Attachment 1

All Weather, Inc. Series 3000
AUTOMATED WEATHER OBSERVING SYSTEM - LEVEL III

DESCRIPTION

This document describes an All Weather, Inc. FAA-approved Level III Automated Weather Observation System (AWOS) in accordance with this specification and the FAA Advisory Circular No. 150/5220-16 latest edition. The system shall be installed at the specified location and in accordance with the dimensions and details shown in the plans and FAA Order No. 6560.20B for Siting Criteria.

EQUIPMENT AND MATERIALS

General

A. The Automated Weather Observing System and other equipment and material covered by FAA specifications shall have the approval of the Federal Aviation Administration, Washington, DC, 20591, as listed in Advisory Circular 150/5345-1, latest edition prior to bid opening.

B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specification.

AWOS System

The Automated Weather Observation System (AWOS) shall be an FAA (type certified) system in accordance with AC No. 150/5220-16, latest edition and Order No. 6560.20, latest edition.

General Performance Standards

A. **Input Power**. AWOS equipment shall operate from a 120V AC (± 5%), 60 Hz (± 5 Hz), 3-wire single-phase service. The Data Collection Platform (DCP) enclosure shall be mounted to the AWOS tower in accordance with the manufacturer's specifications. The maximum service required shall be 20 amps.

B. **Loss of Power**. The AWOS system will return to normal operation without human intervention after a power outage. When power is restored, the system will not output erroneous data. The system shall include the capability of operating from a one hour Uninterruptible Power Supply (UPS.)

Operating Environment. The AWOS equipment shall meet the requirements for operating in a Class 1 environment, as defined in FAA Advisory Circular 150/5220-16 latest edition.

AWOS System and Sensor Specifications. The AWOS System provided for this project shall, as a minimum, include and meet the following specifications.

AWOS SYSTEM AND SENSOR PERFORMANCE STANDARDS

Wind Speed and Direction Sensor. The wind speed and direction sensor shall be of the ultrasonic type. Periodic calibration shall not be required.

Speed:

A. **Range**. 0 - 146 knots. (0 – 168 mph)

B. **Accuracy**. ±0.02 knots or 2%, whichever is greater.

C. **Resolution**. 0.02 knot.

D. **Threshold**. 0.02 knots.

Direction:

A. **Range**. 0 degrees to 360 degrees in azimuth.

B. **Accuracy**. ±2 degrees.

C. **Resolution**. 1 degree.

D. **Dead Band Direction**: None

Ambient Temperature Sensor. The sensor shall be thermally isolated in a motor aspirated radiation shield to accurately measure air temperature.

A. **Range**. From –40C to +60C (-40 ^{o}F t o +140 ^{o}F)

B. **Accuracy**. ±0.3C.

C. **Resolution**. 1 ^{o}F.

D. **Time Constant**. Less than 2 minutes.

Dew Point . Dew point shall be derived using temperature and relative humidity data. Algorithms within the AWOS Data Collection Platform (DCP) shall perform this derivation. The relative humidity sensor shall be thermally isolated in a motor aspirated radiation shield to accurately measure the atmospheric dew point temperature.

A. **Operating Range**. From –40C to +60C (-40 ^{o}F to +140 ^{o}F), 0 to 100% RH (Relative Humidity).

B. **Resolution**. 1 ^{o}F.

C. **Time Constant**. Less than 2 minutes

D. **Accuracy**. Accuracy is as follows:

1. 2 ^{o}F dew point for dry bulb temperature of +30 ^{o}F to +90 ^{o}F (80% to 100% RH), with a maximum error of 3 ^{o}F at any dry bulb temperature.

2. 3 ^{o}F dew point for dry bulb temperature of +30 ^{o}F to +120 ^{o}F (15% to 75% RH) with a maximum error of 4 ^{o}F at any dry bulb temperature.

3. 4 ^{o}F dew point for dry bulb temperature of -20 ^{o}F to +20 ^{o}F (25% to 95% RH) with a maximum error of 5 ^{o}F at any dry bulb temperature. The minimum dew point required is -30 degrees F.

Pressure Sensor

A. **Design**. Two pressure sensors shall be provided, with provisions to accommodate a third as a backup. The sensors shall not require heaters. Pressure sensors shall be vented to the atmosphere using a quad-plate pressure port. Each sensor shall have an independent venting interface (from separate outside vents through dedicated piping) to the sensors.

B. **Range**. From 15.00 to 32.00 inHg. The system shall be capable of reporting altimeter settings between 28.00 and 31.00 inHg when installed at the airport.

C. **Accuracy**. ±0.01 inHg.

D. **Resolution**. 0.001 inHg.

E. **Differential Accuracy**. The sensor shall exhibit a maximum differential accuracy of 0.01 inHg or less between any two pressure measurements taken from the same sensor 3 hours apart.

F. **Maximum Drift With Time**. Each sensor shall be stable and continuously accurate with 0.01 inHg for a period of not less than 6 months.

Cloud Height Sensor

A. **Design**. The cloud height sensor shall be capable of detecting clouds up to 12,500 feet. The sensor shall provide an output of three cloud layers representative of the sky conditions when surface visibilities are equal to or greater than ¼ mile.

B. **Range**. The sensor shall measure cloud heights and the heights of obscuring phenomena aloft to 12,500 feet.

C. **Accuracy**. ±100 feet or 5%, whichever is greater.

D. **Resolution**. Not greater than: 50 feet surface to 5,500 feet; 250 feet from 5,501 to 10,000 feet; 500 feet above 10,000 feet.

E. **Sampling**. The sensor shall provide an output of cloud height at least once every 30 seconds when clouds are present. The sampling rate may be reduced to at least one sample every 3 minutes when no clouds are detected for the preceding 15 minutes.

F. **Detection Performance Accuracy**. Meet or exceed the requirements of FAA Advisory Circular 150/5220-16 latest edition.

G. **Eye Safety**. The cloud height indicator sensor shall be designed to conform to ANSI-Z 136.1, Acceptable Emission Limits for Laser Radiation, with Class 3b maximum accessible emission level applied to direct viewing without optical instruments (excluding ordinary eye glasses). An interlock device in the laser power circuit shall be proved to disable the laser during maintenance thereby preventing inadvertent exposure of the laser emission to the eyes of the technician or other.

H. **Optics Contamination**. An air blower shall be used to reduce the contamination of sensor optics. A signal shall be generated to indicate the amount of optics contamination, thereby indicating the need for optics cleaning.

1. **Snow**. The ceilometer window shall remain clear of snow when subject to precipitation rate of 2 inches per hour for one hour at a temperature of 20 ^{o}F.

2. **Ice**. The window shall remain clear of ice for 60 minutes under conditions of freezing, rain, equivalent to buildup of 1/2 inch per hour thickness of clear ice.

Visibility Sensor

A. **Design**. The visibility sensor shall be of the 4-headed design utilizing the forward scatter method of measurement. The sensor shall be capable of operating in 3-head mode in the event of the failure of one of the heads. A method of calibration traceable to the FAA approved standards shall be provided.

A. **Range**. The visibility sensor shall determine visibility from 30 feet to 10 miles.

B. **Resolution**. In terms of equivalent visibility, the sensor shall provide data to report visibility values as follows (in statute miles); less than 1/4, 1/4,1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 3-1/2, 4, 5, 6, 7, 8, 9 and 10 miles.

C. **Time constant**. The time constant shall not exceed 3 minutes.

D. **Accuracy**. The sensor shall agree with a transmissometer standard as follows:

Table 1. Visibility sensor accuracy requirements.
(All values in statute miles)

Reference Transmissometer Reading	Acceptable Sensor Variance
1/4 through 1-1/4	±1/4
1-1/2 through 1-3/4	+ 1/4, - ½
2 through 2-1/2	±1/2
3 through 3-1/2	+ 1/2, - 1
4 and greater than 4	±1

E. **Ambient Light Sensor**. The visibility sensor shall contain an ambient light sensor (i.e. photocell) to measure the ambient luminance within its field of view, and to generate a signal to the visibility sensor to indicate

whether the ambient light level is day or night. It shall indicate day for increasing illumination between 0.5 and 3 foot-candles (FC), and night for decreasing illumination between 3 and 0.5 FC. This sensor may be exposed to ambient light levels as high as 50 FC.

Precipitation Accumulation Sensor

The sensor should be capable of measuring the precipitation amount with a range of .01 to 5 inches per hour. Precipitation amount is the liquid equivalent of all precipitation forms, i.e., liquid, freezing, frozen, or combinations thereof.

A. Resolution. The resolution shall be 0.01 inches.

B. Accuracy. The accuracy shall be 0.002 inches per hour (RMSE), or 4 percent of actual, whichever is greater.

AWOS Data Processor. The AWOS data processor shall be a Pentium PC, 100MHz (or greater), 16MB RAM with a 1.0 GB or greater hard disk and perform the following functions; data acceptance; data reduction; data processing and product dissemination (digital and voice).

A. The processor shall be capable of attaining AWOS IV configuration by adding the requisite sensors and software only. No major upgrade of the data processor will be required.

B. The processor shall provide a computer-generated voice weather observation to a ground-to-air radio for transmission to aircraft.

C. Number of Sensors. The processor shall be able to receive inputs from up to an unlimited number of sensors.

D. The processor shall contain an operating system working in an open system architecture capable of remote software upgrades.

E. **Data Reduction**. The data reduction function shall preprocess information prior to meteorological algorithm processing. The AWOS data reduction software shall include quality control checks to ensure that the data received is accurate and complete and that the associated equipment is working properly before the weather algorithms are performed. If data from any sensor is erroneous or missing (e.g. sensor power loss, etc.), the parameter and all other parameters derived from the missing parameter shall be reported “missing” in the weather observation. The processor shall continue to sample data, and if the error condition is corrected, the weather parameter shall be reinserted in the AWOS report.

1. The processor shall periodically check reference of calibration points which correspond to the normal operating limits of the sensor.

2. The processor shall set upper and lower limits on the sensor output which correspond to the normal operating limits of the sensor.

F. **Weather Algorithms**. The system processor shall implement algorithms provided by the FAA to generate the elements of the weather observation. An observation shall be generated each minute.

G. **System Output**. The system shall generate the outputs: computer generated voice transmitted to pilots; telephone port for dial-up service and software updates; output port for a video display; input/output ports for up to 8 remote display terminals, and an output to the national weather network.

H. **Real Time Clock**. The system shall report date and time. This information will be used in system displays, computer-generated voice output, etc. The day shall be expressed in Gregorian Calendar. Hours and minutes shall be indicated numerically from 0000 to 2359. The clock function shall be accurate within 15 seconds a month. The clock shall be backed with a battery which will operate the clock for a minimum of 30 days. The system shall be delivered with the clock set to UTC (Universal Time Constant).

I. **Power Outage**. The system shall return to normal operation without human intervention after a power outage. The system shall not output erroneous data when power is restored.

J. **Data Archiving**. The processor shall retain 1-year worth of weather reports and system maintenance activity and have download capability to a 3.5” floppy disk drive, for use by accident investigators. The interval between archived reports shall be 5 minutes or less.

A method shall be provided for the retrieval of archive reports, and the operator shall be able to suspend the updates or archived weather reports to freeze the data until retrieval may be accomplished. In the event of power loss, the archive data shall be retained indefinitely within the processor hard disk.

K. **System Constants**. The following system constants shall be stored in data files on the hard disk drive.

1. Elevation of the pressure sensors at the installation site (MSL).

2. Magnetic variation of the installation site, to the nearest degree.

3. AWOS facility identification.

4. Constants required to convert pressure to altimeter setting.

5. System configuration parameters (sensors, peripherals, interface, port assignments, etc.).

Operator Terminal (OT)

A. **Product Editing**. The Operator Terminal shall have the capability to do product editing. This function allows an authorized observer to initiate or change any observation product. A specific "editing" password shall control access to this function. Manual entries of weather phenomena not automatically observed shall be placed in the remarks section of the observation and will not be included in the voice message. In the case of sensor failure or an incorrect AWOS output, an operator shall have the capability to replace the incorrect parameter value with a missing symbol.

The Operator Terminal shall consist of a video display monitor with keyboard and printer. All necessary interface equipment, video display monitor, detachable keyboard, printer and audio output equipment shall be supplied.

B. **Security**. The system shall require the operator to enter a security code in response to system queries prior to allowing him to proceed with the entry of data.

C. **Telephone Hook-up**. The telephone hook-up shall provide an audio output on an assigned dial-up telephone number. The telephone line shall be provided by others. The phone line shall be terminated at the data processor location.

D. **Periodic Data Validation**. Where an operator terminal is used to modify the report, all manually entered data shall be automatically time tagged by the system. The data shall be valid until the next hourly or manually entered observation. In order to retain the manually entered data in the system, the operator shall be required to revalidate his entries hourly. The data shall be retained in the observation until the "on-the-hour" observation, when it must be revalidated.

E. **Remote Maintenance Monitoring**. Remote maintenance monitoring shall be accomplished over the voice line at a minimum baud rate of 9600.

Voice Subsystem. The voice subsystem shall provide high quality computer-generated speech for output of the AWOS observation. A high level error-checking scheme shall be incorporated to prevent erroneous outputs. The voice

subsystem shall provide the speech for the local ground-air radio broadcast and for telephone dial-up users.

The voice subsystem shall have the capability for the addition of up to two (ninety seconds each) manually input voice messages. These messages will be voiced at the end of the computer-generated voice message. The programming of the manual input voice messages shall be accomplished using a microphone. Security access code shall prevent unauthorized use. The system shall automatically play back the recorded message and allow the user to reprogram, delete or accept the messages.

A. The voice subsystem shall have the following features:

1. The voice signal shall deliver a minimum of 1 milliwatt of power into a balanced 600 ohm line. The output amplitude shall be adjustable to nominal 0 db.

2. The voice message shall be output continuously with approximately a 5-second delay between the completion of one message and the beginning of the next.

3. If the voice message is in process of output when the new AWOS observation is received, the output message will be completed without interruption; voice transmission of the new AWOS observation will begin upon completion of the next delay time.

4. The quality of the automated speech shall provide clear reception from telephone and air-ground radio receivers.

5. The format and sequence of the voice message shall be in accordance with FAA order 7110.10, Flight Services Handbook. When any weather parameter is reported missing due to a disabled or inoperative sensor, as determined by internal AWOS checks, the voice report shall be “(parameter) missing”, e.g., “wind speed missing”, “cloud height missing”, etc. The UCT time of the observation will be given after the location identification.

6. If a valid data update is not received prior to the start of the next voice transmission, the last valid data set received shall be used to compose the voice message. Failure to receive a data update for more than five minutes shall result in the termination of the voice output and generation of a failure message. In this event, the AWOS shall output the message “(station identification) automated weather observing system temporarily inoperative”.

7. The system shall contain an automatic telephone-answering device that will permit user access to the voice message via the public telephone system. The incoming call shall be answered prior to completion of the second ring, and the radio signal in progress at the time the call is received shall be placed on line. The voice subsystem shall automatically disconnect when the weather observation has been completely transmitted twice.

8. Hook-up for telephone audio output on an assigned dial-up telephone number shall be provided by others.

9. The system shall contain a headset or speaker for monitoring the voice output.

VHF Transmitter. It is FAA policy that the output of the AWOS will be transmitted on an existing navigational aid voice outlet whenever possible. If there is no navigational aid available, then the output will be broadcast via a separate VHF transmitter. The transmitter operates in the 118-136 MHz band. The transmitter must have an FCC type acceptance and have the following operational parameters:

A. Channel spacing: 25 KHz

B. RF Power Outlet: 10 watts maximum

C. Frequency Stability: ± 0.001% (-30C to +60C)

D. Emission Type: 6A3

E. Spurious and Harmonic Emissions: 80 db minimum up to 90% modulation.

Equipment Enclosure. AWOS components not designed for outdoor use shall be located in the terminal building as shown in the plans and in accordance with manufacturer and FAA guidelines. All outdoor enclosures will be NEMA -4X enclosures. Hardware will be stainless steel.

Concrete. The concrete shall have a minimum twenty-eight (28) days compressive strength of 3,000 PSI, or as specified by the project engineer.

Reinforcing Steel. Reinforcing steel and bars shall not be used in the tower and sensor foundations. AWOS manufacturers shall submit foundation drawings showing the materials in the foundations.

Conduit. Conduit shall be used between the AWOS tower and sensor foundations for both power and signal cables. The conduit shall meet the requirements of the national electrical code and local code.

Wire and Control Cable. Wire and control cables shall meet the requirements of the national electric code, local electric code and AWOS equipment manufacturer's recommendation. Control cables shall be the manufacturer's required number of pairs plus two spare pair. Each pair is to be individually shielded.

AWOS Data Link. AWOS system shall utilize land-line or wireless technology for transmitting AWOS data from the tower and sensors to the video display, printer, and audio output. The data shall originate at the tower site and broadcast via UHF discreet transmitter or land-line communications.

Tower. The tower shall not exceed the height specified in the drawings. The tower shall conform to all AWOS equipment manufacturer's specification.

Painting. The tower shall be painted with alternating bands of aviation surface orange and white in accordance with AC 70/7460-1, latest edition. The band widths shall be 1/7 of the height of the tower and perpendicular to the vertical axis of the tower with the bands at each end colored orange. Paint and aviation colors referenced to in the specifications should conform to Federal Standards FED-STD595, Colors as follows:

A. Orange Number 12197 (Aviation Surface Orange)

B. White Number 17875 (Aviation White)

The tower shall be primed in accordance with the manufacturer's specifications prior to painting.

Obstruction Light. A dual L-810 LED obstruction light will be placed within 5' (1.5m of the top of the tower in accordance with FAA requirements and manufacturer's plans and specifications. The two lamps on the L-810 are to be wired in parallel on a dedicated circuit.

Transient and Lightning Protection. AWOS equipment is to be protected against damage or operational upset due to lighting-induced surges on all sensor input lines, sensor supply lines and incoming power and data communication lines. Equipment and personnel shall be protected from lightning surges and voltages, from power line transients and charges. Lightning protection systems shall be designed and installed in accordance with the Lightning Protection Code, NFPA 780, latest edition, and manufacturer's recommendations for all equipment structures.

NADIN / WMSCR Interface. The AWOS system is capable of interfacing to the equipment of a vendor that is approved to download information through the National Airspace Data Interchange Network (NADIN) and into the Weather Message Switching Center Replacement (WMSCR). The second tier vendor's services may or may not be required per engineering specification.

Test Equipment **A**WOS test equipment according to the manufacturer's FAA approved maintenance plan. This test equipment includes all standards as specified in the AWOS manufacturer's Operations and Maintenance Manual.

Spares As recommended by manufacturer.