National Oceanic and Atmospheric Administration
National Weather Service
Advanced Weather Interactive Processing System (AWIPS)
Annual Operational Analysis
for January - December 2006

This annual Operational Analysis (OA) report is a status review of the Advanced Weather Interactive Processing System (AWIPS) program in terms of financial performance, system performance, and customer results.   The program continues to meet established cost, schedule and performance parameters and directly facilitates NOAA's strategic goals to; a) "Serve society's needs for weather and water information", b) "Understand climate variability and change to enhance society's ability to plan and respond", and c) "Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation"

The mixed lifecycle AWIPS O&M baseline consists of 169 individual AWIPS systems at 137 geographical locations across all 50 states, and Puerto Rico, and Guam. AWIPS is the primary operational IT system for the operational National Weather Service (NWS) in all six NWS Regions. AWIPS also supports operations at four NCEP Centers; NASA's Spaceflight Meteorology Group (SMG), and supports training at the NWS Training Center and COMET. The AWIPS system is critical to the NWS mission of providing climate, water, and weather forecasts and warnings for the protection of life and property and enhancement the national economy. Along with the field forecaster, AWIPS is critical in enabling the NWS to meet almost every NWS Government Performance and Results Act (GPRA) goal.

1.0   Financial Performance

An annual, recurring O&M investment of $37.6 M provides for a high system availability and would sustain an excellent level overall AWIPS customer satisfaction, however, congressional reduction of $3.9 M/yr in this O&M funding in FY06 has caused us to defer important sustaining engineering activities due to the lack of adequate funding. To deal with this shortfall, we have had to extend hardware warrantees instead of fully executing our planned Continuous Technology Refresh (CTR) hardware refresh (sustaining engineering) projects. This O&M investment must continue in order for NOAA to meet its Strategic Goals of Serving Society's Needs for Weather and Water; and Supporting the Nation's Commerce with Information for Safe, Efficient, and Environmentally Sound Transportation.

The Office of Science and Technology (OST) uses several systems to measure and track financial, schedule, and performance metrics.

a. Cost: OST has oversight responsibility for the AWIPS O&M budget. OST has managed this budget since the program was transferred from the NOAA Systems Acquisition Office to the NWS in 1999. Budget development and execution have been accomplished using PC-based spreadsheets (currently Microsoft Excel) linked to the NOAA financial management systems. These spreadsheets have been used to compare actual cost data to budget models and to make the required model adjustments for subsequent budget development cycles. For seven years, OST

Program Analysts have worked with the Regions to understand AWIPS operations and to establish an O&M budget that ensures AWIPS helps to achieve NOAA's strategic goals at the lowest life-cycle cost and least risk. Cost and financial data are monitored to identify discrepancies with the approved financial plan and to develop corrective actions. The AWIPS prime contractor uses MPM and Primavera to track contract cost and schedule performance and reports this on a monthly basis. This data is also used to monitor contractor performance, contractor rate adjustments, support program/budget reviews, and to answer questions from NWS, NOAA, and DOC management, OMB and the Congress.

b. Schedule: There are typically three to four active software releases in some stage of development, testing or deployment at any one time. The NWS Systems Engineering Center (SEC) plans these software releases as individual projects, using PC-based scheduling software, (currently Microsoft Project) managing and coordinating efforts of the AWIPS prime contractor and Government development organizations. Once schedules are approved by the NWS Operations (Ops) Committee and NWS senior management, they become the baseline used to measure project status. The prime contractor's schedule performance is tracked using Primavera and MPM and is reported monthly. The schedule status of these projects is reported to NWS senior management on a monthly basis via Quad Charts, Brick Charts, and routine Major Investment Reviews.

c. Performance: System performance is routinely and systematically monitored by the Prime Contractor and the NWS Systems Engineering Center. The AWIPS Network Control Facility (NCF) is contractor staffed 24/7/365 and supports all AWIPS sites in the network. Analysis of system performance, availability, and trouble tickets generated at the NCF is reported monthly in the Performance and Availability Report (PAR). Several key program level performance measures are tracked on a regular basis to determine the effectiveness of the program. Key performance measures are: (1) Workstation Performance Rating; (2) Average Message Latency; (3) Satellite Broadcast Network Availability; and (4) NCF Customer Satisfaction Survey Results.

AWIPS receives executive level guidance from the Operations (OPS) Committee of the NWS Corporate Board. The OPS committee establishes direction from an operations perspective for the program, as well as establishing software maintenance priorities for the program. There is a dedicated AWIPS Program Manager (PM) who manages the day to day operations and maintenance and technical evolution of the system within the strategic guidance provided by the Operations Committee. The AWIPS PM is a certified Project Management Professional (PMP) by the Project Management Institute (PMI). Changes to the system configuration and new requirements are carefully managed by the AWIPS Configuration Control Board (CCB), which is chaired by the AWIPS Program Manager. Subordinate to the CCB are several technical management Integrated Product Teams (IPTs), including the AWIPS Partnership IPT, the Software Engineering Working Group (SwEG), and the Software Requirements Evaluation Committee (SREC).

In addition to the NWS AWIPS management structure, AWIPS is also subject to, and complies with, the OMB requirements of Circular No. A-11, Planning, Budgeting, Acquisition, and Management of Capital Assets; and NOAA's Planning, Programming, Budgeting, and Execution
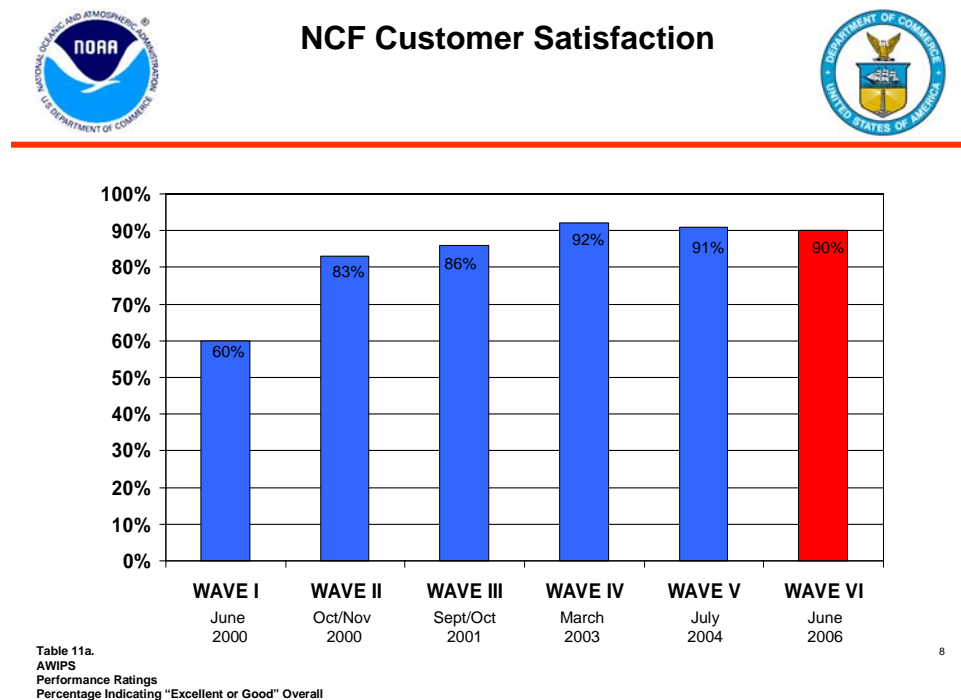
System (PPBES). This ensures the AWIPS O&M investment is exposed to a rigorous review and decision making process that assesses AWIPS performance relative to its contributions to NOAA's strategic goals and that it continues to be a viable and worthy investment.

The most recent review of this investment was accomplished during the annual AWIPS Program Review (APR) which took place on January 30, 2007. During this review all NOAA organizations that contribute to the AWIPS program were required to present their historical FY06 tasking, labor and subcontract costs, and spend plans as well as their plans for FY07 execution. These annual program reviews are key to managing AWIPS O&M cost and schedule performance. The next AWIPS Program Review is scheduled for January 2008.   Further, this investment was reviewed by both the NOAA IT Review Board (NITRB) on July 6, 2006 and the Commerce IT Review Board (CITRB) on July 26, 2006 as a Post Implementation Review IPIR) for the Linux Roll-out.   Cost, schedule, and performance were addressed at the NITRB and CITRB briefings.

FY06 carryover of AWIPS O&M funds was less than 1% indicating that ongoing expenses are nearly equal to the current funding level.

2.0   Customer Results

Customer Satisfaction for 2006, as measured by our annual independent customer satisfaction survey was 90% for the year, exceeding the threshold of 85%. A chart showing the trend in AWIPS customer satisfaction, as measured by this survey, is shown below.

NCF Customer Satisfaction

	WAVE I	WAVE II	WAVE III	WAVE IV	WAVE V	WAVE VI
	60%	83%	86%	92%	91%	90%
	June 2000	Oct/Nov 2000	Sept/Oct 2001	March 2003	July 2004	June 2006

Table 11a.
AWIPS
Performance Ratings
Percentage Indicating "Excellent or Good" Overall

8

2.1 Significant Accomplishments and Milestones

The initial AWIPS O&M contract expired on October 30, 2005 and contract transition costs were substantial, but were be fully covered by the FY06 appropriation. Key near-term schedule milestones are shown below.

a. Begin deployment of software Operational Build 7 (OB7) in November, 2006. OB7 is the final decommissioning build for the aging AWIPS Data Server (DS).
Current status: Milestone complete.

b. Begin deployment of software Operational Build 8 (OB8) in August 2007.
Current status: On schedule.

c. Award of the follow-on AWIPS O&M contract in August 2005. This is a performance based contract for the continuation of AWIPS O&M, including software integration and test.
Current status: Milestone completed. The contract was awarded on August 17, 2005

d. Completion of the AWIPS Software Product Improvement Plan (PIP) by October 2006.
Current status: Milestone completed

f. Completion of the Local Data Acquisition and Dissemination (LDAD) Server by late calendar year 2007.
Current status: On track.

2.2 Problems Experienced

No significant problems were experience during calendar year 2006.

2.3 Adjustments of Plans

The AWIPS FY06 appropriated budget of $33.9 M (reduced from the president's budget by over $3.9M) was sufficient to maintain current operations; however, some important sustaining engineering projects had to be deferred due to this reduction. Government FTE labor costs and corporate costs are an increasingly large burden that will begin to affect program execution in 1-2 years if labor costs continue to escalate at the current rate, and the budget reductions (from the President's Budget) are sustained in future fiscal years.

2.4 Performance Measures – Strategic and Business Results

The following performance goals have been established to ensure that the AWIPS O&M investment continues to further agency goals and objectives:

Performance Metric	Threshold
Workstation Performance Rating (WPR) Benchmark	*110.3 seconds **
Low Priority Message Latency (averaged monthly)	*60 seconds **
Warning Message Latency (averaged monthly)	*60 seconds*
Satellite Broadcast Network (SBN) availability	*99.5%*
NCF Customer Satisfaction Survey Results	*85%*
(% of respondents rating service good or excellent)	

* The threshold for WPR was revised from 155 seconds to a more stringent value of 116 seconds, and the Low Priority Message threshold was revised from 80 seconds to a more stringent value of 60 seconds on June 22, 2006 as a part of our Continuous Process Improvement (CPI) process. These values are periodically reviewed and revised if needed to improve the quality of service AWIPS provides.

The latest performance data is as of December 31, 2006. The data shows AWIPS is meeting or exceeding all of its performance goals. Several key performance measures are tracked on a regular basis to determine the effectiveness of the program. Key measures are: Workstation Performance Rating; Average Message Latency (ML); Satellite Broadcast Network Availability; and NCF Customer Satisfaction Survey Results. AWIPS is currently meeting all the established metric thresholds shown above.

2.4.1   Workstation Performance Rating

The last time Workstation Performance Rating (WPR) was measured (with Operational Build 7.2) it was 22.9 seconds. This is well below the FY07 WPR threshold of 110.3 seconds and is a dramatic 26% improvement in this important metric from FY06. We hope this will improve with release OB8.1 and the full integration of the DX/NAS server cluster. A table of the WPR metric performance for the last few years is provided below. (Please note that the lower the value of the WPR measurement, the better.)

AWIPS Workstation Performance Rating (WPR)

	(Old Baseline) Old Hewlett Packard WS (100 Mbps)	(Full Phase I) ** Linux WS, PP, & CP	(Full Phase I) w/ IFPS @ 5 Km	(Full Phase I) w/ IFPS @ 2.5 Km	Operational Build 5 (March 05)	Operational Build 6 w/ DX June 06	"Most Recent" Operational Build 7.2 w/ new LX ***
T (secs) *	247 Sec.	108 Sec.	138 Sec.	149 Sec.	39 Sec.	31 Sec.	22.9 Sec.
CPU	71.6 %.	13.1 %	17.7 %	36.3 %	--	15.7 %	16.1 %

* "T" above is the total time required to run a series of scripted "Autotests" which perform meteorological actions such as loading various loops of model, satellite, radar, and observational data, in multiple panes simulating severe WX workstation ops.

** From Testing on the NMTW system conducted on 7/10/02 after PX Mod Kit installation

*** "Most Recent" WPR data from testing on the NMTW system conducted after OB7.2 alpha.and new workstation installation.
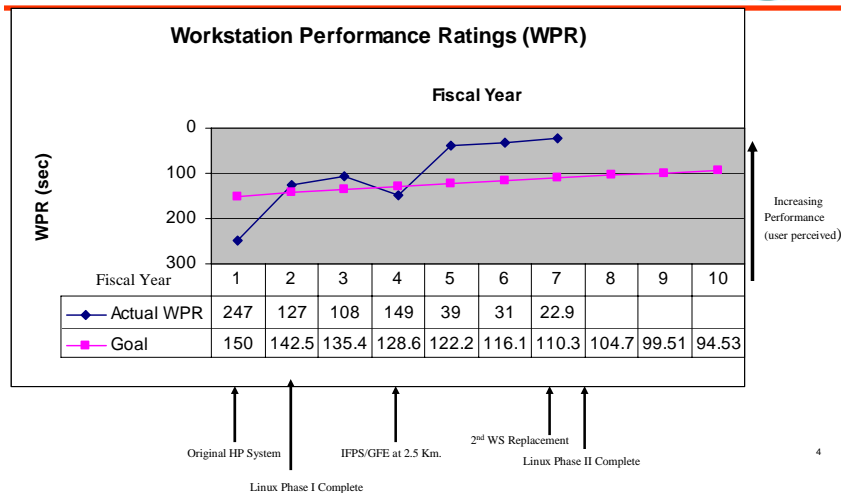
3

When these data are plotted against the threshold for each fiscal year, it can be seen that we have met our threshold for each year except for FY04, when the increased local processing demands of increasing the special resolution of our Interactive Forecast Preparation System (IFPS) from 5 Km to 2.5 Km impacted AWIPS system performance. Subsequent server and workstation refresh projects have increased the level of local computing capacity available, which has brought the WPR benchmark performance back up above the threshold.

Trend in AWIPS Workstation Benchmark Performance

User Perceived System Performance as measured by Workstation Performance Rating (WPR) Benchmark

Workstation Performance Ratings (WPR)

Fiscal Year

Fiscal Year	1	2	3	4	5	6	7	8	9	10
Actual WPR	247	127	108	149	39	31	22.9			
Goal	150	142.5	135.4	128.6	122.2	116.1	110.3	104.7	99.51	94.53

WPR (sec)

Increasing Performance (user perceived)

Original HP System

Linux Phase I Complete

IFPS/GFE at 2.5 Km.
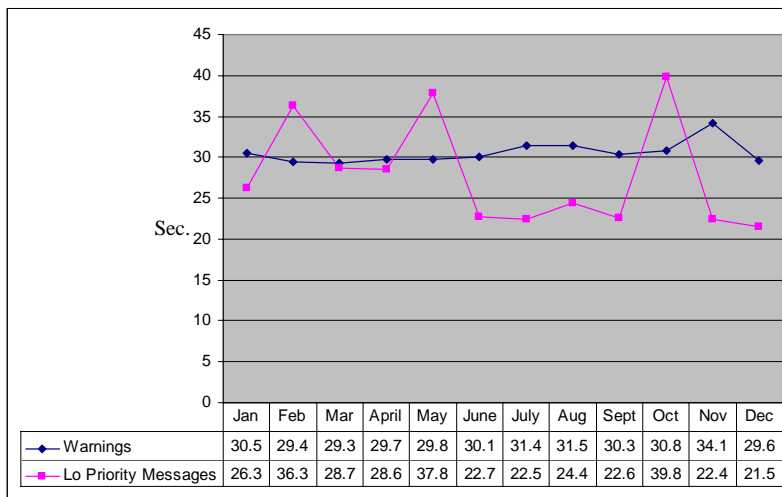
2nd WS Replacement

Linux Phase II Complete

4

2.4.2 Message Latency

The Low Priority Message Latency (ML) metric showed a slightly negative trend (this is good) for the year of 2006, decreasing from 26.3 seconds in January to 21.5 seconds in December. There were noticeable exceptions to this downward trend in February, May, and October that we believe were related to widespread weather events.   The Message Latency metric for 2006 is plotted below.

Trend in Overall AWIPS SBN Message Latency in 2006
Measured at all Hub sites, Averaged Monthly

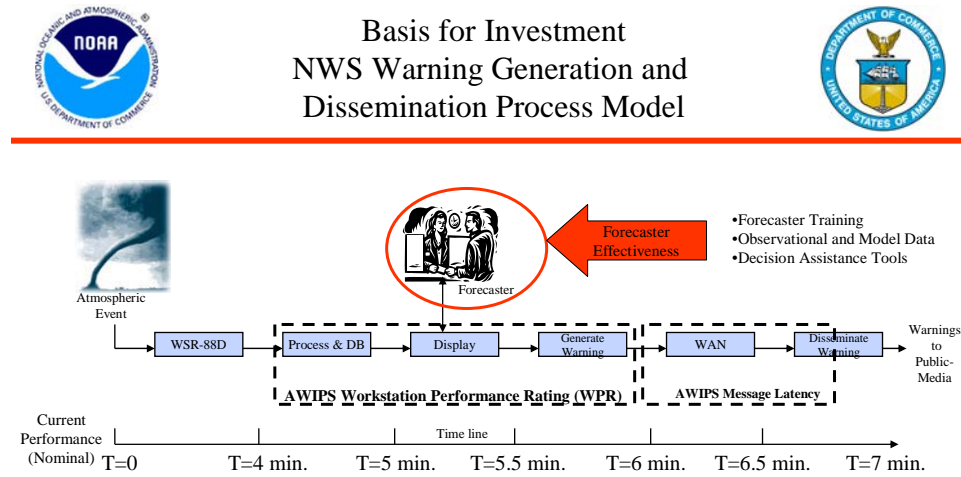|	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	
Warnings	30.5	29.4	29.3	29.7	29.8	30.1	31.4	31.5	30.3	30.8	34.1	29.6	Warnings Goal (60 s)
Lo Priority Messages	26.3	36.3	28.7	28.6	37.8	22.7	22.5	24.4	22.6	39.8	22.4	21.5	Low Priority Goal (60 s)

It should be mentioned that the low priority message timeliness exceeded the threshold (this is bad) in the January 2005 reporting period by 15.3 seconds or by 19.1%, and exceeded this threshold in June, 2004 by 44 seconds or 55%. Operational analysis indicates that the root cause of not meeting this performance goal in January, 2005 and at times during 2004 was related to the limited CPU and disk I/O capability of the aging 1995 vintage UNIX based AWIPS Data Servers, particularly when affected by the increased systems demands resulting from severe weather operations. Analysis shows that the PAC funded AWIPS Product Improvement (API) Data Server Replacement project, known as the DX/NAS, has brought this metric into compliance throughout 2006.   The December 2006 performance for this metric is below the threshold (this is good) by 38.5 seconds or 64.2 %. High priority message latency has been nearly constant through the year of 2006 with little variability.

2.4.3 Linkage of System Performance Metrics to Strategic and Business Results

We believe that the WPR and Message Latency metrics have a significant effect on how AWIPS supports important agency level Government Performance and Results Act (GPRA) goals such as Tornado Warning Lead Time (TWLT) and Flash Flood Warning Lead Time (FFWLT). We

use the following conceptual model to relate these system level metrics to the agency level GPRA goals like TWLT.

Basis for Investment
NWS Warning Generation and
Dissemination Process Model

•Forecaster Training
•Observational and Model Data
•Decision Assistance Tools

Forecaster Effectiveness

Atmospheric Event

| WSR-88D | Process & DB | Display | Generate Warning | | WAN | | Disseminate Warning | | Warnings to Public-Media |

AWIPS Workstation Performance Rating (WPR)   AWIPS Message Latency

Current Performance (Nominal)

Time line

T=0   T=4 min.   T=5 min.   T=5.5 min.   T=6 min.   T=6.5 min.   T=7 min.

Note: Delays shown here are notional. Actual system delays at an operational site depend on many variables such as weather, time of day, etc.

9

We believe that by optimizing system level metrics like WPR and ML we are helping to optimize agency performance as measured by GPRA goals for our agency.

2.4.4   Satellite Broadcast Network Availability

A highly available AWIPS Satellite Broadcast Network (SBN) is also critical to AWIPS and NWS operations, as well as to reliable dissemination of NOAA weather data and information to the private sector. The SBN uplink availability for the month of December was 99.84%, well above the threshold of 99.5%.   The SBN availability metric is plotted for all of calendar 2006 in the graphic below.

2006 SBN Monthly Availability

Requirement = 99.5%
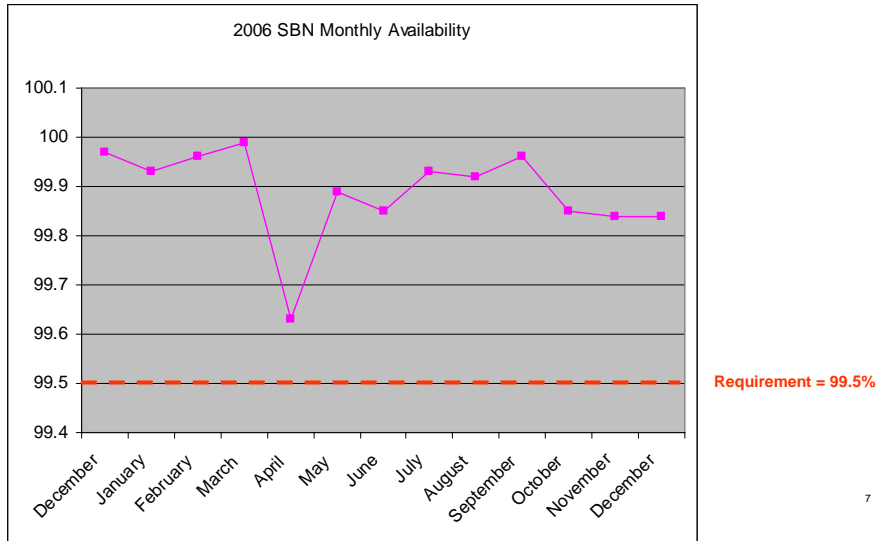
This metric has improved significantly from the April 2006 value of 99.63%. Analysis has indicated that he relatively low SBN availability in April was due to flawed procedures in the NCF related to SBN uplink equipment fail-over. A Corrective Action Plan (CAP) for this problem, which was delivered to the Government in mid 2006. Corrective actions associated with the CAP appear to have solved the problem, as evidenced by the increase SBN availability in the second half of the year.