AUTOMATED SURFACE OBSERVING SYSTEM (ASOS)

RELEASE NOTE

SOFTWARE VERSION - 2.82

February 1, 2006

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service / Office of Operational Systems/Observing Systems Branch
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1.0 Introduction

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1.1 Background

The ASOS Acquisition Control Unit (ACU) software version 2.82 (v2.82) operates on the new single board computer processor developed by Synergy Microsystems, Inc. V2.82 was developed using v2.7B as its baseline. Like v2.7B, v2.82 supports the All Weather Precipitation Accumulation Gauge (AWPAG) developed by Ott Hydrometrie of Germany, and both the new dewpoint temperature sensor (Vaisala DTS1) and the Ice Free Wind (IFW) sensor (Vaisala 425). All three new sensors (AWPAG, DTS1, and IFW) can interface to the new processor using software v2.82.

V2.82 includes 38 new capabilities and nine fixes to problems reported through Operational Trouble Reports (OTRs). The new capabilities will help ASOS to meet the encoding requirements for METAR / SPECI reports as outlined in the Federal Meteorological Handbook No. 1 (FMH-1), improve quality control logic for automated data, improve information provided in log files, add the reporting of ice accretion amounts, and provide support for the Federal Aviation Administration's (FAA) Weather Sensor Processor (WSP) program. Some of these capabilities were available in the past as part of a unique software load installed at specific sites. Now they are included in ASOS's baseline software and will be included in all future baseline software releases. A complete list of the new capabilities can be found in Table 1 and a list of the fixed OTRs can be found in Table 2.

1.2 Purpose

This ASOS Release Note gives a summary of the changes found in ACU application software v2.82, since v2.7B.

2.0 General Information

V2.82 has been evolving since v2.60 was developed and implemented. As each new sensor was readied for deployment a software version had to be prepared to interface to the new sensor. A site receiving the new sensor also had to have the new software to take advantage of the new capabilities offered by the new sensor. Each of these software versions was documented through a set of Release Notes. Some sites will be replacing v2.60 with v2.82. Others will be replacing v2.6A, v2.7A, v2.7B, or v2.79 with v2.82. With this in mind, there are Release Notes available for each software version, i.e., v2.6A (DTS1), v2.7A (DTS1 and IFW), and v2.7B (DTS1, IFW, and AWPAG) on the ASOS website (http://nws.noaa.gov/ops2/Surface/implementation.htm).

Software v2.6A supported the DTS1 and the installation of the new single board computer processor developed by Synergy Microsystems, Inc. The algorithms for processing dewpoint

temperature data for ASOS's products and messages have not changed. A new system maintenance log message was added in v2.6A to help isolate hardware problems with the new processor board.

The Vaisala 425 sonic anemometer, i.e., IFW, can only interface to ACU software versions beginning with v2.7A. (Software v2.6A was used as a baseline to develop v2.7A.) Like v2.6A, v2.7A can only be installed on the new processor board. Except for the implementation of the new 3-second gust sampling period for the IFW, no changes were made to the ASOS wind algorithms (e.g., wind shift, variable wind direction, and peak wind remarks). Software v2.7A supports both the DTS1 and IFW sensors.

The AWPAG can only interface to ASOS using software versions beginning with v2.7B. The precipitation data processing algorithms in the ACU software are identical to those algorithms used by the Heated Tipping Bucket (HTB). In other words, only the source of the data, i.e., precipitation sensor (AWPAG or HTB), has changed and the algorithms used to process the data for the ASOS products and messages are unchanged. Since the AWPAG has advanced self-test maintenance firmware, new maintenance pages and system log messages are available for the electronics technician. Software v2.7B can support the DTS1, IFW, and AWPAG sensors.

2.1 Verifying Installation of Software Version 2.82

Starting at the OID's 1-Minute Screen, use the commands REVUE-SITE-VERSN-SW to verify the installation of the v2.82 ACU application software. (See Figure 1 below.) If you are not sure you are looking at the 1-Minute Screen, press the EXIT function from the current page and that will return you to the 1-Minute Screen. If the EXIT function does not exist, but the SIGN function does, then you are looking at the 1-Minute Screen. (See Figure 2 on page 3.)

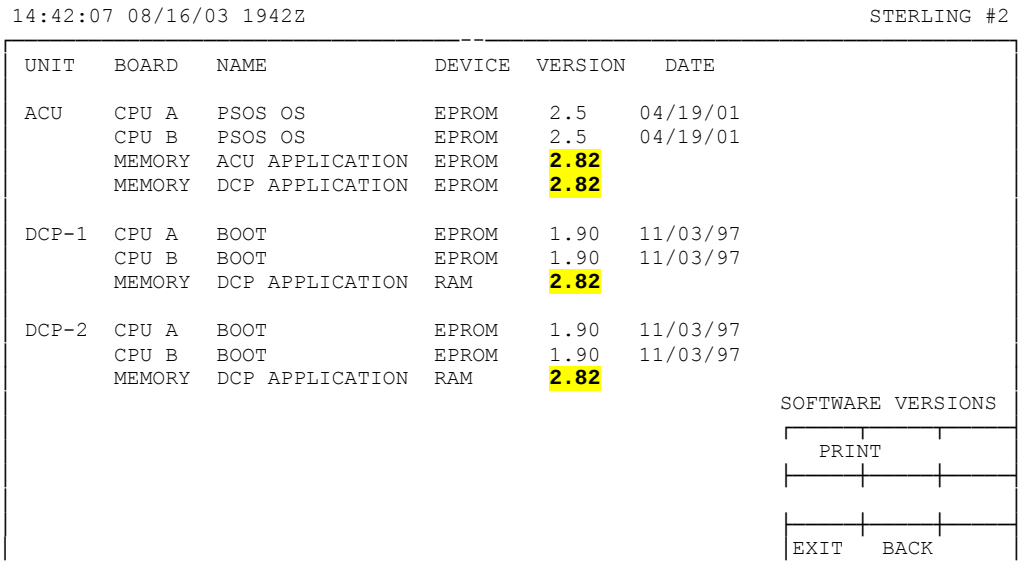

Figure 1: SOFTWARE VERSIONS Page (REVUE-SITE-VERSN-SW).


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14:40:57 08/16/03 1940Z                                        STERLING #2

  SKY        = OVC050

  VISIBILITY = 10SM                    TEMP/DEWPT   = 13.3 /-16.1 C  56 /03  F
  RVR        = RVRNO                   WIND DIR/SPD = 180/07
  PRESENT WX =                         ALTIMETER    = 30.18

  REMARKS    = RMK AO2 PWINO VISNO RY 22R


METAR KAAI 161856Z AUTO 21006KT 10SM OVC050 12/M16 A3019 RMK AO2 SLP224
T01221161 PWINO VISNO RY 22R $ FIBI
```

PRINT | REVUE | SIGN | AUX

Figure 2: OID 1-Minute Screen

3.0 Specific Changes In Software Version 2.82

There are 38 new capabilities and nine fixes to reported software deficiencies included in v2.82. Table 1 lists each new capability with a short discussion, and provides the Request-for-Change number as a reference. Table 2 lists each OTR fix with a short discussion, and the OTR number for reference. Tables 1 and 2 are provided below.

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
1. (S00703)	SOFTWARE SUPPORT FOR ADDITIONAL ASOSs
	Discussion: Allows ASOS to conform to standard METAR encoding practices. An ASOS site that is not required to have a present weather sensor configured shall have "AO1" encoded in the remarks section of the METAR report. ASOS shall retain the use of "AO2" whenever a present weather sensor is required to be configured at the site.
2. (S00704)	IMPROVE PRESENT WEATHER QUALITY CONTROL LOGIC
	Discussion: Reduces false reports of snow after a warm start. ASOS shall not allow the reporting of snow until it evaluates the most recently reported valid ambient temperature during the past 30 minutes from the 12-hour archive.
3. (S00705)	TRANSMIT SPECIALS AT ANY TIME
	Discussion: Implemented in software version 2.79. Allows both automated and manually generated SPECI reports to be generated and transmitted during the edit time of a pending hourly METAR report. Tornadic SPECI reports can still be generated and transmitted during the hourly edit time, i.e., as they were in the past.
4. (S00706)	ADD PRECIPITATION ACCUMULATION REMARK IN ALL 5-MINUTE OBSERVATIONS WHEN PRECIPITATION IS OCCURRING
	Discussion: Whenever precipitation is occurring, or has occurred since the last transmitted hourly METAR report, the hourly precipitation remark (Prrrr) shall be encoded in the 5-minute observations. This will allow forecasters to monitor the rate of precipitation accumulation for their forecast and warning products.
5. (S00707)	MODIFY DAILY SUMMARY PRODUCT WEATHER CODES

DRAFT	Discussion: Provides consistent reporting procedures for encoding weather occurrences with the FMH-1, Part B. When encoding weather codes in the Daily Summary Product, it is not permissible to enter both the values of "1" and "2." If the primary cause for the visibility being reduced to 1/4 mile or less is fog, then the code figure "1" is replaced by code figure "2." Allows for the automated entry of the following weather codes: 1 (mist/fog); 2 (fog reducing visibility to 1/4 mile or less); 3 (thunder); 4 (ice pellets); 5 (hail); 6 (glaze); 8 (haze); 9 (blowing snow); and X (tornado). DRAFT
6. (S00719)	PRECIPITATION BEGIN/END REMARKS
	Discussion: Provides a change to the existing 15-minute rule which is used to reduce long strings of precipitation begin/end remarks. When a precipitation begin/end remark is now transmitted as part of the METAR/SPECI report, the content of that transmitted remark is not to be altered after transmission of the report. Only additional begin and/or end times may be added to the remark.

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
7. (S00786)	ELIMINATE POSSIBLE CLR AUTO ENTRY BEFORE AUGMENTED ENTRY IN SKY FIELD
	Discussion: If ASOS reported automated layers below 12,000 feet, and the observer augmented a layer above 12,000 feet (e.g., FEW100 OVC160), it was possible for the automated layers to change to a clear condition and have a report of "CLR OVC160" included in the METAR/SPECI reports. This software change will remove the automated CLR report and only "OVC160" will be reported.
8. (S00788)	REMOVE ADDITIVE DATA FROM SPECIALS TRANSMITTED DURING HOURLY EDIT TIME
	Discussion: Data groups encoded hourly, as well as 3- and 6-hourly additive data, are not to be encoded in SPECI reports transmitted during the hourly METAR edit time. This change will ensure that only the hourly precipitation accumulation remark (Prrrr) will be encoded in the SPECI report.
9. (S00789)	GENERATE SPECIAL FOR BEGIN/END/CHANGE OF INTENSITY OF ICE PELLETS
	Discussion: If ice pellets (PL) were augmented, ASOS would not recognize this present weather element as a criterion for a SPECI report. (PL is not automatically reported by ASOS.)
10. (S00790)	CHANGE ORDER OF ENCODED REMARKS FOR BEGINNING AND ENDING TIMES OF THUNDERSTORMS
	Discussion: Brings the order of encoding remarks in accordance with the FMH-1. The begin and end times for thunderstorms will be encoded after those for precipitation.
11. (S00791)	DISPLAYING AND VOICING ALL VALUES OF DENSITY ALTITUDE
	Discussion: ASOS would only broadcast and display values of density altitude when they were 1,000 feet or greater. This change will broadcast and display all computed values.
12. (S00815)	SEPARATE REPORT PROCESSING CONTROL FOR EACH SENSOR

DRAFT	Discussion: In the past, when multiple visibility or sky condition sensors were configured, and if the report processing were turned-off for one of those sensors, then all the sensors for visibility or sky condition were turned-off. This change allows for separate report processing control for each configured sensor. DRAFT
13. (S00830)	REPORT MULTIPLE "FEW" LAYERS IN SKY FIELD
	Discussion: ASOS only allowed one cloud layer to be reported as FEW. This change will permit multiple layers to be reported as FEW from both the automated and manual observing process.
14. (S00836)	QC ERROR MESSAGE FOR DEW POINT WITH MISSING AMBIENT TEMPERATURE
	Discussion: ASOS allowed the observer to enter a dew point temperature without an entry for the ambient temperature. This violates the FMH-1 and an error message will now be displayed to the observer if he/she should attempt to enter a dew point without an ambient temperature.

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
15. (S00837)	REVISE VDU DISPLAY FORMAT FOR TEMP/DEWPOINT
	Discussion: The VDU displayed ambient and dew point temperatures in whole degrees Celsius only. This change will display both ambient and dew point temperatures to the nearest tenth of a degree Celsius and to the nearest whole degree Fahrenheit.
16. (S00847)	COMPUTE MINUTES OF SUN AT LATITUDES GREATER THAN 60 DEGREES
	Discussion: ASOS computed the minutes of sunshine for all sites, regardless of latitude, using the algorithm in Naval Observatory Circular 171. This was incorrect for sites with a latitude of greater than 60 degrees. A software check has been implemented so ASOS will not compute minutes of sunshine for sites at a latitude greater than 60 degrees.
17. (S00874)	DISPLAY LAST TRANSMITTED METAR/SPECI REPORT
	Discussion: This change was implemented in software version 2.79. It allows for both the last transmitted METAR or SPECI report to be displayed, along with the METAR or SPECI report that is pending transmission. In other words, the last transmitted report is always displayed on the one-minute screen.
18. (S00914)	MANUAL ENTRY OF ‘000" IN THE SKY CONDITION FIELD
	Discussion: Will allow the manual entry of “000" for a layer height in the SKY condition field.
19. (S00972)	REMOVE SAO LOGIC FROM ACU SOFTWARE
	Discussion: Prior to the METAR era, ASOS encoded Surface Aviation Observations (SAO) in the Airways code. Since the logic to encode SAOs is no longer necessary, it has been removed.
20. (S00983)	CURSOR CONTROL DURING CORRECTION EDIT

DRAFT	Discussion: Allows the observer to use the TAB function to move from element to element to help speed up the editing process while generating a corrected METAR/SPECI report. TAB will move the cursor from left to right, and SHIFT TAB will move the cursor from right to left. DRAFT
21. (S01005)	NEGATIVE PRESSURE REDUCTION CONSTANTS
	Discussion: At sites that have an elevation which is significantly below Mean Sea-Level (MSL), negative pressure reduction constants are required to compute pressure parameters. ASOS can now support these locations.

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
22. (S01016)	MODIFICATION TO WIND DATA QUALITY ALGORITHM
	Discussion: Changes data quality algorithm for the cup and vane anemometer. Introduces ambient temperature dependency into the wind data quality algorithm for wind speeds of 6 knots or greater. If the temperature is 36F or less, then a directions change of 1 degree or less is required within 5 minutes before a Data Quality Error (DQE) condition will be set. If temperature is greater than 36F, then a direction change of 2 degrees or less is required within 11 minutes before a DQE condition is set. If the temperature is missing, use the algorithm for temperatures of 36F or less. The ice free wind sonic anemometer uses a data quality algorithm of 1 degree directional change within 5 minutes, regardless of temperature.
23. (S01018)	CONNECT WSP AND REPORT 10s WINDS
	Discussion: This interface capability is used to support the FAA's Weather Sensor Processor (WSP) program. It has been part of several developmental and site-specific software loads prior to v2.82. The interface uses a dedicated, single user data port to transmit two-minute average wind speed (updated every 10 seconds), magnetic wind direction, and wind gust information. This interface should be completely transparent to the other operators of ASOS.
24. (S01055)	ADAPTIVE BASELINE FREQUENCY FOR FREEZING RAIN SENSOR
	Discussion: The freezing rain sensor is designed to have a resting baseline frequency of 40,000 hertz. When the frequency decreases to 39,967 hertz (i.e., a decrease of 33 hertz), it is possible for ASOS to report the occurrence of freezing rain. Unfortunately, many sensors have a resting frequency lower than 40,000 hertz, and in the past it was possible for ASOS to erroneously report freezing rain. This change will allow ASOS to determine a dynamic resting baseline frequency for the installed freezing rain sensor at the site. Then when a decrease of 33 hertz is detected, it will be possible for freezing rain to be reported. (See Appendix A for details.)
25. (S01078)	INCLUDE TEMP/DP REMARK IN ALL OBS

DRAFT	Discussion: The ambient / dew point temperature remark ($TS_nTTTS_nT_dT_dT_d$) is currently encoded in the hourly METAR report remarks section. This change will encode this remark in all METAR and SPECI reports. DRAFT
26. (S01105)	CHANGE DAILY SUMMARY PRODUCT SKY COVER LABELS
	Discussion: When the United States transitioned to METAR, the SKY COVER amounts reported for the periods of Midnight to Midnight and Sunrise to Sunset were changed from tenths to oktas. The labels on the Daily Summary Product were changed to OKTAS on these fields.
27. (S01106)	IMPROVE CHANGE OF TIME SYSLOG ENTRY
	Discussion: Adds the old date and the new date and time in the SYSLOG message when the ASOS system time is manually changed. The new SYSLOG message will include the old date, old time, the new date, and new time. This makes the message complete and usable.

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
28. (S01110)	VALIDATION OF PRECIP ACCUMULATION
	Discussion: This change is sometimes referred to as "The False Tip Algorithm." It is an effort to remove the false reporting of precipitation from dew, fog, or anything else that might fall into the rain gauge (i.e., Heated Tipping Bucket (HTB) or the All Weather Precipitation Accumulation Gauge (AWPAG)) when precipitation is not occurring. (See Appendix B for details.)
29. (S01113)	ADD "LST" LABEL TO DATE FIELD ON THE PHYSICAL AND OID SCREENS
	Discussion: Include the "LST" indication to the DATE field on the PHYSICAL data screen and after the date in the upper-left-hand corner on all of the OID screens. Without an indication on the screens, it is often confused whether the date is LST or UTC.
30. (S01125)	ELIMINATE UNNECESSARY OID FUNCTION CALLS
	Discussion: ASOS would use processing time to update all eight possible OIDs whether the OIDs were configured or not. This change will save processing time.
31. (S01126)	ADD ICE ACCRETION REMARK TO METAR/SPECI REPORTS
	Discussion: The amount of ice accreting on a flat surface (planar icing) as estimated by the data from the freezing rain sensor, will be included in the remarks section of the METAR / SPECI reports. The remark will have the format of "Ihnnn," where "h" is the hourly time period, i.e., 1, 3 or 6 hours. The value "nnn" is the ice thickness accumulated to the nearest 0.01 inch. A toggle for the ice accretion remark to be included in the METAR/SPECI reports is located on the PHYSICALS page (REVUE-SITE-PHYS). (See Appendix C for details.)
32. (S01133)	PROVIDE TECHNICIAN AUTHORIZATION TO SET DSM/MSM TRANSMIT TIMES
	Discussion: This privilege was once reserved for the SYStem Manager (SYS) password level, but now it has also been provided to the electronics TEChnician (TEC).

33. (S01152)	CORRECT TRANSMISSION LOGIC FOR DSM/MSM "COR"
	Discussion: If the observer edited or augmented the Daily Summary Product or the Monthly Summary Product before the primary transmission time of the respective message, ASOS inserted a COR (i.e., correction) into the message. Since the changes occurred before the primary transmission time, the changes are not considered corrections. Therefore, inserting a COR into the message was incorrect. This software change fixes this logic error.
34. (S01164)	ADD ICE ACCRETION TO AMR FOR DIRECT COMMAND MODE (DCM ACCESS)
	Discussion: This change was first implemented in a software version that was given a limited distribution (v2.62I). The ASOS Meteorological Report (AMR) was developed as a message to transmit non-standard meteorological data observed by ASOS. The ice accretion remarks are generated at 15-minute intervals during the hour when icing is detected. Remarks are also provided for hourly amounts, and both intermediate and mandatory synoptic observing times. (See Appendix C for additional details.)

TABLE 1: New Capabilities In v2.82. (As of 1/30/06)

Change	Title
35. (AA618)	GENERATE GTA RADIO TONE AT TECH LEVEL
	Discussion: In the past only the System Manager could generate the GTA tone. This change allows the Technician password level to generate the GTA tone.
36. (AB419)	AIR FORCE MODIFICATIONS
	Discussion: Three capabilities have been added to support the United States Air Force. Item 1: Incorporates Handar 25K ceilometer into the software baseline. Selection of ceilometer type is now available on the DEFINE page (REVUE-SITE-CONFG-DEFIN). Item 2: Visibility may be transmitted in statute miles or meters. Selection is made on the PHYSICALS page (REVUE-SITE-PHYS) next to label "VIS UNITS." Options are ENGLISH or METRIC. Item 3: 5-Seconds Winds Displayed on VDU. Processed wind data may now be displayed on the VDU at intervals of 5-seconds or 1-minute. Selection is made on the REVUE-SITE-PHYS page next to the label "VDU WIND DATA."
37. (AC302)	AUTO ENABLE / DISABLE OF FREEZING RAIN SENSOR
	Discussion: Turning power off/on to the freezing rain sensor is now governed by dates contained in the AOMC download file to the ACU. Dates for turning off/on power can be viewed on the maintenance page for the sensor.
38. (AC919)	REMOVING IFW PATH ERRORS FROM SYSTEM MAINTENANCE LOG (SYSLOG)
	Discussion: Removes Ice-Free Wind Sensor reports of a path error (error message numbers 1779 through 1784) from the ASOS SYSLOG and stops having these messages sent to the printer. Path error fail counts are now displayed on the Maintenance page for the WIND 425 NWS.

TABLE 2: Operational Trouble Report (OTR) Fixes In v2.82 (As of 1/30/06)

OTR Number	Title
1. (1001)	IF PRESENT WEATHER FIELD IS IN MANUAL MODE WHEN FREEZING RAIN ENDS AND FIELD IS RESET, ASOS WILL CARRY FZRA WHEN NONE EXISTS
	Discussion: If the PRESENT WX field is operating in automated mode, then the algorithms operate as designed and no deficiency is noted. The problem occurs if the PRESENT WX field is in manual mode when the automated FZRA ends. In this case, when the field is reset to automated mode, ASOS well enter FZRA in the PRESENT WX field if conditions for FZRA do not exist.
2. (1002)	EDIT LOG CONTAINS DATE TIME WITHOUT ANY LOG ENTRY
	Discussion: When using the Direct Command Mode (DCM) to download the EDIT LOG from some sites, it was discovered that date and time entries were contained in the log without any detailed description of the edit / augmentation action.
3. (1004)	PEAK WIND REMARK NOT ENCODED DURING TRANSMISSION OF OBSERVATION
	Discussion: During the transmission of an hourly METAR report, ASOS failed to encode a peak wind remark when a gust of 26 knots was automatically entered by ASOS in the WIND DIR / SPD field of the 1-minute screen.
4. (1012)	ASOS EDIT LOG DOES NOT RECORD ABORTED ENTRIES CORRECTLY
	Discussion: During the EDIT process if the ABORT function is used, then all the entries entered during that EDIT session are to be deleted. The aborted entries were not included on the ASOS printout or in the entries on the 1-Minute Screen, but they were incorrectly included in the EDIT LOG.
5. (1014)	ASOS ROUNDS PRECIP ROUNDING FROM NORMAL INCORRECTLY
	Discussion: This OTR refers to the Monthly Precipitation Departure from Normal on the Monthly Summary Product.
6. (1016)	ASOS DOES NOT CORRECTLY UPDATE THE PRESENT WEATHER FIELD AND MAKES INCORRECT ENTRIES IN EDIT LOG

	Discussion: The observer edited the PRESENT WX field from an automated entry of 'UP' to a manual entry of 'FZRA.' When the observer used the RESET function to return the PRESENT WX field to automatic mode, then algorithm output should have provided an automated 'FZRA,' but 'UP' was incorrectly entered in the field. After one minute, the incorrect automated data was changed from 'UP' to the correct entry of 'FZRA.' The EDIT LOG entries also incorrectly indicated an AUTO entry of UP when the algorithm output should have been indicating an AUTO entry of FZRA.

TABLE 2: Operational Trouble Report (OTR) Fixes In v2.82 (As of 1/30/06)

OTR Number	Title
7. (1022)	ASOS AUTOMATICALLY DELETES PL FROM PRESENT WEATHER
	Discussion: After augmenting the PRESENT WX field for 'PL,' ASOS correctly displayed it in the field and pending SPECI report, and then automatically deleted it from both the PRESENT WX field and SPECI report.
8. (1047)	INCORRECT FUNCTION PRESENT WEATHER
	Discussion: If the observer removes the automated entry of UP (unknown precipitation) from the PRESENT WX field by using the <space bar> to enter blank spaces, the PRESENT WX field is not changed from automated to manual mode. This has been fixed and the field is now placed in manual mode.
9. (1057)	INCORRECT ENDING DATES AND TIMES REPORTED ON THE MONTHLY SUMMARY PRODUCT FOR THE SHORT DURATION PRECIPITATION AMOUNTS
	Discussion: The actual amount of rainfall for each short duration precipitation period was found to be correct. However under certain conditions, the actual ending dates and times for these periods of precipitation were incorrect.

4.0 Summary

Software v2.82 has been evolving since the deployment of v2.60. V2.82 operates on the new single board processor, supports all the new sensors (DTS1, AWPAG, and IFW), includes 38 new capabilities, and nine software fixes. It is hoped this software load will enable ASOS operations to become more robust.

APPENDIX - A

ADAPTIVE BASELINE FREQUENCY ALGORITHM

6.12 ADAPTIVE BASELINE FREQUENCY ALGORITHM

6.12.1 Descriptive Statement of the Algorithm

6.12.1.1 This algorithm periodically monitors the idle frequency of the Rosemount freezing rain sensor. If the idle frequency observed during specified environmental conditions is greater than 40010 Hz or less than 39990 Hz, a field calibration shall be requested to correct the reported idle frequency. Upon initial configuring of the freezing rain sensor, the default value for the Adaptive Baseline Frequency (ABF) shall be 40000 Hz until computed by this algorithm.

6.12.1.2 Once per day, examine the reported idle frequency of the sensor. This should be done over a period of one hour during which the following conditions must exist: the sensor status must be Pass ("P"), the visibility sensor photometer is set to "night", no precipitation has occurred, the dew point depression is greater than 6˚ F, the ambient temperature is between 14˚ F and 50˚ F, and the range of idle frequencies is 3 Hz or less. If these conditions cannot be met during the first hour of the night, continue to monitor the environment until the conditions are met or the photometer is set to "day", whichever comes first. If the conditions are not met, discontinue the attempt to establish an Adaptive Baseline Frequency (ABF) for the current calendar day. If the conditions are met, perform the following steps:

(a) The lowest idle frequency during the past hour shall be displayed on the freezing rain maintenance page and shall be designated the ABF. If the ABF is between 39990 Hz and 40010 Hz, inclusive, the current idle frequency shall be displayed on the freezing rain maintenance page. The remainder of this algorithm can be ignored, since no further adjustments to the idle frequency are required.

(b) If the ABF is below 39980 Hz or above 40015 Hz, the freezing rain sensor shall be automatically taken out of service by turning off report processing for the sensor. Set the maintenance flag ("$") and write a message to the SYSLOG indicating the date, time, and ABF when the sensor was removed from service. Write the ABF to the maintenance page.

(c) If the ABF is below 39990 Hz or above 40010 Hz, set the maintenance flag and write a message to the SYSLOG indicating the need for an adjustment in the ABF. The message shall contain the ABF as well as the date and time the ABF was determined to be outside the acceptable range. The technician must respond to the SYSLOG message by authorizing an automated field calibration of the sensor. Once the technician has authorized the field calibration, the maintenance flag shall be reset. The data field authorizing the calibration will be displayed on the freezing rain sensor maintenance page. The maintenance page shall track the number of times during the past 30 days that the ABF was

 determined to need adjustment as well as the number of times the technician authorized a field calibration.

6.12.1.3 If the technician has authorized an automated field calibration, monitor the environmental parameters in 6.12.1.2 until the same conditions are met. Once the conditions are met, poll the sensor with a field calibration command ("F5"). Within 20 seconds, the sensor will respond with the true idle frequency. This frequency should be displayed on the freezing rain sensor maintenance page. A message shall be written to the SYSLOG stating the date and time that the field calibration command was issued and the true idle frequency returned by the sensor. Upon receiving the response to the "F5" command, a counter on the maintenance page shall be incremented to track the number of field calibrations performed during the past 30 days. The technician authorization field on the maintenance page shall be reset once the "F5" command has been issued.

6.12.1.4 Once a response to the "F5" command has been received, suspend routine polling of the sensor for a period of 3 minutes, after which polling with the "Z1" command shall resume. After polling is resumed, the first response to the "Z1" command shall be designated the ABF. Display the ABF on the maintenance page and write a message to the SYSLOG indicating the new ABF value. If the ABF after calibration is within the "normal" operating range (39990 Hz to 40010 Hz) and report processing has been set to "OFF" for the freezing rain sensor, the sensor report processing shall be reset to "ON".

6.12.2 Structured English

6.12.2.1 Determine Adaptive Baseline Frequency

Timing = Once per minute, if conditions permit

Input = Freezing Rain Sensor Status History, Photometer Output, Present Weather Reports, Dewpoint Depression Data, Ambient Temperature Data, Freezing Rain Sensor Frequency Data, Daily Calibration Flag, Calibration Needed Flag

(a) Check the flag indicating a need to determine the Adaptive Baseline Frequency (ABF):

(1) If the current visibility photometer output is set to night ("N") and the photometer output from the previous minute is set to day ("D"), set the Daily Calibration Flag to "ON" to indicate that the ABF needs to be determined.

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(2) If the current visibility photometer output is set to Day ("D"), set the Daily Calibration Flag to "OFF" to indicate that the ABF does not need to be determined. Proceed to step (d).

(b) Check the following parameter values over the past 60 minutes:

(1) Freezing Rain Sensor Status must be set to Pass ("P")

(2) Visibility Photometer Output must be set to Night

(3) Present Weather Reports: No precipitation reported

(4) Dewpoint Depression ($T_a - T_d$) must be greater than 6˚ F

(5) 5-Minute Average Ambient Temperature: $14^\circ F \leq T_a \leq 50^\circ F$

(6) Freezing Rain Sensor Idle Frequency: Range ≤ 3 Hz

(c) If the conditions in paragraph (b) are met, perform the following steps:

(1) Find the lowest freezing rain sensor frequency observed during the past hour. Designate this frequency as the Adaptive Baseline Frequency (ABF). Display the ABF on the freezing rain sensor maintenance page using the format "CURRENT ABF XXXXX". Store the ABF in non-volatile memory. Reset the Daily Calibration Flag to indicate that the ABF does not need to be determined.

(2) If ABF is less than 39980 Hz or above 40015 Hz, declare the freezing rain sensor "Inoperative". Write a message to the SYSLOG indicating "FREEZING RAIN SENSOR INOPERATIVE – ABF = XXXXX HZ", where XXXXX is the current ABF value. Turn off report processing for the freezing rain sensor. Set the maintenance flag ("$") and proceed to step (d).

(3) If ABF is greater than or equal to 39990 Hz and less than or equal to 40010 Hz, no further calibration action is required at this time. Set the "Calibration Needed" flag to indicate that calibration of the sensor is not needed. Display the flag on the freezing rain sensor maintenance page using the format: "CAL NEEDED? NO". Store the Calibration Needed flag in non-volatile memory. Proceed to step (d).

(4) If ABF is less than 39990 Hz or greater than 40010 Hz, set the maintenance flag ("$") and write a message to the SYSLOG indicating a need for an adjustment to the ABF. Format of the message shall be "TECHNICIAN

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CHECK FREEZING RAIN SENSOR CALIBRATION – ABF = XXXXX HZ", where XXXXX is the current ABF value. Set the "Calibration Needed" flag to indicate the need to calibrate the sensor. Display the flag on the freezing rain sensor maintenance page using the format: "CAL NEEDED? YES". Store the Calibration Needed flag in non-volatile memory.

(d) Output:

(1) Adaptive Baseline Frequency (ABF), If Determined

(2) Daily Calibration Flag

(3) Calibration Needed Flag

(4) SYSLOG Message, if required

6.12.2.2 Authorize Field Calibration

Timing = Once per minute, after 6.12.2.1

Input = Maintenance Flag, Calibration Needed Flag

(a) Allow the technician to toggle a flag on the freezing rain sensor maintenance page:

(1) If the technician wishes to authorize a field calibration, toggle the Authorization Flag to "YES". Display the status of the flag on the maintenance page using the format "CAL AUTHORIZED? YES". Store the Authorization Flag in non-volatile memory. If the maintenance flag has been set based on a need to calibrate the sensor, reset the maintenance flag. Proceed to step (b).

(2) If the technician wishes to override the need for a field calibration, toggle the display of the "CAL AUTHORIZED" field on the maintenance page to show "CNCL". The Authorization Flag should be set to "NO". After leaving the maintenance page and subsequently revisiting the maintenance page, the "CAL AUTHORIZED" field shall be displayed as "NO". If the maintenance flag ("$") was set due to the need for sensor calibration, reset the maintenance flag. Reset the Calibration Needed Flag to "NO". Store the Calibration Needed Flag and the Authorization Flag in non-volatile memory. Proceed to step (b).

(3) If the technician wishes to take no action concerning the need for a field calibration, set the Authorization Flag to "NO". Display the status of the flag on the maintenance page using the format "CAL AUTHORIZED? NO". If the Calibration Needed Flag is set to "YES", do NOT reset the Calibration Needed Flag to "NO". Store the Calibration Needed Flag and the Authorization Flag in non-volatile memory. If the maintenance flag was set due to the need for sensor calibration, do NOT reset the maintenance flag.

(b) Output

(1) Authorization Flag

(2) Calibration Needed Flag

6.12.2.3 Perform Field Calibration

Timing = Once per minute, if conditions permit

Input = Freezing Rain Sensor Status History, Photometer Output, Present Weather Reports, Dewpoint Depression Data, Ambient Temperature Data, Freezing Rain Sensor Frequency Data, Daily Calibration Flag, Calibration Needed Flag, Authorization Flag

(a) If the Authorization Flag is set to "NO", proceed to step (d).

(b) If the Authorization Flag is set to "YES", check the following parameter values over the past 60 minutes:

(1) Freezing Rain Sensor Status must be set to Pass ("P")

(2) Visibility Photometer Output must be set to Night

(3) Present Weather Reports: No precipitation reported

(4) Dewpoint Depression ($T_a - T_d$) must be greater than 6˚ F

(5) 5-Minute Average Ambient Temperature: $14^\circ F \leq T_a \leq 50^\circ F$

(6) Freezing Rain Sensor Idle Frequency: Range ≤ 3 Hz

(c) If the conditions in paragraph (b) are met, perform the following steps:

(1) Poll the freezing rain sensor with a calibration ("F5") command. Within 20 seconds, the sensor will respond with the true idle frequency of the sensor. Display the response on the freezing rain sensor maintenance page using the format "TRUE IDLE FREQ XXXXX", where XXXXX is the true idle frequency. Store the true idle frequency in non-volatile memory. Write a message to the SYSLOG, "FREEZING RAIN SENSOR CALIBRATED – TRUE IDLE FREQ = XXXXX HZ".

(2) Suspend polling of the freezing rain sensor for 3 minutes. While polling is suspended, use the previously established ABF as the current sensor response frequency in determining ice accretion. Do not increment the sensor response error counter on the maintenance page during the 3 minutes when the sensor is not being polled. Do not set the maintenance flag ("$") for the freezing rain sensor while polling is suspended.

(3) Increment a counter on the freezing rain sensor maintenance page to track the number of field calibrations performed in the past 30 days. Display the counter using the format "NUM CAL PERFORMED XX", where XX is the number of calibrations performed. Store the number of field calibrations performed in non-volatile memory.

(4) Reset the Authorization Flag to "NO". Display the status of the flag on the maintenance page using the format "CAL AUTHORIZED? NO". Store the Authorization Flag in non-volatile memory.

(5) Reset the Calibration Needed Flag to "NO". Display the status of the flag on the maintenance page using the format "CAL NEEDED? NO". Store the Calibration Needed flag in non-volatile memory.

(d) Output:

(1) Calibration Command

(2) True Idle Frequency

(3) SYSLOG Message, if required

(4) Authorization Flag

(5) Calibration Needed Flag

6.12.2.4 Resume Normal Operation

Timing = 3 minutes after calibration of sensor

Input = Frequency response to first "Z1" command, Report Processing Status

(a) Once the freezing rain sensor has been calibrated, get the frequency response to the most recent "Z1" command.

(b) Designate this frequency as the Adaptive Baseline Frequency (ABF). Store the ABF in non-volatile memory.

(c) Display the new ABF on the freezing rain sensor maintenance page using the format "CURRENT ABF XXXXX".

(d) Write a message to the SYSLOG using the format "ABF AFTER CAL = XXXXX HZ".

(e) If the ABF after calibration is greater than or equal to 39990 and less than or equal to 40010 and report processing has been set to "OFF" for the freezing rain sensor, reset the sensor report processing to "ON".

(f) Output:

(1) ABF

(2) SYSLOG Message

(3) Report Processing Status

```
05:57:11 06/25/04 1057Z   *** HOURLY PENDING ***    STERLING #2
┌──────────────────────────────────────────────────────────────────────┐
│                                                                      │
│ PROBE STATUS          P                    DATA QUALITY          p   │
│ HEATER STATUS         p                    REPORT PROCESS        Y   │
│ ELECTRONICS STATUS    p                    SENSOR RESPONSE       p   │
│                                            POWER STATUS          p   │
│ CURRENT ABF           40000                POWER CONTROL        ON   │
│ DATE/TIME OF ABF                                                     │
│                                                                      │
│ CAL NEEDED?           NO                                             │
│ CAL AUTHORIZED?       NO                                             │
│                                                                      │
│ TRUE IDLE FREQ                                                       │
│ AUTO CAL DATE/TIME                                                   │
│                                                   FREEZING RAIN      │
│ 31 DAY STATISTICS                                                    │
│ NUM CAL  NEEDED          0                             CLEAR       │
│ NUM CAL AUTHORIZED       0                                          │
│ NUM CAL PERFORMED        0                       TEST  CAL  POWER   │
│                                                                      │
│                                                  EXIT  BACK          │
└──────────────────────────────────────────────────────────────────────┘
```

Figure 1 - Freezing Rain Maintenance Page, After Sensor First Configured

```
05:57:11 06/25/04 1057Z   *** HOURLY PENDING ***    STERLING #2
┌──────────────────────────────────────────────────────────────────────┐
│                                                                      │
│ PROBE STATUS          P                    DATA QUALITY          p   │
│ HEATER STATUS         p                    REPORT PROCESS        Y   │
│ ELECTRONICS STATUS    p                    SENSOR RESPONSE       p   │
│                                            POWER STATUS          p   │
│ CURRENT ABF           39997                POWER CONTROL        ON   │
│ DATE/TIME OF ABF      6/22/04 04:17:27                               │
│                                                                      │
│ CAL NEEDED?           NO                                             │
│ CAL AUTHORIZED?       NO                                             │
│                                                                      │
│ TRUE IDLE FREQ        39993                                          │
│ AUTO CAL DATE/TIME    6/20/04 03:29:27                               │
│                                                   FREEZING RAIN      │
│ 31 DAY STATISTICS                                                    │
│ NUM CAL  NEEDED          1                             CLEAR       │
│ NUM CAL AUTHORIZED       1                                          │
│ NUM CAL PERFORMED        1                       TEST  CAL  POWER   │
│                                                                      │
│                                                  EXIT  BACK          │
└──────────────────────────────────────────────────────────────────────┘
```

Figure 2 - Maintenance Page, After First ABF Computed

APPENDIX - B

PRECIPITATION VALIDATION ALGORITHM

Upon system cold boot or following a power outage, initialize a three-member array (current minute, past minute, amount 2 minutes ago) to indicate no precipitation amount (0.00 inches).

Following a warm start, do NOT reinitialize the three-member array.

Once each minute, perform the following steps:

1. Obtain the current precipitation accumulation data from the sensor. If **no** precipitation accumulation was reported by the sensor, enter a valid entry of "0.00" in the 12-hour archive.

2. If the current present weather report field on the one-minute OID screen contains an indication of edited or automated precipitation (PL, GS, GR, RA, SN, DZ, or UP), or any of these precipitation types have occurred within the past 59 minutes, or the site is designated as an "AO1" site:

A. Mark the current precipitation accumulation data as valid.

B. Enter the current precipitation accumulation value in the 12-hour archive.

C. Check the contents of the three-member array. Validate all precipitation amounts in the array. Enter these precipitation amounts in the 12-hour archive. Once validated, sum the contents of the test array as the value to use in updating all derived precipitation parameters.

D. Once validated, reset all values of the three-member array to zero. (Don't use positive precipitation values more than once when updating derived precipitation parameters.)

E. Proceed to step 4.

3. If no precipitation (as defined above) is currently reported in the present weather field and precipitation has not been reported within the past 59 minutes and a positive indication of precipitation accumulation was reported by the sensor 2 minutes ago:

A. Mark the precipitation accumulation value from 2 minutes ago as invalid by entering the value in the 12-hour archive with brackets surrounding it.

B. Do not use the precipitation value from 2 minutes ago to update any derived precipitation parameters in step 4.

4. Use current valid precipitation amount to update the following parameters:

A. Hourly precipitation remark ("Pxxxx" group)

B. Hourly incremental precipitation amount
C. 15-Minute and Hourly SHEF amounts

D. Maximum Short Duration Precipitation amounts

E. Three-Hourly and Six-Hourly Precipitation Amounts (“6xxxx”)

F. Twenty-four Hour Precipitation Amount (“7xxxx”)

G. Calendar Day Total Precipitation amount (Daily Summary)

H. Monthly Total Precipitation amount (Monthly Summary)

APPENDIX - C

ICE ACCRETION REMARK

Table of Contents

1.0 Introduction:

In 1995 the ASOS Program Office sponsored an effort to develop an algorithm to generate quantitative ice accretion amounts using output from the ASOS freezing rain sensor. Over a three year period (1995 - 1998) Al Ramsay of Raytheon Information Technology and Scientific Services worked with the NWS Eastern Region (WSFOs at Cleveland, Binghamton, and Taunton), the Mount Washington Observatory, and Dr. Charles Ryerson of the Cold Regions Research and Engineering Laboratory to develop such an algorithm. Based on a recommendation from the Ice Storm and Flood of January 1998 Service Assessment report, the NWS identified a requirement for the real-time reporting of ice accretion amounts. This was deemed to be critical in supporting the NWS mission of protecting life and property through the winter weather forecast and warning program.

During two winter seasons (1999 - 2000, 2000 - 2001) Al Ramsay continued to evaluate the effectiveness of the algorithm. Although there were no coincident manual icing measurements available to directly verify the quantitative amounts generated by ASOS, there were no indications that the ASOS estimates were anything but reasonable. Estimates from adjacent or near-by airports provided comparable and consistent values of ice accretion. The primary value in ice-thickness estimates from ASOS will lie in the real-time availability of standard, objective, and quantified information which was otherwise unavailable to forecasters and other users.

During the winter season of 2001-2002, the NWS performed a service evaluation of the effectiveness of these quantitative ice accretion amounts. The amounts were only available through the Direct Command Mode (DCM) form of remote access to ASOS. The service evaluation results were positive, and steps were then taken to encode this information in the METAR and SPECI reports generated by ASOS.

The ice accretion amounts are automatically generated by the ASOS ACU software. They are encoded in an ice accretion remark which is then transmitted long-line in METAR and SPECI reports. The remark is also available via the DCM method of remote access to ASOS. These remarks can be downloaded from the site and then used operationally. There is no requirement for observers to manually backup this remark if the freezing rain sensor should malfunction.

2.0 Sensor Operation & Ice Accretion Algorithm:

The ASOS freezing rain sensor is the Rosemount Model 872C3 sensor. (Since the sensor is now being used to detect more than freezing rain, some documents refer to the sensor as the ASOS icing sensor.) The sensor detects ice accumulation by monitoring the resonant frequency (nominally 40,000 hertz) of a vibrating metal probe. The resonant frequency decreases with increasing ice accretion. Data are acquired from the sensor once each minute and are recorded in the ASOS 12-hour data archive file.

The response of the ASOS icing sensor to ice accretion is measured by summing all frequency drops (from a nominal value of 40,000 hertz) over the course of an icing event. The summation of the frequency drops is referred to as the Net Frequency Change (NFC). The ice thickness of glaze ice on a horizontal surface is estimated by the equation below.

$$\text{Ice Thickness (inches)} = 0.000152 * (\text{NFC})$$

The resting baseline frequency of the sensor is nominally 40,000 hertz. However, with the implementation of software version 2.82 (v2.82), ASOS now calculates the resting baseline frequency of each sensor by using the Adaptive Baseline Frequency (ABF) algorithm. So when a 33 hertz drop in frequency, i.e., from the baseline, is detected, this will indicate an ice accretion of 0.005 inches on the probe and an ice accretion remark will be encoded. The sensor will deice when the frequency drops 527 hertz (0.08 inches of ice) from its resting frequency.

There is a very slight possibility for a freezing rain sensor not to detect a freezing rain event. During this type of event the frequency does not drop, but rather increases. This case is called clamping. (Clamping is caused by ice bridging between the sensor probe and the supporting structure.) This is an extremely rare event and over three winters (1999-2000, 2000-2001, and 2001-2002) there have only been two documented cases of clamping where the freezing rain events were missed (Albany, NY on 2/2/99 and Little Rock, AR on 12/25/00).

Since the ice accretion remark is based on the NFC (i.e., frequency drops), it will be encoded when sufficient frequency drops occur. Remarks can be encoded as a result of: frost; ice deposited by fog (FG); freezing fog (FZFG)or mist (BR); freezing drizzle (FZDZ) where the precipitation drop size is too small to be detected by the Light Emitting Diode Weather Identifier (LEDWI); and freezing rain (FZRA). Whenever snow (SN) occurs it causes extreme drops in the sensor's frequency resulting in false ice accretion amounts. It is for this reason that the algorithm ignores the frequency drops from the sensor when ever SN is encoded in the PRESENT WX field on the ASOS 1-Minute Screen, e.g., FZRASN or SN FZFG. The entry of SN in the field could be either automated from ASOS or entered by the observer.

3.0 **Planar vs Radial Ice Accretion Amounts**:

The ice accretion amounts inferred by ASOS are planar amounts. That is they apply to horizontal surfaces like roadways and sidewalks. By contrast, the term radial refers to ice thicknesses which would accumulate on branches and power lines. By knowing the planar amounts inferred by ASOS, it is possible to estimate the ice accreting on trees and wires. In theory, the relationship between radial and planar ice accretion is that radial accretion is 32 percent of planar accretion. A semi-empirical relationship, determined by calculating uniform radial values from field measurements of planar ice thickness is that uniform radial thickness would be about 37 to 40 percent of the ASOS planar ice thickness estimates, depending on assumptions of ice density.

In Theory: Estimated Radial Icing Amount = ASOS Planar Estimates x **0.32**

4.0 **Strengths & Limitations of ASOS Planar Ice Accretion Amounts**:

Using the ASOS planar ice accretion estimates requires knowledge of ASOS operations and some considerations of the local environment where the ASOS sensors are sited.

4.1 Strengths

1. The primary strength of the ice accretion remark is in providing real-time ice-thickness estimates in a standard, objective, and quantified manner. In the past this information was relatively unavailable to forecasters and other users.

2. By using the ASOS planar ice accretion estimates it is possible to estimate the amount of ice accreting on trees and power lines, i.e., radial amounts.

4.2 Limitations

1. Any ice accreting while SN is detected/occurring is ignored due to limitations of the ASOS icing sensor. In cases where the LEDWI misinterprets light drizzle as snow, ice accretion estimates will not be provided.

2. The ASOS icing algorithm can underestimate the amount of ice accretion during periods of heavy rain because the larger raindrops have time to run off the ASOS probe before freezing, and therefore do not contribute to the ASOS estimate of ice thickness. (The field data sets which were used to develop the ASOS ice-accretion algorithm contain primarily the more-common stratiform precipitation regimes, in which large drop sizes are seldom experienced.)

3. Icing detected by the sensor must, of course, freeze upon contact with the sensor. Rain falling onto a cold surface that freezes within minutes of contact, i.e., not the true definition of freezing rain, will be either underestimated or not included in the icing remark.

4. It is possible that the micrometeorology of the local environment could allow ice accretion at the ASOS, but not on surfaces near the observer. It must be noted that all estimates are valid "*at the ASOS*."

5. Users must be careful not to over-interpret the ASOS estimates. Local surface ice accretion estimates are heavily dependent on highly variable non-meteorological factors such as topography, object temperature history and thermal mass, and long-wave radiation sources. ASOS icing estimates can NOT be extrapolated directly to other locations.

6. The icing sensor may take a long time to recover from a deicing cycle when the precipitation is very light and the temperature is near freezing. In this case the icing estimates will be underestimated.

7. Due to sensor and deicing algorithm limitations, the ASOS icing estimates tend to be low. But they have not been so low as to generate concern. Over the past five years, ASOS estimates of planar ice thickness have been considered "reasonable" in comparison to reports from observers and news media.

5.0 Encoded Remark

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The encoded remark explanation includes the reporting periods, message format, encoding conventions, and encoding examples. A remark is encoded if icing has been detected during the reporting period. If the freezing rain sensor is malfunctioning, or is not available, no manual backup/augmentation for the ice accretion remark is required.

5.1 Reporting Periods

The reporting periods for data retrieved via the DCM are from HH_0+00 through HH_0+59, i.e., from the top of the hour to the top of the next hour.

The periods for remarks encoded in the METAR / SPECI reports are based on the observation hour, i.e., from the time of the last hourly METAR report to the time of the current hourly METAR report, e.g., HH_0+57 through HH_1+56 if the hourly METAR report time is HH+56.

5.2 DCM Downloaded Data

Reports are generated at 15-minute intervals (i.e., HH_0+15, HH_0+30, HH_0+45, and HH_1+00) for any hour in which icing is detected. Icing amounts are cumulative during the hour, with the total ice accretion for the hour reported at the top of the hour (HH_0+00). For example, if icing is detected at HH_0:17, a remark will be encoded at HH_0:30. If no additional ice accretes, the amount reported at HH_0:30 will be reported at HH_0:45, and again at the top of the hour $HH_1$00. If ice accretion continually occurred after HH_0:17, a remark would be encoded at HH_0:30, then the increasing cumulative amount for the hour would be reported at HH_0:45, and the total for the hour reported at HH_1:00.

At the intermediate synoptic times (0300Z, 0900Z, 1500Z, and 2100Z), if icing had been detected during the previous 3-hour period, the total ice accretion amount during the 3-hour period would be reported.

At the mandatory synoptic times (0600Z, 1200Z, 1800Z, and 0000Z), if icing had been detected during the previous 6-hour period, the total ice accretion amount during the 6-hour period would be reported.

5.3 METAR / SPECI Encoded Remarks

Hourly ice accretion amounts will be encoded in the remarks section of both the SPECI and METAR reports when icing is detected. If the last transmitted hourly METAR report has a valid time of HH_0+56, and a SPECI is transmitted with a valid time of HH_1+23, the icing remark will contain all the detected icing that occurred from HH_0+57 through HH_1+23. The next hourly METAR report (HH_1+56) will contain an icing remark with all the detected icing from HH_0+57 through HH_1+56.

At the intermediate synoptic times (0300Z, 0900Z, 1500Z, and 2100Z), if icing had been detected during the previous 3-hour period, the total ice accretion amount during the 3-hour period would be reported in the hourly METAR reports. (Example intermediate hourly METAR report times are 0256Z, 0856Z, 1456Z, and 2056Z.)

At the mandatory synoptic times (0600Z, 1200Z, 1800Z, and 0000Z), if icing had been detected during the previous 6-hour period, the total ice accretion amount during the 6-hour period would be reported in the hourly METAR reports. (Example mandatory hourly METAR report times are 0556Z, 1156Z, 1756Z, and 2356Z.)

5.4 Message Format

When downloaded via the DCM, the remark will be encoded in the ASOS Meteorological Report (AMR). (See example below.) The AMR includes the Site Identifier of the ASOS site (KST0), the valid date and time (UTC) of the data (031900Z), and then the icing remark(s). The date and time encoded prior to the "AMR" message type indicator, are the Local Standard Time (LST) date and time when the message was stored in the ASOS data base.

01/07/2000 14:00:12 AMR KST0 031900Z I1007

Where:

01/07/2000 14:00:12 -	Date & Time (LST) when AMR was stored in ASOS data base.
AMR -	ASOS Meteorological Report
KST0 -	Site Identifier for the ASOS site.
031900Z -	Valid Date and Time (UTC) for the ice accretion remark. Ice accretion for the 3rd of the month from 1800Z through 1859Z is reported.
I1007 -	Ice Accretion Remark

Example: ASOS Ice Accretion remark encoded in the AMR.

When the remark is encoded in the remarks section of the METAR / SPECI reports it will follow the encoding conventions described below.

5.5 Encoding Conventions

All ice accretion amounts will be reported to the nearest one-hundredth of an inch (0.01 in.). The amounts are with respect to glaze ice accretion on a horizontal surface, i.e., planar ice.

If augmentation/backup should occur for freezing precipitation, and the freezing rain sensor is either not installed or malfunctioning, then the remark will not be encoded automatically from ASOS. There is no manual backup required for this remark.

A) Hourly Ice Accretion Amount:

Ice accretion for the current hour encoded in hundredths of an inch (0.01 in.) has the following format:

I1nnn

Where: "I" - is the icing indicator for the group
"1" - is the reported time period (one hour)
"nnn" - is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.). A trace amount is encoded as "000."

B) Three (3-) Hourly Ice Accretion Amount:

The accretion of ice over the past three hour time period in one-hundredths of an inch (0.01 in.) would have the format:

I3nnn

Where: "I" - is the icing indicator for the group
"3" - is the reported time period (three hours)
"nnn" - is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.). A trace amount is encoded as "000."

The remark may be encoded at the intermediate synoptic times (0300, 0900, 1500, or 2100 UTC). When conditions warrant, the "I3nnn" remark will be encoded immediately following the hourly ice accretion amount (I1nnn).

C) Six (6-) Hourly Ice Accretion Amount:

The accretion of ice over the past six hour time period in one-hundredths of an inch (0.01 in.) will have the format:

I6nnn

Where: "I" - is the icing indicator for the group
"6" - is the reported time period (six hours)
"nnn" - is the thickness accumulated to the nearest one-hundredth of an inch (0.01 in.). A trace amount is encoded as "000."

The remark may be encoded at the mandatory synoptic times (0600, 1200, 1800, or 0000 UTC). When conditions warrant, the "I6nnn" remark will be encoded immediately following the hourly ice accretion amount (I1nnn).

D) Missing Icing Data:

If the freezing rain sensor is inoperative for more than 25 percent of the reporting period, the icing remark shall be considered missing. Missing groups shall be encoded as I1///, I3///, or I6///, as appropriate. If no icing is detected then the groups will not be encoded.

5.6 Encoding Examples

1. AMR KST0 032100Z I1001 I3001

On the third of the month, the 2100 UTC (intermediate synoptic) AMR is reporting that ice accretion in the last hour is 0.01 inch and the accretion over the last three hours is the same amount.

If a METAR report had been generated with a time of 2056Z with these same remarks, then it would be reporting that 0.01 inch of accretion had occurred from 1957Z through 2056Z. The accretion over the last three hours (1757Z through 2056Z) was the same amount. In other words, all the ice accretion occurred during the past hour.

2. AMR KST0 080030Z I1002

On the eighth of the month, the 0030 UTC report is indicating that icing is occurring at the site and that 0.02 inch of ice has accreted during the period from 0000 UTC through 0029 UTC.

If a SPECI report has a time of 0030 UTC, and if the hourly METAR report has a valid time of 2356 UTC, then the SPECI will be reporting that 0.02 inch of ice has accreted between the times of 2357 and 0030 UTC.

3. AMR KST0 100000Z I1003 I6008

On the 10th of the month, the 0000Z AMR (mandatory synoptic time) report is indicating that icing has occurred during the past hour and accretion has been 0.03 inch. The total accretion from 1800Z through 2359Z (last six hours) is 0.08 inch.

A 2356Z METAR report with these same ice accretion remarks would be reporting that 0.03 inch of ice accreted during the past hour (2257Z throgh 2356Z), and that the total accretion from 1757Z through 2356Z was 0.08 of an inch.

4. AMR KST0 120600Z I1000 I6018

On the 12th of the month, the 0600Z AMR (mandatory synoptic time) report shows that only a trace (less than 0.005 inch) of ice accretion has been detected during the past hour and that the accretion over the last six hours is 0.18 inch. If these same remarks were encoded in the 0556Z METAR report, then the interpretation would be the same.

5. Light freezing rain (-FZRA) is reported in the 0356 UTC METAR and no AMR is available for a valid time of 0400Z.

There are three possible explanations for this scenario. The first is that the freezing rain sensor at the site has malfunctioned and the observer is providing backup. The second is that the freezing rain sensor has not experienced sufficient drops in its frequency to report any icing and the observer is providing backup. The third is that the observer is providing augmentation at a site that does not have a freezing rain sensor installed.

6. AMR KST0 180600Z I1003 I6///

In this case, the freezing rain sensor was operative more than 75% of the reporting period during the current hour. However, the sensor was inoperative more than 90 minutes during the previous 6 hours.

7. AMR KST0 190600Z I1/// I6003

In this case, the freezing rain sensor was operative more than 75% of the reporting period for the previous 6 hours. However, the sensor was inoperative more than 15 minutes during the previous hours.

8. AMR KST0 230700Z I1002

During the past hour (0600 - 0659Z) the sky was a low overcast, temperatures hovered around 30°F, winds were light, visibility was 1/4SM to 3/4SM, and periods of freezing fog (FZFG) and mist (BR) were reported. The ASOS algorithms infer the existence of both FZFG and BR, i.e., they are not actually detected by any sensor(s). In reality, it is likely that the ice accreting is really from freezing drizzle (FZDZ), as well as BR and FZFG. FZDZ being the most significant contributor to the accretion amount.

9. AMR KST0 241100Z I1001

On the 24th of the month, from 1000 - 1059Z the sky was clear. The temperatures dropped to 28°F, visibility was 10SM, winds were calm, and no precipitation nor obscurations were reported in the PRESENT WX field. The ice accretion amount of 0.01 is frost.

10. AMR KST0 250000Z I6008

On the 25th of the month, the 0000Z AMR (mandatory synoptic time) report is indicating that icing occurred during the previous 6 hours, but no accretion was detected during the previous hour. The total accretion from 1800Z through 2359Z (last six hours) is 0.08 inch.

6.0 Accessing The Icing Remark

The ice accretion remark is available in the remarks section of the METAR and SPECI reports, and via the DCM method of remote access to ASOS in the AMR.

The DCM method of remote access is obtained by entering the pound sign(#) before the remote access code at the ACCESS CODE prompt, e.g., ACCESS CODE: #REMOTE. The AMR can be downloaded from ASOS by using the following command string:

AMR $mm_i dd_i$ $hh_i mm_i$ $mm_f dd_f$ $hh_f mm_f$.

Where: $mm_i dd_i$ $hh_i mm_i$ - month, day, hour, minutes to start the download

$mm_f dd_f$ $hh_f mm_f$ - month, day, hour, minutes to end the download

Examples: **AMR 1230 1220Z 0101 2200Z** will download the AMRs from December 30th at 1220 UTC through January 1st at 2200 UTC.

If **AMR 1230 1220 0101 2200** is entered, note that "Z" is not appended to the times, then ASOS assumes that Local Standard Time (LST) dates and times are being entered. AMRs for the period of December 30th at 1220 LST through January 1st at 2200 LST will be downloaded.

Using the **AMR** command without the begin/end dates and times will download all of the stored AMR reports stored in the ASOS memory. The AMRs are stored for a period of at least three days.

Sample DCM Download of the AMR (Icing Remark)

CMD>AMR
LISTING AMR FROM: 01/07/2000 12:30 THRU 01/07/2000 19:01
01/07/2000 12:30:12 AMR KST0 071730Z I1001
01/07/2000 12:45:12 AMR KST0 071745Z I1002
01/07/2000 13:00:12 AMR KST0 071800Z I1002 I6002
01/07/2000 13:15:12 AMR KST0 071815Z I1002
01/07/2000 13:30:12 AMR KST0 071830Z I1006
01/07/2000 13:45:12 AMR KST0 071845Z I1006
01/07/2000 14:00:12 AMR KST0 071900Z I1007
01/07/2000 14:45:12 AMR KST0 071945Z I1002
01/07/2000 15:00:12 AMR KST0 072000Z I1002
01/07/2000 15:30:12 AMR KST0 072030Z I1001
01/07/2000 15:45:12 AMR KST0 072045Z I1002
01/07/2000 16:00:12 AMR KST0 072100Z I1003 I3012
01/07/2000 16:15:12 AMR KST0 072115Z I1000
01/07/2000 16:30:12 AMR KST0 072130Z I1001
01/07/2000 16:45:12 AMR KST0 072145Z I1006
01/07/2000 17:00:12 AMR KST0 072200Z I1010
01/07/2000 17:15:12 AMR KST0 072215Z I1005
01/07/2000 17:30:12 AMR KST0 072230Z I1009
01/07/2000 17:45:12 AMR KST0 072245Z I1014
01/07/2000 18:00:12 AMR KST0 072300Z I1018
01/07/2000 18:15:12 AMR KST0 072315Z I1005
01/07/2000 18:30:12 AMR KST0 072330Z I1012
01/07/2000 18:45:12 AMR KST0 072345Z I1020
01/07/2000 19:00:12 AMR KST0 080000Z I1020 I6061
AMR LISTING COMPLETE, 24 AMR(S) LISTED.