

## **Feasibility Analysis of Weather Observation Equipment at Meteorological Stations in Supporting Flight Safety at Rahadi Oesman Ketapang Airport**

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### **Abstract**

Weather is one of the main factors for the world of aviation in supporting flight safety. Because aircraft are included in the mode of transportation that occurs in the atmosphere, so it greatly influences the operation of aircraft. Bad weather can cause flight schedules to change suddenly, causing delays and threatening flight safety. Therefore it is necessary to carry out weather observations, these observations are carried out by an agency called the Meteorological Station. The implementation of weather observations requires meteorological tools, these tools are divided into two types, namely conventional tools and automatic tools. What must be considered from the weather observation tool at the Rahadi Oesman Ketapang Meteorological Station is its feasibility. Therefore, this study aims to determine the condition of weather observation tools in supporting flight safety and to determine the obstacles experienced by the Ketapang Meteorological Station and the handling of these obstacles. This study used qualitative research methods. The data needed is primary data in the form of interviews and observations. And secondary data documentation in the form of data obtained from the Rahadi Oesman Ketapang Meteorological Station, in addition to other data obtained through journals, articles, or previous research that has something to do with the research that researchers are doing. Data analysis techniques in this study used data reduction, data presentation and conclusion. Based on the data obtained from this study, the tools used at the Rahadi Oesman Ketapang Meteorological Station are operationally feasible, as evidenced by the results in the latest calibration certificate. However, after the calibration was carried out the following month, several obstacles were found, such as conventional and automatic tools that had problems, such as broken glass thermometers, sensors and networks on AWOS and AWS, frequent interruptions occurred which prevented data transmission, and the rain gauge was damaged. Then constrained by a very minimal supply of spare parts, so it is necessary to increase the spare parts.

**Keywords:** Weather Observation Tool, Meteorology, Aviation Safety



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### **INTRODUCTION**

Indonesia is the largest archipelagic country in the world, where the distance between one island and another is quite far apart, it is necessary to have a mode of transportation that can make it easier for humans to carry out inter-island travel activities. Transportation is expected to facilitate the movement of goods and people by always paying attention to the safety of passengers and saving time in its implementation. Easy transportation and shorten the time is air transportation. Weather is one of the main factors for the world of aviation in supporting flight safety. Because aircraft are included in the mode of transportation that occurs in the atmosphere, so it greatly influences the operation of aircraft. As we know, there have been many plane crashes due to bad weather conditions or the weather as the cause, even though the weather is classified as a natural phenomenon that has existed since the creation of the universe. Weather conditions can be categorized in several situations. There are categories of good weather (clear weather) to bad weather categories (bad weather). These various

conditions will determine the flight process, whether the flight can be continued, postponed or cancelled.

There are various types of services provided to aircraft. Based on Law number 1 of 2009 concerning Aviation, the types of services provided include air traffic services, aviation telecommunications services, aviation meteorological information services, aeronautical services and search and rescue services. Of these types of services that can overcome weather problems is aviation meteorology, in Indonesia managed by BMKG. BMKG is the Meteorology, Climatology and Geophysics Agency. This institution is tasked with replacing, processing, analyzing, disseminating information on Meteorology (Weather), Climatology (Climate), and Geophysics (Earthquakes and Tsunamis) (Anjani and Liberti, 2021). BMKG is divided into three parts, namely the Meteorological Station, Climatology Station and Geophysics Station. The weather observations are regulated by the Meteorological Station. Therefore, weather activity can be observed and explained by the science of meteorology.

Meteorology is a science that studies the processes of weather formation and changes that occur in the atmosphere (Pradana, 2015). Meteorology itself is divided into several branches including Aviation Meteorology, Agricultural Meteorology, Hydrometeorology, Synoptic Meteorology, Maritime Meteorology, Climatology/Climate, Aerological Meteorology. Especially in the operation of aircraft requires a branch of science that studies and discusses weather conditions for aviation purposes, the branch of science is Aviation Meteorology. In aviation meteorology there are several weather-forming elements that influence, among others, air temperature, surface wind speed, air pressure, clouds, rainfall, and visibility).

The Class Meteorological Station at Rahadi Oesman Ketapang Airport has several meteorological equipment that functions as a weather observation tool for aviation purposes, both manual equipment and digital equipment. The implementation of weather observations requires meteorological instruments that are placed on an open and flat ground surface which is the physical location of meteorological instruments called the Tool Park. The weather observation tools for aviation purposes are a thermometer, thermohygrometer, anemometer, barometer, rain gauge, psychrometer, meteorological cage (max-min thermometer and dry-bulb thermometer), automatic weather station (AWS) and automatic weather observing system (AWOS). The existence of a weather monitoring device or weather station is a mandatory tool for airport authorities. This tool plays an important role in supporting flight safety, especially when landing and taking off. Meteorological stations support navigation in particular to provide real-time or predictive weather information before flying. With this meteorological information, flights become more comfortable, efficient and safe.

In terms of the equipment used by the Ketapang Meteorological Station, it is currently quite complete. It's just that, if we look at the calibration (regular equipment checks) and the latest routine checks carried out at the Ketapang Meteorological Station, it was found that some equipment was not functioning properly. Among them, namely, the Hellman Rain Gauge, the Hellman rain gauge functions to measure the amount of rainfall automatically by recording it on a measuring tape (gauge) by calculating the amount of rainfall that falls by looking at the graph recorded every hour. Damage to the Hellman rain gauge causes inaccurate rainfall values resulting in inaccurate delivery of data in the form of information to the Automatic Weather Station (AWS) and Automatic Weather Observing System (AWOS) devices. Apart from the Hellman rain gauge, there are also tools that do not work, namely the Automatic Weather Observing System (AWOS) and Automatic Weather Station (AWS). This tool functions to measure, record and record meteorological parameters automatically in the form of meteorological data (temperature, pressure, humidity, rainfall, solar radiation, cloud height, wind direction and wind speed).

The weather measurement results can be seen in the form of electrical data which will be stored and converted in a data logger so that it can be displayed on a computer or translator display screen. The problem that occurs with the AWOS tool is that the wind sensor is damaged and the AWS tool is damaged, namely the humidity sensor. In other words, the officer cannot provide accurate information on the presentation of the data in the form of METAR or SPECI and TAF to the airport and Air Traffic Control (ATC), so that it can have an impact on the aircraft that will take off or land, namely undershoot or overshoot. Data from this meteorological station plays a significant role in ensuring the safety and comfort of passengers. Therefore, the weather is a factor that affects a flight, and to find out the weather conditions, a weather observation tool is needed where the tool must be in good condition according to the standard, which can be seen from the age of the tool, its accuracy, function, and the number of tools needed. Because it can affect the delivery of information and the accuracy of the data submitted, so it is necessary to check periodically and routinely to determine its feasibility. The objectives of this research are: To find out the condition of the weather observation equipment used to support flight safety and to find out what are the obstacles experienced by the Ketapang Meteorological Station and to find out the handling given to the obstacles.

## **Theoretical Basis**

### **Air Transport**

Transportation is defined as an activity that transports or transfers cargo (people or goods) from one place to another, or from a place of origin to a destination, or Origin to Destination. Based on this understanding, air transportation can be defined as an activity that transports or transfers passengers and cargo from an airport of origin to an airport of destination, using an airplane. Aircraft as a mode of air transportation with characteristics, namely having high speeds and being able to reach places that can be served by other modes of transportation (Hutagaul, 2013). With the movement of goods and people, transportation is one of the sectors that can support economic activity and provide services for economic development.

### **Airport**

According to the Minister of Transportation Regulation of 2010 concerning National Airports, an airport is an area on land or water with certain restrictions that is used as a place for aircraft to land and take off, board and drop passengers, load and unload goods, and place intra and modal transfers. transportation equipped with aviation safety and security facilities, as well as basic facilities and other supporting facilities, which consist of general airports and special airports, these public airports are called airports. In short, an airport is a defined area on land or water (including buildings, installations and equipment) intended to be used, either in whole or in part, for the arrival, departure and ground movement of aircraft.

### **Aviation Safety**

Aviation safety is prioritized in accordance with Law Number 1 of 2009 concerning Aviation which must be fulfilled by airport operators, air transportation operators, flight navigation operators, namely part of aviation safety, Aviation Safety is a condition in which safety requirements are met in the use of airspace. , aircraft, airports, air transportation, flight navigation, as well as supporting facilities and other public facilities. Aviation safety is based on Annex 13 of ICAO (International Civil Aviation Organization) concerning Aviation Accident Investigation, which is a condition in which a flight runs smoothly from take-off to landing at the destination with no accidents or incidents. Therefore, safety and security factors are the

most important things that are the main focus in organizing transportation in Indonesia. The Ministry of Transportation in the 2015-2019 Strategic Plan (Renstra) has outlined the national targets for the development of the transportation sector in 3 aspects, namely safety and security; transportation services; and transport capacity. From the Strategic Plan of the Ministry of Transportation it appears that safety and security aspects are the main focus in the development targets of the transportation sector, which include reducing the number of transportation accidents and reducing the number of security disturbances in the implementation of transportation.

#### Meteorology Climatology and Geophysics Council

The Head of the Meteorology, Climatology and Geophysics Agency Number 3 of 2016 concerning the Organization and Work Procedure of the Meteorology, Climatology and Geophysics Agency stated that the Meteorology, Climatology and Geophysics Agency, hereinafter referred to as BMKG, is a Non-Ministry Government Institution that is under and is responsible to the President. BMKG is the Meteorology, Climatology and Geophysics Agency. This institution has the task of observing, processing, analyzing, disseminating information on Meteorology, Climatology and Geophysics. BMKG has 5 Regional Centers I-V and 180 Meteorology Stations, Geophysics Stations, and Climatology Stations to support their tasks. In addition there are also 3 Global Atmosphere Monitoring Stations located on Kototabang Hill (West Sumatra), Lore Lindu Bariri (Palu), and the Peak of the Klademak Temple in Sorong, West Papua (Anjani and Liberti, 2021). The BMKG Organizational Structure consists of the Head, Main Secretariat, Deputy for Meteorology, Deputy for Climatology, Deputy for Geophysics, Deputy for Instrumentation, Calibration, Engineering and Communication Networks, Inspectorate, Center, Technical Implementation Unit.

#### **Meteorology**

There are several definitions of meteorology. Meteorology comes from two Greek words which have the same meaning or meaning, namely meteora which means upper air space (atmosphere) and logos which means science. So, meteorology is a science that studies the changes that occur in the lower atmosphere of the earth (Pradana, 2015). Law of the Republic of Indonesia Number 31 of 2009 concerning Meteorology, Climatology and Geophysics states that meteorology is a natural phenomenon related to weather. In the Big Indonesian Dictionary, meteorology is defined as a branch of geography that studies the physical characteristics of the atmosphere to predict weather conditions in a particular place and throughout the world in general. Another definition of meteorology is that meteorology is a science that studies the processes of formation and changes in the weather that occur in the atmosphere, especially in the lower layers, namely the troposphere.

#### Elements of Weather in Aviation

Weather is one of the main factors for the world of aviation. As we know, there have been many plane crashes due to bad weather. Weather conditions are categorized in several situations, namely good weather (clear weather) to very bad weather (bad weather). These various conditions will affect the flight process, whether the flight is continued, postponed or canceled. Pradana (2015) said that there are several weather-forming elements that affect flights, including wind, air pressure, clouds, as well as rain, fog and snow. Wind is a weather factor that affects flights. Wind direction determines the direction in which the aircraft lands or takes off. Planes will land and take off in the opposite direction to the wind. This is to get the

maximum lifting force. If the runway is pointing east-west and the wind is coming from the west, the plane will take off from east to west and vice versa.

Another factor that plays a role in flight is air pressure. Air pressure is used to estimate the altitude of the aircraft from the surface and becomes very vital when the aircraft is about to land. An error of 1 hPa in air pressure reading will result in an 8.5m error in estimating the altitude. The next factor is clouds, the presence of clouds is a weather factor that disrupts flights because they can cause shocks to airplanes. Cumulonimbus clouds are clouds that airplanes must avoid. In a cumulonimbus cloud there are up and down air currents that can suck up airplanes and even throw them away. In addition to the factors already mentioned, it turns out that rain, fog and snow can also affect flights. Rain, fog and snow can generally have an effect in the form of reduced visibility, making it difficult for pilots to direct their planes. A wet runway due to rain or covered with snow will cause delays for aircraft that will fly or will land. Therefore the existence of a weather monitoring device or weather station is a tool that must be owned by the airport authority. This tool is important to ensure the weather conditions when going to flight. With this information, flights become more comfortable, efficient and safe.

#### Weather Observation Tool

(Yudha, et al) said that based on its type, weather observation tools are divided into 2 types, namely, Conventional Equipment and Automatic Equipment. In terms of how to read, meteorological tools are divided into two types, namely recording and non-recording equipment. Recording equipment (automatic), is equipment that can record data continuously, by looking at the results recorded on the pias as an observation tool. Examples of recording equipment such as barographs, Hellman type rain gauges, thermohygrographs, actinographs and others. Non-recording equipment (conventional) is a tool that must be read at certain times to obtain data. This tool cannot log itself. Tools belonging to this type are generally used in synoptic or aviation meteorology, for example barometers, thermometers, anemometers, Campbell stokes, rain gauges, cup counts, anemometers, theodolites and others. In terms of use, meteorological instruments for routine observations are divided into 3 types, namely, meteorological instruments used on the earth's surface, generally found at synoptic meteorological, agricultural/climatological and maritime meteorology stations. Example: barometer, anemometer, solarimeter, thermometer and others. Meteorological tools are used to observe the upper air layer. This tool is generally used to observe weather elements in the upper air layer (atmospheric layer). Example: balloon pilot observations using theodolites, radiosondes, rawin, weather satellites, weather radar and others. And special meteorological tools, these tools are widely used in field research. Example: hot wire anemometer (weak wind meter), thermocouple psychrometer (humidity meter), ribbon thermopile (radiation meter) and others (Yudha et al., 2016).

#### Tool Eligibility

Based on the Decree of the Director General of Mineral and Coal (2019), the feasibility of equipment and installations is carried out through operational safety checks on pressure vessels and the like, lift or transport aircraft, electrical equipment, rotary equipment, distribution pipes, storage tanks, safety valves, smelters ). The tool referred to in this study is a weather observation tool at the Meteorological Station. Regulation of the Head of the Meteorology and Geophysics Agency No. Kep. 006 of 2008 concerning Meteorological Station Standards stipulates that every equipment, communication facility, and supporting facility needs for data processing, analysis, and presentation of meteorological information must be at a meteorological station must comply with the provisions of the Meteorological Observation

Equipment Standard. Head of the Meteorology and Geophysics Agency No. Kep. 006 of 2008 concerning Meteorological Station Standards states that the feasibility of existing equipment at the Meteorological Station is determined by the presence of standards. Standard meteorological observation equipment as for weather observation tools for aviation purposes are 1 set of Anemometer, 1 set of Psychrometer, 1 Set of Rain Gauge, 1 set of Barometer, 1 unit of Meteo Cage, 1 set of AWOS, 1 set of Transmissiometer, 1 set of Ceilometer.

**Relevant Researcher**

**Table 1. Relevant Researchers**

No	Name	Year	Title	Research Result
1	Dwi Andhitia Rafika	2017	Weather Prediction for Improved Aviation Safety Using Artificial Neural Networks and Genetic Algorithms	Weather predictors using a combined method between Artificial Neural Networks (ANN) and Genetic Algorithms (AG) can improve flight safety as shown by being able to predict the visibility and wind speed that are dangerous for flights in the Juanda International Airport area.
2	M.Ihsan Qudratullah, Asrizal, and Zuhendri Kamus	2017	Analysis of Weather Elements Based on Measurement Results of the Vaisala Maws 201 Automated Weather System (AWS)	The results of measuring weather elements using the AWS vaisala MAWS 201 type include several weather elements, namely temperature, rainfall, humidity, air pressure, wind speed and wind direction. The results of measurements of weather elements carried out at the BMKG Ketaping BIM are widely used as information for smooth flights at the airport.
3	Ammar Rafhei Alqaf, Endang Mulyani, and Rafi'e	2018	Feasibility Study for New Airport in Ketapang Regency	Overall the project for the construction of the Rahadi Oesman New Airport in Ketapang Regency is financially "feasible". By being declared feasible, this airport can be built and is expected to support the need for a comfortable and proper airport for service users and can support economic development in Ketapang Regency

**RESEARCH METHODS**

**Research Design**

The research design contains research related to time and place of research, types and sources of data, data collection techniques, data analysis techniques, and data validity techniques. In this research the writer uses qualitative research methods. Based on Sugiyono (2018) the qualitative research method is a research method used to examine natural object conditions, where the researcher is a key instrument, data collection techniques are carried out in a triangulation (combined) manner, data analysis is inductive in nature, and the results of qualitative research emphasize more meaning rather than generalization. After the data is obtained, it is then presented using qualitative data analysis techniques, in the form of describing or disclosing the characteristics that are the focus of the researcher, disclosing matters relating to the equipment used by the Meteorological Station to predict flight needs.

**Place and Time of Research**

This research was conducted at the Ketapang Meteorological Station at Rahadi Oesman Ketapang Airport. The time needed for research is 1 (one) month, which will be carried out on 6 February - 28 February 2023.

**Data Types and Sources**

In this study the authors have two types of sources used, namely Primary Data and Secondary Data. The explanation is as follows: Primary data is a data source that directly

provides data to data collectors (Sugiyono, 2018). Data collected by researchers themselves directly from the first source or where the object of research is carried out. In this study the authors used the results of interviews obtained from informants regarding the research topic as primary data. Meanwhile, secondary data is a source that does not directly provide data to data collectors, for example from other people or through documents (Sugiyono, 2018). Secondary data in this study are equipment eligibility certificates and other documents such as Regulation of the head of the Meteorology, Climatology and Geophysics Agency Number 006 of 2008 concerning Meteorological Station Standards and Head Regulation Number 7 of 2014 concerning Technical and Operational Standards for Meteorological, Climatological and Geophysical Equipment Maintenance used as a guide or reference.

### **Data Collection Technique**

1. **Observation.** Observation is a complex process, a process composed of various biological and psychological processes (Sugiyono, 2018). Researchers used the observation method carried out at the Ketapang Meteorological Station, West Kalimantan. The author observes the feasibility of weather observation tools used for aviation needs with reference to using observation guidelines that refer to theories from Government documents in the form of Head Regulation No. 7 of 2014 concerning Technical and Operational Standards for the Maintenance of Meteorological, Climatological and Geophysics Observation Equipment, then Regulation of the Head of the Meteorology and Geophysics Agency No. 006 of 2008 concerning Meteorological Station Standards and Guidebooks for the Introduction and Use of Meteorological Equipment.
2. **Interview Techniques.** An interview is a meeting between two people, between the questioner and the person who will be asked with the aim of obtaining or exchanging information as well as ideas through a question and answer, so that they can be placed on a particular topic (Sugiyono, 2018). There are 3 types of interviews including structured, semi-structured and unstructured. In this study, the researcher will use techniques in structured interviews in accordance with the Interview Guidelines which refer to theories from Government documents in the form of Head Regulation No. 7 of 2014 concerning Technical and Operational Standards for the Maintenance of Meteorological, Climatological and Geophysics Observation Equipment, then Regulation of the Head of the Meteorology and Geophysics Agency No. 006 of 2008 concerning Meteorological Station Standards and Guidebooks for the Introduction and Use of Meteorological Equipment.
3. **Documentation.** Documentation is a systematic process of collecting, disbursing, investigating, using and providing documents to obtain information, information, knowledge and evidence and disseminate them to users (Sugiyono, 2018). Documents can be in the form of writing, pictures, or monumental works of a person. Documents in the form of writing, for example diaries, life histories, stories, biographies, regulations, policies. Documents in the form of written images, for example works of art, which can be in the form of drawings, sculptures, films and others. And this document study is a complement to the use of observation and interview methods in qualitative research.

## **RESEARCH RESULTS AND DISCUSSION**

### **Feasibility of weather observation tools at the Class III Meteorological Station at Rahadi Oesman Ketapang Airport**

Based on the results of observations and the results of interviews conducted by researchers for 1 month at the Ketapang Meteorological Station. It was found that the tools used for observation were (Automatic weather observing system, Automatic weather station, Digital barometer, Digital anemometer, Max-min thermometer, Dry-bulb thermometer, Barograph,

Obs Rain Gauge, Hellman Rain Gauge, and Thermohyrometer) deemed fit for operation. To measure the feasibility of the equipment to do calibration. Calibration is comparing the value of the measuring instrument used with standard equipment that has been standardized first. The Ketapang Meteorological Station carried out the final calibration in August 2022. The calibration was carried out by a calibration team from the Meteorological Center at the central BMKG. This calibration is done once a year. It is said to be feasible for operation as evidenced by the deviation (difference) between the operational equipment and the calibrator tool which is not too large, stated in the form of a Calibration Certificate. This calibration certificate is usually accompanied by a supporting book, and a calibration certificate is issued by the Punsikal BMKG laboratory has received accreditation from National Accreditation Committee.

The certificate states that all the tools used are fit for operation. In the calibration certificate there is some important information such as the Correction Value, which is the magnitude of the deviation value or the difference between the average value of the measurement results from the operational equipment to be calibrated against the value of the calibrated measuring standard and the Reference or Measurement Standard, namely the measuring standard is represented by a measuring instrument that has been calibrated. in accordance with the standard, meaning that this tool is still accurate according to the standard of measurement, this tool is used to compare the UUT (Unit Under Test) with the applicable reference standard. Then in the calibration method on this certificate it is usually listed in international standards. The calibration results for the weather observation tools at the Ketapang Meteorological Station: First, there is the Automatic Weather Observing System where this tool has several sensors, namely Pressure, Temperature, Wind, Automatic Rain Gauge, and Solar Radiation Sensors. Based on the results of the inspection and calibration, in general the tools used to carry out the observations were declared feasible and well maintained, the condition of the equipment showed that the calibration results were still within the tolerance limit range. And there are several notes, among others, the elevation setting on each pressure sensor has been adjusted to the elevation data issued by the airport, the minimum Schneider type glass thermometer with serial number 784/16 has a fairly high correction (0.85°C) so that if it is to be used must be corrected first, the battery on the AWOS all Weather power system is worn out and dropped so that at night or in cloudy weather AWOS All Weather is offline, the air humidity sensor on AWOS All Weather needs to be repaired/replaced because the average correction is too large (-9.46% RH) , as well as an automatic rain gauge declared unfit for operation. After the calibration is carried out, it is also necessary to carry out equipment maintenance (equipment monitoring), it is necessary to carry out monitoring of equipment which is carried out routinely per month, with the aim of finding out what problems occur in the tools used.

The standardization of the feasibility of weather observation equipment is stated in the Regulation of the Head of the Meteorology, Climatology and Geophysics Agency Number 7 of 2014 concerning Operational Technical Standards for the Maintenance of Meteorological, Climatology and Geophysics Observation Equipment and the Regulation of the Head of the Meteorology and Geophysics Agency Number Kep. 006 of 2008 concerning Meteorological Station Standards, which serve as the basis and reference for the needs of facilities, equipment and personnel for carrying out tasks at meteorological stations according to the class level of the station.

### **Constraints experienced by the Ketapang Class III Meteorological Station and their handling**

Constraints experienced in conventional tools, namely broken thermometer measuring cup. And the constraints on the first automatic tool, namely AWOS, had problems with the wind,



temperature and humidity sensors, the battery battery had decreased. In both AWS there was interference with the evaporation device sensor. Third, the Hellman rain gauge has a problem with the rain gauge faucet. AWOS and AWS also often experience network interruptions. The impact of this is that the resulting data is inaccurate, data transmission can be disrupted so that it can delay data transmission. Handling is carried out in two ways, namely preventive action (preventive measures taken to prevent damage) for tools that are not damaged, such as maintenance and repressive measures (actions taken after damage occurs) for damaged tools, checking and then repairing them. If a tool is heavily damaged, it will be replaced by coordinating with the BMKG head office to inform about the damage and request a supply of spare parts (if still available).

The repressive treatment given for conventional tools is that the thermometer is replaced with a new thermometer because it has spare parts (equipment back-up). For the first automatic device on AWOS, maintenance is carried out, battery replacement, procurement of new spare parts in the form of generators and UPS and checking on sensors (if they cannot be used or are declared to have been seriously damaged, then a replacement is carried out). Second, on AWS, it is necessary to check the sensor and replace the device (if the sensor cannot be repaired). And third, in the case of the Hellman rain gauge, this tool was badly damaged in the sense that it could not be repaired, so it needed to be replaced, but the tool was no longer produced by the head office, so the office made the decision to deactivate this tool according to instructions and directions from the head office. .

Preventive handling is carrying out maintenance on conventional tools and automatic tools. Routine maintenance activities are carried out periodically, at the Ketapang BMKG office maintenance is carried out weekly, monthly, semiannually (six months) and annually. Then the results of the maintenance are recorded in the form of a monthly report, after which it is submitted to the central BMKG. Each equipment has a different maintenance schedule. The sequence of maintenance steps for the conventional tool is by going straight to the field to check and repair it and if it can't then replace it. Whereas for automatic tools, we first make sure the equipment is in OFF condition before carrying out maintenance. Then, clean all dirt and dust adhering to the entire surface of the tool using a callus brush, clean soft cloth, and cleaning fluid. Then, we clean the dust and dirt attached to the sensors, filters, temperature sensor fan, and tipping bucket rain measuring funnel. After all the tools are confirmed to be clean, then we carry out an inspection of the communication and cabling system. Making sure everything is in good condition, and clean. So that it can function properly. After completing maintenance activities, we ensure that the equipment returns to the ON condition.

The impact caused by conventional tools, namely the thermometer cannot measure the temperature and humidity. The impact on the automatic device, first on AWOS (the value generated on this sensor is not accurate), the impact on the AWOS battery (cannot operate AWOS within 24 hours, can only be operated when there is sunlight). The second is the evaporation sensor on AWS (to measure evaporation cannot be done automatically). Third, on the Hellman rain gauge faucet, it cannot measure rainfall. So it will affect the sending of Metar data (Met Report), the resulting data is not accurate. However, efforts are made not to influence it by using data from conventional tools and other automated tools.

## **CONCLUSION**

Based on the results of the research that has been carried out with analysis using various ways of data collection techniques including observation, interviews from several sources and documentation that has been processed. To determine the feasibility of weather observation tools at the Class III Meteorological Station at Rahadi Oesman Ketapang Airport, it was found that: Feasibility of Weather Observation Equipment at the Ketapang Meteorological Station In

general, the weather observation tools used at the Rahadi Oesman Ketapang Meteorological Station are quite well maintained and declared fit for operation, the condition of the equipment shows a correction of the calibration results which are still within the tolerance range according to the results of the last calibration held in August 2022 as evidenced by the results of the calibration certificate. The standardization of equipment feasibility at the Rahadi Oesman Ketapang Meteorological Station has met the standards according to the Regulation of the Head of the Meteorology, Climatology and Geophysics Agency Number 7 of 2014 concerning Operational Technical Standards for Monitoring Equipment Maintenance. This Perka contains equipment maintenance standards, equipment types, equipment officers or maintainers, equipment monitoring and equipment maintenance. The Ketapang Meteorological Station has met the Meteorological Station Standard according to its class level, namely Class III Meteorological Station which is contained in the Regulation of the Head of the Meteorology, Climatology and Geophysics Agency Number 006 of 2008. But it has not fully complied, for example, in the Operational Building, there is still a shortage of land and personnel, there is still shortages that resulted in several personnel who work concurrently. This Perka contains standards for station locations, operational buildings, observation equipment, and personnel.

Constraints and handling of weather observation tools at the Ketapang Meteorological Station: In conventional tools, namely the measuring cup of the thermometer is broken, so it cannot be used to measure temperature and humidity. Meanwhile, the constraints on the first automatic tool, AWOS, had problems with the wind, temperature and humidity sensors, the battery battery had decreased causing AWOS to not operate for 24 hours. The second AWS is that there is interference with the evaporation device sensor, causing inaccurate humidity measurements. Third, the Hellman rain gauge had a problem with the rain gauge faucet so that the rainfall value was inaccurate. AWOS and AWS also often experience network interruptions, causing delays and delays in the data being generated. These constraints result in inaccurate values generated, and affect the delivery of Metar data (Met Report). So it affects the safety of the flight. The Ketapang Meteorological Station is also constrained by the supply of spare parts for the equipment which is still minimal, so that if damage occurs it takes quite a long time to replace it, because you have to ask the head office for a new tool. The Hellman rain gauge is constrained by its spare parts. This tool is no longer produced by the head office, so the office took the decision to deactivate this tool according to instructions and directions from the head office. Handling is carried out in two ways, namely preventive action (preventive measures taken to prevent damage) for tools that are not damaged, such as maintenance and repressive measures (actions taken after damage occurs) for damaged tools, checking and then repairing them. Preventive handling is carrying out maintenance on conventional tools and automatic tools. Routine maintenance activities are carried out periodically, at the Ketapang BMKG office maintenance is carried out weekly, monthly, semiannually (six months) and annually. The repressive treatment given for conventional tools is that the thermometer is replaced with a new thermometer. Automatic tools, namely AWOS, carry out maintenance, replace batteries, procure new spare parts in the form of generators and UPS and check sensors, on AWS it is necessary to check sensors and replace tools because they can still be repaired, and the Hellman rain measuring tool, this tool has been heavily damaged in the sense that it is not can be repaired, it will need to be replaced.

Based on the conclusions above, there are several suggestions that the author hopes can build a positive effect and are expected to bring good changes in the future, including: For the company, as a form of input for the future, the Rahadi Oesman Ketapang Meteorological Station can maintain and improve maintenance that is already going well, improve spare parts for equipment that are still in operation, improve the quality of the network so that there are no

obstacles, improve services to airports and the public in the form of accurate weather information by carrying out routine maintenance when monitoring equipment. So that it can create accurate data in supporting the safety of a flight at Rahadi Oesman Ketapang Airport. Then the Rahadi Oesman Ketapang Meteorological Station is also expected to see and pay attention to the feasibility of the tools used, because it can affect the data it produces. For the Education Sector, the College of Aerospace Technology is holding an On Job Training program (Field Work Practice) for final year Cadets/I in semester 7 it is recommended to extend the On Job Training period, because when running the On Job Training program, cadets can implement all the things they get during lectures and can be useful especially for cadets themselves in the real world of work and make the right decisions at work. For Future Researchers, For future researchers, if this research becomes a reference source with the same topic and discussion regarding the Feasibility of Equipment at the Meteorological Station, it is hoped that future researchers can make this thesis an additional knowledge related to future research and it is hoped that future researchers will can contribute directly related to the Meteorological Station both in terms of equipment and personnel. Hopefully the data obtained is useful and provides additional insight for future researchers.

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