Enclosure 6
(Ref. Technical Letter F500-L14-004)

MITRE

Center for Advanced
Aviation System Development

Project Data Preparation
and
Computerized Database Loading

Prepared for
Aeropuertos y Servicios Auxiliares

November 2013
1. Introduction

This document deals with two different subjects. The first one relates to MITRE’s initial activities concerning preparatory computer work. The second one concerns data collection requests by MITRE throughout the project now starting. This second subject is of particular importance as some of the information provided in this document will be relevant throughout the duration of the entire project, specifically, this document describes the way data should be collected (i.e., format) and sent (i.e., recipient at MITRE). Subsequent data requests may not contain a specific description on format, recipient, and the like. Therefore, please keep this “master” document handy.

Concerning the first subject mentioned above, as part of MITRE’s support to Aeropuertos y Servicios Auxiliares (ASA), MITRE is planning to utilize sophisticated computer software programs and models to accomplish its analytical work. MITRE’s Air Traffic Management (ATM) laboratory visualization and simulation tools will also be used to examine airport and airspace concepts. In preparation for upcoming analyses, a large multi-disciplinary team of experts have been working on the development of relevant computer software programs and basemaps. Due to its nature, this work cannot be mailed. However, Section 2 of this document describes and illustrates some of MITRE’s computer program and basemap preparation efforts. MITRE will continue to develop its computer programs, basemaps, and other tools as the project progresses and additional, more detailed data are obtained.

Concerning the second subject, MITRE will require a significant amount of data throughout the project. As indicated above, this document (see Section 3) should serve as a guide to ASA in collecting and sending data to MITRE. An initial request is included.

2. Computer Software Program Preparation

A team of MITRE engineers have been developing computerized software programs, basemaps, as well as visualization and simulation tools to support many project tasks. The basemaps provide a three-dimensional (3D) work environment within which MITRE can analyze a wide variety of important aeronautical matters. Preparation of basemaps and other software tools is very labor-intensive, requiring careful planning and coordination. Nevertheless, their preparation is an essential effort that once completed enables better control, usage, and manipulation of data. As a result, more efficient and accurate analyses can be conducted and extensive visualization capabilities provided.

The basemaps not only serve as the repository for project data, but as the operational environment from which MITRE will conduct many of its aeronautical analyses. The basemaps include important aeronautical information and terrain data. Once completed, MITRE will utilize the basemaps and other tools to assess obstacle limitation surfaces, perform aeronautical analyses, site new runways, evaluate instrument approach and departure procedures, and examine airspace issues and conduct noise exposure analyses.
The MITRE team has also begun to prepare its 3D Out-the-Window (OTW) computer simulation and visualization model of the potential airport sites in the State of Hidalgo, preliminarily located near the towns of Tepeji del Río-Tlahuelilpan, Actopan-Santiago de Anaya, and Tulancingo. For example, MITRE’s ATM laboratory engineers have generated terrain data and superimposed publically available imagery over that data to create a realistic view of the above-mentioned areas. As the project progresses, a detailed model of the preferred new airport site in the State of Hidalgo and its surroundings, as well as information generated by other MITRE models (e.g., noise contours) and photogrammetric surveys will be incorporated.

Figure 1 shows an initial AutoCAD (a computer aided design platform) basemap consisting of digital terrain contour line data that MITRE is in the process of creating for the areas being considered for a new airport in the State of Hidalgo. These data will be used to conduct obstacle assessments.

Figure 2 shows a portion of the Hidalgo basemap being created for use in MITRE’s Terminal Air Route Generation, Evaluation and Traffic Simulation (TARGETS) tool. This tool will be used to examine the development of advanced navigation procedures, such as Area Navigation (RNAV) and Required Navigation Performance (RNP), as well as to investigate airspace issues.

Figures 3 and 4 show computer generated pictures of the Hidalgo OTW model currently being produced at MITRE’s ATM Laboratory. The black lines forming triangles in Figure 3 represent vector-based surface terrain being created. Note that the small-format images required for this document cannot show the enhanced level of detail that can be observed within MITRE’s ATM Laboratory.
Figure 2. Hidalgo TARGETS Basemap Preparation

Figure 3. Hidalgo OTW Model Vector-Based Surface Terrain Preparation

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
3. Initial Data Request

This section lists and, if necessary, describes the initial data required by MITRE to conduct some of the early project tasks. The list should not be construed as being all-inclusive, as additional information will be requested throughout the project.

Figures, tables, and information of a mainly numerical nature can be sent to MITRE in Spanish. Other data, particularly lengthy textual material, are required in English. If in doubt, or if such information is lengthy please consult MITRE before spending time in translating the information.

To the extent possible, the information should be sent in electronic format (e.g., Excel, Word, AutoCAD, etc.). While paper format is acceptable, it should be a last resort. In the case of AutoCAD, where appropriate, 3D values (that is, z-values) should be provided (e.g., building elevations). In the case of elevations, these should be provided in meters above Mean Sea Level (MSL). All maps, boundaries, runway thresholds, and in general, all coordinates that are to be provided to MITRE should be based on the Universal Transverse Mercator (UTM)/World Geodetic System 1984 (WGS 84) coordinate system. If for any reason any data sent to MITRE does not use WGS 84, ASA should clearly specify the coordinate system being used. In the absence of such annotation, MITRE will assume that the coordinate system is WGS 84.
It is important to note that MITRE plans to use as a primary source of information the most recent version of Mexico’s Aeronautical Information Publication (AIP). This is the official, publicly available civil aviation authority publication of Mexico regarding principal aeronautical data. Therefore, MITRE cannot take responsibility for errors, discrepancies, or inconsistencies thereof.

ALL THE INFORMATION REQUESTED THROUGHOUT THE REST OF THIS DOCUMENT, AND THE PROJECT IN GENERAL, SHOULD TAKE INTO ACCOUNT THE CONSIDERATIONS MENTIONED ABOVE.

The data is requested as follows:

Section 3.1 -- Friday 15 January 2014

Section 3.2 -- Friday 28 February 2014, and

Section 3.3 -- To be decided. Still, it is important that this section is examined carefully as soon as possible, as this information may be required on short notice.

Please contact Ing. Robert W. Kleinhans, International Assistant Director and Project Technical Coordinator, no later than Friday 20 December 2013, if there are any issues or concerns with providing the requested data on time as this could result in MITRE needing to reallocate staff. Furthermore, note that many tasks are interrelated and, therefore, delays to one task may create a cumulative effect that could impact other tasks. Electronic data transmission is preferred and should be sent via e-mail to rkleinha@mitre.org by the deadline mentioned above.

Please include with the delivery of any data a Table of Contents that references in a clear manner the various parts of a request. Likewise, please describe in detail any differences, if any, between the request and what is being delivered, as well as the original source of each item. If mail is preferred, the information should be shipped via FedEx to the following address:

Ing. Robert W. Kleinhans
The MITRE Corporation
7515 Colshire Drive
McLean, VA 22102
U.S.A.

3.1 General Data

This section provides a listing of general information that MITRE requires.

- A current version of Mexico’s AIP, including all aeronautical charts. A subscription for MITRE, on behalf of Ing. Kleinhans and to the address above. Amendments to the AIP for as long a period of time as possible (but no less than one year) should also be provided.
Known plans for:

- Changes to the existing navigational aid (NAVAID) infrastructure within a 100 NM radius of existing Mexico City International Airport (AICM). For example, the decommissioning of Very High Frequency (VHF) Omni-directional Range (VOR) or Distance Measuring Equipment (DME) facilities.
- Changes to the existing enroute airways structure of Mexico.

MITRE is assuming, unless specifically told otherwise by relevant Mexican authorities, that the existing MEX VOR/DME (located at existing AICM) and the SLM VOR/DME (located at existing Santa Lucía Air Base) will continue to operate after the opening of Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM) and the consequent closure of those airports facilities. If this changes, MITRE needs to be informed as this could affect the results of some of MITRE’s aeronautical analyses.

Note that due to the importance of the above-mentioned items to MITRE’s work, this information should be provided to MITRE as soon as possible. Also, note that MITRE has already made a request for the AIP via e-mail, starting in October 2013.

3.2 AICM and NAICM Data

This section provides a listing of data that MITRE requires in order to conduct tasks pertaining to NAICM-related work, as follows:

- Plans showing the official and legally definitive boundaries, including coordinates, which MITRE may consider for the location of NAICM runways with their associated safety areas in the NAICM project area (assuming only federal land is utilized).

MITRE has received information regarding the possible boundaries from ASA, but it has been informed that the boundaries have not been legally confirmed.

- The location of any proposed developments or any other plans in the vicinity of the NAICM project area that could potentially impact aircraft operations or the siting of runways at NAICM (power lines, buildings, reservoirs, canals, highways, etc.).

MITRE has been informed that a high-tension power line may be installed very close to the NAICM project area. MITRE has requested a geo-registered drawing showing the precise location and height of the power line. This information is needed as soon as possible.

- Any plans being developed by other stakeholders pertaining to the NAICM project including information, such as Master Plans, terminal buildings, auto parking, non-aviation support facilities, land-use plans, etc.
- Existing aerial and/or satellite imagery, if available (as current as possible) of the NAICM project area and its surroundings. The images should preferably be in color and should be geo-registered (e.g., Geo-TIFF files) for insertion into AutoCAD.

- Operational information (excluding helicopters) of AICM, Toluca, Puebla, Querétaro, and Cuernavaca, including Santa Lucía Military Base.
  - Total number of annual operations ("movements") for 2012 and 2013.
  - Total number of monthly operations for 2012 and 2013.
  - Total number of daily operations (arrivals and departures separately) for the two peak-traffic months of 2013.
  - Hourly operations (arrivals and departures separately) for the peak-day of the peak-traffic month of 2013 (this is essentially one 24-line table). Confirm whether the times are local or Coordinated Universal Time (UTC). If in local time, indicate the time difference from UTC that applied on that day. Ensure that the selected day was not a high-volume day due to unusual circumstances (e.g., a very high traffic day due to a major political event).
  - Seven continuous days of detailed daily operations data for AICM for any week considered by ASA as a relatively high-volume peak week (Sunday through Saturday) in 2013. Please choose a week during which both directions of the runways (Runway 05 and Runway 23) were being uses. For a sample of what is expected, see Figure A-1 in Appendix A of this document.

The information being requested should include:

- Date
- Scheduled departure (STD) or arrival (STA) time. Indicate whether the time is local or UTC.
- Actual arrival or departure time. Indicate whether the time is local or UTC.
- Operator name (airline). If not a commercial operation, indicate whether it is General Aviation, military, or governmental.
- Operator flight number.
- Aircraft type (model and sub-model, for example, Boeing 777-200).
- Tail (or registration) number.
- Type of operation (arrival or departure).
- Origin airport (for arrivals) or destination airport (for departures).
- Runway used (e.g., Runway 05R).
- Route name (Standard Instrument Departure [SID], instrument approach procedure or departure/entry fix) utilized for that specific departure or arrival.

- Provide radar data for the same seven days mentioned above with sufficient information to be able to cross-reference aircraft identification with a particular radar track. The radar data should include information on operations at AICM and all other key airports in the Mexico City basin (i.e., Toluca, Puebla, Querétaro, and Cuernavaca), including Santa Lucía Military Base. The information should include:
  - Aircraft position data - format needs to include either:
    - Known origin (usually the radar antenna) in latitude/longitude and then displacement coordinates from the known origin, or
    - Latitude/longitude and altitude of each aircraft position.
  - Time data for each position to at least the nearest second.

- Provide video maps that depict extended runway centerlines, airports, significant fixes, holding patterns, airspace boundaries, sector boundaries, etc. of AICM and all other key airports in the Mexico City basin (i.e., Toluca, Puebla, Querétaro, and Cuernavaca), including Santa Lucía Military Base.

- Provide information regarding the future fleet mix expected to operate at NAICM once it opens.

- Arrival Runway Occupancy Time (AROT) and Departure Runway Occupancy Time (DROT) for AICM. These data will be used to assist MITRE in determining the appropriate location and type of runway exits for new runways at NAICM by providing comparative baseline data. Please consult MITRE before this information is gathered.

### 3.3 Hidalgo Data

The intent of this section is to request information required to conduct analyses pertaining to identifying a feasible site for the development of a new one-runway airport in the State of Hidalgo. This request is being provided before a proposed visit to MITRE by Hidalgo stakeholders takes place. It is afterwards that the data will be needed. This is just information sent ahead of time to assist ASA regarding what MITRE plans to request in upcoming months.

Three potential locations within the State of Hidalgo near the towns of Tepeji del Río-Tlahuelilpan, Actopan-Santiago de Anaya, and Tulancingo are being preliminarily considered as candidate sites that MITRE is currently focusing on to examine the feasibility of a one-runway airport.
The following information will be required:

- Existing survey information for the three potential airport areas, including such information as roads, buildings, canals, water holding basins, and contour lines.

The information expected will be considered as preliminary as new surveys (under the responsibility of MITRE) will be conducted of the three potential airport areas once they are better defined in order for MITRE to site new runways, evaluate instrument approach and departure procedures, and support other tasks, such as the analysis of noise impact.

- List of all issues regarding potential impediments to airport construction within the three potential airport areas. Examples of potential impediments include soil/subsoil composition, flooding, existing infrastructure, environmental and archeological concerns, and any other potentially disruptive conditions. ASA should also examine, directly or indirectly, and inform MITRE on whether the three potential airport areas are appropriate from a social, political, ownership, environmental point of view.

- Existing weather information for the three potential airport areas.

Reliable weather information is important to the project. In accordance with the contract, MITRE requires that an Automated Weather Observing System (AWOS) be installed at the three potential airport areas once they are better defined. MITRE has prepared, under separate cover (reference the enclosure to MITRE Technical Letter F500-L14-003), a document entitled “Specifications for Automated Weather Observing Systems (for three potential airport sites in the State of Hidalgo)” in order to assist ASA in obtaining such a system.

In the meantime, please provide any reliable historical weather data (for as long a period as possible) for the three potential airport areas from appropriate sources (e.g., local weather stations and/or equipment) that could help MITRE in better understanding weather characteristics. Historical data from the existing airport located in the southern part of the city of Pachuca (Aeropuerto Ing. Juan Guillermo Villasana) would also be of some assistance.

The historical weather data requested above should include information on wind direction and speed (including gusts), ceiling, visibility, and temperature in a manner as specific as possible regarding frequency of occurrences. The units of measurement must be provided and data should be delivered electronically in Microsoft Excel.

- Preliminary length of runways for the Hidalgo airport to be constructed. ASA’s recommendations may be provided on the basis of feedback from air carriers and/or cargo companies that are envisioned to operate at the new airport.
Destinations expected to be served in the future as well as the future critical aircraft should be considered. The recommended runway length should also account for the requirements of the Fuerza Aérea Mexicana (FAM). Note that it may be necessary to provide a range of runway lengths (i.e., maximum and minimum) in order to allow for flexibility in runway siting.

- Any previous studies regarding the development of a new airport in the State of Hidalgo, including conceptual airport layouts.

- Existing information on birds or wildlife attractants in the vicinity of the three potential airport areas that could pose a hazard to aircraft operations. For example, a large lake is located near the Tepeji del Río-Tlahuelilpan and Tulancingo areas. Any existing bird survey data that could give MITRE a better understanding of bird activity in those areas would be helpful.

- Existing land-use maps (residential, commercial, environmental, transmission lines, etc.) of the three potential airport areas.

- Location of areas that MITRE should consider as noise sensitive near the three potential airport areas.

- Existing aerial and/or satellite imagery, if available (as current as possible) of the three potential airport areas and their surroundings. The images should preferably be in color and should be geo-registered (e.g., Geo-TIFF files) for insertion into AutoCAD.

- Readily available Geographic Information System (GIS) data for the three potential airport areas. These data should encompass an area within a 40-km radius around the three potential airport areas. Information on the coordinates and elevation of terrain and other obstacles (e.g., buildings, towers, antennas, etc.), residential, commercial and industrial areas, highways and roads, lakes, rivers, canals, and other land use items should be included. The preferred format is ESRI Shape.

- Readily available information on obstacles (e.g., buildings, towers, antennas, etc.) within a 40-km radius around the three potential airport areas. Information on the coordinates and elevation of the obstacles should be included. These data may be available as a result of recent surveys, engineering drawings, or other development projects recently conducted near the areas.

Look for obvious tall structures using binoculars and mark their approximate location on a map (e.g., road atlas) or accurately identify the structure using a hand-held Global Positioning System (GPS) device. This information will help MITRE locate runways and conduct procedure design work early on in the project, prior to receiving more detailed photogrammetric and obstacle survey data.

- Operational information of Aeropuerto Ing. Juan Guillermo Villasana located near the city of Pachuca.
Current number and type of aircraft based at the airport.

Types of transient aircraft that operate on a regular basis.

Annual operations ("movements") in 2012 and 2013. Earlier data, if available, would also be helpful.

Monthly operational statistics for 2013 (earlier data, if available, would also be helpful).

Daily aircraft operations for the peak traffic month of 2013.

Hourly aircraft operations (arrivals and departures separately) for the peak-day of the peak-traffic month of 2013 (this is essentially one 24-line table).

Diagrams showing the current approach and departure procedures available for each runway. This should include diagrams of instrument approach procedures (if any), Visual Flight Rules (VFR) procedures, traffic corridors, traffic patterns, etc. that are related to flight operations both to and from the airport. Approach and departure minima should also be provided, if applicable.

Information on special events or training exercises (e.g., air shows, fly-ins, exercises, etc.) involving a significant increase in the volume of aircraft operations compared to normal volumes of traffic.
## Appendix A

Figure A-1 below shows a sample of the operations data MITRE requires. (Note that the data sample comes from a 2001 survey of AICM operations.) These data should be provided electronically in Microsoft Excel.

**Operational Data - Sample Only**

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Note: STA = scheduled time of departure
      STDSTA = standard time of arrival

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**Figure A-1. Sample of Operations Data**