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Operational Analysis –FY2009

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1.0 Customer Results

OHD leads the research and development activities for NOAA's Hydrology Program. The Hydrology Program supports its customers by providing river level, flood and flash-flood forecast and warnings, water resource information. Customers include emergency response managers; other federal, state and local water management associations; and the general public. Emergency managers use the forecasts and warnings for both strategic, long-term planning as well as tactical, short-term planning. Water resource managers make critical decisions that affect flood control, water supply, river and lake transportation, agriculture and hydropower.

The Hydrology Program provides critical information which provided an estimated cost savings of over $943M annually in FY07 dollars. Details of the economical benefits are described in Use and Benefits of the National Weather Service River and Flood Forecasts.

1.1 Customer Requirements and Costs

The Hydrology Program completed its third biennial American Customer Satisfaction Index (ACSI) survey of emergency response managers in FY08; other federal, state and local water management associations; and the general public to identify successes along with areas for improvement. ACSI is a uniform, cross-industry measure of satisfaction with goods and services available to U.S. consumers, including both the private and public sectors. The ACSI methodology is used within the Hydrology Program to identify areas of customer satisfaction and, more importantly, dissatisfaction. This will help the Hydrology Program address areas to improve services.

The survey has shown customer satisfaction with hydrologic services (score = 80) to be higher than average for other Federal programs (score = 68). The composite score reflects improved customer satisfaction with web products, water supply and reservoir information, and drought information. The survey also shows an overall improvement in the survey respondent's confidence in the National Weather Service.

The program also continually solicits customer feedback from on its Web pages and evaluates it on a regular basis to prioritize the need for improved or new water forecast information products and services. Additionally, the Hydrologic Service Division (HSD) leads a customer outreach program which serves as the interagency liaison, maintains policy and requirements for and assesses the performance of the overall hydrologic services program and provides technical support for the River Forecast Centers (RFC) and Weather Forecast Office (WFO) hydrologic operations.

Hydrological services are provided through NWS Web pages at no cost to its customers.

1.2 Performance Measures

These measures align with the "Customer Results Measurement Area" of the Performance Reference Model developed by the Federal Enterprise Architecture Program Management Office (FEA-PMO). Table 1 summarizes the performance measures.

Table 1: Customer Results Performance Measures

Measurement Area	Indicator	FY09 Target	FY09Actual Result	Comments
Customer Requirements	Hydrology program customer satisfaction index	79	80	
	Hydromet observation data delivery to NWS field offices (Minutes)	3.0 Minutes	2.3 Minutes	
	OHD development environment IT availability	95%	99%	

2.0 Strategic and Business Results

OHD and the Hydrology Program facilitate NOAA's Strategic Plan Mission Goal to serve society's needs for weather and water information. Goals and objectives for the past year have been met or exceeded as the result of program management and monitoring processes in place to ensure continued progress. In addition to program initiated controls, independent evaluations are routinely

and independently conducted to ensure the program is effectively accomplishing its mission and meeting its long-term goals.

2.1 The Hydrology Program Helps to Achieve Strategic Goals

The Hydrology Program supports the DOC Strategic Goal 3.1 "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" and the NOAA Goal to "Serve Society's Needs for Weather and Water Information".

Listed below are activities which support the DOC and NOAA goals:

- Implement River and Lake Probabilistic Forecasts locations which incorporate new science to improve forecasts and provide probabilistic information which provides users with information to make risk based decisions.
- Reduce the time for delivery of Hydromet Information to NWS field Offices. Timeliness in delivering data contributes to the efficiency and accuracy for forecast issued by the operational facilities.

2.2 Business Results

2.2.1 Program Management and Controls

The Hydrology Program collects performance information to manage and improve the program; this includes quarterly measures such as flash-flood forecast accuracy and lead times which help evaluate the adequacy of training programs, hydrologic tools and procedures used by forecasters to generate and issue forecasts; and measures such as schedule performance and implementation status to measure timely delivery of services. These measures are reviewed by managers during monthly, quarterly and annual review to evaluate system performance.

Project statuses are reported monthly to the OHD Director to ensure that project targets and goals detailed in the Annual Operating Plan (AOP) are being attained. The OHD Director presents quarterly program updates on cost, schedule and performance to the NOAA executive panel which oversees the NOAA planning, programming and budgeting process. The NOAA Deputy Undersecretary who heads this panel, then meets with the NOAA administrator on a quarterly basis to review cost, schedule and performance result for all NOAA programs.

2.2.2 Monitoring Cost, Schedule and Performance

<u>Cost</u> – The cost for the Hydrology Program in monitored through a monthly report prepared by the OHD financial officer. The report contains financial information on estimated and actual costs versus projected program cost. Monthly budget reviews are held by the Hydrology Program Manager to assure the program is being managed with cost and schedule. Quarterly reports are submitted to the NOAA executive

<u>Schedule</u> – Key milestones contained in the Annual Operating Plan (AOP) are evaluated each month by project managers. The Hydrology Program 'Quad Chart' contains schedule information which is prepared for the NOAA Deputy Undersecretary each quarter. The Exhibit 300 schedule information is updated each quarter. Milestones have consistently been accomplished on or ahead of schedule.

Performance – Performance measures, including cost and schedule are review monthly at the program level. Quarterly and annual reviews are conducted at the NOAA executive level to assure compliance with baseline measures.

2.4 Security

The HADS and DEIT systems are accredited under requirements spelled out in NOA 212-13 (08/06/90) and NWS Information Technology Security Policy that are based on OMB and NIST guidance. System Security Plans, Risk Assessments, and Contingency Plans were certified and approved in August 2007. New Certification and Accreditations (C&A) were completed in January 2008. Management, operational, and technical security controls are adequate to ensure the confidentiality, integrity and availability of information. OHD successfully completed the annual FISMA requirement for continuous monitoring in August 2009. This requirement includes review and testing of contingency plans. Vulnerability scans are performed quarterly, and more general system security / antivirus scans are performed weekly. FY2009 POA&M actions were completed on time. All current POA&M actions are on target for timely completion.

2.5 Performance Measure

In November 2007 the National Weather Service approved a new baseline for the "River and Lake Probabilistic Forecasts" performance measure. OHD successfully implemented its target of 253 new service locations for FY2009. By the end of FY09, AHPS services were available at 2,490 locations. A 20-location deficit due to reduced FY08 funding was carried through this year.

The performance measure in Table 2 shows the Hydrology Program performance with respect to Strategic and Business Results. Strategic and Business Results performance measures introduced in FY2000 include the number of locations reporting River and Lake Probabilistic Forecasts. These measures align with the Strategic and Business Results Measurement Area, of the Performance Reference Model developed by the FEA-PMO.

Table 2: Business Results Performance Measures

Measurement Area	Indicator	FY2009 Target	FY2009 Actual Result	Comments
Strategic and Business Results	River and Lake Probabilistic Forecasts (Locations)	2510 Locations	2490 Locations	253 new locations implemented.

3.0 Financial Performance

3.1 Current Performance vs. Baseline

The current OHD financial performance, shown in Figure 2, is based on a pre-established cost baseline (e.g., annual spend plan). Program costs are steady state and consist of staffing and contractor expenditures, and information technology equipment such as routers, desktops and data

storage devices. Other planned project costs cover the support and services contracts at each data center.

The total OHD IT expenditures in FY09 were $4.550M, which is $49K (1.1%) over budget.

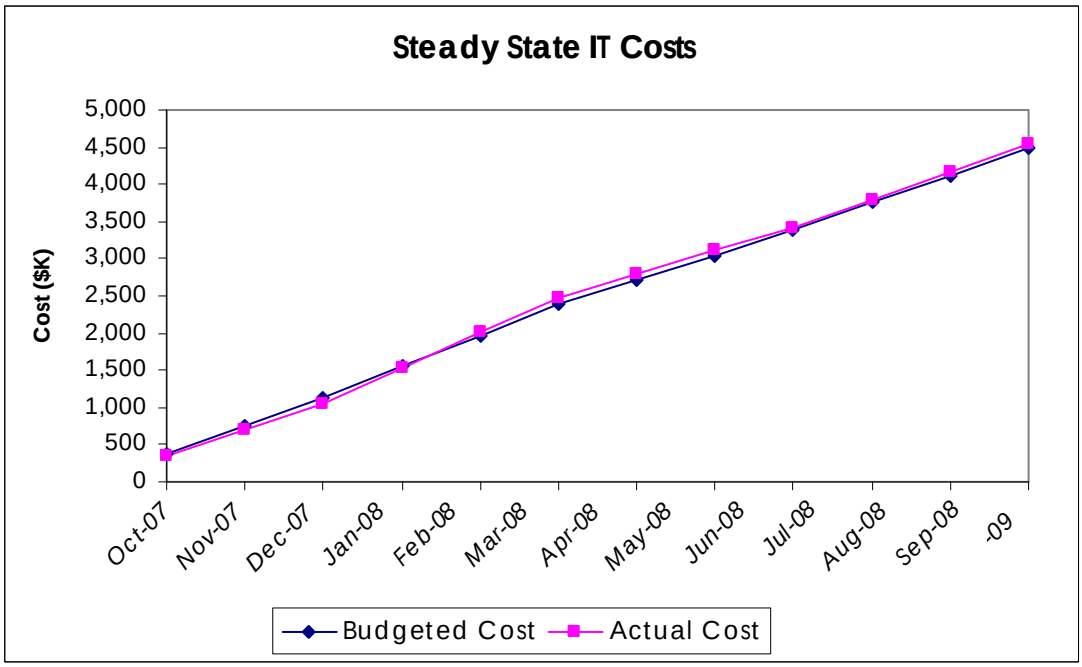

Figure 2: Budget vs. Actual Costs

3.2 Financial Performance Review

OHD's annual spend plan determines the specific dollars to be applied to scientific research (non-IT) and software development / equipment support (steady state IT).

Financial performance is typically subjected to a periodic review for reasonableness and cost efficiency. Weekly budget discussions are held with the program manager, CORs and contract managers to ensure contracts are within cost and on schedule. The contractors issue monthly invoices for all products and services supplied under the contract. These are tracked and evaluated by the COR as well as each government task manager who is responsible for issuing the task order and monitoring the task for deliverables and for the quality assurance of these products and services. Progress meetings are conducted to review each task for its progress, quality, and costs. A detailed review of work and priorities is undertaken if cost is significantly above base lined values. Also, any necessary corrective actions are also identified and implemented.

OHD uses the General Services Administration's (GSA) Federal Supply Schedule Contract Blanket Purchase Agreements (BPAs). The BPAs eliminate contracting and open market costs such as: the search for sources; the development of technical documents and solicitations; and the evaluation of bids and offers. The BPAs further decrease costs, reduce paperwork and save time by eliminating the need for repetitive, individual purchases from the schedule contract. This creates a purchasing mechanism that works better and costs less. By using BPAs, purchases cannot exceed funds available thus always keeping the program within budget.

The OHD funding requirements discussed in this OA report cover a significant portion of the "Support" capability within NOAA's Hydrology Program. The cost lines are reviewed on an annual basis as part of NOAA's Planning Programming Budgeting and Execution System (PPBES) process.

4.0 Innovation to Meet Future Customer Needs

The following work highlights the efforts in the first quarter to address future challenges, better meet customer needs, make better use of technology, and lower operating costs.

4.1 NEXRAD Software

OHD participated in the testing and deployment of NEXRAD release Build 11. One major enhancement in Build 11 is the addition of the Clutter Mitigation Decision (CMD) which reduces clutter in reflectivity and, hence, precipitation products, although HSEB did not help implement that software. Build 11.1 which fixes an issue with the CMD has started Beta Test and is due to start full deployment by the end of July.

DUAL POLARIZATION:

As scheduled at the end of February, HSEB delivered the software for the dual pol QPE algorithm and products to the Radar Operations Center (ROC). This software and other dual pol algorithms and products implemented by ROC and OST and the operational dual pol hardware capability will be part of NEXRAD Build 12.

For the dual pol enhancement, the Radar Product Generator (RPG) software, including new algorithms and products, are being implemented by the ROC, OS&T, and OHD. The Radar Data Acquisition (RDA) software and hardware changes for the dual polarization enhancement are being done by a private contractor, Level III Communications.

In the summer of 2009, the ROC test bed WSR-88D was upgraded with dual pol, and OHD, OST, and ROC started real-time testing of the dual pol software. Following an extended Beta Test period, deployment of Build 12 and the dual pol enhancement begins in late 2010 and lasts into 2012. The long integration and testing period is due to the complexity and magnitude of the dual pol enhancement. The long deployment period is because a major hardware change is part of the enhancement.

4.2 AWIPS Release OB9

HSEB delivered software for OB9.0 projects in May 2008 and deployment began in late January 2009. Unfortunately, a number of problems were found with the OB9.0 software, especially with the RFC-only software which is no longer maintained by HSEB. Raytheon resolved these problems with an OB9.0.2 maintenance release. There are a few special releases scheduled after OB9.0 but before AWIPS II. Our major OB9 projects and work are summarized below.

HIGH-RESOLUTION PRECIPITATION NOWCASTER (HPN)

HPN provides mosaicked radar-based high-resolution forecasts of precipitation rate every 5 minutes. The forecasts are at 15 minute increments up to an hour and of 1-hour precipitation accumulation. HPN uses HPE mosaic grids as input. The HPN forecast accumulation can be used as input to the Flash Flood Monitoring and Prediction (FFMP) tool and to the Site-Specific Hydrologic Predictor (SSHP) model. Also, both the forecast rates and accumulations can be viewed in D2D.

VARIATIONAL DATA ASSIMILATION (VAR) FOR SSHP

VAR capability has been added to the SSHP model to update information about soil moisture conditions, thereby improving accuracy of the resulting stream forecasts.

WFO HYDROLOGIC FORECAST SYSTEM (WHFS) IMPROVEMENTS

The RiverPro application was modified to incorporate Common Alert Protocol (CAP) codes around the call-to-action section, in coordination with CAP changes planned for all watch, warning, advisory products. Also, the ability to perform basic arithmetic operations on numeric template variables was added, and the existing latitude and longitude template variables will be useful for more locations as the feature was expanded beyond just river locations. The rate-of-change quality control operation ("roc checker") was modified in a small but important way by designating data that fails the check as being "bad", rather than just "questionable". Bad data is ignored for use in data intensive applications such as precipitation derivations. Also, a change in the format options for the hydrologic IHFS "alert_alarm" data reports was made.

PRECIPITATION PROCESSING IMPROVEMENTS

Noteworthy changes include the revamping of the Multisensor Precipitation Estimation (MPE) gage table, allowing improved user interaction and supporting more precipitation fields. The satellite-radar-gage products also have a numerical adjustment algorithm incorporated to smooth the transition between areas of different sourced precipitation estimates. Lastly, some minor but important changes to the point precipitation derivation algorithms will provide improved derivations of irregularly reporting data, such as from the NWS Automated Local Evaluation in Real Time (ALERT) networks. These changes will affect values displayed in HydroView point data displays (ad-hoc and time step modes), HydroView point precipitation utility window, RiverPro precipitation extractions, and the precipitation monitoring component of PrecipMon.

AWIPS SYSTEM CHANGES

The AWIPS Software Engineering Group (SwEG) approved an upgrade to the FORTRAN compiler from Portland Group very late in the OB9.0 development process. Upon deployment of OB9.0 software, major problems relating to this change manifested themselves at RFCs, and at WFOs in the case of the SSHP application. The AWIPS contractor prepared an emergency release (OB9.0.2 for July) to address these issues. An upgrade to the RedHat Enterprise Linux operating system from RHEL 4 to RHEL 5 is planned as a maintenance release, OB9.1. The latest AWIPS schedule shows general release dates of 7/21/09 for OB9.0.2, 8/31/09 for OB9.1, 11/9/09 for OB9.2, and 1/8/10 for OB9.3.

4.3 AWIPS Release OB9.2

Release OB9.1 updates the Linux operating system. The OB9.2 release contains fixes for several bugs and the MPE/Daily QC changes for National Mosaic & Multi-Sensor QPE (NMQ) and Community Hydrologic Prediction System (CHPS).

PRECIPITATION PROCESSING IMPROVEMENTS

We made critical changes to MPE/Daily QC related to NMQ and CHPS and provided these changes to RFCs via an AWIPS Testing Authorization Note (ATAN). With OB9.2, those changes will be included in the AWIPS baseline. The MPE/Daily QC changes are described below in more detail. The changes related to CHPS are described in the CHPS section.

For 1-hr MPE precipitation processing, new options were added to read, process, and display NMQ-based grids. NMQ is an experimental system developed and maintained by NSSL; for more information see http://nmq.ou.edu/. The new options include the ability to read and display the raw radar-only NMQ grid and to use the raw grid to generate a local-bias corrected grid. The local-bias corrected grid can be used to generate a multi-sensor grid using the same algorithm used to generate the other multi-sensor grids within MPE. For Satellite-Radar-Gage (SRG) fields, a check was added so that if a top-of-the-hour satellite product is missing, MPE will look for a 15 minute after-the-hour product.

For 6-hr and 24-hr MPE/Daily QC precipitation processing, new options to generate netCDF format files and GRIB1 format files were added. The netCDF format files can be read by GFE. Also, the ability for the forecaster to edit a time distributed 6hr precip value was added.

4.4 AWIPS 2

Raytheon continues to migrate the national AWIPS baseline software suite into a new, modern services-oriented architecture (SOA) as part of overall AWIPS evolution process. The AWIPS software migration is being performed under four task orders: Task Orders (TO) 8, 9, 10, and 11. The TO9 software was delivered in September 2008 and included run-ahead basic SHEF decoder capabilities and time series display features. Raytheon delivered Task Order 10 (TO10) to the NWS in February 2009. TO10 includes the migrated SHEF decoder, TimeSeries display, HydroBase, and portions of HydroView and the Multi-Sensor Precipitation Estimator (MPE) applications. Other applications such as the metar2shef decoder, DPA decoder, HydroGen, and SSHP are being left unchanged and will be configured to operate in the new architecture. Many hydrology software components were scheduled for TO11 or have been deferred to TO11 since they were not completed in TO10. As such, TO11 is an important milestone for hydrology and AWIPS migration efforts.
In February, Raytheon announced the functionality for Task Order 11 (TO11) would be delivered to the NWS in a series of six monthly slices beginning in April. Each of the first three slices was delivered early in the appropriate month (April 8, May 6, and June 3) and was installed for testing by HSEB. Much of the hydrology related functions had been deferred to TO 11, but Slice 3 was described to contain the first significant hydrology functions: all HydroView and XDAT functionality. After overcoming some installation difficulties, HSEB testers subjected the software to a thorough review. So far, HSEB has written14 Test Trouble Reports (TTRs) against this slice to identify missing or defective functionality in Slice 3.
In March and early April HSEB folks spent a lot of effort completing the hydrology related portions of the Master Deliverables Matrix which identified all the functionality expected in AWIPS II. We also mapped test cases and procedures to this functionality. Interactions between Raytheon/Omaha developers and OHD personnel included Technical Interchange Meetings (TIMs) attended by Mark Glaudemans in April and Paul Tilles in May. In June, OHD sent a tarball containing the latest MPE code to Raytheon/Omaha. This code contained the changes related to the Q2 fields and other changes made for DailyQC 6hr and 24 hr processing. This was an attempt to get the latest MPE/DailyQC changes into AWIPS II for RFCs if it was not possible to get them into OB9.2. It appears now that OB9.2 is the preferred route.
In early July, HSEB received the slice 3.1 software and began testing it. HSEB received the combined slice 4/5 software, which included MPE functionality, very late in August and have tested that software throughout September. During the past quarter, HSEB wrote 78 TTRs to identify missing or defective functionality in Slices 3, 3.1, and 4/5.
The Systems Engineering Center (SEC) within the NWS OS&T is managing the testing and evaluation of this and all AWIPS II task orders. OHD is providing considerable support for the TO11 test and evaluation. In addition to conducting testing, OHD is also working with SEC personnel to identify and resolve "gaps" in the test cases for hydro applications. WFOs and RFCs are encouraged to obtain, install, and evaluate TO11 software.

4.5 Community Hydrologic Prediction System (CHPS)

Visit the CHPS web site at http://www.nws.noaa.gov/ohd/hrl/chps/index.html. The "News & Activities" section contains reports from these HSEB quarterly newsletters. The CHPS page can also be accessed from the main OHD page (http://www.nws.noaa.gov/ohd/).

CHPS PROJECT MANAGEMENT TEAM

CHPS migration is split between a pilot group (the CHPS Acceleration Team, or CAT), followed by the remaining offices (CAT-II). The CAT weekly conference call minutes are available at http://www.nws.noaa.gov/oh/hrl/chps/meeting_minutes.html. Through FY2009 4 CAT RFCs completed planning, multiple preparation and migration workshops, prepared for parallel operations, participated in testing, rapid application development on the Interactive Forecaster Displays (IFD), and completed migration of their NWSRFS configurations. The CATs report that they expect to be ready for parallel operations on schedule in October 2009. OHD gave monthly CHPS project status updates to the CAT-II and the Regions on January 8, February 12, and March 12, April 9, May 14, and June 9. These briefings are intended to gradually increase exposure of the CAT-II RFCs to the CHPS project, and to answer questions. The briefings are supplemented by other exchanges, including a "CHPS Day" at the national HIC meeting and a weekly CAT-II conference call, which was initiated on March 10. The weekly conference calls initially focused on deriving a Baseline Operational Capability (BOC) for the CAT-II RFCs, using the CAT BOC document as a starting point.

CHPS HARDWARE

CHPS "prototype" hardware was delivered to the CAT RFCs in October 2008. Deltares and OCWWS HSD traveled to NERFC to conduct the installation and to develop installation instructions for the remaining CAT RFCs. The hardware consists of a Master Controller, a Forecasting Shell Server (FSS) and a Database Server. These 3 servers together comprise an "Online Standby" system; another 3-server hardware suite to be added in 2009 will form the "Online Duty" system. The Operator Client software will run on existing AWIPS LX workstations. Together these form the prototype operational hardware for CHPS. Plans to evolve from the CHPS prototype hardware to AWIPS baseline hardware have still to be worked out between OHD and OS&T.

In November Randy Rieman (OCWWS HSD) traveled to NERFC to install the hardware and finalize installation instructions in the form of an AWIPS-like "mod note". The instructions were then used by the other CAT RFCs to install their hardware locally. In early December Randy Rieman and Xiaobiao Fan (also OCWWS HSD) traveled with Frederik van den Broek (Deltares) to NERFC to learn how to install the FEWS server software on the new prototype hardware. Having successfully mastered the necessary skills, Randy went on to install the FEWS software at NWRFC later in the month. Installations for ABRFC and CNRFC were completed in January.

Purchase of the second set of prototype hardware for the CAT RFCs and the first set of hardware for the CAT-II RFCs was initiated in June. Delivery is expected to be in early October 2009.

CHPS SOFTWARE

In FY2009Q1 HSEB developers completed the initial migration of all the NWSRFS models selected to be part of the CHPS Baseline Operational Capability (BOC). Formal testing of the migrated models in the CHPS environment began the week of December 15. One major capability, the CarryOver Transfer function, was completed in Q2.

In early December HSEB delivered data transfer scripts for testing at ABRFC and CNRFC. These scripts fulfill two tasks: making data extracted from the IHFS database by the OFSDE program available to the FEWS ingest process and transferring input data to a Deltares server to support testing and transition. Policy issues were raised with the latter function which delayed the use of the scripts.

HSEB developers finished migration and testing of the legacy models required for BOC II. These models are planned to be formally tested in December 2009. HSEB developers also worked with Deltares developers to improve the performance of CHPS model runs, especially for ensembles. The improvements were formally tested during the September SAT in Silver Spring.

Quarterly testing was performed. The testing in December was the first formal testing of CHPS with the migrated legacy models integrated with the FEWS system. The April and June tests demonstrated that the CHPS BOC I models produced equivalent results as the NWSRFS

counterparts. At the conclusion of the June tests, CHPS OHD release 1.1.1 was disseminated to the CAT RFCs for their use in migrating to CHPS. At the conclusion of the September tests, OHD CHPS Release 2.0.1 was disseminated to the CAT RFCs for their use in starting CHPS parallel execution. HSEB have supported the CAT RFC migration efforts in conjunction with HSD and Deltares. We investigate each operational support problem which might be related to a problem with the legacy models. When a software problem is identified and corrected the fixed software is packaged and released through the HSD and Deltares.

Deltares held several IFD joint design meetings with some of the CAT forecasters. The focus of the design is to maximize forecaster efficiency (minimize mouse and button clicks) when navigating the user interface, while providing access to all functionality. Some AWIPS-like use of screen "real estate" has been included in the design. In mid-June Deltares delivered to the CAT representatives a demonstration version of the CHPS IFD for evaluation and testing.

CHPS FORCINGS

During the summer of 2008, the CAT made a strategic decision that all forcing data required by the river modeling operations within CHPS would be: a) provided by methods external to CHPS and b) would be provided in gridded form. This decisions means that the existing MAP (Mean Areal Precipitation) and MAT (Mean Areal Temperature) pre-processors will not exist within the new CHPS framework. To accommodate the planning and development necessary for the transition to the new operational approach, a new CHPS Forcings team was established and conducted their first set of conference calls in November 2008.

The elements being considered by the team are precipitation, temperature, freezing level, and potential evapotranspiration, in both the observed and forecast domain. The team is considering the methods to generate these grids, and the physical form of the grids, along with the interface to and usage by the CHPS infrastructure. Discussion to this point has identified use of GFE, MPE/DailyQC, and local applications to generate these grids. The grid form definition includes the grid spatial resolution, grid projection, and grid format. The grid formats to be used for CHPS ingest are not yet decided, but will likely be in GRIB format Another consideration is the temporal resolution of the grids but that is dictated more by the model operations. The immediate team focus is on ensuring proper grid forcings are available for BOC-1, but attention is also being given to BOC-2 and beyond.

The CAT RFCs made major progress in developing methods for generating the gridded forcings data using a combination of GFE methods, MPE/DQC, and local applications. Descriptions of the methods being adopted are also available on the CHPS Forcing team web site. For the BOC-1 period, the grid format used will be GRIB1. OHD has completed prototype methods for transforming GFE output into GRIB1 and we are now working on getting the GRIB1 data imported into FEWS. OHD has also made modifications to MPE/DQC as requested by the RFCs to allow operational use of the DQC mode of MPE. The team is continuing discussions and preparing for the FEWS import of the generated grids and the subsequent side-by-side evaluations which will follow.

A temperature processing application has been developed by OHD which uses hourly reports and maps the data to a grid using distance-PRISM-weighting. Before incorporating a lapse rate adjustment, OHD has suspended work on this application in lieu of RFC evaluations of the RTMA temperature products. Also, OHD is considering incorporating a quadrant-based distance-weighting MAP algorithm into MPE/DQC which would emulate the MAP pre-processor methods.

OHD completed upgrades to MPE/DailyQC to generate grids in netCDF and GRIB1 formats. The netCDF format grid can be ingested by GFE for further processing. The GRIB1 format file can be sent directly to CHPS. The NC2GRIB application was completed which is used to transform netCDF format files (output from GFE or MPE/DailyQC) into GRIB1 format. This application offers a second pathway for generating grids to be ingested by CHPS. OHD worked with NWRFC and Deltares personnel to successfully test ingest of GRIB1 format grids into CHPS.

HSEB developers completed changes to MPE/DailyQC aimed at AWIPS Release OB9.2 and are currently providing support for OB9.2 testing. In addition, developers are working on a few further enhancements which have been identified as being necessary for smooth operations in CHPS. These enhancements will be completed and tested under an ATAN at the CAT RFCs after OB9.2 has been deployed.

HEC RAS

The US Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) delivered a Linux version of the River Analysis System (RAS) software to Deltares in early December. Testing by Deltares at NERFC is expected to occur in late January. With the delivery of a Linux-based RAS, Deltares can now complete their software development activities.

Deltares and HEC met at the Resource Management Associates (RMA) facility in California during the final week of June to address outstanding technical issues with interoperability between FEWS and the Linux version of RAS. RMA is the U.S. Army Corps of Engineers Hydrologic Engineering Center's (HEC) contractor for this task. During this visit Deltares was also able to provide the necessary information for RMA to accept software maintenance responsibility for the Java-based FEWS adapter for RAS. Deltares conducted tests of the HEC-RAS during SAT on September 21-23; most tests passed but HEC has been asked to implement one more fix before HEC-RAS will be considered fully ready for operational use with CHPS.

HEC RESSIM

Deltares conducted tests of the HEC-ResSim during SAT on September 21-23; all tests passed. However OHD is waiting for a revised version of HEC's software which correctly handles warm states; formal testing for this version is expected to occur in December. At the present time CNRFC executes HEC-ResSim from NWSRFS; they will be the first RFC to run it within CHPS. Other RFCs are considering implementing HEC-ResSim in the future.

Experimental Ensemble Forecast System (XEFS)

EXPERIMENTAL ENSEMBLE FOREAST SYSTEM (XEFS)

On November 21, Albrecht Weerts (Deltares) initiated a series of bi-weekly conference calls to better define how the various XEFS components will fit within the FEWS infrastructure and within CHPS. Participants include Rob Hartman (CNRFC), Mary Mullusky, DJ Seo, Hank Herr, Mark Fresch, Chris Dietz, and Julie Demargne. The group is developing a document entitled "Linking XEFS components with CHPS-FEWS: Functional Requirements". Albrecht will also visit OHD during the first week in January to discuss some major XEFS topics, and to define the steps necessary to get an early XEFS out to one or more CAT RFCs.

In January 2009, Mark Fresch took over as XEFS project area leader, started leading weekly XEFS planning meetings among key partners, including Rob Hartman (CNRFC), Mary Mullusky (OCWWS/HSD), representatives from Deltares, and members of OHD's HSMB and HSEB. In addition, in late January and mid-March, we had a series of planning meetings with Deltares. We have set a goal by early Fall 2009 to have the main XEFS components integrated into CHPS.

The XEFS project definition has been subtly changed to include only experimental non-baseline versions of new ensemble-related software, such as the new Ensemble Preprocessor 3 (EPP3). Any new baseline ensemble-related software will be part of the HEFS which is intended to be the operational name to follow XEFS.

XEFS components will be available by fall 2009 as prototypes interfaced to CHPS and FEWS through model adapters. These components are a new Ensemble Preprocessor (EPP), Ensemble Postprocessor (EnsPost), Ensemble Verification System, and Hydrologic Model Output Statistics (HMOS). Each of these components will be available to RFCs with CHPS for field testing. In addition, each of these components will undergo a second phase where the prototype is re-factored into baseline CHPS software.

The Graphics Generator (formerly known as the Ensemble Product Generator (EPG)) will go straight

into the CHPS baseline and will be the first HEFS component. The Graphics Generator will be a GUI where users can change the look of graphics or displays and an engine to create the graphics. The Graphics Generator will be implemented in phases with approximately 6 months between phases. For phase 1 of the Graphics Generator, by fall, we will implement the same functionality as the existing Ensemble Streamflow Prediction Analysis and Display Program (ESPADP). During the past quarter, we completed the phase 1 requirements and design and started coding the Graphics Generator. For phase 2 of the Graphics Generator, the functionality will be extended to deterministic displays. During the quarter, the phase 2 requirements were completed.

For the EPP3 XEFS prototype component, we began work to interface the software with CHPS and FEWS by developing two module adapters and started integration testing of the combined EPP3 prototype and model adapters within CHPS and FEWS.

To help make XEFS easier to use and move toward operations, OHD will be setting up a one-stop web page to provide the needed software (models and adapters) and documentation (installation and configuration notes and users guides).

4.6 Development Environment Information Technology (DEIT)

CUSTOMER SERVICE TICKETS

- The Information Technology Support Group (ITSG) received 750 new work tickets in FY08, and closed 780 tickets. As of 9/30/2009 ITSG had 30 open tickets.
- ITSG supported the online publication of NOAA Atlas 14, Volume 4 “Precipitation-Frequency Atlas of the United States, Hawaiian Islands”
- All FY09 POA&Ms were completed on schedule.
- A building-wide power outage in September 2009 resulted in a complete failure of all DEIT systems. ITSG successfully restored system functionality within 4 hours.

HARDWARE STATUS

- The last two Sun machines were retired in FY09. The entire DEIT system now runs exclusively on RedHat, which reduces maintenance costs.
- ITSG implemented linux-based virus scanning for all DEIT machines.
- ITSG upgraded the listserv software to a web-based system, improving overall usability.

DEVELOPMENT SYSTEMS

- Through FY09, ITSG installed 3 cycles of CHPS and 6 cycles of AWIPS 2 for testing.
- ITSG instituted additional “virtual machines”. Virtual machines are easy to set up, run independently from the AWIPS development environment, and therefore are ideal for science testing and other “special case scenarios”.
- DEIT now consists of multiple development environments – AWIPS 1 (OB9.1, OB9.2), AWIPS 2 (task order 11 slice 6, both standalone and distributed), CHPS 2.0.2, and 14 virtual servers. Additional virtual servers are planned for FY10.

4.7 Hydrometeorological Automated Data System (HADS)

SYSTEM AND SOFTWARE

The software enhancements of implementing gage corrections values, based upon details received from the USGS continues to move forward. There are several phases to evaluating and implementing these corrections, most of which will be fully automated in the near future. We are now at the point in which a manual review occurs before any automated adjustments are allowed, but we are beyond the point where manual adjustments are routinely performed.

This service is directly related to changes in the USGS web based National Water Information System (NWIS). Now that the USGS has completed the modernization of its system and that all district offices are now providing gage correction tables to a single national server, HADS is

routinely retrieving these tables for processing. Unfortunately there are no hard standards for the content of these correction tables and we must evaluate and adjust processing as new/different content is encountered.

In addition to these gage correction values there is another type of data adjustment identified by the USGS as 'draw down corrections'. These data value adjustments are quite different; they are variable and are dependant upon the location of the water level measuring device and the effects of nearby structures that negatively impact the observational values. The process to adjust values at these data locations with known draw down correction factors is now fully automated within the data decoders.

There will still be times in which the HADS stage data for a site will be temporarily out-of-sync with the USGS posting for that same site. There are cases in which a gage correction appears on NWIS before there is access to the correction file. And there are times when the content of the correction file is not fully up to date.

Another improvement that occurred during the past several months involves our ability to provide a cross reference of GOES IDs to USGS station numbers for those DCP locations owned to the U.S. Army Corp of Engineers (USACE) but operated/maintained by the USGS. Basically any USACE DCP that appears on NWIS, is now cross-referenced in HADS at:
http://www.weather.gov/ohd/hads/USGS/

DATA NETWORK

As of September 30, 2009 there were now 13,972 data locations defined for HADS processing, an increase of 680 data points since October 1st. The number of data values delivered to NWS operations is now averaging 2.65 million each day. Details describing numbers and primary types of sensors processed can be found at: http://amazon.nws.noaa.gov/hads/parms/parms.html. The reporting interval of data platforms and the timeliness of data continue to improve. Seventy-two percent of the network provides new data each hour and the majority of hydrologic platforms provide stage and rainfall data at sub-hourly intervals. There are now only 3,000 defined data sites still on the old 4-hour reporting cycle and most of these will convert to hourly reporting over the next couple of years.

Due to the expanded use of gage correction values, an enhancement to the public HADS web pages was implemented that altered the display of Data Collection Platform (DCP) meta-data. Historically most adjustments to observed water level data values were depicted in the field entitled "Base Elevation", but with the significant growth in the use of gage correction values it became apparent that our services needed to be improved in order to add clarity to the use of gage adjustment values. Therefore Base Elevation values and Gage Correction values have been separated. The change was put in place to clearly identify each. The Base Elevation field is used solely to present values, generally permanent in nature, that adjust the observed value due to a defined Sea Level elevation or a defined Datum. The Gage Correction field is now used to depict a gage correction value, expected to be temporary, and likely to be altered as conditions warrant.

Another enhancement to HADS web services was enacted in order to present, in near real-time, the USGS and Corp of Engineers data locations that are subject to draw-down adjustments. The web page at http://amazon.nws.noaa.gov/cgi-bin/hads/listGageCorrectionsWeb.pl presents the data points at which known draw-down adjustments are in place. Sites are added to, or removed from this database table as details are received from the gage operator.

Two important meteorological sub-networks within HADS are NCDC's Climate Reference Network (CRN) and the Historical Climate Network – Modernized ((HCN-M). During the past several months NCDC has altered the programming and added sensors to a number the CRN locations. These updated CRN sites now provide soil moisture and soil temperature data and timelier five minute readings of air temperature and incremental precipitation values. Over the next several months it is expected that all CRN sites will be altered to provide these types of information.

The fourteen prototype HCN-M sites in Alabama have been reprogrammed in order to provide much more timely temperature and incremental precipitation data. These data are recorded at five minute intervals and are now transmitted less than five minutes after the most recent observation is recorded. In the past, most of these data were 40 to 50 minutes old when first released for dissemination. Routine monitoring of the CRN network is performed since these sites change without prior notification to HADS personnel. There are unofficial indications that several HCN-M sites may be deployed in Colorado, New Mexico, Arizona, or Utah later in the year. As HADS learns of their deployment, pertinent information will be provided to the appropriate field offices.