International Civil Aviation Organization

Sixth Meeting of the Asia/Pacific Wildlife Hazard Management Working Group (AP–WHM/WG/6)

Bangkok, Thailand, 14 to 17 May 2024

Agenda Item 5: State's Action Plan for Establishment and Implementation of Wildlife Hazard Management Programme – State's Update

THREATS POSED BY INSECTS (BEES) AT KUALA LUMPUR INTERNATIONAL AIRPORT (KLIA) TERMINAL 1 & 2

(Presented by Malaysia)

SUMMARY

The purpose aims to highlight the hazards caused by insects (bees) at Kuala Lumpur International Airport (KLIA) Terminals 1 and 2, as well as the mitigating actions taken by KLIA to address this issue. Additionally, the paper seeks to explore best practices implemented by other States in the Asia-Pacific Region on this matter.

1. INTRODUCTION

1.1. Birds and insects are well-known hazards to aviation at airports, however the threat posed by insects is less well understood, particularly bees. An example of a serious risk to flight safety comes from the bees, which view aircraft pitot probes as an attractive nesting opportunity at KLIA. Pitot probes measure airspeed, and obstructions can render measurements inaccurate, leading to serious and potentially catastrophic consequences.

1.2. Animal classifications identified as insects are found in nearly every habitat and are dispersed over all continents. They can adapt to a vast range of environments and have carved out a niche for themselves by consuming everything that is nutrient-dense. Hymenopterans, or more precisely, bees (Suborder Apocrita), are an excellent instrument for monitoring environmental pollutants because they can efficiently gather samples of airborne particles from a variety of sources (Negri et al, 2015). Insects, particularly bees, pose a threat to airplanes despite playing vital roles in the ecology. Despite playing vital roles in the ecosystem, not much is known about bees while the majority of studies concentrate on birds as significant risks to the aviation sector.

1.3. The International Civil Aviation Organization (ICAO) establishes global standards and guidelines for wildlife-aviation hazards including (1) assessing hazards posed by birds and mammals in the vicinity of airports certificated for passenger traffic, (2) taking all necessary actions to decrease the numbers of hazardous birds and mammals and (3) eliminating or preventing the establishment of wildlife attractants on or near airports. Another key component of the ICAO guidance is the recommendation that member nations create a committee to assess and respond to wildlife hazard problems at their airports. As the demand for air travel has increased and forthcoming changes to airport capacity are being met with calls for planning to maintain biodiversity in the airport environment, airport managers worldwide face new challenges regarding the management of wildlife hazards.

1.4. The key wildlife hazard that needs to be addressed is the possibility of turbine-powered aircraft striking with wildlife and incurring structural damage that compromises the engine's or the flight surface's ability to function. Bee swarming activities have the potential to jeopardise passenger and aircraft safety. Swarming is defined as a phrase to describe the active aggregational behavior of small animals. Insects swarm for several reasons including reproduction, defense and migration. According to a report by Forest Research Institute Malaysia (FRIM) in 2022, in most cases, the swarming eventually disperses in the early morning with the mated insects locating suitable habitat to develop their new colony. To date, there are several species that have been recorded at KLIA including Giant Honey Bee (*Apis Dorsata*), Asian Honey Bee (*Apis Cerana*), Dwarf Honey Bee (*Apis Florea*) and Tropical Carpenter Bee (*Xylocopa Latipes*).

2. DISCUSSION

2.1 Bee Swarm Activities at KLIA Terminal 1 & 2

2.1.1 Reference is made to Ferrari et al, 2008, swarming represents the natural way a honey bee colony uses to reproduce and normally occurs in strong, populous colonies, mostly occurring from spring to early summer. In addition, there are various environmental conditions that could trigger insect swarming, including temperature, wind speed, relative humidity, and day length (Sansone & Merchant, 2005).

2.1.2 The most recent bee swarming issues in KLIA Terminal 1 & 2 reported until April 2024 (month-to-date), with a total of eight (8) cases, while 11 & five (5) cases were reported in the years 2023 and 2022, respectively (Figure 1). From the trend, it suggests that there is exponential growth in reported bee swarming cases, which is expected to increase by the end of 2024. In order to effectively lower the risk of bees swarming at aerodromes during the spring and summer, it is imperative that the mitigation strategy be put into action.

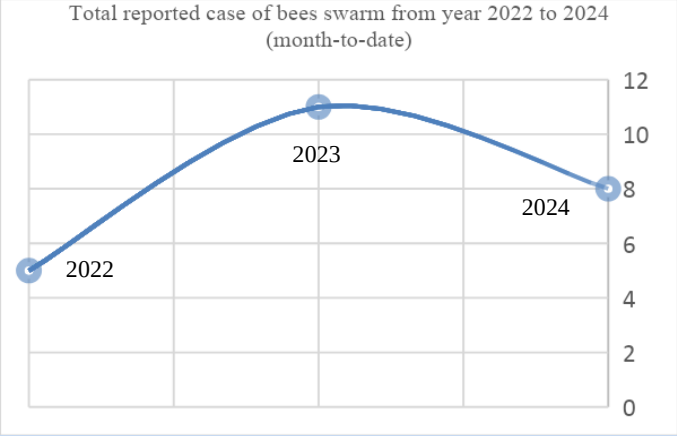

Figure 1: Total reported case of bee swarm activities from 2022 until month of April 2024

2.1.3 In 2023, a total of 73% of cases of bee swarms were reported in KLIA Terminal 1, with the remaining 27% of incidents in KLIA Terminal 2. There are 11 reported incidents, three (3) cases involving aircrafts, while the remaining eight (8) cases were reported in aircraft stand areas and buildings. Meanwhile, based on the recent update for the year 2024 (to date), there have been eight (8) incidents of bee swarms reported, with the occurrence of 4 cases in both KLIA Terminals 1 & 2, respectively. From a total of 8 reported incidents, three (3) cases involved aircraft, while the remaining five (5) cases were reported in aircraft stand areas and buildings.

Year	Date	Zone	Location	Aircraft-related (Y/N)
2023	20/08/2023	Airside – Bay	KUL1	Y
	25/08/2023	Airside – Bay	KUL1	N
	28/08/2023	Airside – Bay	KUL1	Y
	31/08/2023	Airside – Bay	KUL1	N
	25/09/2023	Airside – Bay	KUL1	Y
	22/11/2023	Airside – Bay	KUL2	N
	25/11/2023	Airside – Bay	KUL2	N
	30/11/2023	Airside-Cargo	KUL1	N
	08/12/2023	Airside – Bay	KUL2	N
	11/12/2023	Airside – Bay	KUL1	N
	20/12/2023	Airside-Cargo	KUL1	N
2024 (To-Date)	15/01/2023	Airside – MAS Hangar	KUL1	Y
	16/01/2024	Airside – MAS Hangar	KUL1	Y
	17/01/2024	Airside – MAS Hangar	KUL1	Y
	09/02/2024	Airside – Bay	KUL2	N
	14/02/2024	Airside – Bay	KUL2	N
	14/02/2024	Airside – Bay	KUL2	N
	26/02/2024	Airside - Bay	KUL2	N
	05/03/2024	Airside-Cargo	KUL1	N

Table 1: Bee swarm activities at KLIA Terminal 1 & 2 (Based on data year 2023 – 2024 (To-Date))

2.1.4 From the data obtained, we can observe that the trends of bee swarm activities throughout the year are increasing and will continue to increase by the end of the year 2024. Bee swarm activities that involve aeroplanes are the main cause for concern, as this could compromise aviation safety, which includes passenger safety.

2.1.5 Figure 2 shows the bee swarm activities involving aircraft in KLIA. These incidents may result in flight delays or cancellations as airports implement safety measures to mitigate risks. In addition, bee swarming incidents near airport runways & taxiways can lead to safety hazards for aircraft during takeoff, landing, and taxiing. Wildlife strikes, including bees, can result in costly repairs to aircraft and airport infrastructure if there is no mitigation plan implemented to reduce the risk.

Figure 2: Bee swarm activities involving aircraft at KUL (*Source: AFRS Department, KUL*)

2.1.6 Figure 2(a) shows the incident of a bee swarm at the wing tip of an aircraft reported on August 20, 2023. The KLIA Operation Control Centre (AOCC) received a report regarding bee swarming and escalated the case to the Airport Fire & Rescue Service (AFRS). Dispersal by water was conducted before the area was declared safe to resume operation. The series of bee swarming incidents continues with the incident on August 28, 2023, as shown in Figure 2(b), involving swarming at the aircraft part at the aircraft stand. AFRS used a similar dispersal method for the removal of bee swarms.

2.1.7 Meanwhile, Figure 2(c) shows the swarm of bees at the aircraft radome at the aircraft stand reported on September 25, 2023. The Airside Services Department (ASD) & AFRS have arrived at the location and cordoned off the area for the evaluation process. After the assessment, AFRS decided to remove the bee swarm immediately by dispersal. Meanwhile, ASD is positioned at the location to monitor and ensure the area is clear during the bee removal activity. After AFRS had successfully managed to disperse the bee swarm from the location, ASD commenced the inspection and declared the area safe from any hazards. While ASD & AFRS work on risk mitigation and dispersal activity, this may cause a delay in flight operations. The dispersal of wildlife hazards is an integral aspect of active management at the airport. Hence, early detection and immediate removal of hazards are essential to effective management of risks.

2.1.8 In addition, there is an incident reported in KLIA Terminal 2 in which insects enter the aircraft, especially the sensitive equipment such as the pitot probes, which may cause safety issues for the aircraft and their passengers. Similarly, several cases have been reported in the United Kingdom and Australia of exotic wasps nesting in aircraft pitot probes, covering the sensors and causing reading errors that could potentially be catastrophic (House et al, 2020).

2.1.9 Apart from bees, there are several incidents reported for other groups of insects, including weaver ants (alate). The recent incident was reported on April 18, 2024, at the aircraft stand. An inspection has been carried out, and specimens were collected and sent to FRIM for species identification. However, the information and data for other group insects are scarce compared to the bees' swarming activities. Continuous monitoring and more data are required to study the trends and species occurrence of insects in KLIA.

2.1.10 Insects (like bees and ants) are known to be highly social animals and will always defend their colony if threatened, thus should be considered a greater threat to humans. Hence, effective strategies are essential to mitigate these risks and maintain the safety and integrity of airport operations. Mitigating wildlife impacts at airports is crucial for ensuring aviation safety and minimising environmental disturbances.

2.2 Mitigation Plans

2.2.1. Wildlife Handling & Hazard Control Procedure (SOP - AFRS & Aerodrome Wildlife Hazard Management Plan)

2.2.1.1 KLIA have a dedicated team trained to respond quickly to bee swarm incidents, minimising disruptions and ensuring safety. AFRS has stated in SOP-Special Service (MAHB/KUL/AFRS/SOP/07), which includes the procedure to handle wildlife-related incidents, including bees.

2.2.1.2 According to the Aerodrome Wildlife Management Plan, the hazard related to insects is identified as a common hazard to aircraft ground operations & ground servicing operations. If the insects were spotted on the aircraft or ground servicing equipment, AOCC shall be informed of the incident, and AFRS will conduct the assessment and dispersal process. The process depends on the colony’s size. For small colonies with a less than 6-inch radius, immediate action with a dispersal activity followed by a risk assessment will be conducted.

2.2.1.3 In contrast, a colony exceeding a 6-inch radius necessitates two phases of evaluation: assessment 1 (first one to six hours) and assessment 2 (six hours later). Dispersal will occur when the colony forms groupings and no indication of absconding is present. Non-lethal methods (dispersal method and as discussed in 2.2.2) and lethal methods (pest control, including the use of poison or repellent compounds as discussed in 2.2.3) are the two (2) recommended hazard reduction strategies.

2.2.2 Research Collaborations

2.2.2.1 KLIA had formed research partnerships with the Forest Research Institute of Malaysia (FRIM) and Malaysia Agriculture Research & Development (MARDI) in order to examine the patterns of swarming activities and devise strategies for action or mitigation to reduce swarming in airside areas. One of the endeavours resulting from the partnerships with MARDI is MY Bee Savior™, which aims to establish standardised operating procedures for the removal of swarms of bees using the net while relocating beehives from public area, organise awareness campaigns concerning the sustainability of local honey bees, teach beehive relocation skills courses and coordinate bee-related research and development.

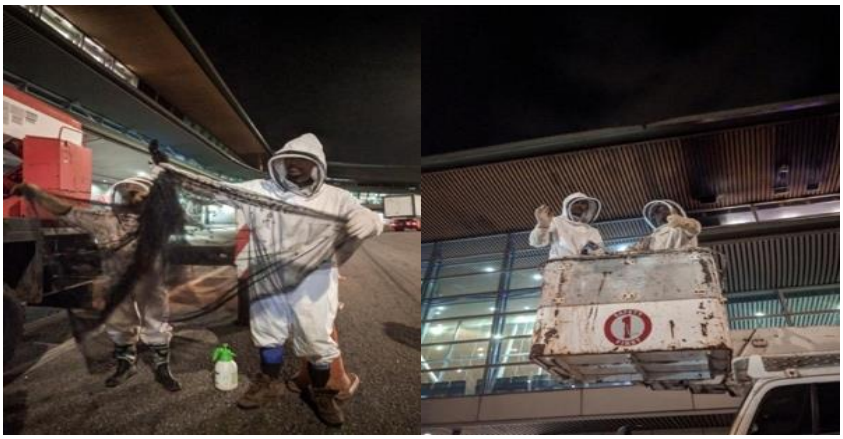

Figure 3: Bee rescue mission at KLIA by MY Bee Savior™

2.2.2.2 A separate partnership with FRIM aims to determine the presence of particular species in airside areas. Specimens collected will be sent to FRIM for species identification and the development of a mitigation strategy to reduce the occurrence of the species. Sampling and monitoring activities continue to be conducted within airside areas. KLIA can effectively mitigate the risks by consistently monitoring insect activity and adjusting their management strategies in response to changing circumstances.

2.2.2.3 Future planning encompasses establishing partnerships with environmental non-governmental organisations (NGOs) and local communities to enhance consciousness regarding bees and engage them in swarm management initiatives, thereby cultivating a collective sense of accountability and augmenting efficacy.

2.2.3 Pest Control

2.2.3.1 An additional option is to employ a pest control service to eliminate bees via fumigation. Due to the inability to predict the location (e.g., aircraft, buildings), preventive measures cannot be implemented in conjunction with monthly scheduled pest control services to avert insect infestation. Therefore, the bee pest control service is provided ad hoc or upon request (in the event of a reported bee swarming incident or when otherwise required).

2.2.4 Safety Information (SI) by CAAM

2.2.4.1 Safety Information 8/22, issued by the Civil Aviation Authority of Malaysia (CAAM) on March 28, 2024, addressed the obstruction of pitot probes on the ground and the pitot cover hazard. The objectives are to inform aircraft maintenance crew of the efforts to be made in order to protect Pitot probes on ground, and at recommending flight crew to accurately check the condition of Pitot probes before flight, and to carry out the abort/reject take-off procedure when airspeed indication is detected unreliable.

2.2.4.2 The SI can be obtained through the following link: SAFETY INFORMATION 8/2022

Figure 4: Pitot probe covered to avoid insects from entering the probe (*Source: FRIM Report, 2022*)

2.2.5 Eliminate potential nesting site

2.2.5.1 In order to deter bees from establishing colonies at KLIA, we have remained watchful and taken measures to eliminate suitable areas for nesting. This initiative is conducted regularly as part of daily routine inspections. This endeavour also includes engaging stakeholders located at KLIA, urging them to promptly report any instances of bee nests or clusters in their vicinity.

2.2.5.2 Bees can enter any structure or object that contains a hole that is a quarter of an inch or larger. Other factors can include favorable microclimates or abundant vegetation, since bees prefer to be within close proximity of a food source. In addition, by incorporating bee-friendly plants and habitats in airport landscaping can attract bees away from operational areas while supporting pollinator populations.

2.2.6 Designated areas for beehive (Apiculture)

2.2.6.1 In the future, KLIA intends to establish partnerships with MARDI and FRIM in order to assess the appropriateness of the designated area for beehives. As of now, none of the airports in Malaysia conduct research on the subject of beekeeping. It is imperative to establish an external "environment" for the bees beyond the aerodrome vicinity in order to prevent their aggregating on the airside.

2.2.6.2 Reference is made to Ohio State University Airport for their collaboration with the University's Entomology Department by setting up an apiary at a dedicated airport area to study the foraging ecology of honeybees (Figure 5). By setting up the "beehives" or providing shelter (home) for

the bees, this would be helpful to minimize the swarming activities and keeping bees away from the aerodrome.

Figure 5: Beehives at Ohio State University Airport (*Source: Ohio State University Airport Website*)

2.2.6.3 However, there has been considerable debate about the best location for the hives. Some research suggested that the hives should be placed near clear springs, ponds or shallow brooks and sheltered from strong winds. In hot tropical climates, hives are often placed under the shade of trees in summer. Most of the species are non-selective, hence it will be sufficient to start by planting any plants (flowering plant) that provide nectar and pollen and collaborate with several beekeeping associations or experts to work on the apiculture program.

2.2.7 Proper specimen handling for species identification by experts

2.2.7.1 KLIA is still continuing efforts to provide baseline data for bee species found in KLIA. As advised by FRIM, more sampling is required to be done within the airside areas to serve as a baseline data for insects (species occurrence). As of now, there is inadequate data on bee species found within the KLIA due to the lack of experts and no specimens collected for further identification. From the management plan there are only four (4) species that have been recorded including the Giant Honey Bee (*Apis Dorsata*), Asian Honey Bee (*Apis Cerana*), Dwarf Honey Bee (*Apis Florea*) and Tropical Carpenter Bee (*Xylocopa Latipes*).

2.2.7.2 Bees are very delicate specimens to handle, hence the right specimen preservation method is crucial to allow the species identification to be made. By preserving the specimens, it will allow us to provide a baseline data on the species occurrences of bees in KLIA, providing proper data documentation and allow us to study their morphological, trends, preferences and also their behavioral aspect. From these data, we might be able to predict the swarm occurrences and enabling preemptive measures to be taken.

2.2.8 Training of airport personnel in mitigation techniques

2.2.8.1 Wildlife hazards management training is an essential requirement for all airside personnel at KLIA. Regular training is conducted through the incorporation of insects in addition to the mitigation of wildlife threats. The wildlife hazard training program adheres to the guidelines outlined in the Civil Aviation Guidance Material (CAGM) 1400, which is recommended by the Civil Aviation Authority of Malaysia (CAAM).

2.2.8.2 To address matters pertaining to wildlife at KLIA, an entomologist specializing in insects and another ornithologist specializing in birds have been employed. In light of this expert's presence, KLIA anticipates that the wildlife mitigation action and training program will be executed efficiently and organise.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) share relevant best practices by other States in the Asia-Pacific Region;

c) suggest AP-WHM/WG to develop regional guidance materials pertaining to insect (bee) threat at aerodromes; and

d) discuss any relevant matters as appropriate.

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