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Examining the Surge in Zainuddin Abdul Madjid International Airport's Traffic Resulting from Tourism Influences and Global Events

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***Abstract*—Zainuddin Abdul Madjid International Airport on the island of Lombok is the venue for the international MOTO GP and WORLD SUPERBIKE events. Line existence of this research aims to provide information related to aircraft traffic during international events and compare it with traffic before international events, which resulted in increased traffic and workload for Air Traffic Controllers at Zainuddin Abdul Madjid International Airport. In this case, the author takes the data obtained from the officer who stores the flight data and then compares the traffic when the incident occurred and during normal circumstances using a comparative type of quantitative method and the author investigates the impact that occurred because of this.**

Keywords—Traffic, Event, Aircraft, Workload, Fatigue

I. INTRODUCTION

The Zainuddin Abdul Madjid International Airport is an airport that serves both domestic and international flights, and therefore, this airport has a significant amount of aircraft traffic involving take-offs and landings. Lombok is also an island with a lot of tourism, including places to visit, food, and culture. Lombok is also the location of annual international events such as the MotoGP and World Superbike (WSBK). This also contributes to the high volume of aircraft traffic at Zainuddin Abdul Madjid Airport. [1][2]

The Madjid Tower is the term used for the air traffic control tower owned by Zainuddin Abdul Madjid International Airport. Madjid Tower is a combined TWR/APP unit whose responsibilities include the movement area (apron, taxiway, and runway) and airspace with a vertical coverage of 6000 ft and a lateral coverage of 30 NM. Therefore, in daily practice, a tower controller is responsible for aircraft from the start, pushback, ATC clearance, taxiing from the apron to the runway, aircraft take-off, controlling aircraft within the airspace with a vertical coverage of 6000 ft and a lateral coverage of 30 NM until the aircraft is transferred to Bali Radar. Similarly, for arriving traffic, a tower controller is responsible for the aircraft transfer by Bali Radar, then providing approach clearance to the landing aircraft, giving landing instructions, and guiding the aircraft from the exit runway to the apron parking stand.". [3][4][5]

The Lombok International Airport has 24 parking stands and 4 taxiways as shown in the following image :

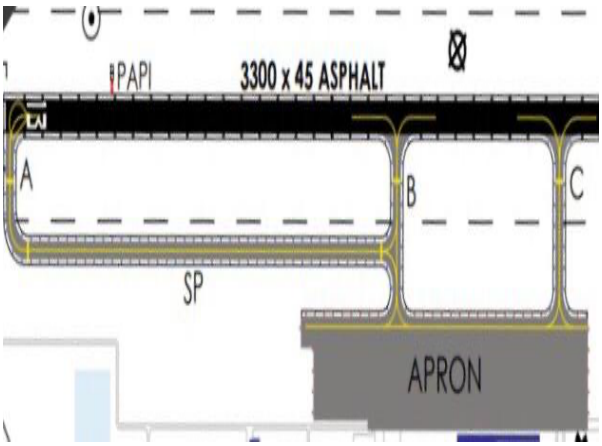

Fig 1. Layout Runway and Movement Area

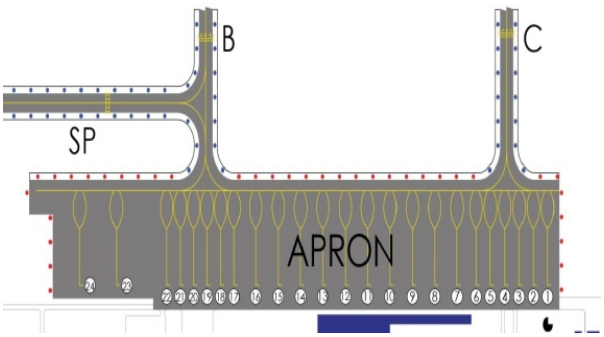

Fig 2. Apron Lombok International Airport

With a significant number of parking stands and conditions on the apron as depicted in the above image, there are often requests for apron usage that require coordination with other units (AMC, ARO, Runway, etc.), such as aircraft requesting pushback and start-up, requesting clearance simultaneously, requesting a taxi, and aircraft wishing to reposition from one parking stand to another. Aircraft may request permission to perform compass swinging on the apron, not to mention the tractors that often request to cross the apron, taxiway, and runway, as well as the grass-cutting operations that usually move around on the apron and taxiway. The high volume of activity on this apron will result in a significant increase in communication load and ATC workload. [6][7][8][9]

Based on the traffic data from the daily movements of Public Company LPPNPI Branch Lombok, the average daily traffic for take-offs and landings at Zainuddin Abdul Madjid Airport reaches between 50 and 90 traffic. This data is based on aircraft movements during the pandemic era where, for the current new normal era, there is a possibility of a 2x increase in traffic compared to usual [10]. Additionally, Lombok is a tourist destination, and there are annual events such as MotoGP and World Superbike (WSBK), which are likely to cause a surge in traffic. [2][10][11][12]

II. LITERATURE REVIEW

The workload in the aviation industry is an event that significantly affects one's mental state and frustration level. Consequently, an air traffic controller may experience depression, stress, and fatigue when faced with an excessive workload that exceeds their limits. The workload for an air traffic controller can be calculated to ensure that each controller does not exceed their capabilities. This can reduce fatigue during duty, excessive workload, and the likelihood of accidents. [8][9][13]

International events are events held with an international nature where participants come from different countries. As is the case with ongoing events in the Mandalika region of Lombok for the next 10 years, such as the international MotoGP and World Superbike events, this is likely to increase aircraft traffic due to heightened visitor enthusiasm. [2][12]

III. METHODOLOGY

A quantitative methodology is a research approach used to collect, analyze, and interpret data in numerical and statistical form. This approach is often utilized in social sciences, natural sciences, economics, and various other research fields. Quantitative methods are frequently employed to address research questions that are numerical in nature, identify correlations, construct mathematical models, or measure the impact of interventions or changes in a variable. This approach is particularly useful for scientific research that requires large data collection and systematic analysis. In this study, the author will use a quantitative research method with a comparative type. Comparative quantitative research is a type of research that involves comparing two or more groups, conditions, or variables to identify differences or relationships between them. This method aims to measure, analyse, and understand differences or relationships between groups or variables using quantitative data. The author will compare two sets of data that have been collected: data on aircraft movement during the WSBK and G20 events in November 2021 and data on aircraft movement during the WSBK and G20 events in November 2022. These datasets contain information about the number of traffic movements during arrivals and departures at Zainuddin Abdul Madjid International Airport per day for one month. The data will then be compared to observe the annual increase, and this data from the two tables will be compared to data from regular days before the events. [14][15]

IV. RESULTS AND DISCUSSION

Data is obtained from aviation safety personnel who manage and store all flight data at Zainuddin Abdul Madjid International Airport. Air Navigation personnel who handle flight data typically work in a department known as Aeronautical Data Management (ADM) or Data Management Unit (DMU) in the Air Navigation Service Provider (ANSP). Aeronautical Data Management (ADM) is a crucial part of flight operations, responsible for collecting, managing, and providing the aeronautical data required for safe aircraft navigation and operations. It is an integral part of the air traffic system and directly impacts flight safety. All data collected is real data regarding aircraft movements at Zainuddin Abdul Madjid International Airport. Table 1 below presents the data obtained from Air Navigation personnel at the Lombok branch who manage flight data, also known as Aeronautical Data Management (ADM). [16][17]

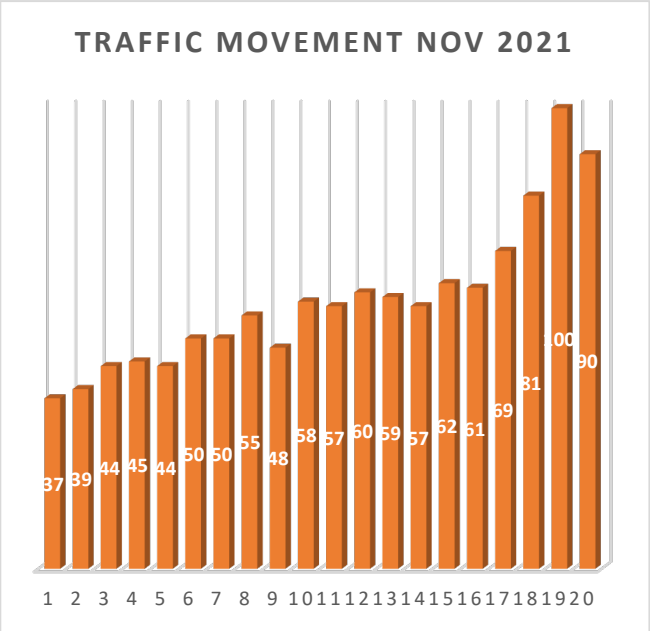

Fig 3. Graph aircraft Movement Chart during the WSBK and G20 Events in November 2021

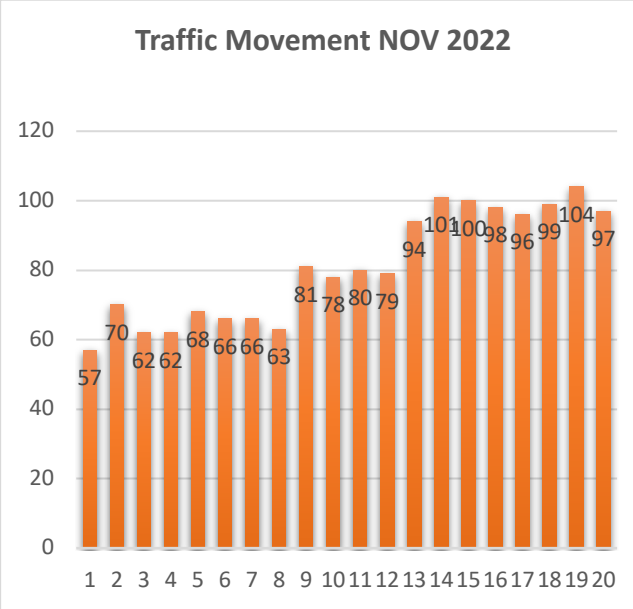

Fig 4. Graph aircraft Movement Chart during the WSBK and G20 Events in November 2022

A. *Data Analysis Method*

The data presented in the results chapter was obtained from ADM (Aeronautical Data Management) at the Lombok branch of Air Navigation during the international events, namely Moto GP and World Superbike (WSBK), in 2021 and 2022 in the same month, December. It can be observed that traffic data during international events is higher compared to traffic data on normal days when there are no international events. Normally, traffic ranges from 30 to 70 movements, while during events, it can reach 40 to 100 movements. Additionally, there is a possibility that traffic will continue to increase in the coming years, considering that Lombok will host the annual WSBK and Moto GP events for the next 10 years. Furthermore, these international events take place at the end of the year, coinciding with the year-end and Christmas holidays, and Lombok's renowned beauty as a tourist destination can attract travellers, leading to increased flight demands. [2][10][11][12][18]

B. *Discussion*

The increase in traffic due to international events such as Moto GP and World Superbike (WSBK) has an impact on existing flights. The impacts on air traffic controllers and flights due to traffic density at Abdul Madjid International Airport are as follows:

A. *Increased ATC Workload*

With increased traffic, ATC tasks are affected, as ATC needs to communicate more with pilots and focus on managing the surging traffic. Additionally, Air Traffic Controllers need to coordinate with various parties, including the airport's ATC units in the vicinity and those within Abdul Madjid Airport itself, such as Apron Movement Control (AMC), Tafor, Aeronautical Information Service (AIS), and others. This can lead to fatigue among ATC personnel and pose a risk to flights. [6][7][8][9][13][19]

B. *Increased Likelihood of Flight Delays*

Even during normal traffic conditions, there are possibilities of delays due to operational or weather-related issues. However, with Lombok's limited and narrow airspace capacity, traffic flow is likely to be affected, especially during international events, which attract a significant number of visitors to the island. This can lead to an increased likelihood of flight delays caused by the surge in passenger numbers, leading to an increased demand for flights and affecting ground capacity, including the number and size of aprons and parking stands. Delays can impact flights by disrupting passenger comfort. [20][21][22]

C. *It inhibits the provided efficiency.*

The high increase in traffic results in congestion in the airspace managed by Lombok Tower. Lombok's airspace is known to be relatively narrow, with a vertical coverage of up to 6000 ft and lateral coverage of 30 NM. This requires ATC in Lombok to optimize and manage work shifts and available resources to prevent fatigue and provide maximum safety services. All of this is closely related to safety management systems. Traffic flow should be maintained for aircraft, and safety personnel at the Air Navigation Lombok branch should enhance the existing safety systems in preparation for international events that will continue for the next 10 years. [23][24]

V. CONCLUSION

In normal circumstances, Zainuddin Abdul Madjid International Airport already experiences significant traffic because of its small and narrow airspace, with airspace coverage of up to 6000 ft vertically and 30 NM laterally. With the upcoming international events that will be held for ten consecutive years and considering that Lombok Island offers a wealth of tourism and a unique culture that will attract many visitors, this will lead to increased demand for flights compared to usual and will impact the total traffic at Abdul Madjid International Airport.

Not only that but there are also various impacts on air traffic controllers and flights due to the high-density traffic at Abdul Madjid International Airport, including:

A. *Increased ATC Workload*

The increase in traffic during international events will add to the workload of air traffic controllers. Moreover, since this is an international event, air traffic controllers may encounter unexpected traffic, requiring them to be more aware of the traffic.

B. *Higher Potential for Flight Delays*

International events will result in higher demand for flights to Lombok. However, given Lombok's small and narrow

airspace capacity, it will affect aircraft traffic flow, and flight delays may occur during the events.

C. *Hindrance to Service Outcomes, Resulting in Suboptimal Service*

The high-density traffic during international events will require ATC in Lombok to maximize and manage work shifts and available resources to prevent fatigue and provide maximum safety services. All of this is related to safety management systems. Safety personnel at the Air Navigation Lombok branch should enhance the existing safety systems in preparation for international events that will continue for the next ten years.

Recommendations

The author suggests preparing for the anticipated impacts, including improving safety measures, shift scheduling to prevent ATC fatigue during duty, and enhancing air traffic management, such as slot time allocation and apron parking stand arrangements. These measures are necessary to manage the peak traffic during international events and to anticipate both domestic and international visitors who will come to Lombok during hectic times like the Christmas and New Year holidays.

There are several suggestions that can be implemented :

1. Enhancement of Safety Management System (SMS): Air Navigation Branch Lombok should ensure that the Safety Management System is improved to anticipate the surge in traffic. This involves providing additional training for security personnel, better evacuation planning, and a reevaluation of existing safety procedures.
2. Wise Shift Scheduling: When dealing with increased traffic during international events, the scheduling of shifts for air traffic controllers should be more judicious. Ensure there is sufficient rotation to prevent fatigue that could impair their decision-making while managing air traffic. Routine evaluations and mental health monitoring should also be part of the human resource management strategy.
3. Slot Time Arrangements: To reduce the potential for flight delays, precise slot time arrangements are necessary. The airport should collaborate with airlines to determine arrival and departure slots that align with the airport's capacity. This will help avoid confusion and schedule overlaps in flight operations.
4. Apron Parking Arrangements: Effective parking arrangements for aircraft on the apron are crucial. Ensure that there is ample parking space on the apron to accommodate additional aircraft during international events. This will also help avoid aircraft overlap, which can lead to delays.
5. Effective Communication: Ensure that effective communication occurs among all relevant parties, including airlines, airport authorities, and air traffic controllers. This will assist in coordinating all operations and preventing confusion.
6. Passenger Education: Inform passengers about potential flight delays that may occur during international events. Provide clear information on the actions they should take in case of delays or changes to flight schedules.
7. Routine Evaluation: After each international event, conduct routine evaluations to identify emerging issues and find better solutions for future events.

All of these steps can help manage the surge in traffic during international events at Zainuddin Abdul Madjid International Airport more effectively and ensure that the services provided remain optimal and safe for all parties involved.

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