ORDER

7110.76B

3/12/84

SUBJ NARROWBAND WEATHER SUBSYSTEM

1. PURPOSE. This order provides Air Route Traffic Control Center (ARTCC) personnel with a description of the Narrowband Weather Subsystem and operational guidelines for its use.

2. DISTRIBUTION. This order is distributed to selected Washington, Regional, Area, Mike Monroney Aeronautical Center, and FAA Technical Center Offices; and all ARTCC's.

3. CANCELLATION. Order 7110.76A, Narrowband Weather Subsystem, dated April 24, 1980, is canceled.

4. ACTION.

a. The weather #1 and #2 keys will be selected in accord with weather and operational requirements. Both keys shall be selected when providing ATC radar inflight weather-avoidance assistance.

b. Facility management shall make every effort to minimize the use of circular polarization (CP) when the Narrowband Weather Subsystem is in use.

c. Facility management shall ensure that appropriate operational personnel are fully cognizant of any change in a radar system's polarization mode.

5. BACKGROUND.

a. Under the present system weather returns are detected and processed by the Weather Fixed Map Unit (WFMU) and Common Digitizer (CD) located at the radar site and transmitted to the ARTCC for further processing and display by the central computer complex and display channel equipment. The detected weather is digitized at two levels, low and high intensity, which outlines weather in general terms only.

b. Thunderstorms may encompass areas of both precipitation and nonprecipitation. Hence, the radar weather contour displayed on a Plan View Display (PVD) may represent only part of the storm area. Turbulence may, or may not, be collocated with an area of radar reflectivity. It may, in fact, be anywhere in the storm area.

c. FAA Advisory Circular AC 006A advises pilots, when using airborne weather radar, ". . . that hail may fall several miles from the cloud, and hazardous turbulence may extend as much as 20 miles from the cloud. Avoid the most intense echoes by at least 20 miles; that is, echoes should be separated by at least 40 miles before you fly between them. As echoes diminish in intensity, you can reduce the distance by which you avoid them."

984

d. Knowledge of the capabilities and limitations of radar systems is a prerequisite for ATC personnel using radar to provide in-flight weather avoidance assistance. The design of ATC radar systems is based upon maximum performance in detecting aircraft targets. Airborne weather radars, however, are designed for maximum weather detection capability. For this reason, it must be understood that the pilot's view of the radar weather picture may be different from that of ATC personnel.

6. RELATED DOCUMENTS.

a. Airman's Information Manual.
b. Advisory Circular 00-6A, Aviation Weather (3-3-75).
c. Advisory Circular 00-24B, Thunderstorms (1-20-83).

7. MEASURING PRECIPITATION INTENSITY. The Narrowband Weather Subsystem is able to measure the signal strength or radar returns from precipitation to obtain an indication of storm intensity.

a. It does not display areas of light precipitation intensity which are considered to be operationally insignificant.

b. When weather keys #1 and #2 are selected, two levels of precipitation intensity may be presented on the PVD. The less intense areas by radial-lines which radiate outwards from the radar site; and the more intense areas which are framed by H symbols.

8. RADIAL-LINE AND H UPDATING CYCLE.

a. The subsystem displays only 1/3 of the H's or 1/3 of the radial-lines every other scan, requiring 12 scans to complete the full weather presentation on the PVD.

(1) Scans 2, 4, and 6 process digital messages for the H's with the radial-lines being processed on scans 8, 10, and 12.

(2) It takes 120 seconds or 144 seconds, depending on radar rotation speed, to update the total weather presentation that is displayed.

9. RADIAL-LINE LATERAL SPACING AND LENGTH.

a. When the output resolution setting is on "HIGH," lateral spacing between the radial-lines decreases with increases in distance from the radar site:

(1)	0 NM to 40 NM	2.8°
(2)	40 NM to 80 NM	1.4°
(3)	80 NM to 136 NM	0.7°
(4)	136 NM to 200 NM	0.35°

b. When the output resolution setting is on "LOW," the lateral spacing between radial-lines will be double the degree values in 9.a.

c. The length of the distance between the radial-line start-point and stop-point will always be greater than 1/2 NM.

d. The lateral spacing of H's, and the length of the distance between H start-and stop-points, is the same as for radial-lines.

10. WEATHER #1 (RADIAL-LINE) AND #2 (H) KEYS.

a. Radial-lines represent all precipitation intensities normally observed on a Broadband Radar PVD in linear polarization (LP) mode except those which are considered to be operationally insignificant (see paragraphs 5 and 10).

b. The areas between H's represent the higher precipitation intensities found in the cores of moderate to severe thunderstorms. This contour should resemble but cover a smaller area than the same weather displayed on a Broadband Radar PVD operating in circular polarization (CP) mode.

c. When the precipitation intensity in a given area just barely qualifies for an H symbol, the precipitation may be only moderate. On the other hand, if the precipitation intensity greatly exceeds the H parameter, the storm is apt to be severe. Since the controller does not know which situation exists, he should, in the absence of other information, consider the "worst case."

11. SYSTEM LIMITATIONS AND ENHANCEMENTS.

a. The Narrowband Weather Subsystem is unusable within a 8 NM radius of the radar site because of site adapted minimum weather processing range and because radar weather returns may be omitted or distorted by the cone of silence over the radar antenna.

b. Narrowband weather is restricted to 200 NM, and due to antenna tilt requirements limited weather data will be displayed below FL 350 and 200 NM.

c. A separate brightness/dimmer control for radial lines and H's was installed with the five level PVD brightness functions which "enhance" controller's ability to track aircraft through areas of weather clutter without deselecting console weather keys #1 and #2.

d. Although operational tests indicate it is a rare occurrence, it is possible for the common digitizer to become saturated with targeted data. If this occurs, the display will not update in normal fashion. Segments of previously displayed precipitation data will not be updated and the display will take on a spoking appearance.

e. Anomalous propagation (AP) may cause ground targets to be detected at abnormally long ranges. These targets sometime appear similar to weather targets. This can be effectively countered by the use of moving target indicator (MTI) circuits. Unfortunately, MTI also reduces the radar's weather detection capability. An important cause of AP is the temperature and moisture gradients which can be formed by the divergent downdraft of a thunderstorm. Except for thunderstorm situations, AP conditions rarely occur during periods of precipitation.

f. When neither the start-point or stop-point of a particular radial-line, or pair of H's, is contained within one PVD, as in the case of an intermediate (middle) sector, the PVD in question will not display the radial-line or either of the H's. This is considered to be a relatively uncommon occurrence which is only apt to happen when the intermediate sector airspace involved is inordinately small.

g. The range resolution of the 200 NM weather fixed map unit (WFMU) is increased at 40, 80, and 136 NM and if a high intensity weather message start-point is equal to 40, 80, or 136 NM, the "H" symbol will not be displayed. The reason for this restriction is to prevent an undesirable ring of symbology from being generated at the range resolution crossover.

c. Facility management shall ensure that appropriate operational personnel are fully cognizant of any change in a radar system's polarization mode.

12. BROADBAND/NARROWBAND WEATHER COMPARISONS. It is important for ATC personnel to understand, when comparing Broadband to Narrowband, that a Broadband Radar PVD is expected to display more weather data than any Narrowband PVD, using the same radar system and polarization mode, because the Broadband system does not screen out the lower intensity precipitation (see 6.a.)

13. CP VERSUS LP. The use of CP circuits significantly degrades storm detection in both Broadband and Narrowband environments. However, the use of CP in the Narrowband environment will be much less commonplace because:

a. Narrowband produces less weather data because it screens out light precipitation intensities.

b. It is easier to track an aircraft target through radial-lines and H's than through Broadband's solid weather clutter.

c. The weather brightness/dimmer controls will allow the display of weather data as background data and reduce its impact on scope clutter.

d. Narrowband's deselect capability (keys #1 and #2) permits weather clutter to be completely eliminated if required by operational circumstances.

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