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NWS Eastern Region Interactive Forecast Preparation System (IFPS) Implementation

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1. BACKGROUND

In accordance with the NWS Strategic Plan, Eastern Region (ER) aggressively moved toward preparing and disseminating new graphical and digital products. Since the late 1990s, ER followed the NWS Vision, "Aggressively and continually infuse science and technological advances to improve products and delivery of services that best meet and anticipate customer needs" (NWS, 2000). Advances were accomplished primarily through AWIPS and associated software. IFPS, in particular, offered significant challenges to the organization. To meet these challenges and achieve agency goals, ER articulated the NWS Vision; held regional workshops; developed training plans; and established time lines, objectives and regional goals. ER forged relationships between the software developers and the field forecasters. As a result of this strategy, ER was quickly able to expand the current suite of products and issue new graphical and digital products. This paper will discuss ER's methodology used for IFPS implementation.

By August 1999, all Eastern Region Weather Forecast Offices (WFOs) were equipped with AWIPS Build 4.2.2 and had the ability to expand their WFO suite of products into the digital and graphical arena. At the same time, ER managers realized that gridded data sets contained high levels of detail and that users of these data sets could make faster and more accurate weather decisions, saving lives and saving millions of dollars in the economy. New technology infusion enabled ER to begin an aggressive campaign to prepare and disseminate new graphical and digital products. The Interactive Computer Worded Forecast (ICWF), a precursor software component to IFPS, allowed for the first time, the preparation and enhancement of the standard suite of NWS forecasts as well as provide the capability to produce new digital and graphical products. The AWIPS 4.2.2 version of the ICWF also contained WWA (Watch, Warning, and Advisory) database and monitoring functions which would allow graphical coordination for the first time. As technology advanced and stable integrated tools were provided, it made sense to begin using WWA, the ICWF and eventually IFPS.

2. METHODOLOGY

To achieve agency goals, ER articulated the NWS Vision; held regional workshops; developed training plans; and established time lines, objectives and specific regional goals over a period of nearly three years. The methodologies employed were for ICWF and WWA, as well as for IFPS. Implementation of each will be discussed as there were both similarities and differences for each piece of software.

2.1 ICWF and WWA

Since ICWF had already been used for almost 10 years at Official Testing & Evaluation (OT&E) sites, ER decided to draw on this experience and required ER WFOs to implement WWA and ICWF first. While ICWF actually initiated the migration to new digital and graphical products, it was the need for graphical coordination and the use of WWA that provided the main impetus to move forward. Graphical coordination was a critical need in the forecast process. The 1996-97 Central Region and Eastern Region Coordination Project (Leivers, 1997) concluded, "Regarding graphical coordination, any system/software must be reliable, robust, easily installed, allowing for continuous point-to-multipoint connectivity. It would incorporate AWIPS-like technologies...which would allow input of proposals, incorporate proposal changes, and show current issuances in effect." WWA contained the database and monitoring functions that would allow "just that," allowing WFOs to propose, test, or cancel long-fused watches and warnings. The Geoviewer feature in WWA enabled the WFOs to see each others watches, warnings and advisories. At the same time, the WWA enabled Eastern Region Headquarters Meteorological Services Division to monitor watches/, warnings and advisories over the entire Eastern Region (Fig. 1).

WATCHES WARNINGS ADVISORIES IN EFFECT
EASTERN REGION
2130 UTC (1630 EST) 12/13/00

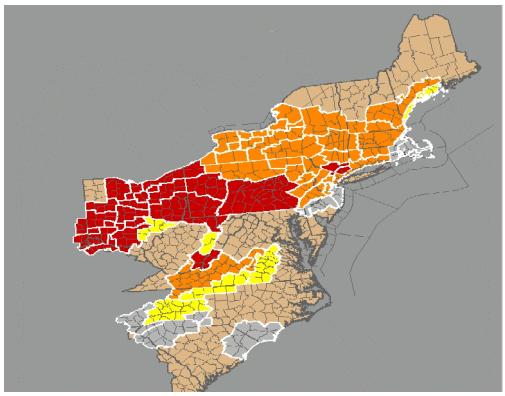

FIGURE 1 - Example of WWA Geoviewer at Eastern Region Headquarters

a. ICWF Workshops

Four ICWF workshops were held over a six month period at WFO Charleston, WV and Eastern Region Headquarters (ERH) to work on ICWF implementation details. Four workshops were chosen because it was the ideal number of offices and people to gather and work on coordination issues. The four regions chosen were the Ohio Valley, Carolinas, mid-Atlantic and New England regions . These workshops included a visionary management session for Meteorologists-In-Charge (MICs) and Scientific Operations Officers (SOOs) which closely resembled the National IFPS Manager's course material provided by the National Weather Service Training Center.

b. Plans and Timelines

At these workshops, each office was presented a list of ER strategic goals and activities. WFOs were asked to provide deadlines and details for these goals. These details became the plan for ER's ICWF Implementation. Offices knew that implementation of the WWA and ICWF would be a challenge for both management and the staff, as change is always a challenge. However, by implementing this initiative in a "two phase" approach, ER gained the necessary WFO support.

1) Phase 1

In Phase I, the focus was on coordination with implementation of WWA functionality. Each WFO collaborated to establish a methodical process for coordination of event-driven weather by using the WWA component of the ICWF. Phase I introduced the WFO to concepts of working with a meteorological database. ERH introduced the general ICWF training plan and provided an overview of WWA. Also, the MICs and Warning Coordination Meteorologists (WCMs) hashed out details on the graphical coordination collaboration. Focal point training was also provided which included ICWF application program overview and file structure.

2) Phase II

In Phase II, the focus was on implementation of the ICWF functionality. Management and staff at each ER WFO recognized this phase as a significant change in the forecast process. Offices issued new NWS products and expanded on ICWF forecast preparation. The WFO defined the success of ICWF implementation in its ability to integrate the software technology into daily operations. ER defined the success of ICWF transition specifically as an office's ability to not only produce its current suite of operational text products, but its ability to develop a digital database and expand its product suite.

With customers requesting detailed data, ER proposed offices expand their Coded Cities Forecast (CCF) (Fig. 2), implement a Revised Digital forecast (RDF) (Fig. 3) and transition from a text-based State Forecast Product to a tabular one by December 2000. Further, because of the challenge of change and historical ICWF implementation failures, ER theorized that if an office did not have a goal to expand its product suite, forecasters would not be as motivated to implement new technology.

Data abundance and detail became one of the immediate benefits of producing a digital database. This became obvious once offices began producing the expanded Coded Cities Forecast, a product that is a digital array of weather and temperature for selected cities. The old format only had a few cities since manual entry of data was required. With the new format being software driven, WFOs could, for the first time, expand the selection of cities and extend the time period detail.

Pre-ICWF CCF VS EXPANDED CCF

```
FPUS41 KRLX 051631
CCFCRW
CRWCCFCRW

CRW EB 043/029 052/036 050 25412
BKW OB 040/027 049/032 045 25722
EKN  OE 040/022 045/031 038 25833
HTS  EE 043/028 050/036 050 25412
PKB  EE 040/027 047/032 046 25413
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FPUS41 KRLX 051631
CCFCRW
CRWCCFCRW

CRW EB 043/029 052/036 050 25412
       BBWEB 035/057 042/055 040/043 027/045 028 21223664310
BKW OB 040/027 049/032 045 25722
       BBWEB 030/050 040/050 038/040 025/040 030 21222664310
EKN  OE 040/022 045/031 038 25833
       BBWOB 023/047 039/048 035/039 020/038 028 31222665420
HTS EE 043/028 050/036 050 25412
       BBWEB 035/057 042/055 037/044 027/045 028 21224663310
PKB EE 040/027 047/032 046 25413
       BBWEB 032/055 041/050 035/040 028/043 027 21223774420
UNI  EE 041/028 047/032 046 25413
       BBWEB 032/055 041/050 035/040 028/043 027 21223774420
CKB OE 041/027 045/031 041 25723
       BBWEB 030/055 041/050 040/041 026/042 028 31223664420
JSN  EE 042/029 050/036 050 25412
       BBWEB 035/057 042/055 037/044 027/045 028 21224663310
SPE  OE 042/027 045/032 041 25723
       BBWEB 030/055 041/050 040/041 026/042 028 31223664420
STN OE 042/027 045/032 041 25723
       BBWEB 030/055 041/050 040/041 026/042 028 31223664420
SUM OB 040/027 049/031 045 25722
       BBWEB 030/050 040/050 038/040 025/040 030 21222664310
SNO OE 032/019 045/028 038 25833
       BBWOB 023/047 039/048 035/039 020/038 028 31222665420
GRY  EE 043/029 050/036 050 25412
       BBWEB 035/057 042/055 037/044 027/045 028 21224663310
CWD EB 041/028 050/036 050 25312
       BBWBB 033/056 041/051 040/043 026/045 030 21223663310=
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FIGURE 2 - Examples of pre-ICWF CCF versus the new format

Of the three products mentioned above, the RDF was clearly a desired goal to achieve. The RDF was the first NWS forecast product that was a three-

hourly digital forecast of such weather parameters as temperature, wind speed and direction, relative humidity, sky cover, weather, and probability of precipitation. This product was recognized as having a great potential to serve Emergency Management Services, private weather vendors and the computer automated systems. This potential served to motivate forecasters.

REVISED DIGITAL FORECAST

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FOUS51 KLWX 281501
RDFLWX

DIGITAL ZONE FORECAST MATRICES
NATIONAL WEATHER SERVICE BALTIMORE/WASHINGTON
1057 AM EDT FRI SEP 28 2001

DC2001-MD2011-290257-
DISTRICT OF COLUMBIA-SOUTHERN BALTIMORE-
INCLUDING THE CITIES OF...BALTIMORE...WASHINGTON
1057 AM EDT FRI SEP 28 2001

              FRI  09/28/01           SAT  09/29/01           SUN  09/30/01
EDT         03 06 09 12 15 18 21 24 03 06 09 12 15 18 21 24 03 06 09 12 15 18

POP 12HR                 20          20          20           0          10
QPF 12HR                  0           0           0           0           0
MAX QPF                   0           0           0           0
MX/MN                    68          50          66          50          67
TEMP              58 61 61 57 54 52 51 52 59 63 63 58 54 52 50
DEWPT             46 46 45 46 46 45 45 45 47 47 47 47 46 45 44
RH                64 58 56 67 74 77 80 77 64 56 56 67 74 77 80
WIND DIR          NW NW  N  N  N  N  N  N  N  N  N  N  N  N  N
WIND SPD          10 15 10 10 10 10 10 10 10 15 15 10 10 10 10  5  5 15 15
CLOUDS            B1 B1 B1 B2 B1 B1 B1 B1 B1 B1 B1 SC CL CL CL B1 B1 B1 B1
RAIN SHWRS                 S

              MON 10/01/01 TUE 10/02/01 WED 10/03/01 THU 10/04/01
EDT         21 03 09 15 21  03 09 15 21  03 09 15 21  03 09 15 21

POP 12HR      10    10     0     0     0     0     0     0
MX/MN         48    72    52    73    54    73    54    74
CLOUDS        B1    B1    B1    SC    SC    B1    B1    B1

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FIGURE 3 - Example of Revised Digital Forecast Product

For motivation, ER established and mandated a "nine-week" implementation time line, which included an evaluated risk-reduction exercise (described below), and identification of an Implementation Duo (ID), consisting of a focal point (who had a detailed knowledge of the application and file structure) and a day worker, to develop and administer training, testing and feedback at each WFO. This time line was coordinated with NWSH Office of Services, ERH Senior Management and WFO MICs.

c. Training, Testing and Feedback

The process for training, testing and feedback occurred differently for the each phase of implementation.

1) Phase I

In Phase I, WWA implementation and graphical coordination required testing of software and training of personnel. Unfortunately, the WWA software was delivered non-configured for local WFO operations. Instead of reinventing the wheel, ER decided that one set of baseline configuration files developed by WFO Charleston, WV would be provided to each site as a starting point. At the same time, ER developed a WWA configuration, training and set-up guide for each office and placed it on the internet. That way, each office would be utilizing one set of files and one set of instructions. Since WWA had never actually been used operationally, ER decided to develop and run mock winter storm scenarios to test the software's utility to make sure it actually worked before implementing it. A great deal of emphasis was placed on the testing of the software. However, training was minimally developed, since it was anticipated that the software would be intuitive and similar to XNOW (Plishke, 2001), a PC-based watch, warning and advisory software package that many forecasters were already using.

Unfortunately, WWA was immature and not intuitive. This complicated implementation at ER WFOs and set the stage for two years of intermittent stress for WFO forecasters, particularly in winter storm scenarios. To help counteract the difficulty ER forecasters were having, ER quickly forged a relationship with Meteorological Development Laboratory software developers and established a process for software improvements. Numerous conference calls were held and a working group was set up to deal with problems.

2) Phase II

By the time ER began with Phase II, it was obvious that an enhanced training and testing period was needed for successful implementation of ICWF. To address training issues, ER decided that it would employ a forecast-exchange program with "expert ICWF" offices to integrate the skills of ICWF forecasters. In theory, ER thought this approach would be better to spread expertise not able to ascertained by a classroom environment. The exchange program involved two forecasters, one from the WFO being trained and the other from the WFO providing the training. The forecaster being trained would travel to the expert office for one week where they would receive expert operational training. The immediate week following that training, the newly-trained forecaster would return to their respective WFO, but would also be accompanied by the forecaster from the expert office. Then, both would begin training the entire staff spinning up on ICWF.

In the beginning, only one office, Charleston, WV, provided the role of expertise. However, soon afterwards, new centers of expertise quickly developed. This reduced the workload on the Charleston, WV staff.

In addition to hands-on training, a "kick-off" vision session was held at many offices and conducted by either the station management or visiting expert forecaster. A tremendous amount of coordination was done between the Region and the WFOs for this forecaster exchange program to be done in a methodical way.

Finally, to solidify buy-in, the ER senior managers suggested one or more risk reduction sites implement the ER plan to determine if the training and testing results would be satisfactory. WFOs Albany, NY and Columbia, SC were chosen as the risk reduction sites. Perhaps the most critical turning point for ER was the debriefing meeting that occurred after the termination of the risk reduction. ERH invited the MICs and forecasters from Albany, NY, and Columbia, SC; MICs and forecasters from

local WFOs and senior officials from the Office of Services and Strategic Planning at NWSH. At this session, the Albany and Columbia forecasters convinced senior managers that the training plan was good, software was tested and worked "good enough" for operational implementation. ER's implementation plan was slightly modified based on these office's suggested changes.

2.2 IFPS

With installation of AWIPS Build 5.0 IFPS at WFOs, a Graphical Forecast Editor (GFE) was introduced to forecasters (Fig. 4). As stated in the FSL Forum (2000), the Graphical Forecast Editor is the tool with which forecasters modify digital data that defines the future state of the atmosphere. These data sets take the form of grids.

GRAPHICAL FORECAST EDITOR

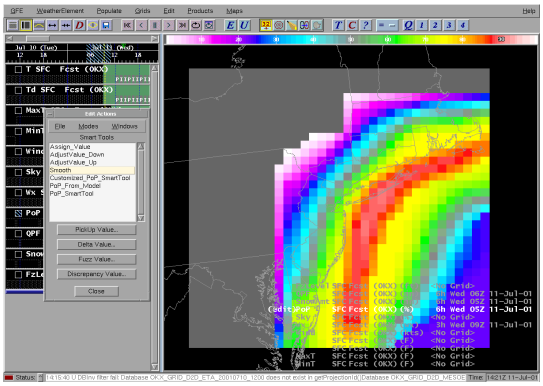

FIGURE 4 - Example of the GFE interface which forecasters used after AWIPS Build 5.0

This new editor enabled not only text, tabular and digial data to be produced, but also allowed grids to be prepared for the first time. Eastern Region began transitioning to IFPS during 3rd and 4th quarters of fiscal year 2001.

a IFPS Workshops

There was not an immediate need or enough resources to hold additional IFPS workshops like those held for ICWF. Because ICWF had already been implemented at ER sites, forecasters were already primed to integrate new components arriving with Build 5.0 IFPS. Further, offices had already received visionary focal point training as well as "Delta" training. Thus, efforts where focused on transition planning and installation activities.

b. Plans and Timelines

ERH created a detailed IFPS implementation plan with established goals. Specifically because of the complexity of the new GFE software in IFPS, the ER plan called for a "5 - 6 month" implementation approach, which was significantly longer than the approach taken with ICWF. The implementation consisted of four modes: Focal Point (FP) Preparation Activities, WFO Training, Operational Mode - Training completed, and Proficiency mode.

Several goals were also stated to MICs. ER proposed that WFOs: 1) produce their current suite of operational products using IFPS (from grids); 2) complete documented GFE training exercises; and 3) send routine issuance of experimental meteorological grids using a web page by March 2002. An additional goal was to conduct enhanced grid field verification.

The following time line was used:

IFPS Implementation Timeline at WFO

Month 1- 2, Focal Point Preparation Activities

- Focal Points should load and configure GFE, collect and develop smart tools, including the capability to upload graphical products to the web

Months 2-4, WFO Training

- Broad Overview....Why IFPS?
- On-station Local training plan

Month 4 Operational Mode - Training completed

- Production of current suite of NWS public products ie., IFPS/GFE is used for all issuances of the Zone Forecast (ZFP), CCF, RDF, Graphical RDF, and Area Forecast Discussion products
- Produce routine (limited suite) of graphical products to a web page produced from grids

TEMPERATURE GRAPHIC PRODUCED FROM 2.5 KM FORECAST GRID

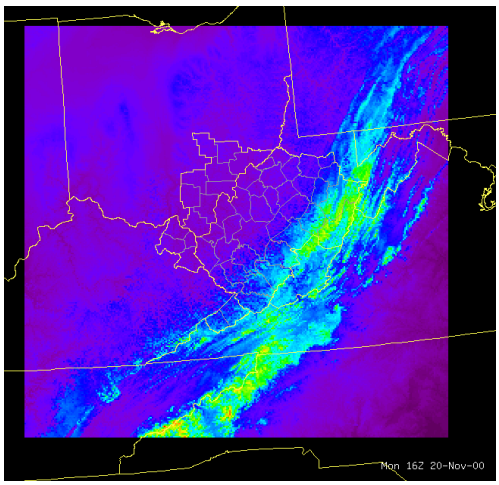

FIGURE 5 - Example of a graphic that forecasters will be producing and sending to a web page for dissemination

- WCM/MSD initiates promotional campaign

c . Training, Testing and Feedback

Despite the general success ER had with ICWF implementation, ER training for IFPS was handled somewhat differently than with ICWF. With the help of WFOs Charleston, WV and Gray, ME, ERH developed a recommended training plan and posted the plan to a web site. WFOs used this recommended plan to develop their own local implementation plan. Several training strategies, such as one-on-one and WFO group sessions were employed. In addition, there was a need at some WFOs for hands-on training, similar to the forecaster-exchange program that was employed for ICWF . However, because of limits on travel resources, only a few offices elected to travel to Charleston, WV.

It should be noted again that NWSTC provided delta training for IFPS focal points. This training was completed in March 2001 but many focal points forgot what was learned because the software was not implemented immediately upon return from training. In addition, to help with additional visionary training, a "Why IFPS" document was developed for ER personnel by ERH. ER offices also participated in a Build 5.0 IFPS course on an "as needed or available " basis.

3. SUPPORT ISSUES

Primary support for WWA, ICWF and IFPS implementation resided with Meterological Development Laboratory (MDL). Offices followed similar trouble shooting procedures as with all AWIPS applications: 1) Offices opened a trouble ticket with the Network Control Facility (NCF). and, 2) NCF forwarded Trouble Tickets to MDL for response.

Responsibility for overall implementation of IFPS resided with the ER AWIPS Program Manager (APM). The APM coordinated with the Regional IFPS/GFE Focal Point who facilitated field site trouble tickets, provided recommendations for software improvement, and identified urgent field needs. The APM coordinated IFPS issues with Division Chiefs, OS (Office of Services), NCF and MDL.

4. SUMMARY

Expressing the weather in a series of gridded fields fundamentally changes the method forecasters do their job (Mathewson, LeFebrve, Hansen, 2000). It is clear that gridded data sets contain the highest level of detail current technology can deliver. Users of these data sets can make faster and more accurate weather decisions saving lives and saving millions of dollars in the economy.

General leadership principles were employed by ER managers to implement IFPS in ER. Because of the change in technology and the challenges they brought to the agency, MICs responded to and lead the change at their offices. They dealt effectively with personnel to get the most out of their workers. Perhaps the most important of all, Regional management embraced the changes early on and communicated a clear vision of where the agency was headed.

5. REFERENCES

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