

A Review of Radio Communication Range for Air Traffic Services

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Abstract— OJT activity is an activity of the Higher Education Tridharma (Education, Research and Community Service) which aims to get to know and add insight and scope of work according to the field of assignment, as well as an encouragement to cadets to be able to work individually or work in a team competently. the data carried out in this research is based on the author's observations and data on the ATS Operational Logbook Unit Approach Control Procedural Airnav Tarakan Branch from September to December 2022, so as to obtain results. In carrying out their duties, ATC really needs situational awareness related to matters regarding ATC internal and external conditions. Based on the author's observations during OJT, traffic conditions at Juwata International Airport are very high. However, the radio communication range used by ATC is less than optimal, causing consequences that can interfere with the comfort of flight traffic services.

Keywords— radio coverage, situational awareness, ATC

I. INTRODUCTION

Indonesian Aviation Polytechnic Curug (PPIC) as an organizing body for education and training in the field of aviation, produces skilled, capable, expert and professional human resources (HR). One form of educational activity carried out to produce superior human resources is On The Job Training (OJT) activities. OJT activities are an activity of the Tridharma of Higher Education (Education, Research and Community Service) which aims to get to know and add insight and scope of work according to the field of duty, as well as encouragement to cadets to be able to work individually and work in teams competently [28]. The OJT activities held by the PPIC Air Traffic Study Program include Aerodrome Control Tower, Approach Control Procedural, and Approach Control Surveillance. Approach Control Procedural OJT activities are carried out in semester 5 at the Approach Control Unit at airports in Indonesia and are carried out for 3 months or the equivalent of 15 credits. In accordance with the Letter of the Director of the Indonesian Aviation Polytechnic Curug dated March 11, 2022 regarding the Letter of Introduction to OJT Diploma IV Lalu Lintas Udara (LLU) - 27 in the field of Approach Control Procedural, one of the locations of On The Job Training activities is Juwata International Airport, specifically at the Approach Control Procedural (APP) Unit of the Tarakan Branch Aviation Navigation Service Provider Corporation or better known as Airnav Tarakan Branch [29]. Juwata Airport is located in

Tarakan City, North Kalimantan province. The airport is located only about 3 km from the city center. Juwata International Airport Tarakan, North Kalimantan, with a runway length of 2250 meters x 45 meters [1]. The Approach Control Procedural (APP) unit of Airnav Tarakan Branch has the responsibility of providing Approach Control Services at the Juwata International Airport Control Zone. Based on the Standard Operational Procedure (SOP) [2]. The Tarakan APP area has a range of 100 Nm centered from "TRK" VOR / DME and has an extension of the traffic corridor centered from "BRZ" VOR / DME to point MABOT, so that the Tarakan APP airspace has a range of 182 Nm centered from "TRK" VOR / DME.

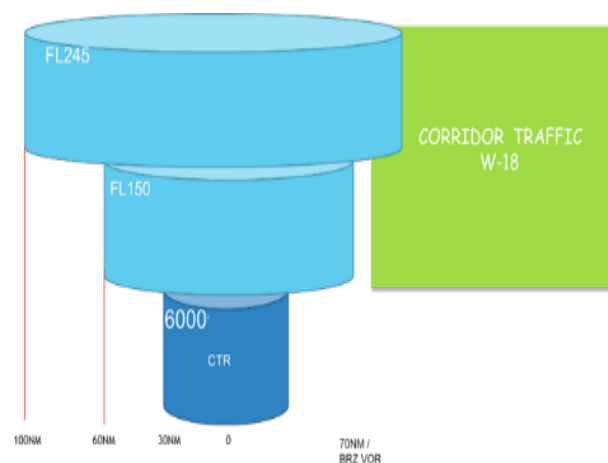


Figure 1. Tarakan Airspace

As an Air Traffic Controller (ATC) has air traffic service objectives, namely "five objectives of Air Traffic Services" by providing safe, comfortable and efficient air traffic services [12].

Based on the author's observations and data on the ATS Operational Logbook Unit Approach Control Procedural Airnav Indonesia Tarakan Branch September 2022 to December 2022, there are several problems that become obstacles in providing optimal flight traffic services. The obstacle faced in providing aviation traffic services in the Tarakan APP area is the range of radio communication that does not reach all of the Tarakan APP airspace [24]. Aircraft flying from Balikpapan below FL150 and entering Tarakan APP airspace sometimes have difficulty communicating with Tarakan APP. Similarly, aircraft leaving Tarakan APP at



distances of more than 130 Nm and at altitudes below FL150 sometimes have difficulty communicating with Tarakan APP.

As mentioned in the LOCA between Balikpapan and Tarakan APP [3]. It states that "All aircraft in the Balikpapan sector area under the TMA Tarakan area must be delegated to Tarakan APP until two-way communication is established and for VHF radio issues the coverage of Tarakan APP". But in fact there are still aircraft that are not controlled by these two units. So that it can potentially cause hazards [22]. The biggest potential hazard that can be caused by the condition of Tarakan APP radio frequencies that do not reach all of Tarakan APP's airspace is the delay in two-way communication between the aircraft and the controller [7]. Ideally air communication facilities should allow direct, rapid, continuous and uninterrupted two-way communication to take place between the unit providing the service and a suitably equipped aircraft under its control [11].

For example, on October 15, 2022 there were, 3 aircraft from Wings Abadi airline, namely, WON 1364, WON 2362, and WON 2366 (ATR 72) on the Balikpapan - Kalimantan route with an altitude of FL 150. The three aircraft experienced problems when trying two-way communication with Tarakan Approach. Where it can be seen from the ATS Operational Logbook when WON 1364 tries to make two-way communication with Tarakan Approach but the sound transmitted is intermittent and finally can make two-way communication with Tarakan Approach at a distance of 66 Nm from BRZ [16]. As for WON 2362 and WON 2366 can establish two-way communication with Tarakan Approach at a distance of about 85 Nm from BRZ..

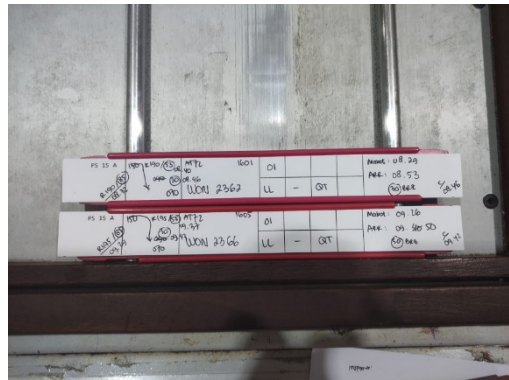


Figure 4. Flight Progress Strip WON 2366 and WON 2362

On another day, on October 30, 2022, there was an example of a situation where WON 1420 (ATR 72) with the route Balikpapan - Tarakan with an altitude of FL 150 could not establish two-way communication with Tarakan Approach and finally got a relay from WALET 11 (C212) with the route Long Bawan - Tarakan, and got the position of WON 1420 on Radial 187 with a distance of 181 Nm from TRK. WON 1420 could only establish two-way communication with Tarakan Approach at a distance of 126 Nm with readability 4.

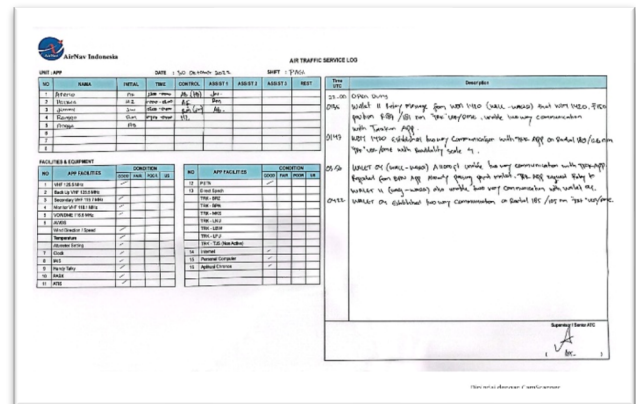


Figure 5. ATS Operational Logbook 30th October 2022

Where there is a WALET 04 (C212) aircraft with the route Balikpapan - Tarakan with an altitude of A11000 has not been able to establish two-way communication with Tarakan Approach. Based on reports from Balikpapan Approach WALET 04 has passed the MABOT point. And tried to request relay assistance from WALET 11, but still could not establish two-way communication with Tarakan Approach. Then, WALET 04 can make two-way communication with Tarakan Approach on Radial 185 with a distance of 105 Nm. From this it can be seen that with the position of WON 1420 at a distance of 181 Nm from TRK, it cannot establish two-way communication with Tarakan Approach. Then, looking at the case of WALET 04 at altitude A11000 only established two-way communication with Tarakan Approach at a distance of 105 Nm. It can be concluded that the radio coverage of Tarakan Approach itself has not been able to reach the distance and altitude of the two aircraft [17].

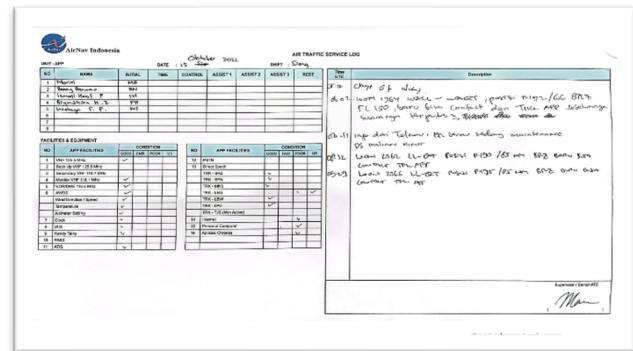


Figure 2. ATS Operational Logbook 15th October 2022

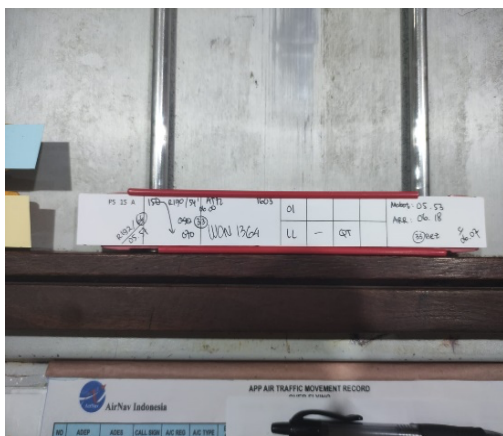


Figure 3. Flight Progress Strip WON 1364



Figure 6. Flight Progress Strip WALET 04

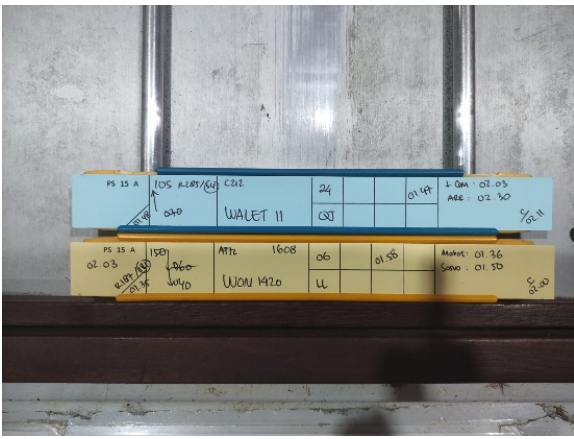


Figure 7. Flight Progress Strip WALET 11 and WON 1420

II. METHOD

For this study, the qualitative description method was chosen as the best way to conduct the research. This works well when the main goal is to provide a simple and clear explanation for something.

In qualitative description methods, researchers focus on understanding fundamental details. Find out who was involved, what happened and where it all happened. This approach is great for seeing things clearly.

When a phenomenon needs to be described directly, a qualitative description method must be chosen. This approach is useful when researchers want to understand an event, who was involved, what was involved, and where it happened [15].

This study used observational data collection techniques, defined as the use of instruments to record symptoms and record them for scientific or other purposes. Further, observation is the collection of impressions of the world around us based on all human sensory abilities [21].

By taking a qualitative approach and utilizing the collection of observational data, deeper understanding and solutions can be achieved. This approach allows the researcher to gain insight into the topic and gain insight into the topic.

III. RESULT AND DISCUSSION

Juwata Tarakan Airport is one of the airports in Indonesia that serves domestic and international flight routes. An ATC

is required to work in complex, dynamic and time-limited traffic conditions [19]. These demands explain that being an ATC requires complex cognitive processes, a high level of awareness and good mental representation [14]. Where a controller has the main task of preventing collisions between aircraft [10]. As also written in the Approach Control Procedural (APP) Flight Traffic Service Standard Operating Procedure at Perum LPPNPI Tarakan Branch states that the Air Traffic Control Service of Perum LPPNPI Tarakan Branch is the provision of Approach Control Service functions on aircraft under its responsibility to ensure safety, order, smooth flight traffic and prevent collisions:

- a) All aircraft departing from Juwata Tarakan Airport and Kalimantan Berau Airport via route W18;
- b) All aircraft landing at Juwata Tarakan Airport and Kalimantan Berau Airport via route W18;
- c) All Aircraft departing and landing outside Juwata Tarakan Airport but still within the TMA/APP Tarakan Approach area via direct route (DCT) [2].

The most significant threat arising from the inability of Tarakan APP's radio frequency to cover the entire Tarakan airspace is the delay in two-way communication between the aircraft and the controller [5]. Other impacts that can arise from these problems include:

1. Tarakan APP is not optimal in communicating and knowing the position of aircraft in Tarakan APP airspace. According to Stephen Morris and Hyun Song Shin in his journal entitled European Economic Association mentioned that Optimal communication to a group often entails a trade-off between precision of information conveyed and common understanding (or approximate common knowledge) of the information within the group [20].
2. Tarakan APP is not optimal in providing traffic information according to the current position of aircraft in Tarakan APP airspace;
3. Tarakan APP has difficulty in determining separation or departure clearance for aircraft that have potential conflicts in Tarakan APP airspace. In document 4444 chapter 5 explained that Any manoeuvre which would reduce the separation between two aircraft to less than the applicable separation in the circumstances shall not be cleared to a distance less than the minimum separation applicable in the circumstances [10].
4. The workload of controllers in the Tarakan APP unit has increased due to efforts to establish communication with aircraft in the Tarakan APP airspace, and must be done through relays from other aircraft or coordinate with other ATS units to find out the current position of the aircraft. According Majumdar and Ochieng in his article entitled Factors Affecting Air Traffic Controller Workload mentioned that Airspace capacity in a high-density air traffic network is determined by controller workload. Controller workload is primarily affected by the features of the air traffic and air traffic control (ATC) sector [18].
5. Tarakan APP has difficulty in ascertaining whether aircraft leaving Tarakan APP airspace have established communication with the next ATS unit;
6. Breakdown of Coordination (BOC) and even Breakdown of Separation (BOS) may occur. Breakdowns in team coordination can lead to significant disruption to an operational response [6].

From some of the potential hazards above, there is a connection with the readback and hearback that pilots must do with the controller. In circular letter AirNav Indonesia has submitted procedures regarding readback and also hearback where in points b. and c. states that:

- The air traffic control unit should ensure that clearances or other instructions, including conditional clearances, are read-back or responded to by airmen to ensure that they understand and will carry out ATC clearances and instructions.
- The flight traffic controller should listen to the read-back to ensure that clearances and instructions have been correctly responded to by the airman and should take immediate action if there are any discrepancies in the read-back [30].

In providing aviation traffic services, in addition to requiring qualified and reliable aviation traffic guides in carrying out their duties to regulate / guide the flow of flight traffic that is safe, fast, and efficient must also be supported by adequate facilities and infrastructure so that the provision of aviation traffic services can be provided optimally, one of which is communication equipment facilities that can work / can be used optimally so that aviation traffic services can be provided optimally [13]. Therefore, based on the explanation above, the author tries to provide alternative problem solving as follows;

1. Short Term

a. Improve coordination with Kalimantan unit. For aircraft with routes from or to Balikpapan that may have difficulty communicating two-way with Tarakan Approach either entering or leaving Tarakan Approach airspace, communication will be delegated to the Kalimantan tower so that the aircraft remains established until two-way communication with the next unit is established. With a record of having coordinated with Kalimantan tower.

b. Improve coordination with Balikpapan Approach and Balikpapan Info units. For aircraft with routes from or to Balikpapan, Tarakan Approach will coordinate intensively with Balikpapan Approach or Balikpapan Info in order to know the current position of the aircraft that will leave or enter the airspace of Tarakan Approach.

2. Long Term

a. Optimizing the range of VHF radio frequency Tarakan Approach so that it can reach all Tarakan Approach airspace [25].

b. HF frequency range optimization from Balikpapan Info.

c. Increase maintenance on the quality of radio communication equipment in Perum LPPNPI Tarakan Branch, because by doing regular maintenance, it is expected that the quality of communication equipment can be maximized [23].

d. Ensure that all aircraft operating in Tarakan airspace Approach be equipped with VHF and HF communication equipment [27].

IV. CONCLUSION

From the results of the discussion of the problem, the author can conclude on the Tarakan Approach unit of AirNav Tarakan Branch that a controller is required to work in complex, dynamic, and time-limited traffic conditions [26]. Where in the process the controller must work optimally based on available information sources, data from flight progress strips, and certainty of two-way communication with pilots to be able to quickly analyze the potential for a conflict between aircraft. These demands explain that being an ATC requires complex cognitive processes, a high level of awareness and good mental representation [4]. In addition, the ability to select and recall information, anticipation and conflict management are also required by ATC in carrying out their duties [9].

In providing aviation traffic services, in addition to requiring qualified and reliable aviation traffic guides in carrying out their duties to regulate / guide the flow of safe, fast and efficient aviation traffic must also be supported by adequate facilities and infrastructure so that the provision of aviation traffic services can be provided optimally, one of which is communication equipment facilities that can work / can be used optimally so that aviation traffic services can be provided optimally.

From the problems and solutions that have been discussed, by realizing some of the solutions that the author provides, the author hopes to support the creation of effectiveness, efficiency, and safety in flight operations. In addition, if the solution has been realized, the author can provide suggestions for checking (maintenance) on the equipment regularly and periodically. Thus, the various equipment can continue to support the performance of ATC in providing flight traffic services [8].

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