



MEMORANDUM

To: Lic. Federico Patiño,
Director General,
Grupo Aeroportuario de la Ciudad de México (GACM)

Date: 3 October 2017

Document: F500-L17-110

Subject: **Conclusion of Cancún Work -- Moving On, as Mexico City Shifts Towards New Procedural and Airspace Structure**

As you know, MITRE has been assisting the Secretaría de Comunicaciones y Transportes (SCT) in multiple areas, with recent special emphasis in supporting Servicios a la Navegación en el Espacio Aéreo Mexicano (SENEAM) in the design of the Cancún Terminal Maneuvering (Control) Area (TMA) airspace to support dual independent test-bed operations. The eventual implementation of dual independent operations at Cancún will allow Mexican air traffic controllers to obtain an understanding of the issues associated with independent operations, and gain valuable experience for the future implementation of such procedures at Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM). Moreover, it will provide an important increase in runway capacity at Cancún.

Background

MITRE's part in the Cancún-related work has now been completed. Therefore, this is a good time to take stock of the past with a view towards the future, and provide a high-level summary of considerations that can benefit upcoming collaborative efforts pertaining to NAICM. Lessons-learned should be taken into consideration, as upcoming collaborative processes and practices can be improved upon with the goal of allowing efforts to advance in an effective and efficient manner.

MITRE, fundamentally a research center, assists Air Navigation Service Providers (ANSPs), such as SENEAM, and Civil Aviation Administrations (CAAs), such as Mexico's Dirección General de Aeronáutica Civil (DGAC), throughout the world, in solving a broad range of complex airport- and Air Traffic Control (ATC)-related problems, especially when such problems MITRE engages upon are not routine or trivial issues. For example, as is the case in Mexico, MITRE has been providing support through the development of conventional and advanced instrument approach and departure

procedures, initial airspace designs to support dual- and triple-independent operations (originally developed in the U.S. through MITRE's assistance), and the identification of key requirements, rules, and considerations needed to conduct those types of complex operations.

This assistance is provided through the know-how, opinion, and feedback of many MITRE experts who have years of experience not only in managing airspace at some of the busiest airports in the world, but also designing creative procedures alongside engineers with very diverse backgrounds, who utilize sophisticated models and other tools.

MITRE's systems engineering assistance and transfer of knowledge is sought by international entities because of MITRE's independent, unbiased, neutral, non-competitive, and non-commercial advice. For example, as SENEAM knows, MITRE avoids recommending specific equipage brands and does not engage in excessive specification work too close to tender processes and fielding of equipment. While MITRE sometimes provides advice beyond its norms, its contract in Mexico specifically states that recommendations close to field work are out of scope.

The instrument procedure and airspace design work being conducted by MITRE for the Mexican aviation authorities, while robust and at an appropriate level to demonstrate technical and operational feasibility, should always be considered preliminary, as it is not intended to be implemented and/or published "as is". Before proceeding with implementation-related matters, all of MITRE's aeronautical work need to be reviewed, as necessary by appropriate authorities to ensure that such critical work is correctly evaluated before it is finally approved.

Cancún Dual Independent Test-Bed Operations

MITRE has worked closely with SENEAM over the past few years on important matters regarding the transition to independent operations in Mexico, including the implementation of dual independent test-bed operations at Cancún. For example, MITRE has provided information on the principal requirements for surveillance, display, and communications for conducting dual independent operations, as well as important airspace and ATC elements to be considered in preparing Cancún for conducting these complex operations.

MITRE has provided assistance regarding key elements for consideration during Cancún's airspace redesign work. This has included MITRE-developed airspace concepts, intended to facilitate SENEAM's airspace redesign process, as well as conventional Instrument Landing System (ILS) approach and conventional departure procedures that have been provided by MITRE. Furthermore, numerous workshops were conducted to assist SENEAM in the development of a preliminary airspace design to support dual independent test-bed operations at Cancún, including consideration of operations at nearby Cozumel.

In late 2016, the Cancún airspace design reached an appropriate and robust level that allowed for the next stage of the Cancún project, whose goal was the evaluation of the conceptual airspace design through Human-In-The-Loop (HITL) simulation work.

HITL simulation activities, which required a major MITRE effort, including internal testing and use of MITRE's Air Traffic Management (ATM) Laboratory, are contractually out of scope activities. Nevertheless, in a spirit of collaboration, and due to its importance to the overall project, MITRE provided equipment and significant support for the Cancún HITL simulation evaluations at no extra cost. In 2017, SENEAM controllers visited MITRE's ATM Laboratory for one full week on four separate occasions to conduct intense HITL simulation evaluation activities. Additionally, to prepare for those activities, MITRE utilized a very large amount of staff time. The final HITL simulation activity was conducted from 28 August 2017 through 1 September 2017 and a formal report on the results of this final HITL simulation evaluation is going to be issued.

As a result of the above, MITRE's Cancún-related HITL simulation evaluation contractual obligations have been satisfied, **representing the end of MITRE's contractual obligations in Cancún. Naturally, MITRE 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.**

MITRE would like to take this opportunity to celebrate with SENEAM on achieving such an important milestone at Cancún. The redesign of an airspace to support dual independent operations is a complicated task and requires a solid team with strong leadership to be successful. In MITRE's opinion, the SENEAM and MITRE teams were able to accomplish this objective due to the creation of an excellent and professional working relationship, which allowed the airspace design to be developed in a collaborative manner taking into consideration the feedback and opinions of key participants. This complicated endeavor could have not been successfully completed without the leadership of CTA. Augusto Gómez, who closely coordinated work activities with MITRE and the SENEAM teams in Mexico City and Cancún. Moreover, MITRE would like to thank CTA. Martín García for his support and oversight throughout the project. Finally, MITRE would like to thank the excellent controller teams from Cancún and Mérida for their participation in the overall effort. Their local airspace knowledge and outstanding controller skills were essential to the successful redesign of the airspace. The MITRE team looks forward to the implementation of dual independent operations at Cancún.

Important Considerations Regarding Cancún

It is important to reiterate that all of MITRE's procedure and airspace design work is based on United States (U.S.) Federal Aviation Administration (FAA) Standard for Terminal Instrument Procedures (TERPS) and other relevant U.S. criteria. The reason for this is that triple independent procedures are only conducted in the U.S. and have only been assessed and approved by the U.S. FAA. Moreover, the government of Mexico contractually requested MITRE to use tried- and proven-methods for NAICM in order not to take any chances. Consequently, Cancún also used TERPS and other appropriate U.S. criteria due to the fact that Cancún is to serve as a test-bed for eventually conducting independent operations at NAICM, which as mentioned above, are based on U.S. criteria.

MITRE Results Out of Scope or Not Evaluated

In the spirit of independence and collaboration that has characterized the entire SENEAM-MITRE relationship, MITRE has supported the Cancún work, whether in or out of scope. MITRE has double checked and/or evaluated most of the work, whether performed by MITRE itself or by SENEAM. Any work checked by MITRE has been reported in writing through letter enclosures¹. On the contrary, work that is not reported in writing is work that MITRE has not double checked for one reason or another. The latter has seldom occurred. A rare exception of work that was not checked is presented below, for reference.

MITRE was informed by SENEAM during a June 2017 airspace design workshop about plans to implement the Cancún airspace design later this year. Then, MITRE was informed less than two months later, in August 2017, that the implementation needed to take place no later than November 2017 and that SENEAM had to submit routes and procedures to the DGAC that same month (i.e., August), as a HITL evaluation was taking place. It was explained that there were formal agreements made by the authorities with third parties regarding the implementation of Performance-Based Navigation (PBN) routes in Mexico by November 2017. That left no room for additional thorough checking by MITRE. Therefore, some of the final PBN routes and procedures associated with the new airspace design, including new SENEAM-developed ILS approach procedures for Cancún and PBN approach procedures for Cozumel were not reviewed by MITRE at that time.

This news created concern with the MITRE team, including senior designers. This is because numerous SENEAM-proposed changes began occurring during June 2017, following the information received during the workshop mentioned above as well as during the final HITL simulation evaluation in late August 2017, without a thorough check by MITRE. Consequentially, MITRE worked extremely hard during the entire month of September, with people working substantial overtime, to help check many modifications that had been submitted by SENEAM. While this was not done with the care or completeness utilized before, MITRE believes that it has checked things substantially well. The exceptions to that are new Cancún ILS and Cozumel PBN approach procedures developed by SENEAM for regular operations (i.e., not for independent procedures) associated with the November 2017 implementation plan. Fortunately, SENEAM informed MITRE that all procedures were based on U.S. TERPS². Furthermore, SENEAM also informed MITRE that the routes and procedures went through flight inspection processes conducted by the DGAC (conceivably with aircraft equipped to perform inspections both, for conventional and PBN procedures).

MITRE understood the irretrievable need for SENEAM to meet the above-mentioned November 2017 implementation deadline. The lesson-learned being requested at this time is that the much more complex NAICM process goes through a non-rushed design,

¹ MITRE, however, does not check SENEAM-provided data nor performs detailed reviews of SENEAM-provided procedures and obstacle assessments that they are based on. Furthermore, all obstacle information considered by MITRE came from SENEAM as no photogrammetry work for Cancún was acquired.

² It is worth mentioning that TERPS criteria changes from time to time, including recent changes.

review, approval, and implementation progression and that MITRE is informed well ahead of time about situations that may need additional resources.

Once again, the above-mentioned situation was a most rare occurrence during the Cancún work process. It is only referenced due to MITRE's need to assert what has taken place (or not), throughout MITRE's peer review processes.

NAICM Airspace Design

As mentioned above, as SENEAM and MITRE continue to advance on the design of the airspace to accommodate dual- and triple-independent operations at NAICM, it is important that SENEAM and MITRE work closely together using agreed upon guidelines. This is important as the NAICM airspace is significantly more complex than the Cancún airspace. Therefore, MITRE intends to prepare a document for review by SENEAM that describes a protocol for SENEAM and MITRE to discuss and later utilize. This document would describe important guidelines for the SENEAM and MITRE teams to follow to avoid issues and complications as work progresses.

One important aspect of that protocol would be that all of NAICM-Toluca routes and procedures should be designed in a "paired-like" manner. The Global Procedure Designer (GPD) software tool, to be acquired by SENEAM before the current version expires (two licenses are recommended), will bring about increased versatility for SENEAM.

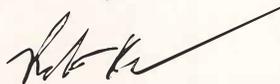
Closing Remarks

The SENEAM and MITRE teams have accomplished a tremendous amount of work together over the past few years on many important topics. The reason for this success, in my opinion, is due to the strong foundation and trusted relationship that has been created between SENEAM and MITRE, along with close collaboration and the desire to do what is best for the project and, ultimately, Mexico. The very fact that I can express some differences here is silent witness of that trust.

The MITRE team looks forward to continuing the advancement of the NAICM work as it enters its next stage, not only with SENEAM but also DGAC, and other entities.

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

Sincerely,



Ing. Robert W. Kleinhans
Project Technical Coordinator
and International Assistant Director