P1.2 IMPROVEMENTS TO THE HUMAN-COMPUTER INTERFACE FOR THE WSR-88D (NEXRAD) RADAR PRODUCT GENERATOR

David L. Priegnitz[1,2], Eddie Forren[1,2], and Michael Jain[1]
[1]NOAA/ERL/National Severe Storms Laboratory, Norman, OK
[2]Cooperative Institute for Mesoscale Meteorological Studies,
University of Oklahoma, Norman, OK

1. INTRODUCTION

In support of the NEXRAD Product Improvement (NPI), a new graphical user interface (GUI) has been developed for the Open Systems Radar Product Generator (ORPG). This new interface, refered to as the ORPG Human-Computer Interface (HCI), is a replacement for the existing, text-based, Unit Control Position (UCP). The initial phase of the NPI consists of replacing the current Radar Product Generator component with one that is "open" and capable of adapting to meet the changing requirements of its users. For an overview on the NEXRAD NPI refer to the paper by Saffle and Johnson, 1998.

In designing the new GUI for the ORPG, human factor methods were used in the design of various graphical components (Priegnitz, et al., 1997). An important consideration was to determine who the users would be (Priegnitz, et al., 1998) and how the interface could be designed to best serve the spectrum of end users (meteorologists, hydrometeorology technicians, electronic technicians). Following the development of a prototype display (GUI window), it was important to have it reviewed by someone outside of the development team (preferably a future user). Suggested improvements were then reviewed by the developers and incorporated into the prototype as deemed appropriate and practical.

Priegnitz, et al., 1998 described several HCI components which were reviewed and tested. This paper addresses additional modifications which were made to these components along with several other new capabilities not included in the earlier paper.

2. CLUTTER SUPPRESSION REGIONS

The maturation of the GUI solution for defining clutter suppression regions is illustrated in the papers by Priegnitz, et al., 1997 and Priegnitz, et al., 1998. The original prototype involved the manipulation of several windows with raw base data as a background. Clutter regions were defined in the base data window and filter properties were defined in a separate control window. However, it became apparent that the use of multiple windows for defining clutter regions was cumbersome and confusing. User feedback indicated the use of a single window for defining clutter regions was highly desirable. Also, due to bandwidth limitations, the use of large raw base data files as a background was not feasible for sites with low-bandwidth communication restrictions.

The latest version of the Clutter Suppression Region editor uses a single window for display and control. A tabular representation of the defined clutter suppression regions is also presented with this version. The user selects the filter properties from this table and can fine tune sector boundary information. Boundary information consists of a pair or azimuth and range values which define an annulus sector. Normally, these sectors are defined with the mouse by first selecting one sector corner point by positioning the cursor over the reflectivity background, pressing the select button, and then dragging the cursor with the select button depressed until the other sector corner point is located.

To accommodate sites with low-bandwidth communication restrictions, the user is now presented an ORPG generated base reflectivity product as a background. The resolution of the product may be configured so sites without a bandwidth limitation can utilize larger, high resolution-products while those sites with bandwidth limitations can make use of a smaller, low bandwidth-product. A sample Clutter Suppression Regions edit display window is presented as Figure 1.

3. PRF SELECTION

Corresponding author address: David Priegnitz, National Severe Storms Laboratory, 1313 Halley Circle, Norman, OK 73069; e-mail <priegni@nssl.noaa.gov>

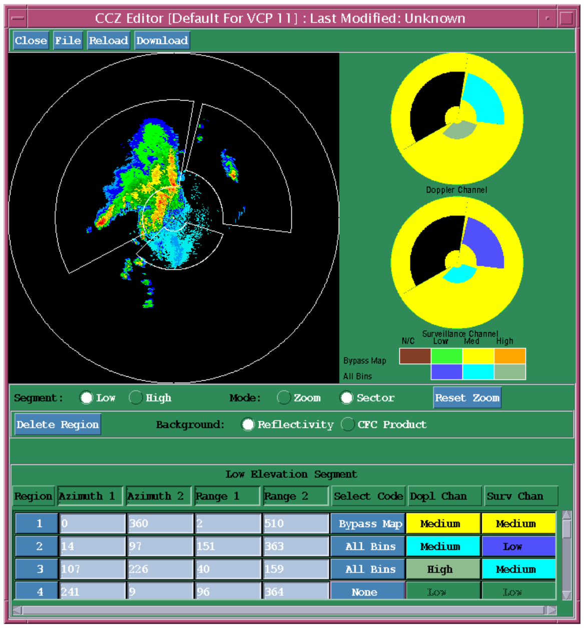

Figure 1. Sample Clutter Suppression Regions Edit display

The Pulse Repetition Frequency (PRF) Selection function provides the user with a very useful mechanism to define up to 3 different sectors per elevation cut, each with a different PRF (currently, 5 Doppler PRFs are selectable for precipitation volume coverage patterns). Range folding in velocity and spectrum width products is a function of the PRF selected. The Auto PRF algorithm determines an optimal PRF by calculating areas of obscuration for all PRFs and selecting the PRF with the minimum obscuration. However, the best fit PRF is determined for all angles and not for a specific meteorological target. In severe weather situations, minimizing obscuration for specific meteorological targets is more desirable.

Although the legacy UCP provides the capability to define PRFs for 3 different sectors, not knowing for certain what effect changing the PRF will have on range folding for a specific meteorological target makes it almost useless since one would have to wait until the next volume scan to see the effects of the changes. In a severe weather situation, every second is valuable.

The GUI solution provides the user with a graphical display of base reflectivity with obscuration data (representing range folded areas) overlaid. This provides clear and immediate feedback to the user, showing regions where the Doppler velocities should be expected to be undetermined. The user can toggle the obscuration data overlay for each PRF and thus determine which PRF works best for a given meteorological target. Priegnitz, et al., 1998, discuss this in more detail and present an excellent example of a case where selecting the proper PRF would have resulted in Doppler velocities free from range obscuration.

The biggest concern with the prototype described by Priegnitz, et al., 1998, was the amount of input data required to present the obscuration information. At that time, base reflectivity and obscuration data were combined to generate a set of composite “PRF Selection” products, one for each PRF. Thus, for the PRF Selection function, five composite products were needed (for precipitation volume coverage patterns types). For users with limited communication bandwidth capabilities, this was a significant performance problem as several minutes were required to transmit and receive these products. The usefulness of the new PRF Selection GUI will be best when rapid decisions can be made and new VCPs downloaded. It was very important to find a way to reduce the amount of data transferred from the ORPG to the PRF Selection task.

The solution to this problem has been to reduce the number of input products from five to two. Since the same reflectivity product is used for all composite displays, only one base reflectivity product is created. The obscuration data for all PRFs are contained in a new bitmap product which uses a single bit to represent whether a particular bin is obscured or not. The PRF Selection function is responsible for creating the composite display from the two data inputs. Testing has shown the bitmap product to be compressible by at least 10:1. This will greatly reduce the amount of time/bandwidth required to transfer the product.

4. ADAPTATION DATA

The ORPG provides a number of data parameters which can be modified at run time by the user. However, many of the “adaptable parameters” are password protected. Not only are many of these parameters password protected, they require different levels of change authority (which is defined in the interface control documents). In the legacy UCP, there is no indication of the level of change authority (LOCA) for a given parameter. A user may know the password to be able to change the parameter but may not know whether they have the LOCA to change it. A common request by user reviewers was to identify the LOCA required to change a given parameter so they would not need to refer to offline documentation.

In the ORPG HCI, parameters requiring passwords are always presented initially as read-only. In this case, the graphical objects associated with these parameters have a common appearance and all edit attributes are disabled. To determine the LOCA for parameters displayed in a given window, the user is provided a special set of selections. When a specific LOCA is identified, the text properties for each parameter which can be modified by that LOCA are changed. If the user determines they have the authority to change a particular parameter, they can enter a password assigned to that LOCA. If a valid password is entered, the object associated with that parameter becomes editable and its appearance changes. Figure 2a presents an example of a window which is initially opened as read-only. Figure 2b illustrates using the LOCA selections to identify the items which can be edited for a specific LOCA. Figure 2c shows the appearance of the graphical objects after a valid password was entered.

By showing the LOCA as a property of each graphical object, the user task of manipulating adaptable parameter data should be much easier.

5. SUMMARY

Work on the Human Computer Interface (HCI) for the Open Systems RPG is almost completed. Many

Figure 2. Sample Alert Threshold adaptation edit display. Part a show's default condition (read-only). Part b shows "URC" level of change authority (read-only). Part c shows display unlocked after entering password for "URC" level of change authority.

lessons have been learned during the course of its development and user feedback has proven to be invaluable. Keeping the development process as visible as possible has resulted in a user interface which is more efficient and easy to use. The ultimate test will be when the ORPG is placed into daily operational use. The continued inclusion of user feedback in subsequent updates to the ORPG HCI will aid in producing a more effective user interface.

6. ACKNOWLEDGEMENTS

We'd like to acknowledge members of the NSSL ORPG development team who have contributed in developing the ORPG software. We would also like to acknowledge personnel at the NEXRAD Operational Support Facility (OSF) for their comments and suggestions in the design and implementation of the ORPG software. We would also like to thank the countless individuals who have reviewed various prototypes and provided valuable suggestions for improvement.

7. REFERENCES

Saffle, R. and L. Johnson, 1998: NEXRAD Product Improvement: An Overview of the Continuing Program to Evolve the WSR-88D System to an Open Systems Architecture, Preprints 14th IIPS, Phoenix, AZ, Amer. Meteor. Soc., Paper 7.1

Priegnitz, D., D. Frashier, T. Marci, T O'Bannon, S. Smith, R. Steadham, M. Bullard, and M. Rausch, 1997: Human Factors Methods in the Design of the Graphical User Interface for the Open Systems Radar Product Generator (ORPG) Component of the WSR-88D, Preprints 13th IIPS, Long Beach, CA, Amer. Meteor. Soc., Paper 8.8

Priegnitz, D., E. Forren, and M. Jain, 1998: Update on the Human Computer Interface for the WSR-88D (NEXRAD) Open Systems Radar Product Generator (ORPG), Preprints 14th IITP, Phoenix, AZ, Amer. Meteor. Soc., Paper 7.5