

Standard Operation Procedures (SOP) for Weather Radars Operation, Monitoring, Maintenance and Calibration.

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1 Introduction

A standard operating procedure, or SOP, is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply regulations. The information collected in to SOP will help the present maintenance personnel in their work as well as the new maintenance personnel familiarizing themselves with operation, monitoring, maintenance and calibration procedures of radars.

This document was prepared as an example of a SOP document and is written in generic way enabling it to be used independently of the radar manufacturer or radar type. With the help of such SOP, the maintenance personnel can monitor, maintain and calibrate the weather radars and make sure that all operations and tasks are made and taken care of. These procedures are to be followed to minimize variation, reduce errors, and ensure accuracy in measurement of meteorological radar parameters.

Procedures should be provide a description of who does what, and when. An SOP characterizes relationships and control measures. It defines the roles and responsibilities to help workers “find themselves” in the process. Procedures should be clarify different decision points and provide the necessary guidance on criteria to make a decision.

This SOP will have a two-tiered system that includes both procedures and work instructions. The procedures provide a general view of the higher level steps, whereas work instructions are significantly more detailed. One advantage of a two-tiered system is that SOP change less often, whereas work instructions may need to be changed or updated more frequently due to changes in radar network structure, equipment, or software. In this document, examples of instructions are not specified.

SOP is written in a concise, step-by-step, easy-to-read format. Also, is used a flow charts to illustrate the process being described.

The SOP is prepared based on FMI radar team experience, Timo Posio’s engineering degree thesis “Functions, maintenance and calibration of the WRM200 weather radar” and an article “MAINTENANCE KEEPS RADARS RUNNING”, BAMS 2017, Saltikoff et.al. ...

2 Content of the Standard Operation Procedures (SOP) for Weather Radars Operation, Monitoring, Maintenance & Calibration

Standard Operation Procedures described in this document consists of five parts (Fig. 1).

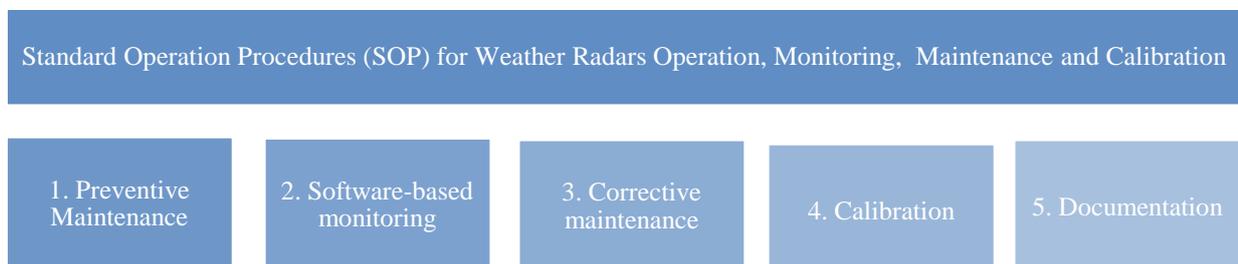


Figure 1: Contents of the Standard Operation Procedures (SOP) for Weather Radars Operation, Monitoring, Maintenance and Calibration.

The preventive maintenance (1) has an important impact on the quality of radar measurements and radar reliability. It is divided into groups: monthly maintenance, every six months maintenance, annual maintenance, three-year maintenance and larger maintenance every five years.

Software-based monitoring (2) checks the quality of the data and can give early indications of component degradation. Several software-based monitoring methods available allow the radar operator to perform monitoring without interrupting radar operation. Some of them are presented in this section.

The radar components are not eternal and some of the components may break down during use. Corrective maintenance (3) is carried out for troubleshooting.

Keeping the radar calibrated is as important as keeping the radar running and ensuring that the radar produces the best-quality data. Calibration (4) can be used to ensure that the radar measures correctly and adjustments are set correctly. Calibration can also detect defective performance, such as broken or broken components.

The documentation (5) shall include all the information required to the operation, monitoring, calibration and maintenance of the radars.

Each part should include the following sub parties. Sub particles are indicated in the tables.

1. Preventive Maintenance

1. Preventive Maintenance				
1.1 Monthly maintenance	1.2 Every six months maintenance	1.3 Annual maintenance	1.4 Three-year maintenance	1.5 Five-year maintenance

Figure 2: Preventive Maintenance

2. Monitoring

2. Software-based monitoring							
2.1. Sun	2.2. Fixed clutter targets	2.3. Birdbath scan	2.4. ZDR	2.5. Daily averages	2.6. Pair comparison	2.7. BITE	2.8. Etc.

Figure 3: Software-based monitoring.

3. Corrective Maintenance

3. Corrective Maintenance	
3.1. Corrective maintenance if necessary	3.2. Spare parts

Figure 4: Corrective maintenance

4. Calibration

4. Calibration				
4.1 Returning power measurements and return damping control	4.2 Measuring pulse lengths	4.3 Measurement of power and pulse force calculation	4.4 Calibration of the receiver	4.5 Calibration Measuring Instruments

Figure 5: Calibration

5. Documentation.

5. Documentation	
5.1. Metadata	5.2. Major database elements

Figure 6: Documentation.

3 Summary

The SOP for final work can be presented in the form of a general scheme. The SOP can be edited as separate documents in the future, which will facilitate their exchange within the meteorological institutions. The documents

can be specially designed for printing, which makes it easier and safer to archive them. Files can be added to electronic databases of institutions, where they can be changed if necessary. Even if the lists have already been tested, they can be updated or added to them. Therefore, documents are well stored as unencrypted files in Microsoft Excel.

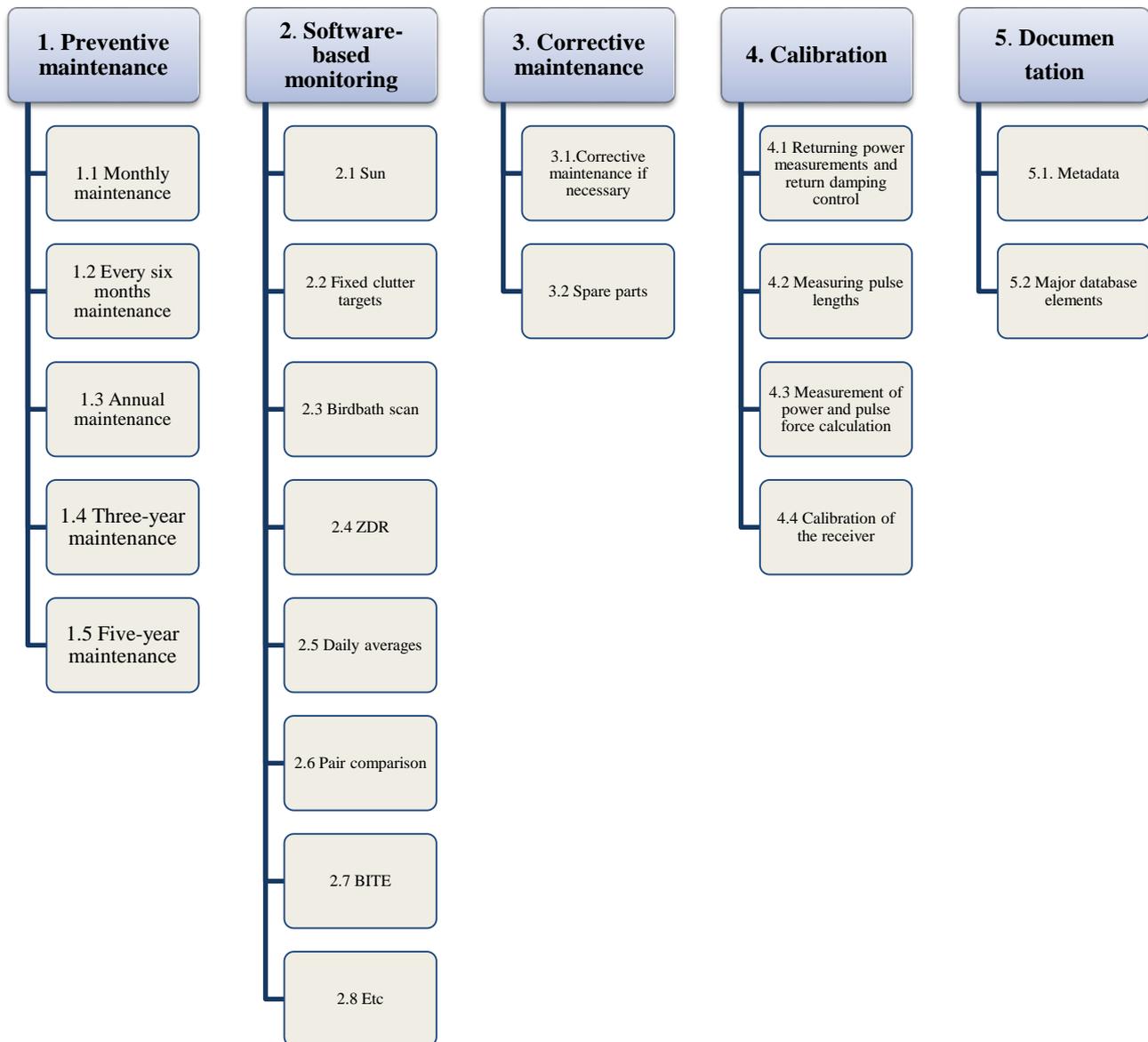


Figure 8: SOP in table

Acknowledgement

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References

Saltikoff et.al. "MAINTENANCE KEEPS RADARS RUNNING", BAMS 2017.

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FMI 2018 Training on weather radar.