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ANALYSIS OF CORRECTIVE MAINTENANCE MONITOR CCA TOOL DVOR SELEX TYPE-1150A

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Abstract

In the aviation industry, navigation has a crucial role in supporting the smooth running of flight routes to maintain the safety and security of air transportation. Perum LPPNPI Pekanbaru branch provides communication, Navigation, Surveillance, and Data Processing facilities to ensure flight safety, regularity, and comfort. One of the navigation facilities available at Perum LPPNPI Pekanbaru branch is the Doppler VHF-Omnidirectional Range (DVOR), an air navigation system control tool that can guide aircraft to land precisely at the destination airport by providing information in the form of azimuth or artificial bearing. This research aimed to analyze the care and maintenance system for DVOR equipment, and identify several potential problems that have arisen during the operation of DVOR equipment at Perum LPPNPI Pekanbaru branch. In this research, evaluations and observations were carried out to assess the level of DVOR maintenance in accordance with Advisory Circular CASR Part 171-12. This research focused on evaluating Corrective Maintenance Monitor (CMM) analysis on DVOR Selex Type-1150A equipment at Perum LPPNPI Pekanbaru Branch. DVOR is a critical air navigation system that requires effective corrective maintenance. The method used in the research is procedural analysis of equipment maintenance as in research conducted by Widasari Mutiara, this research also focused on CMM evaluation, identification of potential problems, and performance analysis to improve maintenance efficiency. Research adopted a qualitative research method with a descriptive approach, because the data collected is textual in nature. This research method involved CMM system inspection, equipment maintenance analysis, and interviews with engineering personnel. The research results provide insights for improving corrective maintenance procedures, and increasing the availability and reliability of the DVOR system. The implications of these findings support safe and reliable flight operations at Perum LPPNPI Pekanbaru Branch.

Keywords: *DVOR, Corrective Maintenance Monitor, Air Navigation System*

Introduction

Kwasiborska et al. (2023) consider as flight navigation is the process of guiding an aircraft's safe and efficient travel from one place to another while attempting to steer clear of any hazards or obstructions that could interfere with the flight. To ensure the safe control of aircraft movements and flights, flight navigation facilities must be dependable, accurate, and accurate. In order to provide the intended level of safety, standard maintenance procedures for aviation navigation facilities have been devised (Errandonea et al., 2020) Guiding the aircraft's movement path is carried out using airwave radio navigation aids or what are known as Radio Navigation Aids (RNA) (Horapong et al., 2017). The RNA equipment that functions to guide the aircraft is DVOR. An important element in supporting guidance and providing directional information to ensure the aircraft lands safely and reliably at the destination airport is called the air navigation system. One key element in the air navigation system is DVOR (Doppler Very High Frequency Omni-Directional Range), an aviation navigation facility that can guide aircraft so they can land with precision at the destination airport (Hidayatullah et al., 2022; Rusman & Safitri, 2018). DVOR provides information in the form of azimuth or artificial bearing, which is not a geographic direction (north, east, west, south), but refers to the position of the DVOR ground station located at the airport (Meriah, 2019). Damage to flight navigation equipment during operational use cannot be avoided because the equipment is always in the ON condition to support flight navigation services. The maintenance system includes all actions necessary to maintain a machine unit or device and carry out repairs until it reaches a condition that follows the guidelines (Muthi, 2015).

As in previous research in 2022 carried out by Widasari Mutiara, namely regarding repairing damage to the Remote Control System Unit (RCSU) on DVOR equipment, a case study at Ahmad Yani Airport, Semarang (Nugraha, 2019), what makes this research different is part of the damage that occurred in the DVOR module, with a different analysis method, namely by repairing maintenance of 1 (one) DVOR monitoring equipment at Perum LPPNPI Pekanbaru Branch. According to Minister of Transportation no 1 year 2009 about maintenance tasks involve efforts to maintain the reliability and operational condition of products, equipment, or facilities available. Maintenance can be defined as a series of actions to maintain factory facilities or equipment, including making necessary repairs, adjustments, or replacements. The aim is to achieve satisfactory production operational conditions in accordance with predetermined plans (Sartika, 2020).

Corrective maintenance on the SELEX system integrating inc, or maintenance in response to failure, refers to actions related to emergencies resulting from damage, and is applicable to various types of activities. Meanwhile, according to Siew (2020) corrective maintenance is a type of maintenance carried out after a failure has been detected, with the aim of returning the asset to its initial condition. A power line communication as a transmission in DVOR remote control and monitoring system develop by (Agustinus et al., 2020). A safety system for DVOR shelter implement by (Rusman & Safitri, 2020) in Sam Ratulangi Airport. Corrective maintenance has a strategic role in repairing and restoring equipment that is experiencing problems or damage. In this context, CMM analysis becomes essential to ensure the effectiveness of corrective maintenance procedures to maintain the reliability of the air navigation system. In order to improve maintenance efficiency, this research addresses both the procedural and technical aspects of equipment maintenance in addition to the technical evaluation of CMM. It is envisaged that the research findings would assist aircraft safety in the area and have a good effect on the availability and dependability of DVOR at Perum LPPNPI Pekanbaru Branch, with a thorough grasp of the difficulties and potential improvements.

Methods

This research adopted a qualitative research method with a descriptive approach as the same way with (Hendra et al., 2023; Kireina et al., 2022), because the data collected is

textual in nature. This research aimed to provide a comprehensive description of the data that has been obtained through analysis. The method used in the research is a procedural analysis of equipment maintenance as in research conducted by Widasari Mutiara, namely regarding repairing damage to the Remote Control System Unit (RSCU) on DVOR equipment in the case study of Ahmad Yani Airport, Semarang (Sitopu, 2022). This research was carried out using the DVOR equipment located at Sultan Syarif Kasim II Airport in Pekanbaru, with a research duration of 4 months. The parameters applied in this research are the RCSU DVOR alarm on the RCSU (Remote Control and Switching Unit) monitor and the DVOR alarm monitor parameters found on TX 1 (Azimuth, 30 Hz Mod, 9960 Hz Mod, 9960 Hz Dev, and RF Level) at Sultan Syarif Kasim II International Airport Pekanbaru. In analyzing Corrective Maintenance Monitor actions, we are guided by the manual book for SELEX brand DVOR 1150A equipment which is carried out using the following steps (Sitopu, 2022).

Corrective maintenance monitor 1 action problems steps are taken to analyze damage to Monitor 1 DVOR equipment, namely, first restart or restart the RSCU DVOR. If the situation is still the same or normal then continue, directly monitor the condition of the DVOR equipment in the shelter, by checking the alarm status on Monitor 1, checked using PMDT, it was found that the azimuth, 30 Hz, 9960 Hz Mod, Dev and RF Alarm Level values were unstable. The researcher checked the Antenna Field Monitor using PIR and found that the parameters were abnormal. Replace the Field Monitor Antenna then check using PIR, it is found that the antenna parameters are in normal condition, but on the DVOR equipment, monitor 1 has an alarm. After that, the researcher checked monitor module 1, finding that one of the Integrated Circuit (IC) components had a short. Then repairs are carried out by removing the IC from the module so that monitor module 1 returns to normal.

Results And Discussions

Steps taken to repair RSCU DVOR equipment include check the impedance of the Antenna Field Monitor cable using Dummy Load. The measured results were not normal, then the researcher checked the transmission cable from the DVOR equipment to the Field Monitor antenna and found that the N-type connector (Gellersen et al., 2023) was peeled and not connected properly. The technician installed a new spare N-type connector and used a dummy load to assess the cable transmission impedance value, and the results were normal (51 ohms).

Next, the technician checked the Antenna Field Monitor, by lowering the antenna and checking the impedance value using an Avometer and getting an abnormal impedance value of 80 ohms, then the technician checked the antenna transmission cable from the field monitor using the PIR Antenna as a replacement for the Antenna Field Monitor. These procedures are based on earlier research that was carried out after the equipment damage operation and was obtained from the results assessing the antenna reception parameters in abnormal conditions.

Figure 1. Results of checking antenna transmission on PIR

Then the technician replaced the RJ-8 transmission antenna cable with a new spare, then rechecked it and obtained the results of receiving the parameters in normal conditions, then the technician replaces the Field Monitor Antenna using a new spare and raises the Antenna to check the reception value of the antenna beam using PIR. As a result of checking using PIR, it was found that the beam reception value was in good condition.

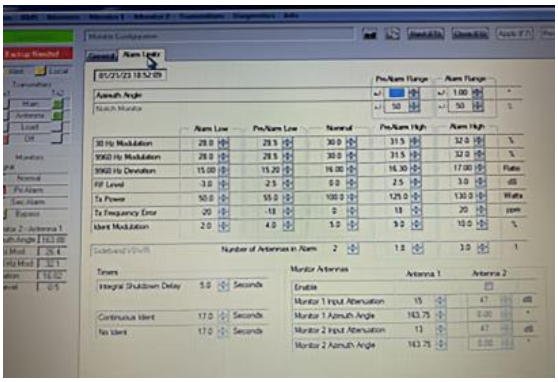

Figure 2. Load Configuration and Setting Attenuation Using PMDT

Next, the technician carries out load configuration and sets the attenuation so that the RF reception level on the monitor module is in accordance with standard parameters, it was found that the RF reception level on monitor 1 (one) did not meet the standard but on monitor 2 (two) was normal. After that, the technician checked the Splitter and tried using the Splitter with a new spare. It was found that there was no change in the RF Level value on Monitor one (1).

Further, the technician removes Monitor Module 1 (one) and checks several components on the Monitor module. It was found that on IC U31 with type-HMC435MS8G, there was a shortness in the number of circuits when checking using an Avometer. Then the technician removes IC U31 from the PCB board to ensure component damage. And the component is certainly damaged.

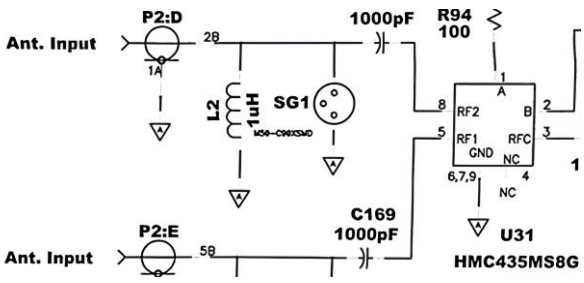

Figure 3. U31 IC wiring diagram

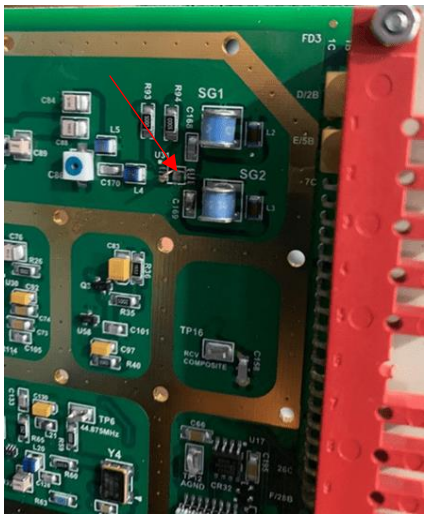

Figure 4. The Position of The IC U31 has Been Removed, Indicated by the Position of the Arrow

Then, the technician jumps pin 3 to pin 8 (without using an IC) and checks again on another circuit. Normal parameter condition in PMDT is illustrated in Figure 5.

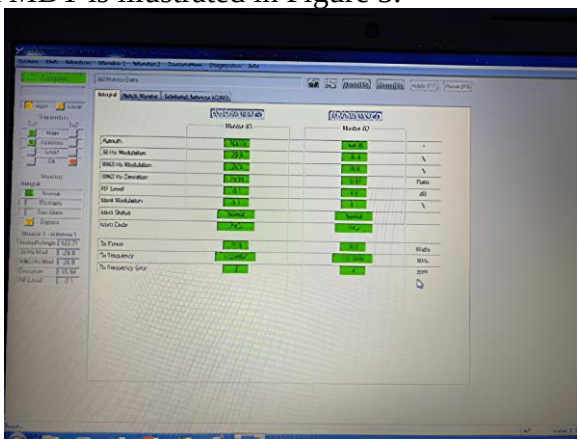

Figure 5. Normal Parameter Conditions in PMDT

Monitor module 1 is reinstalled, the RF Level is stable and the attenuation is set again. RF Level Monitor 1 (one) reading results on PMDT are in normal conditions. Currently, Monitors 1 and 2 have returned to normal.

Table 1. Results of Measuring the impedance values of the RF cable and field monitor antenna

Antenna RF Cable Impedance Value		**Field Monitor Antenna Impedance Value**	
Old RF Cable	New RF Cable	Old Antenna	New Antenna
65 Ω	51 Ω	80 Ω	50 Ω

The impedance value of old equipment is greater than that of new equipment.

Table 2. Results of measuring antenna parameters

Parameters	Old Antenna Field Monitor	Antenna PIR
Azimuth	390.20°	289,99°
30Hz Mod	66.20°	33.20°
9960Hz Mod	87.22°	26.10°
Dev	6.0	1.6

The old antenna parameter value is less than the parameter value tolerance limit.

Table 3. Display of DVOR parameter values on the CCA monitor

Parameters	Monitor 1	Monitor 2
Azimuth	382.32°	299.32°
30Hz Mod	71.22°	31.30°
9960Hz Mod	82.19°	24.10°
Dev	5.2	1.5

The parameter value on monitor 1 does not meet the tolerance limit, whereas on monitor 2 it meets the tolerance limit. The results of measuring the impedance values of the RF antenna cable and the field monitor antenna in table 1 showhat there was damage to the CCA monitor module (Abdu et al., 2022). It can be seen in Table 3 that there was no reduction in attenuation of the antenna RF value parameter reception. Then a check was made on the CCA 1 monitor module and found that There is damage to one of the ICs which affects the reception of RF value parameters on the field monitor antenna. According to previous research conducted by (Siew, 2020)(Muthi, 2015) the equipment must be repaired according to the standards in the equipment manual.

Conclusion

The difficulty that arose with the flight navigation aids at Perum LPPNPI Pekanbaru Branch was damage to one DVOR (Doppler Very High-Frequency Omni-Directional Range) monitor so that it could not change over the transmitter automatically. This happened after a lightning strike damaged the Field Monitor Antenna. Then replace the Antenna Field Monitor with a new spare. Furthermore, because the lightning induction affected several other DVOR equipment, especially monitor 1 (one), it was found that monitor 1 (one) in the RF reception reading level did not decrease after setting the attenuation value using PMDT. Therefore, checking Monitor Module 1 (one) was carried out, it was found that one of the components, namely IC U31 type-HMC435MS8G, was in a short state so that it affected the other circuits, then jumped directly from pin 3 (three) to pin 8 (eight) without using an IC, the reason why the IC is not replaced with a new spare IC is because the function of this IC is as a Contactor, to select the Field Monitor which is connected to the monitor. Because this DVOR equipment only uses 1 (one) Field Monitor Antenna.

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