14.2 AN UPDATE ON NEXRAD PROGRAM PLANS FOR COLLECTING AND DISTRIBUTING WSR-88D BASE DATA IN NEAR REAL TIME

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1. INTRODUCTION

The National Weather Service (NWS) operational requirements for use of Weather Surveillance Radar - 1988 Doppler (WSR-88D) data in near real time have grown as communications bandwidth availability and computational capabilities in the WSR-88D and connecting systems have increased. For example, Environmental Modeling Center numerical weather prediction (NWP) models have reached a sufficiently-small resolution and increased level of physics where the input of WSR-88D base data (aka Level II data) (Crum et al 1993) will increase the skill of NWP models. The Storm Prediction Center and Aviation Weather Center will be able to use regional and national mosaics of the highest-resolution WSR-88D data in near real-time to increase their ability to provide improved operational products. The end of the NEXRAD Information Dissemination System (NIDS) agreement has increased the government's flexibility to provide WSR-88D product and base data to a wider range of users in near real time.

In recent years the Radar Operations Center (ROC) has partnered with the National Severe Storms Laboratory, National Climatic Data Center (NCDC) and the University of Oklahoma Center For Analysis and Prediction of Storms to obtain funding for and execute the Collaborative Radar Acquisition Field Test (CRAFT) Project (Droegemeier et al 2002). This partnership has resulted in a successful prototype demonstration of the capability to compress, transmit, archive and use WSR-88D base data in near real time (time latencies of about 20 seconds usually) from over a third of the 158 operational WSR-88D systems.

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This paper provides an update on the NWS requirements for Level II data, the WSR-88D hardware in place to support the near real-time electronic collection of these data, and NWS plans for collecting and redistributing WSR-88D Level II data in near real time.

2. NWS WSR-88D DATA REQUIREMENTS

The NWS centrally collects and archives radar data to meet agency-validated operational requirements. The NWS Radar Product Central Collection Dissemination Service (RPCCDS) was created to provide the radar data NWS national centers required (NWS 1998). The NWS records and archives WSR-88D Level III/product data at the NCDC to satisfy the need to maintain a record of radar observations. The NWS records and archives Level II data at NCDC to satisfy the needs for research and development, testing, training, and other uses.

The NWS is transitioning from recording Level III data on physical media at each NWS RPG and sending the recorded media to the NCDC for insertion into the archives to use of an electronic transfer approach. By the end of 2002, the NWS will use the AWIPS and RPCCDS to send the Level III data electronically to NCDC in near real time. The benefits of this approach include lower WSR-88D maintenance costs, lower archive costs, increased reliability of data receipt at NCDC, and faster data availability at NCDC.

A motivation for the NWS participation in the CRAFT Project was to determine if WSR-88D base data can be reliably archived in near real time to obtain the same benefits realized by the electronic collection and archive of Level III data. Before the recent validation of the updated NWS requirements for near real-time WSR-88D base data (NWS 2002), the primary NWS motivation for establishing a near real-time network of electronic collection of WSR-88D base data was the cost-benefit of replacing the Level II 8 mm tape-based recorders. These recorders were installed in 1994, are labor intensive for field technicians to maintain and have become increasingly expensive to maintain. These recorders will

likely become unsupportable in FY03. Foreseeing this end-of-life situation, the NWS planned for and requested funding for the replacement of these recorders.

3. WSR-88D HARDWARE FOR BASE DATA COLLECTION

With the completion of the installation of the WSR-88D Open Radar Product Generator (RPG) (Reed et al 2002) in July 2002, a Base Data Distribution System (BDDS) has been installed on all NWS WSR-88D systems. The BDDS provides real-time access to base data that was provided earlier on an experimental basis by the Radar Interface and Data Distribution System. Each BDDS has 4 ports that provide access to users via TCP/IP protocol. Since the FAA has no requirement for base data access or archive, no BDDS are installed on FAA WSR-88D systems. To meet a combination of DOD and NWS requirements for near real-time base data from DOD WSR-88D systems, BDDS have been installed on 8 of the 26 DOD WSR-88D systems.

4. NWS NEAR REAL-TIME BASE DATA DISTRIBUTION PLANS

The NWS considers the CRAFT Project approach for collecting and distributing WSR-88D base data as an interim step toward the final Level II data collection distribution system. The ROC analyzed 9 different approaches to determine the most cost effective approach to collecting and archiving Level II data. The two leading approaches are:

(1) Compress the data in the RPG and send the data via the AWIPS network to the NWS Telecommunications Gateway (NWSTG) for distribution to NCDC, National Centers For Environmental Prediction (NCEP), and other users in near real time. The data in this stream will be similar to the format users receive now. For DOD and FAA sites, the data will be carried to the NWSTG via the nearest AWIPS.

(2) Compress the data in the BDDS and send the data via Internet or Internet2 connections to the NWSTG for distribution to NCDC, NCEP, and other users in near real time.

The NWS will select the final architecture by the end of 2002. The targeted start date for implementing this capability is with the deployment of RPG Software Build 4 in October 2003. The implementation will apply the RPCCDS product data requirements for delivery of data in near real time: data availability - 95% or more and data latency - 60 seconds or less for transmission from the WSR-88D through the NWSTG for delivery to a customer.

5. ADDITIONAL CONSIDERATIONS

Until the NEXRAD agencies have implemented the final architecture for collecting and distributing base data, external agencies can request connection to an existing BDDS. The ROC has produced a BDDS Users Guide to assist connecting agencies and forecast offices in better understanding connections to a BDDS (http://www.osf.noaa.gov/eng/bddsguide.asp). Users may connect to one of the four BDDS ports following the NEXRAD Program Management Committee guidelines (http://www.osf.noaa.gov/BDCI/wbpolicy_PMC_App0702.pdf). The guidelines are intended to minimize the impact of these connections on operations and forecast office staff while still providing access to these data.

With the scheduled FY05 deployment of the WSR-88D Open Radar Data Acquisition (RDA), the capability to produce higher resolution data and dual polarization data will be possible. Below is an estimate of the possible data additions to the RDA to RPG data stream.

Estimated RDA To RPG Data Flow Rates

New Data Requirement	Data Flow Mult. Factor (See note)	Target Imple-ment Date (Q/YY)	Data Flow Cumulative Mult. Factor (See note)
4.1 Minute Volume Coverage Pattern	1.24	4/03	1.24
250 m, vice 1 km, Reflectivity Data	1.56	4/04	1.93
0.5°, vice 1.0° Azimuthal Sampling	2.00	1/05	3.86
Doppler Data To End Of 2nd Trip	1.49	4/05	5.76
Two Different Clutter Filters & SNR Thresholds	1.97	1/05	11.35
Dual Polarization, 4 New Moments	2.32	1/08	26.35

*Note: Assume the data flow rate as of RPG Build 2, October 2002, is 1.0.

The NWS plans to evaluate the need for distributing, collecting, and archiving these additional data streams as they become available. It is possible that not all of these data streams will be added to the near real-time data collection, distribution, and archive plans.

6. SUMMARY

The NEXRAD Program is in a period of transition in regard to the central collection, distribution, and archive of WSR-88D products and base data. In addition, the recently deployed Open RPG and soon to be deployed Open RDA will increase the opportunity for higher quality data, higher resolution data, new products, and new data streams.

The proof-of-concept project, CRAFT, has demonstrated the capability to compress, collect and distribute WSR-88D base data to the NCDC and external users in near real time via the Internet and private communications links. Based on a cost-benefit analysis, these data can be sent from 154 WSR-88D systems (not including the DOD WSR-88D systems in Korea, Japan, and the Azores) to NCDC in near real time for archival at a lower cost than replacing the recorders with a new generation of in-place recorders. Thus, the NEXRAD agencies are planning to send base data to a central server at the NWSTG and then on to NCDC for archiving, to NCEP for operational use, and to external users in near real time.

7. REFERENCES

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