

The Common Operations and Development Environment (CODE) for the WSR-88D Open RPG

CODE B13.0r1.6: June 2012

Includes ORPG Build 13.0 (release 1.6)

CODE Introduction

CODE is produced in two versions:

1. The **U.S. Government Edition** of CODE is the complete version. Distribution is limited to within the United States Government.
2. The **Public Edition** of CODE is intended for public release. Certain Copyrighted material has been removed to permit release outside the U.S. Government.

CODE provides:

- Instructions for setting up the development environment (includes ORPG source code)
- Guidance for compiling software and configuring new ORPG tasks & products
- Instructions for definition and use of algorithm adaptation data and algorithm dependent parameters
- API Programming Guide and the structure of WSR-88D algorithms (with sample algorithms)
- WSR-88D specific analysis tools
- A set of WSR-88D Archive II Data files and other special test case data.

CODE User provides:

- An Intel PC with Red Hat Enterprise Workstation Linux.

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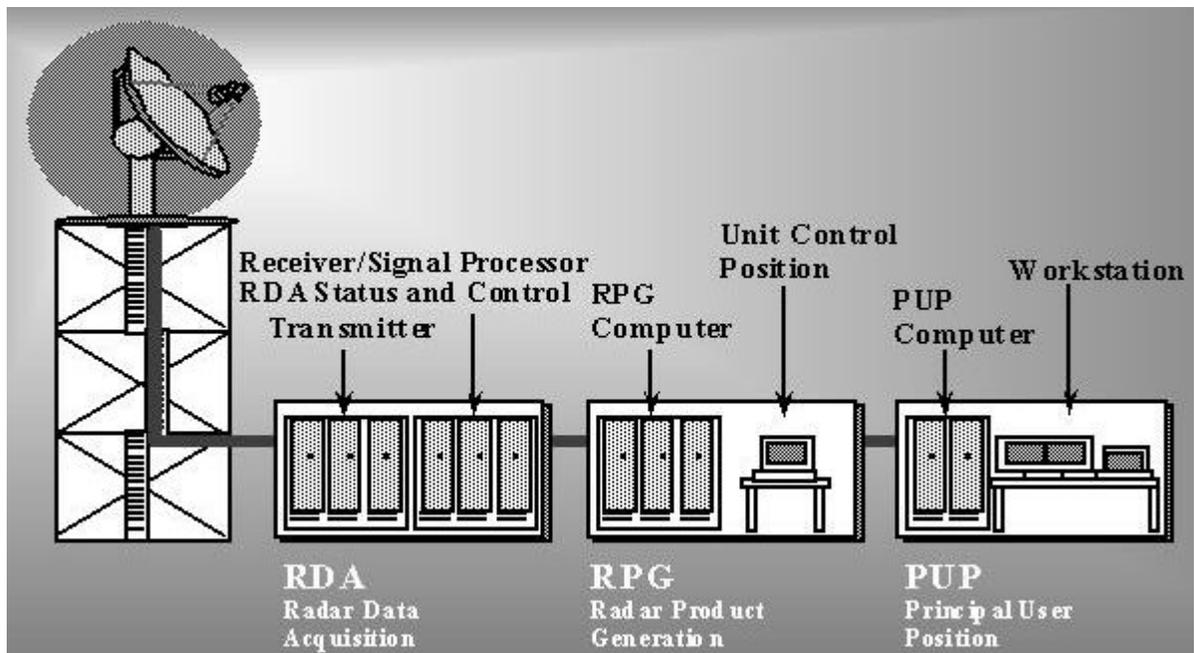
[CODE Documentation](#)

Overview of CODE

The objectives of the Common Operations and Development Environment (CODE) are to greatly enhance the process of meteorological application development, testing, technology transfer, and maintenance for the NEXRAD program.

Introduction

The WSR-88D radar consisted of three subsystems. The RDA includes the radar antenna, transmitter/receiver, and the signal processing computer. The RPG is the radar product generating / distribution computer. The PUP was the integrated product display computer and has been replaced by separate user agency systems.



The RPG, the radar product generation subsystem of the WSR-88D radar, was the first portion of the radar to be redesigned into an open systems architecture and is called the Open RPG (or ORPG).

CODE for the WSR-88D is based upon the capabilities provided by the Open Systems Radar Product Generator (ORPG). ORPG software can be installed and run on a single desktop Intel PC running Red Hat Enterprise Workstation Linux. This "clone" of an operational ORPG does not distribute products to operational users nor control a radar. However, using one of several methods of radar data input, the algorithms running on the ORPG clone utilize services identical to the operational ORPG and can produce products identical to those distributed by an operational system.

Overview of CODE

New algorithms developed on the clone ORPG (assuming these services are used correctly) are much easier to integrate onto the operational system. With the appropriate guidance, new techniques can be more thoroughly tested prior to submission to the NWS Radar Operations Center (ROC). In addition, if the clone is based upon a workstation configured similarly to the operational ORPG hardware, run time performance of new algorithms can be evaluated by the developer.

WSR-88D CODE is targeted for programmers with software development experience in a Unix environment and an appropriate background in Radar Meteorology.

What is CODE?

The Common Operations and Development Environment (CODE) is the primary algorithm development and implementation environment for new science intended for integration into the WSR-88D radar. CODE supports the development and maintenance of WSR-88D algorithms; NOT the ORPG as a whole.

The ORPG design:

- supports ease of expansion and modification,
- includes a layered service architecture that provides a robust but narrow interface between the product algorithms and the rest of the system services, and
- can be run on a single POSIX compliant UNIX workstation.

These design characteristics facilitate an algorithm development environment based on the ORPG itself. CODE is a collection of generic and NEXRAD specific development tools, detailed guidance and documentation that can be used to support both early stages of the algorithm development life cycle (analysis, experimentation, & prototyping) and the later stages of the life cycle (production development, testing, & integration). This development environment is depicted visually below.

Production Development & Integration Environment

Basic Development Tools

- Compilers, linkers, etc.
- Debugging Tools
- Documentation tools

NEXRAD Specific Tools

- WSR-88D Data & Product Display
- Test Tools
- Radar Data Ingest (including test cases)
- Other



ORPG Clone on Desktop Workstation

- **WSR-88D ANSI-C API Services:**
 - The Algorithm API
 - The Common Calculations Library

Documentation & Guidance

- **Vol 1 Installation & Configuration Guide**
- **Vol 2 Algorithm Development Guide**
 - Compiling Software
 - Configuring ORPG for new

Algorithms

- **Vol 3 Algorithm Programming Guide**
 - Algorithm API Reference
 - Structure of Algorithms
- **Vol 4 CODE Utility Guide**

Guidance for Formal Integration (under development)

- ANSI-C Coding Standards
- Documentation & Test Requirements

Some of the listed components of CODE are the responsibility of the individual user to obtain (e.g., the workstation and basic development tools beyond generic compilers). The most important components of CODE are

- The capabilities provided by the ORPG algorithm programming interface. Algorithms & products produced with CODE are identical to operational system.
- The extensive documentation and guidance tailored to support algorithm developers rather than ORPG SW maintenance staff or ORPG operators.
- Product display and data analysis tools specifically for NEXRAD products. These utilities provide a convenient means for decoding specified portions of a product as well as providing a graphical display of geographic products.
- Archived Level 2 radar data is available for use. This consists of standard data streams used in formal tests, special artificial test cases, and collections of data containing various meteorological conditions (storms, tornadoes, snow, etc.).

The WSR-88D Algorithm API is complete in that all services are provided for a fully functional operational algorithm. This API is being improved with each build. Documentation for the API is provided with the CODE Guide Volume 3, *WSR-88D Algorithm Programming Guide*.

How do I get CODE?

CODE is available on CD-ROM from the NPI Development manager. The development environment consists of the *ORPG Software Distribution*, a four volume *WSR-88D CODE Guide*, and the *CODE Software Distribution*. The *ORPG Software Distribution* is a recent release obtained from ROC configuration management.

CODE is produced in two versions:

1. **National Weather Service Edition** - This is the complete version of CODE. Distribution is limited to within the National Weather Service and other U.S. Government Agencies.
2. **Public Edition** - This version of CODE is intended for public release. Certain proprietary software components have been removed to permit release outside the U.S. Government.

The Public Edition of CODE using the latest operational ORPG release is also posted on the following web site:

<http://www.weather.gov/code88d/>

If you have visited this site in the past and you do not see the current distribution, you may need to hit the Refresh/Reload button on your web browser.

CODE System Requirements

Build 12 - What's New?

The recommended minimum amount of RAM and swap space for the Development Configuration has been increased from 512 MB to 1 GB.

Build 11 - What's New?

The operational ORPG uses Red Hat Enterprise Linux 5 beginning with Build 11. The ORPG source is built using the compilers included with Red Hat Enterprise 5 (`gcc` has been upgraded to version 4.1.2 and `g77` has been replaced with `gfortran`).

In addition, the Build 11 source code enforces ANSI/POSIX standards and these are required for all Build 11+ software deliveries. One major impact is that C++ style comments using `/**` are not permitted.

The backward compatibility of Red Hat Enterprise 4 with Build 11/12 software has not been fully investigated but changes to makefiles would be required.

Only the Linux PC platform is currently supported for CODE.

General Notes:

Do not attempt to compile the ORPG source code without meeting the system requirements stated below.

- Attempting to use any version of Linux other than **Red Hat Enterprise 5 Desktop with Workstation option**
- Attempting to use versions of compilers not listed

will require changes to the source code and / or modification of makefiles.

Do not attempt to use 64-bit versions of Linux.

Workstation Platform

The *Operational Configuration* provides a development platform that is essentially the same as the operational system. This is not required for algorithm development or implementation. The *Development Configuration* provides an acceptable platform for running an ORPG clone and developing ORPG algorithms but does not match the performance criteria of the operational system.

Performance Testing. Any desktop PC with a current processor and 2 GB of RAM would be sufficient in order to determine the relative performance of an algorithm.

	Operational Configuration (Note 1)	Development Configuration	Notes
Workstation	AMD Opteron 250 Dual Processor	Any PC with a Pentium 4 or equivalent processor.	
Operating System	Red Hat Enterprise 5 Desktop with Workstation Option (32-bit)	Red Hat Enterprise 5 Desktop with Workstation Option (32-bit)	2
Physical Memory	2 GB	1 GB RAM minimum 2 GB recommended	
Swap Space	TBD	1 GB minimum	3
Disk Drive	serial ATA drives	1 GB plus for each ORPG account	4
Display Capability	N/A	24-Bit color, 1024x768 min, 1280x1024 recommended	

Note 1: **With the amount of overhead in the operational system there is little reason to replicate it for development. Any recent quality desktop PC with 2 GB of RAM can be used to obtain a good idea of an algorithms relative performance.**

Note 2: **Red Hat Enterprise 5 Workstation has been selected as the operating system for the deployed ORPG. Enterprise Workstation version 4 may still be compatible with the ORPG but would require changes to makefiles. The ORPG software requires 32-bit operating systems.**

Note 3: **Currently 1 GB of swap space is sufficient for the CODE development environment.**

Note 4: Does not include space for compilers and other development tools.

Software Language Compilers

The CODE Linux platform uses libraries and software development tools that are provided with the basic distribution of Red Hat Enterprise 5 Desktop with Workstation option.

Compilers used to build the Operational ORPG

- **Compilers and utilities provided with Red Hat Enterprise Workstation**
 - GCC 4.1.2 (includes gcc, g++, and gfortran)
 - GNU make 3.81-1.1
 - GNU linker in binutils 2.17.50.0.6-5
 - glibc 2.5-18

CHANGE HISTORY

What's New for CODE B13.0r1.6 (for ORPG Build 13.0) June 2012

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.0 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 13.0 (release 1.6) April 2012
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.0)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.0)
 - No change.
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What's New for CODE B13.0r1.4 (for ORPG Build 13.0) February 2012

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.0 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - No Change
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No Change
4. **CODE Volume 4 - CODE Utility Guide**
 - Updated for new version of CVG 9.2.
5. **ORPG Source Code**
 - Updated to ORPG Build 13.0 (release 1.4) February 2012
6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.0)
 - Improved display of radial products to greatly reduce the number of black pixels between radials, artifacts of the display resolution and the X-windows drawing primitives.

Change History of CODE

- BUG Fixed: The product database size in CVG was smaller than the maximum possible in the RPG. This would cause the display of product other than the product selected for display when using larger product databases.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.0)
 - No change.
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What's New for CODE B12.3r1.2 (for ORPG Build 12.3) October 2011

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.3 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No Change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No Change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No Change
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.3 (release 1.2) September 2011
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)
 - No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
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What's New for CODE B12.2r1.2 (for ORPG Build 12.2) April 2011

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.2 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - See What's New for CODE B12.2r1.1.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - See What's New for CODE B12.2r1.1.
4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.2r1.1.
5. **ORPG Source Code**
 - Updated to ORPG Build 12.2 (release 1.2) March 2011
6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)

Change History of CODE

- No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
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What's New for CODE B12.2r1.1 (for ORPG Build 12.2) March 2011

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.2 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - See What's New for CODE B12.1r1.10.
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - See What's New for CODE B12.1r1.10.
 4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.1r1.10.
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.2 (release 1.1) February 2011
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)
 - No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
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What's New for CODE B12.1r1.10 (for ORPG Build 12.1) November 2010

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.1 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - Updated description of base data format corresponding to Build 12.1 rels 1.10 ORPG. This includes 250 m reflectivity bins at all elevations and 300 km Doppler range.
 - See What's New for CODE B12.1r1.6.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - Documented changes to `RPGC_get_customizing_data()`
 - See What's New for CODE B12.1r1.6.
4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.1r1.6.
5. **ORPG Source Code**
 - Updated to ORPG Build 12.1 (release 1.10) October 2010
6. **CODE Software**
 - Sample Algorithms - version 1.22a

Change History of CODE

- See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
- CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.1)
 - See Volume 4 Document 2 for a description of changes.
- CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.1)
 - See Volume 4 Document 1 for a description of changes.

What's New for CODE B12.1r1.6 (for ORPG Build 12.1) September 2010

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.1 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - Documented the use of a snippet file for the product generation tables.
 - Documented changes to the encoding/decoding parameters (Scale Offset) for several derived Dual Pol data fields.
 - Added algorithm development guidance to always read the encoding/decoding parameters when reading base data.
 - See What's New for CODE B12.0r1.10.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - A bug with sample algorithm 1 was documented.
 - See What's New for CODE B12.0r1.10.
4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.0r1.10.
5. **ORPG Source Code**
 - Updated to ORPG Build 12.1 (release 1.6) August 2010
6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.1)
 - See Volume 4 Document 2 for a description of changes.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.1)
 - See Volume 4 Document 1 for a description of changes.

What's New for CODE B12.0r1.10 (for ORPG Build 12.0) August 2010

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.0 software.
 - Updated installation instructions for the new CODE sample algorithms and the CODE utility updates.
2. **CODE Volume 2 - ORPG Application Development Guide**

Change History of CODE

- When compiling individual libraries, there are no longer chmod messages concerning changing the permissions of the bzip2 libraries symbolic links
 - Updated discussion of high level algorithm design issues. Emphasized that normal meteorological algorithms usually have no need to register for events but listed two situations where an event driven algorithm might be appropriate.
 - For data packet 20, point feature data, added the symbol number, current use, and description of all symbols currently defined. Noted that new symbols intended for operational products must be coordinated with the Radar Operations Center during the design review. For CVG display, the development lead for CVG must be notified. See Part C.
 - For the area component, noted that even if the following are stated in the product specification ICD, the display attributes for lines, symbols and labels are completely determined by the display device. In the future some effort should be made in defining a set of line and symbol attributes (line thickness, solid / dashed, etc. and label attributes. Standard area component attribute names should also be defined that stipulate the display attributes. For CVG display, the development lead for CVG must be notified. Currently CVG only provides a capability to manually select display attributes from a defined short list. See Part D.
 - Modified the description of determining the radial size (number of bins) for clarity and safety. See Part F.
 - Corrected the description of the recombination the ORPG accomplishes for the original data registrations. See Parts A, D, and F.
 - The recombined rawdata types have been removed, the table in Part D was updated.
 - Removed all references to the actual size of the base data header. The size of this structure is subject to change and the `BASEDATA_HD_SIZE` is now defined as `(sizeof(Base_data_header) / sizeof(short))`.
 - Added recent guidance for setting edit permissions for algorithm adaptation data.
 - Clarified CVG use of threshold fields in the product description block and configuration Method 5 needed for Scale-Offset decoding.
 - Noted that CVT also has a Scale-Offset decoding capability.
 - Documented the Build 12 base data header.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
- Updated discussion of event driven algorithms and the event registration functions. Reemphasized that normal meteorological algorithms usually have no need to register for events. Documented the `ORPGEVT_START_OF_VOLUME_DATA` event as the safest beginning volume event to use in a meteorological algorithm.
 - Updated discussion of high level algorithm design issues. Emphasized that normal meteorological algorithms usually have no need to register for events but listed two situations where an event driven algorithm might be appropriate
 - Modified the discussion of reading base data and determining radial size (number of bins) for clarity and safety.
 - Emphasized that algorithms producing a product must either successfully produce that product or call the appropriate abort service.
 - Added specific examples for when to use the `PGM_PROD_NOT_GENERATED` abort reason code (including the failure to read a non-product data store).
 - Corrected an error in the documentation of `RPGC_rel_outbuf`. When using the optional output it must be OR the disposition with `RPGC_EXTEND_ARGS`, not `EXTENDED_ARGS_MASK`.

Change History of CODE

- Added that `PGM_DISABLED_MOMENT` is also used when a required advanced data field (Dual Pol data) is not in the radial message.
 - Improved the introduction to the API support for Traditional Final Products and the API support for the Generic Data packet. More general information was added and additional references to the details contained in Volume 2 Document 3 were provided.
 - Added guidance for algorithms producing `RADIAL_DATA`. Part C provides limits on input data and output data registration for radial producing algorithms and guidance concerning when radial outputs should be used and when they cannot be used. Part D provides limits on when radial producing algorithms can abort and additional guidance for when there are data problems and the radial is passed along without aborting.
 - Added guidance for measuring algorithm CPU usage.
 - Added guidance for measuring algorithm Memory usage.
 - Expanded guidance for use of `GL_INFO` and `GL_ERROR`.
4. **CODE Volume 4 - CODE Utility Guide**
- Updated for new versions of CVG and CVT.
 - Clarified CVG use of threshold fields in the product description block and configuration Method 5 needed for Scale-Offset decoding.
 - Noted that CVT also has a Scale-Offset decoding capability.
 - Documented two bugs: volume animation with product database buffers that have wrapped several times and a possible minor color selection difference between method 2 and method 5 configuration.
5. **ORPG Source Code**
- Updated to ORPG Build 12.0 (release 1.10) July 2010
6. **CODE Software**
- Sample Algorithms - version 1.22a
 - See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12)
 - See Volume 4 Document 2 for a description of changes.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12)
 - See Volume 4 Document 1 for a description of changes.

What's New for CODE B11r1.12 (for ORPG Build 11) May 2009

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.29**
 - Modifications for the new version of ORPG Build 11 software.
 - One additional software package (giflib-devel) is required for Build 11 r 1.12.
 - Updated installation instructions for the new CODE sample algorithms and the CODE utility updates.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.28**
 - Completely reorganized the section covering base data format to improve clarity.
 - Updated description of RDA volume scanning strategies to include the latest Build 12 VCP definitions. This includes 250 m reflectivity at all elevations, the extended 300 km Doppler range at the lower elevation (Contiguous Doppler and Batch), and the Dual Pol moments in the first scan of each elevation through all elevations.

Change History of CODE

- Expanded the description of data characteristics to include the Build 12 Dual Pol data fields. Emphasized that the precision of some of the processed / derived Dual Pol data fields significantly exceed the specification of the preprocessor algorithm and the actual accuracy of the data.
- Expanded the guidance concerning the determination of the number of and size of radial data arrays. Stated which fields must be checked every elevation.
- See Volume 2 and 'What's New' for Build 11 r 1.9 for additional changes.
- 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.23**
 - Added a summary listing of deprecated functions and their replacements for convenience.
 - Expanded the guidance concerning the determination of the number of and size of radial data arrays. Stated which fields must be checked every elevation.
 - Documented the maximum array sizes for the 9 Dual Pol data types. This is subject to change in Build 12.
 - Expanded the description of decoding the generic moment data fields and included explicitly how many levels are used for flag values.
 - See Volume 3 and 'What's New' for Build 11 r 1.9 for additional changes.
- 4. **CODE Volume 4 - CODE Utility Guide v 1.28**
 - Updated for new versions of CVG and CVT.
 - Described the new generic color palette file that can be used with method 5.
 - Clarified behavior of the play_a2 utility when no prefix or filename is given.
 - See Volume 4 and 'What's New' for Build 11 r 1.9 for additional changes.
- 5. **ORPG Source Code**
 - Updated to ORPG Build 11 (release 1.12) March 2009
- 6. **CODE Software**
 - Sample Algorithms - version 1.21
 - Added option to configure Sample 2 for using DUALPOL_REFldata as the input.
 - See 'What's New' for Build 11 r 1.9 for additional changes.
 - CODEview Graphics (CVG) 8.6 (integrated with ORPG B11)
 - See What's New for CODE B 11 r 1.2.
 - CODEview Graphics (CVG), update to 9.0 supplied with CODE B11 r1.12.
 - Modified the display of non-geographic products so that the product can be displayed in the small image drawing area in addition to the large image drawing area. Corrected the incorrect placement of the two dimensional array data with respect to the distance and altitude graph lines in the cross section products.
 - Added special treatment for the display of text packet 1 with the display of four precipitation products. These products use screen coordinates rather than 1/4 km pixels for geographic products
 - Added ability to support non-geographic products to packet 2, packet 3501, and packet 6. Added ability to support geographic products to packet 4, packet 5, packet 7, packet 9, and packet 10. CVG can now correctly display vector and text data packets with either geographic or non-geographic products
 - Fixed several bugs in displaying layers / packets separately using the packet selection dialog. When selecting individual packets, the correct packet was not always displayed. Overlay of selected layers / packets from some products with a 2 dimensional data array in layer 1 would cause CVG to crash if overlaying a text packet from layer 2.
 - Configured the test Dual Pol products (rawdata) for display by CVG.

Change History of CODE

- CVG no longer uses the ORPG supplied Bzip libraries and the CODE utility internal graphic libraries (libgd and libungif). Libraries supplied with the operating system are now used.
- See Volume 4 and What's New for CODE B 11 r 1.9 for additional changes.
- CODEview Text (CVT) 4.3.2 (integrated with ORPG B11)
 - See What's New for CODE B 11 r 1.2.
- CODEview Text (CVT), update to 4.4.1 supplied with CODE B11 r1.12
 - Modified printout to provide a consistent format of decoded volume and product generation times.
 - Fixed a parsing error in packet 9.
 - CVT no longer uses the ORPG supplied Bzip libraries. Libraries supplied with the operating system are now used.
 - See Volume 4 and What's New for CODE B 11 r 1.9 for additional changes.

What's New for CODE B11r1.9 (for ORPG Build 11) January 2009

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.28**
 - Modifications for the new version of ORPG Build 11 software.
 - One additional software package (libgtop-devel) is required for Build 11 r 1.9.
 - Updated installation instructions for the new CODE sample algorithms and the CODE utility updates.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.27**
 - Added description of the source and installed location of algorithm adaptation data definition files, the directory for adaptation data include files, the directory for algorithm task and data store man pages, and the directory for the temporary 'snippet' configuration files.
 - Expanded guidance on the procedures for compiling source code to include when recompiling of the complete ORPG is needed. Described a recompile procedure that avoids referring to the more complicated procedures in Volume 1.
 - Modified guidance to reflect that development tasks and data stores should always be configured using 'snippet' files rather than modifying the existing configuration files.
 - Documented that certain `product_attr_table` configurations are non-standard and should not be used as an example.
 - See What's New for CODE B 11 r 1.2.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.22**
 - Documented the relationship between input product timing and output product timing and the two unique exceptions to the rule that output timing must be greater than or equal to the largest input timing.
 - Expanded the description of mixing input timing types.
 - Bug fix documented for `RPGC_cleanup_and_abort`.
 - Bug fix documented for `RPGC_release_pdb_product`
 - Noted that `RPGC_get_request_by_name` can also be used (instead of `RPGC_check_data_by_name`) to determine if a particular product has been requested.

Change History of CODE

- Clarified instructions on the handling of multiple product outputs. The function `RPGC_check_data_by_name` is recommended if the task produces more than one output. However if not used the result of attempting to obtain the output buffer will reflect whether the product is requested.
 - Clarified options for getting information about the current volume / elevation with algorithms having no data input.
 - Documented unique algorithm logic contained in existing algorithms that are either special cases or non-standard. This list will be expanded in the future.
 - Expanded the description of determining output timing with event driven algorithms.
 - Updated description of Sample Algorithms and source code extracts.
 - Updated the discussion of alignment of structures in C.
 - See What's New for CODE B 11 r 1.2.
4. **CODE Volume 4 - CODE Utility Guide v 1.27**
- Updated for new versions of CVG and CVT.
 - Reconfigured the sample 1 algorithm products (1990 and 1995) to the range resolution of 0.13 nm for super resolution ingest.
 - Expanded and clarified the description of Method 5 configuration for unsigned integer array products.
 - Added a document describing the configuration and use of the `nbtcp` utility.
 - See What's New for CODE B 11 r 1.2.
5. **Other Documents**
- Updated Data Flow Diagram. See additional changes made in CODE B 11 r 1.2.
 - See What's New for CODE B 11 r 1.2.
6. **ORPG Source Code**
- Updated to ORPG Build 11 (rel 1.9) December 2008
7. **CODE Software**
- Sample Algorithms - version 1.20
 - For all tasks reading radial base data, added a test to ensure that the algorithm did not attempt to read or copy more bins than are actually in each base data radial.
 - Eliminated locally defined structures for packets af1f and 16.
 - Modified Sample 3 to place scale-offset parameters in the product, to use the new API function to determine the last elevation processed and fixed a problem resulting in some blank radials.
 - Modified Sample 4 to not assume both intermediate outputs were scheduled.
 - See changes with Sample Algorithms version 1.19 with CODE B11 r 1.2.
 - Modified Sample 2 and 3 to eliminate overlapping radials at the end of the elevation and noted that many Legacy products do not do this.
 - CODEview Graphics (CVG) 8.6 (integrated with ORPG B11)
 - See What's New for CODE B 11 r 1.2.
 - CODEview Graphics (CVG), update to 8.7 supplied with CODE B11 r1.2
 - See What's New for CODE B 11 r 1.2.
 - CODEview Graphics (CVG), update to 8.8 supplied with CODE B11 r1.9
 - Fixed a bug with method 5 display of packet 16 and the generic radial component introduced in CVG 8.7. All data levels beyond the last color transition definition were not displayed.
 - Improved the data level decoding function to handle the largest and smallest values possible.
 - Fixed three data click bugs. (1) The row reported for packet 17 (LFM grid) was incorrect. (2) The azimuth, radial number, and data level was not reported for the

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- first bin (range = 0). (3) The decoded data values (introduced in CVG 7.7) were not always correct.
- CODEview Text (CVT) 4.3.2 (integrated with ORPG B11)
 - See What's New for CODE B 11 r 1.2.
- CODEview Text (CVT), update to 4.3.3 supplied with CODE Build11 r1.2
 - See What's New for CODE B 11 r 1.2.
- CODEview Text (CVT), update to 4.4 supplied with CODE Build11 r1.9
 - Added the ability to decode data level in packet 16 and the generic radial using Scale-Offset parameters either in the product or via user supplied configuration file. Included Scale-Offset decoding parameters for existing digital products in CVT. The scale selector commands (*scaler*, *scalev1*, *scalev2*, and *scalesw*) are deprecated but are currently retained for backward compatibility.
 - Significantly enhanced the output of the generic data packet.
 - CVT can provide a simple listing of all components or components of a particular type.
 - In addition to printing all components, CVT can print out components of a particular type or a specific single component.
 - The printing of parameters associated with the product and with components can be turned off.
 - The format of the output has been improved and generic product fields having meaning encoded into an integer value are decoded.
 - The output format of data arrays (generic radials) has been improved along with the ability to decode data levels.
 - Added the capability to select a single radial or groups of radials to the display of the generic radial.
 - Modified BSCAN output to handle more than 400 radials to support super resolution products.
 - Fixed a bug in BSCAN output when viewing historical data before ORDA that did not have exactly 360 radials.
 - Added the capability to print out all layers of the symbology block by using the following command: 'layer 0'.
 - Modified the display of radial and raster packets to permit use of the basic display command 'layer c'.

What's New for CODE B11r1.2 (for ORPG Build 11) August 2008

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.27**
 - Modifications for the new version of ORPG Build 11 software.
 - New platform preparation instructions for Red Hat 5.
 - Updated installation instructions for the new CODE sample algorithms and the CODE utility updates.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.26**
 - Documented the Scale-Offset method as the new recommended method of describing the encoding of real data into unsigned integer arrays. Described the approved use of

Change History of CODE

- threshold levels in the product description block to provide encoding and decoding parameters. (Document 3 and Appendix B)
 - o Added description of proper locations for files related to algorithms (include files, man pages, adaptation data).
 - o Procedures for the configuration of 'replay' instances of algorithm tasks were added.
 - o Described the responsiveness to one-time requests as a design consideration.
 - o Clarified the major differences in base data when ingesting historical base data before the ORDA was fielded. (Document 4)
 - o Documented the possibility that the RDA does not process all elevations in a VCP and the new fields in the Scan Summary table structure which provides this information.
 - o Noted that there is a difference in the data levels that can be represented in a base data radial and what can be produced in the radar.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.21**
- o Build 11 changes to the algorithm API (Document 2)
 - Bug fix documented for `RPGC_cleanup_and_abort` and `RPGC_release_pdb_product`.
 - `RPGC_get_input_stream` was documented (new in build 11)
 - `RPGC_is_buffer_from_last_elev` was modified to also return the value of the last elevation index in addition to the whether the current index is the last. `RPGCS_get_last_elev_index` was deprecated
 - o Behavior of replay tasks was described for both data driven and event driven algorithms (Document 2)
 - o Documented the differences in the product request lists obtained by replay instances of tasks. (Document 2)
 - o Documented the purpose and behavior of replay instances of data driven and event driven tasks. Improves responsiveness to one-time requests. (Document 3)
 - o Documented the possibility that the RDA does not process all elevations in a VCP (the modified function `RPGCS_get_last_elev_index` provides the index of the last elevation processed).
4. **CODE Volume 4 - CODE Utility Guide v 1.26**
- o Updated for new versions of CVG and CVT.
 - o Documented the scale-offset method as the new recommended method of describing the encoding of real data into unsigned integer arrays. Described the approved use of threshold levels in the product description block to provide encoding and decoding parameters. Appendix F.
 - o Documented the generic legend for scaled integer products (method 5) as the preferred method for digital products using packet 16.
 - o Expanded and reorganized the discussion of the configuration of digital and generic radial products. Additional examples provided.
5. **Other Documents**
- o Updated Data Flow Diagram for products removed in Build 11 and to indicate which tasks have replay instances and which products are alert paired.
 - o New versions of the Class 1 User ICD and Product Specification ICD.
6. **ORPG Source Code**
- o Updated to ORPG Build 11 (rel 1.2) July 2008
7. **CODE Software**
- o Sample Algorithms - version 1.19
 - Eliminated compile warnings with Red Hat 5 and Build 11.
 - Added ROC RCS header templates to all source files.

Change History of CODE

- Modified for change to `RPGC_is_buffer_from_last_elev`.
- CODEview Graphics (CVG) 8.6 (integrated with ORPG B11)
 - Updated the display configuration for several future dual polarization products.
 - Fixed user interface problems when compiled on Red Hat 5.
 - Added logic to protect CVG from unusual product configurations that would cause buffer overflow and excessive text in the area available.
 - Modified preference file reading and display window to handle longer product names.
 - Converted all C++ style comments using `'''` to ANSI-C style comments required to be compiled with Build 11
- CODEview Graphics (CVG), update to 8.7 supplied with CODE B11 r1.2
 - Modified the generic legend configuration logic to provide the option to use the Scale Offset parameters to calculate designated legend labels. The Scale Offset parameters can be read from either the configuration file or the threshold fields in the product itself
 - The generic legend configuration (method 5) is the recommended method for all digital and generic radial products.
 - Fixed an error in the generic legend configuration color assignments. All colors except for leading flag values were off by 1.
 - Modified the mouse click data query to provide a decoded value using the Scale Offset parameters either in the product threshold levels or the product configuration file.
 - Performance enhancement. Reduced the number of times the legend configuration file is parsed and the legend blocks are drawn.
- CODEview Text (CVT) 4.3.2 (integrated with ORPG B11)
 - Eliminated an incorrect reference to 'message ID' in several outputs: inventory, database search, and help. The term 'message sequence number' is correct.
 - Converted all C++ style comments using `'''` to ANSI-C style comments required to be compiled with Build 11.
- CODEview Text (CVT), update to 4.3.3 supplied with CODE B11 r1.2
 - Added the volume date time as the last column of output from the inventory commands and the database search command.

What's New for CODE B10r1.14 (for ORPG Build 10) April 2008

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.25**
 - Modifications for the new version of ORPG Build 10 software.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.24**
 - Documented recommended encoding scheme for digital products and standard encoding/decoding parameters to be placed in the Product Description block (Appendix B).
 - Document 3 structures: scan summary table, volume status message, and the VPC structure. The volume status message is the primary means of obtaining volume data for algorithms not having product inputs.

Change History of CODE

- Clarified description product configuration parameters in the product_attr_table file.
 - See Volume 2 and 'What's New' for Build 10 r 1.13 for additional changes.
 - 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.20**
 - Expanded the description of the behavior and structure of event driven algorithms.
 - Documented two functions added in Build 10 to obtain the volume status information. This is the primary method of obtaining volume information for algorithms not having product inputs.
 - Documented limits on input parameters for four time conversion functions and an error in the return value for one time conversion function.
 - Documented bug in `RPGC_cleanup_and_abort()`.
 - See Volume 3 and 'What's New' for Build 10 r 1.13 for additional changes.
 - 4. **CODE Volume 4 - CODE Utility Guide v 1.24**
 - Documented recommended encoding scheme for digital products and standard encoding/decoding parameters to be placed in the Product Description block (Appendix A).
 - See Volume 4 and 'What's New' for Build 10 r 1.13 for additional changes.
 - 5. **ORPG Source Code**
 - Updated to ORPG Build 10 (release 1.14) April 2008
 - 6. **CODE Software**
 - Sample Algorithms - version 1.18
 - See 'What's New' for Build 10 r 1.13.
 - CODEview Graphics (CVG) 8.5, (integrated with ORPG B10)
 - See Volume 4 and 'What's New' for Build 10 r 1.13 for changes.
 - CODEview Text (CVT) 4.3 (integrated with ORPG B10)
 - See Volume 4 and 'What's New' for Build 10 r 1.13 for changes.
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What's New for CODE B10r1.13 (for ORPG Build 10) February 2008

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.24**
 - Modifications for the new version of ORPG Build 10 software.
 - Updated installation instructions for the CODE utility update.
 - Updated installation instructions for the new CODE sample algorithms.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.23**
 - Updated for ORPG Build 10 r 1.13.
 - Additional changes to the base data header.
 - Clarified guidance for encoding and decoding data in a scaled integer using the new `scale / offset` formula.
 - Documented the definition and purpose of the cut type bits and radial type bits in the `msg_type` field.
 - Expanded guidance for using the new generic radial component.
 - Expanded and clarified guidance for the overall structure of final products. Reorganized and added requirements for alignment of 2-byte and 4-byte data fields.
 - Documented rules and recommendations for the structure of the symbology block portion of a final product.

Change History of CODE

- Minor clarifications on the use of the RLE data packets and packet 28.
 - Enhanced guidance for use of 'snippet' files for the configuration of new products and algorithm tasks.
 - Documented a requirement for unique filenames for code provided to the ROC.
 - Updated guidance for limits on length of names and descriptions used in product and task configuration files.
 - Clarified the distinction and purpose of message queue and message database type non-product data stores.
 - See Volume 2 and 'What's New' for Build 10 r 1.1 for additional changes.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.19**
- Updated for ORPG Build 10 r 1.13.
 - Continued documentation of the new API functions added in Build 10.
 - Documented a new function for obtaining requests for a specified product.
 - Documented a new function for determining the cut type when registered for BASEDATA or RAWDATA.
 - Documented a new function for run length encoding.
 - Documented functions supporting the assembly of packet 16 header and data.
 - Documented two functions for obtaining slant range.
 - Begun documentation of five functions which provided database style access for non-product data stores.
 - Completed documentation of the description of the API function that converts encoded data fields and a function that reads advanced data fields.
 - Listed functions used in algorithms recently ported from Fortran to C that are inappropriate for use in new algorithms.
 - Added a discussion of problems that can be encountered in using user-defined C structures for writing product data fields. Includes a summary of pre-defined structures already available.
 - Non-Product Data Stores
 - Significantly expanded the description of the linear buffer non-product data store access functions. This includes how the message ID parameters are used with each type of buffer.
 - Described the new LB_DB type and how it relates to the original LB_REPLACE type.
 - Clarified the distinction and purpose of message queue and message database type non-product data stores.
 - See Volume 3 and 'What's New' for Build 10 r 1.1 for additional changes.
4. **CODE Volume 4 - CODE Utility Guide v 1.23**
- Updated to reflect new CODE utility capabilities and the CVG / CVT updates provided with CODE B10r1.8. See the summary of the updates for CVG / CVT below.
 - See Volume 4 and 'What's New' for Build 10 r 1.1 for additional changes.
5. **ORPG Source Code**
- Updated to ORPG Build 10 (release 1.13) February 2008
6. **CODE Software**
- Sample Algorithms - new version 1.18
 - Modified file names to make all names unique.
 - Modified the comments to remove all C++ style comments (using '//') which will be required in build 11.

Change History of CODE

- Eliminated the use of #define values for input and output product IDs. This completes the transition to using RPGC_reg_io() and the by_name data access functions begun in version 1.15.
- Modified sample algorithm 1 to use super resolution data from SR_REFLDATA and REFL_RAWDATA. A variable rather than a defined constant is used to represent the product range (number of bins). Changed range from 230 km to 460 km. NOTE: For the range to display with CVG 8.5, the resolution configured for products 1990 and 1995 must be changed from 0.54 nm to 0.13 nm.
- Modified sample algorithms 2 and 3 to use a variable rather than a defined constant to represent the product range (number of bins). Changed both from 230 km to 460 km. These algorithms continue to read the original data resolution (non super res).
- Configured final products using packet 16 for compression (sample 1 and sample 3).
- Modified sample algorithms 1 and 3 to use the output of the packet 16 helper function to calculate the packet, layer, block, and product size.
- Modified sample algorithms 1, 2, and 3 to uses new helper function RPGC_set_dep_params and RPGC_set_product_float.
- CODEview Graphics (CVG) 8.5, (integrated with ORPG B10 r 1.6 source code)
 - Modified to handle three product structures not previously used. CVG can load empty products (no symbology block, GAB, or TAB), products with empty symbology blocks (no layers), and symbology blocks containing empty layers (no data packets).
 - Configured development Dual Pol precipitation products 166 - 177.
 - In order to support selection of products in a saved database created by an ORPG before Build 8, a work-around for incorrect volume times in the RCS (84) and VCS (83) products was reintroduced to the database list sort function.
 - Bug Fixes
 - When displaying text packet 1 in the symbology block (as used by 3 precipitation products DHP, USP, DPA), the last line of text overlays the previous line of text
 - Fixed a bug where a few non-compressed products were inappropriately decompressed when loaded from a single product binary file
 - Issues involving display of an image at high zoom factors and offset center resulting in the radar location being off of the edge of the screen
 - See Volume 4 and 'What's New' for Build 10 r 1.1 for additional changes (CVG 8.4).
- CODEview Text (CVT) 4.3 (integrated with ORPG B10 r1.6)
 - Modified to handle two product structures not previously used. CVT can load products with empty symbology blocks (no layers) and symbology blocks containing empty layers (no data packets).
 - Improvements in the display of product headers include display of the unsigned integer value for product dependent parameters and formatting changes to improve readability.
 - Added more information to the output of the summary command.
 - Fixed a bug in reported product length if a compressed product had been extracted from the database.
 - See Volume 4 and 'What's New' for Build 10 r 1.1 for additional changes (CVT 4.2).

CODE B10r1.8 (for ORPG Build 10)
January 2008

This was an internal release of CODE not formally distributed. What's New for CODE B10r1.13 includes a description of changes made in this version.

What's New for CODE B10r1.1 (for ORPG Build 10)
September 2007

1. **CODE Volume 1 - Guide to Setting Up the Development Environment v 1.22**
 - Modifications for the new version of ORPG Build 10 software.
 - Updated installation instructions for the CODE utility update.
 - Updated installation instructions for the new CODE sample algorithms.
2. **CODE Volume 2 - ORPG Application Development Guide v 1.21**
 - Updated for ORPG Build 10.
 - Included new versions of the Product Specification ICD and the RPG to Class 1 User ICD.
 - Continued improvements to the preliminary documentation of the future Dual Polarization Data. This includes corrections and clarifications to the data structure and the data contained in the internal DUALPOL data messages.
 - Clarified the meaning of Super Resolution to only refer to the increase azimuth resolution available from the 0.5 degree azimuth sample interval. It does not refer to the increase Doppler range or the increased range bin resolution for the reflectivity moment.
 - Documented changes to the internal base data header.
 - Improved the clarity of the section describing data available when reading the various base data message types.
 - Updated the product data flow diagram to include the new super resolution base data array products and the turbulence algorithm from NCAR.
 - Documented a minor change to the task_attr_table entry for algorithm tasks.
 - Documented the Legacy contour data packets. All products using this packet were removed from the ORPG in Build 4.
 - See Volume 2 and 'Whats New' for Build 9 r1.27 for additional changes.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide v 1.17**
 - Partially updated for ORPG Build 10.
 - Most of the new API functions for Build 10 have not yet been documented.
 - Some of the new functions were created to facilitate the porting of FORTRAN algorithms to ANSI-C.
 - Functions supporting the access of the future DUALPOL basedata types have been documented.
 - Enhanced the documentation for a Build 10 function accessing the Dual Pol data fields from the internal base data message.

Change History of CODE

- Corrected and clarified the definition of the input parameters for the radial run-length encoding function.
- Made additional changes to the description of the procedure for accessing the data fields contained in the internal base data message.
- Added an appendix summarizing the algorithm tasks recently ported from FORTRAN to C.
- See Volume 3 and 'Whats New' for Build 9 r1.27 for additional changes.
- 4. **CODE Volume 4 - CODE Utility Guide v 1.21**
 - Updated to reflect new CODE utility capabilities and the CVG / CVT updates provided with CODE B10r1.1. See the summary of the updates for CVG / CVT below.
 - Documented the new Background Map Maker utility supplied with the CVG update.
- 5. **ORPG Source Code**
 - Updated to ORPG Build 10 (release 1.1) August 2007
- 6. **CODE Software**
 - Sample Algorithms - new version 1.17
 - In sample algorithm 1, replaced `REFL_RAWDATA` with `RECOMBINED_REFL_RAWDATA`.
 - Removed the "-v" argument from the `task_attr_table` 'args' attribute for all tasks.
 - Clarified source code in sample algorithm 2 for use of the new run-length encoding function. Fixed a minor bug using the new run-length encoding function in sample algorithm 2.
 - For clarity, separated the layer 1 header information out of the symbology header structure. This helps demonstrate how to handle additional layer headers and the problems that can occur when using C structures with the integer types not aligned with the 4-byte address positions. Accomplished for all sample algorithms, tsk001, tsk002, tsk004, and tsk006.
 - Added defined offsets to replace explicit numbers when calculating offset to and size of portions of the final product structure.
 - CODEview Graphics (CVG) 8.3, (integrated with ORPG B9 r1.27 source code)
 - See Volume 4 and 'What's New' for Build 9 r1.27.
 - CODEview Graphics (CVG), update to 8.4 supplied with CODE B10 r1.
 - The display of the generic radial component is now supported. This is being used in the future DPR product.
 - A new method of legend configuration is provided. Method 5 supports unsigned integer types (8-bit, 16-bit, and 32-bit) that can be used in the generic radial. This method can also be used for packet 16. Support for signed integer types and real types will be added.
 - Support for display of the legacy contour data packets has been reintroduced into CVG. This will be used by the future melting layer product.
 - Zoom factors have been increased to include ± 16 and ± 32
 - DPR and numerous Dual Pol products have been preconfigured.
 - Corrected the display of the volume sequence number when sorting the database product list using the alternate method
 - See Volume 4 for a complete list.
 - CODEview Text (CVT) 4.1.1 (integrated with ORPG B9 r1.27)
 - See Volume 4 and 'What's New' for Build 9 r1.27.
 - CODEview Text (CVT), update to 4.2 supplied with CODE B10 r1.1
 - Fixed the decoding of base data moment values in the 8-bit basedata products.

Change History of CODE

- Updated support for display of generic products.
 - See Volume 4 for a complete list.
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CODE Guide

Setting Up the ORPG Development Environment



CODE Guide Volume 1. [Guide to Setting Up the Development Environment](#)

Document 1. CODE Specific ORPG Installation Instructions

- I - Preparation for Installation
- II - Installation Instructions
- III - Supplemental Information
- IV - Running the ORPG

Document 2. Installing CODE Software

- I - Software Requisites for CODE Utilities
- II - Instructions for CODE Utilities
- III - Instructions for Sample Algorithms

Volume 1 Appendices

Using the ORPG Development Environment



CODE Guide Volume 2. [ORPG Application Software Development Guide](#)

Document 1. The ORPG Architecture

Document 2. The ORPG Development Environment

- I - Integrating Development Software with ORPG Source Code
- II - Compiling Software in the ORPG Environment
- III - ORPG Configuration for Application Developers
- IV - Configuring Site Specific Adaptation Data

Document 3. WSR-88D Final Product Format

- I - Product Block Structure
- II - Traditional Product Data Packets
- III - Generic Product Components
- IV - ORPG Application Dependent Parameters

Document 4. ORPG Internal Data for Algorithm Developers

- I - Base Data Format
- II - Algorithm Adaptation Data - Configuration & Use
- III - Other Data Inputs

Volume 2 Appendices

Writing ORPG Algorithms



CODE Guide Volume 3. [WSR-88D Algorithm Programming Guide](#)

Document 1. The WSR-88D Algorithm API Overview

Document 2. The WSR-88D Algorithm API Reference

- I - API Service Registration / Initialization
- II - Control - Input/Output - Abort Services
- III - Final Product Construction
- IV - API Convenience Functions

Document 3. The WSR-88D Algorithm Structure and Sample Algorithms

- I - WSR-88D Algorithm Structure
- II - Sample Algorithms

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III - Writing Product Data Fields

Document 4. Special Topics

I - Topics Related to Using the Development Environment

II - Topics Related to Writing Algorithms

Volume 3 Appendices

ORPG Specific Development Utilities



CODE Guide Volume 4. [CODE Utility Guide](#)

Document 1. CODEview Text (CVT)

Document 2. CODEview Graphics (CVG)

I - Displaying Products with CVG

II - Configuring Products for Display by CVG

Document 3. Archive II Disk File Ingest - play_a2 Tool

Document 4. Product Distribution with the nbtcp Tool

Document 5. Additional CODE / ORPG Tools

Volume 4 Appendices