Enclosure 1

(Referenced in Technical Letter F500-L17-030)

MITRE

Center for Advanced
Aviation System Development

Assessment of Centro de Gestión de Residuos Sólidos en el Bordo Poniente

Options 3, 4.1, 4.2, and 5

Prepared for

Subsecretaría de Transportes

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Principal Acronyms and Abbreviations

AGL	Above Ground Level
AICM	Aeropuerto Internacional de la Ciudad de México
AIP	Aeronautical Information Publication
ASA	Aeropuertos y Servicios Auxiliares
CAT	Category
CDMX	Ciudad de México
DGAC	Dirección General de Aeronáutica Civil
DME	Distance Measuring Equipment
FAA	(United States) Federal Aviation Administration
GACM	Grupo Aeroportuario de la Ciudad de México
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
km	kilometers
m	meters
MITRE	The MITRE Corporation
MSL	(above) Mean Sea Level
MVA	Minimum Vectoring Altitude
NAICM	Nuevo Aeropuerto Internacional de la Ciudad de México
OEI	One Engine Inoperative
OLS	Obstacle Limitation Surfaces
PC	Planta de Composta
RNAV	Area Navigation
RNP AR	Required Navigation Performance Authorization Required
SCT	Secretaría de Comunicaciones y Transportes
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales
SENEAM	Servicios a la Navegación en el Espacio Aéreo Mexicano
U.S.	United States
UTM	Universal Transverse Mercator
VOR	Very High Frequency Omnidirectional Range
WGS 84	World Geodetic System 1984

1 Introduction

The MITRE Corporation (MITRE) is assisting Grupo Aeroportuario de la Ciudad de México (GACM) and the aviation authorities of Mexico in general 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 (AICM). As part of that support, MITRE conducts assessments of ideas proposed by stakeholders (e.g., construction of buildings and facilities in the vicinity of NAICM) when requested by certain Mexican authorities, and provides aeronautically-related feedback to assist them in their decision-making process. This was the case, when Lic. Yuriria Mascott, Mexico's Undersecretary of Transportation, requested in the summer of 2016 from MITRE, through CTA. Miguel Peláez, Director-General of the Dirección General de Aeronáutica Civil (DGAC), the work subject of this report.

This document provides a detailed description of MITRE's aeronautical assessment of *Centro de Gestión de Residuos Sólidos en el Bordo Poniente* (a solid waste management plant, hereinafter referred to as the "facility") on future aircraft operations at NAICM and existing operations at AICM. MITRE's assessment includes a determination of whether the facility, located at Option 3, Option 4.1, Option 4.2, or Option 5, as described below, would impact key instrument approach and departure procedures, One Engine Inoperative (OEI) procedures (also known as "engine-out" operations), Minimum Vectoring Altitude (MVA) Sectors, and International Civil Aviation Organization (ICAO) Annex 14 Obstacle Limitation Surfaces (OLS). In addition, MITRE considered the impact from exhaust plumes, electromagnetic effects, and issues pertaining to wildlife.

While MITRE has issued definitive opinions on most of the aeronautical factors that should be considered before the facility is built, it is important to state that MITRE cannot provide an opinion on each and every factor mentioned above. Building the proposed facility near one of the largest airports ever built anywhere, is not a simple decision. Thus, MITRE has insisted that the federal and local Mexican authorities proceed cautiously before such a decision is made.

2 Background

In July 2016, MITRE was informed by the DGAC of potential plans to develop the facility, which would include both solid waste management and bio-digester operations, in a location immediately south of the proposed western runways at NAICM. The ground elevation and coordinate information for the facility was provided to MITRE in file INFO DGAC 180716_V2.pdf, dated 18 July 2016. As per the information provided in the above-mentioned file, the facility would include stacks (i.e., chimneys) extending 70 m Above Ground Level (AGL). However, earlier information provided to MITRE via e-mail indicated that the stacks could have a height of up to 80 m AGL (which for reference purposes, is 13 m higher than the top of the *Monumento a la Revolución* or close to half the height of the terrace on Floor 44 of the *Torre Latinoamericana*, both in Mexico City). Therefore, MITRE designated a team to conduct a special assessment of the facility impact on future operations at NAICM, analyzing a range of stack heights from 65 m to 80 m AGL. MITRE delivered the results of this analysis to the DGAC on 29 July 2016 (see MITRE Technical Letter F500-L16-040), advising to avoid the location initially proposed to construct the facility.

In mid-September 2016, MITRE received updated information regarding the facility, which included more detailed information regarding the proposed Planta de Composta (PC) and Zona 8 sites, an evaluation of locations by Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM), and information regarding the effect of the facility on birds and wildlife. Based on this information, MITRE assessed the potential impact of the facility, located at either PC or Zona 8, on future aircraft operations at NAICM. In addition, MITRE also assessed the potential impact of the facility on existing operations at AICM, as the facility is to be constructed before future NAICM opens and therefore, while AICM is still in operation. It is important to note that, according to the new information, stack heights would not exceed 40 m AGL. Therefore, MITRE assumed 40 m stack heights in the analyses that followed its July work.

In early October 2016, CTA. Peláez and a delegation of officials from the government of Mexico City (CDMX), accompanied by private CDMX consultants, visited MITRE to discuss the proposed facility. MITRE presented its preliminary findings on PC and Zona 8 and, through the various discussions, MITRE was able to get a better understanding of the facility, its needs, and its characteristics. The meeting's participants also conducted an intense brainstorming session to identify alternative sites for relocating the facility. Following the meeting, the visitors returned to Mexico City to explore the feasibility of alternative sites and provided MITRE on 12 October 2016 information about three more options: Option 3, Option 4.1, and Option 4.2, through file, "WTEDF 20161210 MITRE OPTION 3 AND 4.pptx.". Note that afterwards, MITRE was informed by one of the CDMX consultants that **Options 4.1 and 4.2 (potentially the best locations for the facility)** were not desirable due to problems presented by CONAGUA, the Mexican entity in charge of water management throughout the nation. However, it is not clear to MITRE if the problems can be overcome or not or at what cost. Therefore, MITRE continued with its assessment of Options 4.1 and 4.2.

It is important to note that as this was a special and urgent request from the Secretaría de Comunicaciones y Transportes (SCT), MITRE made this analysis a high priority item, which resulted in delaying some of MITRE's other NAICM-related aeronautical work. This required MITRE to obtain approval from Aeropuertos y Servicios Auxiliares (ASA), which was received on 31 October 2016. It should also be stated that delays in obtaining ASA's approval in turn delayed MITRE's work.

In mid-December 2016, MITRE learned about another option that was being considered as a potential location for the facility, referred to as Option 5. MITRE learned that construction planning at this location was ongoing. MITRE's team was highly concerned since it had learned about Option 5 by mere coincidence. Thus, following communication with Undersecretary Mascott, MITRE was provided the coordinates and elevation information for Option 5 through an e-mail dated 15 December 2016. As such, the analysis for Option 5 has also been included in this document.

Figure 1 below shows the location of each option in relation to both NAICM and AICM, including distances from selected runway ends and extended runway centerlines.

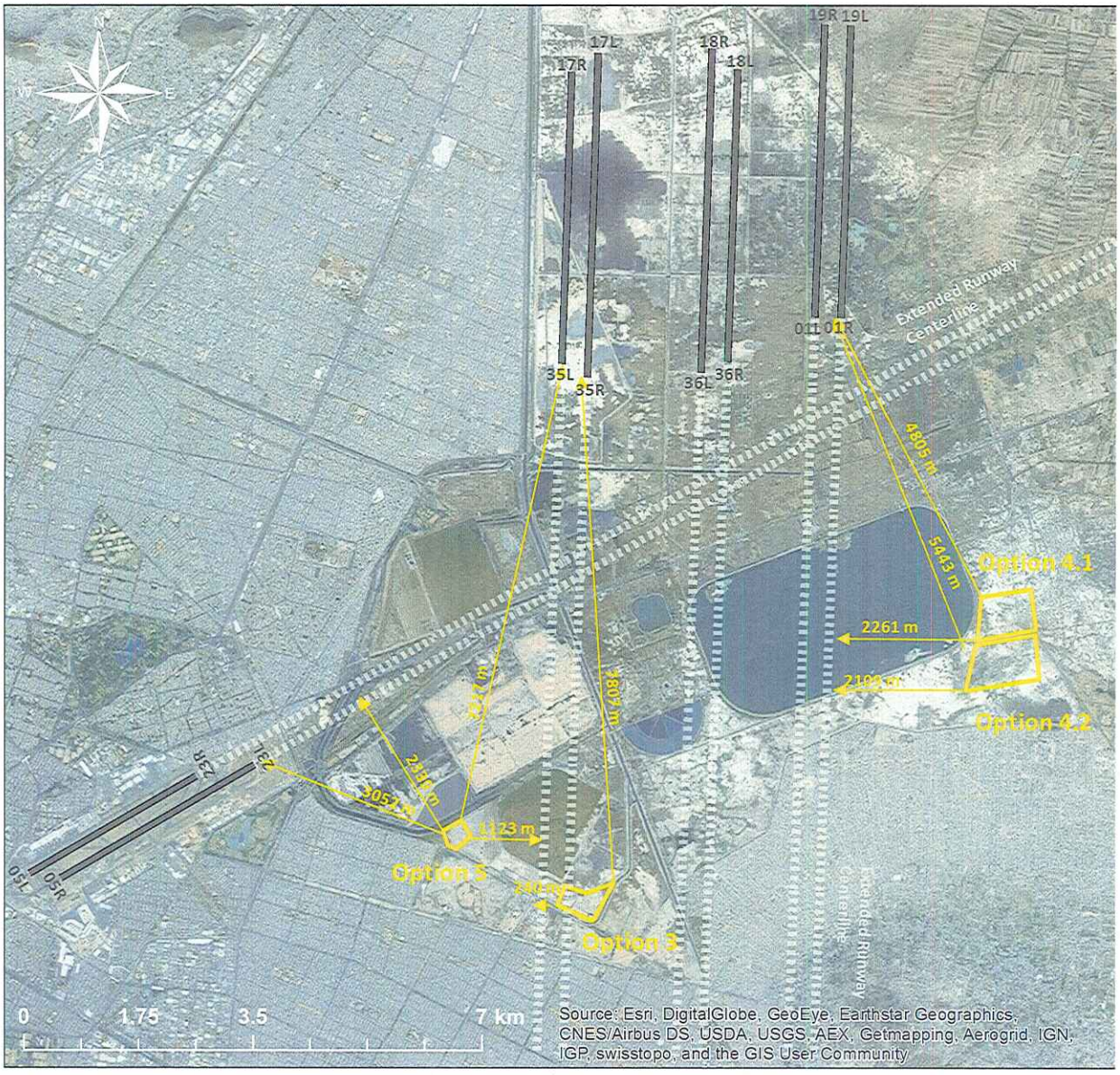

Figure 1. Overview of Options in Relation to NAICM and AICM

It is important to note that Option 3 is directly aligned with the extended runway centerline of Runway 35R/17L at NAICM and 240 m east of the extended runway centerline of Runway 35L/17R at NAICM. Option 5, on the other hand, is 3052 m from the end of Runway 23L/05R at AICM and 2339 m from the extended runway centerline of Runway 23L/05R at AICM.

3 Methodology

This section documents MITRE's technical approach in evaluating the facility. In its analyses, MITRE used the information provided in the file "WTEDF 20161210 MITRE OPTION 3 AND 4.pptx", which defines the coordinates and elevation information for Option 3, Option 4.1, and Option 4.2 and the above-mentioned e-mail for Option 5. Detailed information about each option can also be found in this document in Sections 4, 5, 6, and 7, respectively. As per the data in the aforementioned files, MITRE considered 40 m-stack heights for the facility at each option. MITRE measured the amount of clearance from the top of the stacks to the appropriate obstacle evaluation/limitation surfaces described below. In addition, MITRE analyzed the facility using the most up-to-date information regarding the planned runway configuration and elevations at NAICM. Information on the runway locations, threshold elevations, and instrument approach and departure procedures for AICM was obtained from the Mexico Aeronautical Information Publication (AIP).

3.1 Key Instrument Approach and Departure Procedures

MITRE evaluated the impact of the facility on the development of instrument approach and departure procedures at NAICM. MITRE spent a significant amount of time examining the feasibility of instrument approach and departure procedures on the basis of United States (U.S.) Federal Aviation Administration (FAA) Standard for Terminal Instrument Procedures, which included the development of: Instrument Landing System (ILS) approaches, both conventional and Area Navigation (RNAV) instrument departures, Required Navigation Performance Authorization Required (RNP AR) approaches, and parallel approach obstruction assessment surfaces, which are required to be assessed when conducting independent ILS approaches.

While MITRE included results for all southbound conventional departures at NAICM, it is important to note that MITRE only included detailed results for southbound RNAV departures at NAICM for the opening-day runways (Runway 17L, Runway 18R, and Runway 19L). This is in part due to time constraints, as well as the complexity of developing these procedures. However, MITRE determined that the results from the opening-day runways represent the worst-case scenario for each facility option. In addition, for conservative analytical purposes, MITRE assumed 200 feet per nautical mile climb gradients for departures and missed approaches. In reality, many of the departure and missed approach procedures at NAICM will have higher climb gradients.

Since, as mentioned above, the facility will most likely be constructed before future NAICM opens and the existing AICM closes, MITRE evaluated the impact of the facility on relevant current instrument approach and departure procedures at AICM.

3.2 One Engine Inoperative Procedures

MITRE assessed if the facility would be located within OEI lateral obstacle clearance requirements considering both ICAO and U.S. FAA standards at both NAICM and AICM.[1] The purpose of the OEI lateral obstacle clearance requirements is to identify obstacles for further analysis. Under these standards, if an engine fails at any point during take-off, the flight can be

[1] For reference, MITRE used a 62.5:1 sloping surface to determine clearance amounts over the facility.

safely concluded either by stopping on the remaining runway or by continuing the take-off and clearing all obstacles that may be in the departure flight path. If obstacle clearance cannot be assured, the planned take-off weight must be reduced to the point that all obstacles can be cleared, thus impacting payload and/or range capabilities.

It is important to note that airlines typically develop their own specific departure paths to follow in the event of an engine failure. MITRE had to make some assumptions regarding potential OEI procedure departure paths. For the purposes of this analysis, MITRE assumed straight-out departure paths, which could differ from those actually developed by the airlines. Therefore, it is important that airlines conduct their own analyses to determine the impact of the facility at each location on their respective OEI procedures.

3.3 Minimum Vectoring Altitude Sectors

An MVA chart depicts the lowest altitudes at which air traffic controllers can radar-vector aircraft. MITRE, in close coordination with SENEAM, developed a new MVA chart to support future NAICM operations. MITRE examined the facility to determine if it would require the altitude of an MVA sector to be raised to ensure appropriate clearance of aircraft over the structure. In addition, MITRE examined the facility to determine if it would require the altitude of an existing MVA sector in the current MVA chart to be raised.

3.4 International Civil Aviation Organization Annex 14 Obstacle Limitation Surfaces

MITRE evaluated the impact of the facility on ICAO Annex 14 OLS. ICAO Annex 14 OLS are imaginary surfaces established around and over airports to identify obstacles to air navigation and to prevent the development of obstacles that could adversely impact airport operations. While conducting analyses of these surfaces, MITRE also reviewed the DGAC document *Circular Obligatoria, Requisitos para Regular la Construcción, Modificación y Operación de los Aeródromos Civiles*, which complies with the specifications contained in ICAO Annex 14. MITRE examined the ICAO Annex 14 OLS at both NAICM and AICM.

4 Option 3

The site for Option 3 is shown in Figure 2, and its coordinates are given in Table 1. The site elevation is 2221.69 m above Mean Sea Level (MSL). For conservative analytical purposes, MITRE assumed that the 40 m stacks of the facility could be located anywhere within the site for Option 3; thus MITRE used 2261.69 m (7420.24 ft) MSL as the elevation for its analyses (2221.69 m + 40 m = 2261.69 m).

Figure 2. Option 3

Table 1. Coordinates for Option 3

	World Geodetic System 1984 (WGS 84) Coordinates		WGS 84 Universal Transverse Mercator (UTM) 14N Coordinates	
Point	**Latitude (N)**	**Longitude (W)**	**X**	**Y**
1	19° 25' 41.45"	099° 00' 31.33"	499086.4019	2148205.8108
2	19° 25' 37.58"	099° 00' 20.10"	499413.8704	2148086.8453
3	19° 25' 43.12"	099° 00' 05.76"	499832.0361	2148257.1191
4	19° 25' 23.87"	099° 00' 16.78"	499510.6724	2147665.4391
5	19° 25' 31.85"	099° 00' 35.32"	498970.0348	2147910.7425

4.1 Impact of Option 3 on Instrument Procedures

This section describes the detailed analyses and results for Option 3 as they pertain to instrument approach and departure procedures. Section 4.1.1 focuses on the potential impact of the facility on the development of instrument procedures for NAICM, while Section 4.1.2 focuses on the potential impact to existing instrument procedures at AICM.

4.1.1 Instrument Procedures at NAICM

For this analysis, MITRE examined the potential impact of the facility at Option 3 on the development of appropriate northbound ILS Category (CAT) I/II/III approach procedures, northbound RNP AR approach procedures, southbound ILS CAT I/II/III missed approach procedures, southbound RNP AR missed approach procedures, and southbound departures, both conventional and RNAV, at NAICM.

The results for northbound ILS CAT I/II/III approach procedures are shown in Table 2.

Table 2. Northbound ILS CAT I/II/III Approach Procedures (Option 3)

Runway 35L	Option 3 is located within the lateral confines of the final surface; however, the surface clears the facility by 200 m (657 ft).
Runway 35R	Option 3 is located within the lateral confines of the final surface; however, the surface clears the facility by 196 m (642 ft).
Runway 36L	Option 3 is located within the lateral confines of the final surface; however, the surface clears the facility by 356 m (1169 ft).
Runway 36R	Option 3 is located within the lateral confines of the final surface; however, the surface clears the facility by 420 m (1379 ft).
Runway 01L	Option 3 is located outside of the final surface.
Runway 01R	Option 3 is located outside of the final surface.

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Figure 3 shows the northbound ILS CAT I/II/III approach procedure to Runway 35R at NAICM, which represents the ILS CAT I/II/III approach procedure with the least amount of clearance over the facility.

Figure 3. ILS CAT I/II/III Approach Procedure to Runway 35R (Option 3)

The results for northbound RNP AR approach procedures are shown in Table 3.

Table 3. Northbound RNP AR Approach Procedures (Option 3)

Runway 35L	Option 3 is located within the lateral confines of the approach surface; however, the surface clears the facility by 320 m (1049 ft).
Runway 35R	Option 3 is located within the lateral confines of the approach surface; however, the surface clears the facility by 311 m (1019 ft).
Runway 36L	Option 3 is located within the lateral confines of the approach surface; however, the surface clears the facility by 318 m (1043 ft).
Runway 36R	Option 3 is located outside of the approach surface.
Runway 01L	Option 3 is located outside of the approach surface.
Runway 01R	Option 3 is located outside of the approach surface.

Figure 4 shows the northbound RNP AR approach procedure to Runway 35R at NAICM, which represents the RNP AR approach procedure with the least amount of clearance over the facility.

Figure 4. RNP AR Approach Procedure to Runway 35R (Option 3)

The results for southbound ILS CAT II/III missed approach procedures are shown in Table 4. As mentioned above, MITRE evaluated ILS CAT I/II/III missed approach procedures. However, for reporting purposes, the tables below show clearance amounts associated with ILS CAT II/III missed approach procedures rather than ILS CAT I missed approach procedures, as the corresponding ILS CAT II/III surfaces are lower than the ILS CAT I surfaces; thus, any potential impact from the facility would be greater on the ILS CAT II/III missed approach procedures.

Table 4. Southbound ILS CAT II/III Missed Approach Procedures (Option 3)

Runway 17L	Option 3 is located outside of the missed approach surface.
Runway 17R	Option 3 is located outside of the missed approach surface.
Runway 18L	Option 3 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 263 m (864 ft).
Runway 18R	Option 3 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 272 m (891 ft).
Runway 19L	Option 3 is located outside of the missed approach surface.
Runway 19R	Option 3 is located outside of the missed approach surface.

Figure 5 shows the southbound ILS CAT II/III missed approach procedure for Runway 18L at NAICM, which represents the ILS CAT II/III missed approach procedure with the least amount of clearance over the facility.

Figure 5. ILS CAT II/III Missed Approach Procedure for Runway 18L (Option 3)

The results for southbound RNP AR missed approach procedures are shown in Table 5.

Table 5. Southbound RNP AR Missed Approach Procedures (Option 3)

Runway 17L	Option 3 is located outside of the missed approach surface.
Runway 17R	Option 3 is located outside of the missed approach surface.
Runway 18L	Option 3 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 331 m (1085 ft).
Runway 18R	Option 3 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 331 m (1085 ft).
Runway 19L	Option 3 is located outside of the missed approach surface.
Runway 19R	Option 3 is located outside of the missed approach surface.

Figure 6 shows the southbound RNP AR missed approach procedure for Runway 18L at NAICM, which represents one of the RNP AR missed approach procedure with the least amount of clearance over the facility.

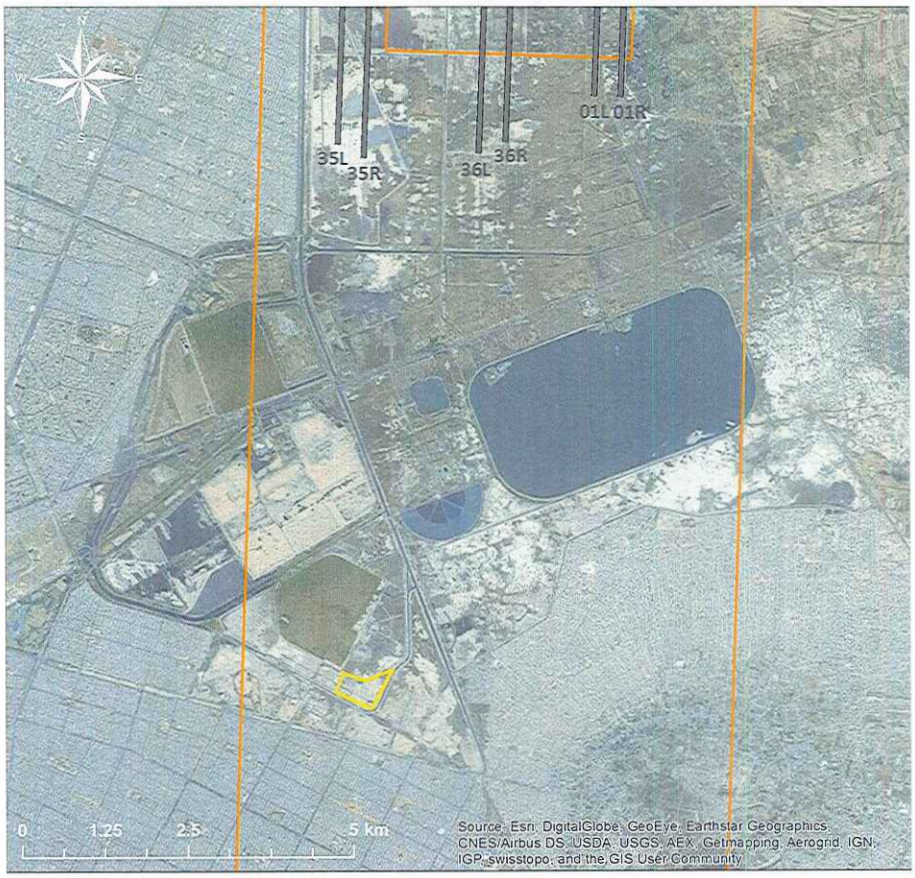

Figure 6. RNP AR Missed Approach Procedure for Runway 18L (Option 3)

The results for southbound conventional departure procedures are shown in Table 6.

Table 6. Southbound Conventional Departure Procedures (Option 3)

Runway 17L	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 163 m (535 ft).
Runway 17R	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 167 m (547 ft).
Runway 18L	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 165 m (567 ft).
Runway 18R	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 168 m (550 ft).
Runway 19L	Option 3 is located outside of the departure surface.
Runway 19R	Option 3 is located outside of the departure surface.

Figure 7 shows the southbound conventional departure procedure for Runway 17L at NAICM, which represents the departure procedure with the least amount of clearance over the facility.

Figure 7. Southbound Conventional Departure Procedure from Runway 17L (Option 3)

The results for southbound RNAV departure procedures are shown in Table 7.

Table 7. Southbound RNAV Departure Procedures (Option 3)

Runway 17L	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 161 m (528 ft).
Runway 18R	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 165 m (540 ft).
Runway 19L	Option 3 is located within the lateral confines of the departure surface; however, the surface clears the facility by 201 m (658 ft).

Figure 8 shows one of the southbound RNAV departure procedures from Runway 17L at NAICM, which represents a departure procedure with the least amount of clearance over the facility.

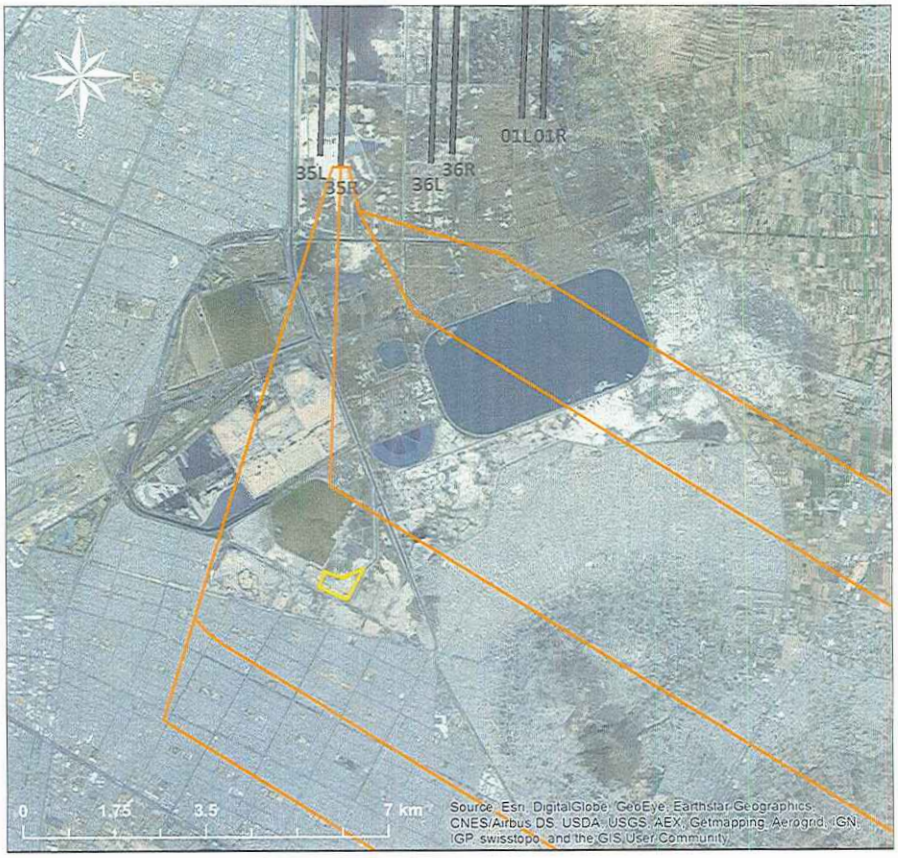

Figure 8. Southbound RNAV Departure Procedure from Runway 17L (Option 3)

Also, MITRE determined that the facility at Option 3 would not adversely affect parallel approach obstruction assessment surfaces at NAICM. In addition, MITRE conducted diverse departure assessments for all runways at NAICM and concluded that Option 3 would not adversely affect departures.

4.1.2 Instrument Procedures at AICM

For this analysis, MITRE examined the potential impact of the facility at Option 3 on the ILS CAT I approach procedure to Runway 23L, the ILS CAT I missed approach procedure to Runway 05R, the Very High Frequency Omnidirectional Range (VOR) and Distance Measuring Equipment (DME) approach procedure to Runway 23L, the VOR/DME missed approach procedure to Runway 05R, and departures from Runway 05L and Runway 05R at AICM. The results of these analyses are shown below in Tables 8 through 12, respectively.

Table 8. ILS CAT I Approach Procedure (Option 3)

Runway 23L	Option 3 is located outside of the final surface.

Table 9. ILS CAT I Missed Approach Procedure (Option 3)

Runway 05R	Option 3 is located outside of the missed approach surface.

Table 10. VOR/DME Approach Procedure (Option 3)

Runway 23L	Option 3 is located outside of the VOR/DME final and intermediate surfaces.

Table 11. VOR/DME Missed Approach Procedure (Option 3)

Runway 05R	Option 3 is located outside of the missed approach surface.

Table 12. Departure Procedures (Option 3)

Runway 05L	Option 3 is located outside of any of the departure surfaces.
Runway 05R	Option 3 is located outside of any of the departure surfaces.

Additionally, MITRE conducted diverse departure assessments for all runways at AICM and concluded that Option 3 would not adversely affect departures.

4.2 Impact of Option 3 on OEI Procedures

MITRE examined the potential impact of the facility at Option 3 on OEI lateral obstacle clearance requirements at NAICM and AICM considering both ICAO and U.S. FAA standards.

4.2.1 OEI Procedures at NAICM

The facility at Option 3 is located within the lateral confines of OEI lateral obstacle clearance requirements for Runways 17L and 17R at NAICM considering both ICAO and U.S. FAA standards; however, the clearance above the facility is 94 m (308 ft) and 95 m (311 ft), respectively. The results of this analysis are shown in Table 13.

Table 13. OEI Procedures (Option 3)

	ICAO	U.S. FAA
Runway 17L	Option 3 is located within the OEI lateral clearance requirements; however, there is 94 m (308 ft) of clearance above the facility.	Option 3 is located within the OEI lateral clearance requirements; however, there is 94 m (308 ft) of clearance above the facility.
Runway 17R	Option 3 is located within the OEI lateral clearance requirements; however, there is 95 m (311 ft) of clearance above the facility.	Option 3 is located within the OEI lateral clearance requirements; however, there is 95 m (311 ft) of clearance above the facility.
Runway 18L	Option 3 is located outside of OEI lateral clearance requirements.	Option 3 is located outside of OEI lateral clearance requirements.
Runway 18R	Option 3 is located outside of OEI lateral clearance requirements.	Option 3 is located outside of OEI lateral clearance requirements.
Runway 19L	Option 3 is located outside of OEI lateral clearance requirements.	Option 3 is located outside of OEI lateral clearance requirements.
Runway 19R	Option 3 is located outside of OEI lateral clearance requirements.	Option 3 is located outside of OEI lateral clearance requirements.

Figure 9 shows the area associated with the ICAO lateral clearance requirements for Runway 17L at NAICM.

Figure 9. OEI Procedure for Runway 17L (Option 3)

4.2.2 OEI Procedures at AICM

The facility at Option 3 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at AICM. See Table 14.

Table 14. OEI Procedures (Option 3)

	ICAO	U.S. FAA
Runway 05R	Option 3 is located outside of OEI lateral clearance requirements.	Option 3 is located outside of OEI lateral clearance requirements.

4.3 Impact of Option 3 on MVA Sectors

The facility would not require modifications to the planned MVA sectors. Sector 1, which is the planned sector above the facility at Option 3, has a surface height of 2896 m MSL (9500 ft). This would be 634 m (2080 ft) above the facility. In addition, the facility would not require modifications to the existing MVA sectors.

4.4 Impact of Option 3 on ICAO Annex 14 OLS

MITRE evaluated the impact of the facility at Option 3 on all of the ICAO Annex 14 OLS at NAICM and AICM. Based on the location of Option 3, MITRE determined that the following OLS are not relevant to the analysis and therefore, are not included in the results below: Inner Approach, Transitional, Inner Transitional, and Balked Landing surfaces.

4.4.1 ICAO Annex 14 OLS at NAICM

The results of this analysis are shown in Table 15.

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Table 15. ICAO Annex 14 OLS (Option 3)

	Approach	Take-Off Climb*
Runway 35L	Option 3 is located within the lateral confines of the Approach surface; however, the surface clears the facility by 115 m (377 ft).	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 35R	Option 3 is located within the lateral confines of the Approach surface; however, the surface clears the facility by 117 m (384 ft).	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 36L	Option 3 is located within the lateral confines of the Approach surface; however, the surface clears the facility by 117 m (384 ft).	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 36R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 01L	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 01R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 17L	Option 3 is located outside of the Approach surface.	Option 3 is located within the lateral confines of one or more of the Take-Off Climb surfaces; however, the surfaces clear the facility by 121 m (397 ft) or more.
Runway 17R	Option 3 is located outside of the Approach surface.	Option 3 is located within the lateral confines of one or more of the Take-Off Climb surfaces; however, the surface clears the facility by 125 m (410 ft) or more.
Runway 18L	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 18R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 19L	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 19R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.

*It is important to note that MITRE analyzed a variety of nominal paths in its assessment of Take-Off Climb surfaces at NAICM, including paths in which the intended track includes changes of heading greater than 15° for operations conducted in instrument meteorological conditions, visual meteorological conditions by night, which necessitate an 1800 m final width. The results in the table are representative of the Take-Off Climb surface with the least amount of clearance.

Also, Option 3 is located outside of the NAICM Inner Horizontal and Conical surfaces.

Figure 10 shows the Approach surface for Runway 35L at NAICM and Figure 11 shows the Take-Off Climb surface for Runway 17L at NAICM, which represent the ICAO Annex 14 surfaces with the least amount of clearance over the facility.

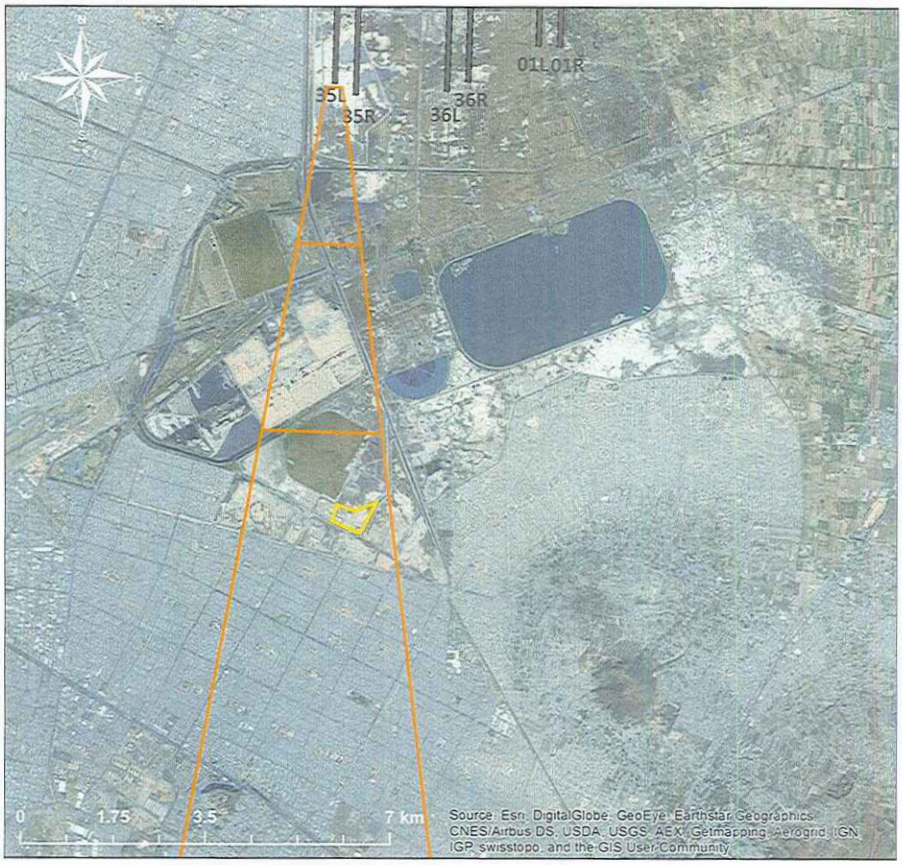

Figure 10. ICAO Annex 14 Approach Surface for Runway 35L (Option 3)

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Figure 11. ICAO Annex 14 Take-Off Climb Surface for Runway 17L (Option 3)

4.4.2 ICAO Annex 14 OLS at AICM

The results of this analysis are shown in Table 16.

Table 16. ICAO Annex 14 OLS (Option 3)

	Approach	Take-Off Climb
Runway 05L	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 05R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 23L	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.
Runway 23R	Option 3 is located outside of the Approach surface.	Option 3 is located outside of the Take-Off Climb surfaces.

Also, Option 3 is located outside of the AICM Inner Horizontal and Conical surfaces.

5 Option 4.1

The site for Option 4.1 is shown in Figure 12, and its coordinates are given in Table 17. The site elevation is 2224.43 m above MSL. For conservative analytical purposes, MITRE assumed that the 40 m stacks of the facility could be located anywhere within the site for Option 4.1; thus MITRE used 2264.43 m (7429.23 ft) MSL as the elevation for its analyses (2224.43 m + 40 m = 2264.43 m).

Figure 12. Option 4.1

Table 17. Coordinates for Option 4.1

	WGS 84 Coordinates		WGS 84 UTM 14N Coordinates	
Point	**Latitude (N)**	**Longitude (W)**	**X**	**Y**
1	19° 28' 06.98"	098° 56' 53.73"	505430.3798	2152679.7607
2	19° 28' 10.89"	098° 56' 27.81"	506185.9916	2152800.1860
3	19° 27' 50.81"	098° 56' 24.95"	506269.5838	2152183.0142
4	19° 27' 45.27"	098° 56' 55.68"	505373.7296	2152012.4419

5.1 Impact of Option 4.1 on Instrument Procedures

This section describes the detailed analyses and results for Option 4.1 as they pertain to instrument approach and departure procedures. Section 5.1.1 focuses on the potential impact of

the facility on the development of instrument procedures for NAICM, while Section 5.1.2 focuses on the potential impact to existing instrument procedures at AICM.

5.1.1 Instrument Procedures at NAICM

For this analysis, MITRE examined the potential impact of the facility at Option 4.1 on the development of appropriate northbound ILS CAT I/II/III approach procedures, northbound RNP AR approach procedures, southbound ILS CAT I/II/III missed approach procedures, southbound RNP AR missed approach procedures, and southbound departures, both conventional and RNAV, at NAICM.

The results for northbound ILS CAT I/II/III approach procedures are shown in Table 18.

Table 18. Northbound ILS CAT I/II/III Approach Procedures (Option 4.1)

Runway 35L	Option 4.1 is located outside of the final surface.
Runway 35R	Option 4.1 is located outside of the final surface.
Runway 36L	Option 4.1 is located outside of the final surface.
Runway 36R	Option 4.1 is located outside of the final surface.
Runway 01L	Option 4.1 is located outside of the final surface.
Runway 01R	Option 4.1 is located outside of the final surface.

The results for northbound RNP AR approach procedures are shown in Table 19.

Table 19. Northbound RNP AR Approach Procedures (Option 4.1)

Runway 35L	Option 4.1 is located outside of the approach surface.
Runway 35R	Option 4.1 is located outside of the approach surface.
Runway 36L	Option 4.1 is located outside of the approach surface.
Runway 36R	Option 4.1 is located outside of the approach surface.
Runway 01L	Option 4.1 is located outside of the approach surface.
Runway 01R	Option 4.1 is located outside of the approach surface.

The results for southbound ILS CAT II/III missed approach procedures are shown in Table 20. As mentioned above, MITRE evaluated ILS CAT I/II/III missed approach procedures. However, for reporting purposes, the tables below show clearance amounts associated with ILS CAT II/III missed approach procedures rather than ILS CAT I missed approach procedures, as the corresponding ILS CAT II/III surfaces are lower than the ILS CAT I surfaces; thus, any potential impact from the facility would be greater on the ILS CAT II/III missed approach procedures.

Table 20. Southbound ILS CAT II/III Missed Approach Procedures (Option 4.1)

Runway 17L	Option 4.1 is located outside of the missed approach surface.
Runway 17R	Option 4.1 is located outside of the missed approach surface.
Runway 18L	Option 4.1 is located outside of the missed approach surface.
Runway 18R	Option 4.1 is located outside of the missed approach surface.
Runway 19L	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 157 m (514 ft).
Runway 19R	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 158 m (518 ft).

Figure 13 shows the southbound ILS CAT II/III missed approach procedure for Runway 19L at NAICM, which represents the ILS CAT II/III missed approach procedure with the least amount of clearance over the facility.

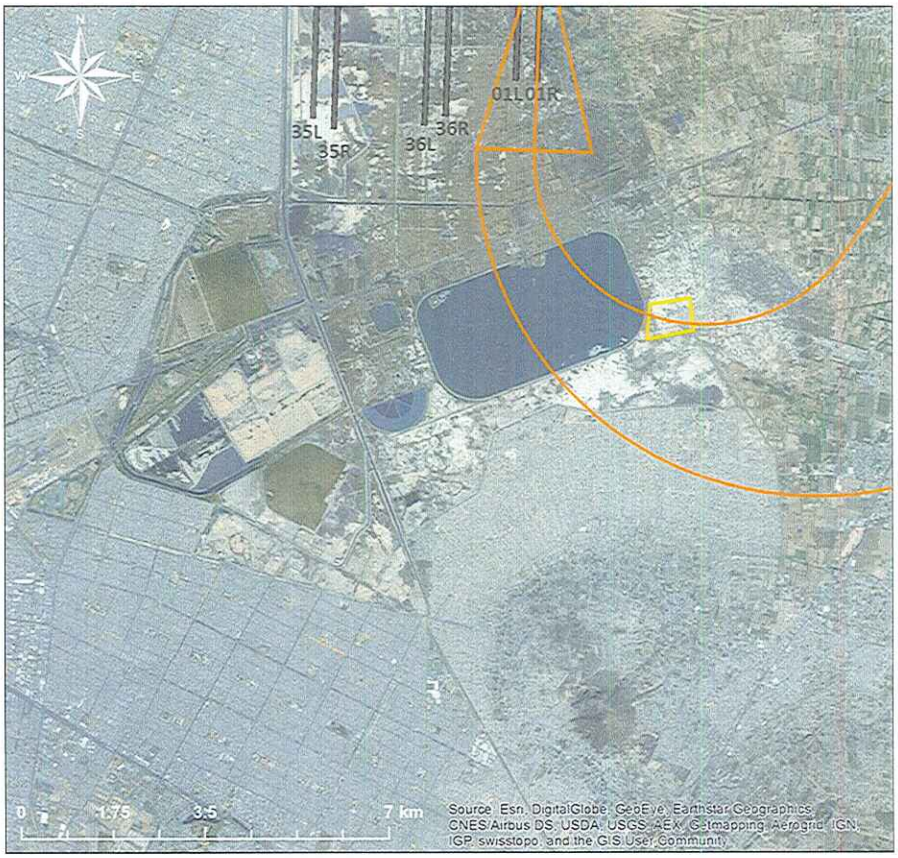

Figure 13. ILS CAT II/III Missed Approach Procedure for Runway 19L (Option 4.1)

The results for southbound RNP AR missed approach procedures are shown in Table 21.

Table 21. Southbound RNP AR Missed Approach Procedures (Option 4.1)

Runway 17L	Option 4.1 is located outside of the missed approach surface.
Runway 17R	Option 4.1 is located outside of the missed approach surface.
Runway 18L	Option 4.1 is located outside of the missed approach surface.
Runway 18R	Option 4.1 is located outside of the missed approach surface.
Runway 19L	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 256 m (839 ft).
Runway 19R	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 251 m (825 ft).

Figure 14 shows the southbound RNP AR missed approach procedure for Runway 19R at NAICM, which represents the RNP AR missed approach procedure with the least amount of clearance over the facility.

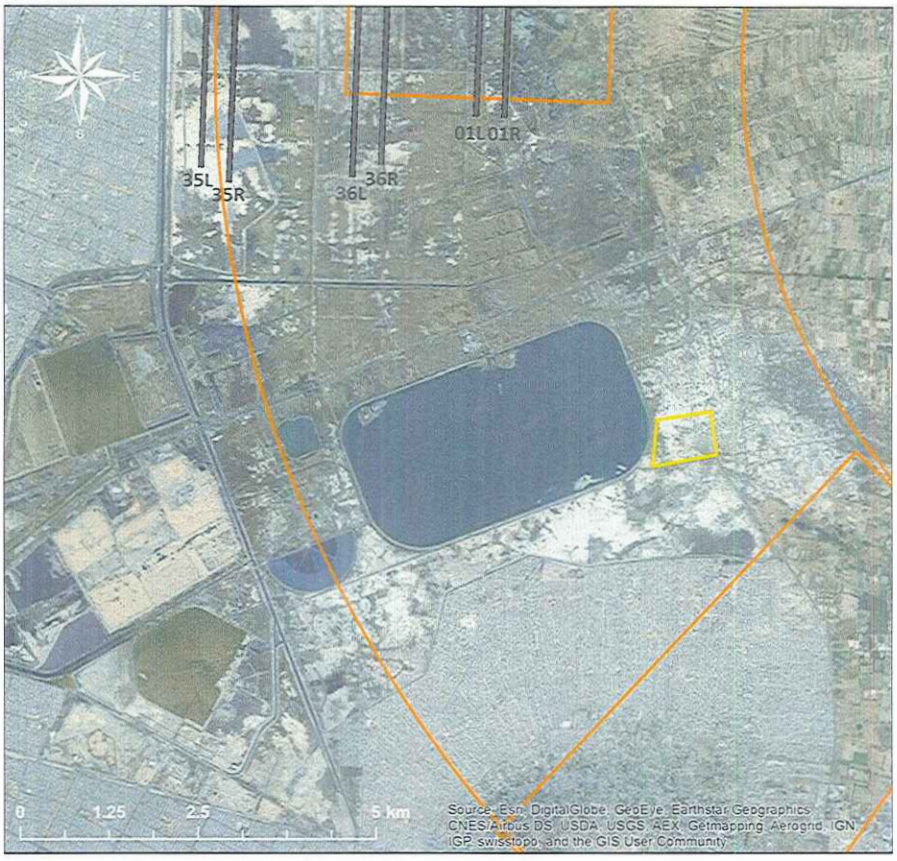

Figure 14. RNP AR Missed Approach Procedure for Runway 19R (Option 4.1)

The results for southbound conventional departure procedures are shown in Table 22.

Table 22. Southbound Conventional Departure Procedures (Option 4.1)

Runway 17L	Option 4.1 is located outside of the departure surface.
Runway 17R	Option 4.1 is located outside of the departure surface.
Runway 18L	Option 4.1 is located outside of the departure surface.
Runway 18R	Option 4.1 is located outside of the departure surface.
Runway 19L	Option 4.1 is located within the lateral confines of the departure surface; however, the surface clears the facility by 92 m (301 ft).
Runway 19R	Option 4.1 is located within the lateral confines of the departure surface; however, the surface clears the facility by 96 m (315 ft).

Figure 15 shows the southbound conventional departure procedure for Runway 19L at NAICM, which represents the departure procedure with the least amount of clearance over the facility.

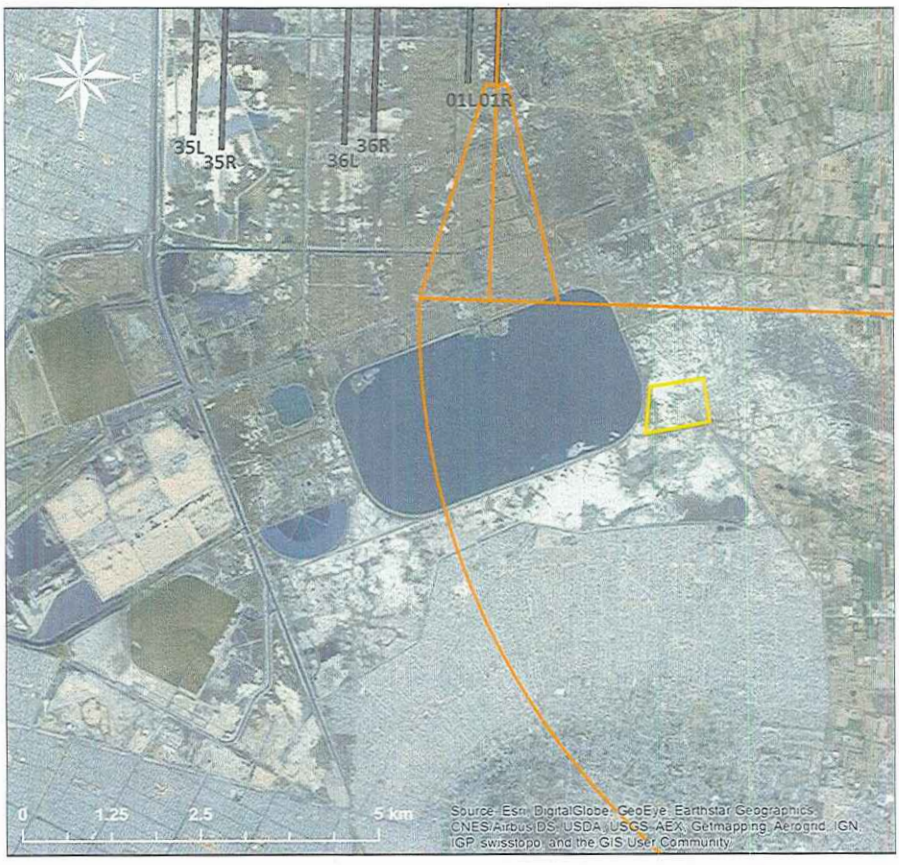

Figure 15. Conventional Departure Procedure from Runway 19L (Option 4.1)

The results for southbound RNAV departure procedures are shown in Table 23.

Table 23. Southbound RNAV Departure Procedures (Option 4.1)

Runway 17L	Option 4.1 is located within the lateral confines of the departure surface; however, the surface clears the facility by 283 m (930 ft).
Runway 18R	Option 4.1 is located within the lateral confines of the departure surface; however, the surface clears the facility by 137 m (451 ft).
Runway 19L	Option 4.1 is located within the lateral confines of the departure surface; however, the surface clears the facility by 92 m (301 ft).

Figure 16 shows one of the southbound RNAV departure procedure from Runway 19L at NAICM, which represents a departure procedure with the least amount of clearance over the facility.

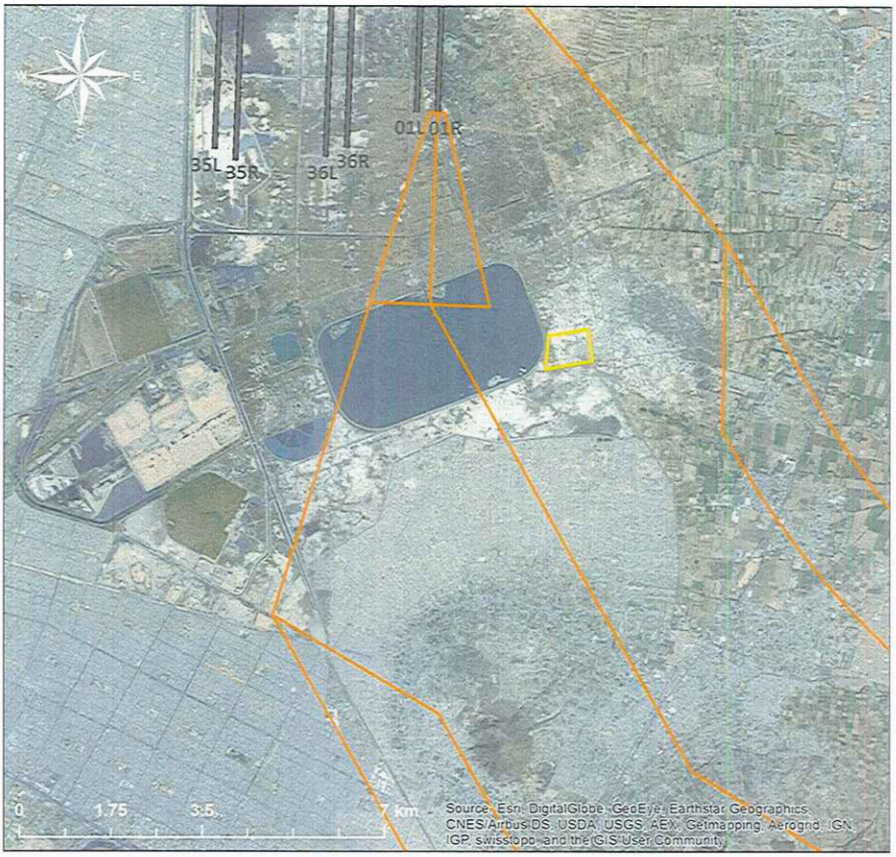

Figure 16. RNAV Departure Procedure from Runway 19L (Option 4.1)

Also, MITRE determined that the facility at Option 4.1 would not adversely affect parallel approach obstruction assessment surfaces at NAICM. In addition, MITRE conducted diverse departure assessments for all runways at NAICM and concluded that Option 4.1 would not adversely affect departures.

5.1.2 Instrument Procedures at AICM

For this analysis, MITRE examined the potential impact of the facility at Option 4.1 on the ILS CAT I approach procedure to Runway 23L, the ILS CAT I missed approach procedure to

Runway 05R, the VOR/DME approach procedure to Runway 23L, and the VOR/DME missed approach to Runway 05R, and departures from Runway 05L and Runway 05R at AICM.

The results of the analysis of the ILS CAT I approach procedure to Runway 23L are shown in Table 24, and the results of the ILS CAT I missed approach procedure to Runway 05R are shown in Table 25.

Table 24. ILS CAT I Approach Procedure (Option 4.1)

Runway 23L	Option 4.1 is located outside of the final surface.

Table 25. ILS CAT I Missed Approach Procedure (Option 4.1)

Runway 05R	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 421 m (1381 ft).

Figure 17 shows the ILS CAT I missed approach procedure for Runway 05R at AICM.

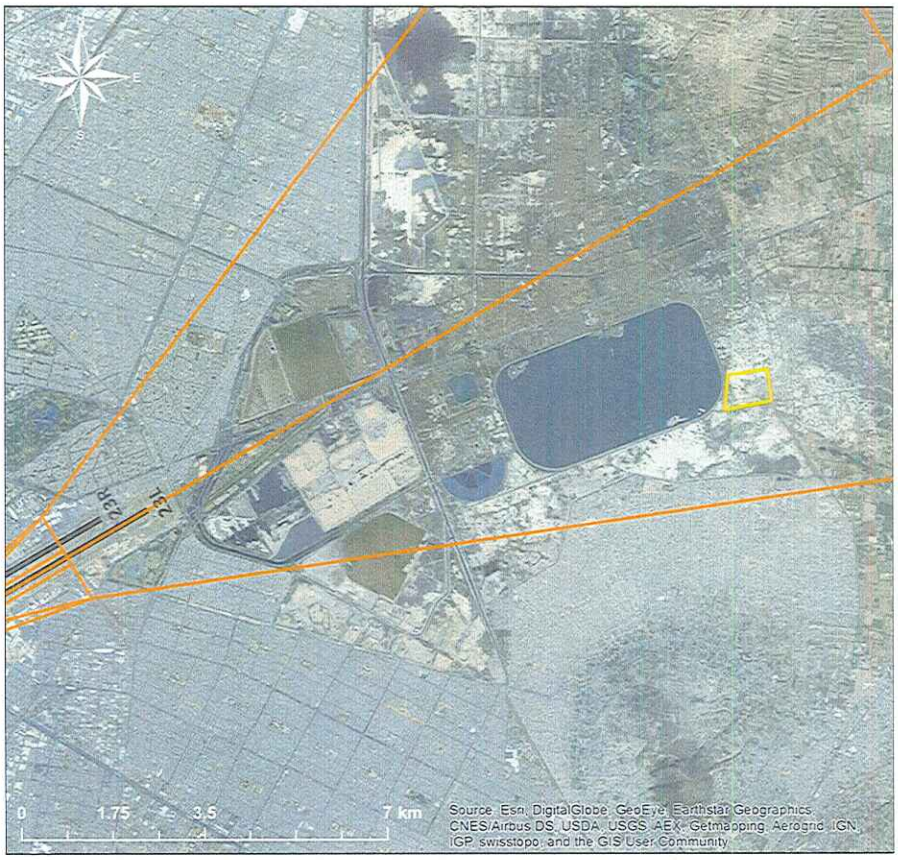

Figure 17. ILS CAT I Missed Approach Procedure for Runway 05R (Option 4.1)

The results of the analysis of the VOR/DME approach procedure to Runway 23L are shown in Table 26.

Table 26. VOR/DME Approach Procedure (Option 4.1)

Runway 23L	Option 4.1 is located outside of the VOR/DME final surface; however, it is located within the lateral confines of the intermediate surface. The surface clears the facility by 468 m (1537 ft).

Figure 18 shows the VOR/DME approach procedure for Runway 23L at AICM.

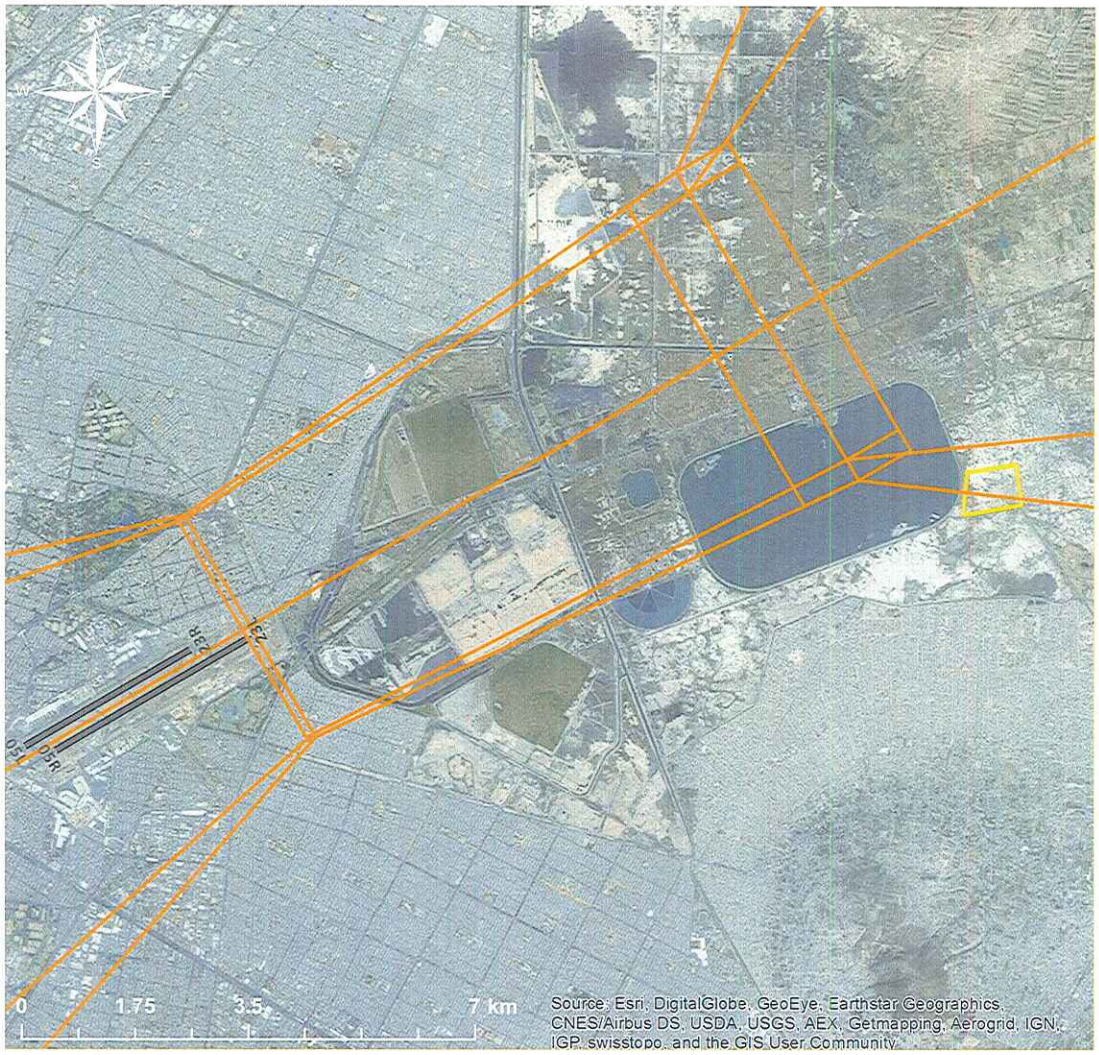

Figure 18. VOR/DME Approach Procedure for Runway 23L (Option 4.1)

The results of the VOR/DME missed approach to Runway 05R are shown in Table 27.

Table 27. VOR/DME Missed Approach Procedure for Runway 05R (Option 4.1)

Runway 05R	Option 4.1 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 410 m (1344 ft).

Figure 19 shows the VOR/DME missed approach procedure for Runway 05R at AICM.

Figure 19. VOR/DME Missed Approach Procedure for Runway 05R (Option 4.1)

The results of the analysis of the departure procedures for Runways 05L and 05R at AICM are shown in Table 28.

Table 28. Departure Procedures (Option 4.1)

Runway 05L	Option 4.1 is located outside of any of the departure surfaces.
Runway 05R	Option 4.1 is located outside of any of the departure surfaces.

Additionally, MITRE conducted diverse departure assessments for all runways at AICM and concluded that Option 4.1 would not adversely affect departures.

5.2 Impact of Option 4.1 on OEI Procedures

MITRE examined the potential impact of the facility at Option 4.1 on OEI lateral obstacle clearance requirements at NAICM and AICM considering both ICAO and U.S. FAA standards.

5.2.1 OEI Procedures at NAICM

The facility at Option 4.1 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at NAICM. The results of this analysis are shown in Table 29.

Table 29. OEI Procedures (Option 4.1)

	ICAO	U.S. FAA
Runway 17L	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.
Runway 17R	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.
Runway 18L	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.
Runway 18R	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.
Runway 19L	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.
Runway 19R	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.

5.2.2 OEI Procedures at AICM

The facility at Option 4.1 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at AICM. The results of this analysis are shown in Table 30.

Table 30. OEI Procedures (Option 4.1)

	ICAO	U.S. FAA
Runway 05R	Option 4.1 is located outside of OEI lateral clearance requirements.	Option 4.1 is located outside of OEI lateral clearance requirements.

5.3 Impact of Option 4.1 on MVA Sectors

The facility would not require modifications to the planned MVA sectors. Sector 1, which is the planned sector above the facility at Option 4.1, has a surface height of 2896 m MSL (9500 ft). This would be 632 m (2073 ft) above the facility. In addition, the facility would not require modifications to the existing MVA sectors.

5.4 Impact of Option 4.1 on ICAO Annex 14 OLS

MITRE evaluated the impact of the facility at Option 4.1 on all of the ICAO Annex 14 OLS at NAICM and AICM. Based on the location of Option 4.1, MITRE determined that the following OLS are not relevant to the analysis and therefore, are not included in the results below: Inner Approach, Transitional, Inner Transitional, and Balked Landing surfaces.

5.4.1 ICAO Annex 14 OLS at NAICM

The results of this analysis are shown in Table 31.

Table 31. ICAO Annex 14 OLS (Option 4.1)

	Approach	Take-Off Climb*
Runway 35L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 35R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 36L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 36R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 01L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 01R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 17L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 17R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 18L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 18R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 19L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 19R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.

*It is important to note that MITRE analyzed a variety of nominal paths in its assessment of Take-Off Climb surfaces at NAICM, including paths in which the intended track includes changes of heading greater than 15° for operations conducted in instrument meteorological conditions, visual meteorological conditions by night, which necessitate an 1800 m final width. The results in the table are representative of the Take-Off Climb surface with the least amount of clearance.

Also, Option 4.1 is located outside of the NAICM Inner Horizontal surface, but is located within the lateral confines of the Conical surface (see Figure 20); however, the surface clears the facility by 48 m (157 ft).

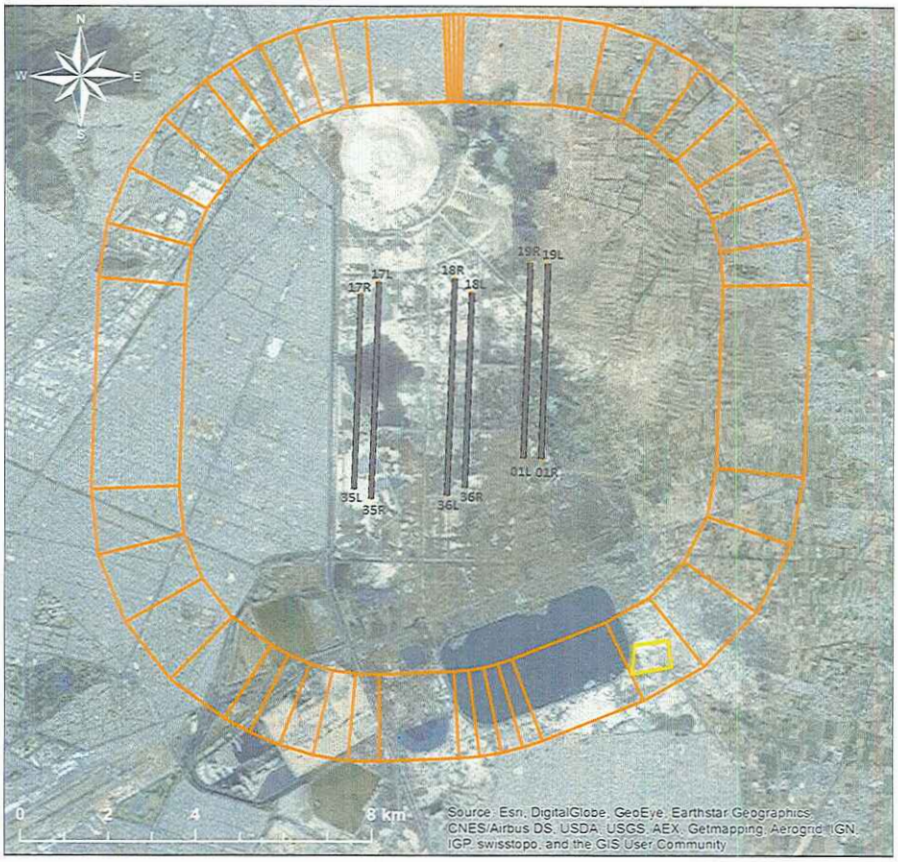

Figure 20. ICAO Annex 14 Conical Surface (Option 4.1)

5.4.2 ICAO Annex 14 OLS at AICM

The results of this analysis are shown in Table 32.

Table 32. ICAO Annex 14 OLS (Option 4.1)

	Approach	Take-Off Climb**
Runway 05L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 05R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 23L	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.
Runway 23R	Option 4.1 is located outside of the Approach surface.	Option 4.1 is located outside of the Take-Off Climb surfaces.

**MITRE analyzed straight-out Take-Off Climb surfaces for AICM. Theoretically, departures procedures could be developed that turn over the facility at Option 4.1, however, aircraft would be more than 11 km away from the closest runway threshold and would have significant clearance over the facility.

Also, Option 4.1 is located outside of the AICM Inner Horizontal and Conical surfaces.

6 Option 4.2

The site for Option 4.2 is shown in Figure 21, and its coordinates are given in Table 33. The site elevation is 2223.82 m above MSL. For conservative analytical purposes, MITRE assumed that the 40 m stacks of the facility could be located anywhere within the site for Option 4.2; thus MITRE used 2263.82 m (7427.23 ft) MSL as the elevation for its analyses (2223.82 m + 40 m = 2263.82 m).

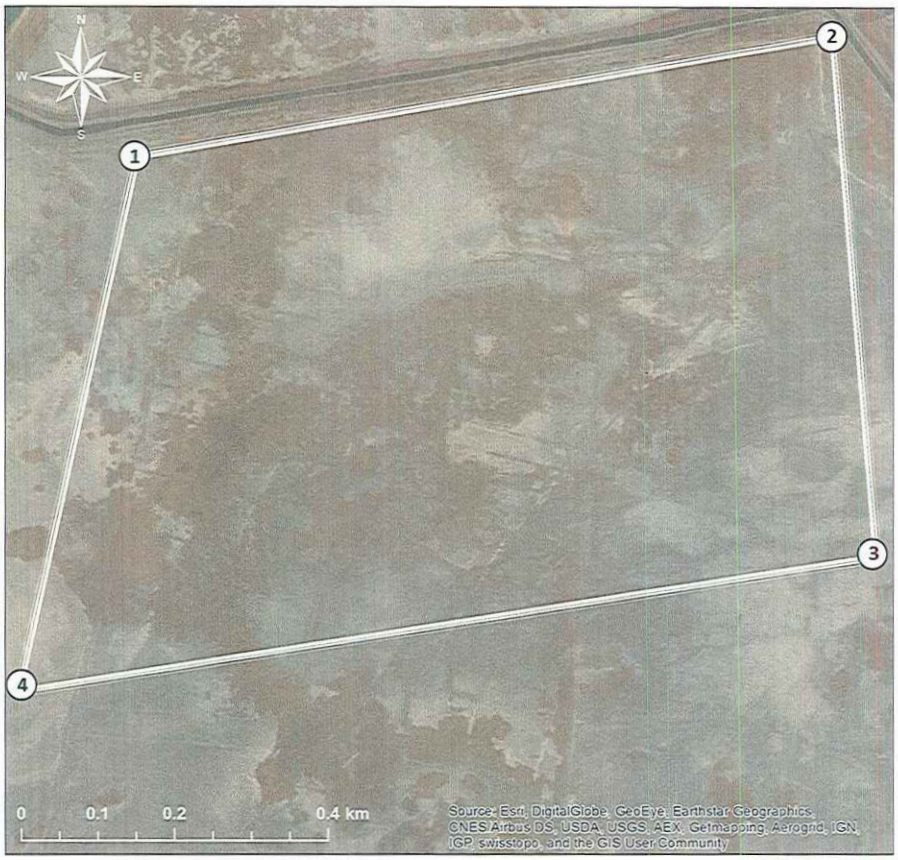

Figure 21. Option 4.2

Table 33. Coordinates for Option 4.2

	WGS 84 Coordinates		WGS 84 UTM 14N Coordinates	
Point	Latitude (N)	Longitude (W)	X	Y
1	19° 27' 43.01"	098° 56' 56.52"	505349.2605	2151942.9688
2	19° 27' 48.16"	098° 56' 25.38"	506257.0758	2152101.5566
3	19° 27' 25.77"	098° 56' 23.41"	506314.7504	2151413.3739
4	19° 27' 19.97"	098° 57' 01.84"	505194.3625	2151234.7420

6.1 Impact of Option 4.2 on Instrument Procedures

This section describes the detailed analyses and results for Option 4.2 as they pertain to instrument approach and departure procedures. Section 6.1.1 focuses on the potential impact of

the facility on the development of instrument procedures for NAICM, while Section 6.1.2 focuses on the potential impact to existing instrument procedures at AICM.

6.1.1 Instrument Procedures at NAICM

For this analysis, MITRE examined the potential impact of the facility at Option 4.2 on the development of appropriate northbound ILS CAT I/II/III approach procedures, northbound RNP AR approach procedures, southbound ILS CAT I/II/III missed approach procedures, southbound RNP AR missed approach procedures, and southbound departures, both conventional and RNAV, at NAICM.

The results for northbound ILS CAT I/II/III approach procedures are shown in Table 34.

Table 34. Northbound ILS CAT I/II/III Approach Procedures (Option 4.2)

Runway 35L	Option 4.2 is located outside of the final surface.
Runway 35R	Option 4.2 is located outside of the final surface.
Runway 36L	Option 4.2 is located outside of the final surface.
Runway 36R	Option 4.2 is located outside of the final surface.
Runway 01L	Option 4.2 is located outside of the final surface.
Runway 01R	Option 4.2 is located outside of the final surface.

The results for northbound RNP AR approach procedures are shown in Table 35.

Table 35. Northbound RNP AR Approach Procedures (Option 4.2)

Runway 35L	Option 4.2 is located outside of the approach surface.
Runway 35R	Option 4.2 is located outside of the approach surface.
Runway 36L	Option 4.2 is located outside of the approach surface.
Runway 36R	Option 4.2 is located outside of the approach surface.
Runway 01L	Option 4.2 is located outside of the approach surface.
Runway 01R	Option 4.2 is located outside of the approach surface.

The results for southbound ILS CAT II/III missed approach procedures are shown in Table 36. As mentioned above, MITRE evaluated ILS CAT I/II/III missed approach procedures. However, for reporting purposes, the tables below show clearance amounts associated with ILS CAT II/III missed approach procedures rather than ILS CAT I missed approach procedures, as the corresponding ILS CAT II/III surfaces are lower than the ILS CAT I surfaces; thus, any potential impact from the facility would be greater on the ILS CAT II/III missed approach procedures.

Table 36. Southbound ILS CAT II/III Missed Approach Procedures (Option 4.2)

Runway 17L	Option 4.2 is located outside of the missed approach surface.
Runway 17R	Option 4.2 is located outside of the missed approach surface.
Runway 18L	Option 4.2 is located outside of the missed approach surface.
Runway 18R	Option 4.2 is located outside of the missed approach surface.
Runway 19L	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 174 m (571 ft).
Runway 19R	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 175 m (574 ft).

Figure 22 shows the southbound ILS CAT II/III missed approach procedure for Runway 19L at NAICM, which represents the ILS CAT II/III missed approach procedure with the least amount of clearance over the facility.

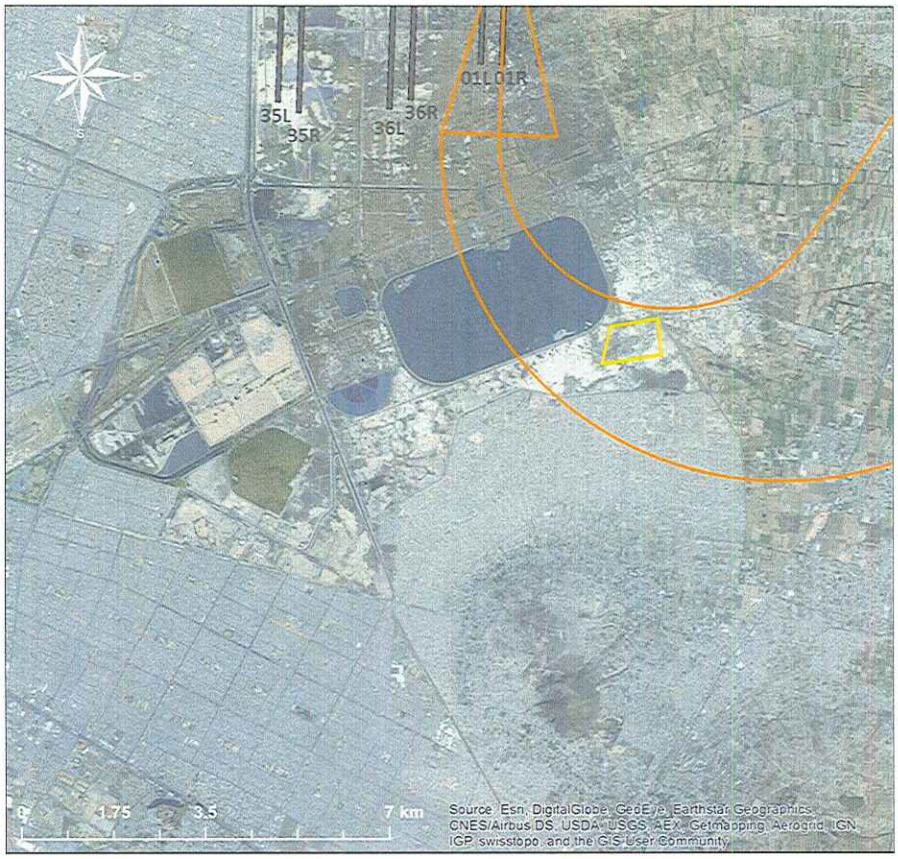

Figure 22. ILS CAT II/III Missed Approach Procedure for Runway 19L (Option 4.2)

The results for southbound RNP AR missed approach procedures are shown in Table 37.

Table 37. Southbound RNP AR Missed Approach Procedures (Option 4.2)

Runway 17L	Option 4.2 is located outside of the missed approach surface.
Runway 17R	Option 4.2 is located outside of the missed approach surface.
Runway 18L	Option 4.2 is located outside of the missed approach surface.
Runway 18R	Option 4.2 is located outside of the missed approach surface.
Runway 19L	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 272 m (892 ft).
Runway 19R	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 269 m (883 ft).

Figure 23 shows the southbound RNP AR missed approach procedure for Runway 19R at NAICM, which represents the RNP AR missed approach procedure with the least amount of clearance over the facility.

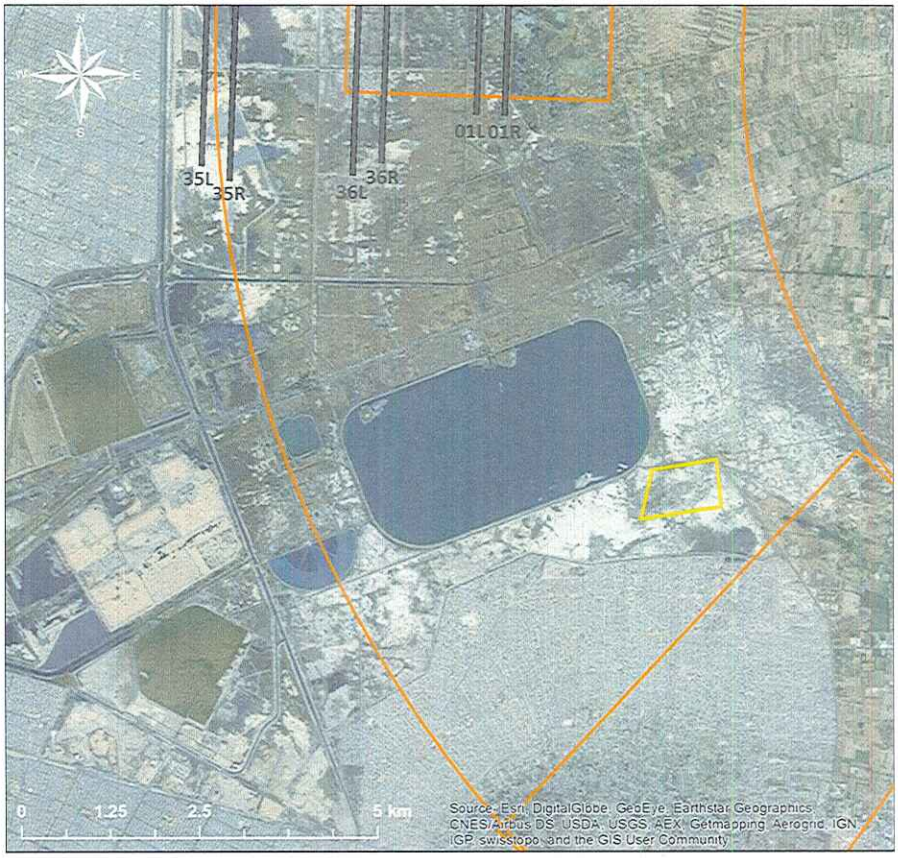

Figure 23. RNP AR Missed Approach Procedure for Runway 19R (Option 4.2)

The results for southbound conventional departure procedures are shown in Table 38.

Table 38. Southbound Conventional Departure Procedures (Option 4.2)

Runway 17L	Option 4.2 is located outside of the departure surface.
Runway 17R	Option 4.2 is located outside of the departure surface.
Runway 18L	Option 4.2 is located outside of the departure surface.
Runway 18R	Option 4.2 is located outside of the departure surface.
Runway 19L	Option 4.2 is located within the lateral confines of the departure surface; however, the surface clears the facility by 102 m (336 ft).
Runway 19R	Option 4.2 is located within the lateral confines of the departure surface; however, the surface clears the facility by 105 m (343 ft).

Figure 24 shows the southbound conventional departure procedure for Runway 19L at NAICM, which represents the departure procedure with the least amount of clearance over the facility.

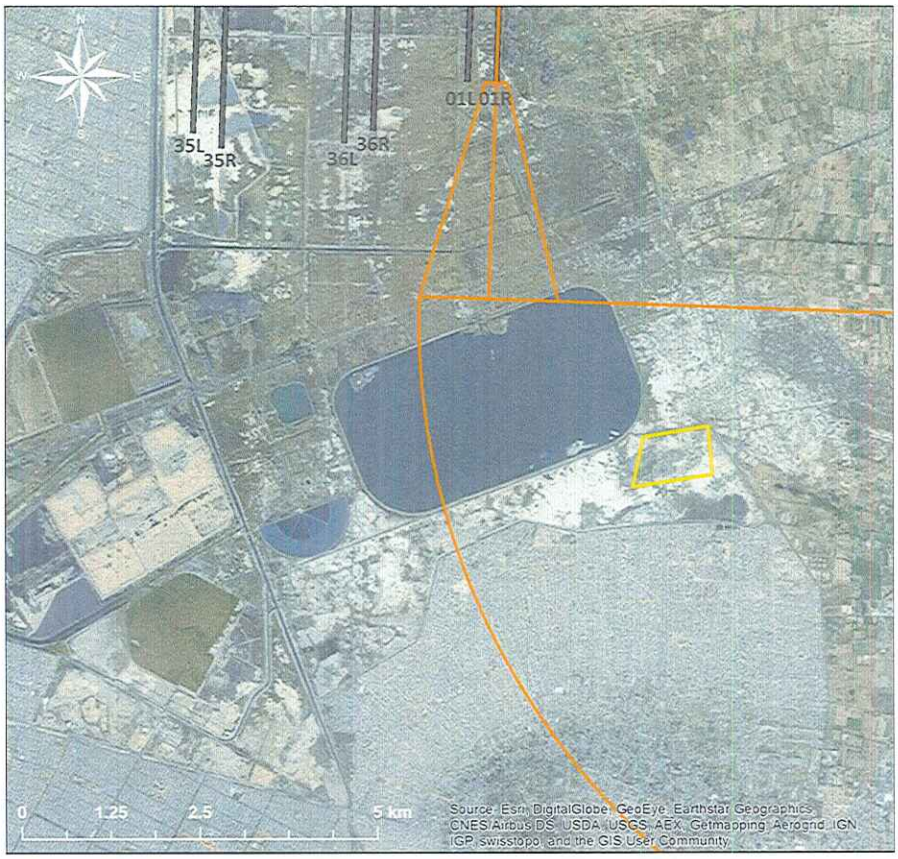

Figure 24. Conventional Departure Procedure to Runway 19L (Option 4.2)

The results for southbound RNAV departure procedures are shown in Table 39.

Table 39. Southbound RNAV Departure Procedures (Option 4.2)

Runway 17L	Option 4.2 is located within the lateral confines of the departure surface; however, the surface clears the facility by 228 m (747 ft).
Runway 18R	Option 4.2 is located within the lateral confines of the departure surface; however, the surface clears the facility by 138 m (452 ft).
Runway 19L	Option 4.2 is located within the lateral confines of the departure surface; however, the surface clears the facility by 102 m (336 ft).

Figure 25 shows one of the southbound RNAV departure procedures from Runway 19L at NAICM, which represents a departure procedure with the least amount of clearance over the facility.

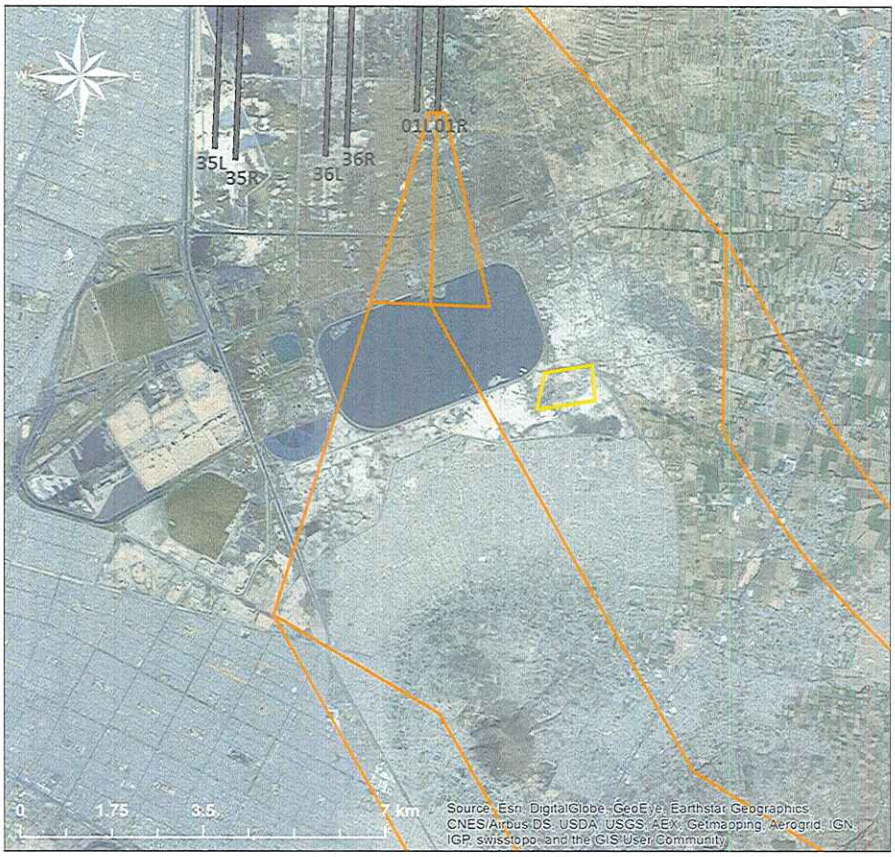

Figure 25. RNAV Departure Procedure from Runway 19L (Option 4.2)

Also, MITRE determined that the facility at Option 4.2 would not adversely affect parallel approach obstruction assessment surfaces at NAICM. In addition, MITRE conducted diverse departure assessments for all runways at NAICM and concluded that Option 4.2 would not adversely affect departures.

6.1.2 Instrument Procedures at AICM

For this analysis, MITRE examined the potential impact of the facility at Option 4.2 on the ILS CAT I approach procedure to Runway 23L, the ILS CAT I missed approach procedure to

Runway 05R, the VOR/DME approach procedure to Runway 23L, and the VOR/DME missed approach procedure to Runway 05R, and departures from Runway 05L and Runway 05R at AICM.

The results of the analysis of the ILS CAT I approach procedure to Runway 23L are shown in Table 40, and the results of the ILS CAT I missed approach procedure to Runway 05R are shown in Table 41.

Table 40. ILS CAT I Approach Procedure (Option 4.2)

Runway 23L	Option 4.2 is located outside of the final surface.

Table 41. ILS CAT I Missed Approach Procedure (Option 4.2)

Runway 05R	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 395 m (1296 ft).

Figure 26 shows the ILS CAT I missed approach procedure for Runway 05R at AICM.

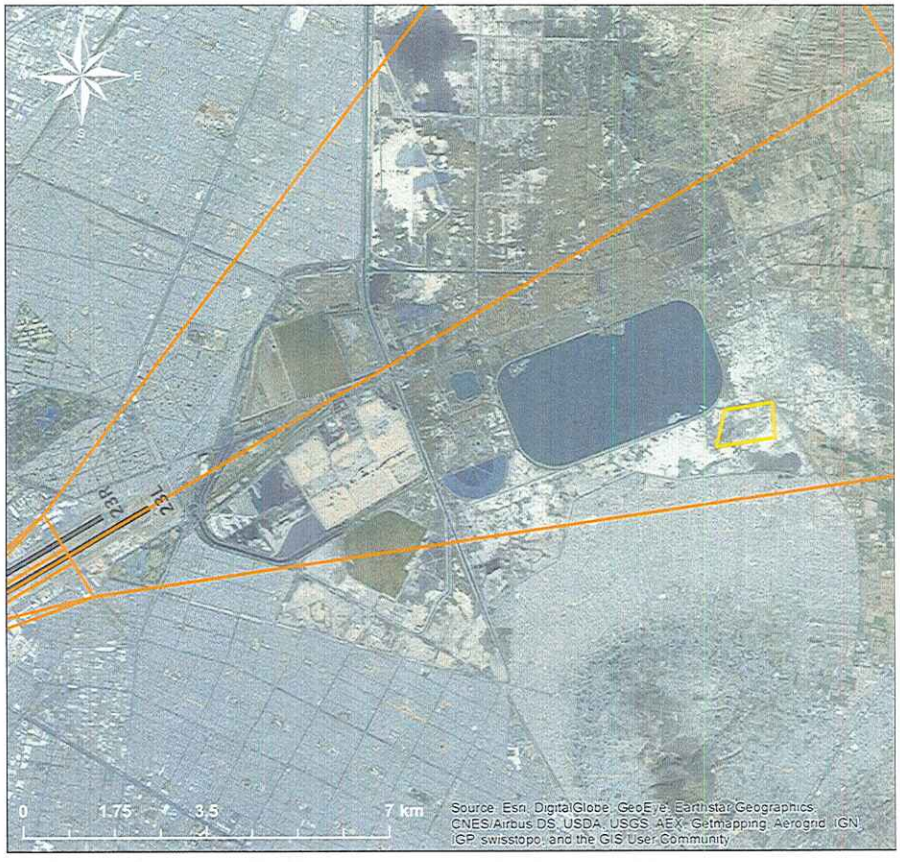

Figure 26. ILS CAT I Missed Approach Procedure (Option 4.2)

The results of the analysis of the VOR/DME approach procedure to Runway 23L are shown in Table 42, and the results of the VOR/DME missed approach procedure to Runway 05R are shown in Table 43.

Table 42. VOR/DME Approach Procedure (Option 4.2)

Runway 23L	Option 4.2 is located outside of the VOR/DME final and intermediate surfaces.

Table 43. VOR/DME Missed Approach Procedure (Option 4.2)

Runway 05R	Option 4.2 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 383 m (1257 ft).

Figure 27 shows the VOR/DME missed approach procedure for Runway 05R at AICM.

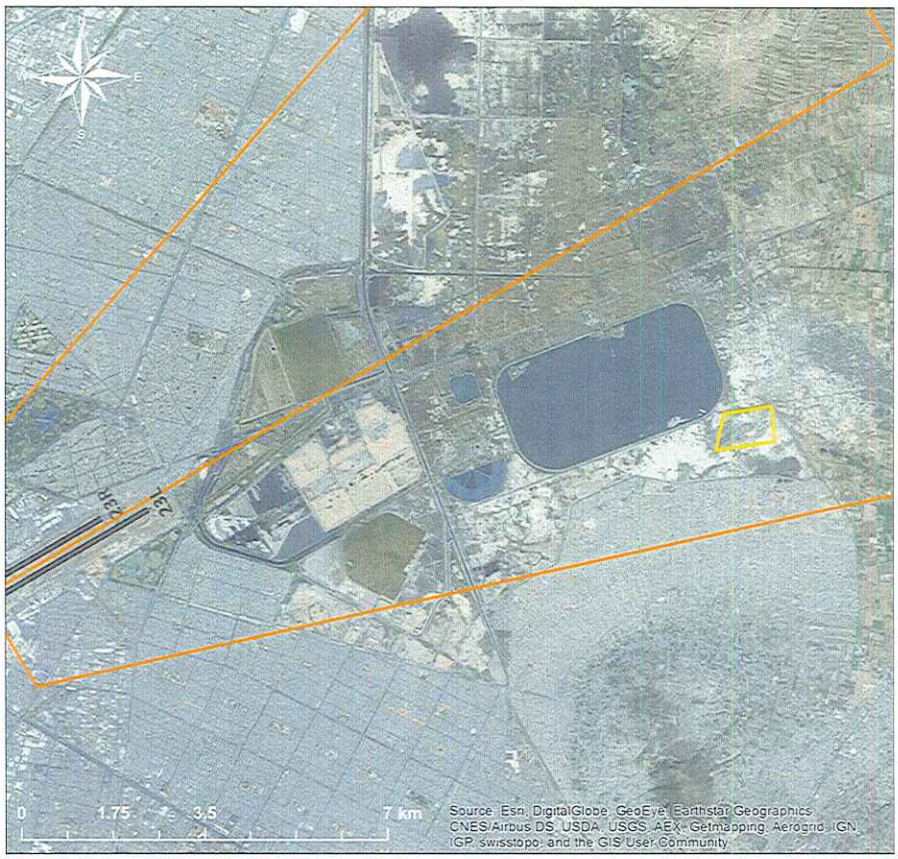

Figure 27. VOR/DME Missed Approach Procedure (Option 4.2)

The results of the analysis of the departure procedures for Runways 05L and 05R at AICM are shown in Table 44.

Table 44. Departure Procedures (Option 4.2)

Runway 05L	Option 4.2 is located outside of any of the departure surfaces.
Runway 05R	Option 4.2 is located outside of any of the departure surfaces.

Additionally, MITRE conducted diverse departure assessments for all runways at AICM and concluded that Option 4.2 would not adversely affect departures.

6.2 Impact of Option 4.2 on OEI Procedures

MITRE examined the potential impact of the facility at Option 4.2 on OEI lateral obstacle clearance requirements at NAICM and AICM considering both ICAO and U.S. FAA standards.

6.2.1 OEI Procedures at NAICM

The facility at Option 4.2 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at NAICM. The results of this analysis are shown in Table 45.

Table 45. OEI Procedures (Option 4.2)

	ICAO	U.S. FAA
Runway 17L	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.
Runway 17R	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.
Runway 18L	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.
Runway 18R	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.
Runway 19L	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.
Runway 19R	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.

6.2.2 OEI Procedures at AICM

The facility at Option 4.2 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at AICM. The results of this analysis are shown in Table 46.

Table 46. OEI Procedures (Option 4.2)

	ICAO	U.S. FAA
Runway 05R	Option 4.2 is located outside of OEI lateral clearance requirements.	Option 4.2 is located outside of OEI lateral clearance requirements.

6.3 Impact of Option 4.2 on MVA Sectors

The facility would not require modifications to the planned MVA sectors. Sector 1, which is the planned sector above the facility at Option 4.2, has a surface height of 2896 m MSL (9500 ft). This would be 632 m (2073 ft) above the facility. In addition, the facility would not require modifications to the existing MVA sectors.

6.4 Impact of Option 4.2 on ICAO Annex 14 OLS

MITRE evaluated the impact of the facility at Option 4.2 on all of the ICAO Annex 14 OLS at NAICM and AICM. Based on the location of Option 4.2, MITRE determined that the following OLS are not relevant to the analysis and therefore, are not included in the results below: Inner Approach, Transitional, Inner Transitional, and Balked Landing surfaces.

6.4.1 ICAO Annex 14 OLS at NAICM

The results of this analysis are shown in Table 47.

Table 47. ICAO Annex 14 OLS (Option 4.2)

	Approach	Take-Off Climb*
Runway 35L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 35R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 36L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 36R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 01L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 01R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 17L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 17R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 18L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 18R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 19L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 19R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.

*It is important to note that MITRE analyzed a variety of nominal paths in its assessment of Take-Off Climb surfaces at NAICM, including paths in which the intended track includes changes of heading greater than 15° for operations conducted in instrument meteorological conditions, visual meteorological conditions by night, which necessitate an 1800 m final width. The results in the table are representative of the Take-Off Climb surface with the least amount of clearance.

Also, Option 4.2 is located outside of the NAICM Inner Horizontal surface, but is located within the lateral confines of the Conical surface (see Figure 28); however, the surface clears the facility by 80 m (262 ft).

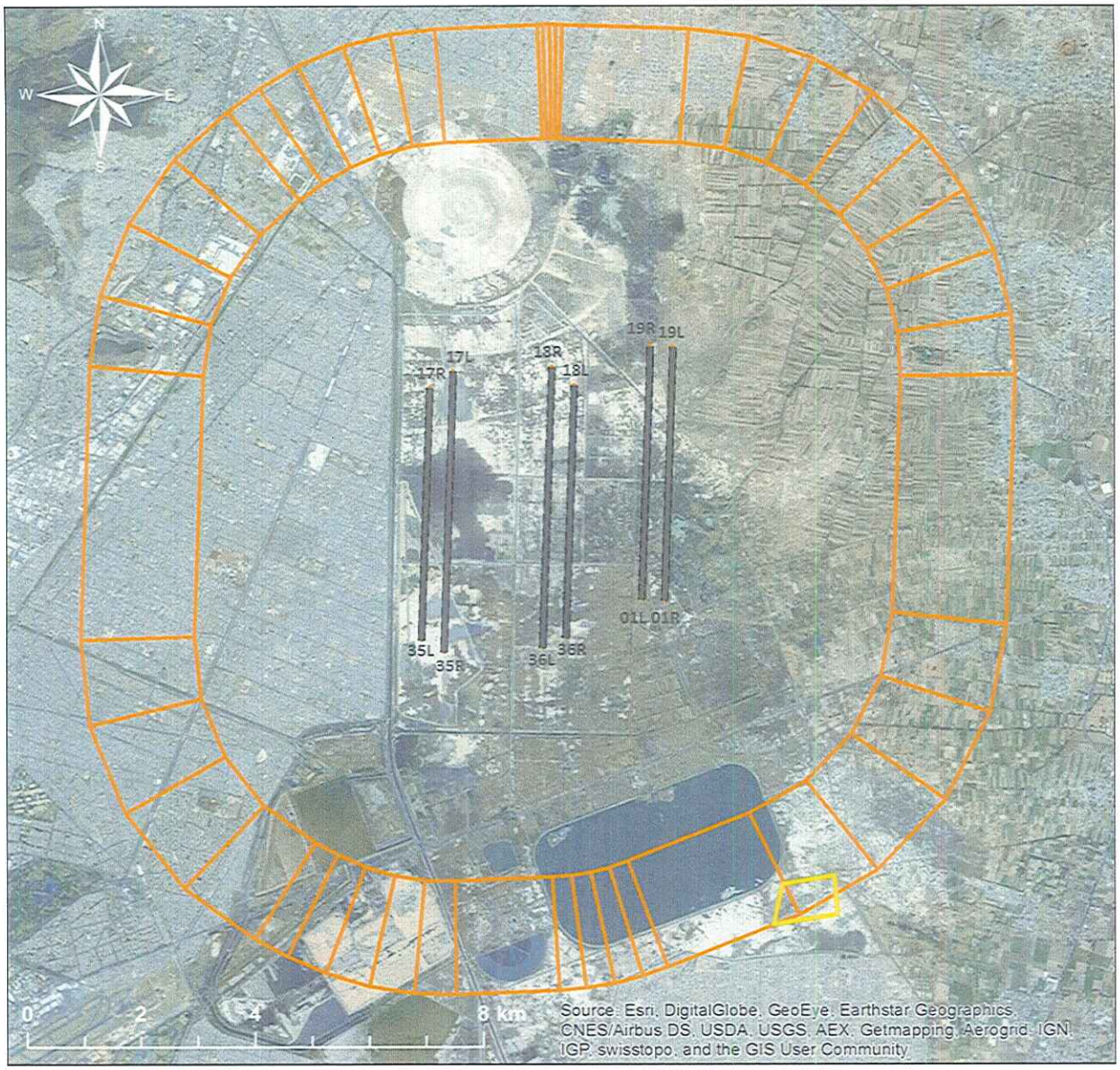

Figure 28. ICAO Annex 14 Conical Surface (Option 4.2)

6.4.2 ICAO Annex 14 OLS at AICM

The results of this analysis are shown in Table 48.

Table 48. ICAO Annex 14 OLS (Option 4.2)

	Approach	Take-Off Climb**
Runway 05L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 05R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 23L	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.
Runway 23R	Option 4.2 is located outside of the Approach surface.	Option 4.2 is located outside of the Take-Off Climb surfaces.

**MITRE analyzed straight-out Take-Off Climb surfaces for AICM. Theoretically, departures procedures could be developed that turn over the facility at Option 4.2, however, aircraft would be more than 11 km away from the closest runway threshold and would have significant clearance over the facility.

Also, Option 4.2 is located outside of the AICM Inner Horizontal and Conical surfaces.

7 Option 5

The site for Option 5 is shown in Figure 29, and its coordinates are given in Table 49. The site elevation is 2233.00 m above MSL. For conservative analytical purposes, MITRE assumed that the 40 m stacks of the facility could be located anywhere within the site for Option 5; thus MITRE used 2273.00 m (7457.35 ft) MSL as the elevation for its analyses (2233.00 m + 40 m = 2273.00 m).

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Figure 29. Option 5

Table 49. Coordinates for Option 5

	WGS 84 Coordinates		WGS 84 UTM 14N Coordinates	
Point	Latitude (N)	Longitude (W)	X	Y
1	19° 26' 09.04"	99° 01' 35.19"	497224.3397	2149054.0282
2	19° 26' 14.07"	99° 01' 25.62"	497503.4209	2149208.6030
3	19° 26' 05.96"	99° 01' 20.83"	497643.0536	2148959.3051
4	19° 25' 59.52"	99° 01' 28.47"	497420.2508	2148761.3883
5	19° 26' 01.40"	99° 01' 32.67"	497297.7856	2148819.1892

7.1 Impact of Option 5 on Instrument Procedures

This section describes the detailed analyses and results for Option 5 as they pertain to instrument approach and departure procedures. Section 7.1.1 focuses on the potential impact of the facility on the development of instrument procedures for NAICM, while Section 7.1.2 focuses on the potential impact to existing instrument procedures at AICM.

7.1.1 Instrument Procedures at NAICM

For this analysis, MITRE examined the potential impact of the facility at Option 5 on the development of appropriate northbound ILS CAT I/II/III approach procedures, northbound

RNP AR approach procedures, southbound ILS CAT I/II/III missed approach procedures, southbound RNP AR missed approach procedures, and southbound departures, both conventional and RNAV, at NAICM.

The results for northbound ILS CAT I/II/III approach procedures are shown in Table 50.

Table 50. Northbound ILS CAT I/II/III Approach Procedures (Option 5)

Runway 35L	Option 5 is located within the lateral confines of the final surface; however, the surface clears the facility by 340 m (1115 ft).
Runway 35R	Option 5 is located outside of the final surface.
Runway 36L	Option 5 is located outside of the final surface.
Runway 36R	Option 5 is located outside of the final surface.
Runway 01L	Option 5 is located outside of the final surface.
Runway 01R	Option 5 is located outside of the final surface.

Figure 30 shows the northbound ILS CAT I/II/III approach procedure to Runway 35L at NAICM.

Figure 30. ILS CAT I/II/III Approach Procedure to Runway 35L (Option 5)

The results for northbound RNP AR approach procedures are shown in Table 51.

Table 51. Northbound RNP AR Approach Procedures (Option 5)

Runway 35L	Option 5 is located outside of the approach surface.
Runway 35R	Option 5 is located outside of the approach surface.
Runway 36L	Option 5 is located outside of the approach surface.
Runway 36R	Option 5 is located outside of the approach surface.
Runway 01L	Option 5 is located outside of the approach surface.
Runway 01R	Option 5 is located outside of the approach surface.

The results for southbound ILS CAT II/III missed approach procedures are shown in Table 52. As mentioned above, MITRE evaluated ILS CAT I/II/III missed approach procedures. However, for reporting purposes, the tables below show clearance amounts associated with ILS CAT II/III missed approach procedures rather than ILS CAT I missed approach procedures, as the corresponding ILS CAT II/III surfaces are lower than the ILS CAT I surfaces; thus, any potential impact from the facility would be greater on the ILS CAT II/III missed approach procedures.

Table 52. Southbound ILS CAT II/III Missed Approach Procedures (Option 5)

Runway 17L	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 230 m (755 ft).
Runway 17R	Option 5 is located outside of the missed approach surface.
Runway 18L	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 240 m (788 ft).
Runway 18R	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 246 m (808 ft).
Runway 19L	Option 5 is located outside of the missed approach surface.
Runway 19R	Option 5 is located outside of the missed approach surface.

Figure 31 shows the southbound ILS CAT II/III missed approach procedure for Runway 17L at NAICM, which represents the ILS CAT II/III missed approach procedure with the least amount of clearance over the facility.

Figure 31. ILS CAT II/III Missed Approach Procedure for Runway 17L (Option 5)

The results for southbound RNP AR missed approach procedures are shown in Table 53.

Table 53. Southbound RNP AR Missed Approach Procedures (Option 5)

Runway 17L	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 319 m (1045 ft).
Runway 17R	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 335 m (1100 ft).
Runway 18L	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 304 m (997 ft).
Runway 18R	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 297 m (976 ft).
Runway 19L	Option 5 is located outside of the missed approach surface.
Runway 19R	Option 5 is located outside of the missed approach surface.

Figure 32 shows the southbound RNP AR missed approach procedure for Runway 18R at NAICM, which represents the RNP AR missed approach procedure with the least amount of clearance over the facility.

Figure 32. RNP AR Missed Approach Procedure for Runway 18R (Option 5)

The results for southbound conventional departure procedures are shown in Table 54.

Table 54. Southbound Conventional Departure Procedures (Option 5)

Runway 17L	Option 5 is located within the lateral confines of the departure surface; however, the surface clears the facility by 129 m (423 ft).
Runway 17R	Option 5 is located within the lateral confines of the departure surface; however, the surface clears the facility by 132 m (432 ft).
Runway 18L	Option 5 is located outside of the departure surface.
Runway 18R	Option 5 is located outside of the departure surface.
Runway 19L	Option 5 is located outside of the departure surface.
Runway 19R	Option 5 is located outside of the departure surface.

Figure 33 shows the southbound conventional departure procedure for Runway 17L at NAICM, which represents the departure procedure with the least amount of clearance over the facility.

Figure 33. Conventional Departure Procedure from Runway 17L (Option 5)

The results for southbound RNAV departure procedures are shown in Table 55.

Table 55. Southbound RNAV Departure Procedures (Option 5)

Runway 17L	Option 5 is located within the lateral confines of the departure surface; however, the surface clears the facility by 129 m (423 ft).
Runway 18R	Option 5 is located within the lateral confines of the departure surface; however, the surface clears the facility by 149 m (488 ft).
Runway 19L	Option 5 is located within the lateral confines of the departure surface; however, the surface clears the facility by 218 m (714 ft).

Figure 34 shows one of the southbound RNAV departure procedures from Runway 17L at NAICM, which represents a departure procedure with the least amount of clearance over the facility.

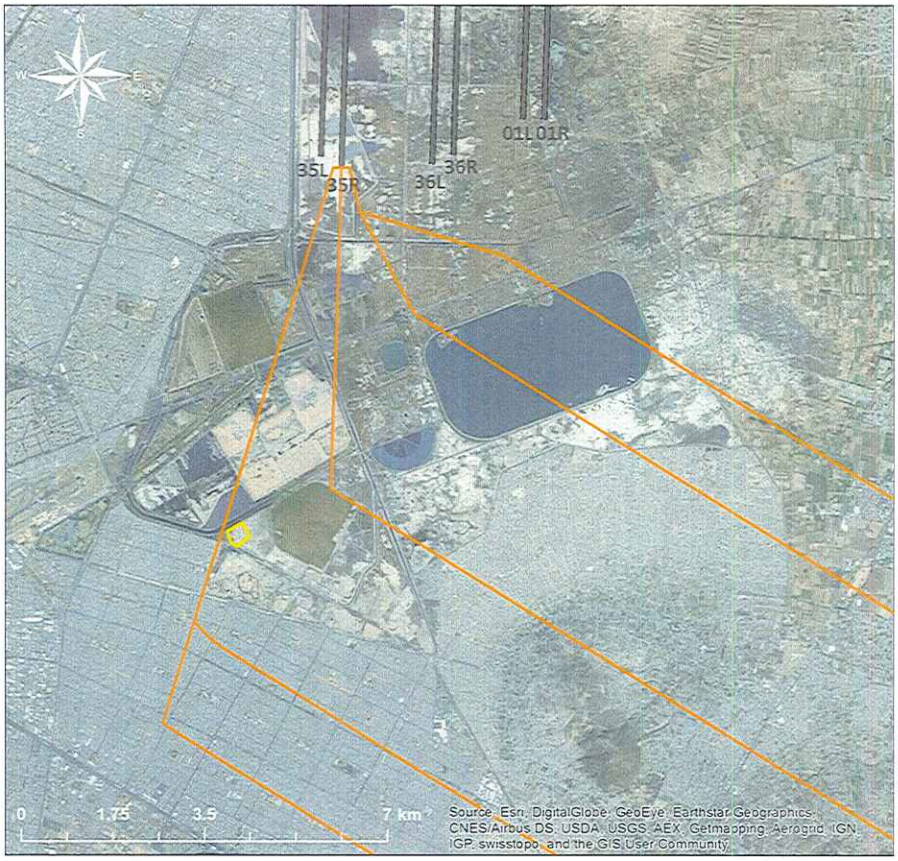

Figure 34. RNAV Departure Procedure from Runway 17L (Option 5)

Also, MITRE determined that the facility at Option 5 would not adversely affect parallel approach obstruction assessment surfaces at NAICM. In addition, MITRE conducted diverse departure assessments for all runways at NAICM and concluded that Option 5 would not adversely affect departures.

7.1.2 Instrument Procedures at AICM

For this analysis, MITRE examined the potential impact of the facility at Option 5 on the ILS CAT I approach procedure to Runway 23L, the ILS CAT I missed approach procedure to Runway 05R, the VOR/DME approach procedure to Runway 23L, and the VOR/DME missed approach procedure to Runway 05R, and departures from Runway 05L and Runway 05R at AICM.

The results of the analysis of the ILS CAT I approach procedure to Runway 23L are shown in Table 56, and the results of the ILS CAT I missed approach procedure to Runway 05R are shown in Table 57.

Table 56. ILS CAT I Approach Procedure (Option 5)

Runway 23L	Option 5 is located outside of the final surface.

Table 57. ILS CAT I Missed Approach Procedure (Option 5)

Runway 05R	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 171 m (562 ft).

Figure 35 shows the ILS CAT I missed approach procedure for Runway 05R at AICM.

Figure 35. ILS CAT I Missed Approach Procedure (Option 5)

The results of the analysis of the VOR/DME approach procedure to Runway 23L are shown in Table 58, and the results of the VOR/DME missed approach to Runway 05R are shown in Table 59.

Table 58. VOR/DME Approach Procedure (Option 5)

Runway 23L	Option 5 is located outside of the VOR/DME final and intermediate surfaces.

Table 59. VOR/DME Missed Approach Procedure (Option 5)

Runway 05R	Option 5 is located within the lateral confines of the missed approach surface; however, the surface clears the facility by 158 m (519 ft).

Figure 36 shows the VOR/DME missed approach procedure for Runway 05R at AICM.

Figure 36. VOR/DME Missed Approach Procedure (Option 5)

The results of the analysis of the departure procedures for Runways 05L and 05R at AICM are shown in Table 60.

Table 60. Departure Procedures (Option 5)

Runway 05L	Option 5 is located outside of any of the departure surfaces.
Runway 05R	Option 5 is located outside of any of the departure surfaces.

MITRE conducted diverse departure assessments for all runways at AICM and concluded that Option 5 would not adversely affect departures.

7.2 Impact of Option 5 on OEI Procedures

MITRE examined the potential impact of the facility at Option 5 on OEI lateral obstacle clearance requirements at NAICM and AICM considering both U.S. FAA and ICAO standards.

7.2.1 OEI Procedures at NAICM

The facility at Option 5 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at NAICM. The results of this analysis are shown in Table 61.

Table 61. OEI Procedures (Option 5)

	ICAO	U.S. FAA
Runway 17L	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.
Runway 17R	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.
Runway 18L	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.
Runway 18R	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.
Runway 19L	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.
Runway 19R	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.

7.2.2 OEI Procedures at AICM

The facility at Option 5 falls outside of the lateral confines of OEI lateral obstacle clearance requirements for all runways at AICM. The results of this analysis are shown in Table 62.

Table 62. OEI Procedures (Option 5)

	ICAO	U.S. FAA
Runway 05R	Option 5 is located outside of OEI lateral clearance requirements.	Option 5 is located outside of OEI lateral clearance requirements.

7.3 Impact of Option 5 on MVA Sectors

The facility would not require modifications to the planned MVA sectors. Sector 1, which is the planned sector above the facility at Option 5, has a surface height of 2896 m MSL (9500 ft). This would be 623 m (2044 ft) above the facility. In addition, the facility would not require modifications to the existing MVA sectors.

7.4 Impact of Option 5 on ICAO Annex 14 OLS

MITRE evaluated the impact of the facility at Option 5 on all of the ICAO Annex 14 OLS at NAICM and AICM. Based on the location of Option 5, MITRE determined that the following OLS are not relevant to the analysis and therefore, are not included in the results below: Inner Approach, Transitional, Inner Transitional, and Balked Landing surfaces.

7.4.1 ICAO Annex 14 OLS at NAICM

The results of this analysis are shown in Table 63.

Table 63. ICAO Annex 14 OLS (Option 5)

	Approach	Take-Off Climb*
Runway 35L	Option 5 is located within the lateral confines of the Approach surface; however, the surface clears the facility by 104 m (341 ft).	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 35R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 36L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 36R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 01L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 01R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 17L	Option 5 is located outside of the Approach surface.	Option 5 is located within the lateral confines of one or more of the Take-Off Climb surfaces; however, the surfaces clear the facility by 94 m (308 ft) or more.
Runway 17R	Option 5 is located outside of the Approach surface.	Option 5 is located within the lateral confines of one or more of the Take-Off Climb surfaces; however, the surface clears the facility by 100 m (328 ft) or more.
Runway 18L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 18R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 19L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 19R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.

*It is important to note that MITRE analyzed a variety of nominal paths in its assessment of Take-Off Climb surfaces at NAICM, including paths in which the intended track includes changes of heading greater than 15° for operations conducted in instrument meteorological conditions, visual meteorological conditions by night, which necessitate an 1800 m final width. The results in the table are representative of the Take-Off Climb surface with the least amount of clearance.

Also, Option 5 is located outside of the NAICM Inner Horizontal and Conical surfaces.

Figure 37 shows the Approach surface for Runway 35L at NAICM and Figure 38 shows the Take-Off Climb surface for Runway 17L at NAICM, which represent the ICAO Annex 14 surfaces with the least amount of clearance over the facility.

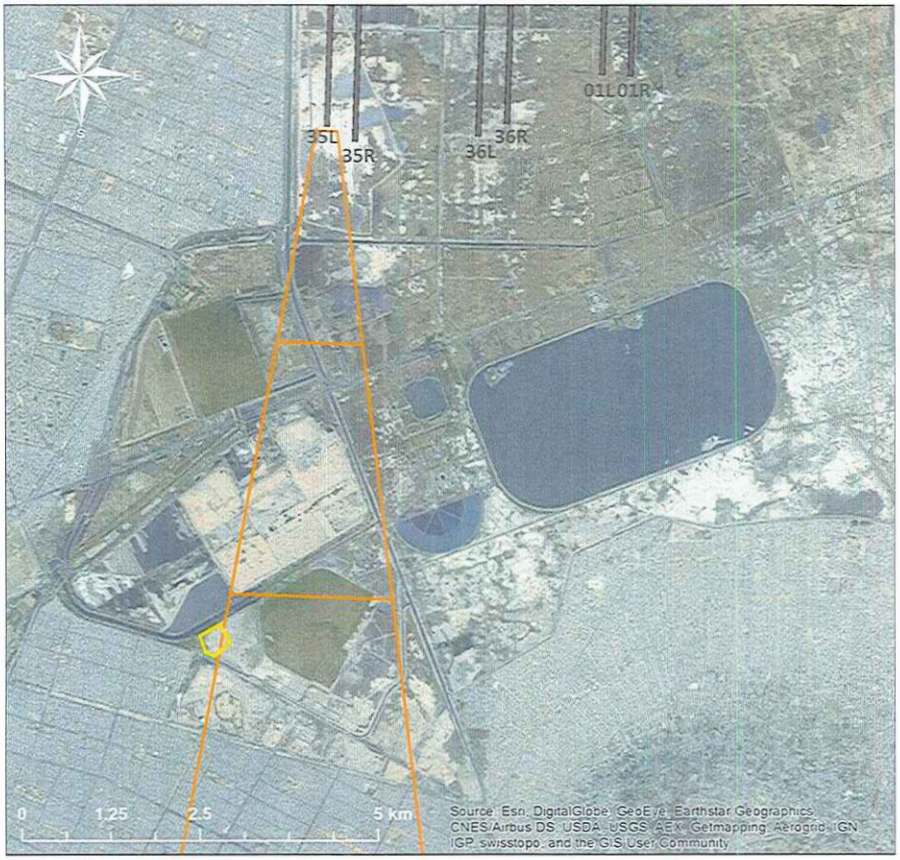

Figure 37. ICAO Annex 14 Approach Surface to Runway 35L (Option 5)

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Figure 38. ICAO Annex 14 Take-Off Climb Surface from Runway 17L (Option 5)

7.4.2 ICAO Annex 14 OLS at AICM

The results of this analysis are shown in Table 64.

Table 64. ICAO Annex 14 OLS (Option 5)

	Approach	Take-Off Climb
Runway 05L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 05R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 23L	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.
Runway 23R	Option 5 is located outside of the Approach surface.	Option 5 is located outside of the Take-Off Climb surfaces.

Option 5 is located within the Inner Horizontal surface of AICM. It is important to note that DGAC document *Circular Obligatoria, Requisitos para Regular la Construcción, Modificación y Operación de los Aeródromos Civiles* states that when constructing the Inner Horizontal surface for an airport that the airport reference elevation should be used. In the case of NAICM, the airport reference elevation has not been established. Therefore, for NAICM, MITRE used the lowest currently planned runway threshold elevation for conservative planning purposes

when constructing the Inner Horizontal surface, resulting in an Inner Horizontal surface elevation of 2272.00 m MSL.

For AICM, the Mexico AIP states that the airport reference elevation is 2230.00 m MSL. Therefore, MITRE used that elevation when constructing the Inner Horizontal surface for AICM, resulting in an Inner Horizontal surface elevation of 2275.00 m MSL, just 2 m above the facility elevation of 2273.00 m (see Figure 39).[2] Option 5 is located outside of the AICM Conical surface. The DGAC should assess this result.

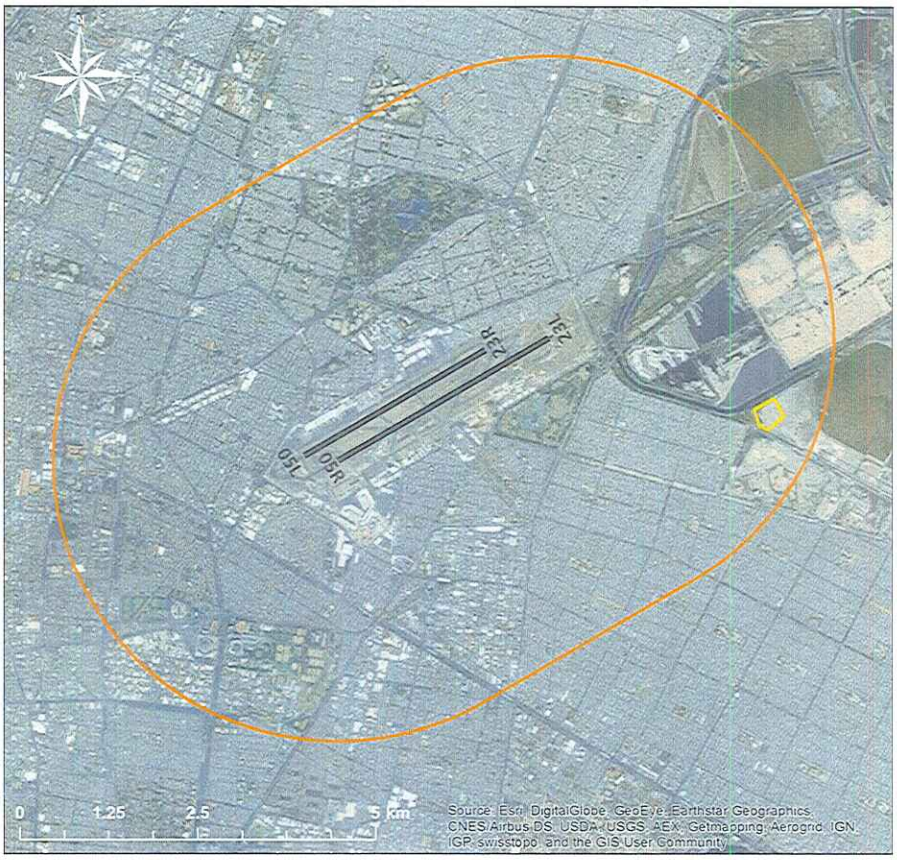

Figure 399. ICAO Annex 14 Inner Horizontal Surface (Option 5)

8 Additional Considerations

The proximity of the facility to both NAICM and AICM has raised important safety concerns, some of which are outside of MITRE's typical areas of expertise. This section describes additional considerations that need to be examined further by the Mexican federal authorities, the DGAC in particular, to determine if they could adversely impact future operations at NAICM and existing operations at current AICM.

[2] Note that if the lowest threshold elevation at AICM was used (i.e., Runway 05R, which is 2226.91 m as per the Mexico AIP) the Inner Horizontal surface would have an elevation of 2271.91 m MSL, which would result in a 1.09 m penetration of the facility to the Inner Horizontal surface.

8.1 Potential Impact from Exhaust Plumes

Research shows that significant turbulence from exhaust plumes can extend over a thousand feet above the top of chimneys or stacks. Depending on the location of the facility, this could mean that arrivals would be flying through or over exhaust plumes, increasing the risk of aircraft experiencing turbulence during this critical phase of flight. Similarly, other operations, such as departures could be affected by exhaust plumes. In addition, exhaust plumes could affect visibility. Some plumes are visible as smoke or condensation clouds that could block the pilots view of the runway environment or other aircraft.

Potential impact by exhaust plumes need to be carefully considered for any proposed location for the facility. Airlines (at least one major airline) should be consulted as they may have similar concerns, especially when there is potential of flying through or over exhaust plumes, including during abnormal operations such as the loss of an engine.

Aircraft incidents involving adverse effects from exhaust plumes have occurred. One of the most well-known incidents involved a commercial aircraft on approach to Morgantown Municipal Airport in West Virginia. The aircrew experienced severe turbulence as they flew over plumes from a power station causing the pilot to initiate a missed approach. Other plume-related incidents/accidents involving General Aviation aircraft and helicopters have also been reported.

8.2 Potential Electromagnetic Effects

Potential electromagnetic effects are a concern. These effects need to be carefully considered for any proposed location for the facility. The appropriate authorities need to investigate the potential electromagnetic effects on communication, navigation, and surveillance systems, especially as this pertains to generation and distribution of energy.

8.3 Potential Wildlife Hazard

Due to the fact that the facility would include both solid waste management and bio-digester operations, it has the potential to act as a wildlife attractant. Even if many of the operations are conducted in closed facilities, thereby limiting odors, there are concerns regarding the transportation and transfer of waste (i.e., it is difficult to avoid the loss and/or leakage of all waste material). In addition, there is international precedent for maintaining safe distances between these types of facilities and vulnerable airport areas. For example, in the U.S., the FAA states that vulnerable airport areas (e.g., aircraft movement areas, loading ramps, or aircraft parking areas) should be located at a distance of at least 3 km from wildlife attractants. Furthermore, airport aircraft operating areas (e.g., runways and taxiways) should be separated by 8 km (5 statute miles) from wildlife attractants, if the attractants could cause wildlife movement into or across the approach or departure airspace. It is important to note that Mexico may have its own standards regarding the location of solid waste management and bio-digester operations in relation to airports.

The Secretaría de Medio Ambiente y Recursos Naturales' (SEMARNAT's) guidance appears to state that when a final disposal site [of urban solid waste] is intended to be located within a distance of 13 km from the center of runway(s) of an airport, a study of bird hazard risk must be conducted. Since Option 3, 4.1, 4.2, and 5 are located within 13 km of both AICM and

NAICM, a study of bird hazard risk is required. This is important given the existing bird hazard risk in the area, especially around Lago Nabor Carillo. Therefore, it is essential to ensure that the proposed facility does not exacerbate the existing bird hazard risk.

9 Summary

MITRE's assessment determined that given 40-m stacks, the facility at Option 3, Option 4.1, Option 4.2, and Option 5 should not have, in general, adverse effects on instrument approach and departure procedures at either NAICM or AICM. Also, MVA sectors would not need to be modified. However, since procedures do not always proceed "by the book", additional aeronautical factors need to be considered before authorities make a final decision on the location of the facility, as described below. Additionally, MITRE recommends careful consideration of Section 8, above.

Location of the Facility in Relation to NAICM and AICM Approach and Departure Paths

- Option 3 is the least desirable as the extended centerline of Runway 35R/17L at NAICM passes through the facility. Also, a facility located at Option 3 would be relatively close to the extended centerline of Runway 35L/17R at NAICM. As a result, aircraft arriving to NAICM would be regularly flying directly over and/or close to a facility located at Option 3.
- Options 4.1 and 4.2 are located the farthest away from the extended centerlines of any of the NAICM runways and are also located far from AICM. In that respect, they constitute the best options.
- Option 5 is approximately 1123 m west of the extended centerline of Runway 35L/17R at NAICM, and is the closest to AICM being approximately 3052 m from the eastern end of Runway 23L/05R at AICM and approximately 2339 m south of its extended centerline. In that respect, this option, while not as good as Options 4.1 and 4.2, is a second best.

MITRE recommends that the DGAC carefully check MITRE's analysis of whichever is determined to be the preferred option. The previous pages are rich in information that may be of interest. Just as an example, the Inner Horizontal surface of AICM is just 2 m above the facility at Option 5.

OEI Procedures

In its analyses of both ICAO and U.S. FAA OEI procedures, Option 3 is located within the lateral clearance requirements of the OEI surface (considering a straight-out procedure for Runways 17L and 17R). It is important to mention, however, that Option 5 is located only 523 m (0.28 NM) outside of the Runway 17R OEI surface lateral clearance requirements.

Airlines typically develop their own specific departure paths to follow in the event of an engine failure, which could differ from those considered by MITRE. As a result, airlines could develop OEI departure paths that go over or close to Options 4.1, 4.2 (probably the two "best" in terms of OEI), or 5. Furthermore, airlines have their own specific practices and procedures regarding OEI matters. Therefore, it is very important that airlines conduct their own analyses of the facility (located at any of the options) on their respective OEI practices and procedures for

operations at both AICM and NAICM to determine if the facility would cause any issues and/or restrict aircraft payload and range capabilities.

MITRE recommends that at least one major airline is consulted on this matter.

Potential Impact from Exhaust Plumes

In some cases, aircraft may fly around 1000 feet above the facility (possibly even less in some operational situations). Significant turbulence from exhaust plumes can extend over 1000 feet above the top of chimneys or stacks. Also, plumes tend to be visible as smoke or condensation clouds that can block pilots' view of the runway environment or other aircraft. Therefore, MITRE strongly recommends that the Mexican aviation authorities and other stakeholders conduct more detailed analyses to assess the potential impact from exhaust plumes on aircraft operations at AICM and on future aircraft operations at NAICM for all of the options.

Option 3, which is located on the extended centerline of Runway 35R/17L at NAICM, raises the most serious concern regarding potential plume-related impact. However, aircraft flight paths could go over any of the facility location options being considered. Therefore, authorities should investigate potential plume-related impact for all options, as necessary.

MITRE recommends that at least one major airline be consulted by the authorities on this matter. Abnormal operations such as the loss of an engine, should be considered. Finally, helicopter operations and procedures should be treated carefully by the DGAC.

Potential Electromagnetic Effects

Another concern is the potential of electromagnetic effects. While this needs to be carefully considered for any proposed location for the facility, the location of Option 3 along the extended centerline of Runway 35R/17L may exacerbate potential electromagnetic effects.

MITRE recommends that the authorities constructing the airport investigate the potential electromagnetic effects on communication, navigation, and surveillance systems.

Potential Wildlife Hazards

MITRE understands that the proposed facility is intended to be designed in a closed manner that restricts the loss and spillage of waste material that could attract birds. However, despite best design practices and techniques, the loss and spillage of all waste material that could attract birds is very difficult to prevent. Therefore, MITRE is concerned that the addition of potential wildlife attractants caused by the loss and/or spillage of waste material could exacerbate the already existing problem of bird activity near the runways at NAICM (e.g., from Lago Nabor Carrillo and other water bodies nearby the facility).

Option 3 and Option 5 fall within the lateral confines of ICAO Annex 14 Approach surfaces at NAICM and, therefore, also fall within the SEMARNAT restricted areas depicted on slide 13 in the PowerPoint briefing sent to MITRE (see "Zonas de Protección PC y Z8.pptx"). MITRE is not familiar with these restricted areas. In contrast, if the restricted areas are consistent with those shown in the above-mentioned slide 13, then Options 4.1 and 4.2 would be outside of the SEMARNAT restricted areas. Note, however, that all four options fall within 13 km from the center of the runways at both NAICM and AICM, which requires a study to assess the risk of bird hazards as per SEMARNAT's guidance.

MITRE recommends that SEMARNAT be made aware of all potential facility options so that appropriate bird risk studies can be conducted and that all SEMARNAT-related restricted area matters are reviewed and addressed, as necessary.

Due to the importance of the decision regarding the location of the facility and its potential long-term effects, MITRE strongly recommends that **all** the above-mentioned factors be investigated by the federal authorities and other stakeholders so that a fully-informed decision may be made. Finally, MITRE recommends that SENEAM reviews this document and be involved in the decision-making process as well.