



## St. Clair Countywide Radio System



# Project Update Report

Edition # 2: October, 2004

### Why this report?

This report is intended to be one in a series of reports that will come over the next few months as the implementation of the County's new state-of-the-art 800 Megahertz (MHz), digital, trunked radio system moves into high gear. The purpose is to keep folks who need to know and those who want to know up to speed on how the implementation is progressing.

### Successful "FAT"

As discussed in last month's report, the Motorola Factory Acceptance Test (FAT) for the overall system infrastructure and system functionality was scheduled at the Motorola main factory in Schaumburg, IL for September 24<sup>th</sup>. The test was conducted as scheduled and all elements passed. As a result of this, within a few hours of the test, all the infrastructure elements of the system were crated up and loaded onto trucks for shipping to St. Clair County. They began arriving a few days later, and before we knew it, the garage at the ETSB building was virtually full of rack after rack of equipment, all awaiting transport out to the various tower sites throughout the County where installation began this week.

A little more explanation of the FAT may be in order: Its purpose was not to test the performance of the new radio system. That can only be done on the ground (and in buildings); in the field once all the infrastructure components are installed and optimized. Rather, its purpose was to test and validate the functionality of the system in a contained environment. In other words, when you press the purple button on a walkietalkie, the planned result is that a certain signal will be sent to a certain dispatcher position. So the purpose of the FAT is to have the customer actually press that purple button on one of the radios, have it transmit (if even for only a few feet) in said signal, and have the customer's dispatcher (CENCOM dispatcher Tina Joaquin was there as a part of the County's team which also included Norm Forshee, Daryl Ostendorf and Bruce Hauck) see and react to said signal at a dispatcher console. This was done for several dozen specific system functionalities, and all the infrastructure components (except for antennas) for all 10 tower sites on the system, and all the dispatcher positions were on-line and passed their tests.

### More on the tower sites:

On several occasions we have mentioned 10 tower sites. Let's cover that issue in a little more detail now. The specific technical design for our system is what is called a "simulcast" system. That term relates to the fact that for any single transmission, everything in that transmission will be simultaneously broadcast out from all ten sites at once. The advantage of simulcast is that you can get far better radio signal penetration into cars, buildings, etc. and that's why we chose it. So, the number of tower sites you have in a given area (like a county) is the primary determinant of the strength of coverage, or signal penetration that system will provide you. In today's County radio system (and all of those for all cities in the county as well) there is only one tower site per radio channel that transmits at any one time.

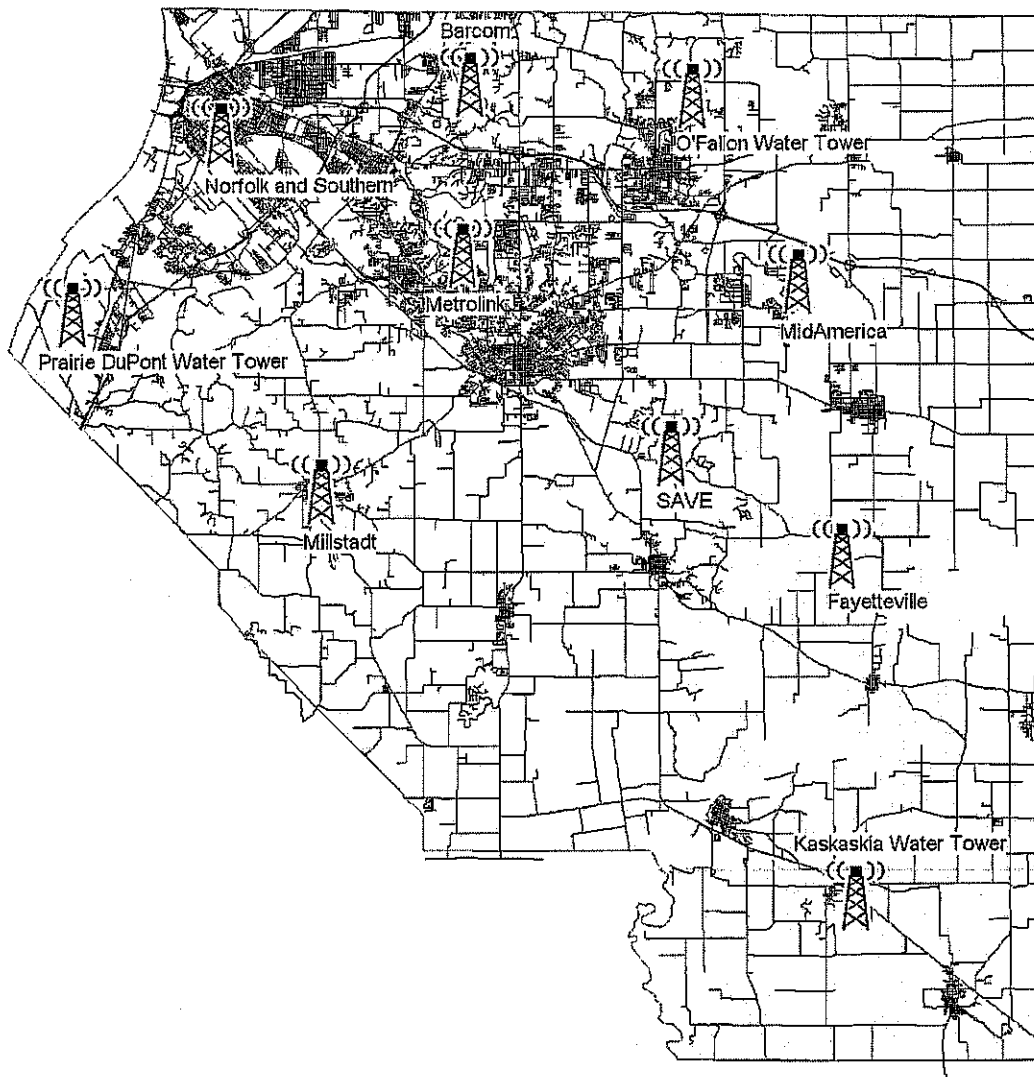
The other relevant topic is that of capacity. This term relates to the number of radios that can be talking at any one time on the entire system. (The number of radios that can listen is unlimited). Capacity relates to the number of individual radio channels that are installed at each tower site. Because this is a simulcast system, there needs to be the same number of radio channels at each of the 10 sites. On day one, each of our ten sites will have 5 radio transmitters (repeaters) installed at them. To a large degree this is driven by the FCC's rules on "channel loading". Since we are going to have something around 400+ radios operating on the system on "day one", we qualify for FCC licensing on 5 radio channels to support those 400+ radios. We actually have 8 such channels licensed (but not all will be installed) at this time, with a second "slow growth license" authority to add 8 more over the next few years. We are only installing 5 at this time because the system usage projections tell us that our 400+ radios will be able to gain virtually 100% access to the system (with few, if any, "system busy signals" being generated when a "transmit" button is pressed) if it has 5 channels. Of these 5 channels, one is always set aside as the "control channel" which is in constant use sending instructions and information out to all active radios all the time, telling each of them what frequencies to be tuned to on a second by second basis to hear and transmit whatever has been programmed into that radio as the "talk groups" (like today's radio channels) it wants to talk on and/or listen to.

Our original contract design called for a total of four channels, with one of them being the control channel. But not wanting to ever run into system busy conditions, and having saved some contract money in other areas, we were able to add one more channel at each site before the upcoming system cut-over. Adding an additional channel at each of the 10 sites runs roughly \$250,000, so one does not do it in an unplanned fashion, but our plan is that as additional users migrate over to the County's trunked radio system and create capacity demands, additional channels will be added, up to the maximum of 16 under our current FCC license.

To put this number of channels into context, our system consultants have a close relationship with a virtually identical system that was installed over in Omaha/Douglas County, Nebraska. In that system they are operating 2,300 radios today. They have 7 tower sites to cover their entire county (about 70% the size of St. Clair) and they are reporting solid in-building coverage to portable radios all over the County. Their system operates on 19 voice channels and one control channel. That means they are running about 121 radios per voice channel, and they report never having seen a "system busy" in one year of operation. In St. Clair the

ratio will be about 112 radios per voice channel, so we should be doing well, especially when one remembers that one of the users of the Douglas County system is the Omaha P.D. with over 1,000 officers.

**So where are all of our tower sites?** Below, we have placed a map of the County with the tower locations indicated. Each of them are pre-existing towers. As referenced in last month's report, to save up-front money, we chose to not go through the time and expense of buying land and erecting new towers. Rather, we had an inventory conducted of existing tower sites in the County, and then set about negotiating leases with the owners of those towers and are now adding our antennas to those towers and constructing or occupying shelter structures at the base of each tower for our equipment. In some cases we are using things like municipal water towers. In other cases we are on traditional radio towers that are owned by commercial interests and we are paying them an annual lease. In other cases we have negotiated free or "in exchange for services" agreements with the tower owners.



## "Trunking 101"

Operations on this radio system will be vastly different than what any of us are used to today. Not only will the coverage be dramatically improved, but actual functionality will change a lot. Today's two way radio systems are, essentially, "party lines", meaning a series of channels that we manually switch our radios to for purposes of transmitting and receiving.

In a trunked radio system, it works a lot differently. Simply put, the four voice radio channels we talked about earlier are "kept on the shelf" (inside a computer) awaiting dynamic assignment to the next user who needs to talk. Assume Radio #1 needs to talk to his dispatcher. Radio #1 selects the "talkgroup" called "MAIN DISPATCH" for his agency. He presses the "push to talk" (PTT) button on the radio which causes his radio to send a data burst on the "control channel" for the trunked radio system. That data burst identifies his radio and which talk group he wants to talk on. If one of the four voice channels is available, the system computer responds to Radio 1 telling it to "tune to Channel 645" to talk. It also sends a data burst out to all other radios on the system which have selected the MAIN DISPATCH talkgroup (or are scanning it) telling them to tune to channel 645 also, so they can hear what Radio 1 is saying. Assuming that the responding party (the called party) answers Radio 1 within a short time, the response will also be carried on Channel 645. If a few seconds elapse before that response, Channel 645 may have been put "back on the shelf" and may have been assigned to some other communication within the system, so the response would be assigned to another channel.

So, a talkgroup **serves the purpose of a channel**, but it is not a "channel", per se, since most every time it is used it will be using any of four different radio frequencies.

If, for any reason (see the earlier discussion on "capacity"), when Radio 1 "requests a channel grant" by pressing the PTT button, and no channel is available, Radio 1 emits a "honk" that equates to a "system busy" signal. Then, as soon as the system has a channel to grant to Radio 1, it "beeps" Radio 1, telling the user it's o.k. to talk now. With this in mind one of the factors that is being used in developing the talkgroup plans for the user agencies is the degree to which having too many talk groups can have a negative impact on system capacity. Simply put, if we created only 1 talk group for the entire system, there would never be any system busy conditions. On the other hand, if we created 200 talkgroups for the system, there would likely be frequent system busy conditions. So we need to strike a happy medium here.

### What about scanning?

Before we conclude, we want to cover the issue of using scanners to monitor this new system. This will be relevant for those agencies (dispatch centers and vehicles) and individuals who like or need to monitor what happens over the air. Unfortunately, the scanners most of you now have will not be able to pick up the trunked transmissions on the trunked system. This is not because they are trunked 800 MHz, but because they are digital 800 MHz transmissions. However, we have found a source for new, digital capable scanners that can tune in the "P25 digital" type of 800 MHz trunked systems and we will be evaluating one of them over the next few weeks. They cost more than older types (about \$500 each) but could be a solution to this problem. We know that they have implemented them over in Omaha and even the local news media have had favorable reactions! For more information go to this web site: [http://www.uniden.com/productpop/00\\_productpop.cfm?prd\\_code=BC796D](http://www.uniden.com/productpop/00_productpop.cfm?prd_code=BC796D)

### What would you like to see discussed?

If you have an issue or topic you'd like to see discussed in our next Project Report, please let Norm Forshee know via e-mail to [Norm911@co.st-clair.il.us](mailto:Norm911@co.st-clair.il.us)