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## 1. INTRODUCTION

The Interactive Forecast Preparation System (IFPS) is a suite of applications that allow National Weather Service (NWS) forecasters to prepare digital forecasts of weather elements interactively (Ruth et al. 1998). From these digital forecasts, NWS forecasters prepare graphical, gridded, tabular, and text products (Peroutka et al. 1998). This helps the NWS achieve its mission, which reads in part, "Expanding information technology capabilities will enable the NWS to distribute high resolution digital forecast databases that provide the flexibility for users to tailor data and information to meet specific needs" (NWS 1999).

Interactive Forecast Preparation (IFP) techniques have been in use in one form or another for over 15 years. The usage and size of the system have expanded dramatically over those years. As a result, the Meteorological Development Laboratory's (MDL) user support methods and activities evolved from an ad hoc operation into a full-time process. The informal software support procedures in place 15 years ago no longer apply in today's environment. Current IFPS usage demands a more formal and thorough level of user support. Present-day support includes NWS Training Center (NWSTC) courses, 24-hour emergency software support, dedicated regular-hours support personnel, and improved tracking of new features and bugs.

## 2. THE EARLY IFPS SUPPORT

Before the NWS fielded the Advanced Weather Interactive Processing System (AWIPS) in the mid-1990s, IFPS existed as the Interactive Computer Worded Forecast (ICWF) on multiple computer platforms. The technology in place at the time was quite different from today. Limited use of ICWF techniques meant software support was only needed occasionally. Travel to the Weather Forecast Offices (WFOs) using the software was more frequent, and direct contact between forecasters and developers was common. Fig. 1 shows how early ICWF support was provided.

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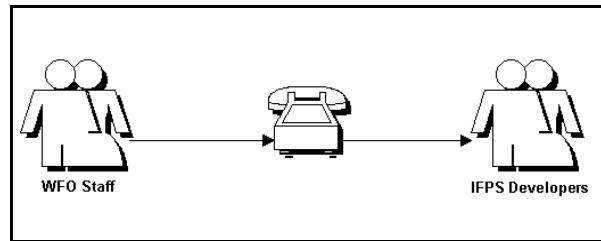


Figure 1. Early ICWF Support Procedures.

### 2.1 AFOS/VAX Platforms

ICWF began as a set of matrix editing and formatting applications that were used in the late 1980s and early 1990s by the Charleston, West Virginia WFO. These applications initially were developed for use with the NWS' Automation of Field Operations and Services (AFOS) system. Shortly thereafter, the applications were ported to the VAX platform and used by forecasters at the Norman, Oklahoma WFO.

During this time, use of the Internet as we know it was in its infancy. File transfer speeds were too slow to be of much use for large software deliveries. For both WFOs, delivery of new software was via tape or disks sent through the mail. In time-critical situations, new software was mailed overnight to the WFOs.

During major software upgrades, developers routinely traveled to each WFO. These visits lasted up to a week in which the new software was manually installed, configured and tested. Once the developer(s) completed the installation, they trained the WFO staff on the new software features directly. This meant that the developer(s) would be at the WFO during all forecast shifts in order to train as many forecasters as possible. If hazardous weather occurred, training could not take place.

After the developer visits took place, software support was performed on an "as-needed" basis. Developers continued their normal tasks, providing user support only when specifically requested. Forecasters at each WFO contacted MDL directly for assistance. Depending on who was available in the computer lab, any one of several ICWF developers would troubleshoot the software. Requests for software enhancements were generally made directly to MDL management.

The speed of response was quite fast since only two WFOs were using ICWF at the time. User support, however, was limited to normal business hours. MDL's support was received quite well, most likely due to the personalized nature of the support and the fact that most

forecasters at the WFOs were not far removed from manually typing their forecast products. Thus, if the software failed for any reason, it was not much trouble for the forecaster to revert to the "old" way of creating the products for their forecast package.

## 2.2 Pre-AWIPS Hewlett-Packard Platform

By the mid-1990s, several WFOs, including the Charleston and Norman WFOs, began receiving Hewlett-Packard (HP) workstations in anticipation of the arrival of AWIPS. The number of ICWF applications and features had grown dramatically since the AFOS/VAX era. With the more robust software came the requirement for more extensive support.

In addition to Charleston and Norman, the HP version of ICWF was installed at several other WFOs, adding to the level of support needed. Software was still sometimes delivered via disk, but the more advanced hardware allowed the ICWF developers to use File Transfer Protocol (FTP) for software deliveries.

Developer trips to the WFOs still took place. Software upgrades and installations were still manually done for the most part. Training was still MDL's responsibility, and again required visits to different forecast shifts around the clock while the developer(s) were on travel to the WFO. Again, developers were at the mercy of the weather. If hazardous weather arose, the developers were unable to install the software or train the WFO staff.

In order to keep track of the versions of ICWF software in each WFO, more formal software delivery procedures were implemented. This involved setting up software version control systems for ICWF source code and setting firmer delivery dates for software upgrades.

One of the more senior users of ICWF became the ICWF Focal Point at each WFO. Most times, these early focal points were the liaison between the WFO and the MDL developers. If a forecaster had a problem or a suggestion, they would tell their ICWF Focal Point. The Focal Point would contact a cadre of some of the more senior MDL developers. Whichever developer was most available responded and helped the WFO. MDL's response time was still rather quick; however, any issues that arose after normal business hours, even emergencies, had to wait for the developers to arrive in the office the following business day.

The support once again was well received. As the original WFOs became more accustomed to ICWF, software outages became more troublesome for the forecasters. However the speed of MDL's support helped ease those concerns.

## 2.3 Early AWIPS Platform

With the advent of AWIPS in the late 1990s, every WFO in the continental United States had access to ICWF software. Only a handful of offices used ICWF at the time, so software support procedures did not change much. However, strict AWIPS software delivery schedules changed the way MDL delivered ICWF software.

ICWF software was delivered along with scheduled general AWIPS software releases. These releases

generally occurred every few months and were handled by a contractor, not MDL as in the past. Since ICWF upgrades were part of the larger AWIPS software delivery, the actual installation date was controlled outside of MDL. Travel was occasional, but far less than in the past. Training of new features was often done remotely by walking the ICWF Focal Point through the new software and by providing an ICWF Users Guide.

User support became even more formal in the AWIPS era. ICWF developers were still contacted directly by forecasters and ICWF Focal Points, but the preferred path was through the Network Control Facility (NCF). The NCF is a group of troubleshooters who help the WFOs with all AWIPS software, 24 hours a day, 7 days a week. The NCF acts as the first line of support for the AWIPS system. If unable to provide help to the WFO, the NCF escalates the problem to the appropriate development organization. The NCF was not very familiar with ICWF at the time, but they tracked the WFO reports to make sure that each issue was properly addressed.

MDL also began tracking all questions and issues that it received to aid in planning for future development tasks. These questions and issues were entered into MDL's IFPS Field Reports Database (IFRED) (Schattel and Meiggs 2000). From this database, MDL was able to more easily manage the growing number of requests and determine their priority. The IFRED reports were posted to MDL's webpage, allowing users to search the archive and determine the status of any report.

Security issues became important in the AWIPS era. System passwords were no longer readily known among IFPS developers, so the WFO or the NCF often had to assist developers in gaining access to the WFO's system.

While more formal and structured, the response time for user support deteriorated. Additional layers of support and access restrictions contributed to the decrease in MDL's responsiveness. This was a serious issue for sites accustomed to immediate response. Many WFOs grew frustrated with the apparent bureaucracy. However, the formal tracking of the growing volume of site requests and issues allowed MDL to provide more reliable support.

## 3. RECENT AND CURRENT IFPS SUPPORT

In autumn of 1999, the consolidation of ICWF with the Forecast System Laboratory's AWIPS Forecast Preparation System (AFPS) (Mathewson 1996) was nearing completion. The new system was renamed IFPS. Around the same time, the NWS' Eastern Region made the decision that its 23 WFOs would begin using ICWF operationally. This resulted in a significant increase in the number of forecast offices needing support. MDL's existing support procedures were changed to handle the questions and issues expected from the WFOs who had never before forecasted using IFP techniques. MDL implemented new support plans such as dedicated support personnel, region-sponsored training, listserver groups, and World Wide Web (WWW) based documentation and troubleshooting that could support expanded use of ICWF and eventually support IFPS. Fig 2 shows how IFPS is supported in the AWIPS era.

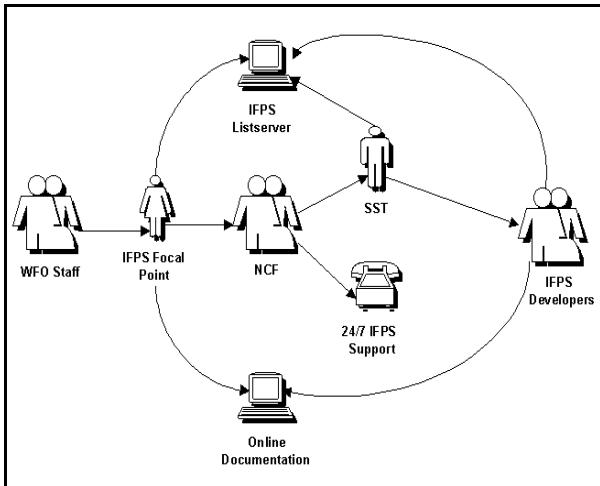


Figure 2. Current IFPS Support Procedures.

### 3.1 IFPS Site Support Team (SST) activities

MDL assigned a senior software developer to provide support during regular business hours to all WFOs using or implementing IFPS operationally. This developer set aside all programming tasks and concentrated completely on user support. The developer became a temporary member of the AWIPS Site Support Team (SST), a group of experts that supported AWIPS software. The SST is the next line of help behind the NCF; if the NCF is unable to resolve a problem at a WFO, they elevate the problem to the SST. The SST group provides after-hours support, however initially the IFPS representative was available only during business hours.

The NCF soon became familiar with common IFPS configuration issues but were still unable to help with operational usage issues. MDL provided several training sessions designed specifically for the NCF and SST. This training focused on recognizing common problems WFOs encountered with IFPS and how to quickly resolve them. Instruction was also provided on the software itself, so that issues that the NCF could not resolve could be accurately explained to the SST IFPS representative.

As the number of WFOs using IFPS continued to rise, the requests for around the clock 24-hour emergency support increased. In early 2001, MDL began assigning after-hours support shifts to IFPS developers. When a critical problem that severely impacts operations occurs at a WFO during non-business hours, the NCF is able to contact an MDL developer. If a developer receives a call from the NCF, the developer is able to access the computer systems at the WFO. After diagnosing the root of the issue, the developer is usually able to either solve the problem or get the WFO into a state where they will be able to resume operations with IFPS until the complete solution can be implemented. This service has been used with great success and provides one more level of support in an era where more WFOs have begun using IFPS operationally.

MDL continues to support IFPS by detailing a developer to the SST for 6- to 12-month rotations. Since the IFPS software changes at WFOs several times a year,

developers isolated from programming eventually are no longer "experts" with the most recent software. By rotating developers into the SST, MDL is able to ensure that IFPS is supported by the most knowledgeable developers.

### 3.2 Additional support activities

In addition to the active support activities described in the previous section, MDL also changed support methods in other areas. Listservers, an online Field Reports Database, improved documentation and training are examples of how MDL's support has changed to keep pace with the interest in IFPS.

Listservers groups were set up to allow for the exchange of ideas, questions, and issues that arose during the setup and usage of IFPS. The IFPS developers were active participants in these discussions, providing news, configuration help, software usage help, and troubleshooting. The SST IFPS representative now responds to all IFPS-related listserv messages, freeing up the IFPS developers' time.

The IFPS listserv is a valuable asset to developers and users alike. All of the Eastern Region WFOs just starting out with IFPS were able to see responses to issues at once. That helped smooth the transition for other offices, while making efficient use of time for the SST IFPS representative. Some senior listserv members even began to answer their peers questions freeing the SST IFPS representative to concentrate on more critical issues. This member contribution also gives the users valuable information from a WFO point of view, something MDL is unable to provide.

As more and more WFOs began using IFPS, some common questions and issues became apparent. To help make the solutions more widely known, MDL set up a Troubleshooting Tips webpage, found at [http://isl715.nws.noaa.gov/tdl/icwf/user\\_guide/troubleshoot.htm](http://isl715.nws.noaa.gov/tdl/icwf/user_guide/troubleshoot.htm). These tips were compiled from documents written by the MDL SST representative and other MDL developers. The webpage allowed WFOs to become more adept at solving common problems while becoming more knowledgeable about IFPS.

To avoid duplication of problem reports from the growing number of WFOs using IFPS, MDL recognized the need to update its IFRED. MDL created the Field Reports database, containing such additional information as the status of the problem, the expected implementation date, and any known workarounds. Improved search capabilities and categorization of entries help make the Field Reports database a significant upgrade from IFRED.

Details regarding new features were handled in release notes accompanying the software and in the online IFPS Users Guide, which is located at [http://isl715.nws.noaa.gov/tdl/icwf/user\\_guide/](http://isl715.nws.noaa.gov/tdl/icwf/user_guide/). The online Users Guide achieved a huge advantage over older paper copies of the IFPS Users Guide in that it could be easily updated and improved in-house and instantly provided to all WFOs at once. The online IFPS Users Guide contains such sections as an Overview, Functionality, Technical information, Customization, Troubleshooting, and Frequently Asked Questions (FAQ) for each major IFPS component.

The NWS Training Center also developed a comprehensive IFPS training plan for all WFOs. This plan consisted of two types of courses, one to brief management at each WFO and one to train the focal points at each WFO. MDL worked with the NWSTC to develop those courses, providing input into the course content and designing the computer system architecture.

MDL also sent a representative to each of the management and focal point courses to help with software maintenance issues and provide assistance where needed. MDL provided the trainers with updated information on each of the new software releases and answered questions about topics unfamiliar to the trainers.

### 3.3 Current support response

The overall response to the latest support procedures has been mixed. While the structure and stability of the AWIPS environment have been beneficial to the overall software quality, this same structure has limited the speed with which MDL can provide updated software to the WFOs. This has been a cause for concern among the IFPS users. The patch process has helped ease this concern to a certain degree, however even patch releases are not rapid enough in some situations.

This long time between software releases simply stresses the importance of quality user support. As problems are found with the software, it is essential to help the WFOs adapt until updated software can be installed. MDL addressed this by detailing one of its IFPS developers to the SST. The response to the SST IFPS representative has been overwhelmingly positive from the WFOs, Regional Headquarters, and the NCF/SST. The MDL after-hours cellular phone support has been received warmly as well, aiding the NCF during nights and weekends.

The growing suite of WWW-based documentation such as the IFPS Users Guide, the Field Reports searchable database, the IFPS Listserver and the Troubleshooting Guide have all served to educate the IFPS users. The IFPS listserver has many participants who are knowledgeable enough to answer each other's questions. The documentation and listserver archives are valuable resources of information that are available at all times.

## 4. SUMMARY

The Meteorological Development Laboratory's IFPS support procedures have changed dramatically over the years due to software and hardware changes as well as the level of usage by the WFOs. To properly support the user community, software support procedures must be dynamic and adapt to the changing environment.

IFPS support began as an informal process. Forecasters from the WFOs contacted individual developers directly during business hours. New software was either delivered by hand or by mail. Travel to WFOs was frequent and training was provided by MDL on-site. As more WFOs began using IFPS and technology advanced, MDL began supporting WFOs from afar, performing software upgrades, training, and support without leaving MDL's office. Support became more formal in order to

provide tracking for software upgrades and issues, and to provide the WFOs with status reports.

Currently, a contractor handles software delivery and the NWS Training Center handles much of the software training. This has freed up resources, allowing MDL to devote more time to user support. MDL has devoted several employees to IFPS support, including the SST IFPS representative. After-hours support by the IFPS developers ensures proper response to critical issues at all times.

As IFPS is implemented nationwide, it is important to serve the users well while avoiding duplication of effort on the part of the MDL support staff. Clear, concise documentation, online resources, and open dialogue are important parts of this process. Proper support also gives the users more confidence in the software, and therefore more acceptance.

**Acknowledgments.** The authors wish to thank Eastern Region Headquarters and the Charleston, West Virginia WFO for their immense help in training the Eastern Region WFOs. Sam Beckman, Bob Hamilton, and Gerry Byrne are also thanked for their work in training NWS management and focal points from each WFO. The authors would also like to acknowledge the IFPS listserver community, who continue to help support the nationwide implementation of IFPS.

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