Lic. Alfonso Sarabia de la Garza  
Director General  
Aeropuertos y Servicios Auxiliares (ASA)  
Avenida 602, Número 161  
15620 México, D.F.  
México

Subject: Technical Letter: Summary of Work During the Period 16 January 2016 through 31 March 2016

Dear Lic. Sarabia:

This letter respectfully submits to your attention a summary of the most significant MITRE project activities conducted or about to conclude during the period 16 January 2016 through 31 March 2016.

Reports

At the outset, before proceeding with a full description of activities, please find below a list of the documents that we are including along with this Technical Letter, some of which have been delivered to various parties throughout the concluding quarter.


The documents designated as Enclosures, are described below:

- **Enclosure 1: Photogrammetric, Satellite-Based Survey of Toluca Airport and Its Surroundings, Satellite Image Acquisition Completion Report.** MITRE is responsible for the procurement of a satellite-based photogrammetric survey of Toluca Airport and its surroundings. MITRE is pleased to report that all of the satellite-based imagery required to conduct the survey has been successfully acquired.

   This enclosure provides a report that was prepared by MDA Geospatial Services Inc. (MDA), the company performing the survey, which describes the satellite image acquisition areas, specifications, as well as illustrations of the satellite images that were acquired of Toluca Airport and its surroundings.

   The next steps are for MDA to conduct a visit to Mexico to conduct Field Validation, Verification and Ground Truth survey work of Toluca Airport and its surroundings, complete the collection of features, followed by a Quality Control process.

- **Enclosure 2: Mexico City Enroute Airspace Redesign, Methodology and Key Considerations.** The purpose of this document is to describe the approach that MITRE intends to use for the analysis of the Mexico City enroute airspace redesign in support of the opening of Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM). This analysis will help to identify and mitigate factors that could limit the capacity of traffic flows arriving to or departing from a new Mexico City Terminal Maneuvering Area (TMA).

- **Enclosure 3: Human-In-The-Loop (HITL) Simulations: A General Overview.** MITRE is assisting Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM) in its planning and conducting of Human-in-the-Loop (HITL) simulation activities for Cancún and NAICM. HITL simulations can be used either for research and evaluation (this is what MITRE is proposing for Cancún
and NAICM) or for training and education. The intent of this document is to explain the key differences between the various uses of HITL simulations and provide SENEAM with a better understanding of those differences.

- **Enclosure 4: Mexico City Terminal Maneuvering Area Geographical Traffic Distribution Analysis, Preliminary Results.** The purpose of this document is to provide insight into the current traffic distribution for the existing Aeropuerto Internacional de la Ciudad de México and Toluca, which will assist airspace designers in redesigning the Mexico City TMA and Mexico Upper (Enroute) airspace. The information is helpful in determining the number of routes necessary for the traffic volume and in assigning routes to runways for balancing operations.

### Activities

The following list describes activities conducted by MITRE during this reporting period:

- A large team of MITRE engineers visited Cancún on 25 and 26 January 2016 to assist SENEAM in the redesign of the Cancún airspace to support dual independent test-bed operations. Other important technical and planning matters were also discussed.

The objective of the trip to Cancún was to re-engage with the SENEAM Cancún airspace design team, advance on important work and discuss next steps. Of particular interest was to define in more detail the test-bed plan for Cancún.

Key activities, presentations and discussions conducted during the visit to Cancún are as follows:

- Project Status
- Preliminary Dual Independent Airspace Design for Cancún
- Project Planning and Discussion Session
- Overview of HITL Simulations
- Dual Independent HITL Simulations for Cancún: Planning and Discussion Session
- MITRE’s Review of SENEAM’s Dual Independent Airspace Design for Cancún: Feedback and Suggestions
- Sectorization: A Few Best Practices
- Other Key Project-Related Considerations
- Dual Independent Test-bed Operations at Cancún: Key Next Steps

The visit to Cancún was very successful and productive. The SENEAM team is now advancing with a clear plan and objective milestones in mind. Since the above-mentioned visit, SENEAM and MITRE have been in close contact, and
several teleconferences have been held. The MITRE team will continue to provide support to the SENEAM team as their work progresses.

- A large team of MITRE engineers visited Mexico City from 27 through 29 January 2016 to assist SENEAM in the redesign of the NAICM airspace and to discuss other important matters.

The objective of the trip to Mexico City was to conduct executive planning meetings with officials from SENEAM, and hold intense discussions on various program and technical matters so that key officials have an overall understanding of the NAICM project, including issues and considerations.

Key activities, presentations and discussions conducted during the visit to Mexico City are as follows:

- MITRE and Its Work
- An Overview of MITRE’s Work on a New Airport for Mexico City
- NAICM: Análisis de Viabilidad Aeronáutica
- Runway Spacing Analysis and Air Traffic Control (ATC) Equipment Requirements
- Independent Operations: Important Airspace and ATC Considerations
- Implementation of Operations at NAICM: Planning and Coordination
- Key NAICM Airspace Design Considerations
- MITRE’s Airspace Design Methodology
- SENEAM/MITRE 2016 Work Plan Discussion
- SENEAM/MITRE Roles and Responsibilities
- Preliminary Airspace Design Concept for NAICM
- Overview of NAICM Instrument Approach and Departure Procedures
- SENEAM/MITRE-Developed MVAC: Overview
- Overview of MITRE’s Work to Support Fuerza Aérea Mexicana (FAM) Operations
- Preliminary Assessment of FAM Special Use Airspace Proposal
- NAICM Airspace Design Matters: General Discussion
- SENEAM and MITRE Near-Term Next Steps and Action Items

Additionally, a MITRE laboratory engineer visited Centro Mexico’s training simulator facility, as well as the Mexico ACC to observe operations. The objective of the visit was to obtain a better understanding of the capabilities of SENEAM’s training simulators, as well as their potential appropriateness for conducting HITLs in support of Cancún and NAICM. In MITRE’s opinion, the current SENEAM
simulators do not have the capabilities to conduct the type of research and evaluation HITLs envisioned for Cancún and NAICM, and are more suited for training-related HITLs.

- Following MITRE’s above-mentioned visit to Mexico, the MITRE team spent a significant amount of time preparing a 95-page document that provides a reflection of informal airspace design-related working notes discussed during meetings between SENEAM and MITRE. The objective of the document is to provide feedback and suggestions for consideration by SENEAM on its preliminary airspace redesign for Cancún. As a result, SENEAM will be able to continue advancing on its airspace redesign to support dual independent test-bed operations. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L16-017).

- As mentioned in MITRE’s previous Technical Letter, during a visit to MITRE on 22 and 23 October 2015, officials from SENEAM were informed of the numerous documents (i.e., reports and special Technical Letters) that have been developed by MITRE and submitted to ASA since the project began. However, SENEAM informed MITRE that they only had a small amount of documents. Therefore, following the visit, CTA Martín García of SENEAM sent MITRE a list of documents they did have so that MITRE could prepare a more complete list of MITRE reports and special Technical Letters of interest to SENEAM (see MITRE document F500-L16-008 that was sent during the previous quarter).

On 12 February 2016, at the request of CTA García, MITRE sent to his attention five copies of 24 separate MITRE reports and special Technical Letters of interest to SENEAM pertaining to the ASA-MITRE project.

- MITRE recently encountered an article published in the Mexico City weekly magazine “Proceso” that discusses different aspects of the NAICM project, including hydrological and flood-related risks. MITRE is concerned about this article because it characterizes MITRE as being somehow responsible for addressing hydrological and flooding matters pertaining to the development of NAICM, which is not MITRE’s responsibility and totally outside MITRE’s area of expertise.

Therefore, MITRE sent a letter to reaffirm to ASA and all other interested authorities, for the record, that MITRE has never been nor is responsible for addressing these matters or any other construction-related issues pertaining to the development of NAICM. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L16-018).

- The Mexico City TMA Minimum Vectoring Altitude Chart (MVAC) plays an important role in the design of instrument procedures and airspace for NAICM and Toluca. However, the existing MVAC needs to be modified to appropriately support NAICM, as well as any required modifications to procedures at Toluca.

Therefore, in anticipation of a SENEAM-MITRE workshop (see farther below for details), MITRE delivered a document to SENEAM that presents guidelines that MITRE developed for use by Mexican aviation authorities in the development of
new MVACs. The document also describes MITRE’s work regarding the development of a future MVAC to support NAICM and Toluca. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L16-C20).

- As previously mentioned, MITRE is glad to report that all of the satellite-based imagery required to conduct the survey of Toluca Airport and its surroundings have been successfully acquired. Refer to Enclosure 1 of this Technical Letter for details. This is an important achievement as it was very difficult to acquire appropriate cloud-free imagery due to the rainy season. It is important to mention that due to complications caused by the rainy season, the MITRE team had to spend a significant amount of time coordinating satellite image acquisition matters with MDA and in reviewing candidate imagery for potential usability in order to reach the present full-image acquisition stage.

The next step is for the MDA team to conduct a 4-week visit to Mexico to conduct Field Validation, Verification and Ground Truth survey work of Toluca Airport and its surroundings. The visit will be conducted from 29 March 2016 through 22 April 20:6. MITRE has already pre-coordinated with ASA the visit details and its objectives.

- MITRE received AutoCAD files from SENEAM that depict their conceptual airspace design for NAICM. MITRE imported the SENEAM design into its analysis and design tools and conducted a thorough review of the overall design. MITRE then suggested modifications to SENEAM, which were considered in the 29 February 2016 through 4 March 2016 airspace design workshop described farther below.

- The MITRE team has been preparing for the Mexico ACC enroute analysis by setting up analysis spreadsheet tools. These tools provide the structure to analyze the routes and sectors by examining the complexity and workload of a sector configuration. The analysis will assist in the identification of issues within a sector, and can be used to determine if the enroute redesign has resolved the identified issues.

- In order to appropriately redesign the Mexico City TMA to support NAICM, it is important to analyze current operational statistics. Understanding the volume and distribution of traffic as well as its origin and destination allows airspace designers to develop a more optimized airspace design. Therefore, MITRE conducted a traffic distribution analysis for the Mexico City TMA considering data provided by SENEAM. Refer to Enclosure 4 of this Technical Letter for details.

- The MITRE team has started preparing for the Cancún HITL simulations by writing the necessary Standard Operating Procedures (SOPs) for the dual independent test-bed operations. The Letters of Agreement (LOAs) are also being modified as necessary to match the new interface between the enroute airspace and the TMA. MITRE is also working on a Concept of Operations for Cancún to be used to inform the HITL participants of what to expect when dual independent test-bed operations at Cancún commence.
• In mid-December 2015, MITRE received the complete Spanish language version of the Arup Master Plan (dated 5 August 2015). MITRE assembled a large team of engineers with diverse areas of expertise to conduct a detailed review of Arup’s Master Plan. The Master Plan consists of a large amount of information contained in several volumes and associated drawings, and required a significant amount of time and effort to review. The MITRE team worked extremely hard to review the material as soon as possible in order to provide appropriate and helpful feedback.

The MITRE team prepared a detailed briefing on its findings, opinions, and concerns regarding relevant parts of the Master Plan. This briefing was presented to Lic. Federico Patiño Márquez, Director-General of Grupo Aeroportuario de la Ciudad de México (GACM), during his 26 February 2016 visit to MITRE. That visit is described in more detail farther below.

Lic. Patiño informed MITRE during his visit that the Master Plan was originally prepared in English and then translated into Spanish. MITRE desires to state that reviewing the Spanish version of the Master Plan not only was contrary to the letter and spirit of the ASA-MITRE contract but it took a significant amount of time and expense. It would have been much easier and more efficient for MITRE to review the original English version. Therefore, in the future, English versions of documents should be provided to MITRE.

Finally, the MITRE team prepared a detailed report describing its review of the above-mentioned Master Plan. MITRE’s review focused primarily on matters that pertain to the aspects of MITRE’s aeronautical work. The objective of the review was to identify differences considered important between MITRE’s and Arup’s work as well as potential issues and/or questions for consideration by Mexican aviation officials.

MITRE completed the report, but has recently learned of a more recent version of the Master Plan that includes important changes. Therefore, the report is not being sent at this time because MITRE needs to re-do its review using the more recent version of the Master Plan (and in English). MITRE has already requested the latest and complete version of the NAICM Master Plan (all volumes and drawings) in English from GACM.

• On 26 February 2016, Lic. Patiño visited MITRE for an intense, 11-hour day of presentations and demonstrations on the NAICM project. During the visit many important project-related matters were discussed, including several pending items that need to be addressed. The visit was extremely successful and, as a result, Lic. Patiño now fully understands the MITRE-NAICM project, its issues and concerns, and its current status.

The following is a listing of the briefings and demonstrations provided by MITRE during the visit:

  o MITRE and its Work
  o NAICM: Aeronautical Feasibility Analysis
• Visit to the Air Traffic Management Laboratory: Flight Demonstrations
• NAICM Runway Spacing Analysis
• NAICM Master Plan Matters
• NAICM Pending Matters
• Collaboration and Coordination

• A large team of MITRE engineers visited Mexico City for one-week from 29 February 2016 through 4 March 2016 to assist SENEAM in the airspace redesign of the new Mexico TMA to support NAICM. The main objectives of the visit were as follows:
  • Conduct intense airspace design workshop sessions pertaining to the redesign of the new Mexico TMA
  • Modify the MVAC to support the design of instrument procedures and airspace

The overall goal of the visit was to collaborate on the development of a preliminary airspace design so that follow-on work can be appropriately conducted. The visit was extremely successful and productive, and allowed the SENEAM-MITRE teams to make important progress on airspace- and MVAC-design matters.

• **Important safety issue:** At airports where independent operations to parallel runways are conducted, certain actions must be taken to ensure the safety of an aircraft on approach to one runway that has to “break-out” should an aircraft on approach to an adjacent parallel runway deviates from its nominal path. As part of that safety action, a Parallel Approach Obstruction Assessment (PAOA) must be accomplished. A PAOA examines the obstacle environment in the direction away from the No Transgression Zone, which is located between the arrival paths. Information from the PAOA is then used to develop an appropriate safety strategy.

The Arup Master Plan for NAICM (dated 5 August 2015) received by MITRE in mid-December 2015 mentions the location and maximum height of two proposed Air Traffic Control Towers (ATCTs): one for opening-day located between runways 2 and 3, and another second ATCT that would be built in the future once additional runways are constructed. MITRE engineers examined the Parallel Approach Obstruction Assessment Surfaces (PAOAS) to determine if either ATCT would pose an issue. MITRE determined that the opening-day ATCT penetrated the CAT II/III PAOAS for approaches to runways 3 and 4 (in both directions) considering aircraft that would need to “break-out” to the west. It is important to note, however, that MITRE needed to make some assumptions in its assessment regarding runway elevations, diameter of the ATCT cabs and true ATCT height and location.

When obstacles penetrate the PAOAS, they shall be identified and, through coordinated actions of those affected, considered for electronic mapping on
controller radar displays. If possible, penetrations should be removed by authorities considering independent approach operations to parallel runways. Where obstacle removal is not feasible, air traffic operational rules shall be established to avoid obstacles that penetrate the PAOAS. Officials from SENEAM were made aware of this matter during MITRE’s above-mentioned visit to Mexico City. Lic. Patiño was also informed during his 26 February 2016 visit to MITRE.

- CTA García requested that MITRE provide more detailed information on NAICM and Cancún upcoming activities and milestones to assist in SENEAM internal planning matters. Therefore, following the above-mentioned visit to Mexico City, the MITRE team prepared two documents that listed the NAICM and Cancún upcoming activities and milestones, which were sent to CTA García on 14 March 2016. Those documents are being sent along with this Technical Letter as a reference (see MITRE documents F500-L16-024 and F500-L16-025).

- Following the above-mentioned visit to Mexico City, MITRE’s airspace design team prepared a document that provides informal airspace design-related working notes on NAICM conventional and Area Navigation (RNAV) Standard Terminal Arrival Routes (STARs). The objective of the document is to provide route information (e.g., coordinates) to SENEAM so that it can conduct more detailed route design work. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L16-026).

- In February 2016, MITRE received a letter from GACM through ASA requesting that MITRE meet with airlines in order to discuss the NAICM project. Please note that Dr. Bernardo Lisker received a request directly from the Undersecretary of Transportation, Lic. Yuriria Mascott, for MITRE to meet with the airlines. Lic. Mascott then provided contact information of top executives at the airlines so that MITRE can coordinate with them. Therefore, it is MITRE’s plan to coordinate such a visit(s) in the near future.

- During the 20 November visit to MITRE by Lic. Mascott and other officials, the topic of the second parallel runway at Toluca was discussed. MITRE expressed its opinion to the officials that Toluca should be planned and protected for long-term growth, even if a second runway is not needed in the near future, and that to do so it is critical to ensure that operations at Toluca, both current and future, do not create capacity-limiting effects on operations at NAICM due to airspace conflicts.

As a result, all the officials present in the meeting, including Lic. Mascott and Lic. Sarabia, agreed that a second parallel runway at Toluca should be considered in MITRE’s work. Therefore, as mentioned in MITRE’s January 2016 Technical Letter received by ASA, **MITRE requests formal written authorization from ASA that re-instates MITRE’s analysis of a second parallel runway at Toluca into its scope of work.**

Additionally, as mentioned in MITRE’s January 2016 Technical Letter to ASA, **MITRE requires feedback from aviation authorities on the preferred location of the second parallel runway for Toluca for analysis by MITRE.** However,
and this is important, as runway spacing standards keep changing, this decision should be made in coordination with MITRE.

- Under Task 8 of the ASA-MITRE contract, MITRE is to assist aviation authorities with examining problems relating to airport expandability in Mexico. More specifically, MITRE will work on a runway-related solution regarding expandability of a critical airport to be selected by the Mexican authorities, after consultation with MITRE. This task was to commence in 2015 with the selection by the Mexican authorities of the airport to be studied. Following the selection of the airport to be studied, an Automated Weather Observing System (AWOS) will be installed by SCT/ASA, if needed. A satellite-based photogrammetric survey (for which MITRE is responsible) will also be required.

This task was discussed with Lic. Mascott and other officials during their 20 November 2015 visit to MITRE. During that visit, the following airports were mentioned by Lic. Mascott as possible candidates for selection:

- Guadalajara Airport
- Puerto Vallarta Airport
- Tijuana (new airport site examination)

As mentioned in MITRE’s previous Technical Letter, it is important that the authorities select an airport soon so that an AWOS can be acquired and installed, if needed, and a satellite-based photogrammetric survey can be procured. Both of these items take a significant amount of time to complete.

- Contractual Matters

  - **Hidalgo-Related Work** – Per ASA information, MITRE’s Hidalgo-related work was stopped due to FAM interest in relocating its fixed-wing non-transport aircraft operations to Querétaro Airport. However, MITRE informed through Technical Letter F500-L15-007, dated 12 January 2015, that FAM operations at Querétaro Airport, along with the establishment of SUAs to support those operations, must be thoroughly examined to ensure that they are feasible and, more importantly, that they do not interfere with future operations at NAICM. Such investigation must be conducted in close coordination with FAM officials.

  Since this work is not contained in MITRE’s current contract, a modification of the contract will be required. This should be done after detailed discussions with officials from FAM are held at MITRE to confirm their plans and priorities. SCT and GACM are going to be coordinating this encounter.

  - **Toluca-Related Work** – As mentioned before in this Technical Letter, MITRE requested over two months ago formal authorization from ASA to re-instate consideration of a second parallel runway at Toluca Airport. This formal notification from ASA is now urgent to avoid further delays in the Toluca work.
Other Items that need to be addressed

- **Retrieval of Revised MITRE Documents** – In MITRE’s previous Technical Letter, dated 14 January 2016 (F500-L016-013), MITRE provided the following revised documents:
  - Enclosure 3: *Nuevo Aeropuerto Internacional de la Ciudad de México—Feasibility of Independent Approach and Departure Procedures (REVISED)*
  - Enclosure 4: *Nuevo Aeropuerto Internacional de la Ciudad de México—Feasibility of Independent Category II/III Approach and Area Navigation Departure Procedures (REVISED).*

To avoid any confusion, all copies of the previous version of those reports should be retrieved by ASA and returned to MITRE. I apologize for any inconvenience. Refer to MITRE’s previous Technical Letter for more information. **Has this action taken place?**

Please do not hesitate to contact me if you need any clarification or assistance.

Sincerely,

Ing. Robert W. Klein Hans
Project Technical Coordinator

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Included with this letter:
Six Technical Documents and four Enclosures

cc: Dr. Bernardo Lisker
This two-page return receipt (acuse de recibo) is to be scanned (both pages) and e-mailed to Ing. R. Kleinhans

I APRIL 2016 TECHNICAL LETTER DISTRIBUTION

MITRE requests that the documents enclosed with this Technical Letter are distributed as follows.

   - ASA: 5 copies
   - GACM: 5 copies
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The distribution of the ten, above-mentioned documents, was completed.

__________________________  __________________________
Ing. Jorge Nevárez Jacobo          Date