Dear Ing. Mejía:

The MITRE Corporation (MITRE) is supporting the Grupo Aeroportuario de la Ciudad de México (GACM) and the aviation authorities of Mexico’s federal government in the development of a new airport, hereafter referred to in this document as Nuevo Aeropuerto Internacional de la Ciudad de México (NAICM), which will serve Mexico City and replace the current Aeropuerto Internacional de la Ciudad de México (AICM). Prior to MITRE’s current support to GACM, MITRE played a fundamental role in determining the aeronautical feasibility for constructing an airport at Texcoco (i.e., the site for NAICM). As part of those studies, MITRE assessed the potential risks from bird attractants within and around Texcoco on future aircraft operations at NAICM.

On 20 April 2017, you visited MITRE to discuss, among other things, the bird-related concerns at Texcoco, as well as water regulation matters related to the mission of the Comisión Nacional del Agua (CONAGUA). During that visit, you provided very valuable information on the hydrological considerations and plans in the Texcoco area, including the possibility of removal of Lago Nabor Carrillo, which MITRE considers a significant bird attractant hazard to aviation. Additionally, and to support CONAGUA, MITRE agreed to provide you with key information from MITRE’s assessment of the potential risks from bird attractants within and around Texcoco. Therefore, the objective of this document is to provide you with a high-level summary of MITRE’s wildlife assessment.

As part of its assessment, MITRE’s airport planning staff worked together with world-renowned wildlife experts who have specific knowledge of the bird population within and around Texcoco. More specifically, MITRE and the wildlife experts examined the risks associated with birds to future aircraft operations at NAICM. Risk was assessed for various runway scenarios at NAICM, and considered both the existence, as well as the removal, of bird attractants in the vicinity of the proposed airport.
The potential impact from wildlife on aircraft operations is an important consideration when determining the feasibility of a site for any new airport, including NAICM. The area within and around Texcoco is inhabited by a large number of birds, especially in winter time, especially at Lago Nabor Carrillo. Most of these birds are migratory birds from the U.S. and Canada.

From 1960 to 2009, worldwide aviation losses due to bird strikes cost approximately U.S. $1.2 billion annually on average. During that period, apart from numerous incidents, 29 large transport aircraft and 37 corporate aircraft were destroyed, and over 400 people were killed.

During 1996 to 2011, 13 bird surveys were conducted by experts from Mexico’s Universidad Nacional Autónoma de México (UNAM), the U.S. FAA, and the U.S. Department of Agriculture (USDA), which indicated the presence of large populations of birds within and around Texcoco. This is in part due to the existence of approximately ten areas identified as bird attractants (nine water bodies and one landfill) at Texcoco. Figure 1 shows the location of the ten bird-attractant areas, as well as the average percentage of birds surveyed at each area.

As shown in Figure 1, on average, Lago Nabor Carrillo is inhabited by the largest percentage of birds (51 percent). Casa Colorada has the second highest percentage with 10 percent. El Caracol only accounts for 8 percent; however, due to its location, this area still poses a potential risk to future operations at NAICM. El Caracol is located just to the north of the proposed runways at NAICM, and it is likely that birds would fly between Lago Nabor Carrillo, which is located just to the south of the proposed runways, to El Caracol, thus, birds would likely end up crossing over NAICM runways and potentially through future approach and departure paths.
It is important to add that even if El Caracol were removed (that is the plan, as MITRE understands it), the high percentage of birds at Lago Nabor Carrillo, by itself, poses a significant risk to future aircraft operations at NAICM.

The mean number of birds counted within and around Texcoco during the peak bird seasons from the 1996 to 2011 period was 78,796, as shown in Figure 2. However, it is important to note that in 2009, the number of bird count exceeded 130,000. In general, bird populations throughout North America and in other regions, appear to be increasing due to wildlife conservation efforts. Therefore, it is possible that since the time of the MITRE assessment, the bird populations within and around Texcoco have also increased.
It is important to note that 96 percent of the birds at Lago Nabor Carrillo and 10 percent of the birds at Casa Colorada are waterfowl (ducks/grebes), which aviation experience has taught for many years present a relatively high hazard to aircraft operations. The main bird groups by species within the Texcoco site are the following:

- Ducks (e.g., Cinnamon Teal): 80 percent
- Herons, egrets, ibises, pelicans (e.g., Great Egret): 10 percent
- Shorebirds (e.g., Western Sandpiper): 6 percent
- Coots, gallinules (e.g., American Coot): 3 percent
- Gulls, vultures, raptors, small birds (e.g., Ring-Billed Gull): 1 percent

Table 1 below shows the mean number of birds by species group in the ten bird-attractant areas.

Figure 2. Bird Population Count at Texcoco during Peak Bird Seasons
It is important to note that these or similar criteria may have been formally adopted by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT).

The U.S. FAA provides recommendations to assist with the siting and operation of airports. Some of these guidelines pertain to the recommended separation distances between the airport and certain types of land use that have the potential to attract hazardous wildlife, including birds.

Key U.S. FAA separation criteria recommendations include:

- At airports serving turbine-powered aircraft, vulnerable airport areas (e.g., aircraft movement areas, loading ramps, or aircraft parking areas) should be located at a distance of at least 10,000 ft (~3 km) from wildlife attractants. NAICM complies with this criterion only marginally (see more below).

- Airport aircraft operating areas (e.g., runways and taxiways) should be separated by 5 miles (i.e., 8 km) from hazardous wildlife attractants, if the attractants could cause hazardous wildlife movement into or across the approach or departure airspaces. NAICM does not comply with this criterion (see more below).

If the two separation criteria mentioned above cannot be met, the potential for bird hazards should be additionally assessed by the airport decision-making authorities, in conjunction with MITRE’s overall bird hazard risk evaluation.¹

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¹ It is important to note that these or similar criteria may have been formally adopted by the Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT).

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Table 1. Annual Mean Number of Birds by Species Group in the Ten Bird-Attractant Areas (1996 to 2011)

<table>
<thead>
<tr>
<th>Bird-Attractant Areas</th>
<th>Herons/egrets/ibises/pelicans</th>
<th>Ducks/grebes</th>
<th>Coots/gallinules</th>
<th>Shorebirds</th>
<th>Birds of prey*</th>
<th>Gulls*</th>
<th>Misc small birds*</th>
<th>Total</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lago Nabor Carrillo</td>
<td>27</td>
<td>39,706</td>
<td>685</td>
<td>908</td>
<td>4</td>
<td>73</td>
<td>27</td>
<td>40,430</td>
<td>51.3</td>
</tr>
<tr>
<td>Casa Colorada</td>
<td>21</td>
<td>5,282</td>
<td>85</td>
<td>2,220</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>7,616</td>
<td>9.7</td>
</tr>
<tr>
<td>Lago Churubusco</td>
<td>2,794</td>
<td>3,030</td>
<td>237</td>
<td>156</td>
<td>2</td>
<td>14</td>
<td>281</td>
<td>6,514</td>
<td>8.3</td>
</tr>
<tr>
<td>El Caracol</td>
<td>81</td>
<td>5,114</td>
<td>321</td>
<td>615</td>
<td>1</td>
<td>0</td>
<td>13</td>
<td>6,125</td>
<td>7.8</td>
</tr>
<tr>
<td>Laguna Facultativa</td>
<td>424</td>
<td>3,897</td>
<td>0</td>
<td>221</td>
<td>1</td>
<td>58</td>
<td>184</td>
<td>4,785</td>
<td>6.1</td>
</tr>
<tr>
<td>La Cruz</td>
<td>150</td>
<td>3,800</td>
<td>94</td>
<td>323</td>
<td>2</td>
<td>1</td>
<td>134</td>
<td>4,504</td>
<td>5.7</td>
</tr>
<tr>
<td>Rellenos Sanitarios</td>
<td>3,583</td>
<td>38</td>
<td>0</td>
<td>43</td>
<td>0</td>
<td>9</td>
<td>51</td>
<td>3,724</td>
<td>4.7</td>
</tr>
<tr>
<td>Laguna Recreativa</td>
<td>115</td>
<td>2,574</td>
<td>491</td>
<td>269</td>
<td>1</td>
<td>66</td>
<td>14</td>
<td>3,530</td>
<td>4.5</td>
</tr>
<tr>
<td>Laguna Xalapango</td>
<td>112</td>
<td>659</td>
<td>182</td>
<td>27</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>685</td>
<td>1.2</td>
</tr>
<tr>
<td>Regulacion Horaria</td>
<td>382</td>
<td>8</td>
<td>0</td>
<td>189</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>581</td>
<td>0.8</td>
</tr>
<tr>
<td>Total in Texcoco</td>
<td>7,669</td>
<td>63,108</td>
<td>2,095</td>
<td>4,971</td>
<td>18</td>
<td>223</td>
<td>712</td>
<td>78,796</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Birds of prey (raptors/vultures), gulls, and miscellaneous small birds were excluded from the risk analysis because only small numbers were present.
When MITRE was examining the aeronautical feasibility for NAICM at Texcoco, the U.S. FAA separation criteria recommendations were important considerations. For example, early concepts for the proposed runway configuration (oriented 002° based on True North), were designed to be wholly located within the NAICM site boundaries. In doing so, the eastern-most pair of runways and other vulnerable airport areas would be located within 3 km of Lago Nabor Carrillo. Fortunately, MITRE was informed that additional land for the airport would be acquired, which would expand the NAICM site boundaries and allow the eastern-most pair of runways to be shifted farther to the north. Subsequently, this would increase the distance of the vulnerable airport areas at NAICM from Lago Nabor Carrillo and would satisfy one of the key above-mentioned U.S. FAA recommendations.

As can be seen in Figure 3, the runways associated with the revised Runway 002° configuration are 3 km away from Lago Nabor Carrillo and other bird attractants located to the south. However, as mentioned above, the U.S. FAA also recommends that airport aircraft operating areas should be separated by 5 miles (8 km) from hazardous wildlife attractants, if the attractants could cause hazardous wildlife movement into or across the approach or departure airspace. Unfortunately, this cannot be achieved at Texcoco. Therefore, effective mitigation strategies to reduce the risks associated with birds to future aircraft operations at NAICM is essential for the safe operation of the airport.

![Figure 3. U.S. FAA Recommended Separation Distances Between the Original Runway 002° Configuration (Left) and the Revised Runway 002° Configuration (Right) and Bird Attractants](image)

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There are various ways to evaluate the risk or probability of a bird strike caused by the bird-attractant areas at and surrounding the Texcoco site. MITRE’s assessment considered the number and species of birds in the bird-attractant areas, as well as the

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2 Note that the revised Runway 002° configuration has been selected by authorities for the development of NAICM.
distance from the bird-attractant areas to the Runway 002° configurations shown above in Figure 3. The removal of bird-attractant areas was also considered. The more birds in an area and the closer the area is to the proposed runways, the greater the probability of bird strikes or engine ingestions.

Table 2 below shows the contribution of risk to aircraft operations based on the average number of birds surveyed between 1996 and 2011 at Texcoco. The contribution to aircraft operations at existing AICM based on the same survey data is provided as well for comparison purposes. This is a helpful comparison as existing AICM does not have a history of significant bird strikes.

MITRE’s evaluation shows that there were (through 2011 only) about 8500 birds that could pose a potential risk to aircraft operations for the original Runway 002° configuration, and about 7500 birds that could pose a potential risk to aircraft operations for the revised Runway 002° configuration (which is the one runway configuration intended to be used for NAICM). If all areas north of the highway (i.e., Autopista Texcoco Peñón) are removed, the amount of birds that could pose a potential risk to operations for the revised Runway 002° configuration decreases by approximately 23 percent.

However, if only Lago Nabor Carrillo and El Caracol were removed, the number of birds that pose a potential risk dramatically decreases to about 2100 and 1800 for the original Runway 002° configuration and the revised Runway 002° configuration, respectively. Interestingly, the number of birds in this case is similar to the risk at the current airport, AICM (~2000). AICM has not had a problematic safety history due to bird strikes. This shows emphatically that removal of Lago Nabor Carrillo (which has a much larger amount of birds than El Caracol) would have a significant effect on the overall risk associated with birds to future operations at NAICM.
There is a large number of birds within and around Texcoco, especially in winter, and especially at Lago Nabor Carrillo. The large number of birds, which continues to increase, creates a significant risk to future aircraft operations at NAICM. As described above, the removal of key bird-attractant areas, including removal of Lago Nabor Carrillo, would significantly reduce this risk.

It is important to emphasize that this analysis was performed utilizing average number of birds in the area over the previous decade or so. That is, the results are conservative because in reality the bird winter population is now likely much larger than the averages used by MITRE.

Mitigation measures recommended by the International Civil Aviation Organization and the U.S. FAA include habitat management (elimination of food, cover, water), resource protection (denying birds access to attractant areas), and population management (removal of birds from the area). These measures may, in some cases, discourage birds from using areas near airports. However, mitigation measures may not be applicable or provide a significant benefit in some situations. Unfortunately, the Texcoco site is a very good example of such a situation due to the very large size of the bird-attractant areas, especially Lago Nabor Carrillo, and other factors.

**Closing Remarks**

There is a large number of birds within and around Texcoco, especially in winter, and especially at Lago Nabor Carrillo. The large number of birds, which continues to increase, creates a significant risk to future aircraft operations at NAICM. As described above, the removal of key bird-attractant areas, including removal of Lago Nabor Carrillo, would significantly reduce this risk.
It is for this reason that MITRE has recommended frequently for several years that significant bird mitigation investigation and experimentation related to the bird-attractant areas in Texcoco (particularly those located south of the highway) be conducted. This is because despite the fact that MITRE achieved at least a 3-km distance between the runways and the water bodies, a significant amount of birds are still expected to migrate to the water bodies in this area.

MITRE has stated for many years that while bird mitigation measures may provide a benefit, the best solution, by far, is removal of all water bodies to the north of the highway and Lago Nabor Carrillo. Also, it is important that new reservoirs and other facilities that can also become bird-attractant areas are not added into the area. The future safety of what is going to become one of the largest airports in the world is at stake.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Ing. Robert W. Kleinhas
Project Technical Coordinator

cc: Dr. Bernardo Lisker, MITRE