U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
1325 East-West Highway
Silver Spring, Maryland 20910-3283

JAN 28 2008

MEMORANDUM FOR: Distribution

FROM: W/OPS2 – John Van Kuren

SUBJECT: ASOS Ice Free Wind Problem Resolution Project Plan (IPRPP)

The final version of the ASOS Ice Free Wind Problem Resolution Project Plan (IPRPP) dated January 28, 2008 is attached. It is the end product of three previous coordinated draft versions. The IPRPP is our road map for finding a resolution to the "Bird" problems experienced in 2007 and also for resolving other problems with the IFWS. If you have any questions, comments, or suggestions, please direct them to Project Manager, Dave Mannarano (301-713-2093x103).

Attachment

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Automated Surface Observing System (ASOS)

Ice Free Wind Problem Resolution
Project Plan

Field Systems Operations Center

As of: 01/28/08

Executive Summary

When the Vaisala model 425NWS Ice Free Wind Sensor (IFWS) was first installed in the Automated Surface Observing System (ASOS) in late summer 2005, it was hailed as a major improvement to the legacy Belfort MODEL 2000 cup and vane anemometer. The legacy sensor had a tendency to freeze during icing winter weather conditions, resulting in missing or incorrect wind reports and excessive and potentially dangerous maintenance action to chip ice off the sensor to return it to service. The new sensor uses ultrasonic technology to measure the wind speed and direction that has no moving parts susceptible to freezing. Because it uses no moving parts it also avoids the inertial dampening in reporting gusts inherent in the legacy Belfort cup and vane design, and is therefore able to provide more responsive 3-second gust information verses 5-second gust information. The reliable provision of timely and accurate ASOS wind data is essential for aviation safety and for support to other vital missions of the sponsoring agencies.

Initial performance statistics for the IFWS indicated a slight dip in reported diagnostic messages in winter and a slight increase in summer 2006. This variance appeared to be within the acceptable range. As more IFWS continued to be installed in 2007 and more descriptive System Maintenance Log (SYSLOG) messages became available in succeeding software loads, more problems were noted and reported and more AOMC Trouble Tickets (TT) issued. The number of error reports rose sharply in May, more so in June 2007, peaked in July, and began a seasonal decline in September. Subsequent analysis revealed these diagnostic messages were associated mostly with erroneous 3-second wind gusts or completely missing wind data. As a result, user confidence declined, complaints increased, and field installation of the remaining IFWS came to a virtual standstill. As a response, an extensive effort was initiated at Weather Service Headquarters (WSH) in July 2007 to resolve the problem.

The problem is both perceptive and technical. Both must be addressed. This IFW Problem Resolution Project Plan (IPRPP) does that by focusing on two primary goals:

1) Short-term interim fix to address user perceptions and satisfy concerns sufficient to resume installation of the IFWS at the remaining ASOS sites not yet installed. As of October 1, 2007 there were 183 of the 883 NWS/FAA sponsored sites not yet installed with the IFWS. A new software load, V2.79E, containing three fixes will be developed, tested and installed at all ASOS locations by summer 2008. This should provide partial, sufficient (to justify completion of IFWS installation at the remaining sites not yet installed with an IFWS), but not complete relief to the problems that plagued the IFWS in 2007. It is important to not overstate the degree of relief or speed of delivering this interim solution and run the risk of falling short of raised expectations. It is also important to not overstate the degree of the problem indicated in the SYSLOG messages. For example, the SYSLOG 1794 message indicates a discrepancy was detected between the current 3-second and 5-second average wind speed, *and the suspect data are filtered from further processing and are <u>not</u> included in the transmitted METAR.* However, the shear number of these messages indicates there is a technical problem that may result in missing data and this must be dealt with. This distinction between bad data and missing data needs to be fully understood and objectively dealt with.
2) Long-term ultimate solution that may include a combination of new innovative software, sensor firmware modifications, and external hardware devices. This solution is intended to provide complete relief to the IFWS problems. It will solve the technical problem and also restore full user confidence. The IPRPP lays out a series of work packages to accomplish that ultimate goal.

To achieve these goals, the IPRPP is organized into five chapters that describe the phases of the project:

1) Project Planning
2) Execution
3) Implement Fixes
4) Monitoring & Control
5) Verification & Closeout

Although all phases of the IPRPP are vital to ultimate success, the Execution phase is arguably the most vital. It is in this phase that data are analyzed and long term solutions devised, tested, and validated before they are operationally deployed. Risk management is the key to a quality outcome and an integral part of the IPRPP.

Table of Contents

Appendices:

ACRONYMS

ACCB	ASOS Configuration Control Board
ACM	ASOS Coordination Meeting
ACU	Acquisition Control Unit (ASOS)
AES	Area Electronic Specialist
AOMC	ASOS Operations and Monitoring Center
ARH	Alaska Region Headquarters
ASOS	Automated Surface Observing System
COTR	Contract Officer's Technical Representative
COTS	Commercial Off-The-Shelf
CRH	Central Region Headquarters
DCM	Direct Command Mode
DCP	Data Collection Package (ASOS)
DOD	Department of Defense
ERH	Eastern Region Headquarters
FAA	Federal Aviation Administration
FAT	Factory Acceptance Test
FSOC	Field Systems Operations Center (OPS2)
FW	Firmware
IAW	In accordance with
IFW	Ice Free Wind
IFWS	Ice Free Wind Sensor
IP	Invalid Peak
IPRPP	Ice Free Wind Problem Resolution Project Plan
METAR	Aviation Routine Weather Report
MODNOTE	Maintenance ModificationNote
MPM	Monthly Performance Metric
NLSC	National Logistics Supply Center
NWS	National Weather Service
OAT	Operational Acceptance Test
OPS12	Maintenance Branch
OPS2	Field Systems Operations Center (FSOC)
OPS22	Observing Systems Branch
OPS23	Software Branch
OPS24	Test and Evaluation Branch
OS7	Observing Services Division
OST 11	Program Management Branch
OTR	Operational Trouble Report
OT&E	Operational Testing & Evaluation
PIV	Performance Index Value
PM	Project Manager
PRH	Pacific Region Headquarters
RBS	Risk Breakdown Structure
RC	Request for Change
RII	Relative Improvement Index
RR	Risk Register

SAIC	Science Applications International Corporation
SFSC	SFSC Field Support Center
SIO	Serial Input Output
SR&DC	SFSC Research and Development Center
SRH	Southern Region Headquarters
ST	System Test
SW	Software
SYSLOG	System Maintenance Log
TT	Trouble Ticket
TTR	Test Trouble Report
USAF	United States Air Force
V2.79D	Software Version Number 2.79D
V2.79E	Software Version Number 2.79E
V2.79W	Software Version Number 2.79W
WBS	Work Breakdown Structure
WFO	Weather Forecast Office
WRH	Western Region Headquarters
WSH	Weather Service Headquarters

INTRODUCTION:

The Automated Surface Observing System (ASOS) provides automated surface weather observations at 883 airport locations nationwide sponsored by the National Weather Service (NWS) and Federal Aviation Administration (FAA), plus an additional 116 Department of Defense (Navy & USAF) locations in the US and overseas. Wind measurements (direction, speed, and character) are among the various surface weather parameters included in the Aviation Routine Weather Report (METAR) message transmitted longline by the ASOS. The accurate and timely reporting of these data is essential to safe and efficient aviation operations and for support of other vital missions of the sponsoring agencies. When the ASOS was first commissioned in 1992, the initial operating capability of the sensor suite included the Belfort model 2000, cup and vane anemometer. Over the next 10 years, all 883 NWS and FAA sponsored sites were commissioned with this sensor. During this period this sensor demonstrated a tendency to freeze and cease operation during inclement winter weather. A follow-on Product Improvement Program was initiated in the 2000's to enhance the performance and reliability of the ASOS. This program included replacing the cup and vane anemometer with an ultrasonic Ice Free Wind Sensor (IFWS) beginning in late summer 2005. This sensor replacement required, and was deployed concurrent with a new ASOS Acquisition Control Unit (ACU) software load, V2.79. Since its initial deployment, the ACU software load transitioned through several iterative improvements; V2.79 A, B, C, and D. As of September 30, 2007 the IFWS along with V2.79C or V2.79D was installed and is operational at 700 of the 883 NWS/FAA sponsored ASOS sites.

Description of the IFWS:

The ASOS Ice-Free Wind system (Vaisala 425NWS) is a heated sonic anemometer utilizing an array of three ceramic transducers spaced 120 degrees apart in a horizontal plane. Each sonic transducer acts as a sonic transmitter and as a sonic receiver. The wind speed is measured by differences in the sonic transit time in both directions between alternate resonating transducers. See photo below.

This sensor was developed from a Handar COTS sonic anemometer. Several improvements were incorporated into the Vaisala 425NWS sensor: higher heating power 150 watts versus 30 watts for the COTS sensor; externally downloadable sensor firmware; a higher internal sonic sampling rate; and an increased number of internal wind speed correction tables for improved sensor accuracy. Vaisala purchased Handar in1999 and took over design and manufacturing of the 425NWS heated sonic anemometer.

The ASOS accuracy specification is ±2 knots or ±3%, whichever is greater, to a maximum speed of 125 knots. The wind direction accuracy is specified as ±3 degrees. Although beyond the ASOS specification, a 425NWS sensor has been tested in the wind tunnel to 165 knots (±10%).

History of recent IFW problems:

Figure 1 shows the national performance statistics for the three most prevalent error messages noted in the ASOS System Maintenance Log (SYSLOG) for each month from January 2006 to August 2007. These error messages are:

Error Code 1794	Invalid Peak Wind
Error Code 1791	Wind Sensor Missing Data
Error Code 1786	Wind Data Quality Error

These statistics are normalized to the number of NWS and FAA ASOS sites installed with an IFWS at the end of each month and so they are per-site, per-month and therefore independent of the number of IFWS installed sites in each period. They show a definite summer time increase for all three error messages per-site in both 2006 and 2007. The average sum for all three error messages during this period was 16.67 diagnostic messages per site per month (shown as the bold horizontal line in the chart). The per-site increase in 2007 was more pronounced than in 2006. The sharp increase in diagnostic messages began in May and peaked in July 2007. The summer time increase in the error codes 1794-Invalid Peak Wind and 1791-Wind Sensor Missing Data can be mostly explained by birds roosting on the IFWS and blocking the signal path (resulting in 1791 missing data), or flapping their wings for take off (resulting in 1794 invalid peak wind). What cannot yet be explained is the sharp increase in these diagnostic messages per-IFWS site from summer 2006 to summer 2007. This sudden increase alerted Weather Service Headquarters (WSH), NWS Regional HQ, and field maintenance personnel. It caused the regions to lose sufficient confidence in the performance of the IFWS to suspend further IFWS installation at most locations until their concerns are adequately addressed. A full understanding of the root cause for this year-to-year increase and a sound solution is necessary for renewed confidence and resumption/completion of IFWS installation at the remaining locations. See figures 1 and 1A for a time series depiction of the IFW diagnostic messages.

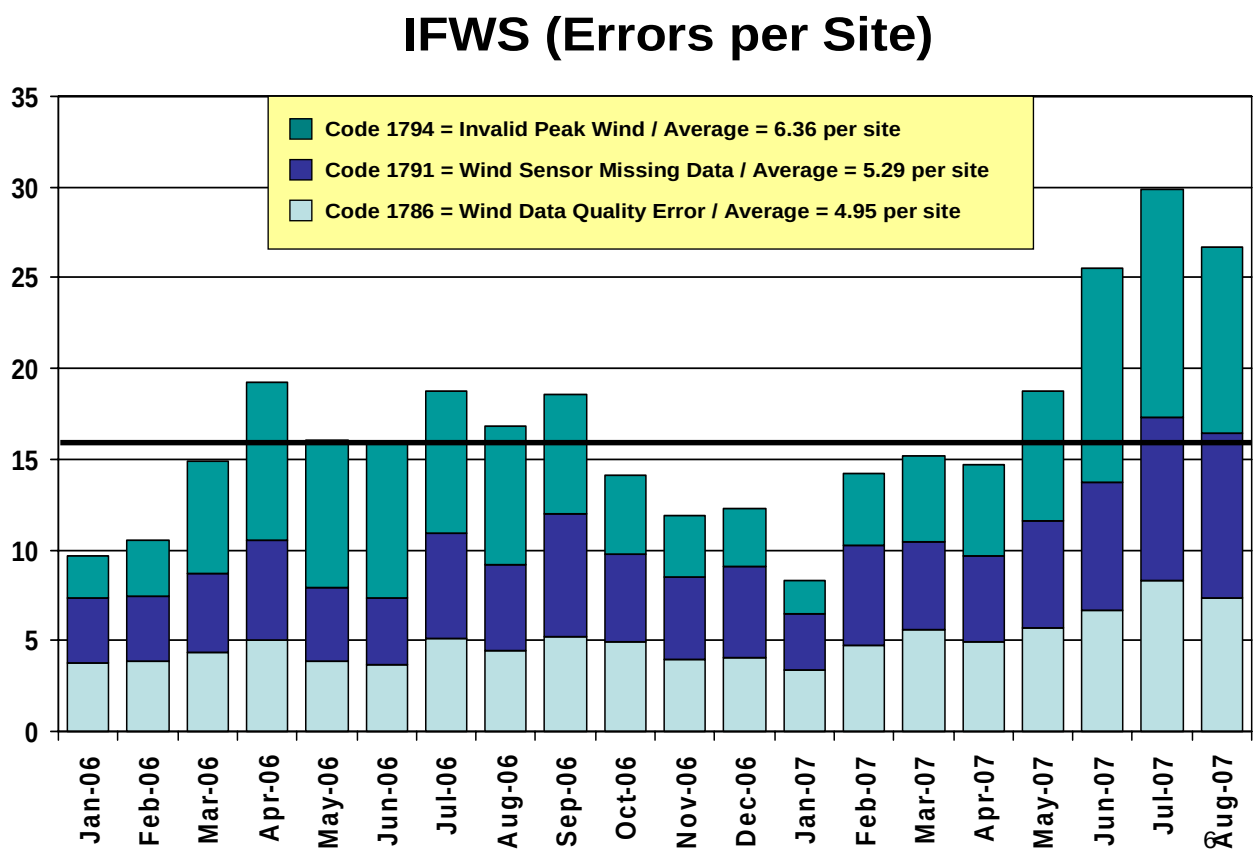


Figure 1: Ice Free Wind Sensor SYSLOG diagnostic Codes Per-Site

As of end of Month	Jan 06	Feb 06	Mar 06	Apr 06	May 06	Jun 06	Jul 06	Aug 06	Sep 06	Oct 06	Nov 06	Dec 06	Jan 07	Feb 07	Mar 07	Apr 07	May 07	Jun 07	Jul 07	Aug 07
# with IFWS installed	166	182	189	198	207	213	216	232	286	320	360	380	387	394	459	559	611	666	686	694

Figure 1A: Number of NWS/FAA ASOS locations with IFWS installed

In November 2007, OPS22 (Rick Parry and Chet Schmitt) with the assistance of OPS13 (Don Rinker) conducted a detailed study comparing the attributes of the most error prone 20 IFWS sites with those sites not reporting any IFW diagnostic messages (164 sites). The study analyzed IFW related diagnostic messages (i.e., system maintenance error messages 1786, 1791, and 1794) during the period of June and July 2007. The attributes compared included: software version, class of system, agency ownership, NWS region location, WFO maintenance responsibility, FAA airport service level, climatology, and both sensor and serial communications configurations. The differences between the two samples were small, and were within the

expected amount of variation. Therefore, it has been concluded that these factors are NOT contributing to the IFWS problem.

Purpose & scope of document:

The purpose of this IFW Problem Resolution Project Plan (IPRPP) is to describe coordinated project team efforts to identify the root cause of the recurring IFW problems, develop timely, orderly, and cost effective solutions in compliance with performance specifications, and complete the installation of the IFWS as quickly as possible.

The most prevalent reoccurring problems that have been noted at ASOS IFW sites are:

1) Anomalous peak wind speed and/or two-minute wind speed
2) Invalid peak wind speed SYSLOG messages (ST1794).
3) Missing wind data caused by: birds; ASOS software (visibility checksum problem); or other unknown reasons.

The scope of these efforts encompass' various potential combinations of software, firmware, and hardware solutions. These solutions range from short-term interim fixes achievable within six to eight months, to long-term permanent fixes that may take one to two years to complete.

Thus, there are two primary objectives of the IPRPP. The first objective is the short-term "fix" of the IFW problem sufficient to significantly reduce the number of IFW-related SYSLOG messages, restore user confidence, and allow installation of the IFWS at the remaining sites not yet installed with the IFWS. The ultimate objective is the long-term solution that resolves all remaining issues and problems.

Initial anecdotal information and a mounting body of evidence indicate a major cause of IFWS problems are birds roosting on the IFWS and interfering with the sonic path(s) between the transducers. A number of possible mechanical "solutions" to the bird-related SYSLOG 1994, 1791, and 1786 error messages were proposed. Candidate fixes include:

- Mylar holographic colored strips
- Nixalite spike strips
- Wind chimes
- Air horns- motion activated
- Placing heated spike at top of transducers
- Owl statue
- Bird perch
- Bird Abatement
- "Tangle foot" pliable calk deterrent coating
- ASOS ACU QC algorithms
- Sensor firmware modifications
- Inverting IFWS so transducers face down instead of up

All of these possible solutions have advantages and disadvantages. The first six were previously considered and found wanting. Limited resources and questionable payoff preclude further evaluation of these first six solutions. Of the remaining candidate solutions, the Bird Perch and Bird Abatement devices will be evaluated as part of this plan for a possible follow-on short-term fix, and the remainder may be considered as part of a long-term solution. What remains in the short-term are software fixes.

The short term fix involves fielding of a software load V2.79E that contains some, but not all quality control fixes in the ASOS ACU for the IFW problem. Three quality fixes are planned for V2.79E that should provide sufficient, measurable relief to the most pressing problems to permit installation of the IFWS at the remaining sites. These fixes are:

1. Checks for the validity of both 3 second and 5 second wind data, and will only use the data if both are valid. Otherwise, both sets of data will be rejected. This will reduce the number of invalid peak wind error code, 1794, reported in the SYSLOG.

2. Utilization of the Visibility checksum feature to prevent memory overwriting of the wind buffer in the ACU and corruption of the output wind data. This will fix a formatting error in the SYSLOG for impossibly large values of invalid peak wind data and result in reduced warm starts which in turn cause both 1786 and 1791 SYSLOG diagnostic messages. This condition occurs relatively infrequently, and so utilization of this feature will minimally reduce the number of missing wind data, and diagnostic codes reported in the SYSLOG.

A note of caution: Although the short-term fixes will provide some relief, they are not the panacea for all the IFW problems. Follow-on fixes will provide added relief. See **Appendix -1** for more details of contents of V2.79W and V2.79E.

Coupled with this initial short-term software fix, a follow-on short-term fix such as a mechanical adaptation to the sensor head assembly via a bird perch or bird abatement device may also be installed at selected high vulnerability sites, pending outcome of initial assessment of these devices. Testing and evaluation of this proposed fix will continue through the summer 2008. If successful, early adaptation of this fix may begin in mid summer 2008. If adequate evidence is developed sooner that one or both of these devices provides substantial relief from bird-induced problems we will move more quickly to deployment.

The second objective is the long-term final solution to the IFW problem that results in consistent, continuous, and reliable operation of the IFWS and provision of accurate wind information in the ASOS METAR output. The aim of this objective is to provide optimal service to the user community. This may involve more elaborate ACU software fixes, IFWS firmware and/or hardware fixes, or any combination of these. Caution: There is a risk of an unfunded mandate for long-term elaborate fixes. This needs to be added to the Risk Register (see Section 1.2.2) and tracked.

On going, four-season analysis of the diagnostic output from V2.79W at the 12identified test sites will provide valuable insight for a comprehensive final solution. These two objectives are on separate parallel critical paths. The first objective serves as non-critical path input to the second.

This IPRPP addresses both the short term and long term goals. To achieve these goals, the IPRPP is organized into five chapters:

1) Project Planning
2) Execution
3) Implement Fixes
4) Monitoring & Control
5) Verification & Closeout

The sub-sections within each chapter are composed of individual “work packages” that define a discrete product or service deliverable. The planned time period (i.e., start date and end date) for accomplishing each work package is defined by the “Inclusive Dates” banner at the beginning of each work package.

Chapter 1.0 PROJECT PLANNING

(Inclusive Dates: Mon 7/2/07 Tue 3/31/09)

The IFW Problem Resolution Project was initiated on July 2, 2007 when an emergency ASOS Coordination Meeting (ACM) was convened to discuss and respond to the sudden escalation of IFW error reports. OPS22 took the lead to assemble an investigative team at the SFSC Field Support Center (SFSC) to examine these error reports and report their findings. The preliminary report delivered on August 30, 2007 indicated there were indeed substantial IFW problems, particularly during the warm summer season. At that time Dave Mannarano was asked to be the project leader to solve these problems. Over the next month, Dave consulted and coordinated with various experts, formed an ad-hoc project team, began formulating the framework of a project plan to address the IFW problem, and concurrently initiated action to solve the problem. On October 4, 2007 he conducted a full project team meeting at the SFSC to review the preliminary draft Project Plan Work Breakdown Structure (WBS) and project schedule and identify the inherent risks and mitigating strategies in achieving the scope and meeting the schedule of the draft plan with the available resources. A draft IPRPP was written, coordinated, and presented to senior management in early November 2007. A final baseline plan will be issued in December 2007 against which future progress can be measured. Through the progressive elaboration process, the plan may be subsequently modified as necessary.

1.1 Preliminary Plan

(Inclusive Dates: Mon 7/2/07Fri 10/22/07)

Immediately upon first becoming aware of paradigm shift in the magnitude of the IFW problem in early July 2007, The ACM Chairperson, Dave Mannarano, marshaled resources and began the process to plan a comprehensive solution. This includes a full understanding of the nature and scope (i.e., frequency and impact) of the problem, the available human resources and financial support (i.e., cost), and the time constraints (i.e., schedule). The preliminary draft IPRPP was circulated for review and comment during the week of October 22, 2007.

**********OPS22, Dave Mannarano **********

1.1.1 Define Scope, Schedule, Responsibility, and Cost

(Inclusive Dates: Mon 7/2/07 Tue 9/18/07)

The preliminary definition of the scope, schedule, and responsibility for the IFW Problem Resolution Project is contained in the first draft IPRPP dated October 22, 2007. It consists of a project Work Breakdown Structure (WBS), a Gantt project schedule decomposed to individual WBS work packages, and a Resource Responsibility Matrix. The IFW Problem Resolution Project Schedule and associated Resource Responsibility Matrix are provided in **Appendix -1**. A key component of this schedule is the development and testing time required to field an initial diagnostic software load V2.79W, and an interim operational fix load, V2.79E. The content of these loads is described in **Appendix-2**. Although the schedule for V2.79W is slightly ahead of V2.79E, it is nevertheless the follow-on *operational* V2.79E load, with three interim fixes, that is on the critical path for short-term resumption of the IFWS installation at the remaining ASOS locations. The V2.79W load with the

three fixes in V2.79E also has diagnostic software that will assist in identifying long term solutions. In short: V2.79E is meant to be the operational load containing the fixes that are in V2.79W. Once Operational Test and Evaluation (OT&E) of V2.79E is successful, the software will be scheduled to replace V2.79D as the official operational load. Installation will occur at all ASOS sites except at the designated V2.79W sites used by SFSC test personnel for further four-season evaluation. V2.79W will be removed at the designated V2.79W operational evaluation sites when its use by SFSC test personnel is finished. V2.79E will then replace V2.79W at those sites. An optimal schedule for fielding these software loads was developed by the OPS23, Software Branch, in coordination with OPS24, Testing Branch. This schedule is included in this plan. See **Appendix-3** for more information on factors and considerations bearing on duration of software development and testing.

IFW Software development and testing schedule estimates

The following IFW software schedule was coordinated between the Software Branch, OPS23, and the Testing Branch, OPS24. A key caveat in this estimate is **no** critical diagnostic messages are found during FAT, ST, or OT&E. As can be seen below, V2.79E is scheduled to begin operational deployment on February 15, 2008. The normal 90-day preventative maintenance visit cycle will permit installation of the V2.79E all sites and IFWS installation completion at the remaining ASOS sites by May 15, 2008, well before the start of the 2008 summer season.

ASOS Software V2.79E

Original Schedule
FAT – November 13-15, 2007
NWS Baseline Procedures – November 16-28, 2007
ST – November 29-December 14, 2007
OT&E – January 3 – February 15, 2008
Begin Deployment – February 15, 2008

Risk Warning: Should V2.79E schedule slippage occur, a significant risk event will be incurred that full installation of the remaining IFWS will be delayed beyond the May 15, 2008 goal. The probability and impact of this risk were rated very high by a panel of 18 experts convened at SFSC on October 4, 2007, to evaluate the risks associated with this project.

Several strategies are available for dealing with this risk: 1) Acceptance; 2) Avoidance; 3) Transference, and; 4) Mitigation. Acceptance is a viable strategy if the degree of risk (i.e., V2.79E critical failure and significant schedule slip) is very low, but it is not. Doing nothing is not an option. Avoidance implies an alternate independent solution can be employed such as use of a complementary remote sensing technology, or an in-situ technological breakthrough found. Neither seems likely at this time. Reengineering of the sensor and the processing software to eliminate the cause and/or effect of the problems may be possible in the long-term if sufficient funding and resources are brought to bear. Transference involves placing the responsibility for dealing with the problem on another party in exchange for a consideration. This may involve asking the local airport authority or contract weather observing facility to assume greater responsibility for monitoring and backing up the wind reports when necessary. Another transference strategy is to perform more robust remote quality control checking, flagging, and filtering (to prevent bad data from being transmitted) in as near real-time

as possible. Automated central servers and processing systems may be used for this. Neither of these strategies solve the root cause of the problem, they just pass the buck. Mitigation fall-back techniques are more readily used when Acceptance, Avoidance, and Transference are not viable options. In this case, one mitigating strategy is to include as many of the remaining IFWS sites as possible, prioritized by incidence of problems, in the V2.79E OT&E. However this strategy has its own risks of exposing more sites to a potential critical flaw (or flaws) in the V2.79E software load before the OT&E is successfully completed. Upon successful completion of the OT&E on schedule (February 15, 2008), first priority for installation of V2.79E and the IFWS could/should be given to the remaining sites not yet installed with the IFWS; second priority should be given to those sites already installed with the IFWS that exhibit the most IFW problems. However, if successful completion of the V2.79E OAT is significantly delayed beyond February 15, 2008, then the first and second priorities should be switched to assure that all "problem" sites are given top priority for installation of V2.79E before the start of the summer season. Should this schedule slip occur, OPS22 will adjust the deployment schedule as necessary based on degree of schedule slip and confidence in completing all installations by May 15, 2008 as originally planed. All remaining IFWS installed sites with the least problems are placed in the final third priority.

1.1.2 Obtain & Organize Resources

(Inclusive Dates: Mon 7/9/07 Fri 7/20/07)

The biweekly ASOS Coordination Meeting (ACM) served as an early venue to focus attention on the growing IFW problem. In early July 2007, the ACM Chairperson, Dave Mannarano formed An ad hoc core project team of 4-5 persons to plan and manage the initial effort to understand the nature of the "problem" and devise solutions. This core group consisted of Dave Mannarano (team lead) at Weather Service Headquarters (WSH), Mike Sturgeon (technical lead) at SFSC, SAIC contract support staff at SFSC (data analysis), and Kevin Conaty at the ASOS Operations and Monitoring Center (AOMC) (Trouble Ticket data collection). In late August 2007 the Director, Field Systems Operations Center (OPS2), formally designated OPS22, Dave Mannarano as the "IFW Problem Resolution Project Manager (PM)." This group's activities were later expanded to engage and solicit input from other WSH staff including Maintenance Branch (OPS12), Software Branch (OPS23), Testing Branch (OPS24), Observing Services Division (OS7), and Program Management Branch (OST11) among others. On going open discussion of this issue was also conducted at the bi-weekly ACM beginning in early July 2007 where a broader audience was engaged, including representatives from the NWS regions, FAA HQ, and DOD.

**********OPS22**********

1.1.3 Roles and Responsibilities

(Inclusive Dates: Mon 7/9/07 Mon 10/22/07)

Organizational roles and responsibilities as they pertain to the IPRPP are:

- WSH

- OPS22 – Serve as overall project manager, and manage IFW evaluation. SAIC staff at SFSC will conduct the IFW evaluation and report on findings.
- OPS23 – Manage software development for V2.79W and V2.79E
- OPS24 – Manage System Test and OT&E for V2.79W and V2.79E
- OPS12 – Manage issuance of maintenance modification notes, and requisition of approved stock items from National Logistics Supply Center (NLSC)
- AOMC – Provide IFW priority-1 and priority-3 (as appropriate) TTs and other data to support detection and analysis of IFW problems.
- OS7 – Provide IFW service requirements
- OST11 – Provide IFWS technical assistance as requested

o NWS Regional HQ, ASOS Focal Points
- Provide review and comment on IPRPP
- Provide coordination bridge between WSH, OPS22, and field offices involved in IFW evaluation
- Provide coordination and feedback to WSH, OPS22, on IFW-related installation and implementation issues

o NWS Field Offices
- Provide assistance in installing IFW evaluation equipment
- Maintain IFW evaluation sites in operational status throughout evaluation period
- Provide feedback through regional channels to WSH, OPS22, on problems or issues related to IFW evaluation

o FAA and DOD
- Provide review and comment on IPRPP
- Provide technical assistance for IFW evaluation as requested and appropriate

Within this context of broad organizational roles and responsibilities, individual roles and responsibilities emerged. As the core team gathered and analyzed information in summer 2007, the scope of the problem, and the goals of the project became clearer, as did the roles and responsibilities of project team members. The team quickly moved through the classic team development stages of *forming, storming and norming*. Details of the Preliminary Planning roles and responsibilities are described in the following subsections of this Chapter below, whereas the *performing* details of the Execution roles and responsibilities are described in Chapter 2. Roles and responsibilities are summarized in **Appendix-1**, Resource Responsibility Matrix.

1.1.4 Perform preliminary Analysis of Problem

(Inclusive Dates: Mon 7/9/07 Thu 8/30/07)

Preliminary ASOS data was provided by the AOMC for the week of July 2-9, 2007. This included "Priority-1" Trouble Tickets (TT) for wind problems and related ASOS SYSLOG data and 12 hour archive for the period surrounding the TT events. The SAIC staff sorted and analyzed these data under the direction of Mike Sturgeon to form insights and conclusions regarding the nature and magnitude of the IFW problem.

**********SAIC**********

1.1.5 Preliminary SAIC report

(Inclusive Dates: Mon 7/9/07 Thu 8/30/07)

A preliminary "Ice Free Wind Trouble Ticket Analysis" report was prepared by the SAIC staff and delivered to the team lead, Dave Mannarano on August 30, 2007. The salient insights from this report include the following comments:

*"During this period (*of one week, from July 2 – 9, 2007)*, there were 80 trouble tickets generated from 58 ASOS sites around the United States. The SYSLOG data from these 58 sites during that period were evaluated and sorted by ASOS site according to the type of IFW related failure, which included missing wind data, anomalous wind data, data quality diagnostic messages and any other occurrences of failure that were encountered. The results in this report reflect the analysis of those SYSLOG diagnostic messages."*

"Seven sites were responsible for 50 percent of the SYSLOG diagnostic messages generated."

"Invalid peak wind and missing data are the most prevalent problems found. These problems were not evenly distributed among all ASOS locations. Analysis of follow-on data for August 2007 reinforces and amplifies these findings."

The knowledge and insights gleaned from this report assisted the PM, Dave Mannarano, in preparing the preliminary IPRPP.

**********SAIC**********

1.1.6 Final SAIC report

(Inclusive Dates: Fri 8/31/07 Fri 10/12/07)

A final SAIC report was delivered on October 11, 2007. This report provided confirmation of the extent of the problem and pointed toward preliminary follow-on actions to address the problem. The salient comments include:

"A project team needs to be formed to coordinate future activities to collect and evaluate high resolution data from selected sites and determine appropriate solutions."

See **Appendix-5** for a copy of this report.

**********SAIC**********

1.1.7 Draft Preliminary IFW Problem Resolution Project Plan

(Inclusive Dates: Thu 8/23/07 Mon 10/22/07)

Work started on the preliminary IPRPP in August 2007. This included drafting of a project WBS, schedules and responsibilities, evaluation of risks and opportunities, and identification of the optimal path and milestones toward a final solution. Initially eight test sites were identified, latter expanded to 12 test sites, and a phased approach defined for collecting high resolution data and evaluating possible solutions at these sites. These test sites were identified for inclusion in V2.79W OT&E to provide exigent temporary relief until V2.79E becomes available, and participation in the Bird Perch/Bird Abatement device assessment. The list of test sites and the evaluation strategy is in **Appendix-4**. The first draft was circulated for review during the week of October 22, 2007. The Second draft was circulated for review and comment on November 19, 2007.

**********OPS22 (Dave M.)**********

1.2 Final Plan Evolution

(Inclusive Dates: Mon 10/22/07 Tue 4/30/09)

The first and second draft IPRPPs were given wide distribution for review and comment. Reviewers included OPS2, OPS22, OPS23, OPS24, OPS12, OST11, AOMC, OS7, ERH, CRH, SRH, WRH, ARH, PRH, FAA, and DOD. All draft plan review comments were considered for inclusion in the final baseline plan. Comments were incorporated in subsequent plans to the maximum extent possible at the discretion of the PM. Thus far, comments were received from OPS2, OPS22, OPS23, OPS24, OPS12, and ERH. Where no comments were received, silence was assumed to be acquiescence. The baseline plan will be prepared and circulated by January 28, 2008.

1.2.1 Review and Revise Draft Project Plan

(Inclusive Dates: Mon 10/23/07 Mon 1/28/08)

The preliminary project plan was circulated for review and comment during the week of October 22, 2007. Comments received were incorporated into a second draft. The second draft was circulated for review and comment on November 19, 2007. Comments received were accepted and incorporated, to the extent possible or practicable, into the baseline plan through December 20, 2007. Additional revision and completion of the baseline plan continued through January 28, 2008.

**********OPS22**********

1.2.2 Develop and Execute Risk Management Plan

(Inclusive Dates: Thu 10/4/07 Wed 6/17/09)

The IPRPP PM, Dave Mannarano, convened a meeting with 18 experts from various WSH offices at the SFSC on October 4, 2007. The purpose was to conduct a full project team review of the preliminary draft Project Plan WBS, project plan schedule, and identify the inherent risks and mitigating strategies in achieving the scope and meeting the schedule of the draft plan with the available resources. A key output from this meeting was a sober assessment of the risks associated with the various work packages of the project plan schedule. A modified Delphi brainstorming technique was used to identify potential risk events for each WBS work package element

and assess the degree or severity of each risk event, in terms of probability of occurrence (on a scale of 1-5) and impact to the project (on a scale of 1-5), to produce a combined overall risk score (on a scale of 1-10). The highest identified risks were associated with software V/2.79W/V2.79E development/testing schedules (previously discussed in Section 1.1.1), SAIC workload for data evaluation, and contention with other projects and initiatives, such as ceilometer development, for scarce available resources. See Figure-2 below for a current summary of the risk events.

Work Package #	**Risk Event #**	**Risk Event Description**	**Risk Probability**	**Risk Impact**	**Risk Rating**
1.1.5	1.1.5.A	Final SAIC report delayed beyond 10/12/07	1	1	2
1.1.6	1.1.6.A	Issue draft IPRPP by 10/22/07	2	5	7
2.1	2.1.A	Install Data Logger/camera @ 4 sites by 11/02/07	3	5	8
2.1.1	2.1.1.A	Reliability of Data Logger/camera	1	4	5
2.1.1 2.2.1 2.3.2	2.1.1.A 2.2.1.A 2.3.2.A	Insufficient SAIC staff resources to accomplish evaluation on schedule (schedule slip)	5	5	10
2.3.2	2.3.2.B	Evaluation of V2.79W data may end too soon, short of 4 -seasons	3	5	8
2.3	2.3.A	Delay in development of V2.79W beyond 11/30/07	4	3	7
2.3	2.3.B	Impact of V2.79W development slippage beyond 11/30/07 on Ceilometer schedule	4	5	9
2.4	2.4.A	Delay in development/Testing of V2.79E beyond 2/15/08	5	4	9

Figure-2 IPRPP Risk Register

Follow-on planned activities include development of a Risk Breakdown Structure (RBS), Risk Register (RR), and a Risk Management Plan concomitant with issuance of the Baseline IPRPP in December 2007. Risk management is an ongoing activity, involving everyone affected throughout the life of the project. Concerns will be added or removed to the risk register as warranted. The risk register will be continuously monitored and updated to reflect the current status of the project risks. Coordinated contingency plans will be developed and updated to deal with known risks (known unknowns). Reserve resource capacity must be available and provided to deal with unknown risks that arise without warning (unknown unknowns).

**********Dave Mannarano/OPS22**********

1.2.3 Issue Baseline IFW Problem Resolution Project Plan (IPRPP)

(Inclusive Dates: Mon 1/28/08 Mon 1/28/08)

OPS22 conducted final coordination with staff from Weather Service Headquarters (WSH) offices and Regional Headquarters offices and Weather Forecast Offices in January 2008 to ensure all preparations are complete and everyone knows what to do to successfully begin the evaluation in February 2008. Any final concerns or questions were addressed and incorporated in the Baseline IPRPP issued on January 28, 2008.

**********Dave Mannarano/OPS22**********

1.2.4 Continuously Review and Revise IPRPP

(Inclusive Dates: Fri 2/1/08 Thu 4/30/09)

OPS22 will conduct ongoing coordination with NWS field offices, Regional Headquarters, and WSH offices to identify and resolve any latent problems or issues and ensure a smooth and effective execution, and successful completion of the IPRPP. The IPRPP may be updated from time to time to reflect these changes.

**********Dave Mannarano/OPS22**********

Chapter 2.0 EXECUTION

(Inclusive Dates: Mon 7/9/07 Wed 12/24/08)

Execution of this project involves those tangible activities that contribute to, lead to, or directly result in achieving the two prime objectives of this project:

1. Installation of the new interim operational software load V2.79E at virtually all ASOS locations (except handful of V2.83 sites defined by OPS24) and installation of the IFWS at the remaining ASOS sites without an IFWS by summer 2008, and determination in summer 2008 if the bird perch or bird abatement device warrants operational deployment.
2. Installation of a long-term comprehensive software, firmware, hardware final solution at all ASOS sites by summer 2010.

These activities include, but are not limited to:

1. Deployment, installation, and operation of diagnostic/data collection equipment at designated sites
2. Development and deployment of initial fixes or alternate solutions to the IFW problem
3. Collecting and evaluating data from test locations in accordance with test plans and procedures
4. Validate efficacy of initial solutions prior to implementation
5. Preparing reports and recommendations for follow-on action
6. Repeat steps 1 through 4 for final follow-on solution
7. Prepare final report

The project work packages involved in the Execution phase are described below. Successful completion of the Execution activities will lead to the follow-on Implementation activities described in Chapter 3.

OPS22 and the SAIC contract staff at SFCC are primarily responsible for executing the activities described in this chapter. Support will be provided by various WSH, Regional Headquarters staff, and field personnel. This is truly a team effort and all team members need to be fully engaged for a successful outcome.

A few words about the capabilities and limitations of the evaluation process:

1. Ideally a fully vetted test and evaluation plan should be published before the start of the evaluation.
2. This should include metrics, criteria, and evaluation process complete with contingency plans.
3. Initial evaluation should occur on a “control” population, under initial conditions. Data should continue to be collected on this control population for the duration of the project to establish a baseline for comparison.
4. A change needs to be introduced after the initial control baseline is established.
5. Collection and analysis of coincident detailed observations (same time and same place) of the baseline control and the change are needed for a valid comparison and evaluation of the effect of the change introduced.
6. Additional changes may be introduced and their effect on what came before may be evaluated in like manner.
7. Analytical techniques are applied to reveal the effect of the change (i.e., the magnitude or percent of change, the trend, bias, or variability within or beyond control limits, etc…).

Items number 1 through 4 described above are part of this plan, as are items 6 and 7. However, collection and analysis of coincident, collocated detailed observations of the initial baseline and the subsequently introduced change, described in item number 5, are beyond the capabilities of this plan. This would require mounting a second (modified) and a third IFWS along side the existing (baseline) IFWS, maintaining all three to the same operational status, and collecting and analyzing three times the data every 5 seconds. The resources are not available to do this. Instead, after the baseline is established at a site, a change will be introduced and evaluated. The serial difference, not the concurrent difference is evaluated.

2.1 Deploy/Install Data Logger/Camera at 4 Sites

(Inclusive Dates: Thu 9/20/07 Fri 11/02/07)

The data logger and camera were installed and became operational at the following sites on the dates indicated.

Camera & data logger
SPI - 9/25/2007
MLB - 10/17/2007
BTR - 10/24/2007

MYV - 10/17/2007 data logger
10/22/2007 camera

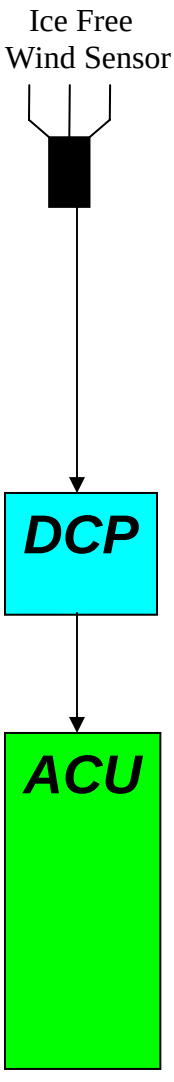
**********Mike S. /SAIC @ SFSC**********

Collect/Evaluate Data from 4 Sites

(Inclusive Dates: Thu 9/20/07 Tue 12/30/08)

In order to properly evaluate the 3-second and 5-second data collected by the data logger, and eventually the V2.79W/2.79E software loads, a basic understanding of the processing of these data are needed. The following explanation serves to provide this understanding. See Figure-3 below.

Wind Data Processing Within ASOS



At the sensor:

1) Every 1 second, the wind direction and speed are sampled

2) Every 1 second, a running average of the most recent 3 seconds of data is computed*, producing the "3 second average"**

3) Every 5 seconds, the average of the most recent 5 seconds of data is computed*, producing a discrete "5 second average"

4) The current Vaisala internal IFW sensor QC algorithm:
Requires two valid one-second samples in the five-second window to report a valid Three-second peak wind, and;
Requires one valid one-second sample in the five-second window to report a valid Five-second average wind.

**** To the nearest degree and tenth of a knot***

***** The running 3 second average is assigned to the 5 second block in which it ends***

At the Data Collection Package (DCP):

1) Every 5 seconds, the 5 second average and the highest 3 second average (i.e., 3 second peak) ending during the 5 second period are collected from the sensor and sent to the ACU.
NOTE: The DCP acts as a "pass through", converting ASCII sensor data to digital format. However data values are not altered by the DCP.

At the Acquisition Control Unit (ACU):

1) Every 5 seconds, the 5-second average and the 3-second peak wind is received from the DCP. Wind speed data are received to the nearest tenth of a knot and are truncated by the ACU to the nearest knot (i.e. 22.8 kts becomes 22 kts).

*****At this point, the algorithm to compute the observed wind (average direction, speed and peak wind direction and speed) will begin*****

2) Every 5 seconds, the average 2-minute wind speed and direction is computed using the most recent 24 5-second samples.

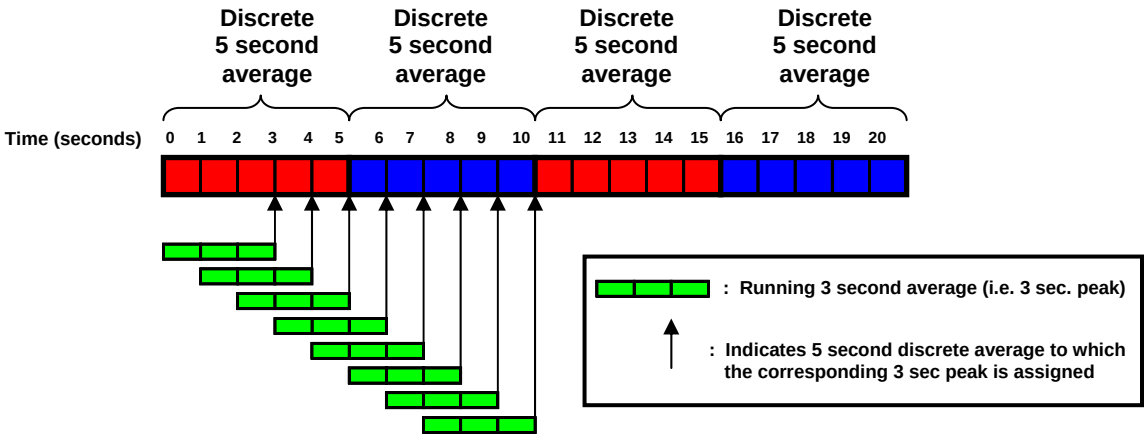


Figure-3 IFW Data processing

Current Software Logic (as implemented in V2.79D)

If the current 2-minute wind speed is less than or equal to 5 knots, and the maximum 3-second wind speed is greater than 2.5 times the ***current 5-second wind speed***, ***and the maximum 3-second wind speed is greater than 5 knots,*** mark the maximum 3-second wind speed invalid. Write a message in the SYSLOG identifying the 3-second wind data as invalid peak winds. (This step mitigates the problem of small birds roosting on the ice-free wind sensor, causing false peak wind speeds.)

Comments:

By requiring the 3-second wind to exceed 5 knots, the current software logic minimizes the possibility that valid peak winds will be identified as invalid data.

Process for analysis of IFWS Data via the Data Logger/Camera at four sites

1. When the memory cards (data logger and camera) are received from the field sites, place data on the FTP server, and download data.
2. Save files to computer and list when the camera pictures occurred.
3. Import and parse wind data, diagnostic data and 12hr data using a macro in the spreadsheet.
4. Spreadsheet automatically calculates, using formulas, missing 5-sec and 3-sec wind speed and direction. Also, invalid peak wind speeds are automatically calculated. First for the preliminary (un-updated) way the structured English is written, then the preliminary (un-updated) way plus adding a check to see if the peak wind speed is greater than 5 knots. Finally, a third method of generating the invalid peak wind speeds using the way that Prism has calculated the numbers in the current version of the ASOS software (V2.79D).
5. Checks in the spreadsheet alert the user to areas where the wind speeds are suspicious (changes in previous 3-second and 5-second sample to the next exceeding 5 knots). These times are examined to see

if they were related to birds, and if not, if these winds appear to be normal. If not normal and not related to birds, the data is sent to Prism and Vaisala.

6. Examine areas of the spreadsheet where the birds were on the sensor for winds leading up to the bird landing on the sensor, wind speeds when the bird left, and erroneous wind speeds that were generated from the bird being on the sensor.
7. Correlate the times when the birds were on the sensor to that of wind issues.
8. Examine the diagnostic data to determine when and which paths were blocked and also for bad one second readings, or any other diagnostic parameters that are out of specification according to the manual.
9. If there are Invalid Peak (IP) winds in the wind data spreadsheet, create the IP spreadsheet. Open the master spreadsheet. Delete all columns that are populated in sheet 1. Copy column A, C, E, G, M, N, and P from the Peak WS tab in the IFW data spreadsheet to sheet on in the IP wind spreadsheet. Delete rows in the IP spreadsheet, sheet1, that contain NO invalid peak winds (columns in red with the number 1). Copy columns from sheet 1 to sheet 2. Now put 'Y' in the column under large bird or small bird when pictures exist at that time. Column K through P.
10. Examine the SYSLOG data for 1786, 1791 and 1794 diagnostic messages and count and list the times when they occur.
11. Examine the 12-hour archive data for outages and suspicious readings and relay it back to the 5-second data.
12. Write-up a document on the wind speed and direction issues and also a document on the invalid peak winds.

Installation Notes:

SPI - No bird perch initially. Bird perch installed 10/26/2007.
MLB - No bird abatement initially installed. FAA bird abatement to be installed ~12/1/2007.
MYV - Bird perch installed initially. Removed bird perch on 11/2/2007 per OPS 2 direction. FAA bird abatement to be installed ~12/1/2007.
BTR - Bird perch installed initially. Bird perch to be removed by 12/1/2007 for one month baseline test. To be reinstalled ~1/4/2007.

*****Mike S. /SAIC @ SFSC (Jenifer D. and Dave E.) *******

2.2 Develop and Test V2.79W

(Inclusive Dates: Mon 10/22/07 Thu 12/20/07)

ASOS Software Version 2.79W was originally developed in 2006 to address a problem at field sites where the peak wind field was being corrupted causing incorrect characters and very large values to appear. The problem was difficult to diagnose, and thus, a new software load was developed to assist in the diagnosis of the problem. The load was developed by Prism Communications, Inc. for installation only at field sites having the problem with remote sensors (local sensors were not intended to be supported by this software load).

Version 2.79W software includes eight new 1794 SYSLOG diagnostic messages whenever corrupt data is suspected in any of the ice free wind sensor parameters (peak wind speed, peak wind direction, average wind

speed, average wind direction, and two WJ averaging parameters). The original 1794 SYSLOG diagnostic message (seen in prior software versions 2.79B, 2.79C, and 2.79D) indicated that an invalid peak wind had been detected by the software (most likely due to bird activity) and the value had been discarded and would not be used in any reports. Please note that there were no invalid peak wind SYSLOG messages for the Belfort wind sensor since the Belfort did not send a peak wind value as part of the sensor response, rather the wind gust was computed based on the average wind speed. The following is an example of the eight new 1794 SYSLOG diagnostic messages in Version 2.79W:

11/07/06 13:58 *ST 1794 WIND 425NWS INVALID WIND DATA START

11/07/06 13:58 *ST 1794 IFW AVERAGE DIRECTION:360 / AVERAGE DIRECTION STRING:360

11/07/06 13:58 *ST 1794 IFW PEAK DIRECTION:320 / PEAK DIRECTION STRING:320

11/07/06 13:58 *ST 1794 IFW AVERAGE TIME SPD DIR:5/ AVERAGE TIME SPD STRING:05

11/07/06 13:58 *ST 1794 IFW AVERAGE TIME PEAK SPD DIR:3/ AVERAGE TIME PEAK SPD DIR:03

11/07/06 13:58 *ST 1794 IFW AVERAGE SPEED:5.0/ AVERAGE SPEED STRING :005.0

11/07/06 13:58 *ST 1794 IFW PEAK SPEED:5.0/ PEAK SPEED STRING:005.0

11/07/06 13:58 *ST 1794 WIND 425NWS INVALID WIND DATA END

Recently, there have been other problems noted in the field with the IFW sensor. The V2.79W load has also been modified to help diagnose and possibly reduce the number of problems. These changes include a 14 hour archive for the 5-second wind data which is accessible via the Direct Command Mode (DCM) download. Along with the 5-second wind data, the “WT” diagnostics data will be archived once per minute for 14 hours to assist in the diagnosis of potential sensor firmware problems. The new software load will include checks for the validity of both 3-second and 5-second wind data, and will only use the data if both are valid. Otherwise, both sets of data will be rejected.

There are two other problems that were found in the software that will be corrected in V2.79W. While analyzing the IFW problems, it was discovered that the visibility sensor checksum was not being utilized and could be causing wind data to be overwritten in memory whenever the visibility sensor had an invalid checksum. This suspicion was partially confirmed by noting a correlation between wind data corruption in the field being accompanied by the visibility sensor becoming inoperative. The other software correction is a fix for the SIO error problem where a great number of SIO diagnostic messages were being seen in the SYSLOG due to lack of bandwidth. The problem was discovered during testing of V2.79W and is not a problem in prior loads because the V2.79W modifications added large informational messages to the ACU-DCP communications path. The problem was resolved in V2.79W by reducing the size of the diagnostic messages being collected. However, a few SIO diagnostic messages are still to be expected on occasion due to the limited bandwidth.

The System Test for V2.79W was successfully completed on November 15, 2007. The recommendation was to go forward with installation at 12 operational ASOS sites the ASOS diagnostic ACU software for the IFW sensor problems, V2.79W beginning November 28, 2007. Furthermore, OPS24 conducted a follow-on, two-

week, monitoring at each site to validate the new diagnostic software does not degrade ASOS operations. The Field Verification Test ended successfully on December 27, 2007.

**********OPS23, OPS24**********

2.2.1 Deploy/Install V2.79W and Bird Perch and Bird Abatement Devices at Evaluation Sites

(Inclusive Dates: Fri 10/22/07 Fri 1/31/08)

There are 20 sites identified for the IFW evaluation. They are divided into five evaluation groups. These sites are identified below in Figure 4. Installation dates for the data logger, camera, and V2.79W are shown. Also start dates for comparable evaluation with 2007 data are shown. These start dates are based on the first full calendar month that the IFWS was installed at a site in 2007. See Section 2.3 and Section 2.4 for further details. If the start date given is 2/1/08, then the installation date for the IFWS was February 2007 or earlier.

Eval. Group #	**Site ID**	**Name**	**IFW Evaluation Period**				
			Baseline Evaluation (V2.79W Only)		**Follow-On Evaluation Compare 2007 vs. 2008**		
			Start Date* Data Logger- V2.79W	**End Date**	**Abmt.-BA Perch -BP**	**Start Date**	**End Date**
1A	SNS	Salinas, CA	NA- 12/13/07	1/31/08	BA	2/1/08	12/31/08
1A	MLB	Melbourne, FL	10/17/07 - 11/29/07	1/31/08	BA	2/1/08	12/31/08
1A	FST	Fort Stockton, TX	NA- 11/29/07	1/31/08	BA	5/1/08	12/31/08
1A	DTW	Detroit, MI	NA- 12/4/07	1/31/08	BA 1/18/08	6/1/08	12/31/08
2A	ACY	Atlantic City, NJ	NA- 12/12/07	1/31/08	BP	2/1/08	12/31/08
2A	STS	Santa Rosa, CA	NA- 12/12/07	1/31/08	BP	4/1/08	12/31/08
2A	PUB	Pueblo, CO	NA- 11/29/07	1/31/08	BP	4/1/08	12/31/08
2A	PEO	Penn Yan, NY	NA- ~01/15/08	1/31/08	BP	2/1/08	12/31/08
1B	MYV	Marysville, CA	10/17/07 – 12/11/07	1/31/08	BA 1/23/08	2/1/08	12/31/08
1B	CLE	Cleveland, OH	NA- 11/30/07	1/31/08	BA 1/17/08	6/1/08	12/31/08
1B	SDF	Louisville, KY	NA- 11/29/07	1/31/08	BA	7/1/08	12/31/08
2B	BTR	Baton Rouge, LA	10/24/07 – 11/30/07	1/31/08	BP 1/18/08	2/1/08	12/31/08
2B	DLS	The Dalles, OR	NA- 12/7/07	1/31/08	BP	2/1/08	12/31/08
2B	SPI	Springfield, IL	9/25/07 – 12/4/07	1/31/08	BP	2/1/08	12/31/08
3	BLI	Bellingham, WA	NA – 01/25/08	01/31/08	V2.79W	02/01/08	12/31/08
3	SET	St. Charles, MO	NA - 01/10/08	01/31/08	V2.79W	02/01/08	12/31/08
3	TAN	Taunton, MA	NA - 01/9/08	01/31/08	V2.79W	02/01/08	12/31/08
3	RTN	Raton, NM	NA - ~ 01/15/08	01/31/08	V2.79W	02/01/08	12/31/08
3	BBW	Broken Bow, NE	NA - 01/11/08	01/31/08	V2.79W	02/01/08	12/31/08
3	PHF	Newport News, VA	NA - 01/10/08	01/31/08	V2.79W	02/01/08	12/31/08

Note: * Date Data Logger installed - Date V2.79W installed

Figure-4 IFW Evaluation Sites and Evaluation Dates

**********Dave Mannarano, OPS22**********

2.3 Define Metrics for Evaluation Groups

(Inclusive Dates: Mon 12/3/07 Fri 12/21/07)

Metrics:

1. In the analysis of the statistics there are some factors that will impact the study, which are beyond the control of the study. For example: migratory bird patterns, changes in precipitation and temperatures from year-to-year, crop rotation, etc., could all have an affect on the study. These changes might impact the level of bird activity at the site. These items can not be controlled by those performing this study.

2. The sites in the study will be separated into three groups. Group 1 contains FAA Bird Abatement sites. Group 2 contains the NWS Bird Perch sites. Group 3 contains Benchmark sites. Sites in groups 1 and 2 have an "A" or "B" designation. The "A" designation indicates that a bird deterrent device was never installed prior to V2.79W. The "B" indicates that the site had a bird deterrent device installed for a period of time prior to V2.79W. Statistics will be computed for each group and each subset (A and B) in groups 1 and 2. Any differences between the subset groups will be discussed in the results.

3. The number of 1786, 1791, and 1794 SYSLOG messages will be compared for the appropriate corresponding months, e.g., June 2007 (V2.79D) compared to June 2008 (V2.79W). These comparisons will be site unique.

4. The number of events for each site will be recorded, i.e., the number of 1786, 1791, and 1794 SYSLOG messages, for each month.

5. There will be two sets of Metrics.

    a. The <u>first</u> will compare the IFW operation at problem sites in 2007 with V2.79D and <u>without</u> any bird deterrent devices (i.e., sites in Group 1A or 2A), to IFW operation in 2008 at these same sites with V2.79W and <u>with</u> a bird deterrent device). Similarly, a separate group of problem sites in 2007 equipped with both V2.79D and a bird deterrent device (Groups 1B or 2B) will be compared to operation at these same sites in 2008 again equipped with both V2.79W and a bird deterrent device. A third group of sites without any bird deterrent device in 2007 or 2008 will be compared to se if the change to V2.79W alone has any effect. In this set of metrics, for each of the three groups, their periods of operation with V2.79D (V2.79B or V2.79C) will only be compared to their periods of operation with V2.79W. The period of evaluation can only begin on, or after, the date the IFW sensor was installed at the site. For example, the evaluation at PUB may only begin on or after 4/4/07. Also, only April 2007 (V2.79B) may be compared to April 2008 (V2.79W).

b. The second set of metrics will compare the performance of the IFW sensor only after V2.79W with the bird deterrent device is installed. This metric will compare the month-to-month performance of the IFW sensor via trouble tickets and SYSLOG diagnostic messages of 1786, 1791, and 1794. This will be a concatenated time series regression computation analyzing relative magnitude and rate of change in the sensor's performance at each site from month to month over the course of the year (2008) in comparison to a stable baseline established for the site early in the year. A similar regression computation may be made for the same site in 2007 and a 2007-2008 comparison may be made of the relative slope or rate of change, particularly after the IFWS was installed, but no absolute performance comparison between 2007 and 2008 will be made.

c. The question to be answered for Groups 1 and 2 is: "How has the performance of the sensor changed since V2.79W and the bird deterrent were installed?" For group 3 the question is: "Has the performance changed at all since V2.79W was installed?"

EXAMPLE METRICS

Metric Set 1: See Data Set Below for DTW. (All data are fictitious.)

	SYSLOG Error Codes				Trouble Tickets		
	1786	1791	1794	Total	Priority 1	Priority 2	Priority 3
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	3	6	56	65			
Jul-07	2	8	78	88			
Aug-07	4	3	34	41			
Sep-07	15	10	100	125			
Oct-07	10	11	98	119			
Nov-07	3	6	44	53			
Dec-07	2	3	21	26			
Jan-08	2	3	10	15			
Feb-08	2	3	12	17			
Mar-08	2	3	13	18			
Apr-08	7	5	45	57			
May-08	5	4	31	40			
Jun-08	5	4	30	39			
Jul-08	8	5	43	56			
Aug-08	4	3	23	30			
Sep-08	3	2	13	18			
Oct-08	3	2	15	20			
Nov-08	6	3	29	38			
Dec-08	6	2	15	23			

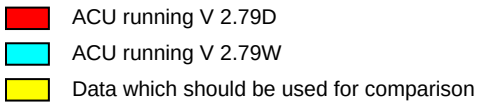
ACU running V 2.79D
ACU running V 2.79W
Data which should be used for comparison

Site DTW had the IFW sensor with V2.79D installed on 6/7/2007 and V2.79W was installed on 12/4/2007. The RED field above indicates the period of time when the IFW sensor was operating with V2.79D. The light blue period indicates when the IFW sensor was operating with V2.79W.

In order to meet the limitations imposed on the study, only the two yellow periods above may be compared for the site. That means only two six-month periods may be compared to see if they are statistically different. This type of analysis would be performed for each site in each group (1, 2, and 3) of the study. Then, the sites in each group could be combined to see if a statistical statement could be made about the population represented by each group in general. Then each group would have to be compared to each other to see if there are any statistical differences. We are trying to answer the question: "Which group showed the best improvement in performance and what anomalies were contained in each sample group (1, 2, and 3)?"

Metric Set 2: See Data Set Below for DTW. (All data are fictitious.)

	SYSLOG Error Codes				Trouble Tickets		
	1786	1791	1794	Total	Priority 1	Priority 2	Priority 3
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	3	6	56	65			
Jul-07	2	8	78	88			
Aug-07	4	3	34	41			
Sep-07	15	10	100	125			
Oct-07	10	11	98	119			
Nov-07	3	6	44	53			
Dec-07	2	3	21	26			
Jan-08	2	3	10	15			
Feb-08	2	3	12	17			
Mar-08	2	3	13	18			
Apr-08	7	5	45	57			
May-08	5	4	31	40			
Jun-08	5	4	30	39			
Jul-08	8	5	43	56			
Aug-08	4	3	23	30			
Sep-08	3	2	13	18			
Oct-08	3	2	15	20			
Nov-08	6	3	29	38			
Dec-08	6	2	15	23			



Metric #2 analyzes only the data gathered after V2.79W was installed. For group 3, all the data gathered since the date of V2.79W installation may be used in this metric. For groups 1 and 2, only data after the bird deterrent device (bird perch or abatement system) was installed may be used. So, potentially, the data highlighted in yellow above could be considered for this metric. Standard regression techniques will be used to answer the question, "Has there been any change in the performance of the IFW sensor during the period when V2.79W alone was installed?" "Has there been any change in the performance of the IFW sensor during the period when V2.79W and the bird deterrent was installed?" There will not be any bird deterrent system installed for group 3. For groups 1 and 2, the above question may only be answered after the bird deterrent system is installed.

**********R. Parry/ OPS22**********

2.4 Define Evaluation Process (criteria, schedule, report format, etc…)

(Inclusive Dates: Wed 1/2/08 Mon 1/28/08)

The intent of this evaluation process is to determine the degree to which the short-term solutions to the IFW bird problem (i.e., the V2.79W, the Bird Perch, and the Bird Abatement devices) evaluated in 2008 reduce the number of IFWS-related SYSLOG diagnostic messages and AOMC Trouble Tickets (TT) experienced in 2007 to the pre-IFWS level experienced with legacy the Belfort wind sensor in 2006. The SYSLOG diagnostic messages are a measure of the inherent availability and quality of the wind data, while the AOMC TTs are a measure of the NWS Area Electronic Specialist (AES) workload generated when they must repeatedly clear the TTs. In this case we are concerned only with wind-related SYSLOG Message numbers 1786, 1791, and 1794, and AOMC Priority 1, and Priority 3 TTs. As such, a separate, yet parallel, assessment will be made for SYSLOG diagnostic messages and AOMC TTs. Since the evaluation will assess the impact of the SYSLOG messages and the AOMC TTs, it is important to understand the nature of these parameters. The triggers for generating the wind-related SYSLOG diagnostic message numbers 1786, 1791, and 1794, and the AOMC Priority 1 and Priority 3 TTs are described below.

For SYSLOG diagnostic messages: Triggering conditions are defined below.

What conditions will trigger a 1786, 1791, or 1794 SYSLOG message?

1786: Data Quality Check Error is set by following conditions.

1. In 2-minute data if missing wind speed data count is more than 6 with at least 18 readings in.
2. In 2-minute data if missing wind direction data count is more than 6 with at least 18 readings in.
3. IFW sensor newly configured.
4. Sensor status is failed.
5. Wind speed or direction is missing.
6. Wind speed is out of range (less than 0 or greater than 300).
7. Wind direction is out of range (less than 0 or greater than 360).
8. Wind data is not updating.
9. If 2-min average wind speed is greater than 5 knots and wind direction is changing less than 1 degree in a 5 minute period.
10. Right after system warm boot.
11. When WJ command is sent.

1791: Wind 425NWS Sensor Is Inoperational is set by follwing condition

1. When WJ command is sent.
2. In 2-minute data if missing wind speed data count is more than 6 with at least 18 readings in.
3. In 2-minute data if missing wind direction data count is more than 6 with at least 18 readings in.
4. Any 1786 DQ error.

1794: Invalid Peak Wind is set by following condition:

1. 2-minute avg wind is less than 5 and Current 3-sec wind speed is greater than (current 5-sec speed * 2.5)

Maintenance flag is generated by following conditions:

1. Sensor data quality error.
2. Sensor response timeout.
3. Sensor status is ‘H’ or ‘F’.
4. Wind 425NWS sensor power command on remained off.
5. If the above error (1-4) is Pass now but previously failed and the error count is not cleared.
6. IFW sensor is configured but report processing is off.
7. Wind 425NWS sensor is inoperational.

For AOMC Trouble Tickets: Priority definitions and triggering conditions are extracted from:
http://www.weather.gov/directives/sym/pd03021011curr.pdf

APPENDIX B - Maximum Outage Times
The ASOS equipment will be restored to full operation within the times shown in the table below, at least 95 percent of the time.

Priority 1: These are safety-related failures. They involve the following sensors and components.

Pressure
Wind speed/direction
Hygrothermometer
Visibility
Ceilometer
Data collection package
Acquisition control unit
Freezing rain occurrence[1]

Priority 2: These are failures affecting flight operations and forecasting. They involve the following sensors and components.

Liquid precipitation accumulation
Snow depth[2]
Other forms of present weather
Operator interface devices (OID)[3]
Video display units
Controller video displays (CVD)[4]

Priority 3: These are low priority failures. They involved the following sensors and components. This priority also applies when all priority 1 and 2 elements are reported correctly, but a maintenance flag is appended to an ASOS product.
Snow depth[2] (when snow cannot occur)
Sunshine switch[2]
Printer

FOOTNOTES:
[1] AOMC treats as priority 1. Station personnel may lower to priority 3 when freezing rain cannot occur.
[2] Sensor not yet fielded.
[3] If no OID is working, the failure is priority 1.
[4] If fewer than half of the available CVDs are working, the failure is priority 1.

The performance during the year 2007 will be used as the reference value for comparison purposes. We are seeking to measure how much performance change there is between 2007 and 2008, and also between 2007 and 2006. A reference Monthly Performance Metric (MPM) will be collected in 2007 for each evaluation site for each full month that an IFWS was installed and operational. These MPMs will be compared to the same MPMs in 2006 and 2008 (e.g., May 2007 vs. May 2006, and May 2007 vs. May 2008). Two MPMs will be collected for each evaluation location. They are:

MPM1: The total number of SYSLOG wind-related diagnostic messages (1786, 1791, and 1794) for the month.
MPM2: The total number of AOMC Priority 1 and Priority 3 wind-related Trouble Tickets for the month.

A relative Performance Index Value (PIV) will be calculated that measures the percent change from the reference 2007 MPM. The PIV comparison to 2008 will measure the percent difference attributable to the short-term candidate solutions under evaluation. The PIV comparison to 2006 will measure the percent difference experienced with the legacy Belfort wind sensor and will establish the performance goal we are striving to achieve. A variety of PIVs can and will be calculated. For example the SYSLOG PIV for a given site for a given month can be expressed as:

PIV1 (2007-2008) = [MPM1 (2007) – MPM1 (2008)] / MPM1 (2007)

Or

PIV1 (2007-2006) = [MPM1 (2007) – MPM1 (2006)] / MPM1 (2007)

The extent to which we achieve the desired performance goal experienced with the Belfort sensor can be expressed as a Relative Improvement Index (RII). For example, the extent to which the above PIV1 (2007-2008) achieves the desired goal is:

RII1 = PIV1 (2007-2008) / PIV1 (2007-2006)

Using the above nomenclature, the following PIVs and RIIs will be calculated and data based for each evaluation site for each evaluation month:

PIV1 (2007-2008)
PIV2 (2007-2008)
PIV1 (2007-2006)
PIV2 (2007-2006)

RII1
RII2

Since each evaluation site is assigned to an evaluation group as defined in Section 2.4, the group average of the above values will also be calculated each month and a weighted cumulative group value also calculated each month (to give more relative weight to those months when more sites are included in the monthly average). Fore example, if the evaluation group had data from the following number of sites in the following months:

MONTH	FEB	MAR	APR
# OF SITES	1	2	4

Then the Cumulative Weighted Average (CWA) of the monthly averages for this group as of April is:

CWA = [(FEB Avg.)(1) + (MAR Avg.)(2) + (APR Avg.)(4)] / 7

The CWA for each group will be the prime statistic reported each month. A time series graphical representation of the CWAs will be depicted each month along with a written analysis, assessment, and recommendation for

follow-on action (as appropriate). The analysis/assessment will include at a minimum, but not necessarily be limited to, consideration of the group trend, individual group site anomalies, and comparisons between groups. Additional data detail may be reported that can shed insight and provide greater understanding. For example, PIV1, RII1 subset data may be provided to contrast SYSLOG 1994 messages vs. 1791 messages, or an intercomparison performed between PIV1 for SYSLOG 1791 messages and PIV2 for Priority 1 Trouble Tickets. Standard statistical packages will be used to augment this analysis and small sample statistical analytical techniques, such as Student's T, will be performed and results included in monthly reports. The SAIC staff at SFSC VA will conduct the evaluation and provide monthly reports.

Monthly reports will be compiled for each calendar month in 2008 beginning with February 2008 and delivered to the IFW Problem Resolution Project Manager, OPS22 by the 15th of the following month. To stimulate innovation, the following interim report format is offered. Feedback is encouraged. The specific report format will be finalized by the Project Manager by February 15, 2008.

DRAFT MONTHLY REPORT FORMAT

Cumulative IPRPP Evaluation Results as of (date, e.g., April 30, 2008)

Evaluation Group	IFW Evaluation Performance Measures					
	PIV1 (2007-2008)	PIV2 (2007-2008)	PIV1 (2007-2006)	PIV2 (2007-2006)	RII1	RII2
1A						
2A						
1B						
2B						
3						

Legend:

Name	Description
Group 1A	"Clean" Sites in 2007 without Bird Deterrent vs. 2008 with V2.79W & Bird Perch
Group 2A	"Clean" Sites in 2007 without Bird Deterrent vs. 2008 with V2.79W & Bird Abatement
Group 1B	"Pre-Deterrent" Sites in 2007 with Bird Perch vs. 2008 with V2.79W and Bird Perch
Group 2B	"Pre-Deterrent" Sites in 2007 with Bird Perch vs. 2008 with V2.79W & Bird Abatement
Group 3	"Clean" Sites in 2007 without Bird Deterrent vs. 2008 with V2.79W & no Bird Deterrent
PIV1 (2007-2008)	SYSLOG Performance Index Value 2007 vs. 2008 Delta Percent Change
PIV2 (2007-2008)	Trouble Ticket Performance Index Value 2007 vs. 2008 Delta Percent Change
PIV1 (2007-2006)	SYSLOG Performance Index Value 2007 vs. 2006 Delta Percent Change
PIV2 (2007-2006)	Trouble Ticket Performance Index Value 2007 vs. 2006 Delta Percent Change
RII1	SYSLOG Relative Improvement Index Percent Change 2006 vs. 2008
RII2	Trouble Ticket Relative Improvement Index Percent Change 2006 vs. 2008

Include additional statistical analysis results and time series charts here. Time series charts should track month-to-month change of the IFW Evaluation Performance Measures described above.

**********D. Mannarano/ OPS22**********

2.5 Collect Baseline V2.79W Data at Evaluation Sites

(Inclusive Dates: Tue 1/1/08 Thu 1/31/08)

Prior to the start of the IPRPP evaluation in February 2008, a stable, verifiable, baseline of operation is necessary to ensure all final preparations are completed at evaluation sites. This baseline verification period is January 2008. An interim check will be conducted in mid January 2008 and a final check conducted in late January by the IPRPP evaluation Project Manager in coordination will all involved parties to ensure all preparations are complete. This check will include, but not be limited to, verification that the software load V2.79W is installed and functioning properly at all evaluation sites, the Bird deterrent devices are also installed and functioning properly, all necessary data collection is in place, all instructions, and documentation are complete and understood by those who will execute the evaluation, and all human and material resources are in place and ready.

******Dave Mannarano, OPS22**********

2.6 Collect Metrics at Evaluation Sites

(Inclusive Dates: Fri 2/1/08 Wed 12/31/08)

The monthly evaluation metrics discussed in Sections 2.3 and 2.4 will be collected from the evaluation sites by the SAIC staff at SFSC VA. SYSLOG data will be downloaded and high resolution 5-second data will be retrieved routinely. These data will be data based for further analysis. Trouble Ticket data will be provided by the AOMC and these data too will be data based for further analysis. All data for a calendar month need to be collected within three working days after the end of the month.

**********SAIC/AOMC**********

2.7 Conduct Evaluation and Provide Monthly Reports

(Inclusive Dates: Mon 3/3/08 Wed 12/31/08)

The SAIC staff at SFSC VA will analyze the data collected each month and conduct the evaluation as described in Section 2.4.

**********SAIC **********

2.8 Develop and Test V2.79E (preliminary SW fix)

(Inclusive Dates: Tue 9/25/07 Fri 2/15/08)

Recently, there have been problems noted at field sites with the IFW sensor. The Version 2.79E load has been developed to help address some of these problems. This load will be suitable for installation at all operational field sites and will support both remote and local sensors. The changes associated with this software include the 14 hour archive for the 5-second wind data which is accessible remotely via the Direct Command Mode (DCM) download. Along with the 5-second wind data, the "WT" diagnostics data will be archived once per minute for 14 hours. The software will include checks for the validity of both 3-second and 5-second wind data, and will only use the data if both are valid. Otherwise, both sets of data will be rejected.

There is one other problem that was found in the software that will also be corrected in V2.79E. While analyzing the IFW problems, it was discovered that the visibility sensor checksum was not being utilized and could be causing wind data to be overwritten in memory whenever the visibility sensor had an invalid checksum. This suspicion was partially confirmed by noting a correlation between wind data corruption in the field being accompanied by the visibility sensor becoming inoperative. The SIO error fix was not included in V2.79E as it is not a problem in V2.79D and the new version does not add the diagnostic messages from V2.79W which causes this problem.

The major risk for V2.79E is the same as V2.79W in that meeting the schedule is very difficult due to the lack of time built into the schedule to resolve critical diagnostic messages. Another aspect that is difficult to manage is the addition of this new software load to the ASOS queue of software loads. There are complaints from the field that there are already too many ASOS software loads. Also, the emergency nature of the resolution of the perceived IFW sensor and software problems has again impacted the schedule for software loads such as V2.85, which has been under development for many years. Implementation of V2.85 has been repeatedly delayed due to the ongoing need for these "emergency" loads. The implementation of V2.79E has also impacted the schedule of the software interface required for the replacement ceilometer due to reassignment of existing resources to handle IFW issues.

*********OPS23, OPS24**********

2.8.1 Deploy/Install V2.79E Nationally at All Designated Sites

(Inclusive Dates: Mon 2/18/08 Fri 5/16/08)

Software load V2.79E will be deployed to virtually all ASOS locations following successful completion of the V2.79E OAT and recommendation from OPS24 that this software load is ready for national deployment. This deployment will be in conformance with an approved ASOS Request for Change (RC) submitted by OPS24.

**********OPS22/OPS24/OPS12/AOMC**********

2.9 Provide Data for Long-Term Sensor FW and DCP/ACU SW Analysis/Fix

(Inclusive Dates: Mon 12/17/07 Tue 12/30/08)

As data are collected and analyzed for the IPRPP evaluation of the candidate short-term bird deterrent solutions, a concurrent data collection, preliminary assessment, compilation, and packaging of specific high resolution 5-

second event duration datasets will be conducted by the SAIC at SFSC to support further in depth evaluation of the event and development of long-term sensor firmware modifications by Vaisala Inc., and DCP/ACU software solutions by Prism Inc.

The Bird perch device's performance will be evaluated at 7 sites. This will include two sites equipped with a data logger/camera system and the V2.79W software load, and five other sites with just the V2.79W software load. Likewise, the Bird Abatement device's performance will be evaluated at 7 other sites. This too will occur at two sites equipped with a data logger/camera system and the V2.79W software load, and five other sites with just the V2.79W software load. See Appendix 4 for a list of these sites.

Process for analysis of IFWS Data via the Data Logger/Camera at four sites

1. When the memory cards (data logger and camera) are received from the field sites, place data on the FTP server, and download data.
2. Save files to computer and list when the camera pictures occurred.
3. Import and parse wind data, diagnostic data and 12hr data using a macro in the spreadsheet.
4. Spreadsheet automatically calculates, using formulas, missing 5-sec and 3-sec wind speed and direction. Also, invalid peak wind speeds are automatically calculated. First for the preliminary (un- updated) way the structured English is written, then the preliminary (un- updated) way plus adding a check to see if the peak wind speed is greater than 5 knots. Finally, a third method of generating the invalid peak wind speeds using the way that Prism has calculated the numbers in the current version of the ASOS software (V2.79D).
5. Checks in the spreadsheet alert the user to areas where the wind speeds are suspicious (changes in previous 3-second and 5-second sample to the next exceeding 5 knots). These times are examined to see if they were related to birds, and if not, if these winds appear to be normal. If not normal and not related to birds, the data is sent to Prism and Vaisala.
6. Examine areas of the spreadsheet where the birds were on the sensor for winds leading up to the bird landing on the sensor, wind speeds when the bird left, and erroneous wind speeds that were generated from the bird being on the sensor.
7. Correlate the times when the birds were on the sensor to that of wind issues.
8. Examine the diagnostic data to determine when and which paths were blocked and also for bad one second readings, or any other diagnostic parameters that are out of specification according to the manual.
9. If there are Invalid Peak (IP) winds in the wind data spreadsheet, create the IP spreadsheet. Open the master spreadsheet. Delete all columns that are populated in sheet 1. Copy column A, C, E, G, M, N, and P from the Peak WS tab in the IFW data spreadsheet to sheet on in the IP wind spreadsheet. Delete rows in the IP spreadsheet, sheet1, that contain NO invalid peak winds (columns in red with the number 1). Copy columns from sheet 1 to sheet 2. Now put 'Y' in the column under large bird or small bird when pictures exist at that time. Column K through P.
10. Examine the SYSLOG data for 1786, 1791 and 1794 diagnostic messages and count and list the times when they occur.
11. Examine the 12-hour archive data for outages and suspicious readings and relay it back to the 5-second data.
12. Write-up a document on the wind speed and direction issues and also a document on the invalid peak winds.

Process for analysis of IFW data via ASOS Software V2.79W

1. Import and parse ASOS V2.79W wind sensor data, diagnostic data and 12hr data using a macro in the spreadsheet.
2. Spreadsheet automatically calculates, using formulas, missing 5-sec and 3-sec wind speed and direction. Also, invalid peak wind speeds are automatically calculated. First for the preliminary (un- updated) way the structured English is written, then the preliminary (un- updated) way plus adding a check to see if the peak wind speed is greater than 5 knots. Finally, a third method of generating the invalid peak wind speeds using the current way that Prism has calculated the numbers in the current version of the ASOS software (V2.79D).
3. Checks in the spreadsheet alert the user to areas where the wind speeds are suspicious (changes in previous 3-second and 5-second sample to the next exceeding 5 knots). These times are examined to see if they were possible external causal factors, and if not, if these winds appear to be normal. If no external causal factor is determined, the data is sent to Prism and Vaisala.
4. Examine areas of the spreadsheet where the anomalous wind speeds occurred and record winds leading up to the event, the erroneous wind speeds that were generated from the event and the winds following the event.
5. Perform analysis of local weather conditions at surrounding locations to determine if there are any weather conditions that could be affecting the wind at the test site.
6. Examine the diagnostic data to determine when and which paths were blocked and also for bad one-second readings, or any other diagnostic parameters that are out of specification according to the manual.
7. If there are Invalid Peak (IP) winds in the wind data spreadsheet, create the IP spreadsheet. Open the master spreadsheet. Delete all columns that are populated in sheet 1. Copy column A, C, E, G, M, N, and P from the Peak WS tab in the IFW data spreadsheet to sheet on in the IP wind spreadsheet. Delete rows in the IP spreadsheet, sheet1, that contain NO invalid peak winds (columns in red with the number 1). Copy columns from sheet 1 to sheet 2. Now put ‘Y’ in the column under large bird or small bird when pictures exist at that time. Column K through P.
8. Examine the SYSLOG data for 1786, 1791 and 1794 diagnostic messages and count and list the times when they occur.
9. Examine the 12-hour archive data for outages and suspicious readings and relay it back to the 5-second data.
10. Write-up a document on the wind speed and direction issues and also a document on the invalid peak winds.

Specific plans for SAIC preliminary assessment, compilation, and packaging of high resolution data sets will be provided in a separate Long-Term Solution Plan, prepared by OPS22. This plan will also consider various solution options and identify the optimal synergistic solution approach to multiple IFW problems, including summer bird problems, severe winter icing event problems, and other problems as they are discovered. This plan will be drafted and circulated for review in February and completed in March 2008. Mike Sturgeon will be the lead author.

*********Mike Sturgeon, OPS22*********

2.9.1 Develop Final FW and SW Fixes

(Inclusive Dates: Mon 12/17/07 Tue 12/30/08)

As the SAIC staff at SFSC collect and filter a myriad of data, incident specific evaluation data sets are created and provided on the fly to the technical experts at Prism Communications Inc., and Vaisala for further analysis and problem solving. It is expected that solutions will emerge in this dynamic process and proposals submitted to the Government for consideration. One long term software fix planned for software version 3.0, build-2 will correct the problem with truncating wind data instead of rounding. This is in response to Operational Trouble Report (OTR) # 1079, IFW Wind Speed Data Not Rounding correctly. Beyond this, it is difficult to estimate the direction, duration, and effectiveness of this creative process too far in advance. More definitive details may be provided in follow-on versions of the Baseline IPRPP as they become available. OPS23 will serve as the COTR for software fixes developed by Prism Communications Inc. and oversee all algorithm development, while OST11 will serve as the COTR for firmware latent defect fixes developed by Vaisala and oversee all firmware development, whereas OPS22 (Mike Sturgeon) will serve as the COTR for firmware enhancements developed by Vaisala and coordinate firmware enhancement development with OST11. All other long-term final fixes will be managed by the IFW PM, Dave Mannarano.

**********SAIC/Vaisala & Prism*********

2.9.2 FAT, ST (for FW & SW fixes)

(Inclusive Dates: Mon 01/05/09 Fri 01/30/09)

Upon development of an effective long term fix, work will begin to test them. Development schedules and coordinated test plans will be needed. The development COTRs will coordinate development plans and activities with OPS24 for follow-on testing.

*********OPS23/OPS24/OST11**********

2.9.3 OAT (for FW & SW fixes)

(Inclusive Dates: Mon 02/02/09 Mon 03/16/09)

OPS24 will manage the planning and execution of the OT&E for all final fixes.

**********OPS24*******

Chapter 3.0 IMPLEMENT LONG-TERM FIXES (for FW & SW)

(Inclusive Dates: Tue 03/17/09 Wed 06/17/09)

OPS22 is ultimately responsible for implementation of all long-term final fixes for the IFW problem. However, depending on the nature of the fix, whether it is primarily or exclusively software, firmware, or hardware, other offices will play a major role in the planning and execution of this implementation. Specific roles and responsibilities will be determined when a clearer picture emerges as the implementation event draws nearer.

3.1 Implement FW Fixes at All Sites

(Inclusive Dates: Tue 03/17/09 Wed 06/17/09)

Implementation may begin upon successful completion of the OT&E conducted by OPS24. OPS22 is ultimately responsible for implementation of all long-term final fixes for the IFW problem and will plan the deployment strategy. A firmware fix will likely require a maintenance technician visit to the site to install the fix. This will require deployment of the material substance of the fix with instructions for installation. OPS12 will ensure the fix material is in stock and ready for deployment, and will also prepare and issue the installation instructions in the form of a Maintenance Modification Note (Mod Note).

********OPS22/OPS12*********

3.2 Implement SW Fixes in Future SW Load at All Sites

(Inclusive Dates: Tue 03/17/09 Wed 06/17/09)

A future SW load will be identified and approved by the ASOS Configuration Control Board (ACCB) for the long-term IFW SW fixes. Implementation may begin upon successful completion of the OT&E conducted by OPS24. OPS22 is ultimately responsible for implementation of all long-term final fixes for the IFW problem and will plan the deployment strategy. A software fix may only require a remote download from the AOMC (provided this capability is developed and implemented), or may require a maintenance technician trip to the site to install the software. If a technician trip is necessary, OPS12 will prepare instructions on proper installation.

**********OPS22/OPS12/OPS12/AOMC********

Chapter 4.0 MONITORING & CONTROL

(Inclusive Dates: Thu 9/20/07 Fri 05/29/09)

4.1 Track Project Progress vs. Earned Value

(Inclusive Dates: Thu 9/20/07 Tue 3/31/09)

Standard Project Management Earned Value techniques will be used to track project status and progress in regard to baseline schedule. This status information will be included in monthly project status reports. Data input and draft reports will be provided by SAIC staff on the 20th of each month. The monthly report will cover all earned value project progress as of the 15th of the current month. OPS22 staff will provide review, comments, and approval for finalization of the earned value report by the end of the month.

The Earned Value Analysis approach will be based on detailed schedules of the work items comprising the evaluation portion of the project. Milestones or predefined components will be established, with an associated level of effort defined for each. These values of effort will be summed to form the planned value cumulative level of effort for the each monthly period in the entire project. Then on a monthly basis, the project team will be credited the predefined value of each milestone or component that has been completed. The 50-50 percent rule will be used to assess completion of monthly evaluation reports by the 15th of each month. The value of the accomplished items will also be accumulated on a monthly basis and plot against the planned values to evaluate the project's progress. A similar tracking of actual versus planned dollars spent will also be maintained.

**********SAIC Staff at SFSC/OPS22**********

4.2 Continuously Evaluate and Adjust Risk Management IAW Risk Management Plan

(Inclusive Dates: Thu 9/20/07 Wed 6/17/09)

Quality is everyone's job. Likewise, risk management is also everyone's job. These concepts go hand-in hand. It is incumbent upon everyone involved in this project to bring real or perceived risks to the attention of the project manager in a timely manner along with risk management suggestions. A risk register will be created, periodically reviewed, and contingency plans will be updated as necessary by the project manager. The SAIC staff at SFSC will assist in monitoring risk events and provide timely notification of adverse variance trends in project performance. This could include unexpected changes in cost, schedule and scope. The Project Manager will use this information to bring the project performance within acceptable limits. This information will be shared with those affected and included in the interim project reports.

**********D. Mannarano/OPS22/Extended Project Team**********

4.3 Prepare and Provide Monthly Short-Term Project Status Reports

(Inclusive Dates: Mon 3/3/08 Mon 12/15/08)

The Project's short term goals include fielding an improved software load V2.79E, deployment of effective bird deterrent devices, and completion of the IFWS installation at the remaining sites. To assure these goals are attained with minimal risk, monthly evaluation status reports will be provided. The reports will be completed by SAIC staff and provided to the project manager by the 15 of each month. Each report will summarize evaluation status through the end of the previous month. The content of these reports is described in Section 2.4. The schedule and responsibility for production of these reports is described below.

**********SAIC Staff at SFSC/OPS22**********

4.3.1 Prepare & Provide 1st Previous Monthly Evaluation Status Report

(Inclusive Dates: Mon 3/3/08 Mon 3/17/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.2 Prepare & Provide 2nd Previous Monthly Evaluation Status Report

(Inclusive Dates: Tue 4/1/08 Tue 4/15/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.3 Prepare & Provide 3rd Previous Monthly Evaluation Status Report

(Inclusive Dates: Thu 5/1/08 Fri 5/16/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related

SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.4 Prepare & Provide 4th Previous Monthly Evaluation Status Report

(Inclusive Dates: Mon 6/2/08 Mon 6/16/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.4.1 Key Decision Point (Deploy Short-Term Bird Deterrent Device(s) and Install IFWS at Remaining Sites)

(Inclusive Dates: Tue 6/17/08 Tue 6/17/08)

It is important that quick decisive action be taken to prevent a recurrence of the problems experienced in summer 2007. The cumulative evaluation results through the end of May 2008 will be used to determine if sufficient improvement is achieved with the short term candidate solutions to warrant national deployment of these solutions and resumption of IFWS installation at the remaining ASOS sites. This decision will be made in mid June after the cumulative May 2008 results are reported. The key decision statistic will be the degree of improvement achieved by the various candidate bird deterrent devices vis-à-vis the performance experienced during a similar period at the same sites in 2006 with the legacy Belfort wind sensor. Several categorical measures of success are employed. They are the number of wind-related SYSLOG messages generated, and the number of Trouble Tickets generated. As an early criterion, the overall categorical performance improvement in 2008 from 2007 should be at least 66% of the improvement seen in 2006 compared to 2007. If a decision is made to deploy a bird deterrent solution, the Project Manager will coordinate the submission and approval of a fast-track RC, and coordinate all activities to deploy and implement the solution in a timely manner. This decision will also trigger the resumption of IFWS installations. The Project Manager will also coordinate expedient installation of the IFWS at the remaining sites without an IFWS. Regardless of the decision, data will continue to be collected, analyzed, and reported monthly. This will help in fine tuning the deployment strategy and provide a comprehensive evaluation.

**********SAIC Staff at SFSC/Project Manager/Senior Management**********

4.3.5 Prepare & Provide 5th Previous Monthly Evaluation Status Report

(Inclusive Dates: Tue 7/1/08 Tue 7/15/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.6 Prepare & Provide 6th Previous Monthly Evaluation Status Report

(Inclusive Dates: Fri 8/1/08 Fri 8/15/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.7 Prepare & Provide 7th Previous Monthly Evaluation Status Report

(Inclusive Dates: Mon 9/1/08 Mon 9/15/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.8 Prepare & Provide 8th Previous Monthly Evaluation Status Report

(Inclusive Dates: Wed 10/1/08 Fri 10/17/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related

SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.9 Prepare & Provide 9th Previous Monthly Evaluation Status Report

(Inclusive Dates: Mon 11/3/08 Mon 11/17/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.3.10 Prepare & Provide 10th Previous Monthly Evaluation Status Report

(Inclusive Dates: Mon 12/1/08 Mon 12/15/08)

Provide project status update report. Include earned value assessment and risk management issues as appropriate. The report will include current status and cumulative summary update on number of IFW-related SYSLOG messages, TTs, unusual events and other findings, actions taken, and recommendations. See Section 2.4 for further details. The report will be prepared during the inclusive dates. Completed report will be provided at end of inclusive date period described above. Data cut-off for inclusion in report: end of calendar month prior to report date.

**********SAIC Staff at SFSC**********

4.4 Prepare and Provide Long-Term Project Status Reports

(Inclusive Dates: Mon 2/2/09 Thu 10/1/09)

Concurrent with the collection and analysis of data for a short term solution, high resolution 5-second data will also be collected by SAIC staff from the evaluation sites and used in conjunction with the short term data to compile data sets of specific problem events that will assist further investigation and development of long-term sensor firmware improvements and ASOS data processing improvements. The collected problem events will not be limited to strictly bird-related events, but will also include other root causes for poor IFW performance. The SAIC staff will perform a preliminary assessment of the compiled data sets to ensure they warrant further investigation. The data sets will be compiled and provided as event opportunities are presented (i.e., provision

of data sets will be event driven). Periodic long-term status reports will be provided by SAIC staff to summarize the results of this activity.

**********SAIC Staff at SFSC**********

4.4.1 Prepare and Provide First Long-Term Status Report

(Inclusive Dates: Mon 2/2/09 Tue 3/31/09)

The SAIC staff at SFSC will summarize nature and extent of the problem (temporal and spatial scope), and the actions taken. The actions taken must identify a responsible Government Contract Officer's Technical representative (COTR) who takes responsibility for coordinating further actions with vendors and contractors to investigate and provide solutions. The COTRs will also provide input to this report as to what actions they have taken, and what results they have achieved, or expect to achieve. The COTR input will identify proposed solutions, and include a projection of costs, benefits, schedule, scope, and risks involved with the various solutions under consideration. The SAIC staff will compile this input into a comprehensive Earned Value report and submit it to the Project Manager for review and comment. The Project manager will coordinate external review and serve as a single point of feedback to SAIC/COTRs for revisions before the report is finalized. Once finalized, the report will be provided to senior management for their consideration. The draft of the report should be compiled during the inclusive period described above, and provided to the Project Manager for review and feedback not less than three weeks before the end of the inclusive date period. The final report is due by the end of the inclusive data period.

********** SAIC Staff at SFSC/COTRs/ Project Manager (Dave Mannarano) **********

4.4.1.1 Key Decision Point (Deploy Long-Term Firmware and/or Software Fixes)

(Inclusive Dates: Wed 4/1/09 Wed 4/1/09)

It is important that decisive action be taken to provide a comprehensive cost/effective solution to the problems experienced in 2007, including summertime bird related problems and wintertime severe icing problems. The cumulative evaluation results through the end of March 2009 will be used to determine if sufficient improvement is achieved with the long term candidate solutions to warrant national deployment of these solutions. This decision will be made in April 2009 after the March 2009 results are reported. The key decision statistic will be the degree of improvement achieved by the various candidate long term solutions vis-à-vis the performance experienced during a similar period at the same sites in 2006 with the legacy Belfort wind sensor. Several categorical measures of success are employed. They are the number of wind-related SYSLOG messages generated, and the number of Trouble Tickets generated. As an early criterion, the overall categorical performance improvement in 2008 from 2007 should be at least 75% of the improvement seen in 2006 compared to 2007. If a decision is made to deploy a long term solution, the Project Manager will coordinate the submission and approval of a fast-track RC, and coordinate all activities to deploy and implement the solution in a timely manner. Regardless of the decision, data will continue to be collected, analyzed, and periodically reported. This will help in fine tuning the deployment strategy and provide a comprehensive evaluation.

**********SAIC Staff at SFSC/Project Manager/Senior Management**********

4.4.2 Prepare and Provide Second Long-Term Status Report

(Inclusive Dates: Fri 5/1/09 Wed 7/1/09)

The SAIC staff at SFSC will summarize nature and extent of the problem (temporal and spatial scope), and the actions taken. The actions taken must identify a responsible Government Contract Officer's Technical representative (COTR) who takes responsibility for coordinating further actions with vendors and contractors to investigate and provide solutions. The COTRs will also provide input to this report as to what actions they have taken, and what results they have achieved, or expect to achieve. The COTR input will identify proposed solutions, and include a projection of costs, benefits, schedule, scope, and risks involved with the various solutions under consideration. The SAIC staff will compile all this input into a comprehensive Earned Value report and submit it to the Project Manager for review and comment. The Project manager will coordinate external review and serve as a single point of feedback to SAIC/COTRs for revisions before the report is finalized. Once finalized, the report will be provided to senior management for their consideration. The draft of the report should be compiled during the inclusive period described above, and provided to the Project Manager for review and feedback not less than three weeks before the end of the inclusive date period. The final report is due by the end of the inclusive data period.

********** SAIC Staff at SFSC/COTRs/ Project Manager (Dave Mannarano) **********

4.4.3 Prepare & Provide Final IFW Project Report

(Inclusive Dates: Mon 8/3/09 Thu 10/1/09)

The SAIC staff at SFSC will summarize nature and extent of the problem (temporal and spatial scope), and the actions taken. The actions taken must identify a responsible Government Contract Officer's Technical representative (COTR) who takes responsibility for coordinating further actions with vendors and contractors to investigate and provide solutions. The COTRs will also provide input to this report as to what actions they have taken, and what results they have achieved, or expect to achieve. The COTR input will identify proposed solutions, and include a projection of costs, benefits, schedule, scope, and risks involved with the various solutions under consideration. The SAIC staff will compile all this input into a comprehensive Earned Value report and submit it to the Project Manager for review and comment. The Project manager will coordinate external review and serve as a single point of feedback to SAIC/COTRs for revisions before the report is finalized. Once finalized, the report will be provided to senior management for their consideration. The draft of the report should be compiled during the inclusive period described above, and provided to the Project Manager for review and feedback not less than three weeks before the end of the inclusive date period. The final report is due by the end of the inclusive data period.

********** SAIC Staff at SFSC/COTRs/ Project Manager (Dave Mannarano) **********

Chapter 5.0 VERIFICATION & CLOSEOUT

(Inclusive Dates: Fri 01/30/09 Thu 06/04/09)

5.1 Provide Final IFW Project Report

(Inclusive Dates: Tue 06/02/09 Tue 06/02/09)

Provide final project status update report. Include final earned value assessment and any remaining risk management issues as appropriate. Include Lessons Learned (see below) as an attachment.

**********OPS22**********

5.2 Lessons Learned Report Prepared & Delivered

(Inclusive Dates: Fri 01/30/09 Thu 4/30/09)

An ongoing list of lessons learned will be compiled by the project manager and included in a lessons learned report filed with the final project report. It will include typical risks and diagnostic messages to avoid, and best practices gleaned that are applicable to this and similar projects. This information will be available for future similar projects.

**********OPS22**********

5.3 Disband Project Team

(Inclusive Dates: Thu 06/04/09 Thu 06/04/09)

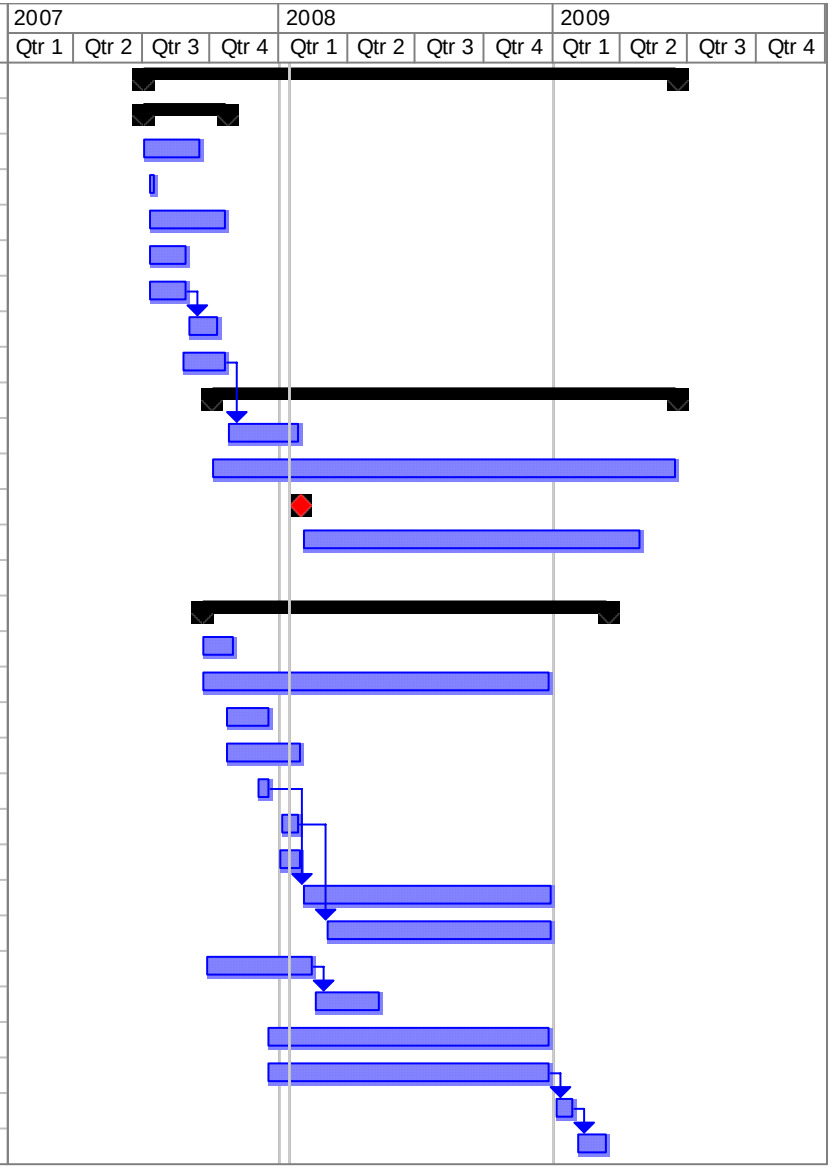
Upon successful conclusion of the project, the project manager will acknowledge and thank team members for their participation and contributions, hold a celebratory meeting, and release team members for other assignments.

**********OPS22**********

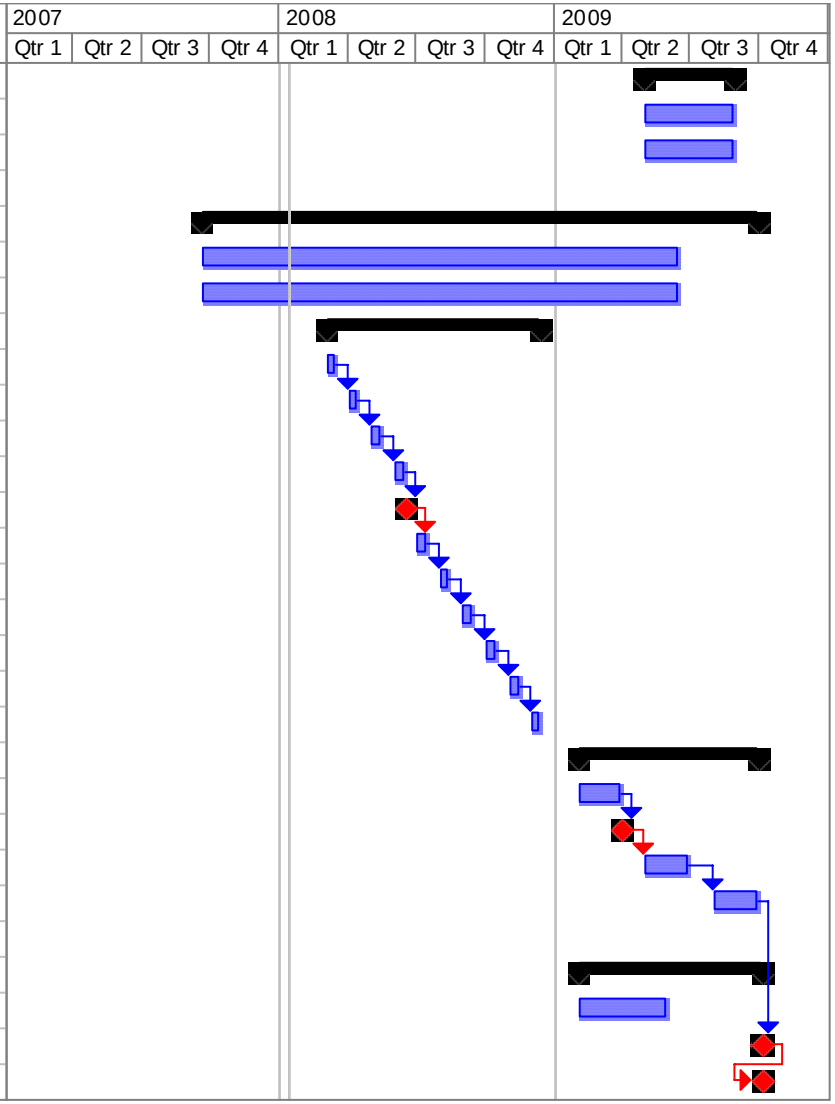
APPENDIX – 1

IFW Problem Resolution Project Schedule

ID	Task Name	Start	Finish
1	**1.0 PROJECTPLANNING**	**Mon 7/2/07**	**Wed 6/17/09**
2	1.1 Preliminary Plan	**Mon 7/2/07**	**Mon 10/22/07**
3	1.1.1 Define Scope, Schedule, and Cost	Mon 7/2/07	Tue 9/18/07
4	1.1.2 Obtain & Organize Resources	Mon 7/9/07	Fri 7/20/07
5	1.1.3 Define Roles and Responsibilities	Mon 7/9/07	Mon 10/22/07
6	1.1.4 Perform Preliminary Analysis of Problem	Mon 7/9/07	Thu 8/30/07
7	1.1.5 Preliminary SAIC report	Mon 7/9/07	Thu 8/30/07
8	1.1.6 Final SAIC report	Fri 8/31/07	Fri 10/12/07
9	1.1.7 Draft Preliminary Project Plan	Thu 8/23/07	Mon 10/22/07
10	1.2 Final Plan Evolution	Thu 10/4/07	Wed 6/17/09
11	1.2.1 Review and revise Draft Project Plan	Tue 10/23/07	Mon 1/28/08
12	1.2.2 Develop & Execute Risk Reduction Plan	Thu 10/4/07	Wed 6/17/09
13	1.2.3 Issue Baseline IFW project Plan	Mon 1/28/08	Mon 1/28/08
14	1.2.4 Continuously Review & Revise IFW Project Plan	Fri 2/1/08	Thu 4/30/09
15			
16	**2.0 EXECUTION**	**Thu 9/20/07**	**Mon 3/16/09**
17	2.1 Install Data Logger/Camera @ 4 Sites	Thu 9/20/07	Fri 11/2/07
18	2.1.1 Collect/Evaluate Data from 4 Sites	Thu 9/20/07	Tue 12/30/08
19	2.2 Develop/Test V2.79W (preliminary SW fix)	Mon 10/22/07	Thu 12/20/07
20	2.2.1 Install V2.79W and BP, BA Devices at Evaluation Sites	Mon 10/22/07	Thu 1/31/08
21	2.3 Define Metrics for: V2.79W; V2.79W & BP; V2.79W & BA	Mon 12/3/07	Fri 12/21/07
22	2.4 Define Evaluation Process	Wed 1/2/08	Mon 1/28/08
23	2.5 Collect V2.79W Baseline Data at Evaluation Sites	Tue 1/1/08	Thu 1/31/08
24	2.6 Collect Metrics at Evaluation Sites	Fri 2/1/08	Wed 12/31/08
25	2.7 Conduct Evaluation & Provide Monthly Statistical Reports	Mon 3/3/08	Wed 12/31/08
26	2.8 Develop/Test V2.79E (preliminary SW fix)	Tue 9/25/07	Fri 2/15/08
27	2.8.1 Install V2.79E Nationally @ All Designated Sites	Mon 2/18/08	Fri 5/16/08
28	2.9 Provide V2.79W Data for L/T Sensor FW & DCP/ACU SW	Mon 12/17/07	Tue 12/30/08
29	2.9.1 Develop Final L/T FW & SW Fixes	Mon 12/17/07	Tue 12/30/08
30	2.9.2 FAT, ST (for L/T FW & SW fixes)	Mon 1/5/09	Fri 1/30/09
31	2.9.3 OAT (for L/T FW & SW fixes)	Mon 2/2/09	Mon 3/16/09



ID	Task Name	Start	Finish
33	**3.0 IMPLEMENT FINAL LONG-TERM FIXES (for FW & SW)**	**Fri 5/1/09**	**Mon 8/31/09**
34	3.1 Implement FW Fixes @ All Sites	Fri 5/1/09	Mon 8/31/09
35	3.2 Implement SW Fixes in V2.85+ @ All Sites	Fri 5/1/09	Mon 8/31/09
36			
37	**4.0 MONITORING & CONTROL**	**Thu 9/20/07**	**Thu 10/1/09**
38	4.1 Track Project Progress vs. Earned Value	Thu 9/20/07	Wed 6/17/09
39	4.2 Continuously Evaluate and Adjust Risk Mgmt. IAW RMP	Thu 9/20/07	Wed 6/17/09
40	**4.3 Prepare and Provide Monthly S/T Proj. Status Reports**	**Mon 3/3/08**	**Mon 12/15/08**
41	4.3.1 Prepare & Provide 1st Previous Monthly Report	Mon 3/3/08	Mon 3/17/08
42	4.3.2 Prepare & Provide 2nd Previous Monthly Report	Tue 4/1/08	Tue 4/15/08
43	4.3.3 Prepare & Provide 3rd Previous Monthly Report	Thu 5/1/08	Fri 5/16/08
44	4.3.4 Prepare & Provide 4th Previous Monthly Report	Mon 6/2/08	Mon 6/16/08
45	4.3.4.1 Key Decision Point (Deploy S/T BP, BA & Instal	Tue 6/17/08	Tue 6/17/08
46	4.3.5 Prepare & Provide 5th Previous Monthly Report	Tue 7/1/08	Tue 7/15/08
47	4.3.6 Prepare & Provide 6th Previous Monthly Report	Fri 8/1/08	Fri 8/15/08
48	4.3.7 Prepare & Provide 7th Previous Monthly Report	Mon 9/1/08	Mon 9/15/08
49	4.3.8 Prepare & Provide 8th Previous Monthly Report	Wed 10/1/08	Fri 10/17/08
50	4.3.9 Prepare & Provide 9th Previous Monthly Report	Mon 11/3/08	Mon 11/17/08
51	4.3.10 Prepare & Provide 10th Previous Monthly Report	Mon 12/1/08	Mon 12/15/08
52	**4.4 Prepare & Provide L/T Project Status Reports**	**Mon 2/2/09**	**Thu 10/1/09**
53	4.4.1 Prepare and Provide 1st L/T Project Status Repor	Mon 2/2/09	Tue 3/31/09
54	4.4.1.1 Key Decision Point (Deploy L/T FW & SW Fixes)	Wed 4/1/09	Wed 4/1/09
55	4.4.2 Prepare & Provide 2nd L/T Project Status Report	Fri 5/1/09	Wed 7/1/09
56	4.4.3 Prepare & Provide Final L/T Project Status Report	Mon 8/3/09	Thu 10/1/09
57			
58	**5.0 VERIFICATION & CLOSEOUT**	**Mon 2/2/09**	**Wed 10/7/09**
59	5.1 Lessons Learned Report Prepared & Delivered	Mon 2/2/09	Mon 6/1/09
60	5.2 Provide Final IFW Project Report	Mon 10/5/09	Mon 10/5/09
61	5.3 Disband Project Team	Wed 10/7/09	Wed 10/7/09



Resource Responsibility Matrix
ASOS IFW Problem Resolution Project

WBS #	**Work Package**	**Start Date**	**End Date**	**Lead Responsibility**	**Support Responsibility**
1.0	**PLANNING**	**Mon 7/2/07**	**Thu 4/30/09**	OPS22	
1.1	Preliminary Plan	Mon 7/2/07	Mon10/22/07	OPS22	
1.1.1	Define Scope, Schedule, and Cost	Mon 7/2/07	Tue 9/18/07	OPS22	
1.1.2	Obtain & Organize Resources	Mon 7/9/07	Fri 7/20/07	OPS22	
1.1.3	Roles and Responsibilities	Mon 7/9/07	Mon 10/22/07	OPS22	
1.1.4	Perform preliminary Analysis of Problem	Mon 7/9/07	Thu 8/30/07	SAIC	
1.1.5	Preliminary SAIC report	Mon 7/9/07	Thu 8/30/07	SAIC	
1.1.6	Final SAIC report	Fri 8/31/07	Fri 10/12/07	SAIC	
1.1.7	Draft Preliminary Project Plan	Thu 8/23/07	Mon 10/22/07	OPS22	
1.2	Final Plan Evolution	Tue 10/23/07	Thu 4/30/09	OPS22	
1.2.1	Review and revise Project Plan	Tue 10/23/07	Thu 12/20/07	OPS22	
1.2.2	Issue Baseline IFW Project plan	Fri 12/21/07	Fri 12/21/07	OPS22	
1.2.3	Develop & execute continuous Risk Reduction Plan	Mon 12/24/07	Thu 4/30/09	OPS22	
1.2.4	Continuously review and revise IFW project plan	Mon 12/24/07	Thu 4/30/09	OPS22	
2.0	**EXECUTION**	**Mon 7/9/07**	**Mon 3/16/09**	OPS22	
2.1	Install data logger/camera @ 4 sites	Thu 9/20/07	Fri 11/2/07	OPS22	SAIC

2.1.1	Collect/evaluate data from 4 sites	Thu 9/20/07	Tue 12/30/08	SAIC	OPS22
2.2	Install bird perch/abatement @ 7 sites for each (total: 14 sites)	Mon 10/22/07	Thu 01/31/08	OPS22	
2.2.1	Collect/evaluate bird perch/abatement data @ 14 sites	Fri 10/19/07	Tue 12/30/08	SAIC	OPS22
2.3	Develop & Test V2.79W	Mon 7/9/07	Fri 11/16/07	OPS23, OPS24	
2.3.1	Install V2.79W @ 20 test sites	Tue 11/27/07	Thu 01/31/08	Local ASOS Technician	NWS Regional Focal Point
2.3.2	Collect/evaluate V2.79W data @ 20 test sites	Tue 11/27/07	Tue 12/30/08	SAIC	
2.4	Develop & Test V2.79E (preliminary SW fix)	Tue 9/25/07	Fri 2/15/08	OPS23, OPS24	
2.4.1	Deploy V2.79E @ all sites	Mon 2/18/08	Fri 5/16/08	OPS22	OPS12, AOMC
2.5	Provide data for Sensor FW & ACU SW analysis/fix	Mon 12/17/07	Tue 12/30/08	SAIC	AOMC
2.5.1	Develop final FW & SW fixes	Mon 12/17/07	Tue 12/30/08	Prism, Vaisala	OPS23, OPS22, OST11
2.5.2	FAT, ST (for FW & SW fixes)	Mon 1/5/09	Fri 1/30/09	OPS23	
2.5.3	OAT (for FW & SW fixes)	Mon 2/2/09	Mon 3/16/09	OPS24	
3.0	**IMPLEMENT FIXES (for FW & SW)**	**Tue 3/17/09**	**Wed 6/17/09**	OPS22	OPS12, OPS23, AOMC
3.1	Implement FW fixes @ all sites	Tue 3/17/09	Wed 6/17/09	OPS22	OPS12
3.2	Implement SW fixes in future SW load @ all sites	Tue 3/17/09	Wed 6/17/09	OPS22	OPS23, AOMC
4.0	**MONITORING & CONTROL**	**Thu 9/20/07**	**Thu 6/29/09**	OPS22	
4.1	Track Project progress vs. Earned Value	Thu 9/20/07	Tue 3/31/09	OPS22	
4.2	Continuously evaluate risk and adjust plan IAW Risk Plan	Thu 9/20/07	Wed 6/17/09	OPS22	All

4.3.1	Prepare & Provide 1st Previous Monthly Evaluation Status Report	Mon 3/3/08	Mon 3/17/08	OPS22	SAIC
4.3.2	Prepare & Provide 2nd Previous Monthly Evaluation Status Report	Tue 4/1/08	Tue 4/15/08	OPS22	SAIC
4.3.3	Prepare & Provide 3rd Previous Monthly Evaluation Status Report	Thu 5/1/08	Fri 5/16/08	OPS22	SAIC
4.3.4	Prepare & Provide 4th Previous Monthly Evaluation Status Report	Mon 6/2/08	Mon 6/16/08	OPS22	SAIC
4.3.4.1	Key Decision Point: Deploy Bird Deterrent Devices?	Tue 6/17/08	Tue 6/17/08	OPS2	OPS22
4.3.5	Prepare & Provide 5th Previous Monthly Evaluation Status Report	Tue 7/1/08	Tue 7/15/08	OPS22	SAIC
4.3.6	Prepare & Provide 6th Previous Monthly Evaluation Status Report	Fri 8/1/08	Fri 8/15/08	OPS22	SAIC
4.3.7	Prepare & Provide 7th Previous Monthly Evaluation Status Report	Mon 9/1/08	Mon 9/15/08	OPS22	SAIC
4.3.8	Prepare & Provide 8th Previous Monthly Evaluation Status Report	Wed 101/08	Fri 10/17/08	OPS22	SAIC
4.3.9	Prepare & Provide 9th Previous Monthly Evaluation Status Report	Mon 11/3/08	Mon 11/17/08	OPS22	SAIC
4.3.10	Prepare & Provide 10th Previous Monthly Evaluation Status Report	Mon 12/1/08	Mon 12/15/08	OPS22	SAIC
4.4.1	Prepare & Provide 1st Long-Term Status Report	Thu 4/30/09	Fri 5/29/09	OPS22	SAIC
4.4.1.1	Key Decision Point: Deploy L/T Fixes?	Wed 4/1/09	Wed 4/1/09	OPS2	OPS22
4.4.2	Prepare & Provide 2nd Long-Term Status Report	Fri 5/1/09	Wed 7/1/09	OPS22	SAIC
4.4.3	Prepare & Provide Final IFW Project Report	Mon 8/3/09	Thu 10/1/09	OPS22	SAIC
5.0	**VERIFICATION & CLOSEOUT**	**Fri 1/30/09**	**Thu 6/4/09**	OPS22	
5.1	Final report delivered	Tue 6/2/09	Tue 6/2/09	OPS22	
5.2	Lessons learned report prepared & delivered	Fri 1/30/09	Thu 4/30/09	OPS22	All
5.3	Disband project team	Thu 6/4/09	Thu 6/4/09	OPS22	All

APPENDIX - 2

Contents of Software Loads
V2.79W & V2.79E

ASOS Software Version 2.79W and Version 2.79E

In 2006, a problem was noted where the peak wind field was being corrupted causing incorrect characters and very large values to appear. The problem was difficult to diagnose, and thus, a new software load was developed to assist in the diagnosis of the problem. The load was developed by Prism Communications, Inc. for installation only at field sites having the problem with remote sensors (local sensors were not intended to be supported by this software load). Several debug capabilities were built into the new load. Extra software flags were added to the DCP application code to determine where memory corruption might be occurring and to check whether incorrect characters are coming directly from the sensor. A new function, DABR, was included to monitor any single variable in the ACU memory to determine if any function is improperly accessing that variable. All accesses to the variable, both proper and improper, will be logged and will include information on which function performs the access. In the V2.79W load, the variable to be monitored will be the peak wind variable. The capabilities described above are for diagnostic purposes at problem sites that have only remote IFW sensors. These changes will not be incorporated into an operational load. Recently, there have been other problems noted in the field with the IFW sensor. The Version 2.79W load has also been modified to help diagnose and possibly reduce the number of problems. The changes described below will also be included in the Version 2.79E software load. These changes include an archive for the 5 second wind data which is accessible via the Direct Command Mode (DCM) download. Along with the 5 second wind data, the WT diagnostics data will be archived once per minute to assist in the diagnosis of potential sensor firmware problems. The new software loads will include checks for the validity of both 3 second and 5 second wind data, and will only use the data if both are valid. Otherwise, both sets of data will be rejected. There are two other problems that were found in the software that will be corrected in both the Version 2.79W and Version 2.79E loads. While analyzing the IFW problems, it was discovered that the visibility sensor checksum was not being utilized and could be causing wind data to be overwritten in memory whenever the visibility sensor had an invalid checksum. This suspicion was partially confirmed by noting a correlation between wind data corruption in the field being accompanied by the visibility sensor becoming inoperative. The other software correction is a fix for the SIO error problem where a great number of SIO errors were being seen in the SYSLOG due to lack of bandwidth. In the Version 2.79W load, this problem was resolved by reducing the size of the diagnostic messages being collected. The SIO error fix was not included in V2.79E as it is not a problem in V2.79D and the new version does not add the diagnostic messages from V2.79W which causes this problem.

APPENDIX - 3

Software Development and Testing Schedule V2.79W and V2.79E

ASOS Software V2.79W

Original Schedule (Optimistic)
FAT – October 19-23, 2007
NWS Baseline Procedures – October 25-31, 2007
ST – November 1-16, 2007
Field Verification – November 27 – December 28, 2007

More Realistic Schedule
FAT – October 19-23, 2007
NWS Baseline Procedures – October 25-31, 2007
ST – November 1-16, 2007
Rework minor critical error found during ST – November 16 – December 14
NWS Baseline Procedures – January 7-11, 2008
2nd ST – January 14-January 25, 2008
Field Verification – January 28- February 8, 2008
Rework minor critical error found at field sites – February 11- March 7, 2008
NWS Baseline Procedures – March 10-14, 2008
Continue Field Verification – March 17-28, 2008

More Pessimistic Schedule
FAT – October 19-23, 2007
Rework minor critical error found during FAT – October 24 - November 30, 2007
NWS Baseline Procedures – December 3-7, 2007
ST – December 10-January 4, 2008
Rework minor critical error found during ST – January 7 – February 8, 2008
NWS Baseline Procedures – February 11-15, 2008
2nd ST – February 18-29, 2008
Field Verification - March 3-14, 2008
Rework minor critical error found at field sites – March 17 – April 11, 2008
NWS Baseline Procedures – April 14-18, 2008
Continue Field Verification - April 21-May 2, 2008

ASOS Software V2.79E

Original Schedule (Optimistic)
FAT – November 13-15, 2007
NWS Baseline Procedures – November 16-28, 2007
ST – November 29-December 14, 2007
OT&E – January 3 – February 15, 2008
Begin Deployment – February 15, 2008

More Realistic Schedule
FAT – November 13-15, 2007
NWS Baseline Procedures – November 16-28, 2007
ST – March 10-21 (*aligned with V2.79W realistic schedule*)
Rework minor critical error found during ST – March 24-April 4, 2008
NWS Baseline Procedures – April 7-11, 2008
2nd ST – April 14-25, 2008
OT&E – April 28- May 31, 2008
Begin Deployment – May 31, 2008

More Pessimistic Schedule
FAT – November 13-15, 2007
Rework minor critical error found during FAT – November 16 – December 7, 2007
NWS Baseline Procedures – December 10-14, 2007
ST – April 14-18 (*aligned with V2.79W pessimistic schedule*)
Rework minor critical error found during ST – April 21-May16, 2008
NWS Baseline Procedures – May 19-23, 2008
2nd ST – May 27-June 6, 2008
OT&E – June 9-July 18
Rework minor critical error found during OT&E – July 21-August 15, 2008
NWS Baseline Procedures – August 18-22, 2008
Continue OT&E – August 25 – September 30, 2008
Begin Deployment – September 30, 2008

Here are OPS24's recommended test schedules:

V2.79W(diagnostic software plus fixes)

FAT - Oct. 19-23
Perform NWS Baseline Procedures - Oct. 15-31
ST - Nov. 1-16.
Field Verification - Nov. 27 - Dec. 28.
NOTE: OPS24 recommends deleting the line "Continue Deployment" from the schedule. ALL sites intended to use V2.79W will get the software as part of the filed verification. Again, we assume V2.79W is not meant to go to other sites. V2.79E will be the operational load based on V2/79D with only the IFW fixes and is meant to replace V2.79D at all other ASOS sites.

_V2.79E (Contains only the V2.79W fixes and meant to replace V2.79D)
_FAT - Nov.13-15, 2007
Perform NWS Baseline Procedures - Nov. 16-28, 2007
ST - Nov. 29 - Dec. 14, 2007.
OT&E - Jan. 3 - Feb. 15, 2008.

ASSUMPTIONS: V2.79W is meant as a diagnostic software load for use by SR&DC test personnel at 8 designated sites. _CLE ASOS will be added at ERH request but without the data logger and recoding camera. It will have the FAA bird abatement device installed along with V2.79W. It will be the responsibility of NWS staff at WFO CLE to report any problems noted while V2.79W is installed at CLE. We believe the "Original Schedules" can be met. There is always the caveat that these assume no critical problems are found during ST or the field tests.

APPENDIX - 4

Ice Free Wind Test Sites

IFWS Test Sites

Station	Location	Region	Codes
SPI	Springfield, IL	CR	1,3,4
SDF	Louisville, KY	CR	2,4
BTR	Baton Rouge, LA	SR	1,3,4
ACY	Atlantic City, NJ	ER	1,4
MYV	Marysville, CA	WR	2,3,4
STS	Santa Rosa, CA	WR	1,4
SNS	Salinas, CA	WR	2,4
FST	Fort Stockton, TX	SR	2,4
MLB	Melbourne, FL	SR	2,3,4
CLE	Cleveland, OH	ER	2,4
DTW	Detroit, MI	CR	2,4
DLS	The Dalles, OR	WR	1,4
PUB	Pueblo, CO	CR	1,4
PEO	Pen Yan, NY	ER	1,4
BLI	Bellingham, WA	WR	4
SET	St. Charles, MO	CR	4
TAN	Taunton, MA	ER	4
RTN	Raton, NM	SR	4
BBW	Broken Bow, NE	CR	4
PHF	Newport News, VA	ER	4

CODES:
1 – NWS Bird Perch;
2-FAA Abatement; 3-Data Logger/Digital-Camera;
4-New ACU Software Load Correcting Software Corruption Problems (2.79W)

APPENDIX - 5

SAIC Final Report
Ice Free Wind Trouble Ticket Analysis

SRDC ASOS DOCUMENT CONTROL SHEET				
TITLE: Final Report for Ice Free Wind Trouble Ticket Analysis				DATE: 8/18/07
ORIGINATOR: Jennifer Dover				
Documents may pass through four stages: Stage 1) if originated by SAIC, a document will go through an internal (contractor) review before delivery to the Test Director for review; Stage 2) if originated by Government personnel, the document will be delivered by the Originator to the Test Director for review; Stage 3) the Test Director will release the document for a five-day "Team" review cycle; Stage 4) comments will be returned through the Test Director for adjudication with the Originator and incorporation of comments where appropriate; document will be forwarded through the Test Director to the ASOS Product Improvement Manager.				
	REVIEWER	**DATE RECEIVED**	**COMMENTS (Y/N)**	**DATE RETURNED**
STAGE 1: SAIC Review if originated by SAIC (Five working days)	Joe Fiore	8/28/07	Y	8/28/07
	Barb Childs	8/28/07	N	--
	Aaron Poyer	8/28/07	N	--
	John Vogel	8/28/07	N	--
STAGE 2: Test Director Review: Michael Sturgeon		8/28/07	DATE RELEASED FOR TEAM REVIEW: 8/28/07	
STAGE 3: "Team" Review (Five working days)	Joe Fiore	--	--	--
	Richard Lewis	8/28/07	N	--
	Mike Sturgeon	8/28/07	Y	8/29/07
	Mike Salyards	8/28/07	Y	8/29/07
STAGE 4: Michael Sturgeon Originator Incorporate Comments		8/29/07	DATE RETURNED TO TEST DIRECTOR: 8/30/07	
COMMENTS:				
FINAL W/OST32 REVIEW & APPROVAL:				**DATE**

SFSC FIELD SUPPORT CENTER

43741 Weather Service Rd SFSC, VA 20166
Tel: 703-661-1211 Fax: 703-471-1374

FINAL REPORT FOR

ICE FREE WIND
TROUBLE TICKET ANALYSIS

Appendix 1 - JULY – AUGUST 2007

Version 6

October 11, 2007

Prepared for

ASOS Product Improvement Program

National Weather Service W/OPS22

by

From Science to Solutions

indicate in any manner, either implied or explicitly, endorsement of the product by the National Oceanic and Atmospheric Administration.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Belfort cup and vane wind system was the initial wind sensor deployed in the Automated Surface Observing System (ASOS). Field experience has demonstrated that rime icing and freezing/frozen precipitation can result in significant degradation in performance, ranging from substantial reductions in reported true wind speed to complete lock-up of the cups and vane. The ASOS Product Improvement Program identified and procured a heated sonic anemometer from Vaisala (425NWS) to replace the ASOS cup and vane system.

In recent months, National Weather Service (NWS) has become aware of increasing SYSLOG diagnostic messages related to the Ice Free Wind (IFW) sensor. The Observing Systems Branch, ASOS Operations and Monitoring Center (AOMC), along with additional NWS offices discussed ways in which to address the mounting IFW issues. It was decided that the AOMC would collect Category 1 IFW Trouble Tickets for a period of one week, from July 2 – 9, 2007, for post-event analysis. During this period, there were 80 trouble tickets generated from 58 ASOS sites around the United States. The SYSLOG data from these 58 sites during that period were evaluated and sorted by ASOS site according to the type of IFW related failure, which included missing wind data, anomalous wind data, data quality diagnostic messages and any other occurrences of failure that were encountered. The results in this report reflect the analysis of those messages.

Seven sites were responsible for 50 percent of the diagnostic messages generated. These sites were:

Site ID	City	State	Site ID	City	State
KMYV	Marysville	CA	KRME	Rome	NY
KOXR	Oxnard	CA	KTAN	Taunton	MA
KMCK	McCook	NE	KGRB	Green Bay	WI
KACY	Atlantic City	NJ			

Of the 58 sites:

Missing Data

- 43 sites - unknown reasons
- 1 site – data corruption from the visibility sensor
- 2 sites – heater voltage failure (possible AC Voltage interrupt and IFW sensor reset)
- 1 site – DCP reset
- 1 site – AC Power interrupt (IFW sensor reset)

- 2 sites – Warm starts
- 1 site – Bad SIO port

Erroneous Gusts

- 2 sites – reasons unknown

Valid Data

- 2 sites

Missing Files

- 3 sites

Invalid peak wind and missing data are the most prevalent problems found. These problems were not evenly distributed among all ASOS locations. Analysis of follow-on data for August 2007 reinforces and amplifies these findings. See appendix D for further information.

Follow-on testing needs to be conducted in the near future and will include installing a data logger and motion activated camera at selected ASOS sites that experience problems. The high resolution data will be captured and post-analyzed along with supplementary data from the camera to find periods of bird interference. The additional data from selected ASOS sites are necessary to determine the impact of the birds on the wind data. In addition to gathering more data, the NWS is also currently investigating bird deterrent devices. A bird perch has been developed and is currently on select ASOS IFW sensors. The standard perch has not been totally effective at all ASOS sites. Therefore a new bird perch design has been developed and is currently being tested at SFSC, Virginia. The prototype bird perch has a horizontal hoop that is positioned at the end of it. It is theorized that birds will gather on the hoop above the sensor instead of on the sensor transducers themselves.

A project team needs to be formed to coordinate future activities to collect and evaluate high resolution data from selected sites and determine appropriate solutions.

1.0 BACKGROUND

The Belfort cup and vane wind system was the initial wind sensor deployed in the Automated Surface Observing System (ASOS). The sensor design consists of a vane and rotating cup anemometer. Previous testing has shown that during rime icing and freezing/frozen precipitation events, the sensor is susceptible to significant degradation in performance, ranging from substantial reductions in reported true wind speed to complete lock-up of the cups and vane.

Several test programs were conducted during the late 1990's to identify candidates for replacement of the current ASOS cup and vane wind system. At the conclusion of testing, an Ice Free Wind sensor manufactured by Vaisala (425NWS IFW) was selected as the replacement for the current system. Currently, there are 768 Ice Free wind sensors installed out of a total 999 sites. These sites include 310 National Weather Service (NWS), 571 Federal Aviation Administration, 71 Navy, and 47 Air Force sites.

In recent months, NWS has become aware of increasing SYSLOG diagnostic messages related to the Ice Free Wind (IFW) sensor. The problems include missing wind data and anomalous peak wind values. The Observing Systems Branch, ASOS Operations and Monitoring Center (AOMC), along with additional NWS offices discussed ways in which to address in mounting IFW issues. It was decided that the AOMC would collect Category 1 IFW Trouble Tickets for a period of one week, from July 2 – 9, 2007, for post-event analysis. The SYSLOG data from these 58 sites during that period were evaluated and sorted by ASOS site according to the type of IFW related failure, which included missing wind data, anomalous wind data, data quality diagnostic messages and any other occurrences of failure that were encountered. The results in this report reflect the analysis of those SYSLOG diagnostic messages.

2.0 PURPOSE

The purpose of this test is to analyze and categorize ice-free wind diagnostic messages from 58 ASOS sites and determine, if possible, the cause of the various diagnostic messages.

3.0 TEST APPROACH

The trouble tickets prepared by the AOMC were submitted for post-event analysis. The data was sorted by ASOS site according to the type of failure, which included missing wind data, anomalous wind data, data quality diagnostic messages, and any other occurrences of failure that were encountered.

3.1 Data Collection

The AOMC distributed the trouble tickets along with all sensor data and SYSLOG data for analysis. In the instances where the SYSLOG data were missing, a terminal program was used to directly dial into the ASOS to capture the missing data.

3.2 Test Location

The sites were determined by whether or not they had IFW sensor data diagnostic messages that generated a trouble ticket. A list of the sites that incurred problems is located in Appendix A.

3.3 Sensor Description

3.3.1 Vaisala 425NWS IFW Sensor

The IFW sensor has an array of three equally spaced sonic transducers in a horizontal plane. The sensor measures transit time, the time it takes the sound wave to travel from one transducer to another. The transit time is measured in both directions. Transit time depends on the wind velocity along the sonic path. For zero wind velocity, both the forward and reverse transit time are the same. If wind along the sound path occurs, the up-wind transit time increases and the down-wind transit time decreases. The micro controller's microprocessor computes the wind velocity in a direction parallel to each possible transducer pair from the transit times using a mathematical formula. The computed wind speeds are independent of altitude, temperature, and humidity. If a bad wind velocity reading is reported between two of the transducers, that reading will be eliminated and the wind speed and wind direction will be calculated from the best two vectors.

Figure 1 IFW Sensor

3.4 Trouble Tickets

There were 80 trouble tickets generated for the week of July 2 - 9, 2007 from a total of 58 ASOS sites around the United States. A list of these sites is located in Appendix A. The trouble tickets list the site, location, number, priority, status, dates of when the ticket was opened and closed, and the initial problem. An example of a trouble ticket is located in Appendix B.

3.5 Error Descriptions

There were three distinct error codes that were logged in the SYSLOG messages relating to the IFW sensor:

> **1791 – `INOPERATIONAL DQ ERROR 0200`** – This error is logged whenever there are less than 75% (18 samples) of the samples necessary to produce a 2-minute average wind report.

1786 – DATA QUALITY CHECK ERROR – This error is logged whenever the sensor does not meet Data Quality requirements. If this error occurs, it is followed by a reason code. In this case, the reason code is the 1791 error.

1794 – INVALID PEAK WIND – This error has been initially linked to the interaction of birds interfering in the transducer paths. If the average wind speed is less than or equal to 5 knots, and the peak wind speed is greater than 2 ½ times the average wind speed, then an invalid peak wind message is generated. The cause of this error will be verified through follow-on testing that will include connecting a data logger at the DCP and a camera. The use of a modified bird perch that is mounted above the sensor is currently being evaluated on KST1 ASOS at SFSC, Virginia. It is thought that the bird perch will encourage the birds to perch on it as opposed to perching on the transducers themselves. See Appendix C for a description of the standard and modified bird perch.

4.0 RESULTS

The trouble tickets were evaluated by site. The 12-hour archive data from each site were examined, including the IFW data and the SYSLOG data. The diagnostic messages listed in each SYSLOG were then summed for each site and categorized.

4.1 Number of Occurrences and Percent of diagnostic messages

The following graphs show the IFW sensor diagnostic messages by site.

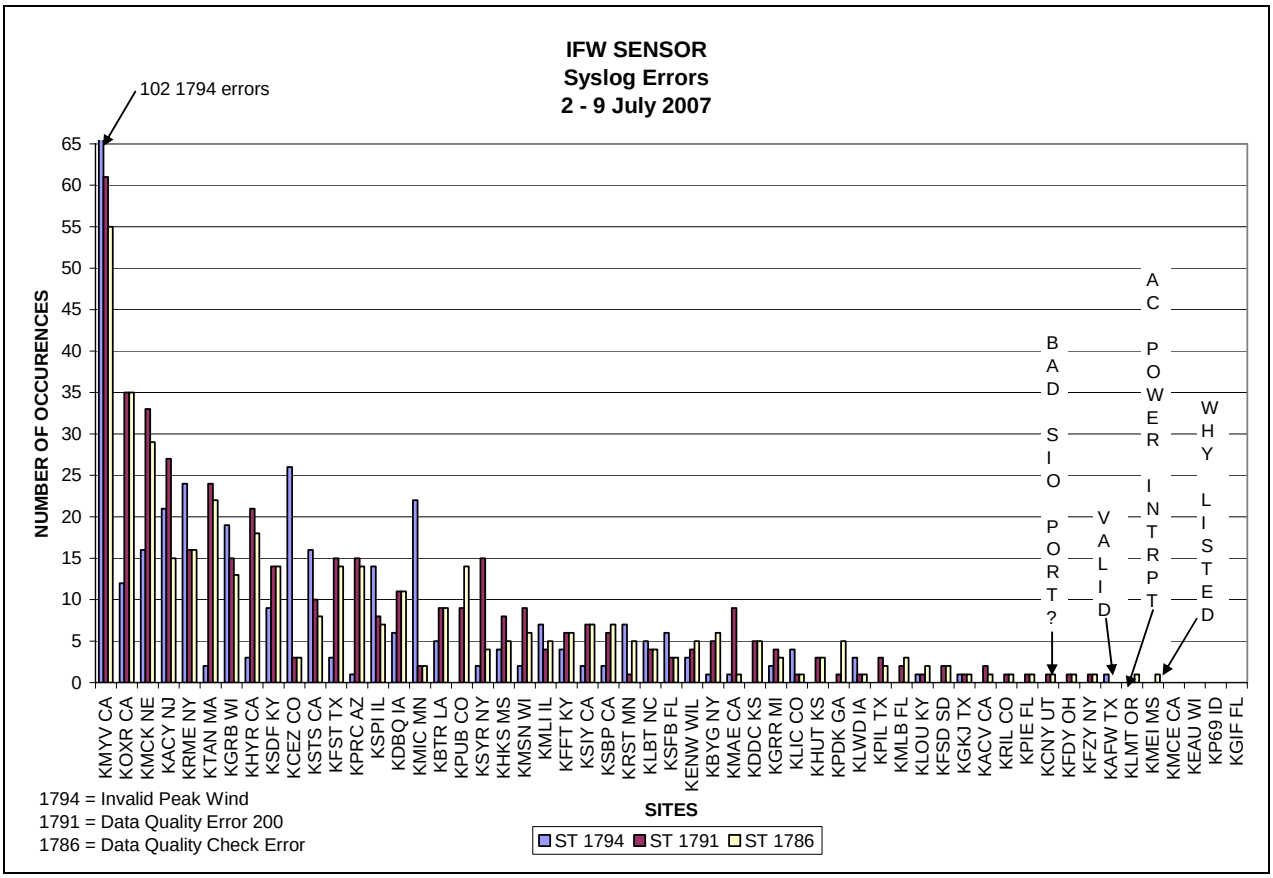


Figure 2 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site. The sites that had the highest number of sensors diagnostic messages are listed at the left and the sites with the lowest number of diagnostic messages are listed on the right.

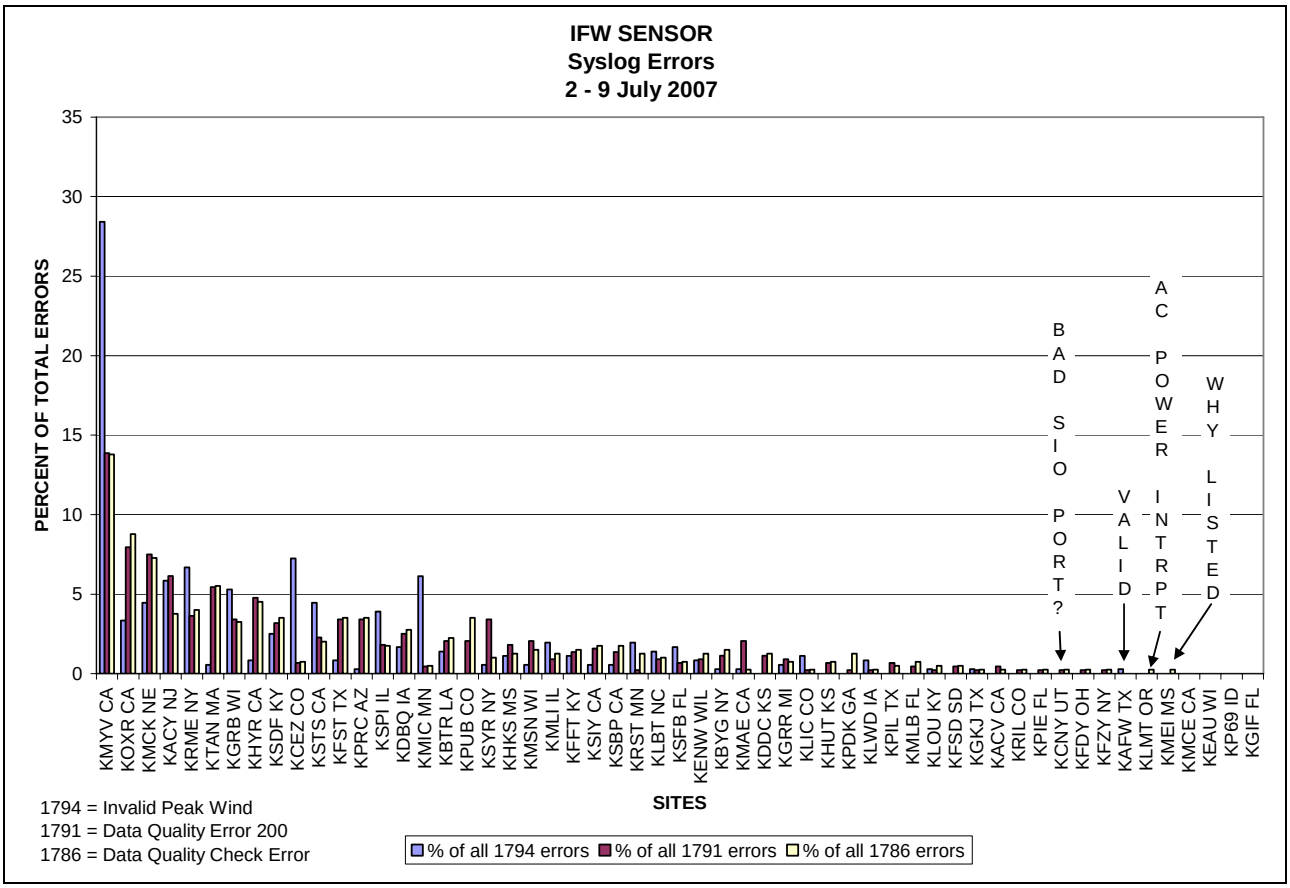


Figure 3 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed. The sites that had the highest percentage of sensor diagnostic messages are listed at the left and the sites with the lowest percentage of diagnostic messages are listed on the right.

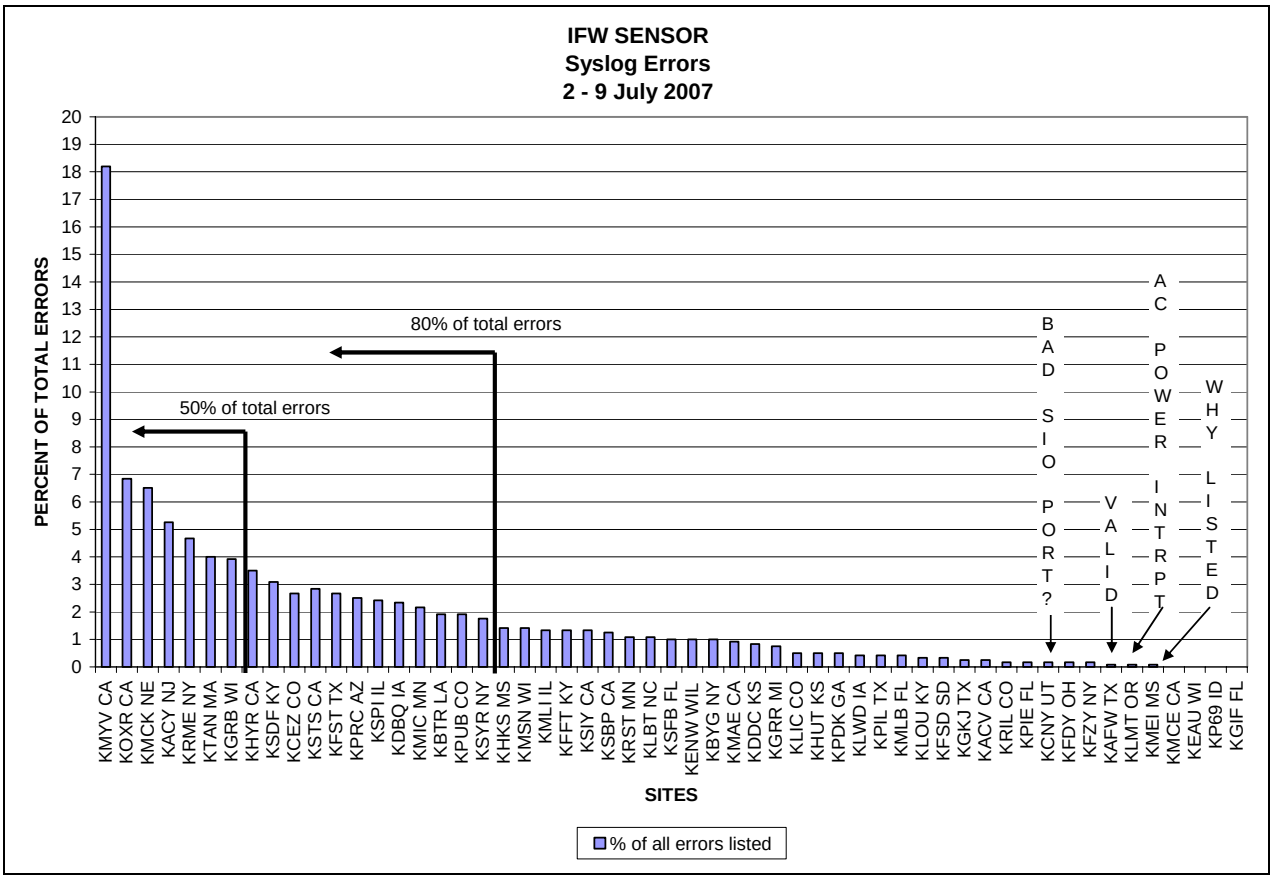


Figure 4 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed. The sites that had the highest percentage of sensor diagnostic messages are listed at the left and the sites with the lowest percentage of diagnostic messages are listed on the right. The sites to the left of the 50% line depict the sites that comprise 50% of the total diagnostic messages at all sites listed. The sites to the left of the 80% line depict the sites that comprise 80% of the total diagnostic messages at all sites listed.

4.2 ASOS Site diagnostic messages

4.2.1 Missing Data – Reasons Unknown

The sites listed below experienced several minutes of missing data.

Site ID	City	State	Site ID	City	State
KPRC	Prescott	AZ	KSDF	Louisville	KY
KSTS	Santa Rosa	CA	KFFT	Frankfort	KY
KMYV	Marysville	CA	KLOU	Louisville	KY
KOXR	Oxnard	CA	KBTR	Baton Rouge	LA
KMAE	Madera	CA	KTAN	Taunton	MA
KMCE	Merced	CA	KGRR	Grand Rapids	MI
KSBP	San Luis Obispo	CA	KRST	Rochester	MN
KACV	Arcata	CA	KHKS	Jackson	MS
KSIY	Montague	CA	KLBT	Lumberton	NC
KRIL	Rifle	CO	KMCK	McCook	NE
KPUB	Pueblo	CO	KACY	Atlantic City	NJ
KLIC	Limon	CO	KTCC	Tucumcari	NM
KPIE	St Petersburg	FL	KSYR	Syracuse	NY
KMLB	Melbourne	FL	KBYG	Buffalo	NY
KSFB	Sanford	FL	KFZY	Fulton	NY
KPDK	Atlanta	GA	KRME	Rome	NY
KDBQ	Dubuque	IA	KFDY	Findlay	OH
KLWD	Lamoni	IA	KFSD	Sioux Falls	SD
KSPI	Springfield	IL	KPIL	Pt Isabel	TX
KMLI	Moline	IL	KMSN	Madison	WI
KDDC	Dodge City	KS	KGRB	Green Bay	WI
KHUT	Hutchinson	KS			

The reasons for missing data at these sites are unknown. There was no pattern in the data found. Possible links included low or high visibility or wind speed, and fixed or variable wind direction before the missing occurred.

4.2.2 Missing Data – WJ Command Issued

Site ID	City	State
KHYR	Hayward	CA

This site experienced missing data. The reasons were unknown, but there were several WJ commands issued. According to Prism, the WJ command issued is transmitted whenever invalid wind averaging times are identified in a data message. This particular problem has been linked to an ASOS software problem related to data corruption by the visibility sensor checksum.

4.2.3 Missing Data – Heater Voltage Failure

Site ID	City	State
KCEZ	Cortez	CO
KEAU	Eau Claire	WI

These sites experienced missing data. The reasons were linked to an AC voltage interrupt that caused the IFW sensor to reset.

4.2.4 Missing Data – DCP Reset

Site ID	City	State
KENW	Kenosha	WI

This site experienced missing data due to a DCP reset that occurred immediately before the data went missing.

4.2.5 Missing Data – AC Power Interrupt

Site ID	City	State
KLMT	Klamath Falls	OR

This site experienced missing data due to an AC power interruption that occurred immediately before the data went missing.

4.2.6 Missing Data – Warm Start

Site ID	City	State
KP69	Lowell	ID
KGKJ	Arlington	TX

These sites experienced missing data due to an ASOS warm start cycle that occurred immediately before the data went missing.

4.2.7 Missing Data – Bad SIO Port

Site ID	City	State
KCNY	Moab	UT

This site experienced missing data for a 12-hour period. This issue was tracked to a bad port. The electronic technician replaced the IFW sensor and possibly the serial I/O card.

4.2.8 Erroneous Gusts

Site ID	City	State
KMIC	Minneapolis	MN
KAFW	Ft Worth	TX

Erroneous gusts occurred at these ASOS sites. There were thunderstorms in the area at the time of the gusts at one of the sites, but it is not believed that the thunderstorms influenced these anomalous gusts.

4.3 Valid Data

Site ID	City	State
KGIF	Winter Haven	FL
KMEI	Meridian	MS

The data from these sites were believed to be valid after further analysis.

4.4 Missing Files

Site ID	City	State
KSJN	St. Johns	AZ
KCEC	Crescent City	CA
KFST	Ft Stockton	TX

No supporting data was provided for these sites. Consequently, no analysis could be performed.

5.0 CONCLUSIONS

There were 80 trouble tickets generated for the week of July 2 - 9, 2007 from a total of 58 ASOS sites around the United States. The trouble tickets prepared by the AOMC were submitted for post-event analysis. The SYSLOG data from these 58 sites during that period were evaluated and sorted by ASOS site according to the type of IFW related failure, which included missing wind data, anomalous wind data, data quality diagnostic messages and any other occurrences of failure that were encountered.

Seven sites were responsible for 50 percent of the diagnostic messages generated. These sites were:

Site ID	City	State
KMYV	Marysville	CA
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KRME	Rome	NY
KTAN	Taunton	MA
KGRB	Green Bay	WI

Of the 58 sites:

Missing Data

- 43 sites - unknown reasons
- 1 site – data corruption from the visibility sensor
- 2 sites – heater voltage failure (possible AC Voltage interrupt and IFW sensor reset)
- 1 site – DCP reset
- 1 site – AC Power interrupt (IFW sensor reset)
- 2 sites – Warm starts
- 1 site – Bad SIO port

Odd Gusts

- 2 sites – reasons unknown

Valid Data

- 2 sites

Missing Files

- 3 sites

6.0 RECOMMENDATIONS

Invalid peak wind and missing data are the most prevalent problems found. These problems were not evenly distributed among all ASOS locations. Analysis of follow-on data for August 2007 reinforces and amplifies these findings. See appendix D for further information.

Follow-on testing needs to be conducted in the near future and will include installing a data logger and motion activated camera at selected ASOS sites that experience problems. The high resolution data will be captured and post-analyzed along with supplementary data from the camera to find periods of bird interference. The additional data from selected ASOS sites are necessary to determine the impact of the birds on the wind data. In addition to gathering more data, the NWS is also currently investigating bird deterrent devices. A bird perch has been developed and is currently on select ASOS IFW sensors. The standard perch has not been totally effective at all ASOS sites. Therefore a new bird perch design has been developed and is currently being tested at SFSC, Virginia. The prototype bird perch has a horizontal hoop that is positioned at the end of it. It is theorized that birds will gather on the hoop above the sensor instead of on the sensor transducers themselves.

A project team needs to be formed to coordinate future activities to collect and evaluate high resolution data from selected sites and determine appropriate solutions.

APPENDIX A: ASOS Sites with IFW generated trouble tickets

Trouble Ticket #	Site ID	City	State	Trouble Ticket #	Site ID	City	State
10,15,40,65,74	KMYV	Marysville	CA	34	KGRR	Grand Rapids	MI
41,54	KOXR	Oxnard	CA	20	KLIC	Limon	CO
46,63,80	KMCK	McCook	NE	5	KHUT	Hutchinson	KS
68	KACY	Atlantic City	NJ	43	KPDK	Atlanta	GA
22	KRME	Rome	NY	36	KLWD	Lamoni	IA
9,67,73	KTAN	Taunton	MA	28	KPIL	Pt Isabel	TX
18,29,52	KGRB	Green Bay	WI	48	KMLB	Melbourne	FL
62	KSDF	Louisville	KY	31	KLOU	Louisville	KY
56,79	KSTS	Santa Rosa	CA	7	KFSD	Sioux Falls	SD
53	KFST	Ft Stockton	TX	2	KGKJ	Arlington	TX
69	KPRC	Prescott	AZ	16	KACV	Arcata	CA
32,77	KSPI	Springfield	IL	78	KRIL	Rifle	CO
25,45	KDBQ	Dubuque	IA	49	KPIE	St Petersburg	FL
64,76	KMIC	Minneapolis	MN	55	KCNY	Moab	UT
51	KBTR	Baton Rouge	LA	38	KFDY	Findlay	OH
66	KPUB	Pueblo	CO	33	KFZY	Fulton	NY
59	KSYR	Syracuse	NY	14	KAFW	Ft Worth	TX
71	KHKS	Jackson	MS	50	KLMT	Klamath Falls	OR
27	KMSN	Madison	WI	70	KMEI	Meridian	MS
4,23,75	KMLI	Moline	IL	39	KCEZ	Cortez	CO
30,57	KFFT	Frankfort	KY	26	KMCE	Merced	CA
19,37,47	KSBP	San Luis Obispo	CA	13	KEAU	Eau Claire	WI
60	KRST	Rochester	MN	12	KP69	Lowell	ID
44,61	KLBT	Lumberton	NC	11	KHYR	Hayward	CA
1,17	KSFB	Sanford	FL	8	KSIY	Montague	CA
24	KENW	Kenosha	WI	3	KGIF	Winter Haven	FL
58	KBYG	Buffalo	NY	42	KSJN	St. Johns	AZ
21	KMAE	Madera	CA	72	KCEC	Crescent City	CA
6	KDDC	Dodge City	KS	35	KTCC	Tucumcari	NM

APPENDIX B: Trouble Ticket

Site Identifier: KBYG
Location: Buffalo, WY
TT Number: 070707-068
Priority: 1
Status: Closed
Opened: 07/07/2007 08:05 GMT
Closed: 07/07/2007 17:54 GMT
Initial Trouble Ticket Problem
OB: KBYG 070753Z AUTO 10SM CLR 24/04 A2999 RMK AO2 SLP074 T02390044 $
Description/Information (Required): Opened TR. AOMC remotely dialed into the site and found 1 Fail count on OID #5, along with 24 path errors and 2 Data Quality diagnostic messages on the Ice Free Wind sensor. POC (AM) notified.
Problem Category: ACU System, IFW (Ice Free Wind)
Priority: 1

APPENDIX C: Bird Perch

Figure 5 below is a photograph of a bird perching on the IFW transducer.

Figure 5 Bird perching on IFW transducer

Figure 6 below is a photograph of a standard ASOS bird perch that was developed to deter birds from perching on the transducers. The standard perch was installed at selected ASOS sites, and has been effective at many locations, but not at all locations.

Figure 6 ASOS Bird Perch

Figure 7 below is a photograph of a prototype bird perch with the hoop design. This design was developed to discourage perching on the IFW sensor. The hoop sits approximately one foot above the sensor. It is theorized that birds will gather on the hoop above the sensor instead of on the sensor transducers themselves.

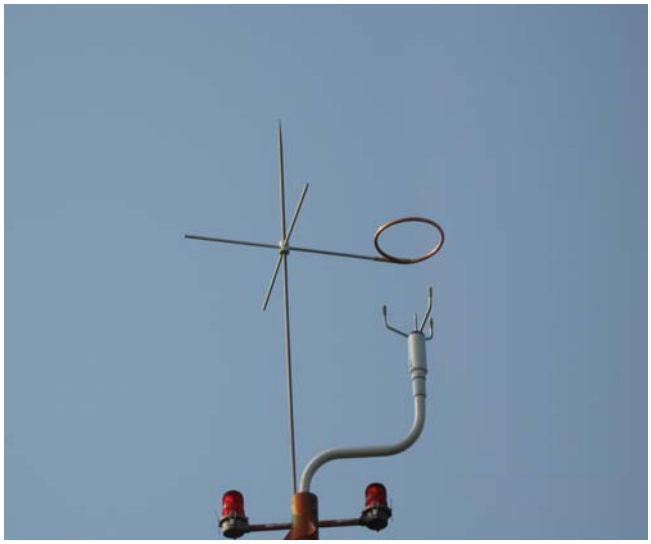

Figure 7 Prototype IFW Bird Perch

Figure 8 below shows the prototype bird perch installed on 8/16/07 on ST1, which is one of two ASOS test systems at SFSC, Virginia. This photograph was taken at 0635 on 8/27/07. ST0 does not have a bird perch installed.

Figure 8 Prototype IFW Bird Perch with four Starlings

Since installation of the prototype bird perch and camera, ST1 has not reported any type 1794 diagnostic messages (invalid peak wind), while system ST0 has reported a total of 24 type 1794 diagnostic messages. The systems are 100 feet apart and neither system has reported any missing or anomalous wind data.

APPENDIX D: Analysis August 2007

AUGUST 1 – 31, 2007

Figures 9 – 11 show the results from the month of August of the 19 sites that account for 80% of all the IFW diagnostic messages at those 58 sites. The order of the sites was kept the same as for the graphs from the week of July 2 – 9. This was done for ease of comparability.

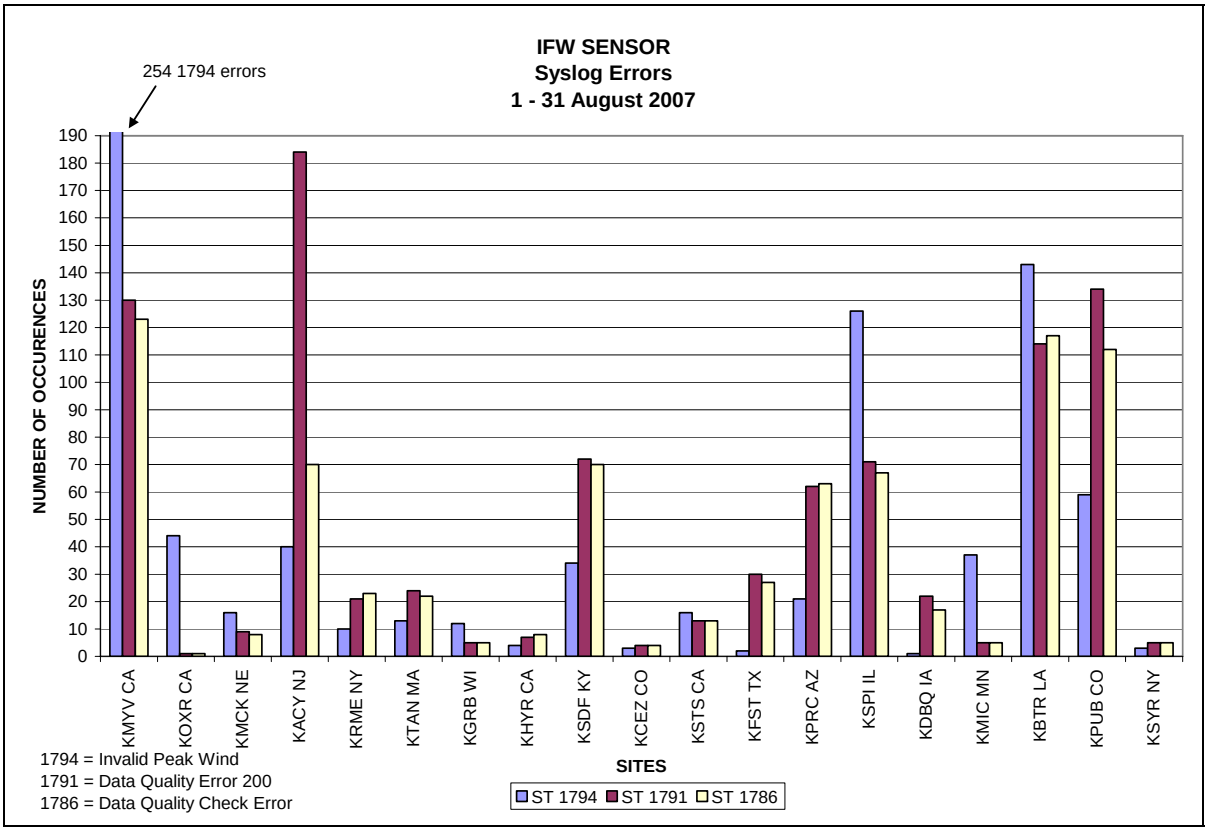

Figure 9 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site.

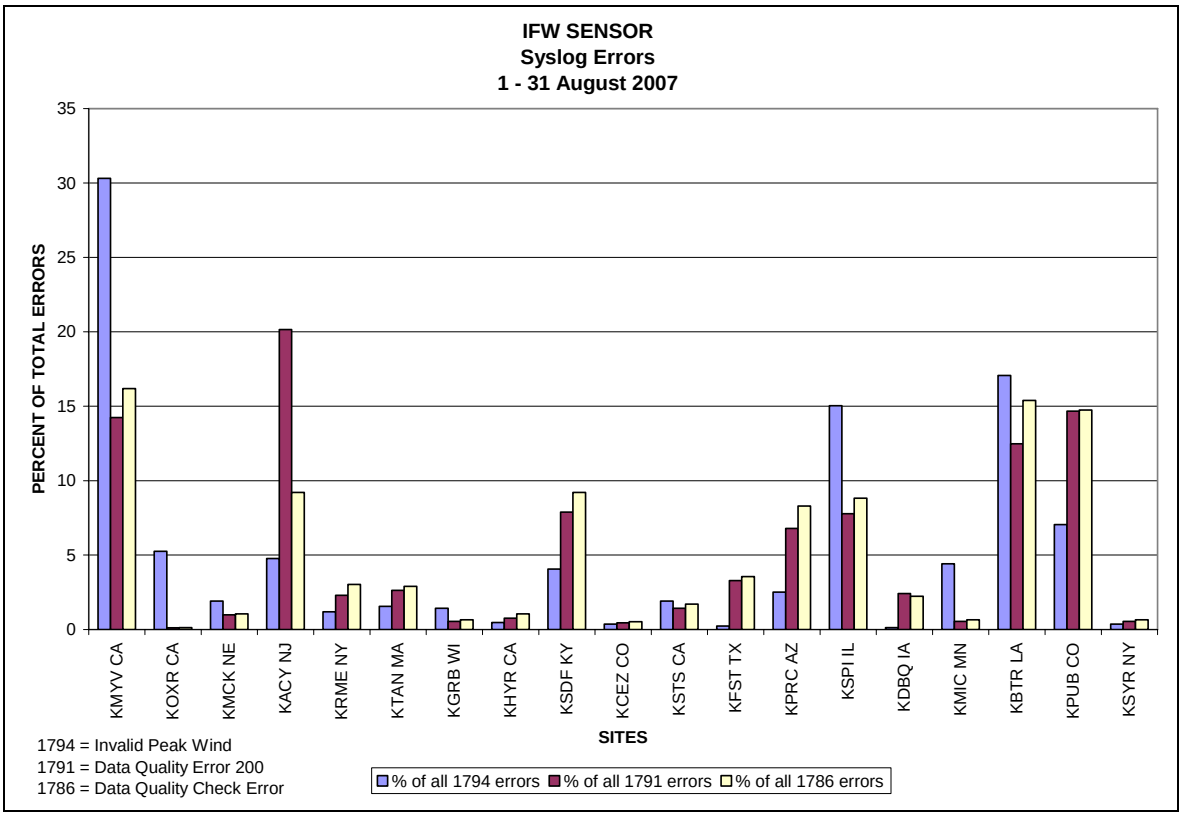

Figure 10 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed.

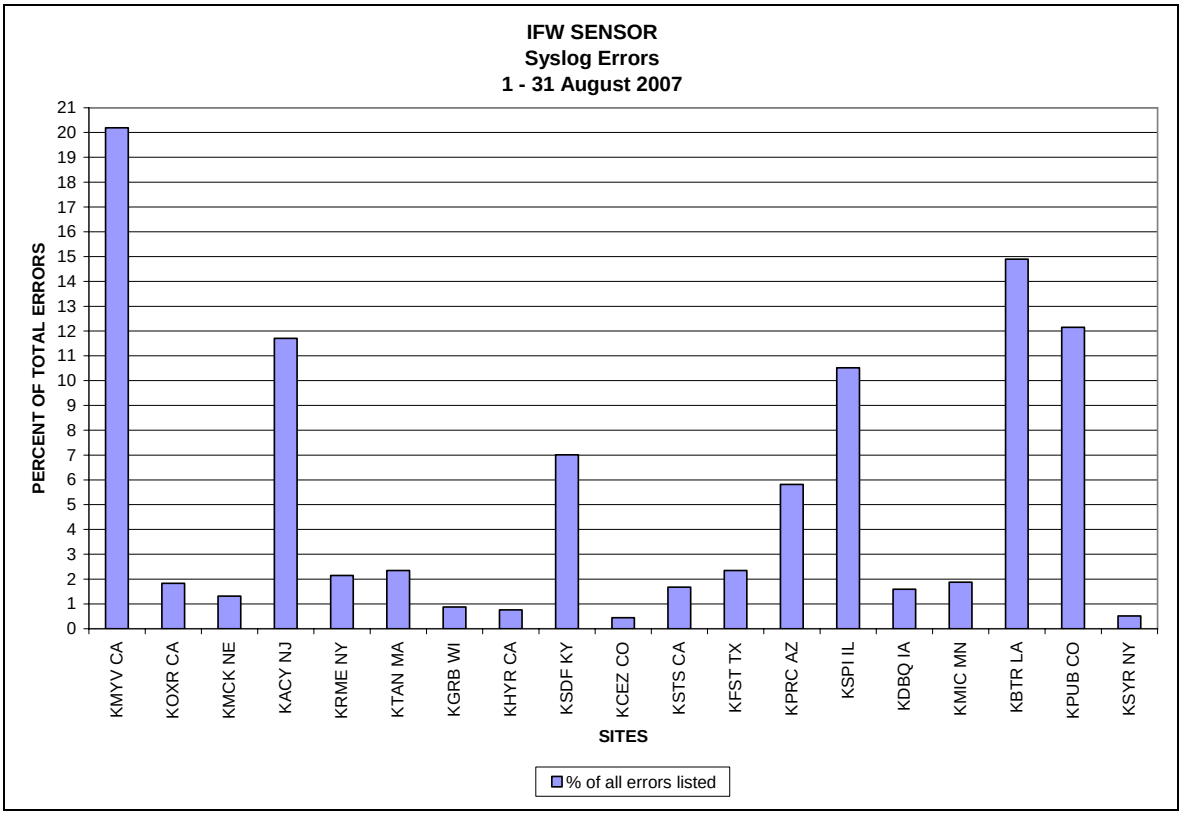

Figure 11 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed.

AUGUST 1 – 8, 2007

Figures 12 – 14 show the results from the first week of August of the 19 sites that account for 80% of all the IFW diagnostic messages at those 58 sites.

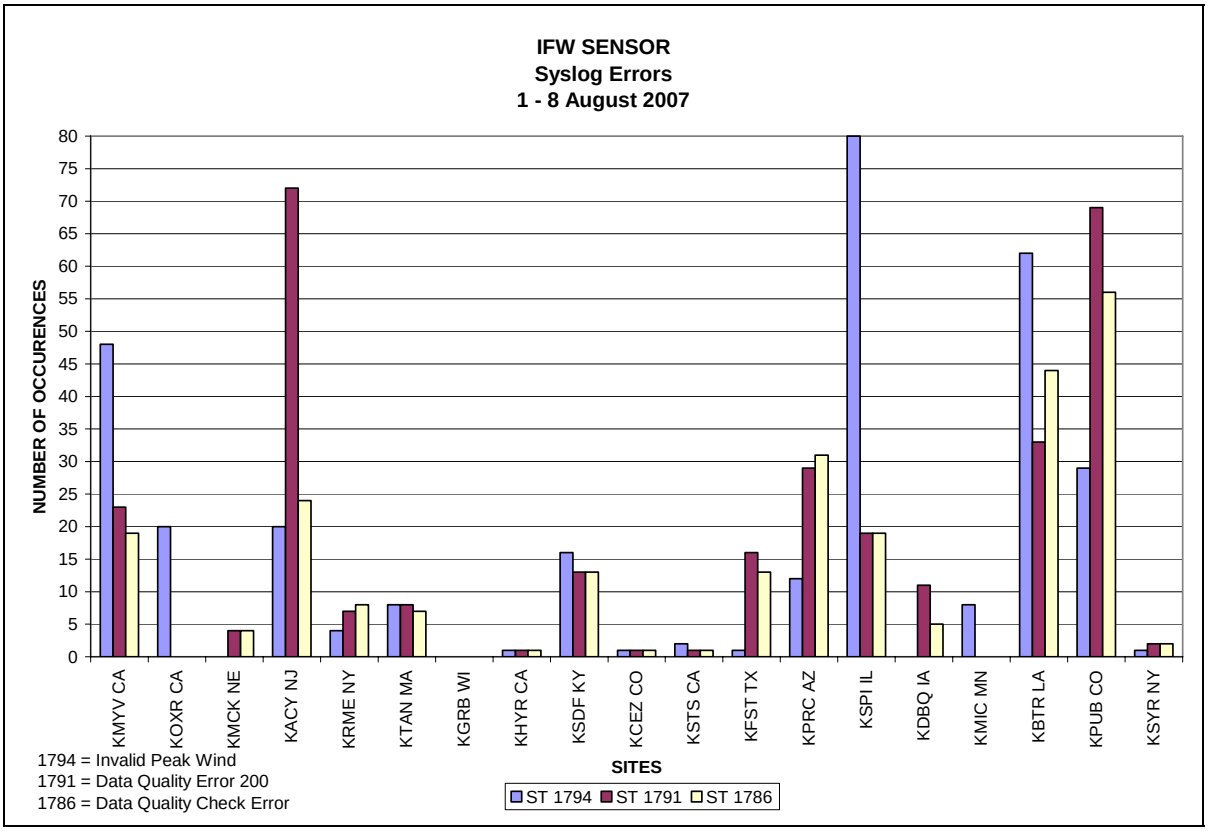

Figure 12 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site.

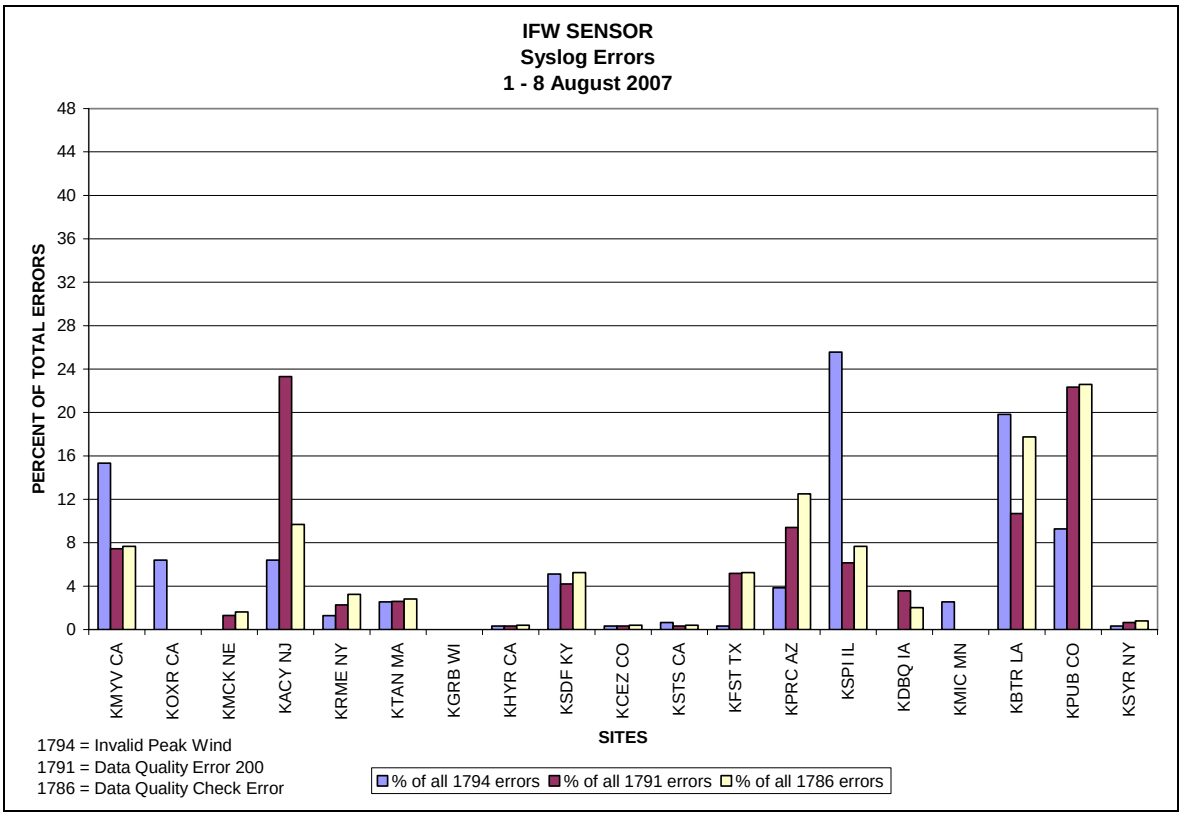

Figure 13 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed.

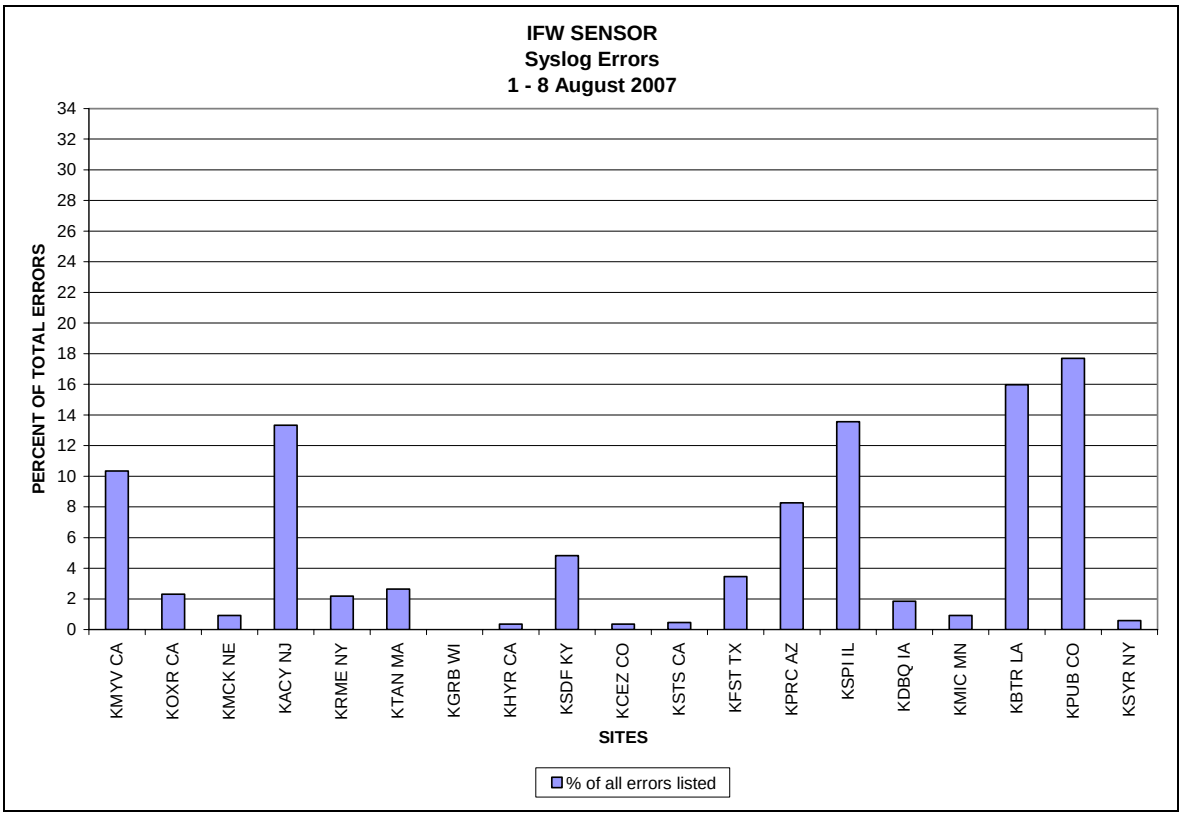

Figure 14 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed.

AUGUST 9 – 16, 2007

Figures 15 – 17 show the results from the second week of August of the 19 sites that account for 80% of all the IFW diagnostic messages at those 58 sites.

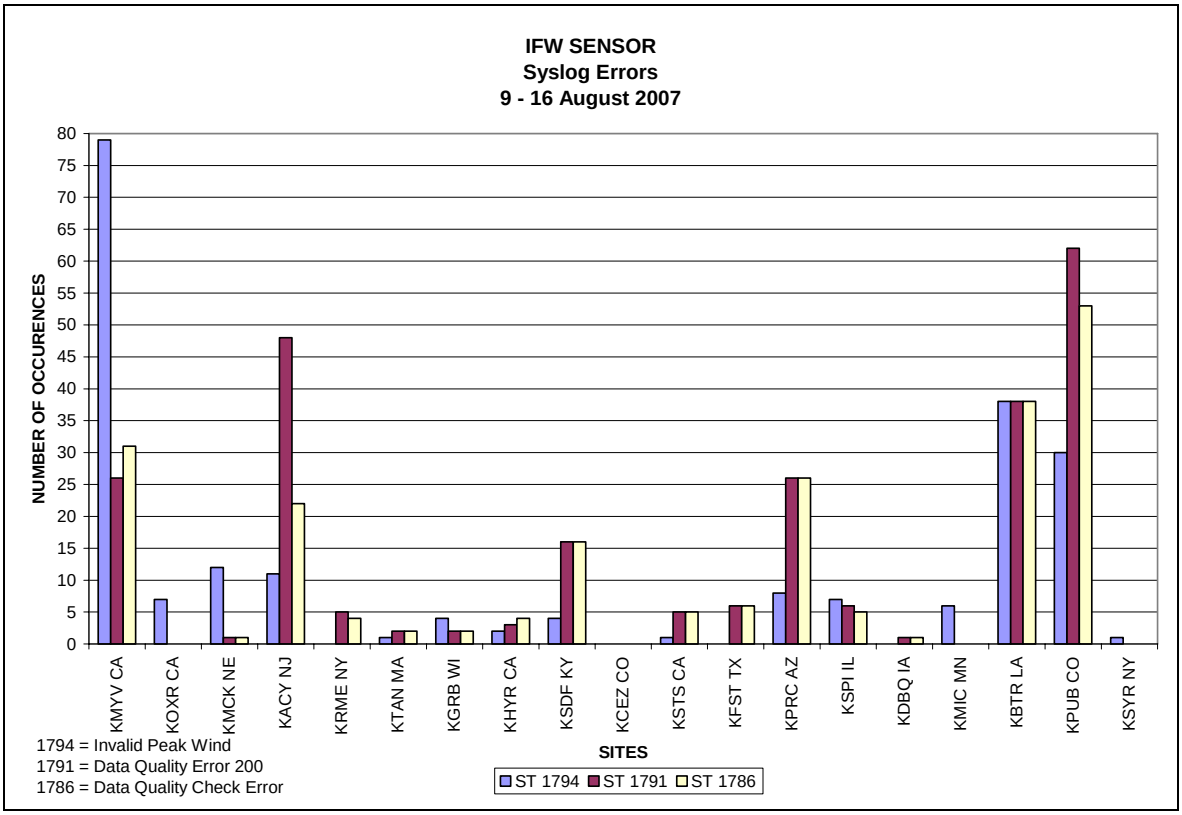

Figure 15 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site.

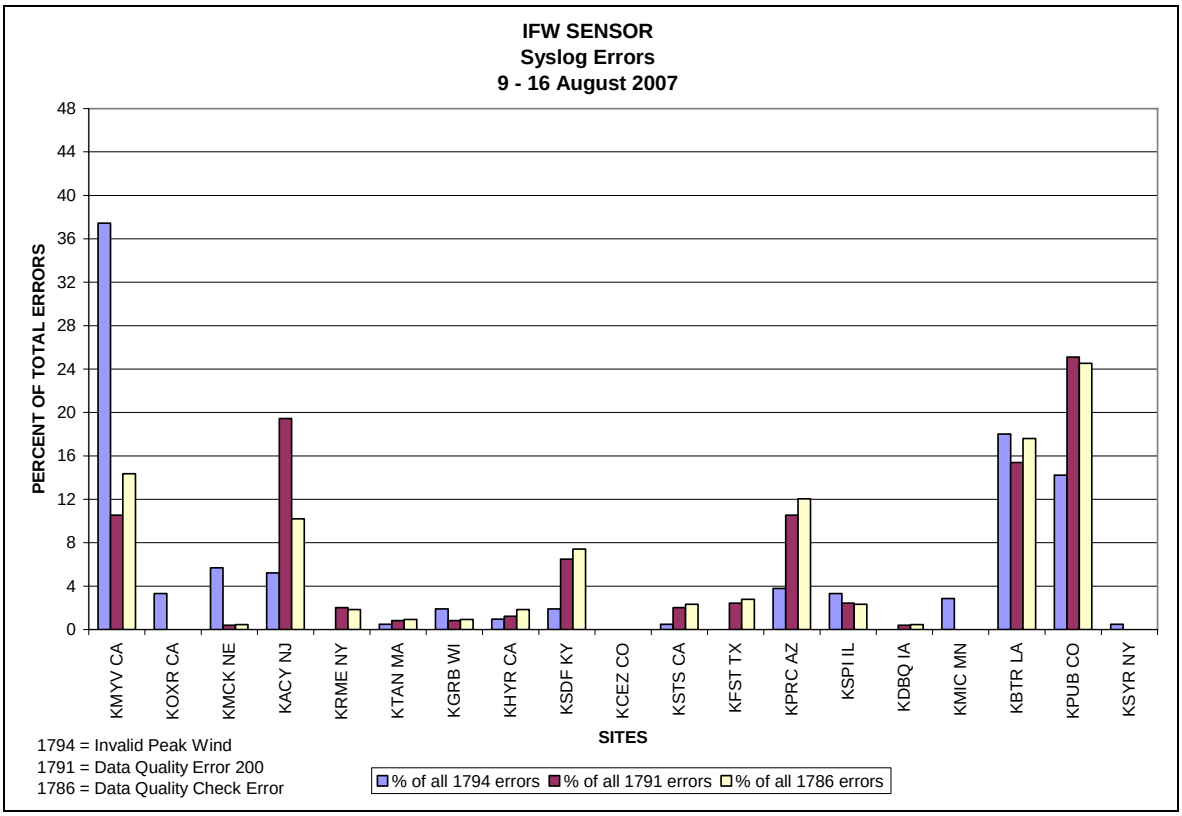

Figure 16 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed.

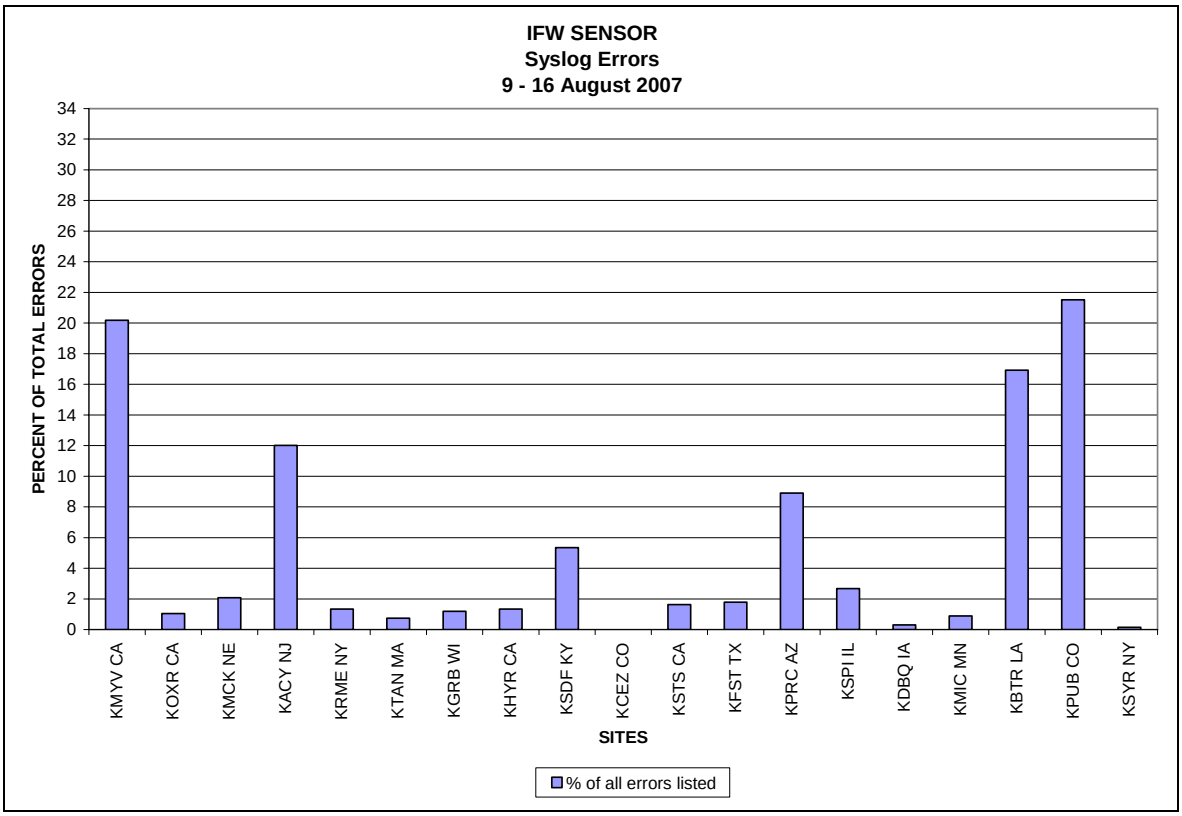

Figure 17 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed.

AUGUST 17 – 24, 2007

Figures 18 – 20 show the results from the third week of August of the 19 sites that account for 80% of all the IFW diagnostic messages at those 58 sites.

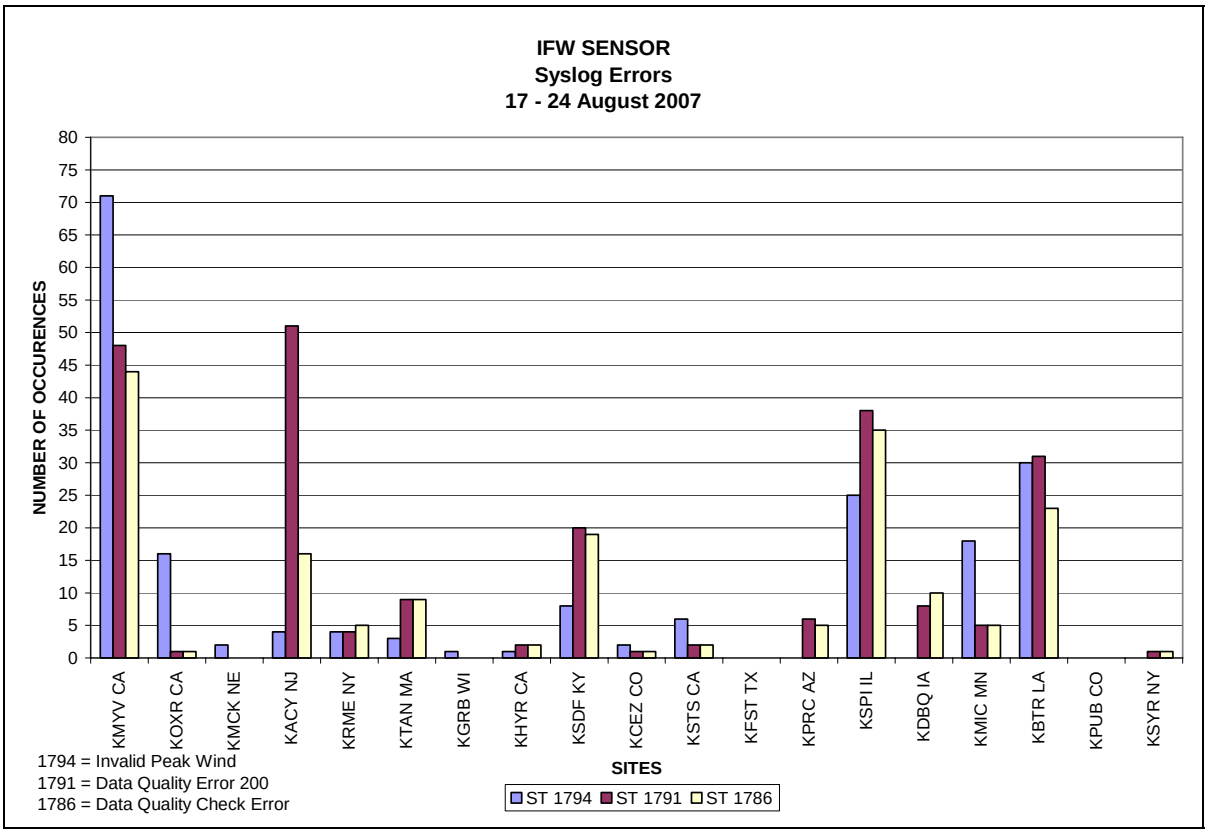

Figure 18 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site.

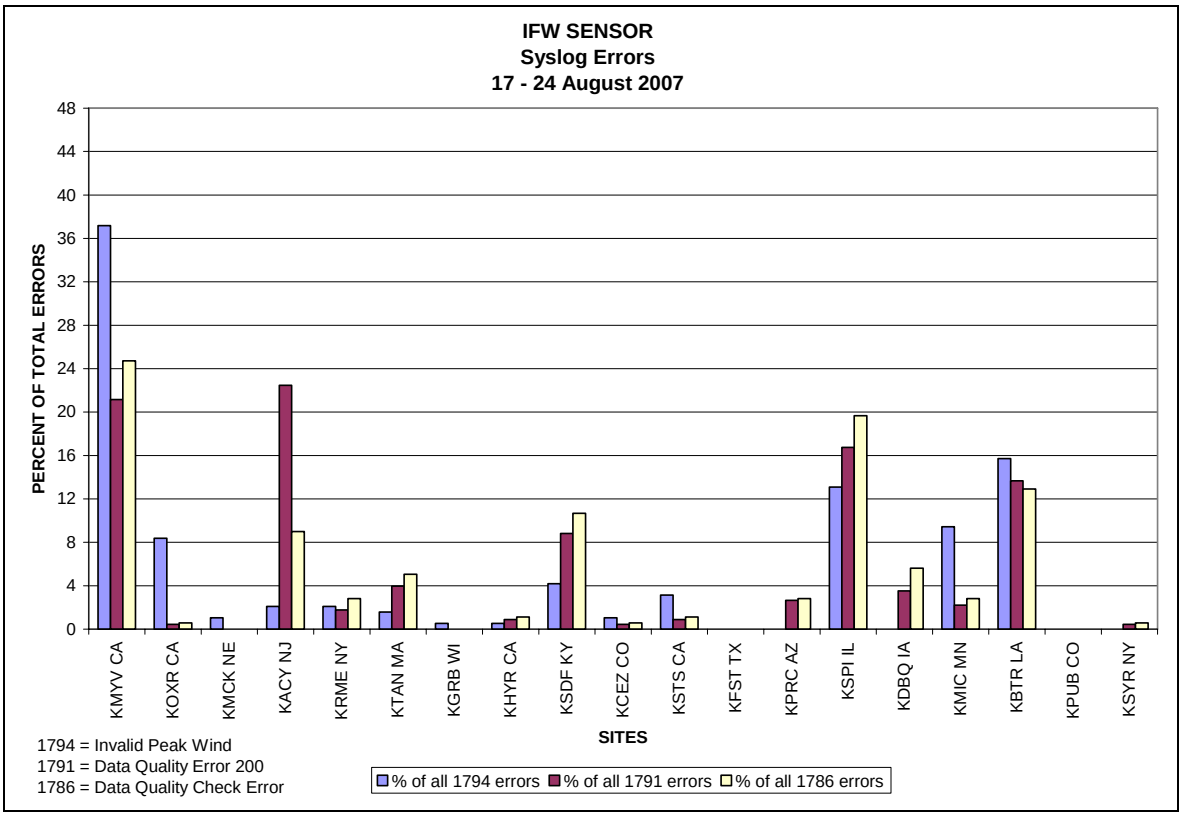

Figure 19 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed.

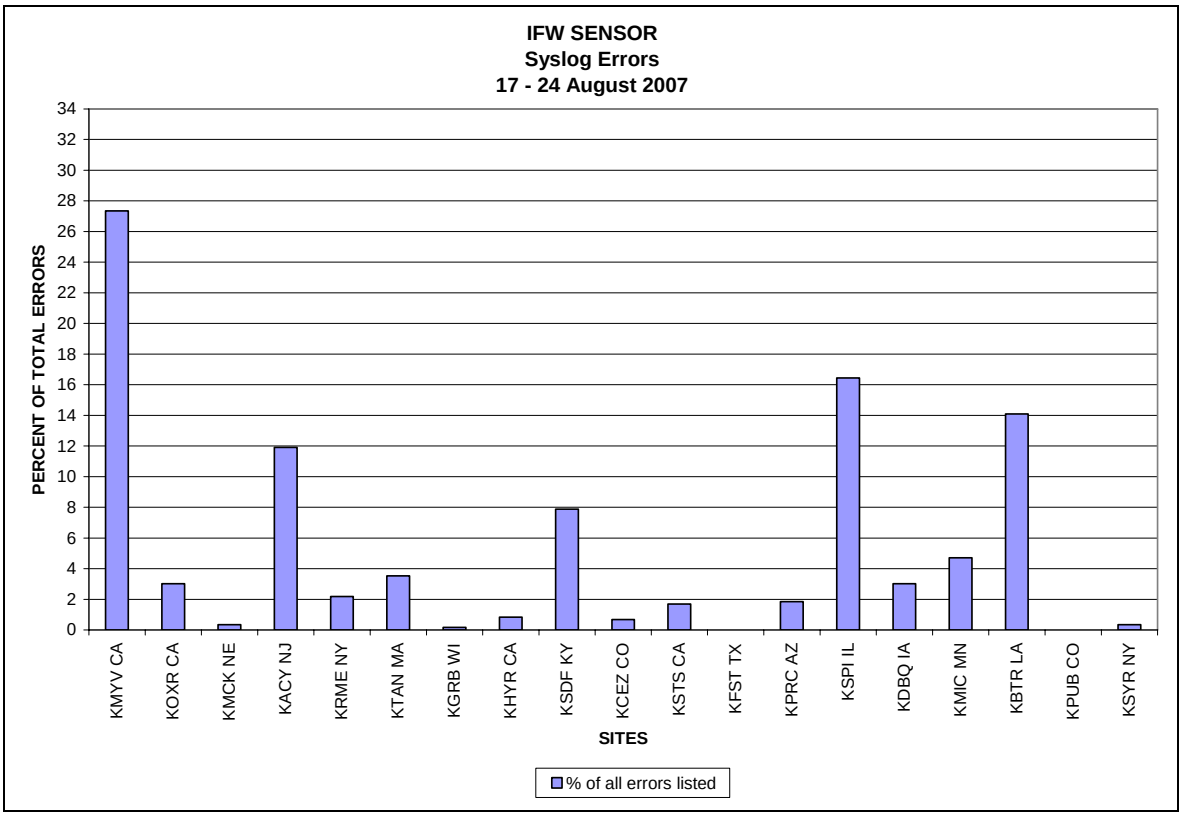

Figure 20 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed.

Figures 21 – 23 show the results from the fourth week of August of the 19 sites that account for 80% of all the IFW diagnostic messages at those 58 sites.

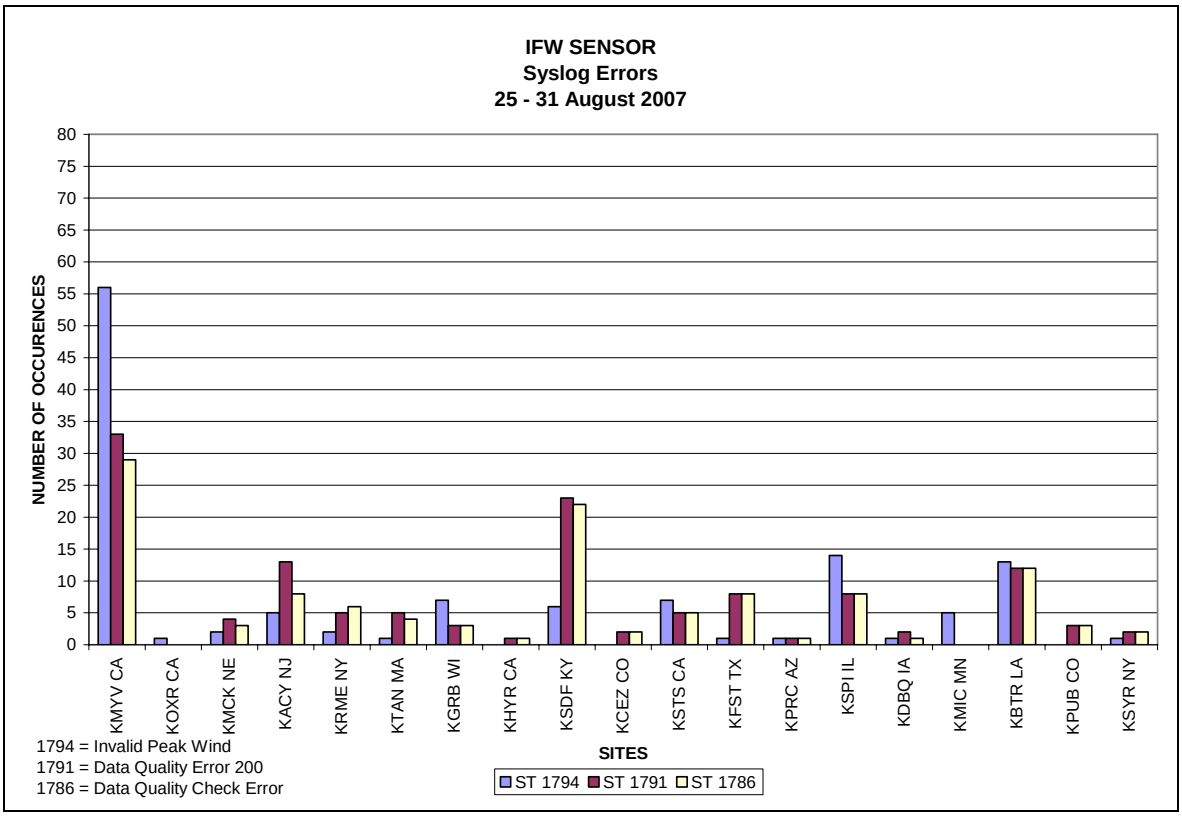

Figure 21 IFW Sensor diagnostic messages by Number of Occurrences

The figure above shows the number of occurrences of specific diagnostic messages by site.

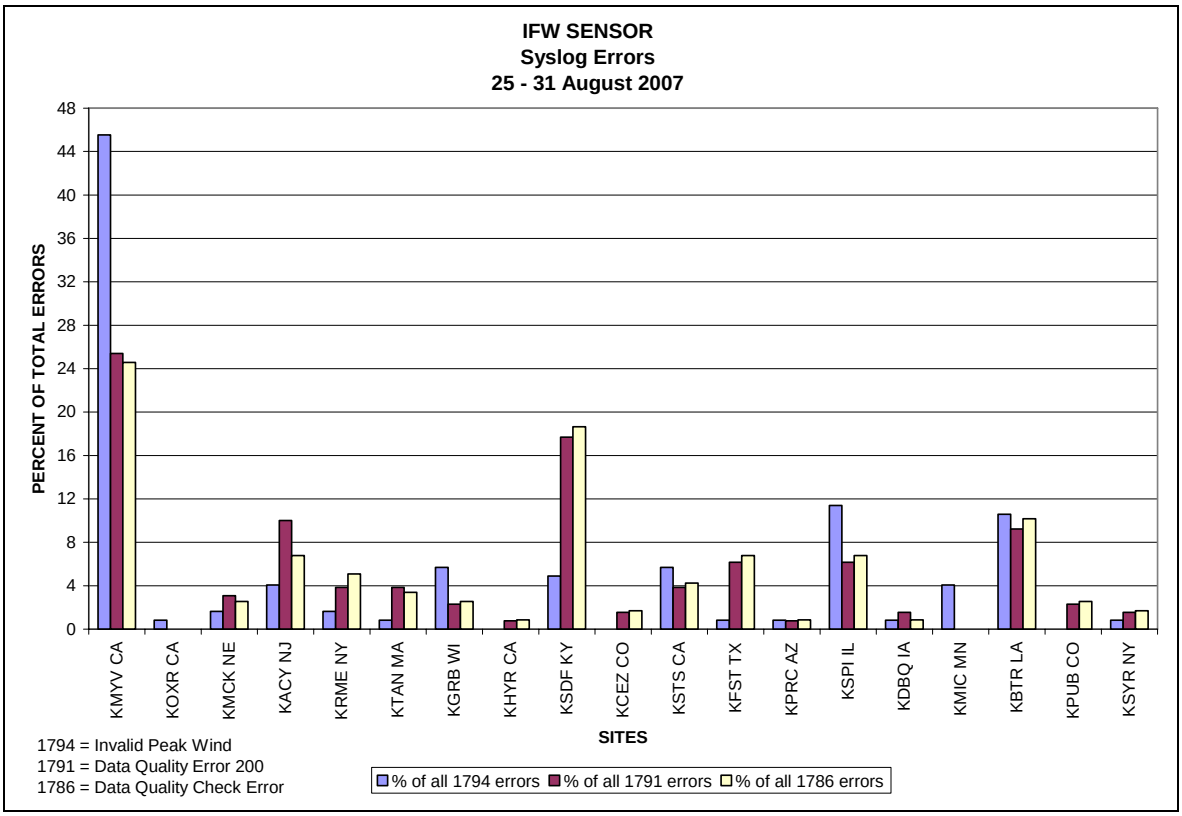

Figure 22 IFW sensor diagnostic messages by percent

The above graph shows the percentage of specific diagnostic messages for each site when compared to the total number of specific diagnostic messages for all sites listed.

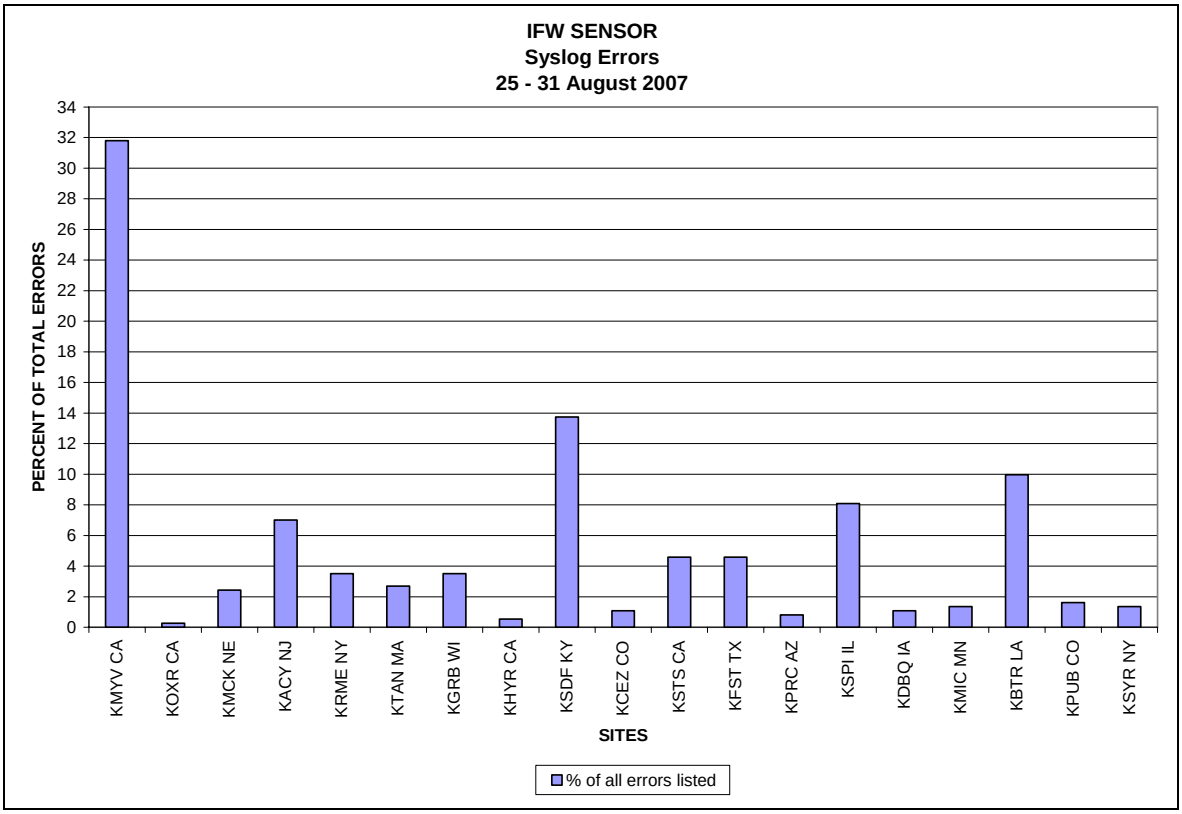

Figure 23 IFW Sensor diagnostic messages by percent

The figure above shows the percentage of all diagnostic messages for each site when compared to the total number of diagnostic messages for all sites listed.