MITRE

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F500-L17-111

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Subject: Technical Letter: Summary of Work Completed or Ongoing During the Period 1 July 2017 through 30 September 2017

Dear Lic. Patiño:

This letter respectfully submits to your attention a summary of the most significant MITRE project activities conducted or being conducted during the period 1 July 2017 through 30 September 2017.

Reports

At the outset, before proceeding with a full description of activities, please find below a list of the documents included with this Technical Letter, most of which (eight documents) have already been delivered in advance to various Parties throughout the concluding quarter.

1. Cancún Airport Terminal Maneuvering Area Redesign - Procedural Separation, Sectorization, and Human-In-The-Loop Results of June 2017 Cancún Workshop: Summary of Key Activities. See MITRE document F500-L17-084, dated 1 August 2017.

2. Carta Técnica: Planes para la resolución de asuntos pendientes en cuanto al Lado Aire del NAICM en materia concerniente al GACM. See MITRE document F500-L17-085, dated 1 August 2017.

3. MITRE Reports Not Received by GACM. See MITRE document F500-L17-093, dated 9 August 2017.

4. Pending Items Pertaining to MITRE's NAICM Project. See MITRE document F500-L17-094, dated 11 August 2017.

5. Technical letter: Ground-Based Augmentation System and Wide Area Augmentation System Considerations Pertaining to NAICM and Mexico. See MITRE document F500-L17-099, dated 7 September 2017.

6. Technical Letter: Opinion Regarding Options 6.1 and 6.2 for the *Centro de Gestión de Residuos Sólidos en el Bordo Poniente*. See MITRE document F500-L17-098, dated 11 September 2017.

7. Technical Letter: Height of NAICM Aircraft on Approach and Departure Over Lago Nabor Carrillo. See MITRE document F500-L17-101, dated 19 September 2017.

8. Memorándum: Edificación cercana al Lago Nabor Carrillo—Resumen final del análisis aeronáutico. See MITRE Memorandum F500-L17-108, dated 29 September 2017.

9. Response to Comments Sent to GACM by SENEAM. See MITRE document F500-L17-109, dated 3 October 2017.

10. Conclusion of Cancún Work -- Moving On, as Mexico City Shifts Towards New Procedural and Airspace Structure. See MITRE Memorandum F500-L17-110, dated 3 October 2017.

11. Enclosure No. 1 to this Technical Letter (F500-L17-111): Mexico Area Control Center Enroute and New Mexico City and Toluca Terminal Maneuvering Area Airspace Redesign: Opening-Day Traffic Demand Sector Analysis, dated 3 October 2017.

12. Enclosure No. 2 to this Technical Letter (F500-L17-111): First Cancún Human-In-The-Loop Simulation Evaluation: Results, dated 3 October 2017.

13. Enclosure No. 3 to this Technical Letter (F500-L17-111): Cancún Terminal Maneuvering Area - Airspace Redesign - Informal Working Notes: Routes and Sectorization, dated 3 October 2017.

The thirteen above-mentioned documents, whether letters, memorandums, or reports (designated as Enclosures) should be read and analyzed in detail.

The Enclosures are described in a very summary manner below:

- **Enclosure 1: Mexico Area Control Center Enroute and New Mexico City and Toluca Terminal Maneuvering Area Airspace Redesign: Opening-Day Traffic Demand Sector Analysis.** This document describes the preliminary results (final by MITRE; preliminary only in the sense that SENEAM needs to review this document) of the analyses that were conducted by MITRE for the new Mexico City Terminal Maneuvering Area (TMA) and the new Mexico Area Control Center (ACC) enroute airspace considering forecasted opening-day traffic demand levels (officially 2020) for the Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM). Forecasted traffic demand levels for other airports associated with the new Mexico City TMA and new Mexico ACC at the time NAICM opens, including overflights, were also considered. The forecasted traffic demand levels

were provided by Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM).

- **Enclosure 2: First Cancún Human-In-The-Loop Simulation Evaluation: Results.** This document describes the results of the first Human-In-The-Loop (HITL) simulation evaluation for Cancún that was conducted at MITRE's Air Traffic Management (ATM) Laboratory from 27 February 2017 through 3 March 2017.

- **Enclosure 3: Cancún Terminal Maneuvering Area - Airspace Redesign - Informal Working Notes: Routes and Sectorization.** This document provides a record of the most up-to-date information on the airspace design, procedural separation, and sectorization to support dual independent test-bed operations at Cancún. Information pertaining to routes for Cozumel Airport is also included. The document contains information as of the second, and final, HITL simulation evaluation that was conducted at MITRE's ATM Laboratory from 28 August 2017 through 1 September 2017.

Activities

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

- On 4 July 2017, Dr. Bernardo Lisker sent a memorandum to the Director General of the Comisión Nacional del Agua (CONAGUA), Mtro. Roberto Ramírez, as well as the Subdirector General Técnico, Dr. Víctor Hugo Alcocer, and Subdirector General de Administración del Agua, Lic. Alejandro Pérez Carreón, inviting them to visit MITRE's facilities in McLean, Virginia. The reason for inviting the officials was to familiarize them with MITRE's work on NAICM and to discuss important hydraulic issues pertaining to birds at Lago Nabor Carrillo (and smaller water bodies), as well as the proposed *Centro de Gestión de Residuos Sólidos en el Bordo Poniente,* and their potential ramifications on NAICM-related aeronautical matters.

  In the end, you, along with four officials from CONAGUA visited MITRE on 21 July 2017 for a full day of presentations, demonstrations, and discussions (described in more detail below). The delegation included:

  - Lic. Federico Patiño, Director General, GACM
  - Mtro. Roberto Ramírez, Director General, CONAGUA
  - Dr. Víctor Hugo Alcocer, Subdirector Técnico
  - Ing. José Muñiz, Subdirector General de Agua Potable, Drenaje y Saneamiento

- Ing. Alfonso Camarena, Coordinador de Asesores

The primary objective of the visit was to familiarize the officials from CONAGUA with MITRE and its work, and to discuss the following topics:

- The proposed development of the *Centro de Gestión de Residuos Sólidos en el Bordo Poniente*
- Bird-related concerns regarding NAICM, as well as water regulation matters managed by CONAGUA

To support the visit, the MITRE team presented briefings on its aeronautical work for NAICM, as well as its assessment of *Centro de Gestión de Residuos Sólidos en el Bordo Poniente* and bird hazards in the Texcoco area. Finally, a tour of MITRE's ATM Laboratory, including flight demonstrations, was provided.

The visit was very useful, especially regarding the important matter of Lago Nabor Carrillo and the need to conduct bird mitigation experimentation to minimize hazards to aircraft operations at NAICM. As a result, follow-on discussions and actions, which are described below, were initiated.

- On 24 July 2017, three copies of MITRE's previously-submitted document that provided an assessment of the *Centro de Gestión de Residuos Sólidos en el Bordo Poniente* and key results, were sent to CTA. Miguel Peláez, Director General of the Dirección General de Aeronáutica Civil (DGAC), for his information. See MITRE document F500-L17-065, dated 8 May 2017.

  It is important to note that the document sent to CTA. Peláez included handwritten changes that were discussed with you and the officials from CONAGUA during the above-mentioned 21 July 2017 visit to MITRE. The changes were required to provide additional clarification. A copy of that document with those handwritten changes was also provided to the officials from CONAGUA at that time.

  The changes to the document were as follows:

  - On page 2, the following sentence was changed (shown in red):

    - Based on the data provided by Aeroméxico, which took into account 40-meter-high smokestacks and other specifications provided to MITRE by consultants to the Ciudad de México (CDMX), MITRE determined that should Option 5 be selected, the airlines and SENEAM need to ensure that takeoff procedures from AICM turning toward Option 5 are to be prevented ~~preventable~~. MITRE does not believe that this is an appropriate solution, as it is nearly unimplementable.

  - On page 3, the following sentence was changed (as shown in red):

- Option 5 is located closest to AICM. In that respect, this option is not preferred by MITRE over Options 4.1 or 4.2. Of the options being considered, it is the next best option to locate the facility. However, as mentioned above, if Option 5 is to be selected, the airlines and SENEAM need to ensure that turning aircraft toward Option 5 are to be prevented ~~is preventable~~. Again, MITRE does not believe that this is an appropriate solution, as it is nearly unimplementable, and likely not a SENEAM responsibility.

- As mentioned in MITRE's previous quarterly Technical Letter, a large team of MITRE engineers conducted an intense two-day workshop in Cancún from 8 through 9 June 2017 to assist SENEAM in the redesign of the Cancún airspace to support dual independent test-bed operations. During this quarter, the MITRE team prepared a document that described the key activities that occurred during the above-mentioned workshop and highlighted important decisions that were made by the SENEAM and MITRE teams. The document was also intended to allow the SENEAM team to review the scenarios that were developed during the workshop in support of the second HITL dry-run simulation evaluations that were later conducted in MITRE's ATM Laboratory from 7 through 11 August 2017 (described in more detail below). That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-084, dated 1 August 2017).

- On 1 August 2017, Dr. Lisker sent to Ing. Ricardo Tapia (copying Ing. Enrique Lavin) a document to serve as a memory aid regarding important points that came out of a telephone conversation between Dr. Lisker and Ing. Tapia on 28 July 2017. The document focused on key items pertaining to bird-related concerns and NAICM. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-085, dated 1 August 2017).

- As requested by Ing. Tapia, MITRE provided two copies of the documents shown below to GACM that were developed and submitted by MITRE to Aeropuertos y Servicios Auxiliares (ASA) and/or other project stakeholders that, in accordance to a list that Ing. Tapia sent MITRE, GACM had never received when the contract was assigned to GACM.

  - MITRE Letter F500-L14-003, dated 7 November 2013, along with an enclosure, entitled *Specifications for Automated Weather Observing Systems (for three potential airport sites in the State of Hidalgo)*

  - MITRE Letter F500-L14-006, dated 10 December 2013, along with an enclosure, entitled *Alternative Runway Configurations for the Nuevo Aeropuerto Internacional de la Ciudad de México*

  - MITRE Letter F500-L14-023, dated 7 April 2014, along with an enclosure entitled, *Exploratory Analysis of Potential New Airport Sites in Hidalgo - Status Report*

The transmittal letter that accompanied the above-mentioned documents is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-093, dated 9 August 2017). The missing documents have already been received by Ing. Tapia and, therefore, are not being resent with this Technical Letter.

- Dr. Lisker visited Mexico City from 14 through 16 August 2017 to conduct several high-level executive meetings to discuss important matters pertaining to the NAICM project. Specifically, Dr. Lisker met separately with Lic. Yuriria Mascott, Undersecretary of Transportation, you, and other GACM officials. Also, Dr. Lisker met officials from CONAGUA at the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). Key items such as bird-related concerns and NAICM, including the need for bird mitigation experimentation, as well as important pending items pertaining to MITRE's NAICM project were discussed.

  Note that prior to the above-mentioned visit, in order to assist GACM and, in general, other aviation authorities and stakeholders that report to the Secretaría de Comunicaciones y Transportes (SCT) on the NAICM project, the MITRE team spent a significant amount of time preparing a document that provides a list of key pending items that should be addressed. That document was hand-delivered and presented to officials by Dr. Lisker during his above-mentioned visit to Mexico City. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-094, dated 11 August 2017).

  MITRE requests that GACM investigate the status of the pending items listed in the above-mentioned document with relevant Mexican aviation authorities and provide MITRE with feedback and an update on their status no later than Friday 27 October 2017.

- At the request of Lic. Masscott, MITRE compiled for her an extensive sampling of relevant documents and correspondence pertaining to bird hazard and mitigation concerns near NAICM that MITRE has provided to different entities in Mexico since 2010. This information was provided to Lic. Mascott during the above-mentioned mid-August 2017 visit to Mexico City by Dr. Lisker. Due to the sensitivity of this information and the fact that GACM should have this documentation, the documents and correspondence were not delivered elsewhere.

- As you know, during a visit by MITRE to GACM's facilities earlier in the year, Lic. Mario Ruiz requested MITRE's opinion regarding NAICM system integration project management concepts/structures. Although system integration is outside of MITRE's scope of work and not within MITRE's area of expertise, Dr. Lisker agreed to investigate the matter.

  In early March 2017, Dr. Lisker and I had the opportunity to meet with officials from Spain who were involved with system integration matters at Madrid Barajas International Airport. The information provided by the officials from Spain was

very relevant and useful. Thus, the information that MITRE obtained was discussed with GACM during the above-mentioned mid-August visit by Dr. Lisker to Mexico City.

- As requested by Ing. Tapia, MITRE prepared a document on advantages and disadvantages of a Ground-Based Augmentation System (GBAS) in Mexico, principally for NAICM. Information on the application of a Wide Area Augmentation System (WAAS), which is associated with actual implementation of a Satellite-Based Augmentation System (SBAS) in Mexico, was also included. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-099, dated 7 September 2017).

- MITRE was recently informed by the DGAC that all the previously proposed locations for the *Centro de Gestión de Residuos Sólidos en el Bordo Poniente* have been discarded. Afterwards, CONAGUA informed MITRE that a new location ("Option 6.2") is being considered and that CONAGUA would like MITRE to express its aeronautical opinion on the appropriateness of those locations.

  Therefore, MITRE prepared a technical letter that provided MITRE's overall opinion on the appropriateness of locating the facility at Option 6.2 (and Option 6.1, since then also discarded), from an aeronautical perspective. This document was provided to SCT, CONAGUA and DGAC, and is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-098, dated 11 September 2017).

  It is important to note that MITRE has not conducted a new full assessment because the facility at Option 6.1 and Option 6.2 would be located very close to and overlapping Option 4.2, which was previously assessed by MITRE. Therefore, MITRE's opinion on Option 6.1 and Option 6.2 is based on the results of its previously conducted assessment of Option 4.2.

  Important: the latest information provided to MITRE by CONAGUA indicates that the elevation of the ground at Option 4.2 is about 9 m higher than what MITRE was provided by CDMX at the time of previously conducted assessments. This raised some concerns as ground elevation is an important factor in MITRE's analysis. Furthermore, MITRE was informed by CONAGUA that the smokestacks would be 45-m high and, to make matters worse, other parts of the facility would be even higher, at 50 m. (Note that MITRE was previously informed that the highest structure at the facility would be the smokestacks, at 40-m high.)

  As a result, authorities asked MITRE to provide its opinion, based on its previously conducted aeronautical assessments, on what should be the maximum elevation of the facility located at Option 6.2. **Therefore, the MITRE team examined its previous results. The maximum elevation of any structure at the facility (smokestacks, towers, buildings, etc.) should not exceed 2275 m above Mean Sea Level.**

A summary of MITRE's opinion, including other important recommendations and considerations, was provided to SCT, CONAGUA and DGAC through a memorandum. This memorandum is being sent along with this Technical Letter as a reference (see MITRE memorandum F500-L17-108, dated 29 September 2017). All of the work concerning this matter, is not out of scope but has taken excessive time.

- At the request of Dr. Alcocer, the MITRE team prepared a document that provided information on the height of aircraft as they pass over Lago Nabor Carrillo while approaching and departing to/from NAICM. As MITRE understands it, this information could be useful to CONAGUA in determining the overall benefits of reducing the width of Lago Nabor Carrillo (from its northern edge) to potentially help mitigate bird hazard risks to aircraft operations at NAICM by removing water away from the airport's operational areas. This is also out of scope work. That document is being sent along with this Technical Letter as a reference (see MITRE document F500-L17-101, dated 19 September 2017).

  Results show that reducing the size of Lago Nabor Carrillo by displacing the northern edge of the lake to the south would increase the height of aircraft above the lake. However, it is not clear how much of a reduction in bird hazard risk this would provide. Therefore, this matter should be discussed further with appropriate experts.

  Nevertheless, reducing the size of Lago Nabor Carrillo would likely help in implementing appropriate and practical mitigation measures (e.g., nets or use of other barriers or bird nuisance techniques) to reduce the number of birds at the lake for reasons other than aircraft above ground level height. This is an important factor that should be considered by authorities and bird mitigation experts when determining how best to reduce the number of birds at Lago Nabor Carrillo to minimize risks to aircraft operations at NAICM.

- On 28 July 2017, Ing. Tapia sent to MITRE via e-mail a document that SENEAM sent to GACM (see SENEAM document 4.5.105.-453/17, dated 24 July 2017) that provides comments regarding MITRE's 1 July 2017 deliverables. MITRE then prepared a letter to Ing. Tapia responding to SENEAM's comments, where appropriate. See MITRE document F500-L17-109, dated 3 October 2017.

- During this quarter, the MITRE team spent a significant amount of time preparing a document describing its analysis of the proposed routes and sectors being considered for both the new Mexico City TMA and new Mexico ACC enroute airspace to support opening-day operations at NAICM. Traffic at other airports within the new Mexico City TMA and new Mexico ACC, as appropriate, was considered as well. Forecasted traffic demand information was provided by SENEAM. Refer to Enclosure 1 of this Technical Letter for details.

  Using sophisticated analytical tools and domain expertise, MITRE assessed the impact that increased traffic demand levels forecasted for opening-day at NAICM

could have on the new Mexico City TMA and new Mexico ACC sectors. Sectors for the new Toluca TMA were considered as well. As the new Mexico ACC, new Mexico City TMA, and new Toluca TMA airspace designs advance, the results of MITRE's above-mentioned analyses will provide airspace designers with insight into the workload that could be expected with the new procedures, routes, and sectorizations. This information is useful to help ensure that the airspace will operate as efficiently as possible, and to assist SENEAM in making informed decisions regarding short-term TMA and ACC airspace modifications to overcome potential issues in accommodating increased traffic levels at the time NAICM opens.

- Following a one-week dry-run with SENEAM air traffic controllers, the first full-fledge HITL simulation evaluation for Cancún was conducted at MITRE's ATM Laboratory from 27 February 2017 through 3 March 2017. During that first HITL simulation evaluation, Cancún Approach Control controllers were asked to handle simulated traffic in specific operational scenarios using instrument procedures and sectors associated with the Cancún airspace design to support dual independent test-bed operations. The objective of the first HITL simulation evaluation was to identify any potential issues associated with the proposed airspace design and to assist in the resolution of any issues discovered.

  The above-mentioned first HITL simulation evaluated the airspace design by collecting and analyzing information from simulation system data (e.g., aircraft state, user inputs), observations, questionnaires, and discussions with the Cancún Approach Control controllers. The MITRE team then reviewed and examined the information and, during this quarter, prepared a detailed document that presents the results of the first HITL simulation evaluation in the form of subjective and objective metrics. Refer to Enclosure 2 of this Technical Letter for details.

- During this quarter, the MITRE HITL simulation evaluation team completed significant preparation efforts to support the second Cancún HITL simulation evaluation dry-runs, which were conducted at MITRE's facilities from 7 through 11 August 2017 (described in more detail below). The HITL simulation evaluations are essential to support the implementation of dual independent test-bed operations at Cancún. For example, this HITL simulation evaluation dry-run preparatory tasks helped in the:

  - Development of the evaluation traffic scenarios, including the incorporation and programming of aircraft on the appropriate routes

  - Finalization of human factors questionnaires

  - Preparation of airspace and route reference packets, which were to be used as visual aids by the controllers during the dry-runs at MITRE

- Development of several presentations to provide an overview of the overall dry-run process, traffic scenarios, as well as human factors questionnaires and surveys

- Five air traffic controllers, including CTA. Augusto Gómez, from the SENEAM Cancún dual independent test-bed operation design team, visited MITRE's facilities in McLean, Virginia from 7 through 11 August 2017. The reason for their visit was to participate in the second HITL simulation evaluation dry-runs at MITRE's ATM Laboratory.

  A dry-run is an essential step to ensure that all elements are appropriately prepared and ready for the actual second, and final, HITL simulation evaluation, which actually did occur from 28 August 2017 through 1 September 2017 (described in more detail below) at MITRE's ATM Laboratory. The objectives of the second HITL simulation evaluation dry-runs were as follows:

  - Verify and validate simulation hardware/software components (e.g., displays, keyboards, communication equipment, video maps, etc.), data collection mechanisms, traffic files (e.g., demand levels, aircraft performance, etc.) and scenarios

  - Review airspace and route designs during scenarios to ensure consensus on designs, and identify any adjustments that need to be made or considered

  - Review appropriateness of airspace design reference packets

  - Ensure that questionnaires and surveys are clear and understandable

  During the second HITL simulation evaluation dry-runs, the MITRE and SENEAM teams reviewed the HITL scenarios, the Air Traffic Control (ATC) sectorization, and airspace design resulting from the previous SENEAM/MITRE airspace design workshop held in Cancún from 8 through 9 June 2017, as well as subsequent discussions. This allowed the SENEAM and MITRE teams to identify and discuss any changes that needed to be made prior to the actual second HITL simulation evaluations.

- Five air traffic controllers from SENEAM visited MITRE's facilities in McLean, Virginia from 28 August 2017 through 1 September 2017. The reason for their visit was to participate in the actual second, and final, HITL simulation evaluations at MITRE's ATM Laboratory.

  The five air traffic controllers included CTA. Gómez, and four other controllers from Cancún. Three of the four controllers from Cancún had not been involved in the airspace redesign project. It was necessary to include controllers who had not been involved in the airspace redesign work so that unbiased opinions and feedback regarding the appropriateness of the design could be obtained.

The objectives of the second HITL simulation evaluations were as follows:

- Evaluate the routes, procedures, altitude restrictions and sectorization associated with the new airspace design
- Identify issues and discuss potential modifications to the airspace design to resolve those issues
- Collect objective and subjective metrics data from participants for further review and analysis
- Hold detailed discussions following each scenario evaluation to obtain valuable feedback

The second HITL simulation evaluations were very successful and all objectives were met. Overall, the Cancún controllers were pleased and satisfied with the airspace design. **As a result, MITRE's Cancún-related HITL simulation evaluation contractual obligations have been satisfied (including the provision, of out of scope, of equipage and thousands of hours of personnel).**

Per contract, SENEAM was to acquire specialized equipment and support most of the HITL effort. In a spirit of collaboration, MITRE provided equipment and support for the Cancún HITL simulation evaluations at no extra cost to Mexico. **All what MITRE requests in exchange, is formal acknowledgment by GACM of this effort by MITRE.**

- Following the above-mentioned second HITL simulation evaluations, the MITRE team spent a significant amount of time preparing a 216-page document that provides a reflection of the most up-to-date Cancún airspace design-related working notes discussed between SENEAM and MITRE. The document is intended to provide the route definition, procedural separation, and sectorization information as of the second HITL simulation evaluation to SENEAM for its use. Refer to Enclosure 3 of this Technical Letter for details.

- As a result of all of the above-mentioned Cancún-related work, apart from a report to be issued on the second HITL, **MITRE's contractual obligations concerning its assistance to SENEAM on the planned implementation of dual independent test-bed operations at Cancún have been completed.** MITRE, however, remains available for consultation and any presentations required by the authorities. Additionally, MITRE would be available during the testing phase after appropriate equipment is installed.

- As mentioned in the previous bullet, MITRE's part in the Cancún-related work has now been completed. Therefore, MITRE prepared a memorandum that provides a high-level summary of considerations and lessons-learned that can benefit upcoming collaborative efforts pertaining to NAICM. See MITRE memorandum F500-L17-110, dated 3 October 2017.

- Two MITRE engineers visited *Centro Mexico* on 7 September 2017 to observe operations and conduct discussions with controllers in preparation for upcoming NAICM-related HITL simulation evaluations. The goal of the visit was for MITRE's HITL laboratory and simulation experts to obtain a better understanding of ATC equipment and system functionality in use at *Centro Mexico* to support upcoming NAICM HITL simulations planned for 2018. CTA. Héctor Miranda of SENEAM accompanied the MITRE engineers and assisted in coordinating matters on-site.

  The MITRE engineers spent several hours observing operations, which allowed the team to obtain a better understanding of ATC system functions that are typically used, as well as working position configurations and settings, peripheral hardware in use, common tasks, and communications and coordination matters.

  The visit was very successful and productive. The MITRE HITL team is now reviewing the information that it gathered.

- In Mexico, Minimum Vectoring Altitude Chart (MVAC) sector altitudes must consider radio and radar coverage. As radio and radar coverage matters are not within MITRE's area of expertise, MITRE has been coordinating with SENEAM to ascertain where coverage, both radio and radar, does or does not exist so that MVAC sector altitudes can be adjusted appropriately. This is important as changes to MVAC sector altitudes can affect the overall airspace design for the new Mexico City TMA to support operations at NAICM and Toluca, as well as other matters (e.g., surveillance requirements).

  During this quarter, MITRE received from SENEAM several files related to radio coverage matters for the Mexico City TMA and Toluca TMA areas. The MITRE team reviewed the radio coverage information. Specifically, MITRE compared the radio coverage information with the proposed MVACs for both NAICM and Toluca and evaluated each minimum vectoring altitude sector to determine if radio coverage was provided at the proposed minimum vectoring altitudes.

  MITRE noted some sectors where radio coverage was not adequate. This information was conveyed to SENEAM for their information. MITRE is currently in the process of coordinating a teleconference with SENEAM to discuss this matter in more detail.

  Regarding radar coverage matters, as mentioned in MITRE's previous quarterly Technical Letter, SENEAM has requested assistance from a radar manufacturer to provide appropriate radar coverage information. However, MITRE has not received any radar coverage information yet. MITRE requires appropriate radar coverage information as soon as possible to determine if operational issues exist and to avoid delays in the overall airspace design process. MITRE is discussing this matter with SENEAM and has requested an update on when the radar coverage information will be provided.

- MITRE's ATM Laboratory engineers have been advancing on the development of the Out-the-Window (OTW) computerized visualization and simulation model of Toluca Airport and its contiguous area. For example, high-resolution imagery obtained from the Toluca satellite-based photogrammetric survey that was procured by MITRE was loaded into the model platform and appropriately geo-referenced. Next, the satellite imagery was combined with digital terrain data to produce a realistic environment of the airport and its surroundings.

- Other important items to mention due to their urgency, some of which were also discussed in MITRE's previous Technical Letter, are described below. Note that some of these items are also discussed in MITRE's previously-mentioned pending items document (refer to MITRE document F500-L17-094, dated 11 August 2017). MITRE requests that GACM investigate the status of these items with the relevant Mexican aviation authorities and provide MITRE with feedback and an update on their status.

  - Acquisition of a Category (CAT) III Instrument Landing System (ILS) for Testing Purposes at NAICM

    - It is critical that GACM ensure that CAT III ILS equipment meeting all appropriate recommendations be acquired as soon as possible. This is important so that pre-commissioning flight validation and inspection activities can be conducted prior to runway construction, something that MITRE has requested for several years. MITRE notes with great concern that preparatory runway construction work is already underway.

      Also, it is important that consideration be given (based on recommendations by the ILS manufacturer) for the need to relocate the CAT III ILS testing equipment to inspect all six initial runway thresholds, as necessary, based on recommendations by experts, to ensure that ILS system signal coverage on all six runway thresholds can be achieved.

      Please keep MITRE informed of the situation regarding the acquisition of the CAT III ILS systems for NAICM.

  - NAICM Runway Visual Range (RVR) and Automated Weather Observing System (AWOS)

    - Both the RVR and AWOS systems experienced operational problems/issues resulting in significant loss of data, which is concerning. Due to the above-mentioned data loss issues and concerns, MITRE proposes to conduct another analysis of RVR data in the spring of 2018, so that more robust results can be provided to further assist authorities in their decision-making process. However, it is first essential that the RVR and AWOS

systems operate in a reliable, accurate, and consistent manner that does not require any data adjustments or manipulations by SENEAM.

On that matter, MITRE has been informed that the RVR and AWOS systems will be relocated inside the NAICM perimeter fence for security reasons. It is important that the systems are relocated as soon as possible. Additionally, once the systems have been relocated they should be appropriately tested and calibrated to ensure that accurate data are being recorded. The clocks of both the RVR and AWOS systems should also be synchronized. Furthermore, a reliable process should be put in place (in coordination with SENEAM) so that both the RVR and AWOS systems are constantly watched and data are sent to MITRE consistently each month for examination.

It has now become urgent that all of the above be completed as soon as possible, before the winter weather period begins. (Note that MITRE previously requested that this be completed by 1 August 2017 and most recently by 1 October 2017.)

Please keep MITRE informed of the situation regarding the relocation of the NAICM RVR and AWOS systems.

- Airport Expansion Feasibility Analysis and Transfer of Technology

  - Under Task 8 of the GACM-MITRE contract, MITRE is to assist the Mexican aviation authorities in the examination of problems relating to airport expandability in Mexico, so that, in the process, Mexican engineers and other analysts practice and learn how to reexamine future modifications concerning NAICM airside and aeronautical matters (i.e., achieving in the process transfer of technology). As mentioned in MITRE's previous quarterly technical letter, the aviation authorities of Mexico have selected Guadalajara Airport for MITRE to examine.

    Last quarter, MITRE submitted a document to GACM requesting initial data on Guadalajara Airport that are needed for MITRE to perform many of the early project tasks (refer to Enclosure 4 referenced to MITRE Technical Letter F500-L17-070, dated 28 June 2017).

    MITRE requested that the data be provided by 31 July 2017, three months ago. However, to date, MITRE has not received any data. **This task is now delayed as the data are required for MITRE to advance on its work, including the procurement of a satellite-based photogrammetric survey**. To avoid further project delays,

GACM needs to gather and obtain the data requested by MITRE as soon as possible.

- Aeronautical Information Publication (AIP) of Mexico
  - MITRE has been requesting for a long while that GACM provide to MITRE a totally new and complete AIP, as well as a subscription to receive regular amendments (either directly or through GACM) for as long a period of time as possible (but at least one year). It is important that MITRE receive the new AIP and subscription as soon as possible. This is essential to ensure that MITRE is using the latest and most up-to-date aeronautical information for Mexico.
- Bird Mitigation Experimentation
  - Significant bird mitigation experimentation is required south of the Autopista Peñón-Texcoco, especially at Lago Nabor Carrillo. This is because, despite the fact that MITRE separated runways from water bodies by at least a 3-km distance, the bird population in the area needs to be reduced sharply.

    MITRE is not an expert in bird hazard and/or mitigation matters. However, as previously mentioned, MITRE has been in discussions with GACM, CONAGUA and others regarding mitigation experimentation plans and ideas to deal with the bird hazard concern. For example, these ideas include, among others, lowering the water level at Lago Nabor Carrillo and improving the habitats at Lago de Zumpago and other areas.

    It is essential that the ideas and actions being proposed by authorities and experts, be implemented as soon as possible, well before mid-October, when the bird population begins to increase. This is urgent so that monthly bird censuses can be conducted to support follow-on studies to determine the impact that the above-mentioned mitigation measures have on bird hazard risks.

    It is also important to mention that MITRE is planning to contract the services of Dr. Richard Dolbeer, a world-renowned wildlife hazard management expert who has in-depth hands-on knowledge of the bird hazard risks at NAICM, to provide assistance and consultation on certain aspects of this matter as well as census experts. However, to do so will require an amendment to MITRE's contract.

- In early 2015, ASA issued a stop-work order to MITRE's work concerning a second runway for Toluca Airport (on the basis that this is a long-run target), despite the fact that the approved contract's plan and budget included a second parallel runway. MITRE immediately expressed in many ways that this was an error because in designing NAICM's airspace, Toluca Airport operations need to be considered.

  During the 20 November 2015 visit to MITRE by Lic. Mascott and other officials, the topic of the second parallel runway at Toluca Airport was discussed. MITRE expressed its opinion that Toluca Airport should be planned and protected for long-term growth along with NAICM's growth. As a result, the officials present at the meeting, including Lic. Mascott, Ing. Roberto Kobeh, Director General of SENEAM, and Lic. Alfonso Sarabia, Director General of ASA, agreed that a second parallel runway at Toluca should be considered, as originally planned. However, MITRE never received ASA's revocation of the stop-work order despite repeated requests over a one-year time period.

  The entire Toluca Airport work is now delayed (both runways need to be analyzed simultaneously) and this is already starting to impact other NAICM-related airspace and procedure design work. Furthermore, part of the MITRE Toluca Airport team has been reassigned to work on other tasks. See the Contractual Matters section below.

- Contractual Matters

  - **Toluca-Related Work** – As mentioned above, MITRE requires formal authorization to re-instate consideration of a second parallel runway at Toluca Airport. This formal notification is now urgent to avoid further work delay in <u>both</u> the Toluca Airport work and part of the NAICM airspace design. Additionally, at that time, MITRE is going to require feedback from appropriate authorities on the preferred location of a second parallel runway for Toluca Airport. Note that runway spacing standards keep changing.

  - **Hidalgo-Related Work** – ASA issued a stop-work order on all of MITRE's work in the state of Hidalgo, based on the Fuerza Aérea Mexicana's (FAM's) preference to relocate Santa Lucía Air Base's fixed-wing non-transport aircraft operations to Querétaro Airport.

    MITRE informed ASA that FAM's operations at Querétaro Airport, along with the establishment of Special-Use Airspace (SUA) to support those operations, must be thoroughly examined to ensure that the airport is feasible and, more importantly, that FAM's operations do not interfere with future operations at NAICM. Such investigation must be conducted in close coordination with FAM and SENEAM officials.

Since this work is not contained in MITRE's current contract, a modification of the contract will be required, possibly exchanging the Hidalgo work, never completed, for the new work for Querétaro, without requiring additional compensation. Before that happens, it is essential that MITRE meet with officials from FAM to discuss the specific work to be conducted for Querétaro Airport once the NAICM airspace and procedure design reaches an appropriate stage.

CTA. Peláez, per instructions by Lic. Mascott, is currently coordinating a visit by officials from FAM to MITRE. MITRE has recently provided CTA. Peláez with available dates.

- **Bird Mitigation Consultation** – As mentioned above, MITRE plans to contract the services of Dr. Dolbeer to provide assistance on certain aspects of the bird hazard and mitigation experimentation matter. Since this work is not contained in MITRE's current scope of work, a modification of the contract will be required.

- **Other Items** – Other contractual items, such as support regarding NAICM HITL simulation evaluations for NAICM and other tasks require contractual modifications as well. MITRE proposes to discuss these modifications with GACM in the October 2017 timeframe.

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

Sincerely,

Ing. Robert W. Kleinhans
Project Technical Coordinator

Included with this letter:
Thirteen documents (including three Enclosures)

cc: Ing. Enrique Lavin, GACM
Dr. Bernardo Lisker, MITRE

This three-page return receipt (*acuse de recibo*) is to be scanned and e-mailed to Ing. R. Kleinhans as soon as possible

1 October 2017 TECHNICAL LETTER DISTRIBUTION

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

1. Cancún Airport Terminal Maneuvering Area Redesign - Procedural Separation, Sectorization, and Human-In-The-Loop Results of June 2017 Cancún Workshop: Summary of Key Activities. See MITRE document F500-L17-084, dated 1 August 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

2. Carta Técnica: Planes para la resolución de asuntos pendientes en cuanto al Lado Aire del NAICM en materia concerniente al GACM. See MITRE document F500-L17-085, dated 1 August 2017.

    - GACM: 5 copies

3. MITRE Reports Not Received by GACM. See MITRE document F500-L17-093, dated 9 August 2017 (only cover letter).

    - GACM: 5 copies

4. Pending Items Pertaining to MITRE's NAICM Project. See MITRE document F500-L17-094, dated 11 August 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

5. Technical letter: Ground-Based Augmentation System and Wide Area Augmentation System Considerations Pertaining to NAICM and Mexico. See MITRE document F500-L17-099, dated 7 September 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

6. Technical Letter: Opinion Regarding Options 6.1 and 6.2 for the *Centro de Gestión de Residuos Sólidos en el Bordo Poniente*. See MITRE document F500-L17-098, dated 11 September 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

7. Technical Letter: Height of NAICM Aircraft on Approach and Departure Over Lago Nabor Carrillo. See MITRE document F500-L17-101, dated 19 September 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

8. Memorándum: Edificación cercana al Lago Nabor Carrillo—Resumen final del análisis aeronáutico. See MITRE memorandum F500-L17-108, dated 29 September 2017

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

9. Response to Comments Sent to GACM by SENEAM. See MITRE document F500-L17-109, dated 3 October 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies

10. Conclusion of Cancún Work -- Moving On, as Mexico City Shifts Towards New Procedural and Airspace Structure. See MITRE memorandum F500-L17-110, dated 3 October 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies

11. Enclosure No. 1 to this Technical Letter (F500-L17-111): Mexico Area Control Center Enroute and New Mexico City and Toluca Terminal Maneuvering Area Airspace Redesign: Opening-Day Traffic Demand Sector Analysis, dated 3 October 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

12. Enclosure No. 2 to this Technical Letter (F500-L17-111): First Cancún Human-In-The-Loop Simulation Evaluation: Results, dated 3 October 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

13. Enclosure No. 3 to this Technical Letter (F500-L17-111): Cancún Terminal Maneuvering Area - Airspace Redesign - Informal Working Notes: Routes and Sectorization, dated 3 October 2017.

    - GACM: 5 copies
    - SENEAM: 5 copies
    - DGAC: 5 copies

The distribution of the thirteen, above-mentioned documents, was completed.

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Signature of GACM Point of Contact for MITRE Date

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Name of GACM Point of Contact for MITRE