

Wind Farms and the WSR-88D: An Update

INTRODUCTION

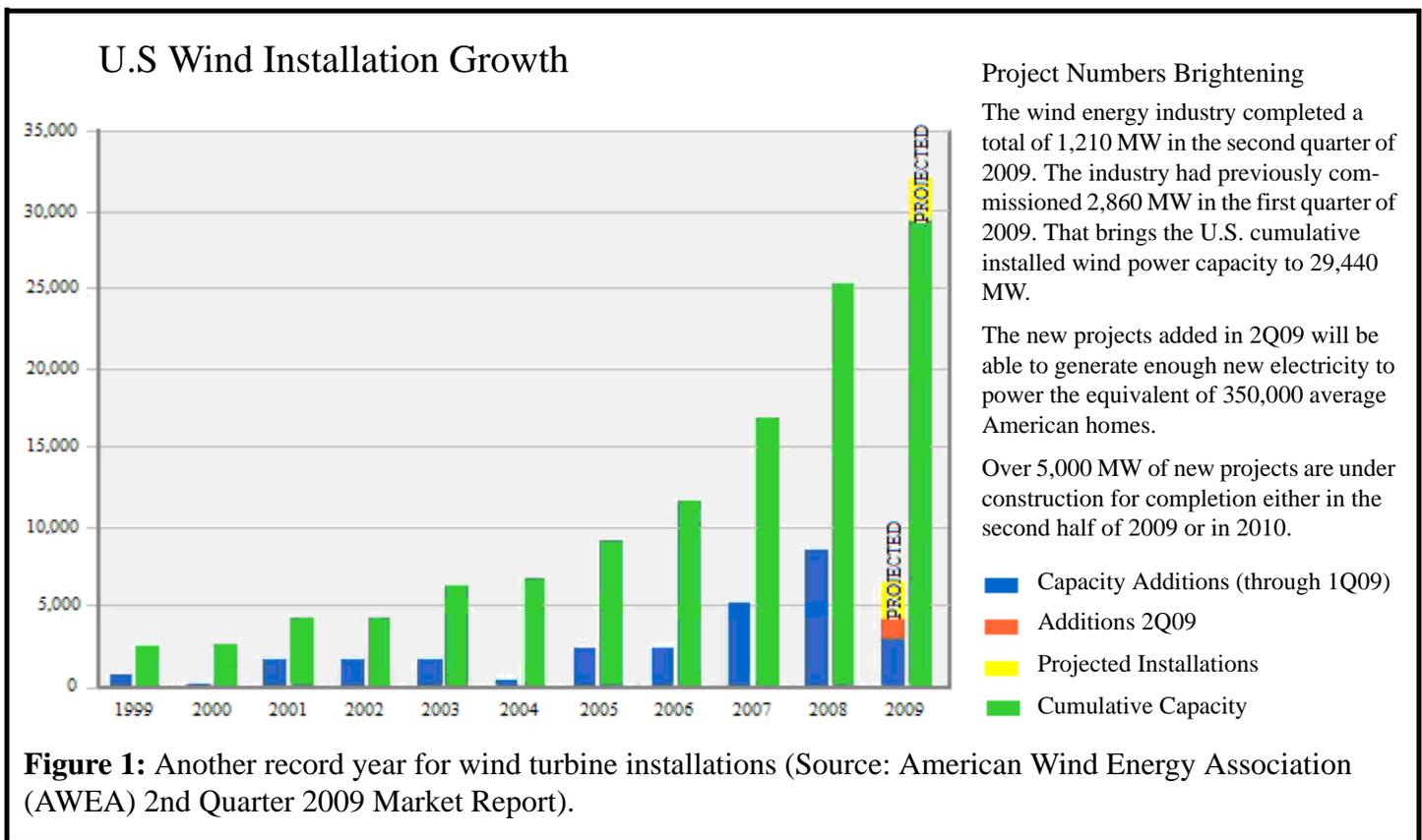
This article is an update to “Wind Farms: Coming Soon to a WSR-88D Near You” published in the last edition of *NEXRAD Now*. Many changes have occurred in the Radar Operations Center’s (ROC) efforts to work with field sites and wind farm developers since the last article, which will be discussed. In addition, we will provide an update on ROC plans for the future and actions WSR-88D operators can take to help the ROC. Those unfamiliar with the potential for WSR-88D and wind farm/wind turbine interaction, please visit last year’s *NEXRAD Now* article and/or the Wind Farm Interaction section on the ROC web site (<http://www.roc.noaa.gov/WSR88D/>) for more background information.

Wind power is one of the primary renewable energy sources being aggressively pursued by government and industry, as one solution to our fossil

fuel dependence. In July 2008, the Department of Energy released a feasibility study on wind energy (20 % Wind Power by 2030, Increasing Wind Energy’s Contribution to U.S. Electricity Supply), which provides a roadmap for reaching the report title’s goal. This report can be found at <http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf>. Currently, only ~2% of the Nation’s total electric supply comes from wind power, thus most of the wind farm construction is yet to occur. Figure 1 depicts another record year for wind turbine installations.

Due to several reasons (e.g., adequate low-level wind resources, power transmission infrastructure) the distribution of wind farms is not and will not be uniform across the country. Figure 2 shows the installed wind energy capacity by state. The growth in the number of wind farms and the fact that opti-

Continued on Page 18



Wind Farms

Continued from Page 17

mum wind farm locations are similar to WSR-88D siting preferences – relatively high, unobstructed terrain - suggests the number of wind farms developed near WSR-88Ds is likely to increase.

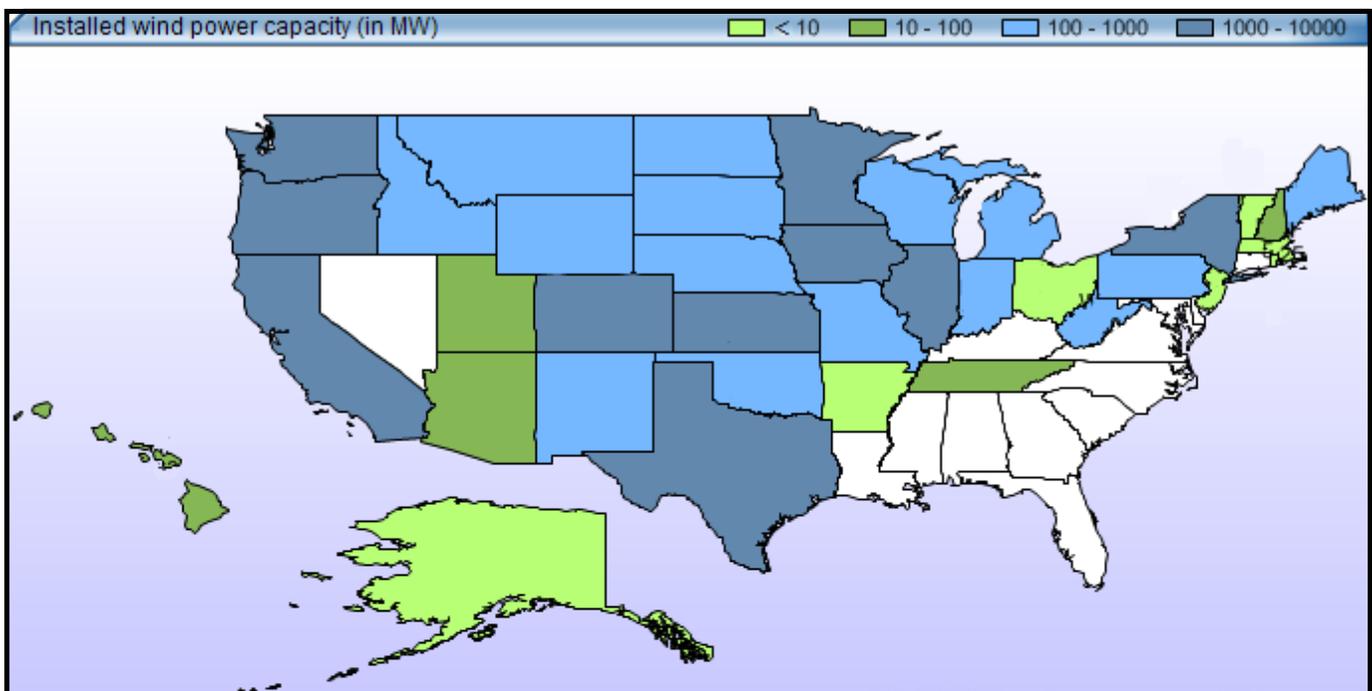
One may ask, “Why should I care about all these new wind farms?” Well, it turns out that rotating wind turbines in the line of sight of the radar can show up very strongly on all three base products (R, V, SW) and some derived products (e.g., precipi-

tation accumulation estimates) of the WSR-88D, even with appropriate clutter filtering applied. The impacted radar data is often referred to as “wind turbine clutter (WTC).”

ROC CHANGING HOW IT EVALUATES WIND TURBINE IMPACTS

During the year, the ROC and affected WSR-88D operators have gained more experience in observing and “working around” WTC. The ROC

Continued on Page 19



State Facts

Texas again gains the largest amount of new capacity bringing the state past the 8-GW mark.

Iowa passed the 3-GW mark with 160 MW of new capacity in the second quarter. It now has a total of 3,043 MW installed, consolidating its position as #2, behind Texas and ahead of California.

The state posting the fastest growth in the 2nd quarter was Missouri, where wind power installations expanded by 90%.

Kansas moved into the “Gigawatt Club” in the 1st quarter of 2009. Nine states now have more than 1,000 MW of wind power capacity installed.

There are now utility-scale wind power installations in 35 states.

Figure 2: Installed wind power capacity (MW) for each state as of July 2009. (Source: American Wind Energy Association (AWEA) 2nd Quarter Market Report.)

Wind Farms

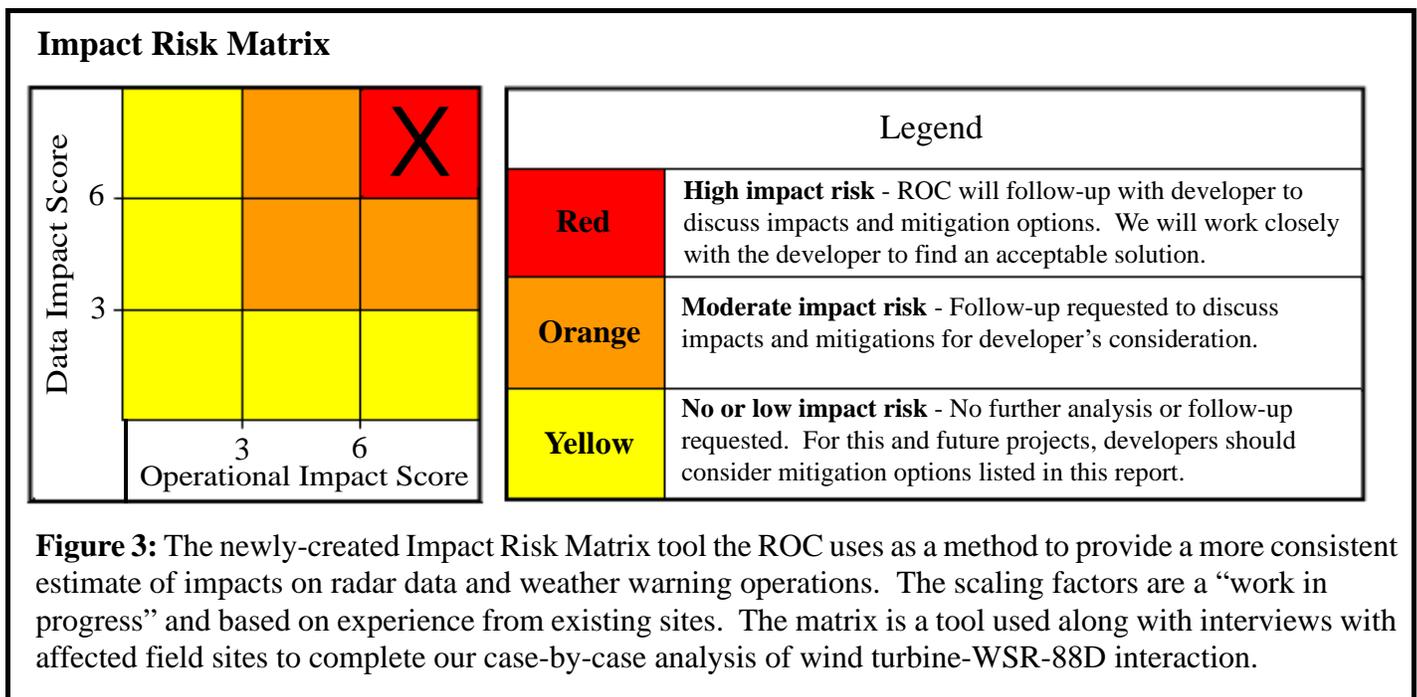
Continued from Page 18

analysis process now considers the potential impact on radar data and potential impact on weather warning operations separately.

There can be situations of a “high or moderate” impact on radar data, products, or imagery, but forecasters can “work around” the impacts without degrading weather warning performance. We do not know precisely what distances or situations will cause weather warning operations impacts, but we know they are more likely to occur due to close proximity, intrusion of turbine blades into multiple

in the radar line of sight and their distance from a WSR-88D versus impacts on operations (Figure 4). While these distances are not absolute values and are situational dependent, the figure has helped us convey to developers the relationship between location and radar impacts.

In general, the public does not have as much radar interpretation experience as National Weather Service (NWS) or Department of Defense (DoD) forecasters. Thus, these users are more likely to incorrectly interpret radar data/products/imagery if the data contain wind turbine clutter, even when



radar angles, the number of turbines, the width of the wind farm with respect to the WSR-88D, and other considerations.

We have used distance between a WSR-88D and a wind farm as a primary, but not only, criteria for focusing our efforts on working with developers to mitigate potential impacts. Based on experience, the ROC has created the simplistic drawing of the estimated relationship between wind turbines

weather warning operations are not impacted. Some WFOs have undertaken educating their users by showing examples of wind turbine clutter imagery from their WSR-88D on their web sites. This is to help the public learn how, just as trained forecasters do, all data/product/imagery users should take the wind turbine signatures into account – just as they need to consider anomalous propagation, terrain blockage, migratory birds, etc., in radar

Continued on Page 20

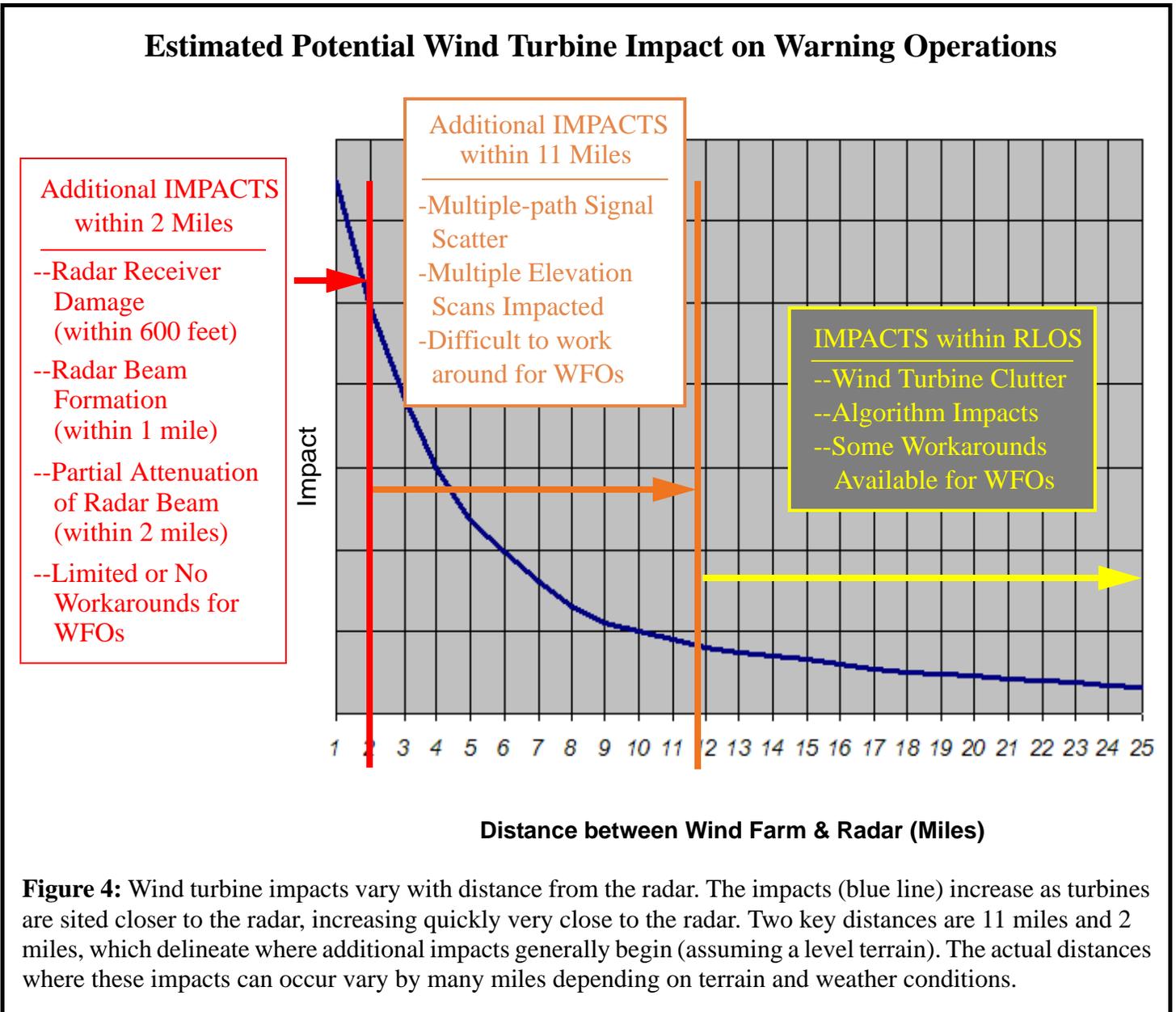
Wind Farms

Continued from Page 19

data. The ROC plans to add an external user section to the ROC web page to help users who do not use radar data frequently to be able to identify wind turbine clutter signatures on radar data.

product users to lessen any current or future potential wind turbine – radar impacts.

- Continue outreach and education efforts to the wind energy industry. In three years we have pro-



ROC PLANS

The ROC has several on-going and planned initiatives to work with the wind energy industry, help WSR-88D operators, and other WSR-88D data and

gressed from the wind energy industry not knowing the possible impacts on weather radars to many developers unilaterally contacting WFOs

Continued on Page 21

Wind Farms

Continued from Page 20

and the ROC for guidance on how to lessen any potential impacts on the WSR-88D.

- Continue to support Oklahoma University (OU) studies in regard to possible changes to the WSR-88D signal processor to mitigate wind turbine clutter.
- Continue to work with some WFOs and wind farm developers to explore the possibility of “operational curtailment” of wind turbines at select sites with “near” wind farms and under certain severe weather potential situations.
- Continue to work with some wind farm developers to explore the possibility of sharing real-time wind farm meteorological data, primarily wind, with WFOs.
- Provide WSR-88D operators a 2-page fact sheet they can use to help answer potential media and public questions in regard to potential wind farm impacts on the WSR-88D, and forecast and warning operations.
- Provide suggested talking points for staff use during media interviews concerning potential wind farm – WSR-88D impacts.
- Publish a 2-page fact sheet that is oriented to distribution to the public to inform them of the WSR-88D capabilities, uses in forecast and warning operations, and state generic facts about wind farm – radar interactions.
- Provide WSR-88D operators information of the location of known/constructed wind farms.
- Work with the American Wind Energy Association (AWEA) and developers to increase common understanding with respect to WSR-88D – wind farm interaction.
- Develop case studies of wind farm impacts on weather warning operations to provide better “work around” information for sites.
- Collaborate with the National Severe Storms Laboratory (NSSL) to provide .shp files of locations of existing wind farms.



WHAT FIELD SITES CAN DO TO HELP THE ROC

First, visit the ROC web site (http://www.roc.noaa.gov/windfarm/windfarm_index.asp) to learn more about the WTC issue.

Second, if site personnel learn about a wind farm development planned for their area, send the information via email to the ROC at: wind.energy.matters@noaa.gov. Wind farm developers are not required to notify us of planned wind farm developments. Sometimes our first knowledge of proposed wind farms comes from forecast offices that notice an announcement in a local newspaper or other source.

Third, if a site is already dealing with WTC and encounter cases that impact forecast and/or warning operations, the ROC needs to hear about them. WFOs may want to document wind turbine clutter impacts for their particular radar with the goal of

Continued on Page 22

Wind Farms

Continued from Page 21

developing a “climatology” of the clutter (how often, under what conditions, products affected, etc.) We are interested in collecting significant impact cases (missed or delayed weather warnings) from around the country to better understand the interaction between wind turbines and the WSR-88D, and if warranted, make a case for action by policymakers. A clearer picture of the impacts may also help the development of a formal policy for working with the wind energy industry and avoid over-reacting or under-reacting to this issue.

THE FUTURE

Wind power will continue to rapidly expand in the U.S. due to its appeal as a clean, alternative energy source. As a result, the number of wind farms installed in the line of sight of WSR-88Ds and in “close” proximity will also increase. Presently, there is not much we can do about developments close to radars because the federal government has no regulatory authority over wind farm developments on private land. Some WFOs (and military bases) will be affected more than others and perhaps feel like they are being surrounded by wind farms. However, it is imperative that we keep this issue in perspective — it’s a clutter issue and largely confined to the lowest radar elevation tilt(s). Yes, the wind farms may impact the radar data and products, but the key is whether or not they affect weather warning operations. WFOs must be ready to document these operational impacts, if we are to successfully make a case for action. In the mean time, WFOs will need to include wind farm signatures and possible impacts on data and products in their forecast and warning process and work around the issue as best they can. However, we must ensure the WSR-88D’s capability to support weather warning operations that are critical for life saving and property protection decisions.

The WSR-88D ROC contact for wind farm issues is: wind.energy.matters@noaa.gov.

Tim Crum
ROC Director’s Office

WSR-88D Electronic Technical Manual Distribution

For the past several years the ROC has distributed WSR-88D technical manuals (TM) on compact discs (CDs) in Adobe PDF format. The CDs are developed and distributed during major software builds (i.e. Build 10.0, 11.0, etc.), and this practice will continue.

In recent years, the ROC has also issued software updates (i.e. 10.1, 11.1, etc.) and minor hardware modifications (i.e. Modification Notes, Electronic Equipment Modifications (EEMs), and Time Compliance Technical Orders (TCTOs)); however, the ROC does not distribute new TM CDs for software updates or minor hardware modifications.

Each time a TM revision or change is required for software updates or minor hardware modifications, the ROC places the updated TM PDFs on the ROC website, which may be downloaded by authorized users.

To find the TM PDFs, log onto the ROC webpage (<http://www.roc.noaa.gov/WSR88D/>) and select System Documentation/Tech Manuals from the menu on the left-hand side of the page. If you have questions/comments please contact Danny Green at danny.g.green@noaa.gov.

Danny Green
ROC Program Branch