

Technical specifications for Automatic Unmanned Sounding System

This document describes the technical requirements and desired performance for the automatic unmanned sounding system to the Norwegian radiosonde network

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1. Introduction

The Norwegian Meteorological Institute (MET) is the government agency responsible for providing meteorological data and other weather related services in Norway.

The Institute has been operating radiosonde systems since 1949. The present launch sites are at Andøya, Sola, Ørland, Ekofisk, Jan Mayen and Bear Island.

The stations situated in Andøya, Sola and Ørland are automatic unmanned sounding systems, and there are plans to automate the sounding systems at Jan Mayen and Bear Island. The data from the soundings are used in synoptic and climatologically studies.

This radio sounding system shall be unmanned and automatically fill pre-loaded balloons with hydrogen. It shall automatically release the balloons with a radiosonde according to a defined schedule.

This specification includes the technical function and quality / performance requirements for the automatic unmanned sounding system to the Norwegian radiosonde network.

In addition to technical and performance related requirements it also asks the tenderer to present information on their economic situation, experience from similar projects, skills, customer follow up; e.g. well established FAT (Factory Acceptance Test), SAT (Site Acceptance Test) and training program.

MTBF, life cycle cost, spare part availability, quality assurance program etc. are also factors that the tenderer will be asked to document.

2. Delivery and pricing

The production and delivery time needed for one complete system shall be clearly stated. A shorter delivery time will be preferred. The normal delivery time for the different spare parts shall be stated as well.

2.1 Pricing

The total price shall be stated. The price of installation, maintenance kits, consumables and spare parts, software upgrades, training, estimated life cycle cost (LCC) and life supply cost (LSC) for a period of 15 years shall be stated.

2.2 Delivery address

One system shall be delivered on the mainland of Norway, and two systems shall be prepared for shipment to Jan Mayen and Bear Island.

Information regarding addresses and freight related matter will be given when the systems are ordered.

3. Working conditions

3.1 Weather considerations

The automatic unmanned sounding system is intended to be used all year round and will be exposed to very varying weather. Varying working conditions shall not impair the operation of the equipment unless the weather is outside the equipment's ratings.

We are aiming at keeping the regularity of the soundings above 96% and it is important that the automatic unmanned sounding system will deliver this availability or better within its intended working conditions.

The automatic unmanned sounding system shall be capable of continuous operation in the temperature range -30 °C to +40°C and in relative humidity up to 100%.

It is desirable that the automatic unmanned sounding system is able to perform soundings in wind up to 20 m/s or higher. Higher wind tolerance will count in a positive way when evaluating offers. It is also important that there are "self-protection" mechanisms so that the system will not allow soundings when the wind exceeds safe limits. This is to avoid mechanical damage to the external parts.

Although the wind is beyond safe limits for sounding, the rest of the external parts, e.g. antennas, amplifiers pneumatic cylinders etc. must withstand wind far beyond the limit for sounding. Survival weather conditions for the sounding system shall be stated in the tender documents.

3.2 Indoor/ working area considerations

The inside of the automatic unmanned sounding system will not only serve as housing for the electronics and controller systems, it will also serve as working area for the on-site operator loading sondes and doing regular maintenance. The inside of the automatic unmanned sounding system shall be temperature regulated by e.g. air condition and heating elements.

3.3 Environmental considerations

MET is aiming as far as possible to make the smallest environmental footprint. It is not possible to recover the sondes, so the tenderer shall describe how their system influences on the environment, e.g. the radiosondes including batteries, waste material, packaging and how to handle these items. Plans on how to reduce the environmental impact of soundings shall be described.

4. Physical and functional Requirements

4.1 Outline

Drawings with dimensions shall be included in the tender documents.

The foundation requirements for the sounding systems shall be described in the tender documents, including drawings.

Systems are planned to be installed on the Bear Island and Jan Mayen island, so the dimensions and weight of the system components packed for shipment shall be stated in the tender documents.

4.2 Capacity and loading

The automatic unmanned sounding system shall contain sondes for one week plus extra spare sondes. The sounding system will normally do two or four regular soundings per day, sometimes more. A capacity of minimum 20 sondes are required, higher capacity will count in a positive way when evaluating offers.

Efficient loading of radiosondes, less time consuming and fewer manual operations will count in a positive way when evaluating offers.

4.3 Balloons and sounding

The automatic unmanned sounding system shall be able to operate with standard balloons (350g) with neck diameter of 3cm and neck length of 10cm.

The sounding system shall have the ability to perform soundings automatically according to a pre-programmed schedule. It shall be possible, if desired, to configure the sounding system to send a release request to a centralized computer. Operators will then authorize the sounding via the centralized computer.

4.4 Filling of hydrogen

The automatic unmanned sounding system shall automatically fill balloons with hydrogen. The hydrogen shall be supplied from a gas storage consisting of one main and one spare industrial rack of hydrogen.

The sounding system shall automatically fill the balloon with appropriate (predefined) amount of hydrogen. The amount is based on the balloon size.

The spare bottle rack is used as a backup. The sounding system shall be equipped with an automatic switch for switching between the hydrogen racks when one rack is empty. This will ensure no missed soundings because of the lack of hydrogen.

The sounding system shall be designed for safe operation, this shall be documented in the tender documents. Any safety systems or procedures shall be documented.

5. Electrical, software and system specifications

5.1 Power

The available power on site is 240V / 30A / 1 phase, 50Hz
All electrical cabling shall be done in accordance with Norwegian regulations.
There should be an backup UPS with capacity for one sounding.

5.2 Local computer and data handling

It shall be possible to use MET supplied computer. This is for ease of maintenance and upgrades. It will also shorten the downtime with computer related issues. The tenderer should provide specifications to the local computer.

It shall be possible to do remote administration of the automatic unmanned sounding system via e.g. remote desktop.

The messages after sounding shall be stored locally. The messages shall also be sent automatically to a remote computer by WAN for further distribution / processing.

5.3 Software

MET shall have the possibility to easily customize the messages with features in the software.

Messages shall be created automatically during flight at 100 hPa.

The software shall automatically produce the standard messages such as: TEMP, BUFR, PILOT BUFR and High resolution BUFR, for both ascent and descent flight mode

The software shall ensure automatic transmission of the messages to a centralized computer.

It shall be possible to simulate an earlier sounding and reproduce and display all curves and data.

The software and upgrades shall be easy to install. The tenderer shall state the level of expertise needed to do installations, upgrades, changes in parameters and system configuration.

The software shall guide the on-site operator through loading and calibration of radiosondes in an intuitive and simple manner.

It shall be possible to export sounding data in a non-proprietary way to ease the work of post processing.

All radiosonde data files shall contain header or filename with sufficient information on time and place of data collection relevant to archiving and further processing.

System performance and malfunction situations shall be recorded continuously in logging files which shall be easily accessible for off-line analysis.

The tenderer shall inform on how they support, update and distribute software for main- and subsystems. Information on how the tenderer handles bugs in software reported by customer shall also be stated.

6. Radiosonde specifications and calibration

6.1 Radiosonde specifications

The tenderer shall describe the performance of all sensors of the radiosonde at ground level, 100 hPA, 50 hPA and 10hPA in flight environment conditions.

The radiosondes shall operate in the frequency range from 400MHz to 406MHz.

The battery shall be capable of operate the radiosonde for at least three hours; one hour on the ground, and at least two hours flight.

The tenderer shall provide information on the radiosonde launch weight. Lighter weight is preferable.

6.2 Radiosonde calibration

The radiosonde calibration (preflight calibration) equipment shall be easy to use. It shall be self-instructing or instructions shall be given by the sounding computer.

Any calibration equipment shall be included in the offer.

The tenderer shall describe their factory calibration and traceability to international standards.

Information shall be given about figures on DOA (Dead on arrival) regarding the radiosondes and how their system for return and refund works.

The automatic unmanned sounding system shall be equipped with weather sensors that measure the local weather to provide ground level data for the soundings.

It shall be possible to display the local weather data, and they should be made available in realtime in a described dataformat

7. Maintenance

7.1 Support

Maintenance support shall be available during normal office hours Monday to Friday. This support shall include telephone support, software support, and availability of spare parts.

A complete list of spare parts for the automatic unmanned sounding system shall be provided. Average expected delivery time and guaranteed maximum delivery time for each part should be provided.

Information if any parts can be locally sourced should be included.

Spare parts and maintenance kits must be available throughout the expected lifetime of the automatic unmanned sounding system. The expected lifetime of the system shall be stated.

7.2 Maintenance cost and availability

The tenderer shall provide a list of spares and consumables, which it is necessary to have in stock locally to achieve availability of the system above 96%.

Based on this list the tenderer shall estimate the cost for a period of 15 years.

The tenderer shall present MTBF and MTTR calculations for the entire system.

It shall also be stated in the tender documents what measures (maintenance frequency, backup solutions) that needs to be fulfilled to keep the system availability above 96%.

Total cost of ownership (Life cycle cost) shall be estimated for a period of 15 years.

7.3 Tools

The tenderer shall list all necessary equipment/tools required for proper maintenance and operation of the automatic unmanned sounding system.

8. Documentation and training

8.1 Documentation

All documentation shall be provided in English language, in open digital formats.

The tenderer shall provide one complete set of the manuals in the offer. The manuals shall be in English language.

The manuals shall contain full information on construction, maintenance and operation of the automatic unmanned sounding system. The manuals shall cover all part of the system, whether it is the tenders own products or products from a subcontractor.

The manuals shall contain all necessary circuit diagrams, giving information on voltage and waveforms where considered appropriate, for efficient fault finding.

The manuals shall contain a complete list of maintenance routines, calibration checks and a complete list of components and parts used in the system.

The manuals shall contain all necessary drawings of mechanical parts down to a detail level that will allow disassembly, maintenance and replacement.

8.1.1 Software Documentation

Software documentation shall be provided as a separate manual. This manual shall cover all essential information and pictures regarding user interfaces, system configuration and update instructions for main and sub-systems.

8.2 Training and FAT

The technical training and maintenance course should be done in conjunction with the factory acceptance test (FAT).

The FAT should be organized by the tenderer.

The tenderer shall supply FAT check list / specifications with the offer.

The training shall be given in English or Norwegian language.

The training shall give the trainees appropriate knowledge of the entire system so that they will be able to operate, diagnose and service the system so that the availability of the automatic unmanned sounding system is maintained.

The training course shall deal with the most essential parts of the software (User interface, system configuration and upgrades), hardware (sounding systems, sensors and mechanical controlling systems).

Trainee level: Electronic engineers with experience in sounding system maintenance and electronic servicing and troubleshooting.

All cost regarding training and FAT shall be included in the offer.

On-site commissioning of the automatic unmanned sounding system shall be done by the tenderer.