

# **SCHEDULE OF REQUIREMENTS AND TECHNICAL SPECIFICATIONS**

## **Procurement list under NMA-GEF/LDCF Project for the period 2014**

**Procurement for the Supply, Installation, Configuration, Testing, Commissioning; Training and After Sales Services of Automatic Weather Station (AWS); Upper Air Observation System (Radio-sonde) and Meteorological Calibration Equipment**

**Project Title: Strengthening Climate Information and Early Warning Systems in Africa for Climate Resilient Development and Adaptation to Climate Change – Ethiopia**

**Addis Ababa, Ethiopia  
August 14, 2014**

# Schedule of Requirements and Technical Specifications

## GENERAL INFORMATION

<b>Services/Work Description:</b>	Supply, Installation, Configuration, Testing, Commissioning; Training and After Sales Services of Automatic Weather Station (AWS); Upper Air Observation System (Radio-sonde) and Meteorological Calibration Equipment
<b>Project/Program Title:</b>	Strengthening Climate Information and Early Warning Systems in Africa for Climate Resilient Development and Adaptation to Climate Change – Ethiopia
<b>Specific Location:</b>	Addis Ababa, Mekelle and Adama
<b>Type of the Contract:</b>	Invitation to Bid (ITB) Firm Level Supply
<b>Expected Delivery Date:</b>	Forty five (45) calendar days after issuing Purchase Order (PO)

## I. BACKGROUND / RATIONALE

Over decades, Ethiopia has been experiencing severe weather events that translate into slow and fast onset disasters such as droughts, flooding and landslides affecting large parts of the population. The unfolding of climate change will increase the variability and intensity of extreme weather events such as heavy rain or drought thereby further compounding the challenges of mitigating and managing these natural disasters. The increase in intensity and unpredictability of natural disasters due to extreme weather has a substantial impact on the economy, on community assets and human lives.

The project-‘Strengthening Climate Information and Early Warning Systems in Africa for Climate Resilient Development and Adaptation to Climate Change – Ethiopia’ is financed by the GEF Least Developed Country Fund (LDCF) and implemented by the UNDP. National Meteorological Agency, Hydrology and Water Quality Directorate of the Ministry of Water, Irrigation and Energy and Disaster Risk Management and Food Security Sector of the Ministry of Agriculture are partnering to execute the project.

The project, aims at strengthening the climate monitoring capabilities, early warning systems and availing climate-related information for responding to climate shocks and planning adaptation to climate change in Ethiopia, through transferring weather and environmental observational technology as well as building capacities for data analysis, modelling and communication of advisories/warnings. The two complementary outcomes expected are: enhanced capacity of the National Meteorological Agency and the Hydrology and Water Quality Directorate to monitor extreme weather and climate change; and efficient and effective use of hydro-meteorological and environmental information for early warnings and long-term adaptation.

To this effect the National Meteorological Agency need to strengthen the climate and weather observation network and infrastructure. The improved infrastructure will enhance the capability of NMA to generate weather/climate data, analyze and store for wide variety of application including for effective early warning system.

## II. SUMMARY OF REQUIREMENTS

Lot No.	Description	UoM	Qty
<b>LOT I</b>	<b>Automatic Weather Stations (AWS) with spare parts</b>		
	1.1 Supply, Installation, Configuration, and customization of Automatic Weather Stations (AWS) with spare parts*.	Set	40
	1.2 Factory level training*	Person	5
<b>LOT II</b>	<b>Upper Air Observation System (Radiosonde) to be installed at Mekelle*</b>	Units	1
<b>LOT III</b>	<b>Meteorological Calibration Equipment</b>		
	3.1 Temperature Calibration Chamber with 2 reference thermometers*		1
	3.2 Humidity Calibration Chamber with 2 reference hygrometers*		1
	3.3 Pressure Calibration Chamber with 2 barometers*		1
	3.4 Rainfall Calibration Unit*		1
	3.5 Radiation Calibration Unit with 2 reference pyranometers*		1
	3.6 Portable Temperature Calibration Unit with case*		5
	3.7 Portable Humidity Calibration Unit with case*		5
	3.8 Portable Pressure Calibration Unit with case*		5
	3.9 Portable Solar Radiation Calibration Unit with case*		5
	3.10 On the job training on full operational activities and basic maintenance skills of technicians and staff*	Person	5

Note: \*for further information kindly refer to the detail specification under each LOT.

The UNDP Ethiopia Country Office hereby invites potentially qualified bidders to supply any or all of the following LOTS as per the product and service specification and/or "its equivalent":

**LOT I: Supply, Installation, Configuration, Customization and Training of Automatic Weather Stations (AWS) with spare parts**

**LOT II: Upper Air Observation System (Radiosonde) to be installed at Mekelle\***

**LOT III: Meteorological Calibration Equipment**

## **LOT I: Technical Specification for Automatic Weather Station (AWS): (40 AWS Units)**

### **Background:**

The National Meteorological Agency of Ethiopia (NMA) has been using automated stations at airports for 10 years including a Automatic Weather Observing System (AWOS), Digital Wind System (DWS), Small AWOS, etc. The recent successful use of AWS at non-airport stations was started in 2010. Since then NMA operates 100 AWSs.. Most stations were installed by NMA staffs after factory and onsite training. These AWSs uses Ethio-telecom GPRS network and Central Data Collection System (CDCS) to transmit the data automatically scheduled every 15 minutes. Thus, data are collected 24/7 in near real time from any of these stations depending on the quality of the GPRS network. These AWS comprise mounted sensors for air-temperature, rainfall, relative humidity, solar radiation, wind speed and wind direction. Two stations will have additional sensors for soil temperature and moisture at different depths. NMA has a plan to extend its AWS stations to 200 in the coming three years and to a larger number beyond. The current system has both tabular and graphic data presentation and incorporates a live data feed. It has a facility for statistical data processing, which helps easily compute daily, monthly and other statistics from 15-minute observations. The 15-minute observations are calculated based on 1-minute sampling at each AWS, and then transmitted to the central archive facility.

Prospective suppliers are hereby kindly invited to supply the **following product specifications or "its equivalent"** to allow NMA to purchase fit-for-purpose Automatic Weather Station (AWS) technology.

### **General Minimum Technical Requirements**

- Fully comply with WMO standards.
- Minimum required working life of all sensors is 5 years after installation / commissioning. The awarded contractor will be required to conduct an initial calibration of each sensor after installation and during commissioning phase.
- The awarded contractor will be required to conduct on-site training of national technical experts during the installation of the first 5 AWS.
- The awarded contractor shall provide manuals for the installation, maintenance and calibration in a print and multimedia format, and in English language.
- All sensors must be coated to protect against dust and chemicals.
- Air temperature and humidity sensors must be protected by a naturally ventilated radiation shield.
- All sensors need to be easily interchangeable and shall be independently operated by the electronics and data processing unit so that a possible failure of any of the sensors shall not affect the performance of the remaining sensors.
- Rain gauges
  - The rain gauge shall be fabricated of corrosion resistant, rugged material or made of anodized aluminum.
  - Any bucket-type sensor should have a leveling arrangement for horizontal mounting
  - Any reed switches and electrical components should be fully encapsulated in water proof materials
  - Protective filter in funnel
- Wind speed
  - Gust survival: 80m/s (minimum duration 30 minutes)
  - Cups must be easily replaceable in the field
- Wind direction:
  - Gust survival: 80m/s (minimum duration 30 minutes)
  - Wind vane must be easily replaceable in the field
- Solar Radiation
  - Solar radiation must be measured using ISO-9060 certified standards

## Detailed Specification

### I. Sensors

No .	Parameter Measured	Minimum sensor specifications	Qty In PCs
1	Wind Speed (Anemometer) for <b>both 2m and 10m</b>	<ul style="list-style-type: none"> <li>Measuring range: 0.0 to 60m/s</li> <li>Starting Threshold: &lt;0.5m/s</li> <li>Resolution: &lt; 0.1 m/s</li> <li>Minimum accuracy: <math>\pm 0.3</math> m/s or 3%, whichever is greater</li> <li>Operating Temp: -10 to +60°C</li> <li>Relative Humidity: 10 – 100%</li> </ul>	80
2	Wind Direction (Wind Vane) on <b>10m mast</b>	<ul style="list-style-type: none"> <li>Measuring range: 0 to 360 Deg.</li> <li>Starting threshold: &lt; 1.0 m/s</li> <li>Operating temperature: -10 to +60°C</li> <li>Minimum resolution: 1°</li> <li>Minimum accuracy: <math>\pm 3</math> Deg.</li> </ul>	40
3	Air Temperature	<ul style="list-style-type: none"> <li>Measurement range: -40 to +60 °C</li> <li>Resolution: &lt; 0.1 °C</li> <li>Accuracy: &lt; <math>\pm 0.1</math> °C.</li> </ul>	40
4	Relative Humidity	<ul style="list-style-type: none"> <li>Measuring Range: 0 – 100%</li> <li>Accuracy: +/- 1% RH from 0 to 90%.</li> <li>Long-term stability better than 1% RH/year.</li> <li>Operating Temp. range: - 40 to +60°C</li> </ul>	40
5	Solar Radiation	<ul style="list-style-type: none"> <li>ISO-9060 First Class Solar Radiation instrument with ISO 9060 Certification</li> </ul>	40
6	Rain, Precipitation	<ul style="list-style-type: none"> <li>Measurement range: 0-200 mm/hour or more</li> <li>Footprint: between 200 and 314 cm<sup>2</sup></li> <li>Resolution/Sensitivity: &lt; 0.2mm</li> <li>Capacity per Minute: at least 30 tips</li> <li>Accuracy: &lt; <math>\pm 1\%</math> (at 25 mm/hr)</li> <li>Measuring Principle: Tipping bucket - double spoon</li> </ul>	40
7	Soil Moisture	Soil water content measurements between 10cm and 1m: <ul style="list-style-type: none"> <li>Precision : &lt; <math>\pm 0.2\%</math> volume</li> <li>Operating range: - 10° to 60°c</li> </ul>	40
8	Leaf wetness	<ul style="list-style-type: none"> <li>Capacitor-based sensor: Measurement Range: 0 (dry) to 100% (wet)</li> <li>Operating Range : -10°C to 70°C</li> <li>Repeatability : &lt; <math>\pm 5\%</math></li> <li>Stability: &lt; <math>\pm 5\%</math> per Year</li> </ul>	20

### II. Data logging (40 Units)

- A multipurpose Meteorological Data Measurement Logger to receive data from at least 10 meteorological sensors. Capacity to store recorded values for a minimum of six months (preferably 1 year) on disconnection of the network. Should be able to send all pending (recorded) data when the network is active.
- All external connectors to be water proof

- The stored data must be able to be retrieved by direct connection to the logger with laptop computer (using a USB interface). Data is also transmitted to a central data receiving system via a GPRS modem which, ideally, should be housed within the logger enclosure/case.
- The logger (outdoor unit) should be able to record data for up to 10 external sensors .
- The logger must be housed in a rugged; water and dust proof sealed enclosure with pad locks that can withstand direct exposure to a harsh environment.
- The software must support WMO compliant measuring methods, especially for wind gust monitoring (4 samples per second) and wind vector monitoring.
- The data logger must support time-based and event-based data processing and transmission back to base (i.e. either based on a predefined schedule or based on a preprogrammed event such as a temperature threshold). Raw collected data need to be processed onboard and transmitted via GPRS at a user-defined interval, which will be a minimum of every 15 minutes.
- The system must have a USB connection port to which a PC can be connected in order to perform system initialization, device software update, and configurations, download stored data and monitor the unit operation

### **III. Power Supply (40 units)**

- The power supply should include back up battery, charging regulator and solar panel. Remote stations use a battery with a regular charge from the solar panel when the sun shines. The system should include rechargeable, sealed and maintenance free backup batteries, sufficient for keeping the station running at least for three weeks without recharging. Backup batteries must have a charge regulator with protection against battery overcharge or deep discharge. The charging regulator must have an indication of the battery condition and charging state. Working time on a full charge and the total working time of the battery should be specified for a set number of sensors and GPRS transmission rates.

### **IV. Communication (1 unit)**

- A PC-Based Central Receiving Station will be installed at NMA Head Office.
- Data from each AWS can be transmitted automatically from AWS to a Central Receiving Unit using GPRS communications. A GSM connection, for the backup connection and connection checking, must also be supported.
- The system must have a serial-pass-through-mode which allows direct communication via a maintenance line with any smart sensor connected to the system.

### **V. Central Data Processor (2 Units: 1-Main and 1-back up)**

The central data processor which will be installed in Addis Ababa should have the following features.

- Be able to collect data from the remote stations directly via static IP address. Data rely though public domain (e.g. internet) or third party server is not allowed even with encryptions, because of NMA data policy.
- The central data processor should handle data it collect sby checking that the data is not missing, processed as predefined statistics, transferred/exported to the main data base (CLIDATA) in appropriate format, carry scheduled backup of configuration and data, display the data in different format, by graph, table, on Ethiopian map, also export data in csv format, etc. Must enable data collection, processing, displaying, archive (back up)
- The software used should have capabilities to automatically process and display real time data as well as "Archived" historical data at a pre-defined interval.
- The data management software should process raw 1 or 15 minute data to hourly, daily and monthly statistics.
- The central telemetry gateway should be able to control >200 AWS units to enable future expansions.

- The base station must support multi-user access, to support access data from 11 NMA branches.
- The base station must have GUI configuration facilities to enable full configuration and management of remote stations.
- It has to log automatically important variable for diagnosis of the remote stations status.
- Should be able manage each remote stations in easily organized manner. Should be able to configure data sample processing type, data sensing frequency, its modem, resetting, etc remotely from the central station.
- Be able to check the functioning of each sensors and battery voltages, communications, etc remotelyThe telemetry gateway should have different connection ports to the LAN and the central data server (Ethernet, serial ports).
- The central system should operate with a well-known operating system like MS-Windows or Linux – operator to specify.

#### **VI. Accessories (for 40 Units)**

- All sensors should be supplied with cables that are UV proof to ensure good performance for > 10 years.
- All support arms holding sensors should be manufactured from anodized aluminum or galvanized steel and fitted to the tower-scaffold by means of stainless steel and/or galvanized clamps.
- Spare parts will be available for a period of 5 years. In the event that a part is no longer available, a substitute identical in function should be identified in time.
- The company should provide Certificates of Calibration for all sensors.
- Users and technical service manuals are to be included.
- Any specialized tools for installation and maintenance should be included.
- Three sensor tester; handheld calibration kit.
- AC power adapter for remote stations should be available as an option and any extra costs associated with this provided.

#### **VII. Equipment Enclosure (for 40 AWS):**

All parts of the electronic and data logging unit must be enclosed in a sealed robust enclosure with easy access to all components and with mounting options at least to a mast or a wall. Options for an additional compartment/box, incorporating the data logger enclosure and cables will be considered beneficial. The enclosure shall have the following

- All connections must be through waterproof connectors, one connector for each sensor or device.
- All connectors must be clearly labeled as to their function.
- The connectors shall be installed at the bottom side of enclosure to reduce the risks of water or humidity penetration.
- The enclosure shall be properly vented with a filter, which will not allow humidity to enter in the enclosure.

#### **VIII. Capacity building / Training**

Factory level training for 5 (five) technicians is necessary for hardware, software and data processing personnel on the calibration, installation, maintenance and data processing. A clear price per person for this will be indicated.

#### **IX. Data Presentation and data exchange**

- Software which allows the presentation of live and recorded data in the following formats: Textual and tabular graphics

- Live spatial data presentation on map of Ethiopia Files containing the raw recorded meteorological data should be easily accessed in different formats including CSV and also allow easy exchange/sharing of data via the GSM/GPRS network
- Data formats should easily be integrated/imported/ to the NMA database, CLIDATA.
- Raw data should automatically be backed up at a scheduled regular time.

**X. Data Security**

- Data security should be ensured by the system both at the remote station and in transition (as required by Ethiopian law).
- The supplier shall provide a separate certification on data security. Especially, the Supplier has to certify that data is not transferred to any third party from the system without the knowledge of NMA.

**XI. Spare Parts for 40 AWSs:**

- Solar panel, battery, humidity and temperature sensors for all 40 stations and leaf wetness sensors for 20 stations supplied.

**XII. Working Life Time**

- Expected working life time should clearly be stated for all the sensors, battery and other major components. A minimum of 5 years is expected for RH, battery and temperature sensor. All other major components expected lifetime 10+ years.

**XIII. Civil Works and Ancillary Construction Materials Supply**

- UNDP Ethiopia will supply construction materials and construct the civil works as per the Bidder's generic detail design and specs in order to best-fit to the requirements of the equipment to be installed. Site specific adaptations, however, will be done by UNDP Ethiopia.



## **LOT II. Specification for Upper-air Observation System / Radio-Sonde (1-unit)**

### **PURPOSE**

This document specifies an upper air radio sounding system that is capable of measuring pressure, temperature, humidity, wind speed and wind direction profiles using a balloon carried radiosonde. The system operates in the meteorological band (MHz) and uses a global navigation satellite system (GNSS) for wind measurement.

This specification follows the guidelines given by the WMO in the latest 'Guide to meteorological instruments and methods of observation', WMO-No. 8 (CIMO Guide).

Prospective suppliers are hereby kindly invited to supply the **following product specification or "its equivalent"** to allow NMA to use a fit-for-purpose UPPER-AIR RADIO SOUNDING SYSTEM.

### **I. GENERAL REQUIREMENTS**

- The system shall include all items necessary to measure, process, output, and archive and display the atmospheric data.
- The system to be offered, consisting of ground equipment and radiosonde, must have been tested in the latest WMO radiosonde inter-comparison test or validated by a neutral party in comparison soundings. A test report needs to be enclosed.
- The system shall be automated so that operator action is not needed after a sounding is initiated. Initiating a sounding includes system startup, balloon filling, radiosonde preparation, surface observation entry and balloon launch.
- A user interface shall be separated from the rest of sounding software and it shall be implemented using web browser technology.
- As recommended by the WMO CIMO Guide No 8, the performance of the radiosonde pressure, temperature and relative humidity sensors should be checked in a controlled environment, such as a calibration cabinet or baseline check facility prior to launch. The baseline check should be automated as far as possible to eliminate the possibility of operator error. The baseline check shall prevent the launch of a faulty radiosonde. Necessary equipment and software for this purpose must be included in the system.
- When using a thin film capacitive sensor for humidity measurement the system shall include a method for preventing of and/or removing possible contamination from the sensor. The method shall effectively remove any contamination accumulated between manufacture and use i.e., during transport and storage.
- For reliable data transfer from the radiosonde to the ground station, an efficient error detection and correction method shall be used. The supplier shall specify the applied error detection/correction method.
- The supplier shall explain if and how the offered system can be expanded into a fully automated unmanned sounding system including balloon filling and launching capability.
- Installation shall be offered.
- Factory level training shall be offered for hardware, software and data processing personnel. If this is not necessary the supplier will indicate so. On-site training shall be offered for operators. The training syllabus shall be attached to the document.
- The supplier shall describe how the system software including the operating system will be kept up to date. For example, how mandatory changes in message coding are made available to the user.
- Warranty period shall be described (minimum expected 3 years)
- All operating and maintenance documentation shall be provided in electronic form and be pre-loaded on the workstation computer. The documentation shall be easily accessible for the operator.

- The supplier must have sufficient resources to maintain the system in operating condition and to introduce changes required by the buyer and to assist the buyer in product related technical matters.
- The supplier must have a strong financial status. Audited financial statements from the past three fiscal years must be attached to the tender. Net profit from the last five fiscal years shall be positive.
- Supplier must indicate the Country of Origin (C/O) of the equipment to be supplied and year of production.
- Supplier quality systems must have been certified and shall meet the requirements of **ISO9001:2000**. Relevant certificates shall be included in the tender.
- suppliers Quality manual and quality assurance plan of the offered equipment shall be attached to the tender
- Where available supplier environmental policy including present state and future plans shall be attached to the tender.
- Where available supplier shall keep accurate and complete quality-related records and upon request make these records available to the buyer.
- The supplier have to provide a spare kit (spare parts) and guarantee these will be available for at least 5 years.

## **II. MEASUREMENT ACCURACY**

- **Definitions**

As recommended by the WMO CIMO Guide No 8, the parameters as specified in the International Vocabulary of Basic and General Terms in Meteorology (VIM) issued by ISO (1993a) must be used in tender response when specifying radiosonde accuracy. The parameters are detailed in the following paragraphs.

- **Repeatability in calibration**

Repeatability in calibration describes the uncertainty of the radiosonde calibration including the calibration equipment and the radiosonde to be calibrated. In supplier responses this parameter shall be specified as will the method used for determining this parameter.

- **Reproducibility in sounding**

In supplier's response this parameter shall be specified as the standard deviation of differences in twin soundings (two radiosonde attached to one balloon) with a one sigma confidence level.

- **Total uncertainty in sounding**

Total uncertainty in sounding represents the total cumulative uncertainty including all error factors: repeatability, long-term stability, effects due to measurement conditions, dynamic effects such as response time and effects due to measurement electronics. Total uncertainty shall be determined so that it covers the whole measurement range as specified by the supplier. In supplier's response this parameter shall be specified.

- **Accuracy requirements**

All parameters listed below shall be specified in accordance with the definitions in the previous section. In addition, the tenderer shall attach relevant test reports or equivalent evidence to support his specification.

## **III. OUTPUT MEASUREMENTS**

The equipment and/or instrument should measure temperature; humidity; pressure & geo-potential height; and wind. Required specific information related to each measurement include:

### **Temperature**

- Supplier shall describe how the offered system maintains the specified performance in the following special conditions:

- ice formation on the temperature sensor
- water accumulation on the temperature sensor
- radiosonde penetrating through a cloud (effect of evaporating water)
- solar radiation at each phase of sounding

## **Humidity**

- The supplier shall describe in detail how the offered system maintains the specified performance in the following special conditions:
  - long time in storage (up to 5 years)
  - ice formation on the humidity sensor
  - water accumulation on the humidity sensor
  - radiosonde penetrating through a cloud (effect of evaporating water)
  - solar radiation at each phase of sounding

## **Pressure and geo-potential height**

- The supplier shall describe how the pressure and geopotential height data is either measured or computed in the offered system.

## **Wind**

- Wind shall be measured using a global navigation satellite system signals (GPS or similar).
- The supplier shall describe and demonstrate how the system eliminates errors induced by the pendulum effect of radiosonde.
  - Wind speed resolution.
  - Wind direction resolution.
  - Wind speed uncertainty.

## **IV. RADIOSONDE**

### **Transmitter**

- The transmitter characteristics must have been tested and the relevant test report shall be attached to the tender.
- To make it possible to choose a free frequency slot in the meteorological band, also in noisy conditions, it shall be possible to tune the radiosonde transmitter to any frequency within the meteorological frequency band.
- The total frequency drift of the transmitter in all sounding phases i.e., preparation, ascent and descent, shall be less +/- 5 kHz.
- Minimum transmission power shall be high enough to ensure reliable telemetry in accordance with other requirements in this specification. Adequacy of the transmission power must have been analyzed and also verified by test soundings.

### **Physical construction**

- The suspension string between the radiosonde and balloon shall be 30 meters or more to eliminate possible temperature and humidity errors caused by the balloon.
- The suspension string shall uncoil slowly enough to prevent the radiosonde from hitting the ground when released.
- The supplier shall describe suspension string degradability.
- Temperature sensor shall be mounted externally above the surrounding supports so that air that has previously been in contact with the surroundings does not affect the measurement.

- Temperature sensor shall be mounted so that thermal conduction from the radiosonde body does not affect the measurement.
- The construction of the radiosonde shall be made so that it is not possible for the user to inadvertently set the temperature sensor into wrong position. The in-flight position of the sensor must be consistent from flight to flight.
- Humidity sensor shall be mounted externally above the surrounding supports so that air that has previously been in contact with the surroundings does not affect the measurement.
- Humidity sensor shall be mounted so that thermal conduction from the radiosonde body does not affect the measurement.
- The construction of the radiosonde shall be made so that it is not possible for the user to inadvertently set the humidity sensor into wrong position. The in-flight position of the sensor must be consistent from flight to flight.
- Humidity sensor must be designed so that the risk of ice formation on the humidity sensor is minimized. This feature must have been tested and the test reports shall be attached in the tender.
- Both humidity and temperature sensor shall recover fast from high humidity conditions or a cloud so that cloud top is reliably detected. This feature must have been tested and the test reports shall be attached in the tender.

### **Radiosonde electronics**

- Supplier shall list any other additional sensors that can be connected to the radiosonde e.g. for ozone measurements
- Battery capacity shall be sufficient for a flight of 120 minutes or longer.
- Sampling rate of all sensors and wind data shall be one per second (1 Hz) or higher.

### **Radiosonde calibration**

- Each radiosonde, comprising of sensors and related electronics, must be calibrated by the manufacturer before delivery. Calibration of sensors separate from the related electronics is not acceptable.
- The references used in the calibration must be traceable to International System of Units (SI) standards through national or international references. The supplier shall describe how the traceability is arranged and maintained. Radiosonde calibration method shall be documented and the document shall be attached to the tender. In the document the supplier shall describe the radiosonde calibration process and how calibration references are kept valid.
- The calibration system uncertainty shall be analyzed and the results shall be included in the tender.
- The supplier shall describe methods applied to ensure that the long term stability of the offered radiosonde is preserved.
- To preserve and validate the offered quality, the supplier is responsible for continuously after commissioning for at least five years and monitoring its radiosonde performance.
- The shelf life of the radiosonde, including battery shall be 12 months or higher.

## **V. GROUND SYSTEM**

### **General**

- Ground system shall include antennas, receiver and workstation computer and any other equipment necessary to perform a sounding.
- The UPS shall have a capacity for running the complete sounding system for 1hr.
- Rating and frequency of the UPS input voltage shall be able to match the available mains voltage.

- The ground system shall operate either from 230 V mains power. The operating voltage range shall be at most +/-10 % from the nominal voltage.
- Operating frequency range shall be specified and ensured it is compatible with frequencies allowed in Ethiopia.
- In fixed installations, antenna feed cables shall be at least 30 meters in length.
- Maximum power consumption of the ground receiving system shall ideally be less than 300 W.

## **VI. RECEIVER**

- The receiver shall be capable of receiving radiosonde signal in the meteorological band of 400.15 - 406.00 MHz
- The system shall have a real-time spectrum display that shows the frequency occupation in the meteorological band so that operator can choose a frequency in an unoccupied and noise-free slot.
- It shall be possible to set frequency bands that are not allowed to be used to prevent the operator from setting the radiosonde to a forbidden frequency.
- To prevent spurious transmissions, the radiosonde transmitter frequency shall be adjustable only via the ground system. Direct adjustment in the radiosonde shall not be possible.
- The system shall be capable of receiving and correctly processing radiosonde transmissions from a distance of at least 350 km (line of sight)
- The system shall be capable of maintaining telemetry when radiosonde is directly above the receiving antenna.
- Direction control if needed, shall be automatic and fully electronic.

## **VII. SOUNDING WORKSTATION AND SOFTWARE**

- The sounding software shall run in the Windows operating system. The Windows version shall be fully supported by Microsoft Corporation at the time of delivery.
- All sounding data shall be stored in easily accessible data files (preferably one per sounding) to preserve data integrity and to make it easy to manipulate archived sounding data.
- The system must be capable of producing formatted meteorological messages, including regional practices, as specified in the latest WMO Manual on codes (e.g. TEMP/FM-35, TEMP SHIP/FM-36, TEMP MOBIL/FM-38, PILOT/FM-32, PILOT SHIP/FM-33 and PILOT MOBIL/FM-34).
- The system should be capable of producing BUFR sequences 3 09 050/PILOT observation type based on pressure and 3 09 051/PILOT observation type based on height. Supplier shall list the available BUFR message sequences, applicable table version numbers and BUFR edition numbers.
- Meteorological messages shall be coded automatically.
- It should be possible to transfer any of the produced WMO meteorological messages or reports automatically to another computer.
- The system software shall include diagnostics capabilities to detect faults and malfunctions of the system. The results of the diagnostics shall be recorded into log files.  
It shall be possible to install the sounding software to any commercially available computer on the market which satisfies the minimum requirements of the sounding system.

## **VIII. SOFTWARE**

The following specifications are desired and the supplier should indicate which specifications are supported:

- The workstation clock can be synchronized to the GPS time stamp at system start-up and additionally in the beginning of sounding preparation.
- The right to manually adjust the workstation clock can be prohibited from the sounding operator i.e., only authorized personnel using a valid password shall have the right to adjust the clock.
- The system can produce a coded ozone data message in NASA Ames 2160 Format for Data Exchange (the so called NILU message).

- There can be a real-time graphical display for checking sounding data during ascent.
- Prior to and during a sounding the status of the GPS signals received locally and by the radiosonde can be viewed.
- A display can show the trajectory path of the radiosonde from the point of launch to the current position at any time during the flight.
- Message coding and data transfer can be initiated both manually and automatically. Automatic message coding can be triggered based on height, pressure, time, and time from launch or at the end of sounding.
- User interface can use web browser based interface.
- The controlling and monitoring of the sounding system can be shared in a controlled manner on the network. Monitoring is possible for multiple users at different locations at the same time.
- The system can have commercially available scripting language for creating customer specific output formats and for performing any calculations.
- System can have simulation functionality for playing back individual archived soundings.

### **Data Exchange and security**

- File containing the raw data should be easily accessed in different formats including CSV and also allow easy exchange/ sharing of data via the network
- Data should easily be integrated/imported/ to the NMA database, CLIDATA.
- Raw data should automatically be backed up on a scheduled regular time.
- The supplier shall provide a separate certification on data security. Especially, the supplier has to certify that data is not transferred to any third party from the system without the knowledge of NMA.

## **X. HYDROGEN GENERATORS SPECIFICATIONS (1-Unit)**

### **1 - Process**

- The process required for producing hydrogen shall be electrolysis using alkaline technology. PEM or SPE technology is not allowed.
- The hydrogen generator shall generate pressurized hydrogen for an easy gas transfer into a hydrogen storage vessel without any compression system.
- The hydrogen generator shall produce instantaneous gas; modulation of the hydrogen flow rate shall be from 0% to 100%
- The hydrogen generator shall be equipped of a built-in analysis unit, thus to check continuously the quality of the gas produced

### **2 - Specifications**

The hydrogen generator shall comply to the below minimum requirements:

- Hydrogen flow rate at atm. pressure 500+ Liters/hour
- Hydrogen purity: 99.9%
- Hydrogen pressure: 8 bars (115 psi)
- Operating environment: min: 0°C / max: 50°C
- Relative ambient air humidity: up to 100%
- Power supply: able to handle 230 VAC

### **3- Hydrogen Storage**

- Water capacity 1,000 liters (optional 2000 liters)
- Service pressure 8-10 bars
- Fluid allowed Hydrogen gas
- Conformity European standards

#### **4 - Particularities**

- The hydrogen generator shall have a battery backup with autonomy of 2 hours minimum for maintaining and balancing gases safely.
- The hydrogen generator shall have an automatic gases depressurization system in case of power supply failure higher than 30 minutes.
- The hydrogen generator shall restart automatically without any external assistance after a power failure even prolonged. The hydrogen generator shall be equipped with an audible and visual signaling device in case of alarm.
- The hydrogen generator shall be able to operate with a standard quality of water from either rain or household water supply.
- All equipments are installed and commissioned by bidder.
- On-site commissioning and training must be provided
- European safety standards are required

#### **Capacity building / Training**

Factory or onsite training shall be offered for 5 (five) technicians for five days at least for hardware, software and data processing personals. Onsite training shall be offered for operators. The training syllabus shall be attached to the document.

#### **Civil Works and Ancillary Construction Materials Supply**

UNDP Ethiopia will supply construction materials and construct the civil works as per the Bidder's detail design and specs in order to best-fit to the requirements of the equipment to be installed.

### LOT III. Specification for Meteorological Calibration Equipment

Prospect suppliers are hereby kindly invited to supply the **following product specification or "its equivalent"** to allow NMA use fit-for-purpose Meteorological Calibration Equipment.

#### General Considerations for Calibration Equipment:

- Installation, commissioning and on-site training is required for all laboratory calibration equipment (as listed in 3A; 3.1-3.5)
- Complete use and maintenance manual in both softcopy and hard copy is required for all instruments
- Video guide on the operation and maintenance of both laboratory and mobile calibration units is preferred – bidder/supplier to indicate if this is available.
- Appropriate consumables for a year and recommended spare parts should be included.
- \* On the Job Training on full operational activities and basic maintenance skill is required for 5 (five) Technicians and staffs. It means the same technicians (five) should be trained for all calibration equipment

Laboratory and Mobile Meteorological Calibration Equipment			
No.	Item/ Description of Minimum Specification	Qty	Unit
<b>A</b>	<b>Laboratory Calibration</b>		
3.1	<b>Calibration Chamber For Thermometer Air chamber Type</b>	<b>1</b>	<b>Pcs</b>
	<ul style="list-style-type: none"> <li>• Range: -50 to +50 °C</li> <li>• Accuracy minimum +/-0.3 °C</li> <li>• With Verification certificate from Accredited laboratory</li> <li>• Manufactured as per the requirement of WMO standard</li> <li>• With 2 WMO primary reference thermometer</li> <li>• Installation and Commissioning</li> </ul>		
	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
3.2	<b>Calibration Chamber For Hygrometer (Wet &amp; Dry Air mixed Type)</b>	<b>1</b>	<b>Pcs</b>
	<ul style="list-style-type: none"> <li>• Range: 15 to +95 %RH</li> <li>• Accuracy minimum +/-2 %RH (at 25 °C)</li> <li>• With Verification certificate from Accredited laboratory</li> <li>• With 2 WMO primary reference hygrometers</li> <li>• Manufactured as per the requirement of WMO standard</li> <li>• Installation and Commissioning</li> </ul>		
	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
3.3	<b>Calibration Chamber For Barometer</b>	<b>1</b>	<b>pcs</b>
	<ul style="list-style-type: none"> <li>• Range: 10 to 1150 hPa</li> <li>• Accuracy:- +/- 0.1 hpa</li> <li>• With Verification certificate from Accredited laboratory</li> <li>• With 2 WMO primary reference barometer</li> <li>• Manufactured as per the requirement of WMO standard</li> <li>• Installation and Commissioning</li> </ul>		



	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
	<b>Rainfall Calibration Unit</b>	<b>1</b>	<b>pcs</b>
3.4	Mass set • Range 25- 500 mm/h Or Flow Bench • Class secondary • Range 0-500 mm/h • Uncertainty 1% • Complete operational Unit with Installation and Commissioning		
3.5	<b>Laboratory Radiation Calibration Unit</b> • WMO Primary type • Complete set including reference WMO Primary Pyranometer and Lighting facilities	<b>1</b>	<b>pcs</b>
<b>B</b>	<b>Mobile Calibration Units with carrying case</b>		
	<b>Hand-Held Barometric meter (calibration)</b> • WMO Primary type that is compatible to WMO mobility requirement • With Verification certificate from Accredited laboratory	5	set
3.6	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
	<b>Hand-Held Thermometer meter (Calibration Unit) with carrying case</b> • Measurement range -10 to +40 °C • Accuracy within 0.2 °C at -10 to +40 ° • Unit : °C • Carrying case for device & accessories • With Verification certificate from Accredited laboratory • Manufactured as per the requirement of WMO primary standard	5	Pcs
3.7	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
	<b>Hand-Held Humidity Meter (Calibration Unit) with carrying case</b> • Measurement range 0 to 100 %RH • Accuracy at 20 °C < ± 2 % RH (0 to 100 % RH) • Carrying case for device & accessories • With Verification certificate from Accredited laboratory • Manufactured as per the requirement of WMO primary standard	5	Pcs
3.8	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person
	<b>Mobile Radiation Calibration Unit: Pyranometer with carrying case</b> • Detector: Photovoltaic silicon cell • Spectral response: 300-1150 nm • With Verification certificate from Accredited laboratory • Manufactured as per the requirement of WMO primary standard	5	pcs
3.9	On the Job Training on full operational activities and basic maintenance skill for Technician and staffs*	5	person

Further to the Schedule of Requirements in the preceding Table, Bidders are requested to take note of the following additional requirements, conditions, and related services pertaining to the fulfillment of the

requirements:

No.	Related Services	Terms / Responsibilities
1	Exact Address of Delivery/Installation Location	<input checked="" type="checkbox"/> Adama Brach Office for LOT I <input checked="" type="checkbox"/> Mekelle for LOT II <input checked="" type="checkbox"/> Addis Ababa for LOT III
2	Mode of Transport Preferred	<input checked="" type="checkbox"/> AIR
3	Expected Delivery Date	<input checked="" type="checkbox"/> Forty five (45) calendar days after issuing Purchase Order (PO)
4	Customs, if needed, clearing shall be done by:	<input checked="" type="checkbox"/> UNDP Ethiopia Country Office will be responsible to clear cargo from Addis Ababa Airport
5	Ex-factory / Pre-shipment inspection	<input checked="" type="checkbox"/> By independent firm to be hired by UNDP Ethiopia Country Office
6	Inspection upon delivery	<input checked="" type="checkbox"/> UNDP/ NMA Project will conduct post-delivery inspection on each field unit, and will then verify operating functions as per the requirement
7	Installation Requirements	<input checked="" type="checkbox"/> The Supplier will be required to install and supervise the equipment installation <input checked="" type="checkbox"/> Provide suitable ancillary civil works details such as drawings and detail civil works that will be constructed by the beneficiary prior to installation in an effort to best fit with equipment installation civil works requirement.
8	Testing Requirements	<input checked="" type="checkbox"/> The Supplier will conduct site test for all equipment. Any defects found shall be rectified at no additional cost to UNDP
9	Scope of Training on Operation and Maintenance	<input checked="" type="checkbox"/> The Supplier will supply all manual, software and training materials required for the operation and maintenance of the equipment supplied as per the detail Specs
10	Commissioning	<input checked="" type="checkbox"/> The Supplier will assist the beneficiary and its representatives in the commissioning of all equipment supplied
11	Technical Support Requirements	<input checked="" type="checkbox"/> The Supplier will ensure provision of technical support via telephone, electronic mail or any other appropriate means of communication for a period not less than five (5) year after installation and final commissioning
12	After-sale services required	<input checked="" type="checkbox"/> Warranty on Equipment and Labor for minimum period of five (5) years <input checked="" type="checkbox"/> Technical Support <input checked="" type="checkbox"/> Training on Operations and Maintenance

**This Product Spec is approved by:** [\[indicate name of IP Approving Manager\]](#)

**Signature:** \_\_\_\_\_

**Name and Designation:** Dr. Driba Korecha; Meteorological Forecast & early Warning Directorate  
Director

**Date of Signing:** August 15, 2014      **IP Corporate Seal:** \_\_\_\_\_