZLA. MEAs were also changed on the procedure: · BYSEN to KONNG lowered from 11,000 feet to 10,000 feet · TETRS to KONNG lowered from 11,000 feet to 10,000 feet · JOTNU to ZELMA raised from 13,000 to 15,000 feet · TNP to JOTNU raised from 13,000 feet to 15,000 feet MEA changes were evaluated in TARGETS DME evaluation and passed.	Mater TARGETS file	

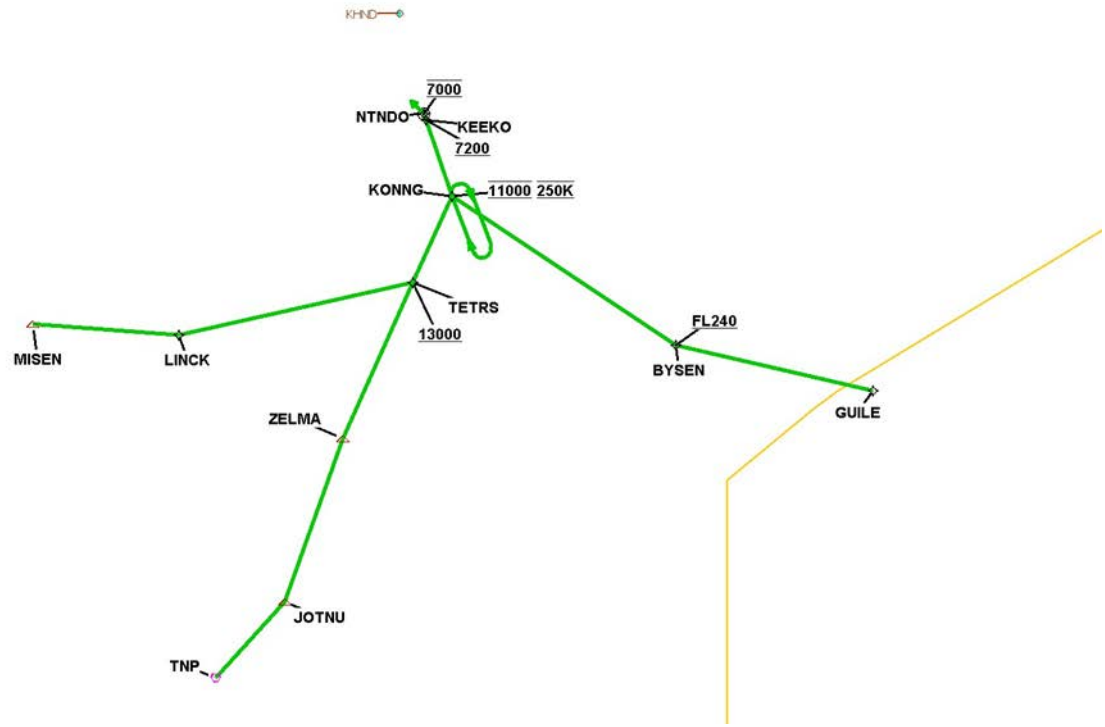


Figure 1. Original Proposed Final Design NTNDO STAR

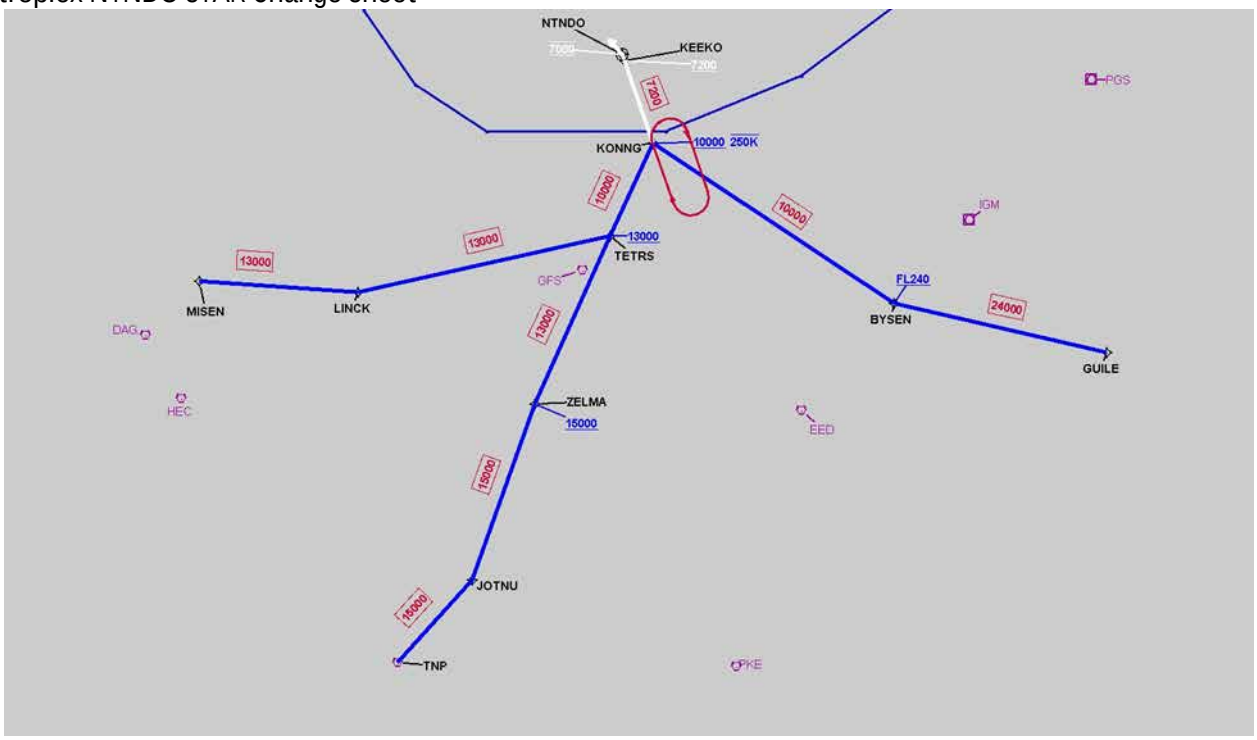


Figure 2. Revised Proposed Final Design NTNDO STAR

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

4/3/2020

Date

NATCA Metroplex Co-Lead

4/3/2020

Date

Las Vegas OAPM Design Package

KHND NTNDO STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

Henderson Executive Airport (KHND) arrivals from southwestern, southern and southeastern origins will use a new flight path procedure called the NTNDO (pronounced "Nin-ten-doe") RNAV STAR. The NTNDO STAR will replace the current JOMIX (pronounced "Joe-mix") RNAV STAR. The NTNDO STAR will also serve KHND arrivals that currently utilize a conventional arrival routing from the Kingman (IGM) VORTAC (ground-based navigational aid).

The Las Vegas Metroplex Study Team (MST) noted that the current KHND arrival procedures cause aircraft to level off for extended periods and require close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing the complexity of operations.

The NTNDO STAR will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage. The NTNDO STAR will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new NTNDO STAR addresses KHND. Due to additional traffic routes into and out of the area, the Las Vegas Metroplex Design and Implementation Team (D&I Team) decided to include North Las Vegas Airport (KVGT) to the proposed STAR. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package
KHND NTNDO STAR

Name of Change and Airport(s)	Change Classification
Henderson Executive Airport (KHND) **North Las Vegas Airport (KVGT)** **NTNDO Area Navigation (RNAV) Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 17, 35, 37, 38, 39, 68 **Albuquerque ARTCC (ZAB) Sectors: 43, 92** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: CYN** **KHND** **KVGT**	**N/A**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders reported that due to the close proximity of KHND and KLAS, current procedures for arrivals into KLAS create delays for KHND departures.

Multiple entry points for aircraft landing at KHND from the southwest, south, and southeast directions require coordination between ZLA Sectors 6 and 8, and increases task complexity for L30.

Las Vegas OAPM Design Package
KHND NTNDO STAR

Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design efficient arrival procedures for KHND. The MST created three conceptual RNAV STARS (KHND NE STAR, KHND NW STAR, and KHND S STAR).

The KHND S STAR has three en route transitions and a common route into L30 airspace from the south. The procedure continues to HAKID, the initial waypoint for the RNAV (GPS) B approach. The waypoints and restrictions are depicted in Figure 1.

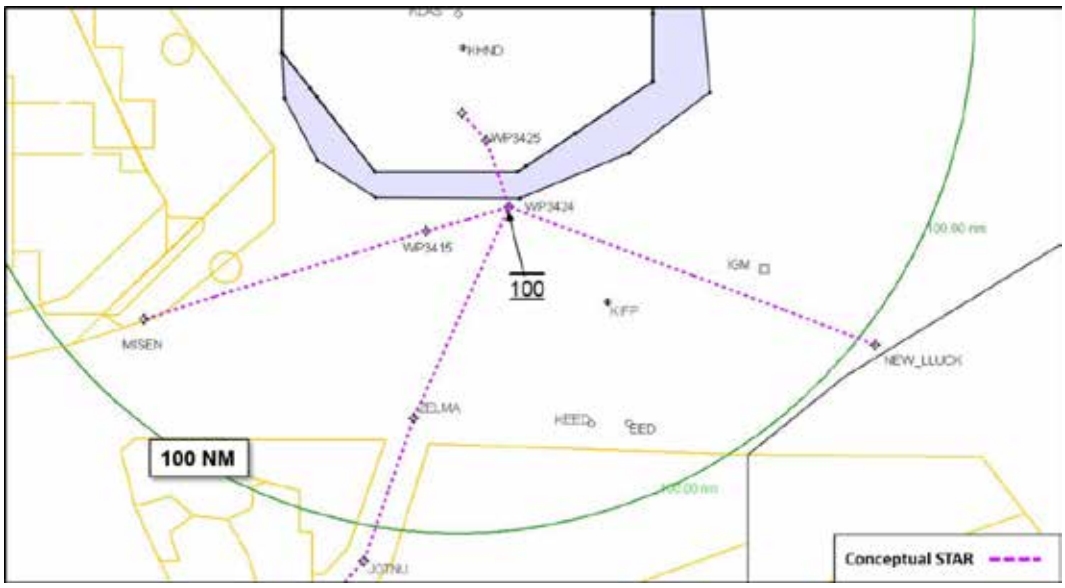


Figure 1: KHND S MST Conceptual STAR Design

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal. Considering both the issues and recommendation, the D&I Team decided to include KVGT to the proposed STAR. The D&I Team developed three en route transitions for KHND/KVGT arrivals from the south. The KHND NTNDO STAR is depicted in Figure 2.

En Route Transitions

GUILE Transition

- GUILE (located near current arrival point used by ZAB)
- BYSEN (at or above FL240/reduces complexity in ZLA Sector 8)
- KONNG (at 110/250 knots/provides segregation from the KLAS RADYR Standard Instrument Departure [SID])

MISEN Transition

- MISEN (utilized for Los Angeles basin departures as a tie in point for KHND and KVGT arrivals/provides segregation from the KLAS RADYR SID)
- LINCK (provides segregation from the KLAS RADYR SID)
- TETRS (at or above 130 to protect for the MEA/serves as a sequencing point with the TNP transition)
- KONNG (at 110/250 knots/provides segregation from the KLAS RADYR SID)

Twenty-nine Palms (TNP VORTAC) Transition

- TNP (existing waypoint/avoids Military Operations Areas [MOAs])
- JOTNU (existing waypoint/avoids MOAs)
- ZELMA (existing waypoint/avoids MOAs)
- TETRS (at or above 130 to protect for the MEA/serves as a sequencing point with the MISEN transition)
- KONNG (at 110/250 knots/provides segregation from the KLAS RADYR SID)

All the en route transitions join a common route regardless of the active runway(s) at KHND or KVGT.

Common Route

- KEEKO (AOA 072/provides terrain avoidance)
- NTNDO (at 070/provides segregation from the KLAS CHOWW and RKSTR STARs and the KLAS OYODA SID)

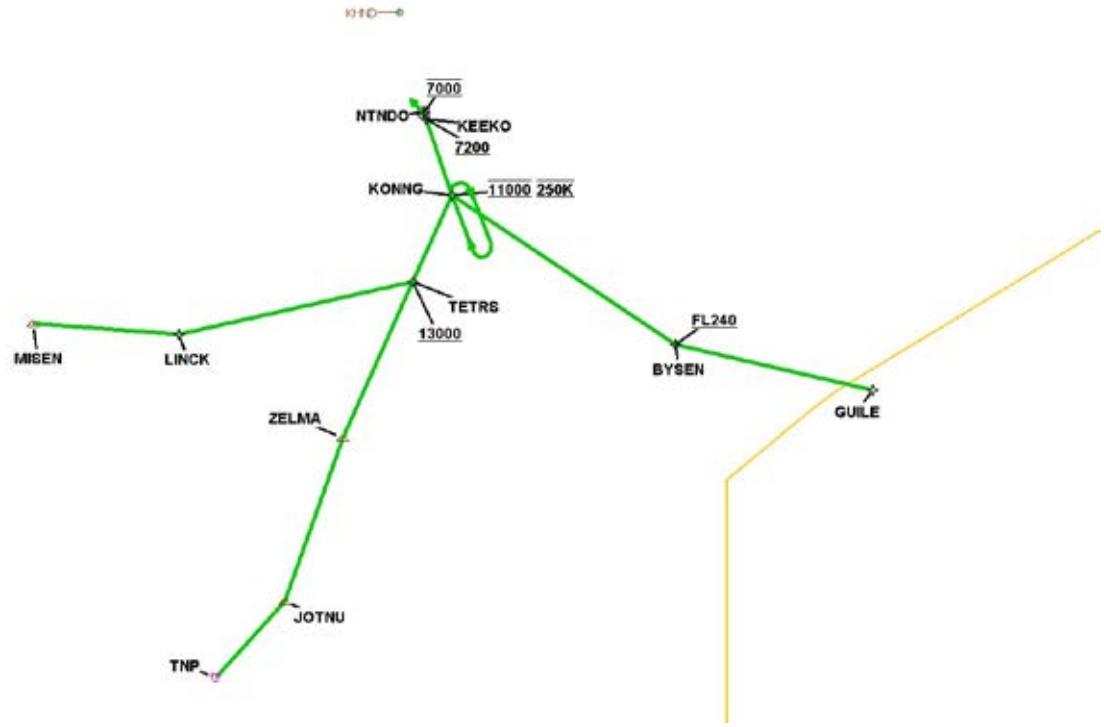


Figure 2: KHND NTNDO STAR - PFD

Additional Design Considerations

- The KHND NTNDO STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The NTNDO STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 8, 10, 17, 35, 37, 38, 39, 68
- ZAB Sectors: 43, 92
- L30 Sectors: CYN
- KHND
- KVGT

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KHND and KVGT.

Document changes/modifications include:

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZAB LOA
- L30/HND LOA
- L30/VGT LOA
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- ZAB SOP
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- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

KLAS CHOWW STAR Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	FLYES waypoint moved 1.64 nm east for criteria.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS CHOWW CHANGE SHEET

METROPLEX CHOWW Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
8/15/2019	TetraTech ran reference software based on new TARGETS criteria. The altitude restriction at TATUU was changed to meet criteria from 094 to 105 to 095 to 105.	Mater TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

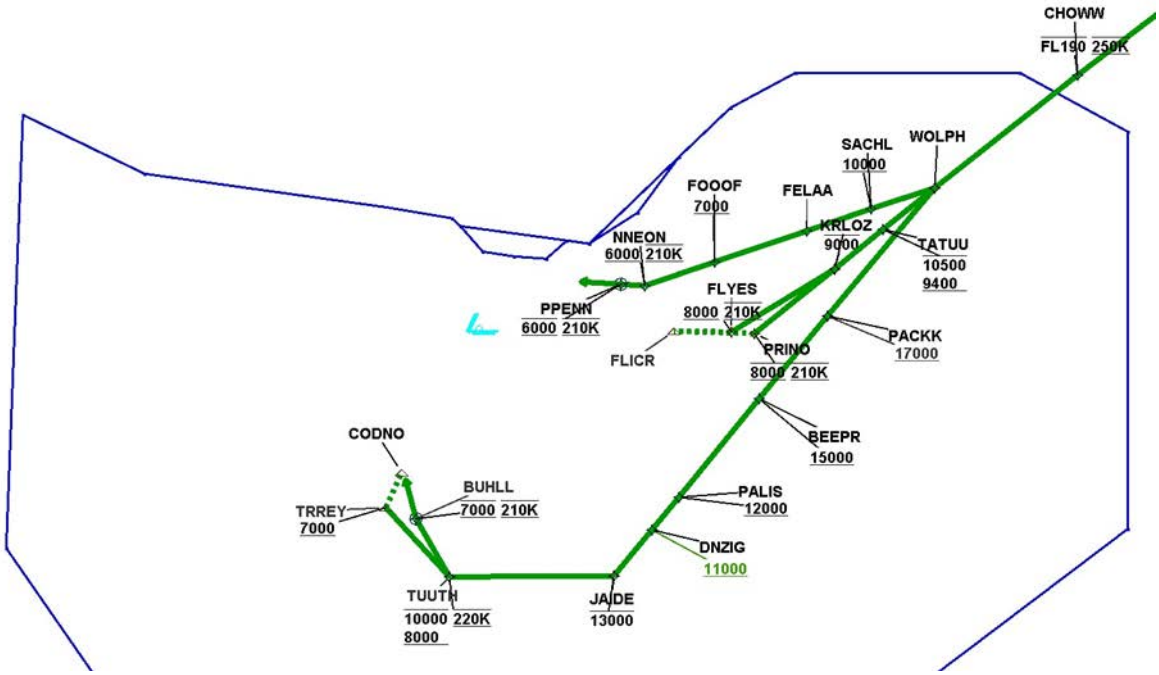


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

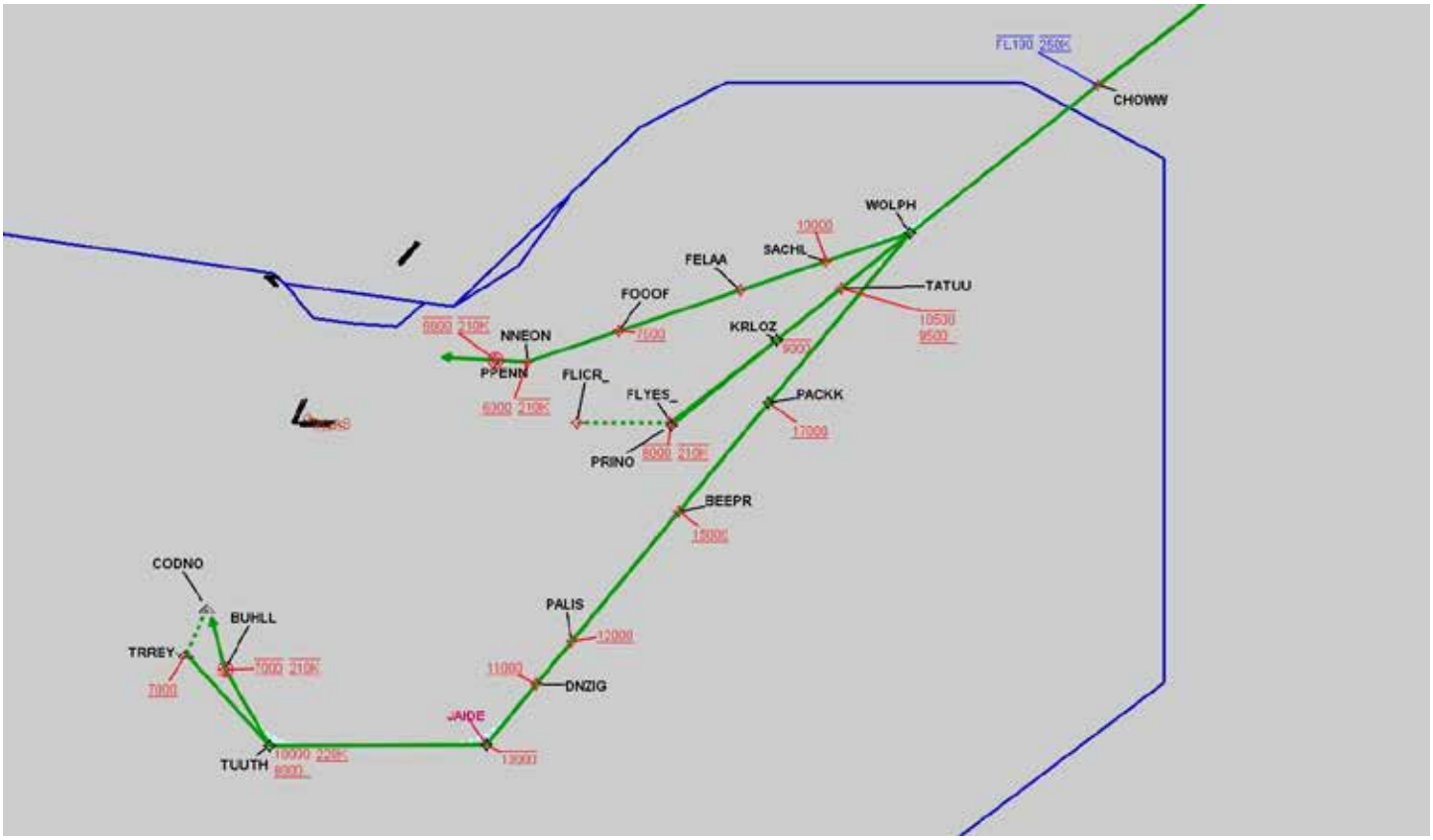


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

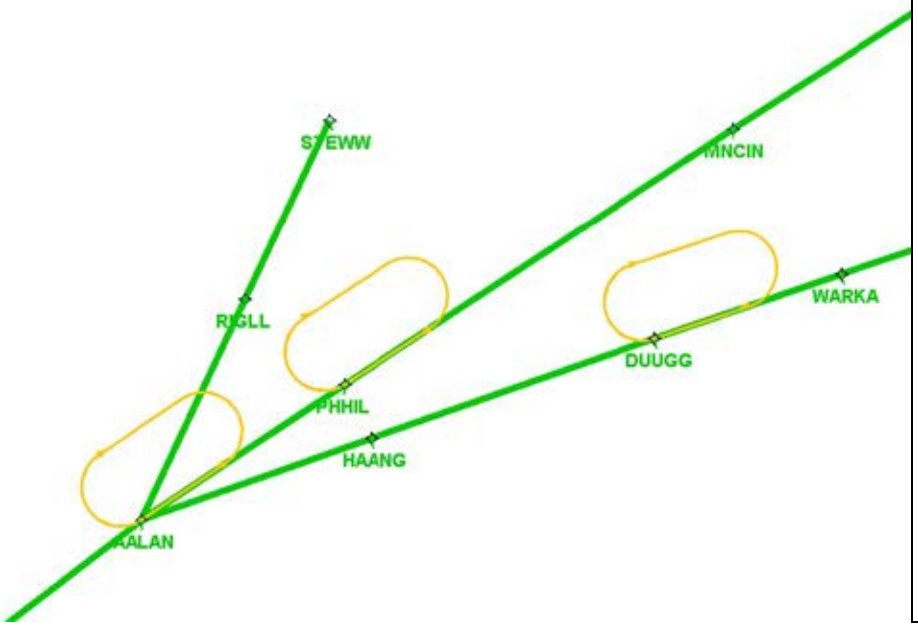
Date

NATCA Metroplex Co-Lead

2/11/2020

Date

KLAS CHOWW STAR Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	WP71980 created midway between GGAPP and PHHIL as a re-route/coordination point between ZLC and ZLA. WP71980 renamed MNCIN. 	Master TARGETS Files	

KLAS CHOWW STAR Change Sheet

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

Date

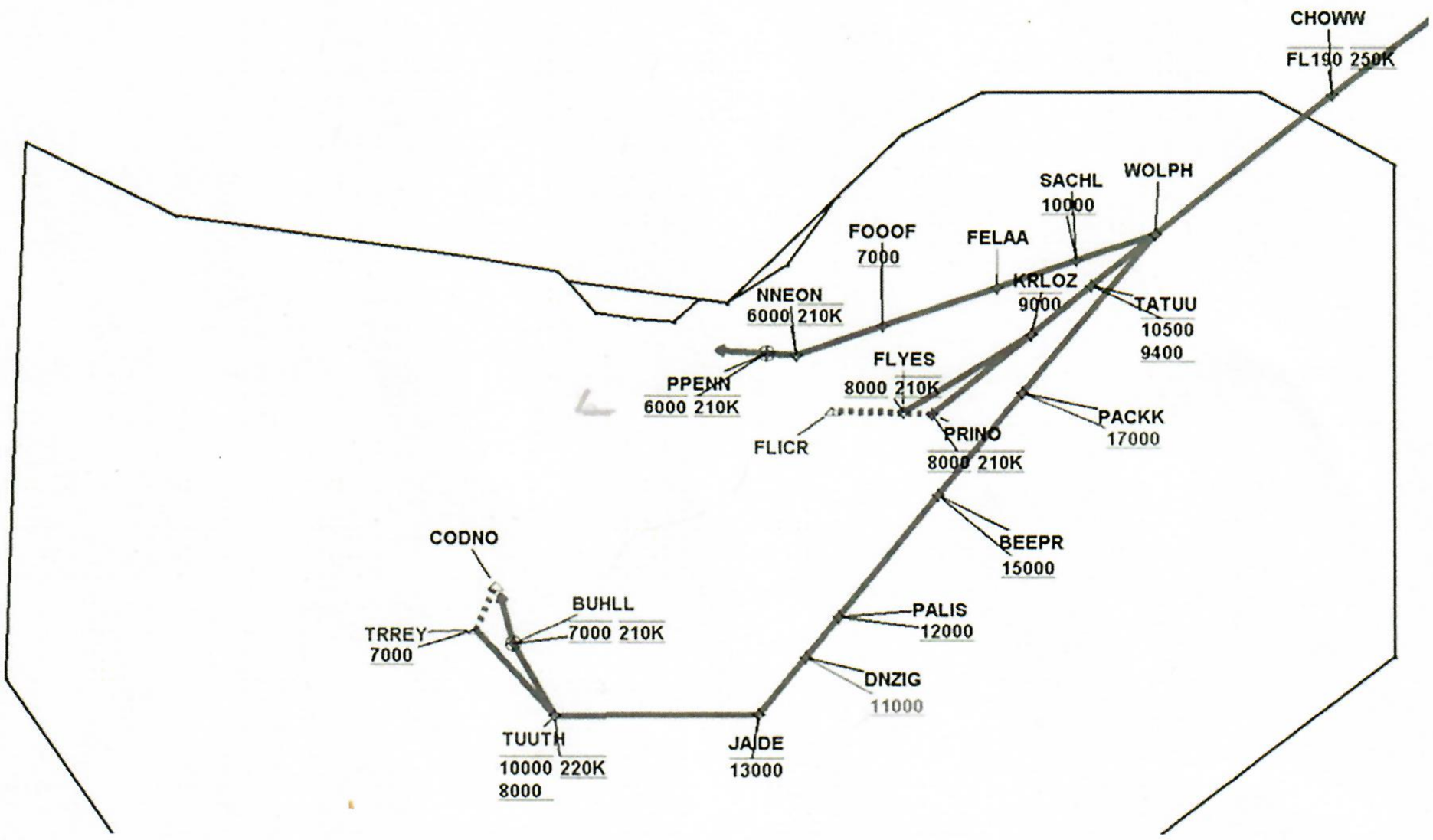
NATCA Metroplex Co-Lead

2/11/2020

Date

KLAS CHOWW Change Sheet

Las Vegas Metroplex KLAS CHOWW STAR Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
3/4/20	For Class B containment, an altitude restriction of AOA 085 was added to the FELAA waypoint. No lateral change. Restriction added to RKSTR also.	LAS Master TARGETs File	



Original Proposed Final Design KLAS CHOWW STAR

KLAS CHOWW Change Sheet

Amended Proposed Final Design KLAS CHOWW STAR

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Original Signed

Bradley R. Mayhugh
FAA Metroplex Co-Lead

3-12-2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

3/12/2020
Date

LAS Metroplex CHOWW Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
11/21/19	The Metroplex Team discovered that the waypoint name PALIS was not available. Waypoint PALIS changed to RFUSE. TARGETS file updated. No map attached waypoint name spelling was only change.	Master TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

Post Implementation: As part of the formal conclusion of the Metroplex Project, the Air Traffic Facilities will receive all design packages and change control sheets. As indicated below, the Co-Leads signatures acknowledge the accuracy of the information in the change control sheets and that all actions are completed by the Metroplex Team.

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS CHOWW STAR CHANGE SHEET

METROPLEX CHOWW Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
8/28/2019	In order to meet design criteria and to increase efficiency, the Team removed the speed (210 knots) at NNEON. FOOOF (AOA 070) was moved 2.5 miles to the southwest and a speed of 220 knots was added.	Mater TARGETS File	
Post Design Package Submission	FLYES was moved marginally to a location abeam of PRINO at Industry request in order to reduce complexity (Shown in Figure 1)	Master TARGETS Files	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

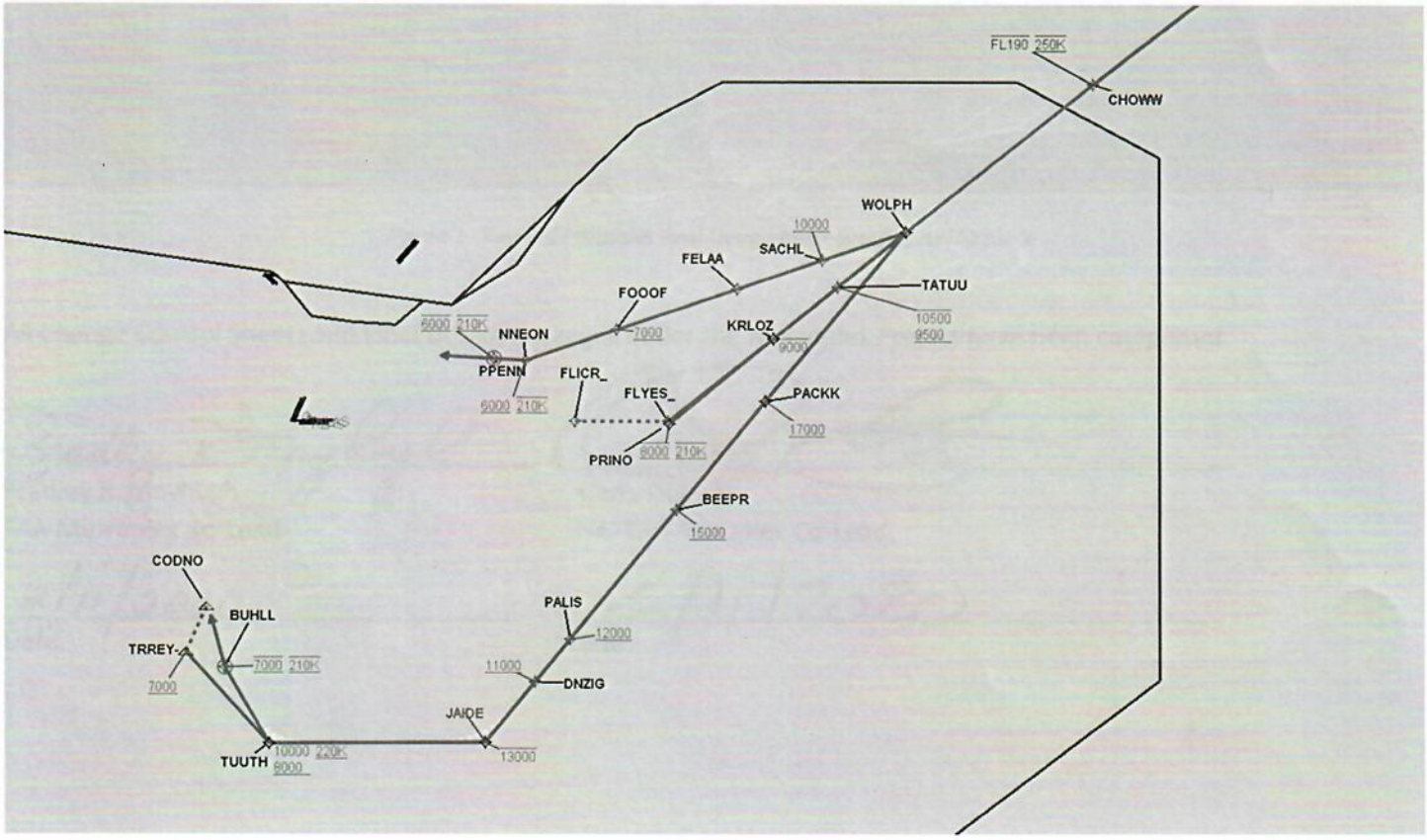


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

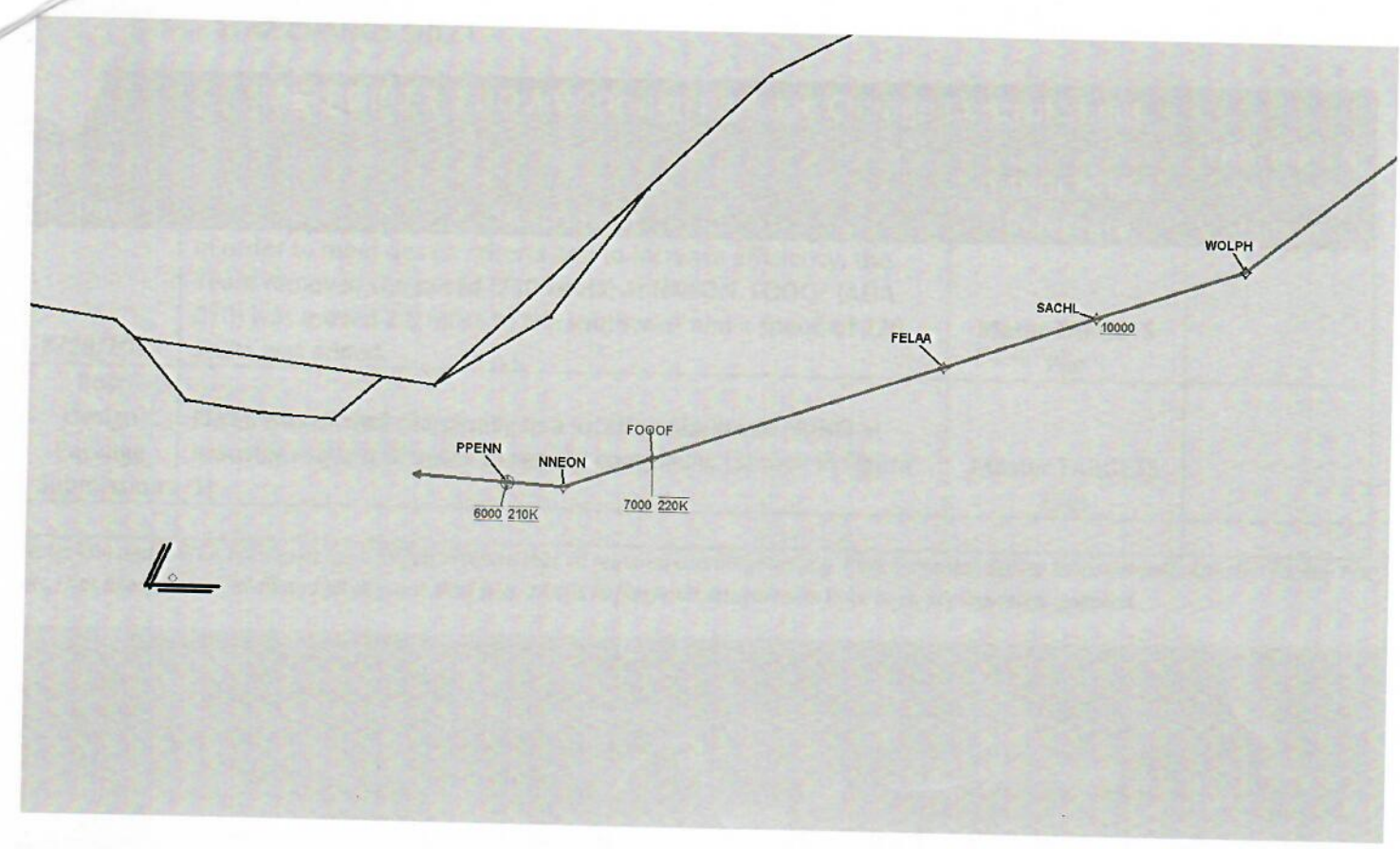


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R. Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KLAS CHOWW STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

McCarran International Airport (KLAS) arrivals from northeastern origins will use a new flight path procedure called the CHOWW (pronounced “Chow”) RNAV STAR. The CHOWW STAR will replace the current SITEE (pronounced “City”) RNAV STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current SITEE STAR causes aircraft to level off for extended periods and requires close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

In order to segregate KLAS arrivals from the northeast from other aircraft traffic flows, the CHOWW STAR includes altitude restrictions. These restrictions will allow descents that are more continuous at reduced power. In air traffic control terms, this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage.

The new CHOWW RNAV STAR will provide connectivity to all KLAS runways except KLAS Runways 08L/R. A transition to Runways 08L/R was not feasible.

The new CHOWW STAR addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KLAS CHOWW STAR

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran International Airport (KLAS) CHOWW Area Navigation (RNAV) Standard Terminal Arrival Route (STAR)	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.1.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 54, 55 **Salt Lake City ARTCC (ZLC) Sectors: 33, 34, 44, 46** **Denver ARTCC (ZDV) Sectors: 23, 24, 68** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: LAK, SAT, FNL** **KLAS**	**KLAS RATPK and GIDGT Standard Instrument Departures (SIDs)** **Henderson Executive Airport (KHND) BOEGY STAR** **KHND SCAMR SID** **North Las Vegas Airport (KVGT) WYLND STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed KLAS CHOWW RNAV STAR is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders agree that the GRNPA/SITEE STAR[1] has numerous inefficiencies in its design. GRNPA/SITEE arrivals incur an approximate ten nautical mile (NM) level-off at 12,000 feet and an approximate ten to twenty NM level-off at 8,000 feet to comply with other inefficient procedures.

[1] The SITEE STAR replaced the GRNPA STAR in 2017 outside of the LAS Metroplex Project but after the MST report was published.

The GRNPA/SITEE STAR does not provide repeatable and predictable course guidance to runways other than Runways 19L/R. The lack of runway transitions requires controllers to vector aircraft to other runways increasing pilot/controller task complexity.

The sharp left turn at LUXOR creates excessive compression at the L30/ZLA boundary. L30 controllers vector arrivals off the procedure to maintain in trail spacing. Sequencing three flows at KSINO by multiple ZLA sectors is complex and inefficient.

Recommendation

The MST created an RNAV Optimized Profile Descent (OPD) STAR (NE STAR) usable for all configurations, which reduces flight track miles and level segments and connects to current and proposed Standard Instrument Approach Procedures (SIAP). The KLAS NE STAR incorporates altitude windows and speed constraints to reduce pilot/controller task complexity.

During the second Outreach, ZLA provided input as to the location of the en route transitions sequencing point. This new location is east of the current KSINO merge point.

The MST recommendation is depicted in Figures 1 and 2.

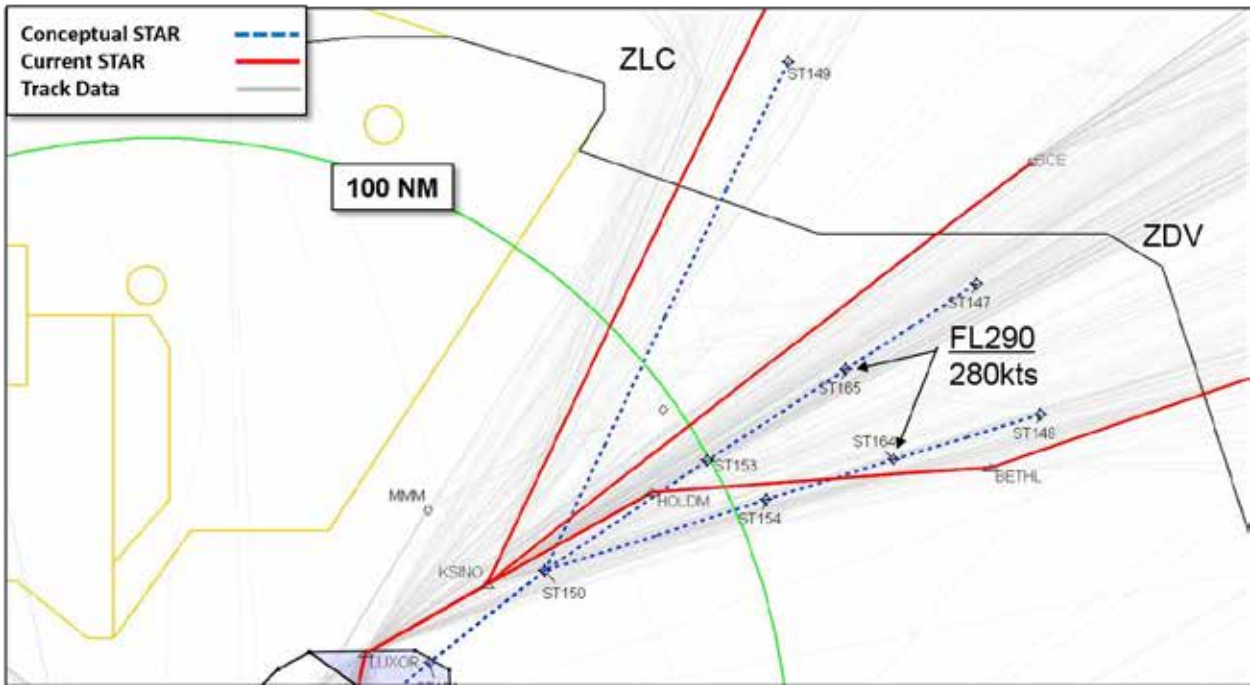


Figure 1: Current KLAS GRNPA/SITEE STAR and MST's Conceptual KLAS NE STAR - En Route View

Las Vegas OAPM Design Package
KLAS CHOWW STAR

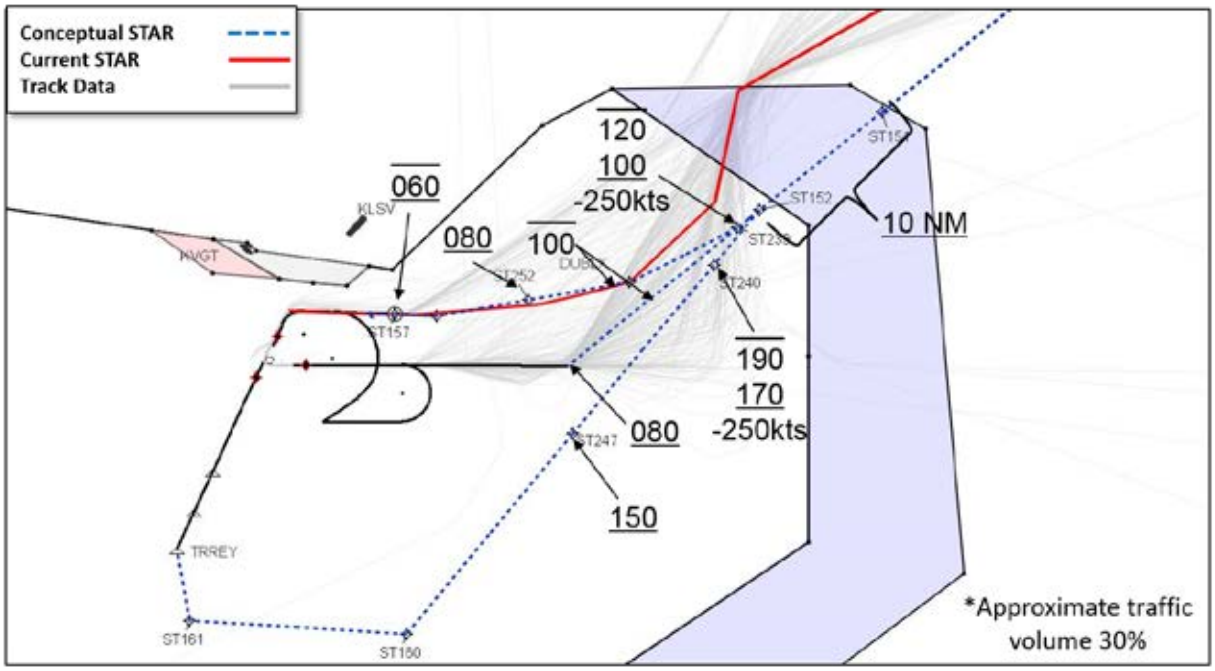


Figure 2: Current KLAS GRNPA/SITEE STAR and MST's Conceptual KLAS NE STAR – Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation. The CHOWW RNAV STAR was designed as an OPD STAR with enhanced repeatability and predictability. It will increase efficiency and reduce complexity by reducing controller and flight crew workloads and task complexity. In en route airspace, the procedure closely follows the MST recommendation.

The KLAS CHOWW STAR was designed with three en route transitions, a common route and runway transitions to six of the eight KLAS runways.

The KLAS CHOWW STAR's PFD is depicted in Figures 3 and 4.

En Route Transitions

GGAPP Transition (for flights that depart within or overfly ZLC airspace)

- GGAPP (coordination waypoint with ZLC)
- PHHIL (At or above FL 240/provides airspace integrity/published standard holding pattern)
- AALAN (altitude window of 170 to FL230/reduces complexity in ZLA Sector 54/ published standard holding pattern)
- CHOWW (at or below FL190/250 knots/ ensures aircraft enter L30 airspace prior to boundary/reduces compression)

STEWW Transition (accommodates flights from the north from ZLC)

- STEWW (coordination waypoint with ZLC)
- RIGLL (at or above FL 240/provides airspace integrity)
- AALAN (altitude window of 170 to FL230/reduces complexity in ZLA Sector 54/published standard holding pattern)
- CHOWW (at or below FL190/250 knots/ ensures aircraft enter L30 airspace prior to boundary/reduces compression)

TYEGR Transition (for flights that depart within or overfly ZDV airspace)

- TYEGR (coordination waypoint with ZDV)
- WARKA (used for sequencing flexibility/provides segregation from J11)
- DUUGG (published standard holding pattern)
- HAANG (at or above FL 240/provides airspace integrity)
- AALAN (altitude window of 170 to FL230/reduces complexity in ZLA Sector 54/published standard holding pattern)
- CHOWW (at or below FL190/250 knots/ ensures aircraft enter L30 airspace prior to boundary /reduces compression)

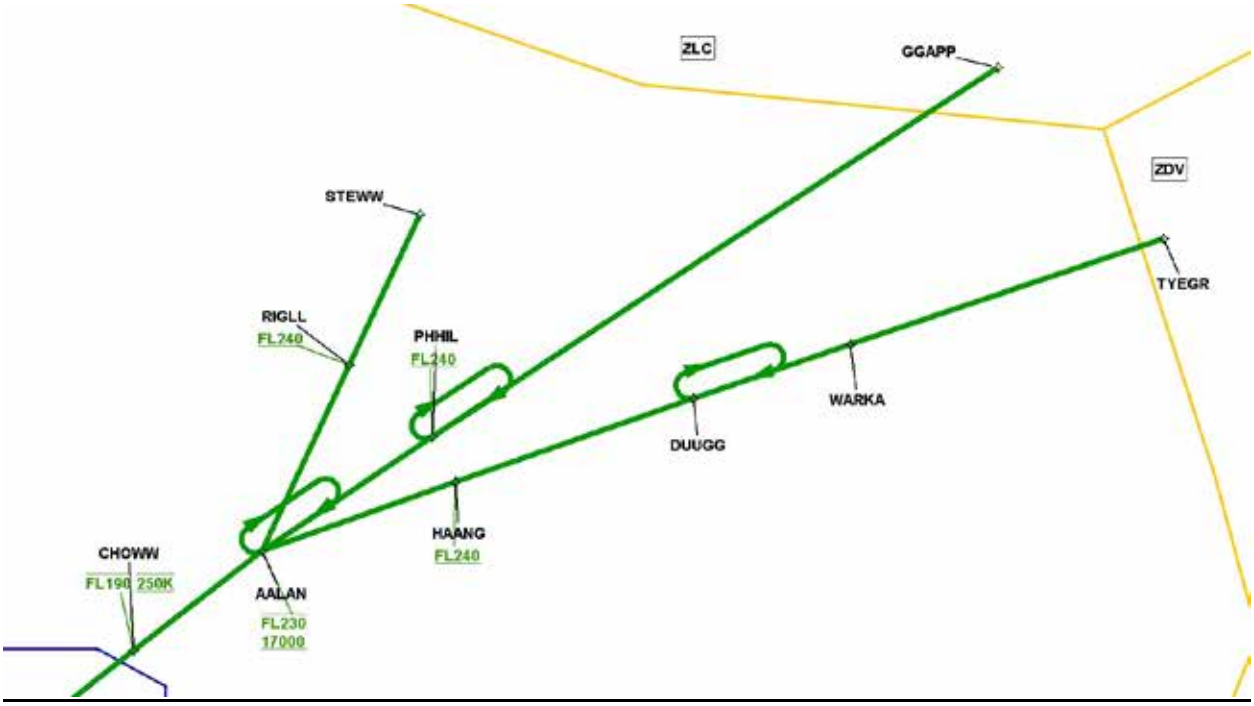


Figure 3: KLAS CHOWW STAR – En Route View

Las Vegas OAPM Design Package

KLAS CHOWW STAR

Common Route

- CHOWW (at or below FL190/250 knots/ensures aircraft enter L30 airspace prior to boundary reduces compression)
- WOLPH (accommodates runway transitions)

The terminal portion of the CHOWW STAR provides course guidance to serve all KLAS runways except Runways 08L/R. A transition to Runways 08L/R was not feasible.

Runway Transitions

Runways 01L/RTransition

- WOLPH (accommodates runway transitions)
- PACKK (at or above 170/provides continuity of descent/reduces compression)
- BEEPR (at or above 150/provides segregation from KLAS GIDGT, RASLR and NIITZ SIDs)
- PALIS (at or above 120/provides segregation from KHND SCAMR SID)
- DNZIG (at or above 110/provides segregation from KHND SCAMR SID/provides airspace integrity)
- JAIDE (at or below 130/tie-in to KLAS RKSTR STAR)
- TUUTH (altitude window of 080 to 100/220 knots/provides segregation from KHND SCAMR and OYODA SIDs/required for design criteria)
- BUHLL (at 7,000 feet/210 knots/ensures Class B containment/ required for design criteria/ provides Runway 01R approach connectivity)

  Or
- TRREY (at or above 7,000 feet/ensures Class B containment/provides Runway 01L approach connectivity)

Runways 19L/R Transition

- WOLPH (accommodates runway transitions)
- SACHL (at or above 100/resolves Minimum Obstruction Clearance Altitude (MOCA) criteria)
- FELAA (tie-in to the KLAS RKSTR STAR)
- FOOOF (at or above 070/resolves MOCA criteria)
- NNEON (at or above 060/210 knots/required for design criteria)
- PPENN (at 060/210 knots/required for design criteria/provides approach connectivity)

Runways 26L/R Transition

- WOLPH (accommodates runway transitions)
- TATUU (altitude window of 094 to 105/required for design criteria/provides segregation from KLAS GIDGT SID/resolves MOCA criteria)
- KRLOZ (at or below 090//provides segregation from KLAS NIITZ and RASLR SIDs)
- PRINO (at 080/210 knots/provides Runway 26L approach connectivity)

Or

- FLYES was moved approximately 1.6 miles east for approach criteria (at or above 080/210 knots/provides Runway 26R approach connectivity)

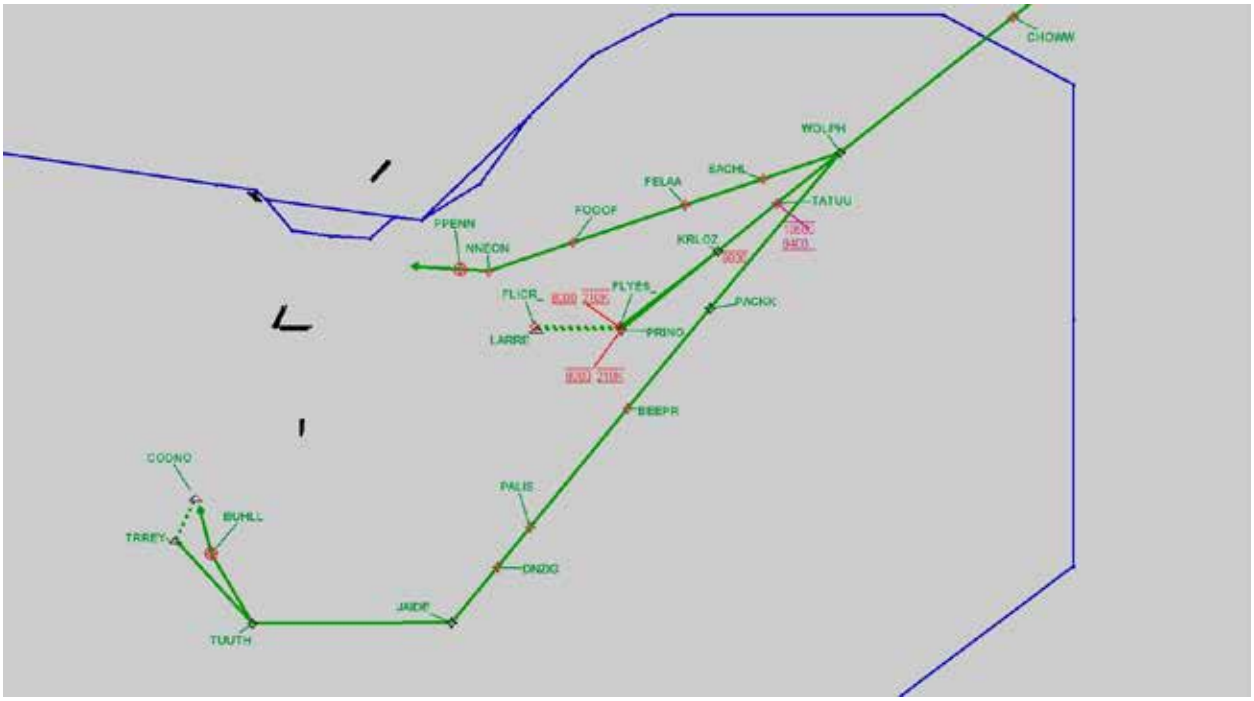


Figure 3: KLAS CHOWW STAR – Terminal View

Additional Design Considerations

- The KLAS CHOWW STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The LAS CHOWW STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 54, 55
- ZLC Sectors: 33, 34, 44, 46
- ZDV Sectors: 23, 24, 68
- L30 Sectors: LAK, SAT, FNL
- KLAS

Las Vegas OAPM Design Package
KLAS CHOWW STAR

Implementation Dependencies

The procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT airports.

Document changes/modifications include:

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZLC LOA
- ZLA/ZDV LOA
- ZLA Standard Operating Procedures (SOP)
- ZLC SOP
- ZDV SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- SIAPs
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
    - TARGETS distribution package
    - Flight Simulator worksheet
    - RNAV Pro analysis results
    - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

KLAS COKTL STAR CHANGE SHEET

METROPLEX COKTL Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
8/28/2019	The Team determined that removal of the AOA 090 altitude restriction at BAUMM would allow the procedure to pass criteria from BAUMM to ROAMN and BAUMM to YAGGR.	Mater TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

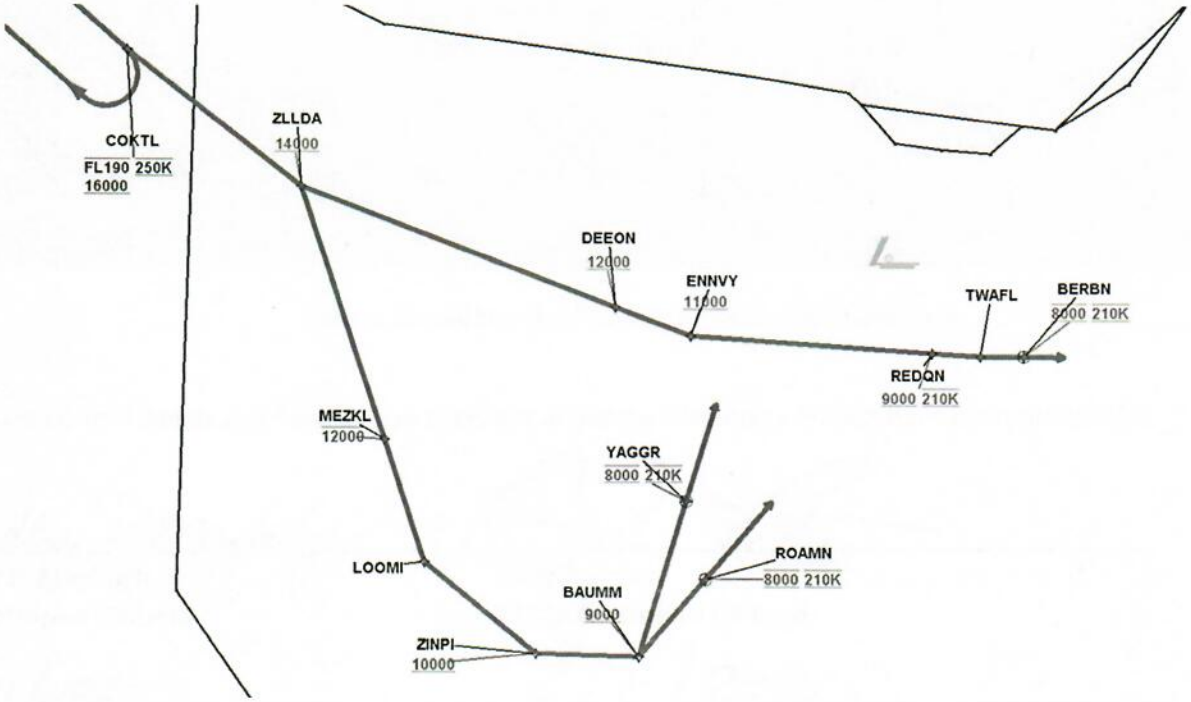


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

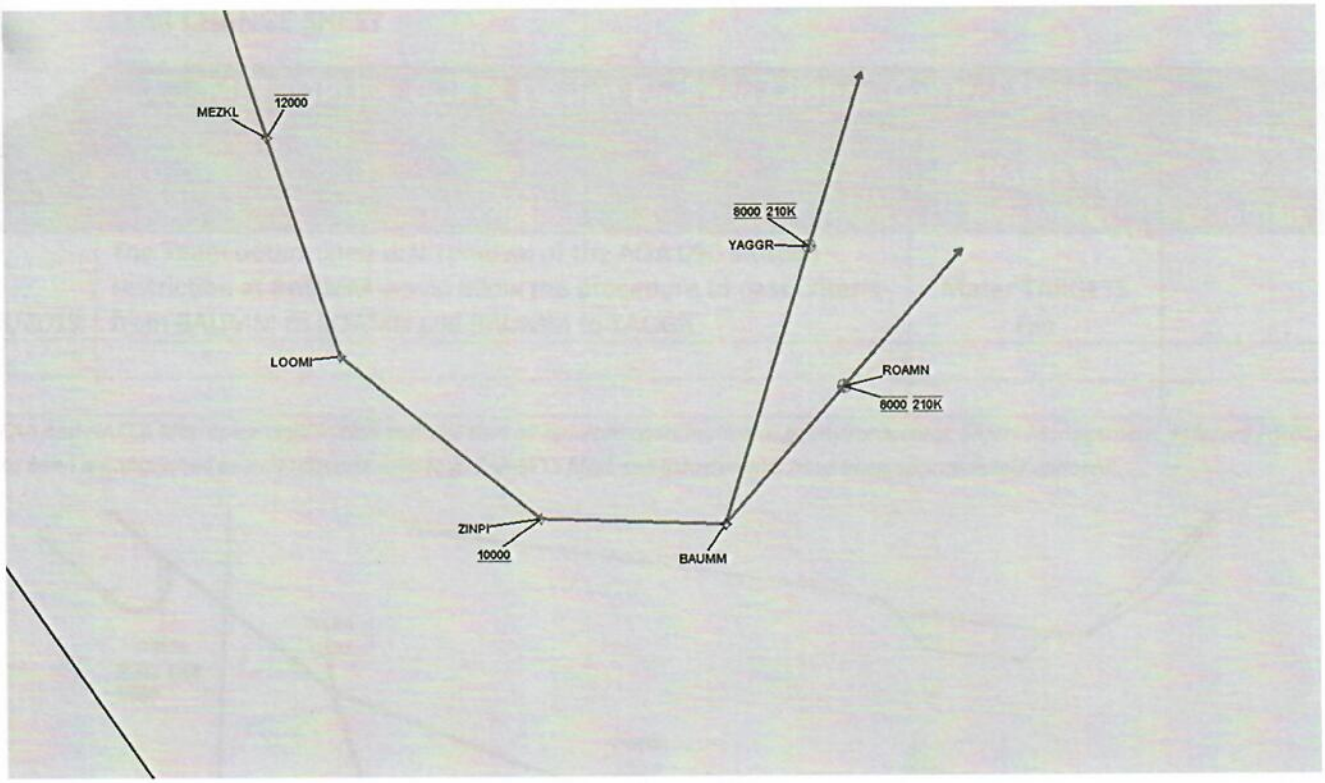


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R. Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KLAS COKTL STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

McCarran International Airport (KLAS) arrivals from northwestern origins will use a new flight path procedure called the COKTL (pronounced "Cock-tail") RNAV STAR. The COKTL STAR will replace the current SUNST (pronounced "Sun-set") RNAV STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current SUNST STAR causes aircraft to level off for extended periods and requires close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

Las Vegas Valley arrivals from and departures to the northwest require routing through a nineteen mile wide corridor formed by military restricted airspace. The narrow airspace corridor supports one KLAS departure procedure and three KLAS and satellite airport departure/arrival routes. The design is further complicated by interactions closer to the airport with aircraft assigned the KLAS JOHKR Standard Instrument Departure (SID). In an area where terrain is a factor, KLAS JOHKR departure aircraft are accomplishing climbs to altitude while COKTL STAR aircraft are descending.

In order to segregate KLAS arrivals from the northwest and from other aircraft traffic flows, the new procedure includes altitude restrictions. These restrictions will allow more continuous descents at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage.

The new COKTL RNAV STAR will provide connectivity to all KLAS runways.

The new COKTL STAR addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KLAS COKTL STAR

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran International Airport (KLAS) COKTL Area Navigation (RNAV) Standard Terminal Arrival Route (STAR)	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.1.5	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 16 **Oakland ARTCC (ZOA) Sectors: 15, 33, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: GNT, FNL, SAT** **Nellis Air Traffic Control Facility (NATCF)** **KLAS**	**North Las Vegas Airport (KVGT) FLCHR STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed KLAS COKTL RNAV STAR is to provide a repeatable and predictable path for KLAS arrivals from the northwest that address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholder input indicates that the SUNST STAR has numerous inefficiencies in its current design. SUNST arrivals incur an approximately 15 to 20 nautical mile (NM) level-off at 16,000 feet and a 5 to 10 NM level-off at 11,000 feet to comply with other inefficient procedures.

The SUNST STAR does not provide repeatable and predictable course guidance to runways other than Runways 26L/R. The lack of runway transitions requires controllers to vector aircraft to other runways increasing pilot/controller task complexity.

Las Vegas OAPM Design Package

KLAS COKTL STAR

The SUNST STAR requires aircraft to cross MYCAL at or above FL210, making it difficult for arrival aircraft to meet speed and altitude restrictions at FUZZY.

The current Q-Route structure in ZLA's Sector 16 does not provide necessary connectivity when considering the arrival, departure and overflight route structure.

MST Recommendation

The MST originally proposed an alternative design for the northwest arrival/departure corridor showing a conceptual Standard Instrument Departure (SID) and STAR that reversed the arrival/departure flows in the northwest corridor. Initial designs of the SID in this quadrant had climb gradient concerns and needed further exploration. During the second Outreach, ZLA and L30 provided feedback indicating they would prefer this alternative design as the primary proposal, if feasible.

The MST was able to address these concerns by making the reverse flow alternative the primary recommendation. The RNAV Optimized Profile Descent (OPD) STAR (KLAS NW STAR) is usable for all configurations, reduces level segments, and connects to current and proposed Standard Instrument Approach Procedures (SIAP).

The KLAS NW STAR provides connectivity to the current Q-Route structure and incorporates altitude windows and speed assignments to reduce pilot/controller task complexity.

Reversing the arrival and departure flow in the northwest corridor provides aircraft on the KLAS NW STAR additional track miles for an optimal descent. The reversal of flows has also removed interaction with the KLAS NW SID (LAS Study Team Final Report Section 4.3.2.6).

The MST recommendation is depicted in Figures 1 and 2.

Las Vegas OAPM Design Package
KLAS COKTL STAR

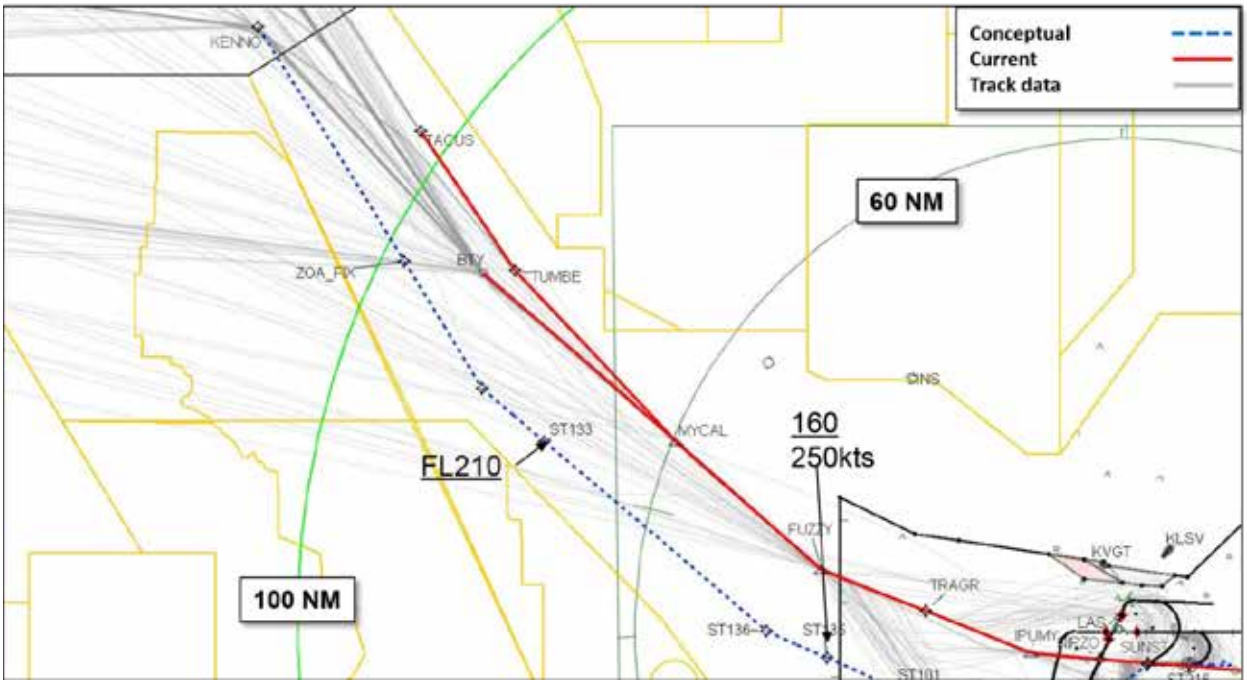


Figure 1: Current KLAS SUNST STAR and MST's Conceptual KLAS NW STAR – En Route View

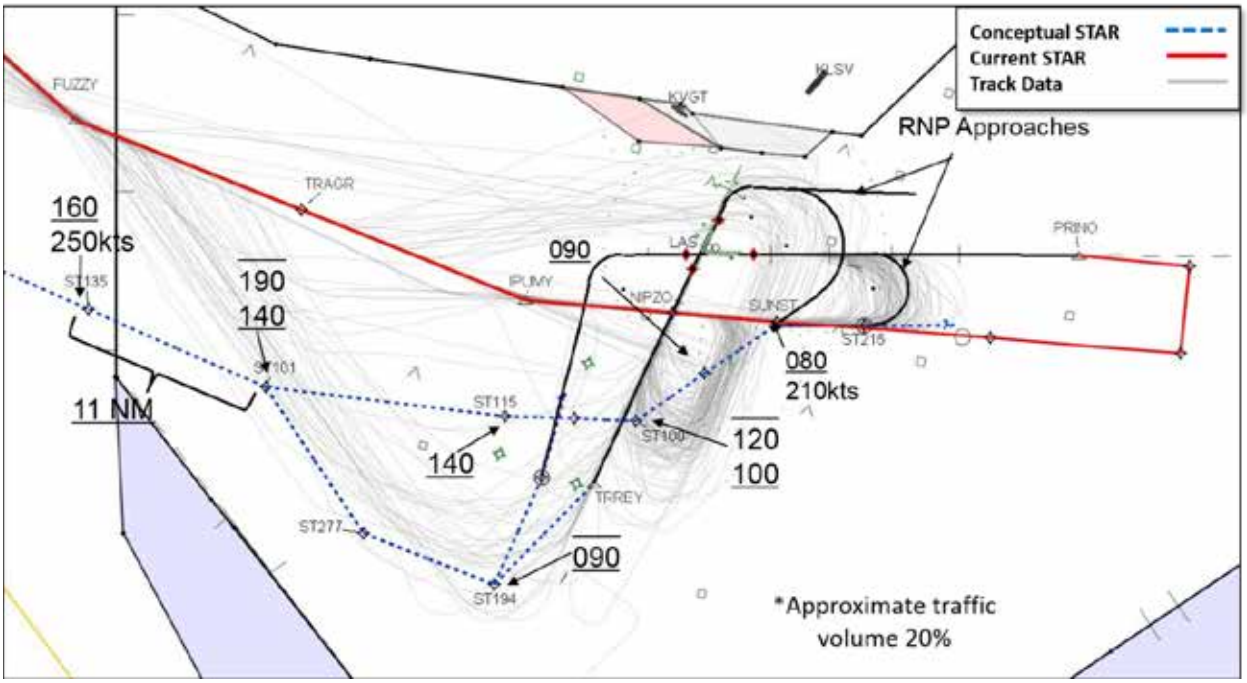


Figure 2: Current KLAS SUNST STAR and MST's Conceptual KLAS NW STAR – Terminal View

Las Vegas OAPM Design Package
KLAS COKTL STAR

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation.

The MST recommendation was for a reversal of the arrival and departure traffic flows out to the northwest. The D&I Team utilized HITLS using I-SIM to test the conceptual designs submitted by the MST. After analysis of the simulations and discussion with Industry partners, the D&I Team decided to disregard the MST proposal and redesign the SUNST STAR without reversing the arrival and departure flows. Reasoning for this decision is provided in the next section.

The COKTL STAR serves KLAS arrivals from the northwest. Las Vegas Valley arrivals from and departures to the northwest require routing through a nineteen mile wide corridor formed by military restricted airspace to the northeast and southwest. The narrow corridor supports one KLAS departure procedure and three KLAS and satellite airport departure/arrival routes. The design is further complicated by interactions closer to the airport with aircraft assigned the KLAS JOHKR SID. In an area where terrain is a factor, KLAS JOHKR departure aircraft are accomplishing climbs to altitude while COKTL STAR aircraft are descending.

The COKTL RNAV STAR (Figures 3 and 4) was designed as an OPD STAR with enhanced repeatability and predictability. It will increase efficiency and reduce complexity by reducing controller and flight crew workloads and task complexity.

To provide maximum flexibility for ATC, two en route transitions along the STAR were created, one common route and runway transitions to all KLAS runways.

En Route Transitions

BASIC Transition

- BASIC (coordination waypoint with ZOA/provides segregation from Q13/15, restricted airspace, Henderson Executive Airport (KHND) GAMES STAR and OYODA SID, and KLAS JOHKR SID)
- FLCHR (provides connectivity with Q174/provides segregation from Q13/15, restricted airspace, KHND GAMES STAR and OYODA SID)
- TBRAN (provides segregation from Q13/15, restricted airspace, KHND GAMES STAR and OYODA SID)
- ARYEL (at or above FL210/provides NATCF airspace integrity/standard published holding pattern)
- COKTL (altitude window of 160 to FL190/250 knots/ensures aircraft enter L30 airspace/reduces compression issues/standard published holding pattern

Las Vegas OAPM Design Package

KLAS COKTL STAR

GIINN Transition (ATC assigned only for times when military airspace is inactive)

- GIINN (coordination point with ZOA and Joshua Control Facility [JCF])
- TBRAN (provides segregation from Q13/15, restricted airspace, KHND GAMES STAR and OYODA SID)
- ARYEL (at or above FL210/provides NATCF airspace integrity/standard published holding pattern)
- COKTL (altitude window of 160 to FL190/250 knots/ensures aircraft enter L30 airspace/reduces compression issues/standard published holding pattern

FLCHR Transition

- FLCHR (provides connectivity with Q174/provides segregation from Q13/15, restricted airspace, KHND GAMES STAR and OYODA SID)
- TBRAN (provides segregation from Q13/15, restricted airspace, KHND GAMES STAR and OYODA SID)
- ARYEL (at or above FL210/providesNATCF airspace integrity/standard published holding pattern)
- COKTL (altitude window of 160 to FL190/250 knots/ensures aircraft enter L30 airspace/reduces compression issues/standard published holding pattern

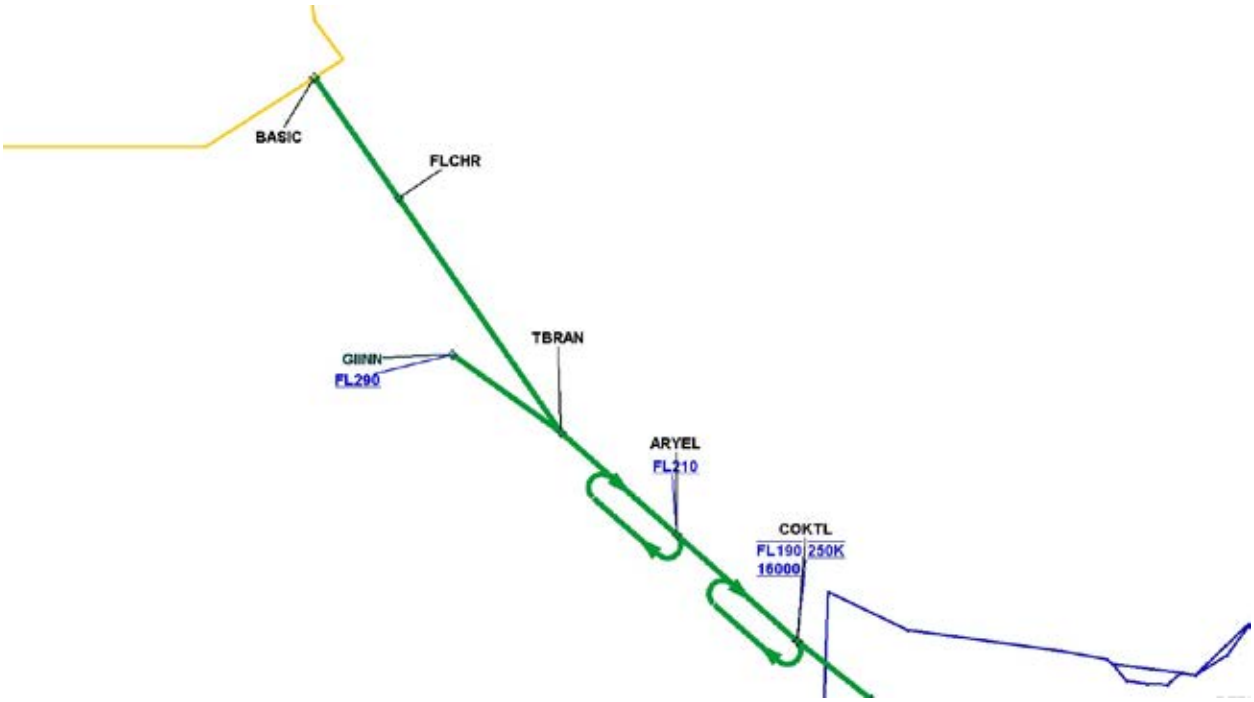


Figure 3: KLAS COKTL RNAV STAR – En Route View

Common Route (all transitions)

KLAS COKTL (SUNST) STAR

Las Vegas OAPM Design Package

KLAS COKTL STAR

- COKTL (altitude window of 160 to FL190/250 knots/ensures aircraft enter L30 airspace/reduces compression issues/standard published holding pattern
- ZLLDA (at or above 140/provides terrain avoidance/provides runway connectivity)

Runways 01L/R Transition

- MEZKL (provides segregation from KLAS JOHKR SID)
- LOOMI (provides segregation from KLAS JOHKR SID)
- ZINPI (at or above 100/provides terrain avoidance)
- BAUMM (at or above 090/required for design criteria)
- ROAMN (at 080/210 knots/provides approach connectivity)

Runways 08L/R Transition

- MEZKL (provides segregation from KLAS JOHKR SID)
- LOOMI (provides segregation from KLAS JOHKR SID)
- ZINPI (at or above 100/provides terrain avoidance)
- BAUMM (at or above 090/ required for design criteria)
- YAGGR (at 080/210 knots/provides approach connectivity)

Runways 19L/R and 26L/R Transitions

- DEEON (at or above 120/provides terrain avoidance)
- ENNVY (at or above 110/provides terrain avoidance/provides segregation from KLAS JOHKR SID)
- REDQN (at or above 090/210 knots/required for design criteria/provides segregation from KLAS JOHKR, RAYDR, NIITZ and RASLR SIDs)
- TWAFL (creates a straight segment required for design criteria)
- BERBN (at 080/210 knots/provides segregation from KHND Runway 35 departures/required to match approach restrictions/initial approach waypoint)

KLAS COKTL (SUNST) STAR

Las Vegas OAPM Design Package

KLAS COKTL STAR

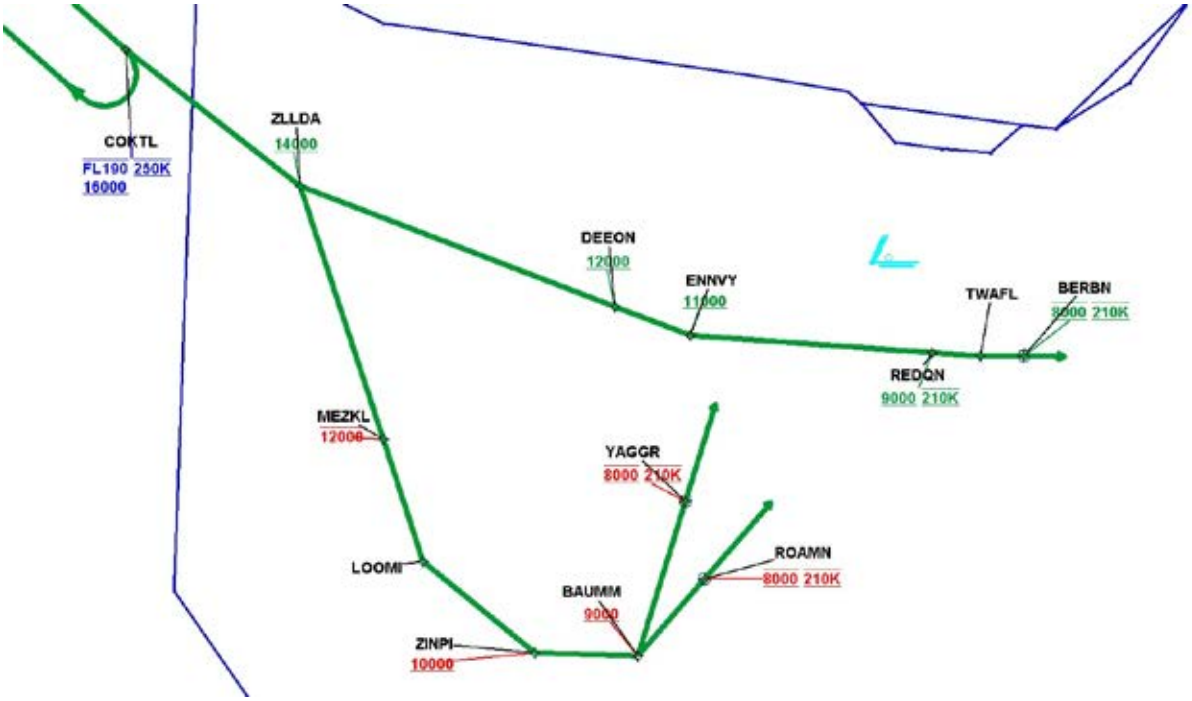


Figure 4: LAS COKTL RNAV STAR Terminal View

MST Recommendation Design Differences

The MST recommended a reversal of the arrival and departure traffic flows from/to the northwest. The D&I Team utilized HITLS using I-SIM to test the conceptual designs submitted by the MST. After analysis of the simulations and discussion with Industry partners, the D&I Team decided to disregard the MST proposal and redesign the SUNST STAR without reversing the flows.

The following are the reasons the team decided against the reversal of traffic flows:

- Terrain to the west of the airport rises faster than aircraft are able to climb
  - Departure aircraft would have difficulty meeting an excessive climb gradient to 10,000 feet, especially on Configuration 3. If an aircraft was unable to meet the altitude restrictions and was below the Minimum Vectoring Altitude (MVA), L30 would have no options to mitigate the situation
  - Eliminates L30's ability to turn departures for sequencing due to departures remaining below the MVA longer
  - L30 would have reduced ability to allow aircraft to deviate if weather were to impact the area
- Department of Energy flights (JANET Flights) are in conflict with proposed northwest departures

Las Vegas OAPM Design Package

KLAS COKTL STAR

- KHND departure routes are excessively long, especially in Configurations 2 and 4, and in conflict with traffic in L30 Sectors FNL, LAK and GNT
- ZLA's Sector 16 would have no room to maneuver aircraft for sequencing. Departures would be lower and could not be vectored to the west to climb, as they would be in conflict with arrival traffic descending nor could they be vectored to the east due to Special Use Airspace (SUA)
- Fewer track miles on departures would not allow aircraft to climb above NATCF's LEE Sector (A7 shelf)
- Inability to provide direct routings due to interactions with arrival traffic

Additional Design Considerations

- The KLAS COKTL STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The COKTL STAR affects the following facility area(s) as indicated:

- ZLA Sector: 16
- ZOA Sectors: 15, 33, 46
- L30 Sectors: GNT, FNL, SAT
- NATCF
- KLAS

Implementation Dependencies

The procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT airports.

Document changes/modifications include:

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- L30/LAS LOA

Las Vegas OAPM Design Package
KLAS COKTL STAR

- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- L30 SOP
- LAS SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- SIAPs
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

KLAS JAYSN STAR CHANGE SHEET

METROPLEX JAYSN Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
8/28/2019	The Team determined that removal of the AOA 090 altitude restriction at BAUMM would allow the procedure to pass criteria from BAUMM to ROAMN and BAUMM to YAGGR.	Mater TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

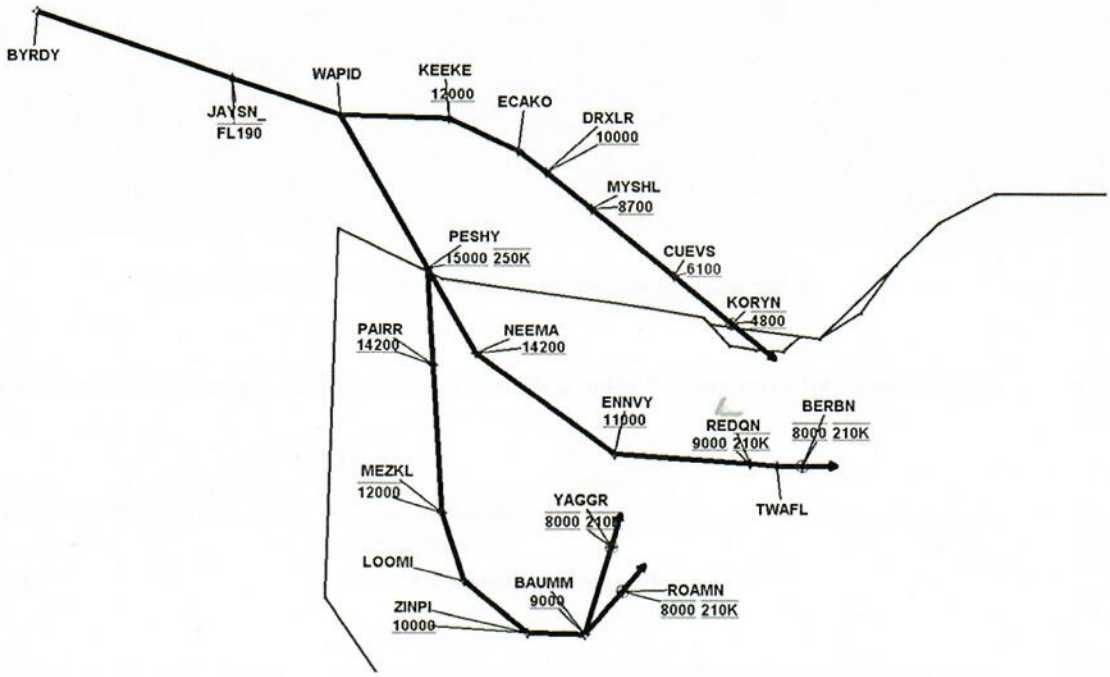


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

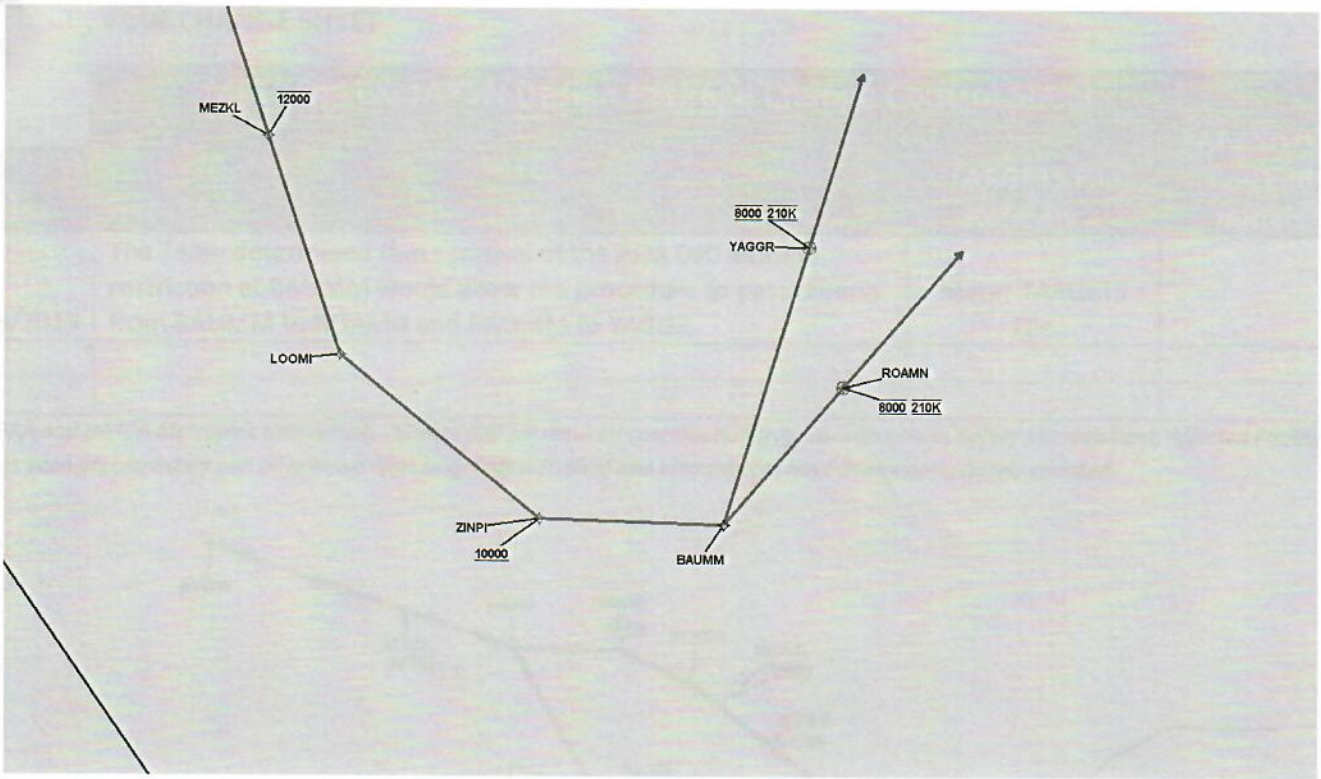


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R. Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KLAS JAYSN STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

McCarran International Airport (KLAS) arrivals from the Tonopah Test Range Airport (KTNX) will use a new flight path procedure called the JAYSN (pronounced "Jay-son") RNAV STAR. The JAYSN STAR will replace a historically developed preferential routing.

The Las Vegas Metroplex Design and Implementation Team (D&I Team) determined that the current routing interferes with other traffic flows, reducing efficiency and increasing complexity.

The JAYSN STAR will allow continuous descents at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

The JAYSN STAR will provide connectivity to all KLAS runways.

This procedure is not anticipated to change runway usage. The JAYSN STAR will increase flight path predictability and will decrease controller/pilot workload and task complexity, which will enhance safety.

The new JAYSN STAR addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KLAS JAYSN STAR

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran International Airport (KLAS) **JAYSN Area Navigation (RNAV)** **Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: GNT, FNL, SAT **Nellis Air Traffic Control Facility (NATCF)** **KLAS**	**KLAS LOHLA Standard Instrument Departure (SID)** **KLAS BASIC, COKTL, and RKSTR STARs** **North Las Vegas Airport (KVGT) FLCHR STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The Las Vegas Metroplex Design and Implementation Team (D&I Team) identified a need for efficient departure and arrival procedures for Tonopah Test Range Airport (KTNX) that account for up to 4% of the daily flights to/from KLAS.

Las Vegas Metroplex Study Team (MST) Recommendation

There was no specific recommendation from the MST for developing a STAR for aircraft departing from KTNX to KLAS.

Proposed Final Design

The JAYSN STAR (Figure 1) was designed to provide course guidance from KTNX to all KLAS runways. The D&I Team worked closely with NATCF in the design of the JAYSN STAR.

The KLAS JAYSN STAR's PFD is depicted in Figure 1.

En Route Transition

Las Vegas OAPM Design Package

KLAS JAYSN STAR

BYRDY Transition

- BYRDY (provides segregation from military Special Use Airspace [SUA])
- JAYSN_ (at or below FL190/provides segregation from Nellis Air Force Base (KLSV) westbound departures)

Common Route

- JAYSN_ (at or below FL190/provides segregation from KLSV westbound departures)
- WAPID (provides terrain avoidance/functions as a split point for runway transitions)

Runway Transitions

Runways 01L/R Transition

- WAPID (functions as a split point for runway transitions)
- PESHY (at or above 150/250 knots/coordination waypoint/provides terrain avoidance/functions as a split point for runway transitions)
- PAIRR (at or above 142/required for Minimum Obstruction Clearance Altitude [MOCA] requirements)
- MEZKL (at or below 120/provides segregation from the KLAS JOHKR SID/joins same lateral track as the KLAS COKTL STAR)
- LOOMI (joins same lateral track as the KLAS COKTL STAR)
- GIINN (at or above 100/provides terrain avoidance)
- BAUMM (at or above 090/required for design criteria)
- ROAMN (at 080/210 knots/provides approach connectivity)

Runways 08L/R Transition

- WAPID (functions as a split point for runway transitions)
- PESHY (at or above 150/250 knots/coordination waypoint/provides terrain avoidance/functions as a split point for runway transitions)
- PAIRR (at or above 142/required for MOCA requirements)
- MEZKL (at or below 120/provides segregation from the KLAS JOHKR SID/joins same lateral track as the KLAS COKTL STAR)
- LOOMI (joins same lateral track as the KLAS COKTL STAR)
- GIINN (at or above 100/provides terrain avoidance)
- BAUMM (at or above 090/required for design criteria)
- YAGGR (at 080/210 knots/initial approach waypoint)

Runways 19L/R Transition

- WAPID (functions as a split point for runway transitions)
- KEEKE (at or above 120/provides terrain avoidance)
- ECAKO (provides terrain avoidance/provides segregation from SUA)
- DRXLR (at or above 100/provides terrain avoidance)
- MYSHL (at or above 087/provides terrain avoidance)

- CUEVS (at or above 061/provides terrain avoidance)
- KORYN (at 048/coordination waypoint for L30 and NATCF)

Runways 26L/R Transition

- WAPID (functions as a split point for runway transitions)
- PESHY (at or above 150/250 knots/coordination waypoint/provides terrain avoidance/functions as a split point for runway transitions)
- NEEMA (at or above 142/required for MOCA requirements)
- ENNVY (at or above 110/provides terrain avoidance/required for design criteria/joins same lateral track as the KLAS COKTL STAR)
- REDQN (at or above 090/210 knots/provides segregation from the KLAS RASLR, NIITZ, JOHKR and RAYDR SIDs/provides terrain avoidance/required for design criteria)
- TWAFL (adds straight segment prior to approach for design criteria)
- BEBRN (at 080/210 knots/initial approach waypoint)

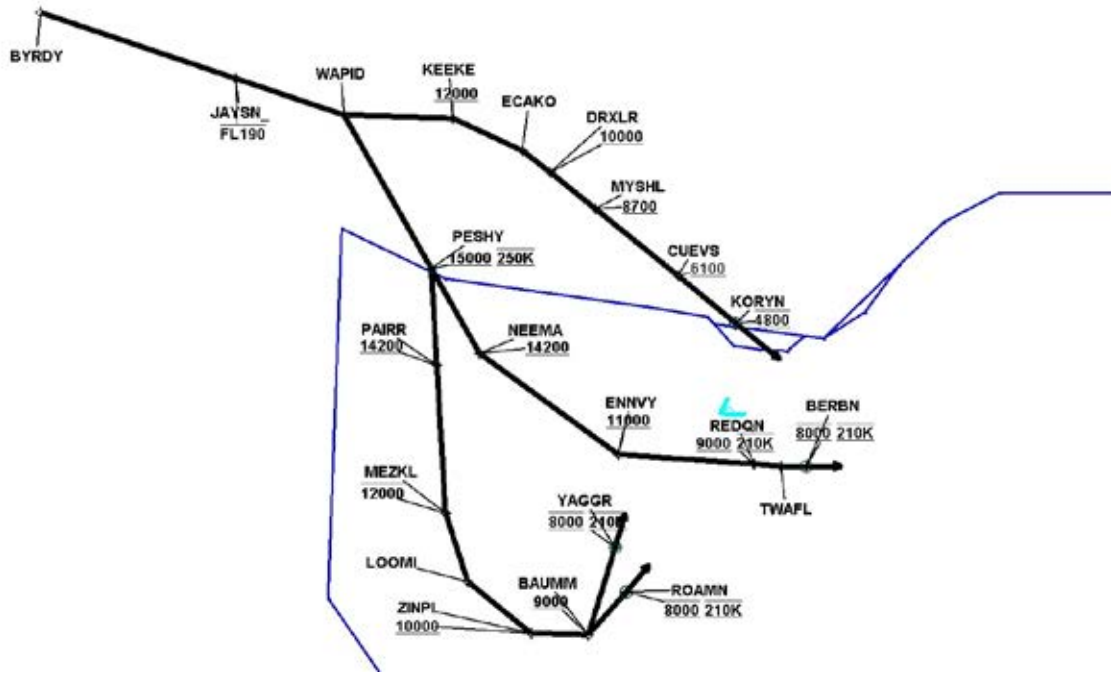


Figure 1: Proposed LAS JAYSN STAR

Additional Design Considerations

- The KLAS JAYSN STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage

- The following chart notes will be included with this procedure:
  - For turbojet aircraft only
  - ATC assigned only

The JAYSN STAR affects the following facility area(s) as indicated:

- L30 Sectors: GNT, FNL, SAT
- NATCF
- KLAS

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS and KVGT.

Document changes/modifications include:

- STAR filings with airline dispatchers
- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- L30 sector boundary maps and video maps
- LSV/L30 Letter of Agreement (LOA)
- L30/LAS LOA
- L30 Standard Operating Procedures (SOP)
- STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
LAS FAA Lead	Date	LAS NATCA Lead	Date
Sarah Fletcher	4/23/19	Martin Ramirez	5/2/19
ZLA Facility POC	Date	ZLA NATCA POC	Date
Anita Engelmann	4/25/19	Dan Hauptman	23 Apr 19
TWAB Representative	Date	L30 NATCA POC	Date

Available via electronic signature

_____ Date

Nellis Air Traffic Control Facility

KLAS RKSTR STAR Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	Waypoint JJEAN renamed FEREL.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS RKSTR STAR Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	WP1263 renamed JJEAN.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS RKSTR STAR Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	FLYES waypoint moved 1.64 nm east for criteria.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

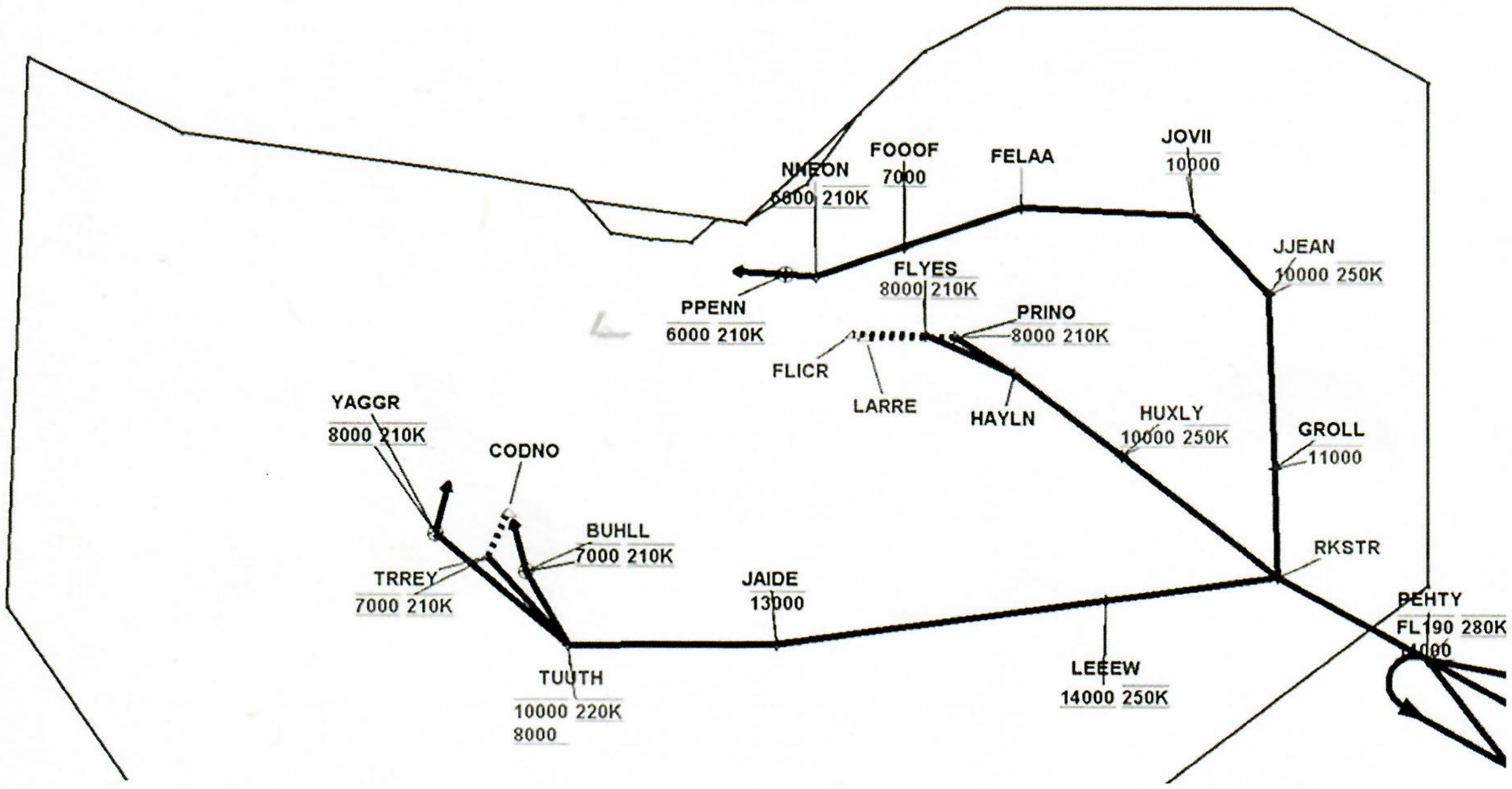
2/11/2020
Date

NATCA Metroplex Co-Lead

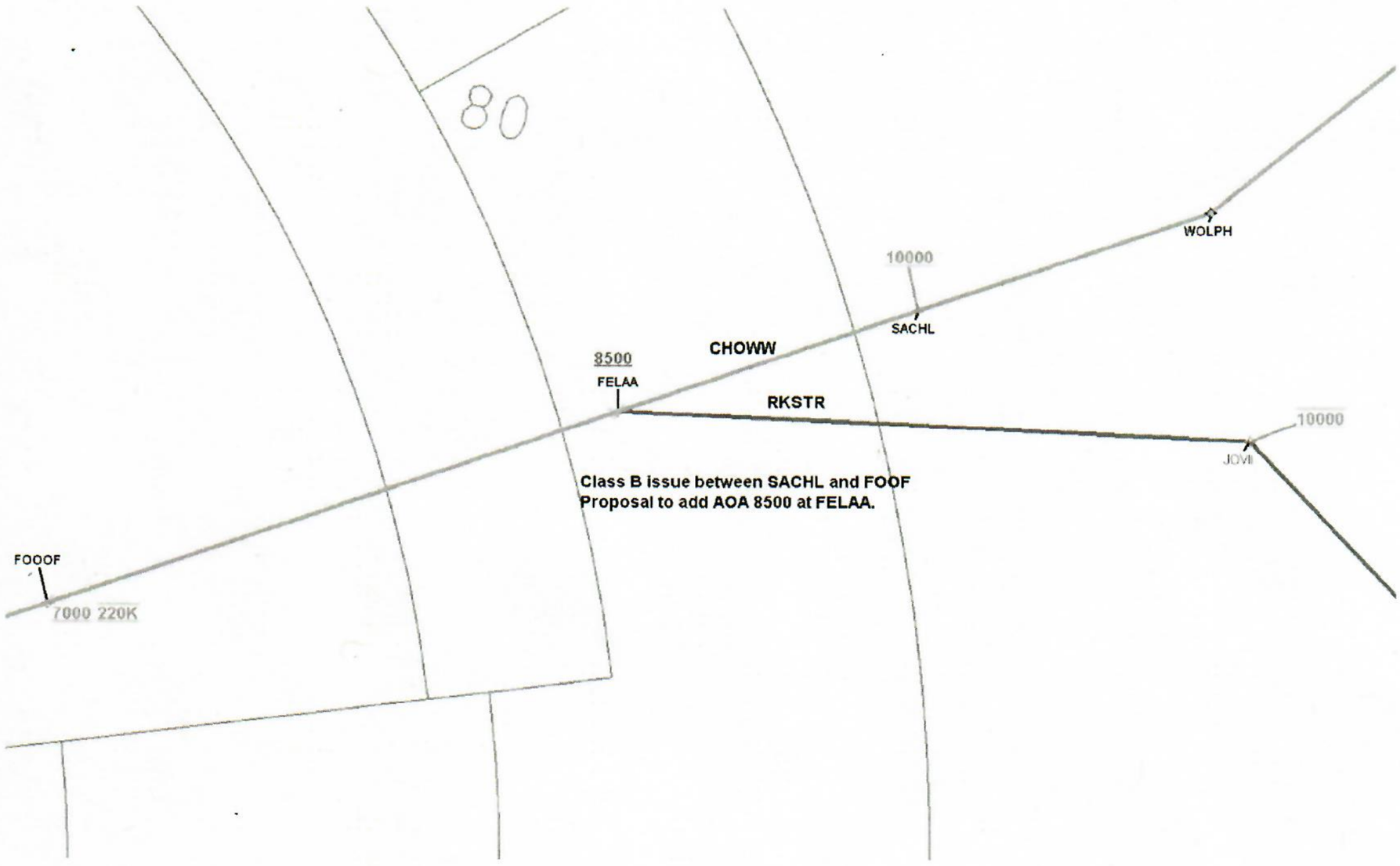
2/11/2020
Date

KLAS RKSTR Change Sheet

Las Vegas Metroplex KLAS RKSTR STAR Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
3/4/20	For Class B containment, an altitude restriction of AOA 085 was added to the FELAA waypoint. No lateral change. Restriction added to CHOWW also.	LAS Master TARGETs File	



Original Proposed Final Design KLAS RKSTR STAR



Amended Proposed Final Design KLAS RKSTR STAR

KLAS RKSTR Change Sheet

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Original Signed

Bradley B. Mayhugh
FAA Metroplex Co-Lead

3-12-2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

3/12/2020
Date

KLAS RKSTR CHANGE SHEET

METROPLEX RKSTR Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
5/23/2019	A new waypoint (WP1263/AOA FL240) was added 23.59 miles north of ELLDA on the ELLDA transition of the KLAS RKSTR STAR. This fix does not change the lateral track of the transition, but will serve as a holding fix (left turns/10 mile legs) if necessary. ZAYNE was removed from the procedure.	Mater TARGETS File	
5/23/2019	JJEAN waypoint name was changed to FEREL on the Runways 19L/R Transitions of the RKSTR STAR.	Mater TARGETS File	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

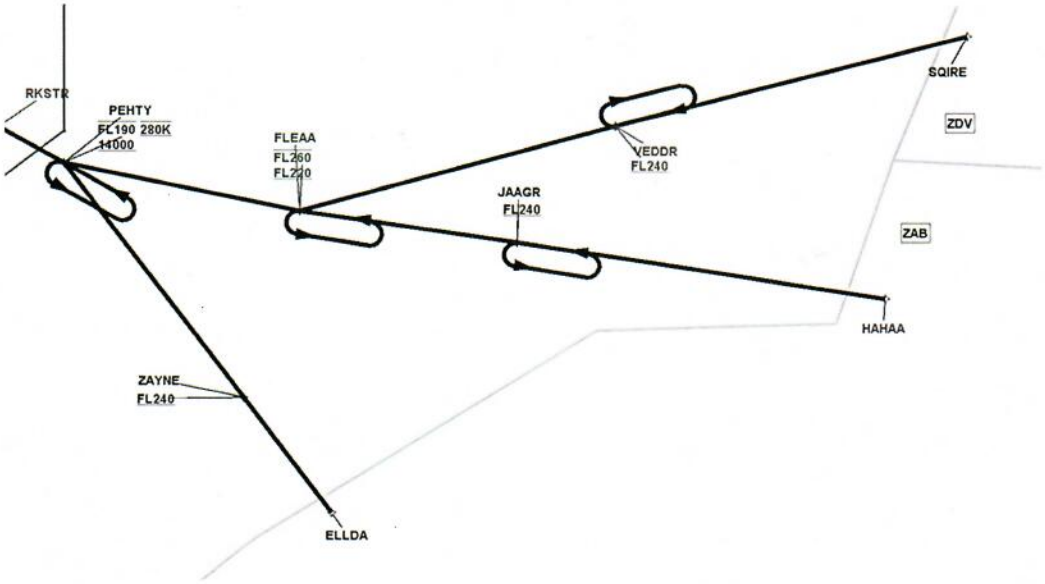


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

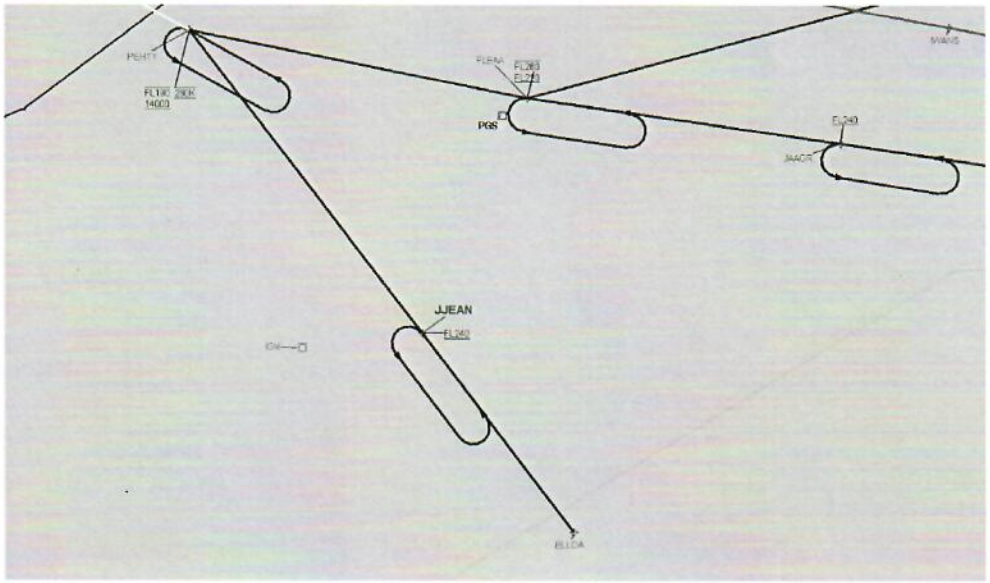


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

KLAS RKSTR STAR CHANGE SHEET

METROPLEX RKSTR Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
8/28/2019	The Team removed the altitude restriction of 058 and 210-knot speed restriction from NNEON. Moved FOOOF 2.5 miles southwest and added 220 knots for criteria and efficiency.	Mater TARGETS File	
Post Design Package Submission	FLYES was moved marginally to a location abeam of PRINO at Industry request in order to reduce complexity (Shown in Figure 1)	Master TARGETS Files	

Note: FAA and NATCA Metroplex Lead initials indicate that all required coordination (e.g. Environmental, Safety Management, Affected Facility POC, etc.) has been accomplished and all relevant data (e.g. TARGETS files) and attachments have been appropriately updated.

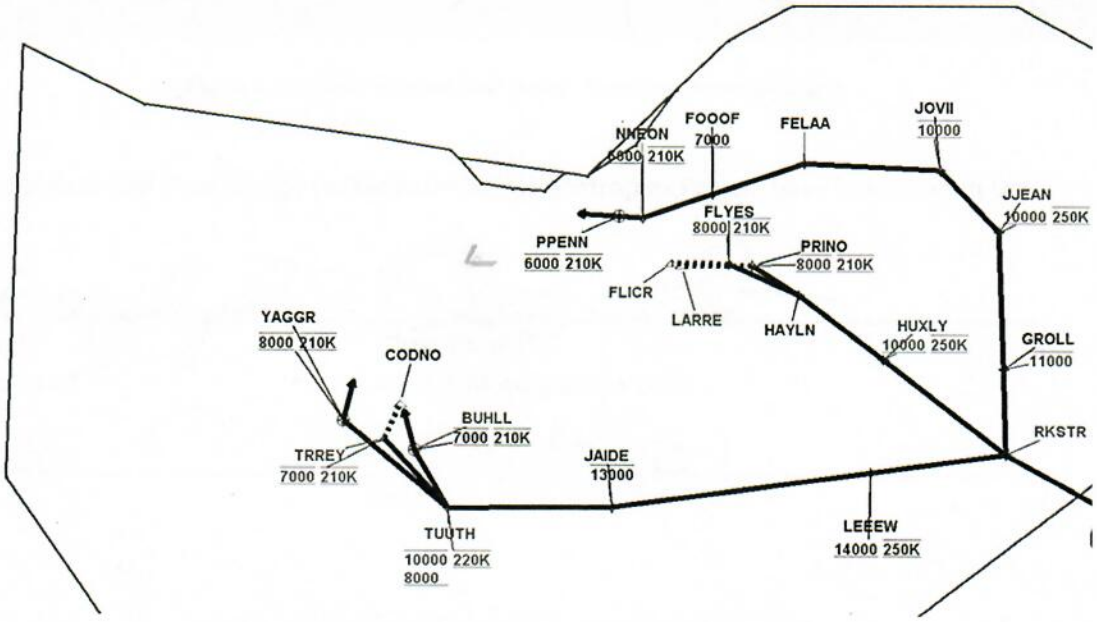


Figure 1. Original Proposed Final Design Procedure/Route/Airspace

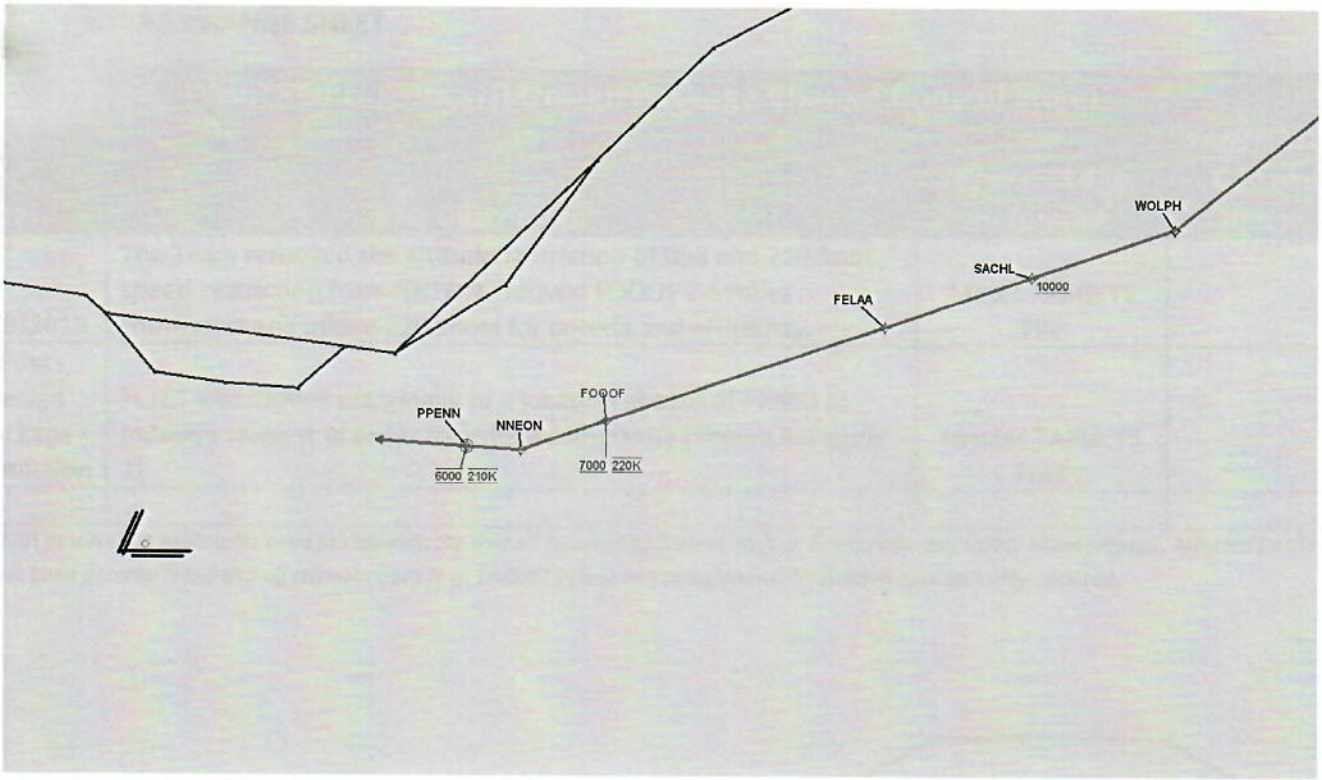


Figure 2. Revised Proposed Final Design Procedure/Route/Airspace

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R. Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

Chris Thomas
NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

KLAS RKSTR STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

McCarran International Airport (KLAS) arrivals from eastern/southeastern origins will use a new flight path procedure called the KLAS RKSTR (pronounced “Rock-star”) RNAV STAR. The RKSTR STAR will replace the current TYSSN (pronounced “Tie-sun”) RNAV STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current TYSSN STAR causes aircraft to level off for extended periods and requires close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

In order to segregate KLAS arrivals from the east/southeast from other aircraft traffic flows, the new procedure includes altitude restrictions. These restrictions will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage.

The new RKSTR RNAV STAR will provide connectivity to all KLAS runways.

The new RKSTR STAR addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KLAS RKSTR STAR

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran International Airport (KLAS) **RKSTR Area Navigation (RNAV)** **Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.1.2 **4.3.1.3**	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 8, 35 **Albuquerque ARTCC (ZAB) Sectors: 43, 45, 67, 92** **Denver ARTCC (ZDV) Sectors: 23, 24, 36** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Positions: LAK, GNT, SAT, FNL** **KLAS**	**KLAS NIITZ and RASLR Standard Instrument Departures (SIDs)** **Henderson Executive Airport (KHND) SCAMR SID** **KHND NTNDO STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed KLAS RKSTR RNAV STAR is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders agree that the TYSSN STAR has numerous inefficiencies in its design. TYSSN arrivals incur approximately 15 to 20 nautical mile (NM) level-offs at 12,000 feet and at 8,000 feet to comply with other inefficient procedures.

The TYSSN STAR does not provide repeatable and predictable course guidance to runways other than Runways 26L/R. The lack of runway transitions requires controllers to vector aircraft to other runways increasing pilot/controller task complexity.

Las Vegas OAPM Design Package

KLAS RKSTR STAR

A sharp right turn at KADDY creates overtake situations at the L30/ZLA boundary. Currently, L30 controllers vector arrivals off the procedure to maintain in-trail spacing. Two arrival transitions and the PRFUM SID all fly over KADDY requiring ZLA sectors to descend arrivals early to maintain vertical separation.

The TYSSN STAR does not align with the proposed Phoenix Metroplex procedures.

Recommendation

The MST created two RNAV Optimized Profile Descent (OPD) STARs (KLAS SE1 STAR and KLAS SE2 STAR) usable for all configurations, which reduce overall flight track miles, minimize level segments and connect to current and proposed Standard Instrument Approach Procedures (SIAPs). The dual STARs in the southeast quadrant may require the use of (Time-Based Flow Management (TBFM) and an update to the TBFM adaptation. The STARs incorporate altitude windows and speed constraints to reduce pilot/controller task complexity and readback/hearback errors.

The KLAS SE2 STAR was designed to be used for traffic flying from western Mexico, Phoenix and Tucson area airports. The MST met with the Phoenix Metroplex leads and discussed connectivity to the Phoenix Metroplex proposals. The Phoenix Metroplex leads provided input that the LLUCK waypoint could be slightly moved without impacting their designs. To address the dual arrival concerns the MST created an ATC assigned cross over transition that will allow for a single arrival flow when warranted (i.e., weather impacts or reduced arrival rates).

Figures 1 and 2 depict the MST recommendation.

Las Vegas OAPM Design Package

KLAS RKSTR STAR

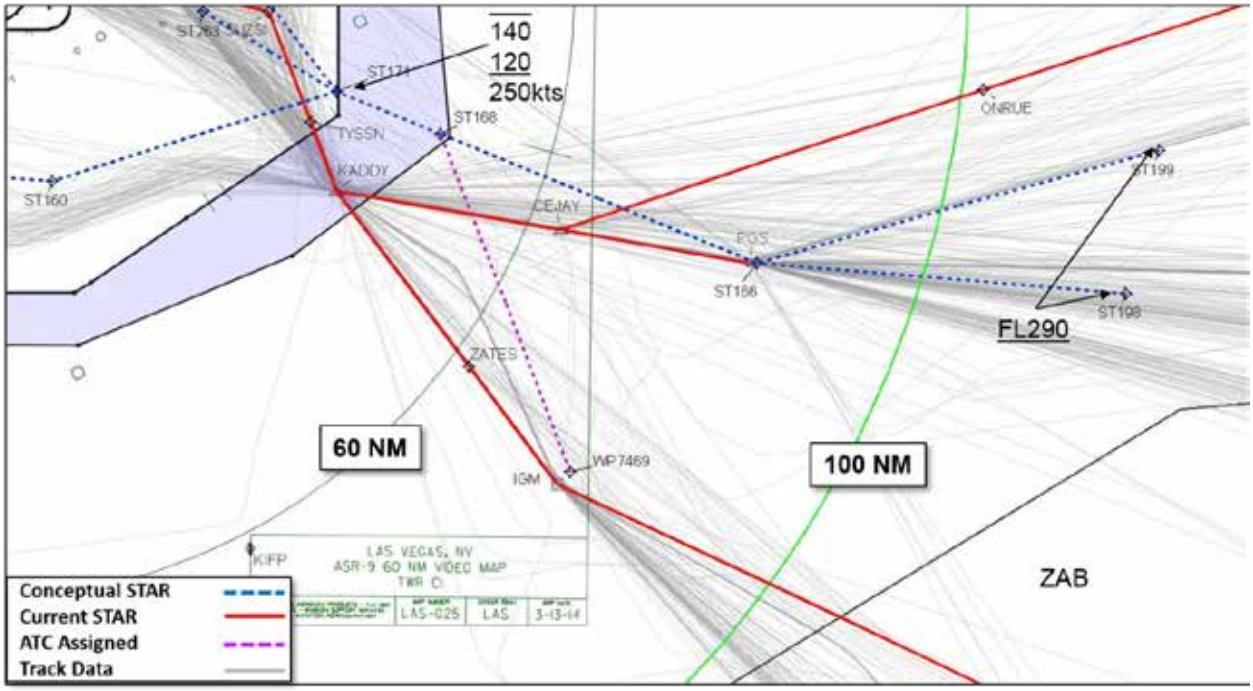


Figure 1: Current KLAS TYSSN STAR and MST's Conceptual KLAS SE1 STAR – En Route View

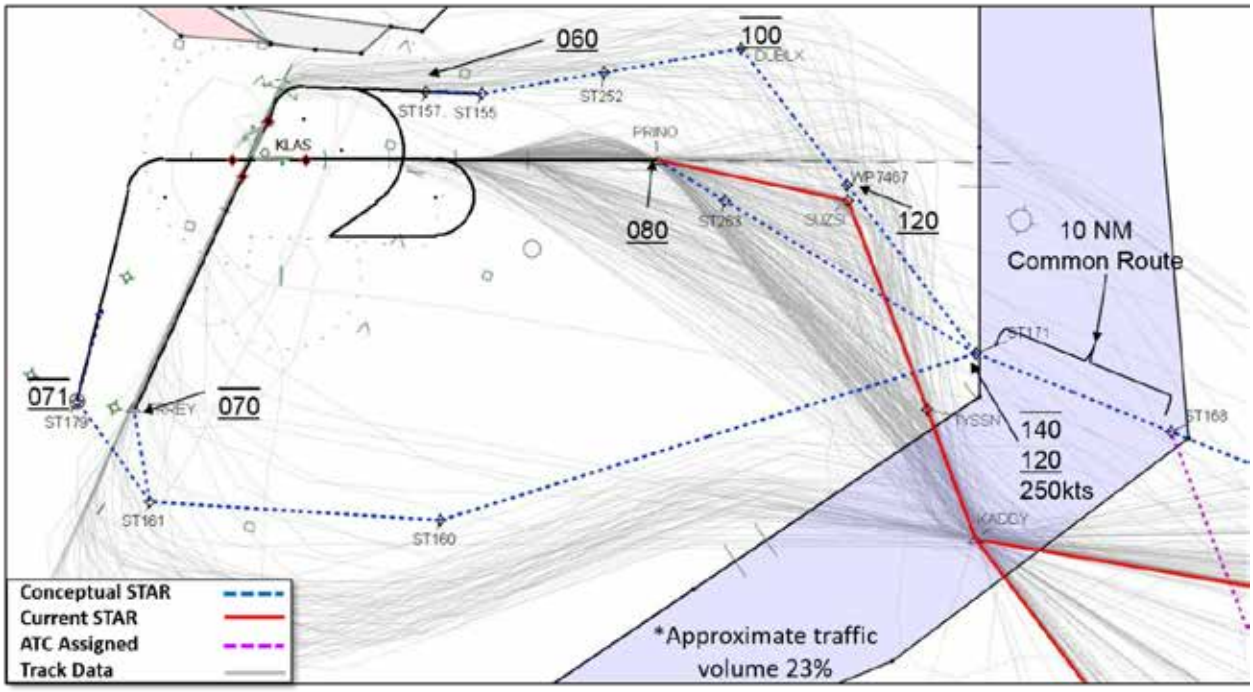


Figure 2: Current KLAS TYSSN STAR and MST's Conceptual KLAS SE1 STAR – Terminal View

Las Vegas OAPM Design Package

KLAS RKSTR STAR

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation. The MST proposed two separate STARs from the southeast to serve KLAS. After careful consideration and numerous design attempts, the D&I Team decided to create one STAR, which provides course guidance to all KLAS runways with three en route transitions.

The RKSTR RNAV STAR was designed as an OPD STAR with enhanced repeatability and predictability. It will increase efficiency and reduce complexity by reducing controller and flight crew workloads and task complexity. In en route airspace, the procedure closely follows the MST recommendation.

The RKSTR RNAV STAR's PFD is depicted in Figures 3 and 4.

En Route Transitions

ELLDA Transition (for flights that originate in and/or fly through ZAB airspace)

- ELLDA (provides a point in ZAB airspace for a crossing restriction, if needed)
- ZAYNE (at or above FL240/provides airspace integrity)
- PEHTY (altitude window of 140 to FL190/280 knots/ensures aircraft enter L30 airspace/prevents compression with successive arrivals/standard published holding pattern)

HAHAA Transition (for flights that originate in and/or fly through ZDV airspace)

- HAHAA (coordination waypoint with ZAB)
- JAAGR (at or above FL240/provides airspace integrity/published holding pattern with left turns/provides segregation from the KLAS RKSTR STAR and the KLAS NIITZ SID)
- FLEAA (altitude window of FL220 to FL260/ facilitates sequencing with competing transitions/published holding pattern with left turns/provides segregation from the KLAS NIITZ SID)
- PEHTY (altitude window of 140 to FL190/280 knots/ensures aircraft enter L30 airspace/prevents compression with successive arrivals/standard published holding pattern)

SQIRE Transition (for flights that originate in and/or fly through ZDV airspace)

- SQIRE (coordination waypoint with ZDV)
- VEDDR (at or above FL240/provides airspace integrity/standard published holding pattern/provides segregation from KLAS RKSTR STAR)
- FLEAA (altitude window of FL220 to FL260/facilitates sequencing with competing transitions/published holding pattern with left turns/provides segregation from the KLAS NIITZ SID)

Las Vegas OAPM Design Package

KLAS RKSTR STAR

- PEHTY (altitude window of 140 to FL190/280 knots/ensures aircraft enter L30 airspace/prevents compression with successive arrivals/standard published holding pattern)

Common Route

- PEHTY (altitude window of 140 to FL190/280 knots/ensures aircraft enter L30 airspace/prevents compression with successive arrivals/standard published holding pattern)
- RKSTR

Runways 01L/R Transition

- LEEEW (at or above 140/250 knots/provides segregation from the KLAS RASLR SID)
- JAIDE (at or below 130/provides segregation from the KLAS RADYR SID/tie-in to KLAS CHOWW STAR)
- TUUTH (altitude window of 080 to 100/220 knots/required for design criteria/provides segregation from KHND SCAMR and OYODA SIDs)
- BUHLL (at 070/210 knots/ensures Class B containment/ensures aircraft flyability/ joins the approach to Runway 01R)

  Or
- TRREY (at 070/210 knots/ensures Class B containment/joins the approach to Runway 01L)

Runways 08L/R Transition

- LEEEW (at or above 140/250 knots/provides segregation from the KLAS RASLR SID)
- JAIDE (at or below 130/provides segregation from the KLAS RADYR SID)
- TUUTH (altitude window of 080 to 100/220 knots/required for design criteria/provides segregation from the KHND SCAMR and OYODA SIDs)
- YAGGR (at 080/210 knots/joins the approach)

Runways 19L/R Transition

- GROLL (at or below 110/provides segregation from the KLAS NIITZ SID)
- JJEAN (at or above 100/250 knots/provides turn towards airport/provides segregation from the KLAS GIDGT SID/prevents early slowing providing consistency between aircraft)
- JOVII (at 100/required for Minimum Vectoring Altitude [MVA] criteria/provides segregation from the KLAS GIDGT SID)
- FELAA (tie-in to the KLAS CHOWW STAR)
- FOOOF (at or above 070/required for Minimum Obstruction Clearance Altitude [MOCA] criteria)
- NNEON (at or above 060/210 knots/required for design criteria)
- PPENN (at 060/210 knots/provides approach connectivity)

Runways 26L/R Transition

- HUXLY (at or above 100/250 knots/prevents early slowing providing consistency between aircraft)
- PRINO (at 080/210 knots/provides Runway 26L connectivity)

  Or

  FLYES was moved approximately 1.6 miles east for approach criteria (at or above 080/210 knots/provides Runway 26R connectivity)

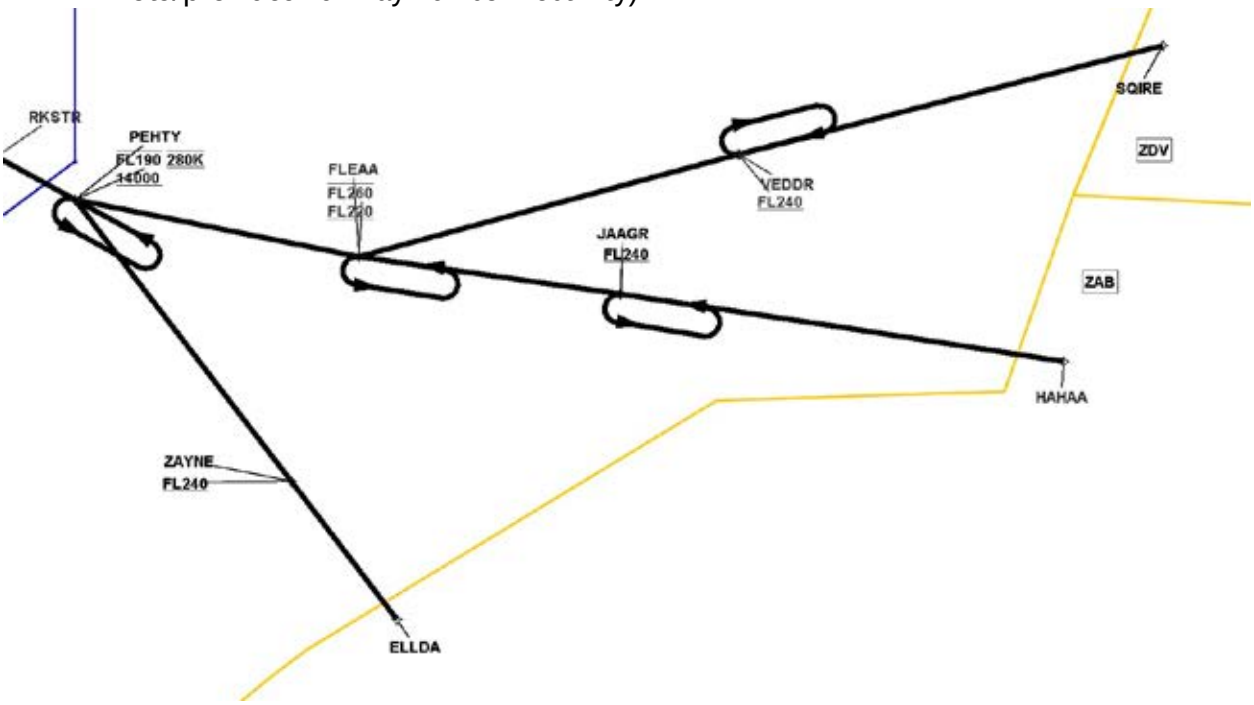


Figure 3: KLAS RKSTR RNAV STAR – En Route View

Las Vegas OAPM Design Package
KLAS RKSTR STAR

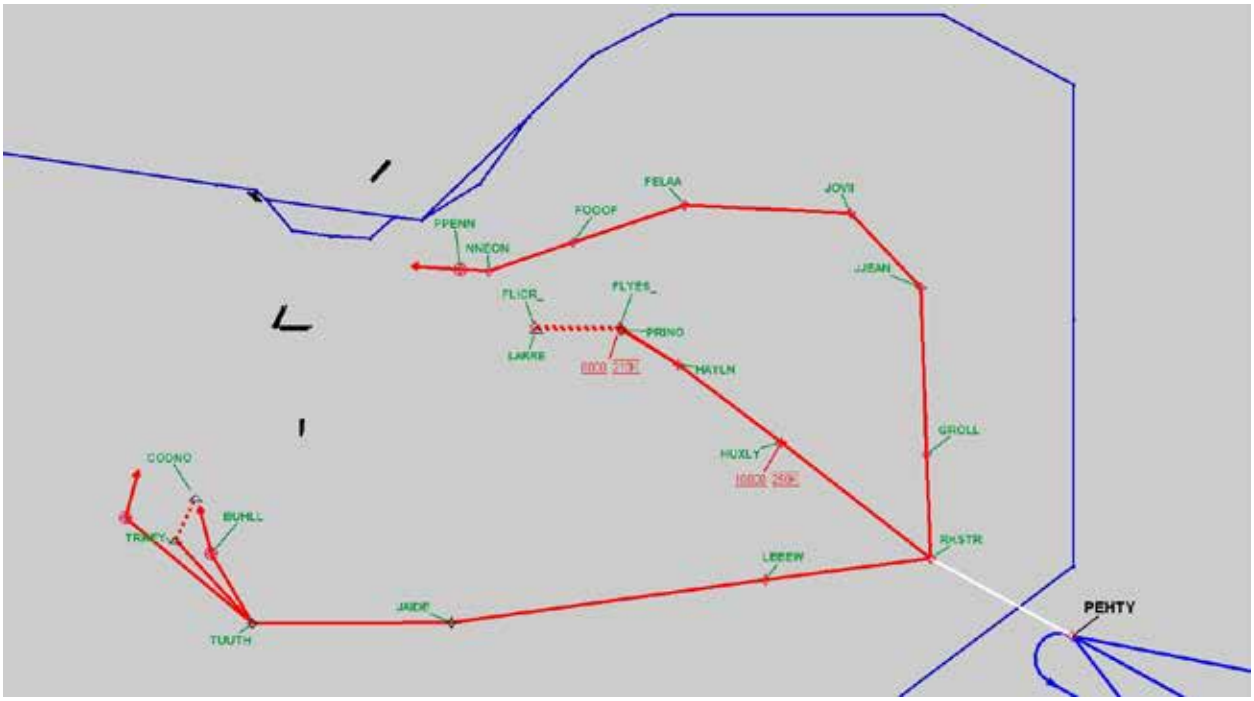


Figure 4: KLAS RKSTR RNAV STAR – Terminal View

MST Recommendation Design Differences

The MST proposed two separate STARs from the southeast to serve KLAS. After careful consideration and numerous design attempts, the D&I Team decided to create one STAR with three en route transitions.

Rationale for One STAR

Two STARs would have the following issues:

- Negative Impact to Safety
  - Multiple confliction points on the south/southwest transitions
  - False conflict alerts caused by arrival routes converging at 90 degree angles
  - Increased complexity and workload adversely impacting operation and safety
- ZAB Issue
  - KLAS departing traffic would be moved into an already complex area in ZAB
- ZLA Issues
  - No way to efficiently segregate southern arrival transition from the southeast departure procedure – procedural segregation would be overly restrictive
  - Arrivals from south/southwest would be difficult to descend into KLAS
  - Departures from KLAS would be held down due to descending arrival traffic
  - Sequencing arrival traffic between the two transitions would be limited because of the route structure (angles of headings, winds, etc.)
- System Efficiency Impacts

- Over restrictive procedural segregation would cause loss of efficiency
- Additional track mileage would be added to flights
  - To Runways 26L/R - would add 17 nm to each flight
  - To Runways 01L/R - would add 31 nm to each flight
- Unable to design OPDs on the south/southwest transitions
- Negative impact on departure traffic from Phoenix Sky Harbor International Airport (KPHX) to KLAS
- KLAS departures are constrained because two current KLAS SIDs are combined into one
- During Severe Weather Avoidance Program (SWAP) events, current northeast departures would have to fly greater distances to get to destination airports

Additional Design Considerations

Careful consideration was given to the National Parks and Tribal Nation Lands when designing the en route portion of the KLAS RKSTR STAR. Review of current traffic destined for Las Vegas Valley airports indicates arrival aircraft at lower cruise altitudes and higher descent power settings overflying the park areas and Tribal Nation Lands than on the new optimized procedures.

PEHTY was moved five nautical miles (NM) southwest. This was done to accommodate moving the KLAS NIITZ SID departure traffic south in order to avoid the Grand Canyon National Park overlook areas. The KLAS RKSTR STAR design accommodated the KLAS NIITZ SID design since departing aircraft would have a more negative impact to these areas.

- The KLAS RKSTR STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not expected to change runway usage
  - The following chart notes will be included with this procedure:
    - For turbojet aircraft only

The RKSTR STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 8, 35
- ZAB Sectors: 43, 45, 67, 92
- ZDV Sectors: 23, 24, 36
- L30 Positions: LAK, GNT, SAT, FNL
- KLAS

Implementation Dependencies

The procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS and KHND airports.

- STAR filings with airline dispatchers
- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZAB LOA
- ZLA/ZDV LOA
- ZLA Standard Operating Procedures (SOP)
- ZDV SOP
- ZAB SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- SIAPs
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

McCarran International Airport (KLAS) arrivals from southern and southwestern origins will use a new flight path procedure called the RNDRZ (pronounced “Round-ers”) RNAV STAR. The RNDRZ STAR will replace the current KEPEC (pronounced “Kay-peck”) RNAV STAR.

The Las Vegas Metroplex Study Team (MST) noted that the current KEPEC STAR causes aircraft to level off for extended periods and requires close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

In order to segregate KLAS arrivals from the south/southwest from other aircraft traffic flows, the new procedure includes altitude restrictions. These restrictions will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

This procedure is not anticipated to change runway usage.

The RNDRZ RNAV STAR will provide connectivity to all KLAS runways.

The new RNDRZ STAR addresses KLAS. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran International Airport (KLAS) **RNDRZ Area Navigation (RNAV)** **Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.3.1.4	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 17, 37, 38, 39 **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: GNT, FNL** **KLAS**	**KLAS JOHKR and RAYDR Standard Instrument Departures (SIDs)** **Henderson Executive Airport (KHND)** **OYODA SID** **KHND NTNDO STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed KLAS RNDRZ RNAV STAR is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholder input indicates that the KEPEC STAR has numerous inefficiencies in its current design. KEPEC arrivals incur approximately 20 to 30 nautical mile (NM) level-offs at FL240 and at 13,000 feet to comply with other inefficient procedures.

Aircraft landing on Runways 01L/R have difficulty complying with speed and altitude restrictions.

The KEPEC STAR does not provide repeatable and predictable course guidance to runways other than Runways 26L/R. The lack of runway transitions requires controllers to vector aircraft to other runways increasing pilot/controller task complexity.

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

Recommendation

The MST created an RNAV Optimized Profile Descent (OPD) STAR (KLAS SW STAR) that is usable for all configurations which reduces overall flight track miles, minimizes level offs and connects to current and proposed Standard Instrument Approach Procedures (SIAPs).

The KLAS SW STAR utilizes altitude windows and speed restraints providing predictable and repeatable flight paths as well as reducing pilot/controller task complexity.

The MST recommendation is depicted in Figures 1 and 2.

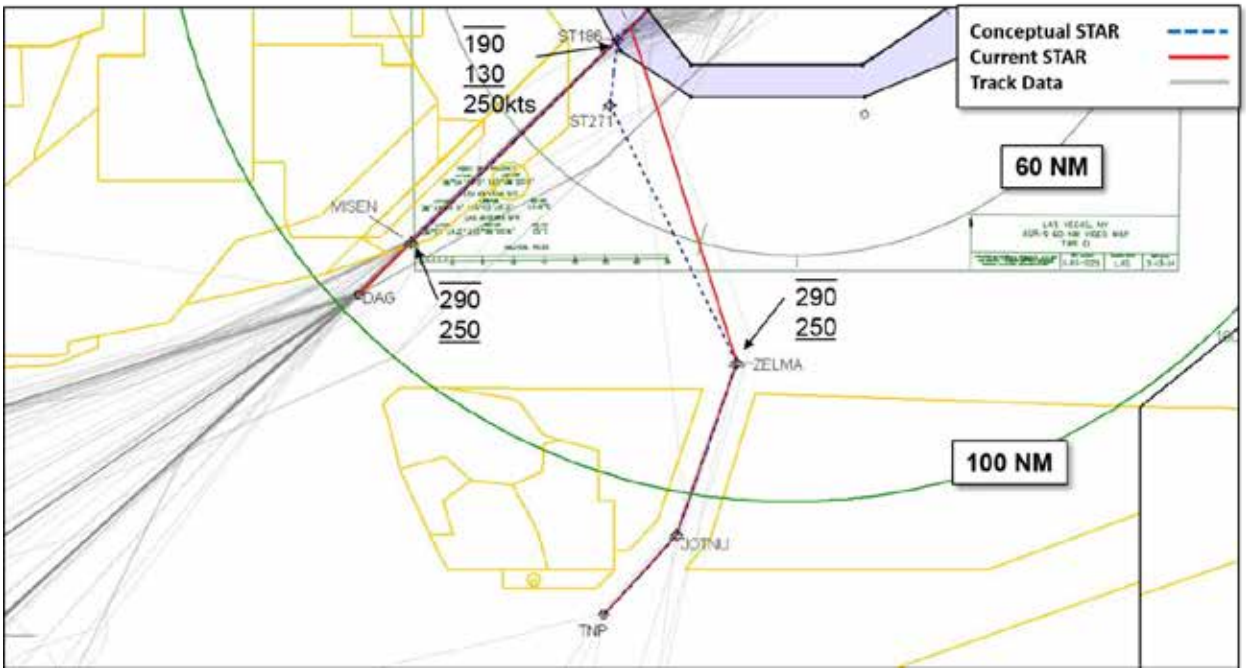


Figure 1: Current KLAS KEPEC STAR and MST's Conceptual KLAS SW STAR – En Route View

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

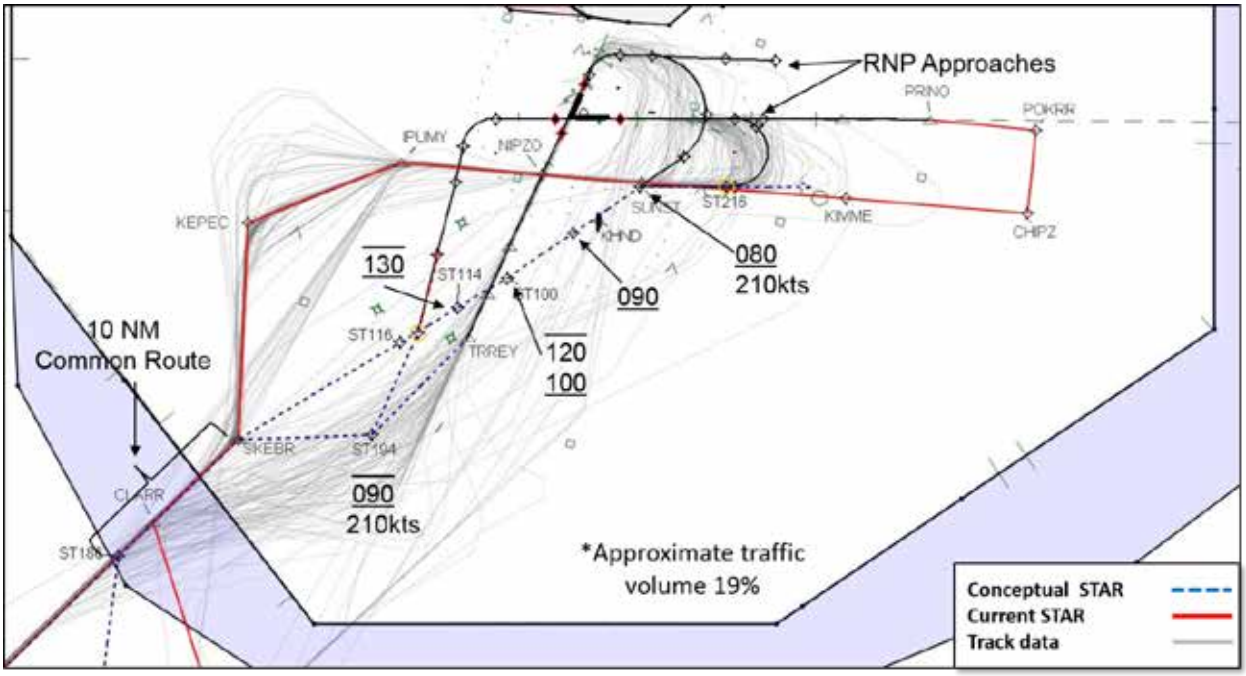


Figure 2: Current KLAS KEPEC STAR and MST's Conceptual KLAS SW STAR – Terminal View

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation.

The KLAS RNDRZ STAR was designed as an OPD STAR. It will increase flight path predictability and decrease controller/pilot task complexity. In en route airspace, the procedure closely follows the MST recommendation.

The en route transition of the KLAS RNDRZ STAR has three transitions.

The KLAS RNDRZ STAR provides connectivity to all KLAS runways and is not anticipated to change runway usage.

The D&I team deviated from the MST recommendation to segregate from the KLAS RASLR, NIITZ and RADYR SIDs. These departure aircraft would be held at lower altitudes longer than necessary if arrivals were allowed to fly direct to the base leg. By segregating these departure streams from the KLAS RNDRZ STAR, complexity and workload are reduced and departures can be assigned higher altitudes sooner.

The KLAS RNDRZ STAR's PFD is depicted in Figures 3 and 4.

En Route Transitions

KLAS RNDRZ (KEPEC) STAR

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

MISEN Transition

- MISEN (at or above FL240/reduces complexity in ZLA allowing for OPD)
- TEDDE
- WATEV (provides a waypoint for sequencing aircraft/standard published holding pattern/allows for holding at higher altitudes)
- TOETS (provides a waypoint for sequencing aircraft/standard published holding pattern)
- RNDRZ (altitude window of 130 to FL190/250 knots/ensures aircraft enter L30 airspace/protects ZLA Sector 16 airspace)

Needles VOR (EED) Transition – ATC assigned only for weather situations

- EED (commonly used navaid between ZAB and ZLA north of Special Use Areas [SUAs])
- ZELMA (at or below FL230/reduces complexity in ZLA/avoids restricted area airspace/provides segregation from Los Angeles Basin arrival traffic)
- MIYKE (provides ability for ATC to issue a crossing restriction, if needed, to segregate from departing traffic)
- RNDRZ (altitude window of 130 to FL190/250 knots/ ensures aircraft enter L30 airspace/protects ZLA Sector 16 airspace)

Twenty-nine Palms VOR (TNP) Transition

- TNP (avoids Restricted Area 2501 [R2501])
- JOTNU (avoids R2501 and BRISTOL Military Operations Area [MOA])
- ZELMA (at or below FL230/reduces complexity in ZLA/avoids restricted area airspace/provides segregation from Los Angeles Basin arrival traffic)
- MIYKE (provides ability for ATC to issue a crossing restriction, if needed, to segregate from departing traffic)
- RNDRZ (altitude window of 130 to FL190/250 knots/ensures aircraft enter L30 airspace/protects ZLA Sector 16 airspace)

Runway Transitions

Runways 01L/R Transition

- RUMLY (at or above 100/provides terrain avoidance)
- BAUMM (at or above 090/required for design criteria)
- ROAMN (at 080/210 knots/initial approach waypoint/required to match approach restrictions)

Runways 08L/R Transition:

- BAUMM (at or above 090/required for design criteria)
- YAGGR (at 080/210 knots/initial approach waypoint/required to match approach restrictions)

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

Runways 19L/R and 26L/R Transitions

- GRMMA (provides segregation from the KLAS JOHKR SID)
- BUETY (at or above 125/provides segregation from the KLAS JOHKR SID)
- ENNVY (at or above 110/provides terrain avoidance/provides segregation from the KLAS JOHKR SID)
- REDQN (at or above 090/210 knots/required for design criteria/provides segregation from the KLAS JOHKR, RAYDR, NIITZ and RASLR SIDs)
- TWAFL (creates straight segment required for design criteria)
- BERBN (at 080/210 knots/provides segregation from KHND Runway 35 departures/initial approach waypoint/required to match approach restrictions)

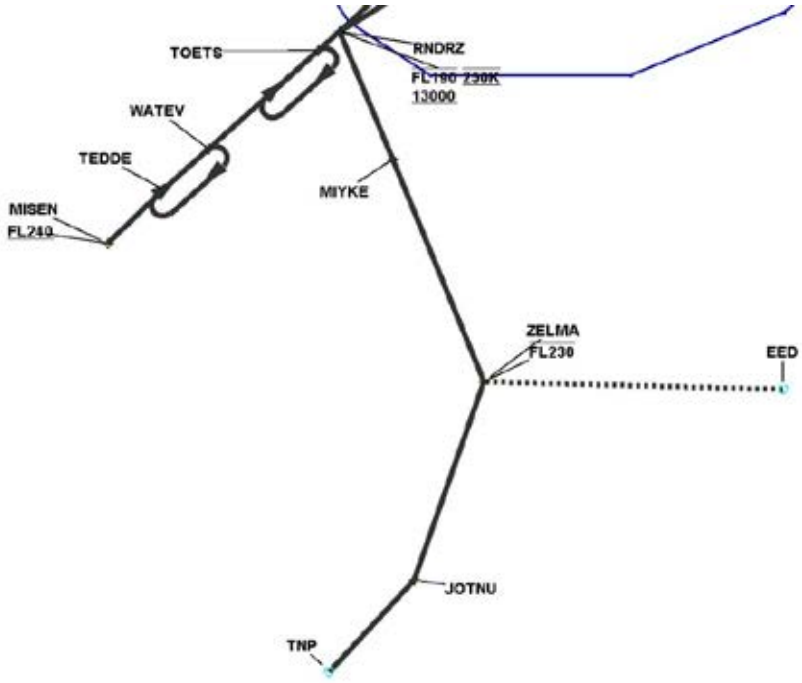


Figure 3: KLAS RNDRZ RNAV STAR's PFD – En Route View

Las Vegas OAPM Design Package

KLAS RNDRZ STAR

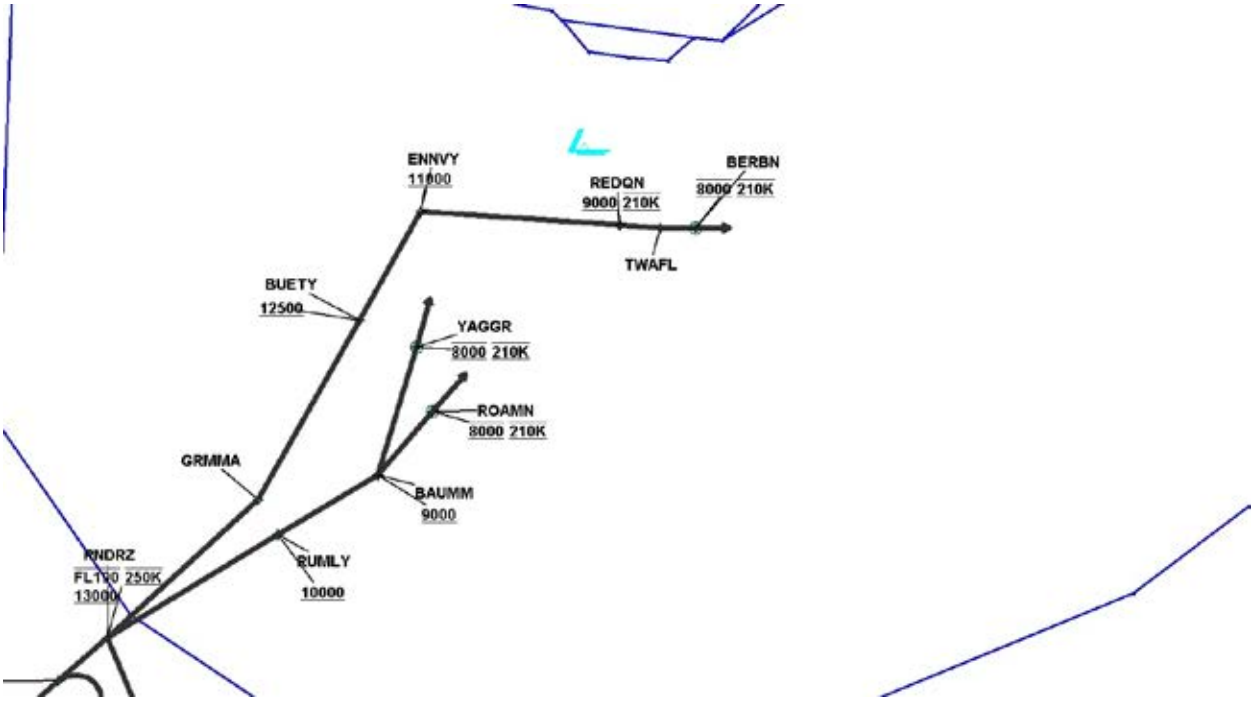


Figure 4: KLAS RNDRZ RNAV STAR's PFD – Terminal View terminal view

Additional Design Considerations

- The KLAS RNDRZ STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage.
    - The following chart notes will be included with this procedure:
        - For turbojet aircraft only

The KLAS RNDRZ STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 10, 17, 37, 38, 39
- L30 Sectors: GNT, FNL
- KLAS

Implementation Dependencies

The procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS and KHND airports.

Document changes/modifications include:

- STAR filings with airline dispatchers

Las Vegas OAPM Design Package
KLAS RNDRZ STAR

- ZLA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA Standard Operating Procedures (SOP)
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- SIAPs
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- Terminal Procedures:
  - TARGETS distribution package
  - Flight Simulator worksheet
  - RNAV Pro analysis results
  - HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/2/19
Sarah Fletcher ZLA Facility POC	Date	FMartin Ramirez ZLA NATCA POC	Date
	4/25/19		23APR19
Anita Engelmann TWAB Representative	Date	Dan Hauptman L30 NATCA POC	Date

Las Vegas OAPM Design Package

KVGT FLCHR STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

North Las Vegas Airport (KVGT) arrivals from northwestern origins will use a new flight path procedure called the FLCHR (pronounced “Flet-cher”), RNAV STAR. There is no current procedure for aircraft arriving from the northwest.

Stakeholders requested that the current conventional procedures be replaced with more efficient Performance Based Navigation (PBN) procedures.

Current operations cause aircraft to level off for extended periods and require close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

In order to segregate from KLAS arrivals from the northwest and other aircraft traffic flows, the new FLCHR STAR includes altitude restrictions. These restrictions will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

The new FLCHR STAR address KVGT. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KVGT FLCHR STAR

Name of Change and Airport(s)	Change Classification
North Las Vegas Airport (KVGT) **FLCHR Area Navigation (RNAV)** **Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.2	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 16 **Oakland ARTCC (ZOA) Sectors: 15, 33, 46** **Nellis Air Traffic Control Facility (NATCF)** **KVGT**	**McCarran International Airport (KLAS) COKTL and JAYSN STARs;** **KLAS LOHLA Standard Instrument Departure (SID)** **Q174 Route**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders requested that the current conventional procedures be replaced with more efficient Performance Based Navigation (PBN) procedures.

Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design four conceptual RNAV STARs (KVGT NE STAR, KVGT NW STAR, KVGT SE STAR, and KVGT SW STAR).

The KVGT NW and NE STARs transition from the en route structure through NATCF airspace bypassing L30.

Figure 1 depicts the MST recommendation.

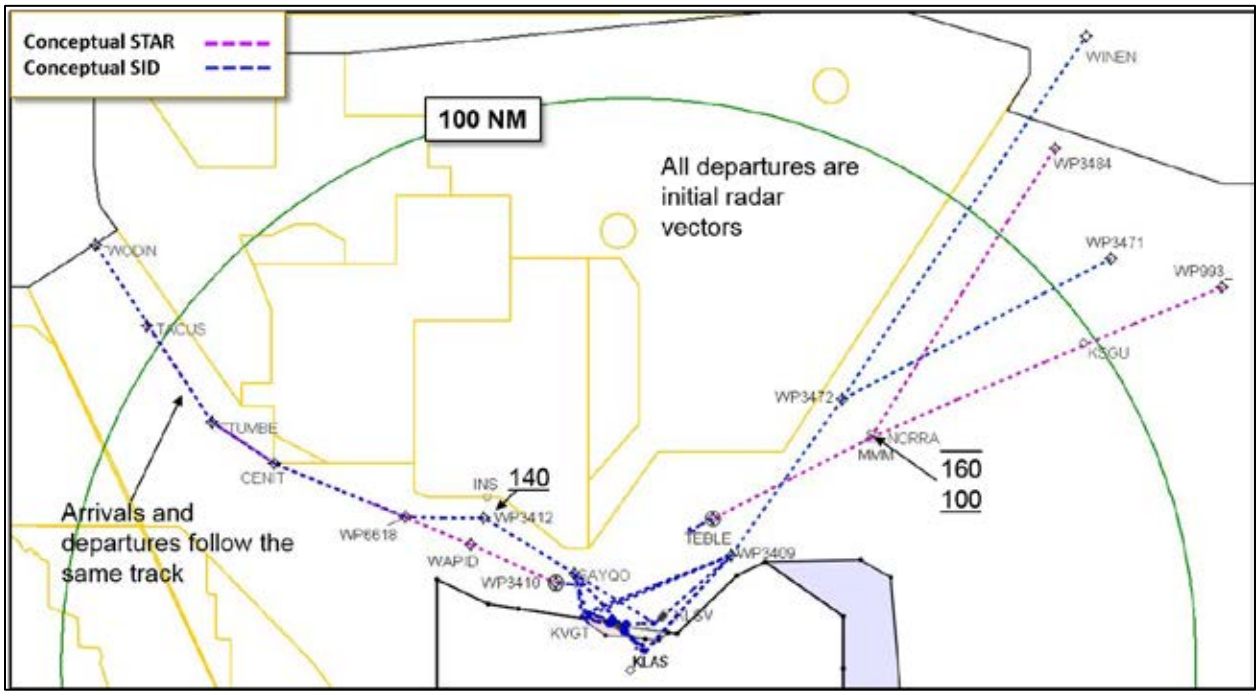


Figure 1: KVGT MST STAR/SID Designs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation. For arrivals from the northwest, the team designed the KVGT FLCHR STAR to closely align with the newly designed KLAS JAYSN STAR, in an effort to maximize use of constrained airspace. There are a limited number of flights that will utilize the FLCHR STAR to KVGT and the KLAS JAYSN STAR will be utilized only by Department of Energy flights (JANET Flights). Due to the low number of flights, the D&I Team felt that the best use of the airspace would be to overlap the routes.

Aircraft join the arrival at the FLCHR waypoint, which is shared by the KLAS COKTL STAR and Q174. By mutual agreement between ZLA's Sector 16 and NATCF, aircraft will be descended to FL210 (the bottom of Sector 16's airspace which lies over NATCF's LEE Sector), then, traffic permitting, handed off to NATCF and descended out of Sector 16's airspace.

The KVGT FLCHR STAR Proposed Final Design is depicted in Figure 2.

En Route Transitions

FLCHR Transition

- FLCHR (provides connectivity with Q174/provides segregation from Q13/15, restricted airspace, and from Henderson Executive Airport (KHND) GAMES and OYODA RNAV SIDs)
- OPNOW (coordination waypoint/provides NATCF airspace integrity/avoids Restricted Area 4806 [R4806])
- GEOOF (provides terrain avoidance/provides segregation from westbound KLSV departures/avoids restricted airspace)
- KEEKE (at or above 105/no greater than 250 knots/provides terrain avoidance/for design criteria)
- ECAKO (at 090/no greater than 230 knots/joins an RNAV GPS approach to KVGT Runway 12R)

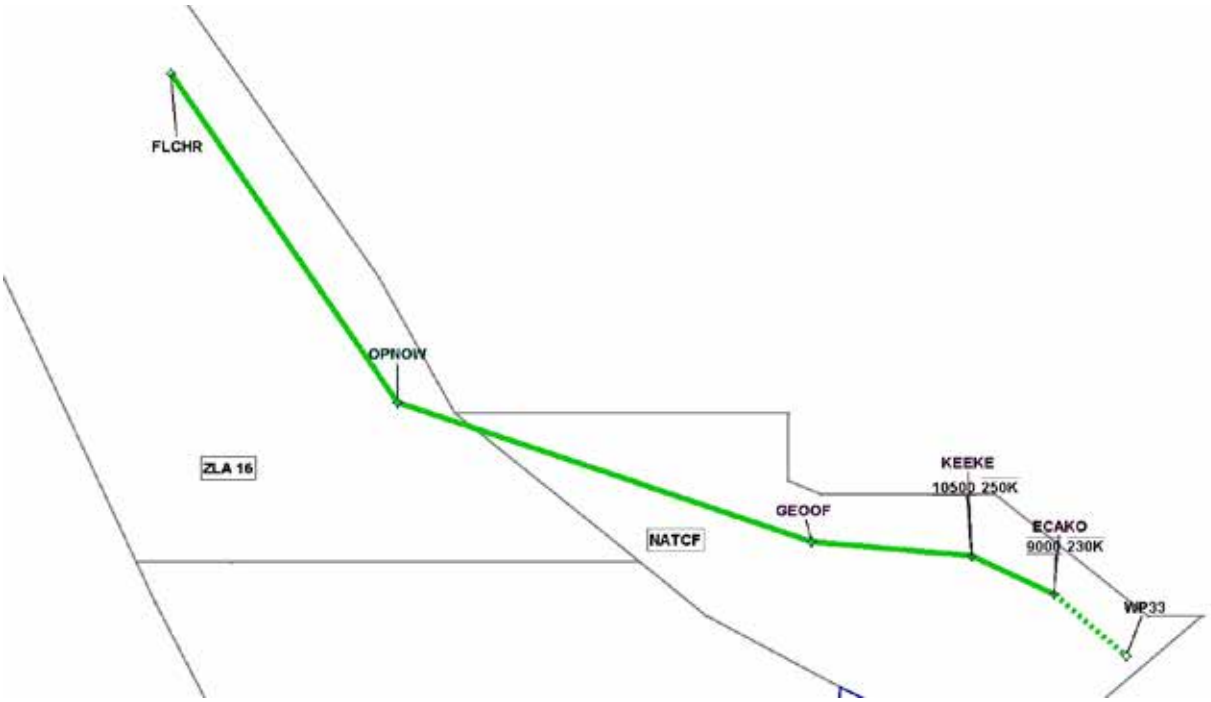


Figure 2: KVGT FLCHR STAR

Additional Design Considerations

- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage.
    - The following chart notes will be included with this procedure:
        - For turbojet and turboprop aircraft only
        - GPS Required

The FLCHR STAR affects the following facility area(s) as indicated:

- ZLA ARTCC Sectors: 16
- ZOA Sectors: 15, 33, 46
- NATCF
- KVGT

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND, KLSV, and KVGT.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/NATCF sector boundary maps and video maps
- ZLA/ZOA Letter of Agreement (LOA)
- ZLA/NATCF LOA
- ZLA Standard Operating Procedures (SOP)
- NATCF SOP
- VGT SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results
- HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19		4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

	4/23/19		5/2/19
Sarah Fletcher	Date	Martin Ramirez	Date
ZLA Facility POC		ZLA NATCA POC	

Available via electronic signature

_____

Date

Nellis Air Traffic Control Facility

Las Vegas OAPM Design Package

KVGT WYLND STAR

An Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) is a procedure that serves as a lateral path for aircraft landing at an airport. RNAV STARs are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports.

North Las Vegas Airport (KVGT) arrivals from eastern/southeastern origins will use a new flight path procedure called the WYLND (pronounced “Why-land”), RNAV STAR. There is no current procedure for aircraft from the east or southeast.

Stakeholders requested that the current conventional procedures be replaced with more efficient Performance Based Navigation (PBN) procedures.

Current operations cause aircraft to level off for extended periods and require close interactions with other arrival and departure flight paths into and out of the Las Vegas Valley, increasing complexity of operations.

In order to segregate from KLAS arrivals from the east and southeast, and from other aircraft traffic flows, the new WYLND STAR includes altitude restrictions. These restrictions will allow descents that are more continuous at reduced power. In air traffic control terms this is called an Optimized Profile Descent (OPD).

The new WYLND STAR address KVGT. Additionally, other procedures are being proposed that will serve nearby airports in a similar manner, providing a more safe and efficient operation for all airports in the area.

Las Vegas OAPM Design Package

KVGT WYLND STAR

Name of Change and Airport(s)	Change Classification
North Las Vegas Airport (KVGT) **WYLND Area Navigation (RNAV)** **Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.5.2	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 8, 35, 36 **Denver ARTCC (ZDV) Sectors: 23, 24, 36, 68** **Albuquerque ARTCC (ZAB) Sectors: 45, 67** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: LAK, MED, DAG** **Nellis Air Traffic Control Facility (NATCF)** **KVGT**	**Henderson Executive Airport (KHND) BOEGY STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The purpose of the proposed procedure is to address the issues identified by the Las Vegas Metroplex Study Team (MST).

MST Issues and Recommendation

Issues

Stakeholders requested that the current conventional procedures be replaced with more efficient PBN procedures.

Recommendation

The MST worked extensively with the National Business Aviation Association (NBAA) to design four conceptual RNAV STARs (KVGT NE STAR, KVGT NW STAR, KVGT SE STAR, and KVGT SW STAR).

Las Vegas OAPM Design Package
KVGT WYLND STAR

The KVGT SE and SW STARs are designed to traverse L30 airspace and will exit L30 northwest of McCarran International Airport (KLAS), with connectivity to the GPS RWY12R approach.

Figure 1 depicts the MST recommendation.

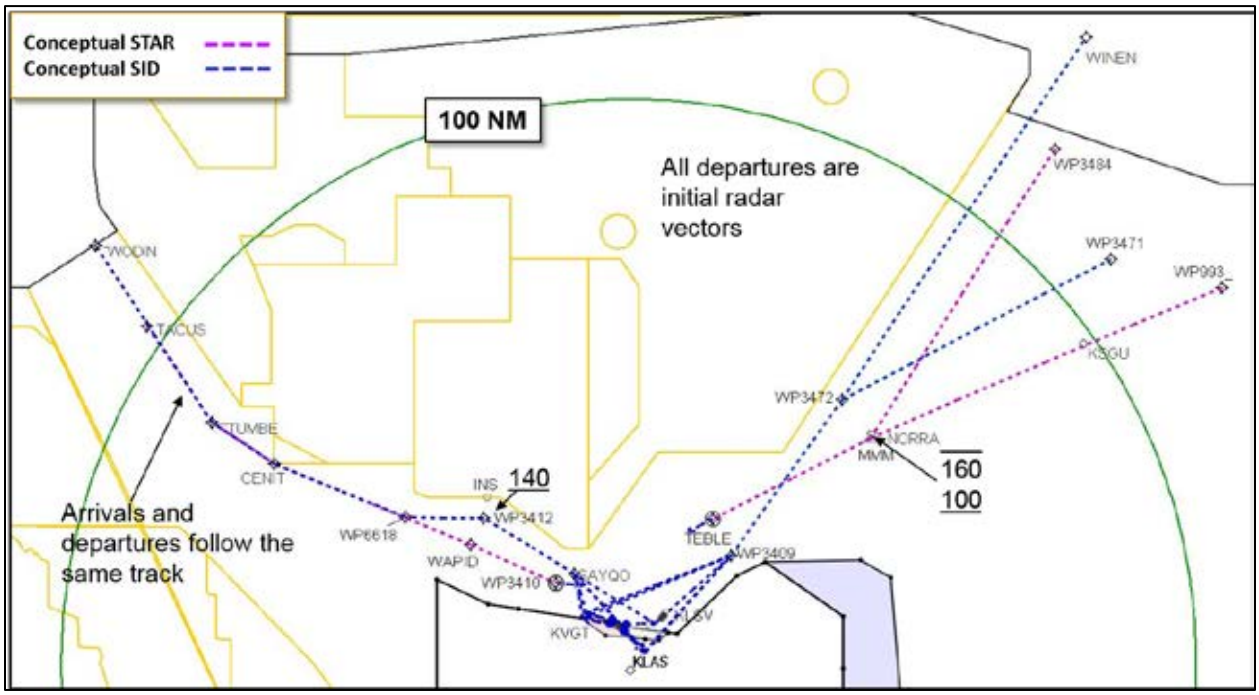


Figure 1: KVGT MST STAR/SID Designs

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) used the MST recommendation as the basis for the initial design proposal, considering both the issues and recommendation. For arrivals from the east and southeast, the team decided to share the BOEGY waypoint for both KVGT and KHND arrivals.

The D&I Team differed from the MST with respect to the north arrivals, because there is a current arrival route from the north over Mormon Mesa VOR (MMM) which will still be utilized per NATCF request.

The KVGT WYLAND STAR Proposed Final Design is depicted in Figure 2.

En Route Transitions

SSKEE Transition (from ZAB):

- SSKEE (coordination waypoint with ZAB)

- BOEGY (at 150/250 knots/provides segregation from KLAS arrival and departure traffic/coordination waypoint with L30/provides continuity with new T-routes)
- WYLND (provides segregation from KLAS arrival and departure traffic)
- LNDIN (at 090/coordination waypoint with NATCF)

TOADD Transition (from ZDV):

- TOADD (existing waypoint/coordination waypoint with ZDV)
- BOEGY (at 150/250 knots/provides segregation from KLAS arrival and departure traffic/coordination waypoint with L30/provides continuity with new T-routes)
- WYLND (provides segregation from KLAS arrival and departure traffic)
- LNDIN (at 090/coordination waypoint with NATCF)

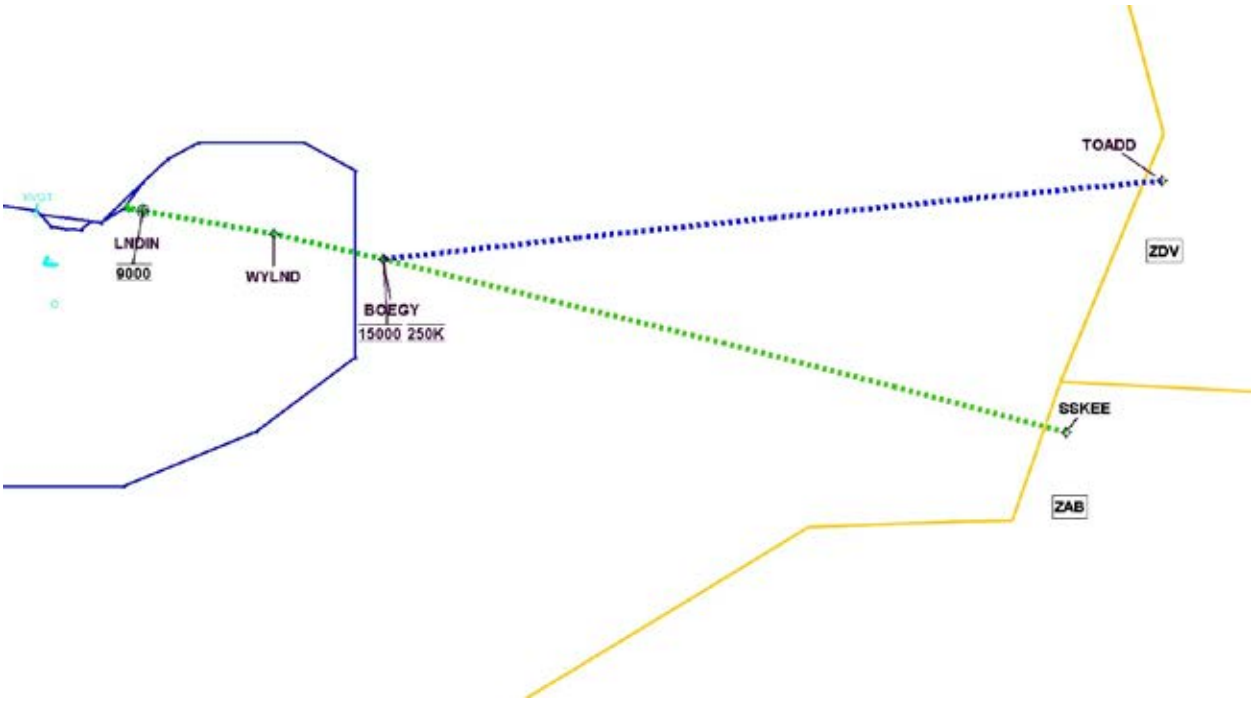


Figure 2 KVGT WYLND STAR - PFD

Additional Design Considerations

- The KVGT WYLND STAR concept was validated by the D&I Team via HITLS
- Spectrum analysis will be required for any proposed airspace changes associated with the proposed STAR
- This procedure will be used by RNAV-equipped turbojet aircraft only and is not anticipated to change runway usage
    - The following chart notes will be included with this procedure:

- For turbojet aircraft only

The WYLND STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 8, 35, 36
- ZDV Sectors: 23, 24, 36, 68
- ZAB Sectors: 45, 67
- L30 Sectors: LAK, MED, DAG
- NATCF
- KVGT

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND and KVGT.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZDV LOA
- ZLA/ZAB LOA
- ZLA Standard Operating Procedures (SOP)
- ZDV SOP
- ZAB SOP
- L30 SOP
- VGT SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results
- HITLS results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
LAS FAA Lead	Date	LAS NATCA Lead	Date
Sarah Fletcher	4/23/19	Martin Ramirez	5/2/19
ZLA Facility POC	Date	ZLA NATCA POC	Date
Anita Engelmann	4/25/19	Dan Hauptman	23 Apr 19
TWAB Representative	Date	L30 NATCA POC	Date

Available via electronic signature

_____ Date

Nellis Air Traffic Control Facility

Las Vegas Metroplex KLAS BLAID STAR Design Package Change Control Sheet			
Date	Description	TARGETS File Reference	FAA/NATCA Co-Lead Initials
12/9/19	After a review of the Proposed Final Design for the KLAS BLAID conventional STAR, criteria dictated a move of the BLAID waypoint 3.85 miles to the southwest. Flight Standards advised the move. Concurrence received from L30 and ZLA	LAS Master TARGETs File	

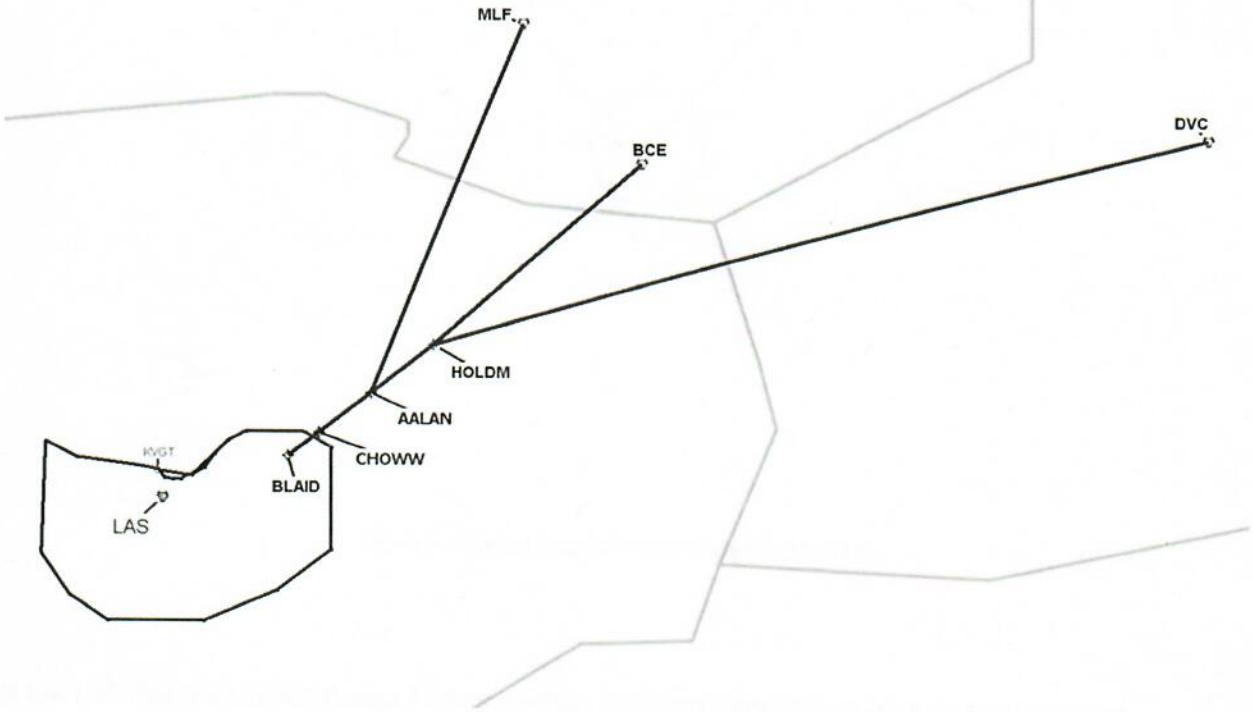


Figure 1. Original Proposed Final Design BLAID STAR

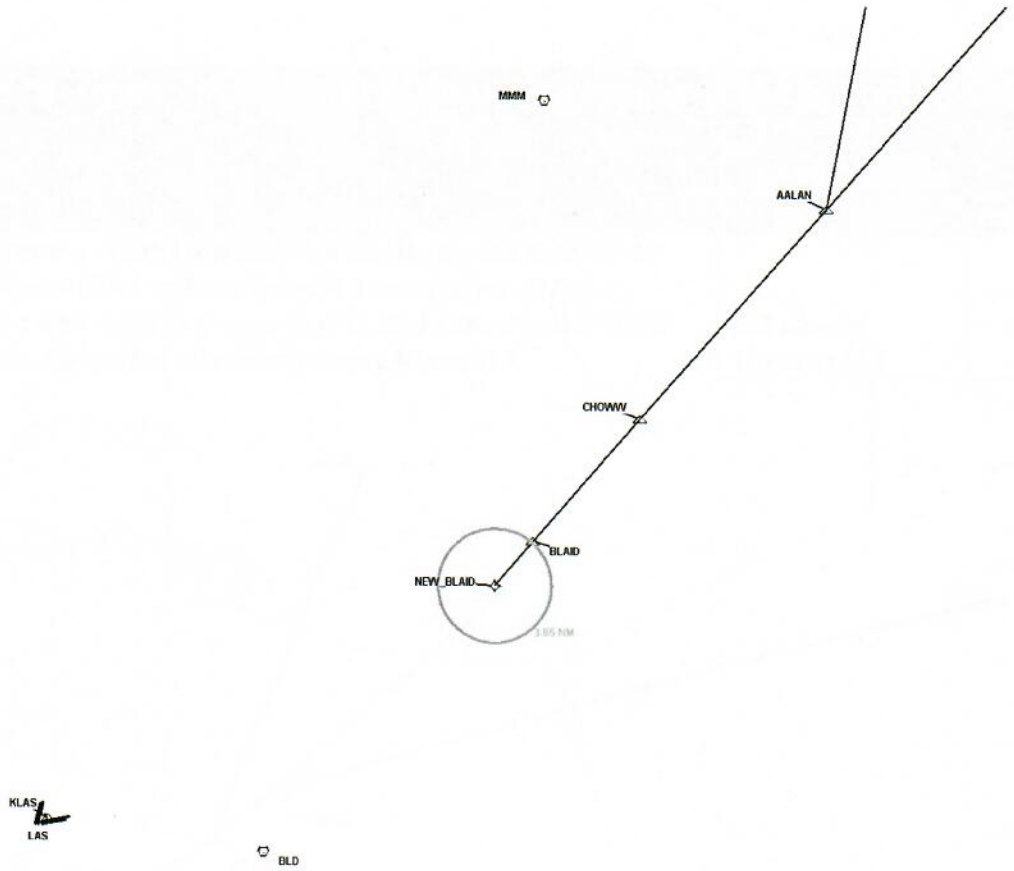


Figure 2. Revised Proposed Final Design BLAID STAR

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

2/11/2020

Date

NATCA Metroplex Co-Lead

2/11/2020

Date

Las Vegas OAPM Design Package

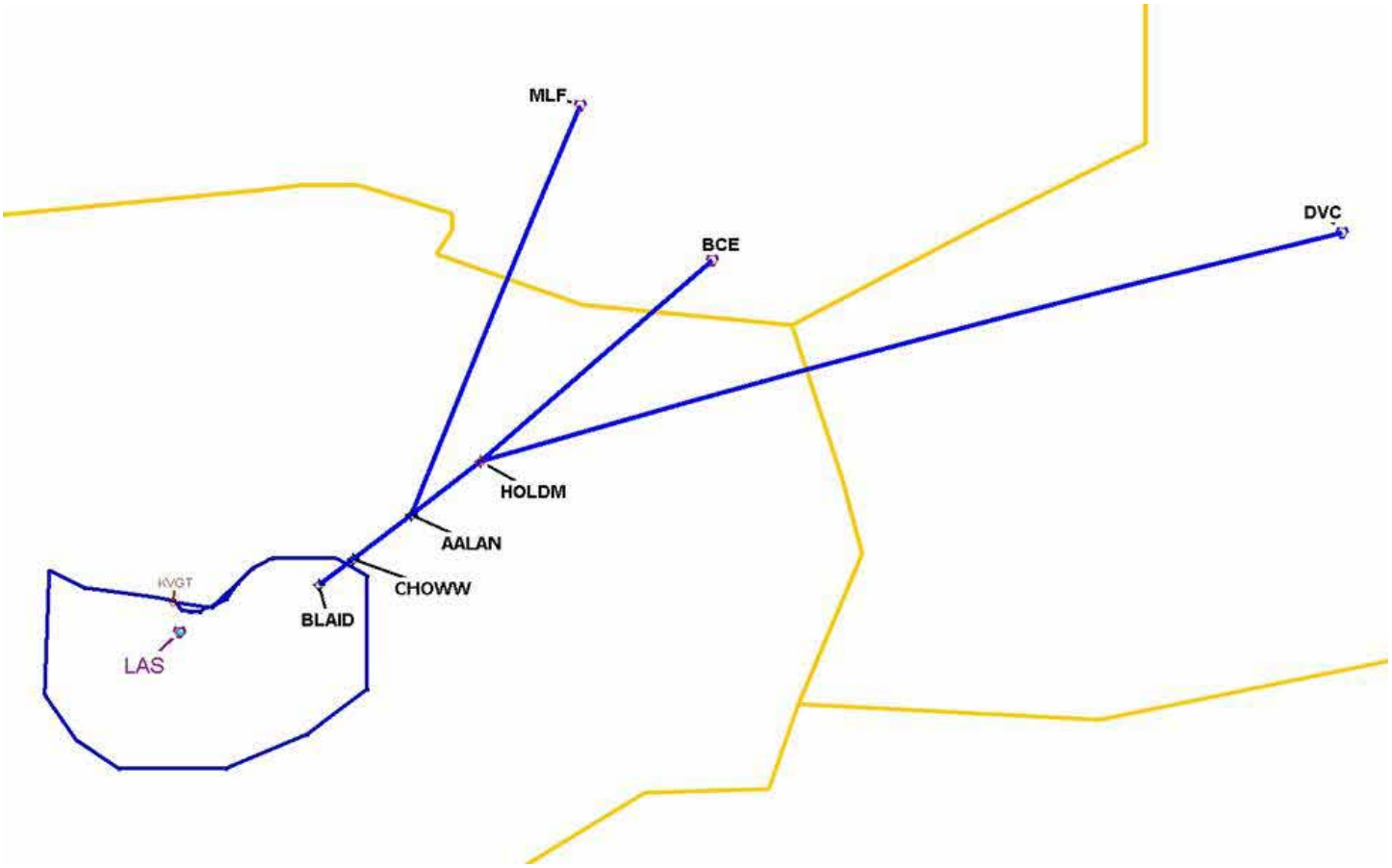
KLAS BLAID STAR

The Las Vegas Metroplex Project (Project) was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures into and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

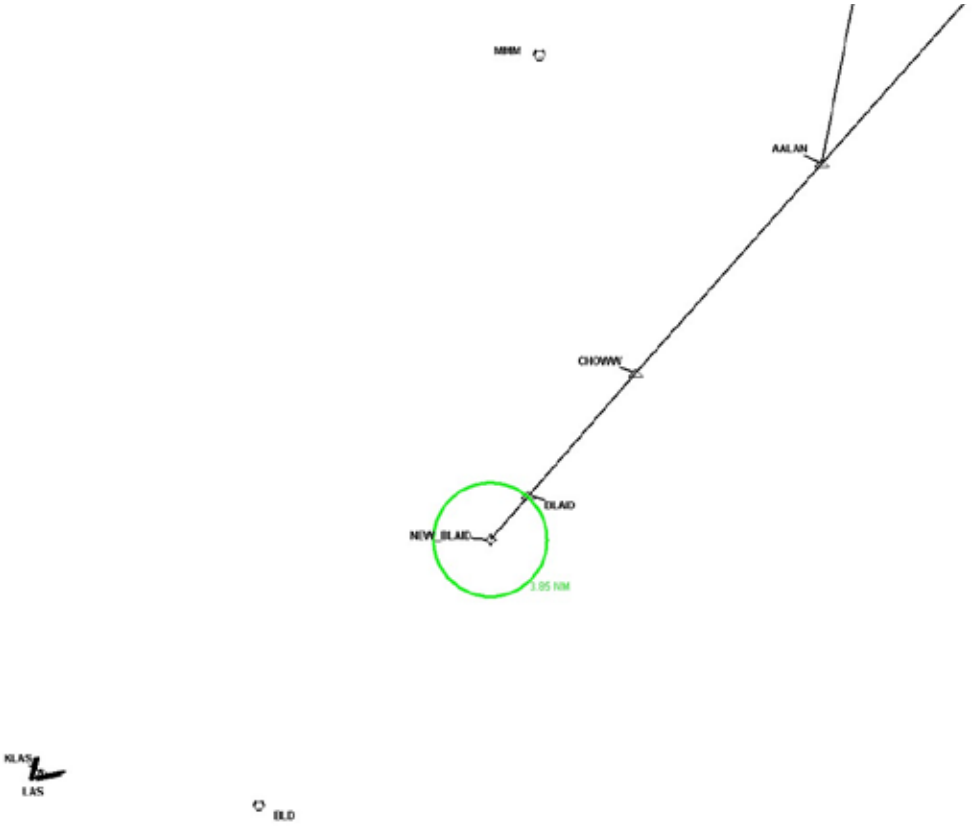
RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) CHOWW RNAV STAR and the conventional LUXOR TWO STAR. A new lateral path was developed to more closely align the conventional arrival with the newly developed RNAV STAR. The BLAID ONE STAR will replace the LUXOR TWO STAR, providing conventionally equipped aircraft a similar arrival path as RNAV capable flights from the northeast. The BLAID ONE STAR will serve KLAS.

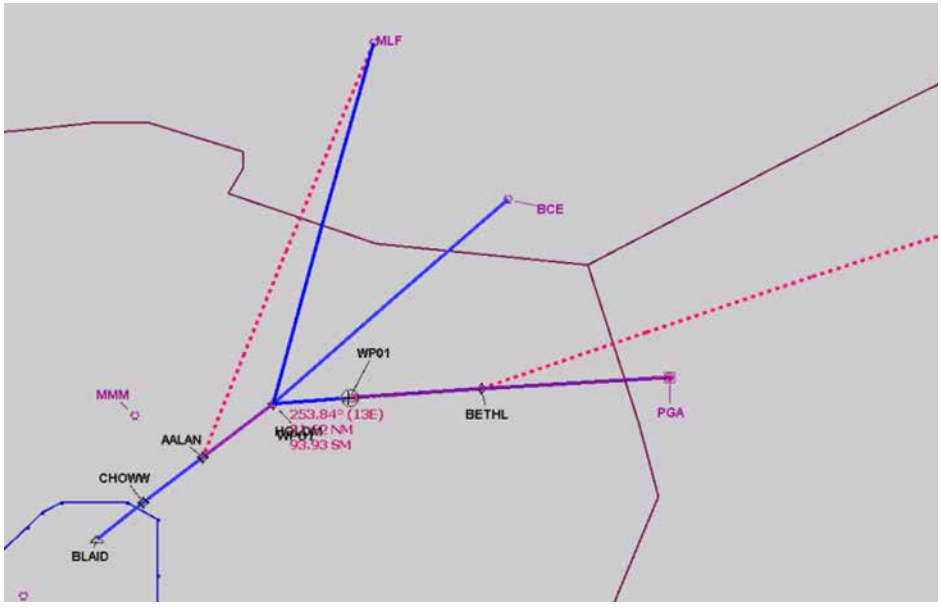
KLAS BLAID STAR Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
5/12/20	The proposed KLAS BLAID STAR MLF and DVC transitions failed Flight Inspection due to NAVAID reception. The MLF transition is now proposed to route via MLF, direct HOLDM, direct AALAN, then as previously proposed. The DVC transition was eliminated with a new proposed transition via PGA, direct BETHL, direct WP01 (not part of procedure, entered as NAVAID crossover point), direct HOLDM, direct AALAN then as previously proposed. This change is in addition to the previously submitted BLAID waypoint move (3.85 miles to the southwest) on 12/9/19. Graphics below show original Proposed Final Design, the 12/9/19 change and the Amended Proposed Final Design.	Master TARGETS File	



Original Proposed Final Design KLAS BLAID STAR



12/9/19 Change to BLAID Waypoint



Amended Proposed Final Design KLAS BLAID STAR

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

5/12/2020

Date

NATCA Metroplex Co-Lead

5-12-2020

Date

Las Vegas OAPM Design Package

KLAS BLAID STAR

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) **BLAID ONE Conventional Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 54, 55 **Denver ARTCC (ZDV) Sectors: 23, 24, 36, 68** **Salt Lake City ARTCC (ZLC) Sectors: 33, 34, 44, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: LAK, FNL, SAT** **KLAS** **KVGT** **KHND** **KBLD**	**KLAS CHOWW STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **Human in the Loop Simulation (HITLS) results**	

Purpose

The BLAID ONE STAR will provide an arrival procedure that merges KLAS, North Las Vegas Airport (KVGT), Henderson Executive Airport (KHND) and Bolder City Municipal Airport (KBLD) conventional arrivals into a similar traffic flow with RNAV aircraft utilizing the KLAS CHOWW STAR. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity. The BLAID ONE STAR will replace the LUXOR TWO STAR.

Study Team Recommendation

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Las Vegas OAPM Design Package

KLAS BLAID STAR

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the BLAID ONE STAR to serve conventional arrivals from the northeast to all runways at KLAS. The BLAID ONE STAR will replace the existing LUXOR TWO STAR.

The KLAS BLAID ONE STAR is depicted in Figure 1 and with KLAS CHOWW RNAV STAR in Figure 2.

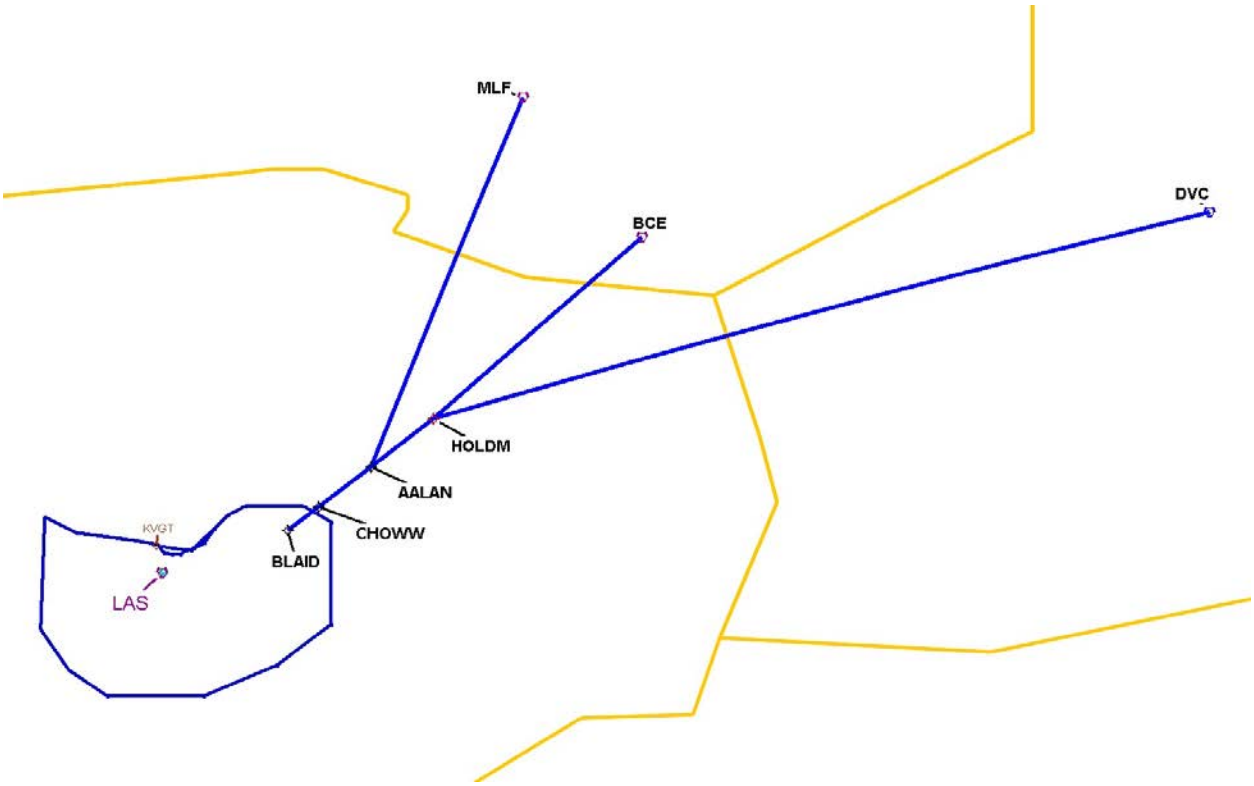


Figure 1: KLAS BLAID ONE Conventional STAR

Las Vegas OAPM Design Package

KLAS BLAID STAR

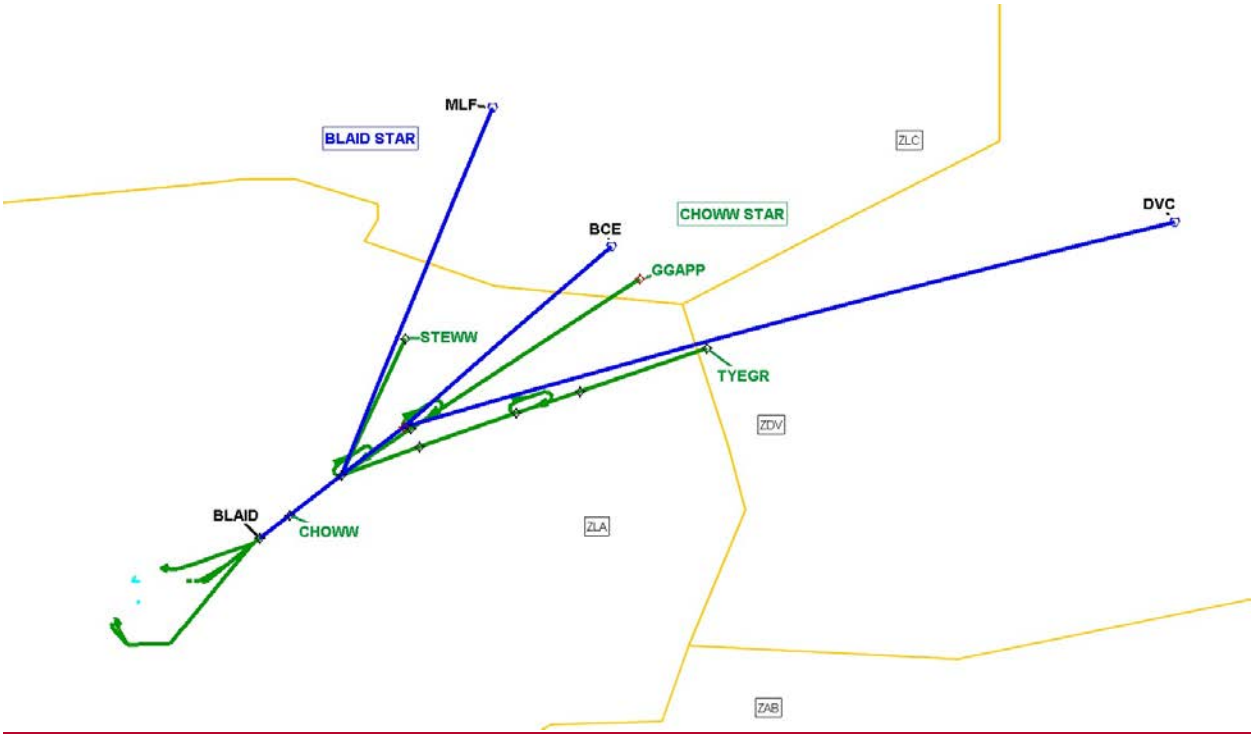


Figure 2: KLAS BLAID ONE Conventional STAR and KLAS CHOWW RNAV STAR

The BLAID ONE STAR's lateral paths are listed below:

BCE Transition

- BCE
- HOLDM (364907.73N-1133230.82W)
- AALANX (363516.97N-1135503.78W)
- CHOWX (362341.51N-1141344.92W)
- BLAID (361656.85N-1142432.12W)

DVC Transition ~~Verify Beth designing this transition~~

- DVC
- HOLDM (364907.73N-1133230.82W)
- AALANX (363516.97N-1135503.78W)
- CHOWX (362341.51N-1141344.92W)
- BLAID (361656.85N-1142432.12W)

MLF Transition

- MLF
- AALANX (363516.97N-1135503.78W)

KLAS BLAID (LUXOR) STAR

- CHOWX (362341.51N-1141344.92W)
- BLAID (361656.85N-1142432.12W)

After BLAID, arrivals will be assigned radar vectors to the appropriate runway.

Additional Design Considerations

- This procedure is not anticipated to change runway usage.
    - The following chart notes will be included with this procedure:
        - Turbojets only
        - DME required
        - Lost communications - Proceed to BLD and hold

The BLAID STAR affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 54, 55
- ZDV Sectors: 23, 24, 36, 68
- ZLC Sectors: 33, 34, 44, 46
- L30 Sectors: LAK, FNL, SAT

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS, KHND, KVGT and KBLD.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZLC Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZDV LOA
- ZLA/ZLC LOA
- ZLA Standard Operating Procedures (SOP)
- ZDV SOP
- ZLC SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)

KLAS BLAID (LUXOR) STAR

- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results
- HITLS results

Review Signatures

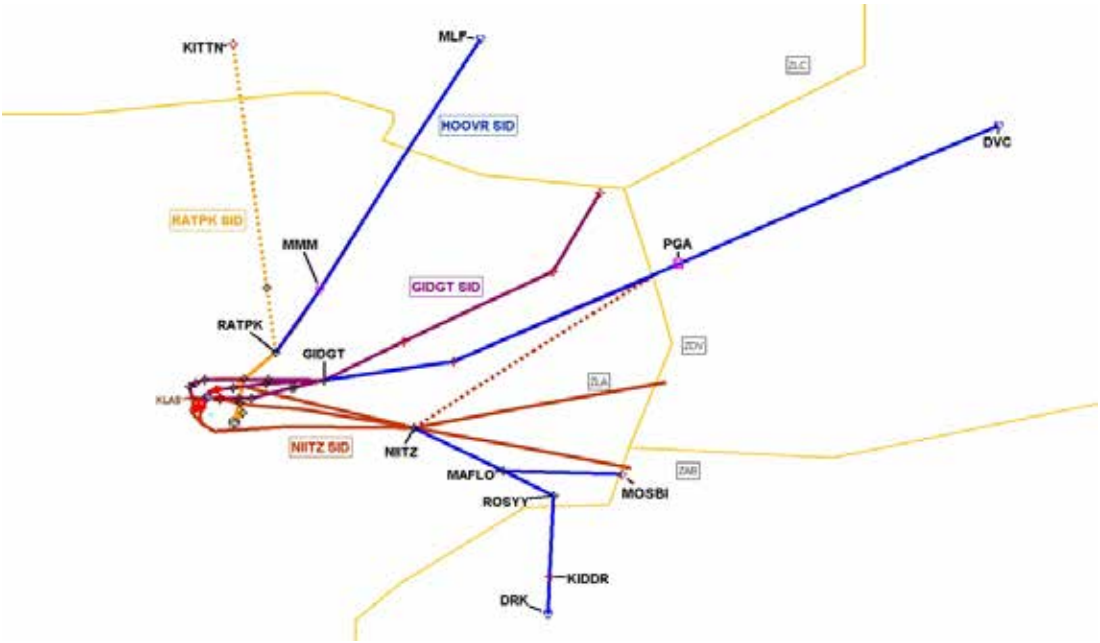
The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

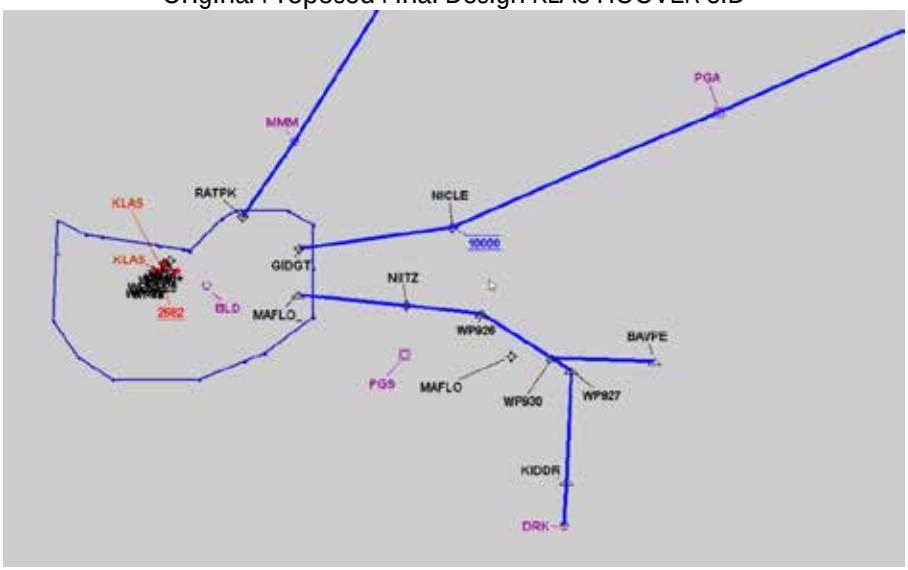
Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

KLAS HOOVER SID Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
5/12/20	The proposed KLAS HOOVER SID DRK, FLG and MOSBI transitions failed Flight Inspections due to NAVAID reception. The DRK transition is now proposed to route via NIITZ, WP926, WP930, WP927, KIDDR, then DRK. The MOSBI transition was deleted. A BAVPE transition is now proposed, routing via NIITZ, WP926, WP930, then BAVPE.	Master TARGETS File	



Original Proposed Final Design KLAS HOOVER SID



Amended Proposed Final Design KLAS HOOVER SID

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh

FAA Metroplex Co-Lead

5/12/2020

Date

NATCA Metroplex Co-Lead

5-12-2020

Date

Las Vegas OAPM Design Package

KLAS/KHND HOOVER SEVEN SID

The Las Vegas Metroplex Project (Project) was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures into and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) GIDGT, RATPK, and NIITZ RNAV SIDs and the conventional HOOVER SIX SID. A new lateral path for the HOOVER SID was developed to more closely align the conventional departure with the newly developed RNAV SIDs. The HOOVER SEVEN SID will replace the HOOVER SIX SID, providing conventionally equipped aircraft a similar departure path as RNAV capable flights to northeast, east and southeast destinations. The HOOVER SEVEN SID will serve both KLAS and Henderson Executive Airport (KHND).

Las Vegas OAPM Design Package

KLAS/KHND HOOVER SEVEN SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) Henderson Executive Airport (KHND) HOOVER SEVEN Conventional Standard Instrument Departure (SID)	Terminal Procedure; SID
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ Preliminary Operational Design (PD) ☒ Proposed Final Design (PFD)
Package Date	**Implementation Date**
5/31/2019	5/21/2020
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 7, 8, 35, 36, 54, 55 Albuquerque ARTCC (ZAB) Sectors: 43, 45, 67, 92 Denver ARTCC (ZDV) Sectors: 23, 24, 36, 37, 38 Salt Lake ARTCC (ZLC) Sectors: 33, 44 Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: DAG, MED Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD KLAS KHND	KLAS GIDGT, RATPK, and NIITZ SIDs
Associated Data Files	
TARGETS output packages Flight Simulator worksheet RNAV Pro analysis results Human in the Loop Simulation (HITLS) results	

Purpose

The KLAS/KHND HOOVER SEVEN SID will merge KLAS and KHND conventional departures into a similar traffic flow with RNAV aircraft utilizing the KLAS GIDGT, RATPK, and NIITZ RNAV SIDs. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity.

Study Team Recommendation

Las Vegas OAPM Design Package

KLAS/KHND HOOVER SEVEN SID

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the KLAS HOOVER SEVEN SID to serve conventional departures from all runways at KLAS. The HOOVER SEVEN SID will replace the existing HOOVER SIX SID (Figure 1).

The HOOVER SEVEN SID will serve conventional KLAS and KHND departures to the northeast and east.

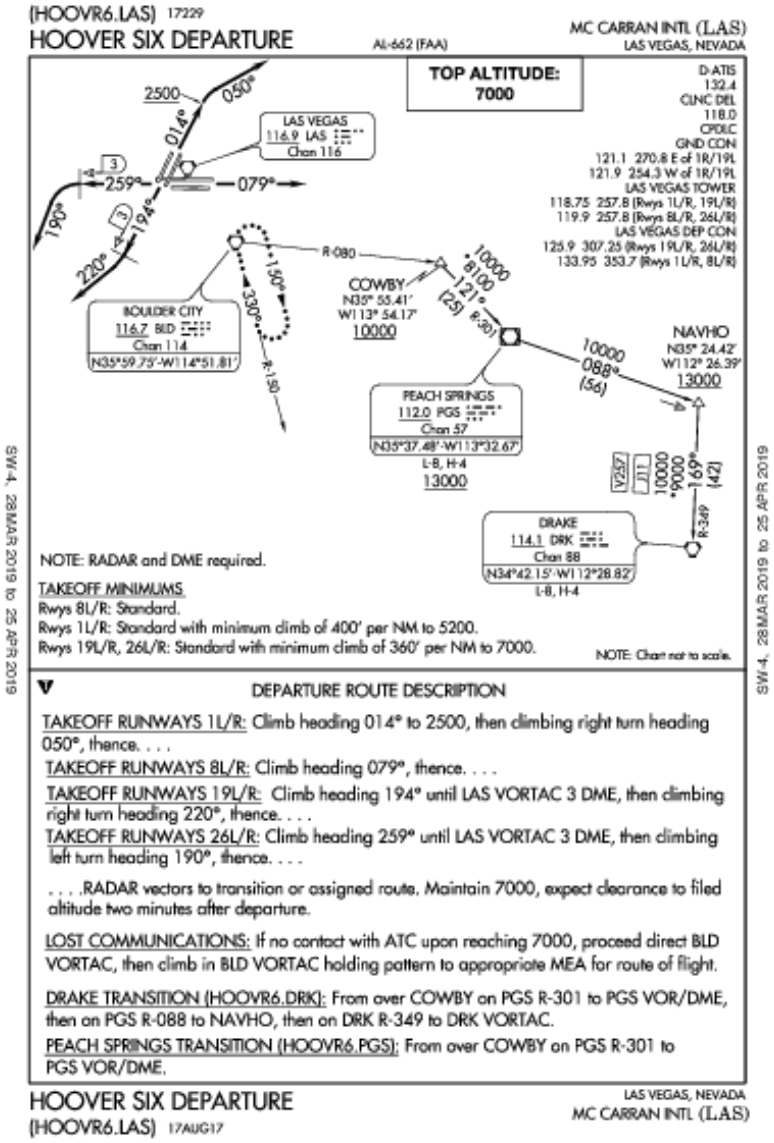


Figure 1: KLAS HOOVER SIX Current Conventional SID

Las Vegas OAPM Design Package

KLAS/KHND HOOVER SEVEN SID

The HOOVER SEVEN SID's lateral paths are listed below.

Runway Transitions

KLAS Runways 01L/R

- Heading 014 to at or above 025
- Right turn heading 060
- Vectors to assigned transition

KLAS Runways 08L/R

- Heading 079
- Vectors to assigned transition

KLAS Runways 19L/R

- Heading 194
- Vectors to assigned transition

KLAS Runways 26L/R

- Heading 259 to 3 miles DME
- Left turn heading 190
- Vectors to assigned transition

En Route Transitions

DRK Transition

- NIITZ (355319.52N-1133200.85W)
- MAFLO (353649.51N-1124953.54W, FLG 282.54 Magnetic, PGS 76.87 Magnetic)
- ROSYY (352722.06N-1122609.33W, FLG 282.54 Magnetic, DRK 348.76 Magnetic)
- Right turn on DRK R-349 to KIDDR
- DRK

DVC Transition

- GIDGT (361136.43N-11425.32W/at or above 100)
- LAS R-066 to NICLE
- PGS R-234 to PGS
- PGA R-053 and DVC R-233 to DVC

MLF Transition

- RATPK (362204.14N-1143721.47W, LAS R-041, 31.3 DME)
- MMM R-199 to MMM
- MMM R-016 and MLF R-198 to MLF

MOSBI Transition

- NIITZ
- MAYFLO
- Left turn on PGS R-076 (J72-86) to MOSBI

The KLAS GIDGT, RATPK, and NIITZ RNAV SIDs, as well as the HOOVER SEVEN SID are depicted in Figure 2.

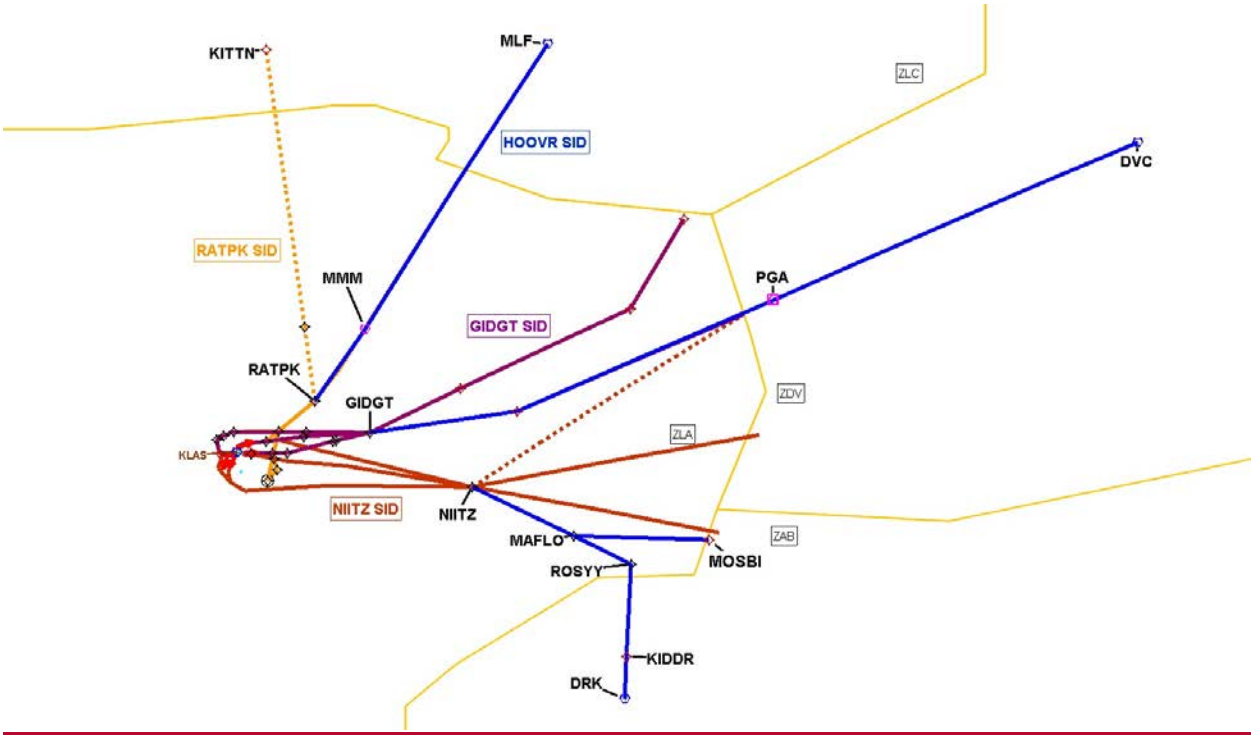


Figure 2: KLAS GIDGT, RATPK, and NIITZ RNAV SIDs and HOOVER SEVEN Conventional SID

Additional Design Considerations

- This procedure is not anticipated to change runway usage.
    - The following chart notes will be included with this procedure:
        - DME required
        - Lost communications - Proceed to BLD and hold

The HOOVER SEVEN SID affects the following facility area(s) as indicated:

- ZLA Sectors: 7, 8, 35, 36, 54, 55
- ZAB Sectors: 43, 45, 67, 92
- ZDV Sectors: 23, 24, 36, 37, 38
- ZLC Sectors: 33, 44
- L30 Sectors: DAG, MED

- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS
- KHND

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve airports for KLAS and KHND.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA Standard Operating Procedures (SOP)
- L30 SOP
- LAS SOP
- HND SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

Las Vegas OAPM Design Package

KLAS ISHEE STAR

The Las Vegas Metroplex Project (Project) was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures into and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) RKSTR RNAV STAR and the conventional KADDY TWO STAR. A new lateral path was developed to more closely align the conventional arrival with the newly developed RNAV STAR. The ISHEE ONE STAR will replace the KADDY TWO STAR, providing conventionally equipped aircraft a similar arrival path as RNAV capable flights from the northeast. The ISHEE ONE STAR will serve KLAS.

Las Vegas OAPM Design Package

KLAS ISHEE STAR

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) **ISHEE ONE Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 8, 35 **Albuquerque ARTCC (ZAB) Sectors: 43, 45, 67, 92** **Denver ARTCC (ZDV) Sectors: 23, 24, 36 and 68** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: LAK** **KLAS**	**KLAS RKSTR STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results**	

Purpose

The KLAS ISHEE ONE STAR will merge KLAS conventional arrivals into a similar traffic flow with RNAV aircraft utilizing the KLAS RKSTR STAR. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity. The ISHEE ONE STAR will replace the KADDY TWO STAR.

Study Team Recommendation

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Proposed Final Design

Las Vegas OAPM Design Package

KLAS ISHEE STAR

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the ISHEE ONE STAR to serve conventional arrivals from the southeast to all runways at KLAS. The ISHEE ONE STAR will replace the existing KADDY TWO STAR (Figure 1).

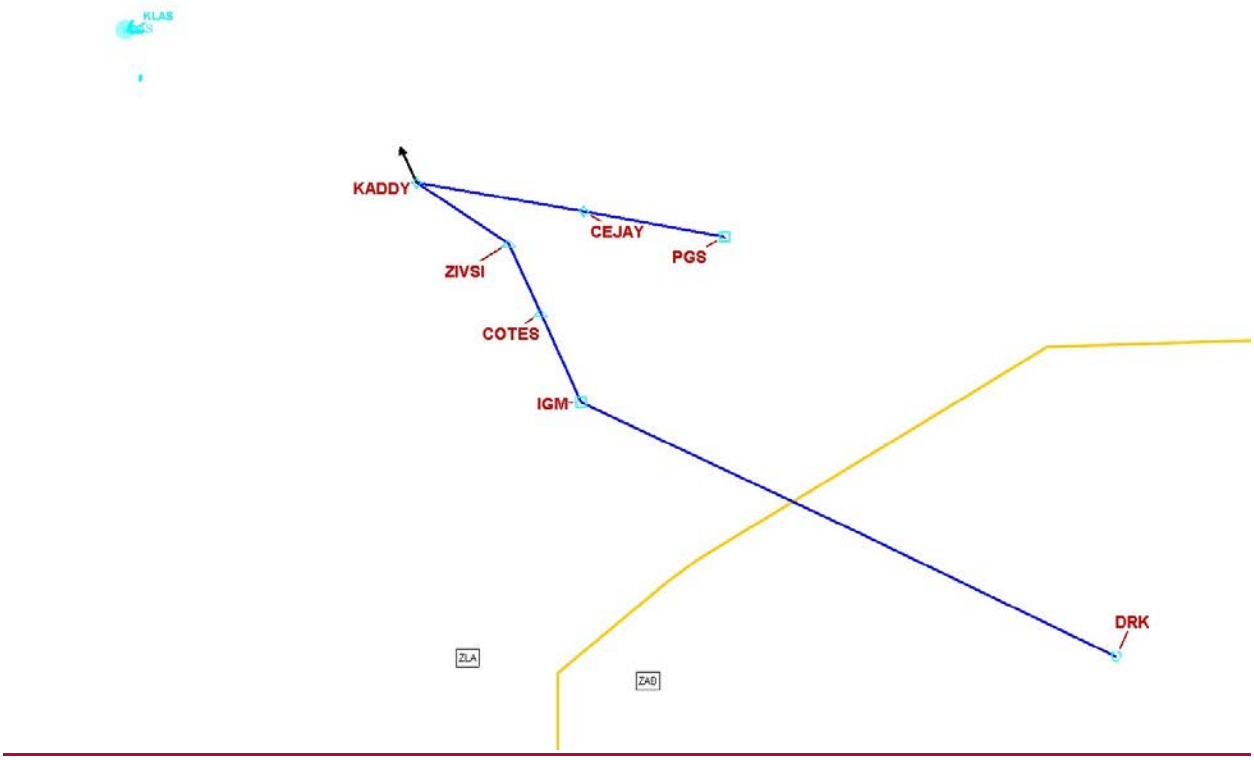


Figure 1: KLAS KADDY TWO Current Conventional STAR

The KLAS RKSTR STAR and the ISHEE ONE STAR are depicted in Figure 2.

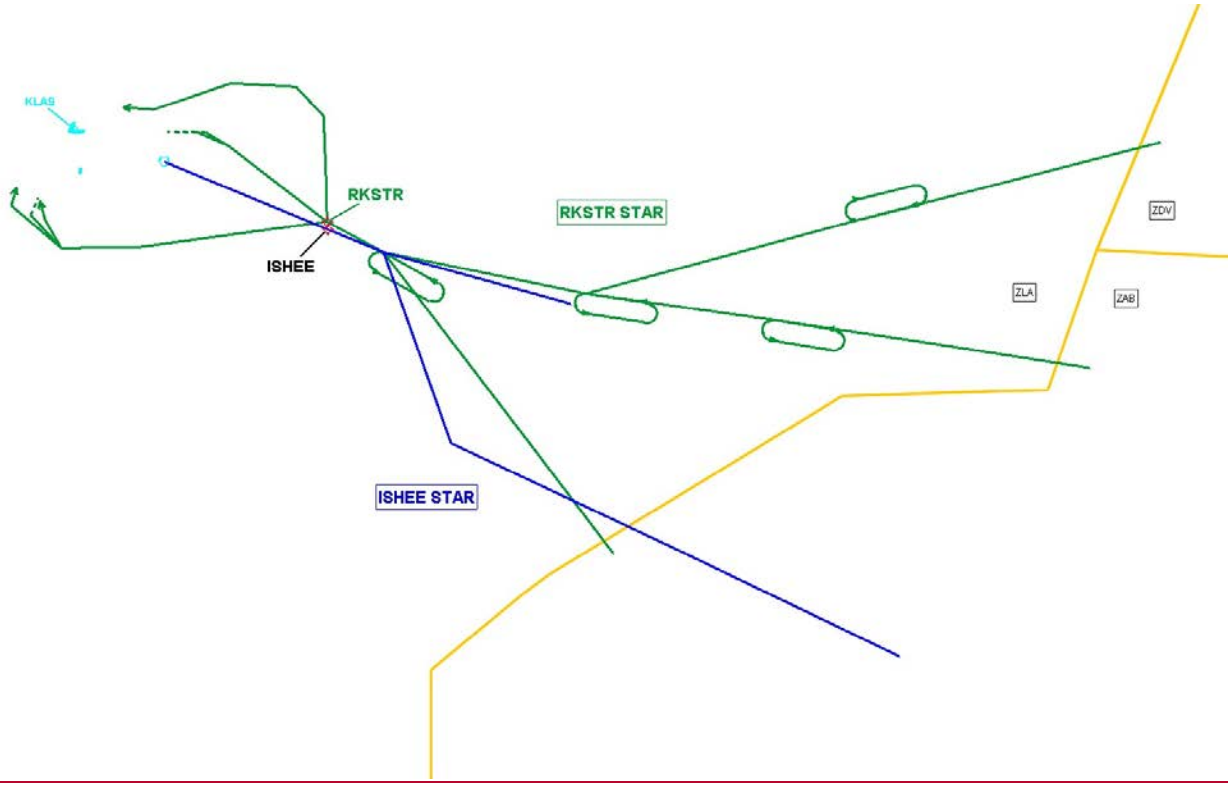


Figure 2: KLAS RKSTR STAR and ISHEE ONE Conventional STAR

The ISHEE ONE STAR's lateral path is listed below:

DRK Transition

- DRK
- IGM
- PEHTY (354530.55N-1140911.11W)
- ISHEE (354907.50N-1141954.95W)
- BLD

PGS Transition

- PGS
- PEHTY (354530.55N-1140911.11W)
- ISHEE (354907.50N-1141954.95W)
- BLD

After BLD, arrivals will be assigned radar vectors to the appropriate runway.

Additional Design Considerations

This procedure is not anticipated to change runway usage.

- The following chart notes will be included with this procedure:
  - Turbojets only
  - DME required
  - Lost communications - Proceed to BLD and hold (Hold S, RT R150, 330 Inbound)

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS.

- ZLA Sectors: 8, 35
- ZAB Sectors: 43, 45, 67, 92
- ZDV Sectors: 23, 24, 36 and 68
- L30 TRACON Sectors: LAK
- KLAS

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZDV Facility Operations and Administration Order 7210.3
- ZAB Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZDV LOA
- ZLA/ZAB LOA
- ZLA Standard Operating Procedures (SOP)
- ZDV SOP
- ZAB SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

Las Vegas OAPM Design Package

KLAS LARKK STAR

The Las Vegas Metroplex Project was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures into and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) RNDRZ RNAV STAR and the conventional CLARR THREE STAR. A new lateral path was developed to more closely align the conventional arrival with the newly developed RNAV STAR. The LARKK ONE STAR will replace the CLARR THREE STAR, providing conventionally equipped aircraft a similar arrival path as RNAV capable flights from the northeast. The LARKK ONE STAR will serve KLAS.

Las Vegas OAPM Design Package

KLAS LARKK STAR

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) LARKK ONE Conventional Standard Terminal Arrival Route (STAR)	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 17, 37, 38, 39 Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: GNT, FNL, SAT, DAG, MED KLAS KVGT	**KLAS RNDRZ STAR**
Associated Data Files	
TARGETS output packages Flight Simulator worksheet RNAV Pro analysis results Human in the Loop Simulation (HITLS)results	

Purpose

The LARKK ONE STAR will provide an arrival procedure that merges KLAS conventional arrivals into a similar traffic flow with RNAV aircraft utilizing the KLAS RNDRZ STAR. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity. The LARKK ONE STAR will replace the CLARR THREE STAR.

Study Team Recommendation

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the LARKK ONE STAR to serve conventional arrivals from the southwest to all runways at KLAS and KVGT. The LARKK ONE STAR will replace the existing CLARR THREE STAR (Figure 1).

KLAS LARKK (CLARR) STAR

Las Vegas OAPM Design Package

KLAS LARKK STAR

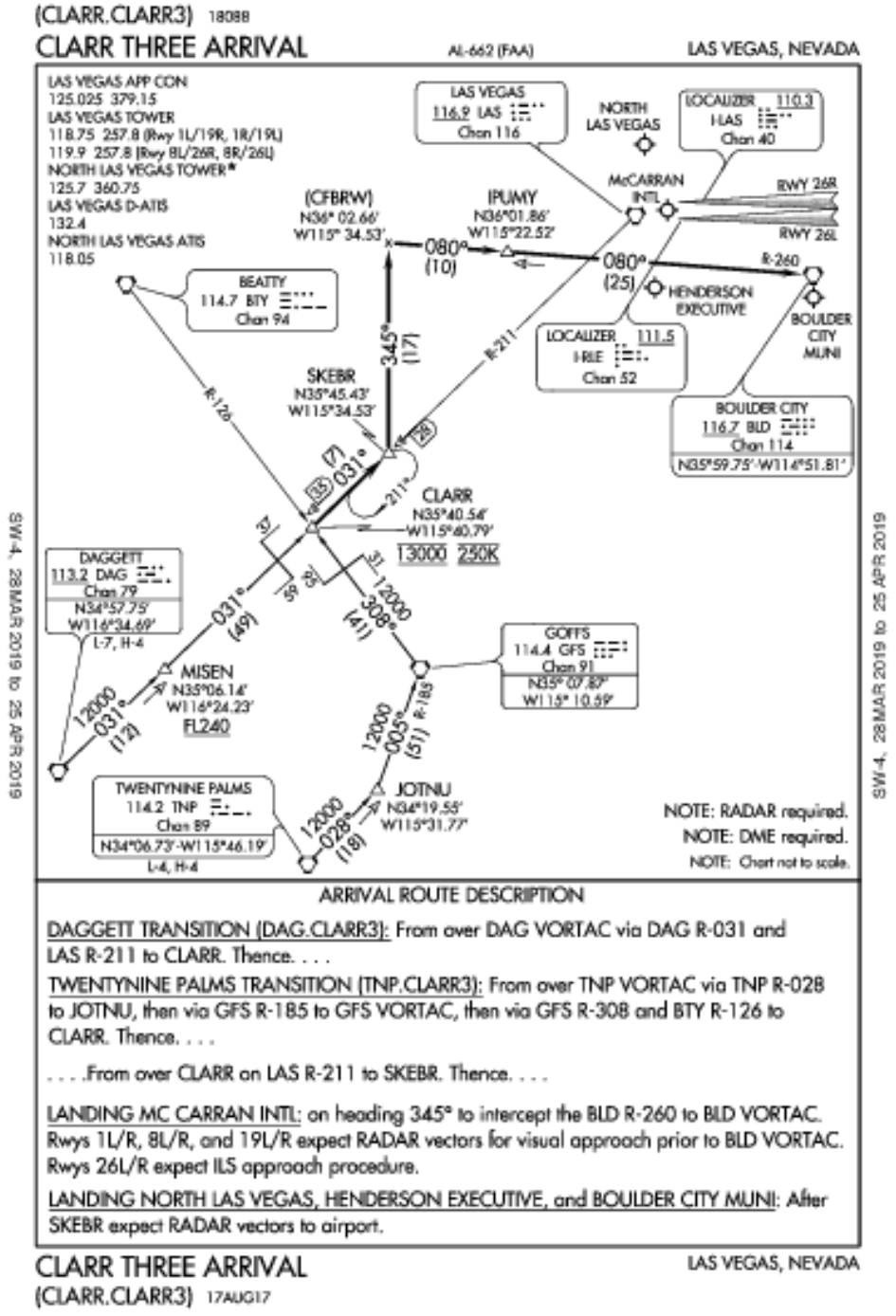


Figure 1: KLAS CLARR THREE – Current Conventional STAR

The KLAS RNDRZ STAR and the LARKK ONE STAR are depicted in Figure 2.

KLAS LARKK (CLARR) STAR

Las Vegas OAPM Design Package

KLAS LARKK STAR

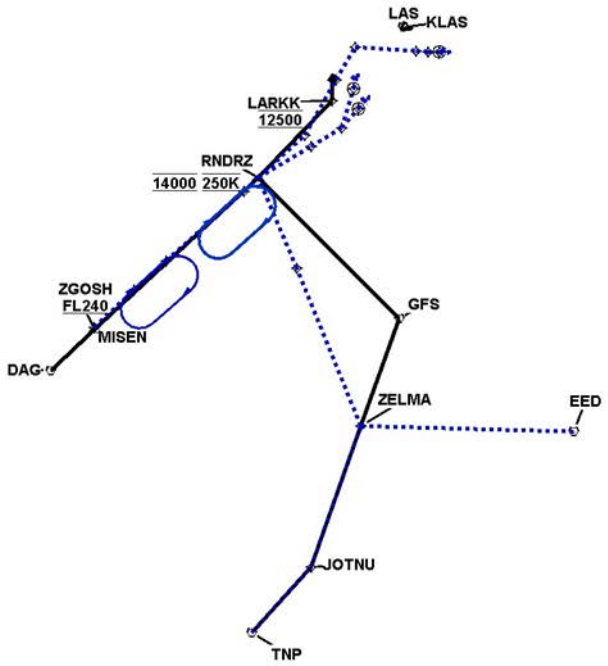


Figure 2: KLAS RNAV RNDRZ STAR and LARKK ONE Conventional STAR

The LARKK ONE STAR's lateral path is listed below:

- DAG Transition
  - DAG VORTAC (345744.84N / 1163441.40W)
  - ZGOSH (350553.71N / 1162356.85W)
  - RNDRZ (353526.72N/1154430.06W)
  - LARKK (355026.86N/1152643.57W)
  - From LARKK fly heading 350° and expect vectors to final approach

- TNP Transition
  - TNP VORTAC (340644.04N / 1154611.66W)
  - JOTNU (341933.11N/1153146.29W)
  - ZELMA (344659.99N/1151947.51W)
  - GFS VORTAC (350752.12N / 1151035.19W)
  - RNDRZ (353526.72N/1154430.06W)
  - LARKK (355026.86N/1152643.57W)
  - From LARKK fly heading 350° and expect vectors to final approach

Additional Design Considerations

- This procedure is not anticipated to change runway usage
  - The following chart notes will be included with this procedure:

KLAS LARKK (CLARR) STAR

- DME required
- Lost communications - Proceed to BLD and hold

The LARKKSTAR affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 10, 17, 37, 38, 39
- L30 Sectors: GNT, FNL, SAT, DAG, MED
- KLAS
- KVGT

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS.
Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- VGT Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA Standard Operating Procedures (SOP)
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results

Las Vegas OAPM Design Package

KLAS LARKK STAR

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh FAA Metroplex Co-Lead	2/11/20 Date	Chris Thomas NATCA Metroplex Co-Lead	2/11/2020 Date
Sarah Fletcher ZLA Facility Lead	2/25/20 Date	Martin Ramirez ZLA NATCA Lead	3/4/2020 Date
William Wadley L30 Facility Lead	2/12/2020 Date	Dan Hauptman L30 NATCA Lead	2/11/2020 Date

Las Vegas OAPM Design Package

KLAS/KHND MCCARRAN SIX SID

The Las Vegas Metroplex Project (Project) was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures into and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) JOHKR and RADYR RNAV SIDs and the conventional MCCARRAN FIVE SID. A new lateral path for the MCCARRAN SID was developed to more closely align the conventional departure with the newly developed RNAV SIDs. The MCCARRAN SIX SID will replace the MCCARRAN FIVE SID, providing conventionally equipped aircraft a similar departure path as RNAV capable flights to south and west destinations. The MCCARRAN SIX SID will serve both KLAS and Henderson Executive Airport (KHND).

Las Vegas OAPM Design Package

KLAS/KHND MCCARRAN SIX SID

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) **Henderson Executive Airport (KHND)** **MCCARRAN SIX Conventional Standard Instrument Departure (SID)**	**Terminal Procedure; SID**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 6, 10, 16, 37, 39 **Oakland ARTCC (ZOA) Sectors: 33, 46** **Joshua Control Facility (JCF)** **Nellis Air Traffic Control Facility (NATCF)** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: MED, DAG** **Las Vegas Air Traffic Control Tower (LAS ATCT) Positions: LC1, LC2, LC3, GCE, GCW, CD** **KLAS** **KHND**	**KLAS JOHKR and RADYR SIDs**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results**	

Purpose

The KLAS/KHND MCCARRAN SIX SID will merge KLAS and KHND conventional departures into a similar traffic flow with RNAV aircraft utilizing the KLAS JOHKR and RADYR RNAV SIDs. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity.

Study Team Recommendation

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Las Vegas OAPM Design Package

KLAS/KHND MCCARRAN SIX SID

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the MCCARRAN SIX SID to serve conventional departures from all runways at KLAS. The MCCARRAN SIX SID will replace the existing MCCARRAN FIVE SID (Figure 1).

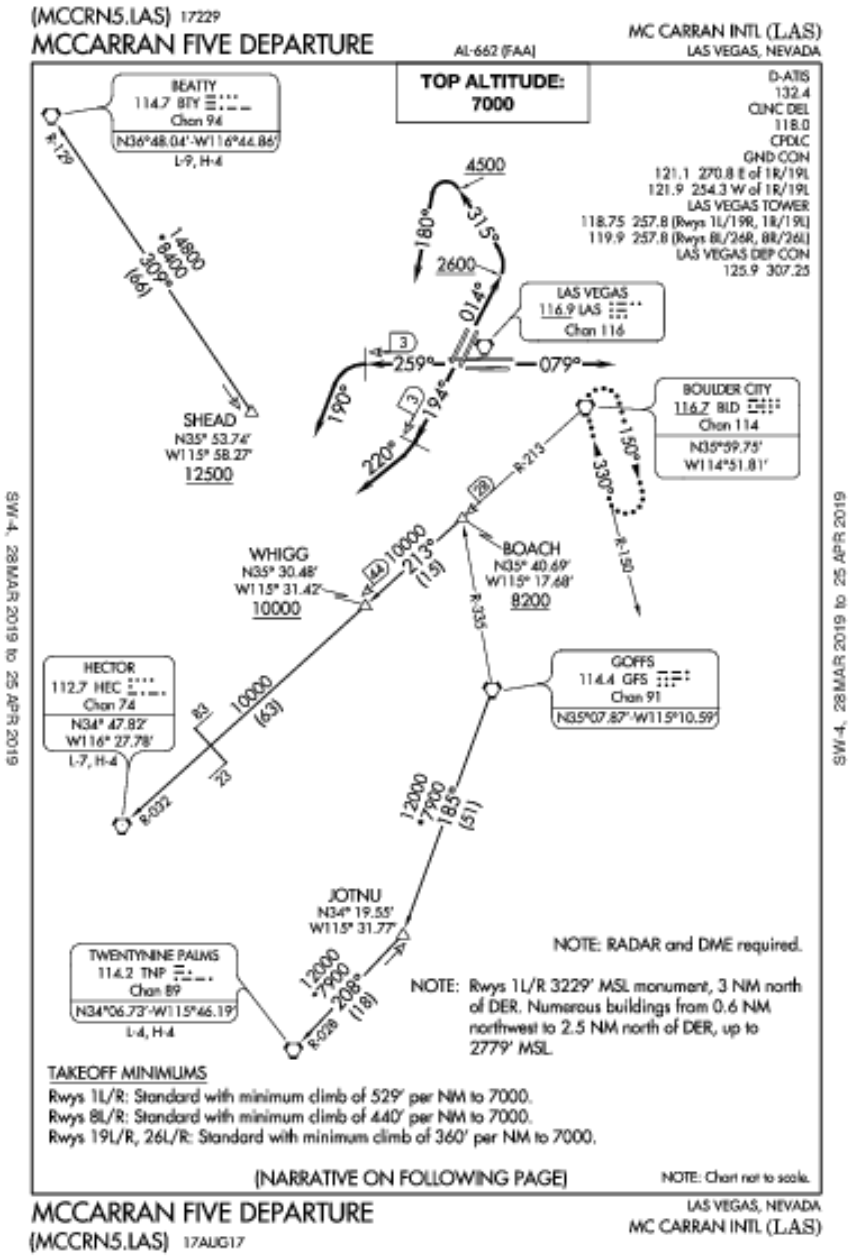


Figure 1: KLAS MCCARRAN FIVE Current Conventional SID

The KLAS JOHKR and RADYR RNAV SIDs, as well as the MCCARRAN SIX SID are depicted in Figure 2.

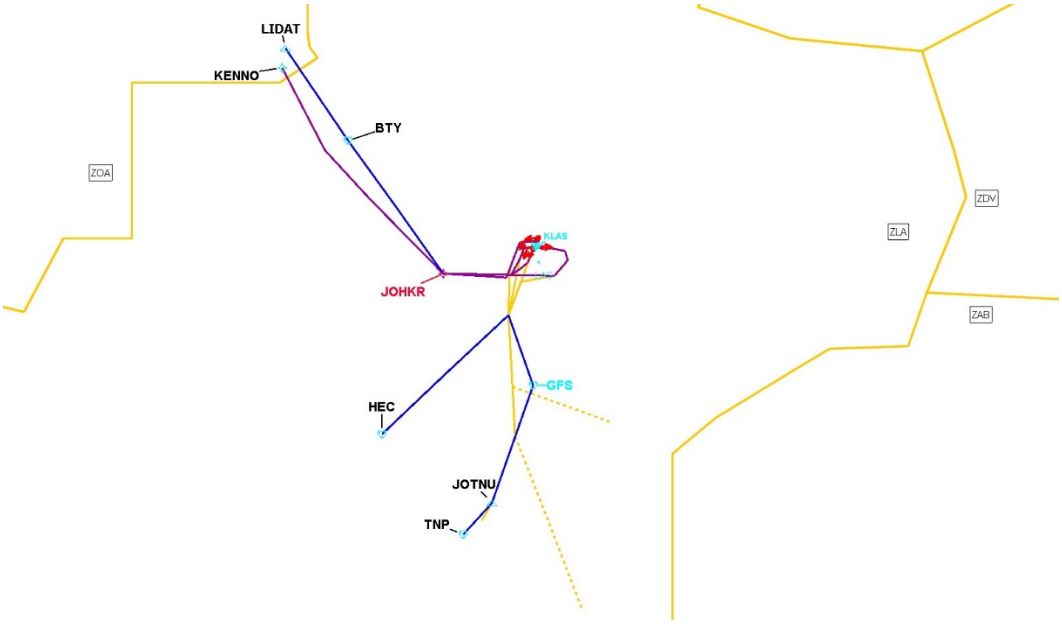


Figure 2: KLAS JOHKR and RADYR RNAV SIDs and MCCARRAN SIX Conventional SID

For conventional KLAS departures to the south and west, the MCCARRAN SIX SID's lateral paths are listed below.

Runway Transitions

KLAS Runways 01L/R

- 014 heading to at or above 026
- Left turn heading 255 to at or above 045
- Left turn heading 200
- Vectors to assigned transition

KLAS Runways 08L/R

- Heading 079
- Vectors to assigned transition

KLAS Runways 19L/R

- Heading 194
- Vectors to assigned transition

KLAS Runways 26L/R

- Heading 259 to 3 miles DME
- Heading 190
- Vectors to assigned transition

En Route Transitions

HEC Transition

- RADYR (BLD R-213/BLD/BLD R-213/HEC R-032)/HEC

TNP Transition

- RADYR (GFS R-335/GFS/GFS R-185/JOTNU/TNP R-028/TNP)

LIDAT Transition:

- JOHKR
- BTY (128 radial)/BTY
- BTY (310 radial)/LIDAT~~**BTY Transition**~~
  - ~~JOHKR/BTY (128 radial)/BTY~~

Additional Design Considerations

- This procedure is not anticipated to change runway usage.
  - The following chart notes will be included with this procedure:
    - DME required
    - Lost communications - Proceed to BLD and hold

The MCCARRAN SIX SID affects the following facility area(s) as indicated:

- ZLA Sectors: 6, 10, 16, 37, 39
- ZOA Sectors: 33, 46
- Joshua Control Facility (JCF)
- Nellis Air Traffic Control Facility (NATCF)
- L30 Sectors: MED, DAG
- LAS Positions: LC1, LC2, LC3, GCE, GCW, CD
- KLAS
- KHND

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS and KHND.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- JCF Facility Operations and Administration Order 7210.3
- NATCF Facility Operations and Administration Order 7210.3

- L30 Facility Operations and Administration Order 7210.3
- LAS Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- ZLA/JCF LOA
- ZLA/NATCF LOA
- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- JCF SOP
- HND SOP
- LAS SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

Las Vegas OAPM Design Package

KLAS PUMLE STAR

The Las Vegas Metroplex Project (Project) was tasked with developing advanced Area Navigation (RNAV) air traffic control procedures for the Las Vegas Valley area. These new procedures are based on satellite navigation providing repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS). The final RNAV designs provide dedicated, but not exclusive, corridors that funnel arrivals and departures in to and out of Las Vegas area airports in a more efficient manner. The procedures were designed to provide segregation of traffic flows allowing Optimized Profile Descents (OPDs) for arrivals and less restrictive climbs for departures. The Project developed Standard Terminal Arrival Routes (STARs), Standard Instrument Departures (SIDs) and Required Navigation (RNP) approach procedures. Extensive changes were made to designated airspace in air traffic control sectors at the Las Vegas Terminal Radar Approach Control (L30 TRACON) and the Los Angeles Air Route Traffic Control Center (ZLA ARTCC) to accommodate new traffic flows.

RNAV procedures can only be flown by properly equipped aircraft and certified aircrews. For those aircraft that are unable to take advantage of satellite navigation procedures, conventional procedures using ground-based radio signals are currently, and will continue to be, available for use. While RNAV usage continues to increase, it is necessary to provide aircraft using older technologies navigational direction that will integrate them into a system designed for the 21st Century. To maintain the benefits gained by the development of RNAV procedures, the Project made changes to existing ground-based conventional procedures that will provide similar paths for all aircraft arriving at or departing from area airports.

The Project's team reviewed the McCarran International Airport's (KLAS) COKTL RNAV STAR and the conventional FUZZY EIGHT STAR. A new lateral path was developed to more closely align the conventional arrival with the newly developed RNAV STAR. The PUMLE ONE STAR will replace the FUZZY EIGHT STAR, providing conventionally equipped aircraft a similar arrival path as RNAV capable flights from the northeast. The PUMLE ONE STAR will serve KLAS.[JB-j1]

Las Vegas OAPM Design Package

KLAS PUMLE STAR

Name of Change and Airport(s)	Change Classification
McCarran International Airport (KLAS) **PUMLE ONE Standard Terminal Arrival Route (STAR)**	**Terminal Procedure; STAR**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sectors: 16 **Oakland ARTCC (ZOA) Sectors: 33, 46** **Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: GNT, FNL** **KLAS**	**KLAS COKTL STAR**
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results**	

Purpose

The KLAS PUMLE ONE STAR i will merge KLAS conventional arrivals into a similar traffic flow with RNAV aircraft utilizing the KLAS COKTL STAR. The integration of conventional and RNAV procedures will maintain airspace integrity and reduce complexity. The PUMLE ONE STAR will replace the FUZZY EIGHT STAR.

Study Team Recommendation

The Las Vegas Metroplex Study Team (MST) did not address amendments to conventional procedures.

Proposed Final Design

The Las Vegas Metroplex Design and Implementation Team (D&I Team) designed the PUMLE ONE STAR to serve conventional arrivals from the southeast to all runways at KLAS. The PUMLE ONE STAR will replace the existing FUZZY EIGHT STAR (Figure 1).

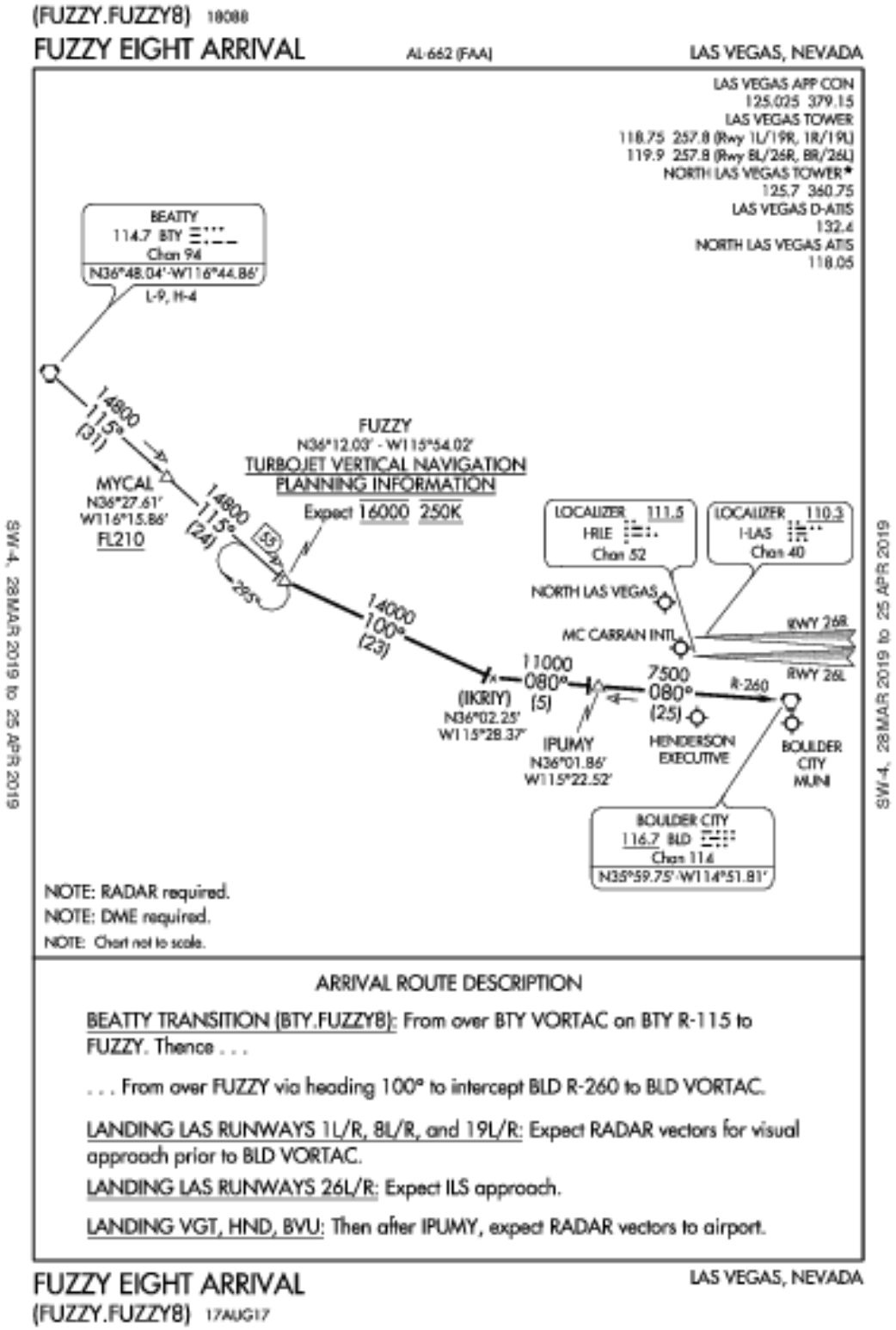


Figure 1: KLAS FUZZY EIGHT Current Conventional STAR

The KLAS COKTL STAR and the PUMLE ONE STAR are depicted in Figure 2.

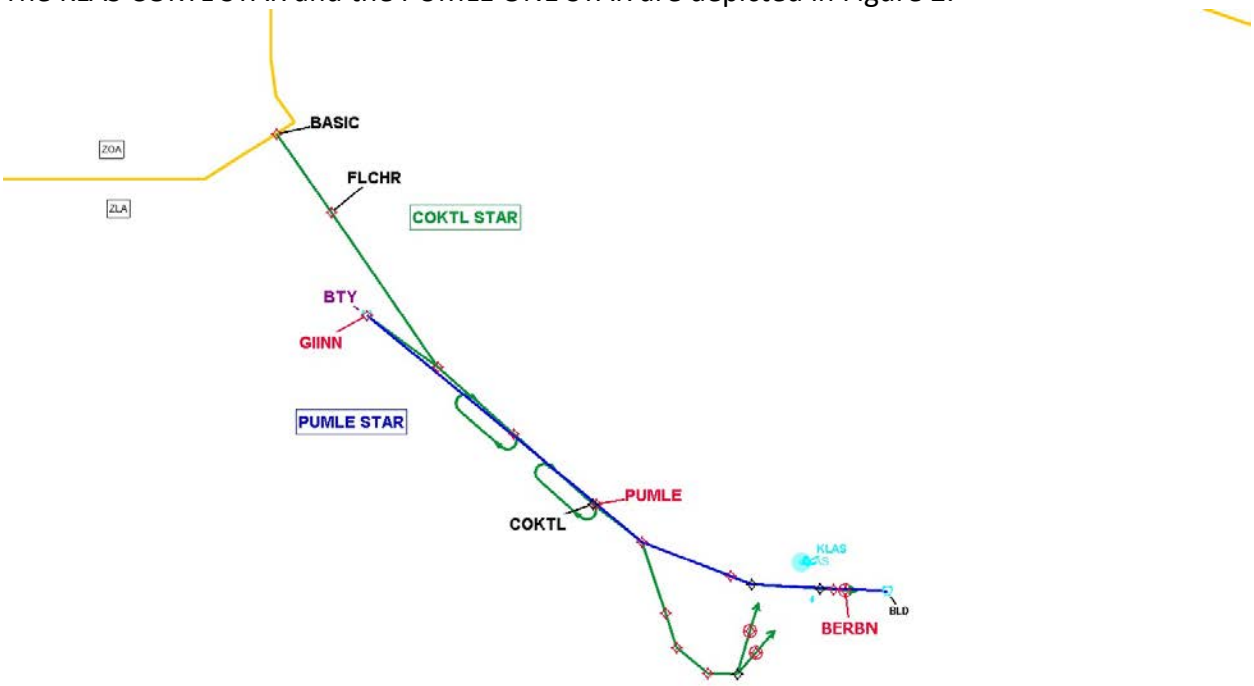


Figure 2: KLAS COKTL STAR and PUMLE ONE Conventional STAR

The PUMLE ONE STAR's lateral path is listed below:

BTY Transition

- BTY
- PUMLE (361500.00N-1155459.29W)
- ZLLDA (360819.66N-1154503.06W)
- CNF (360112.49N-1152711.16W)ENNVY
- BLD

After BLD, arrivals will be assigned radar vectors to the appropriate runway.

Additional Design Considerations

This procedure is not anticipated to change runway usage.

- The following chart notes will be included with this procedure:
  - Turbojets only
  - DME required
  - Lost communications - Proceed to BLD and hold

Implementation Dependencies

This procedure will be implemented in conjunction with affected SIDs and STARs designed to serve KLAS.

Document changes/modifications include:

- ZLA Facility Operations and Administration Order 7210.3
- ZOA Facility Operations and Administration Order 7210.3
- L30 Facility Operations and Administration Order 7210.3
- ZLA/L30 sector boundary maps and video maps
- ZLA/L30 Letter of Agreement (LOA)
- ZLA/ZOA LOA
- ZLA Standard Operating Procedures (SOP)
- ZOA SOP
- L30 SOP
- ERAM and STARS automation changes (ADAR, AARS, Waypoint Pairs, etc.)
- National Route Program (NRP) Database including Coded Departure Routes (CDRs)
- Airport Facility Directory (AFD) Preferential Routings (Green Book)
- National Airspace System (NAS) Integrated Display System (NIDS)
- Enroute Information Display System (ERIDS)
- Enroute Decision Support Tool (EDST)

Additional staffing, facilities, or equipment requirements:

- None anticipated

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

Las Vegas OAPM Design Package

Las Vegas RNP Runway 08R Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The RNP Runway 08R Approach was designed in conjunction with the KLAS RKSTR, CHOWW, RNDRZ, COKTL and JAYSN STARs, allowing access to Runway 08R from multiple directions. The use of satellite navigation will provide connectivity to the approach via either a curved of straight in path.

This procedure is not anticipated to change runway usage. The KLAS RNP Runway approach will increase flight path predictability and decrease controller/pilot workload and task complexity, which will enhance safety.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNP Runway 08R Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) RNP Runway 08R Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: FINAL (FNL) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Procedures (RNP) approach procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, using historical track data as a baseline. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course.

Study Team Recommendation

As depicted in Figure 1, KLAS RNP procedures to the final approach course were designed for all configurations (25L/R, 19L/R, 07R and 01L/R)[2]. The Las Vegas Metroplex Study Team (MST) recommends that conceptual RNP Standard Instrument Approach Procedures (SIAPs) at KLAS be reviewed during the Design and Implementation (D&I) phase for optimized downwind alignment and reduction in arc length.

Initial conceptual approaches were designed for all runways. During the Second Outreach, L30 requested the Runway 07L RNP approach be deleted.

The MST recommendation is depicted in Figure 1.

[2] In August 2017 Las Vegas runways had a magnetic variance adjustment. Runways 07 L/R and 25 L/R were adjusted to 08L/R and 26 L/R.

Las Vegas OAPM Design Package

Las Vegas RNP Runway 08R Approach

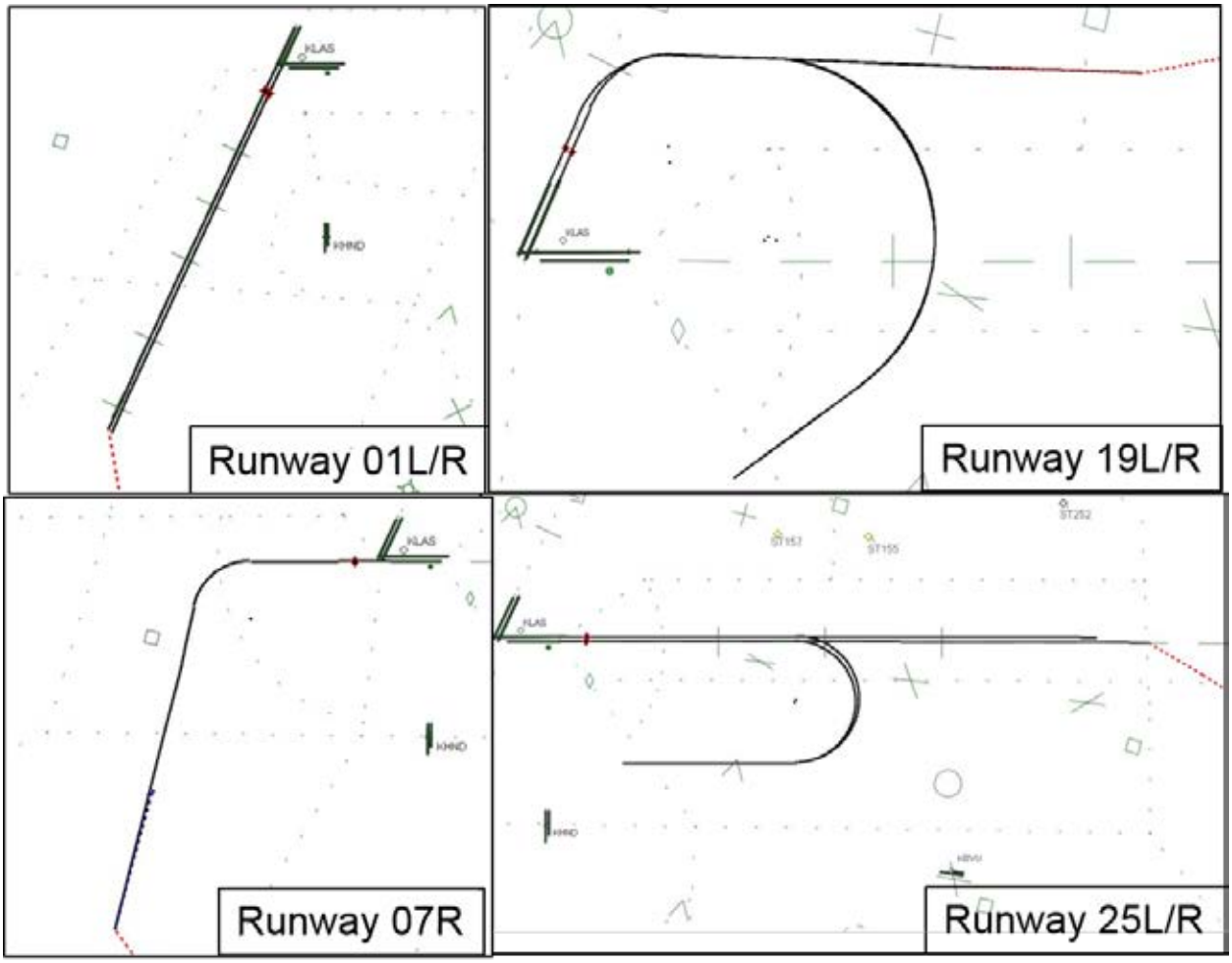


Figure 1: KLAS RNP Approaches-Study Team Recommendations

Proposed Final Design

The Las Vegas Design and Implementation (D&I) Team reviewed the MST proposal to refine and provide optimization to the greatest extent possible. The RNP Runway 08R Approach was designed for connectivity from all Metroplex KLAS RNAV STAR designs. The KLAS COKTL, JAYSN, RKSTR and RNDRZ STARs all share a waypoint (YAGGR) with the approach, while the KLAS CHOWW will allow connection via radar vectors.

The KLAS Runway 08R RNP Approach begins at YAGGR. Waypoints with restrictions (altitudes/speeds) were added to meet design criteria and to assist in aircraft flyability.

The D&I Team proposed final design is depicted in Figure 2.

KLAS Runway 08R RNP Authorization Required (AR) Approach

- YAGGR (at 080/no greater than 210 knots)
- CEENA (at or above 070)
- MNDRN (at or above 060/terrain avoidance)

- SAMOA (at or above 050/Class B containment)
- EYUNG (at or above 045/terrain avoidance)
- BHARP (at 038)

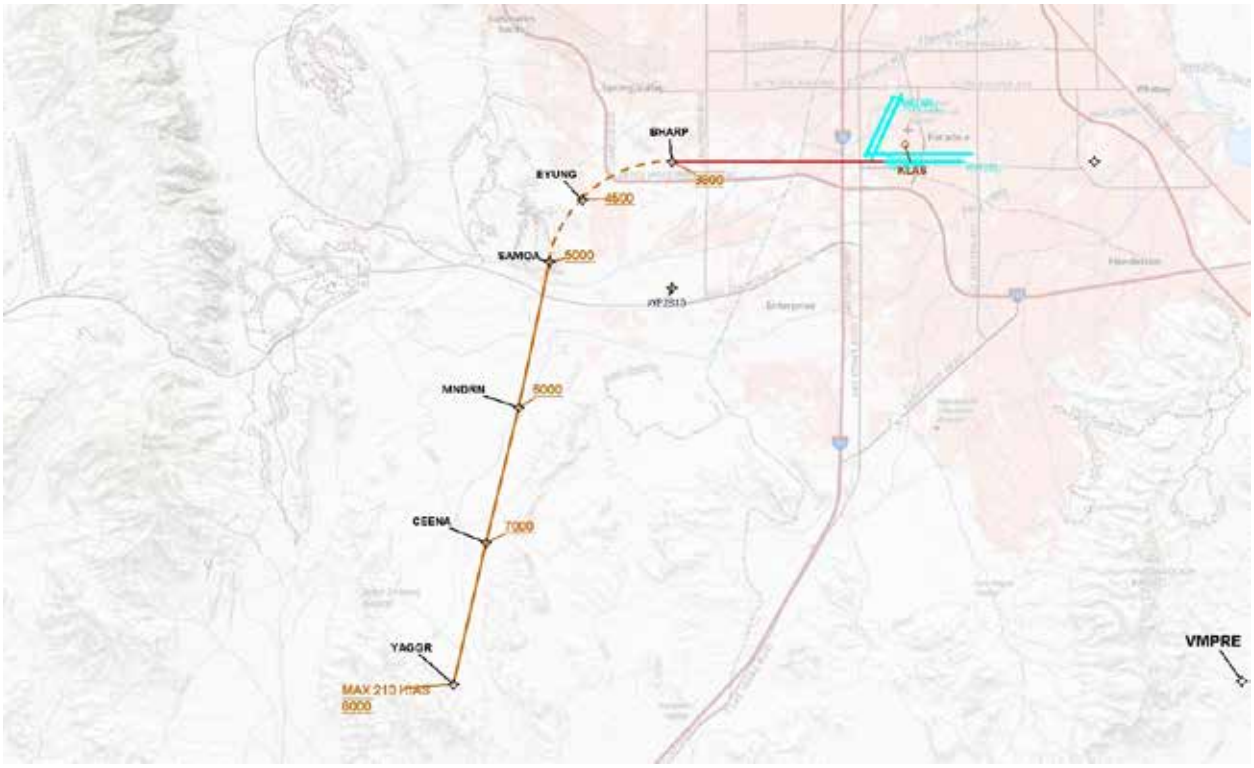


Figure 2: KLAS Runway 08R RNP AR Approach Proposed Final Design

Study Team Recommendation Design Differences

The proposed KLAS RNP Runway 08R Approach is in line with the Study Team recommendation.

Implementation Dependencies

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

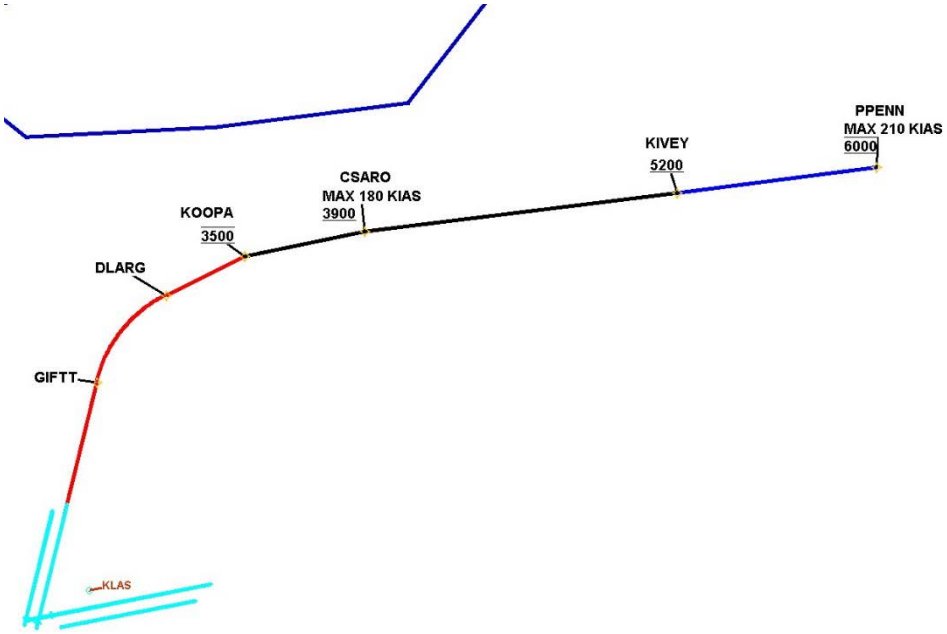
Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

LAS Metroplex RNAV RNP Z LAS RWY 19L Approach Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
4/23/20	During administrative reconciling, it was determined that undocumented minor changes to the RNAV RNP Z LAS RWY 19L were accomplished to meet design criteria. This change sheet corrects information contained in the original Design Package. On 6/13/19, the following changes were made: • CSARO moved .18 nm W/NW and restriction changed from AOA 4000 to AOA 3900. • KOOPA moved .13 nm W/NW • DLARG moved .16 nm N/NE • WILSE moved .1 nm N and renamed GIFTT These changes were included in the Environmental Assessment modeling  	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Maybrugh

FAA Metroplex Co-Lead

4/23/2020

Date

NATCA Metroplex Co-Lead

4/23/2020

Date

KLAS RNP RUNWAY 19L Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	CSARO waypoint renamed MOBBB.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19L Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1]

The RNP Runway 19L Approach was designed in conjunction with the KLAS RKSTR, CHOWW, RNDRZ, COKTL and JAYSN STARs, allowing access to Runway 19L from multiple directions. The use of satellite navigation will allow joining of the approach via either a curved of straight in path.

This procedure is not anticipated to change runway usage. The KLAS RNP Runway 19L approach will increase flight path predictability and decrease controller/pilot workload and task complexity, which will enhance safety.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19L Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Required Navigation (RNP) Runway 19L Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: Satellites (SAT) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Procedures (RNP) approach procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, using historical track data as a baseline. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course.

Study Team Recommendation

As depicted in Figure 1, KLAS RNP procedures to the final approach course were designed for all configurations (25L/R, 19L/R, 07R and 01L/R)[2]. The Las Vegas Metroplex Study Team (MST) recommends that conceptual RNP Standard Instrument Approach Procedures (SIAPs) at KLAS be reviewed during the Design and Implementation (D&I) phase for optimized downwind alignment and reduction in arc length.

Initial conceptual approaches were designed for all runways. During the Study Team Second Outreach L30 requested the Runway 07L RNP approach be deleted.

The MST recommendation is depicted in Figure 1.

[2] In August 2017 Las Vegas runways had a magnetic variance adjustment. Runways 07 L/R and 25 L/R became 08 L/R and 26 L/R.

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19L Approach

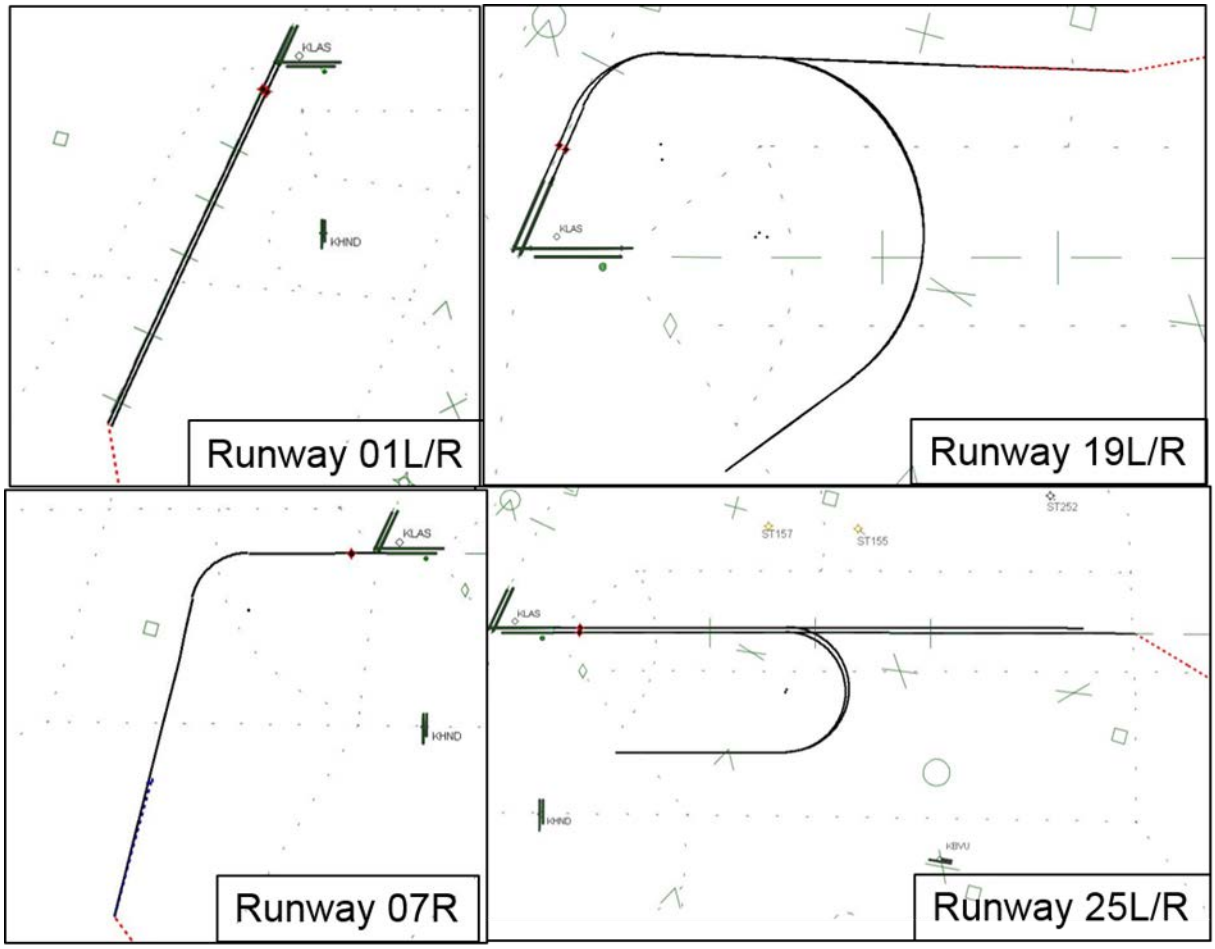


Figure 1: KLAS RNP Approaches-Study Team Recommendations

Proposed Final Design

The D&I Team reviewed the MST proposal to refine and provide optimization to the greatest extent possible. The RNP Runway 19L Approach was designed for connectivity from all Metroplex KLAS RNAV STAR designs. The KLAS RKSTR and CHOWW Standard Terminal Arrival Routes (STARs) share a waypoint (PPENN) with the approach, while the KLAS RNDRZ, COKTL and JAYSN STARs will allow connection via radar vectors.

The KLAS Runway 19L RNP Approach begins at PPENN. Waypoints with restrictions (altitudes/speeds) were added to meet design criteria and to assist in aircraft flyability.

The D&I Team proposed final design is depicted in Figure 2.

KLAS Runway 19L RNP Authorization Required (AR) Approach

- PPENN (at 080/no greater than 210 knots)
- KIVEY (at or above 052/terrain avoidance)
- CSARO (at or above 040/no greater than 180 knots)

- KOOPA (at 035/segregates from tour helicopter routes)
- DLARG
- WILSE

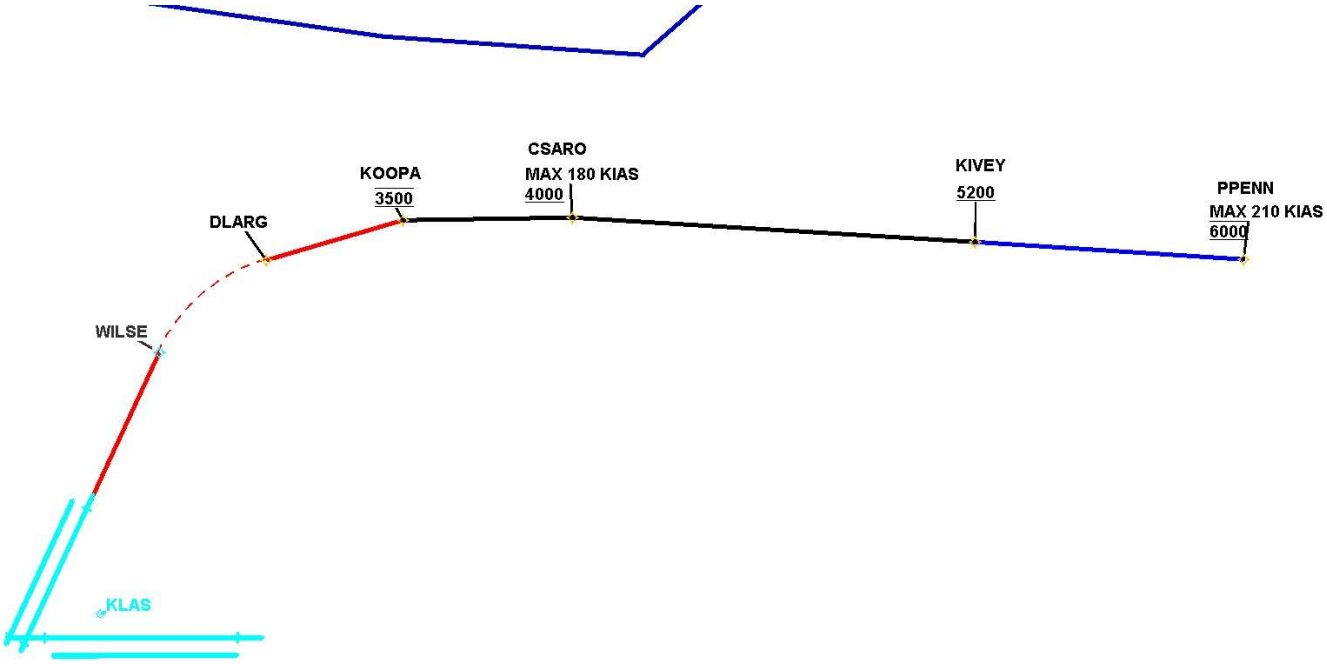


Figure 2: Proposed KLAS RNP Runway 19L Approach

Study Team Recommendation Design Differences

The Study Team proposed a transition from the southeast side of the airport. This was not feasible due to conflicting traffic departing the KLAS Runway 08 complex.

Implementation Dependencies

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results (may be completed during Evaluation Phase
- HITL simulation results (when applicable - may be completed during Evaluation Phase)

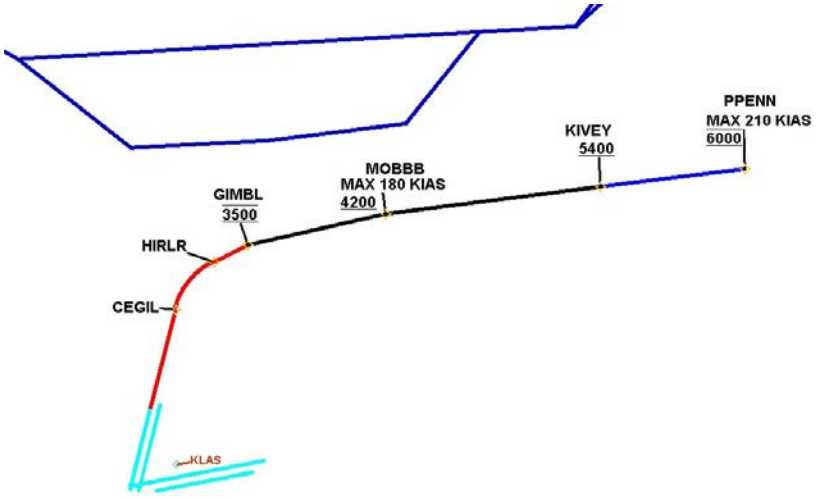
Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

LAS Metroplex RNAV RNP Z LAS RWY 19R Approach Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/ NATCA Co-Lead Initials**
4/23/20	On 2/20/2020 during administrative reconciling, it was determined minor changes to the RNAV RNP Z LAS RWY 19R were accomplished on October 17, 2019 to meet design criteria. These changes were not documented and this change sheets shows those changes. • Glide path changed to 3.5 degrees from 3.24 • WP PPENN location and altitude (6000) remained the same • WP KIVEY location changed from Lat/Long 36 8 18.49/114 59 3.75 to 36 8 15.49 /114 59 3.75 • WP KIVEY changed from AOA 5200 to AOA 5400 and speed restriction of MAX 180kts WP CSARO changed to MOBBB and location moved to 36 8 30.21/115 3 41.65 • WP MOBBB altitude of AOA 4200 • WP GIMBL location changed to 36 8 24.01/115 6 42.48 altitude remained at 3500 • WP HIRLR location changed to 36 8 12.92/115 7 30.11 • WP CEGIL location changed to 36 7 31.20/115 8 30.23 • Missed approach procedure remained same On 4/23/2020, the speed restriction at WP KIVEY of MAX 180kts was moved to WP MOBBB because it was discovered that it was a clerical error. 	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Maybrugh

FAA Metroplex Co-Lead

4/23/2020

Date

NATCA Metroplex Co-Lead

4/23/2020

Date

KLAS RNP RUNWAY 19R Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	PFAF2 waypoint named GMBIL.	Master TARGETS Files	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19R Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1]

The RNP Runway 19R Approach was designed in conjunction with the KLAS RKSTR, CHOWW, RNDRZ, COKTL and JAYSN STARs, allowing access to Runway 19R from multiple directions. The use of satellite navigation will allow joining of the approach via either a curved of straight in path.

This procedure is not anticipated to change runway usage. The KLAS RNP Runway 19R approach will increase flight path predictability and decrease controller/pilot workload and task complexity, which will enhance safety.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19R Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Required Navigation (RNP) Runway 19R Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: Satellites (SAT) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Procedures (RNP) approach procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, using historical track data as a baseline. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course.

Study Team Recommendation

As depicted in Figure 1, KLAS RNP procedures to the final approach course were designed for all configurations (25L/R, 19L/R, 07R and 01L/R)[2]. The Las Vegas Metroplex Study Team (MST) recommends that conceptual RNP Standard Instrument Approach Procedures (SIAPs) at KLAS be reviewed during the Design and Implementation (D&I) phase for optimized downwind alignment and reduction in arc length.

Initial conceptual approaches were designed for all runways. During the Second Outreach L30 requested the Runway 07L RNP approach be deleted.

The MST recommendation is depicted in Figure 1.

[2] In August 2017 Las Vegas runways had a magnetic variance adjustment. Runways 07 L/R and 25 L/R became 08 L/R and 26 L/R.

Las Vegas OAPM Design Package

Las Vegas RNP Runway 19R Approach

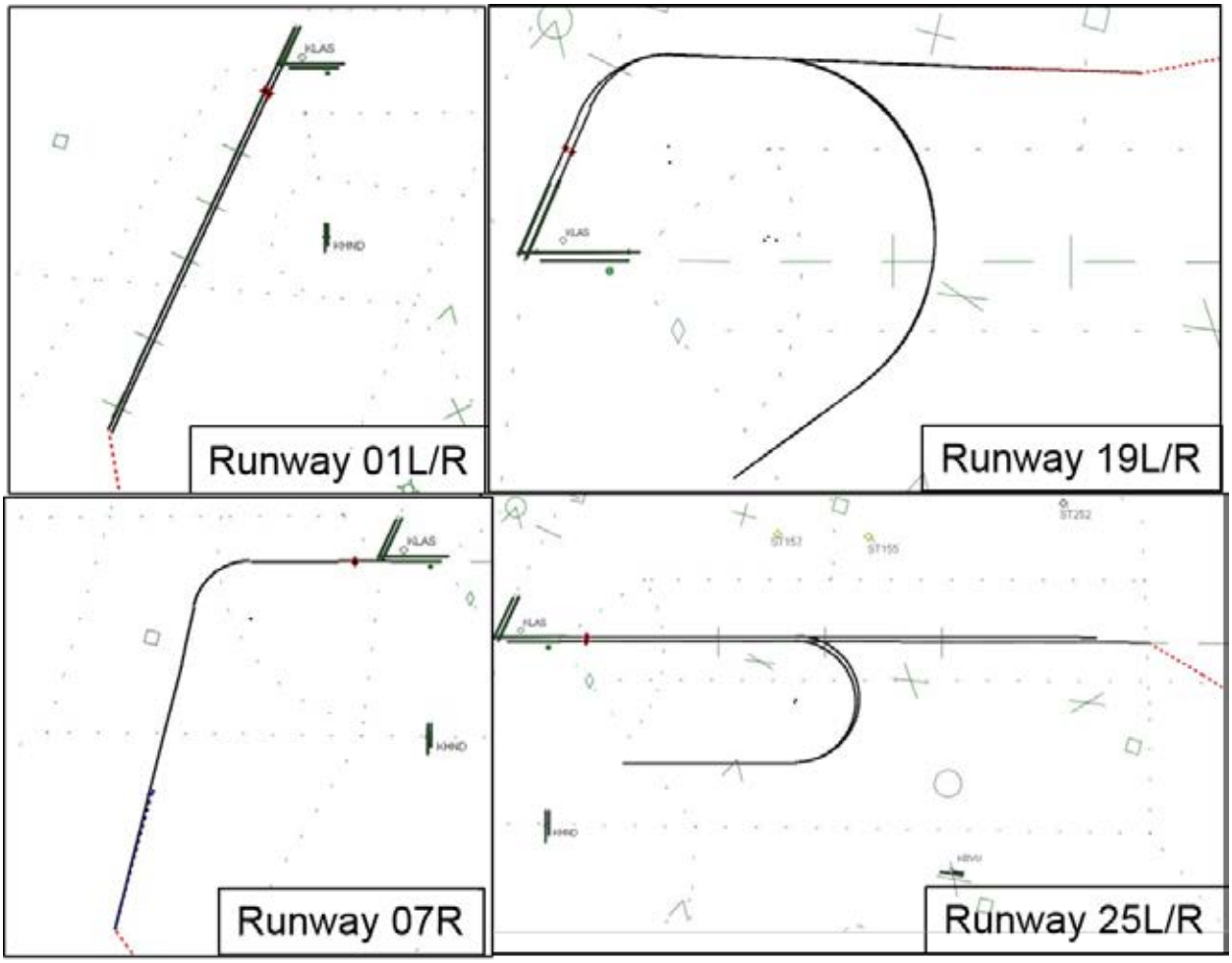


Figure 1: KLAS RNP Approaches-Study Team Recommendations

Proposed Final Design

The D&I Team reviewed the MST proposal to refine and provide optimization to the greatest extent possible. The RNP Runway 19R Approach was designed for connectivity from all Metroplex KLAS RNAV STAR designs. The KLAS RKSTR and CHOWW Standard Terminal Arrival Routes (STARs) share a waypoint (PPENN) with the approach, while the KLAS RNDRZ, COKTL and JAYSN STARs will allow connection via radar vectors.

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The KLAS Runway 19R RNP Approach begins at PPENN. Waypoints with restrictions (altitudes/speeds) were added to meet design criteria and to assist in aircraft flyability.

The D&I Team proposed final design is depicted in Figure 2

KLAS Runway 19R RNP Authorization Required (AR) Approach

- PPENN (at 060/no greater than 210 knots)
- KIVEY (at or above 052/no greater than 180 knots)

- MOBBB (at or above 040)
- GMBIL (at 035/segregate from tour helicopter routes)
- HIRLR
- CEGIL

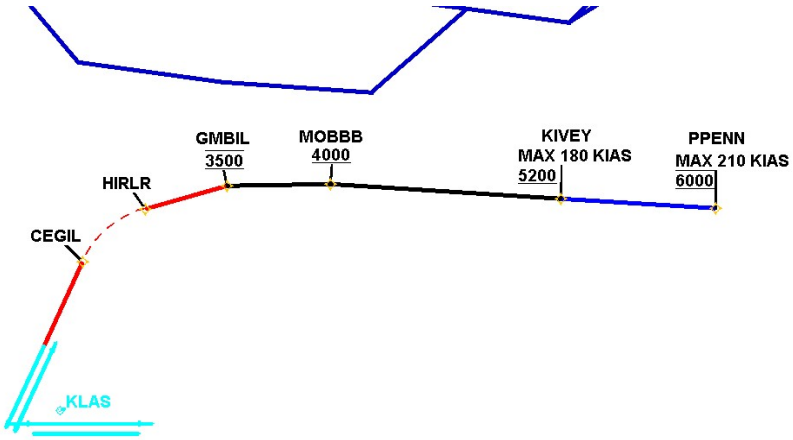


Figure 2: KLAS Runway 19R RNP AR Approach Proposed Final Design

Study Team Recommendation Design Differences

The Study Team proposed a transition from the southeast side of the airport. This was not feasible due to conflicting traffic departing the KLAS Runway 08 complex.

Implementation Dependencies

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26L Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The RNP Runway 26L Approach was designed in conjunction with the KLAS RKSTR, CHOWW, RNDRZ, COKTL and JAYSN STARs, allowing access to Runway 26L from multiple directions. The use of satellite navigation will allow joining of the approach via either a curved of straight in path.

This procedure is not anticipated to change runway usage. The KLAS RNP Runway 26L approach will increase flight path predictability and decrease controller/pilot workload and task complexity, which will enhance safety.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26L Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Required Navigation (RNP) Runway 26L Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: FINAL (FNL) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Procedures (RNP) approach procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, using historical track data as a baseline. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course.

Study Team Recommendation

As depicted in Figure 1, KLAS RNP procedures to the final approach course were designed for all configurations (25L/R, 19L/R, 07R and 01L/R)[2]. The Las Vegas Metroplex Study Team (MST) recommends that conceptual RNP Standard Instrument Approach Procedures (SIAPs) at KLAS be reviewed during the Design and Implementation (D&I) phase for optimized downwind alignment and reduction in arc length.

Initial conceptual approaches were designed for all runways. During the Study Team Second Outreach L30 requested the Runway 07L RNP approach be deleted.

The MST recommendation is depicted in Figure 1.

[2] In August 2017 Las Vegas runways had a magnetic variance adjustment. Runways 07 L/R and 25 L/R became 08 L/R and 26 L/R.

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26L Approach

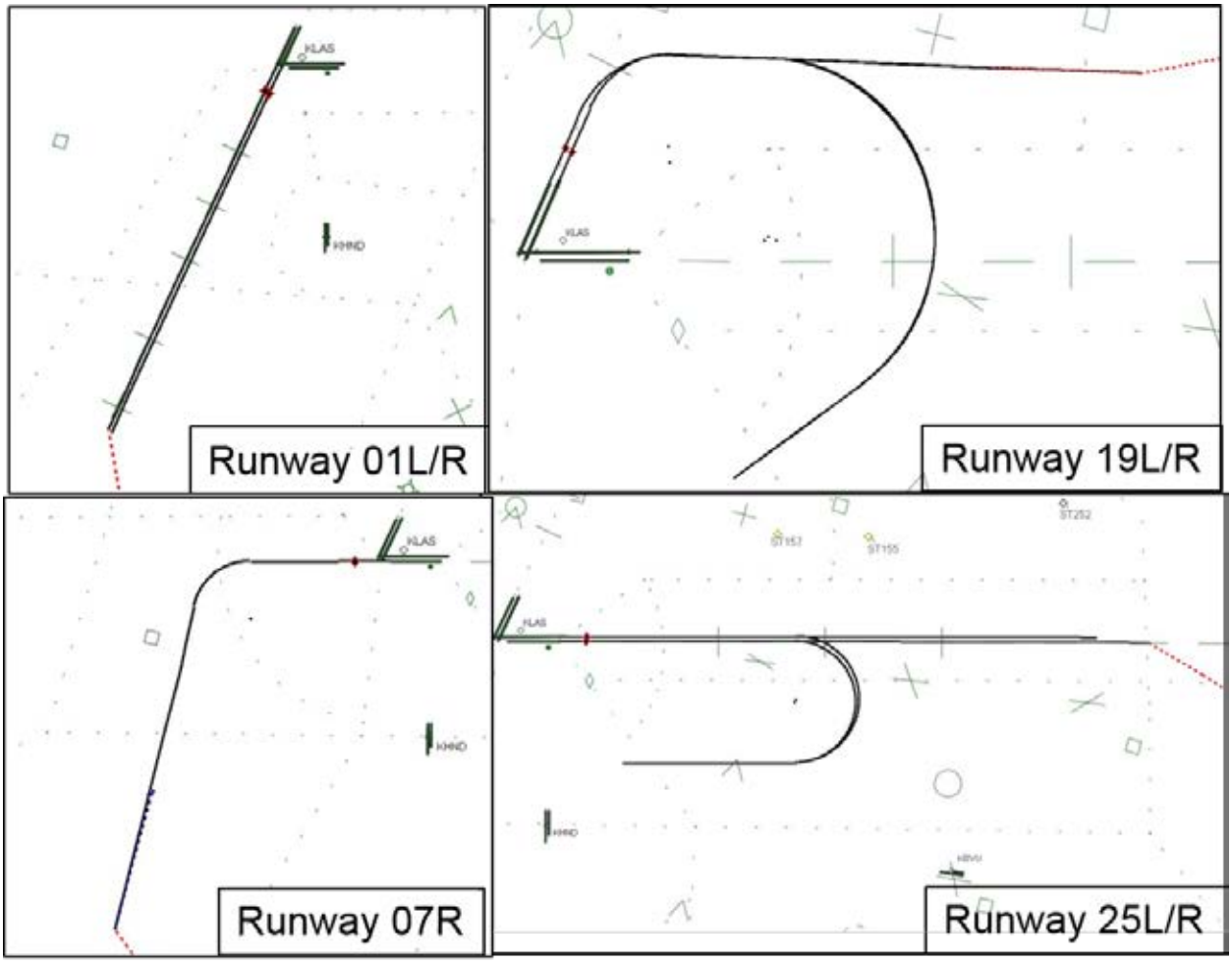


Figure 1: LAS RNP Approaches-Study Team Recommendations

Proposed Final Design

The Las Vegas Design and Implementation (D&I) Team reviewed the MST proposal to refine and provide optimization to the greatest extent possible. The Runway 26L RNP Approach was designed for connectivity from all Metroplex KLAS RNAV STAR designs. The KLAS RKSTR and CHOWW Standard Terminal Arrival Routes (STARs) share a waypoint (PRINO) with the straight in approach segment. The KLAS RNDRZ, COKTL and JAYSN STARs share a waypoint (BERBN) with the downwind approach segment.

The KLAS Runway 26L RNP Approach straight in segment begins at PRINO. The KLAS Runway 26L RNP Approach downwind segment begins at BERBN. Waypoints with restrictions (altitudes/speeds) were added for design criteria and to assist in aircraft flyability.

The D&I Team proposed final design is depicted in Figure 2.

KLAS Runway 26L RNP Authorization Required (AR) Approach

Straight In Segment:

- PRINO (at 080)

- LARRE (at or above 065 for Class B)
- SHAND (at or above 048)
- RELIN (at 038)

Downwind Segment:

- BERBN (at 080/no greater than 210 knots)
- BISHP (at or above 070)
- SHAND (at or above 048)
- RELIN (at 038)

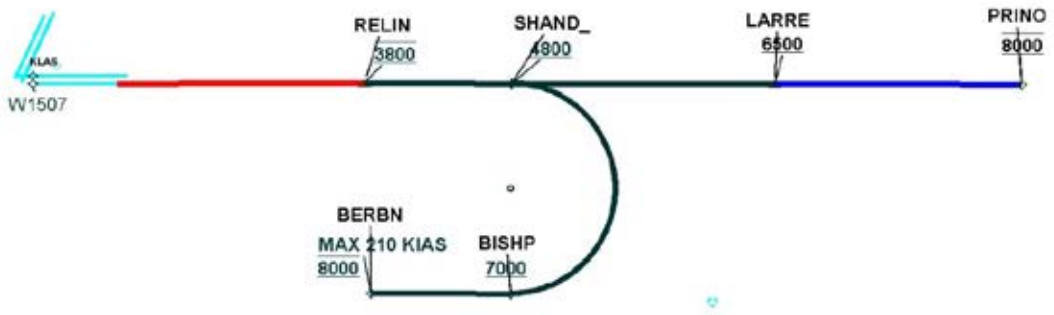


Figure 2: Proposed KLAS RNP Runway 26L Approach

Study Team Recommendation Design Differences

The proposed LAS RNP Runway 26L Approach is in line with the Study Team recommendation.

Implementation Dependencies

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26R Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1]

The RNP Runway 19L Approach was designed in conjunction with the KLAS RKSTR, CHOWW, RNDRZ, COKTL and JAYSN STARs, allowing access to Runway 19L from multiple directions. The use of satellite navigation will allow joining of the approach via either a curved of straight in path.

This procedure is not anticipated to change runway usage. The KLAS RNP Runway 19L approach will increase flight path predictability and decrease controller/pilot workload and task complexity, which will enhance safety.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26R Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Required Navigation (RNP) Runway 26R Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: FINAL (FNL) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Procedure (RNP) approaches for KLAS. Industry and L30 requested RNP approaches for all configurations which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course.

Study Team Recommendation

As depicted in Figure 1, KLAS RNP procedures to the final approach course were designed for all configurations (25L/R, 19L/R, 07R and 01L/R)[2]. The Las Vegas Metroplex Study Team (MST) recommends that conceptual RNP Standard Instrument Approach Procedures (SIAPs) at KLAS be reviewed during the Design and Implementation (D&I) phase for optimized downwind alignment and reduction in arc length.

Initial conceptual approaches were designed for all runways. During the Study Team Second Outreach L30 requested the Runway 07L RNP approach be deleted.

The MST recommendation is depicted in Figure 1:

[2] In August 2017 Las Vegas runways had a magnetic variance adjustment. Runways 07 L/R and 25 L/R became 08 L/R and 26 L/R.

Las Vegas OAPM Design Package

Las Vegas RNP Runway 26R Approach

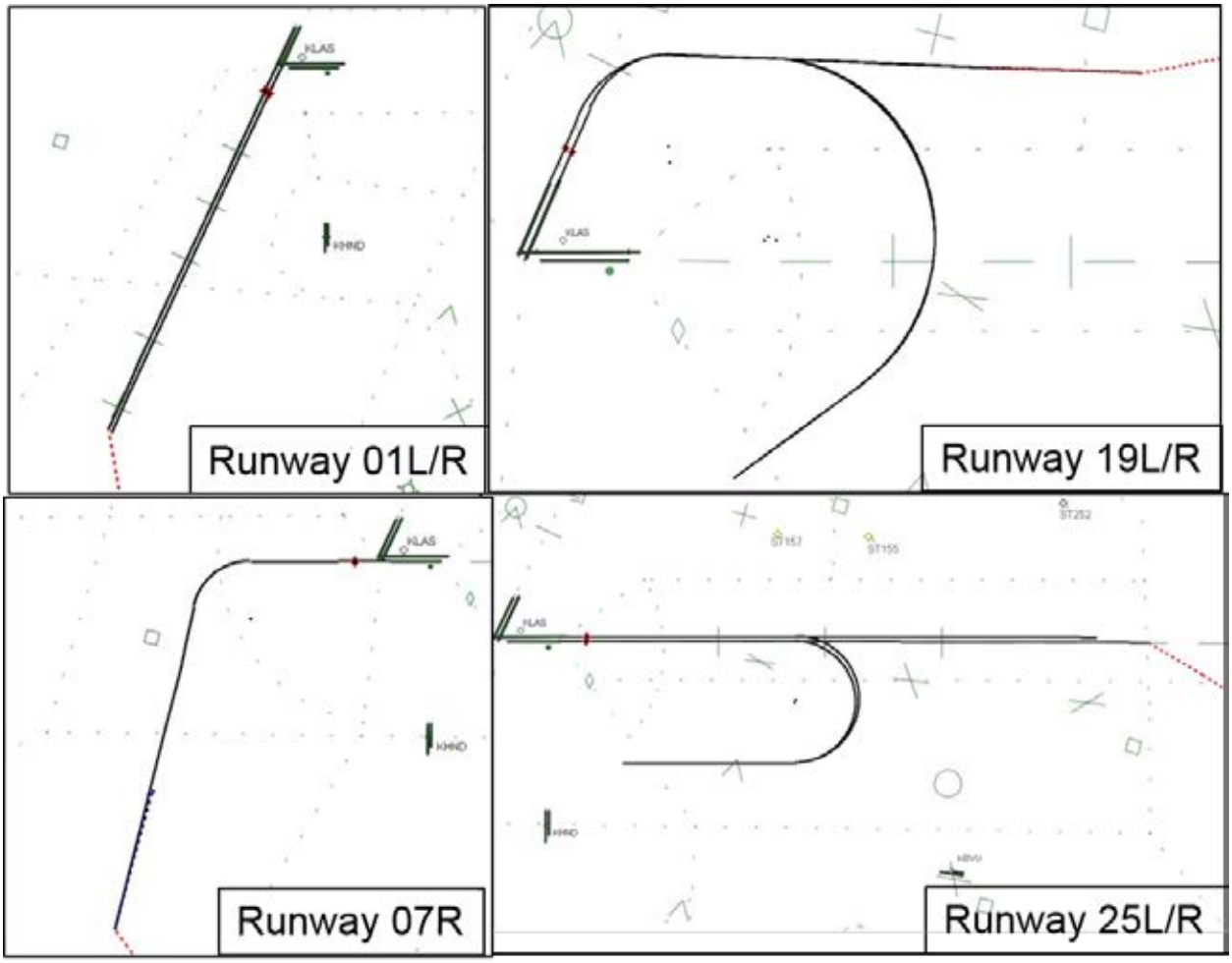


Figure 1: KLAS RNP Approaches-Study Team Recommendations

Proposed Final Design

The D&I Team reviewed the MST proposal to refine and provide optimization to the greatest extent possible. The Runway 26L RNP Approach was designed for connectivity from all Metroplex KLAS RNAV STAR designs. The KLAS RKSTR and CHOWW Standard Terminal Arrival Routes (STARs) share a waypoint (FLIKR) with the straight in approach segment. The KLAS RNDRZ, COKTL and JAYSN STARs share a waypoint (BERBN) with the downwind approach segment.

The KLAS Runway 26L RNP Approach straight in segment begins at PRINO. The KLAS Runway 26L RNP Approach downwind segment begins at BERBN. Waypoints with restrictions (altitudes/speeds) were added to meet design criteria and to assist in aircraft flyability.

The D&I Team proposed final design is depicted in Figure 2.

KLAS Runway 26R RNP Authorization Required (AR) Approach

Straight In Segment:

- FLYES (at 080/no greater than 210 knots)

- FLICR (at or above 065 for Class B)
- W2353 (at or above 053)
- BJORG (at or above 047)
- CONDY (at 038)

Downwind Segment:

- BERBN (at 080/no greater than 210 knots)
- LUISA (at or above 070)
- BJORG (at or above 047)
- CONDY (at 038)

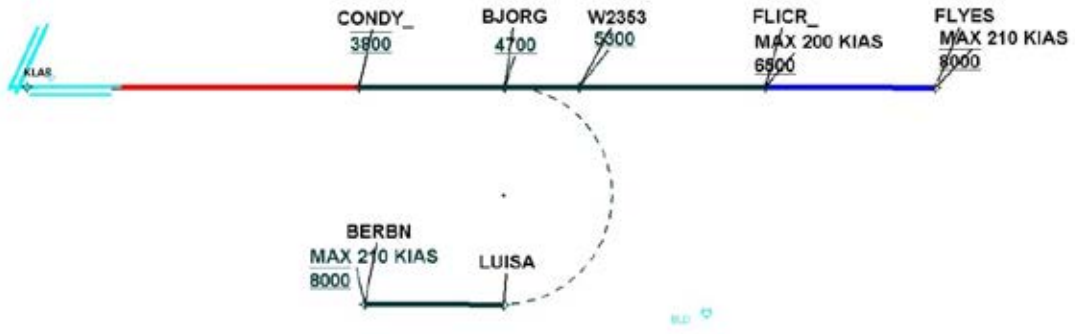


Figure 2: Proposed KLAS RNP Runway 26R Approach

Study Team Recommendation Design Differences

The proposed LAS RNP Runway 26R Approach is in line with the Study Team recommendation.

Implementation Dependencies

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Chris Iwanski	Date
LAS NATCA POC	

Las Vegas OAPM Design Package

KLAS Runway 01R RNAV (GPS) Y Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight-in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation Team (D&I Team) elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground-based radio navigation) ILS approaches.

This procedure is not anticipated to change runway usage.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*

https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

KLAS Runway 01R GPS Approach

Las Vegas OAPM Design Package

KLAS Runway 01R RNAV (GPS) Y Approach

Name of Change and Airport(s)	Change Classification
Las Vegas McCarran (KLAS) Runway 01R Global Position System (GPS) Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
3/12/2020	**7/16/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON) Sectors: SAT, FNL	**KLAS RNDRZ, CHOWW, COKTL, RKSTR, and JAYSN Standard Terminal Arrival Routes (STARs)**
Associated Data Files	

Purpose

The D&I Team elected to amend the Runway 01R GPS Approach to add an additional entry point at BUHLL for the RNDRZ and CHOWW RNAV STARs.

Figure 1 depicts the current KLAS Runway 01R GPS Approach.

Study Team Recommendation

There was no Las Vegas Metroplex Study Team (MST) recommendation for GPS approaches.

Las Vegas OAPM Design Package

KLAS Runway 01R RNAV (GPS) Y Approach

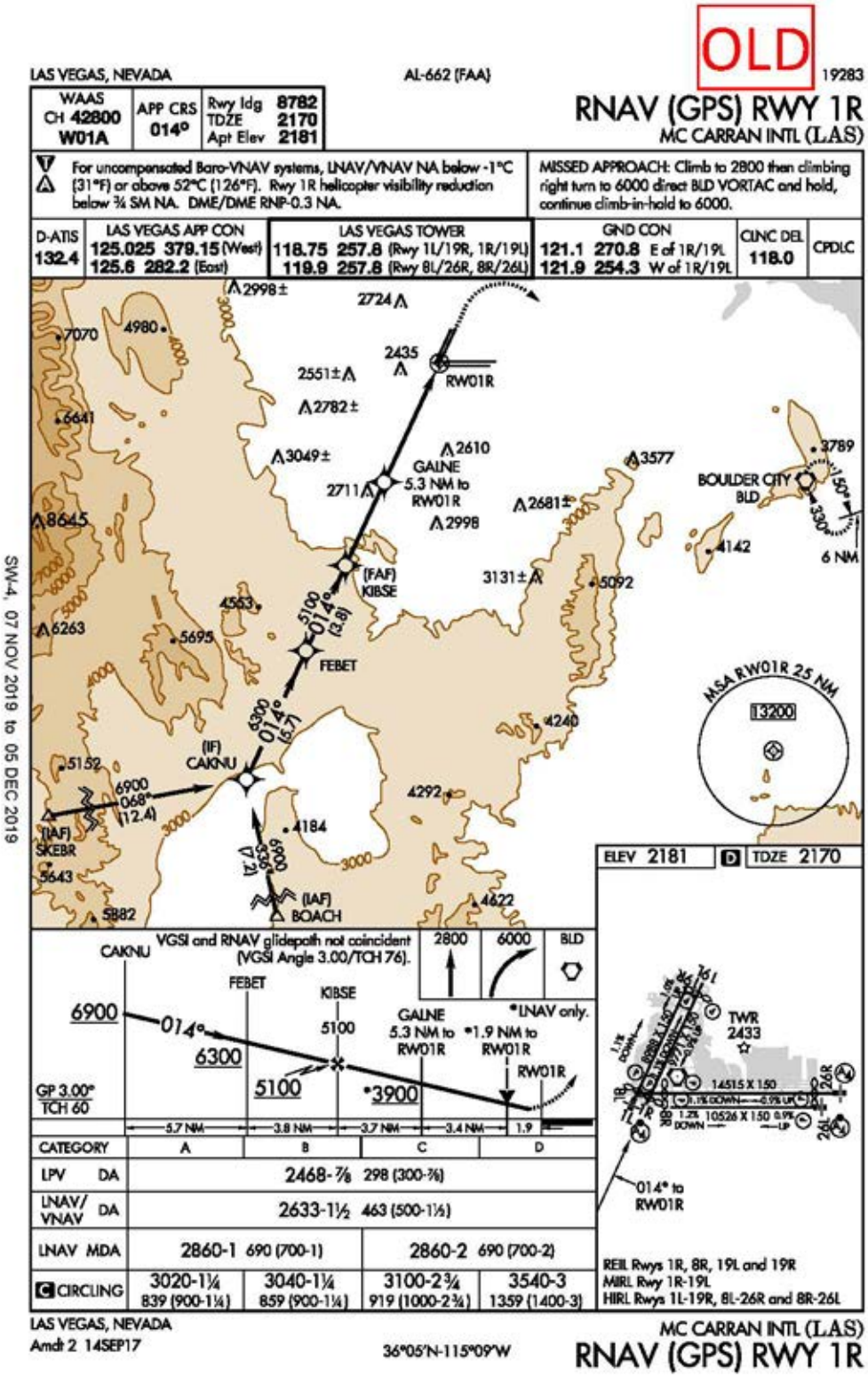


Figure 1: Current KLAS Runway 01R GPS Approach

Las Vegas OAPM Design Package

KLAS Runway 01R RNAV (GPS) Y Approach

Proposed Final Design

Waypoint and altitude restriction changes were made to the KLAS Runway 01R RNAV (GPS) Y Approach to allow an additional entry point at BUHLL in order to accommodate arrivals on the KLAS RNAV RNDRZ and CHOWW RNAV STARs.

Figure 2 depicts the KLAS Runway 01R GPS Approach.

KLAS Runway 01R GPS Approach

- CAKNU (at or above 7,000 feet) or BUHLL (at 7,000 feet/no greater than 210 knots) as entry points
- FEBET (at or above 6,000 feet)
- KIBSE (at 5,100 feet – PFAF Fix)
- GALNE (at or above 3,900 feet - positioned as a step down fix)
- MOLME (at or above 3,500 feet)

KLAS Runway 01R GPS Approach

Las Vegas OAPM Design Package

KLAS Runway 01R RNAV (GPS) Y Approach

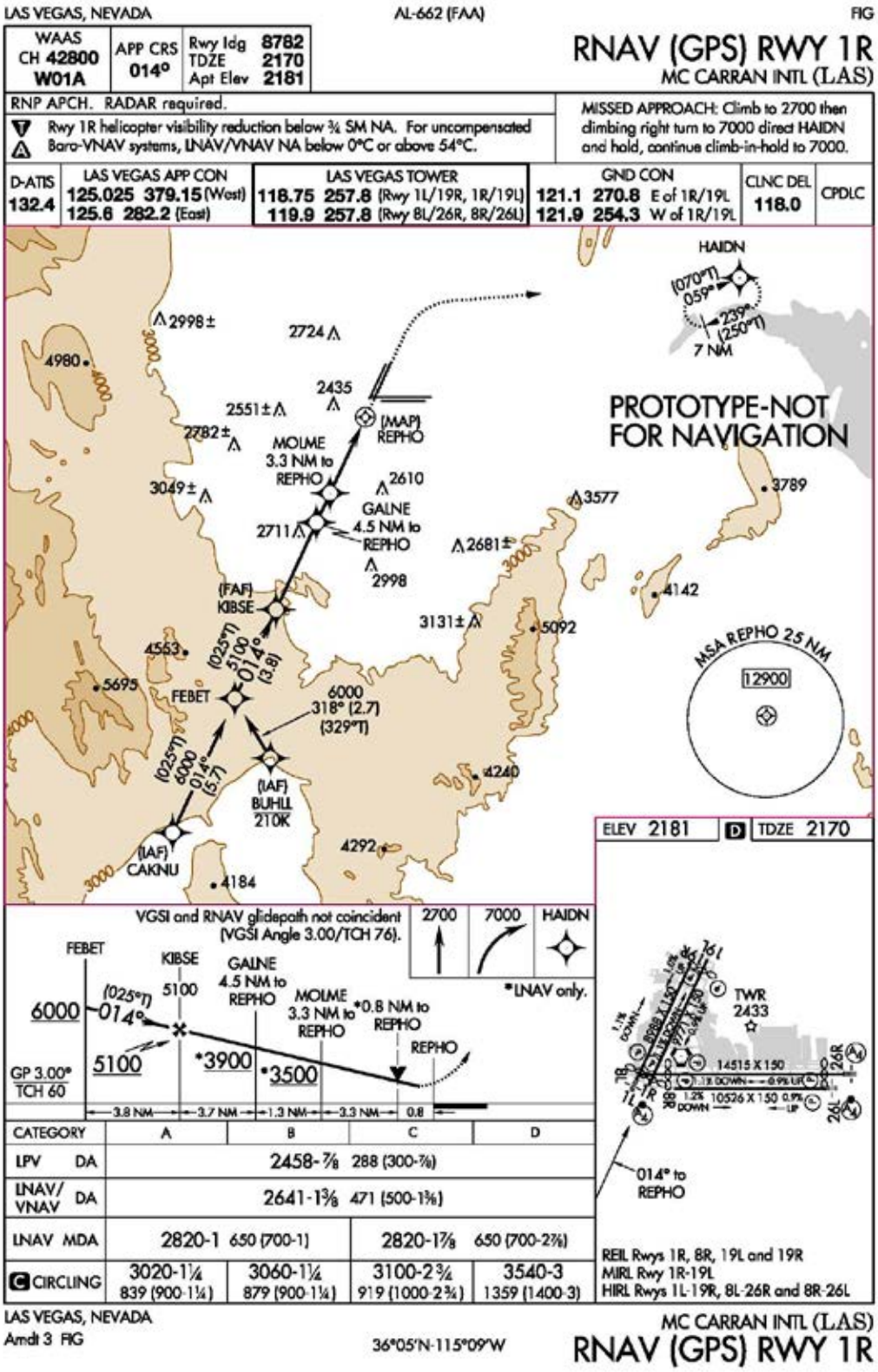


Figure 2: Proposed KLAS Runway 01R GPS Approach

KLAS Runway 01R GPS Approach

Las Vegas OAPM Design Package

Review Signatures

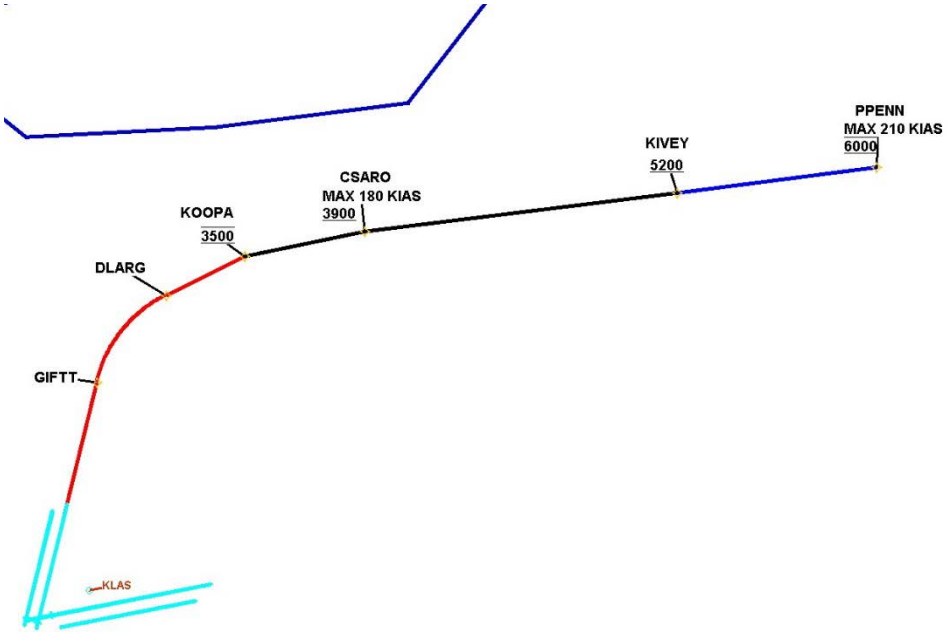
The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 2/11/20
Bradley R. Mayhugh — Date
FAA Metroplex Co-Lead

2/11/2020
Chris Thomas — Date
NATCA Metroplex Co-Lead

2/12/2020
William Wadley — Date
L30 Facility Lead

2/11/2020
Dan Hauptman — Date
L30 NATCA Lead

LAS Metroplex RNAV RNP Z LAS RWY 19L Approach Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
4/23/20	During administrative reconciling, it was determined that undocumented minor changes to the RNAV RNP Z LAS RWY 19L were accomplished to meet design criteria. This change sheet corrects information contained in the original Design Package. On 6/13/19, the following changes were made: • CSARO moved .18 nm W/NW and restriction changed from AOA 4000 to AOA 3900. • KOOPA moved .13 nm W/NW • DLARG moved .16 nm N/NE • WILSE moved .1 nm N and renamed GIFTT These changes were included in the Environmental Assessment modeling  	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Maybrugh

FAA Metroplex Co-Lead

4/23/2020

Date

NATCA Metroplex Co-Lead

4/23/2020

Date

Las Vegas OAPM Design Package

Las Vegas GPS Runway 19L Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight-in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Performance (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan.

The Las Vegas Metroplex Design and Implementation Team (D&I Team) elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground-based radio navigation) ILS approaches. The KLAS Runway 19L GPS Approach is changing to provide vertical navigation guidance.

This procedure is not anticipated to change runway usage.

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Global Positioning System (GPS) Runway 19L Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**

Las Vegas GPS Runway 19L Approach

Las Vegas OAPM Design Package

Las Vegas GPS Runway 19L Approach

March 12, 2019	7/16/2020
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: Satellites (SAT) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation (RNP) procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius-to-Fix (RF) turns to the final approach course. The Las Vegas Metroplex Design and Implementation Team (D&I Team) developed RNP Authorization Required (AR) approaches to KLAS Runways 08R, 19L/R and 26L/R. For a number of reasons, RNP approaches to Runways 01L/R and 08L were not feasible.

The D&I Team elected to provide continuity between PBN and conventional procedures by amending the existing GPS approach. When the decision to add vertical navigation guidance to the KLAS RNAV (GPS) Y Runway 19R approach was made, the FAA determined it would be beneficial to also add it to the KLAS RNAV (GPS) Y Runway 19L approach.

The KLAS Runway 19L GPS Approach was changed to provide vertical navigational guidance.

Study Team Recommendation

There was no Las Vegas Metroplex Study Team (MST) recommendation for GPS approaches.

Las Vegas OAPM Design Package

Las Vegas GPS Runway 19L Approach

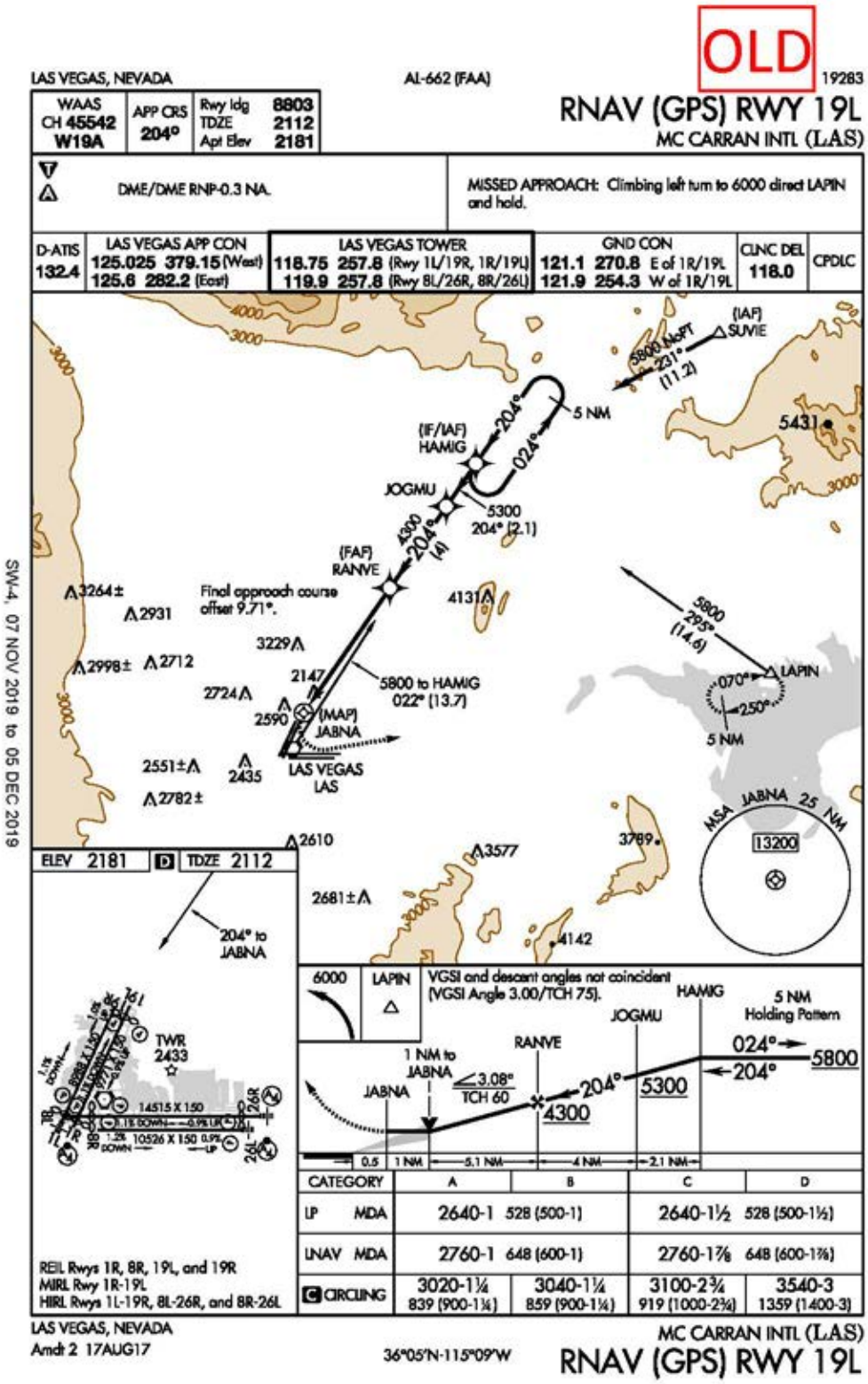


Figure 1 Current KLAS RNAV GPS RWY 19L

Las Vegas GPS Runway 19L Approach

Proposed Final Design

The lateral path was changed on the KLAS 19L GPS Approach to add vertical guidance and for criteria.

The D&I Team proposed final design is depicted in Figure 2 below.

KLAS Runway 19L GPS Approach

- SUVIE (at or above 7,500 feet) or LAPIN (at or above 6,000 feet) as entry points
- STORA (at 6,000 feet)
- MOZOS (at or above 5,300 feet)
- DIRDE (at 4,300 feet)

Las Vegas OAPM Design Package

Las Vegas GPS Runway 19L Approach

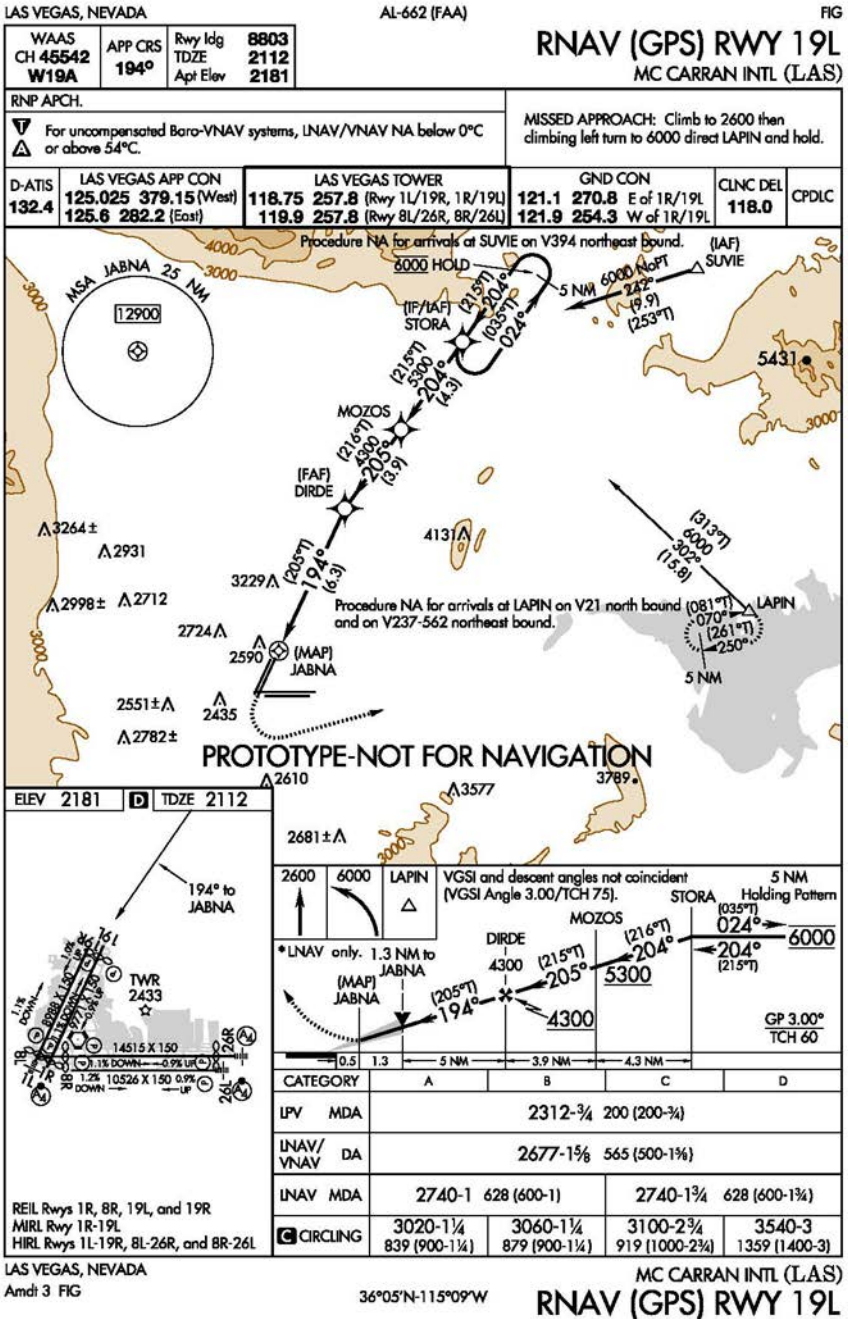


Figure 1 Proposed KLAS RWY 19L

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

Las Vegas GPS Runway 19L Approach

Las Vegas OAPM Design Package

Review Signatures

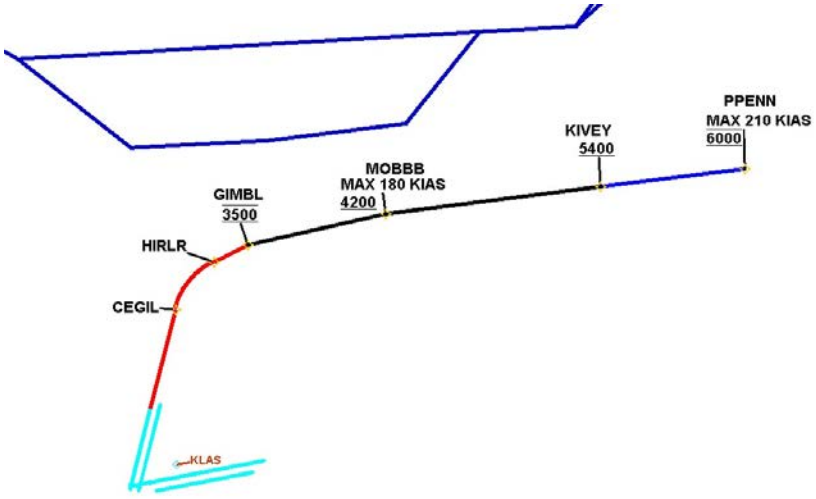
The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

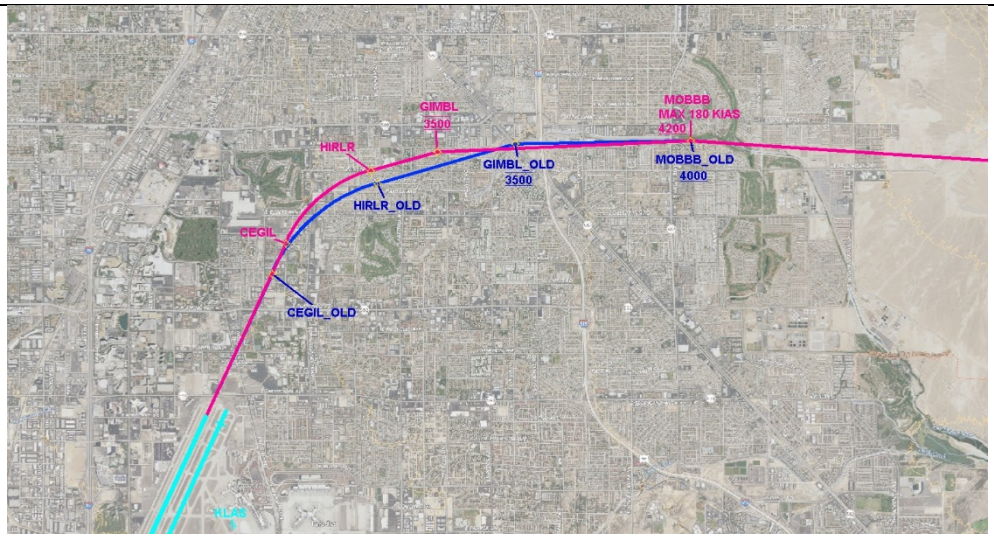
Bradley R. Mayhugh 2/11/20
Bradley R. Mayhugh — Date
FAA Metroplex Co-Lead

2/11/2020
Chris Thomas — Date
NATCA Metroplex Co-Lead

2/12/2020
William Wadley — Date
L30 Facility Lead

2/11/2020
Dan Hauptman — Date
L30 NATCA Lead

LAS Metroplex RNAV RNP Z LAS RWY 19R Approach Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/ NATCA Co-Lead Initials**
4/23/20	On 2/20/2020 during administrative reconciling, it was determined minor changes to the RNAV RNP Z LAS RWY 19R were accomplished on October 17, 2019 to meet design criteria. These changes were not documented and this change sheets shows those changes. • Glide path changed to 3.5 degrees from 3.24 • WP PPENN location and altitude (6000) remained the same • WP KIVEY location changed from Lat/Long 36 8 18.49/114 59 3.75 to 36 8 15.49 /114 59 3.75 • WP KIVEY changed from AOA 5200 to AOA 5400 and speed restriction of MAX 180kts WP CSARO changed to MOBBB and location moved to 36 8 30.21/115 3 41.65 • WP MOBBB altitude of AOA 4200 • WP GIMBL location changed to 36 8 24.01/115 6 42.48 altitude remained at 3500 • WP HIRLR location changed to 36 8 12.92/115 7 30.11 • WP CEGIL location changed to 36 7 31.20/115 8 30.23 • Missed approach procedure remained same On 4/23/2020, the speed restriction at WP KIVEY of MAX 180kts was moved to WP MOBBB because it was discovered that it was a clerical error.  The following picture depicts the approach path modeled in the draft EA in blue and the approach path modeled in the final EA in red.	Master TARGETS File	


GIMBL
3500
MOBBB
MAX 180 KIAS
4200
HIRLR
GIMBL_OLD
3500
MOBBB_OLD
4000
HIRLR_OLD
CEGIL
CEGIL_OLD
KLAS

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Maybrugh

FAA Metroplex Co-Lead

4/23/2020

Date

NATCA Metroplex Co-Lead

4/23/2020

Date

Las Vegas OAPM Design Package

Las Vegas RNAV GPS Runway 19R Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight-in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Performance (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation Team (D&I Team) elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground-based radio navigation) ILS approaches. Additionally, the KLAS Runway 19R GPS Approach is changing to provide the same glide path angle as the KLAS RNAV (RNP) Runway 19R approach.

This procedure is not anticipated to change runway usage.

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*

https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas RNAV GPS Runway 19R Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Global Positioning System (GPS) Runway 19R Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
3/12/2020	**7/16/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30) Sectors: Satellites (SAT) **KLAS**	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation Performance (RNP) procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius-to-Fix (RF) turns to the final approach course. The Las Vegas Metroplex Design and Implementation Team (D&I Team) developed RNP Authorization Required (AR) approaches to KLAS Runways 08R, 19L/R and 26L/R. For a number of reasons, RNP approaches to Runways 01L/R and 08L were not feasible.

The D&I Team elected to provide continuity between PBN and conventional procedures by amending the existing GPS approach. The KLAS Runway 19R GPS Approach was changed to provide the same glide path angle as the KLAS RNAV (RNP) Runway 19R approach and to provide vertical guidance navigation.

Study Team Recommendation

There was no Las Vegas Metroplex Study Team (MST) recommendation for GPS approaches.

Las Vegas OAPM Design Package

Las Vegas RNAV GPS Runway 19R Approach

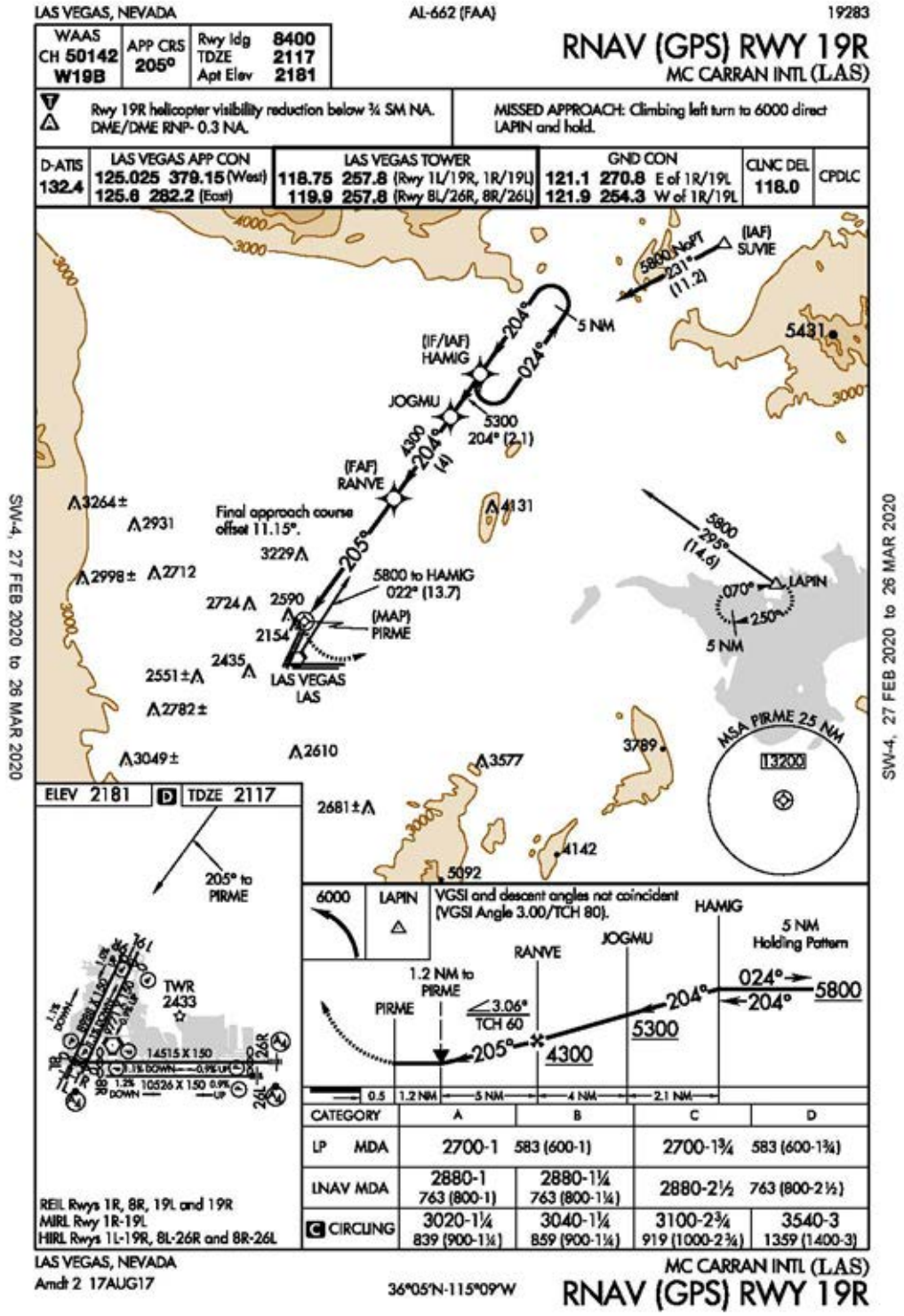


Figure 1 Current KLAS GPS RWY 19R

Las Vegas RNAV GPS Runway 19R Approach

Las Vegas OAPM Design Package

Las Vegas RNAV GPS Runway 19R Approach

Proposed Final Design

The lateral path was changed on the KLAS 19R GPS Approach match the glide slope angle of the KLAS RNAV (RNP) Z Runway 19R approach and to add vertical guidance. The glide slope of this approach is 3.5 degrees, the same as the KLAS RNAV (RNP) Runway 19R approach.

The D&I Team proposed final design is depicted in Figure 2 below.

KLAS Runway 19R GPS Approach

- LAPIN (at or above 6,000 feet) or SUVIE (at or above 7,500 feet) (initial approach fixes)
- STORA (at or above 6,000 feet) (intermediate fix)
- MOZOS (at or above 5,300 feet)
- WAKSI (at 4,300 feet)

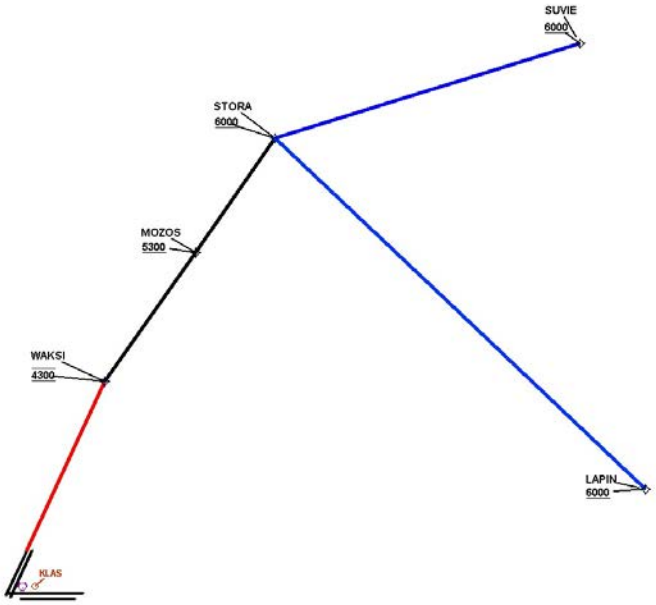


Figure 2: KLAS Runway 19R GPS Approach Proposed Final Design

Attachments

- TARGETS Distribution Package
- Flight Simulator Worksheet
- RNAV Pro analysis results
- HITL simulation results

Las Vegas OAPM Design Package

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh 2/11/20
Bradley R. Mayhugh — Date
FAA Metroplex Co-Lead

2/11/2020
Chris Thomas — Date
NATCA Metroplex Co-Lead

2/12/2020
William Wadley — Date
L30 Facility Lead

2/11/2020
Dan Hauptman — Date
L30 NATCA Lead

Las Vegas OAPM Design Package

Las Vegas Runway 01L ILS Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground based radio navigation) ILS approaches.

This procedure is not anticipated to change runway usage.

---

[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas Runway 01L ILS Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Runway 01L ILS Approach	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
L30 Sectors: FNL, SAT	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **RNAV Pro analysis results**	

Purpose

There are currently no Required Navigation (RNP) procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course. The Las Vegas Metroplex Design and Implementation (D&I) Team developed RNP Authorization Required (AR) approaches to KLAS runways 08R, 19 L/R and 26 L/R. For a number of reasons, RNP approaches to Runways 01 L/R and 08 L were not feasible.

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing (ground based radio navigation) ILS approaches.

Figure 1 depicts the current KLAS Runway 01L ILS Approach.

Study Team Recommendation

There was no Metroplex Study Team (MST) recommendation for ILS approaches.

Las Vegas OAPM Design Package

Las Vegas Runway 01L ILS Approach

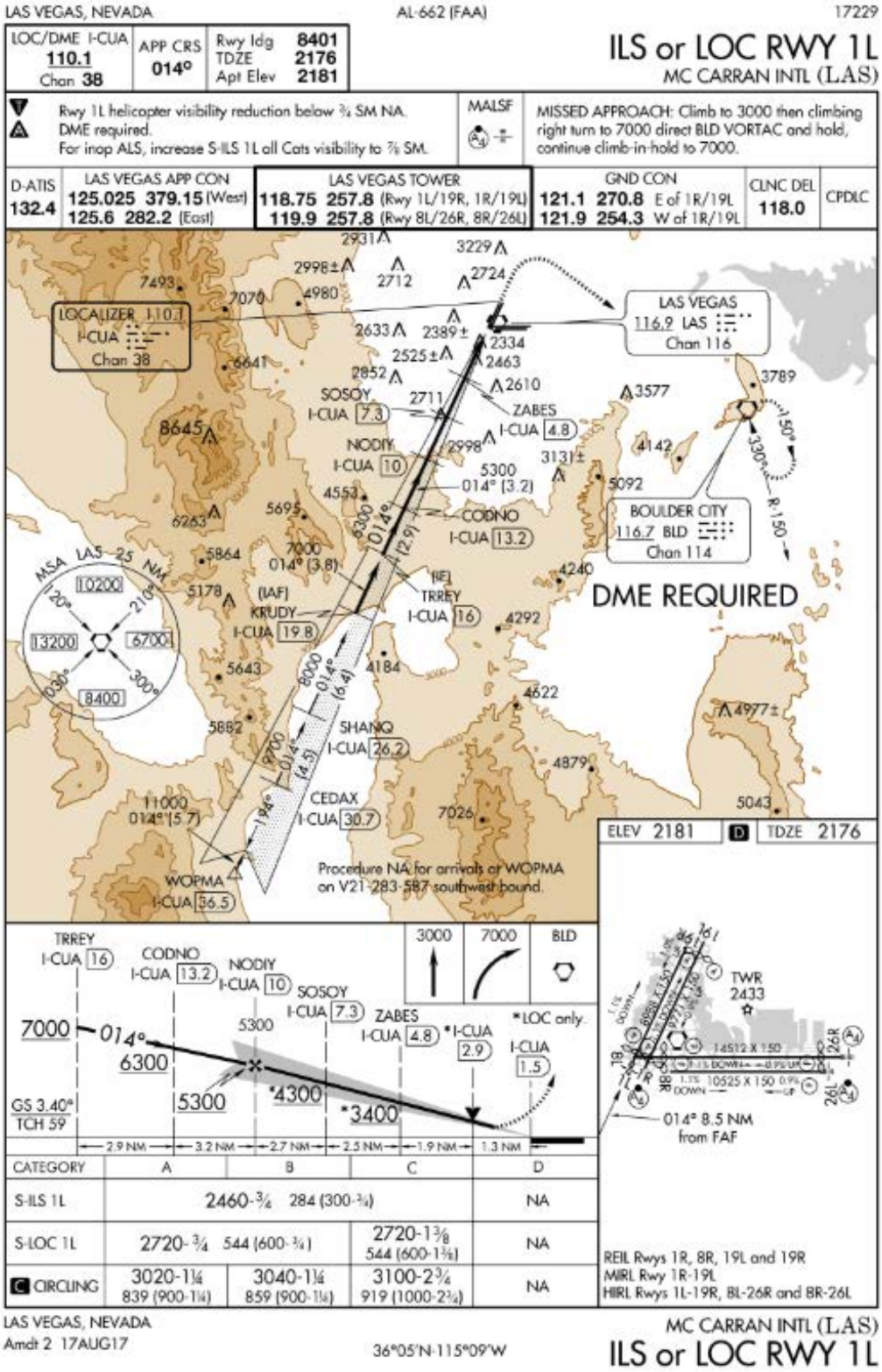


Figure 1: Current KLAS Runway 01L ILS Approach

Las Vegas OAPM Design Package

Las Vegas Runway 01L ILS Approach

Proposed Final Design

Waypoint changes were made to the KLAS 01L ILS Approach. Two transitions allow greater flexibility.

Figure 2 depicts the KLAS Runway 01L ILS Approach Proposed Final Design.

KLAS Runway 01L ILS Approach from WOPMA

- WOPMA (at or above 110)
- CEDAX (at or above 110)
- SHANQ (at or above 097)
- KRUDY (at or above 080)
- TRREY (at or above 070 for terrain/Class B containment)
- CODNO (at or above 063 for terrain/Class B containment)
- PFAF3 (at or above 053 for terrain/Class B containment)
- SOSOY (at or above 043 for Class B containment)
- ZABES (at or above 034 for criteria)

KLAS Runway 01L ILS Approach from ROAMN

- ROAMN (at 080 for terrain/Class B containment and no greater than 210 knots for criteria)
- TRREY (at or above 070 for terrain/Class B containment)
- CODNO (at or above 063 for terrain/Class B containment)
- PFAF3 (at or above 053 for terrain/Class B containment)
- SOSOY (at or above 043 for Class B containment)
- ZABES (at or above 034 for criteria)

Las Vegas OAPM Design Package

Las Vegas Runway 01L ILS Approach

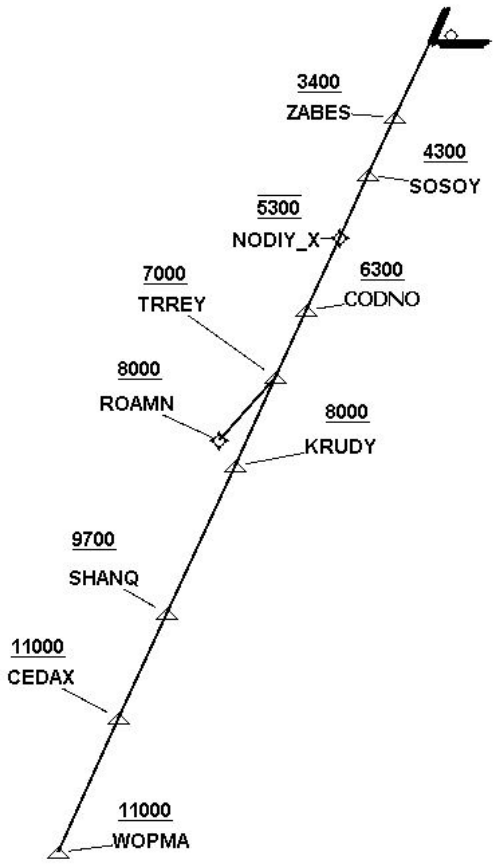


Figure 2: KLAS Runway 01L ILS Approach Proposed Final Design

Attachments

- TARGETS Distribution Package
- RNAV Pro analysis results (may be completed during Evaluation Phase

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

KLAS RUNWAY 26L ILS/LOCALIZER Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	Waypoint68 renamed HOGOG and speed restriction changed to at 200 knots. Removed crossing radials on ILS or LOC RWY 26R to avoid chart clutter. Altitude at SHAND changed from at or above 4,800 feet to at 4,800 feet. Restriction at BERBN changed from at or above 8,000 feet to at 8,000 feet and the speed restriction remains the same, no greater than 210 knots. This was done to comply with industry's request.	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

Las Vegas Runway 26L ILS Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground based radio navigation) ILS approaches. The KLAS Runway 26L ILS Approach was changed to provide a similar path to RNP approaches.

This procedure is not anticipated to change runway usage.

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[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas Runway 26L ILS Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Runway 26L ILS Approach/RNAV Entry to Runway 26L ILS	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
L30 Sectors: FNL	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **Flight Simulator Worksheet** **RNAV Pro analysis results** **HITL simulation results**	

Purpose

There are currently no Required Navigation (RNP) procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course. The Las Vegas Metroplex Design and Implementation (D&I) Team developed RNP Authorization Required (AR) approaches to KLAS runways 08R, 19 L/R and 26 L/R. For a number of reasons, RNP approaches to Runways 01 L/R and 08 L were not feasible.

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing (ground based radio navigation) ILS approaches. The KLAS Runway 26L ILS Approach was changed to provide a similar path to RNP approaches.

Figure 1 depicts the current KLAS Runway 26L ILS Approach.

Study Team Recommendation

There was no Metroplex Study Team (MST) recommendation for ILS approaches.

Las Vegas OAPM Design Package

Las Vegas Runway 26L ILS Approach

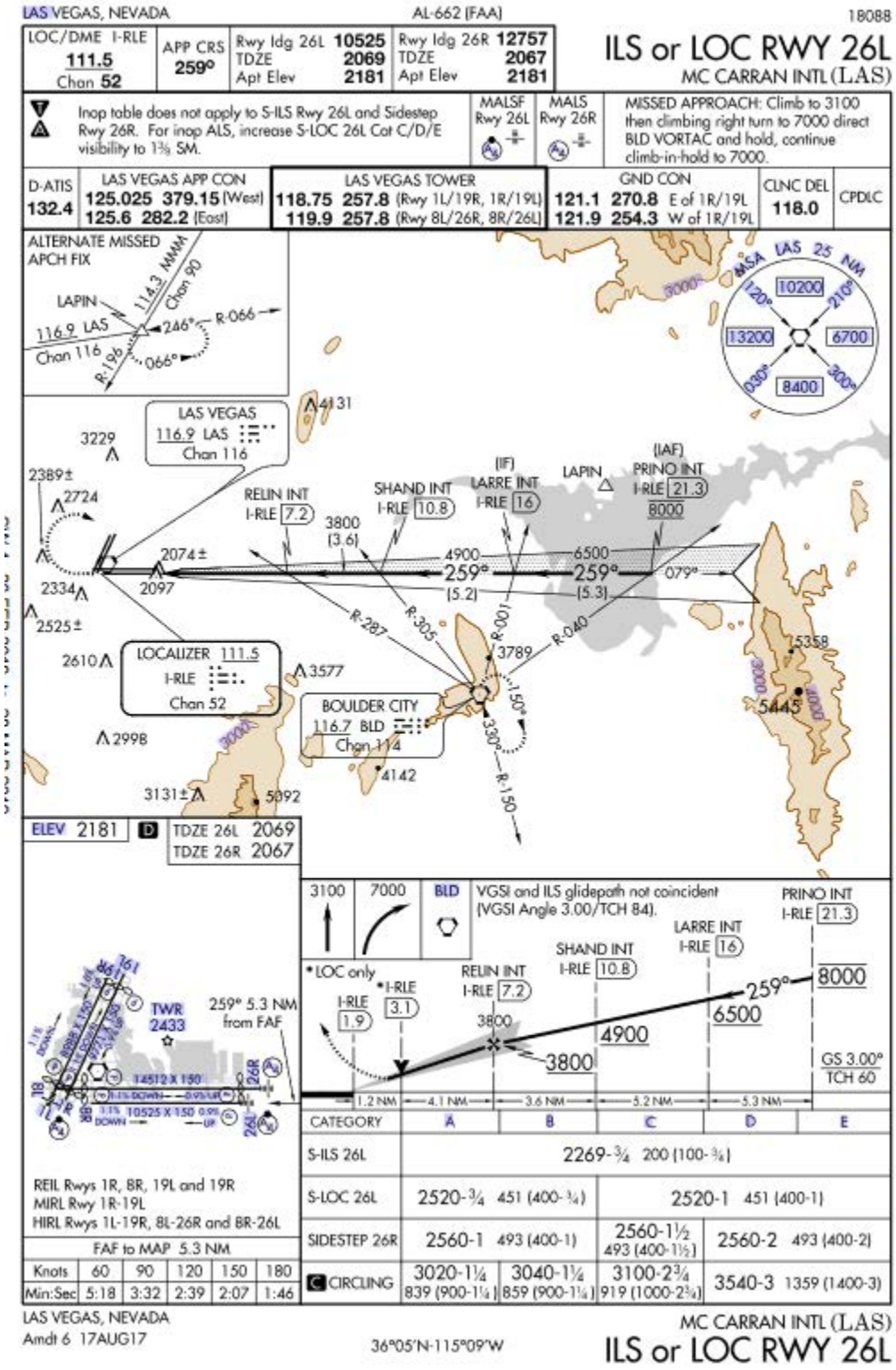

Figure 1: Current KLAS Runway 26L ILS Approach

Las Vegas OAPM Design Package

Las Vegas Runway 26L ILS Approach

Proposed Final Design

A point-to-point route was developed for RNAV equipped aircraft arriving from the west. This RNAV entry to KLAS Runway 26L ILS Approach will mimic the KLAS Runway 26L RNP AR Downwind Approach. Aircraft from the west that are not RNAV equipped will receive radar vectors to join the straight-in ILS approach.

The straight-in ILS approach was also amended to comply with design criteria.

Figure 2 depicts the RNAV entry to KLAS Runway 26L ILS Approach and the KLAS Runway 26L ILS Approach Proposed Final Design.

RNAV entry to KLAS Runway 26L ILS Approach

- BERBN (at 080 for Class B containment and no greater than 210 knots for criteria)
- BISHP (at or above 070 for criteria/segregates from KHND departures and no greater than 200 knots)
- WP68 (at or above 066 for criteria)
- WP70 (at or above 058 for criteria)
- WP67 (at or above 052 for criteria and ties in to ILS Approach)
- SHAND (at or above 048 for Class B containment)
- PFAF9 (at 038)

KLAS Runway 26L ILS Approach

- PRINO (at 080 for Class B containment)
- LARRE (at or above 065 for Class B containment)
- WP67 (at or above 052 for criteria)
- SHAND (at or above 048 for Class B containment)
- PFAF9 (at 038)

Las Vegas OAPM Design Package

Las Vegas Runway 26L ILS Approach

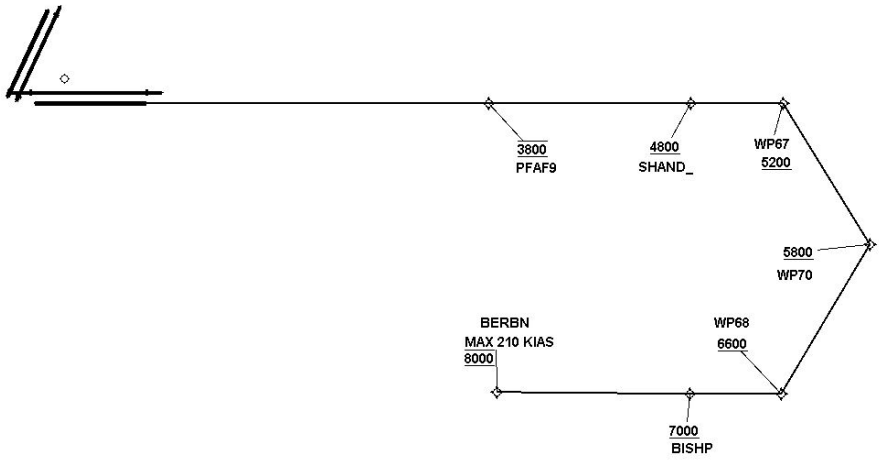

Figure 2: RNAV entry to KLAS Runway 26L ILS Approach and the KLAS Runway 26L ILS Approach Proposed Final Design

Attachments

- TARGETS Distribution Package
- RNAV Pro analysis results (may be completed during Evaluation Phase)

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

KLAS RUNWAY 26R ILS/LOCALIZER Change Sheet

Las Vegas Metroplex KLAS Design Package Change Control Sheet			
Date	**Description**	**TARGETS File Reference**	**FAA/NATCA Co-Lead Initials**
2/11/2020	Waypoint62 renamed ZEPAM and speed restriction of at 200 knots added. FLYES fix changed to Initial Approach Fix (IAF). FLICR fix changed to an additional IAF and added as an intersection. HAWKO changed to an Intermediary Fix and added as an intersection. BYORG added as a Step Down Fix and added as an intersection. Restriction at BYORG changed from at or above 4,800 feet to at 4,800 feet. CONDY PFAF add as an intersection. DME REQUIRED removed from procedure. Restriction at BERBN changed from at or above 8,000 feet to at 8,000 feet and the speed restriction remains the same, no greater than 210 knots. This was done to comply with industry's request.	Master TARGETS File	

All Change Control Sheets and Final Design Packages under the Metroplex Project have been completed.

Bradley R Mayhugh
FAA Metroplex Co-Lead

2/11/2020
Date

NATCA Metroplex Co-Lead

2/11/2020
Date

Las Vegas OAPM Design Package

Las Vegas Runway 26R ILS Approach

Approach procedures to the Las Vegas McCarran International Airport (KLAS) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing conventional (ground based radio navigation) ILS approaches. The KLAS Runway 26R ILS Approach was changed to provide a similar path to RNP approaches.

This procedure is not anticipated to change runway usage.

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[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*
https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

Las Vegas Runway 26R ILS Approach

Name of Change and Airport/s	Change Classification
Las Vegas McCarran (KLAS) Runway 26R ILS Approach/RNAV Entry to ILS Runway 26R	**Terminal Procedure**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
May 31, 2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
L30 Sectors: FNL	**KLAS RNDRZ Standard Terminal Arrival Route (STAR), KLAS CHOWW STAR, KLAS COKTL STAR, KLAS RKSTR STAR, KLAS JAYSN STAR**
Associated Data Files	
TARGETS Output Packages **RNAV Pro analysis results**	

Purpose

There are currently no Required Navigation (RNP) procedures for KLAS. Industry and L30 requested RNP approaches for all configurations, which mimic historical flight track data. Stakeholders requested RNP approaches which utilize Radius to Fix (RF) turns to the final approach course. The Las Vegas Metroplex Design and Implementation (D&I) Team developed RNP Authorization Required (AR) approaches to KLAS runways 08R, 19 L/R and 26 L/R. For a number of reasons, RNP approaches to Runways 01 L/R and 08 L were not feasible.

The Las Vegas Metroplex Design and Implementation (D&I) Team elected to provide continuity between PBN and conventional procedures by amending existing (ground based radio navigation) ILS approaches. The KLAS Runway 26R ILS Approach was changed to provide a similar path to RNP approaches.

Figure 1 depicts the current KLAS Runway 26R ILS Approach.

Study Team Recommendation

There was no Metroplex Study Team (MST) recommendation for ILS approaches.

Las Vegas OAPM Design Package

Las Vegas Runway 26R ILS Approach

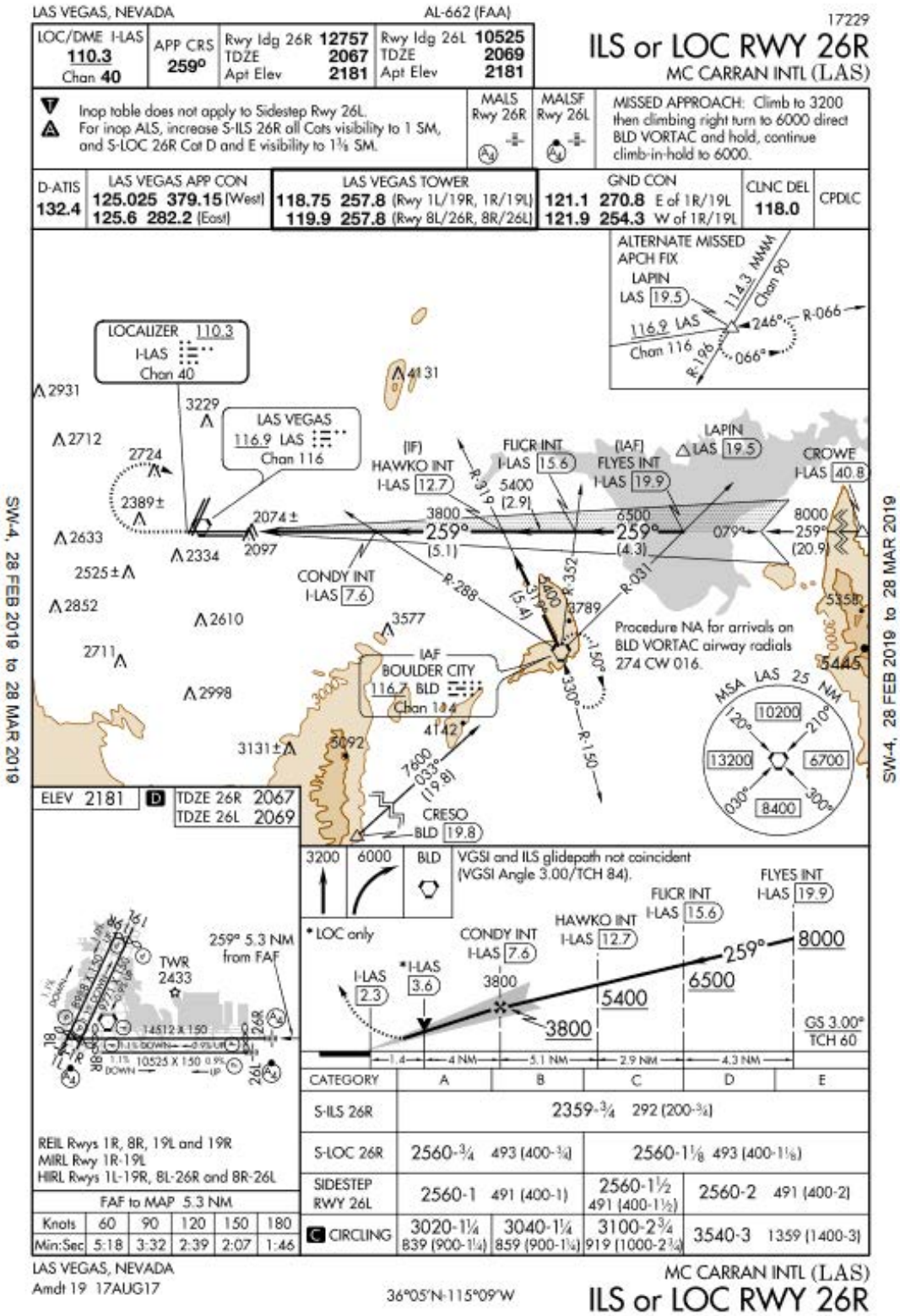

Figure 1: Current KLAS Runway 26R ILS Approach

Las Vegas OAPM Design Package

Las Vegas Runway 26R ILS Approach

Proposed Final Design

A point-to-point route was developed for RNAV equipped aircraft arriving from the west. This RNAV entry to KLAS Runway 26R ILS Approach will mimic the KLAS Runway 26R RNP AR Downwind Approach. Aircraft from the west that are not RNAV equipped will receive radar vectors to join the straight-in ILS approach.

The straight-in ILS approach was also amended to comply with design criteria.

Figure 2 depicts the RNAV entry to KLAS Runway 26R ILS Approach and the KLAS Runway 26R ILS Approach Proposed Final Design.

RNAV entry to KLAS Runway 26R ILS Approach

- BERBN (at 080 for Class B and no greater than 210 knots for criteria)
- LUISA (at or above 070 to segregate from KHND departures and no greater than 210 knots for criteria)
- WP65 (at or above 066 for criteria)
- WP62 (at or above 059 for criteria)
- HAWKO_ (at or above 052 for Class B containment and joins RWY26R ILS)
- BJORG (at or above 047 for Class B containment and criteria)
- PFAF7 (at 038)

KLAS Runway 26R ILS Approach

- FLYES (at or above 080 for Class B containment)
- FLICR (at or above 065 for Class B containment)
- HAWKO_ (at or above 052 for Class B containment)
- BJORG (at or above 047 for Class B containment and criteria)
- PFAF7 (at 038)

Las Vegas OAPM Design Package

Las Vegas Runway 26R ILS Approach

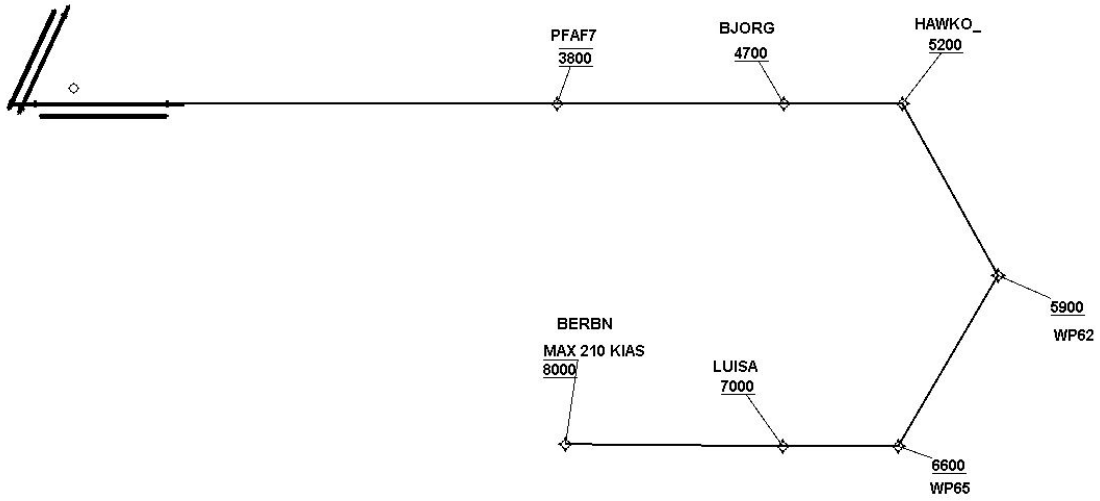

Figure 2: RNAV entry to KLAS Runway 26R ILS Approach and the KLAS Runway 26R ILS Approach Proposed Final Design

Attachments

- TARGETS Distribution Package
- RNAV Pro analysis results (may be completed during Evaluation Phase)

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley D. Mayhugh	4/23/19	Chris Thomas	4/23/19
Date		Date	
LAS FAA Lead		LAS NATCA Lead	

Anita Engelmann	4/25/19	Dan Hauptman	23 APR 19
Date		Date	
TWAB Representative		L30 NATCA POC	

Chris Iwanski	23 APR 19
Date	
LAS NATCA POC	

Las Vegas OAPM Design Package

KVGT Runway 12R GPS Approach

Approach procedures to the McCarran International Airport (KLAS) and North Las Vegas Airport (KVGT) are currently limited to Instrument Landing System (ILS), Global Positioning System (GPS) or visual procedures. The ILS and GPS approaches both involve intercepting an extended runway line in preparation for landing (straight-in approach). Visual approaches require sighting of the airport and hand flying to touchdown.

As part of the Las Vegas Metroplex Project, Area Navigation (RNAV) procedures were developed for arrivals and departures serving the Las Vegas Valley. These procedures include Standard Instrument Departures (SIDs), Standard Terminal Arrival Routes (STARs) and Required Navigation Procedure (RNP) approaches. RNAV procedures are designed to take advantage of Performance Based Navigation (PBN) capabilities in modern aircraft and may also provide vertical guidance and/or speed restrictions. Utilization of PBN provides repeatable and predictable paths, reduces task complexity and increases efficiency in the National Airspace System (NAS). PBN procedures assist in the segregation of aircraft utilizing different routes or landing at/departing from different airports. Implementation of PBN will assist in the Federal Aviation Administration's (FAA) Trajectory Based Operations (TBO) Infrastructure 2025 Plan[1].

The Las Vegas Metroplex Design and Implementation Team (D&I Team) elected to provide continuity between PBN and conventional procedures by amending three existing conventional (ground-based radio navigation) ILS approaches and one GPS approach for KLAS.

The Las Vegas Metroplex Project received a request from the North Las Vegas Air Traffic Control Tower (VGT ATCT) to help improve the GPS approach for KVGT. The current procedures prevent the use of simultaneous approaches to parallel Runways 12L/R.

The KVGT Runway 12R GPS Approach was amended to provide a more efficient operation that would allow parallel instrument/GPS approaches to Runways 12L/R.

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[1] *Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the NAS by using time-based management, information exchange between air and ground systems, and the aircraft's ability to fly precise paths in time and space.*

https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/tbo.html#intro1

Las Vegas OAPM Design Package

KVGT Runway 12R GPS Approach

Name of Change and Airport(s)	Change Classification
North Las Vegas (KVGT) **Runway 12R Global Positioning System (GPS) Approach**	**Terminal Procedure; GPS Approach**[NL1]
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.1	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**5/21/2020**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Nellis Air Traffic Control Facility (NATCF) **North Las Vegas Air Traffic Control Tower (VGT ATCT)** **KVGT**	**KLAS RNDRZ, CHOWW, COKTL, RKSTR, and JAYSN Standard Terminal Arrival Routes (STARs)**[NL2]
Associated Data Files	
TARGETS output packages **Flight Simulator worksheet** **RNAV Pro analysis results** **HITL**[NL3]**S results**	

Purpose

The Las Vegas Metroplex Project received a request from VGT ATCT to help improve the GPS approach for KVGT. The current procedures prevent the use of simultaneous approaches to parallel Runways 12L/R.

Figure 1 depicts the current KVGT Runway 12R GPS Approach.

Study Team Recommendation

There was no Las Vegas Metroplex Study Team (MST) recommendation for GPS approaches.

Las Vegas OAPM Design Package

KVGT Runway 12R GPS Approach

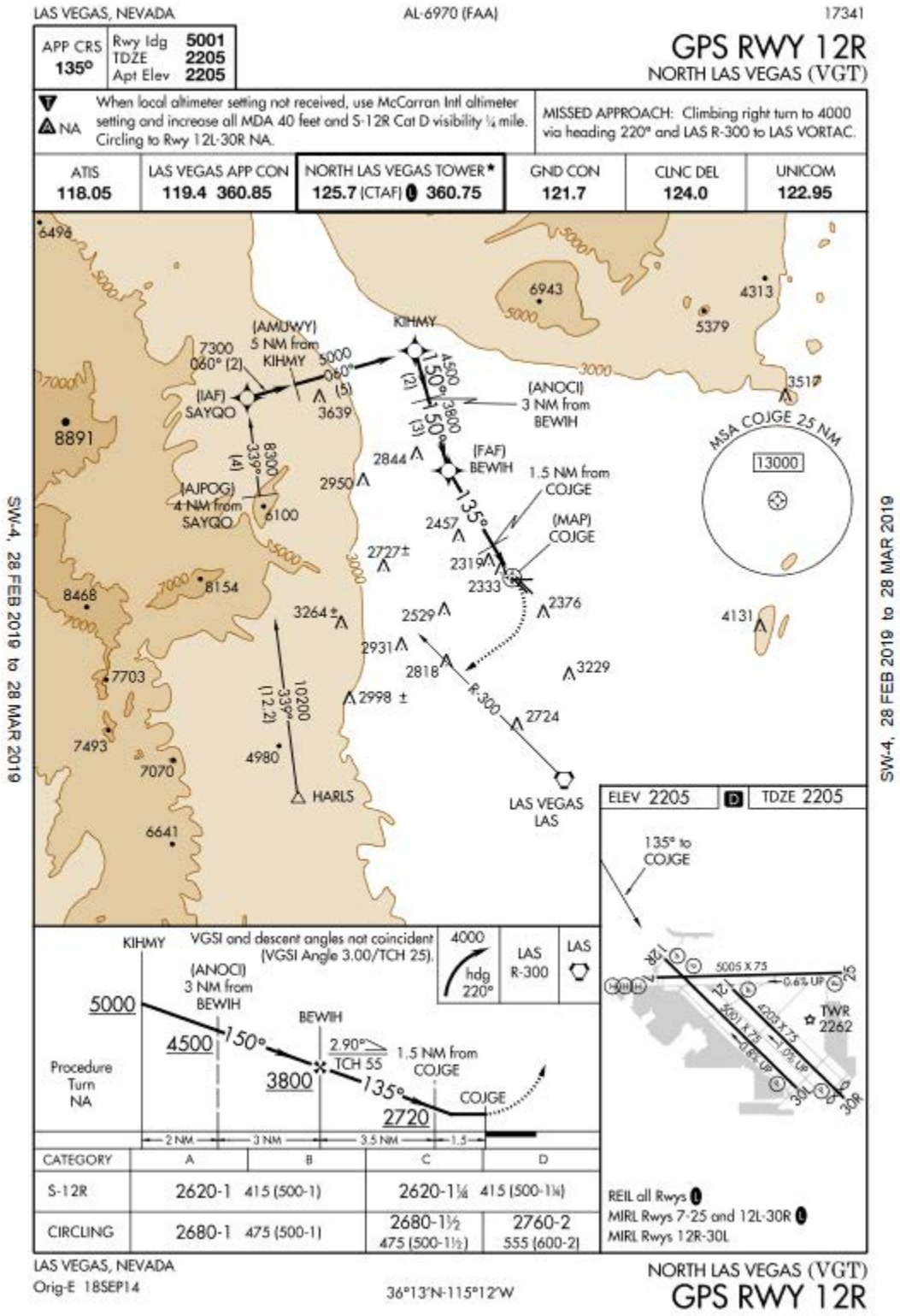

Figure 1: Current KVGT Runway 12R GPS Approach

KVGT Runway 12R GPS Approach

Las Vegas OAPM Design Package

KVGT Runway 12R GPS Approach

Proposed Final Design

The KVGT Runway 12R GPS Approach was amended to provide a more efficient operation that would allow parallel instrument/GPS approaches to Runways 12L/R.

Lateral and vertical changes were made to the KVGT Runway 12R GPS Approach.

Figure 2 depicts the KVGT Runway 12R GPS Approach PFD.

KVGT Runway 12R GPS Approach

- ECAKO (at or above 090/no greater than 230 knots/for terrain[NL4])
- WP33 (at or above 067/ no greater than 230 knots/for terrain)
- WP02 (at or above 060/for terrain)
- PFAF (at 052/for design criteria)
- WP05 (at or above 038/for terrain)
- WP06 (at or above 3,080 feet/for terrain)

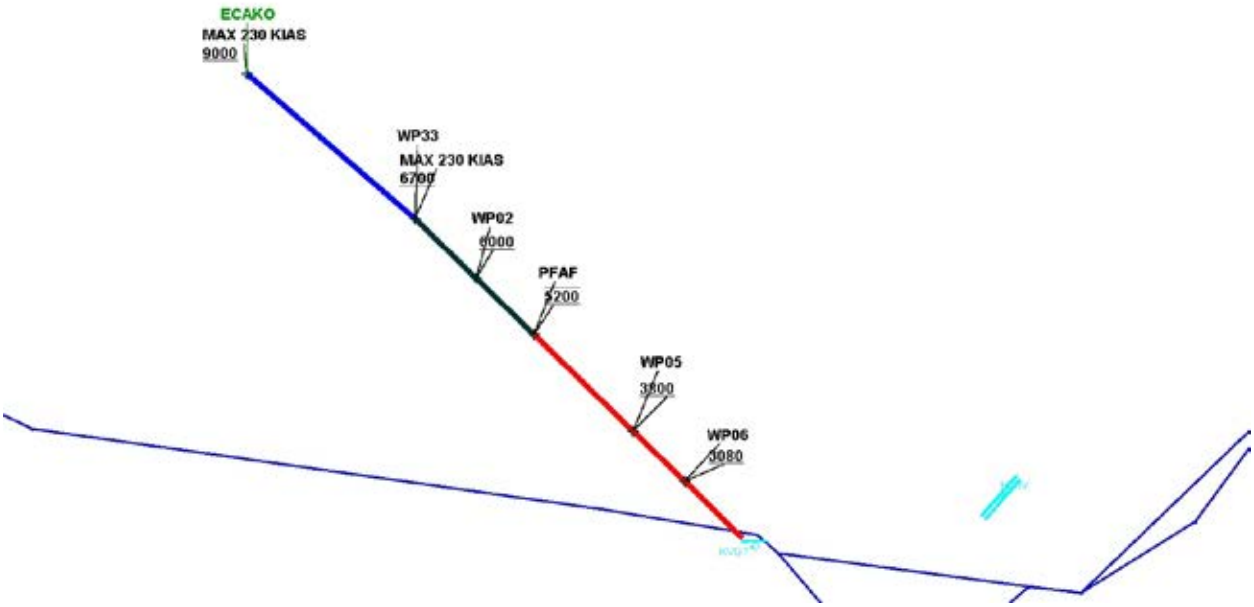

Figure 2: KVGT Runway 12R GPS Approach PFD

Attachments

- TARGETS distribution package
- Flight Simulator worksheet
- RNAV Pro analysis results (may be completed during Evaluation Phase)
- HITLS results (when applicable - may be completed during Evaluation Phase)

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

	30 Apr 19	Ashley L. Magee	4/30/19
Tom Black	Date	Ashley Magee	Date
VGT Facility POC		VGT NATCA POC	

Anita Engelmann	4/29/19	Dan Hauptman	23 Apr 19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

Chris Iwanski	4-23-19	Available via electronic signature	
Chris Iwanski	Date		Date
LAS NATCA POC		Nellis Air Traffic Control Facility	

Las Vegas OAPM Design Package

T338 Route

A T-route is an airway that serves as a lateral path for aircraft at or below 17,999 feet, which allows flights to traverse airspace. A T-route can also serve as a defined path connecting other procedures or routes. It is based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

T338 is a proposed Area Navigation (RNAV) route that will provide a lateral path for arrivals and departures to the North Las Vegas Airport (KVGT), Boulder City Municipal Airport (KBVU) and McCarran International Airport (KLAS). It will serve prop aircraft that are arriving at KVGT and KLAS from points east or that are departing from KVGT and KLAS to points east. The routing duplicates a new proposed KVGT WYLAND Standard Terminal Arrival Route (STAR) serving jet aircraft arriving to KVGT from the east. The T-route will serve prop KVGT arrivals. This defined routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the NAS.

Las Vegas OAPM Design Package

T338 Route

Name of Change and Airport/s	Change Classification
T338 Route	**Terminal Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON): LAK, SAT, KNO, MED **McCarran International Airport Tower (LAS): CD, LC1, LC2** **Los Angeles Air Route Traffic Control Center (ZLA ARTCC): Sector 7 and 8** **North Las Vegas Airport (VGT):** **Nellis Air Traffic Control Facility (NATCF)**	**N/A**
Associated Data Files	
xxxxxxxx_LAS_tgs	

Purpose

The purpose of T338 is to provide a repeatable and predictable east/west route for prop traffic arriving to and departing from North Las Vegas Airport (KVGT), Boulder City Municipal Airport (KBVU) and McCarran International Airport (KLAS).

Study Team Recommendation

There was no specific recommendation from the Las Vegas Metroplex Study Team (MST) for the development of T338.

Issues

The Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) issues radar vectors to aircraft in the absence of published routes to traverse Class B airspace. Stakeholders requested

low altitude Area Navigation (RNAV) routes through Class B airspace which will provide predictable, repeatable paths.

Solutions

The Las Vegas Metroplex Design and Implementation (D&I) Team identified an opportunity to proceduralize routes below FL180 by utilizing low altitude RNAV routes (T-Routes) in the terminal and en route airspaces.

Proposed Final Design

The D&I Team determined that a repeatable and predictable east/west route was needed for prop traffic arriving to and departing from KVGT, KBVU and KLAS.

T338 route:

- BOEGY (located as a coordination fix for L30 and ZLA)
- WYLND (located for use as a crossing point if needed to segregate from KLAS arrivals/departures)
- LNDIN (located as a coordination point for L30 and NATCF and as a fix to tie-in to other T-routes)
- DSIRE (located as a fix to join the approach to KVGT, for use by NATCF to route aircraft through their airspace and as a fix to tie-in to other T-routes)

This routing allows KVGT prop arrivals to follow the same arrival path as jet traffic landing at KVGT assigned the proposed KVGT WYLND STAR.

Figure 1 depicts T338.

Las Vegas OAPM Design Package

T338 Route

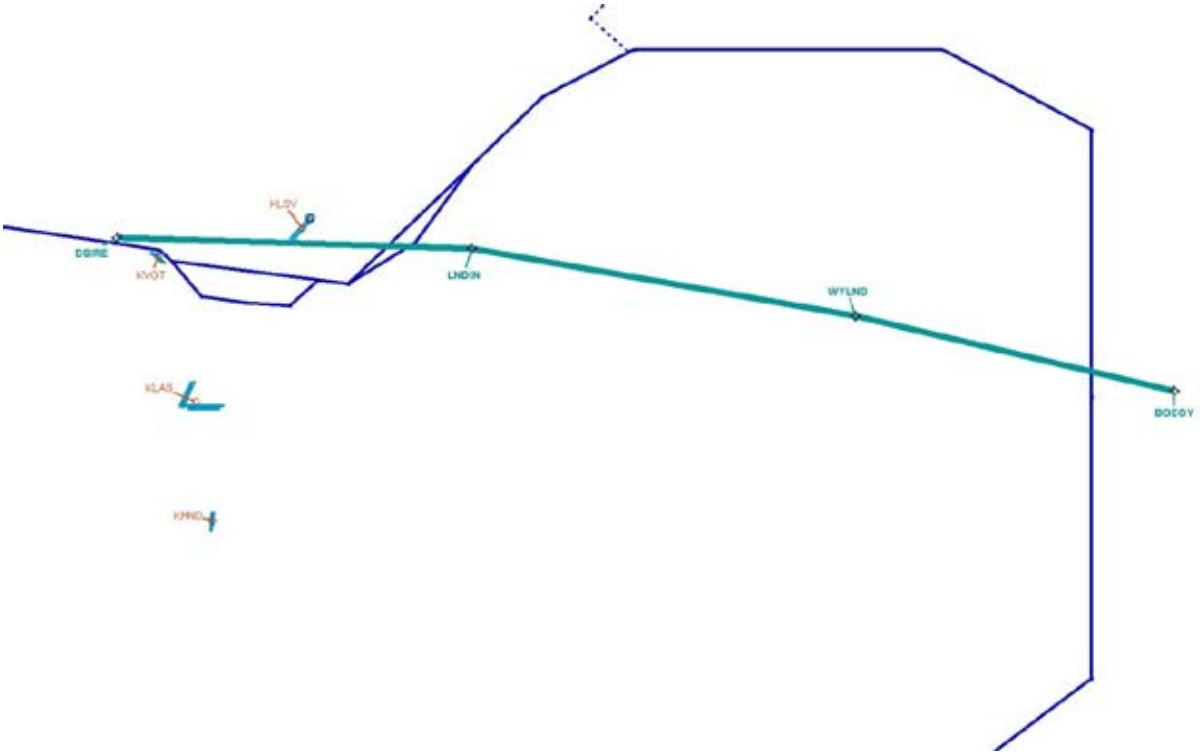

Figure 1: T338 Route

Additional Design Considerations

Implementation Dependencies

- Requires modifications to VGT, LAS, ZLA and L30 Letters of Agreement (LOA) and Standard Operating Procedures (SOP)
- Requires modification to L30/LSV LOA
- Requires no airspace modifications
- Requires controller training
- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh 4/23/19			4/23/19
Bradley R Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	
	30 Apr 19 Ashley C. Magee		4/30/19
Tom Black	Date	Ashley Magee	Date
VGT Facility POC		VGT NATCA POC	
Anita Engelmann 4/25/19			23APR19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	
4/23/19			5/2/19
Sarah Fletcher	Date	for Martin Ramirez	Date
ZLA Facility POC		ZLA NATCA POC	
4-23-19		Available via electronic signature	
Chris Iwanski	Date		Date
LAS NATCA POC		Nellis Air Traffic Control Facility	

Las Vegas OAPM Design Package

T361 Route

A T-route is an airway that serves as a lateral path for aircraft at or below 17,999 feet, which allows flights to traverse airspace. A T-route can also serve as a defined path connecting other procedures or routes. It is based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

T361 was developed to provide a predictable and repeatable flight path for aircraft flying through the Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) airspace and to serve as an arrival/departure airway for McCarran International Airport (KLAS), North Las Vegas Airport (KVGT), Boulder City Municipal Airport (KBVU) and Henderson Executive Airport (KHND). T361 will reduce the current requirement for air traffic control facilities to issue radar vectors or itinerant routing for KLAS and KHND. This defined routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the NAS.

Las Vegas OAPM Design Package

T361 Route

Name of Change and Airport/s	Change Classification
T361 Route	**Terminal Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON): CYN, DAG, GNT, FNL, MED, SAT, LAK, KNO **McCarran International Airport Tower (LAS): CD, LC1, LC2** **Los Angeles Air Route Traffic Control Center (ZLA ARTCC): Sectors 7 and 8** **Henderson Executive Airport (HND)** **North Las Vegas Airport Tower (VGT)**	**Not dependent on any other procedures**
Associated Data Files	
xxxxxxx_LAS_tgs	

Purpose

The purpose of T361 is to provide a repeatable and predicable route for overflights through L30 airspace and to serve as an arrival/departure airway for North Las Vegas Airport (KVGT), McCarran International Airport (KLAS), Boulder City Municipal Airport (KBVU) and Henderson Executive Airport (KHND). It will serve aircraft transitioning to/from the east and northeast.

Study Team Recommendation

There was no specific recommendation from the Las Vegas Metroplex Study Team (MST) for the development of T361.

Issues

Las Vegas OAPM Design Package

T361 Route

The Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) issues radar vectors to aircraft in the absence of published routes to traverse Class B airspace. Stakeholders requested low altitude Area Navigation (RNAV) routes through Class B airspace which will provide predictable, repeatable paths.

Solutions

The Las Vegas Metroplex Design and Implementation (D&I) Team identified an opportunity to proceduralize routes below FL180 by utilizing low altitude RNAV routes (T-Routes) in the terminal and en route airspaces. This T-Route will be utilized by arrivals and departures to/from KVGT and KHND and by prop aircraft into and out of KLAS. T361 will provide connectivity to other T-Route designs, allowing aircraft to transition the airspace. This design will reduce phraseology and complexity, and increase efficiency for aircraft landing in, departing from or transitioning the airspace.

Proposed Final Design

The D&I Team developed a route for prop aircraft from the north and east to KBVU, KVGT, KLAS and KHND airports. This route also ties in to the other T-routes developed for L30 in order to provide transition through the airspace for prop aircraft.

From the north:

- Mormon Mesa Vortac (MMM) (existing navaid utilized as an initial fix)
- SHIEK (coordination fix between ZLA/L30 that segregates from KLAS arrival and departure routes and as a fix to tie-in to other T-routes)
- LNDIN (located as a coordination point for L30 and Nellis Air Traffic Control Facility (NATCF) and as a fix to tie-in to other T-routes)
- WANDR (located to segregate from KLAS arrivals/departures)
- DICSA (provides routing to and from KHND and as a fix to tie-in to other T-routes)
- PUTTT (located to be used to tie in to other T-routes)
- BOEGY (coordination fix for ZLA/L30)

The route can be flown in either direction and aircraft can transition to another T-route or to the KVGT, KHND, KBVU or KLAS airports.

Figure 1 depicts T361.

Las Vegas OAPM Design Package

T361 Route

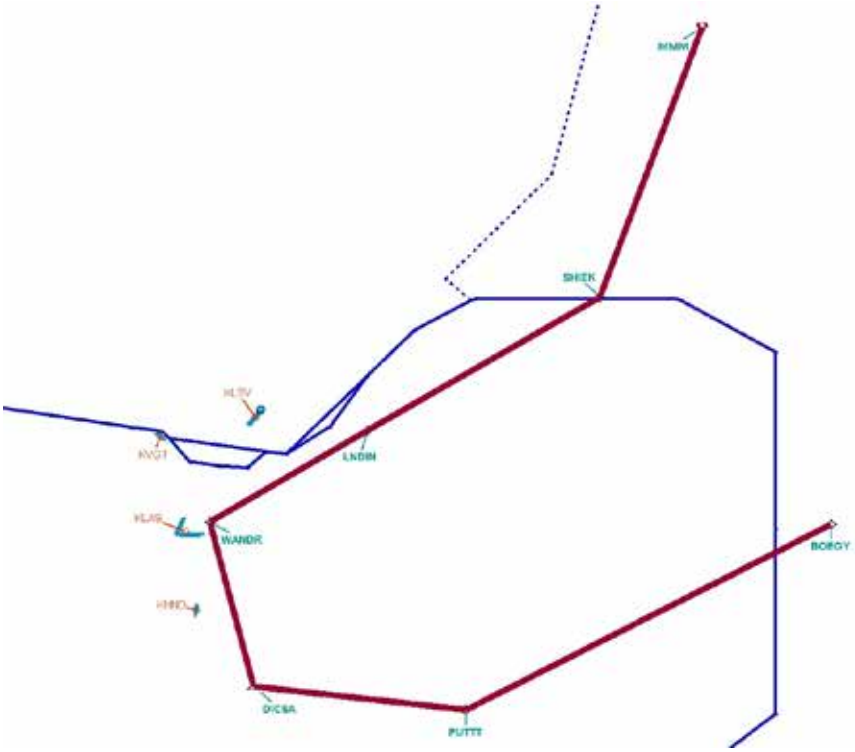

Figure 1: T361 Route

Additional Design Considerations

Implementation Dependencies

- Requires modifications to VGT, LAS, ZLA and L30 Standard Operating Procedures (SOP) and Letter of Agreements (LOA)
- Requires modification to L30/HND LOA
- Requires no airspace modifications
- Requires controller training
- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
LAS FAA Lead	Date	LAS NATCA Lead	Date
Sarah Fletcher	4/23/19	Martin Ramirez	5/2/19
ZLA Facility POC	Date	ZLA NATCA POC	Date
Anita Engelmann	4/25/19	Dan Hauptman	23APR19
TWAB Representative	Date	L30 NATCA POC	Date

Chris Iwanski 23 APR 19
LAS NATCA POC Date

Las Vegas OAPM Design Package

T363 Route

A T-route is an airway that serves as a lateral path for aircraft at or below 17,999 feet, which allows flights to traverse airspace. A T-route can also serve as a defined path connecting other procedures or routes. It is based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

T363 is a proposed Area Navigation (RNAV) route that will provide a predictable and repeatable path for arrivals and departures to and from Henderson Executive Airport (KHND) and Boulder Municipal City Airport (KBVU) to and from points north. This defined routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the National Airspace System (NAS).

Las Vegas OAPM Design Package

T363 Route

Name of Change and Airport/s	Change Classification
T363 Route	**Terminal Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON): CYN, DAG, FNL, MED, SAT, KNO, LAK **McCarran International Airport Tower (LAS): CD, LC1, LC2** **Henderson Executive Airport Tower (HND)** **Los Angeles Air Route Traffic Control Center (ZLA ARTCC): Sector 7**	**Not dependent on any other procedures**
Associated Data Files	
XXXXXXX_LAS_tgs	

Purpose

The purpose of T363 is to provide a repeatable and predictable routing for prop aircraft arriving to and departing from Henderson Executive Airport (KHND) and Boulder City Municipal Airport (KBVU) routed to and from points north and northeast as well as prop aircraft arriving KLAS.

Study Team Recommendation

There was no specific recommendation from the Las Vegas Metroplex Study Team (MST) for the development of T363.

Issues

The L30 TRACON uses radar vectors in the absence of published routes to traverse Class B airspace. Stakeholders requested low altitude RNAV routes through Class B airspace which provide predictable, repeatable paths.

Las Vegas OAPM Design Package

T363 Route

Solutions

The Las Vegas Design and Implementation (D&I) Team identified an opportunity to proceduralize routes below FL180 by utilizing low altitude RNAV routes (T-routes) in the terminal and en route airspaces. This conceptual T-route can be used to enter and exit the L30 airspace and will serve KLAS and KHND arrivals and departures to and from the north and northeast.

Proposed Final Design

The D&I Team developed a lateral RNAV path that serves as an arrival/departure route to/from KLAS/KHND for prop aircraft. The route begins at the Mormon Mesa Vortac (MMM) and proceeds to waypoints:

- SHIEK (coordination fix that segregates from KLAS arrival and departure routes and as a fix to tie-in to other T-routes)
- PUTTT (located to be used to tie in to other T-routes)
- DICSA (provides routing to and from KHND and as a fix to tie-in to other T-routes)

Figure 1 depicts T363.

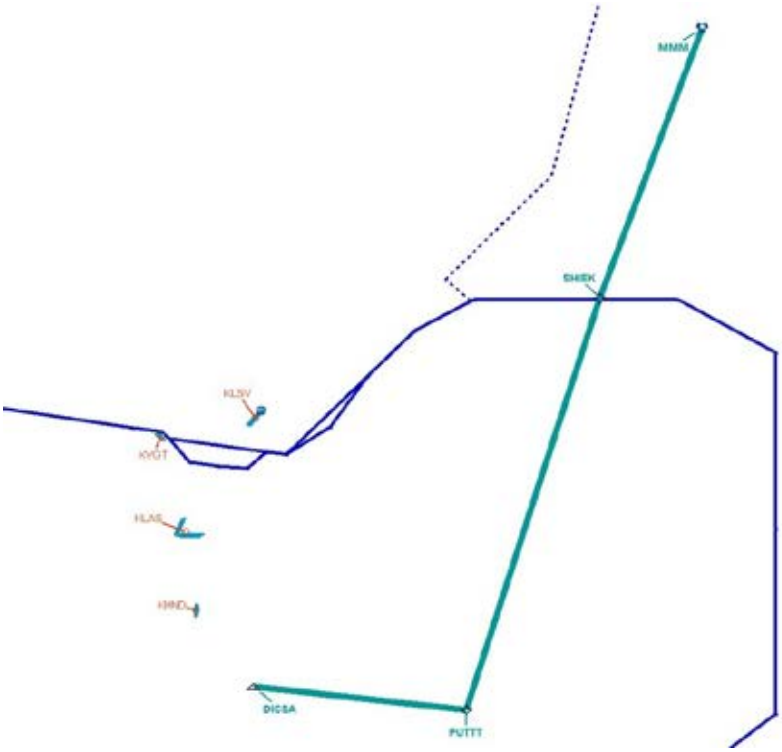

Figure 1 T363 Route

Las Vegas OAPM Design Package
T363 Route

Additional Design Considerations

Implementation Dependencies

- Not dependent upon any other procedure implementation
- Requires modifications to ZLA and L30 Standard Operating Procedures (SOP) and Letters of Agreement (LOA)
- Requires modification to L30/HND LOA
- Requires no airspace modifications
- Requires controller training
- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
LAS FAA Lead	Date	LAS NATCA Lead	Date
Sarah Fletcher	4/23/19	Martin Ramirez	5/2/19
ZLA Facility POC	Date	ZLA NATCA POC	Date
Anita Engelmann	4/25/19	Dan Hauptman	23APR19
TWAB Representative	Date	L30 NATCA POC	Date

Chris Iwanski 23 APR 19
LAS NATCA POC Date

Las Vegas OAPM Design Package

T357 Route

A T-route is an airway that serves as a lateral path for aircraft at or below 17,999 feet, which allows flights to traverse airspace. A T-route can also serve as a defined path connecting other procedures or routes. It is based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

T357 is a proposed Area Navigation (RNAV) route that will provide a predictable and repeatable path for overflights through the Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) airspace and serve as an arrival/departure airway for North Las Vegas Airport (KVGT), Henderson Executive Airport (KHND), Boulder City Municipal Airport (KBVU) and McCarran International Airport (KLAS) aircraft. T357 will reduce the current requirement for air traffic control facilities to issue radar vectors or itinerant routing for North Las Vegas Airport (KVGT) arrivals/departures or overflights.

Las Vegas OAPM Design Package

T357 Route

Name of Change and Airport/s	Change Classification
T357 Route	**Terminal Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON): CYN, DAG, GNT, FNL, MED, SAT, LAK **Los Angeles Air Route Traffic Control Center (ZLA ARTCC): Sector 6** **McCarran International Airport Tower (LAS): LC1, LC2, LC3** **Nellis Air Traffic Control Facility (NATCF)**	**Not dependent on any other procedures**
Associated Data Files	
xxxxxxxxx_LAS_MASTER.tgs	

Purpose

The purpose of T357 is to provide a repeatable and predicable north/south route for overflights through L30 airspace and to serve as an arrival/departure airway for North Las Vegas Airport (KVGT), Henderson Executive Airport (KHND), Boulder City Municipal Airport (KBVU) and McCarran International Airport (KLAS) aircraft.

Study Team Recommendation

Issues

The Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) issues radar vectors to aircraft in the absence of published routes to traverse Class B airspace. Stakeholders requested low altitude Area Navigation (RNAV) routes through Class B airspace which will provide predictable, repeatable paths. The Los Angeles Air Route Traffic Control Facility (ZLA) identified multiple Victor airways that were being filed by small prop aircraft exiting L30 airspace to the southwest.

Las Vegas OAPM Design Package

T357 Route

Solutions

The Las Vegas Metroplex Study Team (MST) identified an opportunity to proceduralize routes below FL180 by utilizing low altitude RNAV routes (T-Routes) in the terminal and en route airspaces. L30 assisted the Las Vegas MST in the design of two T-Routes (T357 and T359) to be used east or west of McCarran International Airport (LAS) based on LAS runway configuration, terminating in the vicinity of KVGT. ZLA requested a T-Route for departure traffic destined for Southern California airports. This conceptual T-Route can be used to traverse the L30 airspace. Figure 1 shows the MST T-route recommendation

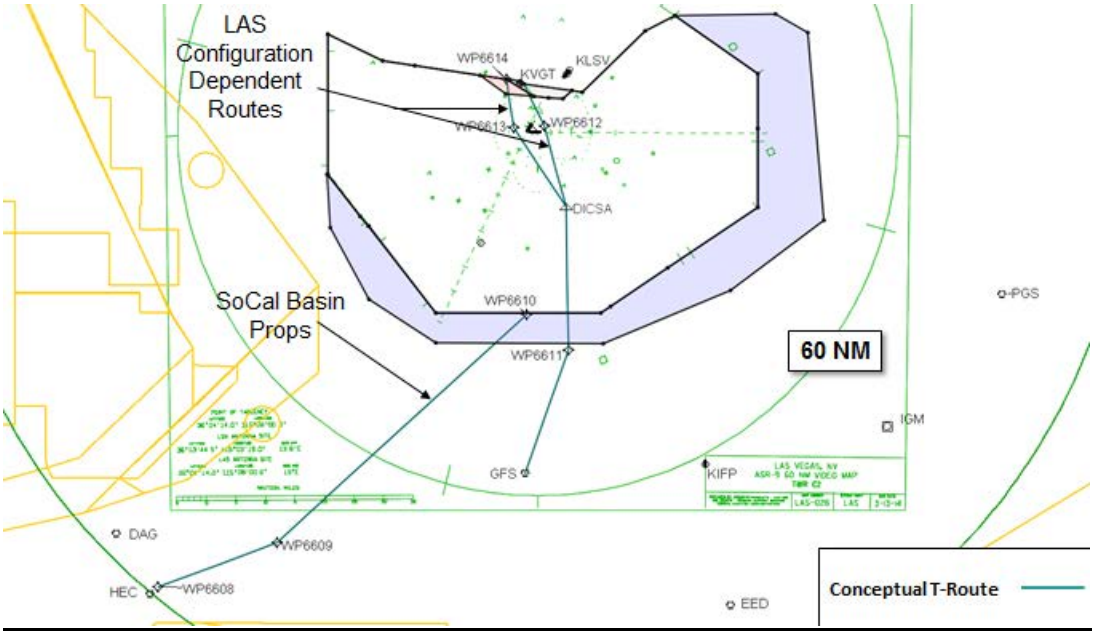

Figure 1: MST Recommendation for T-route

Proposed Final Design

The D&I Team developed a north/south route through L30 airspace that could be used to transition the area and also as an arrival and departure route for aircraft to/from KHND, KVGT and prop aircraft to/from KLAS.

T357 route:

- KONNG (used as a coordination fix between ZLA/L30)
- DICSA (provides routing to and from KHND and flexibility for ATC to send aircraft east [T357] or west [T359] of LAS)
- WANDR (located to segregate from KLAS arrivals/departures)

- DSIRE (located as a fix to join the approach to KVGT and use by NATCF for aircraft entering and exiting their airspace)

Figure 1 depicts proposed T357.

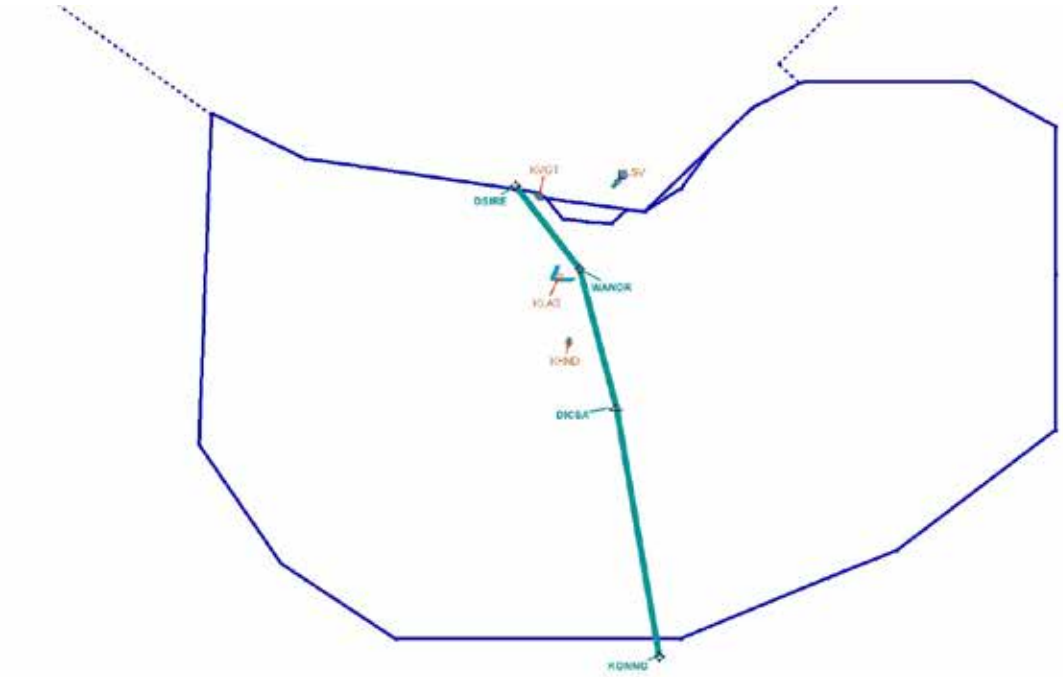

Figure 2: T357 Route

Additional Design Considerations

Implementation Dependencies

- Not dependent upon any other procedure implementation
- Requires modifications to VGT, HND, LAS, ZLA and L30 Standard Operating Procedures (SOP) and Letter of Agreement (LOA)
- Requires no airspace modifications
- Requires controller training
- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	

	30 Apr 19	Ashley C. Magee	4/30/19
Tom Black	Date	Ashley Magee	Date
VGT Facility POC		VGT NATCA POC	

Anita Engelmann	4/25/19		23APR19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	

	4/23/19	for	5/2/19
Sarah Fletcher	Date	Martin Ramirez	Date
ZLA Facility POC		ZLA NATCA POC	

	4-23-19	Available via electronic signature	
Chris Iwanski	Date		Date
LAS NATCA POC		Nellis Air Traffic Control Facility	

Las Vegas OAPM Design Package

T359 Route

A T-route is an airway that serves as a lateral path for aircraft at or below 17,999 feet, which allows flights to traverse airspace. A T-route can also serve as a defined path connecting other procedures or routes. It is based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

T359 is a proposed Area Navigation (RNAV) route that will provide a predictable and repeatable path for overflights through the Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) airspace and to serve as an arrival/departure airway for North Las Vegas Airport (KVGT), Henderson Executive Airport (KHND), Boulder City Municipal Airport (KBVU) and McCarran International Airport (KLAS) aircraft. T359 will reduce the current requirement for air traffic control facilities to issue radar vectors or itinerant routing for North Las Vegas Airport (KVGT) arrivals/departures or overflights.

Las Vegas OAPM Design Package

T359 Route

Name of Change and Airport/s	Change Classification
T359 Route	**Terminal Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
4.4.3	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Las Vegas Terminal Radar Approach Control (L30 TRACON): CYN, DAG, GNT, FNL, MED, SAT, LAK **Los Angeles Air Route Traffic Control Center (ZLA): Sector 6** **McCarran International Airport Tower (LAS): LC1, LC2, LC3** **Henderson Executive Airport Tower (HND)** **North Las Vegas Airport Tower (VGT)** **Nellis Air Traffic Control Facility (NATCF)**	**Not dependent on any other procedures**
Associated Data Files	
xxxxxxxxx_LAS_MASTER.tgs	

Purpose

The purpose of T359 is to provide a repeatable and predicable north/south route for overflights through Las Vegas Terminal Radar Control Facility (L30 TRACON) airspace and to serve as an arrival/departure airway for North Las Vegas Airport (KVGT), Henderson Executive Airport (KHND), Boulder City Municipal Airport (KBVU) and prop aircraft to/from McCarran International Airport (KLAS).

Study Team Recommendation

Issues

The Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) issues radar vectors to aircraft in the absence of published routes to traverse Class B airspace. Stakeholders requested low altitude Area Navigation (RNAV) routes through Class B airspace which will provide

predictable, repeatable paths. The Los Angeles Air Route Traffic Control Facility (ZLA) identified multiple Victor airways that were being filed by small prop aircraft exiting L30 airspace to the southwest.

Solutions

The Las Vegas Metroplex Study Team (MST) identified an opportunity to proceduralize routes below FL180 by utilizing low altitude RNAV routes (T-Routes) in the terminal and en route airspaces. L30 assisted the Las Vegas MST in the design of two T-Routes (T357 and T359) to be used east or west of McCarran International Airport (LAS) based on LAS runway configuration, terminating in the vicinity of KVGT. ZLA requested a T-Route for departure traffic destined for Southern California airports. This conceptual T-Route can be used to traverse the L30 airspace. Figure 1 shows the MST T-route recommendation.

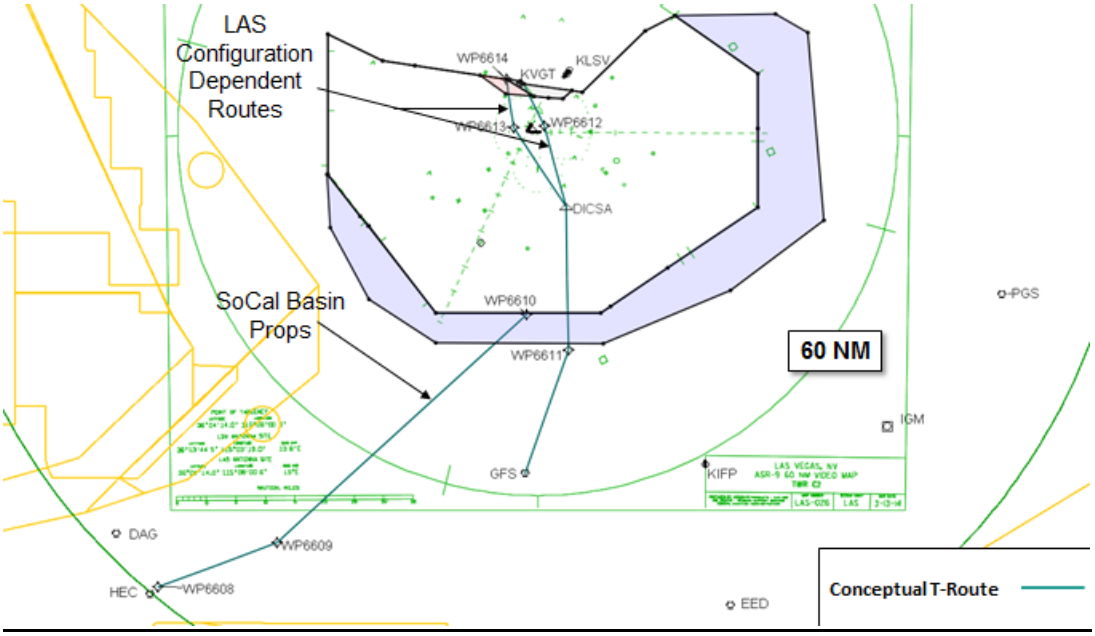

Figure 1: MST Recommendation for T-route

Proposed Final Design

The Las Vegas Metroplex Design and Implementation (D&I) Team developed a north/south route through L30 airspace that could be used to transition L30 airspace and also as an arrival and departure route for aircraft to/from KBVU, KHND, KVGT and prop aircraft to/from KLAS. T359 was developed beginning in ZLA sector 6 airspace at:

- DANBY (existing waypoint that segregates from KLAS BASIC STAR)
- WHIGG (existing waypoint as a coordination fix between ZLA and L30)

- BOOOO (to allow for a lower MEA)
- DICSA (provides routing to and from KHND and flexibility for ATC to send aircraft east [T357] or west [T359] of LAS)
- RAATT (to provide separation from the KLAS arrival/departure corridor)
- DSIRE (located as a fix to join the approach to KVGT and use by NATCF for aircraft entering and exiting their airspace)

Figure 1 depicts proposed T359.

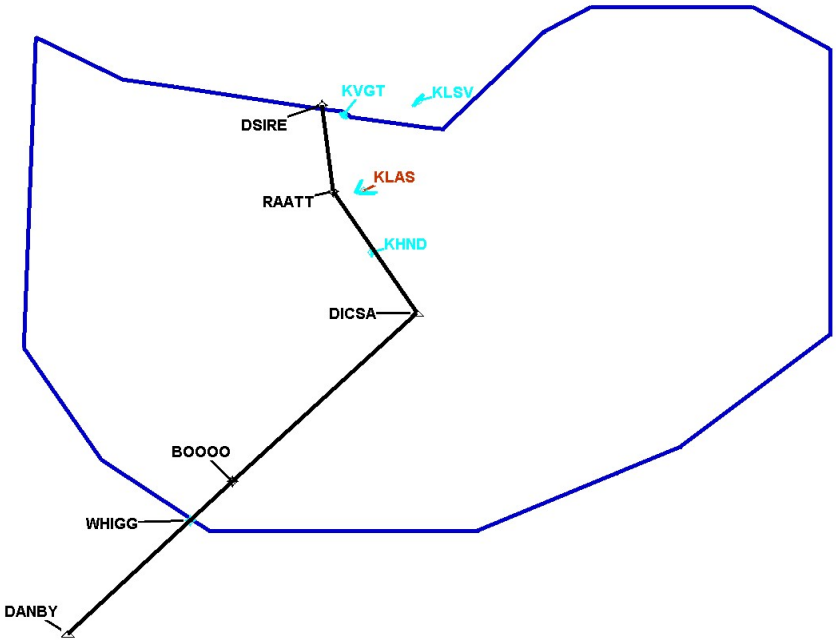

Figure 2: T359 Route

Additional Design Considerations

Implementation Dependencies

- Not dependent upon any other procedure implementation
- Requires modifications to VGT, LAS, ZLA and L30 Standard Operating Procedures (SOP) and Letter of Agreement (LOA)
- Requires no airspace modifications
- Requires controller training

Las Vegas OAPM Design Package
T359 Route

- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R Mayhugh 4/23/19			4/23/19
Bradley R Mayhugh	Date	Chris Thomas	Date
LAS FAA Lead		LAS NATCA Lead	
	30 Apr 19 Ashley C. Magee		4/30/19
Tom Black	Date	Ashley Magee	Date
VGT Facility POC		VGT NATCA POC	
Anita Engelmann 4/25/19			23APR19
Anita Engelmann	Date	Dan Hauptman	Date
TWAB Representative		L30 NATCA POC	
4/23/19			5/2/19
Sarah Fletcher	Date	for Martin Ramirez	Date
ZLA Facility POC		ZLA NATCA POC	
4-23-19		Available via electronic signature	
Chris Iwanski	Date		Date
LAS NATCA POC		Nellis Air Traffic Control Facility	

Las Vegas Metroplex Design Package

Q13 AMEND

A Q-Route is an airway that serves as a lateral path for aircraft at or above 18,000 feet that allows flights to traverse airspace or serves as a defined path that allows connectivity to other procedures or other routes to or from airports. Q-Routes are based on satellite navigation and provide repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

The Las Vegas Metroplex Design and Implementation (D&I) Team has developed new procedures to serve airports located in the Las Vegas Valley. To provide connectivity to and from these new designs and to add lateral distance between aircraft, the D&I Team proposes an amendment to the lateral path of the existing Q13. To reduce complexity and increase flexibility, the team moved Q13 to the west and created the waypoint SOTOO where Q13 will join Q15. The purpose of this routing is to segregate overflight traffic on Q13 from McCarran International Airport (KLAS) arrival and departure traffic on the new RNAV Metroplex Area navigation (RNAV) Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs).

This change to the lateral path will also allow the Oakland Air Route Traffic Control Center (ZOA ARTCC) to deliver KLAS arrival traffic to the Los Angeles (ZLA) ARTCC at higher altitudes than current state and will provide the opportunity for Optimized Profile Descents (OPD's) into KLAS. The lateral changes that were part of this procedure will cause marginally greater flight miles for arrivals. Industry was involved in the design of this amendment and advised the Team that they would prefer the benefits of an OPD versus a slight increase in track miles.

The Las Vegas Metroplex D&I Team coordinated design plans with the Albuquerque ARTCC (ZAB). ZAB requested that the Q-Route be extended to allow additional routes to southwest Texas.

This amended routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the NAS.

Las Vegas Metroplex Design Package
Q13 AMEND

Name of Change and Airport/s	Change Classification
Q13 AMENDMENT	**ATS Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) **Sector 16, 34, 35, 36** **Oakland (ZOA) ARTCC** · **Sector 33, 46**	**Proposed Q-Routes** · **Q15 Amendment, Q174**
Associated Data Files	
xxxxxxxxx_LAS_MASTER.tgs	

Purpose

The purpose of the proposed procedure is to address issues identified by the Las Vegas Metroplex Design and Implementation (D&I) Team. This issue was not identified by the Metroplex Study Team (MST):

The Las Vegas Metroplex Design Team identified a need to amend current Q-Routes in order to increase the efficiency throughout ZLA airspace and to help segregate overflight traffic from McCarran International Airport (KLAS) arrival/departure traffic.

Design Team Recommendation

To reduce complexity and increase flexibility, the team amended Q13, moving the route to the west to segregate overflight traffic on Q13 from McCarran International Airport (KLAS) arrival and departure traffic on the new KLAS COKTL Standard Terminal Arrival Route (STAR) and KLAS JOHKR Standard Instrument Departure (SID). By segregating the Q-Route from inbound and outbound traffic, KLAS departures can be assigned requested altitudes sooner. This will also allow ZOA to deliver KLAS arrival traffic to ZLA at higher altitudes than current state and will provide the opportunity for Optimized Profile Descents (OPD's) into KLAS. The lateral changes that were part of this procedure will cause marginally greater flight miles for arrivals. Industry was involved in the design of this amendment and advised the Team that they would prefer the benefits of an OPD versus a slight increase in track miles.

The D&I Team coordinated design plans with the Albuquerque ARTCC (ZAB). ZAB requested that the Q-Route be extended to allow additional routes to southwest Texas.

Las Vegas Metroplex Design Package
Q13 AMEND

Q13 waypoints:

- ELP VORTAC
- VERNO
- NABOB
- DRK VORTAC
- WOTRO
- PRFUM (existing waypoint currently on Q13)
- SOTOO (new waypoint placed to segregate from the KLAS COKTL STAR and KLAS JOHKR SID)
- HOUZZ (new waypoint placed to segregate from the KLAS COKTL STAR and KLAS JOHKR SID)
- FUULL (new waypoint placed to segregate from the KLAS COKTL STAR and KLAS JOHKR SID)
- SKANN (existing waypoint on Q15)
- LOMIA (existing waypoint currently on Q13 in ZOA airspace)

Figure 1 depicts current Q13 and Q13 Amend.

Figure 2 depicts Q13 Amend and Q15 Amend with the KLAS JOHKR SID and KLAS COKTL STAR.

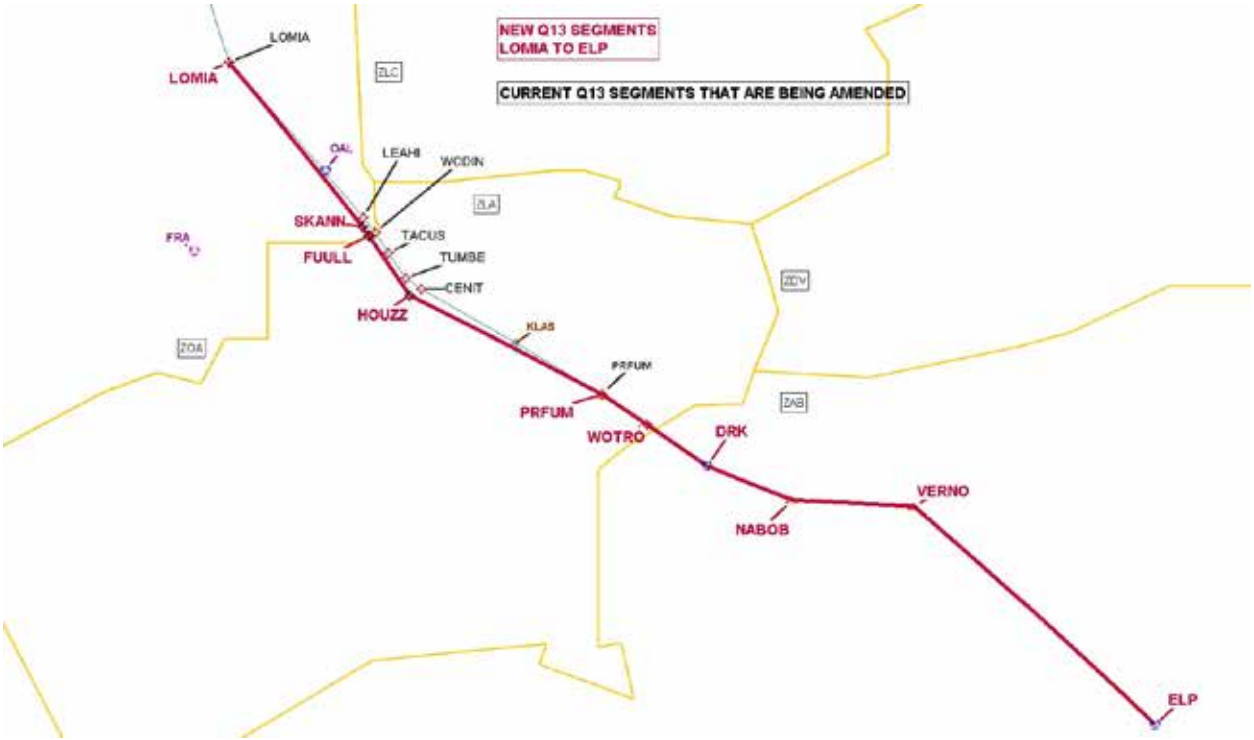

Figure 1: Current Q13 and Q13 Amend

Las Vegas Metroplex Design Package
Q13 AMEND

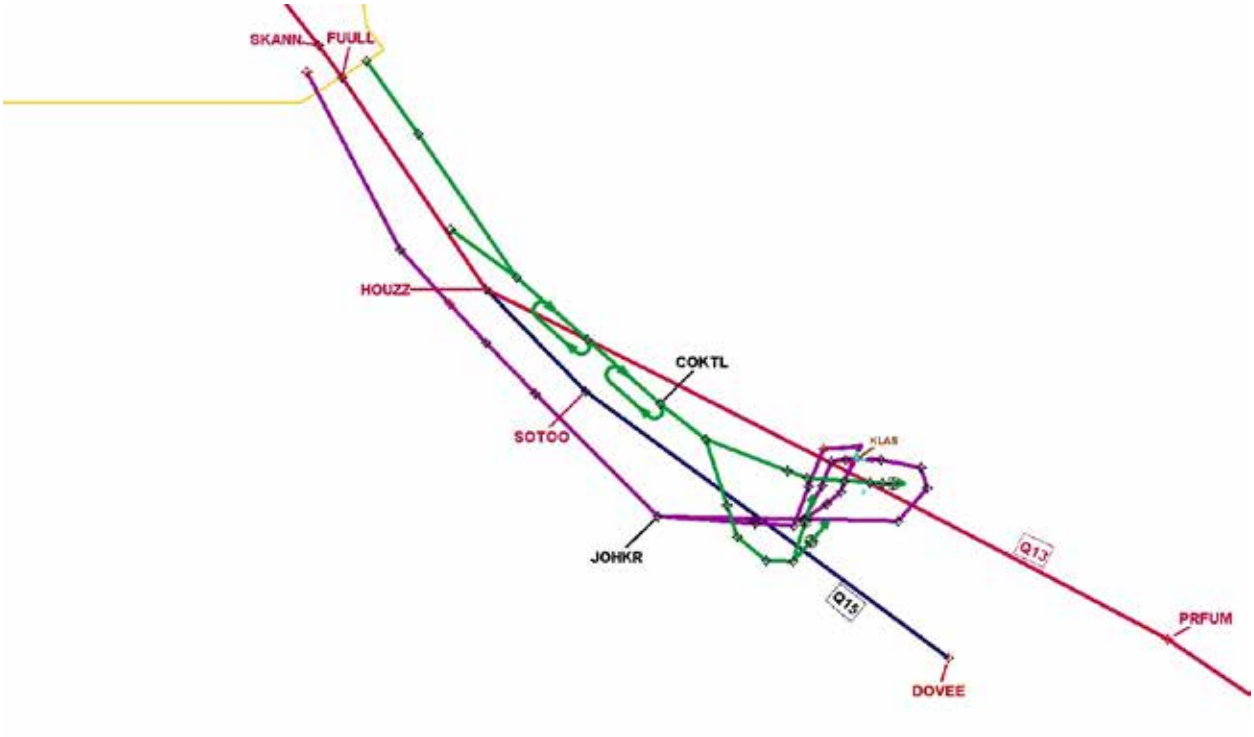

Figure 2: Q13 and Q15 with LAS JOHKR SID and LAS COKTL STAR/need new graphic

Implementation Dependencies

- Requires modifications to ZOA, ZLA and Las Vegas Terminal Radar Approach Control Facility (L30 TRACON) Standard Operating Procedures (SOP) and Letter of Agreement (LOA)
- Requires no airspace modifications
- Requires controller training
- Requires automation changes

Attachments

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
LAS FAA Lead	Date	LAS NATCA Lead	Date
Sarah Fletcher	4/23/19	Martin Ramirez	5/2/19
ZLA Facility POC	Date	ZLA NATCA POC	Date
Anita Engelmann	4/25/19	Dan Hauptman	23 Apr 19
TWAB Representative	Date	L30 NATCA POC	Date
Brett Stewart	5/2/19	Paul Chavez	5/2/19
ZAB Facility Lead	Date	ZAB NATCA Lead	Date

Las Vegas Metroplex Design Package

Q15 AMENDMENT

A Q-Route is an airway that serves as a lateral path for aircraft at or above 18,000 feet that allows flights to traverse airspace or serves as a defined path that allows connectivity to other procedures or other routes to or from airports. Q-Routes are based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

The Las Vegas Metroplex Design and Implementation (D&I) Team has developed new procedures to serve airports located in the Las Vegas Valley. To provide connectivity to and from these new designs and to add lateral distance between aircraft, the D&I Team proposes an amendment to the lateral path of the existing Q15. To reduce complexity and increase flexibility, the team created the waypoint SOTOO where Q15 will join Q13. The purpose of this routing is to segregate overflight traffic on Q15 from McCarran International Airport (KLAS) arrival and departure traffic on the new RNAV Metroplex Area navigation (RNAV) Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs).

This amended routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the NAS.

Las Vegas Metroplex Design Package
Q15 AMENDMENT

Name of Change and Airport/s	Change Classification
Q15 AMENDMENT	**ATS Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☐ **Preliminary Operational Design (PD)** ☒ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
5/31/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) **Sector 16, 34, 35, 36** **Oakland (ZOA) ARTCC** · **Sector 33, 46**	**Proposed Q-Routes** · **Q13 AMENDMENT, Q174**
Associated Data Files	
xxxxxxxxx_LAS_MASTER.tgs	

Purpose

The purpose of the proposed procedure is to address issues identified by the Las Vegas Metroplex Design and Implementation (D&I) Team. This issue was not identified by the Metroplex Study Team (MST):

- The Las Vegas Metroplex Design Team identified a need to amend current Q-Routes in order to increase efficiency throughout ZLA airspace and to help segregate overflight traffic from McCarran International Airport (KLAS) arrival/departure traffic.
- The Q-Route will have limited dependence on ground based navigational aids and will provide a more seamless route structure for aircraft utilizing Area navigation (RNAV) when transitioning from a Standard Instrument Departure (SID)/Standard Terminal Arrival Route (STAR) or for aircraft overflying the airspace or from other Q-Routes.

Design Team Recommendation

The Las Vegas Metroplex D&I Team proposes an amendment to Q15. To reduce complexity and increase flexibility, the team created the waypoint SOTOO where Q15 will join Q13. The purpose of this routing is to segregate overflight traffic on Q15 from KLAS arrival and departure traffic on the new RNAV Metroplex RNAV SIDs and STARs.

Q15 waypoints:

- DOVEE (existing waypoint on Q15)
- SOTOO (placed to segregate from KLAS JOHKR SID and KLAS COKTL STAR)
- HOUZZ (placed to segregate from KLAS JOHKR SID and KLAS COKTL STAR)
- FUULL (placed to segregate from KLAS JOHKR SID and KLAS COKTL STAR)
- SKANN (existing waypoint)

Las Vegas Metroplex Design Package
Q15 AMENDMENT

Figure 1 depicts the current Q13 and Q15 merging in ZOA airspace at the LOMIA waypoint. The current Q15 overlies the new KLAS JOHKR SID, which could result in delays for aircraft departing KLAS receiving higher requested altitudes.

Figure 2 depicts Q13 AMEND and Q15 AMEND merging in ZLA airspace at the new SOTOO waypoint.

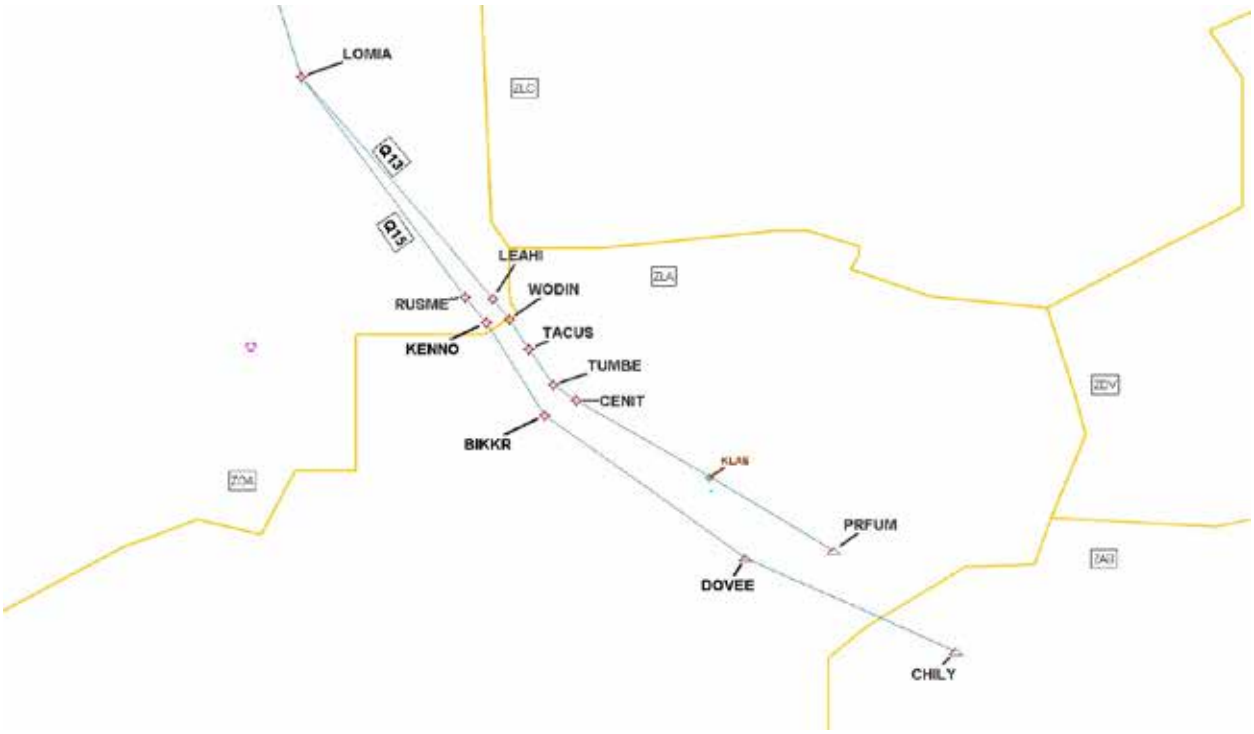

Figure 1: Current Q13 and Q15

Las Vegas Metroplex Design Package
Q15 AMENDMENT

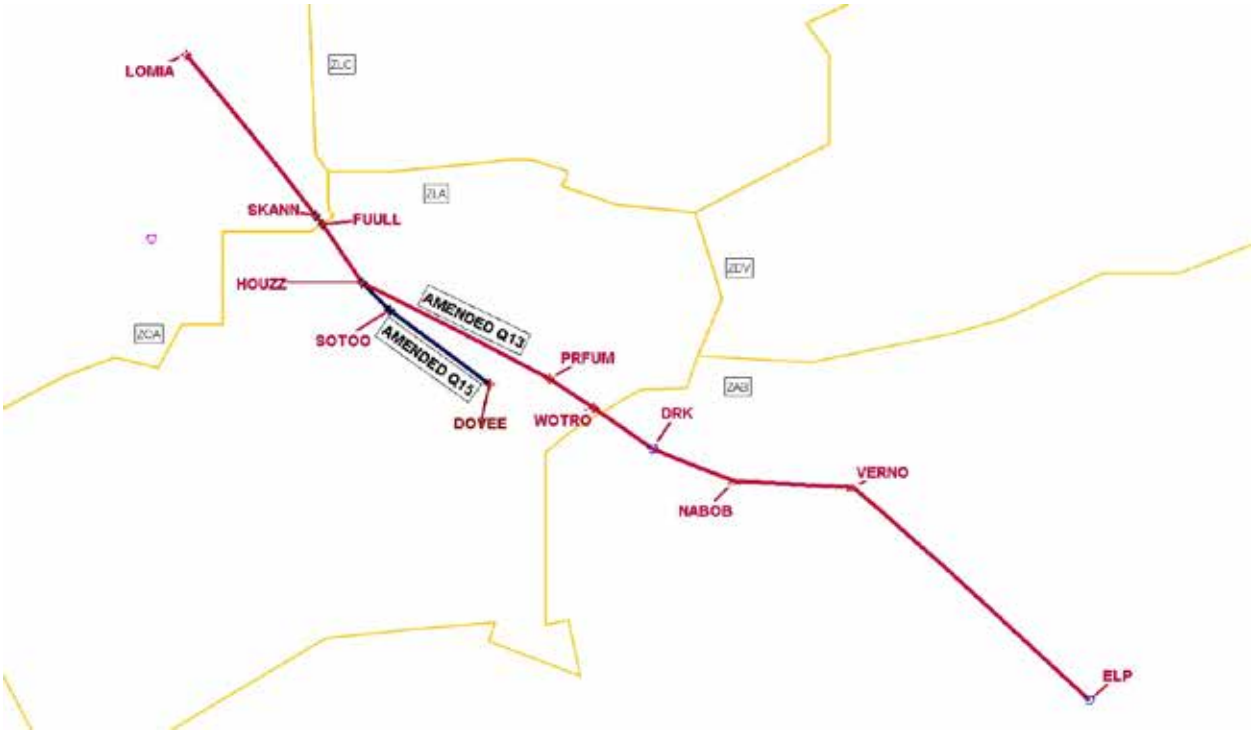

Figure 2: Q13 AMEND and Q15 AMEND

Implementation Dependencies

- There are no procedures dependent on this route.
- Requires modifications to ZLA and ZOA internal Standard Operating Procedures
- Requires modifications to Letter of Agreement between ZLA and ZOA
- Requires no airspace modifications
- Requires controller training
- No automation changes needed

Attachments

- **xxxxxxxxx_LAS_MASTER.tgs**
-

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/14/19
Sarah Fletcher ZLA Facility POC	Date	Martin Ramirez ZLA NATCA POC	Date
	4/30/19		4/30/19
Tommy Thompson ZOA Facility Lead	Date	Jesse Randall ZOA NATCA Lead	Date

Las Vegas Metroplex Design Package

Q174 (Q162 Amend)

A Q-Route is an airway that serves as a lateral path for aircraft at or above 18,000 feet that allows flights to traverse airspace or serves as a defined path that allows connectivity to other procedures or other routes to or from airports. Q-Routes are based on satellite navigation and provides repeatable and predictable paths, reducing complexity and increasing efficiency in the National Airspace System (NAS).

The Las Vegas Metroplex Design and Implementation (D&I) Team has developed new procedures to serve airports located in the Las Vegas Valley. To provide connectivity to and from these new designs and to add lateral distance between aircraft, the D&I Team proposed an amendment to the lateral path of the existing Q162.

Because existing procedures utilize waypoints on Q162, it is impossible to amend the Q-Route without having an impact on current operations. The D&I Team elected to develop a new Q-Route that incorporates the planned changes to Q162 but allows independent implementation that will not disrupt current operations.

The new Q174 will provide connectivity to the proposed McCarran International Airport (KLAS) COKTL Standard Terminal Arrival Route (STAR) at the FLCHR waypoint.

This amended routing will reduce complexity and workload for both controller and flight crews along with increasing efficiency in the NAS.

After implementations of both Q174 and the KLAS COKTL STAR, Oakland ARTCC will evaluate whether Q162 will be removed from the National Airspace System (NAS)

Las Vegas Metroplex Design Package

Q174 (Q162 Amend)

Name of Change and Airport/s	Change Classification
Q174	**ATS Route**
OAPM Study Team Reference(s)	**Current Phase of Design**
N/A	☒ **Preliminary Operational Design (PD)** ☐ **Proposed Final Design (PFD)**
Package Date	**Implementation Date**
2/22/2019	**TBD**
Affected Airport(s), Facilities and Positions, Areas, and/or Sectors	**Related/Dependent Submissions**
Los Angeles Air Route Traffic Control Center (ZLA ARTCC) Sector 16 **Oakland (ZOA) ARTCC Sectors 33, 46**	**N/A**
Associated Data Files	
xxxxxxxxx_LAS_MASTER.tgs	

Purpose

The purpose of the proposed procedure is to address issues identified by the Las Vegas Metroplex Design and Implementation (D&I) Team. This issue was not identified by the Metroplex Study Team (MST):

- The Las Vegas Metroplex Design Team identified a need to amend the current Q-routes to increase the efficiency throughout ZLA airspace and to help segregate overflight traffic from McCarran International Airport (KLAS) arrival/departure traffic.
- The Q-Route will have limited dependence on ground based navigational aids and will provide a more seamless route structure for aircraft utilizing RNAV when transitioning from a Standard Instrument Departure (SID)/Standard Terminal Arrival Route (STAR) or for aircraft transitioning the airspace or from other Q-Routes.
- Q174 will provide connectivity from California Bay Area airports to the new KLAS COKTL STAR and to/from Q13 and Q15.

Design Team Recommendation

The D&I Team originally proposed an amendment to the existing Q162 to provide connectivity with the proposed McCarran International Airport (KLAS) COKTL STAR. The Q162 amendment was expected to connect to the KLAS COKTL STAR at FLCHR.

Q162 currently shares waypoints located on existing arrival procedures and is utilized for transitioning from the en route environment to the arrival phase of flight. Because the changes required to provide connectivity to newly designed Metroplex procedures would involve waypoint changes and affect existing procedures, the D&I Team elected to develop a new Q-Route (Q174).

Las Vegas Metroplex Design Package

Q174 (Q162 Amend)

After implementations of both Q174 and the KLAS COKTL STAR, the Las Vegas Metroplex Evaluation Team, ZLA and ZOA will evaluate whether Q162 will be removed from the National Airspace System (NAS).

Figure 1 depicts the proposed Q174 and current Q162.

Q174 waypoints:

- NTELL (on the current Q162 and will be utilized as the initial fix on Q174)
- CABOB (existing fix used to avoid Special Use Airspace (SUA) and for leg length design criteria)
- TTMSN (placed as a holding fix for ZOA)
- SKANN (placed to provide connectivity to Q13/Q15 and for design criteria)
- FLCHR (allows connectivity to the KLAS COKTL STAR)

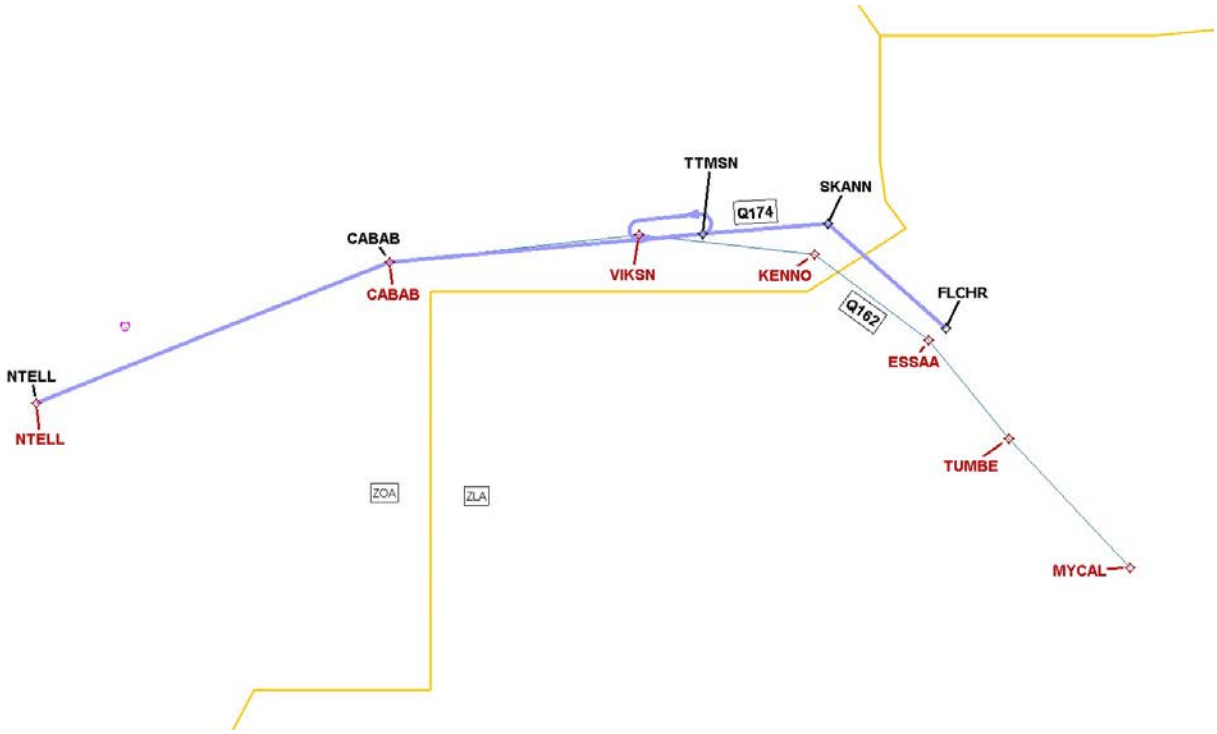

Figure 1: Proposed Q174 and Current Q162

Las Vegas Metroplex Design Package

Q174 (Q162 Amend)

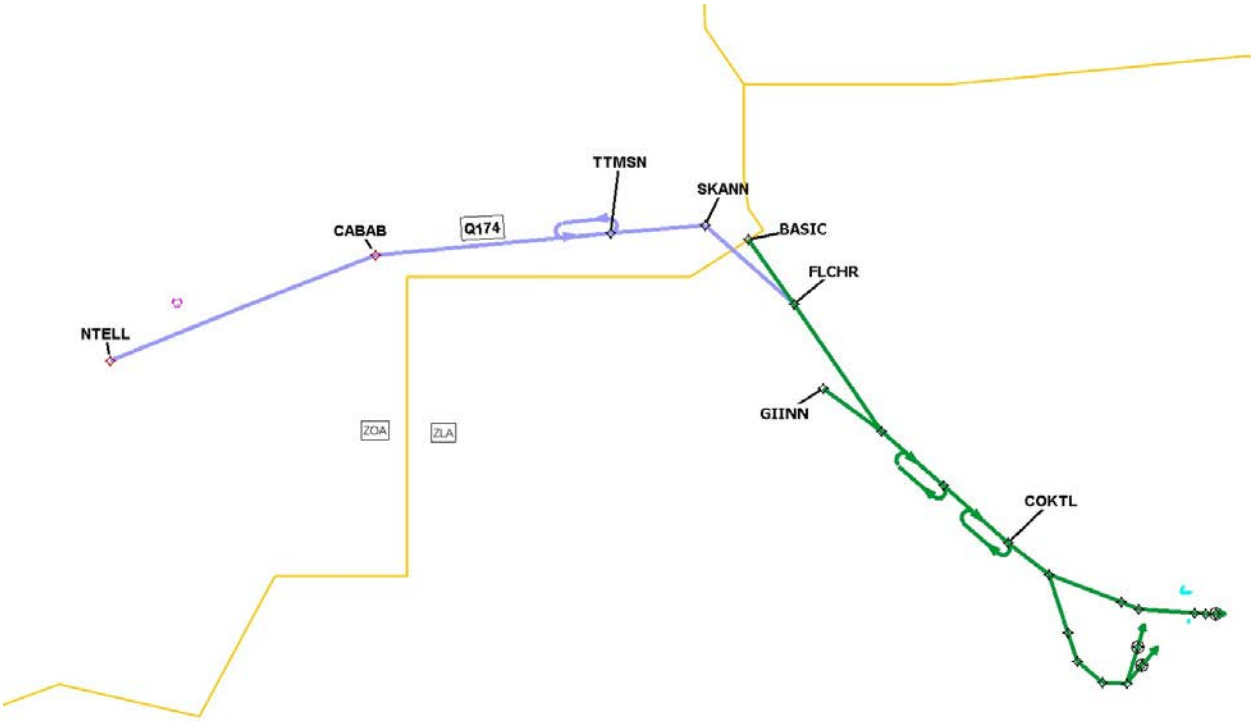

Figure 2 Q174 and Proposed KLAS COKTL STAR

Design Considerations

Q174 was designed to allow a defined path for overflights through ZOA airspace transitioning for landing at KLAS or KVGT. It allows connectivity to Q13 and Q15.

Implementation Dependencies

- There are no procedures dependent on this route.
- Requires modifications to ZLA and ZOA Standard Operating Procedures
- Requires modifications to Letter of Agreement between ZLA and ZOA
- Requires no airspace modifications
- Requires controller training
- No automation changes needed

Attachments

xxxxxxxxx_LAS_MASTER.tgs

Review Signatures

The D&I Team have reached agreement through consensus on these procedures using the OAPM process in accordance with the OAPM Memorandum of Understanding.

Bradley R. Mayhugh	4/23/19	Chris Thomas	4/23/19
Bradley R. Mayhugh LAS FAA Lead	Date	Chris Thomas LAS NATCA Lead	Date
	4/23/19		5/14/19
Sarah Fletcher ZLA Facility POC	Date	Martin Ramirez ZLA NATCA POC	Date
	4/30/19		4/30/19
Tommy Thompson ZOA Facility Lead	Date	Jesse Randall ZOA NATCA Lead	Date