

# **Enclosure 4**

(Ref. Technical Letter F500-L16-039)



**Center for Advanced  
Aviation System Development**

## **Dual Independent Test-Bed Operations at Cancún**

***Initial Concept of Operations, Letters of Agreement,  
and Standard Operating Procedures in Support of  
Human-In-The-Loop Simulations***

**Prepared for**

**Aeropuertos y Servicios Auxiliares**

**30 June 2016**

## Principal Acronyms and Abbreviations

<b>ACC</b>	Area Control Center
<b>AIP</b>	Aeronautical Information Publication
<b>APP</b>	Approach
<b>ARR</b>	Arrival
<b>ATCT</b>	Air Traffic Control Tower
<b>ATIS</b>	Automatic Terminal Information Service
<b>CDO</b>	Continuous Descent Operations
<b>ConOps</b>	Concept of Operations
<b>CTM</b>	Chetumal VOR/DME
<b>CUN</b>	Cancún VOR/DME
<b>CZA</b>	Chichen Itza VOR/DME
<b>CZM</b>	Cozumel VOR/DME
<b>CZM App</b>	Cozumel Approach
<b>DEP</b>	Departure
<b>DGAC</b>	Dirección General de Aeronáutica Civil
<b>DME</b>	Distance Measuring Equipment
<b>FAC</b>	Final Approach Course
<b>FL</b>	Flight Level
<b>ft</b>	Feet
<b>HITL</b>	Human-In-The-Loop
<b>IAC</b>	Instrument Approach Chart
<b>IAP</b>	Instrument Approach Procedure
<b>ICAO</b>	International Civil Aviation Organization
<b>IFR</b>	Instrument Flight Rule
<b>ILS</b>	Instrument Landing System
<b>KIAS</b>	Knots Indicated Air Speed
<b>LOA</b>	Letter of Agreement
<b>MID ACC</b>	Mérida Area Control Center

<b>MITRE</b>	The MITRE Corporation
<b>MMAC</b>	Cancún Approach Control
<b>MMCZ</b>	Cozumel International Airport
<b>MMUN</b>	Cancún International Airport
<b>MON</b>	Monitor Position
<b>NAICM</b>	Nuevo Aeropuerto Internacional de la Ciudad de México
<b>NM</b>	Nautical Miles
<b>NTZ</b>	No Transgression Zone
<b>RNAV</b>	Area Navigation
<b>SENEAM</b>	Servicios a la Navegación en el Espacio Aéreo Mexicano
<b>SID</b>	Standard Instrument Departure
<b>SOP</b>	Standard Operating Procedure
<b>STAR</b>	Standard Terminal Arrival Route
<b>SVFR</b>	Special Visual Flight Rules
<b>TBD</b>	To Be Determined
<b>TCP</b>	Transfer of Control Point
<b>TMA</b>	Terminal Maneuvering Area
<b>VFR</b>	Visual Flight Rules
<b>VHF</b>	Very High Frequency
<b>VOR</b>	VHF Omnidirectional Range
<b>WP</b>	Waypoint



## 1. Introduction

The MITRE Corporation (MITRE) is assisting through Aeropuertos y Servicios Auxiliares the aviation authorities of Mexico with the implementation of a new airport to serve Mexico City, referred to in this document as Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM), to replace the current Aeropuerto Internacional de la Ciudad de México (International Civil Aviation Organization [ICAO] code MMMX). The proposed runway layout of NAICM will allow for dual-and triple-independent arrival and departure operations. In connection with that, MITRE is assisting the Mexican aviation authorities in implementing independent arrival and departure operations at Aeropuerto Internacional de Cancún (hereinafter referred to by its ICAO code MMUN) to and from its two existing parallel runways. This would provide a significant increase in capacity for MMUN. Moreover, it would also allow MMUN to serve as a test-bed location where Mexican air traffic controllers could obtain an understanding of the issues associated with independent operations and gain valuable experience for the future implementation of such procedures at NAICM.

> As part of the assistance being provided to Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM) to plan the necessary changes that will permit the introduction of independent approach and departure operations at MMUN, SENEAM and MITRE have conducted several meetings, workshops, and telephone conference calls to help ensure that SENEAM is fully aware of the many aspects and tasks that must be completed in order to transition smoothly to these complex arrival and departure operations. Most recently SENEAM and MITRE conducted an intense airspace design workshop in late January 2016 where MITRE presented a refined airspace design and worked with SENEAM on planning matters in preparation for upcoming Human-In-The-Loop (HITL) simulations to evaluate the airspace design for the Cancún/Cozumel Terminal Control (Maneuvering) Area (TMA).

This document provides MITRE's input pertaining to a potential Concept of Operations (ConOps) to support dual independent test-bed operations at MMUN. Information contained in this document should also serve as a baseline for upcoming dual independent operation HITL simulations. It is important to mention that this document was prepared by MITRE's Subject Matter Experts (SMEs) who have decades of experience conducting dual independent operations at both Denver International Airport (ICAO code KDEN) and the Hartsfield-Jackson Atlanta International Airport (ICAO code KATL).

This document compares the current operations at Mérida Area Control Center (MID ACC), and Cancún Approach Control (MMAC), including operations in and out of MMUN and Cozumel International Airport (hereinafter referred to by its ICAO code MMCZ) vs. the proposed ConOps that are being considered at these facilities. The ConOps is based on the airspace designs being examined by SENEAM and MITRE as of 1 May 2016. Note that these designs, however, may change based on future workshops, discussions and review sessions.

Standard Operating procedures (SOPs) and Letters of Agreement (LOAs) are necessary to establish standardized operating practices that should be adhered to during dual independent operations at MMUN. While SOPs are necessary to outline air traffic controller's actions during dual independent operations at MMUN, LOAs document operational and procedural needs requiring the cooperation and concurrence of other persons, facilities and/or organizations.



The initial ConOps, and associated LOAs and SOPs are intended to be initial drafts for review and consideration by SENEAM. The ConOps and other documents represent a first cut at the development of documents that need to be revisited and revised as airspace and procedure design, as well as other activities advance and move closer to operational implementation. The LOAs and SOPs also provide a starting point for the development of documents for the upcoming Cancún HITL simulations by aiding participants in understanding how dual independent operations are conducted. These documents may also be used later on as the basis for the development of actual SOPs and LOAs for MID ACC, MMAC, and MMUN Air Traffic Control Tower (ATCT).

This document is structured as follows:

- Section 2 compares current airspace and operations to the initial draft ConOps at MID ACC (as it affects dual independent operations at MMUN), MMAC, and MMUN ATCT
- Section 3 presents initial draft SOPs and LOAs to support the future ConOps described in Section 2
- Section 4 provides a summary and discusses next steps

## 2. Current Operations and Proposed ConOps

The following section describes the current airspace design and operations at MID ACC and MMAC along with a proposed ConOps for MID ACC and MMAC. The proposed ConOps supports dual independent arrival and departure operations at MMUN.

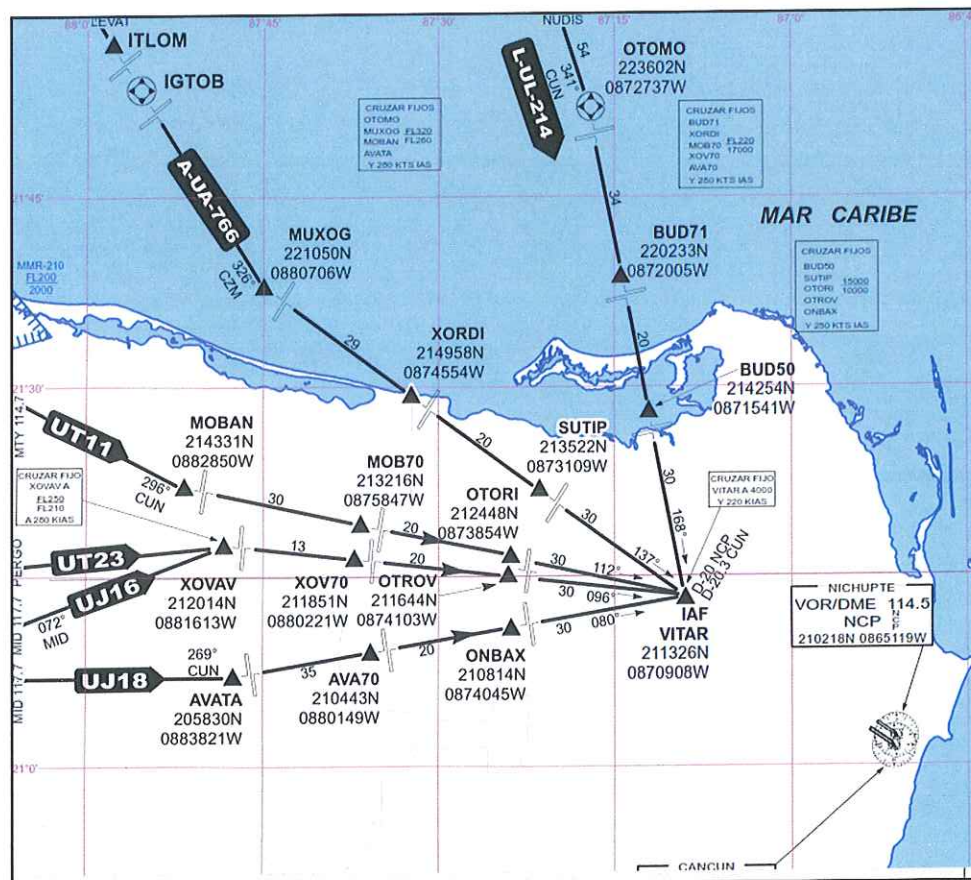
### 2.1 MID ACC Operations

Current operations are described in Section 2.1.1. The proposed ConOps is described in Section 2.1.2.

#### 2.1.1 MID ACC Current Operations

MID ACC radar controllers deliver aircraft to MMAC from three main flows: one from the northwest, one from the northeast, and one from the south. Required spacing is 10 nautical miles (NM) in-trail on each flow. Approximately 70% of the aircraft arrive from the northwest sector (Sector 4) on Continuous Descent Operation (CDO) Standard Terminal Arrival Routes (STARs) to cross VITAR at 4000 feet (ft)<sup>1</sup> and 220 knots indicated air speed (KIAS) when landing Runways 12L/R, or on a CDO to cross VITAR between 11,000 and 13,000 ft and 250 KIAS when landing Runways 30L/R. Some aircraft are taken off the STAR and cleared direct to the VITAR intersection. These aircraft are instructed to cross VITAR at the altitudes and speeds described above. Figure 1 depicts the STARs for Runways 12L/R and Figure 2 depicts the STARs for Runway 30L/R.

<sup>1</sup> All altitudes are in feet above Mean Sea Level

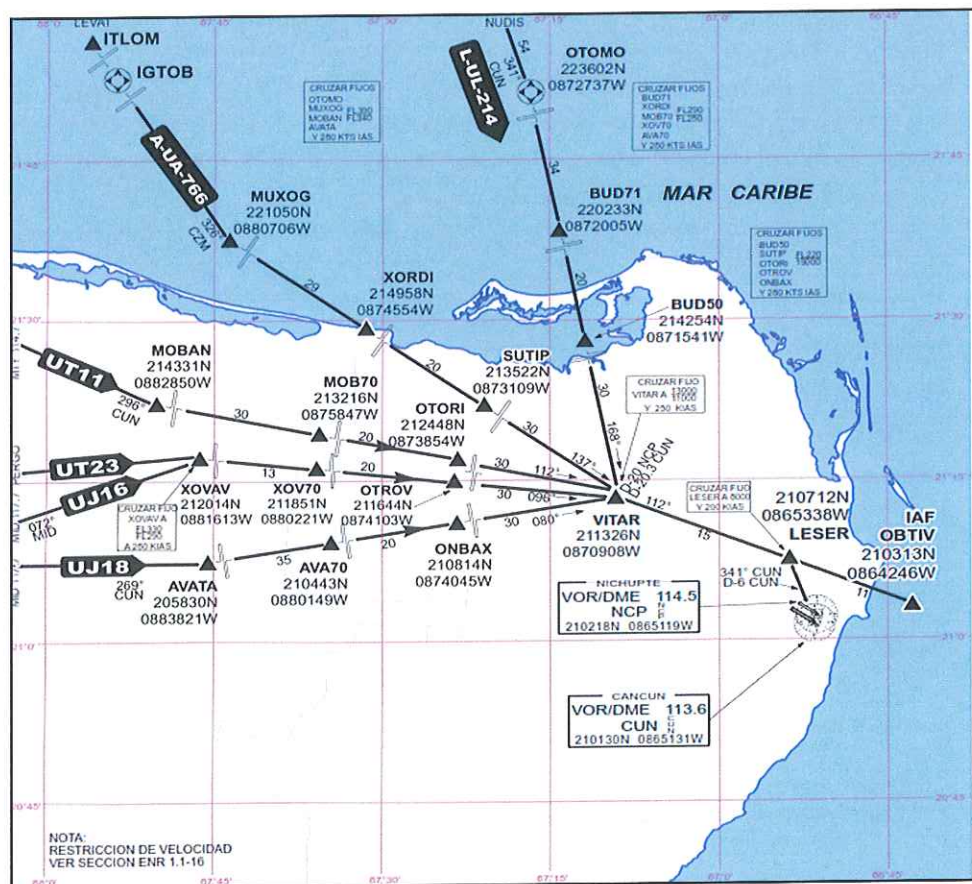


Source: Mexico AIP, March 2016

Figure 1. MMUN Runways 12L/R STAR

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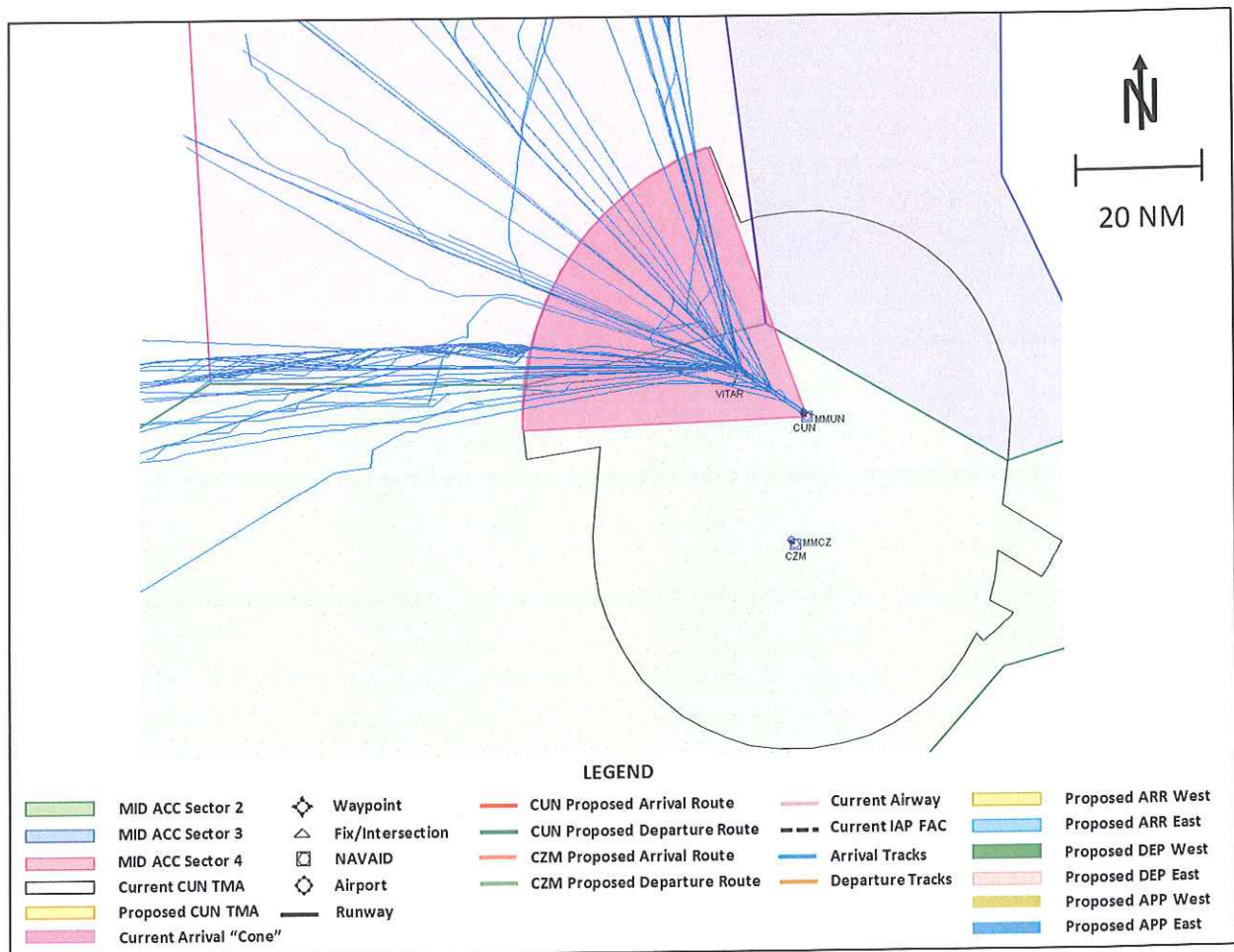


Source: Mexico AIP, March 2016

**Figure 2. MMUN Runways 30L/R STAR**

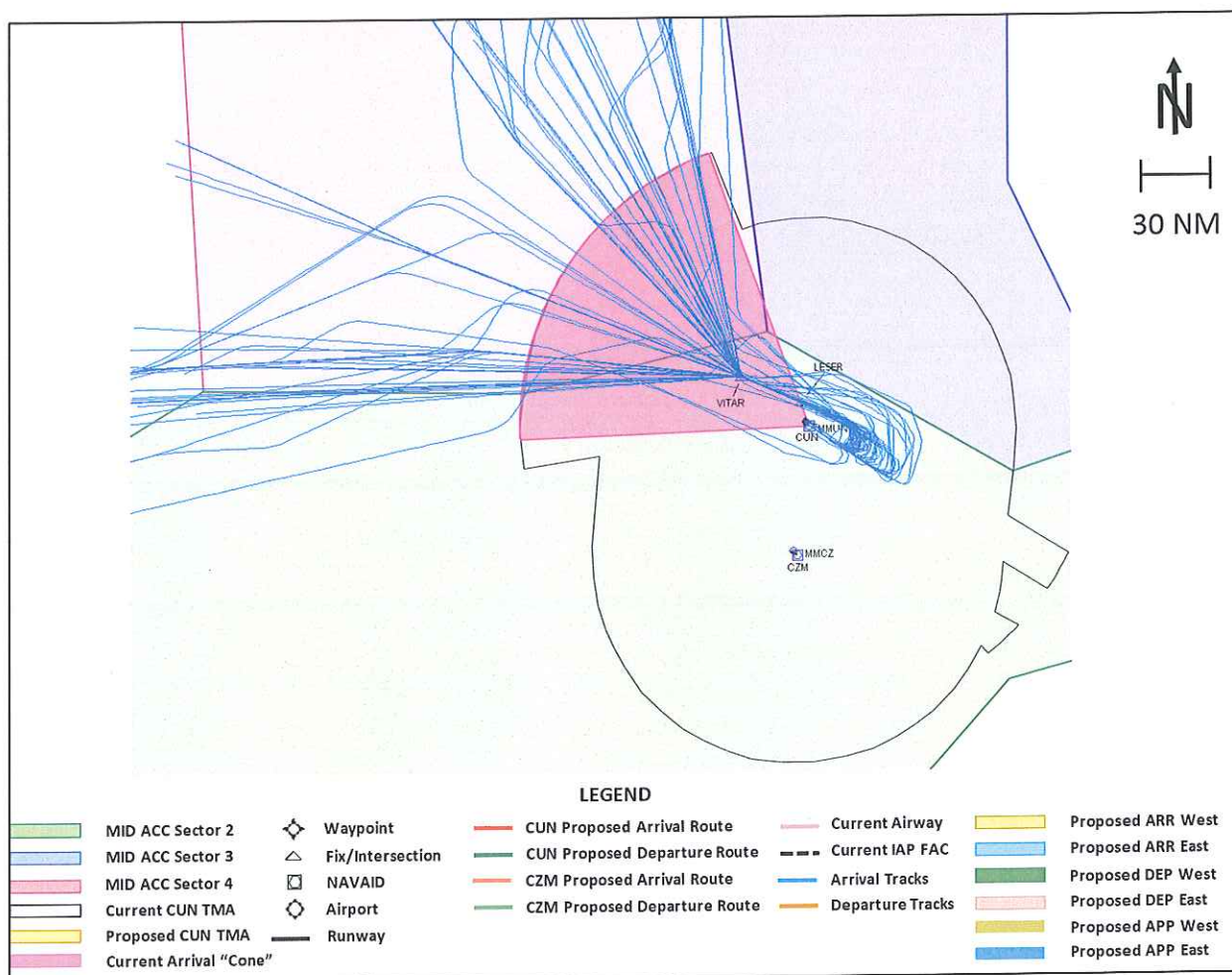
This current method of delivering aircraft is often referred to as a “cone” concept. MID ACC delivers aircraft into the “cone” on multiple routes that merge at VITAR. Figure 3 depicts the Sector 4 arrival tracks for aircraft landing Runways 12L/R, and Figure 4 depicts the Sector 4 arrival tracks for aircraft landing Runways 30L/R. The “cone” is depicted in both figures. All radar track data in the following images are based on data from MITRE’s Global Data Repository, which includes MITRE’s Threaded Track (synthetic surveillance track based on fusion of radar, Automatic Dependent Surveillance – Broadcast [ADS-B], and relevant automation systems), MITRE-owned ADS-B receivers, Aircraft Communications Addressing and Reporting System (ACARS), Aircraft Meteorological Data Reporting (AMDAR), Innovata, Official Airline Guide (OAG), FlightRadar24, Jeppesen, Advanced Technologies and Oceanic Procedures (ATOP), International Civil Aviation Organization (ICAO) Global Flight Information Regions (FIRs), National Oceanic and Atmospheric Administration (NOAA) Global Forecast System (GFS), Meteorological Aviation Reports (METAR), and National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM).





**Figure 3. MID ACC Sector 4 Arrival Tracks for Aircraft Landing Runways 12L/R**

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**Figure 4. MID ACC Sector 4 Arrival Tracks for Aircraft Landing Runways 30L/R**

Approximately 20% of the aircraft arrive from the northeast sector, Sector 3, descending to Flight Level (FL) 240 and are cleared via UB879 to the Cancún Very High Frequency (VHF) Omnidirectional Range (VOR)/Distance Measuring Equipment (DME), designated as CUN. Most of these arrivals originate from Florida. Aircraft are handed off to the MMAC Arrival position and are normally advised to expect vectors for the Instrument Landing System (ILS) Runway 12L Approach, VOR/DME Runway 30L Approach, or a visual approach. Figure 5 depicts UB879 and Sector 3 arrival tracks for aircraft landing Runways 12L/R and Figure 6 depicts UB879 and Sector 3 arrival tracks for aircraft landing Runways 30L/R. A single radar controller staffs this sector.

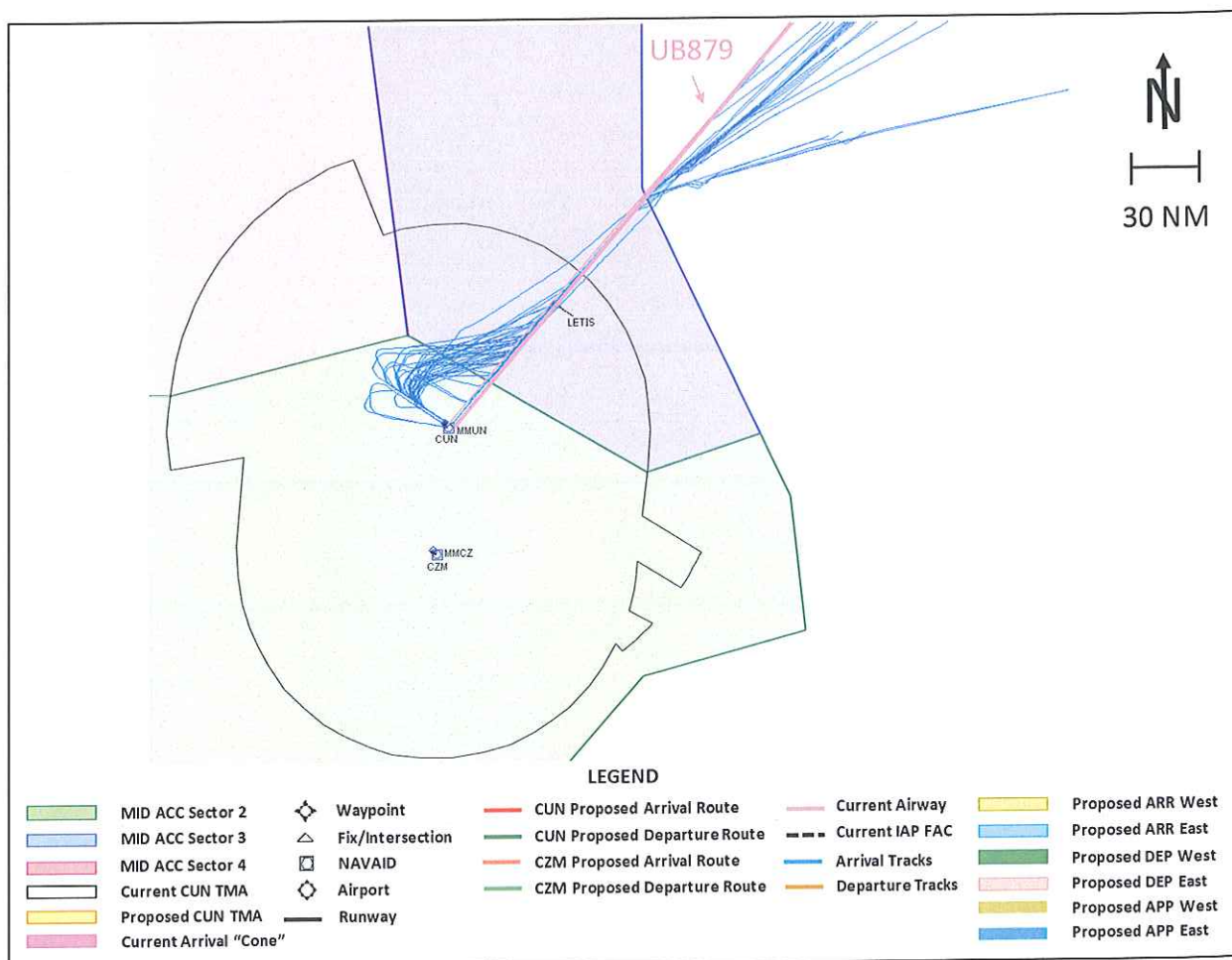
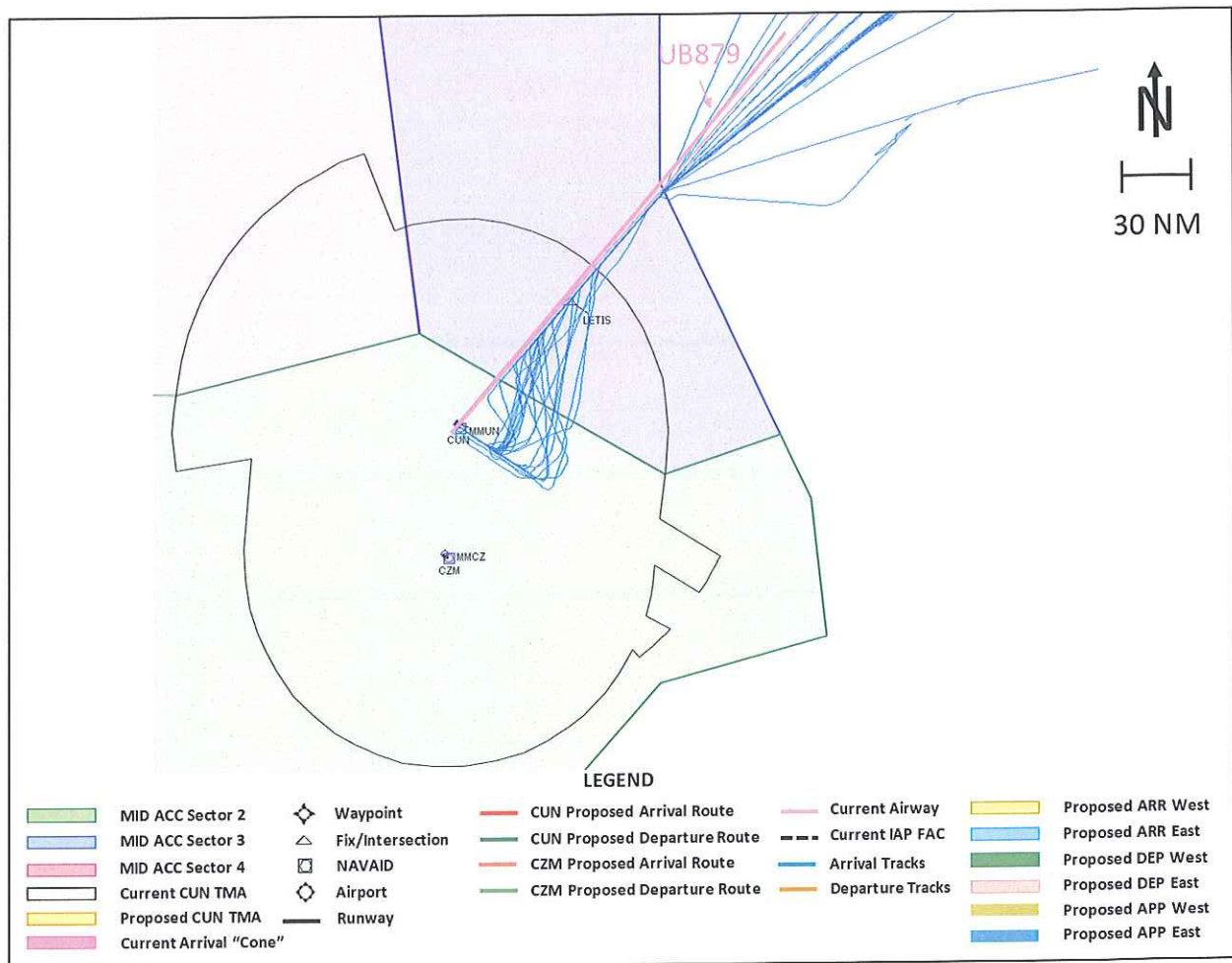


Figure 5. MID ACC Sector 3 Arrival Tracks for Aircraft Landing Runways 12L/R

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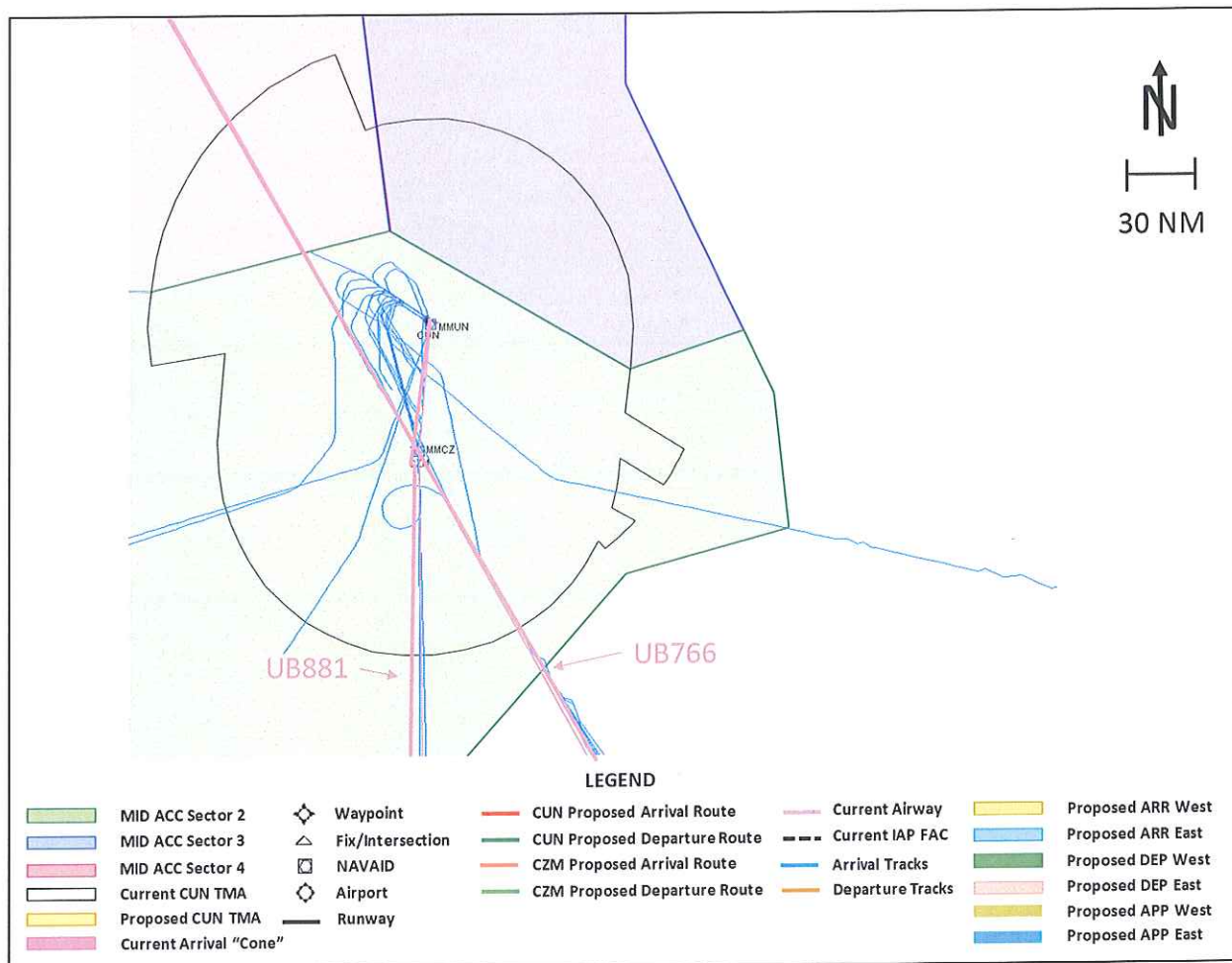




**Figure 6. MID ACC Sector 3 Arrival Tracks for Aircraft Landing Runways 30L/R**

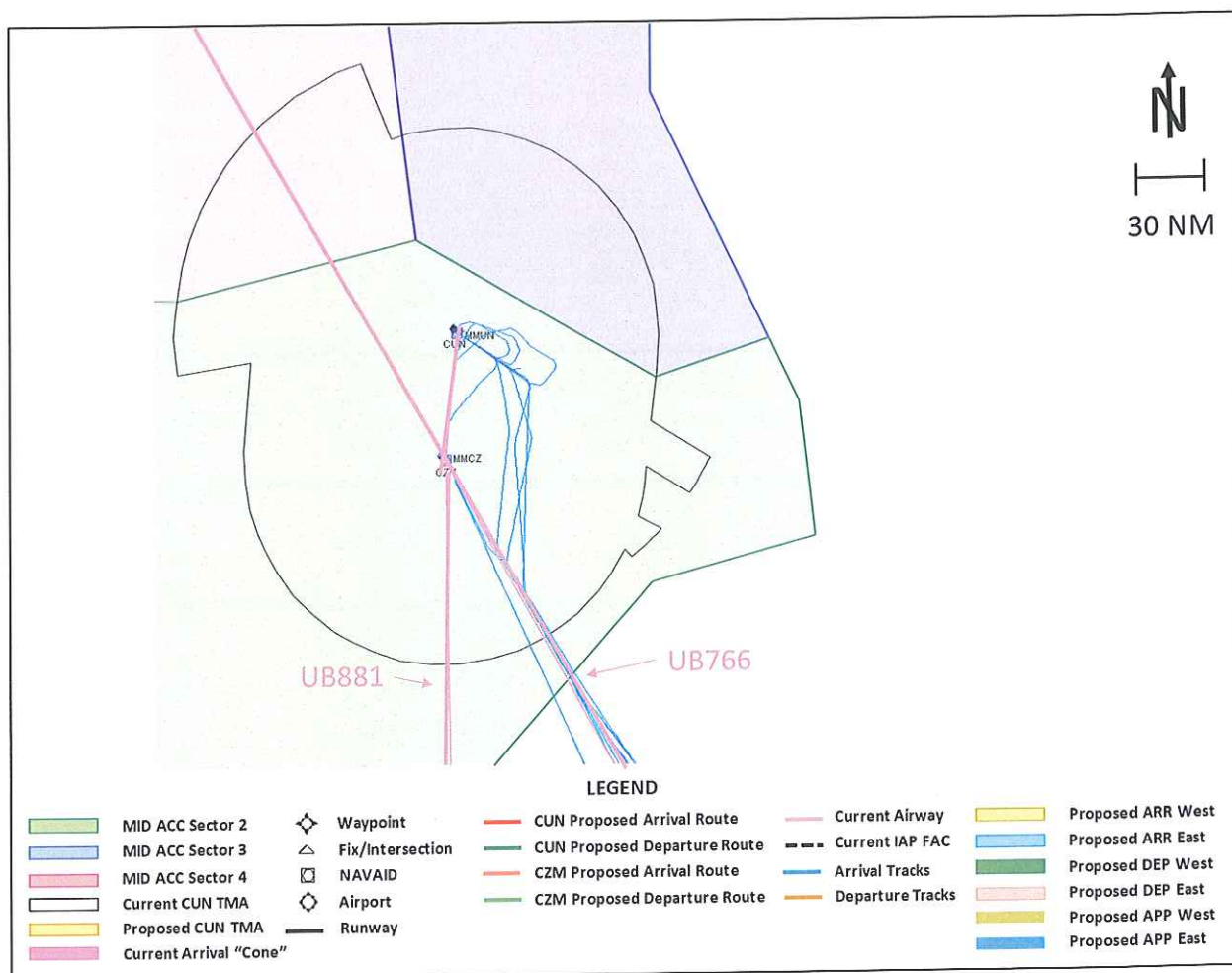
The remaining aircraft arrive from the south sector, Sector 2. Jet traffic is normally descending to FL210 and are cleared via UA766 or UB881 to CUN. Other aircraft may be cleared on different routes and altitudes as coordinated. The arrivals from the south generally originate in Central and South America. Aircraft are handed off to the MMAC Departure (DEP) South<sup>2</sup> position and are cleared to the Cozumel VOR/DME (CZM). Aircraft are normally advised to expect vectors for an ILS Runway 12L Approach or the VOR/DME Runway 30R Approach. Figure 7 depicts Sector 2 arrival tracks for aircraft landing Runways 12L/R and Figure 8 depicts Sector 2 arrival tracks for aircraft landing Runways 30L/R. UA766 and UB881 are depicted in both images. A single radar controller staffs this sector.

<sup>2</sup> DEP South is commonly referred to as CZM Approach by MMAC. CZM App will be used in this document.



**Figure 7. MID ACC Sector 2 Arrival Tracks for Aircraft Landing Runways 12L/R**

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**Figure 8. MID ACC Sector 2 Arrival Tracks for Aircraft Landing Runways 30L/R**

Other low performance aircraft flying at lower altitudes are assigned published arrival routes as designated in the MID ACC/MMAC LOA.

### 2.1.2 MID ACC Proposed ConOps

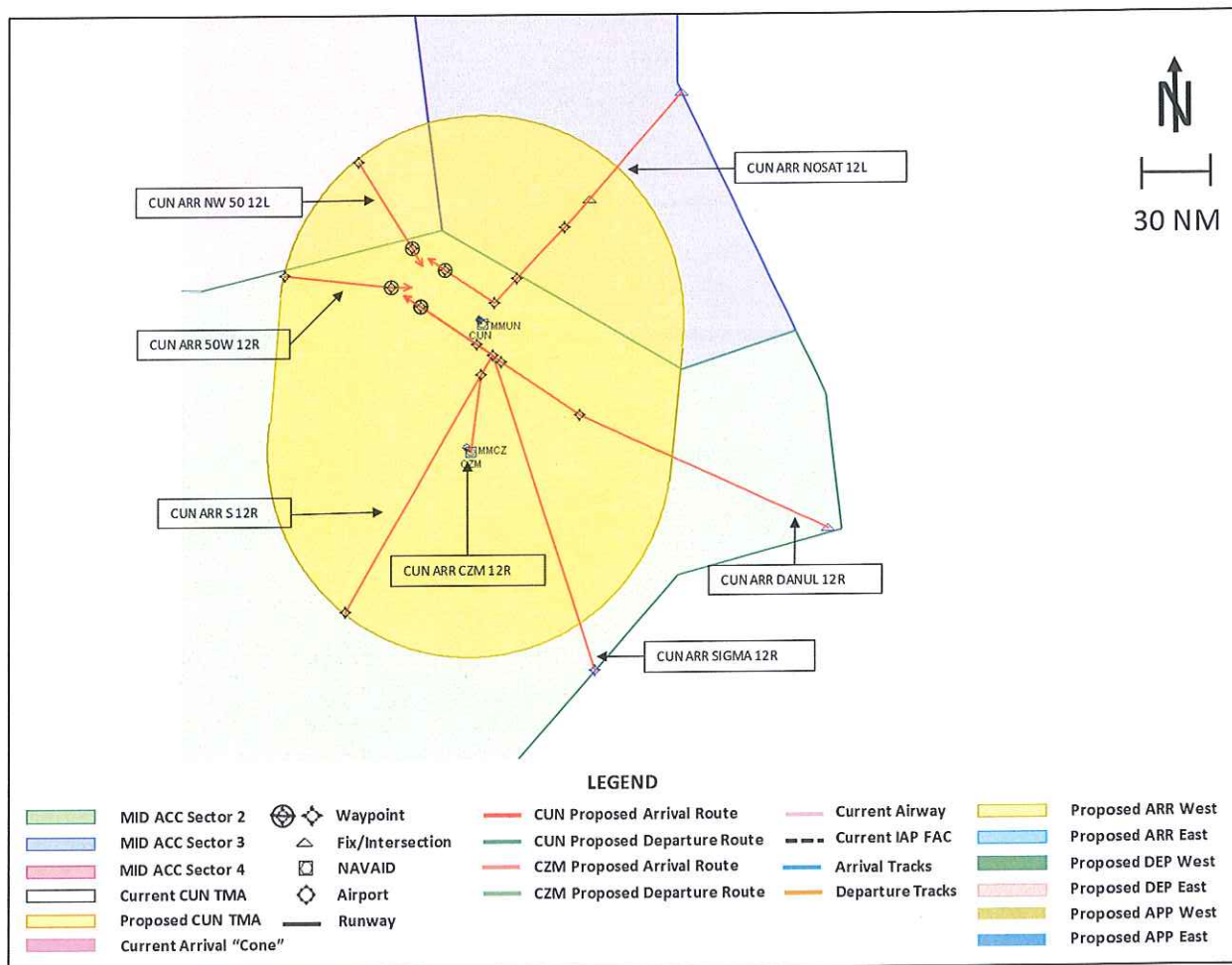
The proposed ConOps for MID ACC contains 13 Area Navigation (RNAV) STARs for MMUN. Seven of the STARs will serve aircraft landing Runways 12L/R and six will serve aircraft landing Runways 30L/R. These STARs are “open” STARs<sup>3</sup> as opposed to “closed” STARs<sup>4</sup>. The proposed STARs from the northwest will no longer merge into a single fix, but will be delivered over two separate fixes to enable a more balanced feed for dual independent runway operations. Aircraft from the northeast and south will be assigned CDO STARs as opposed to the current non-STAR routings. Altitudes for the CDOs will be developed in subsequent workshops. Figure 9 depicts the conceptual STARs for aircraft landing Runways 12L/R. It is anticipated that aircraft arriving on the CUN ARR NOSAT 12L and CUN ARR NW

<sup>3</sup> STARs that end on a leg with an aircraft flying a heading or track

<sup>4</sup> STARs that end by intercepting a final approach course

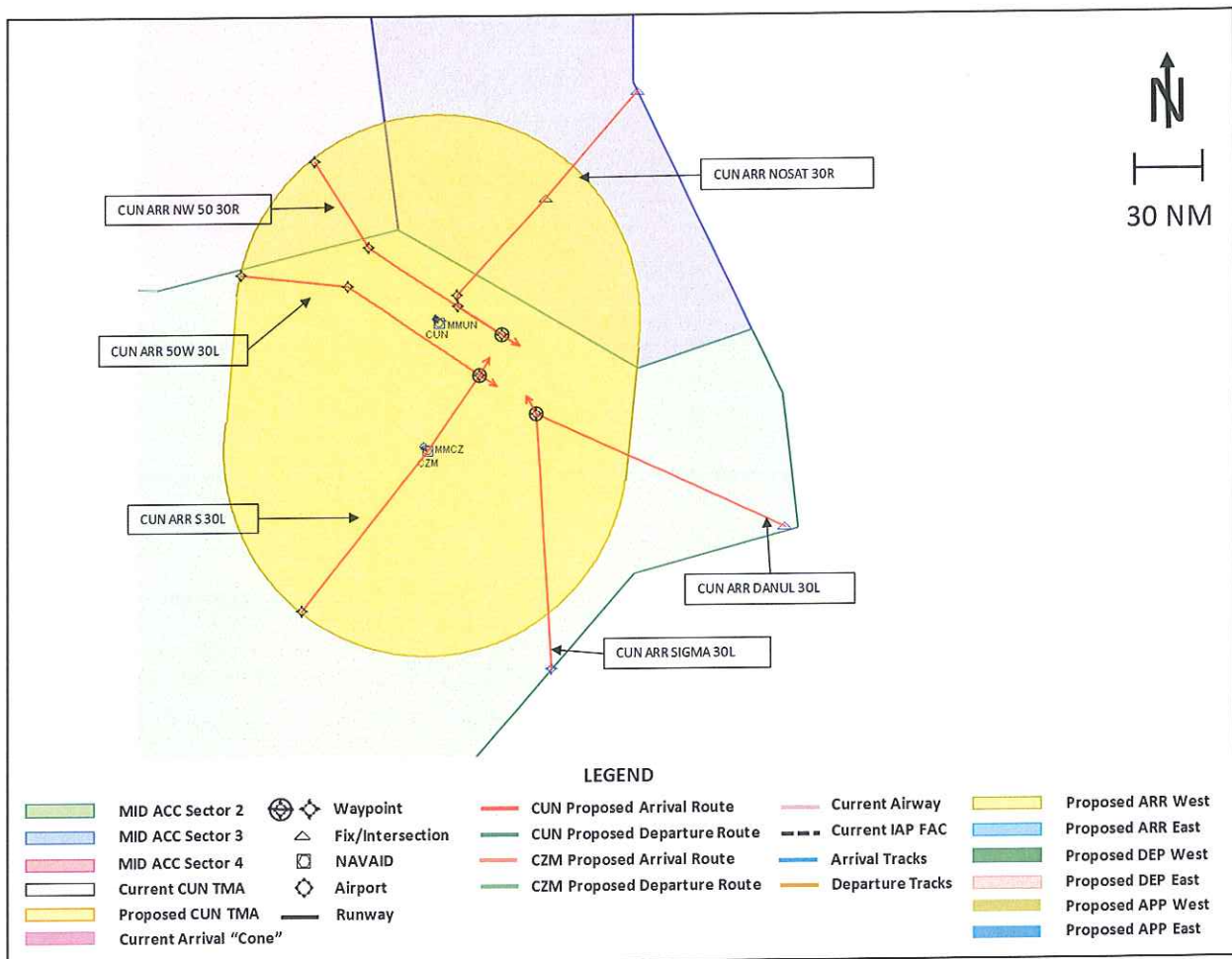


50 12L STARs will land on Runway 12L and aircraft arriving on the CUN ARR 50W 12R, CUN ARR S 12R, CUN ARR CZM 12R, CUN ARR SIGMA 12R, and CUN ARR DANUL 12R STARs will land on Runway 12R.



**Figure 9. Conceptual MMUN STARs for Aircraft Landing Runways 12L/R**

Figure 10 depicts the conceptual STARs for aircraft landing Runways 30L/R and the conceptual TMA airspace (further discussion in Section 2.2.2). It is anticipated that aircraft arriving on the CUN ARR NOSAT 30R and CUN ARR NW 50 30R STARs will land on Runway 30R and aircraft arriving on the CUN ARR 50W 30L, CUN ARR S 30L, CUN ARR SIGMA 30L, and CUN ARR DANUL 30L STARs will land on Runway 30L. Aircraft are delivered at the same initial fixes whether landing on Runways 12L/R or Runways 30L/R.



**Figure 10. Conceptual MMUN STARs for Aircraft Landing Runways 30L/R**

Other low performance aircraft flying at lower altitudes will be assigned arrival routes as designated in the MID ACC/MMAC LOA. These routes may be modified based on the final STAR designs.

## 2.2 Cancún TMA Arrival Sector

Current operations are described in Section 2.2.1. The proposed ConOps is described in Section 2.2.2.

### 2.2.1 Cancún TMA Current Arrival Sector Current Operation

MMAC operates two different sectors for arriving aircraft: Arrival (ARR) and Approach (APP). ARR sequences traffic from the three MID ACC arrival flows along with regional general aviation flights and low performance aircraft in order to deliver aircraft to MMUN ATCT with 3 to 7 NM separation, depending on aircraft types and runway designation. ARR is staffed with a single controller when this position is operational. The ARR and APP sectors can be combined and/or de-combined with increases and decreases in traffic volume.

APP is normally staffed from 1000 to 1700 local and other times, depending on traffic volume or workload complexity. When APP is staffed, ARR sequences aircraft to APP in such a manner that enables APP to deliver aircraft to MMUN ATCT with 3 to 7 NM separation.

For Runway 12L/R operations, aircraft are almost always sequenced to Runway 12L as Runway 12R is the primary departure runway due to taxiway constraints. ARR may on occasion sequence aircraft for Runway 12R when this represents an operational advantage or at a pilot's request (when possible). Simultaneous approaches to both runways are only approved when both aircraft are on visual approaches or a minimum of 3 NM is maintained between aircraft. When APP is staffed, sequencing aircraft to Runway 12R is normally coordinated between the ARR and APP sectors.

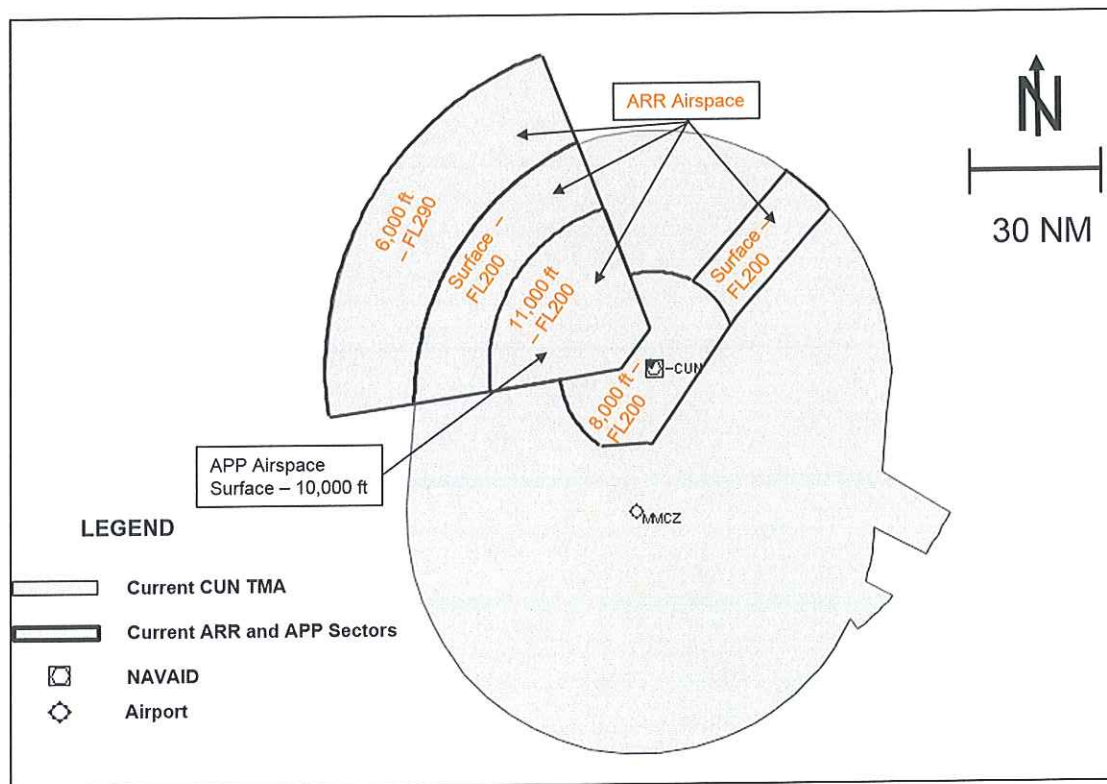
For Runway 30L/R operations, aircraft are sequenced to Runway 30L, as Runway 30R does not have taxiways to clear the runway after landing. It should be noted that MMUN ATCT manages the use of Runway 12R and 30R for low performance traffic and local Visual Flight Rules (VFR) flights.

ARR shares a portion of airspace with both APP and DEP on a vertically segregated basis in areas where airspace overlaps. Within 20 NM of CUN, in airspace not delegated to APP, DEP is delegated airspace from the surface to 7,000 ft. ARR is delegated airspace from 8,000 ft to FL200, except in the 50 NM to 70 NM shelf northwest of CUN where ARR is delegated 6,000 ft to FL290 and the area above APP airspace where ARR is delegated 11,000 ft to FL 200.

Aircraft controlled by DEP that must climb through ARR airspace remain on DEP control frequency and coordination for climb is accomplished on an individual basis. Figure 11 depicts current ARR and APP airspace when landing Runways 12L/R. Figure 12 depicts current ARR and APP airspace when landing Runways 30L/R. All airspace not designated to ARR or APP is delegated to DEP North or Cozumel APP.

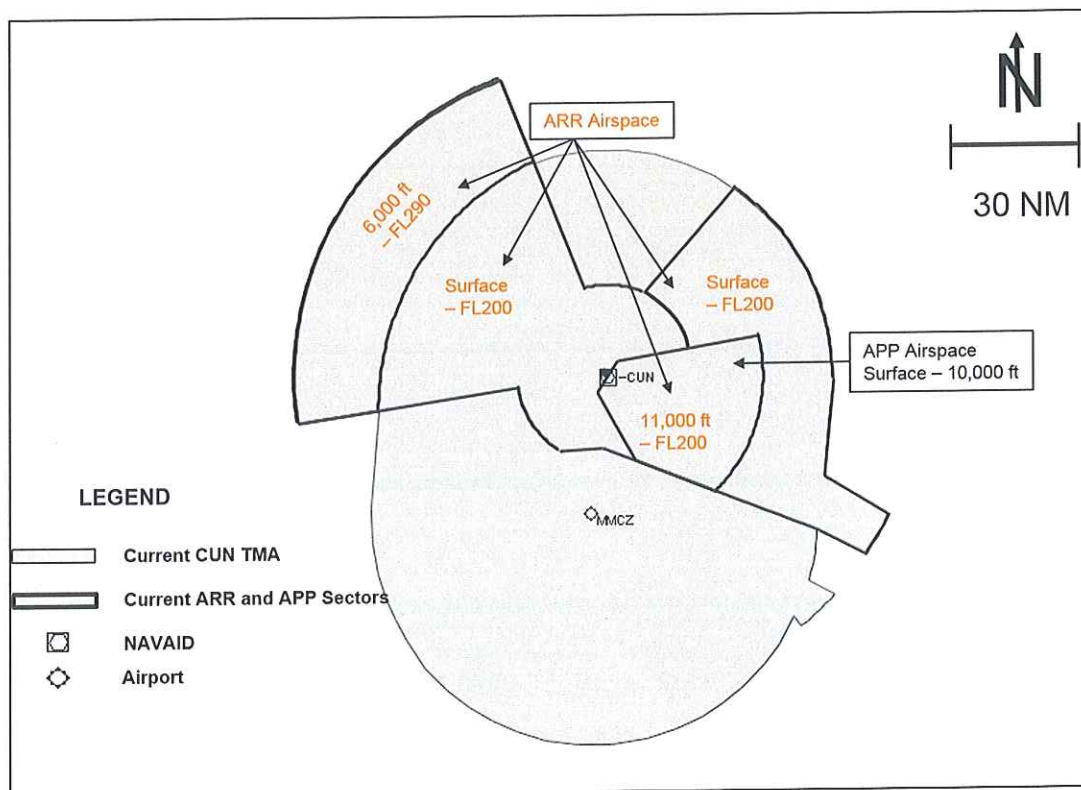
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**Figure 11. Current ARR and APP Airspace when Landing Runways 12L/R**

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**Figure 12. Current ARR and APP Airspace when Landing Runways 30L/R**

As previously mentioned, during Runway 12L/R operations, aircraft from the northwest are delivered from MID ACC to ARR on continuous descent to 4,000 ft. Aircraft are either on the published STAR or flying direct to the VITAR intersection, restricted to cross VITAR at 4,000 ft and 220 KIAS. ARR normally advises aircraft to expect vectors for the appropriate ILS approach or for a visual approach. The ILS/DME 1 Runway 12L Initial Approach Chart (IAC) is depicted in Figure 13. When APP is staffed, ARR typically hands off aircraft to APP approximately 20 NM from VITAR.



**Figure 13. MMUN ILS/DME 1 Runway 12L IAC**

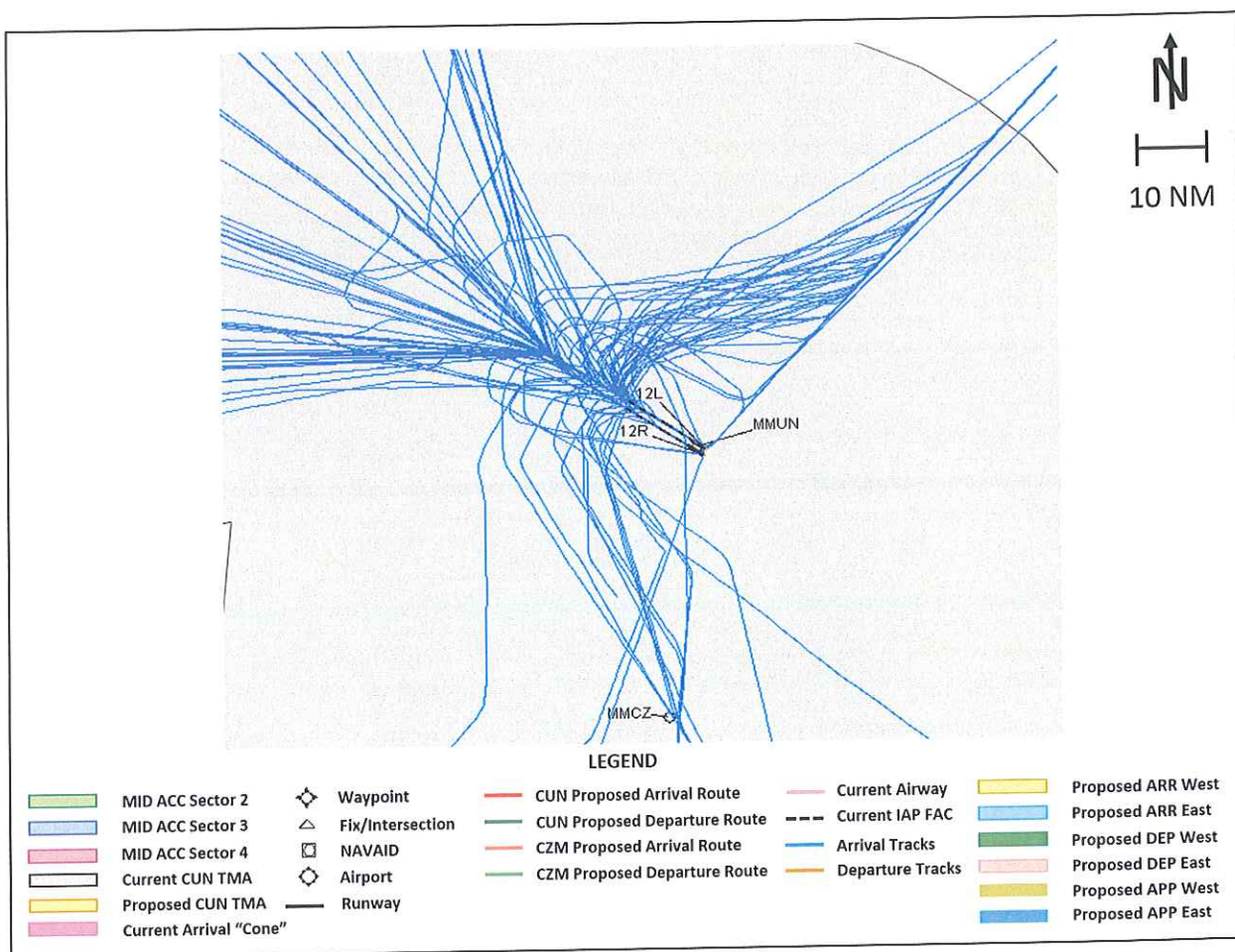
Aircraft from the northeast are delivered from MID ACC descending to FL200 and ARR descends them into TMA airspace via UB879 and normally advises aircraft to expect vectors for the appropriate ILS approach or for a visual approach. The ILS/DME 3 Runway 12L IAC is depicted in Figure 14. When APP is staffed, aircraft are normally handed off to APP at 8,000 ft on westbound radar vectors; prior to, or after overflying CUN, depending on the traffic sequence situation.





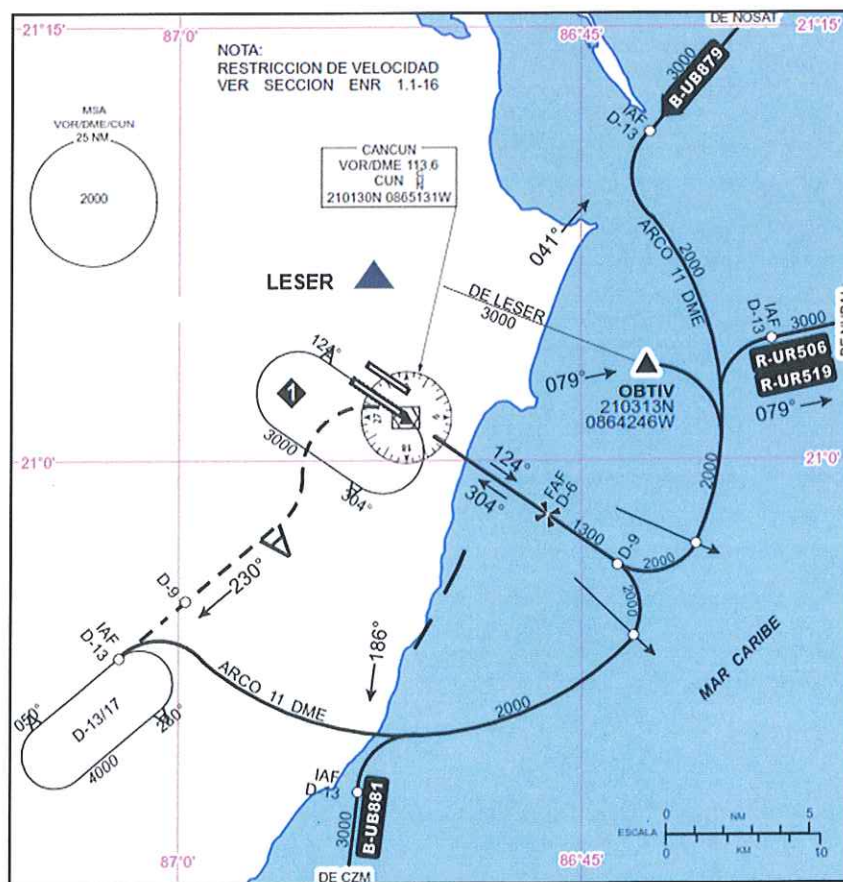
**Figure 14. MMUN ILS/DME 3 Runway 12L IAC**

Aircraft from the south are initially controlled by the Cozumel Approach Sector at MMAC and are handed off to ARR descending to 12,000 ft. ARR normally advises aircraft to expect vectors to the appropriate ILS approach or for a visual approach. When APP is staffed, aircraft are normally assigned 12,000 ft and handed off to APP after crossing CZM. Figure 15 depicts arrival tracks when landing Runway 12L/R.



**Figure 15. Arrival Tracks for Aircraft Landing Runways 12L/R**

During Runway 30L/R operations, aircraft arriving from the northwest are delivered from MID ACC on the published STAR to cross LESER at 8,000 ft and 200 KIAS or are flying direct VITAR to cross VITAR at 11,000 ft and 250 KIAS. ARR normally advises aircraft to expect vectors to the appropriate VOR/DME approach. The VOR/DME 2 Runway 30L IAC is depicted in Figure 16. When APP is staffed, aircraft are normally handed off prior to crossing LESER.



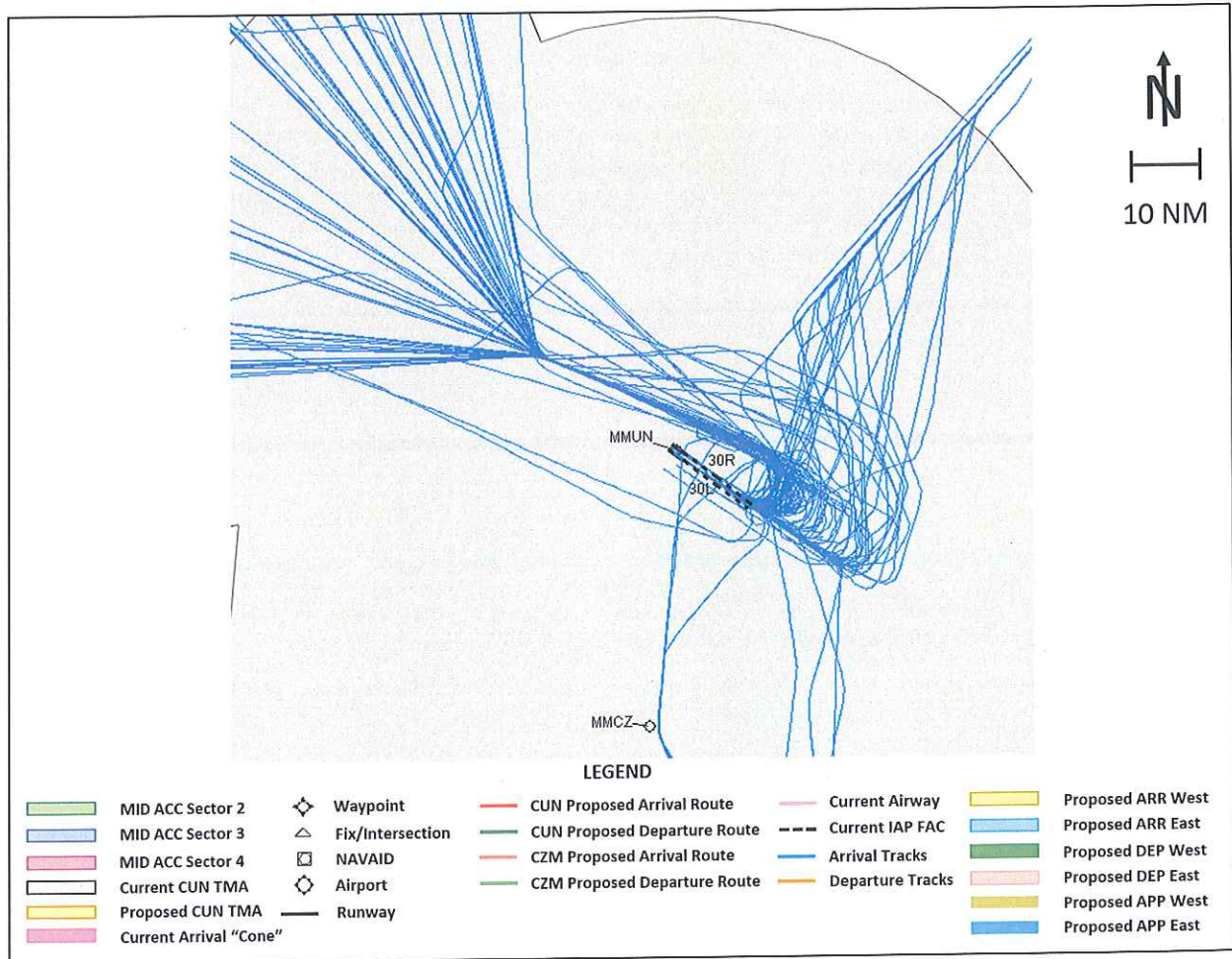
Source: Mexico AIP, March 2016

**Figure 16. MMUN VOR/DME 2 Runway 30L IAC**

Aircraft arriving from the northeast are delivered from MID ACC over NOSAT on UB879 descending to FL200. ARR descends them into TMA airspace and normally advises aircraft to expect vectors for the appropriate VOR/DME approach or for a visual approach. When APP is staffed, aircraft are normally handed off to APP at 8,000 ft approximately 35 NM from the airport, depending on the traffic sequence situation.

Aircraft from the south, initially controlled by CZM App, are descending to 12,000 ft. CZM App normally advises the aircraft to expect vectors for the appropriate VOR/DME approach or for a visual approach. When APP is staffed, aircraft are normally assigned 12,000 ft and handed off to APP after crossing CZM. Figure 17 depicts arrival tracks when landing Runway 30L/R.





**Figure 17. Arrival Tracks for Aircraft Landing Runways 30L/R**

Arrival routes from the north and west are segregated from the departure routes, however arrival and departure routes from the east, southeast, and south share some of the same exit/entry fixes. Altitude separation is used to eliminate conflicts. Other low performance aircraft flying at lower altitudes are assigned arrival routes as designated in the MMAC SOP.

### 2.2.2 Cancún TMA Proposed Arrival Sector ConOps

Two ARR sectors will be developed in order to incorporate two separate arrival controllers with segregated airspace for each controller. "East" ARR airspace will consist of designated airspace east of a boundary line equidistant from the centerlines and parallel to the MMUN runways, extending to the TMA airspace boundary. "West" arrival airspace will consist of designated airspace west of this same line. When landing Runway 12L/R, ARR airspace to the northeast and south will be stratified by altitudes that will be delegated to either DEP or ARR. ARR airspace on the approach side of the airport will be stratified by altitudes that will be delegated to either ARR or APP. When landing Runways 30L/R, ARR airspace to the northeast,

south, and on the departure side of the airport will be stratified by altitudes that will be delegated to either ARR or DEP. ARR airspace on the approach side of the airport will be stratified by altitudes that will be delegated to either ARR or APP. Airspace sectorization will be designed at a later workshop. Figure 18 depicts the conceptual ARR airspace when landing Runways 12L/R and Figure 19 depicts conceptual ARR airspace when landing Runways 30L/R.

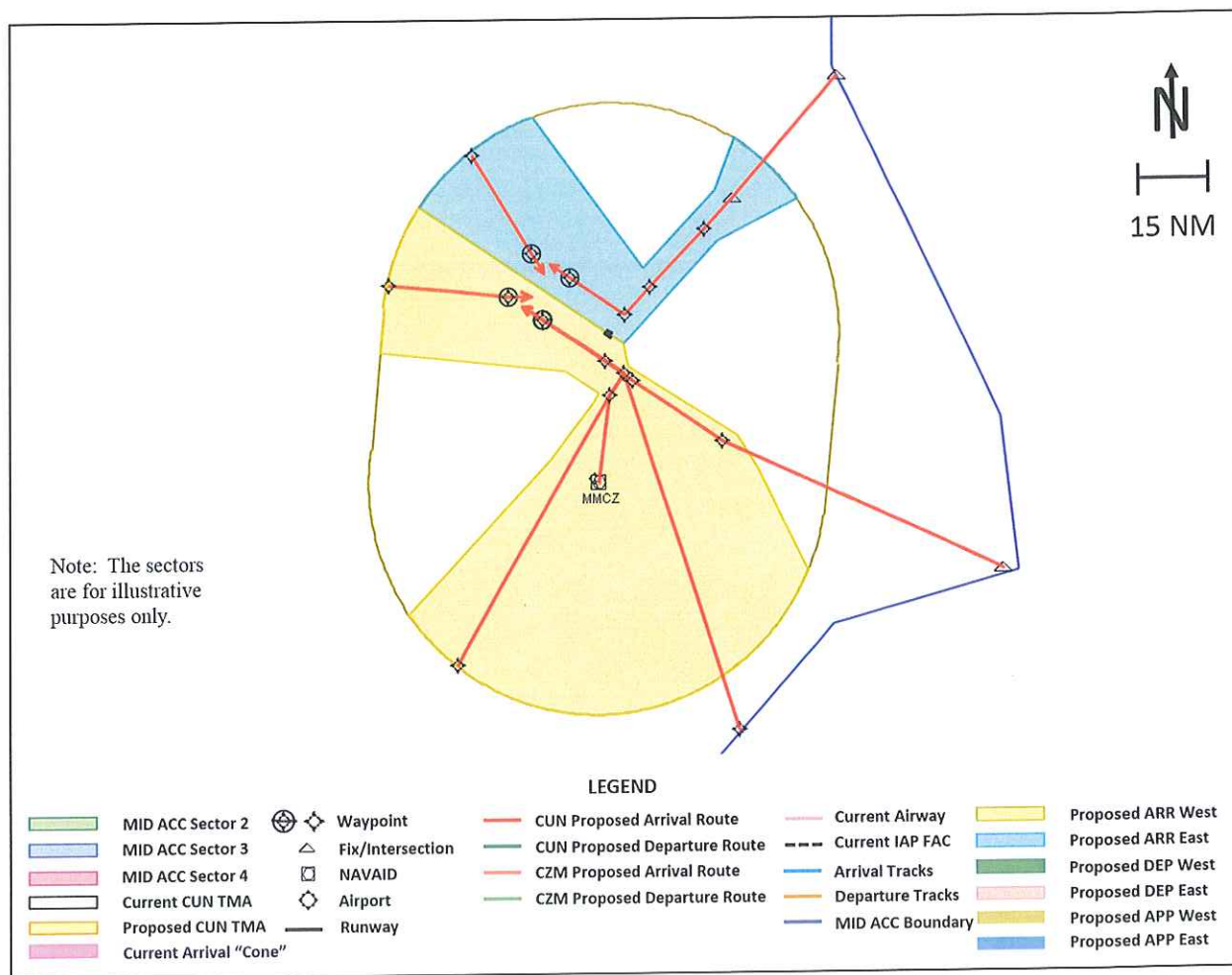
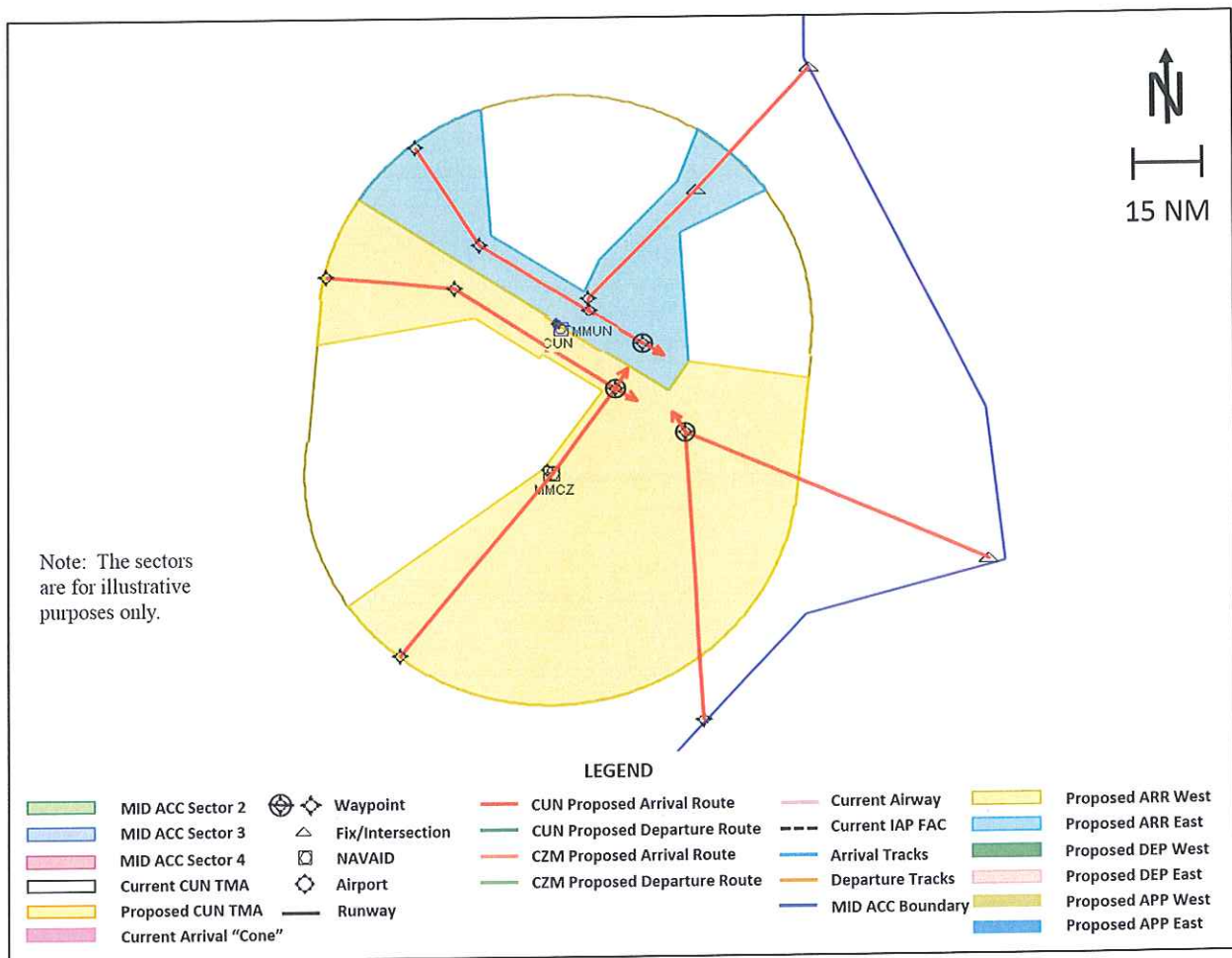


Figure 18. Conceptual ARR Airspace Landing Runways 12L/R



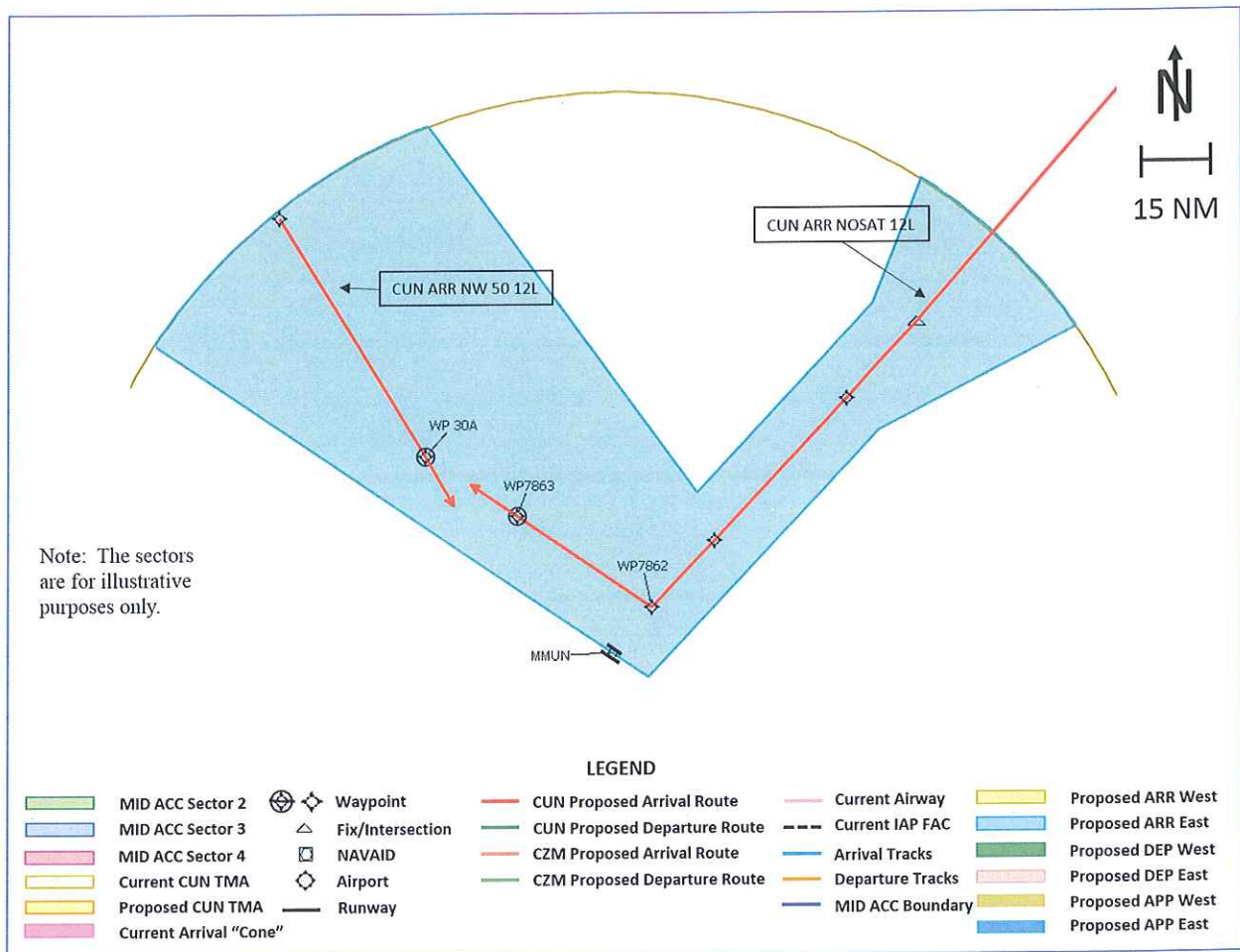


**Figure 19. Conceptual ARR Airspace Landing Runways 30L/R**

When conducting dual independent arrival operations at MMUN, two arrival controllers will each control their segregated airspace as opposed to a single controller controlling the entire ARR airspace. During independent arrival operations, the APP sectors must also be staffed with two controllers. When dual independent arrival operations are not being conducted, only a single ARR position is required. Aircraft will be delivered from MID ACC to ARR on CDO RNAV STARs as described in Section 2.1.2 and depicted in Figures 9 and 10.

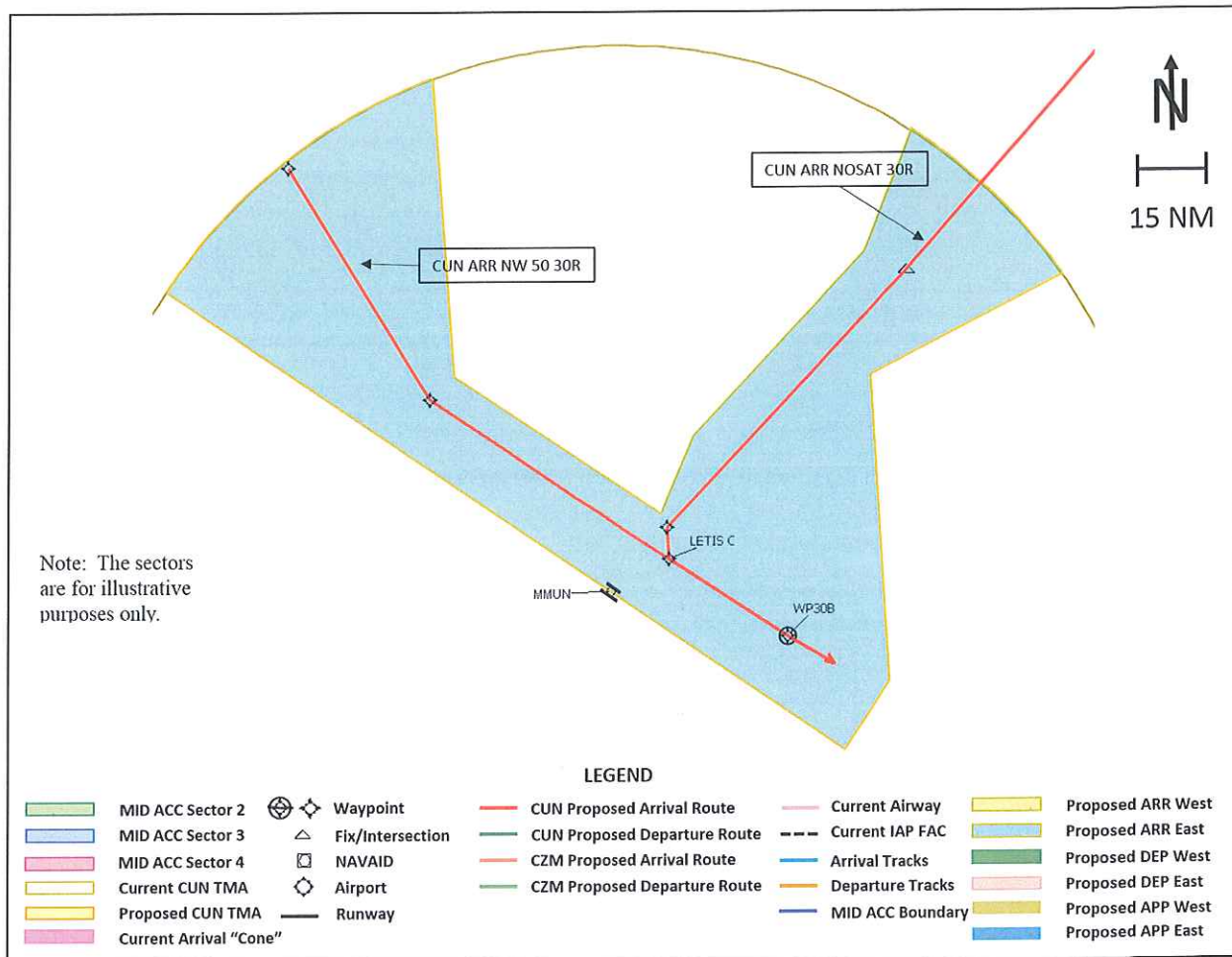
During dual independent arrival operations an "east" arrival controller will control aircraft arriving on the CUN ARR NOSAT 12L and CUN ARR NW 50 12L STARs for Runway 12L, and the CUN ARR NOSAT 30R and CUN ARR NW 50 30R for Runway 30R. Aircraft on the CUN ARR NOSAT 12L STAR will be descending to cross a to be determined (TBD) waypoint (WP) on the downwind between WPs 7862 and 7863 at 6,000 ft. Aircraft on the CUN ARR NOSAT 30R STAR will be descending to cross a TBD WP between LETIS C and WP 30B at 6,000 ft. Aircraft on the CUN ARR NW 50 12L STAR will be descending to cross WP 30A at 4,000 ft, and aircraft on the CUN ARR NW 50 30R STAR will be descending to cross the downwind at a TBD WP at 6,000 ft. These STARs and waypoints are depicted when landing Runways 12L/R in Figure 20 and when landing Runways 30L/R in Figure 21.





**Figure 20. Conceptual ARR East STARs when Landing Runways 12L/R**

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**Figure 21. Conceptual ARR East STARs when Landing Runways 30L/R**

A "west" arrival controller will control aircraft arriving on CUN ARR 50W 12R, CUN ARR CZM 12R, CUN ARR DANUL 12R, CUN ARR S 12R, and CUN ARR SIGMA 12R STARs for Runway 12L/R operations. That controller will also handle aircraft on CUN ARR 50W 30L, CUN ARR DANUL 30L, CUN ARR S 30L, and CUN ARR SIGMA 30L STARs for Runway 30L/R operations.

Aircraft on the CUN ARR 50W 12R STAR will be descending to cross WP 30 E at 3,000 ft, and aircraft on the CUN ARR 50W 30L STAR will be descending to cross a TBD WP prior to WP SUR A at 5,000 ft. Aircraft on the CUN ARR DANUL 12R, CUN ARR SIGMA 12R, CUN ARR CZM 12R, and CUN ARR S 12R STARs will be descending to cross at a TBD WP between WP 7867 and WP 7866 at 5,000 ft. Aircraft on the CUN ARR DANUL 30L and CUN ARR SIGMA 30L STARs will be descending to cross WP CUN 12E at 4,000 ft, and aircraft on the CUN ARR S 30L STAR will be descending to cross WP SUR A at 2,000 ft. There is not a CZM STAR designed for a Runway 30 operation. It is anticipated that aircraft departing MMCZ will be cleared direct to CUN and aircraft will be vectored to join the Runway 30L/R Final Approach Course (FAC) per the MMAC SOP. These STARs and waypoints are depicted when landing Runways 12L/R in Figure 22 and when landing Runways 30L/R in Figure 23.

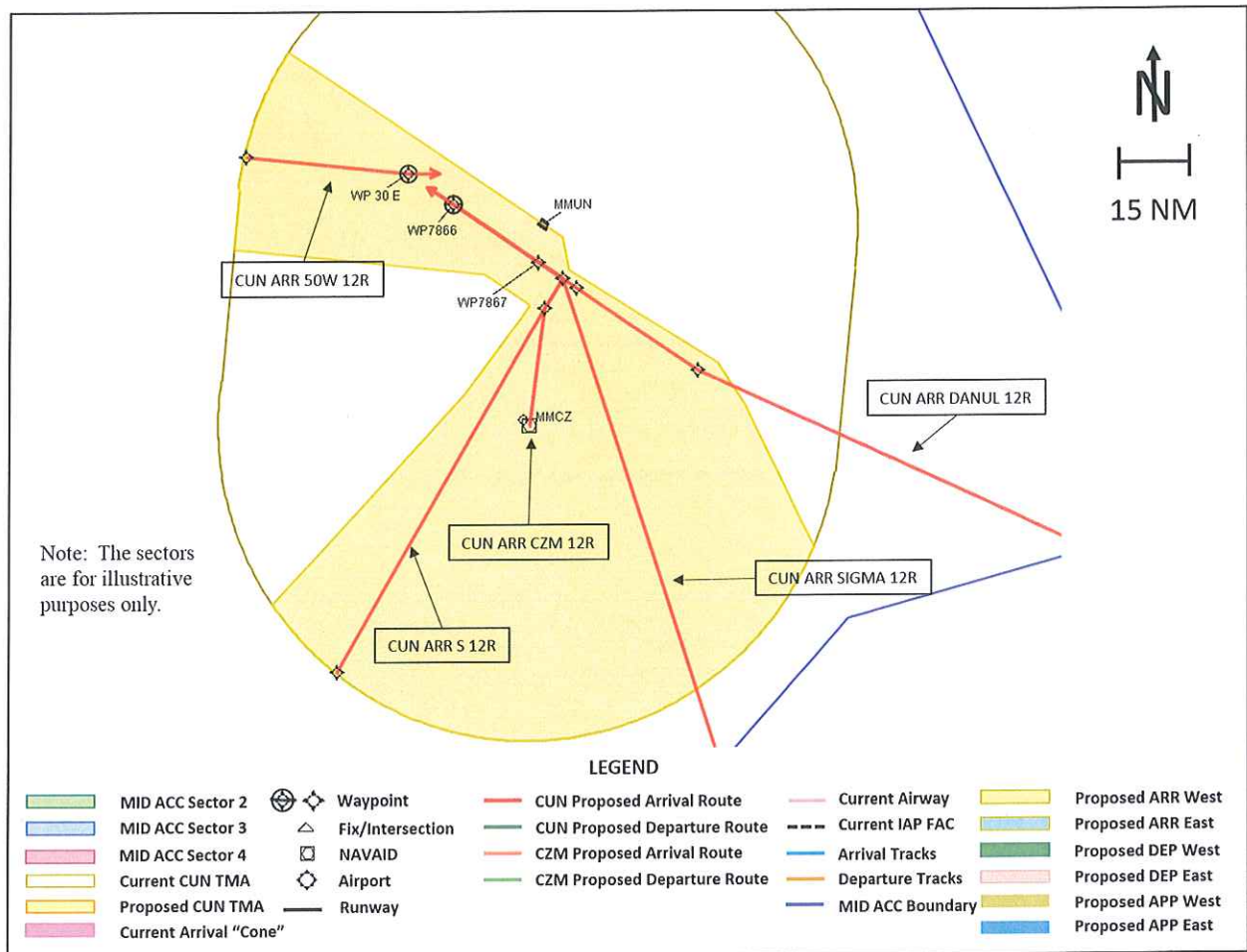
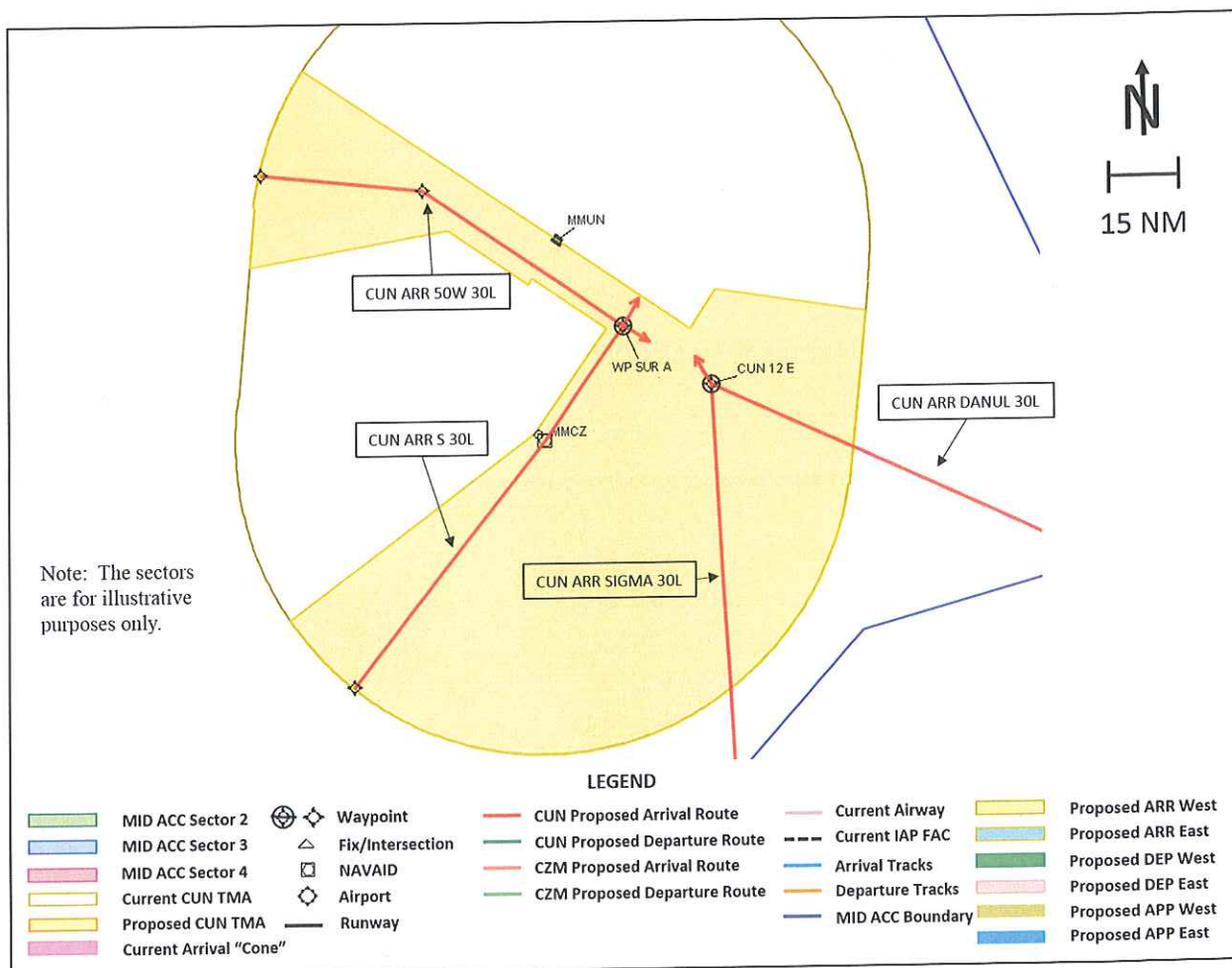


Figure 22. Conceptual ARR West STARS when Landing Runways 12L/R

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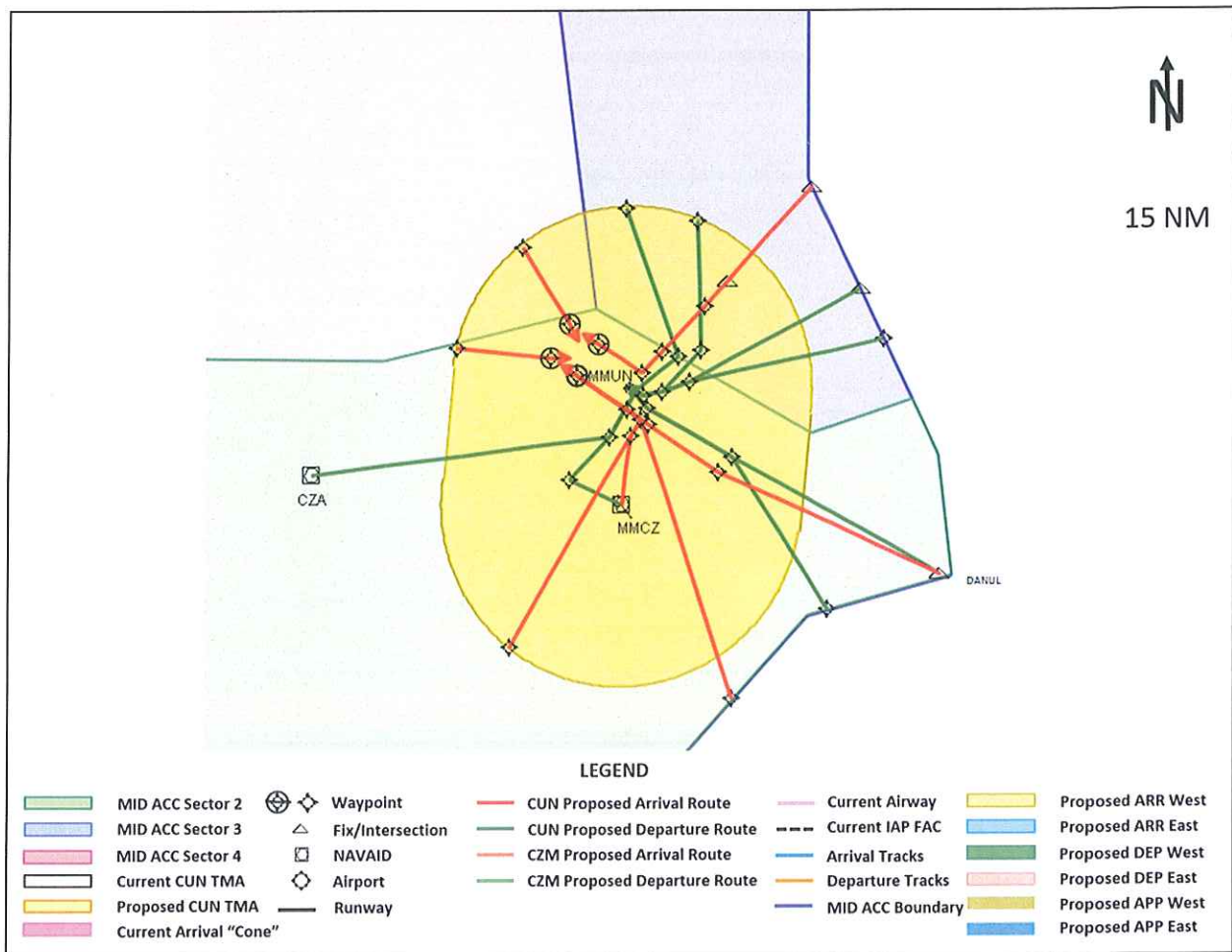
**Figure 23. Conceptual ARR West STARs when Landing Runways 30L/R**

Normally ARR will leave aircraft on the STARs since they are CDO STARs and will use speed control to adjust the sequence as opposed to vectoring aircraft. Vectoring aircraft will still be an option just as it is today, but should be minimized due to the loss of design efficiencies, (e.g. increased level offs, additional controller phraseology, added flight deck workload, possible additional track miles, etc.). Operating procedures will be developed and defined in the MMAC SOP in the event aircraft must be transitioned from one ARR controller to the other ARR controller. Aircraft are normally transitioned to balance runways and/or workload, comply with operational needs, deviate for weather, etc.

Each ARR controller will sequence aircraft to their designated runway in a manner such that the APP controller for that runway can comply with the runway interval that is required for operational purposes. For example, if the ATCT has no departures on the arrival runway the runway interval required may be 3 NM, while if there are numerous departures at the runway the runway interval required may be 6 NM in order to allow two departures to depart between each arriving aircraft. The ARR controller must sequence aircraft in such a manner as to allow the APP controller to remain within designated APP airspace and comply with the required runway interval. This sequencing is very similar to the function accomplished by ARR today, the

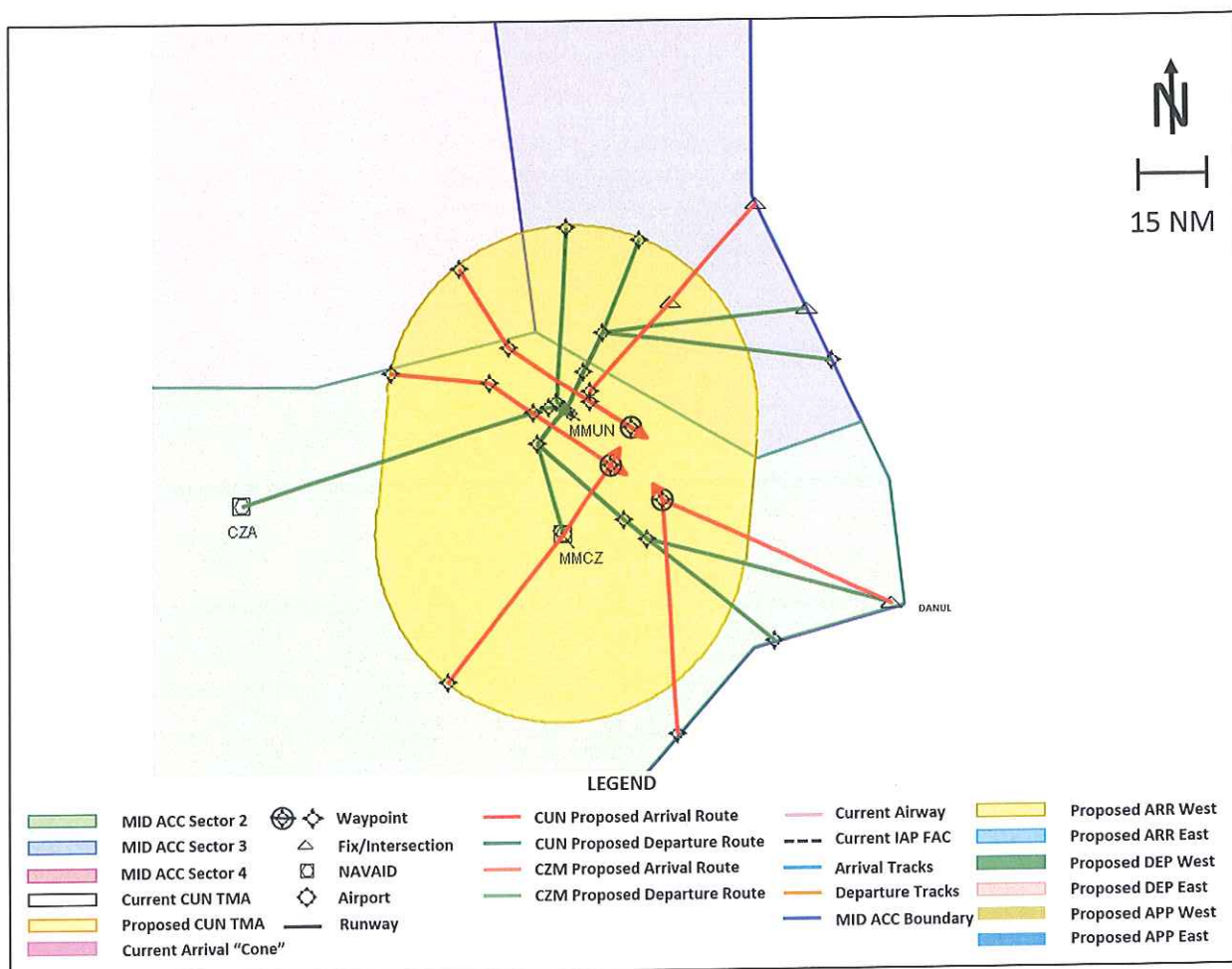
differences being that aircraft will be delivered from the MID ACC on CDO STARs and separate arrival controllers will sequence specific STARs to a specific runway. (Refer to Figure 18 for a depiction of the conceptual airspace for the two arrival sectors when landing Runways 12L/R, and Figure 19 for a depiction of the same when landing Runways 30L/R.)

All arrival routes except for the arrival route over DANUL, will not share entry/exit fixes with the departure routes. DANUL is shared due to very low levels of arrival and/or departure traffic and based on the request of SENEAM. Airspace and altitude constraints will be finalized at later workshops. Figure 24 depicts the routes that share the entry/exit fix at DANUL and the other segregated routes for the conceptual Standard Instrument Departures (SIDs) and STARs when landing Runways 12L/R, and Figure 25 depicts the same when landing Runways 30L/R.



**Figure 24. Conceptual MMUN STARs and SIDs when Landing Runways 12L/R**





**Figure 25. Conceptual MMUN STARs and SIDs when Landing Runways 30L/R**

Other low performance aircraft flying at lower altitudes will be assigned arrival routes as designated in the MMAC SOP. These routes may be modified based on the final STAR designs.

## 2.3 Cancún TMA Approach Sector

Current operations are described in Section 2.3.1 and the proposed ConOps is described in Section 2.3.2.

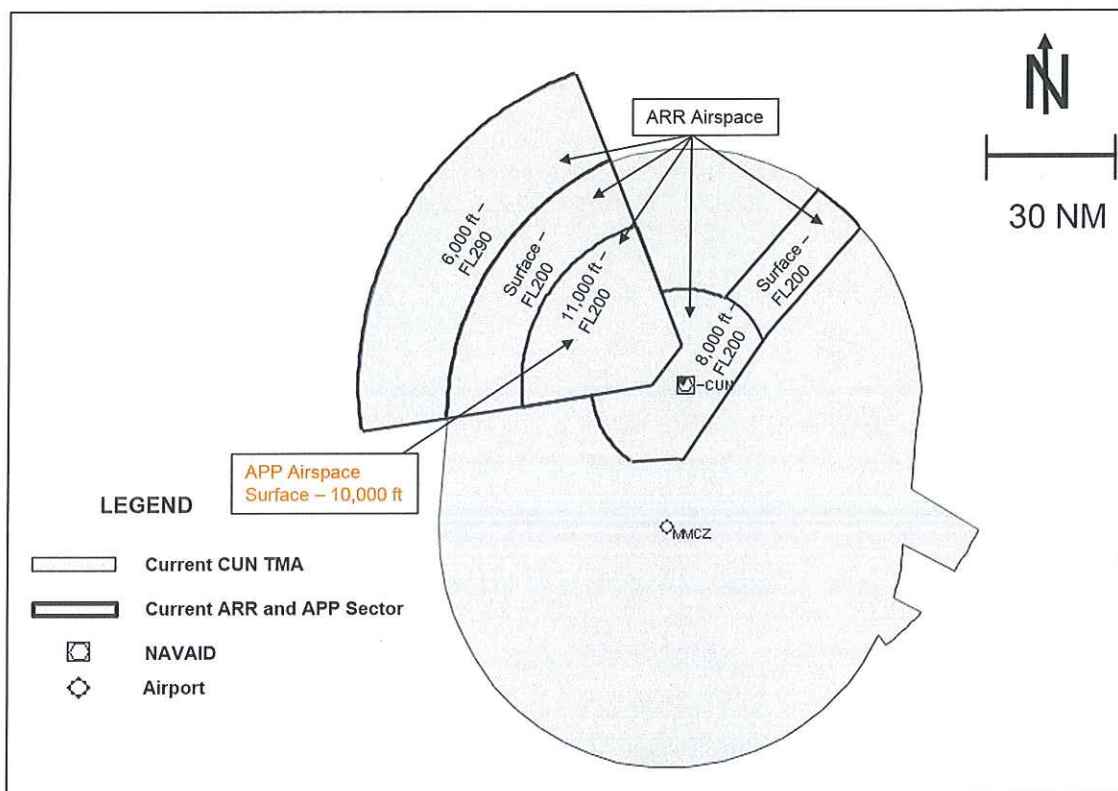
### 2.3.1 Cancún TMA Current Approach Sector Operation

MMAC APP sector sequences arriving traffic received from the ARR and DEP/CZM App sectors to the final approach, combining traffic from the three main flows from the northwest, northeast and south. APP is normally staffed from 1000 to 1700 local and other times depending on traffic volume or workload complexity. A single APP controller delivers aircraft to MMUN ATCT with 3 to 7 NM separation, depending on aircraft types and runway designation.

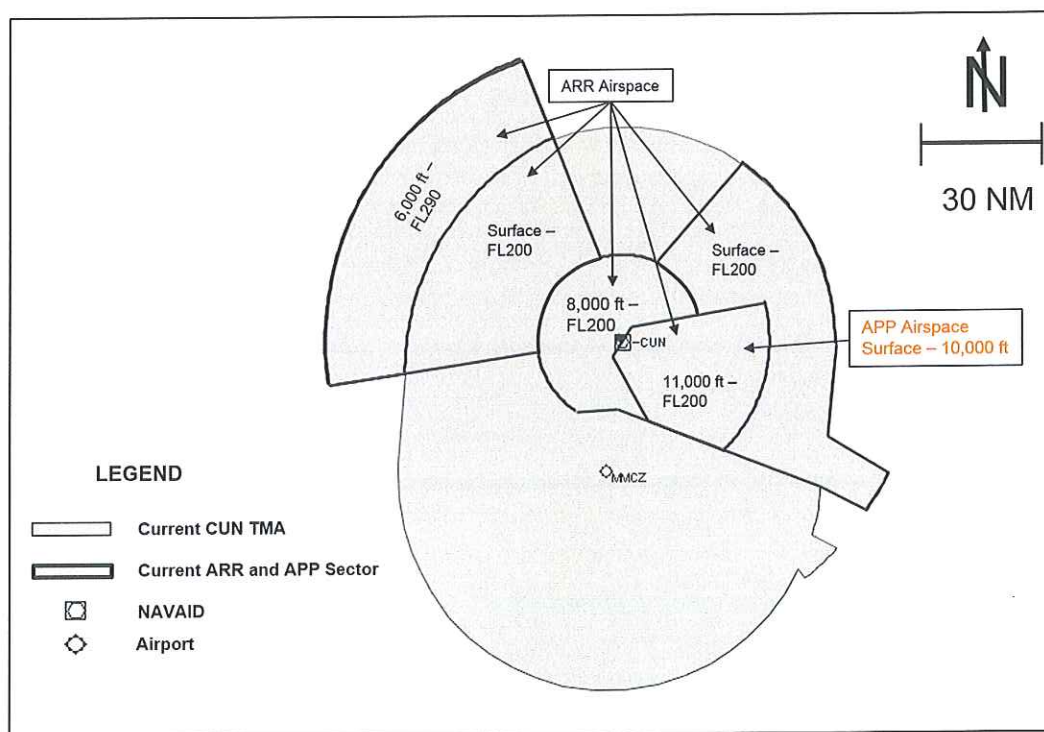


For Runway 12L/R operations, aircraft are almost always sequenced to Runway 12L as Runway 12R is the only departure runway due to taxiway constraints. APP may on occasion sequence aircraft for Runway 12R when this represents an operational advantage or at a pilot's request (when possible). Runway 12R is normally used for general aviation traffic, low performance traffic, and local VFR flights. Simultaneous approaches to both runways are only approved when both aircraft are on visual approaches or a minimum of 3 NM is maintained between aircraft. For Runway 30L/R operations, aircraft are almost always sequenced to Runway 30L as Runway 30R does not have taxiways to clear the runway after landing. It is noted that MMUN ATCT manages the use of Runway 12R and 30R for low performance traffic and local VFR flights.

APP airspace starts on a northwest/southeast line over CUN and extends 35 NM to the northwest when landing Runway 12L/R and 35 NM to the southeast when landing Runway 30L/R. APP airspace underlies ARR airspace. The vertical limits of APP airspace are from the surface to 10,000 ft. Figure 26 depicts current APP and ARR airspace when landing Runways 12L/R and Figure 27 depicts current APP and ARR airspace when landing Runways 30L/R. All airspace not delegated to APP or ARR is delegated to DEP.



**Figure 26. Current APP and ARR Airspace when Landing Runways 12L/R**



**Figure 27. Current ARR and APP Airspace when Landing Runways 30L/R**

During Runway 12L/R operations, aircraft from the northwest are delivered from ARR to APP on continuous descent to 4,000 ft. Aircraft are either on the published STAR or flying direct to VITAR intersection, restricted to cross VITAR at 4,000 ft and 220 KIAS and are normally assigned vectors for an ILS/DME Runway 12L Approach or a visual approach. Aircraft are typically handed off to APP approximately 20 NM from VITAR. Aircraft from the northeast are descending to 8,000 ft and are normally assigned vectors for an ILS/DME Runway 12L Approach or a visual approach. Aircraft are normally handed off on a westbound radar vector, either prior to or after overflying CUN, depending on the traffic sequence situation. Aircraft from the south are handed off to APP descending to 12,000 ft and are advised to expect vectors to the appropriate ILS approach or visual approach. (Refer to Figure 15 for a depiction of arrival tracks for aircraft landing Runway 12L/R.)

During Runway 30L/R operations, aircraft arriving from the northwest are delivered from ARR on the published STAR to cross LESER at 8,000 ft and 200 KIAS or are flying direct to VITAR to cross VITAR at 11,000 ft and 250 KIAS. Aircraft are normally advised to expect vectors for a VOR/DME Runway 30L Approach or a visual approach. Aircraft are normally handed off to APP after crossing VITAR. Aircraft arriving from the northeast are descending to FL240 and ARR descends them into TMA airspace and normally advises the aircraft to expect vectors for a VOR/DME Runway 30L Approach or a visual approach. Aircraft are normally handed off to APP at 8,000 ft approximately 35 NM from the airport, depending on the traffic sequence situation. Aircraft from the south, initially controlled by DEP, are handed off to APP descending to 12,000 ft. Aircraft are advised to expect vectors for a VOR/DME Runway 30L Approach or a visual approach. Aircraft are handed off to APP after crossing CZM. (Refer to Figure 17 for a depiction of arrival tracks when landing Runway 30L/R.)



### 2.3.2 Cancún TMA Proposed Approach Sector ConOps

When conducting dual independent arrival operations at MMUN, the APP sector will be staffed with two APP controllers as opposed to a single controller. Segregated APP airspace will be developed for each approach controller. "East" APP airspace will consist of designated airspace east of a boundary line equidistant from the centerlines and parallel to the MMUN runways, extending to the TMA airspace boundary, and "west" arrival airspace will consist of designated airspace west of this same line. Airspace sectorization development will occur at a later workshop. Figure 28 depicts the conceptual APP "east" and "west" airspace when landing Runways 12L/R. Figure 29 depicts the conceptual APP "east" and "west" airspace when landing Runways 30L/R. When dual independent arrival operations are not being conducted, APP may be staffed with a single controller or the sector may be combined with the ARR sector just as it is today. Aircraft will be delivered from ARR to APP on CDO RNAV STARs as described in Section 2.2.2 and depicted in Figures 20 through 23.

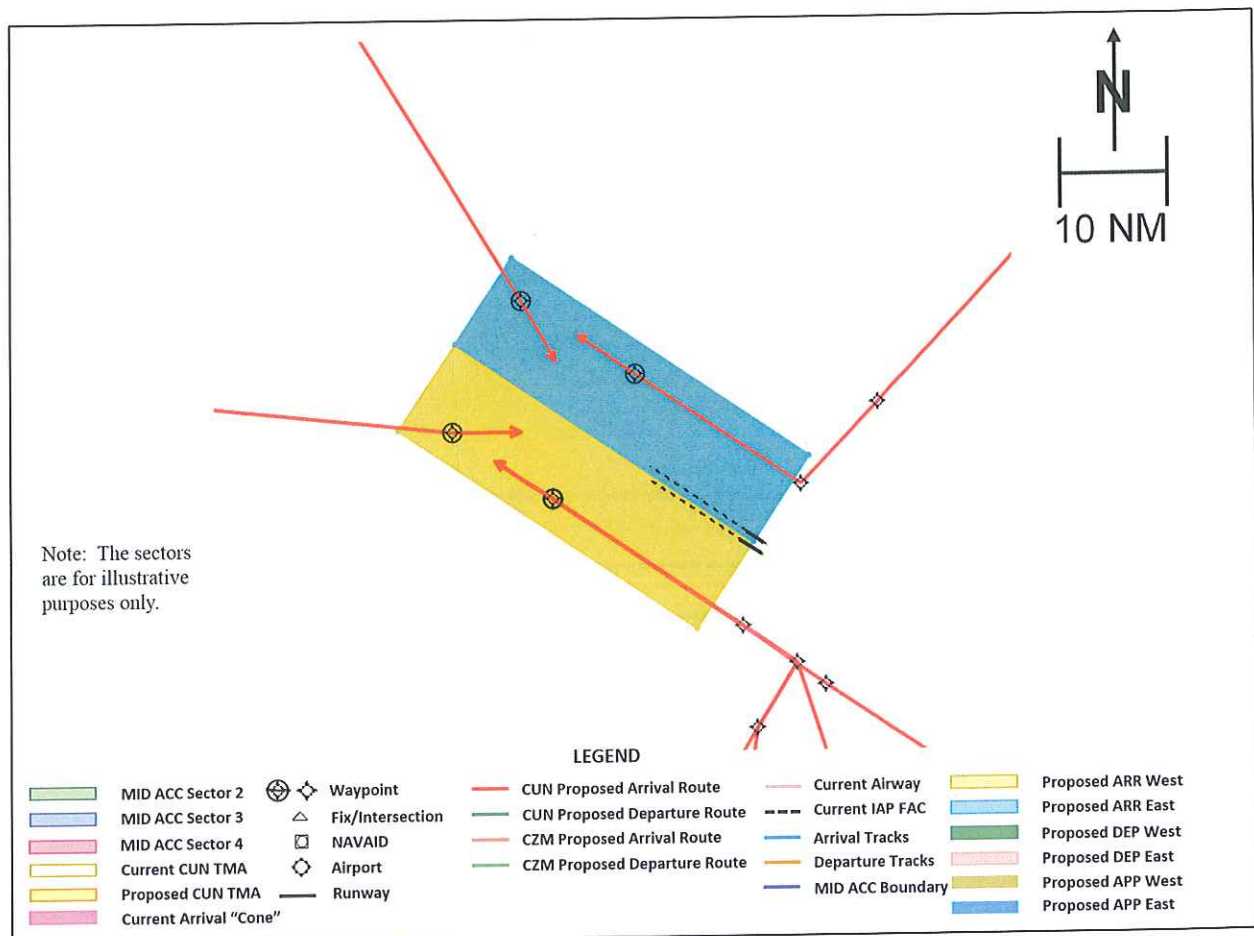
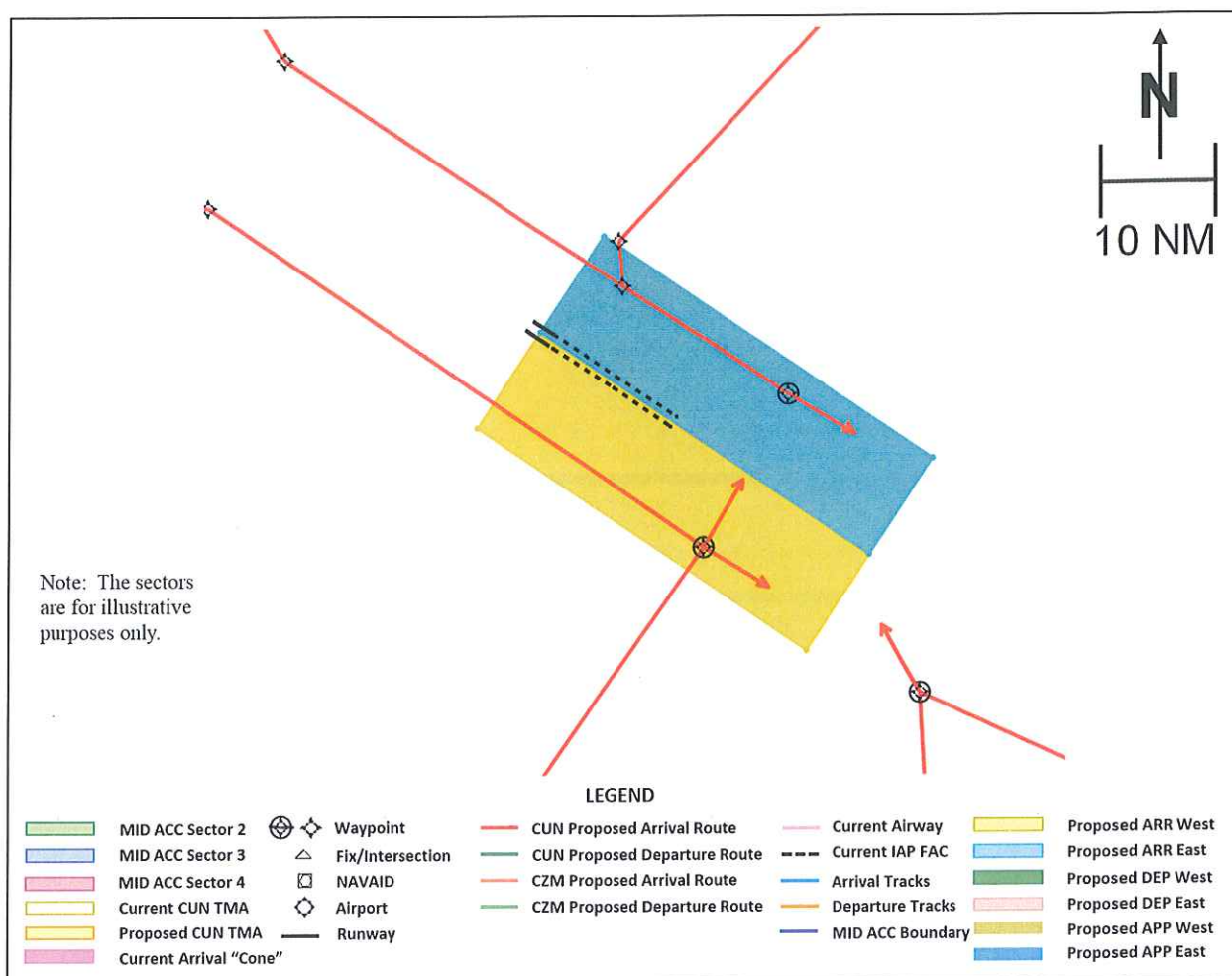


Figure 28. Conceptual APP East and West Airspace Landing Runways 12L/R





**Figure 29. Conceptual APP East and West Airspace Landing Runways 30L/R**

During dual independent arrival operations, an "east" approach controller must sequence aircraft arriving on the NOSAT and NW 50 STARs for Runway 12L and Runway 30R. Aircraft on the NOSAT and NW 50 STARs will be descending on the CDO RNAV STARs as discussed in Section 2.2.2. Dual independent arrival operations require aircraft to be turned on to the FAC with either vertical or lateral separation and it is anticipated that the MMAC SOP will have more stringent requirements and stipulate that aircraft must be vertically separated at turn on.

The east runway (i.e., Runway 12L/30R) will be the "high" runway, meaning the turn on altitude will be 1,000 ft above the turn on altitude for the west runway (i.e., Runway 12R/30L). East APP must descend their aircraft to be at or above 3,000 feet when turning on the FAC. A "Duals Bar" will be defined and added to the APP video map. The "Duals Bar" is the location where aircraft must be established on the FAC at the altitudes defined in the MMAC SOP, changed to the Cancún Tower/MMAC Monitor Position (MON) controller's frequency, and where the MON assumes control of the aircraft. Aircraft must be vectored to intercept the FAC outside the designated "Duals Bar" at an altitude at or below the glideslope and must be transferred to the appropriate Cancún Tower/Cancún MON frequency prior to losing standard (vertical or lateral) separation with aircraft on the parallel FAC. Figure 30 depicts these

independent operation requirements when landing Runway 12L. Figure 31 depicts these independent operation requirements when landing Runway 30R

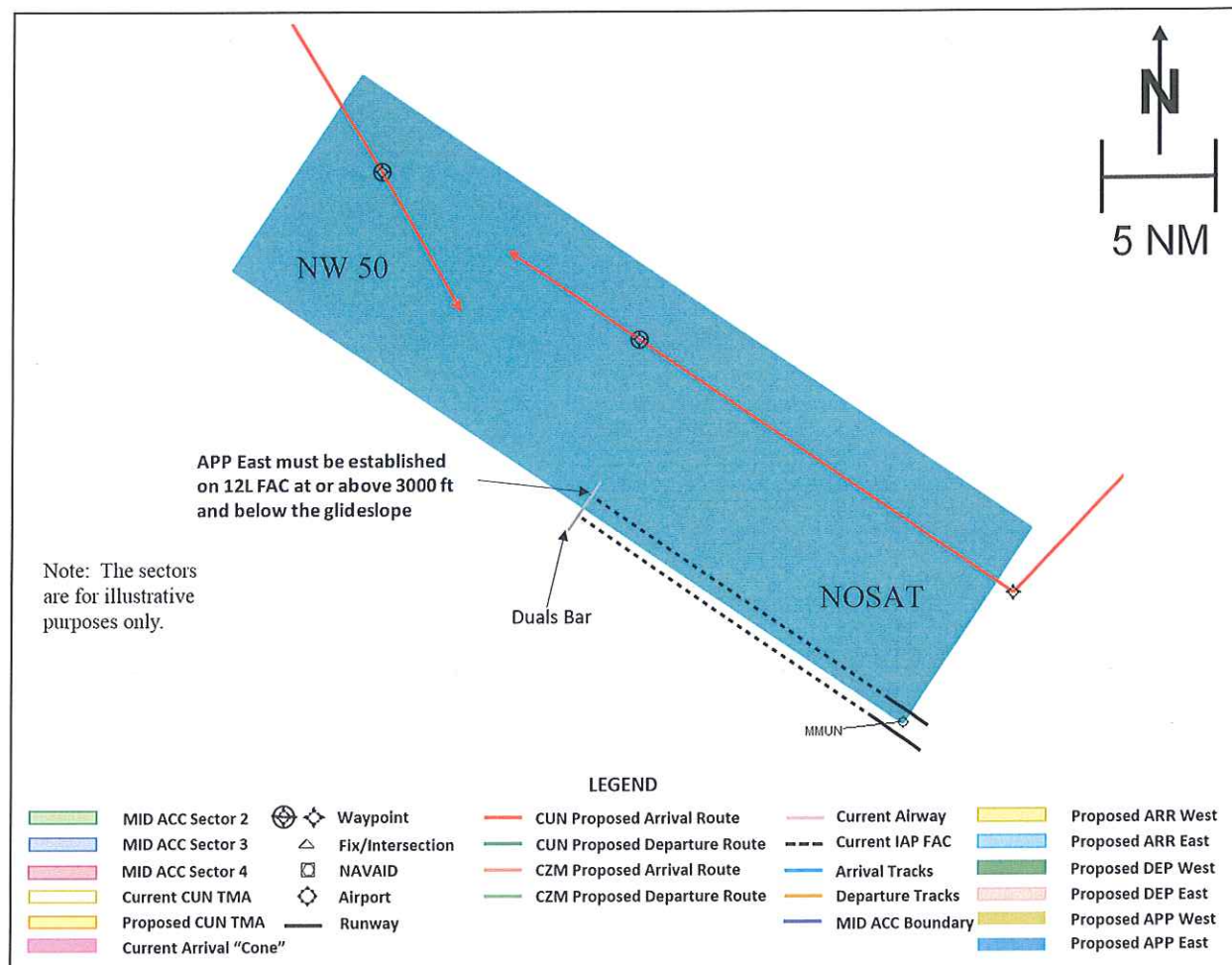
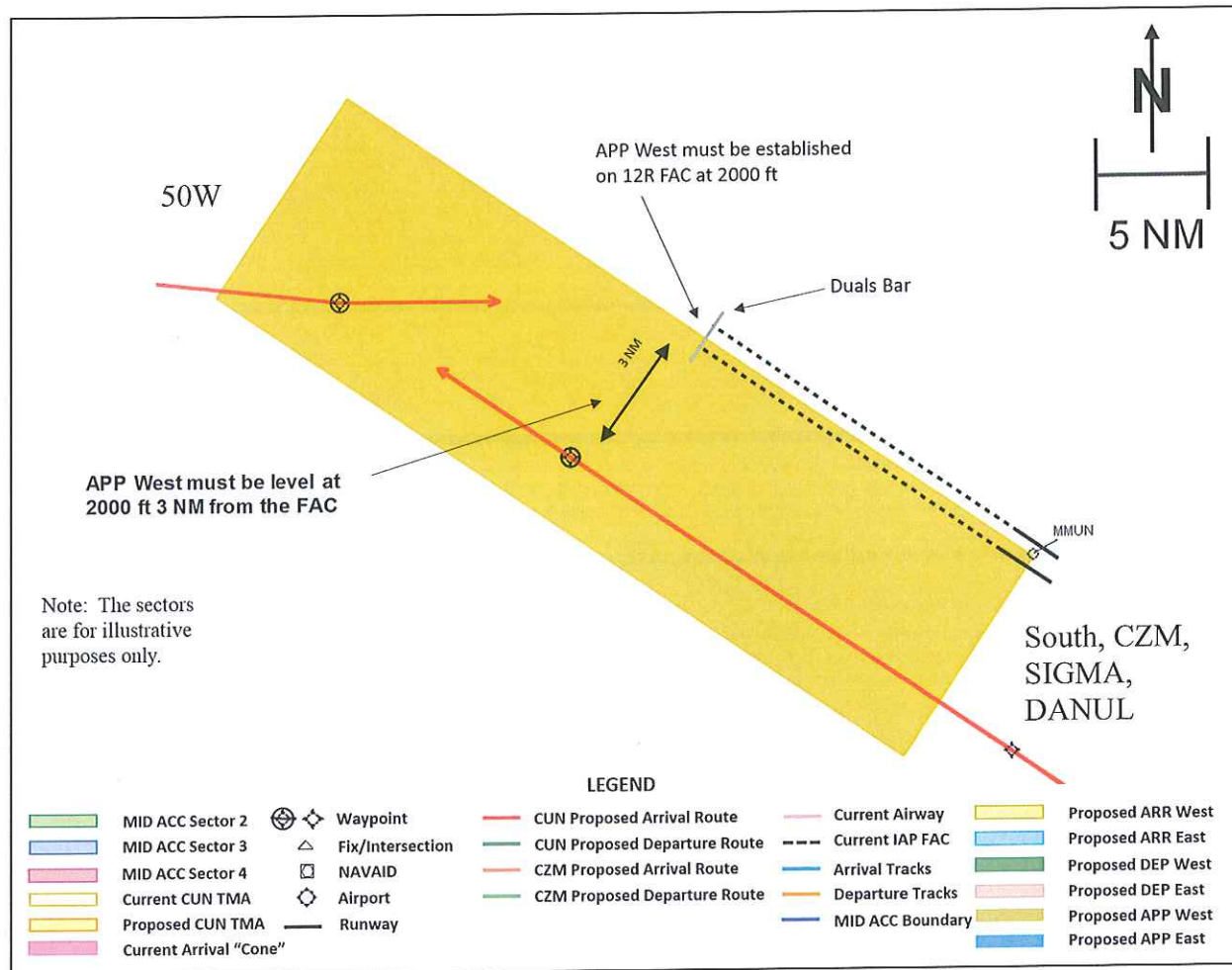


Figure 30. APP East Requirements for Runway 12L During Independent Operations

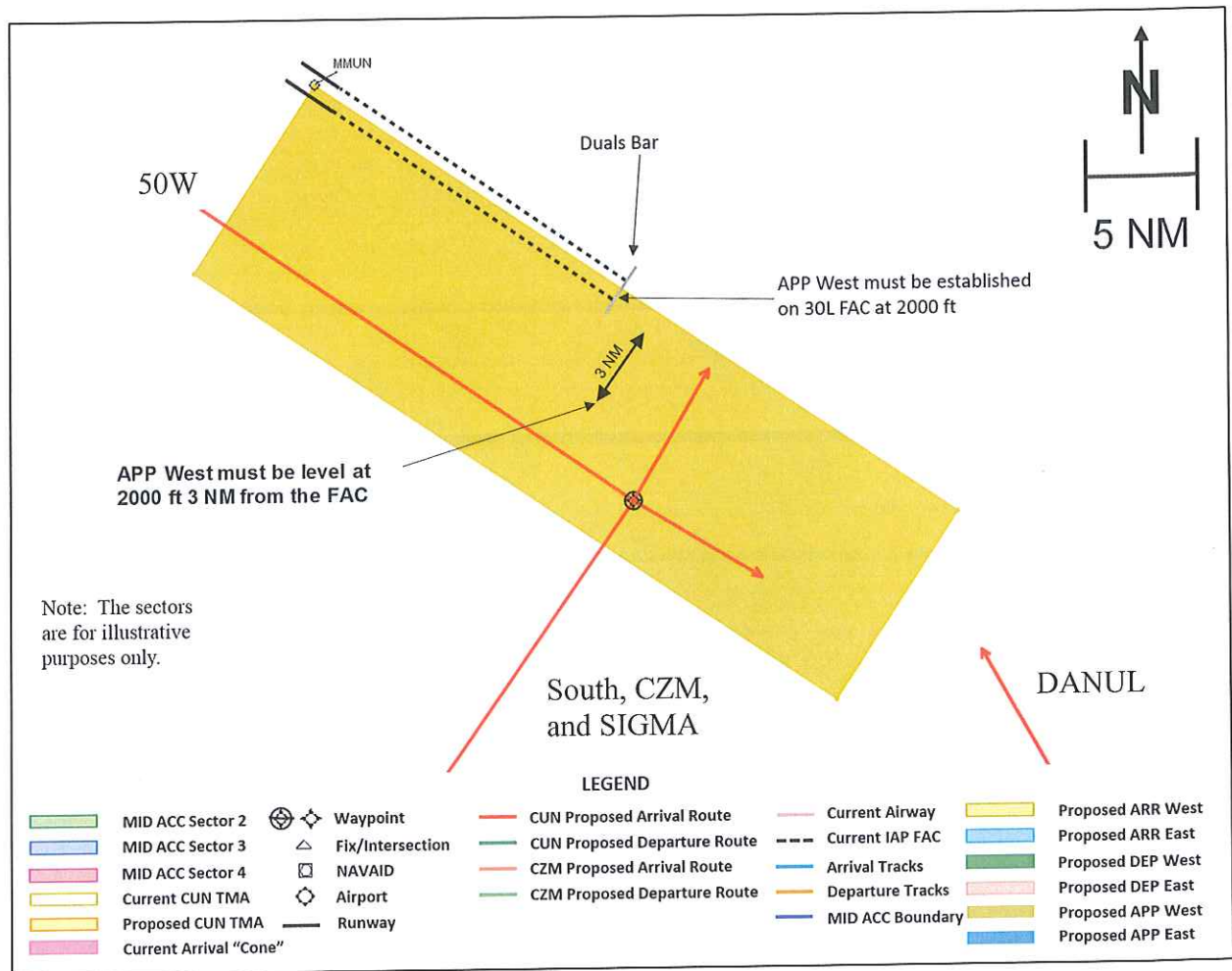


A “west” arrival controller must sequence aircraft arriving on 50W, South, CZM, SIGMA, and DANUL STARs for Runways 12R and 30L. Aircraft on these STARs will be descending on the CDO RNAV STARs as discussed in Section 2.2.2. The west runway (i.e., Runway 12R/30L) will be the “low” runway, meaning the turn on altitude will be 1,000 ft below the 3,000 ft turn on altitude for the east runway (i.e., Runway 12L/30R). In order to ensure separation from aircraft on the east runway, aircraft on the west runway must be at or below 2,000 feet at least 3 NM from the centerline of Runway 12R/30L. Aircraft must be vectored to intercept the FAC outside the designated “Duals Bar” at or below 2,000 ft, but above the Minimum Vectoring Altitude. Aircraft must be transferred to the appropriate Cancún ATCT/MON frequency prior to losing standard (vertical or lateral) separation with aircraft on the parallel FAC. Figure 32 depicts these independent operation requirements when landing Runway 12R. Figure 33 depicts these independent operation requirements when landing Runway 30L.





**Figure 32. APP West Requirements for Runway 12R During Independent Operations**



**Figure 33. APP West Requirements for Runway 30L During Independent Operations**

Each APP controller will sequence aircraft to their designated runway to comply with the required runway interval as needed for operational purposes. The interval may be different for each approach controller based on operational need.

Other low performance aircraft flying at lower altitudes will be assigned arrival routes as designated in the MMAC SOP. These routes may be modified based on the final STAR designs. Today's procedures permit MMUN ATCT to manage the use of runways for low performance traffic and local VFR flights. Independent dual arrival operations will allow these operations to continue; however additional coordination will be required between the ATCT, APP, and MON controllers. This coordination will be contained in the MMAC/MMUN ATCT LOA. Additional discussion of this subject is contained in Section 2.4.

## 2.4 Cancún TMA Proposed Monitor Position ConOps

MMAC does not operate monitor positions since dual independent arrival operations are not currently being conducted at MMUN. In order to support dual independent arrival operations,



two monitor positions will be required, one for each arrival runway. The MON has three primary responsibilities; 1) alert aircraft if they are deviating off the FAC, 2) initiate breakout procedures in the event an aircraft enters the No Transgression Zone (NTZ)<sup>5</sup> and 3) maintain longitudinal separation between aircraft on the same runway.

When independent arrival operations are being conducted, each approach controller vectors aircraft to the FAC outside the Duals Bar using altitude separation. Approach controllers are required to instruct aircraft to contact MMUN ATCT on the appropriate tower frequency prior to crossing the Duals Bar and subsequently losing vertical separation with the aircraft on the adjacent FAC. The MON controller monitors the tower frequency and is responsible for separation of the aircraft on the FAC being monitored. In order to prevent communications by the MON controller from being “blocked” due to the tower controller transmitting on the frequency at the same time, the communications system is configured to allow the MON controller to “override” any tower controller transmissions. Any transmission made by the MON controller will block out a transmission made at the same time by the tower controller and the pilot will only hear the MON controller. The MON controller assumes responsibility for separation of the aircraft at the Duals Bar until: 1) visual separation is applied, 2) the aircraft reports the approach lights or runway in sight, or 3) the aircraft is 1 NM or less from the runway threshold, if procedurally required and contained in facility directives. The MMAC SOP will contain specific procedures regarding handling aircraft that must be vectored off the FAC due to operational reasons.

Today’s procedures permit MMUN ATCT to manage the use of runways for low performance traffic and local VFR flights. Dual independent arrival operations will allow these types of operations to continue; however, additional coordination will be required between the ATCT, APP, and MON controllers. The key factor in this operation is clarifying separation responsibility. During independent operations, the MON controller has separation responsibility until 1 NM from the runway threshold. In order for the ATCT to manage the use of runways for VFR or other low performance flights, coordination must be accomplished with both MON controllers. The ATCT controller must ensure visual separation between the aircraft that is being managed by the tower and aircraft on both finals. Additional coordination may be required with APP in the event additional spacing is required on the final to accommodate the VFR/low performance aircraft. This coordination is similar to the coordination that occurs today.

## **2.5 Cancún TMA Departures**

Current operations are described in Section 2.5.1 and the proposed ConOps is described in Section 2.5.2.

### **2.5.1 Cancún TMA Current Departure Sector Operation**

MMAC operates two departure positions: DEP North and CZM App. DEP North accepts all departures from MMUN, hands off to CZM App all southbound departures transiting over CZM,

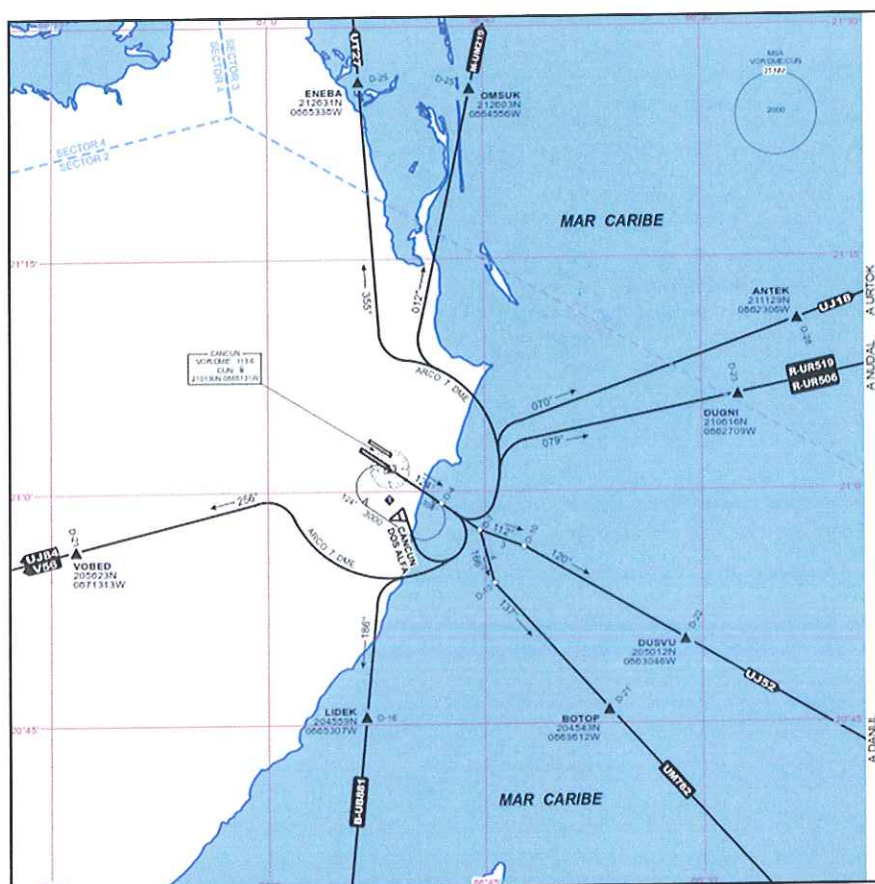
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<sup>5</sup> A 2,000-foot-wide zone located equidistant between the parallel runways (described in detail in other MITRE documents).



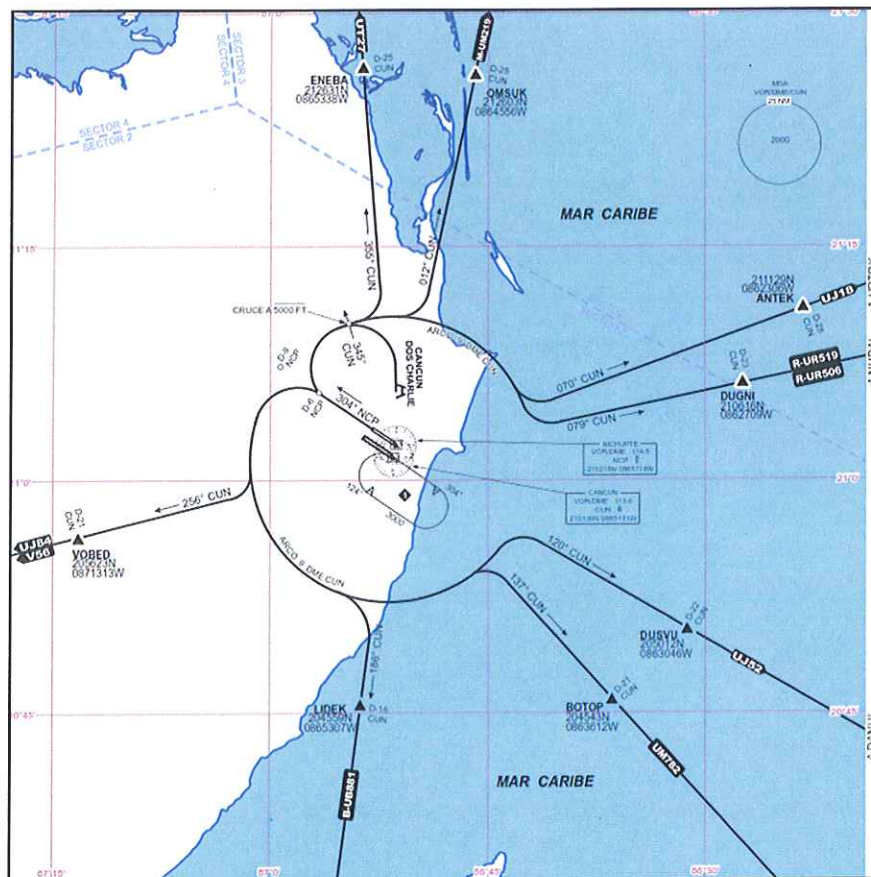
and accepts handoffs from CZM App on MMCZ departures to the north. CZM App accepts all departures from MMCZ, accepts handoffs from DEP North on all MMUN departures to the south, accepts handoffs from MID ACC on MMUN arrivals from the south and MMCZ arrivals from the east, south, and west, and accepts handoffs from East ARR on MMCZ arrivals from the north.

MMUN departures normally depart Runway 12R or Runway 30R due to taxiway constraints and are assigned a conventional SID that joins the airway structure. Aircraft departing to the north fly to ENEBA and then join UT27 to OMVIP or fly to OMSUK to join M-UM219 to XOPGI. Departures to the east fly to ANTEK and then join UJ18 to URTOK or fly to DUGNI and join R-UR519 or UR506 to NUDAL. Southbound departures fly to LIDEK then join B-UB881 to CZM. Departures to the west fly to VOBED and join UJ84 or V56 to Chichen Itza VOR/DME (CZA). The Runway 12R SIDs are depicted in Figure 34 and the Runway 30R SIDs are depicted in Figure 35.



Source: Mexico AIP, March 2016

**Figure 34. MMUN Runway 12R SIDs**



Source: Mexico AIP, March 2016

**Figure 35. MMUN Runway 30R SIDs**

Aircraft departing on the MMUN SIDs are assigned an initial altitude of 7,000 ft and maintain 200 KIAS until the CUN 4 DME in order to eliminate overtake situations between consecutive departures. MMUN ATCT provides 4 NM separation between departures, unless successive aircraft are departing on the same SID, in which case 2 minutes is normally provided between aircraft. This helps achieve the 10 NM in-trail requirement between departures on the same SID at the MID ACC transfer point. DEP North shares a portion of airspace with ARR and APP on a vertically segregated basis in areas where airspace overlaps. Within 20 NM from CUN, DEP North is delegated airspace from the 2,000 to 7,000 ft, except in APP airspace where DEP is delegated no airspace. Aircraft controlled by DEP, that must climb through ARR airspace, remain on DEP control frequency. Coordination is accomplished on an individual basis by DEP with ARR. Outside of 20 NM, in DEP North delegated airspace, DEP North is delegated altitudes from the surface to FL200. CZM App is also delegated airspace from the surface to FL200.

Figure 36 depicts current DEP North airspace when landing Runways 12L/R and Figure 37 depicts DEP North airspace when landing Runways 30L/R. Figure 38 depicts current CZM App airspace when landing Runways 12L/R and Figure 39 depicts current CZM App airspace when landing Runways 30L/R.

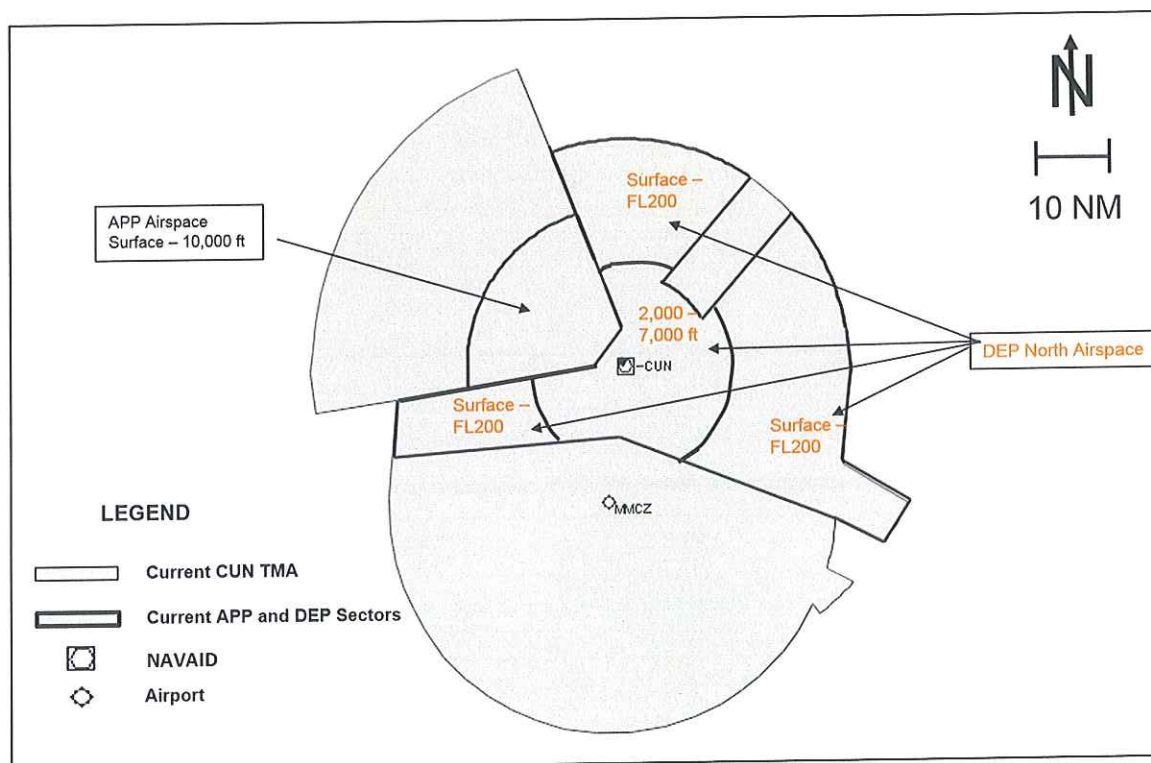


Figure 36. Current DEP North Airspace Landing Runways 12L/R

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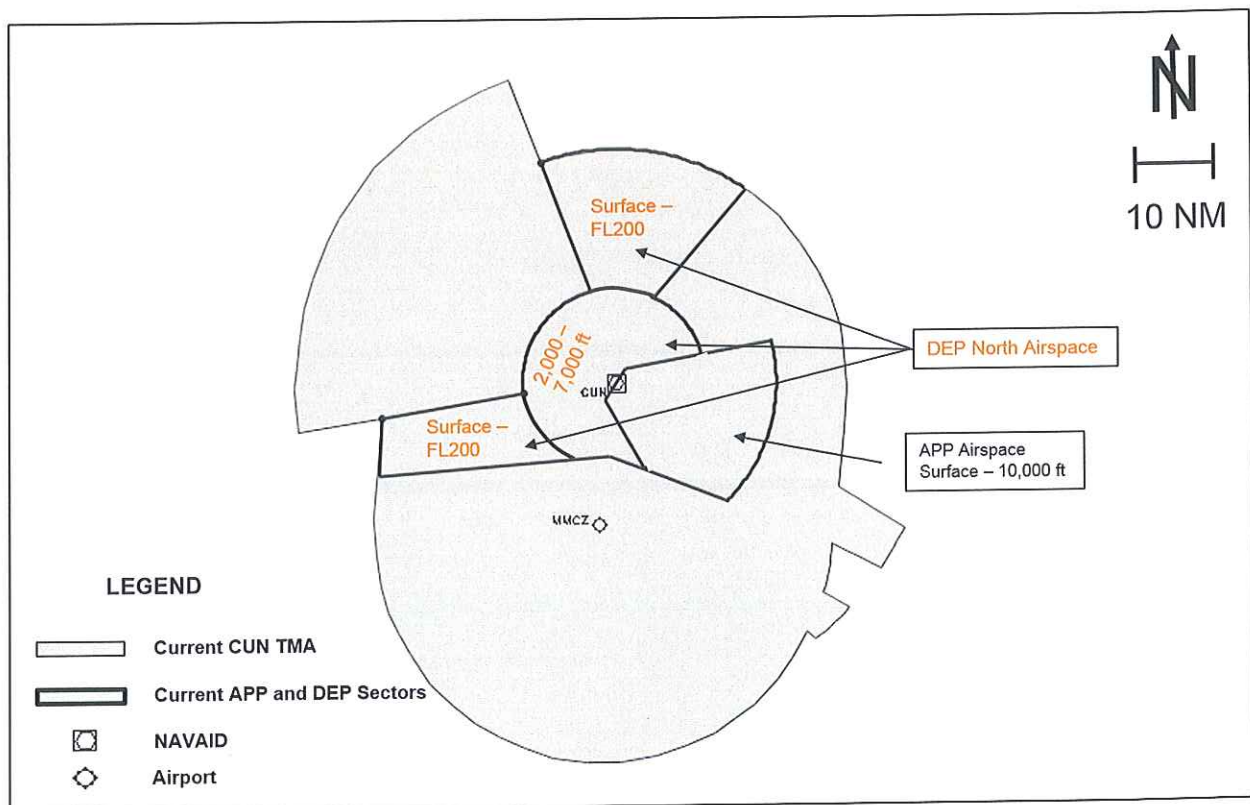


Figure 37. Current DEP North Airspace Landing Runways 30L/R

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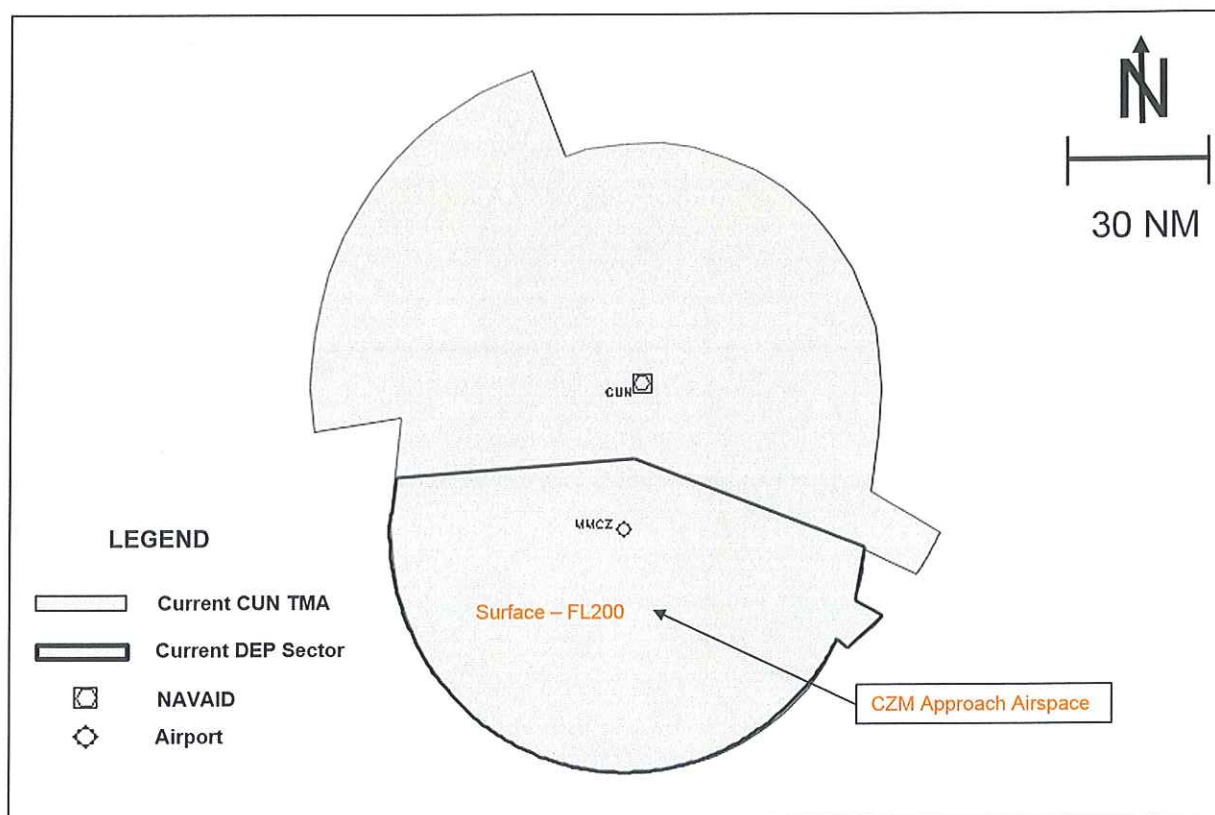
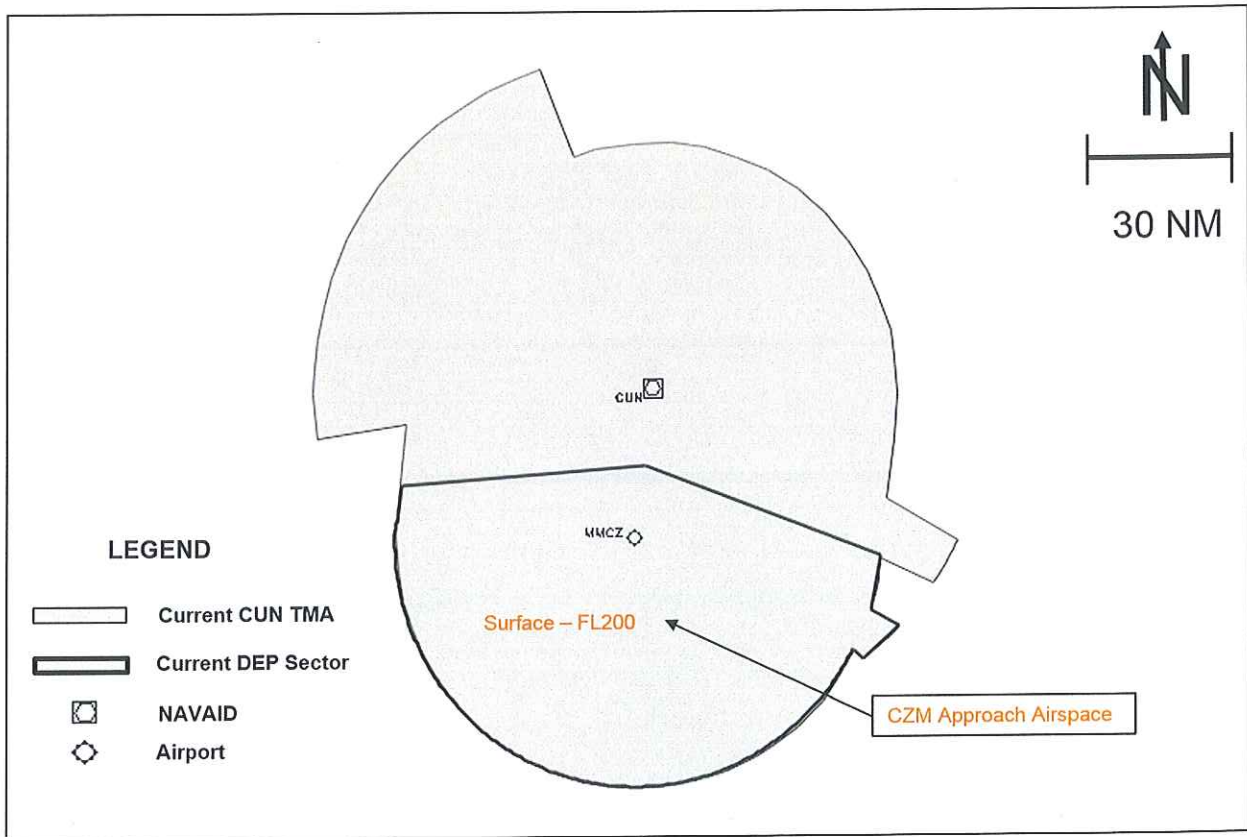


Figure 38. Current CZM App Airspace Landing Runways 12L/R

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**Figure 39. Current CZM App Airspace Landing Runways 30L/R**

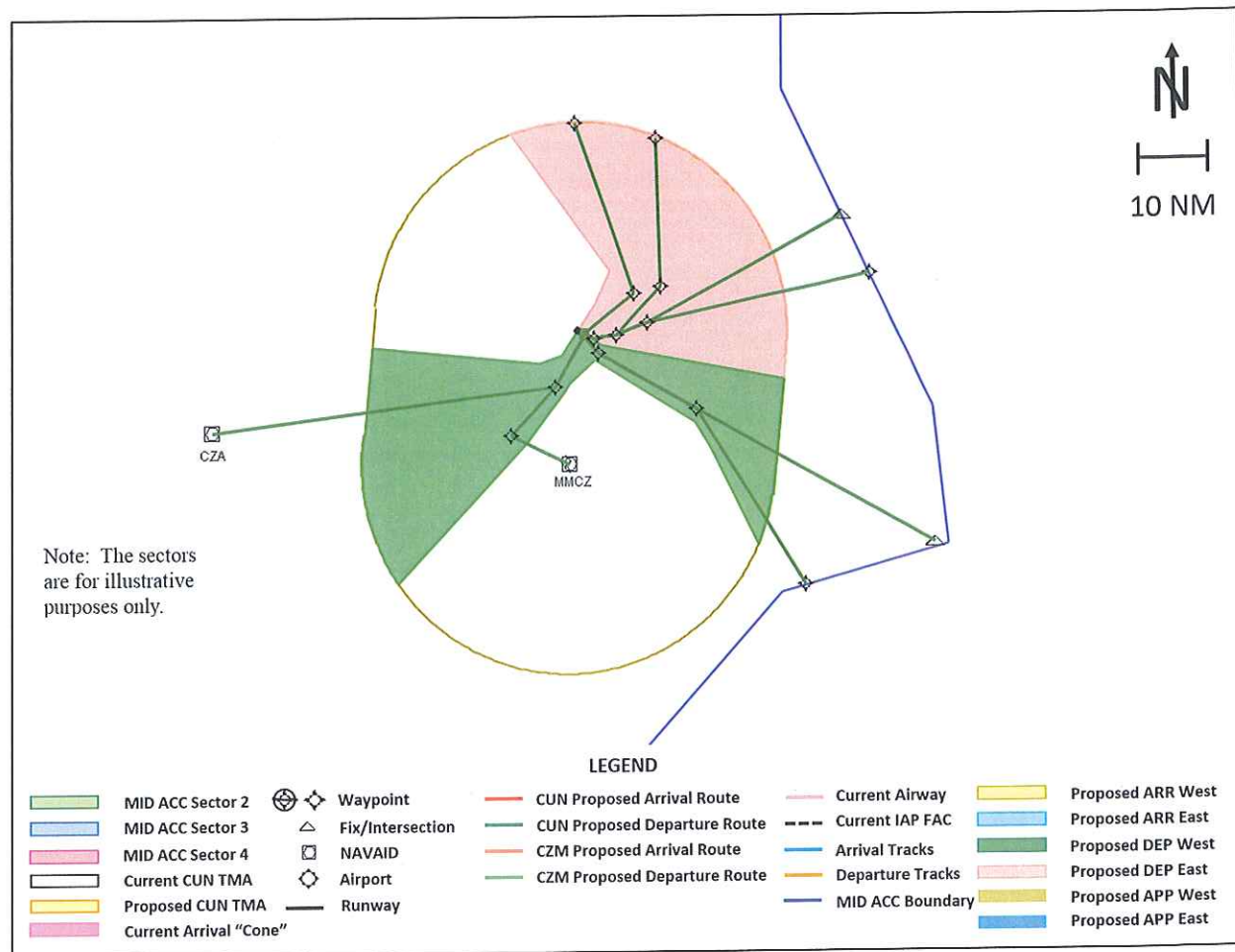
MMUN departure routes to the north and west are laterally segregated from the arrival routes. However, departure routes to the east, southeast, and south share the same exit/entry fixes and are therefore vertically separated to eliminate conflicts.

CZM App also controls all aircraft landing and departing MMCZ. MMCZ current operations will be discussed in Section 2.6.1 and the proposed ConOps will be discussed in Section 2.6.2.

### **2.5.2 Cancún TMA Proposed Departure Sector ConOps**

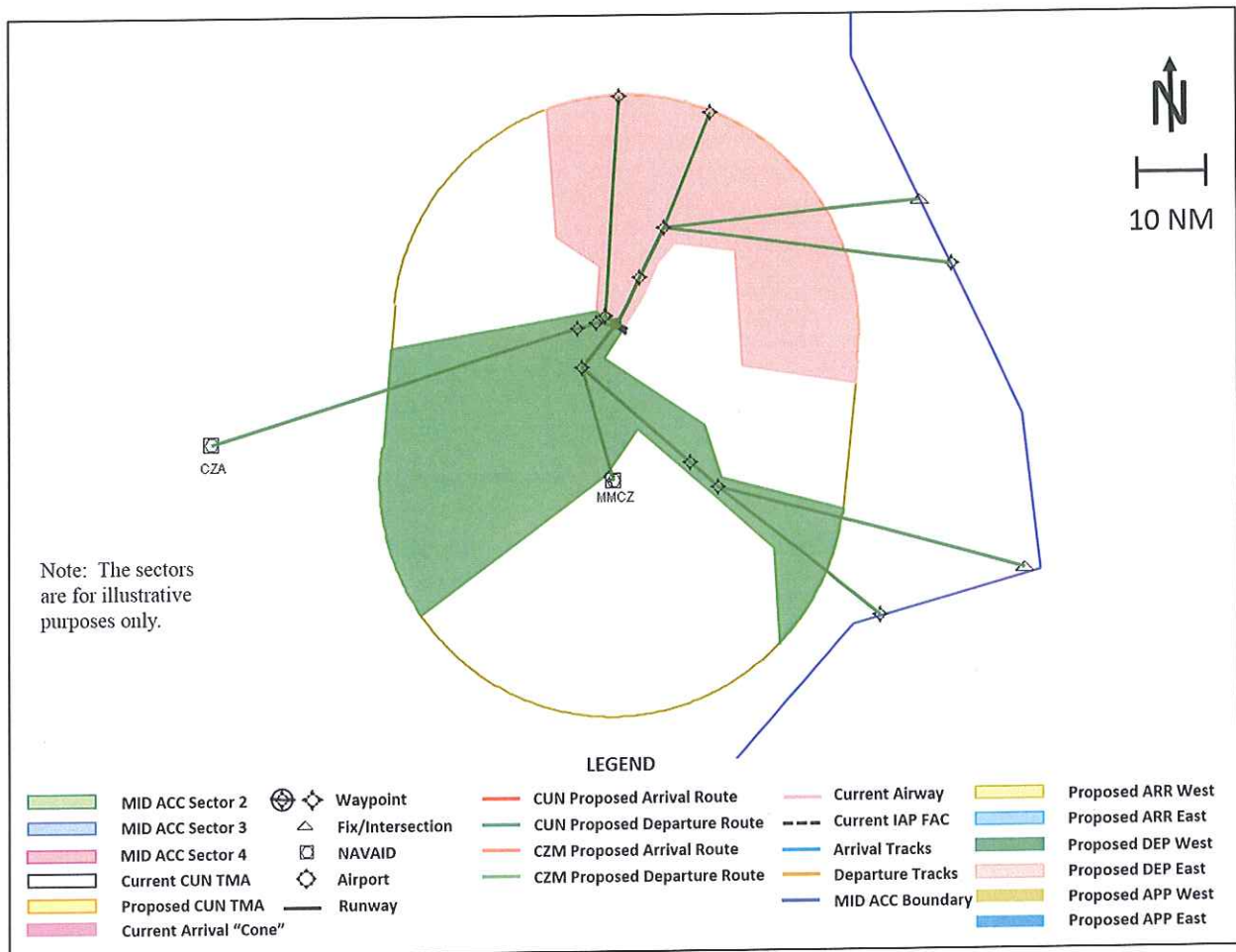
When conducting dual independent departure operations at MMUN, the DEP sector will be staffed with two DEP controllers. The current DEP airspace will be modified into segregated East and West DEP airspace with the dividing line being the same as described in the ARR and APP ConOps sections. Airspace and altitude development will occur during an airspace design workshop to be conducted later on in the project. Figure 40 depicts conceptual DEP “East” and “West” airspace when departing Runways 12 L/R. Figure 41 depicts conceptual DEP “East” and “West” airspace when departing Runways 30 L/R.





**Figure 40. Conceptual DEP East and West Airspace Departing Runways 12L/R**

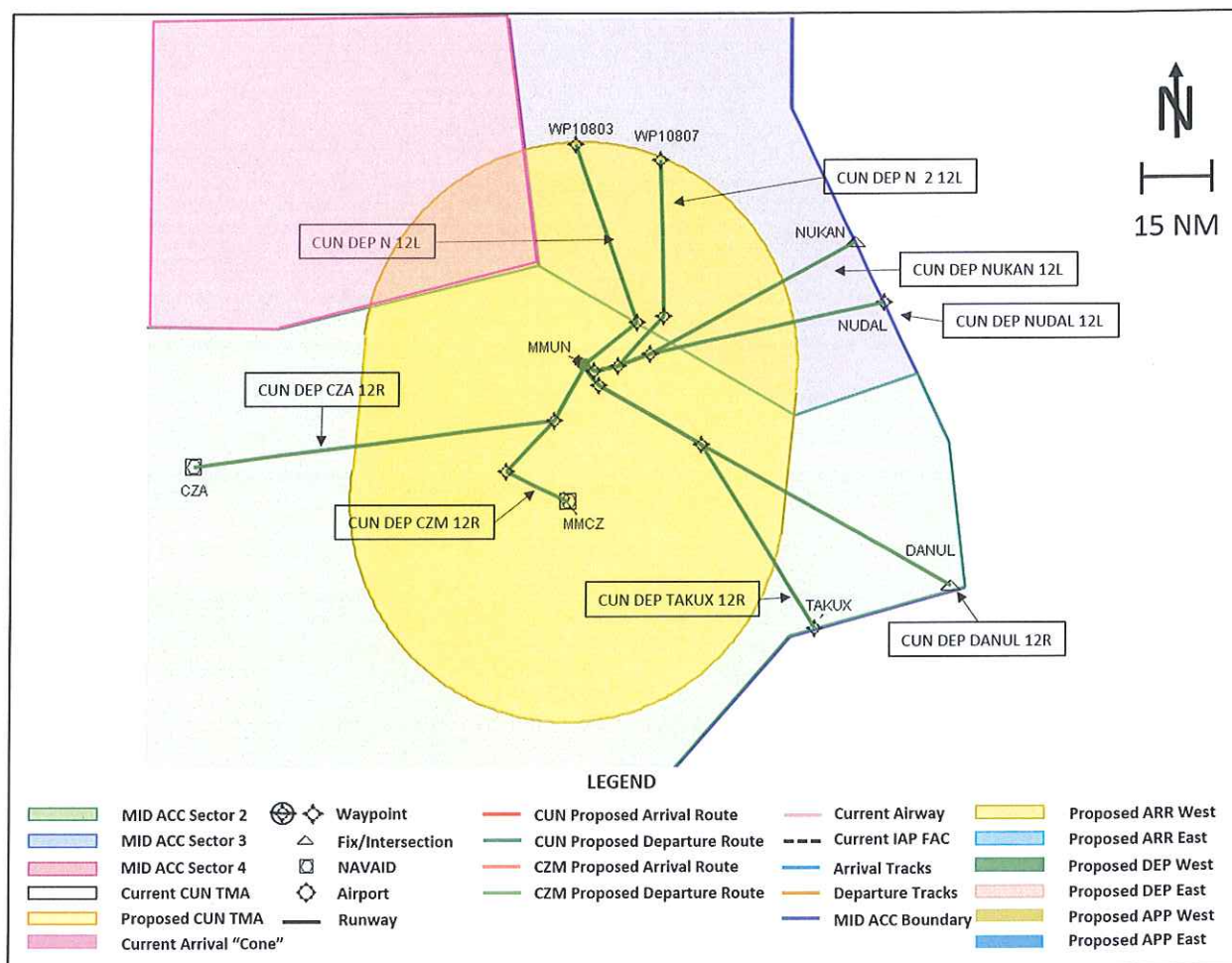
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**Figure 41. Conceptual DEP East and West Airspace Departing Runways 30L/R**

The conceptual airspace and procedures are designed to support dual independent departure operations and also incorporate diverging routes off the same runway to maximize departure efficiency. During Runway 12L/R operations, aircraft assigned the north and east SIDs will depart Runway 12L and aircraft assigned the southeast, south, and west SIDs will depart Runway 12R.

Figure 42 depicts the conceptual SIDs when departing Runways 12L/R. Aircraft departing Runway 12L that are assigned CUN DEP N 12L will make a left turn off the runway to the northeast and aircraft assigned CUN DEP N 2 12L, CUN DEP NUDAL 12L, and CUN DEP NUKAN 12L will follow a route that diverges from CUN DEP N 12L in order to allow MMUN ATCT to depart successive aircraft using diverging route rules. Aircraft that depart Runway 12R on CUN DEP DANUL 12R and CUN DEP TAKUX 12R will follow a route that diverges from the CUN DEP N 2 12L, CUN DEP NUDAL 12L, and CUN DEP NUKAN 12L routes. This divergence allows MMUN ATCT to depart Runway 12L and Runway 12R independently. The CUN DEP DANUL 12R and CUN DEP TAKUX 12R routes also diverge from the CUN DEP CZA 12R and CUN DEP CZM 12R routes allowing MMUN ATCT to apply diverging route rules between successive Runway 12R departures.

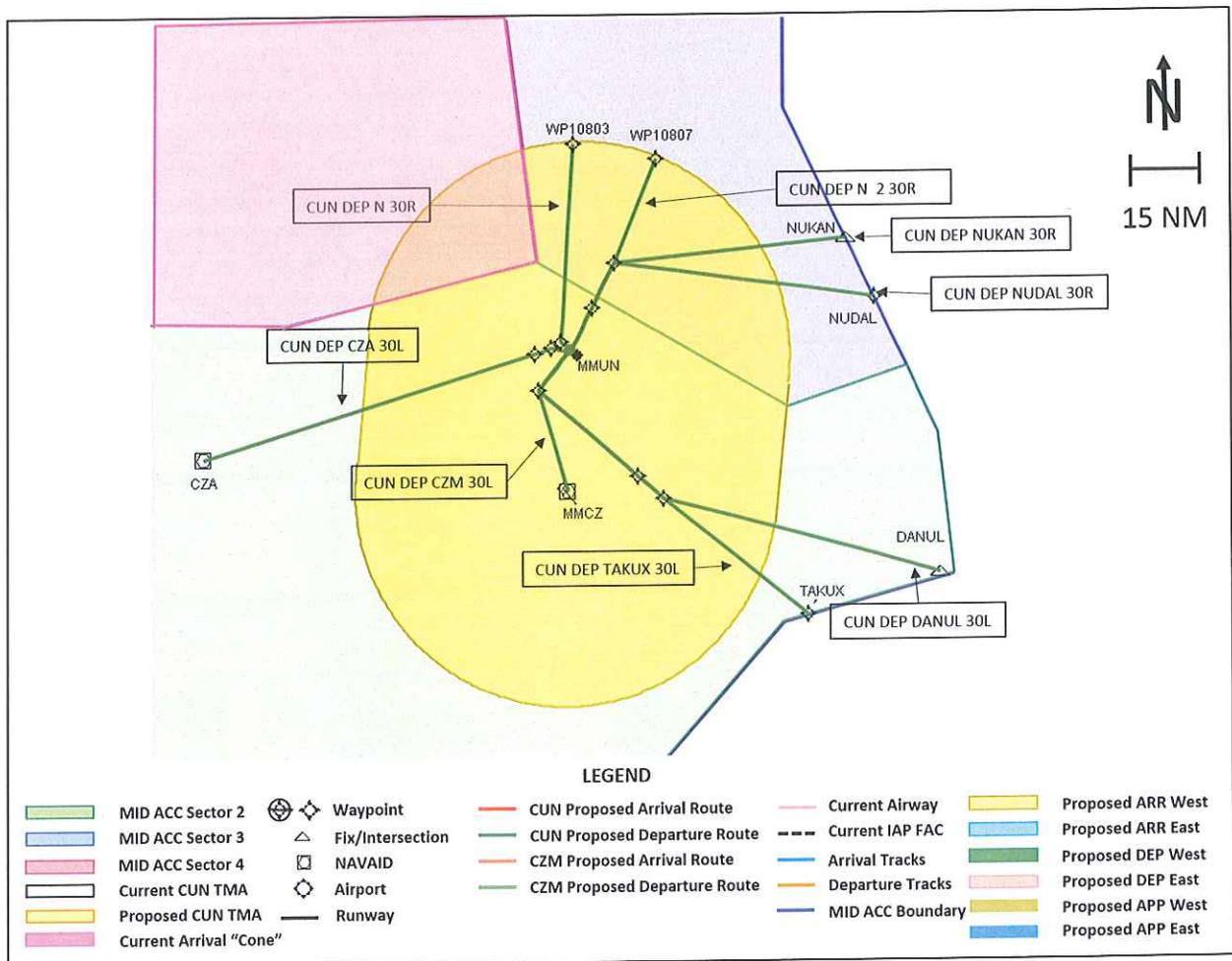


**Figure 42. Conceptual SIDs when Departing Runways 12L/R**

During Runway 30L/R operations, aircraft assigned the north and east SIDs will depart Runway 30R and aircraft assigned the southeast, south, and west SIDs will depart Runway 30L. Figure 43 depicts the conceptual SIDs when departing Runways 30L/R. Aircraft departing Runway 30R that are assigned CUN DEP N 30R will fly runway heading until separation is ensured with aircraft flying the CUN DEP N 2 30R, CUN DEP NUDAL 30R, and CUN DEP NUKAN 30R routes, which all make a right turn off the runway. This design allows MMUN ATCT to depart Runway 30R using diverging route rules.

Aircraft that depart Runway 30L on CUN DEP CZA 30L will follow a route that diverges from CUN DEP N 30R. This divergence allows MMUN ATCT to depart Runway 30L and Runway 30R independently. The CUN DEP CZM 30L, CUN DEP DANUL 30L, and CUN DEP TAKUX 30L routes also diverge from the CUN DEP CZA 30L route allowing MMUN ATCT to apply diverging route rules between these Runway 30L departures.





**Figure 43. Conceptual SIDs when Departing Runways 30L/R**

All departure exit fixes, except for DANUL, will be laterally segregated from the arrival entry fixes. Airspace and altitude development will occur during an airspace design workshop to be conducted later on in the project. (Refer to Figure 24 for a depiction of conceptual SIDs and STARs for a Runway 12L/R operation and Figure 25 for a depiction of procedures for a Runway 30L/R operation.

Other low performance aircraft flying at lower altitudes will be assigned departure routes as designated in the MMAC SOP and MMAC/MMUN ATCT LOA. These routes may be modified based on the final SID and STAR designs.

## 2.6 MMCZ Operations

Current operations are described in Section 2.6.1 and the proposed ConOps is described in Section 2.6.2.

### 2.6.1 MMCZ Current Operations

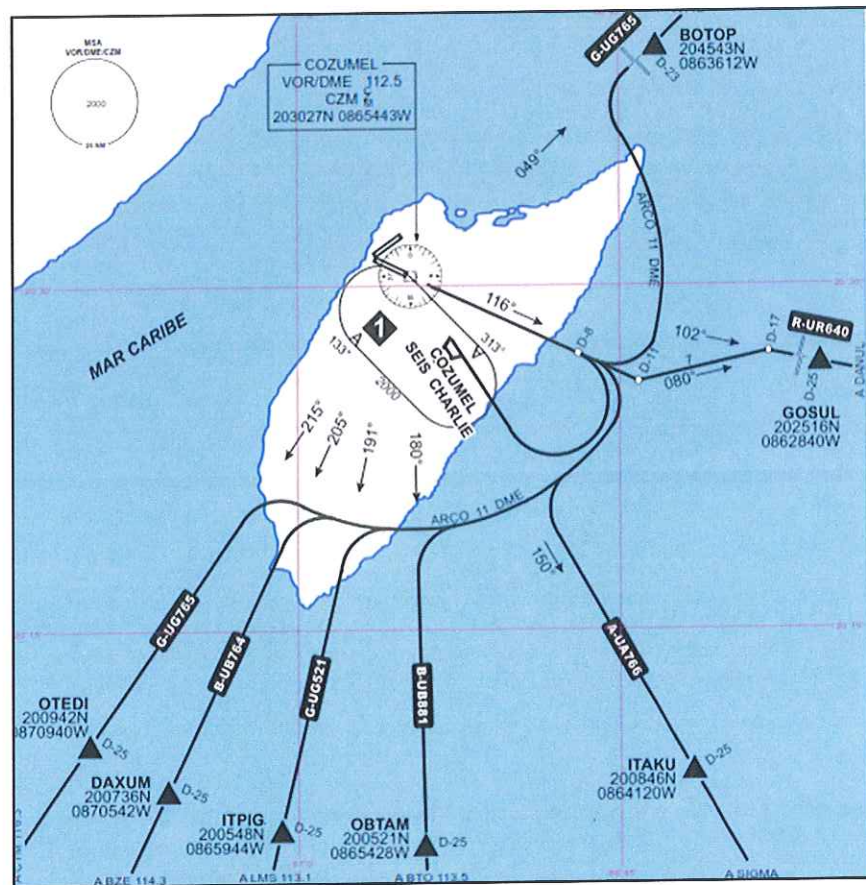
As discussed in Section 2.5.1, CZM App controls traffic arriving and departing MMCZ. When Runway 12L/R is in use at MMUN, CZM App accepts all departures from MMCZ, accepts handoffs from MID ACC on all MMCZ arrivals from the east, south, and west, accepts handoffs from ARR on MMCZ arrivals from the north, and hands off east, south, and west departures to MID ACC, and hands off north departures to DEP North.

When Runway 30L/R is in use at MMUN, CZM App initially accepts all departures from MMCZ, accepts handoffs from DEP North for all MMCZ arrivals from the east, accepts handoffs from ARR on MMCZ arrivals from the north, accepts handoffs from MID ACC on MMCZ arrivals from the south and west, hands off south and west departures to MID ACC, and hands off north and east departures to DEP North.

MMCZ departures depart Runway 11 or Runway 29 and are assigned a conventional SID that joins the airway structure. The Runway 11 SIDs are depicted in Figure 44 and the Runway 29 SIDs are depicted in Figure 45.

Aircraft departing to the north and east fly the CZM 11 DME arc to BOTOP to join G-UG765, to GOSUL to join R-UR640, to LIDEK to join B-UB881 or VOBED to join A-UA766. Aircraft departing to the south fly the CZM 11 DME arc to join G-UG785 to OTEDI, B-UB764 to DAXUM, G-UG521 to ITPIG, B-UB881 to OBTAM, or A-UA766 to ITAKU. Aircraft departing to the west fly the CUN 11 DME arc to UJ9/V45 to DUPIX or UJ24/V30 to OKUVA. No initial altitudes or speeds are published on the SIDs.

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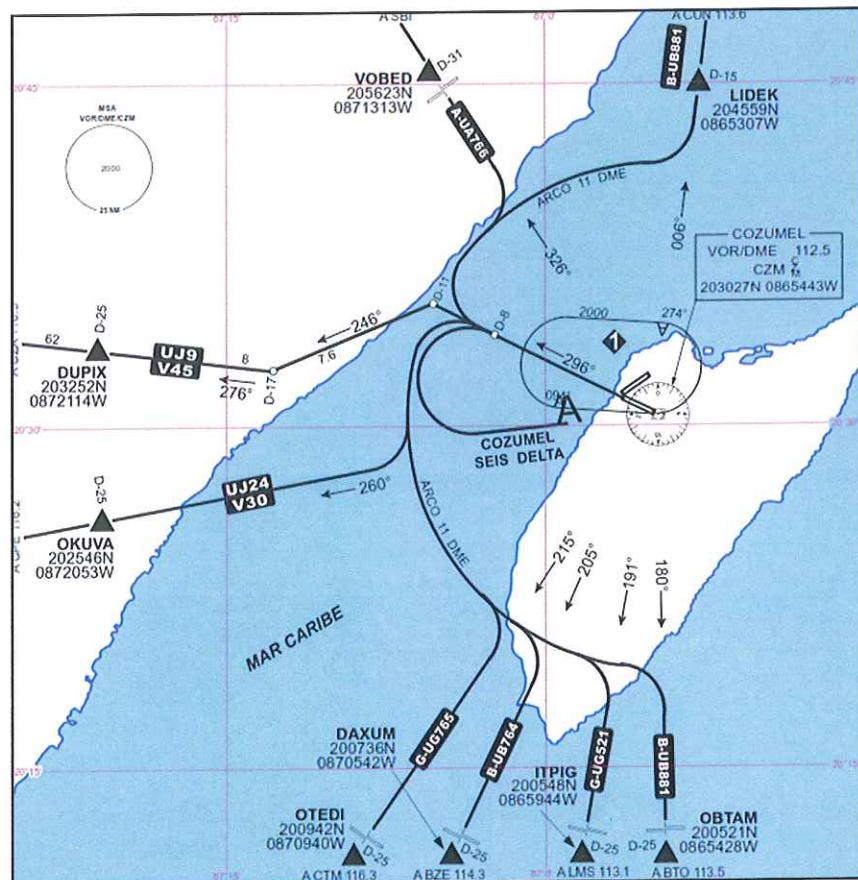


Source: Mexico AIP, March 2016

Figure 44. MMCZ Runway 11 SIDs

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Source: Mexico AIP, March 2016

**Figure 45. MMCZ Runway 29 SIDs**

MMCZ arrivals fly most of the same airways as the departures. Aircraft are advised to expect vectors for the VOR/DME approach or the visual approach to Runway 11 or 29. Aircraft arriving from the north and east fly R-UR640, B-UB881, A-UA766, or R-UR640 prior to being vectored for the approach. Aircraft arriving from the south fly G-UG765, B-UB764, G-UG521, B-UB881, or A-UA766 prior to being vectored for the approach. Aircraft arriving from the west fly UJ9/V45 to DUPIX or UJ24/V30 prior to being vectored for the approach. The VOR/DME 2 Runway 11 IAC is depicted in Figure 46 and the VOR/DME 2 Runway 29 IAC is depicted in Figure 47.

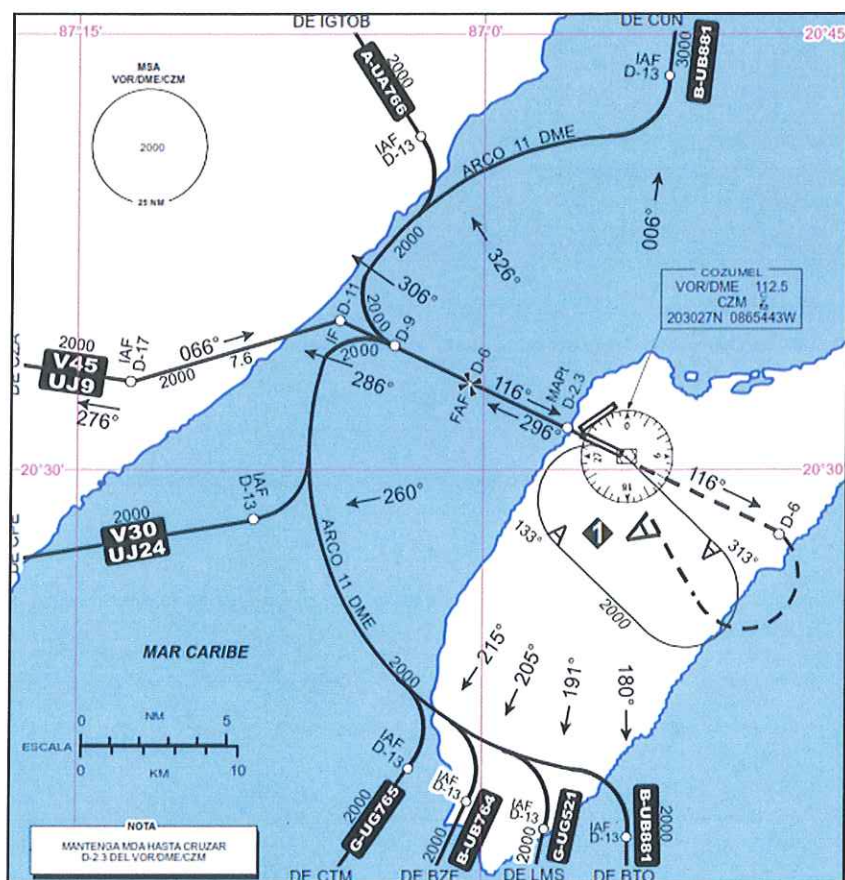
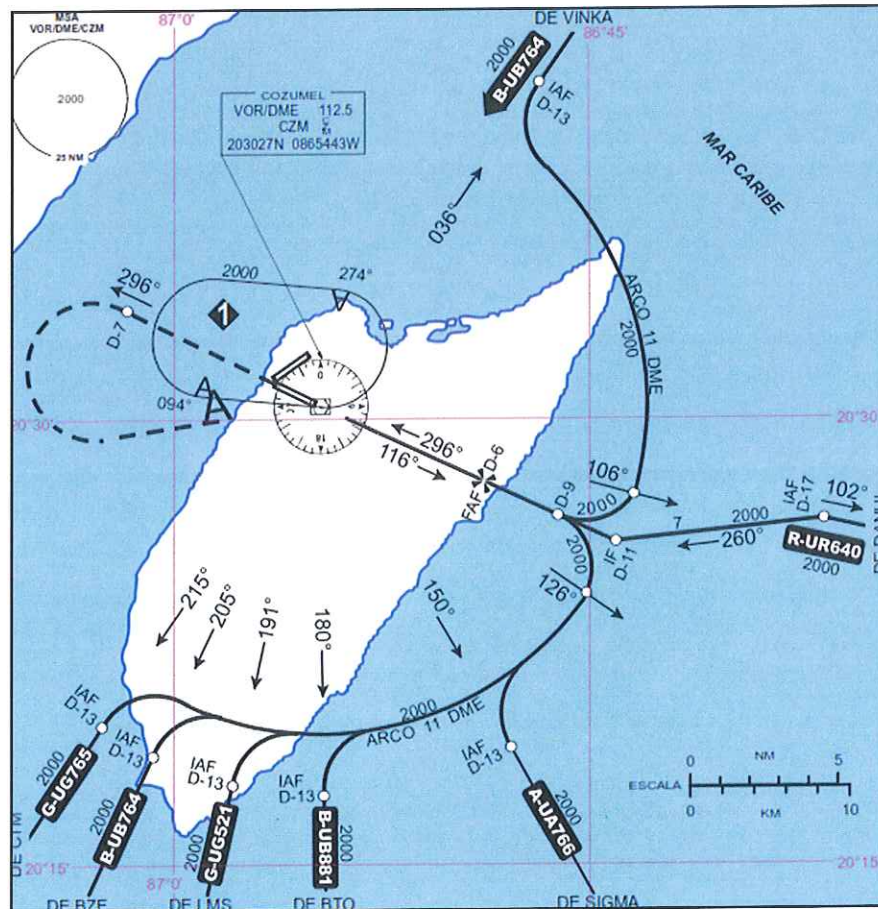


Figure 46. MMCZ VOR/DME 2 Runway 11 IAC

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Source: Mexico AIP, March 2016

**Figure 47. MMCZ VOR/DME 2 Runway 29 IAC**

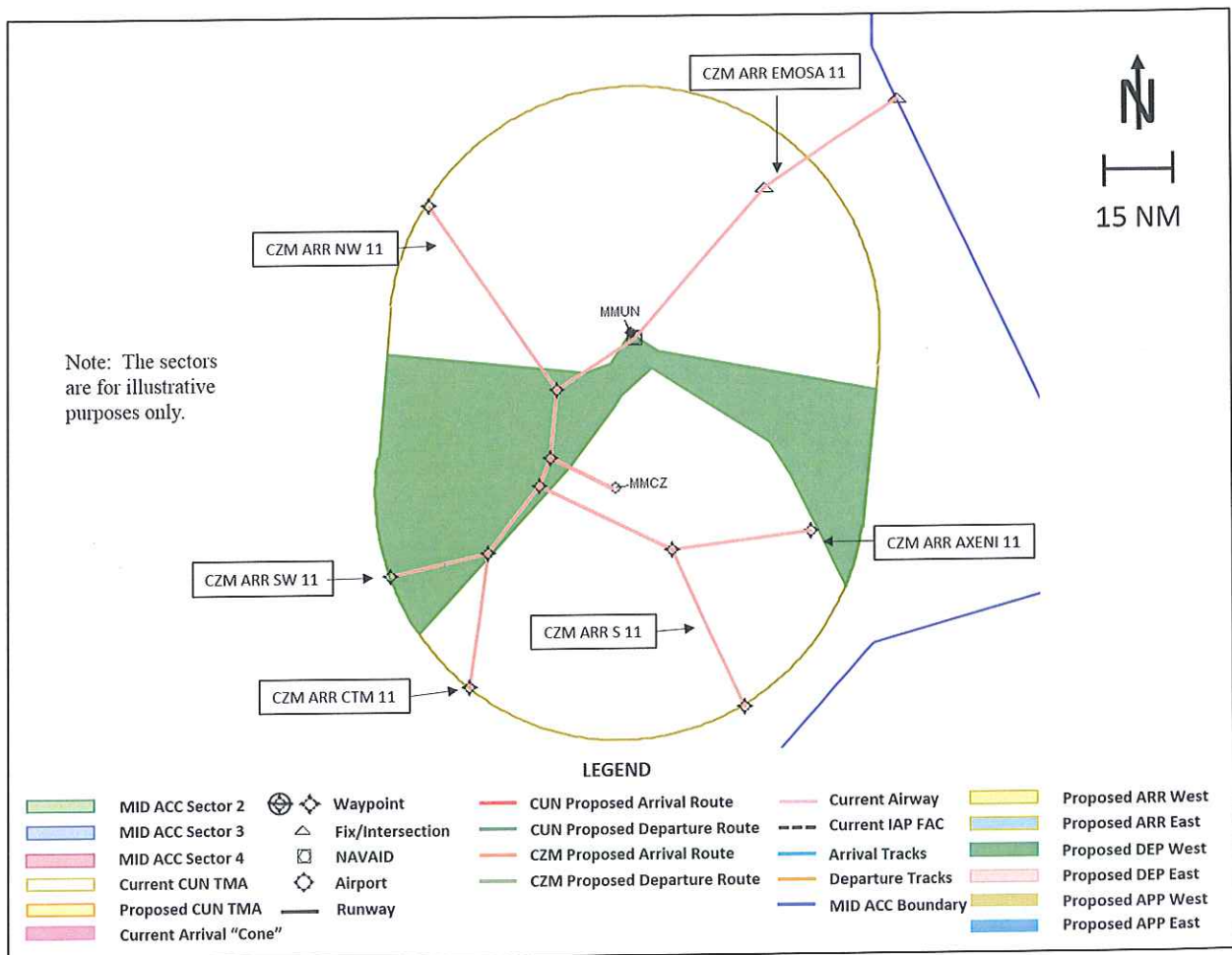
### 2.6.2 MMCZ Proposed ConOps

The proposed ConOps for MMCZ departures and arrivals is similar to the MMUN proposed ConOps. RNAV STARs and SIDs are proposed for jet aircraft and some lower performing turboprop aircraft. Most low performance aircraft flying at lower altitudes will be assigned departure and arrival routes as designated in the MMAC SOP and MMAC/MMCZ ATCT LOA. Airspace and altitude development will occur during an airspace design workshop to be conducted later on in the project. The MMCZ STARs are not designed as CDOs. TMA controllers will assign altitudes as appropriate to separate aircraft on these STARs from other aircraft. The STARs are “open” STARs as opposed to “closed” STARs. It’s anticipated that DEP West will vector the aircraft to join the FAC.

Figure 48 depicts the conceptual MMCZ Runway 11 STARs with the conceptual DEP West airspace. Six STARs are proposed for aircraft landing Runway 11. DEP West will accept handoffs from MID ACC on aircraft arriving on the CZM ARR SW 11, CZM ARR CTM 11, CZM ARR AXENI 11, and CZM ARR S 11 STARs, from ARR West on the CZM ARR NW 11 STAR, and accept handoffs from ARR East on the CZM ARR EMOSA 11 STAR. It is anticipated the airspace to the south, which is delegated to ARR West, will be stratified by



altitudes delegated to ARR West and DEP West. MMCZ arrivals may be assigned lower altitudes on the CZM ARR CTM 11, CZM ARR S 11, and CZM ARR AXENI 11 STARs in order to ensure these aircraft enter MMAC airspace in DEP West airspace as opposed to ARR West airspace. This will reduce the workload on ARR West and enhance arrival planning for DEP West. Airspace and altitude development will occur during an airspace design workshop to be conducted later on in the project.

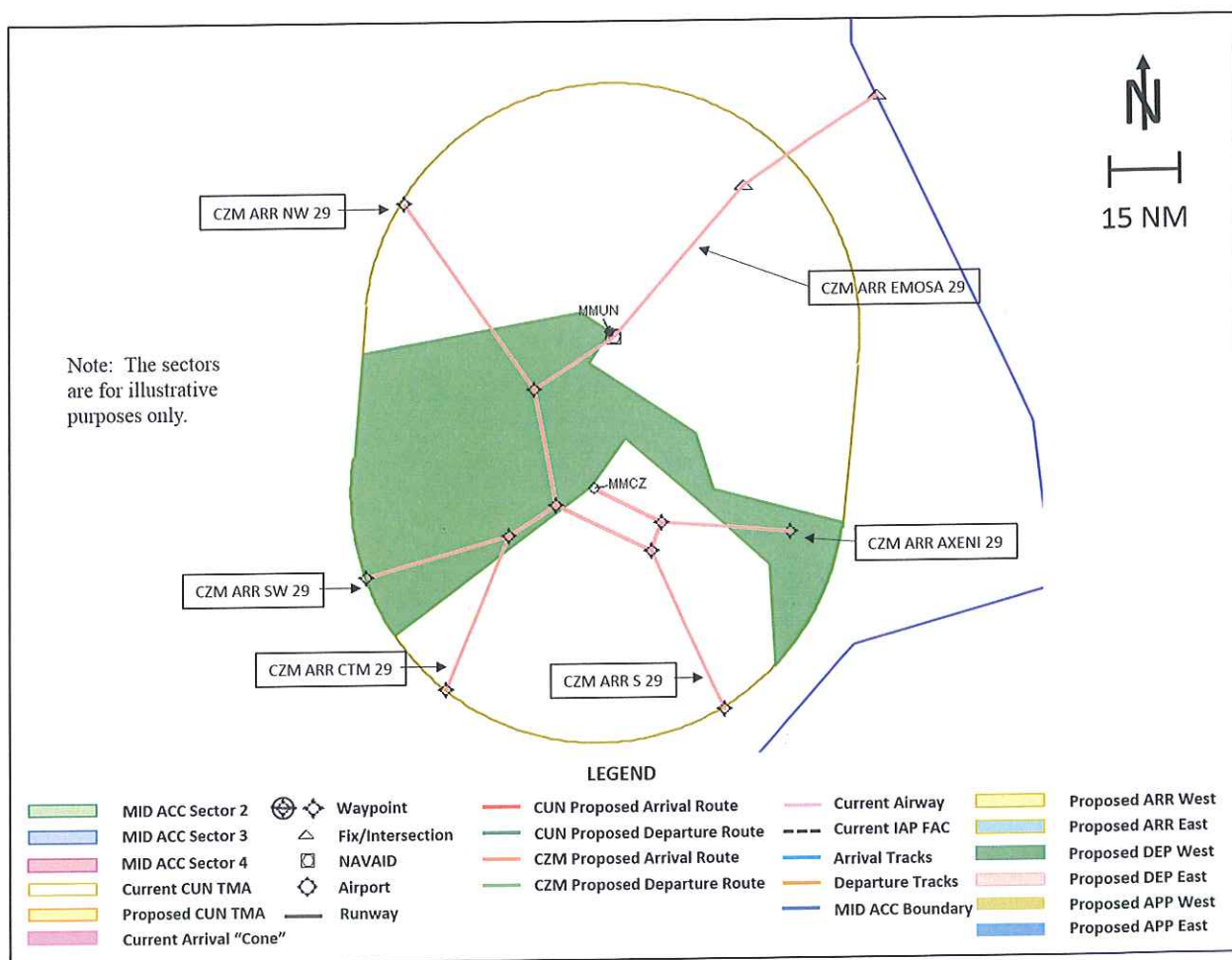


**Figure 48. Conceptual MMCZ Runway 11 STARs and DEP West Airspace**

Figure 49 depicts the conceptual MMCZ Runway 29 STARs with the conceptual DEP West airspace. Six STARs are proposed for aircraft landing Runway 29. These STARs will initiate at the same WPs as the Runway 11 STARs. DEP West will accept handoffs from MID ACC on aircraft arriving on the CZM ARR SW 29, CZM ARR CTM 29, CZM ARR AXENI 29, and CZM ARR S 29 STARs, accept handoffs from ARR West on the CZM ARR NW 29 STAR, and accept handoffs from ARR East on the CZM ARR EMOSA 29 STAR.

It's anticipated the airspace to the south, which is delegated to ARR West, will be stratified by altitudes delegated to ARR West and DEP West. MMCZ arrivals may be assigned lower altitudes on the CZM ARR CTM 29, CZM ARR S 29, and CZM ARR AXENI 29 STARs in

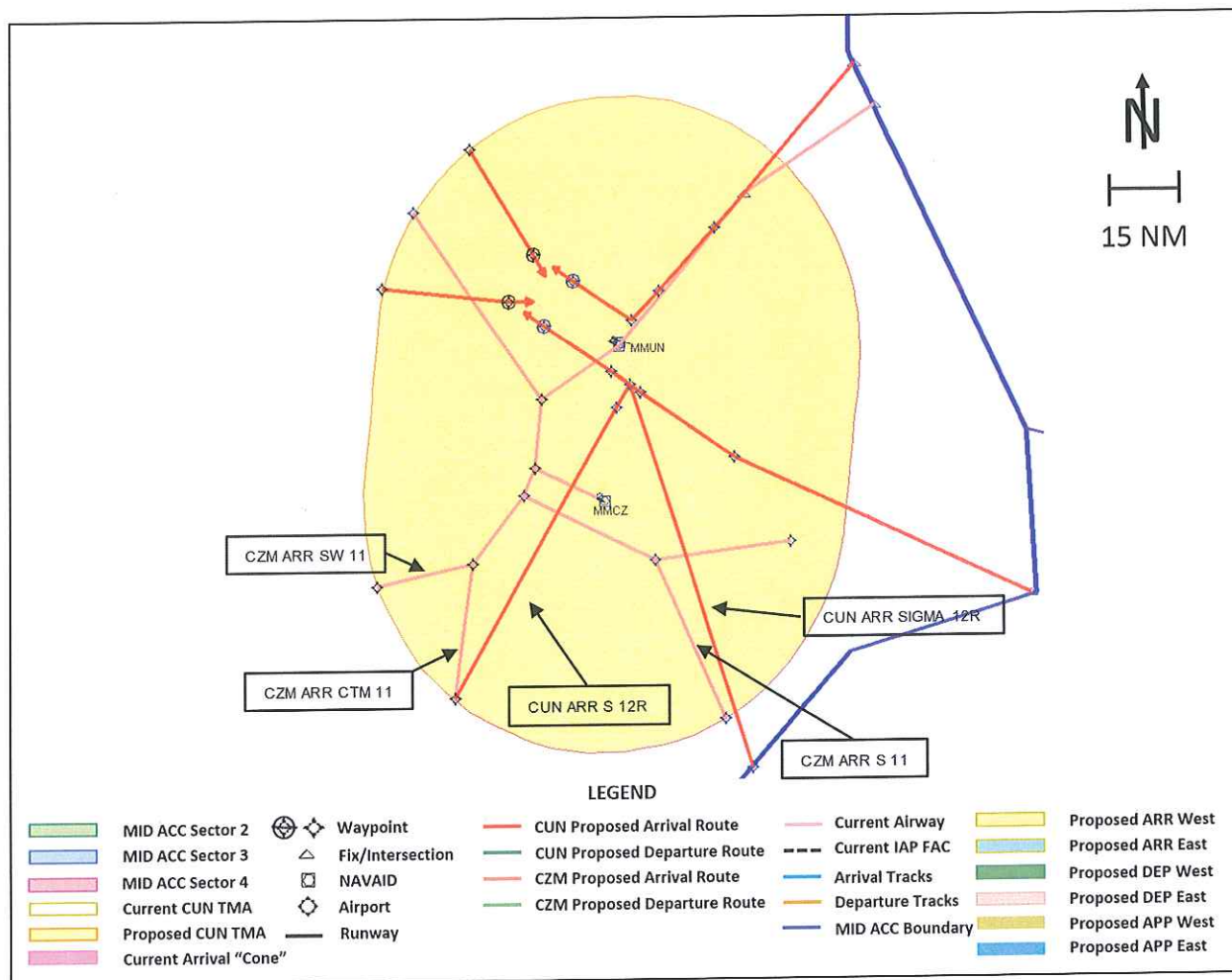
order to ensure these aircraft enter MMAC airspace in DEP West airspace as opposed to ARR West airspace. This will reduce the workload on ARR West and enhance arrival planning for DEP West. Airspace and altitude development will occur during an airspace design workshop to be conducted later on in the project.



**Figure 49. Conceptual MMCZ Runway 29 STARs and DEP West Airspace**

The proposed MMCZ STARs and the proposed MMUN STARs are designed to operate independently. The STARs are initially laterally separated except for the CUN ARR S (12R and 30L)/CZM ARR CTM (11 and 29) and the CUN ARR SIGMA (12R and 29)/CZM ARR S (11 and 29). The STARs that are not laterally separated will be vertically separated.

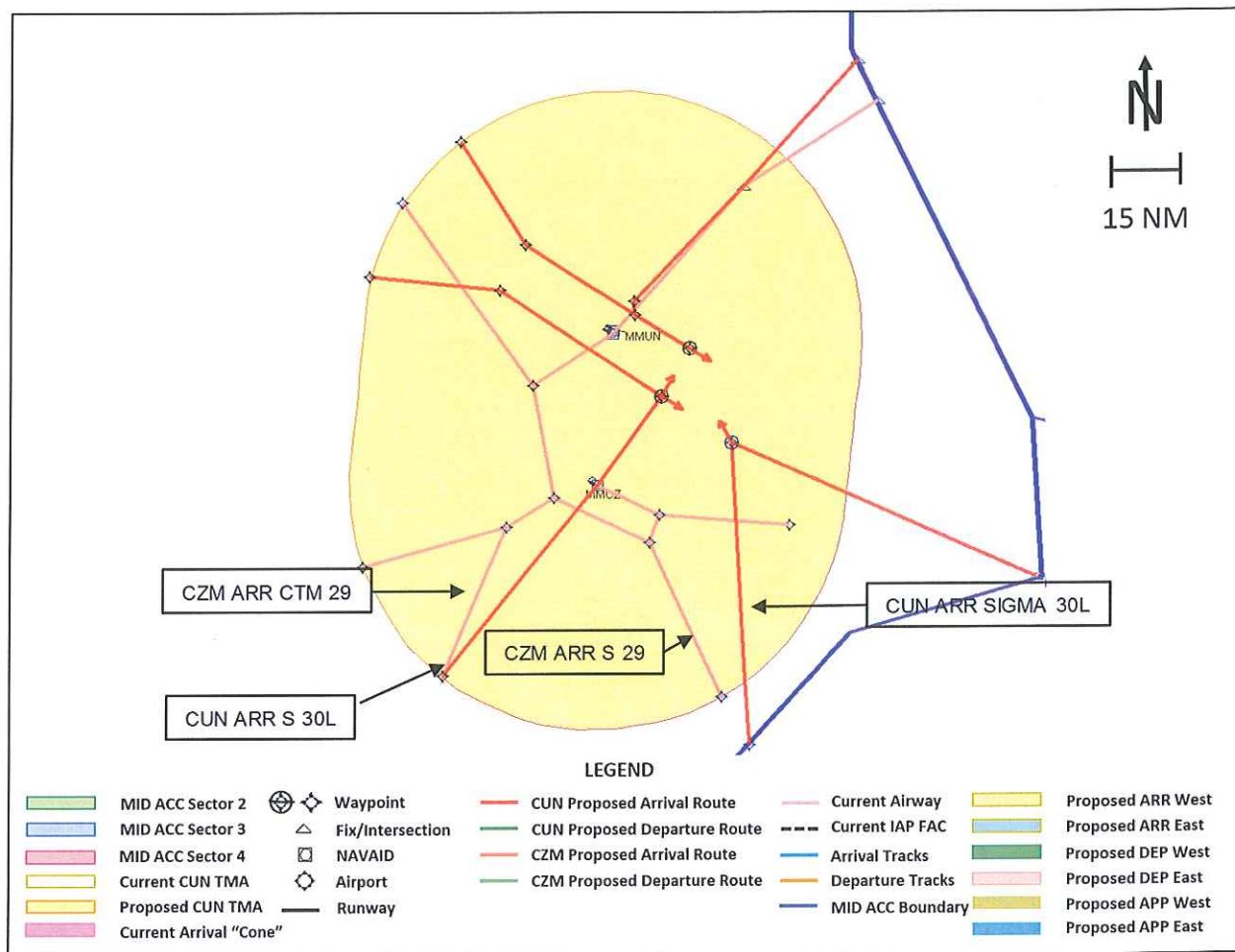
Figure 50 depicts the conceptual MMUN Runway 12L/R and MMCZ Runway 11 STARs, and Figure 51 depicts the conceptual MMUN Runway 30L/R and MMCZ Runway 29 STARs. The conceptual TMA airspace is shown in both depictions.



**Figure 50. Conceptual MMUN Runway 12L/R STARs and MMCZ Runway 11 STARs**

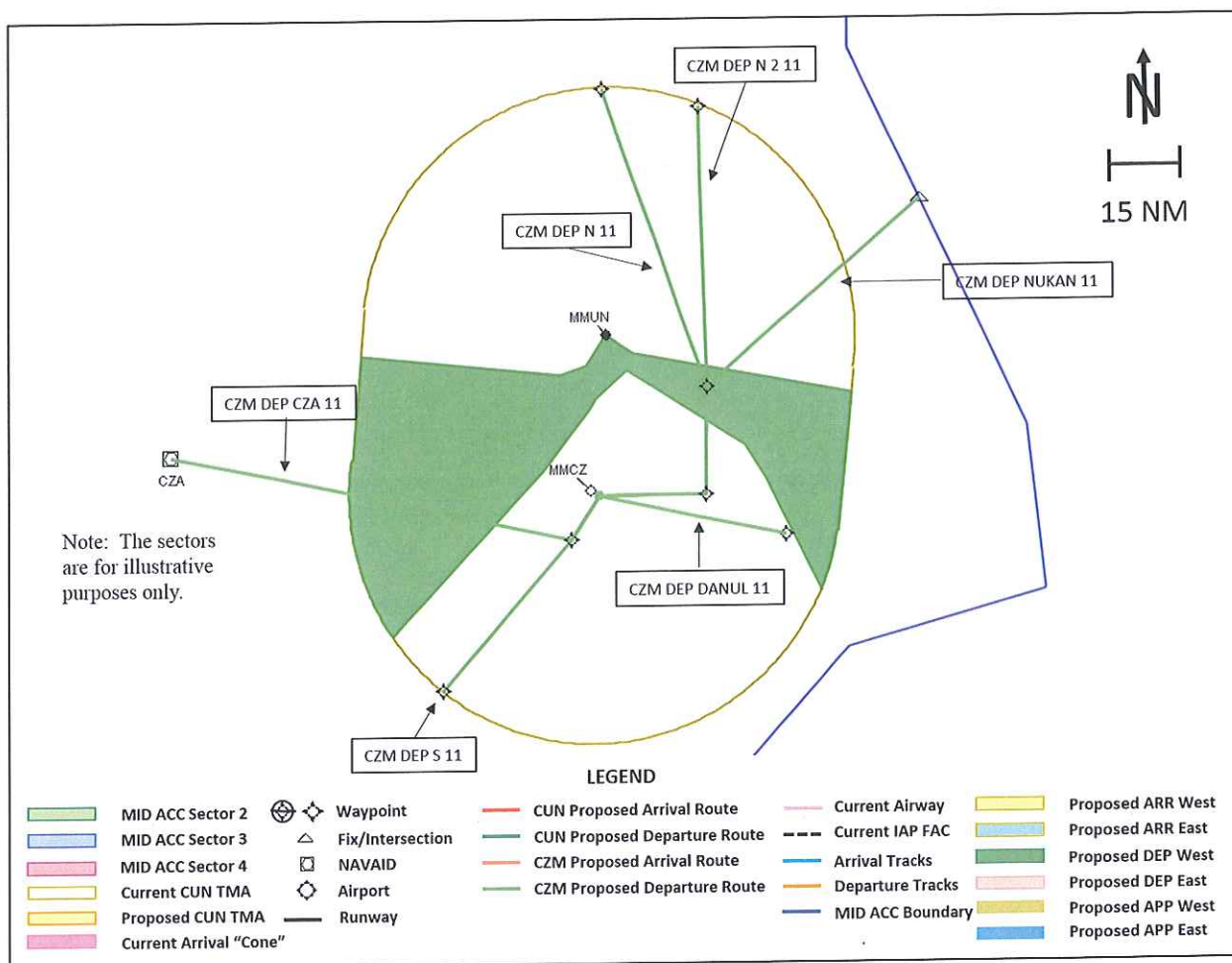
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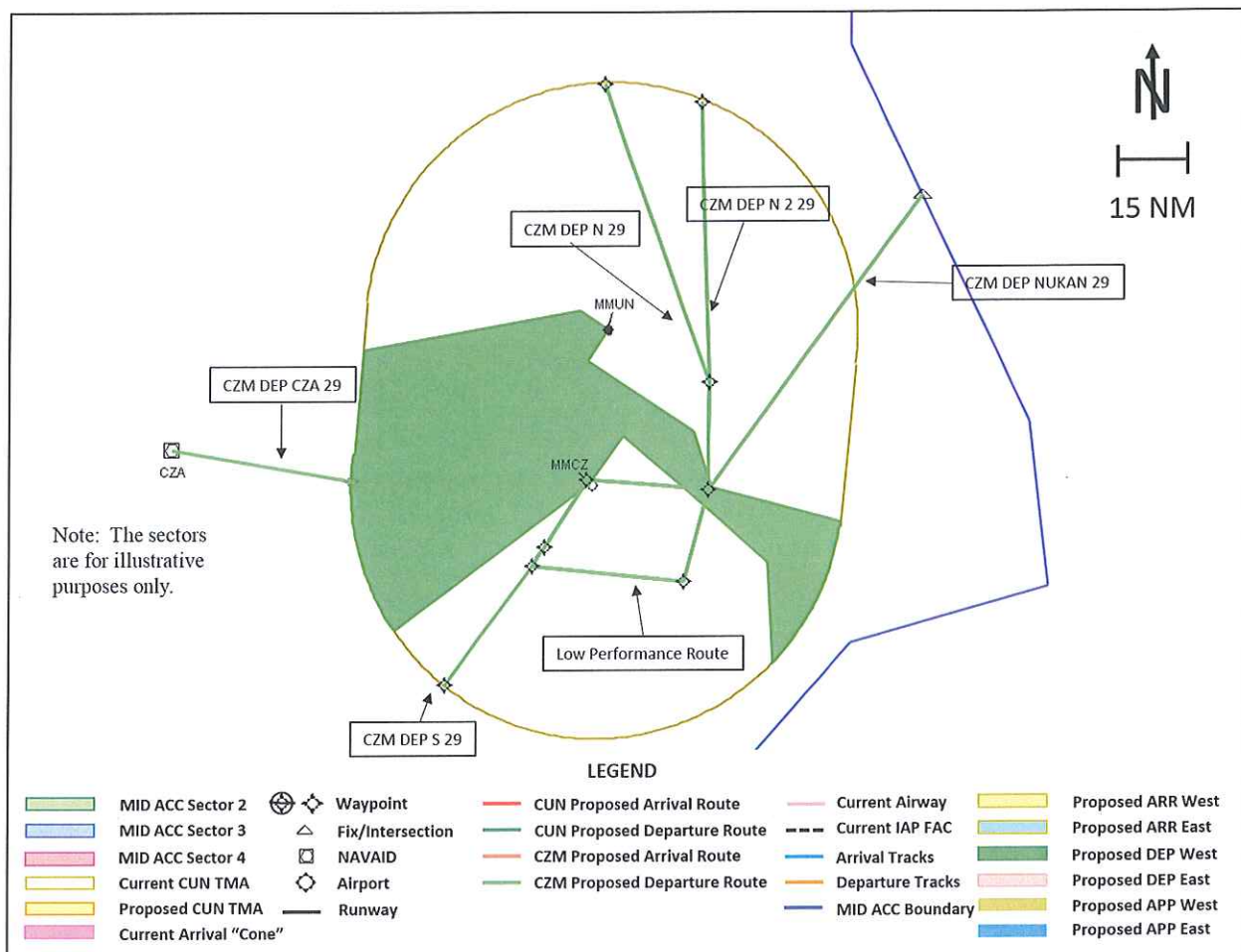
**Figure 51. Conceptual MMUN Runway 30L/R STARs and MMCZ Runway 29 STARs**

Figure 52 depicts the conceptual MMCZ Runway 11 SIDs with the conceptual DEP West airspace. Six SIDs are proposed for Runway 11. Departure West will hand off aircraft on the CZM DEP CZA 11, CZM DEP S 11, and CZM DEP DANUL 11 SIDs to MID ACC and hand off aircraft on the CZM DEP N 11, CZM DEP N 2 11, and CZM DEP NUKAN 11 SIDs to DEP East.



**Figure 52. Conceptual MMCZ Runway 11 SIDs and DEP West Airspace**

Figure 53 depicts the conceptual MMCZ Runway 29 SIDs with the conceptual DEP West airspace. The Low Performance Route depicted is the initial path for the CZA DEP N 29, CZA DEP N 2 29, and CZA DEP NUKAN 29 Low Performance SIDs. Eight SIDs are proposed for Runway 29. Low Performing Aircraft SIDs were proposed for Runway 29 because it was anticipated these aircraft could not climb above aircraft departing MMUN Runway 12L/R. DEP West will hand off aircraft on the CZA DEP CZA 29 and CZA DEP S 29 SIDs to MID ACC and hand off aircraft on the CZA DEP N 29, CZA DEP N 29 Low Performing Aircraft, CZA DEP N 2 29, CZA DEP N 2 29 Low Performing Aircraft, CZA DEP NUKAN 29, and CZA DEP NUKAN 29 Low Performing Aircraft SIDs to DEP East.



**Figure 53. Conceptual MMCZ Runway 29 SIDs and DEP West Airspace**

The proposed MMCZ SIDs are designed to depart over the same fixes as the proposed MMUN SIDs. These proposed SIDs are designed to integrate with the proposed MMUN SIDs in order to allow the MMCZ SIDs to either fly under or climb above the MMUN SIDs.

Figure 54 depicts the conceptual MMUN Runway 12L/R SIDs and conceptual MMCZ Runway 11 SIDs and Figure 55 depicts the conceptual MMUN Runway 30L/R and conceptual MMCZ Runway 29 SIDs. The proposed TMA airspace is shown in both depictions.



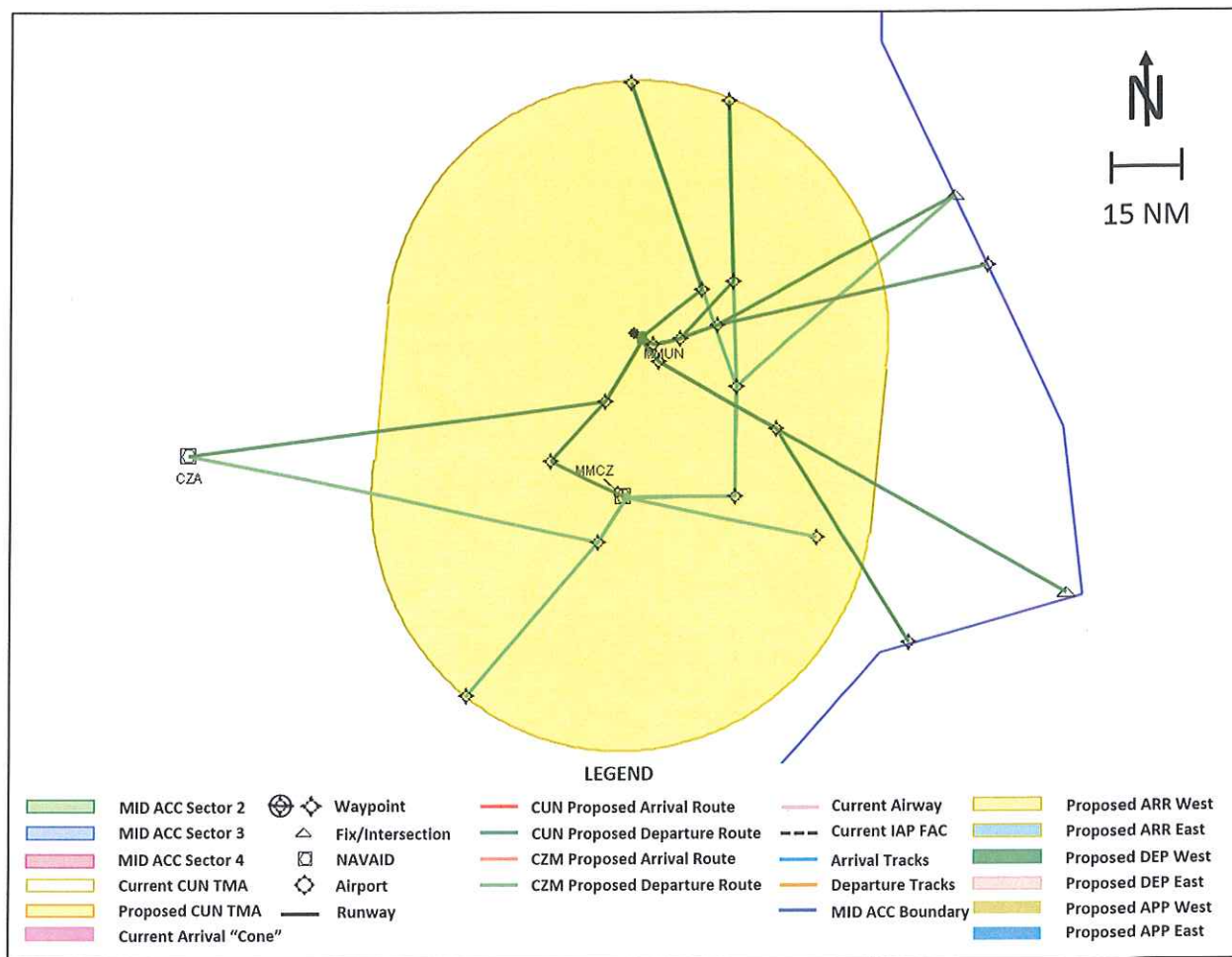
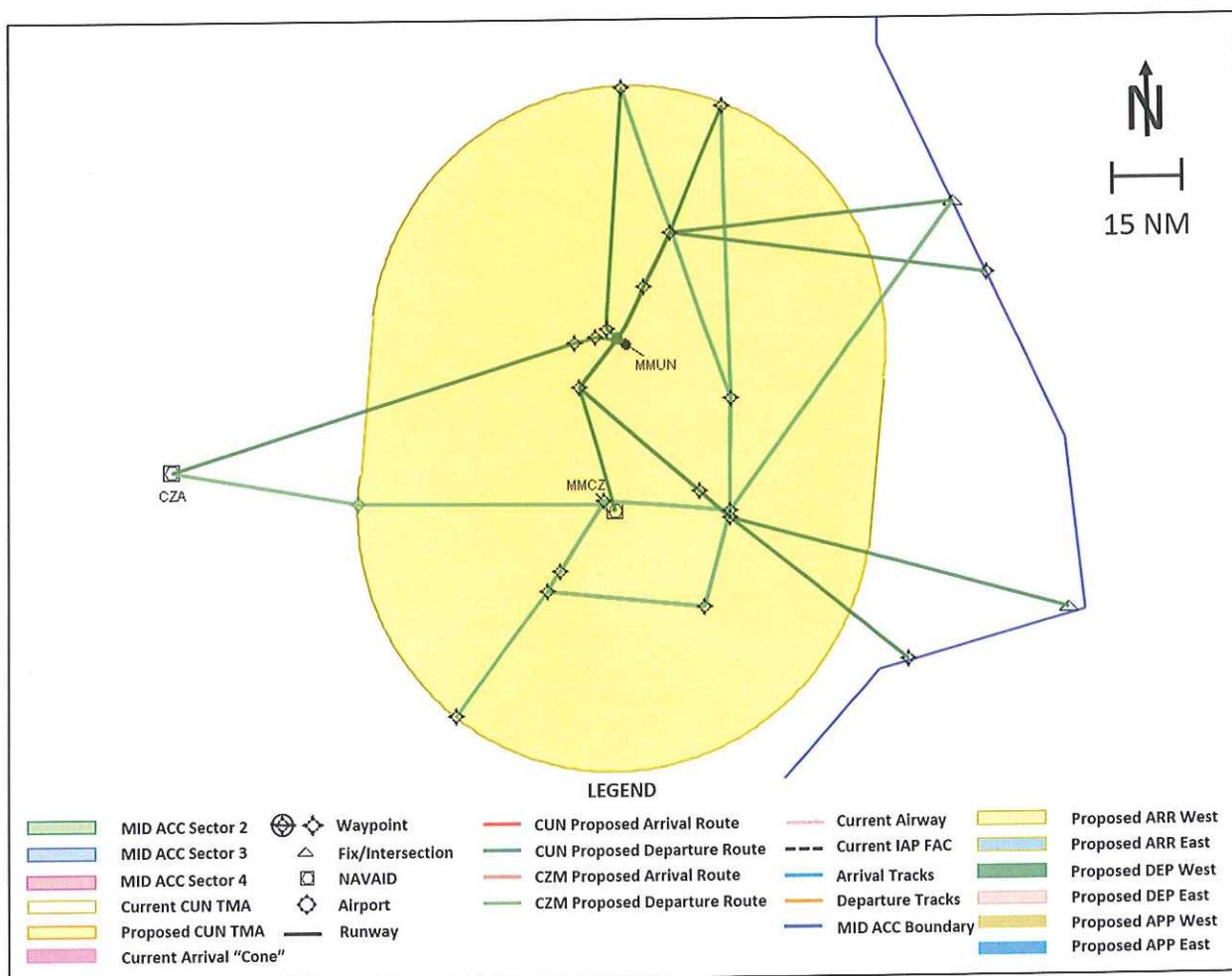


Figure 54. Conceptual MMUN Runway 12L/R SIDs and MMCZ Runway 11 SIDs

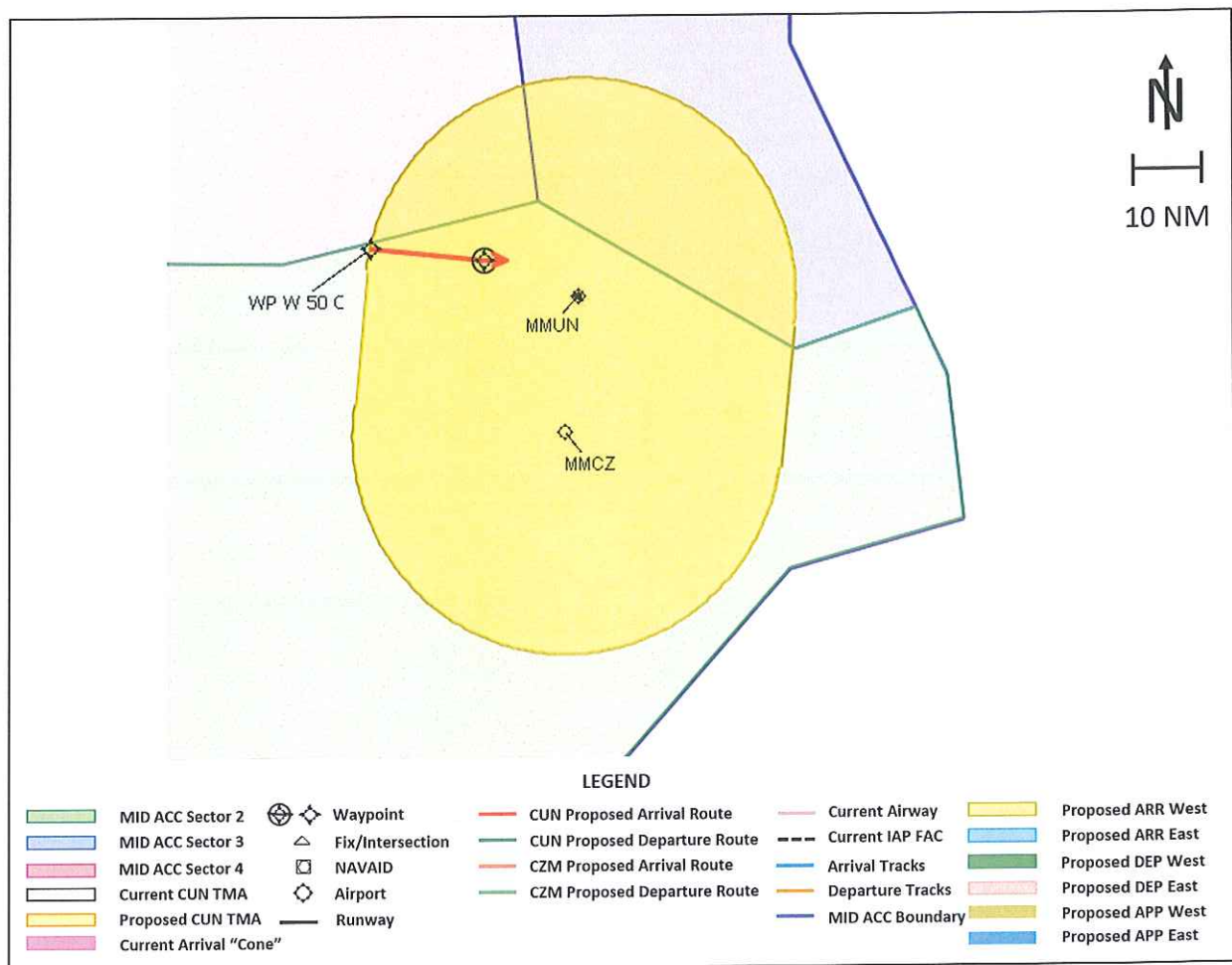
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**Figure 55. Conceptual MMUN Runway 30L/R SIDs and MMCZ Runway 29 SIDs**

## 2.7 Proposed MID ACC Airspace Changes

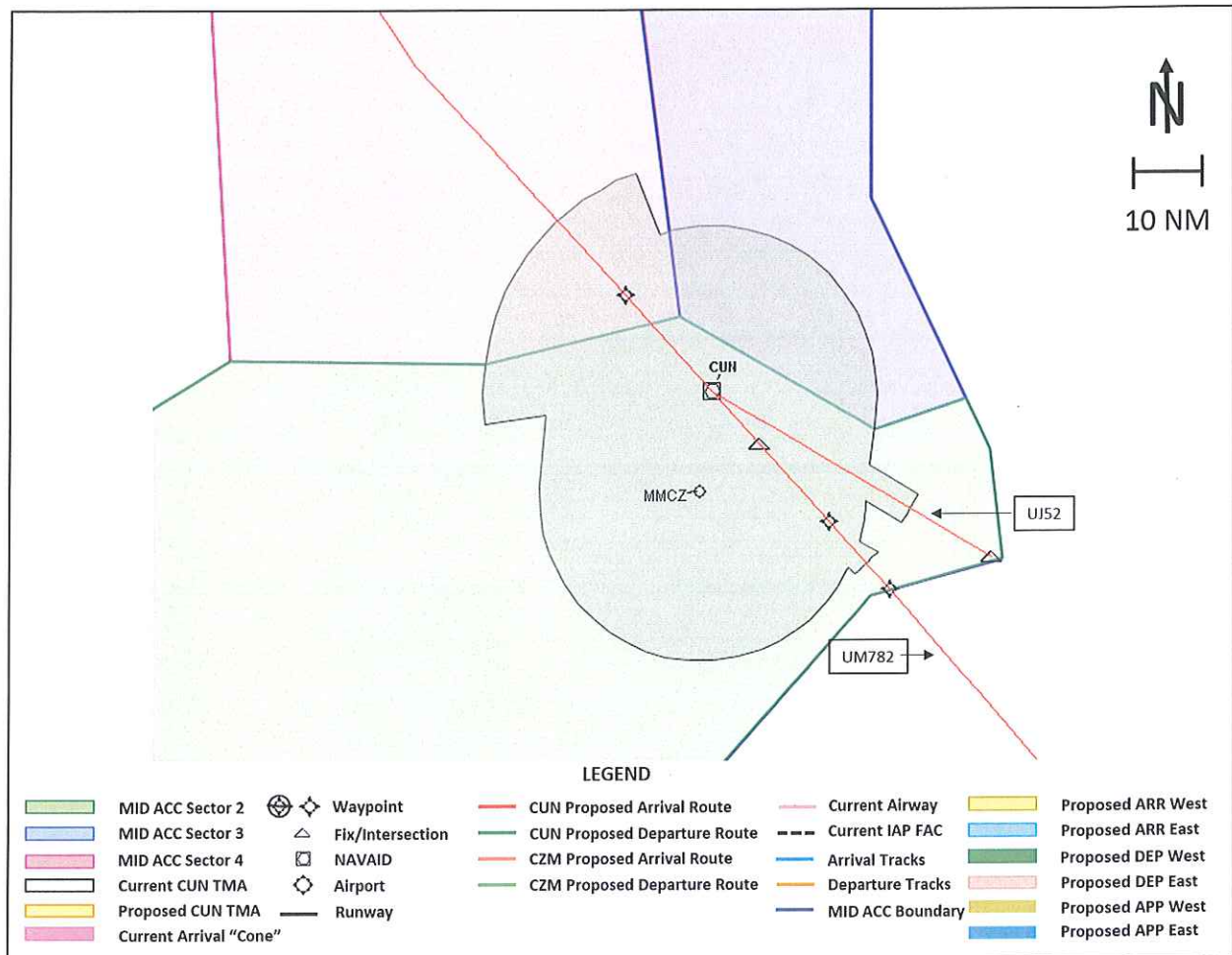
It is anticipated that MID ACC's Sector 2 may need to be modified to the north and Sector 4 to the south to accommodate the proposed STAR design for MMUN. The CUN ARR 50W 12R STAR from the northwest may otherwise require a point out from Sector 4 to Sector 2. Figure 56 depicts the proposed CUN ARR 50W 12R STAR, which may cause the boundary to MID ACC sector 4 to change. It is also anticipated that Sector 4 may require two radar controllers as opposed to the current staffing of one radar controller and one procedural controller. The continued development of the Cancún/Cozumel TMA airspace may lead to additional changes in the MID ACC airspace.



**Figure 56. MMUN CUN ARR 50W 12R STAR**

Modifications to the TMA airspace are proposed for the future ConOps as well. The current TMA airspace contains extensions for UJ52 and UM782 along with a 20 NM airspace extension to the northwest. Figure 57 depicts the current TMA airspace. The conceptual TMA airspace as depicted in Figure 58 eliminates the airway extensions and the northwest extension. The elimination of these extensions was based on the recommendation of MMAC personnel.





**Figure 57. Current TMA Airspace**

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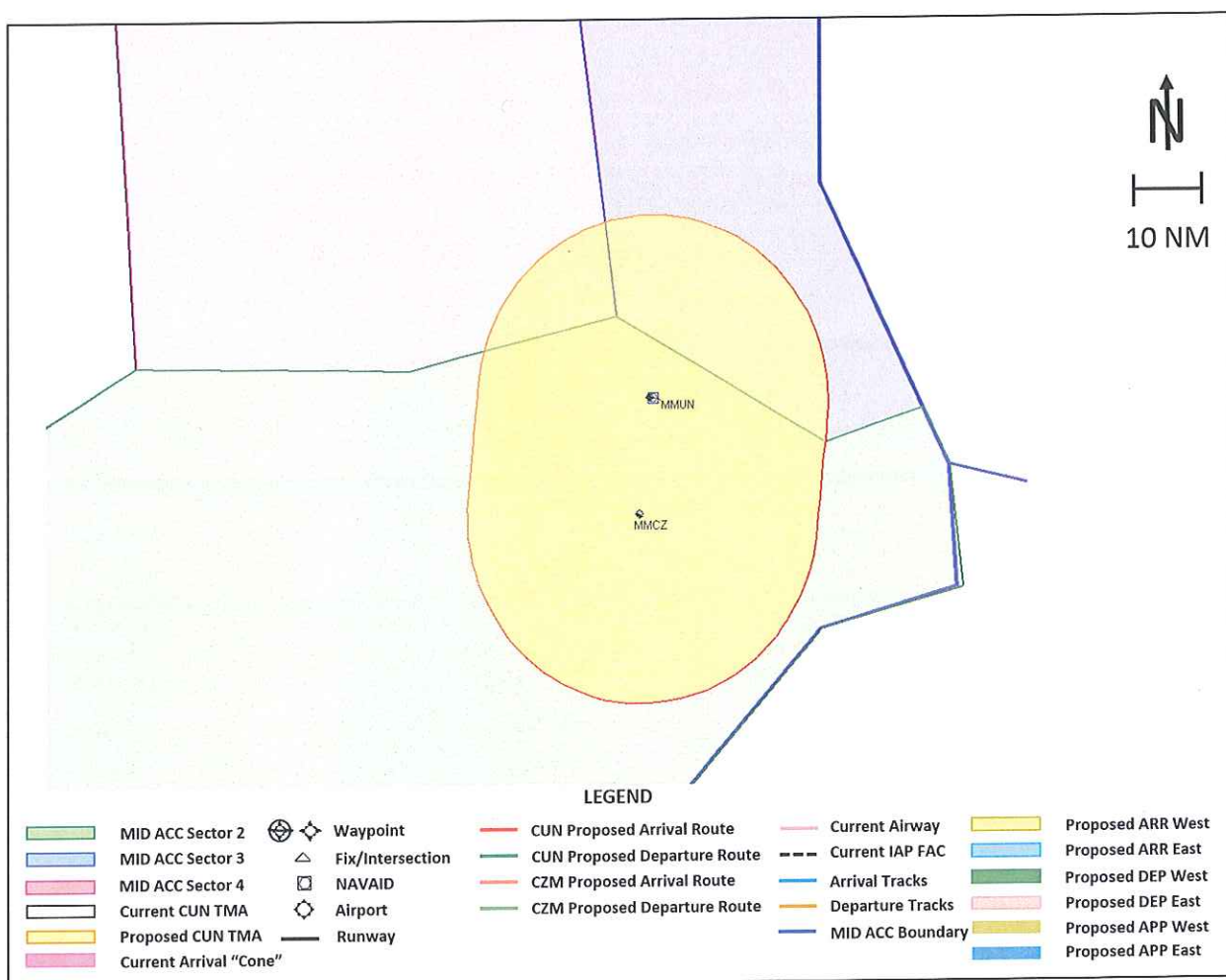


Figure 58. Conceptual TMA Airspace

### 3. Letters of Agreement and Standard Operating Procedures

This section describes the initial draft LOAs and SOPs to support the ConOps described in Section 2 for consideration by SENEAM. The LOAs and SOPs may also be used to support upcoming HITL simulations, and aid SENEAM in the eventual development of such documents to support the implementation of dual independent operations at MMUN.

As previously mentioned, the LOAs and SOPs are initial drafts and are for discussion purposes only. They represent a baseline that need to be revisited and refined in close collaboration with SENEAM as airspace- and procedure-design and other activities advance. As a result, they are expected to be modified as the airspace design moves closer to operational implementation. Also, it is important to note that they LOAs and SOPs only address areas specific to independent operations at MMUN. SENEAM may need to develop additional LOA and SOP documentation to support other types of operations at MMUN.

Appendix A provides a draft LOA for the Mérida ACC and MMAC facilities. Appendix B contains a draft LOA for MMAC and Cancún ATCT facilities. Appendix C includes a draft SOP for MMAC.

### 3.1 MID ACC and MMAC Letter of Agreement

A new LOA between the MID ACC and MMAC facilities must be developed to incorporate new SIDs, new STARs, CDOs, and airspace changes. An initial draft LOA that delegates authority and responsibility for air traffic control service in the new airspace is contained in Appendix A. The initial draft LOA addresses facility responsibilities, as well as Cancún and Cozumel arrival and departure procedures. Incomplete items that (in most cases) must be addressed as part of future airspace design workshops and other activities are denoted in red as “TBD”. While not included in this document, new MID ACC SOPs may also be required to address specific items added to the LOA.

### 3.2 MMUN ATCT and MMAC Letter of Agreement

A new LOA between MMUN ATCT and MMAC must be developed to incorporate new SIDs, new STARs, independent dual arrival and departure operation responsibilities, and airspace changes. A draft LOA that delegates airspace and describes authorizations for separation service and inter-facility coordination procedures is contained in Appendix B. The draft LOA also addresses departure procedures, arrival procedures, and simultaneous independent approach procedures, including breakout/pullout procedures. Incomplete items that (in most cases) must be addressed as part of future airspace design workshops and other activities are denoted in the color red and/or as “TBD”.

### 3.3 MMAC Standard Operating Procedures

New SOPs are required for MMAC in order to support dual independent arrival and departure operations. The draft ARR, APP, DEP, and MON (a totally new position for MMAC) SOPs address matters such as Areas of Jurisdiction, Position Duties and Responsibilities, and Position Standard Operating Procedures.

- The ARR SOP addresses managing arrival traffic for dual independent procedures and the sectorized airspace.
- The APP SOP addresses arrivals to dual runways in multiple scenarios including visual and instrument conditions, sectorized airspace, and identifies potential problem areas.
- DEP SOP is basic and will be modified as departure routes are better established and refined.
- The MON SOP addresses Areas of Jurisdiction, Position Duties and Responsibilities, breakout/pullout procedures, and identifies potential problem areas.



Draft SOPs for all four positions (ARR, APP, DEP, and MON) are contained in Appendix C. Incomplete items that (in most cases) must be addressed as part of future airspace design workshops and other activities are denoted in the color red and/or as “TBD”.

#### 4. Summary

This document presents the initial draft ConOps, LOAs and SOPs that are needed to prepare for upcoming HITL simulations in support of the eventual implementation of dual independent test-bed operations at MMUN. It is important that officials from SENEAM review the information contained in this document and provide feedback to MITRE so that appropriate discussions can take place and modifications made, as necessary.

As the project moves forward, MITRE will continue to work closely with SENEAM as it refines its airspace and procedure designs for MMAC and MID ACC, and makes other important decisions leading towards the implementation of dual independent operations at MMUN.

# **Appendix A**

## **Mérida Area Control Center and Cancún Approach Control**

### **Letter of Agreement**

*Initial Draft*

# MÉRIDA AREA CONTROL CENTER AND CANCÚN APPROACH CONTROL

## LETTER OF AGREEMENT *INITIAL DRAFT*

### SUBJECT: APPROACH CONTROL SERVICE

1. **PURPOSE.** This Letter of Agreement (LOA) between Merida Area Control Center (MID ACC) and Cancún Approach Control (MMAC) delegates authority and responsibility for air traffic control services in the airspace described in the attached annexes (annexes are still to be determined [TBD]).
2. **RESPONSIBILITIES.**
  - a. MMAC shall provide a minimum of 10 NM separation, constant or increasing, between departures and/or en route aircraft entering MID ACC airspace at or climbing to the same altitude.
  - b. MID ACC shall provide Cancún International Airport (MMUN) arrivals with a minimum of 10 NM separation, with comparable speed at the MID ACC/MMAC boundary.
  - c. Radar hand offs and communication transfer for MMUN arrivals and departures should be accomplished prior to the MID ACC/MMAC boundary.
3. **MMUN APPROACH PROCEDURES.**
  - a. MMUN arrivals shall be cleared as follows:
    1. To MMUN via the appropriate Standard Terminal Arrival Route (STAR), all jet arrivals shall be established on the STAR prior to the Terminal Maneuvering Area (TMA) boundary. All jet arrivals capable of flying Continuous Descent Operation (CDO) STARs shall be issued a Continuous Descent Clearance. Jets, turboprops, and props not assigned a Continuous Descent Clearance shall be issued speeds and altitudes. Tables A-1 and A-2 describe arrival procedures and restrictions.



Table A-1: Jets

<i>Description</i>	<i>Restrictions</i>
<i>a. From the Northeast</i>	
CUN ARR NOSAT 12L/30R	CDO
NOSAT Conventional STAR 12L/30R	TBD
<i>b. From the South</i>	
CUN ARR DANUL 12R/30L	CDO
DANUL Conventional STAR 12R/30L	TBD
CUN ARR SIGMA 12R/30L	CDO
SIGMA Conventional STAR 12R/30L	TBD
CUN ARR CZM 12R	CDO
CZM Conventional STAR	TBD
<i>c. From the Southwest</i>	
CUN ARR S 12R/30L	CDO
S Conventional STAR 12R/30L	TBD
<i>d. From the West</i>	
CUN ARR 50W 12R/30L	CDO
50W Conventional STAR	TBD
<i>e. From the North</i>	
CUN ARR NW 50 12L/30R	CDO
NW 50 Conventional STAR	TBD

Table A-2: Turboprops and Props

<i>Description</i>	<i>Restriction</i>
<i>a. From the Northeast</i>	
TBD	TBD
<i>b. From the South</i>	
TBD	TBD
<i>c. From the Southwest</i>	
TBD	TBD
<i>d. From the West</i>	
TBD	TBD
<i>e. From the North</i>	
TBD	TBD

b. Arrivals to Cozumel International Airport (MMCZ) shall be cleared as described in Table A-3 and Table A-4.

**Table A-3: Jets**

<i>Description</i>	<i>Restrictions</i>
<i>a. From the Northeast</i>	
CZM ARR EMOSA 11/29	TBD
EMOSA Conventional STAR 11/29	TBD
<i>b. From the South</i>	
CZM ARR AXENI 11/29	TBD
AXENI Conventional STAR 11/29	TBD
CZM ARR S 11/29	TBD
S Conventional STAR 11/29	TBD
<i>c. From the Southwest</i>	
CZM ARR CTM 11/29	TBD
CTM Conventional STAR 11/29	TBD
CUN ARR SW 11/29	TBD
50W Conventional STAR	TBD
<i>e. From the North</i>	
CUN ARR NW 50 11/29	TBD
NW 50 Conventional STAR	TBD

**Table A-4: Turboprops and Props**

<i>Description</i>	<i>Restriction</i>
<i>a. From the Northeast</i>	
TBD	TBD
<i>b. From the South</i>	
TBD	TBD
<i>c. From the Southwest</i>	
TBD	TBD
<i>d. From the North</i>	
TBD	TBD

c. MMUN departures:

1. Clear all Instrument Flight Rules (IFR) departures via the appropriate Standard Instrument Departure (SID).
2. Ensure all departures join the SID prior to the TMA boundary.
3. Assign the altitudes in Table A-5 to departing aircraft.

Table A-5

<i>Aircraft</i>	<i>Altitude Assigned</i>
<u>1</u> All Turbojets	TBD ft, or requested altitude, if lower
<u>2</u> All Other Aircraft	TBD ft, or requested altitude, if lower

## d. MMCZ departures

1. Clear all IFR departures via the appropriate SID.
2. Ensure all departures join the SID prior to the TMA boundary.
3. Assign the altitudes in Table A-6 to departing aircraft.

Table A-6

<i>Aircraft</i>	<i>Altitude Assigned</i>
<u>1</u> All Turbojets	TBD ft, or requested altitude, if lower
<u>2</u> All Other Aircraft	TBD ft, or requested altitude, if lower

## e. MMAC shall accept all en route overflights.



## **Appendix B**

# **Cancún Approach Control and Cancún Air Traffic Control Tower**

## **Letter of Agreement**

*Initial Draft*

# CANCÚN APPROACH CONTROL AND CANCÚN AIR TRAFFIC CONTROL TOWER

## LETTER OF AGREEMENT *INITIAL DRAFT*

### **SUBJECT: Delegation of Airspace, Authorization for Separation Services and Inter-Facility Coordination Procedures**

- 1. PURPOSE:** This agreement delegates airspace to Cancún International Airport (MMUN) Air Traffic Control Tower (MMUN ATCT) and defines the responsibilities and standard operating procedures between MMUN ATCT and Cancún Approach Control (MMAC).
- 2. SCOPE:** The responsibilities and procedures contained herein shall apply to all Instrument Flight Rule (IFR), Visual Flight Rule (VFR), and Special VFR (SVFR) aircraft, except as noted.
- 3. AIRSPACE DELEGATION:** MMUN ATCT is delegated that airspace from .... **TBD**.
- 4. RESPONSIBILITIES:** MMUN ATCT is authorized to perform the following radar services/procedures: **TBD**
  - a. Separation between successive/parallel departures.
  - b. Separation between successive arrivals.
  - c. Separation between arrivals and departures.
  - d. Separation between SVFR/VFR overflights and arrivals.
  - e. Separation between SVFR/VFR overflights and departures.
  - f. Separation between SVFR/VFR overflights.
  - g. Issuance of radar vectors.
  - h. Issuance of visual approach clearances.
  - i. Visual separation

### **5. PROCEDURES:**

#### a. Departures

##### 1. MMUN ATCT shall:

- a) Determine which Area Navigation (RNAV) Standard Instrument Departures (SIDs) and/or conventional procedures will be assigned to each departure runway (Departure Runway Assignment/Departure Split).
- b) Ensure the departure runway assignment is communicated to MMAC Departure Position (DEP). (**TBD --via information display, verbal coordination, etc.**).
- c) Assign departing aircraft the following initial altitudes as identified in Table B-1.

Table B-1

Type Aircraft	Initial Altitude
Jet	TBD
Turboprop	TBD
Prop	TBD

d) Verbally advise DEP that an aircraft will depart a runway different from the runway normally assigned in the current departure runway assignment/split.

e) Ensure the proper interval is provided to DEP.

f) Assign headings for conventional departures as identified in the following table (Table TBD).

2. DEP shall not turn aircraft off the departure procedure until TBD Distance Measuring Equipment (DME) from the airport.

b. Arrivals

1. MMAC Approach Position (APP) shall:

a) Transfer radio communications and control, for other than monitored independent instrument approaches, at the final approach fix for instrument approaches and 5 miles from the approach end of the runway or the final approach fix for visual approaches and VFR operations.

b) Enter the landing runway in the data block information area whenever an aircraft will land on a runway on the opposite side of its base leg entry and is within 10 NM of the airport.

c) Include in the LOA any landing runway assignment information for specific aircraft/air carriers. These are special cases that would eliminate airport taxi issues. Include in the statement "To the extent possible, assign aircraft".

c. Independent Instrument Approach Procedures

1. MMUN ATCT shall:

a) NOT adjust the speed of an aircraft on the final approach course when the Monitor position (MON) has responsibility for separation.

b) Issue any traffic to the appropriate MON that will enter the portion of MMUN ATCT's (if MMUN ATCT is delegated airspace) delegated airspace on the arrival side of the airport.



## 2. APP shall:

- a) Advise MMUN ATCT of the first and last aircraft to be monitored.
- b) Obtain a transmitter/receiver check with the appropriate Local Control position and ensure frequency override capability exists prior to beginning monitoring.
- c) NOT change aircraft to MMUN ATCT frequency until they are established on the localizer.

## d. Pullout/missed approach/go around procedures

In all circumstances, MMUN ATCT has the option to use departure headings and coordinate with departure control.

## 1. No MON (This part covers cases when Simultaneous Independent Visual Approaches are being conducted)

- a). Local Control will cancel Approach Clearance, retain aircraft in **ATCT airspace**, and:

- 1). issue 3,000 ft to aircraft on the East Runway.
- 2). issue 2,000 ft to aircraft on the West Runway.
- 3). coordinate with the appropriate APP controller.

- b). APP will issue Local Control a heading toward the downwind.

- c). Local Control will issue the APP assigned heading to the aircraft, a speed not to exceed 210 knots and transfer communications to the appropriate APP controller. Communications transfer to APP constitutes Local Control release of control for turns to the downwind, speed and altitude changes.

## 2. With MON, and aircraft is at or inside the Final Approach Fix

- a) MON will cancel Approach Clearance and issue:

- 1) 3,000 ft and a 030 heading to aircraft on the East Runway.
- 2) 2,000 ft and a 210 heading to aircraft on the West Runway.,
- 3) a speed not to exceed 210 knots.

- b) Local Control will verbally release control to MON for turns to the downwind, speed and altitude changes. Local Control will not issue a frequency change to the aircraft.

**EXAMPLE:** "MEX123 is your control."

## 3. With MON, and aircraft is outside the Final Approach Fix

- a) MON shall cancel approach clearance and not turn aircraft more than 15-degrees off the final approach course without coordination with the appropriate APP controller.
- b) APP must issue specific instructions to MON including heading, altitude, speed, and traffic as appropriate to re-sequence the aircraft back into the arrival pattern.
- c) MON must ensure aircraft remain on the arrival side of the airport unless otherwise coordinated with the appropriate Local Control.
- d) MON will establish aircraft on the downwind and issue frequency change to APP.

**NOTE-**

*Action taken by MON to break aircraft off the final approach course constitutes coordination with the appropriate Local Control*

## e. Use of Quick Look for Data Transfer

1. Quick Look functions must be used to forward arrival data from MMAC to MMUN ATCT. A blank data block entry indicates that the aircraft is conducting the type of approach that is advertised on the Automatic Terminal Information Service (ATIS).
2. MMUN ATCT is responsible for determining whether the use of the Quick Look function is satisfactory, or if some other mode of transfer is to be used (e.g., voice call or hand off).
3. Table B-2 identifies data block entries that are available for MMUN arrivals.

**Table B-2**

Entry	Definition
Blank	Aircraft is conducting the type of approach that is advertised on the ATIS
I	Aircraft is on an ILS approach when visual approaches are advertised on the ATIS
V	Aircraft is on a visual approach when ILS approaches are advertised on the ATIS
VS	Aircraft is maintaining visual separation from traffic on a parallel final approach course
VR	Aircraft is cleared for a visual approach and radar separation is being provided
L	Aircraft is executing a Localizer only approach
G	Aircraft is executing a Global Positioning System/RNAV approach

LA	Aircraft executing a low approach
12L	Aircraft assigned Runway 12L
12R	Aircraft assigned Runway 12R
30L	Aircraft assigned Runway 30L
30R	Aircraft assigned Runway 30R



# **Appendix C**

## **Cancún Approach Control**

### **Standard Operating Procedures**

*Initial Draft*

# CANCÚN APPROACH CONTROL

## STANDARD OPERATING PROCEDURES *INITIAL DRAFT*

### ARRIVAL

#### Area of Jurisdiction

##### 1. AREA OF JURISDICTION

A description of airspace and areas of jurisdiction will need to be inserted after future airspace design workshops and other discussions are conducted.

#### Position Duties and Responsibilities

##### 2. ARRIVAL (ARR)

- a. Provide approach control service to aircraft arriving to Cancún International Airport (MMUN). ARR East will normally assign aircraft Runway 12L/30R. ARR West will normally assign aircraft Runway 12R/30L.
- b. On initial contact, inform aircraft of the approach and landing runway to expect.
- c. Ensure user receipt of current arrival Automatic Terminal Information Service (ATIS).
- d. All runway changes should be accomplished as soon as practical and no later than 15 flying miles from the ARR East and ARR West Sector boundary. As appropriate, the transferring ARR controller shall ensure that changes to the runway assignment and/or type of approach are issued to and acknowledged by the pilot prior to transfer of communications. The transferring ARR controller shall issue a vector and altitude to maintain.
- e. If a runway change is issued when an aircraft is on the downwind or base leg, issue the new localizer frequency associated with the new runway.

#### Position Standard Operating Procedures

##### 3. MANAGING ARRIVAL TRAFFIC

ARR primarily delivers traffic to Approach (APP) from either the base leg or downwind leg.

- a. Base leg delivery:
  1. Ensure aircraft placed on the base leg can remain on the base leg and be contained within APP airspace.
  2. Traffic should be at a manageable speed, usually not above 210 knots.
  3. The east base leg clearance limit is 5,000 ft.

4. The west base leg clearance limit is 3,000 ft.
  5. Traffic cleared via a CDO STAR shall be descending via the profile.
- b. Downwind leg delivery:
1. Ensure downwind aircraft are established on the appropriate RNAV STAR or on a vector to emulate the RNAV STAR.
  2. Traffic should be at a manageable speed, usually not above 210 knots.
  3. East downwind leg clearance limit is 6,000 ft.
  4. West downwind leg clearance limit is 5,000 ft.
  5. Traffic cleared via a CDO STAR shall be descending via the profile.
- c. Display the automated data tag to the appropriate ARR controller when sequencing traffic to the approach not normally associated with your ARR position.

**EXAMPLE-**

*When an aircraft inbound from the east on the base leg is requesting the west runway, the ARR east controller shall display the automated data tag on the ARR west position.*

**4. CONTROL TRANSFER BETWEEN ARR AND APP**

- a. The ARR controller may change assigned heading, airspeed, and altitude of an aircraft after the hand off to APP has been accepted.
- b. Acceptance of a radar hand off by APP constitutes coordination for aircraft on a “continuous descent” clearance to continue to the clearance limit.
- c. All non-Area Navigation (RNAV) aircraft shall display “NR” (for non-RNAV) in the aircraft data block.

**5. CONTROL TRANSFER BETWEEN ARRIVAL POSITIONS**

- a. The transferring ARR controller may change assigned heading, airspeed, and altitude after the receiving ARR controller accepts the hand off.
- b. For aircraft assigned a different runway on the long side/downwind leg, the transferring ARR controller releases control for:
  1. Turns.
  2. Descent not below 8,000 ft.
  3. Speed restrictions not below 250 knots until the Cancún VOR 20 DME.



**POTENTIAL PROBLEM AREAS****6. POTENTIAL PROBLEM AREAS**

- a. Failure to descend base leg arrivals from the west in a timely manner may result in aircraft being too high for APP to ensure proper IFR separation at turn-on to the final approach course.
- b. Failure of ARR to transfer communication to APP in a timely manner may result in a loss of separation.
- c. Failure of ARR to ensure base leg traffic is contained within ARR delegated airspace may result in a loss of separation.
- d. Failure to issue runway changes and/or localizer frequencies in a timely manner.
- e. Failure to descend from the west could result in aircraft being too high for glideslope intercept.

## APPROACH

### Area of Jurisdiction

#### 1. AREA OF JURISDICTION

A description of airspace and areas of jurisdiction will need to be inserted after future airspace design workshops and other discussions are conducted.

### Position Duties and Responsibilities

#### 2. APPROACH (APP)

- a. Maintain a consistent interval on the final approach course in accordance with appropriate minima.
- b. Should, on initial contact, restate the landing runway assignment.
- c. Unless otherwise coordinated with a supervisor/Controller In Charge, a hand off and transfer of communications shall be accomplished to ensure that APP controllers work all aircraft assigned a runway for which they have responsibility. If coordinated otherwise, the aircraft data block shall be displayed in yellow.
- d. The APP controller initiating a runway change shall ensure that the new runway assignment and localizer frequency are issued to and acknowledged for by the pilot.
- e. To the maximum extent practical, allow aircraft navigating on an RNAV STAR that contains altitude restrictions to remain on the STAR by issuing "Continuous Descent" and approach clearances when appropriate.

### Position Standard Operating Procedures

#### 3. SCRATCH PAD/DATA BLOCK INFORMATION

- a. As appropriate, use the data block entries contained in the Cancún Approach Control and Cancún Air Traffic Control Tower (ATCT) Letter of Agreement (LOA). This constitutes coordination with the Cancún International Airport (MMUN) ATCT using Automatic Information Transfer. Place these data block entries in the appropriate data block.
- b. When the Monitor Positions (MON) are open, use the same data block entries (as above) to coordinate with MON when other than the advertised approach will be used. Place these entries in the appropriate data block.
- c. Ensure the assigned runway is displayed in the appropriate data block prior to turning aircraft onto the final approach course.
- d. When a controller enters a "V", "VR" or "RVR" into the scratch pad, the controller is declaring that the aircraft is **OR** will be cleared for a visual approach prior to losing standard separation with any other aircraft on an adjacent final. Use "VS" to indicate that your pilot is providing visual separation with other aircraft and is or will be cleared for an ILS.

- e. The controller entering the data block entry accepts all separation responsibility for that aircraft from aircraft on the adjacent finals.

#### 4. ARRIVALS TO TWO RUNWAYS (DUAL INDEPENDENT APPROACHES)

a. Simultaneous Independent Visual Approaches

1. Assign headings that will ensure a track to intercept the extended centerline of the runway at an angle not greater than 30 degrees.
2. APP East normally issues a clearance limit of 3,000 ft or above.
3. APP West normally issues a clearance limit of 2,000 ft or below.
4. APP East and APP West must remain 3 NM from the adjacent final approach course in use until a visual approach clearance is issued and acknowledged, unless another form of separation is provided.

b. Visual Approaches to one Runway and Instrument Approaches to the Other Runway

1. Instrument approach east/visual approach west:

- a) APP East conducts instrument approaches; normally issues a clearance limit at or above 3,000 ft, and turns on outside the Duals Bar. Ensures the aircraft is established on "an approach segment, or on a 30-degree intercept heading to join the final approach course, prior to 3 NM from the adjacent final approach course in use.
- b) APP West conducts visual approaches; normally issues a clearance limit of 2,000 ft or below, and assigns aircraft a heading to intercept the extended runway centerline at an angle not greater than 30 degrees.
- c) APP West remains 3 NM from adjacent final approach course in use, until visual approach clearance is issued and acknowledged, unless another form of separation is provided.

2. Instrument approach west/visual approach east:

- a) APP West conducts instrument approaches; normally issues a clearance limit of 2,000 ft or below, and turns on outside the Duals Bar. Ensures the aircraft is established on an approach segment, or on a 30-degree intercept heading to join the final approach course, prior to 3 NM from the adjacent final approach course in use.
- b) APP East conducts visual approaches; normally issues a clearance limit at or above 3,000 ft, and assigns aircraft a heading to intercept the extended runway centerline at an angle not greater than 30 degrees.
- c) APP East remains 3 NM from adjacent final approach course in use, until visual approach clearance is issued and acknowledged, unless another form of separation is provided.

**NOTE-**

*Weather requirements for visual approaches dictate that aircraft vectored to intercept parallel final approach courses at the same altitude would be in VFR conditions. Therefore, the controller conducting*



*instrument approaches should issue specific traffic information to aircraft vectored to intercept the final approach course inside the appropriate outer fix, side-by-side with aircraft conducting visual approaches.*

c. Simultaneous Independent Instrument Approaches

1. During simultaneous independent ILS/RNAV approaches, each APP controller is required to ensure aircraft under their control are separated from all aircraft on adjacent/parallel finals until established on the final approach course and on MMUN ATCT/MON frequency.
2. Aircraft shall be turned on so as to ensure they are established on the final approach course and switched to the appropriate MMUN ATCT/MON frequency prior to the Duals Bar except in the following cases:
  - a) Visual separation is applied.
  - b) 1,000 feet vertical or a minimum of three (3) miles radar separation between aircraft during turn-on to parallel Final Approach Courses (FACs) is provided.
  - c) APP controllers providing separation in accordance with (a) or (b) above are responsible for that separation until the aircraft is established on the FAC, and the aircraft is on the appropriate Local Control frequency.

**NOTE-**

*Complying with the Duals Bar requirement ensures aircraft are procedurally separated if they are established, cleared and on MMUN ATCT/MON frequency. Joining the finals at fixes/altitudes not consistent with these procedures must be coordinated.*

3. Traffic vectored to the east runway FAC shall be at or above 3,000 ft unless coordination has been made with APP West.
4. Traffic vectored to the west runway FAC shall be at or below 2,000 ft unless prior coordination has been made with APP East.

**NOTE 1-**

*Aircraft shall not be changed to the MMUN ATCT/MON frequency before being established on the final approach course.*

**NOTE 2-**

*Advise the Monitor any time aircraft are being turned on to the final approach course and will not be established in accordance with the Simultaneous Independent Instrument Approach Requirements.*

5. The following procedures shall be used by the MON controllers:

- a) Instruct the aircraft to return to the correct final approach course when an aircraft is observed to overshoot the turn-on or continue on a track which deviates from the final approach course in the direction of the adjacent final approach course.

**PHRASEOLOGY-**

*YOU HAVE CROSSED THE FINAL APPROACH COURSE. TURN (left/right) IMMEDIATELY AND RETURN TO THE FINAL APPROACH COURSE,*

*or*

*TURN (left/right) AND RETURN TO THE FINAL APPROACH COURSE*

- b) Instruct aircraft on the adjacent FAC to alter course to avoid the deviating aircraft when an aircraft is observed or in the controller's judgment has deviated from the FAC in the direction of the adjacent final approach course.

**PHRASEOLOGY-**

*TRAFFIC ALERT, (call sign) TURN (left/right) IMMEDIATELY HEADING (degrees), CLIMB AND MAINTAIN (altitude)*

d. Non-Transponder Aircraft:

1. Coordinate with other affected positions on all untracked targets.
2. Advise MON East and MON West of non-transponder aircraft landing at MMUN when conducting dual simultaneous independent instrument approaches.

**5. AUTOMATIC ALTITUDE READOUT OF AN AIRCRAFT UNDER ANOTHER CONTROLLER'S JURISDICTION**

APP East/APP West and MON East/MON West are authorized to use the automatic altitude readout of their respective aircraft for vertical separation purposes without verbal coordination provided:

- a. APP East/APP West quick look each other and MON positions. However, APP positions may use Limited Data Blocks if the Altitude Filter Limits are set to display all altitudes from the surface up to and including 7,000 ft.
- b. The aircraft are in communication with APP East/APP West or MON East/MON West.
- c. The aircraft are within ARR or APP delegated airspace.
- d. All displays are using the same radar sensor.
- e. Any erroneous altitude readout is coordinated with all APP and MON positions.

**6. CONTROL TRANSFER Between APP and ARR**

APP may change assigned heading, airspeed, and altitude of an aircraft in ARR airspace after accepting the handoff from ARR. However, APP shall advise ARR prior to initiating vectors to the downwind with base leg traffic.

**7. USE OF QUICK LOOK FOR DATA TRANSFER BETWEEN MMAC AND MMUN ATCT**

Coordination between the APP positions and the tower Local Control positions concerning arrival aircraft shall be considered to have been made when the following actions have been accomplished:

- a. The Local Control positions shall Quick Look the APP positions, or as appropriate, the ARR or Departure (DEP) positions.
- b. Except during monitored instrument approaches, transfer of control and communications changeover points are identified in Table C-1.

**Table C-1**

<b>Runway</b>	<b>Changeover Point</b>
12L	TBD
12R	TBD
30L	TBD
30R	TBD

- c. There are no hours or conditions under which facility policy prohibits the use of the Quick Look function for data transfer. At all times, the Local Control positions are responsible for determining whether the use of the Quick Look function is satisfactory, or if some other mode of transfer is to be used (e.g., voice call or radar hand off).



## MONITOR

### 1. AREA OF JURISDICTION

A description of airspace and areas of jurisdiction will need to be inserted after future airspace design workshops and other discussions are conducted.

### Position Duties and Responsibilities

### 2. MONITOR (MON)

- a. Ensure frequency override capability exists prior to beginning monitoring.
- b. Ensure longitudinal and lateral separation during standard instrument approach procedures when MON controllers are required.
- c. Advise the supervisor or the appropriate ARR controller, in the absence of the supervisor, of MON controller initiated pullouts.
- d. Separate MON controllers, each with transmit/receive and override capability on the Local Control frequency, must ensure aircraft do not penetrate the depicted No Transgression Zone (NTZ).

### 3. MONITOR POSITION SETUP

Prior to conducting monitored approaches, complete the following actions:

- a. Off-center the Final Monitor Aid to display a minimum of a 20 NM final and a 4-1 magnification ratio.
- b. Quick Look the APP East and APP West position symbols.
- c. Set altitude filter limits to display the Mode C readout from the surface to 7,000 ft.
- d. Conduct a transmitter/receiver check:
  1. Coordinate with the appropriate Local Control position to obtain a radio check with an aircraft.
  2. Local Control and the MON shall key their transmitters simultaneously to ensure that MON has override capability.
- e. Obtain from the supervisor the first aircraft to be monitored. Forward this information to the appropriate Local Control position.
- f. Obtain from the supervisor the last aircraft to be monitored. Forward this information to the appropriate Local Control position.

#### **NOTE -**

*When the automation is inoperative, the approach sequence shall be relayed by supervisor.*

### 4. MONITOR SEPARATION RESPONSIBILITIES

- a. Ensure radar separation in accordance with the appropriate standard.

- b. MON responsibility for separation begins when the aircraft is established on the final approach course and the aircraft is on the appropriate Local Control frequency.

**NOTE -**

*If the aircraft has not contacted Local Control by the Duals Bar, it is the responsibility of MON to initiate action to have the aircraft transferred to the appropriate Local Control frequency.*

- c. Monitor responsibility for lateral NTZ separation terminates one (1) mile from the runway or when the aircraft reports the runway/approach lights in sight.

**NOTE-**

*Responsibility for Longitudinal (Same Runway) Separation transfers to Local Control when the trailing aircraft crosses a 1 NM final.*

**NOTE -**

*When MON has responsibility for separation, Local Control shall not adjust the speed of aircraft on the final approach course.*

## 5. PULLOUT PROCEDURES

- a. Pull-out procedures are procedures used by Local Control or MON to vector aircraft off the final approach course for reasons other than aircraft entering the NTZ.

1. No MON

- a) Local Control will cancel Approach Clearance and turn the aircraft 15 degrees off the inbound FAC and:

- 1) Issue 3,000 ft to aircraft on the east runway.
- 2) Issue 2,000 ft to aircraft on the west runway.
- 3) Coordinate with the appropriate APP controller.

- b) APP will issue to Local Control a heading towards the downwind.

- c) Local Control will issue a speed not to exceed 210 knots and transfer communications to the appropriate APP. Communications transfer to APP constitutes Local Control release of control for turns toward the downwind, speed and altitude changes.

2. With MON, and aircraft is inside the Final Approach Fix

- a) MON will cancel Approach Clearance and issue:

- 1) 3,000 ft and a 030 heading to aircraft on the east runway.
- 2) 2,000 ft and a 210 heading to aircraft on the west runway.
- 3) A speed not to exceed 210 knots.

- b) MON will initiate a hand off to APP.

- 1) Local Control will verbally release control to MON for turns to the downwind, speed and altitude changes.

2) Local Control will not issue a frequency change to the aircraft.

**EXAMPLE:** "MEX123 is your control."

3. With MON, and aircraft is Outside the Final Approach Fix

- a) MON shall cancel approach clearance and not turn aircraft more than 15-degrees off the final approach course without coordination with the appropriate APP controller.
- b) APP must issue specific instructions to the MON including heading, altitude, speed, and traffic as appropriate to re-sequence the aircraft back into the arrival pattern.
- c) MON must ensure aircraft remain on the arrival side of the airport unless otherwise coordinated with the appropriate Local Control.
- d) MON will establish aircraft on the downwind and issue frequency change to Final.

**NOTE-**

*If it is necessary to pull aircraft off the final approach course for reasons other than separation (i.e. Weather) it is preferred to allow the aircraft to continue approach until coordination can be made rather than issuing a turn prior to completion of coordination.*

**6. BREAKOUT/BLUNDER PROCEDURES**

- a. Breakout Procedures are used when an aircraft is observed to be deviating (blundering) into the NTZ.
  - 1. Normally the aircraft that is not deviating is issued breakout instructions.
  - 2. Since the deviating aircraft has not complied with ATC instructions, control instructions must be expeditiously issued to provide separation from the deviating aircraft. The first priority is to issue whatever instructions are necessary to ensure separation.

**PHRASEOLOGY-**

*TRAFFIC ALERT, (call sign), TURN (right/left) IMMEDIATELY HEADING (degrees), and/or CLIMB/DESCEND AND MAINTAIN (altitude).*

- b. After the breakout is initiated as described in Paragraph a above, use the procedures in **PULLOUT PROCEDURES.**



## Potential Problem Areas

### 7. POTENTIAL PROBLEM AREAS

- a. There is a potential for loss of IFR separation when turning aircraft onto the final approach course.
- b. Timely transfer of communication from APP to Local Control must be accomplished prior to aircraft losing vertical separation during monitored approaches.
- c. When swapping aircraft from one final to another, ensure appropriate vertical separation is achieved in order to prevent aircraft from being nose-to-nose at the same altitude.
- d. Application of visual separation by Local Control during monitored approaches does not relieve the responsibility for application of wake turbulence separation by MON.
- e. In order to avoid unnecessarily compounding traffic complexity and workload, take the following actions: Prior to breaking aircraft off the adjacent final of an aircraft who has not established radio communication with the tower in a timely manner AND is following the instrument approach profile:
  1. Attempt direct communication with the aircraft.
  2. Ask APP to switch the aircraft to Local Control again and reattempt direct communication with the aircraft.
  3. If no reply is received from the flight crew, ask the flight crew to *IDENT* to establish they are on frequency.
  4. If communications cannot be established, advise the other MON and the supervisor.
  5. MON should only break aircraft off the final if communications cannot be established with aircraft on the parallel final.

## **DEPARTURE**

### **Area of Jurisdiction**

#### **1. AREA OF JURISDICTION**

A description of airspace and areas of jurisdiction will need to be inserted after future airspace design workshops and other discussions are conducted.

### **Position Duties and Responsibilities**

#### **2. DEPARTURE (DEP)**

- a. Provide departure control service to aircraft departing MMUN. DEP East will normally initially control traffic departing Runway 12L/30R and DEP West will normally initially control traffic departing Runway 12R/30L.
- b. DEP West may initially control MMCZ arrivals depending on the arrival fix/STAR. DEP West will vector MMCZ arrivals to the FAC.
- c. DEP West will initially control MMCZ departures.

### **Position Standard Operating Procedures**

#### **3. MANAGING DEPARTURE TRAFFIC**

- a. Southeast, south, and west SIDs departing Runway 12L/30R will normally be initially assigned DEP West frequency.
- b. North and east SIDs departing Runway 12R/30L will normally be initially assigned DEP East frequency.
- c. Ensure departure aircraft are routed via the appropriate departure gate/RNAV SID.
- d. Aircraft departing the same runway are considered separated provided their takeoff courses diverge by 15 degrees or more immediately after departure. Immediately after departure is considered to be any turn that provides at least 15 degrees of divergence that commences no later than 2 NM from the departure end of the runway.
- e. Aircraft departing in the same direction on parallel runways are authorized to depart simultaneously provided the takeoff courses diverge by 15 degrees or more immediately after departure.