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PRODUCT SPECIFICATION

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INTRODUCTION

The Product Specification Interface Control Document is an internal engineering document for detail design criteria for the SS meteorological products.

SCOPE

The product descriptions and the product range/resolution of the 31 October 2001 issue of 2810000D, WSR-88D System Specification, form the basis for the product specification. The specifications define special symbols and characters.

Appendix A contains standard and product specific units and dimensions, symbols, abbreviations, parameters and display features. These are also defined in each product specification.

Appendix B contains product display formats. Alphanumeric tabular formats are contained in C.

1 REFLECTIVITY (R, DR, DR7 AND SDR)

1.1 SS Product Description

"This product shall provide the reflectivity data displayable as an image1 and formatted as a data array. For the image version, variations of the product shall be organized to provide various areas of coverage and display resolutions, while the data array version will provide the highest resolution available for the entire coverage area.2 On Super-Resolution azimuth scans, variations of the data array version of the product shall be organized to provide super-resolution and legacy-resolution coverage and resolution requirements. Both versions will be limited to the lowest 70,000 feet AGL of the atmosphere. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time.3 For the image version, each product shall be available for both 8 and 16 reflectivity data levels, while 256 reflectivity data levels will be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum data value (dBZ), radar position, radar elevation above MSL, and radar operational mode."

Super-Resolution refers to the following three spatial resolution and coverage enhancements: 0.5deg azimuth sampling, 0.13nmi range sampling of Reflectivity, 162nmi coverage area for Mean Radial Velocity and Spectrum Width. The relevant distinction for Reflectivity is the reduced azimuth sample interval and range sample interval. “Super-Resolution” was introduced in 2008 (Build 10) and was optionally generated during “Split Cuts” processing (the lowest 2 or 3 elevation angles) as specified in the Volume Coverage Pattern definition.

1.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

1.2.1 Data Levels

For the image version, the range of data level values (dBZ) varies with operational mode, area climatology and season, and with NEXRAD system (or agency) adaptation data. The range of reflectivity supported by the RDA is -32 to +95 dBZe.

1.2.2 Color Level Code Tables

The color level code used for display of the image version of reflectivity is NEXRAD (or agency) system adaptation data. Some examples of color tables for both Modes A and B are listed. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

- - - - - - -

"1Defines the form of presentation on a graphic display; not necessarily the form of transmission."
"2The exception is the Base Reflectivity Data Array (DoD Version - DR7) which limits the coverage area to 124 nmi."
"3Defined in Appendix B"

Color Level Codes
Precipitation Mode

16-Level Code	Display dBZ	Range dBZ	Color Levels	
			Code	Color
0	ND	SNR<TH OR dBZ<5	(00 00 00)	black
1	5	5<dBZ<10	(9C 9C 9C)	medium gray
2	10	10<dBZ<15	(76 76 76)	dark gray
3	15	15<dBZ<20	(FF AA AA)	light pink
4	20	20<dBZ<25	(EE 8C 8C)	medium pink
5	25	25<dBZ<30	(C9 70 70)	dark pink
6	30	30<dBZ<35	(00 FB 90)	light green
7	35	35<dBZ<40	(00 BB 00)	medium green
8	40	40<dBZ<45	(FF FF 70)	light yellow
9	45	45<dBZ<50	(D0 D0 60)	dark yellow
A	50	50<dBZ<55	(FF 60 60)	light red
B	55	55<dBZ<60	(DA 00 00)	medium red
C	60	60<dBZ<65	(AE 00 00)	dark red
D	65	65<dBZ<70	(00 00 FF)	blue
E	70	70<dBZ<75	(FF FF FF)	white
F	75	75<dBZ	(E7 00 FF)	purple

Color Level Codes
Clear Air Mode

16-Level Code	Display dBZ	Range dBZ	Color Levels	
			Code	Color
0	ND	SNR<TH or dBZ<-28	(00 00 00)	black
1	-28	-28<dBZ<-24	(9C 9C 9C)	medium gray
2	-24	-24<dBZ<-20	(76 76 76)	dark gray
3	-20	-20<dBZ<-16	(FF AA AA)	light pink
4	-16	-16<dBZ<-12	(EE 8C 8C)	medium pink
5	-12	-12<dBZ<-8	(C9 70 70)	dark pink
6	-8	-8<dBZ<-4	(00 FB 90)	light green
7	-4	-4<dBZ<0	(00 BB 00)	medium green
8	0	0<dbZ<+4	(FF FF 70)	light yellow
9	+4	+4<dBZ<+8	(D0 D0 60)	dark yellow
A	+8	+8<dBZ<+12	(FF 60 60)	light red
B	+12	+12<dBZ<+16	(DA 00 00)	medium red
C	+16	+16<dBZ<+20	(AE 00 00)	dark red
D	+20	+20<dBZ<+24	(00 00 FF)	blue
E	+24	+24<dBZ<+28	(FF FF FF)	white
F	+28	+28<dBZ	(E7 00 FF)	purple

Precipitation Mode and Clear Air Mode

8-Level Code	Display dBZ	Range dBZ	Color Levels Code	Color Levels Color
0	ND	SNR<TH or dBZ<5	00 00 00)	black
1	5	5<dBZ<18	(FF AA AA)	light pink
2	18	18<dBZ<30	(C9 70 70)	dark pink
3	30	30<dBZ<41	(00 BB 00)	medium green
4	41	41<dBZ<46	(FF FF 70)	light yellow
5	46	46<dBZ<50	(DA 00 00)	medium red
6	50	50<dBZ<57	(00 00 FF)	blue
7	57	57<dBZ	(FF FF FF)	white

1.2.3 Range/Data Resolution

The image products will be available for the range/resolution combinations as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar location
0 to 248	1.1 x 1	Radar location
0 to 248	2.2 x 1	Radar location

The data array product will be available for the range/resolution combination as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 2481	0.54 x 1	Radar location
0 to 248	0.13 x 0.5	Radar location

"1The range coverage for the Base Reflectivity Data Array (DoD Version) - DR7 product is 124 nmi."

1.3 Annotations

1.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum Data Value Detected

1.3.2 Special Symbols

None defined

1.4 Product Interaction

All overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature

2 MEAN RADIAL VELOCITY (V, DV, DV7 AND SDV)

2.1 SS Product Description

"This product shall provide the mean radial velocity data both displayable as an image and formatted as a data array. For the image version, variations of the product shall be organized to provide various areas of coverage and display resolution, while the data array version will provide the highest resolution available for the entire radar coverage area.1 On Super-Resolution azimuth scans, variations of the data array version of the product shall be organized to provide super-resolution and legacy-resolution coverage and resolution requirements. Both versions will be limited to lowest 70,000 feet AGL of the atmosphere. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time. For the image version, each product shall include both 8 and 16 mean radial velocity data levels, while 256 velocity data levels will be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum data value detected (knots, positive and negative), radar position, radar elevation above MSL, and radar operational mode."

Super-Resolution refers to the following three spatial resolution and coverage enhancements: 0.5deg azimuth sampling, 0.13nmi range sampling of Reflectivity, 162nmi coverage area for Mean Radial Velocity and Spectrum Width. The relevant distinction for Mean Radial Velocity is the increased coverage area and reduced azimuth sample interval.

2.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

2.2.1 Data Levels

For the image version, the range of mean radial velocity values will vary with operational mode and with NEXRAD system (or agency) adaptation data. The data thresholds are site adaptable.
The range of values used is a function of meteorological mode and/or operator option.

2.2.2 Color Level Code Tables

The color level code used for display of the image version of mean radial velocity is NEXRAD system (or agency) adaptation data. Examples for currently defined color tables are shown. With the exception of end point values the lower value of the velocity range is assigned to the individual colors displayed. The range of values for each is also indicated.

"1The range resolution for the Base Velocity Data Array (DoD Version - DV7) is 0.27 nmi."

Color Level Codes

16-Level Code	Display knots	Range knots	Color Levels Code	Color Levels Color
0	ND	SNR<TH	(00 00 00)	black
1	-64	-64>knots	(00 E0 FF)	light blue
2	-50	-50>knots>-64	(00 80 FF)	medium blue
3	-36	-36>knots>-50	(32 00 96)	dark blue
4	-26	-26>knots>-36	(00 FB 90)	light green
5	-20	-20>knots>-26	(00 BB 99)	medium green
6	-10	-10>knots>-20	(00 8F 00)	dark green
7	-1	0>knots>-10	(CD C9 9F)	light gray
8	0	0<knots<+10	(76 76 76)	dark gray
9	+10	+10<knots<+20	(F8 87 00)	medium orange
A	+20	+20<knots<+26	(FF CF 00)	medium yellow
B	+26	+26<knots<+36	(FF FF 00)	yellow
C	+36	+36<knots<+50	(AE 00 00)	dark red
D	+50	+50<knots<+64	(D0 70 00)	medium brown
E	+64	+64<knots	(FF 00 00)	bright red
F	RF	RF	(77 00 7D)	dark purple

8-Level Code	Display knots	Range knots	Color Levels Code	Color Levels Color
0	ND	SNR<TH	(00 00 00)	black
1	-10	-10>knots	(00 E0 FF)	light blue
2	-5	-5>knots>-10	(00 BB 00)	medium green
3	-1	0>knots>-5	(00 8F 00)	dark green
4	0	0<knots<+5	(F8 87 00)	medium orange
5	+5	+5<knots<+10	(FF CF 00)	medium yellow
6	+10	+10<knots	(FF 00 00)	bright red
7	RF	RF	(77 00 7D)	dark purple

2.2.3 Range/Data Resolution

The image products will be available for the range/resolution combinations as indicated below. Displayed values for lower resolution products are chosen by selecting every other bin value (0.27 nmi resolution) and every fourth bin value (0.54 nmi resolution).

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 32	0.13 x 1	Radar location
0 to 62	0.27 x 1	Radar location
0 to 124	0.54 x 1	Radar location

The data array product will be available for the range/resolution as indicated.

Coverage Area (nmi)	Resolution (nmi x deg)	Product Center
0 to 124	0.27 x 11	Radar location
0 to 162	0.13 x 0.5	Radar location

"1The range resolution for the Base Velocity Data Array (DoD Version) - DV7 is 0.27 nmi."

2.3 Annotations

2.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum Data Value Detected (both positive and negative)

2.3.2 Special Symbols

None defined

2.4 Product Interaction

All overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

3 SPECTRUM WIDTH (SW AND SDW)

3.1 SS Product Description

"This product shall provide the radial velocity spectrum width data both displayable as an image and formatted as a data array. For the image version, variations of the product shall be organized to provide various areas of coverage and display resolutions, while the data array version shall provide the highest resolution available for the entire radar coverage area. Both versions will be limited to lowest 70,000 feet AGL of the atmosphere. The image version of the product shall be generated for any azimuth scan at a single elevation angle based on user requirements. The data array version of the product shall be generated for any super-resolution azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time. For the image version, each product shall be available for 8 spectrum width data levels, while 256 spectrum width data levels shall be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum data value detected (knots), radar position, radar elevation above MSL, and radar operational mode."

Super-Resolution refers to the following three spatial resolution and coverage enhancements: 0.5deg azimuth sampling, 0.13nmi range sampling of Reflectivity, 162nmi coverage area for Mean Radial Velocity and Spectrum Width. The relevant distinction for Spectrum Width is the increased coverage area and reduced azimuth sample interval.

3.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

3.2.1 Data Levels

For the image version, the range of spectrum width data values displayed is from 0 to 20 kts (Any levels exceeding 20 kts will be truncated to 20 kts). For the data array version, the range of spectrum width data values displayed is from 0 to 40 kts (the RDA clips spectrum width at Nyquist Velocity/√3).

3.2.2 Color Level Code Tables

The color level code used for display of the image version spectrum width is NEXRAD system (or agency) adaptation data. The currently defined color table for spectrum width is listed.

8-Level Code	Display knots	Range knots	Color Levels	
			Code	Color
0	ND	SNR<TH	(00 00 00)	black
1	0	knots<4	(76 76 76)	dark gray
2	4	4<knots<8	(9C 9C 9C)	medium gray
3	8	8<knots<12	(00 BB 00)	medium green
4	12	12<knots<16	(FF 00 00)	bright red
5	16	16<knots<20	(D0 70 00)	medium brown
6	20	20<knots	(FF FF 00)	yellow
7	RF	RF	(77 00 7D)	dark purple

3.2.3 Range/Data Resolution

The image products will be available for the range/resolution combination as indicated below. Displayed values for lower resolution products are chosen by selecting every other bin value (0.27-nmi resolution) and every fourth bin value (0.54 nmi resolution).

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 32	0.13 x 1	Radar location
0 to 62	0.27 x 1	Radar location
0 to 124	0.54 x 1	Radar location

The data array product will be available for the range/resolution as indicated.

Coverage Area (nmi)	Resolution (nmi x deg)	Product Center
0 to 162	0.13 x 0.5	Radar location

3.3 Annotations

3.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum Data Value Detected

3.3.2 Special Symbols

None defined

3.4 Product Interaction

All overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

4 DELETED

5 DELETED

6 COMPOSITE REFLECTIVITY AND COMPOSITE REFLECTIVITY EDITED FOR ANOMALOUS PROPAGATION (CR AND CRE)

6.1 SS Product Description

"This product shall provide composite reflectivity data displayable as an image. For each geographical resolution element, this product shall provide the highest reflectivity value above the resolution element available from any elevation angle scan of a volume scan. This product shall be updated once per volume scan. The product shall be available for both 8 and 16 reflectivity data levels. The product shall include annotations for the product name, radar ID, time and date of scan, data level code, maximum data value (dBZ), radar position, radar elevation above MSL and radar operational mode. In addition, storm information generated by the various meteorological algorithms, e.g. the Storm Cell Identification & Tracking (SCIT) algorithm and Tornado Detection Algorithm (TDA) shall be included as annotations or graphic overlays, or both, as the user selects. When selected, the algorithm generated information shall be provided for all identified storms. When these additional annotations or overlays are selected by the user, they shall be provided routinely until deselected. The information in these optional overlays and annotations shall be updated once per volume scan time.

For the second version of this product (CRE), a clutter editor is applied to the reflectivity image data (using both velocity and spectrum width data as inputs) to remove clutter contaminated data."

6.2 Display Format

6.2.1 Graphic Display

The product is displayable in full-screen or quarter-screen format (see Appendix B).

6.2.1.1 Data Display

6.2.1.1.1 Data-Levels

The range of data level values vary with operational mode, area climatology and season, and is NEXRAD system (or agency) adaptation data.

6.2.1.1.2 Color Level Code Tables

The color level code used for display of reflectivity is NEXRAD system (or agency) adaptation data. Currently defined color tables for both 8 and 16 levels are listed in the product specification 1.2.2. A gray scale color table is available for use at PUP operator option. (The composite reflectivity gray scale will allow the overlay colors to be easily distinguishable from the composite reflectivity image.)

6.2.1.2 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
124	0.54 x 0.54	Radar Location
248	2.2 x 2.2	Radar Location

6.2.1.3 Graphic Overlay

Not Applicable

6.2.2 Alphanumeric Display

Not Applicable

6.3 Annotations

Combined Attribute Table (Configuration 5, Format III, Appendix B)

6.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Data Level Code
Maximum (CR or CRE) Data Value Detected

6.3.2 Special Symbols

None defined

6.4 Product Interaction

The following overlay prod Color Levels products are displayable on this product:

- Attribute Tables
- Hail
- Mesocyclone
- Storm Track Information
- Tornado Vortex Signature.

7 DELETED

8 ECHO TOPS (ET)

8.1 SS Product Description

"This product shall provide the echo tops information displayed as an image. This product shall be produced from the output of the Echo Tops Algorithm. The product shall be updated once per volume scan time. The product shall be available for 16 altitude range data levels referenced to mean sea level. The product shall include annotations for product name, radar ID, time and date of scan, maximum data value detected (Height in feet, MSL), radar position, radar elevation above MSL, and radar operational mode."

8.2 Display Format

This product is displayable in full- or quarter-screen format (see Appendix B).

8.2.1 Data Levels

The product will be available for 16 altitude range levels. The range of altitude values are 5,000 feet to 70,000 feet in increments of 5,000 feet. The component with the highest altitude of each echo which meets the minimum reflectivity value specified in adaptation data (default value of 18.5 dBZ) will be used as the echo top.

8.2.2 Color Level Code Tables

16-Level Code	Display kft	Range kft MSL	Color Levels	
			Code	Color
0	ND	No Data	(00 00 00)	black
1	0	kft<5	(00 00 00)	black
2	5	5<kft<10	(76 76 76)	dark gray
3	10	10<kft<15	(00 E0 FF)	light blue
4	15	15<kft<20	(00 B0 FF)	lt medium blue
5	20	20<kft<25	(00 90 CC)	dk medium blue
6	25	25<kft<30	(32 00 96)	dark blue
7	30	30<kft<35	(00 FB 90)	light green
8	35	35<kft<40	(00 BB 00)	medium green
9	40	40<kft<45	(00 EF 00)	bright green
A	45	45<kft<50	(FE BF 00)	tan
B	50	50<kft<55	(FF FF 00)	yellow
C	55	55<kft<60	(AE 00 00)	dark red
D	60	60<kft<65	(FF 00 00)	bright red
E	65	65<kft<70	(FF FF FF)	white
F	70	70<kft	(E7 00 FF)	purple

8.2.3 Range/Data Resolution

Coverage Area (nmi Radius)	Resolution (nmi x nmi)	Product Center
0 to 124	2.2 x 2.2	Radar Location

8.3 Annotations

8.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Maximum Data Value Detected
Data Level Code

8.3.2 Special Symbols

None defined

8.4 Product Interaction

The following overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

9 DELETED

10 DELETED

11 DELETED

12 VELOCITY AZIMUTH DISPLAY (VAD), (VWP)

12.1 SS Product Description

"This product shall provide the Velocity Azimuth Display Algorithm derived wind speed and direction. Two versions of the product shall be produced. For the first version, the wind speed and direction at up to 30 altitudes shall be computed and displayed as wind barbs on a height scale. The specific altitude levels at which VAD winds are computed and reported shall be site adaptable in one thousand feet increments. The specific altitudes at which winds are requested shall be used to derive the specific slant range and elevation angle for the VAD algorithm analysis. The use of look up tables relating a specific slant range and elevation angle to a specific wind reporting altitude for computational efficiency is permitted. To facilitate this, off-line processing may be used to generate new look-up tables whenever adaptation parameters are changed or new scanning sequences are invoked. The specific methods of computing slant range and elevation angle are subject to Government approval.

Wind speed and direction will be reported to the highest altitude level at which sufficient signal is available for processing by the VAD algorithm. This product will be produced in a tabular format of alphanumeric values and as a stand-alone graphic product. The graphic product will contain the current and up to 10 previous height plots (user selectable) displayed simultaneously on a time versus height scale. This version of the product will include annotations for the product name, radar ID, radar position, radar elevation above MSL, time and date of volume scan, and maximum wind speed and associated direction of most current plot. Altitude levels will be shown referenced to mean sea level. The alphanumeric format will contain all wind data derived by the VAD algorithm for the current volume scan. Upon user request, all site adaptable parameters identified as input to the algorithm used to generate data for this product will be available at the alphanumeric display.
A second version of the VAD winds product shall be produced upon user request. This version shall present the VAD wind analysis for a specific altitude. The data displayed shall consist of the Doppler velocity data used to compute the VAD wind and the best fit function used to determine the horizontal wind speed and direction.

The data shall be presented to the user as a graphical plot of the actual Doppler velocity and the best fit function on an orthogonal axis of speed versus azimuth. The vertical axis presented shall be speed, scaled as necessary, to allow all data to be displayed. The Nyquist velocity for the specific scan shall be graphically annotated on the display if the range of the scaled vertical axis is sufficient. The horizontal axis shall be azimuth, scaled from 0-360 degrees with true North as 0/360 degrees. This product shall be available for any wind value included in the most recent time-height cross-section of the VAD Winds Product. This version of the product shall include annotations for the product name, radar ID, radar position, radar elevation above MSL, time and date of volume scan, slant range, elevation angle, wind speed and direction, computed altitude of winds, RMS error, and best fit function in the form $A1 + V \sin(\theta+\delta)$. (See Algorithm Report.)"

12.2 Display Format

The VWP is displayable in grid Format IVA, Appendix B. The grid is considered to be part of the image and will always be displayed simultaneously with the image.
The grid for the VWP will consist of a vertical scale for altitude in thousands of feet above MSL and a horizontal time scale. The specific altitude levels are site adaptable. The vertical grid scale for the heights will be divided to equally space the number of heights that are selected. It will not be necessarily scaled since the screen is not large enough to accommodate the total interval that is possible to select. The adaptation data may have intervals of varying increments of 1,000. The

horizontal time scale will accommodate up to 10 previous user selectable height plots (e.g., the last 10 volume scans in addition to the current volume scan).

The altitude levels will be indicated in thousands of feet along the right and left ordinates and the time (hour and minutes) along the abscissa. Full screen display will be used for this product. Wind barb units will be in knots. Direction in both cases will be the direction from which the wind is blowing in degrees.

The VAD product is displayable in grid Format IVB, Appendix B. The grid is considered to be part of the image and will be displayed simultaneously with the image. In addition, the Nyquist Velocity for the specified scan will be graphically annotated on the display if it falls within the range of the scaled vertical axis.

The grid for the VAD product consists of a vertical scale for velocity and a horizontal scale for azimuth. The equation for the FIT function in the form of A1 + V sin (Aε +δ) will also be displayed. The vertical scale is labeled with velocity values scaled such that all the data fits on the display. The unit for the velocity grid is knots. The horizontal scale is labeled with azimuth in 0 to 360 degrees. True North is 0/360 degrees. The FIT function is defined as above, where A1, V and δ corresponds to CF1, SPW and -DW-90 as defined in the NEXRAD Algorithm Report.

The velocity values will be plotted as individual points on the orthogonal axis and overlaid with the best fit sine wave function.

12.2.1 Data Levels

For the VWP product, the wind vector flag shaft origin will be plotted to the appropriate elevation (ordinate) and time (abscissa) intersection.

The wind vector will be plotted at the height at which it was observed. If the wind is calm, i.e., sufficient echoes are present but velocities are <5 knots, then a circle 5 pixels in diameter is placed at the appropriate point.

12.2.2 Color Level Code Table

For the VWP Product:

The wind vector color will reflect the RMS code as follows:

5-Level Code	Display RMS/knots	Range RMS/knots	Color Levels Code	Color Levels Color
1	0	<knots<4	(00 FF 00)	green
2	4	4<knots<8	(FF FF 00)	yellow
3	8	8<knots<12	(FF 00 00)	bright red
4	12	12<knots<16	(00 E0 FF)	light blue
5	16	16<knots	(FF 70 FF)	medium purple

The color level table for the VAD product:
The velocity points will be color coded to the reflectivity value at the same position. The eight-level color table is defined as follows:

8-Level Code	Display dBZ	Range dBZ	Color Levels Code	Color Levels Color
0		Not Used	(00 00 00)	black
1	<5	5>dBZ	(77 77 90)	medium gray
2	5	5<dBZ<18	(FF AA AA)	light pink
3	18	18<dBZ<30	(C9 70 70)	dark pink
4	30	30<dBZ<41	(00 BB 00)	medium green
5	41	41<dBZ<46	(FF FF 70)	light yellow
6	46	46<dBZ<50	(DA 00 00)	medium red
7	50	50<dBZ	(00 00 FF)	blue

12.2.3 Range/Data Resolution

Coverage Area (nmi Radius)	Resolution (nmi x nmi)	Product Center
N/A	Nearest 5 kts	N/A

12.2.4 Alphanumeric Display

In the alphanumeric product (tabular format for the alphanumeric screen), if the VAD derived with at a given level is valid (i.e., failed threshold for RMS, symmetry, or number of points), data for that height shall not be included. A three-line header, which includes a title, date, time column labels, and units, shall appear at the top of each VAD Algorithm Output page. Each page contains up to 14 height levels of VAD wind data. However, if there are no valid winds in the volume scan, the VWP product will not contain VAD Algorithm Output page (s). The vertical velocity (W) and divergence (DIV) columns will contain valid data only for constant slant range wind estimates. For all other estimates, these fields shall contain "NA", indicating not applicable.

12.2.4.1 Alphanumeric Screen

The tabular format, display on the alphanumeric screen (i.e. the VWP alphanumeric product), shall include up to 52 VAD derived winds. Namely, the RPC selected altitudes (up to 30), one per elevation at a constant slant range (up to 20), and the low altitude supplemental wind (2). Wind shall be ordered by increasing altitude. The format used is specified in Appendix C.

(a) Altitude above mean sea level in hundreds of feet
(b) Eastward, northward components of the wind in m/s
(c) Upward component of the wind in cm/s
(d) Wind direction in degrees
(e) Wind speed in knots
(f) Scatter between velocity points and the VAD fitted curve in knots
(g) Divergence of the wind in 10 per second
(h) Slant range of the VAD analysis in nautical miles
(i) Elevation angle of the VAD analysis in degrees
(j) Adaptable VAD Parameters

12.3 Annotations

12.3.1 Alphanumeric

For the VWP Product:
Standard Annotations (Appendix A, I(A))
Data Level Code
Maximum Wind Speed (current plot)
Direction of Wind Speed (current plot)
Site Adaptable Parameters
For the VAD Product:
Standard Annotations (Appendix A, I(A))
Slant Range
Elevation Angle
Wind Speed and Direction
Root Mean Square (RMS) Error
Computed Altitude of Wind

12.3.2 Special Symbols

For the VWP Product:
The wind speed and direction will be plotted with the standard meteorological wind barb presentation.
The direction will be plotted as a straight line of 20 pixels in length from the direction of the wind. The vector will terminate at the intersection of the appropriate altitude and time.
Wind direction is plotted to the nearest 5 degrees and speed to the nearest 5 knots. The special symbol for the wind barbs is a flag consisting of lines which are perpendicular and to the left of the wind shaft using the scale as indicated.

½ barb (5 pixels in length) = 5 knots, example: 270° 65 kts
1 barb (10 pixels in length) = 10 knots
Full triangle (10 pixels in length and 4 pixel base) = 50 knots
Shaft length = 20 pixels

For the VAD Product:
The velocity data will be plotted as single points on the grid of velocity vs. azimuth. The best fit function will be plotted over the field of velocity points as a linked vector in a contrasting color.
The span of velocity data displayed on the grid is as follows:

Velocity	Span of Velocity data (grid)
<60 kts	80 kts
60<100	120
100<140	160
140<180	180
>180	400

12.4 Product Interaction

None

12.5 Comment

All site adaptable parameters identified as input used to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in tabular layout showing the parameter name in one column, and value in an adjacent column.

13 DELETED

14 CROSS SECTION (RCS, VCS)

14.1 SS Product Description

"This product shall provide a vertical cross section of reflectivity or mean radial velocity data displayable as an image for a user selected vector. This vector shall be defined by the operator using two end-points, up to 230 km apart, and at any orientation and location within 230 km of the radar. This product shall be produced by mapping the nearest value in range along a radial, to a point in the plane of the vertical cross section defined by the intersection of the plane and the radial. The displayable version of the product shall be produced by linearly interpolating between the mapped values, both horizontally and vertically as necessary. The product shall be generated only on request. The product shall be available for both 8 and 16 data levels defining the intensity range and velocity range data levels. The product shall include annotations for the product name, radar ID, time and date of volume scan, maximum data value and location(s), radar position, radar elevation above MSL, and the radar operational mode. The location of the vector center and the end points (az/ran) shall also be indicated."

14.2 Display Format

The product is displayable on a unique grid (Format V, Appendix B) with height as ordinate and the distance along the cross section as the abscissa. The distance grid scale of the abscissa will be one of three with the range of the data determining which grid scale is used. The three scales are 0 to 50 nmi, 0 to 80 nmi, and 0 to 120 nmi. Range marks are labeled every 5 nmi for the 0 to 50 nmi range and every 10 nmi for the remainder.

The origin of the grid represents the Western nearest or Northern end point of the vector, depending upon its orientation, and the data that is contained in the label of the grid is the range from the radar of this point. Vectors will be plotted to outline the cross section area. These vectors will show the extent of the data domain that is limited because of the length of the user supplied vector, and these outline vectors will also show the difference between the area of no data versus no radar sampled data.

The grid is considered an integral part of the product and will always be available simultaneously with the image.

14.2.1 Data Levels

The data level values that may be selected for reflectivity and mean radial velocity are the same as those specified in 1.2.1 and 2.2.1, respectively.

14.2.2 Color Level Code Tables

The color level code table for the Reflectivity will be the 16-level table defined in 1.2.2. The Velocity table will be the 16-level velocity table defined in 2.2.2. The grid color will be light gray.

14.2.3 Range/Data Resolution

Coverage Area (R-Z plane)	Resolution (nmi x nmi)	Product Center
124 nmi x 70 kft Altitude	0.54 nmi Horizontal x 0.27 nmi Vertical	N/A

14.3 Annotations

14.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Maximum Data Value Detected
Location of Maximum Data Values
Location of Vector Center (AZRAN)
Location of Vector End Points (AZRAN)
Data Level Codes
Base Data Type

14.3.2 Special Symbols

None defined

14.4 Product Interaction

None

15 DELETED

16 STORM RELATIVE MEAN RADIAL VELOCITY (SRM, SRR)

16.1 SS Product Description

"This product shall provide mean radial velocity for: (a) a small geographic area centered upon or near an identified storm of interest with the storm motion removed, or (b) the entire area of radar coverage (to 230 km) with the average storm motion removed. This product shall be produced upon request for any azimuth scan at any elevation angle. The product shall be generated as a displayable image by removing the radial (velocity component away from the radar antenna) component of storm motion from the mean radial velocity values.
The radial component of storm motion shall be computed using the storm motion value computed for the identified storm by the Storm Cell Tracking Algorithm, the vector average of all currently identified storms or a value input by the user. The value of storm motion used to adjust the mean radial velocity values shall be user selectable at the time of product request, or default to the vector average of all currently identified storms if not selected. Each product shall contain 16 data levels for storm-adjusted mean radial velocity. Each product shall include annotations for the product name, radar ID, time and date of scan, elevation angle, storm motion, coordinates of product center, radar position, radar elevation above MSL, and radar operational mode."

16.2 Display Format

Each product version is displayable in full- or quarter-screen format (see Appendix B).
16.2.1 Data Levels
Both product versions use 16 data levels. The data level code may vary with operational mode and with NEXRAD (or agency) system adaptation data. One currently identified velocity table is shown.

16.2.1 Color Level Code Tables

16-Level Code	Display knots	Range knots	Color Levels	
			Code	Color
0	ND	SNR<TH	(00 00 00)	black
1	-50	-50>knots	(00 E0 FF)	light blue
2	-40	-40>knots>-50	(00 80 FF)	medium blue
3	-30	-30>knots>-40	(32 00 96)	dark blue
4	-22	-22>knots>-30	(00 FB 90)	light green
5	-10	-10>knots>-22	(00 BB 00)	medium green
6	-5	-5>knots>-10	(00 8F 00)	dark green
7	-1	0>knots>-5	(CD C0 9F)	light gray
8	0	0<knots<+5	(76 76 76)	dark gray
9	+5	+5<knots<+10	(F8 87 00)	medium orange
A	+10	+10<knots<+22	(FF CF 00)	medium yellow
B	+22	+22<knots<+30	(FF FF 00)	yellow
C	+30	+30<knots<+40	(AE 00 00)	dark red
D	+40	+40<knots<+50	(D0 70 00)	medium brown
E	+50	+50<knots	(FF 00 00)	bright red
F	RF	RF	(77 00 7D)	dark purple

16.2.2 Range/Data Resolution

Coverage Area (a) (nmi x nmi) (b) (nmi radius)	Resolution (nmi x deg)	Product Center
Version (a) 27 x 27 (Region)	0.27x1	Location of storm center
Version (b) 0 to 124 (Map)	0.54x1	Radar location

16.3 Annotations

16.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Coordinates of Product Center (AZRAN or Lat/Long)
Data Level Code
Maximum Data Values Detected (after storm motion removal)
Motion Vector*
Height Above Ground level of the Window Containing the Meteorological Phenomena**

16.3.2 Special Symbols

None defined

16.4 Product Interaction

All overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

- - - - - - -

*Either a mean for all storms (map), or for one particular storm (region) derived from storm series algorithms or as operator input.

17 VERTICALLY INTEGRATED LIQUID (VIL)

17.1 SS Product Description

"This product shall provide vertically integrated liquid values displayed as an image. The output of the VIL Algorithm shall be used to produce this product. The product shall be updated once per volume scan time. The product shall be available for 16 data levels. Each product shall include annotations for product name, radar ID, time and date of volume scan, maximum data value (VIL value,), radar position, radar elevation above MSL, and the radar operational mode.'

17.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

17.2.1 Data Levels

The VIL values displayed range upwards to a maximum adaptable value (default = 80 Kg/m2). Values greater than that value are truncated to that value.

17.2.2 Color Level Code Tables

The color level code used for display of VIL is a NEXRAD (or agency) system adaptation data. The currently defined color table for VIL is listed.

16-Level Code	Display kg m-2	Range kg m-2	Color Levels	
			Code	Color
0	ND	kg m-2<1	(00 00 00)	black
1	1	1<kg m-2<5	(9C 9C 9C)	medium gray
2	5	5<kg m-2<10	(76 76 76)	dark gray
3	10	10<kg m-215	(FA AA AA)	light pink
4	15	15<kg m-2<20	(EE 8C 8C)	medium pink
5	20	20<kg m-2<25	(C9 70 70)	dark pink
6	25	25<kg m-2<30	(00 FB 90)	light green
7	30	30<kg m-2<35	(00 BB 00)	medium green
8	35	35<kg m-2<40	(FF FF 70)	light yellow
9	40	40<kg m-2<45	(D0 D0 60)	dark yellow
A	45	45<kg m-2<50	(FF 60 60)	light red
B	50	50<kg m-2<55	(DA 00 00)	medium red
C	55	55<kg m-2<60	(AE 00 00)	dark red
D	60	60<kg m-2<65	(00 00 FF)	blue
E	65	65<kg m-2<70	(FF FF FF)	white
F	70	70<kg m-2	(E7 00 FF)	purple

17.2.3 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
0 to 124	2.2 x 2.2	Radar location

17.3 Annotations

17.3.1 Alphanumeric

The automated annotations for this product are:
Standard Annotations (Appendix A, I(A))
Data Level Code
Maximum Data Value Detected

17.3.2 Special Symbols

None defined

17.4 Product Interaction

All overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

18 STORM TRACKING INFORMATION (STI)

18.1 SS Product Description

"This product shall provide information concerning the past, present and future positions of each identified storm cell. This product shall be generated from the output of the Storm Cell Tracking and Storm Position Forecast algorithms. It shall be produced in a tabular format of alphanumeric values, as a stand alone graphic product, and in a format for generating graphic overlays to other products. This product shall be updated once per volume scan time. Each product shall include a standard set of total annotations and number of identified storm cells for which tracking is available. Upon user request, all site adaptable parameters identified as inputs to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

18.2 Display Format

Each storm cell identified will be given a unique ID of two characters. The first character will be a capital letter, A through Z, and the second will be a number, 0 through 9. The sequence will be A0, B0, C0,...Z0, A1,...Z9. The sequence is recycled following Z9. When there have not been any storm cells identified in a user specified "number of past volume scans", then the sequence of IDs will be reset so that the next storm cell identified will have the ID A0. See also Appendix A, I(B)(21) for more details on the Storm Cell ID.

18.2.1 Graphic Display

The product is displayable in full- and quarter-screen formats (see Appendix B, Formats I and II).

18.2.1.1 Data Display

The ID will be placed 5 pixels to the right and 5 pixels down from the current centroid positions. The ID will be white (code FF FF FF) and the background in black (code 00 00 00). See also Appendix A, I(B)(2).

When sufficient data is available, the past positions for each volume scan (up to the number of past volume scan minus the current volume scan) will be shown along with the current position and up to four future positions (e.g., +15, +30, +45, +60 min).

The forecast position interval and number of past volumes (or positions) are Unit Radar Committee (URC) level adaptation data and will vary over a range of 5 to 60 minutes (in 5-minute increments) and 5 to 13 volume scans, respectively. The default interval is 15 minutes, and the default number of past volumes (or positions) is 10. The past positions displayed will be the actual centroid positions where each storm cell was identified for up to the specified number of past volume scans (including the current volume scan). Storm cell tracks will consist of past, current and forecast storm cell centroid positions connected by one pixel wide linear segments. The PUP operator will have the ability through a menu at the Alphanumeric Terminal to select whether to display the past and/or forecast tracks and positions.

In the event an identified storm cell's forecast speed is less than a user-specified minimum speed, the storm cell's motion is considered stationary. For stationary storm cells, no past or forecast storm cell positions will be displayed. The minimum storm cell speed is URC level adaptation data and will vary over the range of 0.0 m/s to 10.0 m/s. The default is 2.5 m/s.

Note: See "Special Symbols and Characters" of Appendix A, 1(B(2)) for more details on the Storm Cell Track

The PUP operator will have the ability through a one level password protected menu at the Alphanumeric Terminal to select a maximum number of storm cells for display within the current display area (or window). The default is 20 storm cells. When the number of identified storm cells in the current window exceeds the maximum number of cells for display, the storm cells with the largest Cell-based VIL will be selected for display and a message will be displayed in the lower left corner of the screen indicating the number of identified storm cells in the current window which are not displayed. The message will have the same format as in the following example: "4 CELLS IN WINDOW NOT DISPLAYED". If the number of storm cells not displayed in the current window changes, the message will change as well.

18.2.1.2 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
0 to 248	N/A	Radar location

18.2.1.3 Graphic Overlay

As a graphic overlay to other products, only the overlay portion of the graphic display product is displayed; that is, the screen right annotations are not displayed. Symbols and characters are described in the data display above.

18.2.2 Alphanumeric Display

18.2.2.1 Alphanumeric Screen

A tabular format (Appendix C) of up to an adaptable number of identified storms cells will be displayable on the alphanumeric display screens. The tabular format will include:
(a) Storm Cell ID
(b) Current storm Position in (AZRAN) degrees and nmi to the nearest integer from the RDA
(c) The Forecast Direction in degrees (to the nearest integer) from which the storm cell is moving
(d) The Forecast Speed of the storm cell in kts to the nearest integer
(e) The azimuth and range forecast position of the storm cell to the nearest integer in degrees and nmi for each forecast interval up to four forecast positions
(f) The forecast error and mean forecast error in nmi to the nearest 0.1 nmi
(g) On the first page, Average Storm Cell Speed in kts to the nearest integer
(h) On the first page, Average Storm Cell Direction in degrees to the nearest integer
(i) Storm Cell Tracking/Forecast Position Adaptable Parameters
By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 7 to 100.
Note: Storm cells which are new (i.e., lack history) shall indicate "NEW" in the Movement field.
Note: If a forecast position(s) for a storm cell can not be determined, then "NO DATA" shall be displayed for that interval in the Forecast Positions field of the alphanumeric display.

18.2.2.2 Graphic Screen

A tabular format (appendix B, Format III, configuration 1) of all identified storm cells will be displayable on the graphic display screens. The tabular format will include:
(a) Storm Cell ID
(b) Current Storm Position in (AZRAN) degrees and nmi to the nearest integer form the RDA
(c) The Forecast Direction in degrees to the nearest integer form which the storm cell is moving
(d) The Forecast Speed of the storm cell in kts to the nearest integer
(e) The forecast error and mean forecast error in nmi to the nearest 0.1 nmi
(f) Maximum reflectivity in dBZ to the nearest integer
(g) Height of the Maximum Reflectivity in kft to the nearest integer

Note: Storm cells which are new (i.e., lack history) shall indicate "NEW" in the Forecast Movement field.

18.3 Annotations

18.3.1 Alphanumeric

Standard Annotations
Total Number of Identified Storms

18.3.2 Special Symbols

Past positions of the storm will be shown as small (5-pixel diameter) white, filled circles and forecast positions as white plus (+) marks of similar size. The current position is a circle (7-pixel diameter) within which is an "X".
The past, current, and forecast position symbols are connected with white line segments.

18.4 Product Interaction

The graphic portion of the product including the tabular format is displayable as an overlay on all geographically based products.

18.5 Comments

All site Storm Cell Tracking/Forecast adaptable parameters identified as inputs to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in a tabular layout showing the parameter name in one column and the value in an adjacent column.

19 HAIL INDEX (HI)

19.1 SS Description

"This product shall provide, for each storm cell identified by the Storm Cell Identification and Tracking algorithm, the Probability of Hail, the Probability of Severe Hail, and the Maximum Expected Hail Size. The hail probabilities and size shown for each storm cell shall be generated by the Hail Algorithm. This product shall be produced in a tabular format of alphanumeric values, as a stand alone graphic product, and in a format for generating graphic overlays to other products. This product shall include a standard set of annotations. Upon user request, all site adaptable parameters identified as inputs to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

19.2 Display Format

The Probabilities of Hail and Severe Hail are computed in 10% increments. The Maximum Expected Hail Size is calculated to the nearest 0.25 inch.

19.2.1 Graphic Display

The product is displayable in full- or quarter-screen formats (See Appendix B, Formats I and II).

19.2.1.1 Data Display

If the Probability of Hail and/or the Probability of Severe Hail for a storm cell meet minimum display adaptable parameters, then a Hail Symbol (see Appendix A, I(A)(6) is placed immediately to the right of the storm cell ID. That position will be 19 pixels to the right and 2 pixels down form the storm cell centroid location. As a graphic overlay to other products, the hail symbol flashes and only the overlay portion of this product are displayed. The operator has the option to stop the flashing of the hail symbol. No hail symbol is displayed if the Probability of Severe Hail and the Probability of Hail are 0%.

The Maximum Expected Hail Size is also displayed in the middle of the Hail Symbol in white to the nearest inch. In this display, if the Maximum Expected Hail Size is less than 0.75 inches, an asterisk will be displayed, and if the size is greater than 4 inches, "4" inches will be displayed.

19.2.1.2 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x deg)	Product Center
0 to 124	N/A	N/A

19.2.1.3 Graphic Overlay

As a graphic overlay to other products, only the overlay portion of the graphic display product and the attribute table is displayed.

19.2.2 Alphanumeric

19.2.2.1 Alphanumeric Display

In the alphanumeric product (tabular format for the alphanumeric screen), the Hail Attribute Table (see Appendix B, format III, configuration 4), and the combined Attribute Table (see Appendix B, Format III, configuration 5), the following apply: if the Probability of Severe Hail and the Probability of Hail are 0%, then "0.00" inches is displayed; if the Probability of Severe Hail and the Probability of

Hail ore greater than 0% and the Maximum Expected Hail Size is less than 0.50 inches, then "<0.50" inches is displayed; if the Maximum Expected Hail Size is greater than 4.00 inches, then the value ">4.00" inches is displayed; if the hail characteristics can not be determined (e.g. storm cell is beyond 124 nmi range) the hail characteristics are labeled 'UNKNOWN'.
By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 10 to 100.

19.2.2.2 Alphanumeric Screen

The tabular format, displayed on the alphanumeric screen (i.e. the Hail alphanumeric product), includes up to an adaptable number of storm cells identified by the Storm Cell Centroids Algorithm. The format used is specified in Appendix C.
(a) Storm Cell ID
(b) Probability of Severe Hail in percentage
(c) Probability of Hail in percentage
(d) Maximum Expected Hail Size in inches
(e) Adaptable Hail Parameters

19.2.2.3 Graphic Screen

The tabular format, displayed on the graphic screen (i.e. the Hail Attribute Table) includes all storm cells identified by the Storm Cell Centroids Algorithm. The format used is specified in Appendix B, Format III, Configuration 4.
(a) Storm Cell ID
(b) Current Storm Position in (AZRAN) degrees and nmi to the nearest integer from the RDA
(c) Probability of Severe Hail in percentage
(d) Probability of hail in percentage
(e) Maximum Expected hail Size in inches
(f) Altitude of 0°C and -20°C environmental temperatures in kft (from adaptation data)
(g) Time and Date of the last change to the Hail Temperature Altitudes

19.3 Annotations

19.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))

19.3.2 Special Symbols

The hail symbol is a green isosceles triangle. The triangle can be small (a base of 8 pixels and a height of 12 pixels) or large (a base of 16 pixels and a height of 20 pixels). The size of the triangle and whether the triangle is filled depends upon the Probability of Severe Hail and the Probability of Hail. The following are the rules of display and default settings.

Triangle	Prob. Of Svr. Hail	Prob. Of Hail
Large/Filled	>50%	N/A
Large/Open	>30%	N/A
Small/Filled	0%	>50%
Small/Open	0%	>30%

However, the probabilities are adaptable parameters at the PUP alphanumeric terminal, and the user has the ability to disable the display of one or both of the small and/or large triangles. The Maximum Expected Hail Size will be displayed in the middle of the triangle.

19.4 Product Interaction

The graphic portion of the product including the tabular format is displayable as an overlay to all geographically based products.

19.5 Comments

All site adaptable parameters identified as inputs to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in a tabular layout showing the parameter name in one column and the value in an adjacent column.

When ranking of storm cells by hail characteristics, storm cells labeled 'UNKNOWN' are considered of lower rank than those with a Probability of Severe Hail of 0% and a Probability of Hail of 0%.

20 MESOCYCLONE (M, MRU, MD, DMD) *

20.1 SS Product Description

"The Mesocyclone (M) product shall provide information about identified shear and mesocyclone features. This product shall be generated from the output of the Legacy Mesocyclone Detection Algorithm. This product shall be generated in a format that can be used to generate an alphanumeric tabular display for an identified feature or all simultaneously, a graphic display or a graphic overlay to other products. This product shall be updated once per volume scan time. If on a particular volume scan there is no output from the Legacy Mesocyclone Detection Algorithm (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, radar position, radar elevation above MSL, and radar operational mode. Upon user request, all site adaptable parameters identified as input to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

“A Mesocyclone Rapid Update (MRU) version of this product shall be generated once per elevation scan time to provide updated Legacy Mesocyclone Detection Algorithm information. Current Legacy Mesocyclone Algorithm data at an elevation scan shall be based on the elevations that have been completed thus far in the current volume scan. This information shall be combined with Mesocyclone and Storm Track Algorithm information from the previous volume scan to form the MRU product.

The average motion of all SCIT storm cells from the previous volume scan shall be used to derive a forecast position of each previous feature at the current volume scan time. In feature type order, the forecast position of each feature from the previous volume scan shall be matched to the closest feature from the current volume scan, within a search radius defined by SCIT algorithm adaptation data. Current 3D features which are not matched to a feature from the previous volume scan, shall be assigned the status of New. If previous volume scan data are unavailable, all features shall be reported as new. Current features shall inherit the attributes of the matched previous feature (associated storm ID, feature type, maximum tangential shear, height of maximum tangential shear, top height, base azimuth, base range, base height, azimuth diameter, range diameter).
The position attributes (base azimuth, range, and height) of a previous feature matched to a current feature shall be updated to the current detection. If the top height of the matched feature is higher, the feature top height shall be updated. The position attributes of a previous feature not matched to a current feature, shall be set to the extrapolated forecast position. The status of unmatched previous features shall be assigned to Extrapolated. Strength attributes shall be updated if they increase in magnitude.

The strength attributes are feature type and maximum tangential shear. If the maximum tangential shear is updated, the radial and azimuthal diameters and the height of the maximum tangential shear shall also be updated. Features with increasing strength attributes shall be assigned the status of Increasing. All other matched features shall be assigned the status of Persistent. Attribute data updated with current volume data shall be identified. At the end of the volume scan extrapolated features shall be removed.

This product shall be generated in a format that can be used to generate an alphanumeric tabular display, a graphic display or a graphic overlay to other products. On alphanumeric displays, the status (Persistent, Increasing, New, or Extrapolated) of each feature status shall be reported. In the graphic symbol display, features status shall be reported as either extrapolated or current. Current features include all features with a status of Increasing, Persistent, or New. If on a particular elevation scan there is no output (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, elevation angle, radar position, radar elevation above MSL, and radar operational mode."

"The MD version of this product shall provide information about circulation features generated from the output of the new Mesocyclone Detection Algorithm. This product shall provide information concerning the past and future positions of each tracked circulation feature. This product shall be generated in a format that can be used to generate an alphanumeric tabular display for an identified feature or all simultaneously, a graphic display or a graphic overlay to other products. This product shall be updated once per volume scan time. If on a particular volume scan there is no output from the Mesocyclone Detection Algorithm (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, radar position, radar elevation above MSL, and radar operational mode."

The DMD version of this product shall be generated to support generation of interactive user displays at an external system (e.g., AWIPS). This product shall be updated once per elevation scan time. The end-of-volume edition shall contain complete algorithm data for the volume scan. The elevation editions shall contain the algorithm data which has been updated since the previous volume edition product. A detection status shall be reported for circulation features that are topped or extrapolated. If on a particular elevation scan there is no output from the Mesocyclone Detection Algorithm (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, elevation angle, radar position, radar elevation above MSL, and radar operational mode.
* In RPG Build 12, the Mesocyclone (M) and Mesocyclone Rapid Update (MRU) products are being removed and will no longer be generated.

20.2 Display Format

20.2.1 Graphic Display

The products are displayable in full- or quarter-screen format (see Appendix C).

20.2.1.1 Data Display

The mesocyclone or 3D correlated shear symbol will be placed directly over the position of the mesocyclone or shear at the lowest elevation scan in which it was detected. For the MRU product: extrapolated mesocyclone and 3D correlated shear features will be displayed centered on the forecasted position at the lowest elevation scan it was previously detected; mesocyclone and 3D correlated shear features detected in the current volume scan will be displayed centered on the position of the matched current feature at the lowest angle in which it is detected. See also Appendix A, I(B)(4).

For the MD version, the graphic display will contain up to 100 MDA detected features, sorted first by strength rank, then by Mesocyclone Strength Index (MSI). The number of features in the product can be reduced by raising the minimum display filter rank and/or the overlap filter, both MDA adaptable parameters.

When sufficient data are available, the past positions of each feature for each volume scan (up to 10 past volume scans) will be shown along with the current position and up to six future positions (at 5 minute intervals). The past positions will be displayed at the lowest elevation each MDA feature was detected. MDA tracks will consist of past, current and forecast positions connected by linear segments with a width of one pixel. The operator at the external display system (e.g., AWIPS) will have the ability to select whether to display the past and/or forecast tracks and positions and feature IDs.

In the event an identified MDA feature forecast speed is less than 2.5 m/s the feature motion is considered stationary. For stationary MDA features, a single past position will be reported at the current feature center.

20.2.1.2 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
0 to 124	N/A	Radar location

20.2.1.3 Graphic Overlay

As a graphic overlay to other products, it will be possible to display only the image portion of this product; that is, the screen right area annotations will not be displayed when the product is used as an overlay. Each mesocyclone will be identified with the associated storm ID in white. In overlay form, the mesocyclone and 3D shear symbol have pixel priority over all but the TVS symbol. The mesocyclone and 3D shear symbols, which are displayed in yellow, flash when displayed as overlays. The operator will have the option to stop the flashing of the mesocyclone symbol.

For the MRU version, the AWIPS operator will have the option to turn off display of extrapolated features.

For the MD version, circulations strong enough to be classified as mesocyclones will be identified with the Circulation ID (0 to 999) displayed next to the mesocyclone symbol.

20.2.2 Alphanumeric Display

An alphanumeric tabular product version is generated for display on the alphanumeric display. The format to be used is defined in Appendix C.

With the following exceptions, the format of the MRU graphic attribute and alphanumeric tabular portions of the product will follow the non-rapid update Mesocyclone product: feature status will be reported as EXT, PER, INC, and, NEW to denote extrapolated, persistent, increasing, and new features, respectively; and the character ^ (hexadecimal value 5E) will be placed next to data which was computed from current volume scan detections. The format to be used is defined in Appendix B and C.

For the MD version, up to 100 features will be listed from highest to lowest strength rank with Mesocyclone Strength Index (MSI) as a secondary order (highest MSI to lowest MSI).

Except for those parameters indicated with an asterisk above, the elevation edition will contain only parameters updated since the previous volume. A complete time history of MDA information for a feature is available from a collection of DMD volume editions along with the latest DMD elevation edition. All data for an on-going feature can be linked by its Meso ID parameter that remains constant through out the life time of a feature.

If the base is detected on the lowest elevation scan of the volume scan, then the BASE (height) is qualified with '<'. If either the base or top are detected on the lowest or highest elevation scan of the volume scan, respectively, then the DEPTH is qualified with a '>'.

20.2.3 DMD Format for External Systems

The DMD product is a rapid update implementation of the MDA, meaning that after each elevation cut of the current volume scan, algorithm output is available to update any MDA results from the previous volume scan. Therefore, it is important to distinguish between products with the Last Elevation Flag set (i.e. a volume edition) and those without the Last Elevation Flag set (i.e. an elevation edition). A volume edition, will contain complete MDA information for the volume scan. For the volume edition, the parameters listed below are included for all detected MDA features meeting a minimum strength rank of 1 (up to a maximum of 100 features):

As specified in Figure 3-15b, Note 1, of the RPG To Class 1 User ICD, the DMD product is encoded using an API available from the Radar Operations Center. This API also provides functions for those wishing to decode a DMD product, as well as extract product parameters and feature parameters. The DMD product contains up to 100 MDA detected circulation features. All DMD products contain the following three DMD Product Parameters:

DMD Format for External Systems

DMD Product Parameters (One parameter per DMD product)	Units ; Precision or Values
Average Direction of Tracked Features	deg ; 0.1
Average Speed of Tracked Features	m/s ; 0.1
Last Elevation Flag	Values = 0 or 1 if last elevation
Elevation Angle (array)	deg ; 0.1
Elevation Time (array)	s ; 1
MDA Feature Parameters (One parameter per MDA detected circulation)	Units ; Precision or Values
Meso ID (1)	na ; 1
Detection Status (1)	Values = "TOP", "EXT", " "
Base Azimuth (1)	deg ; 0.1
Base Range (1)	km ; 0.1
Age	s ; 1
Strength Rank	na ; 1
Strength Rank Type	Values = ' ', 'L' or 'S' (2)
MSI	na ; 1
Base Diameter	km ; 0.1
Base Height	km ; 0.1
Depth	km ; 0.1
Storm Relative Depth	percent ; 1
Base Gate-to-Gate Velocity Difference	m/s ; 0.1
Base Shear	m/s/km ; 0.1
Base Rotational Velocity	m/s ; 0,1
Max Rotational Velocity	m/s ; 0.1
Height of Max Rotational Velocity	km ; 0.1
Max Shear	m/s/km ; 0.1
Height of Max Shear	km ; 0.1
0-2 km ARL Convergence	m/s ; 0.1

2-4 km ARL Convergence	m/s ; 0.1
Associated TVS	Values = 'Y', 'N' or 'U'
Associated Storm ID	Values = "A0" through "Z9"
Overlaps Lower Feature	Values = "Y" or "N"
Base on Lowest Elevation	Values = "Y" or "N"
Direction	deg ; 0.1
Speed	m/s ; 0.1
# Past Positions	na ; 1
Past Latitude Position (array)	deg; 0.0001
Past Longitude Position (array)	deg; 0.0001
# Forecast Positions	na ; 1
Forecast Latitude Position (array)	deg; 0.0001
Forecast Longitude Position (array)	deg; 0.0001
Number of 2D Features in this 3D Feature	na ; 1
Tilt Number (array)	na ; 1
2D Height (array)	km ; 0.1
2D Diameter (array)	km ; 1
2D Gate-to-Gate Velocity Difference (array)	m/s ; 1
2D Shear (array)	m/s/km ; 1
2D Rotational Velocity (array)	m/s ; 1
2D Strength Rank (array)	na ; 1

(1) Always included for all features
(2) L = Low core. This means the "core depth" must be LESS THAN 3 km AND the core depth must be GREATER THAN 25% of the mean SCIT cell depth AND the core base must be LESS THAN 3km. S = Shallow. This means the "core depth" must be GREATER THAN 1 km AND the core top must be LESS THAN 3km AND the strength rank is GREATER THAN OR EQUAL TO 5.

20.3 Annotations

20.3.1 Alphanumeric

Standard annotations
Site Adaptable Parameters for the legacy version
Elevation angle for the MRU version
All annotations (except for Radar position) with the alphanumeric product format will be included in the message.

20.3.2 Special Symbols

The mesocyclone will be displayed (centered on the location of the mesocyclone at the lowest elevation angle in which it is detected) as a yellow open circle, whose perimeter is 4 pixels thick. The size of the symbol will be proportional to the average of the mesocyclone radial and azimuthal diameters. The minimum size symbol will be a circle having a diameter of 14 pixels.
The 3D correlated shear will be displayed as a yellow open circle, 1 pixel thick and is centered (similarly to the mesocyclone) on the 3D shear center at the lowest elevation angle at which it was detected. The size will be proportional to the average diameter. The minimum size symbol will be a circle having a diameter of 14 pixels.
For the MRU version, AWIPS will distinguish between the Mesocyclone and 3D correlated shear features will by the thickness of the perimeter of a circle (i.e., thick perimeter is a Mesocyclone and thin for 3D Correlated Shear). In addition, AWIPS will distinguish between current (new,

persistent, and increasing) and extrapolated (unmatched) 3D features by the line style of the circle perimeter (i.e., traditional AWIPS mesocyclone and 3D Correlated shear symbols are used for current features, but symbols with a dashed perimeter are used for extrapolated features).

For the MD version, features having a strength rank 5 or higher will be displayed similar to the legacy Mesocyclone symbol. In addition, if the feature's base was detected on the lowest elevation angle, or its base height was at or below 1 kilometer, the Mesocyclone symbol will contain outward spikes. For MDA features having a strength rank less than 5, the symbol will be similar to the legacy 3D correlated shear symbol. The size of the symbol will be drawn to scale with the base level feature diameter.

The MDA track consists of past, current, and forecast feature positions connected by linear segments one pixel wide. Past positions will be displayed as yellow filled diamond. Forecast positions will be displayed as yellow x cross signs, of similar size.

20.4 Product Interaction

This product is displayable as an overlay on all geographically based products. For the MRU version, the AWIPS operator will be provided the option to choose between displaying the latest elevation (i.e., highest elevation) and displaying a specific elevation; when the latest elevation is selected, the display will automatically update when higher elevation products are received.

20.5 Comments

All site adaptable parameters identified as inputs to the algorithm used to generate data for this product will be available for display at the applications terminal upon user request. See 12.8 for the format description.

The current value of the three MDA adaptable parameters will be placed in a corner of the graphic overlay display. If there are no features, the text "No Circulations" will be placed on the graphic display.

21 TORNADO VORTEX SIGNATURE (TVS)

21.1 SS Product Description

"This product shall provide information regarding the existence and location of an identified Tornado Vortex Signature (TVS). This product shall be produced from the output of the Tornado Detection Algorithm. The product shall produce an alphanumeric tabular display and a graphic overlay of the algorithm output data for each identified TVS (and Elevated TVS (ETVS)) signature information when such is identified. This product shall be updated once per volume scan time. This product shall include annotations for the product name, radar ID, time and date of volume scan, radar position, radar elevation above MSL, and radar operational mode. Upon user request, all site adaptable parameters identified as inputs to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

"A Tornado Vortex Signature Rapid Update (TRU) version of this product shall be generated once per elevation scan time to provide updated Tornado Detection Algorithm (TDA) information. Current Tornado Detection Algorithm data at an elevation scan shall be based on the elevations that have been completed thus far in the current volume scan. This information shall be combined with TDA, MDA, and Storm Track Algorithm information from the previous volume scan to form the TRU product.

The average motion of all tracked MDA features from the previous volume scan shall be used to derive a forecast position of each TDA feature from the previous volume scan at the current volume scan time. If the average motion from MDA is unavailable, the average motion of all SCIT storm cells from the previous volume scan shall be used. In priority rank order, the forecast position of each feature from the previous volume scan shall be matched to the closest feature from the current volume scan, within a search radius defined by SCIT algorithm adaptation data.

Priority rank order places TVS types before ETVSs, and within each type features are ordered by Low-level Delta Velocity, from greatest to least. Current TVS/ETVS features which are not matched to a feature from the previous volume scan, shall be assigned the status of New. If previous volume scan data are unavailable, all features shall be reported as New. Current features shall inherit the attributes of the matched previous feature (associated storm ID, feature type, low-level delta velocity, maximum delta velocity and its height, average delta velocity, maximum shear and its height, base and top heights, depth, and base azimuth and range).

The position attributes (base azimuth, range, and height) of a previous feature matched to a current feature shall be updated to the current detection. The position attributes of a previous feature not matched to a current feature, shall be set to the extrapolated forecast position (base azimuth and range only). The status of unmatched previous features shall be assigned to Extrapolated. Strength attributes of a previous feature matched to a current feature shall be updated if they increase in magnitude. The strength attributes are feature type, low-level delta velocity, and depth. The attributes maximum delta velocity, maximum shear, and average delta velocity are also updated to the current value if they increase in magnitude, but their increase will not trigger a status change to Increasing. If the maximum delta velocity and maximum shear are updated, their heights shall also be updated. Features with increasing strength attributes shall be assigned the status of Increasing. All other matched features shall be assigned the status of Persistent.

Attribute data updated from current volume data shall be identified. At the end of the volume scan, the extrapolated features shall be removed. This product shall be generated in a format that can be used to generate an alphanumeric tabular display, a graphic display or a graphic overlay to other products. In each type of display, features shall appear in priority rank order. On alphanumeric displays, the status (Persistent, Increasing, New, or Extrapolated) of each feature status shall be reported.

In the graphic symbol display, features status shall be reported as either extrapolated or current. Current features include all features with a status of Increasing, Persistent, or New. If on a particular elevation scan there is no output (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, elevation angle, radar position, radar elevation above MSL, and radar operational mode."

21.2 Display Format

The product has three parts. Geographic and alphanumeric table parts are displayable on the graphic screen. And the alphanumeric table is displayable on the alphanumeric screen. For all three parts, data (described below) will be provided for all detected TVSs and Elevated TVS (ETVS). By default, a maximum of 15 TVSs and 20 ETVSs are detectable; however, these numbers are adaptable at the MSCF up to values of 25 TVSs and 25 ETVSs.
Each TVS (and ETVS) is associated with the nearest storm cell within an MSCF adaptable distance. If the TVS (or ETVS) is not associated with a storm cell, "??" will be displayed as the Storm Cell ID. With the following exceptions, the format of the TRU graphic attribute and alphanumeric tabular portions of the product will follow the non-rapid update TVS product: feature status will be reported as EXT, PER, INC, and, NEW to denote extrapolated, persistent, increasing, and new features, respectively; and the character ^ (hexadecimal value 5E) will be placed next to data which was computed from current volume scan detections. The format to be used is defined in Appendix B and C.

21.2.1 Graphic Screen

These parts of the product are displayable concurrently as an overlay on all geographically based products. As a graphic overlay to other products, it will be possible to display only the image portion of this product; that is, the screen right area annotations will not be displayed when the product is used as an overlay.

21.2.1.1 Geographic

The graphic display consists of the TVS and ETVS symbols (see Section 21.3.2) The symbols are placed such that the apex of the triangle is centered on the geographic position of the TVS (or ETVS) at the lowest elevation angle where it is found. For the TRU product: extrapolated TVS and ETVS features will be displayed centered on the forecasted position at the lowest elevation scan it was previously detected; TVS and ETVS features detected in the current volume scan will be displayed centered on the position of the matched current feature at the lowest angle in which it is detected. The symbols flash when displayed as an overlay. The operator will have the option to stop the flashing. Along with each TVS (and ETVS), the Storm Cell ID (see Section 18.2) is displayed in white (Code: FF FF FF) 5 pixels to the right and 5 pixels down from the location of the storm cell centroid. This part of the product is displayable in full- and quarter-screen formats (see Appendix B).

The PUP operator will have the ability through a one level password protected menu at the Alphanumeric Terminal to select whether to display the symbols for only TVSs or both TVSs and ETVSs. The default will be to only display TVS symbols. For the TRU version on the AWIPS the following applies: the operator will have the option to turn off display of extrapolated features; the operator will be provided the option to choose between displaying the latest elevation (i.e., highest elevation) or displaying a specific elevation; when the latest elevation is selected, the display will automatically update when higher elevation products are received.

21.2.1.1.1 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
0 to 124	N/A	Radar Location

21.2.1.2 Alphanumeric Table

A tabular format is displayable on the graphic screen (i.e. the TVS Attribute Table). The format used is specified in Appendix B, Format III, Configuration 3 and includes the following information about all TVSs and ETVSs.
(a) TYPE - TVS or ETVS
(b) STORM ID - ID of the closest associated Storm Cell
(c) AZ/RAN - Azimuth and range in degrees and nmi to the nearest integer.
(d) AVGDV - Average Delta Velocity in knots to the nearest integer
(e) LLDV - Low-level (base) Delta Velocity in knots to the nearest integer
(f) MDV - Maximum Delta Velocity in knots to the nearest integer
(g) BASE - Base height (of the signature) in kft to the nearest tenths
(h) DPTH - Depth (of the signature) in kft to the nearest integer
TVSs are listed before ETVSs, and both types are ranked by their Low-level Delta Velocity (from greatest to least). (NOTE: If the base is detected on the lowest elevation scan of the volume scan, then the BASE (height) is qualified with '<' respectively. And, if either the base or top are detected on the lowest or highest elevation scan of the volume scan, then the DPTH is also qualified with a '>'.) A brief description of this format can also be found in Appendix A, II(4).

21.2.2 Alphanumeric Screen

A tabular format is displayable on the alphanumeric screen (i.e. the TVS alphanumeric product). The format used is specified in Appendix C and includes the following information about all TVSs and ETVSs (up to an adaptable number):
(a) Feat Type - Feature Type, TVS or ETVS
(b) Feat ID - Feature ID (or number)
(c) Storm ID - Storm Cell ID
(d) AZ/RAN - Azimuth and range in degrees and nmi to the nearest integer
(e) AVGDV - Average Delta Velocity in knots to the nearest integer
(f) LLDV - Low-level (base) Delta Velocity in knots to the nearest integer
(g) MXDV/Hgt - Maximum Delta Velocity in knots to the nearest integer and the Height in kft to the nearest tenths
(h) Depth - Depth (of the signature) in kft to the nearest tenths
(i) Base/Top - Base and Top (of the signature) in kft to the nearest tenths
(j) MXSHR/Hgt - Maximum Shear in m/s/km to the nearest integer and Height in kft to the nearest tenths
TVSs are listed before ETVSs, and both types are ranked by their Low-level Delta Velocity (from greatest to least). (NOTE: If the base or top are detected on the lowest or highest elevation scan of the volume scan, respectively, then the Base/Top (height(s)) is qualified with '<' or '>', respectively. And, if either the base or top are detected on the lowest or highest elevation scan of the volume scan, respectively, then the Depth is also qualified with a '>'.) In addition, this part of the product includes

all TDA adaptable parameters. The adaptable parameters are formatted in a tabular layout showing the parameter name in one column and the value and units in an adjacent column.

21.3 Annotations

If the TDA found more than the (adaptable) maximum number of TVSs or ETVSs, then the number of TVSs or ETVSs (as appropriate) in the Annotations will be preceded by a '>'.

21.3.1 Graphic Screen

Standard Annotations (Appendix A,I(A))
Number of TVSs and ETVSs
Elevation angle for the TRU version

21.3.2 Alphanumeric Screen

Product Specification
Standard Units and Abbreviations,
Product Name
Date/time of volume scan
RDA ID
Elevation angle for the TRU version
Number of TVSs and ETVSs

21.4 Special Symbols

The symbol for a TVS is a red (code: FF 00 00) filled inverted isosceles triangle, and the symbol for an ETVS is the same except it is unfilled (i.e. only a red triangle outline). The triangle has a base of 10 pixels and a height of 14 pixels. For the TRU version on the AWIPS, extrapolated (unmatched) TVS and ETVS features will be distinguished (less prominent symbols) from current (new, persistent, and increasing) features (normal TVS and ETVS symbols).

22 STORM STRUCTURE (SS)

22.1 SS Product Description

"This product shall provide, for each identified storm cell, information regarding the structure of the storm cell. This product shall be produced from and contain the values that are output by the Storm Cell Centroids Algorithm. This product shall be updated once per volume scan time. This product shall be produced in a tabular alphanumeric format and shall include annotations for the product name, radar ID, time and date of volume scan, and the total number of identified storm cells. Upon user request, all site adaptable parameters identified as inputs to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

22.2 Display Format

22.2.1 Graphic Display

This product does not have a graphic component. However, Trend data is available with this product. The contents and format of the Trend Data are delineated in packet codes 21 and 22 of the Interface Control Document for RPG/Associated PUP (2620001).

22.2.2 Alphanumeric Display

This product is displayable only on the applications terminal in tabular alphanumeric format (see Appendix C). The alphanumeric tabular format, displayed on the alphanumeric screen includes the following information for up to an adaptable number of storm cells identified by the Storm Cell Centroids Algorithm.

(a) Storm Cell ID
(b) Current Storm Position in (AZRAN) degrees and nmi to the nearest integer from the RDA
(c) Storm base in kft
(d) Storm top in kft
(e) Cell Based VIL in kg/m2
(f) Maximum Reflectivity in dBZ
(g) Height of Maximum Reflectivity in kft
(h) Number of Storm Cells
(i) Adaptable Parameters for all SCIT algorithms

By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 10 to 100.

22.2.2.1 Range/Data Resolution

Coverage Area (nmi radius)	Resolution (nmi x nmi)	Product Center
0 to 248	N/A	Radar location

22.3 Annotations

22.3.1 Alphanumeric

Standard annotations (Appendix A, I(A))
Number of Storms detected

22.3.2 Special Symbols

None defined

22.4 Product Interaction

None

22.5 Comments

All site adaptable parameters identified as inputs to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in a tabular layout showing the parameter name in one column and the value in an adjacent column.

23 LAYER COMPOSITE REFLECTIVITY (LRM, LRA, APR)

23.1 SS Product Description

"Each product shall contain annotations for product name, radar ID, date and time of volume scan, maximum data value detected, radar position, radar elevation above MSL, and radar operational mode. All layer products shall be on a geographically based Cartesian grid, centered on the radar. Up to three layers shall be available for layer products at each site; the depth of each layer shall be controlled via adaptation data. The exception to this is the Layer Composite Reflectivity - Anomalous Propagation Removed (APR) product which consists of one layer, and that layer has the same layer boundaries as the lowest layer of the Layer Composite Reflectivity product. The default values are listed in SS, Table E-1. No layer will be less than 6,000 ft thick. Each layer product shall be updated on a volume scan basis.

Eight data levels shall be available for each product, including one for data below minimum threshold and one for no data. The default values for the reflectivity shall be standard NWS DVIP levels, as defined in FMH 7. The data level thresholds shall be controlled via adaptation data.

Before layering, the reflectivity data shall be thresholded with respect to mean noise level and shall also be filtered to remove spurious isolated data caused by point targets. It shall be possible to select either a maximum value or the average reflectivity for the grid box, but not both simultaneously.

The range of coverage for each product shall be controlled via adaptation data; the default is a 460-km x 460-km square centered on the radar.

For the APR product, a clutter editor is applied to the reflectivity data (using both velocity and spectrum width data as inputs) to remove clutter contaminated data. This product displays the maximum value for each grid box. The range of coverage for this product is fixed as a 460-km x 460-km squared centered on the radar.

A three-dimension (3-D) grid box shall be defined as the vertical projection of the geographically based Cartesian grid square through the appropriate layer. All radar resolution volumes whose centers are contained in a given 3-D grid box shall be included in the computation for the 3-D grid box. All 3-D boxes whose centers fall in a radar resolution volume shall include the radar resolution volume in the computation for that 3-D grid box. A center that falls on a boundary shall be considered to fall on both/all sides of the boundary. The product resolution shall be 4 km by 4 km.

The use of look-up tables for computational efficiency is permitted. To facilitate this, off-line processing may be used to generate new look-up tables whenever adaptation parameters are changed or new scanning sequences are added to the system."

23.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

23.2.1 Data Levels

The reflectivity data levels will vary as specified in adaptation data.

23.2.2 Color Level Code Tables

The color level code used for display will default to the NWS DVIP values specified in FMH 7. However, other levels may be substituted via adaptation data. The currently defined color code is listed.

			Color Levels	
8-Level Code	Display dBZ	Range dBZ	Code	Color
0	ND	SNR<TH or dBZ<5	(00 00 00)	black
1	5	5<dBZ<18	(FF AA AA)	light pink
2	18	18<dBZ<30	(C9 70 70)	dark pink
3	30	30<dBZ<41	(00 BB 00)	medium green
4	41	41<dBZ<46	(FF FF 70)	light yellow
5	46	46<dBZ<50	(DA 00 00)	medium red
6	50	50<dBZ<57	(00 00 FF)	blue
7	57	57<dBZ	(FF FF FF)	white

23.2.3 Range/Data Resolution

Layer	Coverage Area (nmi x nmj)	Resolution (nmi x nmi)	Product Center
(APR product) SFC to 24,000 ft above MSL	248 x 248	2.2 x 2.2	Radar location
(Lowest LRM and LRA) Site adaptable to 24,000 ft above MSL same coverage area, resolution and product center	248 x 248	2.2 x 2.2	Radar location
(LRM and LRA products only) 24,000 ft to 33,000 ft above MSL	248 x 248	2.2 x 2.2	Radar location
33,000 ft to 60,000 ft above MSL	248 x 248	2.2 x 2.2	Radar location

Note: Other coverage areas may be specified via adaptation data.

23.3 Annotations

23.3.1 Alphanumeric

Standard Annotation (Appendix A, I(A))
Maximum Data Value Detected
Layer Boundary (vertical depth)
Maximum (LRM, APR) or Layer Average Reflectivity (LRA) Displayed
Data Level Code

23.3.2 Special Symbols

None defined

23.4 Product Interaction

The following overlay products are displayable on this product:

- Hail
- Mesocyclone
- Storm Track Information
- Tornado Vortex Signature.

24 DELETED

25 USER ALERT MESSAGE (UAM)

25.1 SS Product Description

"This product shall provide a brief message defining an area of indicated severe weather. The message shall contain the location, type and severity of the weather event, and storm speed and direction of movement. The product shall be updated once per volume scan. The product shall include annotations for the product name, radar ID, time and date of scan, radar position, radar elevation above MSL, and severe weather information as appropriate."

25.2 Display Format

UAM	NNN (RDA ID) (MONTH/DAY/YEAR)	HH:MM (HOUR:MINUTES)	MM/DD/YY

Alert Area(1 or 2)
Position (see note 1) Azimuth XXX.X DEG
Range XXX.X NM
Alert Category XXXXXXXXXXXXXXXXX (see Table IV of 2620001)
Threshold (Operator Selected Value and units)
Exceeding (Alert Triggering Value and units)
Storm Cell ID XX STORM MOTION XXX/XXX DEG/KTS.

25.3 Annotations

25.3.1 Alphanumeric

Standard Annotations
Location of Alerting Phenomena
Severe Weather Information as appropriate

25.3.2 Special Symbols

None defined.

Note 1:Position is the alert grid box center for grid base alerts, features base center for mesocyclone and TVS alerts, not applicable for VAD and One Hour rainfall alerts, and Storm cells centroid for all other alerts.

26 RADAR CODED MESSAGE (RCM)

26.1 SS Product Description

"The Radar Coded Message (RCM) shall be produced in accordance with, SS, 2810000A, Appendix K and made available from the RPG.

The RCM product shall be produced automatically up to 2 times per hour based on time of day specified at the MSCF in minutes after the hour. This product shall also be produced upon one-time request from the designated RPGOP/PUP using data from the last completed volume scan. For a continually scanning radar, the product shall be produced from the last completed volume scan prior to the scheduled time.

26.2 Display Format

26.2.1 A/N Message Format

The A/N message format for Parts A, B and C are outlined in Appendix B, Radar Coded Message, in 2620001 RPG/Class 1 User ICD.

27 FREE TEXT MESSAGE (PTM, FTM)

27.1 SS Product Description

"This product shall provide a capability for defining an alphanumeric message for one-time transmission to specific NEXRAD Unit interface(s). The product shall be generated by an operator through the MSCF or RPGOP for transmission to the RPG's users or by the PUP operator for transmission to the PUP's users. Messages may be designated to be transmitted to a specific or several NEXRAD Unit interfaces. Product shall include radar ID, date, and time that the message was completed."

27.2 Display Format

A prose style paragraphed statement or message

27.3 Annotations

Standard annotations as applicable

27.4 Product Interaction

None

28 SURFACE RAINFALL ACCUMULATION (OHP, THP)

28.1 SS Product Description

"These products shall provide 1-hour and 3-hour rainfall accumulation maps displayed as an image. The 1-hour map shall be updated every volume scan time and the 3-hour map shall be updated once per hour. These products shall be available for 16 accumulated precipitation data levels. Each product shall include annotations for the product name, radar ID, date and ending time (TSavgcur* or clock hour as appropriate) of the rainfall rate integration, maximum data value, radar position, radar elevation above MSL, radar operational mode, mean-field bias in the radar estimate of the precipitation rate (Bcur*), and the effective (Gage-Radar Pair) sample size associated with the bias estimate (GRPcur*)."

28.2 Display Format

These products are displayable in full-screen format or quarter-screen format (see Appendix B).

28.2.1 Data Levels

The product will contain 16 data levels. The data level code may vary with operational mode and with NEXRAD (or agency) system adaptation data. The data thresholds are also site adaptable.

28.2.2 Color Level Code Table

			Color Levels	
16-Level Code	Display Inches	Range Inches	Code	Color
0	ND	in=0.0	(00 00 00)	black
1	>0.00	0.0<in<0.1	(AA AA AA)	gray
2	0.10	0.1<in<0.25	(76 76 76)	dark gray
3	0.25	0.25<in<0.5	(00 FF FF)	cyan
4	0.50	0.5<in<.075	(00 AF AF)	dark cyan
5	0.75	0.75<in<1.0	(00 FF 00)	green
6	1.00	1.0<in<1.25	(00 8F 00)	dark green
7	1.25	1.25<in<1.5	(FF 00 FF)	magenta
8	1.50	1.5<in<1.75	(AF 32 7D)	dark magenta
9	1.75	1.75<in<2.0	(00 00 FF)	blue
A	2.00	2.0<in<2.5	(32 00 96)	dark blue
B	2.50	2.5<in<3.0	(FF FF 00)	yellow
C	3.00	3.0<in<4.0	(FF AA 00)	orange
D	4.00	4.0<in<6.0	(FF 00 00)	bright red
E	6.00	6.0<in<8.0	(AE 00 00)	dark red
F	8.00	8.0<in	(FF FF FF)	white

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*See Algorithm Report

28.2.3 Range/Data Resolution

The resolution of the graphic products is 1.1-nmi (range) by 1 deg (azimuth) out to a range of 124 nmi.

28.3 Annotations

28.3.1 Alphanumeric

Standard Annotations
Date and End Time of Rainfall Integration
Maximum Data Value
Radar Bias Estimate (mean bias for 3-hour product)
Effective G-R Pair Sample Size (mean for 3-hour product)
Missing Periods
Gage Adjustment Bias Flag

28.3.1.1 Paired Alphanumeric

See Section 29.3.1.1 for complete list of adaptation data. See Format IX for OHP. [Note: THP paired alphanumeric product contains no adaptation data list.]

28.3.2 Special Symbols

None

28.4 Product Interaction

The following overlay products are displayable on this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signature.

28.5 Comment

All site adaptable parameters identified as inputs to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in a tabular layout showing the parameter name in one column and the value in an adjacent column.

29 STORM TOTAL RAINFALL ACCUMULATION (STP AND DSP)

29.1 Product Description

"This product shall provide rainfall accumulation data, both displayed as an image and formatted as non-displayable, digital data. The product format and content of the image version (STP) shall be the same as the surface Rainfall Accumulation Product except the time period shall be a variable and shall equal the period of continuous rainfall in the radar area of coverage. This product shall include annotations for product name, radar ID, maximum data value detected, radar position, times and dates of the beginning and end (TSavgcur* or clock hour as appropriate) of the rainfall rate integration, radar position, radar elevation above MSL, radar operational mode, the mean-field bias in the radar estimate of the precipitation rate (Bcur*), and the effective (Gage-Radar Pair) sample size associated with the bias estimate (GRPcur*)."

"The digital version of this product (DSP) shall be available for 256 data levels at each sample bin location of a 1 degree by 2 kilometer polar grid, extending to a range of 230 kilometers (124 nautical miles). The digital version is provided to support processing external to the NEXRAD system. It shall be updated every volume scan and will include the same annotations as the graphical version of the product (listed above)."

29.2 Display Format

The image version of this product is displayed in full-screen format or quarter-screen format (see Appendix B). It will be formatted as an image radial product. The digital version is non-displayable.

29.2.1 Data Levels

In the image version of the product, the storm total precipitation is displayed in 16 data levels. The data level code may vary with operational mode and with NEXRAD (or agency) system adaptation data. The data thresholds are site adaptable.

The digital version of the product will contain 256 data levels on an automatically- adjustable, linear scale based on the maximum storm accumulation. Level code 0 will correspond to no accumulation and level codes 1 through 255 will indicate accumulations, with a minimal step of .01 inches. For every multiple of 2.55 inches exceeded, the scale will increment by a corresponding integer multiple. That is, if the maximum accumulation exceeds 2.55 inches, the scale will become .02 inches; if the maximum exceeds 5.10 inches, the scale will become .03 inches, etc. The scale (as integer multiple of .01 inches) will be included in the product header.

The digital data will be compacted on a radial basis.

*See NEXRAD Algorithm Report

29.2.2 Color Level Code Tables (for the image version of the product):

			Color Levels	
16-Level Code	Display Inches	Range Inches	Code	Color
0	ND	in=0.0	(00 00 00)	black
1	>0.00	0.0<in<0.3	(AA AA AA)	gray
2	0.3	0.3<in<0.6	(76 76 76)	dark gray
3	0.6	0.6<in<1.0	(00 FF FF)	cyan
4	1.0	1.0<in<1.5	(00 AF AF)	dark cyan
5	1.5	1.5<in<2.0	(00 FF 00)	green
6	2.0	2.0<in<2.5	(00 8F 00)	dark green
7	2.5	2.5<in<3.0	(FF 00 FF)	magenta
8	3.0	3.0<in<4.0	(AF 32 7D)	dark magenta
9	4.0	4.0<in<5.0	(00 00 FF)	blue
A	5.0	5.0<in<6.0	(32 00 96)	dark blue
B	6.0	6.05<in<8.0	(FF FF 00)	yellow
C	8.0	8.0<in<10.0	(FF AA 00)	orange
D	10.0	10.0<in<12.0	(FF 00 00)	bright red
E	12.0	12.0<in<15.0	(AE 00 00)	dark red
F	15.0	15.0<in	(FF FF FF)	white

29.2.3 Range/Data Resolution

The resolution of both the graphic and digital versions of this product is 1.1 nmi (range) by 1 deg (azimuth), out to a range of 124 nmi.

29.3 Annotations, Both versions of the product will contain the following:

29.3.1 Alphanumeric

Standard Annotations
Beginning/Ending Date and Time of Rainfall Rate Integration
Maximum Data Value
Radar Bias Estimate
Effective G-R Pair Sample Size
AWIPS Site ID of Most Recent Bias Source (STP Only)

29.3.1.1 (STP) Paired and (DSP) Digital Alphanumeric:

Precipitation Status Message, Including:
Current Date Precip Function Ran
Current Time Precip Function Ran
Last Date Precip Detected
Last Time Precip Detected
Current Precip Category
Last Precip Category

Adaptation Data, including:

(Enhanced Preprocessing Algorithm)
Width of the Radar Beam
Blockage Threshold

Clutter Threshold
Weight Threshold
Full Hybrid Scan Threshold
Low Refl. Threshold
Rain Detection Refl. Threshold
Rain Detection Area Threshold
Rain Detection Time Threshold
Z-R Multiplicative Coefficient
Z-R Power Coefficient
Minimum Reflectivity to Convert to Rate
Maximum Reflectivity to Convert to Rate
Number Exclusion Zones
(Rate Algorithm)
Range Cut-Off
Range Effect Coefficient #1
Range Effect Coefficient #2
Range Effect Coefficient #3
Minimum Precip. Rate
Maximum Precip. Rate
(Accumulation Algorithm)
Threshold Elapsed Time to Restart
Maximum Time for Interpolation
Minimum Time in Hourly Period
Threshold Hourly Outlier
Ending time Gage Accumulation
Maximum Period Accumulation Value
Maximum Hourly Accumulation Value
(Adjustment Algorithm)
Time bias Estimation
Threshold Number of Gage-Radar Pairs
Reset Bias Value
Longest Allowable Lag (Hours)

The following alphanumeric data only applies to the STP product.
AWIPS Site ID of Most Recent Bias Source

The following alphanumeric data only applies to the DSP product.

Selected Supplemental Data, including:

Average Scan Date
Average Scan Time
Flag Zero Hybrid
Flag Rain Detected
Flag Reset Storm Total
Flag Precip. Begin
Last Date Rain
Last Time Rain
Total No. of Blockage Bins Rejected
Total No. of Clutter Bins Rejected
Total Bins Smoothed

Percent of Hybrid Scan Filled
Highest Elevation Angle (degree)
Rain Area
Spot Blanking Status

Bias-Related Fields, including:
Time (secs) Bias Value Last Updated Locally
Date (modified Julian) Bias Value Last Updated Locally
Time (secs) of Last Update of Local Bias Table
Date (modified Julian) of Last Update of Local Bias Table
Observation Time (secs) of Latest Bias Table
Observation Date (modified Julian) of Latest Bias Table
Generation Time (secs) of Latest Bias Table
Generation Date (modified Julian) of Latest Bias Table
Mean- Field Bias Estimate
Effective G-R Pair Sample Size
Memory Span (Hours) used in Bias Estimate

29.3.2 Special Symbols

None

29.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:
- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signatures.

29.5 Comment

All site adaptable parameters identified as inputs to generate data for this product will be available at the alphanumeric display upon user request. This data will be formatted in a tabular layout showing the parameter name in one column and the value in an adjacent column.

30 HOURLY DIGITAL PRECIPITATION ARRAY (DPA)

30.1 SS Product Description

"The product shall provide hourly running total digital radar-rainfall estimates in an array format (not display oriented) to support processing performed external to the NEXRAD System. This product shall be available for 256 data levels for each array element. Each product shall include annotations for product name, radar ID, date and ending time (TSavcur* or clock hour as appropriate) of the rainfall rate integration, radar position, the radar operational mode, the maximum data value, the mean-field bias in the radar estimate of the precipitation rate (Bcur*), and the effective (Gage-Radar Pair) sample size associated with the bias estimate (GRPcur*)."

30.2 Display Format

This is not a displayable product.

30.2.1 Data Levels

The accumulation data will be compacted-in the 1/40-LFM grid in a maximum of 256 levels, while the rate data will be compacted in the 1/4 LFM grid with a maximum of 8 levels. These levels are defined as follows:

8-Level Code	Display	Range (in/hr)
0	0.0	0.0<in/hr<0.1
1	0.1	0.1<in/hr<0.3
2	0.3	0.3<in/hr<0.5
3	0.5	0.5<in/hr<1.0
4	1.0	1.0<in/hr<2.0
5	2.0	2.0<in/hr<4.0
6	4.0	4.0<in/hr
7	ND	

30.2.2 Color Level Code Tables

Not Applicable

30.2.3 Range/Data Resolution

The Adjusted Accumulation data ranges from -6 to 25.625 dBA and is reported in .125 dBA increments, where level codes 0 and 255 represent no accumulation and data outside the coverage area, respectively. Level codes 1 through 254 represent data values of -6 dBA to 25.625 dBA in 0.125 dBA increments. Rate data ranges from 0 to over 4 inches/hour in variable increments of rate. (Refer to para. 30.2.1.)

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*See Algorithm Report

30.3 Annotations

30.3.1 Alphanumeric

Standard Annotations
Maximum Data Value
Supplemental Data, including:

End Date and End Time Hourly Accumulation
Total No. of Blockage Bins Rejected
Total No. of Clutter Bins Rejected
Number of Bins Smoothed
Percent of Hybrid Scan Bins Filled
Highest Elevation Angle used in Hybrid Scan
Total Hybrid Scan Rain Area
Number of Bad Scans in Current Hour
Radar Bias Estimate
Effective G-R Pair Sample Size
Current Volume Coverage Pattern Number
Current Operational (Weather) Mode
Missing Periods (Begin Date; Begin Time; End Date; End Time)
Adaptation Data, including:
 (Enhanced Preprocessing Algorithm)
Width of the Radar Beam
Blockage Threshold
Clutter Threshold
Weight Threshold
Full Hybrid Scan Threshold
Low Refl. Threshold
Rain Detection Refl. Threshold
Rain Detection Area Threshold
Rain Detection Time Threshold
Z-R Multiplicative Coefficient
Z-R Power Coefficient
Minimum Reflectivity to convert to Rate
Maximum Reflectivity to convert to Rate
Number Exclusion Zones
 (Rate Algorithm)
Range Cut-Off
Range Effect Coefficient #1
Range Effect Coefficient #2
Range Effect Coefficient #3
Minimum Precip. Rate
Maximum Precip. Rate
 (Accumulation Algorithm)
Threshold Elapsed Time to Restart
Maximum Time for Interpolation
Minimum Time in Hourly Period
Threshold Hourly Outlier
Ending Time Gage Accumulation
Maximum Period Accumulation Value
Maximum Hourly Accumulation Value
 (Adjustment Algorithm)
Time Bias Estimation
Threshold Number of Gage-Radar Pairs
Reset Bias Value
Longest Allowable Lag (Hours)
Bias Applied Flag

30.3.2 Special Symbols

None

30.4 Product Interaction

None

31 SUPPLEMENTAL PRECIPITATION DATA (SPD)

31.1 SS Product Description

"This product shall provide selected supplemental data generated or collected during the operation of the precipitation processing subsystem algorithm. This product shall also provide the complete table of mean-field, gage-radar Bias values evaluated at different memory timespans (hours), received from AWIPS. This product shall be updated once per volume scan time.
This product shall be produced in a tabular alphanumeric format. This product shall include annotations for product name, radar ID, radar position, date and time of volume scan, maximum data value, radar elevation above MSL, and radar operational mode."

31.2 Display Format

31.2.1 Graphic Display

This product does not have a graphic component.

31.2.2 Alphanumeric Display

This product is displayable only on the alphanumeric screen in tabular alphanumeric format (see Appendix C).

31.3 Annotations

31.3.1 Alphanumeric

Standard Annotations
(Part I----Supplemental Precipitation Data):
Site Adaptation-RPG ID Number
Volume Scan Date and Time
Volume Coverage Pattern
Operational (Weather) Mode
Bias Applied Flag
Bias Estimate
Effective # Gage-Radar Pairs
Memory Span (Hours) used in Bias Estimate
Average Scan Date (Last Bias Update)
Average Scan Time (Last Bias Update)
Total No. of Blockage Bins Rejected
Total No. of Clutter Bins Rejected
Total No. of Final Bins Smoothed
Hybrid Scan Percent Bins Filled
Hybrid Scan Highest Elevation used
Hybrid Scan Total Rain Area
Begin Missing Period Date
Begin Missing Period Time
End Missing Period Date
End Missing Period Time
(Part II----Gage-Radar Mean Field Bias Table):
Average Scan Date (Last Bias Update)
Average Scan Time (Last Bias Update)
Bias Applied Flag (Yes/No)

Memory Span (Hours) (per evaluation timespan)
Effective # Gage-Radar Pairs (per evaluation timespan)
Average Gage Value (per evaluation timespan)
Average Radar Value (per evaluation timespan)
Mean-Field Bias Value (per evaluation timespan)

31.3.2 Special Symbols

None

31.4 Product Interaction

None

32 USER SELECTABLE RAINFALL ACCUMULATION (USP)

32.1 SS Product Description

"This product shall provide a rainfall accumulation map displayed as an image, for a user selected accumulation period. The product format and content shall be the same as the Surface Rainfall Accumulation (SS 28) and Storm Total Rainfall Accumulation (SS 29) products, except the accumulation period shall be of variable duration (in whole clock hours), ranging from a beginning to an ending time specified by the user. The product will usually be generated by request, but may also be generated routinely for limited, designated periods. One of these periods shall be the Default Period, which will span a 24 hour period from 1200z of the previous day to 1200z of the present day. The default version of the product may be generated any time following the completion of the first volume scan to start after 1200z each day, up to 6 hours later. The period of accumulation shall be defined by the operator via two parameters: the Ending Hour (ranging from 0 to 23z), and the Time Span (ranging form 1 to 24 whole clock hours prior to the Ending Hour.) No more than 30 hours of rainfall data prior to the most recent clock-hour will be required to generate this product.
If a requested product cannot be generated due to an error condition, a message will be displayed explaining why, and the available hours of precipitation accumulation in the precipitation data base will be listed.
"This product shall include annotations for product name, radar ID, maximum data value detected, radar position, times and dates of the beginning and end (clock hour) of the rainfall rate integration, radar position, radar elevation above MSL, radar operational mode, the mean-field bias in the radar estimate of the precipitation rate (Bcur*), and the effective (Gage-Radar Pair) sample size associated with the bias estimate (GRPcur*)."

32.2 Display Format

The product is displayed in full-screen or quarter-screen format (see Appendix B).

32.2.1 Data Levels

The User Selectable Rainfall Accumulation is displayed in 16 data levels on one of two possible scales, based on the maximum data value detected: one scale corresponding to that presently in use for the Surface Rainfall Accumulation products (OHP & THP); the other scale corresponding to that presently in use for the Storm Total Rainfall Accumulation product (STP). The scale used for the User Selectable product will switch automatically between the two, with the OHP & THP scale in effect unless the product maximum data value exceeds the lower limit of the maximum data level (e.g. 8 inches), in which case the STP scale will be invoked. Each data level code may vary with operational mode and with NEXRAD (or agency) system adaptation data.
*See Algorithm Report

32.2.2 Color Level Code Tables

See sections 28.2.2 and 29.2.2.

32.2.3 Range/Data Resolution

The resolution of this graphic product is 1.1 nmi (range) by 1 deg (azimuth) out to a range of 124 nmi.

32.2.4 Alphanumeric Display

32.2.4.1 Graphic Screen

A tabular format (Appendix B, Format III, Configuration 6) will be displayable on the graphic display screens. The tabular format will include:
(a) Gage Bias Flag
(b) Number of Hours in product
(c) End Times
(d) Bias
(e) Hours Included Flag

32.3 Annotations

32.3.1 Standard Annotations

Beginning/ending Date and Time of Rainfall Rate Integration
Maximum Data Value
Radar Bias Estimate
Effective G-R Pair Sample Size
Gage Adjustment Bias Flag
32.3.2 Special Symbols
None

32.4 Product Interaction

The following overlay products are displayable on this product:
· Hail Index
· Mesocyclone
· Storm Tracking Information
· Tornado Vortex Signatures.

33 HYBRID SCAN REFLECTIVITY (HSR) AND DIGITAL HYBRID SCAN REFLECTIVITY (DHR)

33.1 SS Product Description

"This product shall provide radar-reflectivity values for the composite Hybrid Scan*, both displayed as an image and formatted as non-displayable digital data. This product shall be assembled from the lowest four elevation angles and yielding a representative reflectivity value at every sample bin location of a 1 degree by 1 kilometer polar grid, out to a range of 230 kilometers (124 nautical miles). This digital data is provided to support processing performed external to the NEXRAD System, and is not display oriented. This product shall be updated once every volume scan time.

The digital version of this product shall be available for 256 data levels at each sample bin location. Each digital product shall include annotations for the product name, radar ID, date and time of the scan (TSavcur*), radar position, radar elevation above MSL, radar operational mode, and the maximum data value (dBZ).

The image version of this product shall represent the Reflectivity data. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, maximum data value (dBZ), radar position, radar elevation above MSL, and radar operational mode."

33.2 Display Format

The image version of this product is displayed in full-screen format or quarter-screen format (see Appendix B). It will be formatted as an image radial product. The digital version is not a displayable product.

33.2.1 Data Levels

The 256 data levels of the digital product cover a range of reflectivity from -32.0 to 94.5 dBZ, in .5 dBZ increments. Level codes 0 and 1 correspond to "Below Threshold" and "Range Folded", respectively, while level codes 2 through 255 correspond to the reflectivity data itself.

The image version of this product shall contain 16 data levels. The range of data level values (dBZ) varies with operational mode, area climatology and season, and with NEXRAD system (or agency) adaptation data. The range of Reflectivity supported by the RDA is -32 to +95 dBZe.

33.2.2 Color Level Code Tables

For the digital version of this product, the color table is not applicable. The graphic version of this product color level codes shall be identical to that used by the 16 data level base Reflectivity defined in product specification 1.2.2.

33.2.3 Range/Data Resolution

The Hybrid Scan extends to a range of 124 nmi, on a 230 x 360 (.54 nmi x 1 degree-resolution) polar grid.

33.3 Annotations

33.3.1 Digital Alphanumeric

Standard Annotations
Time and Date of the Scan (Tsavcur*)
Spot Blanking Status
Maximum Data Value
Precipitation Status Message, including:

Current Date Precip Function Ran
Current Time Precip Function Ran
Last Date Precip Detected
Last Time Precip Detected
Current Precip Category
Last Precip Category
Adaptation Data, including:
(Enhanced Preprocessing Algorithm)
Width of the Radar Beam
Blockage Threshold
Clutter Threshold
Weight Threshold
Full Hybrid Scan Threshold
Low Refl. Threshold
Rain Detection Refl. Threshold
Rain Detection Area Threshold
Rain Detection Time Threshold
Z-R Multiplicative Coefficient
Z-R Power Coefficient
Minimum Reflectivity to convert to Rate
Maximum Reflectivity to convert to Rate
Number Exclusion Zones
(Rate Algorithm)
Range Cut-Off
Range Effect Coefficient #1
Range Effect Coefficient #2
Range Effect Coefficient #3
Minimum Precip. Rate
Maximum Precip. Rate
(Accumulation Algorithm)
Threshold Elapsed Time to Restart
Maximum Time for Interpolation
Minimum Time in Hourly Period
Threshold Hourly Outlier
Ending Time Gage Accumulation
Maximum Period Accumulation Value
Maximum Hourly Accumulation Value
(Adjustment Algorithm)
Time Bias Estimation
Threshold Number of Gage-Radar Pairs
Reset Bias Value
Longest Allowable Lag (Hours)
Bias Applied Flag
Selected Supplemental Data, including:
Average Scan Date
Average Scan Time
Flag Zero Hybrid
Flag Rain Detected
Flag Reset Storm Total
Flag Precip. Begin
Last Date Rain

Last Time Rain
Total No. of Blockage Bins Rejected
Total No. of Clutter Bins Rejected
Total Bins Smoothed
Percent of Hybrid Scan Filled
Highest Elevation Angle (degree)
Rain Area
Spot Blanking Status
Bias-Related Fields, including:
Time (secs) Bias Value Last Updated Locally
Date (modified Julian) Bias Value Last Updated Locally
Time (secs) of Last Update of Local Bias Table
Date (modified Julian) of Last Update of Local Bias Table
Observation Time (secs) of Latest Bias Table
Observation Date (modified Julian) of Latest Bias Table
Generation Time (secs) of Latest Bias Table
Generation Date (modified Julian) of Latest Bias Table
Mean-Field Bias Estimate
Effective G-R Pair Sample Size
Memory Span (Hours) used in Bias Estimate

33.3.2 Graphic Alphanumeric

Standard Annotations (Appendix A, I(A))

33.4 Product Interaction

Product interaction for the image version of this product is identical to the base Reflectivity defined in product specification 1.4.

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*See NEXRAD Algorithm Report

34 CLUTTER FILTER CONTROL

34.1 SS Product Description

"This product will provide for display of Clutter Filter and Bypass Maps as a radial image, for the user selected elevation segment. The product, while considered a volume product, may not be generated every volume scan. The product will be generated upon detection of updated Clutter Filter Map and/or Bypass Map data received from the RDASC or in response to user request(s) when product is not in the RPG Product Database. Up to five elevation segments are available for selection." If Clutter Mitigation Decision (CMD) is active, all five segments will be generated every volume scan in response to the RPG receipt of the CMG generated Bypass Map."

Version 1 of the CFC product is different than Version 0 in four distinct ways: (1) the "Notchwidth Map" is now called the "Clutter Filter Map", (2) there can be up to five elevation segments instead of two, (3) there is no "channel" information, and (4) the azimuthal resolution has changed from 1.4 deg to 1.0 deg.

Version 0 of the CFC product shall include annotations for elevation segment number (1 or 2), channel (Surveillance or Doppler), bypass map generation date/time, Notchwidth Map generation date/time, all other standard annotations.

Version 1 of the CFC product shall include annotations for elevation segment number (up to 5), Bypass Map generation date/time, CMD flag, Clutter Filter Map generation date/time, and all other standard annotations.

34.2 Display format

The product is displayed in full-screen or quarter screen format (see Appendix B).

34.2.1 Data Levels

The Clutter Filter Control product is displayable in 8 and 4 data levels for Version 0 and 1, respectively. These data levels designate the filtering enabled over each area.

34.2.2 Color Level Code Tables

CFC Product Version 0

8-Level Code	Op Select Code	Filter Level	Description
0	0	Filter Off	Disable Filter
1	1	No Clutter	Bypass Map in CTRL
2	1	Low (1)	Bypass Map in CTRL
3	1	Medium (2)	Bypass Map in CTRL
4	1	High (3)	Bypass Map in CTRL
5	2	Low (1)	Force Filter
6	2	Medium (2)	Force Filter
7	2	High (3)	Force Filter

CFC Product Version 1

4-Level Code	Op Select Code	Filter Level	Description
0	0	Filter Off	Disable Filter
1	1	No Clutter	Bypass Map in CTRL
4	1	Clutter	Bypass Map in CTRL
7	2		Force Filter

34.2.3 Range/Data Resolution

The resolution of Version 0 of the Clutter Filter Control product is 1 km (range) by 1.4 deg (azimuth) out to a range of 124 nmi. (230 km). The resolution of Version 1 of the Clutter Filter Control product is 1 km (range) by 1.0 deg (azimuth) out to a range of 124 nmi. (230 km).

34.3 Annotations

34.3.1 Alphanumeric

CFC Product Version 0
Standard Annotations
Elevation Segment Number
Channel (Surveillance or Doppler)
Bypass Map generation date/time
Notchwidth Map generation date/time
CFC Product Version 1
Standard Annotations
Elevation Segment Number
Bypass Map generation date/time
Clutter Filter Map generation date/time
CMD flag

34.3.2 Special Symbols

None defined

34.4 Product Interaction

None

35 ITWS DIGITAL BASE VELOCITY (ITWSDBV)

35.1 SS Product Description

"This product shall provide mean radial velocity in a digital array format to support processing external to the NEXRAD system. This product shall be generated for each azimuth scan (elevation) based upon user requirements. This product shall consist of a one degree by 1 kilometer polar grid out to a range of 115 kilometers (62 nautical miles). This product shall provide 256 data levels (including 254 mean radial velocity data levels and indications for data "below the Signal-to-Noise threshold" and "Range Folding") for each array element. The product shall be formatted as a Graphic Product as specified in the ICD for the RPG/Associated PUP, Document Number 2620001, using Digital Radial Data Array Packets, Figure 3-11c. In addition to the standard contents of the Graphic Product, this product shall include the minimum data value (in meters per second), the increment (in meters per second), the number of data levels, the elevation (in degrees), the maximum negative velocity detected (in knots) and the maximum positive velocity detected (in knots).

35.2 Display Format

This is not a displayable product.

35.2.1 Data Levels

The product will have 256 data levels with codes "0" and "1" corresponding to "Below Signal-to-Noise (S/N) Threshold" and "Range Folding", respectively. Data level codes 2 through 255 correspond to mean radial velocity -63.5 to +63 meters per second respectively in 0.5 meters per second increments. This data coding will be adhered to regardless of the Doppler Velocity Resolution of the data provided by the RDA. With a velocity precision code of 2 (see Product Specific Data), the range of velocities produced by RDA is -127 to +126 meters per second. Any velocity data exceeding the maximum (-63.5/+63) will be represented by the maximum velocity.

35.2.2 Color Level Code Tables

Color level code tables are not provided. The encoding velocities into the 256 level value is according to Table III-E, Base Data Scaling, in the RDA/RPG ICD, Document Number 2620002, with LSB=0.5.

35.2.3 Range/Data Resolution

This product will be a polar data array with a sample bin for each 0.54 NM slant range and each 1 degree (nominal) of angular rotation. The array will normally have up to 366 radials based upon the variation in width of the NEXRAD radials from 0.95 to 1.1 degrees. However, in certain conditions, radial width could vary from 0.1 to 2.0 degree with a maximum of 400 radials in a product. Angular rotation will be in degrees clockwise relative to True North. This product will extend to a range of 62 NM (115 km) with a data value for each .54 NM (1 km). This resolution is obtained by sampling every fourth data bin of the base velocity data. To reduce the product size to a useful detection volume, the range coverage at higher elevations will not include data over 18,000 feet AGL above the radar (as measured above a flat plane at the radar).

35.2.4 Product Specific Data

The following data, specific to this product, is included in the Graphic Product message according to standard procedures as follows. This information is also provided in the ICD for the RPG/Associated PUP, Figure 3-6 and Table V.

Halfword	Field Name	Contents	Units	Range	Precision/ Accuracy
30	Product Dependent (P3)	elevation angle	degrees	-1.0 to +45.0	0.1, Note 1
31	Data Level 1 Threshold	minimum data value	m/s*10	-63.5	Note 1
33	Data Level 2 Threshold	increment	m/s*10	0.5	Note 1
47	Data Level 3 Threshold	number of levels	N/A	0 - 255	1
48	Product Dependent (P4)	maximum negative velocity detected	knots	-123 to 0	1
49	Product Dependent (P5)	maximum positive velocity detected	knots	0 to +123	1
50	Product Dependent (P7)	velocity precision code	N/A	1 or 2	1, Note 2

Note 1.Scaled integer, precision determines scaling.
Note 2. Velocity precision code indicates the quantization of the base velocity data used to create this product. A value of 1 denotes 0.5 m/s and 2 denotes 1.0 m/s. Regardless of this code, product 93 is formatted as if the precision is always 0.5 m/s.

35.3 Annotations

35.4 Product Interaction

36 CLUTTER LIKELIHOOD REFLECTIVITY (CLR)

36.1 SS Product Description

The Clutter Likelihood Reflectivity product shall provide a displayable image of the percentage probability that the radar is detecting ground clutter in the reflectivity radial samples. The processing shall be based on the output of the Radar Echo Classifier (REC) algorithm using the Anomalous Propagation /Clutter target logic. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each product shall be available in an 11-level display. A separate data level code shall be used to represent sampled bins below SNR threshold. The product shall display the percentage likelihood of clutter for each reflectivity bin, from the radar to 124 nautical miles range. The product shall be a radial format display with a range resolution of 0.54 nautical miles. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, radar position, radar elevation above MSL and radar operational mode. Upon user request, all site adaptable parameters identified as inputs to the algorithm used to generate data for this product shall be available to the user.

36.2 Display Format

The product is displayable as a radial format, graphic image as described in the Interface Control Document for the RPG to Class 1 User.

36.2.1 Data Levels

The 11 color level codes used for display of REC AP/Clutter Likelihood Reflectivity are NEXRAD (or agency) system adaptation data. An example of color table for both Precipitation and Clear Air Modes is listed. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

36.2.2 Color Level Code Tables

11-Level Clear Air and Precipitation Modes

11-Level Code	Display Percent	Range Percent	Color Levels	
			Code	Color
0	ND	SNR<TH or dBZ<5(<-28 for clear air mode)	(00 00 00)	black
1	0	0<%<10	TBD	TBD
2	10	10<%<20	(TBD)	(TBD)
3	20	20<%<30	(TBD)	(TBD)
4	30	30<%<40	(TBD)	(TBD)
5	40	40<%<50	(TBD)	(TBD)
6	50	50<%<60	(TBD)	(TBD)
7	60	60<%<70	(TBD)	TBD
8	70	70<%<80	(TBD)	TBD
9	80	80<%<90	(TBD)	TBD
A	90	90<%	(TBD)	TBD

36.2.3 Range/Data Resolution

The products are available for the following:

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar Location

36.3 Annotations

36.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Site Adaptable Parameters

36.3.2 Special Symbols

None defined.

36.4 Product Interaction

All overlay products are displayable on this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

37 CLUTTER LIKELIHOOD DOPPLER (CLD)

37.1 SS Product Description

The Clutter Likelihood Doppler product shall provide a displayable image of the percentage probability that the radar is detecting ground clutter in the Doppler radial samples. The processing shall be based on the output of the Radar Echo Classifier (REC) algorithm using the Anomalous Propagation /Clutter target logic. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each product shall be available in a 12-level display. A separate data level code shall be used to represent sampled bins below SNR threshold. A separate data level code shall be used to represent bins where the Doppler data is undermined due to range folded data. The product shall display the percentage likelihood of AP/clutter for each Doppler bin, from the radar to 124 nautical miles range. The product shall be a radial format display with a range resolution of 0.54 nautical miles. The value displayed for a given 0.54 nautical mile bin shall be the maximum of the four corresponding Doppler bins. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, radar position, radar elevation above MSL and radar operational mode. Upon user request, all site adaptable parameters identified as inputs to the algorithm used to generate data for this product shall be available to the user.

37.2 Display Format

The product is displayable as a radial format, graphic image as described in the Interface Control Document for the RPG To Class 1 User.

37.2.1 Data Levels

The 12 color level codes used for display of REC Clutter Likelihood Doppler are NEXRAD (or agency) system adaptation data. An example of color table for both Precipitation and Clear Air Modes is listed. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

37.2.2 Color Level Code Tables

12-Level Clear Air and Precipitation Modes

12-Level Code	Display Percent	Range Percent	Color Levels	
			Code	Color
0	ND	SNR<TH or dBZ<5(<-28 for clear air mode)	(00 00 00)	black
1	0	0<%<10	(TBD)	(TBD)
2	10	10<%<19	(TBD)	(TBD)
3	20	20<%<29	(TBD)	TBD
4	30	30<%<39	(TBD)	TBD
5	40	40<%<49	(TBD)	TBD
6	50	50<%<59	(TBD)	TBD
7	60	60<%<69	(TBD)	TBD
8	70	70<%<79	(TBD)	TBD
9	80	80<%<89	(TBD)	TBD
A	90	90<%	(TBD)	TBD
B	RF	RF	(TBD)	TBD

37.2.3 Range/Data Resolution

The products are available for the following:

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar Location

37.3 Annotations

37.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Site Adaptable Parameters

37.3.2 Special Symbols

None defined

37.4 Product Interaction

All overlay products are displayable on this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

38 SUPEROB

38.1 SS Product Description

This product will contain 8 bit precision radial velocity data as an average of all base velocity bins within discrete sampling areas for a predetermined time span. The product, while considered a volume product, will not be generated every volume scan. The time span over which the velocity data is averaged will be adaptable between 10 minutes and 3 hours with the default value being 1 hour. The product will be generated at the end of the time span.

Each elevation scan will be divided into multiple sampling areas, or SuperOb cells. The SuperOb cells are defined by an adaptation data supplied range size and azimuth size. A maximum range will also be defined to limit the range extent of the averaging.

Velocity data will be averaged within these SuperOb cells for each elevation of the volume coverage pattern. If the volume coverage pattern changes during the time span, thereby causing a change in elevation angles, a tolerance will be established so that elevation differences beyond the tolerance will cause velocity data for the new elevation(s) to be averaged separately. Elevation differences within the tolerance value will cause velocity data from the new elevation(s) to be included in the averages for the nearest elevation.

A minimum number of samples for a usable average will be defined in adaptation data. If a SuperOb cell does not meet this minimum number of samples within the time span, an average will not be computed for that cell.

At the end of a time span, the resulting product will supply the following information for each SuperOb cell in each elevation: average radial velocity, root mean square of the average radial velocities, azimuth, latitude, longitude, height, and time deviation. The time deviation is the mean number of seconds deviation from the base time of all the sample times included in the SuperOb cell. The base time is defined as the center of the time span of data collection base. The latitude, longitude, height and azimuth values are also determined from the mean of all samples in the SuperOb cell.

38.2 Display Format

38.2.1 Data Levels

The product will contain averaged velocity data in 8 bit (256 data level) precision.

38.2.2 Color Level Code Tables

Color level code tables are not provided. Information for the SuperOb cells in each elevation is formatted according to the RPG To Class I User Interface Control Document, Document Number 2620001, packet code 27.

38.2.3 Range/Data Resolution

The resolution and range extent of the SuperOb cells are determined from RPG adaptation data. Adaptation data defines a range size (default 5 kilometers) and an azimuth size (default 6 degrees). Adaptation data also defines a maximum range for processing (default 100 kilometers).

38.2.4 Product Specific Data

The following data, specific to this product, is included in the Graphic Product message according to standard procedures as follows. This information is also provided in the ICD for the RPG to Class I User, Figure 3-6 and Table V.

Halfword	Field Name	Contents	Units	Range	Precision/Accuracy
27	Product Dependent (P1)	Base Time	minutes	0 to 1439	1
28	Product Dependent (P2)	Time Radius	minutes	5 to 90	1
47	Product Dependent (P4)	SuperOb Cell Range Size	km	1 to 10	1
48	Product Dependent (P5)	SuperOb Cell Azimuth Size	degrees	2 to 12	1
49	Product Dependent (P6)	Maximum Range	km	60 to 230	1
50	Product Dependent (P7)	Minimum Number of Samples	N/A	20 to 200	1

38.3 Annotations

38.4 Product Interaction

39 DIGITAL HIGH RESOLUTION VERTICALLY INTEGRATED LIQUID (HRVIL)

39.1 SS Product Description

“This product shall provide digital values of vertically integrated liquid (VIL) in a polar radial format. These digital, high-resolution VIL data are provided to support processing performed external to the NEXRAD System. A polar VIL algorithm similar to the original NEXRAD VIL Algorithm shall be used. Input to HRVIL is provided on an elevation basis by the Data Quality Assurance (DQA) algorithm. The DQA analyzes the reflectivity factor data to detect and remove both constant power signature artifacts and anomalous propagation. The HRVIL product shall produce a representative VIL value at every sample bin location of a 1 kilometer (0.54 nautical mile) by 1 degree polar grid, out to a range of 460 kilometers (248 nautical miles). The distance to center of the first range bin is the same as that for the input data. The product shall be updated once per completion of a full volume scan. This product shall provide for 256 data levels including three values reserved for flagging. The product shall be formatted as a Graphic Product as specified in the ICD for Class 1 Users (Document Number 2620001) using Digital Radial Data Array Packets as described in Figure 3-11c.

Each digital product shall include annotations for product name, radar ID, time and date of volume scan, maximum data value (digital VIL value), radar position, radar elevation above MSL, and the radar operational mode.”

39.2 Display Format

This is not a displayable product.

39.2.1 Data Levels

The product will have 256 data levels with codes "0" and "1" corresponding to "Below threshold data" and "flagged data", respectively. Digital value 255 also is reserved for future use as a flag, if needed. Data level codes 2 through 254 correspond to VIL values ranging from 0.05 kg m-2 to a maximum of 80 kg m-2. Any VIL value above 80 kg m-2 is assigned a digital data value of 254. The following table lists the equations used to convert VIL to a digital value through the Build 8 version of this product:

Digital VIL (DVL) Range	VIL Range (kg m-2)	Equation
0	<0.05	-
2-19	0.05 <= VIL < 0.189	DVL = 123.2702*VIL - 4.1635
20-254	>=0.189	DVL = 38.8763*LN(VIL) + 83.9028

Beginning with Build 9, HRVIL has a modified linear scale for improved depiction of weak weather signatures. The following table lists the equations used to convert VIL to a digital value:

Digital VIL (DVL) Range	VIL Range (kg m-2)	Equation
0	0	-
2-19	0 < VIL < 0.189	DVL = 90.66*VIL + 2.0
20-254	>=0.189	DVL = 38.8763*LN(VIL) + 83.9028

39.2.2 Color Level Code Tables

For this digital product, the color table is not applicable.

39.2.3 Range/Data Resolution

The resolution of this polar product is 0.54 nmi (1 km) in range by 1 degree in azimuth out to a radial range of 248 nmi (460 km). The distance to center of the first range bin is the same as that for the input data. The radar location is at the product center.

39.3 Annotations

39.3.1 Alphanumeric

The automated annotations for this product are:
Standard Annotations (Appendix A, I(A))
Digital Data Level to VIL Conversion Information
Maximum Digital Data Value Detected
Number of artifact edited radials volume

39.3.2 Special Symbols

None defined.

39.4 Product Interaction

None.

40 USER SELECTABLE LAYER COMPOSITE REFLECTIVITY (ULR)

40.1 SSS Product Description

"This product shall be provided on a 1 degrees by 1 kilometer polar grid, out to a range of 230 kilometers (124 nautical miles). For each resolution element, this product shall provide the maximum reflectivity value above the resolution element of sample bins intersecting the layer from any elevation angle scan of a volume scan. At most ten layers shall be available per volume. The altitude limits of each layer shall be specified by user product request. No layer shall be less than 1,000 ft thick. Each layer product shall be updated on a volume scan basis. Sixteen data levels shall be available for each product, including one for data below minimum Signal-to-Noise threshold and one for unavailable data. Data is unavailable at a given range resolution element to gaps between elevation scans or if the given resolution element lies above the layer or below the layer. Each product shall contain annotations for product name, radar ID, date and time of volume scan, maximum data value detected, radar position, radar elevation above MSL, and radar operational mode."

40.2 Display Format

40.2.1 Data Level

This product shall contain 16 displayable levels (4 bits) as follows: the first data level shall depict data below the signal - to- noise ratio threshold; the second data level shall depict data which is unavailable due to gaps in the Volume coverage Pattern; the third data level shall contain all data greater than signal-to-noise threshold and less than -5 dBZ; the last data level shall contain all data greater or equal to 55 dBZ; the remaining twelve data levels shall depict reflectivity values greater or equal to -5 dBZ to less than 55 dBZ, at increments to 5 dBZ.

40.2.2 Color Level Code Tables

16-Level Code	Display dBZ	Range dBZ	Code	Color
0	>TH	SNR<TH or dBZ <-32	(00 00 00)	black
1	ND	ND	(9C 9C 9C)	medium gray
2	>-5	-32<=dBZ<-5	(76 76 76)	dark gray
3	-5	-5<=dBZ<0	(FF AA AA)	light pink
4	0	0<=dBZ<5	(EE 8C 8C)	medium pink
5	5	5<=dBZ<10	(C9 70 70)	dark pink
6	10	10<=dBZ<15	(00 FB 90)	light green
7	15	15<=dBZ<20	(00 BB 00)	medium green
8	20	20<=dBZ<25	(FF FF 70)	light yellow
9	25	25<=dBZ<30	(D0 D0 60)	dark yellow
10	30	30<=dBZ<35	(FF 60 60)	light red
11	35	35<=dBZ<40	(DA 00 00)	medium red
12	40	40<=dBZ<45	(AE 00 00)	dark red
13	45	45<=dBZ<50	(00 00 FF)	blue
14	50	50<=dBZ<55	(FF FF FF)	white
15	55	55<=dBZ	(E7 00 FF)	purple

40.2.2 Range/Data Resolution

The product coverage area is 360 degrees x 124 nm. The resolution is 1 degree x 0.54 nm. The product is centered at the radar location.

40.3 Annotations

40.3.1 Alphanumeric

Standard Annotation (Appendix A).
Data Level Codes
Maximum Data Value Detected
Requested Altitudes of the Layer Bottom and (to correct request errors as described below)

To permit product generation, invalid product request parameters (i.e., ICD non-compliance such as layer altitude outside of 0 or 70k ft, or minimum thickness less than 1k ft) shall be modified according to the following rules: (A) If the layer bottom altitude is less than 0k ft, generate a product based on a layer bottom altitude of 0k ft; (B) If the layer top altitude is greater than 70k ft, generate a product based on a layer top altitude of 70k ft; (C) If the layer thickness is zero, generate a product based on the top altitude being 1k ft higher than the layer bottom altitude; (D) If the layer top (bottom) altitude are both above (below) the valid altitude limits, generate a product with the layer top (bottom) altitude set to 70k ft (0k ft) and with the other altitude set to 1k ft lower (higher); (E) If the layer top altitude is less than the layer bottom altitude, switch the limits so that the layer depth is greater than zero.

40.3.2 Special Symbols

None defined.

41 DIGITAL HIGH RESOLUTION ENHANCED ECHO TOPS (HREET)

41.1 SS Product Description

“This product shall provide the echo tops information to support processing performed by external systems. Reflectivity data used to generate this product shall be edited for artifacts and anomalous propagation by the Data Quality Assurance algorithm. The HREET algorithm also removes meteorologically implausible spurious tops at or above 45,000 feet. The HREET product shall be updated once per volume scan time. This product shall report echo tops at a vertical resolution of 1000 feet referenced to mean sea level on a 1 degree by 1 kilometer polar grid to a range of 345 kilometers (186 nautical miles). Echo top data shall be flagged to indicate the “topped” condition, meaning echo tops may be higher than indicated. A Topped condition results when either the reflectivity is greater than the threshold of 18 dBZ at the top elevation scan, or when the value immediately above an 18+ dBZ value is bad and no other values at higher elevations are above threshold. Additionally, two values shall be reserved for “no data” and “bad data”. A sample bin is flagged “bad data” if the reflectivity was edited by the DQA algorithm. The value “no data” means there are no reflectivity data above threshold at the location of the sample bin. The flagged conditions can not be “topped”.

"Each product shall include annotations for product name, radar ID, time and date of volume scan, maximum data value (echo top), echo top reflectivity threshold value, the number of radials in volume determined to be artifacts, the number of spurious points removed, radar position, radar elevation above MSL, and the radar operational mode.”

41.2 Display Format

41.2.1 Data Levels

The product will have 71 data levels with codes "0" and "1" corresponding to "missing data" and "bad data", respectively. Data level codes 2 through 71 correspond to EET values ranging from 0.0 kft to a maximum of 69.9 kft. Any EET value at or above 70 kft is assigned a value of 1 (bad data). The following table lists the data levels used and their corresponding EET values.

Digital EET Range	EET Range (kft)
0	Missing data
1	Bad data
2-71	0 <= EET < 70
130-199	0 <= “topped” EET < 70

41.2.2 Color Level Code Tables

For this digital product, the color table is not applicable.

41.2.3 Range/Data Resolution

The resolution of this polar product is 0.54 nmi (1 km) in range by 1 degree in azimuth out to a radial range of 186 nmi (345 km). The radar location is at the product center.

41.3 Annotations

41.3.1 Alphanumeric

The automated annotations for this product are:
Standard Annotations (Appendix A, I(A))

Digital Data Level to EET Conversion Information
Maximum Digital Data Value Detected
Number of artifact edited radials in volume
Echo Top threshold value (in dBZ)
Number of spurious points removed

41.3.2 Special Symbols

None defined.

41.4 Product Interaction

None.

42 ONE HOUR SNOW ACCUMULATION (OSW, OSD)

42.1 SS Product Description

"These products shall provide radar algorithm estimated 1-hour snow water equivalent and snow depth accumulation images. The products shall be updated every volume scan. The products shall be available for 16 data levels. Each product shall include annotations for the product name, radar ID, date and ending time of the accumulation, the type of range/height correction (such as algorithm derived or static) has been applied to the accumulation, maximum data value, azimuth and range of the maximum value, radar position, radar elevation above MSL, and radar operational mode."

42.2 Display Format

42.2.1 Graphical Display

The products are displayable in full-screen format or quarter-screen format (see Appendix B) as a radial product. The product will contain 16 data levels. The table below defines the default color and data levels. Color and data levels may vary with display systems and with NEXRAD (or agency) preferences.

42.2.1.1 Color Level Code Table

	OSW		OSD		Color Levels	
16-Level Code	Display 100ths Inches	Range Inches	Display Inches	Range Inches	Code	Color
0	ND	in=0.0	ND	in=0.0	(00 00 00)	black
1	>0	0.0<in<0.01	>0.00	0.0<in<0.05	(AA AA AA)	gray
2	1	0.01<in<0.02	0.05	0.05<in<0.10	(76 76 76)	dark gray
3	2	0.02<in<0.03	0.10	0.10<in<0.15	(00 FF FF)	cyan
4	3	0.03<in<0.05	0.15	0.15<in<0.25	(00 AF AF)	dark cyan
5	5	0.05<in<0.07	0.25	0.25<in<0.50	(00 FF 00)	green
6	7	0.07<in<0.09	0.50	0.50<in<0.75	(00 8F 00)	dark green
7	9	0.09<in<0.11	0.75	0.75<in<1.00	(FF 00 FF)	magenta
8	11	0.11<in<0.13	1.00	1.00<in<1.50	(AF 32 7D)	dark magenta
9	13	0.13<in<0.16	1.50	1.50<in<2.00	(00 00 FF)	blue
A	16	0.16<in<0.20	2.00	2.00<in<2.50	(32 00 96)	dark blue
B	20	0.20<in<0.25	2.50	2.50<in<3.00	(FF FF 00)	yellow
C	25	0.25<in<0.30	3.00	3.00<in<3.50	(FF AA 00)	orange
D	30	0.30<in<0.35	3.50	3.50<in<4.00	(FF 00 00)	bright red
E	35	0.35<in<0.40	4.00	4.00<in<5.00	(AE 00 00)	dark red
F	40	0.40>in	5.00	5.00>in	(FF FF FF)	white

42.2.1.2 Range/Data Resolution

The resolution of the graphic products is 0.54 nmi (range) by 1 deg (azimuth) and has a maximum range of 124 nmi.

42.2.2 Alphanumeric Display

Upon request, all site adaptable and configuration parameters for this product will be available as an alphanumeric display. This data will be formatted in a tabular layout showing in sequential columns the parameter names, values, and units.
42.3 Annotations
42.3.1 Alphanumeric
Standard annotations
Starting date [of snow accumulation]
Starting time [of snow accumulation]
Ending date [of snow accumulation]
Ending time [of snow accumulation]
Maximum Value
Azimuth of Maximum Value
Range to Maximum Value
Range/height Correction Applied: RCA or static
Missing Time - cumulative length in time of the missing periods

42.2.2 Special Symbols

None

42.3 Product Interaction

None

43 STORM TOTAL SNOW ACCUMULATION (SSW AND SSD)

43.1 SS Product Description

"These products shall provide radar algorithm estimated storm total snow water equivalent and snow depth accumulation images. The products shall be updated every volume scan. The products shall be available for 16 data levels. Each product shall include annotations for the product name, radar ID, starting and ending date and time of the accumulation, the type of range/height correction (such as algorithm derived or static) has been applied to the accumulation, maximum data value, azimuth and range of the maximum value, radar position, radar elevation above MSL, and radar operational mode."

43.2 Display Format

43.2.1 Graphical Display

The products are displayable in full-screen format or quarter-screen format (see Appendix B) as a radial product. The product will contain 16 data levels. The table below defines the default color and data levels. Color and data levels may vary with display systems and with NEXRAD (or agency) preferences

43.2.1.1 Color Level Code Table:

	SSW		SSD		Color Levels	
16-Level Code	Display Inches	Range Inches	Display Inches	Range Inches	Code	Color
0	ND	in=0.0	ND	in=0.0	(00 00 00)	black
1	>0.00	0.0<in<0.05	>0.00	0.0<in<0.5	(AA AA AA)	gray
2	0.05	0.05<in<0.10	0.5	0.5<in<1.0	(76 76 76)	dark gray
3	0.10	0.10<in<0.15	1.0	1.0<in<2.0	(00 FF FF)	cyan
4	0.15	0.15<in<0.20	2.0	2.0<in<3.0	(00 AF AF)	dark cyan
5	0.20	0.20<in<0.25	3.0	3.0<in<4.0	(00 FF 00)	green
6	0.25	0.25<in<0.30	4.0	4.0<in<5.0	(00 8F 00)	dark green
7	0.30	0.30<in<0.40	5.0	5.0<in<6.0	(FF 00 FF)	magenta
8	0.40	0.40<in<0.50	6.0	6.0<in<8.0	(AF 32 7D)	dark magenta
9	0.50	0.50<in<0.75	8.0	8.0<in<10.0	(00 00 FF)	blue
A	0.75	0.75<in<1.00	10.0	10.0<in<12.0	(32 00 96)	dark blue
B	1.00	1.00<in<1.25	12.0	12.0<in<15.0	(FF FF 00)	yellow
C	1.25	1.25<in<1.50	15.0	15.0<in<20.0	(FF AA 00)	orange
D	1.50	1.50<in<2.00	20.0	20.0<in<25.0	(FF 00 00)	bright red
E	2.00	2.00<in<2.50	25.0	25.0<in<30.0	(AE 00 00)	dark red
F	2.50	2.50>in	30	30.0>in	(FF FF FF)	white

43.2.1.2 Range/Data Resolution

The resolution of the graphic products is 0.54 nmi (range) by 1 deg (azimuth) and has a maximum range of 124 nmi.

43.2.2 Alphanumeric Display

Upon request, all site adaptable and configuration parameters for this product will be available as an alphanumeric display. This data will be formatted in a tabular layout showing in sequential columns the parameter names, values, and units.

43.3 Annotations

43.3.1 Alphanumeric

Standard annotations
Starting date [of snow accumulation]
Starting time [of snow accumulation]
Ending date [of snow accumulation]
Ending time [of snow accumulation]
Maximum Value
Azimuth of Maximum Value
Range to Maximum Value
Range/height Correction Applied: RCA or static
Missing Time - cumulative length in time of the missing periods

43.3.2 Special Symbols

None

43.4 Product Interaction

None

44 USER SELECTABLE SNOW ACCUMULATION (USW, USD)

44.1 SS Product Description

"These products shall provide radar algorithm estimated storm total snow water equivalent and snow depth accumulation images for a user selected accumulation period. The product format and content shall be the same as the storm total snow accumulation products, except the accumulation period shall be of variable duration and in whole top-of-the-hour clock hours. The products shall be updated at the top of the every hour (as requested). The accumulation period shall be definable by the requester via two parameters: the Ending Hour (ranging from 0 to 23Z) and the Time Span (ranging from 1 to 30 whole clock hours prior to the Ending Hour.) The product will usually be generated by request, but may also be generated routinely for designated periods. The default accumulation period shall span a 24 hour period from 1200Z of the previous day to 1200Z of the present day.

The products shall be available for 16 data levels. Each product shall include annotations for the product name, radar ID, dates and times of the starting and end (clock hour) of the snow accumulation, the type of range correction (such as algorithm or static derived) has been applied to the accumulation, maximum data value, azimuth and range of the maximum value, radar position, radar elevation above MSL, and radar operational mode."

44.2 Display Format

44.2.1 Graphical Display

The product is displayed in full-screen or quarter-screen format (see Appendix B).

44.2.1.1 Color Level Code Tables

The User Selectable Snow Accumulation is displayed in 16 data levels on one of two sets of scales based on the maximum data value detected: a) one scale corresponding to that presently in use for the One Hour Snow Accumulation products (OSW for snow water equivalent or OSD for snow depth), or b) a scale corresponding to that used for the Storm Total Snow Accumulation products (SSW for snow water equivalent or SSD for snow depth). The scale used for the user selectable snow accumulation product (USW or USD) will switch automatically between the two, with the OSW or OSD scales in effect unless the product maximum data value exceeds the lower limit of the maximum data level in which case the SSW or SSD scale will be invoked. Color and data levels will vary with display systems and with NEXRAD (or agency) preferences. Data levels will vary as changes are made to the OSW, OSD, SSW, and SSD color and data levels.

44.2.1.2 Range/Data Resolution

The resolution of this graphic product is 0.54 nmi (range) by 1 deg (azimuth) out to a range of 124 nmi.

44.2.2 Alphanumeric Display

Upon request, all site adaptable parameters for this product will be available as an alphanumeric display. This data will be formatted in a tabular layout showing in sequential columns the parameter names, values, and units.

44.3 Annotations

44.3.1 Alphanumeric

Standard annotations
Starting date [of snow accumulation]
Starting time [of snow accumulation]
Ending date [of snow accumulation]
Ending time [of snow accumulation]
Maximum Value
Azimuth of Maximum Value
Range to Maximum Value
Range/height Correction Applied: RCA or static
End Hour
Time Span
Available hours

44.3.2 Special Symbols

None

44.4 Product Interaction

None

45 ARCHIVE III STATUS PRODUCT (ASP)

45.1 SS Product Description

Section 3.7.1.6.3 states "The capability shall (1) be provided to detect, record, and display all status and error messages."

The ASP product contains an adaptable number of hours of RPG status log messages. The product (by default) is generated every eight hours at 00:00, 08:00, and 16:00 GMT. The product contains all RPG status log messages since the last product was generated.

This product shall include annotations for the product name, radar ID, date and time of volume scan, elevation angle, radar position, radar elevation above MSL, and radar operational mode.

45.2 ASP Format for External Systems

The product is formatted according to the Generic Product Format (GPF) packet description and encoded using External Data Representation (XDR). See the RPG to Class 1 User ICD for more information about GPF and XDR.

45.3 Annotations

45.3.1 Alphanumeric

Standard annotations

46 GUST FRONT MIGFA (GFM)

46.1 SS Product Description

“This product shall provide convergence boundary detections (such as gust fronts) with 10 and 20 minute forecast positions. The product extends to 70 kilometers (38 nautical miles) range from the radar. This product is provided to support processing performed by external systems and is not display oriented. Input to MIGFA is a merger of the 0.5 and 1.5 degree elevation cuts for all VCPs but VCP 12 and VCP 212. For VCP 12 and VCP 212, the merger is for the 0.5 and 1.3 degree elevation cuts. This product will be updated once every volume scan time. Each product will include a standard set of annotations and a count of the number of detections in the volume. The product shall be formatted as a Generic Data Product as specified in the ICD for Class 1 Users (Document Number 2620001) using Packet 28 as described in Appendix E.”

Each product shall include annotations for product name, radar ID, time and date of volume scan, number of detections in the volume, radar position, radar elevation above MSL, and the radar operational mode.”

46.2 Display Format

46.2.1 Data Levels

The product does not have data levels. Detections and their 10 and 20 minute forecast positions consist of a series of location points.

46.2.2 Color Level Code Tables

For this product the color table is not applicable.

46.2.3 GFM Format for External Systems

MIGFA output is encoded using Generic Data Packet 28. This packet is described in Note 1 for Figure 3-15b of the RPG To Class 1 User ICD (Document 2620001I). Packet 28 provides for a self-describing NEXRAD output product. The Radar Operations Center (ROC) supports API to encode (serialize) and decode (deserialize) Packet 28 formatted products. It is available upon request from the ROC.

MIGFA uses the Area Component Data Structure to describe both detections and predictions. Appendix E describes the many data structures available in Packet 28. Figure E-6 (Area Component Data Structure (Sheet 2)) is pertinent to MIGFA. A set of three structures is provided IF MIGFA detects a convergence boundary. The set includes a detection with two predictions. For each, a set of component parameters and X,Y radar-centric geographic location points is provided in units of kilometers. The specific component parameters are listed:

DETECTION COMPONENT PARAMETERS	
Parameter Name	Units;Default Values
Detection ID Number	n.a
Forecast Time Offset	Minutes; 0
Convergence Boundary Propagation U	m/s
Convergence Boundary Propagation V	m/s
Average Speed of Wind Behind Front	m/s
Average Direction of Wind Behind Front	Degrees

Wind Behind Front U Component	m/s
Wind Behind Front V Component	m/s
Wind Behind Analysis Point X Coordinate	km
Wind Behind Analysis Point Y Coordinate	km
Wind Shear Hazard	m/s

PREDICTION COMPONENT PARAMETERS	
Parameter Name	Units; Default Values
Detection ID Number	n/a
Forecast Time Offset	Minutes; 10 or 20

46.3 Annotations

NOTE: The detection ID number component parameter for the prediction is set to match the parent detection's ID component parameter value. This method links the two predictions and one detection as a set. The detection ID number for each detection or prediction is volume specific. MIGFA does not apply ID number consistency between volumes. Any ID numbering similarity between volumes is coincidental.

46.3.1 Alphanumeric

The automated annotations for this product are:
Standard Annotations (Appendix A, I(A))
Number of detections in volume

46.3.2 Special Symbols

None defined.

46.4 Product Interaction

None.

47 NEXRAD TURBULENCE DETECTION ALGORITHM (EDR, EDC)

47.1 SS Product Description

This product shall provide digital values of in-cloud atmospheric turbulence (eddy dissipation rate, EDR, denoted □1/3 and having units m2/3 s-1) and of an associated data quality control index, or "confidence," EDC, for each elevation tilt in a polar radial format. These digital EDR and EDC data are provided to support the detection of conditions hazardous to aviation. In particular, it is anticipated that they will be used by a turbulence product developed under the FAA's Aviation Weather Research Program and disseminated via the NOAA Aviation Weather Center's Aviation Digital Data Service. Input to the NTDA is provided on an elevation basis by the Level II data products and the Radar Echo Classifier (REC) algorithm, which identifies the likelihood that data are contaminated by clutter. The NTDA shall use the REC data, along with internal quality control procedures, to avoid or mitigate the use of Doppler data contaminated by poor signal quality, overlaid echoes or non-atmospheric returns. The NTDA product shall produce a representative EDR value and associated confidence value at every sample bin location on a 2 kilometer (1.08 nautical mile) by 1 degree polar grid, from 2 km out to a maximum range of 230 kilometers (124 nautical miles), but limited to the lowest 70,000 feet AGL of the atmosphere. The product shall be generated for each elevation at its completion. This product shall provide for 64 data levels for EDR including one value reserved for flagging, and 8 data levels for EDC. Each digital product shall include annotations for product name, radar ID, time and date of scan, elevation angle, radar position, radar elevation above MSL, and the radar operational mode.

47.2 Display Format

This product is not currently intended for display.

47.2.1 Data Levels

The NTDA EDR product, EDR, shall have 64 data levels with code "0" corresponding to "missing data". Data level codes 1 through 62 correspond to EDR values ranging from 0.0 m2/3 s-1 to 1.525 m2/3 s-1. Any EDR value greater than or equal to 1.55 m2/3 s-1 is assigned a digital data value of 63. The following table lists the equations used to convert EDR to a digital value. DEDR is "digital EDR".

DEDR Range	EDR Range (m2/3s-1)	Equation
0	Bad or Missing	-
1-62	0.0 £ EDR < 1.55	DEDR = 40.0*EDR + 1
63	³ 1.55	DEDR = 63

The NTDA confidence product, EDC, shall have 8 data levels. Data level codes 0 through 7 correspond to EDC values ranging from 0 to 1, where 0 designates that the associated EDR estimate is of low quality and 1 represents high quality. The following table lists the equations used to convert confidence to a digital value. DEDC is "digital EDC".

DEDC Range	EDC Range	Equation
0-6	0.0 £ EDC < 0.875	DEDC = 8*EDC
7	³ 0.875	DEDC = 7

47.2.2 Color Level Code Tables

Since this product is not currently intended for display, the color table is not applicable.

47.2.3 Range/Data Resolution

The resolution of this polar product is 1.08 nmi (2 km) in range by 1 degree in azimuth out to a maximum radial range of 124 nmi (230 km). The distance to center of the first range bin is 2 km. The radar location is at the product center.

47.3 Annotations

47.3.1 Alphanumeric

The automated annotations for this product are:
Standard Annotations (Appendix A, I(A))

47.3.2 Special Symbols

None defined.

47.4 Product Interaction

None.

48 DIFFERENTIAL REFLECTIVITY (ZDR, DZD)

48.1 SS Product Description

"This product will provide the polarimetric differential reflectivity data displayable as an image1 and formatted as a data array. Both versions will be limited to the lowest 70,000 feet Above Radar Level (ARL) of the atmosphere. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time.2 For the image version, the product shall be available for 16 data levels, while 256 data levels will be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum and minimum data value (dB), radar position, radar elevation above MSL, and radar operational mode."

48.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

48.2.1 Data Levels

For the image version, the range of data level values (dB) varies with NEXRAD system adaptation data. The range of differential reflectivity supported by the RDA and reported in the DZD (full resolution) base product is -7.9 to +7.9 dB, at a precision of 0.0625 dB.

48.2.2 Color Level Code Tables

The color level code used for display of the image version of differential reflectivity is NEXRAD (or agency) system adaptation data. A recommended color table is listed. The range of displayed data levels shall be the same for all Operational Modes. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

Color Level Codes Precipitation or Clear Air Mode				
16-Level Code	Display dB	Range dB	Color Levels	
			Code	Color
0	ND	SNR<TH or <-4.0	(00 00 00)	Black
1	-4.0	-4.0<dB<-2.0	(40 40 40)	dark gray
2	-2.0	-2.0<dB<-0.5	(9C 9C 9C)	medium gray
3	-0.5	-0.5<dB<0.0	(C9 C9 C9)	light gray
4	0.0	0.0<dB<0.25	(8C 78 B4)	Dark purple/gray
5	0.25	0.25<dB<0.5	(00 00 98)	Dark blue
6	0.5	0.5<dB<1.0	(23 98 D3)	Blue
7	1.0	1.0<dB<1.5	(44 FF D2)	aqua
8	1.5	1.5<dB<2.0	(57 DB 56)	green
9	2.0	2.0<dB<2.5	(FF FF 60)	pastel yellow
A	2.5	2.5<dB<3.0	(FF 90 45)	orange
B	3.0	3.0<dB<4.0	(DA 00 00)	Medium red
C	4.0	4.0<dB<5.0	(AE 00 00)	dark red
D	5.0	5.0<dB<6.0	(F7 82 BE)	Pink
E	6.0	6.0<dB<8.0	(FF FF FF)	white
F	RF	RF	(77 00 7D)	Dark Purple

"1Defines the form of presentation on a graphic display; not necessarily the form of transmission."
"2Defined in Appendix B"

48.2.3 Range/Data Resolution

The image products will be available for the range/resolution as indicated. Displayed values for the lower resolution product are chosen by selecting every fourth bin value.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar location

The data array product will be available for the range/resolution as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 162	0.13 x 1	Radar location

48.3 Annotations

48.3.1 Alphanumeric
Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum and Minimum Data Value Detected
48.3.2 Special Symbols
None defined
48.4 Product Interaction
All overlay products are displayable on this product:
Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

49 CORRELATION COEFFICIENT (CC, DCC)

49.1 SS Product Description

"This product shall provide the polarimetric correlation coefficient data displayable as an image[1] and formatted as a data array. Both versions will be limited to the lowest 70,000 feet ARL of the atmosphere. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time.[2] For the image version, the product shall be available for 16 data levels, while 256 data levels will be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum and minimum data value, radar position, radar elevation above MSL, and radar operational mode."

49.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

49.2.1 Data Levels

For the image version, the range of data level values (dimensionless) varies with NEXRAD system (or agency) adaptation data. The range of correlation coefficient supported by the RDA and reported in the DCC (full resolution) base product is 0.2 to +1.05, at a precision of 0.00333.

49.2.2 Color Level Code Tables

The color level code used for display of the image version of polarimetric correlation coefficient is NEXRAD (or agency) system adaptation data. A recommended color table is listed. The range of displayed data levels shall be the same for all Operational Modes. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

Color Level Codes Precipitation or Clear Air Mode				
16-Level Code	Display dimensionless	Range dimensionless	Color Levels	
			Code	Color
0	ND	SNR<TH or CC<0.20	(00 00 00)	Black
1	0.20	0.20<CC<0.45	(95 94 9C)	gray-blue
2	0.45	0.45<CC<0.65	(16 14 8C)	dark blue
3	0.65	0.65<CC<0.75	(09 02 D9)	blue
4	0.75	0.75<CC<0.80	(89 87 D6)	blue-green
5	0.80	0.80<CC<0.85	(5C FF 59)	green
6	0.85	0.85<CC<0.90	(8B CF 02)	green-yellow
7	0.90	0.90<CC<0.93	(FF FB 00)	yellow
8	0.93	0.93<CC<0.95	(FF C4 00)	orange
9	0.95	0.95<CC<0.96	(FF 89 03)	dark orange
A	0.96	0.96<CC<0.97	(FF 2B 00)	red
B	0.97	0.97<CC<0.98	(E3 00 00)	medium red
C	0.98	0.98<CC<0.99	(A1 00 00)	dark red
D	0.99	0.99<CC<1.00	(97 05 56)	deep purple
E	1.00	1.00<CC<1.05	(FA AC D1)	Pink
F	RF	RF	(77 00 7D)	Dark Purple

"1Defines the form of presentation on a graphic display; not necessarily the form of transmission."
"2Defined in Appendix B"

49.2.3 Range/Data Resolution

The image products will be available for the range/resolution as indicated. Displayed values for the lower resolution product are chosen by selecting every fourth bin value.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar location

The data array product will be available for the range/resolution as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 162	0.13 x 1	Radar location

49.3 Annotations

49.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum Data Value Detected
Minimum Data Value Detected

49.3.2 Special Symbols

None defined

49.4 Product Interaction

All overlay products are displayable on this product:
Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

50 SPECIFIC DIFFERENTIAL PHASE (KDP, DKD)

50.1 SS Product Description

"This product shall provide the polarimetric specific differential phase data displayable as an image1 and formatted as a data array. Both versions will be limited to the lowest 70,000 feet ARL of the atmosphere. The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time.2 For the image version, the product shall be available for 16 data levels, while 256 data levels will be provided in the data array version. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, maximum and minimum data value (deg/km), radar position, radar elevation above MSL, and radar operational mode."

50.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

50.2.1 Data Levels

For the image version, the range of data level values (deg/km) varies with NEXRAD system (or agency) adaptation data. The range of polarimetric specific differential phase supported by the dual-polarization data preprocessing algorithm and reported in the DKD (full resolution) base product is -2 to +10 deg/km, at a precision of 0.05 deg/km.

50.2.2 Color Level Code Tables

The color level code used for display of the image version of polarimetric specific differential phase is NEXRAD (or agency) system adaptation data. A recommended color table is listed. The range of displayed data levels shall be the same for all Operational Modes. With the exception of the end points, the lower value of the range is assigned to the individual colors displayed. The range of values for each is also indicated.

Color Level Codes Precipitation or Clear Air Mode				
16-Level Code	Display deg/km	Range deg/km	Color Levels	
			Code	Color
0	ND	SNR<TH OR deg/km<-2.0	(00 00 00)	Black
1	-2.0	-2.0<deg/km<-1.0	(76 76 76)	dark gray
2	-1.0	-1.0<deg/km<-0.5	(4B 4B 4B)	maroon/gray
3	-0.5	-0.5<deg/km<0.0	(4B 00 00)	dark maroon
4	0.0	0.0<deg/km<0.25	(73 00 19)	maroon
5	0.25	0.25<deg/km<0.5	(A5 08 2C)	dark red
6	0.5	0.5<deg/km<1.0	(D5 47 5C)	dark pink
7	1.0	1.0<deg/km<1.5	(EB 78 B9)	pink/purple
8	1.5	1.5<deg/km<2.0	(96 81 B7)	soft purple
9	2.0	2.0<deg/km<2.5	(62 FF FA)	aqua
A	2.5	2.5<deg/km<3.0	(14 B9 32)	green
B	3.0	3.0<deg/km<4.0	(0A FF 0A)	lime green
C	4.0	4.0<deg/km<5.0	(FF FF 00)	yellow
D	5.0	5.0<deg/km<7.0	(FF 78 14)	orange
E	7.0	7.0<deg/km<10.0	(FF CD 82)	pale orange
F	RF	RF	(77 00 7D)	Dark Purple

"1Defines the form of presentation on a graphic display; not necessarily the form of transmission."
"2Defined in Appendix B"

50.2.3 Range/Data Resolution

The image products will be available for the range/resolution as indicated. Displayed values for the lower resolution product are chosen by selecting every fourth bin value.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar location

The data array product will be available for the range/resolution as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 162	0.13 x 1	Radar location

50.3 Annotations

50.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum and Minimum Data Value Detected

50.3.2 Special Symbols

None defined

50.4 Product Interaction

All overlay products are displayable on this product:
Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

51 HYDROMETEOR CLASSIFICATION (HC, DHC, HHC)

51.1 SS Product Description

"This product shall provide derived hydrometeor classification data displayable as an image1 and formatted as a data array. All versions will be limited to the lowest 70,000 feet ARL of the atmosphere. The HC and DHC products shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each azimuth scan shall be updated once per volume scan time.2 The HHC product shall be a data array version generated once per volume scan time2 and consist of a hybrid of the azimuth scan versions where the displayed hydro classification for each range bin is the value used by the Quantitative Precipitation Estimation (QPE) algorithm. The displayable image version shall be generated for 16 hydrometeor categories. The data array versions shall be generated for all hydrometeor categories generated by the Hydrometeor Classification Algorithm. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, radar position, radar elevation above MSL, and radar operational mode."

51.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

51.2.1 Data Levels

For the image version, the range of hydrometeor categories varies with NEXRAD system (or agency) adaptation data.

51.2.2 Color Level Code Tables

The color level code used for display of the image version of hydrometeor classification is NEXRAD (or agency) system adaptation data. A recommended color table is listed. The hydrometeor categories selected for display shall be the same for all Operational Modes.

Color Level Codes Precipitation or Clear Air Mode				
16-Level Code	Display Category Code	Display Condition	Color Levels	
			Code	Color
0	ND	SNR<Threshold	(00 00 00)	Black
1	BI	Biological	(9C 9C 9C)	medium gray
2	GC	AP/Ground Clutter	(76 76 76)	dark gray
3	IC	Ice Crystals	(FF B0 B0)	light pink
4	DS	Dry Snow	(00 FF FF)	light blue
5	WS	Wet Snow	(00 90 FF)	medium blue
6	RA	Light-Moderate Rain	(00 FB 90)	light green
7	HR	Heavy Rain	(00 BB 00)	medium green
8	BD	Big Drops Rain	(D0 D0 60)	dark yellow
9	GR	Graupel	(D2 84 84)	medium pink
A	HA	Hail, Possibly With Rain	(FF 00 00)	red
B		TBD	TBD	TBD
C		TBD	TBD	TBD
D		TBD	TBD	TBD
E	UK	Unknown Type	(E7 00 FF)	Purple
F	RF	RF	(77 00 7D)	Dark Purple

"1Defines the form of presentation on a graphic display; not necessarily the form of transmission."
"2Defined in Appendix B"

51.2.3 Range/Data Resolution

The HC product will be available for the range/resolution as indicated. Displayed values for the lower resolution product are chosen by selecting every fourth bin value after the high resolution data has undergone a 9 bin Mode filter (center bin +/- 4 bins along each radial).

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.54 x 1	Radar location

The DHC product will be available for the range/resolution as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 162	0.13 x 1	Radar location

The HHC product will be available for the range/resolution as indicated.

Coverage Area (nmi Radius)	Resolution (nmi x deg)	Product Center
0 to 124	0.13 x 1	Radar location

51.3 Annotations

51.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code

51.3.2 Special Symbols

None defined

51.4 Product Interaction

All overlay products are displayable on this product:
Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signature

52 MELTING LAYER (ML)

52.1 SS Product Description

"This product shall provide contours of the melting-layer/radar-beam intersections and shall be produced by contouring the output of the Melting Layer Detection Algorithm. This product shall be displayable alone or as an overlay on elevation based products. At 1 degree azimuth angle increments, it shall depict the range where the radar beam is centered on the top and bottom of the melting layer and the range where the beam starts and stops intersecting the melting layer. The ranges for each of these four melting-layer/radar-beam transitions will be used to construct four contours.

The product shall be generated for any azimuth scan at a single elevation angle based on user requirements. Each scan shall be updated once per volume scan time. Each product shall include annotations for the product name, radar ID, time and date of scan, data level code, elevation angle, radar position, radar elevation above MSL, and radar operational mode."

52.2 Display Format

The product is displayable in full- or quarter-screen format (see Appendix B).

52.2.1 Data Levels

The contours have defined meaning.

52.2.2 Color Level Code Tables

Color Level Codes Precipitation or Clear Air Mode				
16-Level Code	Display Category Code	Display Condition	Color Levels	
			Code	Color
0	TE	Melting Layer Top Edge	(9C 9C 9C)	medium gray
1	TC	Melting Layer Top Center	(F5 F5 F5)	near white
2	BC	Melting Layer Bottom Center	(F5 F5 F5)	near white
3	BE	Melting Layer Bottom Edge	(9C 9C 9C)	medium gray
4		TBD	TBD	TBD
5		TBD	TBD	TBD
6		TBD	TBD	TBD
7		TBD	TBD	TBD
8		TBD	TBD	TBD
9		TBD	TBD	TBD
A		TBD	TBD	TBD
B		TBD	TBD	TBD
C		TBD	TBD	TBD
D		TBD	TBD	TBD
E		TBD	TBD	TBD
F		TBD	TBD	TBD

52.2.3 Range/Data Resolution

Coverage Area (nmi x nmi)		Resolution (nmi x deg)	
162 x 162	0	.13 nmi x 1 deg	Product Center Radar Location

52.3 The Annotations

52.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code

52.3.2 Special Symbols

None defined

52.4 Product Interaction

The product is displayable as an overlay on all geographical elevation base products from the same elevation scan.

53 ONE-HOUR ACCUMULATION (OHA)

53.1 SS Product Description

The One-Hour Accumulation (OHA) product shall be a polar grid of precipitation accumulation over the last hour. The product will be displayable as a graphical image. The accumulations are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. The product format is similar to the Storm Total Accumulation product. The product shall be updated every volume scan.

53.2 Display Levels

53.2.1 Data Levels

The product will contain 16 data levels. Below are the default color levels and data levels thresholds. The data levels thresholds are site adaptable.

53.2.2 Color Level Code Table

16-Level Code	Display Inches	Range Inches	Code	Color
0	ND	in = 0.0	(00 00 00)	black
1	>0.00	0.0 < in < 0.1	(AA AA AA)	gray
2	0.10	0.1 ≤ in < 0.25	(76 76 76)	dark gray
3	0.25	0.25 ≤ in < 0.5	(00 FF FF)	cyan
4	0.50	0.5 ≤ in < 0.75	(00 AF AF)	dark cyan
5	0.75	0.75 ≤ in < 1.0	(00 FF 00)	green
6	1.00	1.0 ≤ in < 1.25	(00 8F 00)	dark green
7	1.25	1.25 ≤ in < 1.5	(FF 00 FF)	magenta
8	1.50	1.5 ≤ in < 1.75	(AF 32 7D)	dark magenta
9	1.75	1.75 ≤ in < 2.0	(00 00 FF)	blue
A	2.00	2.0 ≤ in < 2.5	(32 00 96)	dark blue
B	2.50	2.5 ≤ in < 3.0	(FF FF 00)	yellow
C	3.00	3.0 ≤ in < 4.0	(FF AA 00)	orange
D	4.00	4.0 ≤ in < 6.0	(FF 00 00)	bright red
E	6.00	6.0 ≤ in < 8.0	(AE 00 00)	dark red
F	8.00	8.0 ≤ in	(FF FF FF)	white

53.3 Range, Data, & Temporal Resolution

The resolution of the graphic products is 2 km range by 1 degree azimuth (1.1-nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

53.4 Annotations

53.4.1 Alphanumeric

Standard annotations (Appendix A, I(A))
Maximum accumulation (inches)
Ending date of accumulation
Ending time of accumulation
Mean-field-bias (bias information for future implementation)
Sample Size (Effective No. Gage/Radar Pairs) (for future implementation)

53.5 Product Interaction

The following overlay products are displayable on the graphic version of this product:
Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

54 DIGITAL ACCUMULATION ARRAY (DAA)

54.1 SS Product Description

The Digital Accumulation Array (DAA) product shall be a polar grid of digital high-resolution one-hour precipitation accumulation. The product will span the last hour regardless of when the Precipitation Accumulation Initiation Function (PAIF) indicated that precipitation began. The product will be displayable as a graphical image. The accumulations are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. The product shall be updated every volume scan. This product shall not have a bias applied (within the RPG).

54.2 Display Format

54.2.1 Data Levels

This product will contain 256 data levels on an automatically adjustable linear scale based on the maximum accumulation in the grid over the user specified time span. Data level 0 will correspond to either no accumulation or NO_DATA, and data levels 1 through 255 will indicate accumulations scaled to 0.01 inches. Color levels can be determined by the display system.

54.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

54.3 Annotations

54.3.1 Alphanumeric

Standard annotations (Appendix A, I(A))
Maximum accumulation (inches)
Ending date of accumulation
Ending time of accumulation
Mean-field-bias (bias information for future implementation)

54.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

55 STORM TOTAL ACCUMULATION (STA)

55.1 SS Product Description

The Storm Total Accumulation (STA) product shall be a polar grid of precipitation accumulation since the Precipitation Accumulation Initiation Function (PAIF) indicated that precipitation has begun. The product will be displayable as a graphical image. The beginning of the precipitation and the accumulations are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. If there has not been any precipitation in the last hour, the polar grid shall be blank. The product format and content is similar as to the One-Hour Accumulation product except this product also has an alphanumeric layer. This product shall be appended with an alphanumerical layer including the adaptable parameter values, bias information (for future implementation), and other supplemental (precipitation status) data.

55.2 Display Format

55.2.1 Data Levels

The product will contain 16 data levels. Below are the default color levels and data levels thresholds. The data levels thresholds are site adaptable.

55.2.2 Color Level Code Table

16-Level Code	Display Inches	Range Inches	Code	Color
0	ND	in = 0.0	(00 00 00)	black
1	>0.00	0.0 ≤ in < 0.3	(AA AA AA)	gray
2	0.3	0.3 ≤ in < 0.6	(76 76 76)	dark gray
3	0.6	0.6 ≤ in < 1.0	(00 FF FF)	cyan
4	1.0	1.0 ≤ in < 1.5	(00 AF AF)	dark cyan
5	1.5	1.5 ≤ in < 2.0	(00 FF 00)	green
6	2.0	2.0 ≤ in < 2.5	(00 8F 00)	dark green
7	2.5	2.5 ≤ in < 3.0	(FF 00 FF)	magenta
8	3.0	3.0 ≤ in < 4.0	(AF 32 7D)	dark magenta
9	4.0	4.0 ≤ in < 5.0	(00 00 FF)	blue
A	5.0	5.0 ≤ in < 6.0	(32 00 96)	dark blue
B	6.0	6.0 ≤ in < 8.0	(FF FF 00)	yellow
C	8.0	8.0 ≤ in < 10.0	(FF AA 00)	orange
D	10.0	10.0 ≤ in < 12.0	(FF 00 00)	bright red
E	12.0	12.0 ≤ in < 15.0	(AE 00 00)	dark red
F	15.0	15.0 ≤ in	(FF FF FF)	white

55.3 Range, Data, & Temporal Resolution

The resolution of the graphic products is 2 km range by 1 degree azimuth (1.1-nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

55.4 Annotations

55.4.1 Alphanumeric

Standard annotations (Appendix A, I(A))
Start date of accumulation
Start time of accumulation
Maximum accumulation (inches)
Ending date of accumulation
Ending time of accumulation
Mean-field-bias (bias information for future implementation)
Sample Size (Effective No. Gage/Radar Pairs) (for future implementation)

55.4.2 Paired Alphanumeric

Precipitation status, bias information, and all dual-polarization URC LOCA adaptable parameters below will be appended to this product in text as formatted in Appendix C, Format XIV.
Adaptation Data, including:
(Melting Layer Detection Algorithm)
Default Melting Layer Depth
Use MLDA Heights
(Rate Algorithm)
Kdp Multiplier Coefficient
Kdp Power Coefficient
Z-R Multiplier Coefficient
Z-R Power Coefficient
Zdr/Z Multiplier Coefficient
Zdr/Z Power Coefficient for Z
Zdr/Z Power Coefficient for Zdr
Maximum Correlation Coef./Kdp
Maximum Kdp Beam Blockage
Maximum Usability Blockage
Maximum Reflectivity
Minimum Kdp Usage Rate
Wet Snow Multiplicative Coefficient
Graupel Multiplicative Coefficient
Rain/Hail Multiplicative Coefficient
Dry Snow Multiplicative Coefficient
Crystals Multiplicative Coefficient
Percent of the precipitation rate grid filled
PAIF Precipitation Rate Threshold
PAIF Precipitation Area Threshold
Precipitation Detection Time Threshold
Number of Exclusion Zones
(Accumulation Algorithm)
Threshold Elapsed Time to Restart
Maximum Time for Interpolation
Maximum Hourly Accumulation Value
(Adjustment Algorithm)
Time bias Estimation (bias information for future implementation)
Threshold Number of Gage-Radar Pairs (bias information for future implementation)
Reset Bias Value (bias information for future implementation)
Longest Allowable Lag (Hours) (bias information for future implementation)
Bias Applied Flag (bias information for future implementation)

55.5 Product Interaction

The following overlay products are displayable on the graphic version of this product:

- Hail Index
- Mesocyclone
- Storm Tracking Information
- Tornado Vortex Signatures
- Melting Layer

56 DIGITAL STORM TOTAL ACCUMULATION (DSA)

56.1 SS Product Description

The Digital Storm Total Accumulation (DSA) product shall be a polar grid of digital high-resolution precipitation accumulation since the Precipitation Accumulation Initiation Function (PAIF) indicated that precipitation has begun. The product will be displayable as a graphical image. The beginning of the precipitation and the accumulations are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. The product shall be updated every volume scan. If there has not been any precipitation in the last hour, the polar grid shall be blank. The product is appended with an alphanumerical layer including the adaptable parameter values, bias information (for future implementation), and other supplemental (precipitation status) data.

56.2 Display Format

56.2.1 Data Levels

This product will contain 256 data levels on an automatically adjustable linear scale based on the maximum accumulation in the grid over the duration of a storm event. Data level 0 will correspond to either no accumulation or NO_DATA, and data levels 1 through 255 will indicate accumulations scaled to 0.01 inches. Color levels can be determined by the display system.

56.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

56.3 Annotations

56.3.1 Alphanumeric

Standard annotations (Appendix A, I(A))
Start date of accumulation
Start time of accumulation
Maximum accumulation (inches)
Ending date of accumulation
Ending time of accumulation
Mean-field-bias (bias information for future implementation)

56.3.2 Digital Alphanumeric

Bias information, supplemental data, and all dual-polarization URC LOCA adaptable parameters will be appended to this product in the format shown in Appendix C, Format XIV.

Adaptation Data, including:
(Melting Layer Detection Algorithm)
Default Melting Layer Depth
Use MLDA Heights
(Rate Algorithm)
Kdp Multiplier Coefficient
Kdp Power Coefficient
Z-R Multiplier Coefficient
Z-R Power Coefficient
Zdr/Z Multiplier Coefficient

Zdr/Z Power Coefficient for Z
Zdr/Z Power Coefficient for Zdr
Maximum Correlation Coef./Kdp
Maximum Kdp Beam Blockage
Maximum Usability Blockage
Maximum Reflectivity
Minimum Kdp Usage Rate
Wet Snow Multiplicative Coefficient
Graupel Multiplicative Coefficient
Rain/Hail Multiplicative Coefficient
Dry Snow Multiplicative Coefficient
Crystals Multiplicative Coefficient
Percent of the precipitation rate grid filled
PAIF Precipitation Rate Threshold
PAIF Precipitation Area Threshold
Precipitation Detection Time Threshold
Number of Exclusion Zones
(Accumulation Algorithm)
Threshold Elapsed Time to Restart
Maximum Time for Interpolation
Maximum Hourly Accumulation Value
(Adjustment Algorithm)
Time Bias Estimation (bias information for future implementation)
Threshold Number of Gage-Radar Pairs (bias information for future implementation)
Reset Bias Value (bias information for future implementation)
Longest Allowable Lag (Hours) (bias information for future implementation)
Bias Applied Flag (bias information for future implementation)
Supplemental Data, including:
Scan Date
Scan Time
Flag Precip Detected
Flag Storm Total Active
Flag Precip Begin
Last Date Precip
Last Time Precip
Percent of Hybrid Rate Filled
Highest Elevation Angle Used
Total Precipitation Area
Spot Blanking Volume Status
Bias-Related Fields, including: (for future implementation)
Time Bias Value Last Updated Locally
Date Bias Value Last Updated Locally
Time of Last Update of Local Bias Table
Date of Last Update of Local Bias Table
Observation Time of Latest Bias Table
Observation Date of Latest Bias Table
Generation Time of Latest Bias Table
Generation Date of Last Bias Table
Mean-Field Bias Estimate
Effective G-R Pair Sample Size
Memory Span used in Bias Estimate

AWIPS Site ID of Most Recent Bias Source

56.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

57 DIGITAL USER-SELECTABLE ACCUMULATION (DUA)

57.1 SS Product Description

The Digital User-Selectable Accumulation (DUA) product shall be a polar grid of high-resolution precipitation accumulation over a user-selected accumulation period. The product will span the user-selected period regardless of when the Precipitation Accumulation Initiation Function (PAIF) indicated that precipitation began. The product will be displayable as a graphical image. The accumulations are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. The accumulation period shall be of variable duration as specified by the user and defined via two parameters: the Ending Time (Z) in hh:mm format, and the Time Span in hh:mm format (ranging from a minimum of 15 minutes to 24 hours prior to the Ending Time). The product can be generated by request or routinely for designated periods and times. By default, the DUA product shall be generated at 1200 Z for a time span of 24 hours and every volume scan for time spans of 1 and 3 hours.

57.2 Display Format

57.2.1 Data Levels

This product will contain 256 data levels on an automatically adjustable linear scale based on the maximum accumulation in the grid over the user specified time span. Data level 0 will correspond to either no accumulation or NO_DATA, and data levels 1 through 255 will indicate accumulations scaled to 0.01 inches. Color levels can be determined by the display system.

57.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated as specified by the user.

57.3 Annotations

Standard annotations (Appendix A, I(A))
Time Span Minutes
Start Minutes
Maximum accumulation (inches)
End Date
End Time
Mean-field-bias (bias information for future implementation)

57.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

58 DIGITAL ONE-HOUR DIFFERENCE (DOD)

58.1 SS Product Description

The Digital One-Hour Difference product shall be a polar grid of digital accumulation differences. The differences are computed by subtracting the latest one-hour-estimate computed by the legacy PPS from the one-hour estimates computed by the QPE. Neither estimate will have any bias applied. This product will be generated every volume scan whether or not precipitation has been detected.

58.2 Display Format

58.2.1 Data Levels

This product will contain 256 data levels on an automatically adjustable linear scale based on the difference with the maximum magnitude (positive or negative). The 0 data level always indicates NO_DATA. The remaining data levels will be scaled at equal steps centered at 0 difference for the 128th data level. The minimum step will be 0.01 inches. The difference with the maximum magnitude (greatest positive or negative value) is used to determine the scale and offset values used to encode the data levels. Color levels can be determined by the display system.

58.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

58.3 Annotations:

Standard annotations (Appendix A, I(A))
Maximum difference (inches)
Ending date of accumulation
Ending time of accumulation
Minimum difference (inches)

58.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

59 DIGITAL STORM TOTAL DIFFERENCE (DSD)

59.1 SS Product Description

The Digital Storm Total Difference product shall be a polar grid of digital accumulation differences. The differences are computed by subtracting the storm total estimates computed by the legacy PPS from the storm total estimates computed by the QPE. Neither estimate will have any bias applied. The product shall be a volume-based product and shall be updated every volume scan. However, this product will only contain a graphical image whenever one of the systems (legacy PPS or dual-polarization QPE) has detected precipitation and is accumulating storm total information. That is, this product will only have a graphical image present when at least one of the systems is generating storm total products.

59.2 Display Format

59.2.1 Data Levels

This product will contain 256 data levels on an automatically adjustable linear scale based on the difference with the maximum magnitude (positive or negative). The 0 data level always indicates NO_DATA. The remaining data levels will be scaled at equal steps centered at 0 difference for the 128th data level. The minimum step will be 0.01 inches. Color levels can be determined by the display system.

59.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

59.3 Annotations:

Standard annotations (Appendix A, I(A))
Start date of accumulation
Start time of accumulation
Maximum difference (inches)
Ending date of accumulation
Ending time of accumulation
Minimum difference (inches)

59.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

60 DIGITAL INSTANTANEOUS PRECIPITATION RATE (DPR)

60.1 SS Product Description

The Digital Instantaneous Precipitation Rate (DPR) shall be a polar grid of digital high-resolution instantaneous precipitation rates. The product will be generated independent of whether the Precipitation Accumulation Initiation Function (PAIF) indicates precipitation is present. The product can be displayable as a graphical image. The rates are computed using the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. The product shall be a volume-based product and shall be updated every volume scan.

60.2 Display Format

60.2.1 Data Levels

The product contains 65536 data levels on a linear scale from 0.000 inches/hour to 65.535 inches/hour, with a precision of 0.001 inches. Color levels can be determined by the display system. The Scale and Offset used in the equation (F = (N - OFFSET) / SCALE), where N is the integer data value and F is the resulting floating point value) to relate the integer data values to accumulation values, which are ANSI/IEEE Standard 754-1985 floating point values. Halfwords 31 and 32 contain the Scale, which for product 176 is always 1000.0, and halfwords 33 and 34 contain the Offset, which for product 176 is always 0.0. Halfword 36 contains the maximum data level, an unsigned short int which is always 65535; halfword 37 contains the number of number of leading flag values (always 0); and halfword 38 contains the number of number of trailing flag values (always 0). Note that for product 176, halfword 36 contains the maximum data level. The other scale and offset precipitation products store the number of possible values in this halfword, but for product 176, the number of possible values is 65,536 which will not fit into a halfword.

60.2.2 Range, Data, & Temporal Resolution

The resolution of the graphic products is 250 m range by 1 degree azimuth (0.13 nmi by 1 degree), and the maximum range is 230 km (124 nmi.). This product is updated every volume scan.

60.2.3 DPR Format for External Systems

DPR product shall be formatted as a Generic Radial Product Format using Packet 28 as described in Appendix E of the RPG To Class 1 User ICD. This product uses the Radial Component Data Structure (Figure E-3, Sheet 2) to describe Digital Instantaneous Precipitation Rate data. As specified in Figure 3-15c, Note 2, of the RPG To Class 1 User ICD, the DPR product is encoded using an API available from the Radar Operations Center.

60.3 Annotations:

Standard annotations (Appendix A, I(A))
Avg. date of hybrid rate scan
Avg. time of hybrid rate scan
Precip detected flag
Maximum instantaneous precipitation rate (inches/hour)
Hybrid rate percent bins filled
Highest elev. used
Gage bias to be applied flag

60.4 Product Interaction

The following overlay products are displayable on the graphic version of this product:

Hail Index
Mesocyclone
Storm Tracking Information
Tornado Vortex Signatures
Melting Layer

61 DIGITAL REFLECTIVITY DQA-EDITED (DRQ)

61.1 SS Product Description

"This product shall provide the reflectivity data formatted as a data array that could be decoded and used for display in external systems. The DRQ reflectivity data product is created at the completion of each elevation scan. The reflectivity data have been edited by the Data Quality Assurance (DQA) algorithm. The DQA analyzes the reflectivity data to detect and remove constant power signature artifacts, anomalous propagation, solar strobes, and spikes/speckle. The DRQ product shall produce a representative reflectivity value at every sample bin location of a 1 kilometer (0.54 nautical miles) by 1 degree polar grid to a maximum range of 460 kilometers (248 nautical miles). A maximum range of DRQ for an elevation scan is determined by the 70,000 feet AGL limit. The product shall be updated per each completion of a full elevation scan. This product shall provide for 256 data levels including two values reserved for flagging. The product shall be formatted as a Graphic Product as specified in the ICD for Class 1 Users (Document Number 2620001) using Digital Radial Data Array Packets as described in Figure 3-11c.

Each digital product shall include annotations for product name, radar ID, time and date of scan, maximum data value (dBZ), radar position, radar elevation above MSL, and the radar operational mode."

61.2 Display Format

The DRQ product is not a displayable product.

61.2.1 Data Levels

The product will have 256 data levels with codes "0" and "1" corresponding to "Below threshold data" and "flagged data" (such as range folded data), respectively. Data level codes 2 through 255 correspond to reflectivity (dBZ) when decoded with the standard NEXRAD conversion.

61.2.2 Color Level Code Tables

For this digital product, the color table is not applicable.

61.2.3 Range/Data Resolution

The resolution of this polar product is 0.54 nmi (1 km) in range by 1 degree in azimuth out to a maximum radial range of 248 nmi (460 km). The radar location is at the product center.

61.3 Annotations

61.3.1 Alphanumeric

Standard Annotations (Appendix A, I(A))
Elevation Angle
Data Level Code
Maximum Data Value Detected
AVSET Status

Number of artifact edited radials in the elevation

61.3.2 Special Symbols

None defined.

61.4 Product Interaction

None.

APPENDIX A

Annotations, Symbols, Abbreviations, and Display Features

I. Annotations

(A)Standard Annotations

Every color Graphic product and most alphanumeric products will have, as a minimum, the following automated annotations (except as otherwise noted in specific product descriptions):

- Product Specification
- Standard Units, Annotations, Symbols, Abbreviations, and Display Features
- Product name
- Date/time of elevation, volume or azimuth scan
- RDA ID
- RDA Position (A/N Location)
- RDA elevation above MSL (feet)
- Operational mode.

(B)Special Symbols and Characters

The following special symbols and characters will be used in each product display as appropriate. Any further refinement for particular product will be made in the product specification.

(1) Storm ID
Each identified storm will be given a unique ID of two characters. The first character will be a capital letter, A through Z, and the second will be a number, 0 through 9. The sequence will be A0, B0, C0,...Z0, A1, B1, C1,...Z1, A2,...Z9. The sequence is recycled following Z9. When there has not been any storm cells identified in a user specified "number of past volume scans", then the sequence of IDs will be reset so that the next storm cell identified will have the ID A0. The ID will be white (code FF FF FF) and the background in black (code 00 00 00).

(2) Storm Cell Track
The storm cell track consists of past, current, and forecast storm cell centroid positions connected by one pixel wide linear segments. Past positions will be displayed as white filled (5-pixel diameter) circles.
Current positions will be displayed as a circle (7-pixel diameter) with an "X" inside the circle.
Forecast positions will be displayed as a circle (7-pixel diameter) of white plus signs, 1 pixel wide, of similar size. Forecast interval is a user agency or NEXRAD system option. This product specification uses a 15-minute default value.
For stationary cells, no past or forecast storm cell positions will be displayed. Instead, stationary storm cells shall be denoted by a circle (12-pixel diameter) concentric with the current position symbol.

(3) RDA Position
The associated RDA symbol will be displayed as a white open 1 pixel circle which is 5 pixels in diameter and is centered on the RDA location.

(4) Mesocyclone
The mesocyclone will be displayed (centered on the location of the mesocyclone at the lowest elevation angle in which it is detected) as a yellow open circle, whose perimeter is 4 pixels thick. The size of the symbol will be proportional to the average of the mesocyclone radial and azimuthal diameters. The minimum size symbol will be a circle having a diameter of 14 pixels. See section 20.3.2 for MRU, MD and DMD special symbol product requirements.

(5) Correlated 3D Shear
The 3D correlated shear will be displayed as a yellow open circle 1 pixel thick and is centered (similarly to the mesocyclone) on the 3D shear center at the lowest elevation angle at which it was detected. The size will be proportional to the average diameter. The minimum size symbol will be a circle having a diameter of 14 pixels. See section 20.3.2 for MRU, MD and DMD special symbol product requirements.

(6) Hail
The hail symbol is a green isosceles triangle. The triangle can be small (a base of 8 pixels and height of 12 pixels) or large (a base of 16 pixels and a height of 20 pixels). The size of the triangle and whether the triangle is filled depends upon the Probability of Severe Hail and the Probability of Hail. The following are the rules of display and default settings.

Triangle	Probability of Severe Hail	Probability of Hail
Large/Filled	>50%	N/A
Large/Open	>30%	N/A
Small/Filled	0%	>50%
Small/Open	0%	>30%

However, the probabilities are adaptable parameters at the PUP alphanumeric terminal, and the user has the ability to disable the display of one or both of the small and/or large triangles. The Maximum Expected Hail Size will be displayed in the middle of the triangle.

(7) TVS
The TVS symbol is an inverted red-filled isosceles triangle, and the symbol for an Elevated TVS (ETVS) is the same except it is unfilled. The triangle has a base of 7 pixels and a height of 12 pixels. See section 21.4 for TRU special symbol product requirements.

II. Standard and Product Specific Annotation Display

The annotations are automated, entered and displayed on the 128 by 512 pixel screen right area in white except where specified. All alphanumeric characters will fit into a 7 by 9 pixel area and the number of characters in a single horizontal line will not exceed 18 characters assuming standard spacing between them.

In addition:

(1)The radar position which will be displayed at its actual location as described (I.B.3) on the graphic display. In addition, the RDA latitude and longitude will be displayed in the screen right area.

(2)The Data Level Code colors will be displayed as specified in the Color Level Code Tables.

(3)Storm ID, Storm Track, TVS, mesocyclone and hail overlays are all to be overlaid on a number of other products. They may be overlaid individually or in combination on a displayed product. To ensure readability when displayed in combination, a placement algorithm is required that will allow the symbols to be placed in close proximity with the storm to which the phenomena apply without interference between symbols and without interference with the image.

The following rules apply to the algorithm:

- Storm ID - will be placed 5 pixels east and 5 pixels to the south of the storm centroid for all products and overlays.
- Storm Track - will be displayed as indicated on the Storm Track Information product.
- TVS - The apex of the symbol will be placed on any product at the position corresponding to the TVS (or ETVS) position at the lowest elevation angle where it is detected.
- Mesocyclone - will be overlaid on any product at a position corresponding to its position at the lowest elevation angle where it is detected.
- Hail symbol - will be placed to the right of the storm ID.

Pixel color precedence, in the event that some symbols overlay each other, or the imagery is specified in PUP adaptation Data. The current precedence follows:

- TVS
- Mesocyclone
- Storm track information and storm ID
- Hail

Background Map (background or foreground) and imagery have the lowest precedence and which one is the absolute lowest depends on whether the background maps are in the foreground or background.

(4) Display of Storm Attribute Data

Storm attribute data is obtained as direct output of the following algorithms: mesocyclone, hail, TVS detection, storm cell segments, storm cell centroids, storm cell tracking, and storm position forecast. These will be displayed on the upper portion (52 by 512 pixel area) of the graphic display area. This storm attribute section has been designed into the graphic display Format III (Appendix B). In each of the configurations only a limited number of storm cells can be accommodated, and, therefore, to obtain attribute information on remaining storm cells, paging is necessary. The data content and format have been configured for five different attribute data sets which are listed below.

Configuration 1 is applied to the Storm Tracking Information (STI) and includes data on storm ID, storm cell centroid position (AZRAN), forecast speed and direction of the storm cell ("NEW" is indicated during first volume scan storm cell is detected); forecast error and mean forecast error; maximum reflectivity in dBZ and its height. The table outline for the STI attribute data shall be cyan. When STI is displayed as a stand alone product, the annotations will be displayed. When it is overlaid on other products which include an attribute table, the STI table replaces the overlaid product's table. By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 6 to 100.

Configuration 2A, associated with the Mesocyclone product data set, includes storm ID, feature position (AZRAN), feature type, base and top of the feature and radial and azimuthal diameter. The table outline for the Mesocyclone attribute data shall be yellow. The mesocyclone product is a stand alone product as well as an overlay product and the manner in which Configuration 2 is handled is the same as that of Configuration 1.

Configuration 2B, associated with the Mesocyclone Rapid Update (MRU) product closely follows the Mesocyclone product. Differences are described in section 20.2.2. The table outline for the MRU attribute data shall be yellow. The MRU product is a stand alone product as well as an overlay product and the manner in which Configuration 2B is handled is the same as that of Configuration 1.

Configuration 2C, associated with the Mesocyclone Detection (MD) product closely follows the Mesocyclone product. Differences are described in section 20.2.2. The table outline for the MD attribute data shall be yellow. Due to a limit of 6 pages, only the strongest 36 MDA features are included in the Attribute Data. The MD product is a stand alone product as well as an overlay product and the manner in which Configuration 2C is handled is the same as that of Configuration 1.

Configuration 3 is applied to the TVS product, which is a stand alone product and overlay or annotation to other products. For each TVS and Elevated TVS (ETVS) the following attributes are listed: type (TVS or ETVS), storm cell ID, (base) position (AZ/RAN), average delta velocity, low-level (base) delta velocity, maximum delta velocity, base height, and depth. (NOTE: If the base is detected on the lowest elevation scan of the volume scan, then the base (height) is qualified with '<' respectively. And, if either the base or top are detected on the lowest or highest elevation scan of the volume scan, then the depth is also qualified with a '>'.) The table outline for the TVS attribute data shall be red. Configuration 3B, associated with the TVS Rapid Update (TRU) product closely follows the TVS product. Differences are described in section 21.2 and 21.2.1.1. The manner in which the configuration data and the image data are handled when overlaid on other products (including other overlay products) is the same as that of Configurations l and 2.

Configuration 4 is applied to the Hail Index product, which is a stand alone product or an overlay to other products. The attribute data set of Configuration 4 includes the storm cell ID, storm cell centroid position (AZRAN), the probability of severe hail, the probability of hail, the maximum expected hail size, the user selectable hail temperature altitudes (MSL) (of the 0° C and -20° C environmental temperatures), and the time and date of the last change to the hail temperature altitudes. The table outline for the Hail attribute data shall be green. The manner in which Configuration 4 is displayed is the same as that described for Configuration 1. By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 6 to 100.

Configuration 5 is displayable only with the composite reflectivity products. The information displayed includes storm ID; storm cell centroid position (AZRAN) (to the nearest degree/nmi); TVS (TVS, ETVS, or NONE); mesocyclone (MESO, 3DCO, UNCO, or NONE); probability of severe hail (%), probability of hail (%), and maximum expected hail size (to the nearest quarter inch); cell-based VIL (to the nearest kg/m**2); maximum reflectivity (to the nearest dBZ) and its height (AGL) size (to the nearest tenths kft); storm tops (to the nearest tenths kft); and forecast speed and direction (to the nearest degree/nmi) of the storm cell ("NEW" is indicated during first volume scan storm cell is detected). If both a TVS and ETVS are associated with the same storm cell, then "TVS" will be displayed. The storm cells will be ranked in the following order: TVSs, ETVSs, MESOs, 3-D Correlated Shears, 2-D Uncorrelated Shears, POSH, POH, and Cell-based VIL. TVSs or ETVSs which are not associated with a storm cell will not be included in this table. The table outline for the combined attribute data shall be orange. (NOTE: The Storm Top (TOP) data is qualified with '>' if the storm top was detected on the highest elevation scan of the Volume Coverage Pattern.) By default, all storm cells (entries), up to a maximum of 100, can be displayed in this format. However, the MSCF has the capability to limit the number of storm cells included in this format from 4 to 100. The maximum number of storm cells whose attributes are included is adaptable at the MSCF.

Notes:
(1) All overlay products may be overlaid on each other or other geographic products.
(2) All complete attribute data sets for each of the overlay products are also available as a tabular output on the A/N screen.
(3) Any overlay may be defined in PUP adaptation data as a default overlay on any geographic product.
(4) Magnification of an individual storm or limited area requires special handling of the attribute data display. Any of the Attribute Tables may be accessed. However, to obtain specific attribute data for the magnified storm (or area), paging of the data may be required until the specific storm attribute data appears.

III. Summary Tables

(l) Units
Table I, Parameter Standard Dimensions, specifies where applicable, the units and resolutions of the parameters that will be used in the product display design.
(2) Product Parameters
Table II, Product Parameters, lists those parameters which define each of the SS products and their variations.
(3) Standard Abbreviations
The standard abbreviations to be used on the graphic display are contained in Table III.

IV. Product Display Formats

The 640 by 512 pixel display screen has been partitioned into two major areas. The status and annotation area is defined as the 128 by 512 pixel area on the extreme right of the display screen. The remaining 512 by 512 pixel area is identified as the "graphic display area."

Two basic graphic area formats (Appendix B) have been identified; they are:

(1) Format I - Full screen display (512 by 512 pixels) with a 52 by 512 pixel area available in the upper portion of the screen for displaying storm attribute data and the remaining 460 by 512 pixel area reserved only for image display.

(2) Format II - Quarter screen display with the 512 by 512 pixel area partitioned into four quarter screens, 256 by 256 pixels each. Each quarter screen reserves the lower 56 by 256 pixel area for color level code and product name display; the remainder is used for imagery.

TABLE I. PARAMETER STANDARD DIMENSIONS FOR DISPLAY

PARAMETER	CHARACTERS	UNITS
Altitude	HHHHH	feet
Base/Tops	XX.X	103 feet
Clutter Likelihood	XX	percent
Date (Calendar)	MM:DD:YY	month, day, year
Date Level Code	XX.X	(integer)
Display Center Coordinate:		
Azimuth/Range (AZRAN)	DDD/XXX	degrees/nmi (integer)
Latitude/Longitude	DDMMSS/DDDMMSS	degrees, minutes/seconds
Diameter	XX.X	nmi
Direction of storm motion	DDD	degrees (integer)
Elevation Angle	DD.D	degrees and tenths
Error, Variance	XX.X	kts
Mean Radial Velocity	XX	kts (integer)
Orientation/Rotation	XX.X/.XXX	degrees/radians
Radar elevation above MSL	HHHH	feet
Range	XXX	nmi (integer)
RDA	XXXX	alphabetical identifier
Reflectivity	XX	dBZ (integer)
Resolution	X.XX	nmi
Shear	XX	10/s, 10/s
Speed of storm motion	XX.X	kts
Time (GMT)	HH:MM:SS	hour, min, sec
Turbulence	XX.X	cm 2/3 s
Velocity Spectrum Width	XX	kts (integer)
Wind direction	DDD	degrees (integer)
Wind speed	XX	kts (integer)

TABLE II. PRODUCT PARAMETERS

	RPG	SCREEN SELECT	RANGE / RESOL	DATA LEVELS	ELEV. ANGLE	LAYER OR ALTITUDE	DISPLAY CENTER	CONTOUR INTERVAL	ALPHA TABULAR	ALPHA ANNOTATE	OVERLAY	STAND-ALONE GRAPHIC	ECHO MOTION
BASE REFLECTIVITY	X	X	X	X	X								
MEAN RADIAL VELOCITY	X	X	X	X	X								
SPECTRUM WIDTH	X	X	X		X							X	
Deleted	X	X			X							X	
Deleted													
COMPOSITE REFLECTIVITY	X	X	X	X								X	
Deleted													
ECHO TOPS	X	X										X	
Deleted													
Deleted	X	X			X		X					X	
Deleted	X	X									X	X	
VELOCITY AZIMUTH DISPLAY	X	X				ALTITUDE						X	
Deleted													
CROSS SECTION	X	X			AZRAN END PTS.							X	
Deleted													

STORM RELATIVE MEAN RADIAL VELOCITY REGION	X	X			X		X					X	X
STORM RELATIVE MEAN RADIAL VELOCITY MAP	X	X			X							X	X
VERTICALLY INTEGRATED LIQUID	X	X										X	
STORM TRACKING INFORMATION	X	X							X	X	X	X	
HAIL INDEX	X	X							X	X	X	X	
MESOCYCLONE	X	X							X	X	X	X	
TORNADO VORTEX SIGNATURE	X	X							X	X	X	X	
STORM STRUCTURE	X	X							X				
LAYER COMPOSITE REFLECTIVITY	X	X	X			LAYER						X	
Deleted													
USER ALERT MESSAGE	X								X				
RADAR CODED MESSAGE	X								X				

FREE TEXT MESSAGE	X								X				
SURFACE RAINFALL ACCUMULATION	X		X									X	
STORM TOTAL RAINFALL ACCUMULATION	X		X									X	
HOURLY DIGITAL PRECIPITATION ARRAY	X								X				
SUPPLEMENTAL PRECIPITATION DATA	X								X				
USER SELECTABLE RAINFALL ACCUMULATION	X	X										X	
HYBRID SCAN REFLECTIVITY													
DIGITAL HYBRID SCAN REFLECTIVITY	X												
HYBRID SCAN REFLECTIVITY	X	X	X	X	X				X				
CLUTTER FILTER CONTROL	X	X										X	

ITWS Digital Base Velocity Array	X				X								
CLUTTER LIKELIHOOD REFLECTIVITY	X	X			X					X			
CLUTTER LIKELIHOOD DOPPLER	X	X			X					X			
SUPEROB	X												
DIGITAL HIGH RESOLUTION VERTICALLY INTEGRATED LIQUID	X	X											
USER SELECTABLE LAYER COMPOSITE REFLECTIVITY	X	X					LAYER					X	
DIGITAL HIGH RESOLUTION ENHANCED ECHO TOPS (HREET)													
ONE HOUR SNOW ACCUMULATION	X	X	X	X					X	X		X	
STORM TOTAL SNOW ACCUMULATION	X	X	X	X					X	X		X	

USER SELECTABLE SNOW ACCUMULATION	X	X	X	X					X	X		X	
ARCHIVE III STATUS PRODUCT													
GUST FRONT MIGFA													
NEXRAD TURBULENCE DETECTION ALGORITHM													
DIFFERENTIAL REFLECTIVITY	X	X	X	X	X								
CORRELATION COEFFICIENT	X	X	X	X	X								
SPECIFIC DIFFERENTIAL PHASE	X	X	X	X	X								
HYDROMETEOR CLASSIFICATION	X	X	X	X	X								
MELTING LAYER	X	X	X	X	X								
ONE-HOUR ACCUMULATION	X	X	X	X							X		
DIGITAL ACCUMULATION ARRAY	X	X	X	X							X		

STORM TOTAL ACCUMULATION	X	X	X	X				X			X		
DIGITAL STORM TOTAL ACCUMULATION	X	X	X	X							X		
DIGITAL USER-SELECTABLE ACCUMULATION	X	X	X	X							X		
DIGITAL ONE-HOUR DIFFERENCE ACCUMULATION	X	X	X	X							X		
DIGITAL STORM TOTAL DIFFERENCE ACCUMULATION	X	X		X							X		
DIGITAL INSTANTANEOUS PRECIPITATION RATE	X	X	X	X							X		

NOTE: ALL PRODUCTS ARE GENERATED (AS FREQUENTLY AS ONE PER VOLUME SCAN) BASED ON
1) PUP ROUTINE PRODUCT SETS (RPS) LISTS
2) RPG PRODUCT GENERATION AND DISTRIBUTION LIST
3) ONE-TIME PRODUCT REQUEST
4) PAIRED PRODUCT/ALERT WHEN ALERT THRESHOLD/CATEGORIES ARE MET OR EXCEEDED
EXCEPTIONS
1) RADAR CODED MESSAGE GENERATED ONCE OR TWICE AN HOUR (MSCF OPTION)
2) USER ALERT MESSAGE & FREE TEST MESSAGE GENERATED AS REQUIRED

NOTES: A) RANGE SELECTION IS SYNONYMOUS WITH RESOLUTION SELECTION. ONLY NTR1 (BASE REFLECTIVITY) HAS A RESOLUTION CHANGE WITH NO CHANGE IN AREA COVERAGE (0 - 248 NMI PRODUCT).
B) BACKGROUND MAPS MAY BE DEFAULTED FOR EACH PRODUCT. BACKGROUND CHANGES ARE ACCOMPLISHED (BY THE USER) AFTER THE DEFAULT PRODUCT SELECTION IS DISPLAYED.

TABLE III. STANDARD ABBREVIATIONS

Background Maps	Display Annotations
Airport	AP
Airway High	AH
Airway Low	AL
City	CI
County/State	CO/ST
Highways	HY
LFM Grid	LF
Military Operations Area	MO
Navigation Aids	NA
Instrument Landing System	ILS
Non-Directional Beam	NDB
VHF Omni-Directional Range	VOR
VHF Omni-Directional Range/Directional Measuring Equipment	VORDME
VHF Omni-Directional Range/Tactical Air Navigation	VORTAC
Prohibited Area	PA
Radar Site	PS
Restricted Area	RA
River	RV
River Basin	RB
Warning Area	WA
Operational Mode	Display Annotations
Clear Air Mode	B
Precipitation Mode	A
Overlays	Display Annotations
Alert Grid 1	A1
Alert Grid 2	A2
Annotations	AN
Attribute	AT
Hail Index	HI
Mesocyclone	M
Mesocyclone Rapid Update	MRU
Storm Track	ST
TVS	TV
SS Products	Abbreviations

Composite Reflectivity	CR
Correlation Coefficient	CC
Cross Section	RCS, VCS
Differential Reflectivity	ZDR
Digital Accumulation Array	DAA
Digital Correlation Coefficient	DCC
Digital Differential Reflectivity	DZD
Digital Hydrometeor Classification	DHC
Digital Instantaneous Precipitation Rate	DPR
Digital One-Hour Difference Accumulation	DOD
Digital Specific Differential Phase	DKD
Digital Storm Total Accumulation	DSA
Digital Storm Total Difference Accumulation	DSD
Digital User-Selectable Accumulation	DUA
Echo Tops	ET
Free Text Message	FTM
Hail Index	HI
Hourly Digital Precipitation Array	DPA
Hybrid Scan Reflectivity	HSR
Hybrid Scan Hydrometeor Classification	HHC
Hydrometeor Classification	HC
Layer Composite Reflectivity (Average, Maximum, Anomalous Propagation Removed)	LRA, LRM, APR
Layer Composite Turbulence (Average, Maximum)	LTA, LTM
Mean Radial Velocity	V, DV, SDV
Melting Layer	ML
Mesocyclone	M
Mesocyclone Detection	MD
Digital Mesocyclone Detection	DMD
One-Hour Accumulation	OHA
One-Hour Rainfall Accumulation	OHP
One-Hour Snow Water Equivalent	OSW
One-Hour Snow Depth	OSD
Precipitation Accumulation Initiation Function	PAIF
Precipitation Preprocessing Subsystem	PPS
PUP Text Message	PTM
Quantitative Precipitation Estimation	QPE
Radar Coded Message	RCM
Reflectivity	R, DR, SDR
Specific Differential Phase	KDP
Spectrum Width	SW, SDW
Storm Relative Mean Radial Velocity Map	SRM
Storm Relative Mean Radial Velocity Region	SRR
Storm Structure	SS
Storm Total Accumulation	STA
Storm Total Rainfall Accumulation	STP
Storm Total Snow Water Equivalent	SSW
Storm Total Snow Depth	SSD
Storm Tracking Information	STI
Supplemental Precipitation Data	SPD

Three-Hour Rainfall Accumulation	THP
Tornado Vortex Signature	TVS
Tornado Vortex Signature Rapid Update	TRU
User Alert Message	UAM*
User Selectable Layer Composite Reflectivity	ULR
User Selectable Snow Water Equivalent	USW
User Selectable Snow Depth	USD
Velocity Azimuth Display	VAD
Vertical Wind Profile	VWP
Vertically Integrated Liquid	VIL
Above Ground level	AGL
Alphanumeric	A/N
Azimuth	AZ
Azimuth/Range	AZRAN
Center Point	C/P
Cathode Ray Tube	CRT
Centered	CTRD
10 log (Rainfall Accumulation/mm)	dBA
10 log (Equivalent Reflectivity)	dBZ
degree	deg
Diameter	DIAM
Digital Video Integrator and Processor	DVIP
Elevation	ELEV
Elevated TVS	ETVS
Error	ERR
Feature	FEAT
Federal Meteorological Handbook	FMH
feet	ft
Forecast	FCST
Greenwich Mean Time	GMT
height	Hgt
Identification Number	ID
Interface Control Document	ICD
Interval	INT
kilofeet	Kft
knots	kts
Limited Fine Mesh	LFM
Maximum Reflectivity	MAX Z
Maximum Spectrum Width	MAX WIDTH
Maximum Velocity	MAX VEL
Master System Control Function	MSCF
Mean Sea Level	MSL
National Weather Service	NWS
nautical miles	nmi
NEXRAD Technical Requirements	NTR
Next Generation Weather Radar	NEXRAD
No Data	ND
Not Applicable	N/A
Orientation	ORI
Overhang	OVH

Overlay	OVLA
Positive	YES
Principle User External Systems	PUES
Principle User Processor	PUP
Probable	PBL
Radar Data Acquisitions	RDA
Radar Product Generation	RPG
Radial	RAD
Range Folding	RF
Root Mean Square	RMS
Rotation	ROT
Routine Product Set	RPS
second(s)	s
Signal-to-Noise Ratio	SNR
System Specification	SS
Storm	STM
Surface	SFC
To Be Determined	TBD
Unknown	UNK
Variance	VAR
Video Integrated Processor	VIP
Volume	VOL

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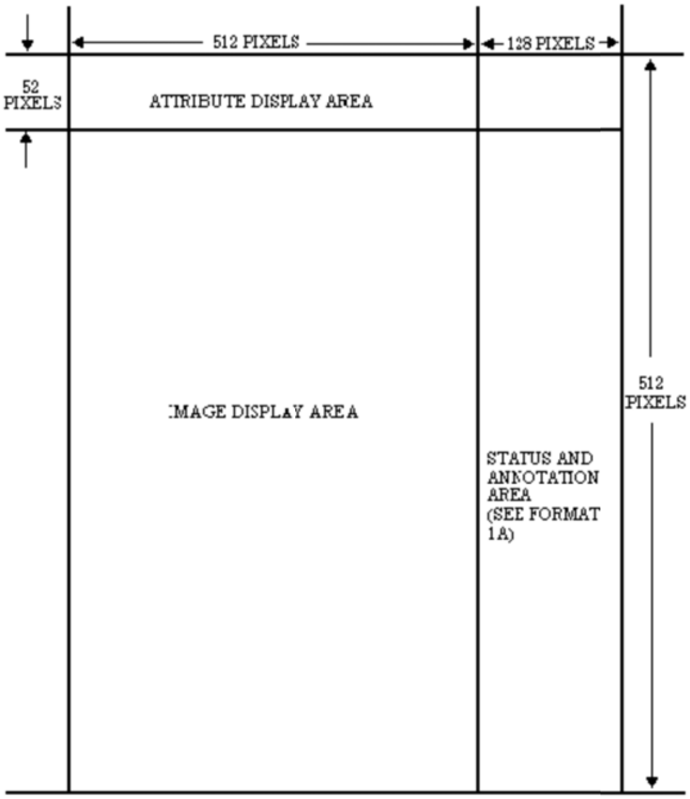
* A complete listing of alert abbreviations used in the UAM appears in section 8.3.1 of PUP/RPGOP User's Manual.

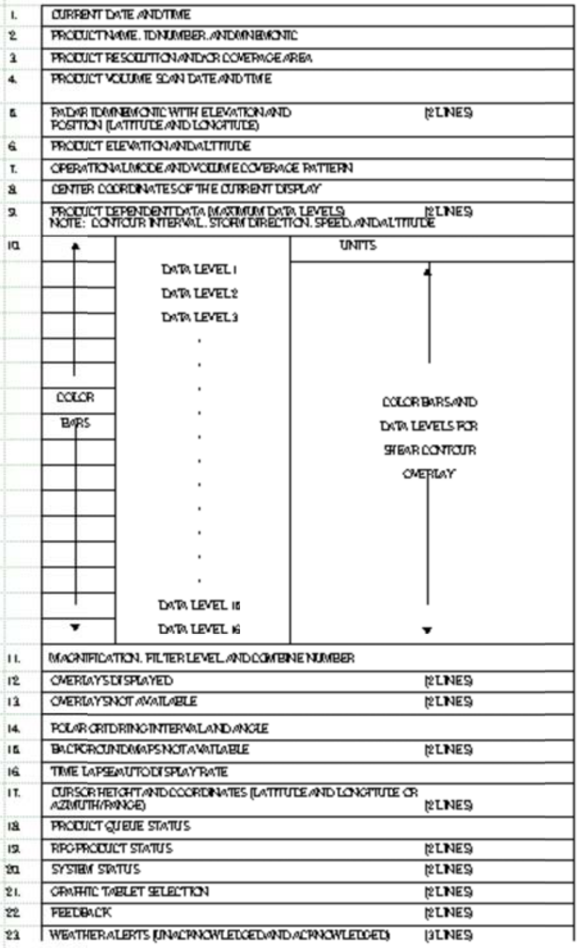
APPENDIX B

Graphic Display Formats


512 PIXELS
128 PIXELS
52 PIXELS
ATTRIBUTE DISPLAY AREA
IMAGE DISPLAY AREA
512 PIXELS
STATUS AND ANNOTATION AREA (SEE FORMAT 1A)

FORMAT (FULL SCREEN DISPLAY)

Format I. Full Screen



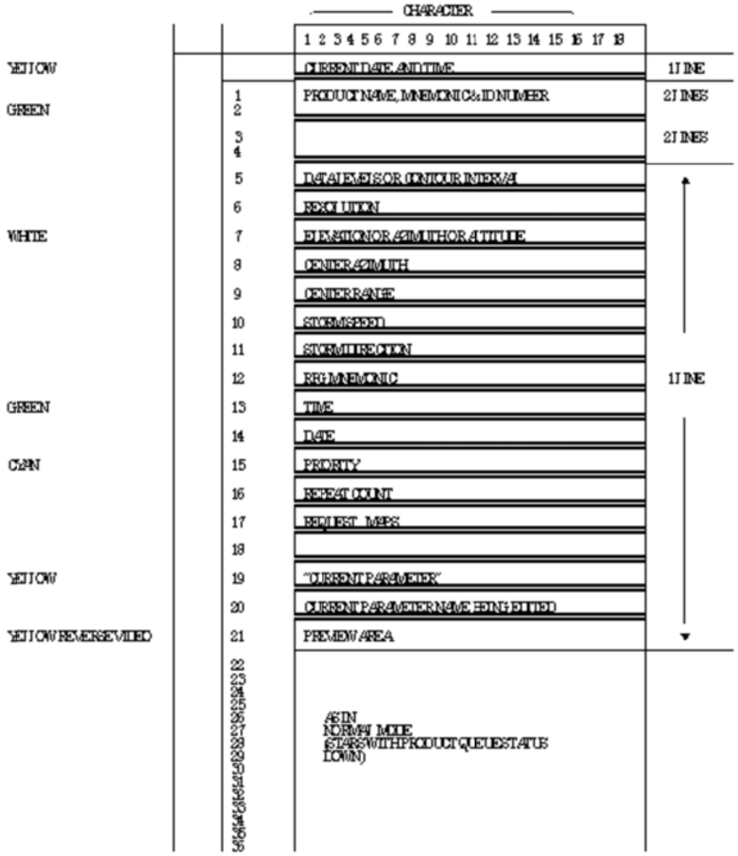
1. CURRENT DATE AND TIME
2. PRODUCT NAME, ID NUMBER, AND MNEMONIC
3. PRODUCT RESOLUTION AND/OR COVERAGE AREA
4. PRODUCT VOLUME SCAN DATE AND TIME
5. RADAR ID MNEMONIC WITH ELEVATION AND POSITION (LATITUDE AND LONGITUDE) (2 LINES)
6. PRODUCT ELEVATION AND ALTITUDE
7. OPERATIONAL MODE AND VOLUME COVERAGE PATTERN
8. CENTER COORDINATES OF THE CURRENT DISPLAY
9. PRODUCT DEPENDENT DATA (MAXIMUM DATA LEVELS) (2 LINES)
NOTE: CONTOUR INTERVAL, STORM DIRECTION, SPEED, AND ALTITUDE
10.

COLOR BARS	DATA LEVEL 1 DATA LEVEL 2 DATA LEVEL 3 . . . DATA LEVEL 15 DATA LEVEL 16	UNITS COLOR BARS AND DATA LEVELS FOR SHEAR CONTOUR OVERLAY

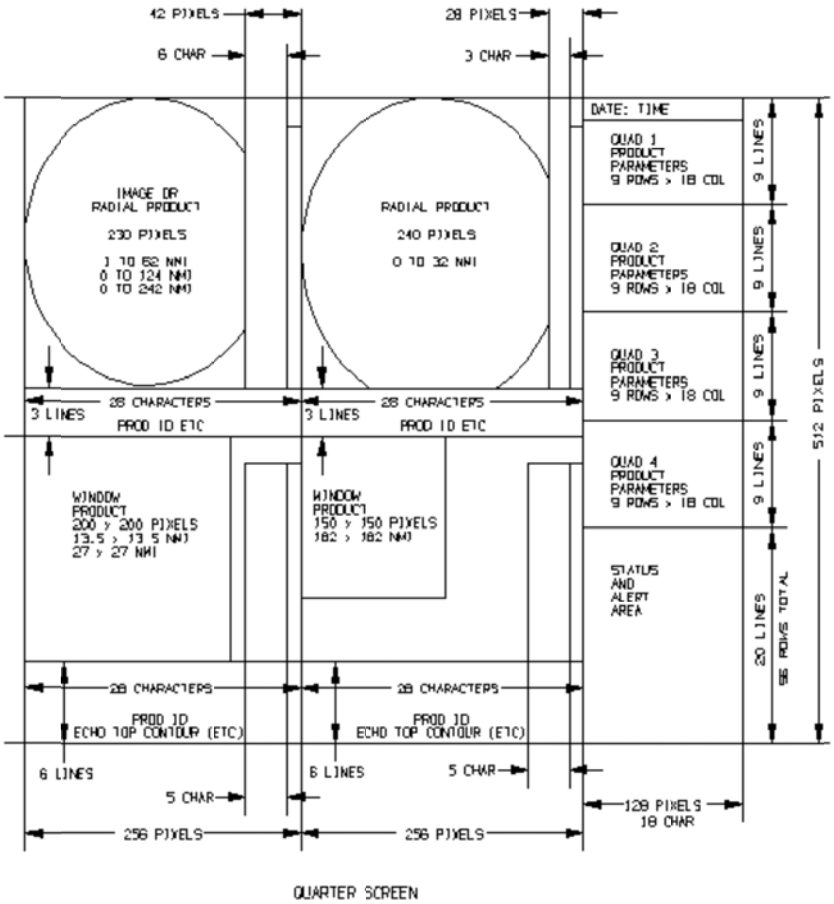
11. MAGNIFICATION, FILTER LEVEL, AND COMBINE NUMBER
12. OVERLAYS DISPLAYED (2 LINES)
13. OVERLAYS NOT AVAILABLE (2 LINES)
14. POLAR GRID RING INTERVAL AND ANGLE
15. BACKGROUND MAPS NOT AVAILABLE (2 LINES)
16. TIME LAPSE AUTO DISPLAY RATE
17. CURSOR HEIGHT AND COORDINATES (LATITUDE AND LONGITUTE OR AZIMUTH/RANGE) (2 LINES)
18. PRODUCT QUEUE STATUS
19. RPG PRODUCT STATUS (2 LINES)
20. SYSTEM STATUS (2 LINES)
21. GRAPHIC TABLET SELECTION (2 LINES)
22. FEEDBACK (2 LINES)
23. WEATHER ALERTS (UNACKNOWLEDGED AND ACKNOWLEDGED) (3 LINES)

Format Ia. Full Screen (Status and Annotation Area)

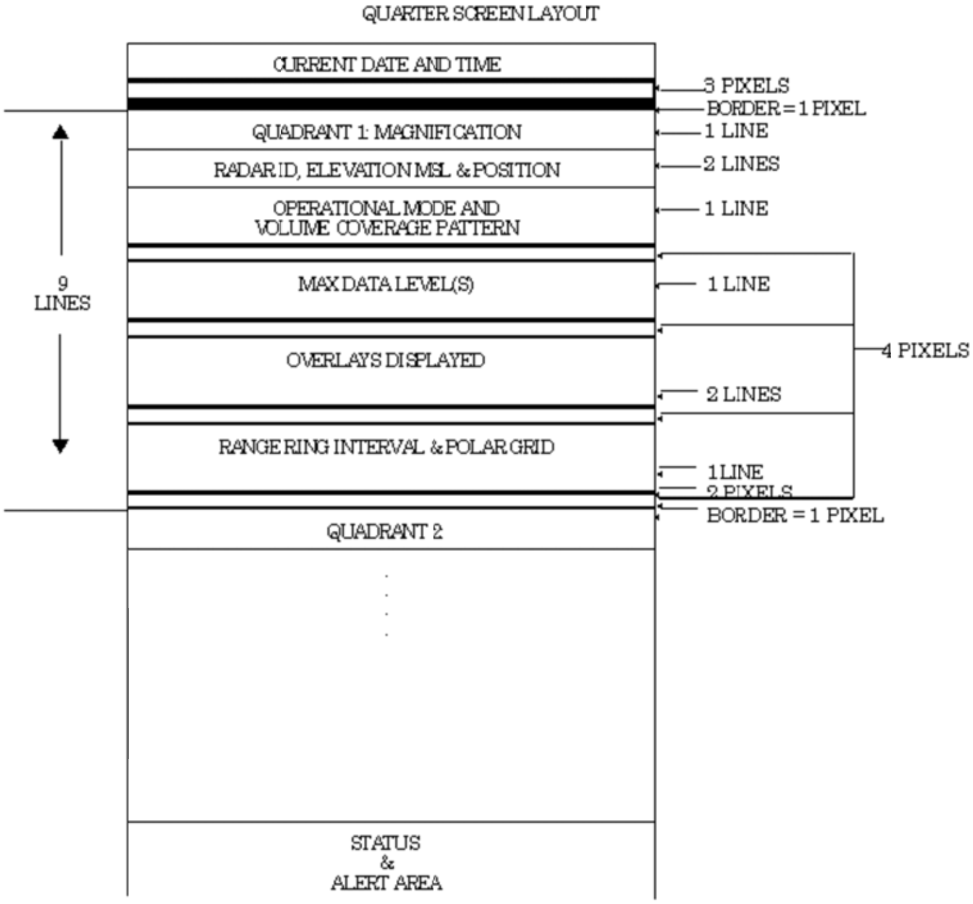
STATUS AND ANNOTATION AREA (PARAMETER SELECT MODE)


CHARACTER
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
YELLOW
CURRENT DATE AND TIME
1 LINE
GREEN
1
2
PRODUCT NAME, MNEMONIC & ID NUMBER
2 LINES
3
4
2 LINES
5
DATA LEVELS OR CONTOUR INTERVAL
6
RESOLUTION
WHITE
7
ELEVATION OR AZIMUTH OR ALTITUDE
8
CENTER AZIMUTH
9
CENTER RANGE
10
STORM SPEED
11
STORM DIRECTION
12
RPG MNEMONIC
1 LINE
GREEN
13
TIME
14
DATE
CYAN
15
PRIORITY
16
REPEAT COUNT
17
REQUEST MAPS
18
YELLOW
19
"CURRENT PARAMETER"
20
CURRENT PARAMETER NAME BEING EDITED
YELLOW REVERSE VIDEO
21
PREVIEW AREA
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
AS IN
NORMAL MODE
(STARS WITH PRODUCT QUEUE STATUS
DOWN)

Format Ib. Status and Annotation Area (Parameter Select Mode)

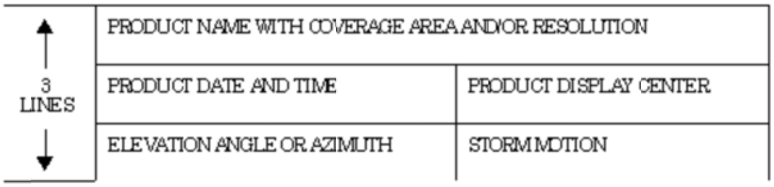

42 PIXELS
6 CHAR
28 PIXELS
3 CHAR
DATE: TIME
IMAGE OR
RADIAL PRODUCT
230 PIXELS
1 TO 62 NMI
0 TO 124 NMI
0 TO 242 NMI
RADIAL PRODUCT
240 PIXELS
0 TO 32 NMI
QUAD 1
PRODUCT
PARAMETERS
9 ROWS X 18 COL
9 LINES
QUAD 2
PRODUCT
PARAMETERS
9 ROWS X 18 COL
9 LINES
QUAD 3
PRODUCT
PARAMETERS
9 ROWS X 18 COL
9 LINES
QUAD 4
PRODUCT
PARAMETERS
9 ROWS X 18 COL
9 LINES
512 PIXELS
28 CHARACTERS
3 LINES
PROD ID ETC
28 CHARACTERS
3 LINES
PROD ID ETC
WINDOW
PRODUCT
200 X 200 PIXELS
13.5 X 13.5 NMI
27 X 27 NMI
WINDOW
PRODUCT
150 X 150 PIXELS
182 X 182 NMI
STATUS
AND
ALERT
AREA
20 LINES
96 ROWS TOTAL
28 CHARACTERS
PROD ID
ECHO TOP CONTOUR (ETC)
28 CHARACTERS
PROD ID
ECHO TOP CONTOUR (ETC)
6 LINES
5 CHAR
6 LINES
5 CHAR
128 PIXELS
18 CHAR
256 PIXELS
256 PIXELS
QUARTER SCREEN

Format II. Quarter Screen


QUARTER SCREEN LAYOUT
CURRENT DATE AND TIME
3 PIXELS
BORDER = 1 PIXEL
QUADRANT 1: MAGNIFICATION
1 LINE
RADAR ID, ELEVATION MSL & POSITION
2 LINES
OPERATIONAL MODE AND VOLUME COVERAGE PATTERN
1 LINE
9 LINES
MAX DATA LEVEL(S)
1 LINE
4 PIXELS
OVERLAYS DISPLAYED
2 LINES
RANGE RING INTERVAL & POLAR GRID
1 LINE
2 PIXELS
BORDER = 1 PIXEL
QUADRANT 2
STATUS & ALERT AREA

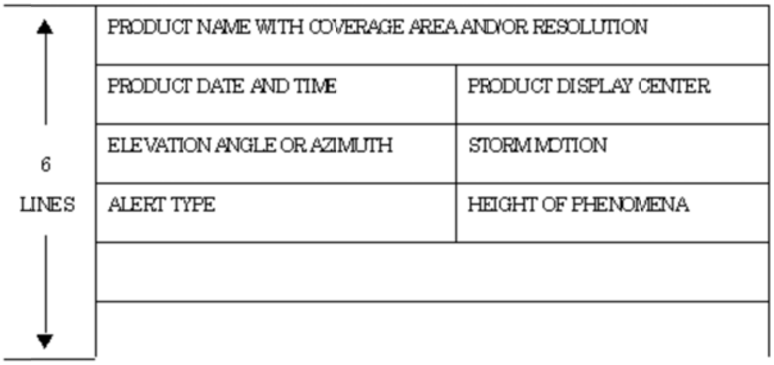
Format IIa: Quarter Screen Layout

QUARTER SCREEN LAYOUT BENEATH NON-WINDOW PRODUCTS



PRODUCT NAME WITH COVERAGE AREA AND/OR RESOLUTION	
PRODUCT DATE AND TIME	PRODUCT DISPLAY CENTER
ELEVATION ANGLE OR AZIMUTH	STORM MOTION

BENEATH WINDOW PRODUCTS



PRODUCT NAME WITH COVERAGE AREA AND/OR RESOLUTION	
PRODUCT DATE AND TIME	PRODUCT DISPLAY CENTER
ELEVATION ANGLE OR AZIMUTH	STORM MOTION
ALERT TYPE	HEIGHT OF PHENOMENA

Format IIb. Quarter Screen Window/Non-Window Products

	STORM ID	XX		NTR 18 STORM TRACKING INFORMATION
	AZ RAN	XXX XXX		NOTE: STORMS ARE ORDERED ACCORDING TO: 1) CELL-BASED VIL AND 2) MAXIMUM REFLECTIVITY
CONF 1	FCST MVT	XXXXX.XX		
	TRACK ERR	XX.X XX.X		
	DBZM HGT	XX.X XX.X		

	STORM ID	XX		NTR 20 MESOCYCLONE
	FEATURE	XXXXXXX		FEATURES ARE 1. MESO (MESOCYCLONE)
CONF 2A	AZ RAN	XXX XXX		2. 3 DC SHR (3D CORRELATED SHEAR)
	BASE TOP	XX.X XX.X		NOTE: STORMS WITH MESOCYCLONE ARE GIVEN DISPLAY PRIORITY
	RAD AZ DIA	XX.X XX.X		
	STATUS/ID	XXX / XX		NTR 20B MESOCYCLONE RAPID UPDATE
	FEATURE	XXXXXXX^		FEATURES ARE 1. MESO (MESOCYCLONE)
CONF 2B	AZ RAN	XXX ^ XXX		2. 3 DC SHR (3D CORRELATED SHEAR)
	BASE TOP	XX.X^XX.X		NOTE: STORMS WITH MESOCYCLONES HAVE PRIORITY
	RAD AZDIA	XX.X^XX.X		
	CIR STMID	XXX XX		NTR 20 MESOCYCLONE DETECTION
	SR LLRV	XXa XXX		
CONF 2C	AZ RAN	XXX XXX		

	HGT MXRV	XX XX		
	BASE DPTH	<XX >XX		NOTE: CIRCULATIONS LISTED FROM HIGHEST TO LOWEST STRENGTH RANK.
	TYPE STM ID	XXXX XX		NTR 21 TVS
	AZ RAN	XXX XXX		TYPES ARE 1. TVS
CONF 3A	AVGDV	XXX		2. ETVS (Elevated TVS)
	LLDV MDV	XXX XXX		NOTE: TVSs are listed before ETVSs, and both types are ordered by Low-level Delta Velocity (from highest to lowest).
	BASE DEPTH	XXX.X XX		
	TYPE STID	XXXX ^ XX		NTR 21 TVS
	AZ RAN	XXX ^XXX		TYPES ARE 1. TVS
CONF 3B	LLDV MDV	^XXX ^XXX		2. ETVS (Elevated TVS)
	STA AVGDV	XXX ^XXX		NOTE: TVSs are listed before ETVSs, and both types are
	BASE DPTH	<XX.X^>XX		ordered by Low-level Delta Velocity (from highest to lowest).
	STORM ID	XX		NTR 19 HAIL
	AZ RAN	XXX XXX		NOTE: STORMS ARE ORDERED ACCORDING TO: 1) PROBABILITY OF SEVERE HAIL AND 2) PROBABILITY OF HAIL
CONF 4	POSH/POH	XXX/XXX		
	MAX HAIL SIZE	XX.XX		

					0/-20 C TEMP ALT XX.X/XX.X KFT(MSL) - LAST CHANGE HH/MM DD/MM/YY					
	STM ID	AZ/RAN	TVS	MDA	POSH/POH/MX SIZE	VIL	DBZM HGT	TOP	FCST MVMT	
	XX	XXX/XXX	XXX	XXX	XXX/XXX/XX.XX	XX	XX XX.X	XX.XX	XXX/XXX	COMBINED
CONF 5										ATTRIBUTE
										TABLE

NOTE: STORM CELLS ORDERED: TVSs, ETVS, MESOs (by strength rank if meeting Minimum Display Filter strength rank), POSH, POH, AND CELL-BASED VIL. MDA column contains "NONE" if no MDA feature is associated with the storm cell, otherwise the 2-digit strength rank is displayed.

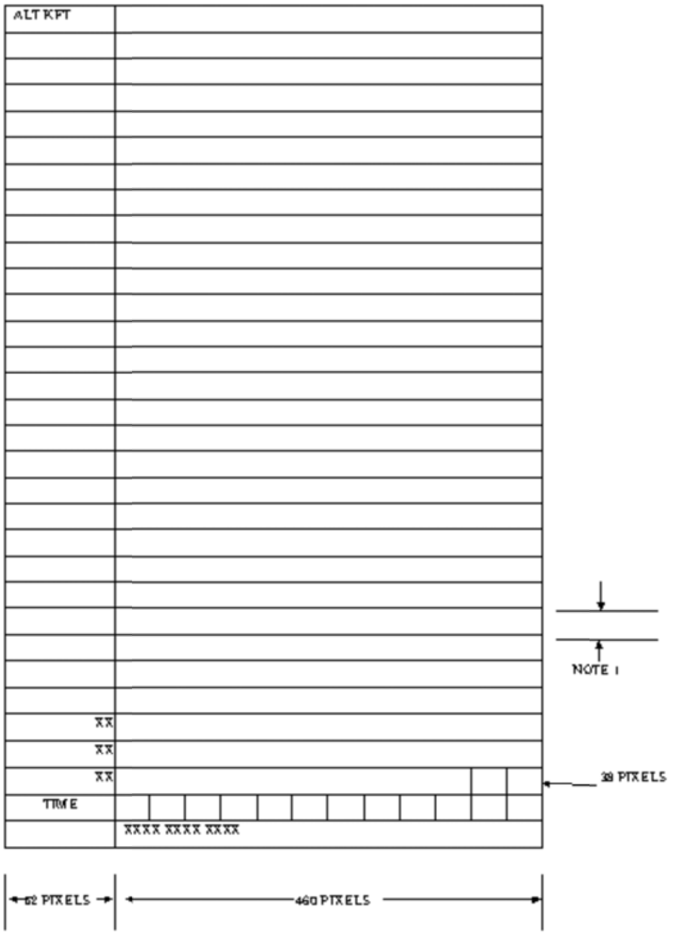
NOTE: THE STORM CELL TOP(TOP) DATA IS QUALIFIED WITH '>' IF THE CELL WAS DETECTED ON THE HIGHEST ELEVATION SCAN OF THE VOLUME COVERAGE PATTERN.

				GAGE BIAS - APPLIED			NTR 32 USP		
					XX OF YY HOURS IN PRODUCT				
CONF 6	END TIMES	XXZ							
	BIAS	Y.YY							
	HOURS INCLUDED?	YES/NO							

GENERAL NOTES: 1 ALL HORIZONTAL AND VERTICAL LINES SEPARATING THE PARAMETERS ARE ONE PIXEL WIDE.

2 LETTER SIZES (ALL A/N) FIT INTO A 7 X 9 PIXEL AREA.

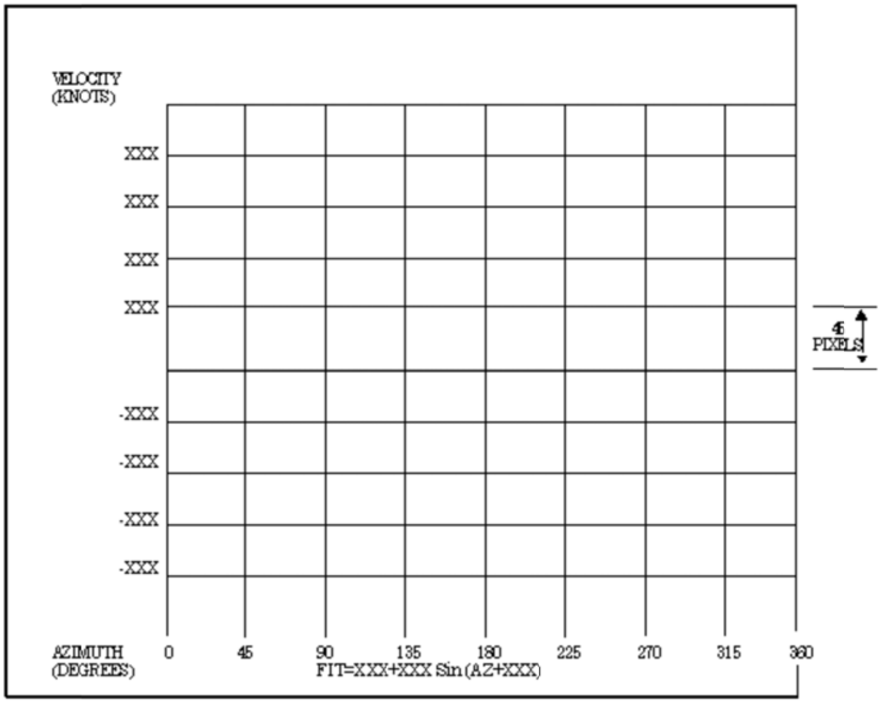
Format III. Attribute Area


ALT KFT
XX
XX
XX
TIME
XXXX XXXX XXXX
NOTE 1
38 PIXELS
62 PIXELS
460 PIXELS

VWP GRID

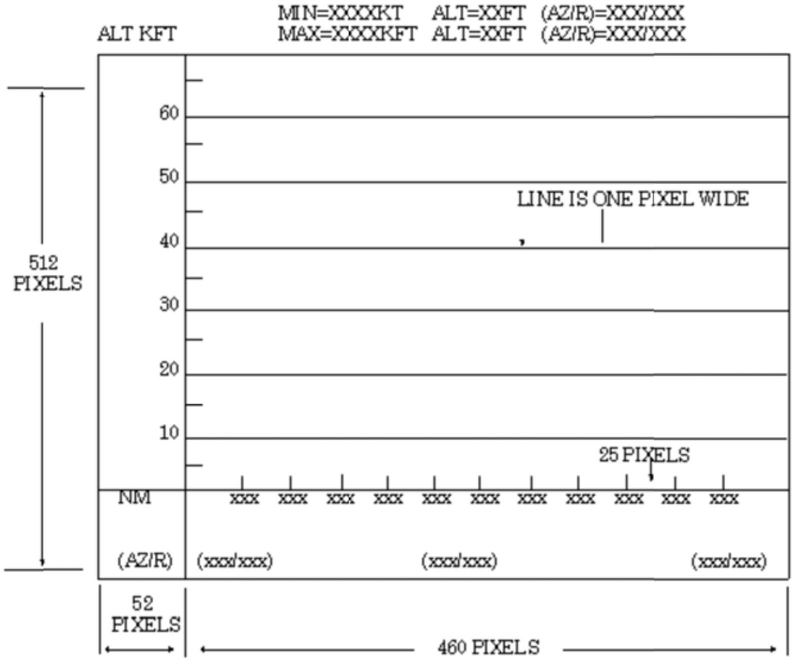
NOTE 1:THE NUMBER OF PIXELS BETWEEN HORIZONTAL HEIGHT LINES IS A FUNCTION OF THE NUMBER OF MSCF SELECTED HEIGHTS (THE MINIMUM NUMBER IS 14 PIXELS)

Format IVA VWP Grid


VELOCITY (KNOTS)
XXX
XXX
XXX
XXX
-XXX
-XXX
-XXX
-XXX
45 PIXELS
AZIMUTH (DEGREES)
0
45
90
135
180
225
270
315
360
FIT=XXX+XXX Sin (AZ+XXX)

VAD WIND ANALYSIS GRID

Format IVb. VAD Grid


MIN=XXXXKT ALT=XXFT (AZ/R)=XXX/XXX
MAX=XXXXKFT ALT=XXFT (AZ/R)=XXX/XXX
ALT KFT
60
50
40
30
20
10
LINE IS ONE PIXEL WIDE
512 PIXELS
25 PIXELS
NM
xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx
(AZ/R)
(xxx/xxx)
(xxx/xxx)
(xxx/xxx)
52 PIXELS
460 PIXELS

Format V. Cross-Section Grid

APPENDIX C

Alphanumeric Tabular Formats

- Storm Tracking
- Hail Index
- Mesocyclone
- TVS
- Storm Structure
- Supplementary Precipitation Data
- Hourly Digital Precipitation Array
- Digital Hybrid Scan Reflectivity
- Precipitation Adaptation Data
- Wind Profile adaptable Parameter
- Clutter Likelihood Adaptation Data
- One-Hour and Storm Total Snow Accumulation
- User Selectable Snow Accumulation
- Storm Total Accumulation

STORM POSITION/FORECAST

<table>
<tr><td>RADAR ID:</td><td colspan="2">nnn</td><td>DATE/TIME</td><td>MM:DD:YY:/HH:MM:SS</td><td colspan="2">NUMBER OF STORMS</td><td>nnn</td></tr>
<tr><td colspan="2"></td><td colspan="2">CURRENT POSITION</td><td></td><td colspan="2">FORECAST POSITION</td><td>ERROR</td></tr>
<tr><td>STORM ID</td><td>AZRAN (DEG/NM)</td><td>MOVEMENT (KEG/KTS)</td><td>15 MIN (DEG/NM)</td><td>30 MIN (DEG/NM)</td><td>45 MIN (DEG/NM)</td><td>60 MIN (DEG/NM)</td><td>FAST/MEAN (NM)</td></tr>
<tr><td>XX</td><td>XXX/XXX</td><td>XXX/XXX</td><td>XXX/XXX</td><td>XXX/XXX</td><td>XXX/XXX</td><td>XXX/XXX</td><td>XX.X/XX.X</td></tr>
</table>

NOTE:STORMS ARE ORDERED ACCORDING TO: 1) MAXIMUM CELL-BASED VIL AND 2) MAXIMUM REFLECTIVITY.
NOTE:THE NUMBER OF STORM CELLS DISPLAYED FROM THE TOP OF THE ORDERED LIST IS ADAPTABLE AT THE MSCF.

Format I. Storm Tracking

STORM CELL TRACKING/FORECAST ADAPTATION DATA

XXX	(DEG)	DEFAULT (DIRECTION)	X.X	(M/S)	THRESH (MINIMUM SPEED)
XX.X	(KTS)	DEFAULT (SPEED)	XX	(KM)	ALLOWABLE ERROR
XX	(MIN)	TIME (MAXIMUM)	XX	(MIN)	FORECAST INTERVAL
XX		NUMBER OF PAST VOLUMES	X		NUMBER OF INTERVALS
XX.X	(M/S)	CORRELATION SPEED	XX	(MIN)	ERROR INTERVAL

SCIT REFLECTIVITY MEDIAN FILTER

X.X	(KM)	FILTER KERNEL SIZE	X.X		THRESH (FILTER FRACTION)
XXX		REFLECTIVITY FILTERED			

Format I. Storm Tracking

HAIL

RADAR ID nnn	DATE/TIME MM:DD:YY/HH:MM:SS	NUMBER OF STORM CELLS nnn

STORM ID	PROBABILITY OF SEVERE HAIL (%)	PROBABILITY OF HAIL (%)	MAX EXPECTED HAIL SIZE (IN)
XX	XXX	XXX	XX.XX

NOTE: STORMS ARE ORDERED ACCORDING TO: 1) PROBABILITY OF SEVERE HAIL AND 2) PROBABILITY OF HAIL.
NOTE: THE NUMBER OF STORM CELLS DISPLAYED FROM THE TOP OF THE ORDERED LIST IS ADAPTABLE AT THE MSCF.

Format II. Hail Index

HAIL DETECTION ADAPTATION DATA					
XX.X	(KFT)	HEIGHT (0 DEG CELSIUS)	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #1
XX.X	(KFT)	HEIGHT (-20 DEG CELSIUS)	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #2
X.XE-XX		HKE COEFFICIENT #1	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #3
XXX		HKE COEFFICIENT #2	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #4
XX.X		HKE COEFFICIENT #3	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #5
XX.X		POSH COEFFICIENT	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #6
XX	(%)	POSH OFFSET	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #7
.XX		SHI HAIL SIZE COEFFICIENT	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #8
.X		SHI HAIL SIZE EXPONENT	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #9
XX	(dBZ)	THR HKE REF WGT LOWER LIM	\	X.XXX	(KM) POH HEIGHT DIFFERENCE #10
XX	(dBZ)	THR HKE REF WGT UPPER LIM	\	XX	(dBZ) THR MIN REFLECTIVITY POH
XX	(%)	THRESH(RCM PROBABLE HAIL)	\	XX	(1%) THRESH(RCM POSITIVE HAIL)
XX.X	10E2	J/M**2/S)WTSM COFFICIENT	\	-XX.X	(10E5 J/MS) WTSM OFFSET

XXX	(KM)	MAX HAIL PROCESSING RANGE	\		

Format II Hail Index

MESOCYCLONE									
RADAR ID NNN			DATE/TIME MM:DD:YY/HH:MM:SS				NUMBER OF STORMS NN		
FEAT ID	STOR ID	FEAT TYPE	BASE KFT	TOP KFT	AZRAN DEG-NM	HGT KFT	DIAM RAD	(NM) AZ	SHEAR (E-3/S)
XX	XX	MESO	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	MESO	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	MESO	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	3DC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	3DC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX

Format III. Mesocyclone

MESOCYCLONE ADAPTATION PARAMETERS

MIN	# PATTRN VEC	XX	
MAX	HGT MESO	X.X	KM
HGH	MOMENTUM THR	XXX.X	KM**2/HR
LOW	MOMENTUM THR	XXX.X	KM**2/HR
HGH	SHR THR	XX.X	1/HR
LOW	SHR THR	X.X.X	1/HR
MAX	DIAM RATIO THR	X.X	
FAR	MAX DIAM RATIO THR	X.X	
MIN	DIAM RATIO THR	X.X	
FAR	MIN DIAM RATIO THR	X.X	
RANGE	FAR MAX/MIN	XXX.X	KM
MAX	RADIAL DIFFERENCE	X.X	KM
MAX	AZIMUTHAL DIFFERENCE	X.X	DEG

Format III Mesocyclone

MESOCYCLONE RAPID UPDATE

			RADAR ID: NNN		DATE: MM/DD/YY TIME: HH:MM:SS			Elev: xx.x deg	
FEATURE STATUS	STORM ID	FEATURE TYPE	BASE kft	TOP kft	AZRAN deg-nm	HGT kft	DIAM RAD	(NM) AZ	SHEAR (E-3/S)
EXT	XX	MESO	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
PER	XX	MESO	HH.H ^	HH.H	DDD/XXX ^	HH.H	XXX	XXX	XXX
INC	XX	MESO ^	HH.H ^	HH.H	DDD/XXX ^	HH.H	XXX	XXX	XXX
INC	XX	3DC SHR	HH.H ^	HH.H	DDD/XXX ^	HH.H ^	XXX^	XXX	XXX^
INC	XX	3DC SHR^	HH.H ^	HH.H	DDD/XXX ^	HH.H ^	XXX^	XXX	XXX^
EXT	XX	UNC SHR	HH.H	HH.H	DDD/XXX ^	HH.H	XXX	XXX	XXX
XXX	XX	UNC SHR	HH.H	HH.H ^	DDD/XXX	HH.H	XXX	XXX	XXX
XXX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XXX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX
XXX	XX	UNC SHR	HH.H	HH.H	DDD/XXX	HH.H	XXX	XXX	XXX

Format IIIb. Mesocyclone Rapid Update (Sheet 1 of 1)

<table>
<tr><td colspan="10">MESOCYCLONE DETECTION ALGORITHM</td></tr>
<tr><td colspan="2"></td><td colspan="2">RADAR ID: NNN</td><td colspan="2">DATE: MM/DD/YY
TIME: HH:MM:SS</td><td colspan="2"></td><td colspan="2">Avg dir/spd: XXX/XXX</td></tr>
<tr><td>CIRC ID</td><td>AZRAN deg/nm</td><td>SR</td><td>STM ID</td><td>|-LOW LEVEL-| RV DV BASE</td><td>|--DEPTH--| kft STMREL%</td><td>|-MAX RV-| kft kts</td><td>TVS</td><td>MOTION deg/kts</td><td>MSI</td></tr>
<tr><td>XXX</td><td>XXX/XXX</td><td>XXa</td><td>XX</td><td>XX XX <XX</td><td>>XX XX</td><td>XX XX</td><td>X</td><td>XXX/XXX</td><td>XXXXX</td></tr>
</table>

Format IIIc. Mesocyclone Detection (Sheet 1 of 1)

TORNADO VORTEX SIG									
RADAR ID NNN			DATE/TIME MM:DD:YY/HH:MM:SS			NUMBER OF TVS/ETVS NNN/NNN			
Feat Type	Feat ID	Storm ID	AZ/RAN (deg,nm)	AVGDV (kt)	LLDV (kt)	MXDV/Hgt (kt,kft)	Depth (kft)	Base/Top (kft)	MXSHR/Hgt (m/s/km,kft)
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X
HHHH	XX	HH	XXX/XXX	XXX	XXX	XXX/XX.X	XXX.X	XXX.X/XXX.X	XXX/XX.X

TORNADO VORTEX SIGNATURE ADAPTATION PARAMETERS

0(dBZ)	. . .MIN REFLECTIVITY	2.5(KM)	. . .CIRCULATION RADIUS #1
11(M/S)	. . .VECTOR VELOCITY DIFFERENCE	4.0(KM)	. . .CIRCULATION RADIUS #2
100(KM)	. . .MAX PATTERN VECTOR RANGE	80(KM)	. . .CIRCULATION RADIUS RANGE
10.0(KM)	. . .MAX PATTERN VECTOR HEIGHT	600	. . . .. MAX # OF 2D FEATURES
2500	. . .MAX # OF PATTERN VECTORS	3	. . . . .MIN # OF 2D FEAT/ 30 FEATURE
11(M/S)	. . .DIFFERENTIAL VELOCITY #1	1.5(KM)	. . . MIN 3D FEATURE DEPTH
15(M/S)	. . .DIFFERENTIAL VELOCITY #2	25(M/S)	. . .MIN 3D FEAT LOW-LVL DELTA VEL
20(M/S)	. . .DIFFERENTIAL VELOCITY #3	36(M/S)	. . MIN TVS DELTA VELOCITY
25(M/S)	. . .DIFFERENTIAL VELOCITY #4	35	. . . . .MAX # OF 3D FEATURES
30(M/S)	. . .DIFFERENTIAL VELOCITY #5	15	. . . . .MAX # OF TVSS
35(M/S)	. . .DIFFERENTIAL VELOCITY #6	20	. . . . .MAX # OF ELEVATED TVSS
3	. . .MIN # OF VECTORS/ 2D FEATURE	0.6(KM)	. . . .MIN TVS BASE HEIGHT
0.5(KM)	. . .2D VECTOR	1.0(DEG)	. . . MIN TVS

	RADIAL DISTANCE		ELEVATION
1.5(DEG)	. . .2D VECTOR AZIMUTHAL DIST	3.0(KM)	. . . .MIN AVG DELTA VELOCITY HGT
4.0(KM/KM)	. . .2D FEATURE ASPECT RATIO	20.0(KM)	. . . MAX STORM ASSOCIATION DIST

Format IV. TVS

TVS Rapid Update									
RADAR ID: nnn	DATE: mm/dd/yy	TIME: hh:mm:ss	TVS/ETVS: >xx/>xx	ELEV: xx.x					
FEATURE		STORM	AZ/RAN	AVGDV	LLDV	MXDV/Hgt	Depth	Base/Top	MXSHR/Hgt
STAT TYPE		ID	(deg,nm)	(kt)	(kt)	(kt,kft)	(kft)	(kft)	(E-3/s, kft)
XXX	TVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	TVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	TVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	TVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	ETVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	ETVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	ETVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^
XXX	ETVS^	XX	XXX/XXX^	XXX	XXX^	XXX/XX.X^	>XX.X	<XX.X/>XX.X^	XXX/XX.X^

Format IVb. TVS Rapid Update

STORM STRUCTURE						
RADAR ID NNN		DATE/TIME MM:DD:YY/HH:MM:SS		NUMBER OF STORMS NNN		
STORM ID	AZ/RAN (DEG,NM)	BASE KFT	TOP KFT	CELL BASED VIL KG/M**2	MAX REF dBZ	HEIGHT KFT
XX	XXX/XXX	XX.X	XXX.X	XXX	XX	XX.X

NOTE: The Storm Cell Top (TOP) and Storm Cell Base are the height above ground level (AGL).
NOTE: The Storm Top (TOP) data is qualified with '>' if the cell was detected on the highest elevation scan of the Volume Coverage Pattern.
NOTE: The Storm Cell Base (BASE) data is qualified with '<' if the cell was detected on the lowest elevation scan of the Volume Coverage Pattern.
NOTE: Will display the 40 most intense Storm Cells
NOTE: Storm Cells ordered according to Cell-based VIL and secondly Maximum Reflectivity

Format V. Storm Structure

SUPPLEMENTAL PRECIPITATION DATA - RDA ID XXXXX MM/DD/YY HH:MM
VOLUME COVERAGE PATTERN = XXX MODE = X

GAGE BIAS APPLIED BIAS ESTIMATE EFFECTIVE # G/R PAIRS MEMORY SPAN (HOURS) DATE/TIME LAST BIAS UPDATE	- {YES,NO} - {XXXXX.XX} - {XXXXX.XX} - {XXXXX.XX} - {MM/DD/YY HH:MM}
TOTAL NO. OF BLOCKAGE BINS REJECTED CLUTTER BINS REJECTED FINAL BINS SMOOTHED	- {XXXXXXXX} - {XXXXXXXX} - {XXXXXXXX}
HYBRID SCAN PERCENT BINS FILLED HIGHEST ELEV. USED (DEG) TOTAL RAIN AREA (KM**2)	-{XXXXX.XX} -{XXXXX.XX} -{XXXXXX.X}
MISSING PERIODS: NONE or {MM/DD/YY HH:MM mm/dd/yy hh:mm}	

FORMAT VI SPD (Sheet 1 of 2)

GAGE-RADAR MEAN FIELD BIAS TABLE
LAST BIAS UPDATE TIME:MM/DD/YY HH:MMBIAS APPLIED? {YES/NO}

MEMORY SPAN (HOURS)	EFFECTIVE NO. G-R PAIRS	AVG. GAGE VALUE (MM)	AVG. RADAR VALUE (MM)	MEAN-FIELD BIAS
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX
XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX	XXXXXXXX.XXX

FORMAT VI. SPD (sheet 2 of 2)

DATA FORMAT: (TIME(HH:MM), VALUE(INCHES), DURATION(MINUTES)
GAGE ID: XXXX TYPE: {ACC;INC} LAT: XX.XX LON: XXX.XX AZ: XXX.X RNG: XXX.X #RPTS: XX

Variable Description	**Format**	**Range**	**Units**	**Default**
(PPS ADAPTATION DATA)	{ADAP(nn)}			
Beam Width	{XXXXX.XX}	0.8 - 1.0	DEG	0.9
Blockage Threshold	{XXXXX.XX}	0.0 - 100.0	%	50.0
Clutter Threshold	{XXXXX.XX}	0 - 100	%	50
Weight Threshold	{XXXXX.XX}	0.0 - 100.0	%	50.0
Full Hybrid Scan	{XXXXX.XX}	90.0 - 100.0	%	99.7

Threshold				
Low Refl. Threshold	{XXXXX.XX}	-40.0 - -20.0	dBZ	-32.0
Rain Detection Refl. Threshold	{XXXXX.XX}	10.0 - 30.0	dBZ	20.0
Rain Detection Area Threshold	{XXXXX.XX}	0 - 82800	KM**2	80
Rain Detection Time Threshold	{XXXXX.XX}	0 - 1440	MIN	60
Z-R Mult. Coef.	{XXXXX.XX}	30.0 - 3000.0	--	300.0
Z-R Power Coef.	{XXXXX.XX}	1.0 - 2.5	--	1.4
Min Refl. to convert to Rate	{XXXXX.XX}	-32.0 - 20.0	dBZ	0.0
Max Refl. to convert to Rate	{XXXXX.XX}	50.0 - 90.0	dBZ	70.0
Number Exclusion Zones	{XXXXX.XX}	0 - 20	--	0
Range Cut-Off	{XXXXX.XX}	0 - 230	KM	230
Range Effect Coeff. #1	{XXXXX.XX}	0.0 - 3.0	dBR	0.0
Range Coeff. Coeff. #2	{XXXXX.XX}	1.0 - 10.0	dBR	1.0
Range Coeff. Coeff. #3	{XXXXX.XX}	0.0 - 1.0	dBR	0.0
Min Precip. Rate for inclusion	{XXXXX.XX}	0.0 - 10.0	MM/HR	0.0
Max Precip. Rate allowed	{XXXXX.XX}	50.0 - 1600.0	MM/HR	103.8
Thresh. Elapsed Time to Restart	{XXXXX.XX}	45 - 60	MINS	60
Max. Time for Interpolation	{XXXXX.XX}	15 - 60	MINS	30
Min. Time in Hourly Period	{XXXXX.XX}	0 - 60	MINS	54
Threshold Hourly Outlier	{XXXXX.XX}	50 - 800	MM	400
End Time Gage Accumulation	{XXXXX.XX}	0 - 59	MINS	0
Max Period Accum Value	{XXXXX.XX}	50 - 400	MM	400
Max Hourly Accum Value	{XXXXX.XX}	50 - 1600	MM	800
Time Bias Estimation	{XXXXX.XX}	50 - 59	MINS	50
Thresh. No. Gage-Radar Pairs	{XXXXX.XX}	6 - 30	-	10
Reset Bias Value	{XXXXX.XX}	0.5 - 2.0	-	1.0
Longest Allowable Lag	{XXXXX.XX}	100 - 1000	HOURS	168
Bias Applied Flag	{T or F}	T - F	-	F

(BIAS TABLE DATA)	{BIAS(nn)}			
(Same as Appendix C, Format VI, SPD, sheet 2)				
(PPS SUPPLEMENTAL DATA)	{SUPL(nn)}			
Rate Scan 1			Date: {XXXXXXX} Time: {XXXXX}	
. . . . . .				
. . . . . .				
Rate Scan nn (Note: nn can range from 2 to 16)			Date: {XXXXXXX} Time: {XXXXX}	
Hourly Accumulation End Date	{XXXXXXXX}			
Hourly Accumulation End Time	{XXXXXXXX}			
Total No. of Blockage Bins Rejected	{XXXXXXXX}			
Total No. of Clutter Bins Rejected	{XXXXXXXX}			
Total Bins Smoothed	{XXXXXXXX}			
Percent of Hybrid Scan Bins Filled	{XXXXX.XX}			
Highest Elevation Angle Used	{XXXXX.XX}			
Total Hybrid Scan Rain Area	{XXXXXX.X}			
Number of Bad Scans in Hour	{XXXXXXXX}			
Bias Estimate	{XXXXX.XX}			
Effective No. Gage-Radar Pairs	{XXXXX.XX}			
Memory Span (Hours)	{XXXXX.XX}			
Current Volume Coverage Pattern	{XXXXXXXX}			
Current Operational (Weather) Mode	{XXXXXXXX}			
No Missing Periods in Current Hour				

NOTE 1: The alphanumeric data package of the DPA product (#81) is contained in the last layer of the product, which can range from layer #2 to layer #18, depending on the number of layers of RLE-formatted Rate Scans which precede it (i.e., 0-16). It is formatted using Text and Special Symbols Packet Code 1: Write Text (No Value). (See RPG/Associated PUP ICD for details.) It contains two "sub-layers" of information: Adaptation Data and Supplemental Data. Each sub-layer is preceded by an 8-character field containing a mnemonic for the data type followed by the number of elements of that type to follow (i.e., "ADAP(nn)", then "SUPL(nn)").

NOTE 2: The Adaptation Data sub-layer contains values only (i.e., no preceding descriptive information), but the values are always listed in the exact order seen above. Each value is given in a field of 8 ASCII characters, as seen in the "Format" column (which, alone, contains the entire contents of the Adaptation Data sub-layer of the product). The meaning of each field can be ascertained from the additional columns, above.

NOTE 3: The Supplemental Data sub-layer contains values along with preceding descriptive information. Up to 80 ASCII characters are used for the description and value of each field. The number in parentheses following the mnemonic "SUPL" (e.g., 27) refers to the number of elements of information to follow.

Format VII. DPA

Variable Description	Format	Range	Units	Default
(PRECIP STATUS MESSAGE DATA)	{PSM (nn)}			
Current Precip Function Ran	{XXXXXXXX}	0 - 99999	JULIAN DAYS	--
Current Time Precip Function Ran	{XXXXXXXX}	0 - 86399	SEC	--
Last Date Precip Detected	{XXXXXXXX}	0 - 99999	JULIAN DAYS	--
Last Time Precip Detected	{XXXXXXXX}	0 - 86399	SEC	--
Last Precip Category	{XXXXXXXX}	0, 1 or 2	--	--
Previous Precip Category	{XXXXXXXX}	0, 1 or 2	--	--
(PPS ADAPTATION DATA)	{ADAP (nn) }			
Beam Width	{XXXXX.XX}	0.8 - 1.0	DEG	0.9
Blockage Threshold	{XXXXX.XX}	0.0 - 100.0	%	50.0
Clutter Threshold	{XXXXX.XX}	0 - 100	%	50
Weight Threshold	{XXXXX.XX}	0.0 - 100.0	%	50.0
Full Hybrid Scan Threshold	{XXXXX.XX}	90.0 - 100.0	%	99.7
Low Refl. Threshold	{XXXXX.XX}	-40.0 - -20.0	dBZ	-32.0
Rain Detection Refl. Threshold	{XXXXX.XX}	10.0 - 30.0	dBZ	20.0
Rain Detection Area Threshold	{XXXXX.XX}	0 - 82800	KM**2	80
Rain Detection Time Threshold	{XXXXX.XX}	0 - 1440	MINS	60
Z-R Mult. Coef.	{XXXXX.XX}	30.0 - 3000.0	--	300.0
Z-R Power Coef.	{XXXXX.XX}	1.0 - 2.5	--	1.4
Min Refl. to convert to Rate	{XXXXX.XX}	-32.0 - 20.0	dBZ	0.0
Max Refl. to convert to Rate	{XXXXX.XX}	50.0 - 90.0	dBZ	70.0
Number Exclusion Zones	{XXXXX.XX}	0 - 20	--	0
Range Cut-Off	{XXXXX.XX}	0 - 230	KM	230
Range Effect Coeff. #1	{XXXXX.XX}	0.0 - 3.0	dBR	0.0
Range Coeff. Coeff. #2	{XXXXX.XX}	1.0 - 10.0	dBR	1.0
Range Coeff. Coeff.	{XXXXX.XX}	0.0 - 1.0	dBR	0.0

#3				
Min Precip. Rate for inclusion	{XXXXX.XX}	0.0 - 10.0	MM/HR	0.0
Max Precip. Rate allowed	{XXXXX.XX}	50.0 - 1600.0	MM/HR	103.8
Thresh. Elapsed Time to Restart	{XXXXX.XX}	45 - 60	MINS	60
Max. Time for Interpolation	{XXXXX.XX}	15 - 60	MINS	30
Min. Time in Hourly Period	{XXXXX.XX}	0 - 60	MINS	54
Threshold Hourly Outlier	{XXXXX.XX}	50 - 800	MM	400
End Time Gage Accumulation	{XXXXX.XX}	0- 59	MINS	0
Max Period Accum Value	{XXXXX.XX}	50 - 400	MM	400
Max Hourly Accum Value	{XXXXX.XX}	50 - 1600	MM	800
Time Bias Estimation	{XXXXX.XX}	50 - 59	MINS	50
Thresh. No. Gage-Radar Pairs	{XXXXX.XX}	6 - 30	--	10
Reset Bias Value	{XXXXX.XX}	0.5 - 2.0	--	1.0
Longest Allowable Lag	{XXXXX.XX}	100-1000	HOURS	168
Bias Applied Flag	{ T or F }	T - F	--	F
SUPPLEMENTAL DATA (EPRE ALG))	{SUPL(nn)}			
Average Scan Date	{XXXXXXXX}	0 - 99999	JULIAN DAYS	--
Average Scan Time	{XXXXXXXX}	0 - 86399-	SEC	-
Flag Zero Hybrid	{XXXXXXXX}	0 or 1	--	--
Flag Rain Detected	{XXXXXXXX}	0 or 1	--	--
Flag Reset Storm Total	{XXXXXXXX}	0 or 1	--	--
Flag Precip Begin	{XXXXXXXX}	0 or 1	--	--
Last Date Rain	{XXXXXXXX}	0 - 99999	JULIAN DAYS	--
Last Time Rain	{XXXXXXXX}	0 - 86399	SEC	--
Total No. of Blockage Bins Rejected	{XXXXXXXX}	0 - 82800	--	--
Total No. of Clutter Bins Rejected	{XXXXXXXX}	0 - 82800	--	--
Total Bins Smoothed	{XXXXXXXX}	0 - 82800	--	--
Percent of Hybrid Scan Bins Filled	{XXXXX.XX}	9.0 - 100.0	%	--

Highest Elevation Angle Used	{XXXXX.XX}	0.5 - 19.5	DEG	--
Total Hybrid Scan Rain Area	{XXXXX.XX}	0.0 - 99999	KM**2	--
Spot Blanking Volume Status	{XXXXXXXX}	0 or 1	--	--
(BIAS-RELATED FIELDS)	{BIAS(nn)}			
Time Bias Value Last Updated Locally	{XXXXXXXX}	0-86399	SEC	--
Date Bias Value Last Updated Locally	{XXXXXXXX}	0-99999	JULIAN DAYS	
Time of Last Update of Local Bias Table	{XXXXXXXX}	0-99999	SEC	
Date of Last Update of Local Bias Table	{XXXXXXXX}	0-86399	JULIAN DAYS	--
Observation Time of Latest Bias Table	{XXXXXXXX}	0-86399	SEC	
Observation Date of Latest Bias Table	{XXXXXXXX}	0-99999	JULIAN DAYS	--
Generation Time of Latest Bias Table	{XXXXXXXX}	0-86399	SEC	
Generation Date of Last Bias Table	{XXXXXXXX}	0-99999	JULIAN DAYS	--
Mean-Field Bias Estimate	{XXX.XXXX}	.0001-99.9999		
Effective G-R Pair Sample Size	{XXXXX.XX}	0.00-999.99	---	
Memory Span used in Bias Estimate	{XXXXXXX}	0.001-10.**7	--	

NOTE 1: The alphanumeric data package of the DHR product (#32) and the DSP product (#138) is contained in the last (i.e., 2nd) layer of the product. It is formatted using Text and Special Symbols Packet Code 1: Write Text (No Value). (See RPG/Associated PUP ICD for details.) It contains four "sub-layers" of information: Precipitation Status Message parameters, Adaptation Data, Supplemental Data (Precipitation Preprocessing Algorithm only), and Bias-related parameters. Each sub-layer is preceded by an 8-character field containing a mnemonic for the data type followed by the number of elements of that type to follow (i.e., "PSM (nn)", followed by "ADAP(nn)", "SUPL(nn)" and "BIAS(nn)").

NOTE 2: The alphanumeric data sub-layer contains values only (i.e., no preceding descriptive information), but the values are always listed in the exact order seen above. Each value is given in a field of 8 ASCII characters, as seen in the "Format" column (which, alone, contains the entire contents of the alphanumeric data sub-layer of the product). The meaning of each field can be ascertained from the additional columns, above.

Format VIII. DHR and DSP

RADAR HALF POWER BEAM WIDTH.	0.90 DEG
MAXIMUM ALLOWABLE PERCENT OF BEAM BLOCKAGE.	50.00 %
MAXIMUM ALLOWABLE PERCENT LIKELIHOOD OF CLUTTER.	50.00 %
PERCENT OF BEAM REQUIRED TO COMPUTE AVERAGE POWER.	50.00 %
PERCENT OF HYBRID SCAN NEEDED TO BE CONSIDERED FULL.	99.70 %
LOW REFLECTIVITY THRESHOLD (dBZ) FOR BASE DATA	-32.00 dBZ
REFLECTIVITY (dBZ) REPRESENTING SIGNIFICANT RAIN	20.00 dBZ
AREA WITH REFLECTIVITY EXCEEDING SIGNIFICANT RAIN THRESHOLD. .	80.00 KM**2
THRESHOLD TIME WITHOUT RAIN FOR RESETTING STP	60.00 MINUTES
REFLECT-TO-PRECIP RATE CONVERSION MULTIPLICATIVE COEFFICIENT. .	300.00
REFLECT-TO-PRECIP RATE CONVERSION POWER COEFFICIENT.	1.40
MIN dBZ FOR CONVERTING TO PRECIP RATE (VIA TABLE LOOKUP)	0.00 dBZ
MAX dBZ FOR CONVERTING TO PRECIP RATE (VIA TABLE LOOKUP).	70.00 dBZ
NUMBER OF EXCLUSION ZONES	0.00

Format IX Precipitation Adaptation Data (sheet 1 of 4)

RANGE BEYOND WHICH TO APPLY RANGE-EFFECT CORRECTION	230.00 KM
1ST COEFFICIENT OF RANGE-EFFECT FUNCTION	0.00 dBR
2ND COEFFICIENT OF RANGE-EFFECT FUNCTION	1.00 dBR
3RD COEFFICIENT OF RANGE-EFFECT FUNCTION	0.00 dBR
MIN RATE SIGNIFYING PRECIPITATION	0.00 MM/Hr
MAX PRECIPITATION RATE	103.80 MM/Hr

Format IX Precipitation Adaptation Data (sheet 2 of 4)

REINITIALIZATION TIME LAPSE THRESHOLD (FOR ACCUM PROCESS)	60.00 MINUTES
MAX TIME DIFFERENCE BETWEEN SCANS FOR INTERPOLATION.	30.00 MINUTES
MIN TIME NEEDED TO ACCUMULATE HOURLY TOTALS.	54.00 MINUTES
THRESHOLD FOR HOURLY OUTLIER ACCUMULATION.	400.00 MM
HOURLY GAGE ACCUMULATION SCAN ENDING TIME.	0.00 MINUTES
MAX ACCUMULATION PER SCAN-TO-SCAN PERIOD.	400.00 MM
MAX ACCUMULATION PER HOURLY PERIOD.	800.00 MM

Format IX Precipitation Adaptation Data (sheet 3 of 4)

MINUTES AFTER CLOCK HOUR WHEN BIAS IS UPDATED.	50.00 MINUTES
THRESHOLD # OF GAGE/RADAR PAIRS NEEDED TO SELECT BIAS FROM TABLE.	10.00
RESET VALUE OF GAGE/RADAR BIAS ESTIMATE.	1.00
LONGEST AVAILABLE LAG FOR USE OF BIAS FROM BIAS TABLE.	168.00 HOURS
AWIPS SITE ID OF MOST RECENT BIAS SOURCE	XXX

Format IX Precipitation Adaptation Data (sheet 4 of 4)

VAD Algorithm Output MM/DD/YY HH:MM

ALT	U	V	W	DIR	SPD	RMS	DIV	SRNG	ELEV
100ft	m/s	m/s	cm/s	deg	kts	kts	E - 3/s	nm	deg
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X
XXX	XXX.X	XXX.X	XXX.X	XXX	XXX	XX.X	XXX.XXXX	XXX.XX	XX.X

Note: The column labels are described as follows:
ALT- Altitude above mean sea level in hundreds of feet;
U, V - Eastward, northward components of the wind in m/s;
W- Upward component of the wind in cm/s;
DIR - Standard wind direction in degrees;
SPD - Standard wind speed in knots;
RMS - Scatter between velocity points and the VAD fitted curve in knots;
DIV- Divergence of the wind in 10 per second;
SRNG - Slant range of the VAD analysis in nautical miles;
ELEV - Elevation angle of the VAD analysis in degrees;

Format X for VAD Wind Data to VWP Tabular Alphanumeric Block (TAB) (Sheet 1 of 3)

VAD Algorithm Output MM/DD/YY HH:MM

ADAPTABLE PARAMETERS - WIND PROFILE		
VAD ANALYSIS SLANT RANGE	16.2	NMI
BEGINNING AZIMUTH ANGLE	0.0	DEGREE
ENDING AZIMUTH ANGLE	0.0	DEGREE
NUMBER OF PASSES	2	
RMS THRESHOLD	9.7	KNOTS
SYMMETRY THRESHOLD	13.6	KNOTS
DATA POINTS THRESHOLD	25	

Format X Wind Profile Adaptable Parameters (Sheet 2 of 3)

ALTITUDES SELECTED

2000	3000	4000	5000	6000	7000
8000	9000	10000	11000	12000	13000
14000	15000	16000	17000	18000	19000
20000	21000	22000	24000	25000	26000
28000	30000	35000	40000	45000	50000
OPTIMUM SLANT RANGE			16.2		

Format X Wind Profile Adaptable Parameters (Sheet 3 of 3)

Radar Echo Classifier Adaptation Data

Variable Description	Format	Range	Units	Default
AP/Clutter Target Scaling Function Thresholds:				
Texture of Reflectivity generating a 0% likelihood	XX.X	0.0 - 80.0	dBZ**2	0.0
Texture of Reflectivity generating a 100% likelihood	XX.X	0.0 - 80.0	dBZ**2	45.0
Abs. value of Sign	X.X	0.0 - 1.0	--	1.0

of Refl. Change generating a 0% likelihood				
Abs. value of Sign of Refl. Change generating a 100% likelihood	X.X	0.0 - 1.0	--	0.0
Abs. value of (Refl. Spin Change - 50) generating a 0% likelihood	XXX.X	0.0 - 100.0	--	50.0
Abs. value of (Refl. Spin Change - 50) generating a100% likelihood	XXX.X	0.0-100.0	--	0.0
Abs. value of Mean Velocity generating a 0% likelihood	XX.X	0.0 - 10.0	m/s	2.3
Abs. value of Mean Velocity generating a 100% likelihood	XX.X	0.0-10.0	m/s	0.0
Standard Deviation of Velocity generating a 0% likelihood	X.X	0.0 - 5.0	m/s	0.7
Standard Deviation of Velocity generating a 100% likelihood	X.X	0.0-5.0	m/s	0.0
Mean Spectrum Width generating a 0% likelihood	X.X	0.0 - 5.0	m/s	3.2
Mean Spectrum Width generating a 100% likelihood	X.X	0.0 - 5.0	m/s	0.0
AP/Clutter Target Spin Characteristic Thresholds:				
Spin Change Threshold	XX.X	0.0 - 20.0	--	2.0
Spin Reflectivity Threshold	XX.X	0.0 - 20.0	dBZ	5.0
AP/Clutter Target Category Weighting:				

Texture of Reflectivity weight	X.XX	0.0 - 1.0	--	1.0
Sign of Reflectivity Change weight	X.XX	0.0 - 1.0	--	1.0
Reflectivity Spin Change weight	X.XX	0.0 - 1.0	--	1.0
Mean Velocity weight	X.XX	0.0 - 1.0	--	1.0
Standard Deviation of Velocity weight	X.XX	0.0 - 1.0	--	1.0
Mean Spectrum Width weight	X.XX	0.0 - 1.0	--	1.0
Extents for Radial Processing:				
Azimuthal Extent	X	1-4	Radials	1
Reflectivity Range Extent	X	1-4	Bins	2
Doppler Range Extent	X	1-8	Bins	4

Format XI Radar Echo Classifier Adaptable Parameters (Sheet 1 of 1)

[product name]1	([product mnemonic])
RPG Name: XXXX Date: MM/DD/YYYY Time: HH:MMZ2	
Starting Date:................	MM/DD/YYYY
Starting Time:................	HH:MMZ2
Ending Date:..................	MM/DD/YYYY
Ending Time:..................	HH:MMZ2
Maximum Snow Depth:...	X.XX inches3
Azimuth of Maximum Value:.....	XXX degrees
Range to Maximum Value:.......	XXX nautical miles
Range/height Correction Applied:	Static
Missing Time:.................	XXX minutes

NOTE 1: Product names and product mnemonics are “ONE HOUR SNOW WATER EQUIVALENT (OSW)”, “ONE HOUR SNOW DEPTH (OSD)”, “STORM TOTAL SNOW WATER EQUIVALENT (SSW)”, and “STORM TOTAL SNOW DEPTH (SSD)”, “USER SELECTABLE SNOW WATER EQUIVALENT (USW)”, and “USER SELECTABLE SNOW DEPTH (USD)”.

NOTE 2: Times are in UTC and are followed by a “Z”.

NOTE 3: One Hour Snow Water Equivalent (OSW) and Storm Total Snow Water Equivalent (SSW) products will have the “Maximum Snow Water Equivalent” listed instead of the “Maximum Snow Depth”.

FORMAT XII One-hour and Storm Total Snow Accumulation (sheet 1 of 2)

Snow Accumulation Algorithm Configuration Parameters	
RPG Name: XXXX Date: MM/DD/YYYY Time: HH:MMZ	
Z-S Multiplicative Coefficient.......................................	XXX.X
Z-S Power Coefficient...	X.X
Snow - Water Ratio...	XX.X in/in
Minimum Reflectivity/Isolated Bin Threshold............	X.X dBZ
Maximum Reflectivity/Outlier Bin Threshold..............................	XX.X dBZ
Base Elevation for Default Range Height Correction.................	X.X deg
Minimum Height Correction Threshold........................	X.X km
Range Height Correction Coefficient #1.....................	X.XXXX
Range Height Correction Coefficient #2.....................	X.XXXX
Range Height Correction Coefficient #3.....................	X.XXXX
Time Span Threshold.......................................	XX min
Minimum Time Threshold....................................	XX min
Use RCA Correction Flag (RCA Currently Not Available).......	XXX

FORMAT XII One-hour and Storm Total Snow Accumulation (sheet 2 of 2)_
[product name]1 ([product mnemonic])

[product name]1	([product mnemonic])
RPG Name: XXXX Date: MM/DD/YYYY Time: HH:MMZ2	
Starting Date:................	MM/DD/YYYY
Starting Hour:................	HH:MMZ2
Ending Date:..................	MM/DD/YYYY
Ending Hour:..................	HH:MMZ2
Maximum Snow Depth:...........	X.XX inches3
Azimuth of Maximum Value:.....	XXX degrees
Range to Maximum Value:.......	XXX nautical miles
Range/height Correction Applied:	Static
End Hour Requested:...........	HHZ2
No. of Hours Requested:.......	XX
Available Hours:..............	XX4
HHZ2 HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ HHZ	

NOTE 1: Product names and product mnemonics are “USER SELECTABLE SNOW WATER EQUIVALENT (USW)”, and “USER SELECTABLE SNOW DEPTH (USD)”.

NOTE 2: Times are in UTC and are followed by a “Z”.

NOTE 3: The User Selectable Snow Water Equivalent (USW) product will have the “Maximum Snow Water Equivalent” listed instead of the “Maximum Snow Depth”.

NOTE 4: For the list of available hours, all available hours (in UTC) are listed, even if the hours aren’t included in the product due to the number of hours requested. Up to 30 hours can be listed.

FORMAT XIII User Selectable Snow Accumulation (sheet 1 of 2)

Snow Accumulation Algorithm Configuration Parameters	
RPG Name: XXXX Date: MM/DD/YYYY Time: HH:MMZ	
Z-S Multiplicative Coefficient............................	XXX.X
Z-S Power Coefficient....................................	X.X
Snow - Water Ratio..	XX.X in/in
Minimum Reflectivity/Isolated Bin Threshold................	X.X dBZ
Maximum Reflectivity/Outlier Bin Threshold.................	XX.X dBZ
Base Elevation for Default Range Height Correction..........	X.X deg
Minimum Height Correction Threshold........................	X.X km
Range Height Correction Coefficient #1.....................	X.XXXX
Range Height Correction Coefficient #2.....................	X.XXXX
Range Height Correction Coefficient #3.....................	X.XXXX
Time Span Threshold..	XX min
Minimum Time Threshold....................................	XX min
Use RCA Correction Flag (RCA Currently Not Available).......	XXX

FORMAT XIII User Selectable Snow Accumulation (sheet 2 of 2)

Variable Description	Format	Range	Units	Default2
(ADAPTATION DATA)	{ADAP(nn)}1			
Default Melting Layer Depth	{X.X}	0.0 - 3.0	Km	0.5
Manual Override Flag	{ T or F }	T - F	N/A	F
Kdp Multiplier Coefficient	{XX}	10 - 1000	N/A	44
Kdp Power Coefficient	{X.XXX}	0.010 - 1.000	N/A	0.822
Z-R Multiplier Coefficient	{XXX}	30 - 3000	N/A	300
Z-R Power Coefficient	{X.X}	1.0 - 2.5	N/A	1.4
Zdr/Z Multiplier Coefficient	{X.XXXX}	0.1 - 10.0	N/A	0.0142
Zdr/Z Power Coefficient for Z	{X.XXX}	-5.0 - 5.0	N/A	0.770
Zdr/Z Power Coefficient for Zdr	{X.XX}	-5.0 - 5.0	N/A	-1.67
Minimum Correlation Coef. For Precip	{X.XXXX}	-1.0 - 1.0	N/A	0.8500
Minimum Correlation Coef. For Kdp	{X.XXXX}	-1.0 - 1.0	N/A	0.9000
Maximum Reflectivity	{XX.X}	45.0 - 60.0	dBZ	53.0
Maximum Kdp Beam Blockage	{XX}	0 - 100	%	70
Maximum Usability Blockage	{XX}	0 - 100	%	50
Minimum Kdp Usage Rate	{XX.X}	0.0 - 50.0	mm/hr	10.0
Wet Snow Multiplicative Coefficient	{X.X}	0.0 - 5.0	N/A	0.6
Graupel Multiplicative Coefficient	{X.X}	0.0 - 5.0	N/A	0.8
Rain/Hail Multiplicative Coefficient	{X.X}	0.0 - 5.0	N/A	0.8
Dry Snow Multiplicative Coefficient	{X.X}	0.0 - 5.0	N/A	2.8
Crystals Multiplicative	{X.X}	0.0 - 5.0	N/A	2.8

Coefficient				
% Rate Grid Filled Threshold	{XXX.X}	90.0 - 100.0	%	99.7
PAIF Precipitation Rate Threshold	{X.X}	0.5 - 50.0	mm/hr	0.5
PAIF Precipitation Area Threshold	{XXXXX}	0 - 82800	km2	80
Precipitation Detection Time Threshold	{XX}	0 - 1400	mins	60
Number of Exclusion Zones	{XX}	0 - 20	N/A	0
Threshold Elapsed Time to Restart	{XX}	45 - 60	mins	60
Maximum Time for Interpolation	{XX}	15 - 60	mins	30
Maximum Hourly Accumulation Value	{XXX}	50 - 1600	mm	800
Time Bias Estimation	{XX}	50 - 59	mins	50
Thresh. No. Gage-Radar Pairs	{XX}	6 - 30	N/A	10
Reset Bias Value	{X.X}	0.5 - 2.0	N/A	1.0
Longest Allowable Lag	{XXX}	100-1000	hours	168
SUPPLEMENTAL DATA (RATE ALG)	{SUPL(nn)}1			
Scan Date	{XXXXX}	0 - 32767	Julian Date	--
Scan Time	{XXXXX}	0 - 86399	sec	-
Flag Precip Detected	{ T or F }	T - F	--	--
Flag Storm Total Active	{ T or F }	T - F	--	--
Flag Precip Begin	{ T or F }	T - F	--	--
Last Date Precip	{XXXXX}	0 - 32767	Julian Date	--
Last Time Precip	{XXXXX}	0 - 86399	sec	--
Percent of Hybrid Rate Filled	{XX.XX}	90.00 - 100.00	%	--
Highest Elevation Angle Used	{XX.X}	0.5 - 19.5	deg	--
Total Precipitation Area	{XXXXXX.X}	0.0-169190.0	km2	--
Spot Blanking Volume Status	0 or 1	0 - 1	--	--
(BIAS-RELATED FIELDS)	{BIAS(nn)}1			
Time Bias Value Last Updated	{XXXXX}	0 - 86399	sec	--

Locally				
Date Bias Value Last Updated Locally	{XXXXX}	0 - 32767	Julian Date	--
Time of Last Update of Local Bias Table	{XXXXX}	0 - 86399	sec	--
Date of Last Update of Local Bias Table	{XXXXX}	0 - 32767	Julian Date	--
Observation Time of Latest Bias Table	{XXXXX}	0 - 86399	sec	--
Observation Date of Latest Bias Table	{XXXXX}	0 - 32767	Julian Date	--
Generation Time of Latest Bias Table	{XXXXX}	0 - 86399	sec	--
Generation Date of Last Bias Table	{XXXXX}	0 - 32767	Julian Date	--
Gage Bias Applied	{YES, NO}	YES - NO		NO
Mean-Field Bias Estimate	{XX.XXXX}	.0001-99.9999	--	--
Effective G-R Pair Sample Size	{XXX.XX}	0.00-999.99	--	--
Memory Span used in Bias Estimate	{XXXXXXXX}	0.001-10.**7	--	--
AWIPS Site ID of Most Recent Bias Source	{XXX}	alphanumeric	N/A	--

NOTE 1: The alphanumeric data package of the DSA product (#172) is contained in the last (i.e., 2nd) layer of the product. It is formatted using Text and Special Symbols Packet Code 1: Write Text (No Value). (See RPG/Associated PUP ICD for details.) It contains three "sub-layers" of information: Adaptation Data, Supplemental Data (QPE Rate Algorithm only), and Bias-related parameters (for future implementation). Each sub-layer is preceded by an 8-character field containing a mnemonic for the data type followed by the number of elements of that type to follow (i.e., "ADAP(nn)", followed by "SUPL(nn)" and "BIAS(nn)").

NOTE 2: The alphanumeric data sub-layer contains values only (i.e., no preceding descriptive information), but the values are always listed in the exact order seen above. Each value is given in a field of 8 ASCII characters, as seen in the "Format" column (which, alone, contains the entire contents of the alphanumeric data sub-layer of the product). The meaning of each field can be ascertained from the additional columns, above.

Format XIV. Digital Storm Total Accumulation (DSA)

STORM TOTAL ACCUMULATION	
RADAR ID: XXXX DATE: MM/DD/YY TIME: HH:MM	
VOLUME COVERAGE PATTERN: XXX MODE: XXXXXXXXX {Precip or Clear-Air}	
GAGE BIAS APPLIED	- {YES, NO}
BIAS ESTIMATE	- { XX.XXXX }
EFFECTIVE # G/R PAIRS	- { XXX.XX }
MEMORY SPAN (HOURS)	- { XXXXXXXX }
DATE/TIME LAST BIAS UPDATE	- {MM/DD/YY HH:MM}
HYBRID RATE PERCENT BINS FILLED	- {XXX.XX}
HIGHEST ELEV. USED (DEG)	- {XX.X}
TOTAL PRECIP AREA (KM**2)	- {XXXXXX.X}
AWIPS Site ID of Most Recent Bias Source	- {XXX}

Format XV: Storm Total Accumulation TAB (Sheet 1 of 3)

Default Melting Layer Depth	X.X	km		Max Kdp Beam Blockage	XX	%
Use MLDA Heights	XXX			Max Usability Blockage	XX	%
Kdp Multiplier Coefficient	XX			Min Kdp Usage Rate	XX.X	MM/HR
Kdp Power Coefficient	X.XXX			Wet Snow Mult Coeff	X.X	
Z-R Multiplier Coefficient	XXX			Graupel Mult Coeff	X.X	
Z-R Power Coefficient	X.X			Rain/Hail Mult Coeff	X.X	
Zdr/Z Multiplier Coeff	X.XXXX			Dry Snow Mult Coeff	X.X	
Zdr/Z Power Coefficient for Z	X.XXX			Crystals Mult Coeff	X.X	
Zdr/Z Power Coefficient for Zdr	X.XX			% Rate Grid Filled Threshold	XX.X	%
Min Correl Coef For Precip	X.XXXX			PAIF Precip Rate Threshold	X.X	mm/hr
Min Correl Coef for Kdp	X.XXXX			PAIF Precip Area Threshold	XXXXX	km^2
Max Reflectivity	XX.X	dBZ		Precip Detection Time Threshold	XX	min

Format XV: Storm Total Accumulation TAB (Sheet 2 of 3)

Number Of Exclusion Zones	XX	
Threshold Elapsed Time to Restart	XX	MINUTES
Maximum Time for Interpolation	XX	MINUTES
Maximum Hourly Accumulation Value	XXX	MM
Time Bias Estimation	XX	MINUTES
Threshold Number of Gage-Radar Pairs	XX	
Reset Bias Value	X.X	
Longest Allowable Lag	XXX	HOURS

Format XV: Storm Total Accumulation TAB (Sheet 3 of 3)