Example of Terminal Digital Radar Weather Display *(photo courtesy of AOPA)*

Introducing Revised ATC Terms for Describing Radar Weather Echoes to Pilots

by Christine Soucy and Michael Lenz

When thunderstorm season begins this year, pilots will start hearing some very important changes in the way Air Traffic Control (ATC) describes radar weather echoes to pilots. Beginning in late spring 2006, pilots will hear ATC use four terms, "light," "moderate," "heavy," and "extreme" to describe weather radar echoes. Each term represents a precipitation intensity level paired with a dBZ range (Figure 1) to help pilots interpret the severity of the flight conditions present. (A dBZ is a measure of radar reflectivity in the form of a logarithmic power ratio [in decibels or dB] with respect to radar reflectivity factor "Z.") The four terms will be used universally in the National Airspace System (NAS) by approach controllers and Air Route Traffic Control Center (ARTCC) and Automated Flight Service Station (AFSS) specialists. The decision to standardize the terminology was easy to make because the ARTCC facilities and many of the terminal approach control facilities now have digital radar display systems with processors that can better determine the intensity (dBZ) of radar weather echoes and display that information to the controller.

Most of us are familiar with The *Weather Channel* and local news and weather broadcasts that use the

Figure 1

ATC Weather Radar Terms	dBZ Reflectivity Levels
LIGHT	< 30 dBZ(not available to ARTCC)
MODERATE	30 to 40 dBZ
HEAVY	>40 to 50 dBZ
EXTREME	>50 dBZ

Doppler NEXRAD (next generation radar) WSR 88D weather radar. Some of you may even use those broadcasts to supplement your flight planning and overall weather awareness. However, there are significant differences with how weather information is displayed on a controller's radarscope and the local news weather broadcast depictions. NEXRAD is designed to detect and display weather, but ATC radar systems are designed to detect and display aircraft. Because the NEXRAD color coding and 16 individualized precipitation levels can provide excess clutter and possibly compromise the ability of controllers to safely perform their duties, different systems for depicting weather radar echoes needed to be developed for the ATC environment.

In air route traffic control centers, NEXRAD data is fed through the Weather And Radar Processor (WARP) that organizes the 16 NEXRAD levels into four reflectivity (dBZ) categories. (See Figure 1). Reflectivity returns of less than 30 dBZ are classified as "LIGHT" and are filtered out of the center controllers' display. The remaining three categories correlate to bands of dBZ values to assist pilots in evaluating the severity of flight conditions that might be associated with those precipitation returns. Therefore, the wide range of color coding available to NEXRAD is not available to the controller and, as you can see in Figure 2, the ARTCC's WARP system does not display dBZ levels below 30, therefore center controllers will not be able to report areas of "light" weather radar echoes.

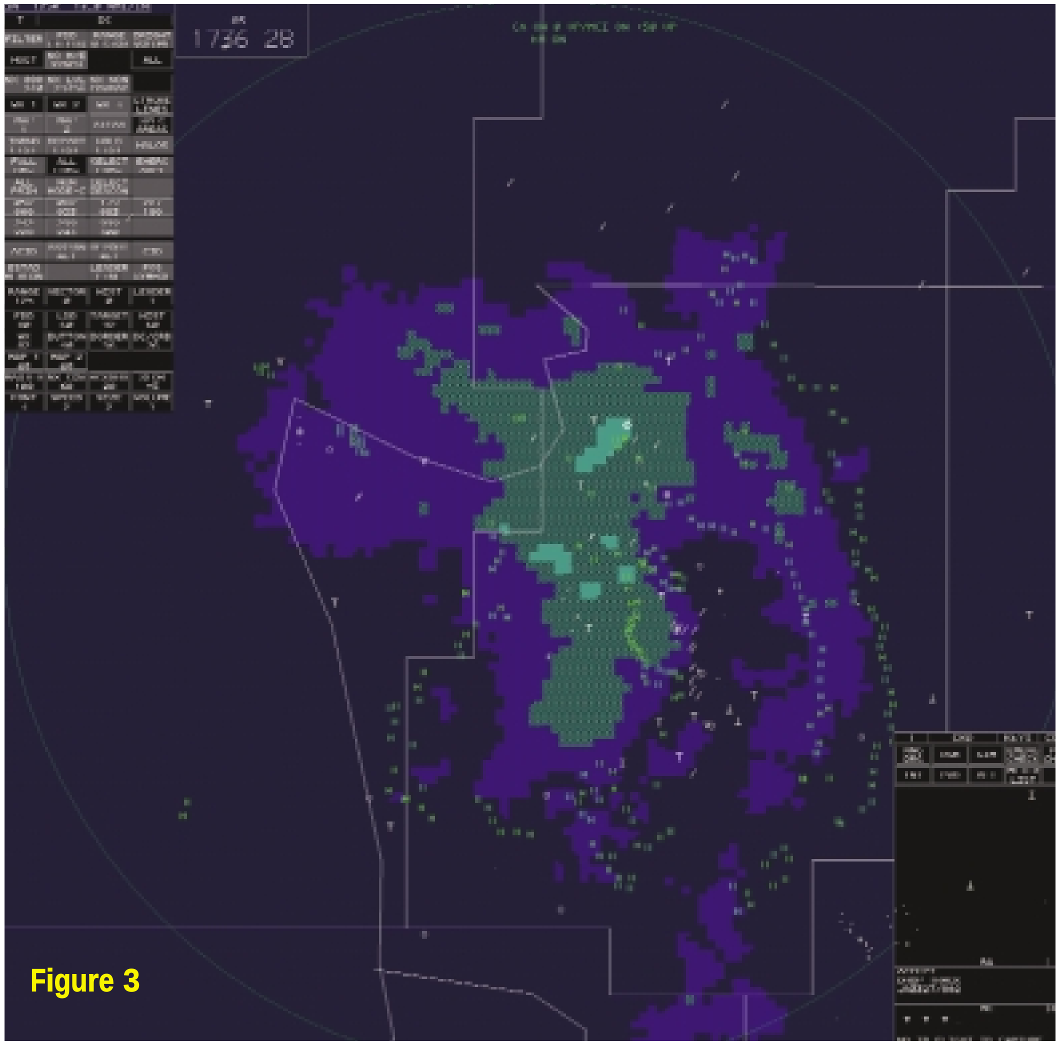


Figure 3

ARTCC Displaying both WARP/NEXRAD (color) and ARSSR (/////'s and HHHH's) depicting moderate through extreme precipitation

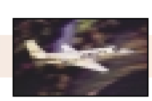
WARP/NEXRAD is a vast improvement over the Air Route Surveillance Radar (ARSR) display of weather radar echoes that center controllers used exclusively prior to the implementation of the NEXRAD type weather radars. The ARSR displays the echoes to the controller by indicating "moderate" intensities with a slash mark "/" and more intense areas with the letter "H" (see Figure 3 for an example of an ARSR and WARP display).

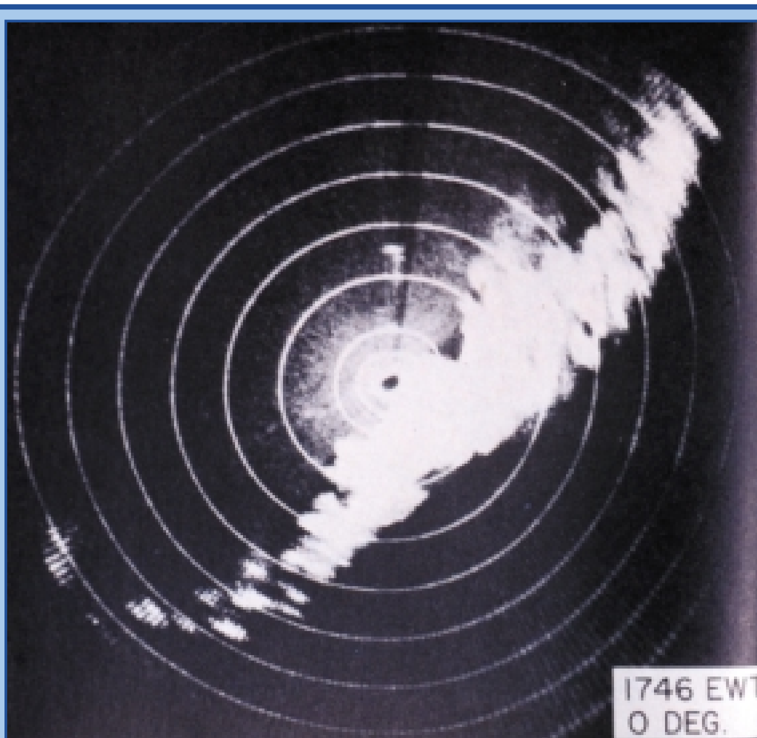
Figure 2

ATC Weather Radar Terms used in ARTCC	dBZ Reflectivity Levels
MODERATE	30 to 40 dBZ
HEAVY	>40 to 50 dBZ
EXTREME	>50 dBZ

In the approach control world, neither NEXRAD nor WARP is available. Instead, radar weather echoes are displayed by the Airport Surveillance Radar (ASR) systems using Common Automated Radar Terminal System (Common ARTS) or Standard Terminal Automation Replacement System (STARS) digital processors. The digitized ASR 9 and 11 systems (and some ASR 8 systems that have been digitized) paired with a weather processor, display the four weather radar echo intensity categories (see Figure 1) to the controller. Terminal facilities can and do display "light" (less than 30 dBZ) areas of precipitation.

Of course, there are no absolutes. In the universe of terminal radars, the NAS still has a few non-digital ASR systems. While these systems do a good job of displaying weather radar





Precipitation echo depiction similar to non-digital ATC display - Intensity is unknown

echoes, they lack processors that can discern the intensity of the echoes. These facilities will not be able to use the terms, "light," "moderate," "heavy," or "extreme." Controllers who work from these displays will be able to tell pilots the position of weather radar echoes but will state, "intensity unknown" because their system does not indicate what dBZ level of reflectivity is present.

In the world of ATC, weather radar echoes are all referred to as "precipitation" even though, technically, it is possible the echo could be associated with birds, volcanic ash, etc., or precipitation that is not reaching the Earth's surface (virga). Controllers will tell pilots the location of significant areas of "precipitation" when it appears that it may affect the aircraft's flight path. They will also provide assistance in the form of course deviations when requested by the pilot.

Rainfall rates (i.e., inches/hour) as they relate to intensity (dBZ) have not been correlated with the ATC displays. Therefore, the terms (light/moderate/heavy/extreme) cannot be equated/correlated to rates of rainfall per se, at this time. Generally however, the more intense the echo, the more likely there is to be greater intensities of precipitation; and when conditions are favorable for convective activity, turbulence and other weather hazards should be expected. As the intensity of precipitation increases, so too, does the likelihood of more severe weather conditions. Pilots should also remember that turbulence can be present in areas where ATC does not display precipitation at all. Therefore, pilots should always exercise care when transiting areas of known or suspected convective activity.

Pilots of light general aviation aircraft should even approach areas of "light" precipitation with caution. A rapidly growing thunderstorm can increase at a rate of 6,000 feet per minute! Think of the time-lapse photographs and weather radar loops showing building thunderstorms. "Light" precipitation could grow to "moderate" and "heavy" levels within a very short period of time, given the right conditions. The following tips are offered to assist pilots in navigating stormy skies safely.

- Request course deviations early. Don't wait until the last moment.
- Ask for information updates as needed. The ARTCC WARP/NEXRAD updates every one to six minutes. Terminal (ASR based) systems show near "real time" echoes.
- Make sure the controller understands what services you want.
- Maintain situational awareness concerning your position and the weather areas you wish to avoid.
- Include the information that you are on a heading assigned/approved by ATC for weather avoidance, when you report onto the next controller's frequency.
- Verify what additional services ATC is providing to you. Is it what you need?

PIPE UP WITH A PIREP!

Pilot reports (PIREP) of flight conditions are an invaluable source of information for other pilots and controllers as well. PIREPs should include reports of turbulence, icing, cloud tops and bases, intensity of rain, presence of hail, sleet, etc. A PIREP is often the only source of information regarding actual flight conditions a pilot may encounter. Do your part for flight safety and pipe up with a PIREP!

PIREP REPORTING FORMAT

For anyone who has never submitted a PIREP, the *Aeronautical Information Manual* (AIM) explains how to submit one, the uses of a PIREP, and the format a pilot should use in reporting information. AIM paragraph 7-1-21, Pilot Weather Reports, is the reference. Table 7-1-6, PIREP Element Code Chart, explains the reporting format with the elements explained.

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