Here are excerpts of what the National Weather Service has to say about NEXRAD Radar. You can read it in more detail at http://www.srh.noaa.gov/radar/radinfo/radinfo.html

How does the radar work?

Ground based **NEXRAD** (**Nex**t Generation **Rad**ar) obtains weather information (precipitation and wind) based upon returned energy. The radar emits a burst of energy. If the energy strikes an object (rain drop, bug, bird, etc), the energy is scattered in all directions. A small fraction of that scattered energy is directed back toward the radar.

This reflected signal is then received by the radar during its listening period. Computers analyze the strength of the returned pulse, time it took to travel to the object and back, and phase shift of the pulse. This process of emitting a signal, listening for any returned signal, then emitting the next signal, takes place very fast, up to around 1300 times each second.

NEXRAD spends the vast amount of time "listening" for returning signals it sent. When the time of all the pulses each hour are totaled (the time the radar is actually transmitting), the radar is "on" for about 7 seconds each hour. The remaining 59 minutes and 53 seconds are spent listening for any returned signals.

Is everything I see on the images an accurate picture of my weather?

Weather surveillance radars such as the WSR-88D can detect most precipitation within approximately 80 nautical miles (nm) of the radar, and intense rain or snow within approximately 140 nm. However, light rain, light snow, or drizzle from shallow cloud weather systems is not necessarily detected.

The radar is limited close in by its inability to scan directly overhead. Therefore, close to the radar, data are not available due to the radar's maximum tilt elevation of 19.5°. This area is commonly referred to as the radar's "Cone of Silence".

Though surface echoes appear in the base and composite reflectivity images, special automated error checking generally removes their effects from precipitation accumulation products.

The National Reflectivity Mosaic or Composite radar picture This is the accumulated picture from all the weather sites around the country that make up the big overall picture seen on your TV on the Weather Channel or in the cockpit on today's NexRad displays such as the Avidyne EX-5000 in "new" Piper panels or the Garmin G-100 displays. Because this signal is composite it requires extra time to process the data from each of the Doppler Weather Radar locations to present in one total picture across the country with details from each location displayed and available. This time factor translates as update time to you in the cockpit.

The national reflectivity mosaic product is also automatically edited to detect and remove most non-precipitation features. Even with limited experience, users of unedited products can differentiate precipitation from other echoes, if they are aware of the general meteorological situation.

How often are the images updated?

Image updates are based upon the operation mode of the radar at the time the image is generated. The WSR-88D Doppler radar is operated in one of two modes -- ***clear air mode or precipitation mode***. In clear air mode, images are updated every 10 minutes. In precipitation mode, images are updated every four to six minutes. The collection of radar data, repeated at regular time intervals, is referred to as a volume scan.

In ***Clear Air Mode*** the radar is in its most sensitive operation with the antenna operating at it's slowest rotation rate which permits the radar to sample a given volume of the atmosphere for a longer time span. Usually a complete sample of the atmosphere takes 10 minutes to complete.

In ***Precipitation Mode*** the radar does not need to be as sensitive as in clear air mode as rain provides plenty of return signals. The radar is also angled higher to look more at the tops of heavy precipitation echoes. This mode of operation is faster at 5 to 6 minutes total while looking at nine different elevations for cloud height.

Why does it sometimes take longer to get the signal to me in the cockpit?

There are a variety of reasons this delay occurs but chief among them are:

1. The satellites transmitting the data play a large effect on receipt of the weather picture signal. The most current resource is XM weather that is provided (transmitted) through various vendors such as Heads-Up Technology or WSI. This weather comes from the same two satellites in stationary orbit over the US which transmits a continuous signal to receivers capable of receiving their signal. This resource has much larger band with than the older resource and is capable to send much larger volumes of data and does not rely on your equipment requesting data..
2. The original and older resource is Orbcomm provided satellite data provided through a series of satellites orbiting in non stationary orbits around the earth. This service uses a much smaller bandwidth and older computing technology and responds to the requests of on-board equipment asking for data to be sent back to the plane.
3. The sheer volume of data sent is expressed in terms of bandwidth and as the weather echoes get larger and more intense it requires more bandwidth for computers to process, package and send the data to the cockpit, hence slowing up the updates of data in the cockpit – usually when you need it most around heavy weather.
4. The multiplicity of infinite frequencies being issued by lightning activity has a small role in delaying the signal reception in the cockpit too (although shielding is good some delay can be accounted for here).
5. Finally we should remember that this is relatively new technology of getting the data to us in the cockpit of GA equipment so it can still be a little bit bug infested. For example, the equipment manufacturers have now determined the signal intensity has a self blocking effect on the equipment causing logjams at the antenna area. The fix is to add a signal attenuator at the antenna of the plane to reduce the signal size allowing freer flowing data.

The over riding theme is don't rely solely on the equipment without understanding the possible pitfalls. Put it another way; ***don't go picking your way through heavy weather with NexRad equipment, you can't rely on it to update as quickly as the weather can change!***