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PREVIEW OF OPEN SYSTEMS FOR THE WSR-88D

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[Note: The figures will not be printed in hard copy, but can be accessed in the Web version of the TA.]

Introduction

The NEXRAD Operational Support Facility (OSF), National Severe Storms Laboratory (NSSL) and the Office of Systems Development are in the process of developing and upgrading the WSR-88D computer and communications system. The new architecture will take advantage of Unix-based workstations and TC/IP communication standards that will allow NEXRAD to be more hardware and software independent, and hence the term WSR-88D **"open system"** upgrade.

There are three key components of the "Open Systems" upgrade. They are the:

Radar Data Acquisition (O-RDA) which processes the data from the receiver and sends base data (reflectivity, spectrum width, and radial velocity) to the RPG and,

Radar Products Generator (O-RPG) which ingests base radar data and runs the various algorithms (e.g., PPS and Hail Detection Algorithm).

UCP Upgrade which provides the HMTs/forecasters an interfacee to control basic WSR-88D operations and algorithm processing.

This Technical Attachment briefly describes three components of the Open Systems upgrade and time lines for deployment. Web sites with additional training material are cited below. The current operational system will be referred to as the "legacy system." Network structures shown are for NWS forecast offices; Department of Defense and Federal Aviation Administration sites will be slightly different.

Open RDA

The O-RDA processes the data from the receiver and sends base data (reflectivity, spectrum width, and radial velocity) to the RPG. Many of the O-RDA upgrades will be at the technical level and will be transparent to the forecaster. A few notable changes will

include the deployment of alternate signal processing scheme. The prototype O-RDA is expected to be completed by April 2000 with deployment targeted to begin by late CY 2000. Dual polarization capabilities will be added between CY 2005 and CY 2007.

Open RPG

The O-RPG ingests base radar data and runs the various algorithms. The O-RPG will consist of SUN Microsystems workstations. The bulk of the processing will be done on a SUN Ultra 10. The Ultra 10 has a 480 MHz processor and uses SCSI connections for data transfer. The current operating system (O/S) for SUN systems is Solaris 2.7. This O/S is UNIX and is very similar to HP10.2. Figure 1 shows the O-RPG LAN configuration and associated basic system functionality. A brief summary of the more significant O-RPG changes are. .

1. Data Communications Server - converts between current (HDLC/X.25) and open system (TCP/IP) data formats (sometimes referred to as a data gateway).

2. LAN switch - directs the flow of data (base data, status/maintenance information, products and command issuances) between various open RPG components as well as sending base data to external user communication ports.

3. RPG processor - processes base data into products and controls/coordinates distribution of said products to users as well as formats and distributes status/maintenance information. The RPG processor also implements and/or directs command issuance from the MSCF (9).

4. Archive III

5. Base Data Distribution Server (BDDS) - receives base data from the LAN switch then routes data to external users via said switch.

6. Keyboard/Video/Mouse (KVM) switch - allows keyboard, monitor, and mouse usage to be shared (switched) between the RPG processor and BDDS.

7. RPG processor/BDDS monitor, keyboard and mouse.

8. Narrowband Modems - the RPG processor (3) sends products to the LAN Switch (2) which in turn sends those products to the Data Communications Server (1). The Data Communications Server then converts the products' data format from TCP/IP to HDLC/X.25 and sends the products to the appropriate narrowband modem(s) for transmission to the requesting user(s).

9. Master System Control Function (MSCF) - to a degree, is to the open RPG what the UCP is to the current system. One of the major differences is the MSCF scope of control, which will eventually encompass not only those control aspects currently residing at the UCP, but also those of the RDA's MMI.

10. Power Administrator - allows for remote user control (via network-issued/routed commands) of power output to connected devices (1, 2, 3, 5). For example the user can issue a command from the MSCF to the power administrator to turn off the power output to the BDDS.

11. Uninterruptible Power Supply (UPS) - maintains (battery) power in the event of a power outage. Typically used to keep a computer running for several minutes after a power outage to enable a graceful shut down, the open RPG UPS utilizes a software component that automatically implements shut down procedures in case of a power failure.

A major improvement over the legacy system is the way data are passed to the various algorithms. The legacy system uses a buffer manager whereby each algorithm is a potential bottleneck. If an algorithm has a problem, base data transmission to another algorithm may be interrupted. In Open Systems, base data are equally available to all algorithms via a "linear buffer" with no inter-dependancy among algorithms. Base data distribution will be done by a SUN Ultra 5.

For more information please visit the OSF Open Systems Training Site (www.osf.noaa.gov/OSTeam/jamba/lanorpg/lanorpg.html).

UCP Upgrade

Part of the 0-RPG, the Unit Control Position (UCP) PC will be replaced by a SUN Ultra 5 workstation and is called the Master System Control Function (MSCF). This is perhaps the biggest improvement (from a forecaster's point of view) over the legacy system and features a new user interface. The interface uses a graphical display showing a schematic of the radar and various data interfaces (Fig. 2). All user interaction is through pull-down menus. Current status of data flow and antenna motion are depicted by animated flow diagrams and color coding. For example, if a wide band line is down the connection will turn red on the display. The UNIX windows environment will also allow the status window to be displayed on any other UNIX machine in the office.

One impressive application is the graphical interface that controls the radar pulse repetition frequency (Fig. 3). The different sectors are controlled by moving the boundary lines with the mouse. Affected parameters are automatically re-calculated and displayed. For instance, the per cent area obscured in each sector is displayed in the table with minimum values highlighted.

Schedules and Builds

Deployment of the O-RPG is tentatively scheduled to begin sometime in CY 2000 and last ~18 months. The first "open system build" (build 1) will be simply a duplication of the current WSR-88D Build 10. Build 2 with more extensive algorithm upgrades is planned ~1 year later (CY 2001). The technical manual is being developed and a short in-house training session will take place in Kansas City (dates TBD). UCP training is still under development.

A prototype of the O-RDA is due by April 2000. Deployment is expected to begin in late CY 2002.

Open PUP and AWIPS

As part of its modernization, National Weather Service forecast offices are replacing the Principle User Position (PUP) functionality with the Advanced Weather Interactive Processing System (AWIPS). Starting with Build 5, additional radar display and post-processing will be bundled with the SCAN upgrade. Scan is currently being tested at Sterling VA, Forecast Office.

The U.S. Air Force will not get AWIPS and has contracted with NSSL to provide an "Open-PUP." The O-PUP is a UNIX workstation that replaces the PUP with a commensurate improvement in user interfaces. Deployment is expected to begin late CY 2000.

Summary

Open Systems RPG Build 1 consists of mainly hardware and architecture upgrades to an "open systems" UNIX platform and a new, more user friendly O-UCP. The upgrades prepare the WSR-88D processing system for future enhancements to the algorithms as well increase flexibility to expand the system in the future.

Additional information can be found at the National Severe Storms Laboratory's Open Systems web site:

www.nssl.noaa.gov/srad/orpg

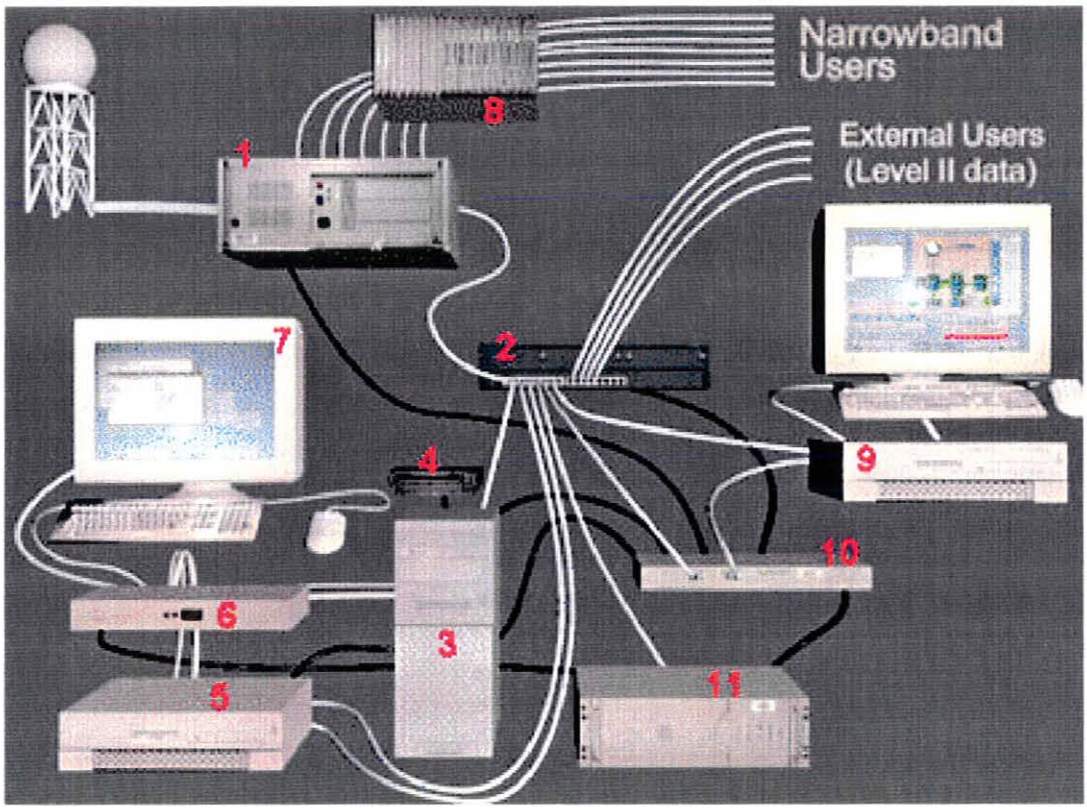
and the WSR-88D Operational Support Facility's web site:

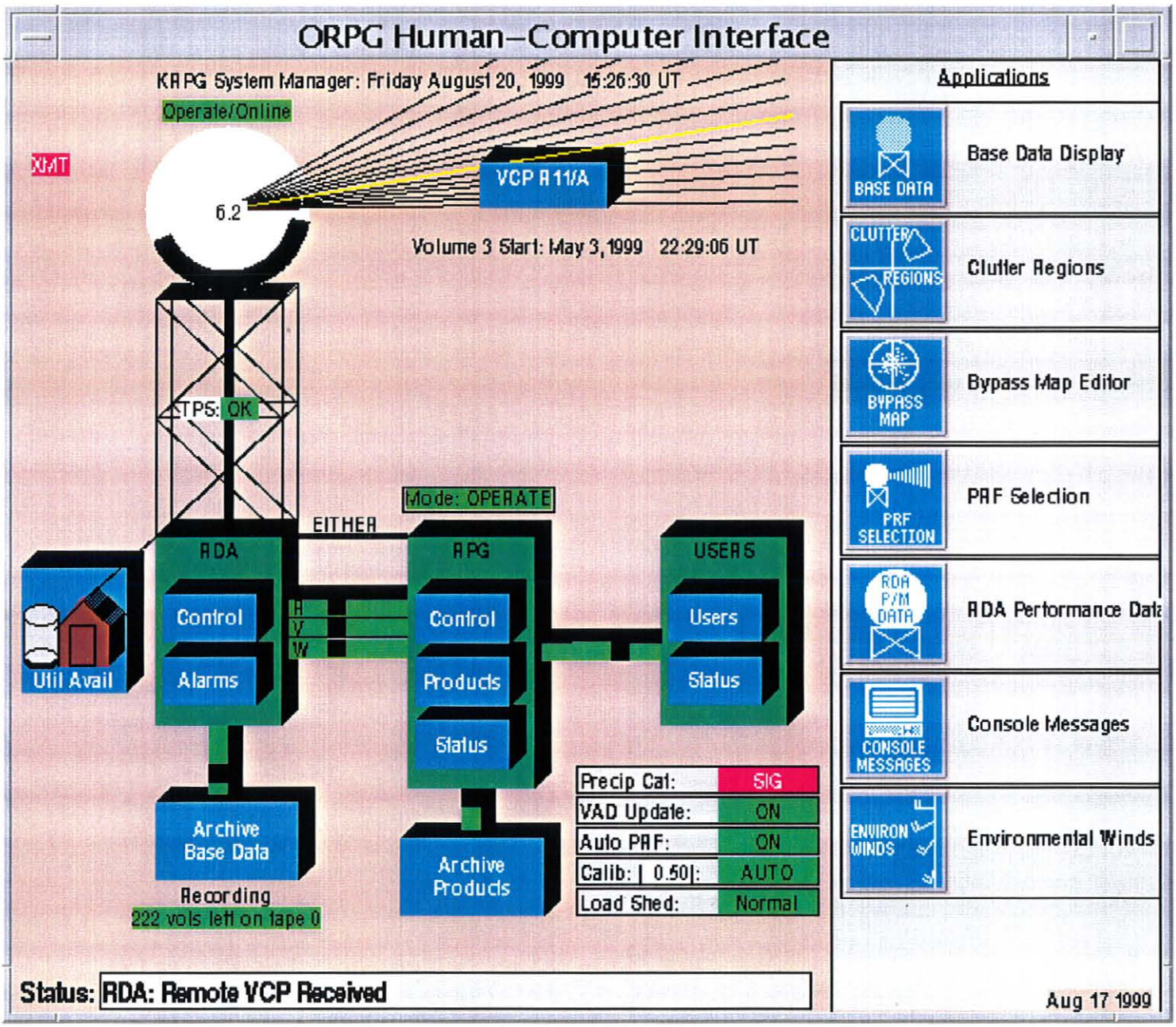
www.osf.noaa.gov/osteam/osmain.htm

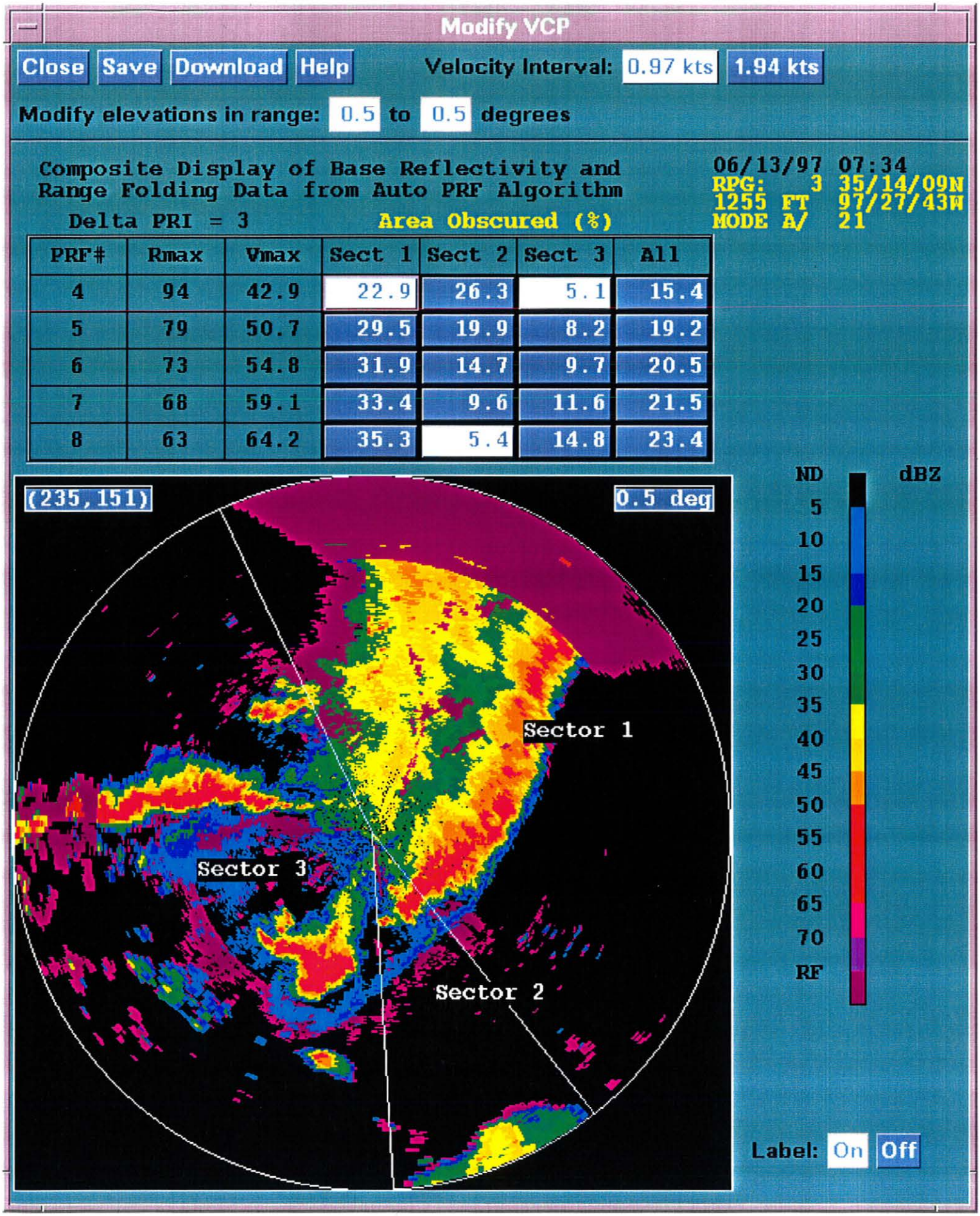
Figure 1. Diagram of the Open RPG network. Numbers correspond to description in text.

Figure 2. Main display on the MSCF showing system status including status of communications, VCP number, and archiving. The final MSCF display may differ slightly. Applications are accessed by the buttons on the right. See Fig. 3 for the PRF Selection application interface.

Figure 3. PRF Selection application interface. The final display may differ slightly. Note that the user can define separate PRFs for three different sectors. The shape of the sectors can be changed by simply dragging a line with the mouse.


Narrowband
Users
External Users
(Level II data)
1
2
3
4
5
6
7
8
9
10
11


ORPG Human–Computer Interface
KRPG System Manager: Friday August 20, 1999 15:26:30 UT
Operate/Online
XMT
6.2
VCP A11A
Volume 3 Start: May 3, 1999 22:29:06 UT
TPS: OK
Mode: OPERATE
EITHER
RDA
Control
Alarms
H
V
W
RPG
Control
Products
Status
USERS
Users
Status
Util Avail
Archive Base Data
Recording
222 vols left on tape 0
Archive Products
Precip Cat: SIG
VAD Update: ON
Auto PRF: ON
Calib: | 0.50|: AUTO
Load Shed: Normal
Status: RDA: Remote VCP Received
Applications
BASE DATA
Base Data Display
CLUTTER REGIONS
Clutter Regions
BYPASS MAP
Bypass Map Editor
PRF SELECTION
PRF Selection
RDA P/M DATA
RDA Performance Data
CONSOLE MESSAGES
Console Messages
ENVIRON WINDS
Environmental Winds
Aug 17 1999


Modify VCP
Close
Save
Download
Help
Velocity Interval:
0.97 kts
1.94 kts
Modify elevations in range:
0.5
to
0.5
degrees
Composite Display of Base Reflectivity and
Range Folding Data from Auto PRF Algorithm
Delta PRI = 3
Area Obscured (%)
06/13/97 07:34
RPG: 3 35/14/09N
1255 FT 97/27/43W
MODE A/ 21
PRF# Rmax Vmax Sect 1 Sect 2 Sect 3 All
4 94 42.9 22.9 26.3 5.1 15.4
5 79 50.7 29.5 19.9 8.2 19.2
6 73 54.8 31.9 14.7 9.7 20.5
7 68 59.1 33.4 9.6 11.6 21.5
8 63 64.2 35.3 5.4 14.8 23.4
(235,151)
0.5 deg
Sector 1
Sector 3
Sector 2
ND
dBZ
5
10
15
20
25
30
35
40
45
50
55
60
65
70
RF
Label:
On
Off