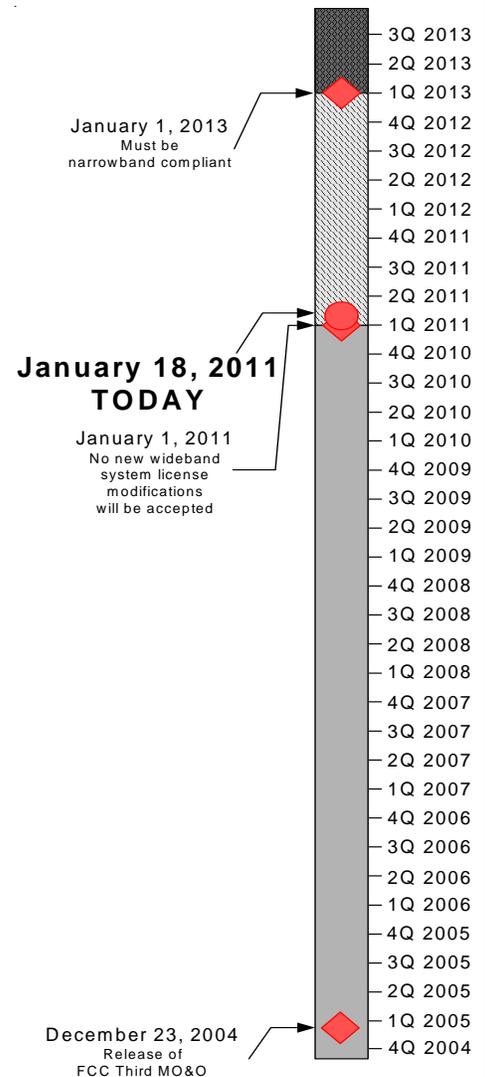## Narrowbanding, MotoTurbo, NXDN and P25

—Peter C. Abraham

With all the focus on narrowbanding and P25, it is worth looking at other available technologies such as MOTOTRBO by Motorola and NXDN by both Icom (IDAS) and Kenwood (NEXEDGE). The attention to P25 is driven by the public safety community as they adopt this standard for digital land mobile communications; this standard was adopted to help foster digital interoperability. Agencies and users that are not part of the public service community (such as transit, public works, or private commercial users) are not bound to the P25 standard and can consider other options such as MOTOTRBO and NXDN. No matter what the technology, all three conform to the FCC's 2013 12.5 kHz narrowbanding mandate. What differs is what these technologies offer above and beyond the 12.5 kHz mandate. At some point in the future, the FCC will require a migration to 6.25 kHz equivalency per channel. P25 does not yet comply but will do so in its Phase 2 deployment; P25 Phase 2 standards are still under development. MOTOTRBO and NXDN are currently capable of being 6.25 kHz equivalent. From a licensing perspective, when the FCC eventually requires 6.25 kHz equivalency, what matters is that it is being implemented not the way in which it is implemented.

A single Phase 1 P25 narrowband channel only takes up 12.5 kHz and can support one voice channel. A single NXDN or a single MOTOTRBO channel in analog narrowband mode also takes up 12.5 kHz, but in digital mode they can support up to two voice channels. What this means is that for the same amount of channels you now have twice the talking capacity, that is, you will be operating at 6.25 kHz per channel equivalency. In the future, when the FCC mandates 6.25 kHz equivalency, these technologies will already be compliant without the need for further migration.

How NXDN and MOTOTRBO is able to fit two voice channels into one radio channel is due to the digital modulation schemes they use. NXDN uses an FDMA-based modulation scheme and MOTOTRBO uses an TDMA-based modulation scheme. FDMA stands for Frequency Division Multiple Access, which means the channel can support multiple users by dividing the frequency. In the case of NXDN, the 12.5 kHz channel is split into two separate 6.25 kHz channels. TDMA stands for Time Division Multiple Access, which means the channel can support multiple users by allocating specific periods of time when a user can use the frequency. In the case of MOTOTRBO, each 12.5 kHz channel is shared by two different users; the two users alternate when they can use the radio channel. This is analogous to cars sharing the road: there is only one road (channel) but multiple cars (users) are able to use the same road because they do so at different times. This time limitation of the sharing of channels is not perceived by the end user since each "time slot" is a few milliseconds in length.

The ability to have 6.25 kHz equivalency translates into several financial savings. First, as stated above, when the FCC mandates 6.25 kHz equivalency, these technologies will already be compliant. Since further migration will not be needed, this directly translates into savings in equipment upgrades and other migration-related efforts. In the short-term, there is savings in infrastructure; although there are two voice channels per radio channel, the infrastructure is based on the number of 12.5 kHz radio channels used. For example, only one repeater would be needed to support the two talk channels. This is a savings of 50 percent when compared to using two conventional analog channels; here the agency would see savings in initial deployment costs and ongoing maintenance costs. Only needing half the frequencies means a savings cost in searching for available frequencies, time spent in coordinating and licensing; it also means a greater chance of attaining all the frequencies your agency

3Q 2013
2Q 2013
1Q 2013
January 1, 2013 — Must be narrowband compliant
4Q 2012
3Q 2012
2Q 2012
1Q 2012
4Q 2011
3Q 2011
2Q 2011
1Q 2011
January 18, 2011 TODAY
January 1, 2011 — No new wideband system license modifications will be accepted
4Q 2010
3Q 2010
2Q 2010
1Q 2010
4Q 2009
3Q 2009
2Q 2009
1Q 2009
4Q 2008
3Q 2008
2Q 2008
1Q 2008
4Q 2007
3Q 2007
2Q 2007
1Q 2007
4Q 2006
3Q 2006
2Q 2006
1Q 2006
4Q 2005
3Q 2005
2Q 2005
1Q 2005
December 23, 2004 — Release of FCC Third MO&O
4Q 2004

Thinking About ...

Narrowbanding

needs. For example, finding four available frequencies pairs in high population areas would prove to be more difficult and more costly when compared to finding just two frequency pairs. For existing agencies that wish to increase their capacity, switching to NXDN or MOTOTRBO would immediately double their talk channel capacity. Existing agencies may be able to reduce the number of RF channels they would need, which would reduce their infrastructure costs and related maintenance costs. Or, instead of reducing the number of channels, they could potentially generate revenue by renting out excess capacity to other agencies.

The migration to one of these digital technologies could be done in phases. The repeaters and radios are capable of wideband analog, narrowband analog, and narrowband digital. So an agency could purchase one of these technologies today and initially deploy them as wideband analog. In the coming months as the subscriber units begin to be migrate to narrowband analog, the repeaters could follow.

The migration from 12.5 kHz analog to digital slightly differs between the two. The NXDN infrastructure is capable of working in dual mode (analog and digital) whereas MOTOTRBO can only operate in either analog or digital. With NXDN, as an agency decides to switch to digital modulation and replace the current subscriber units, the repeaters could migrate first and be able to support both analog and digital traffic as the subscriber units were systematically migrated. With MOTOTRBO, once the repeaters have been migrated, then all the radios would also need to migrate so that they can use the communication network. Despite the difference, the important thing to remember is that either technology can be procured

and deployed in analog mode with the intent to migrate to digital in the future. Financially, this allows an agency to work within the constraints of a yearly budget without limiting future improvements to their communications network.

Other considerations besides narrowbanding compliance needs to be taken into account if an agency were to look at one of these technologies. NXDN and MOTOTRBO are not compatible with each other and both are not compatible with P25. Any type of interoperability will require the use of analog channels. Although both types of subscriber units are capable of multimode operation (that is, the ability to choose between analog or its respective digital format), it will require additional coordination and possible additional analog frequencies. Although NXDN and MOTOTRBO conform to technical standards, they are not necessarily an industry recommended/recognized standard. That is, except for personal incentives, there is not motivation for a neighboring agency to also use the same technology as yours. NXDN is capable of simplex/talk-around communications while maintaining its 6.25 kHz bandwidth in digital mode, whereas MOTOTRBO requires a repeater to maintain its 6.25 kHz bandwidth equivalency. For MOTOTRBO to communicate in simplex/talk-around mode would require it to use an analog channel. Depending on your agencies' needs, this may or may not be a problem. Agencies in urban areas that have little available spectrum and often use tactical channels in simplex/talk-around mode may find this to be an issue. Both NXDN and MOTOTRBO are available for VHF, UHF and T-Bands, but only MOTOTRBO has products for the 800/900 MHz bands. This may make MOTOTRBO more attractive to agencies that are located in urban areas where VHF and UHF spectrum is limited.

Equipment for MOTOTRBO is proprietary to Motorola, whereas there are multiple sources of equipment for

NXDN. NXDN subscriber units are currently manufactured by Icom and Kenwood and there are several other manufactures of NXDN infrastructure.

Bottom line, non public safety agencies should also consider NXDN and MOTOTRBO for a digital migration path. Both technologies comply with the 2013 narrowbanding 12.5 kHz mandate as well as the future 6.25 kHz equivalency. In addition, both technologies allow for an increase in spectral efficiency without the need for additional infrastructure, which can save in finances without sacrificing capacity growth or advanced digital features.

Management Tip
—Dave Magnenat, PMP

The Annual Report is one of the most useful documents your agency can produce. A well-constructed annual report serves as a year-end summary, a marketing device, a recruitment tool, and is a great way to highlight the positive accomplishments of your agency to the public, your client agencies, and your elected officials.

Thinking of your annual report as an informational, historical, and public relations document helps decide what should be in it. Factual performance metrics should be included: your budget, the number of calls answered, events processed, transmissions handled, and so on. Response times for your agency should be included, broken out by priority of the event. An agency description including mission statement, governing values, number of employees, organizational chart/division chart with explanation of each division's function, and a short description of how the agency is governed should also be in the report. List each customer

THINKING ABOUT … CONTINUED

agency (include a photo of their badge or logo if you like). The name and picture of each member of your governing board should appear early in the report.

Annual reports are also your chance to showcase the agency's successes and discuss the challenges it faced in the previous year, and to set the tone for the following year. A "Letter From The Director" is an excellent way to do that. The letter should be early in the report (right after the governing board's section is a common placement) and should address the organization's future as well as its past performance. The letter should address significant changes affecting the organization, such as next generation 9-1-1, the narrowband mandate, and so on. Significant projects underway and on the horizon should be highlighted here. The letter should always be forward looking and upbeat without being overly technical. Remember to write for a general audience.

If your agency is large enough, give each department or division its own section, expanding the description of the division's purpose, performance highlights, and major projects underway. Accomplishments should always be emphasized (such as finishing the addressing of the county, upgrading the CAD system, or successfully training 20 new employees), and the contributors should be identified by name.

Highlight your Employee(s) of the Quarter and Year, and make sure your APCO nominees are included along with a synopsis of their nomination narrative. Awards and recognition from peers and superiors make great photos and terrific material for the annual report as well. Dispatchers meeting the babies they've helped deliver or the people they've helped save is always a powerful event and putting it in the annual report reminds readers that you are in the public safety business.

To create your Annual Report, first lay out a Table of Contents to describe what you plan to include. This in itself is a useful exercise, as it may highlight gaps you have in your data collection and reporting. If you don't have everything you want for this year's edition, put the missing pieces on your project list and include it next year; it's okay to start small and build the annual report up from year to year.

Once you know what you want to include, collect or create the pieces and drop them in to your favorite word processing or page layout program. Microsoft Word has all the features you need, but many people find Microsoft Publisher easier to work with. Free alternatives also exist: Scribus (www.scribus.net) has versions for Windows, Mac, and various Linux distributions, and you might want to check out Page Plus from Serif (www.serif.com). Serif offers a free "starter edition" that packs in lots of features, and purchasing the latest full version is only $100.

How and where to distribute your Annual Report is important to consider. Electronic distribution is the most cost effective and Adobe's Portable Document Format (PDF) is the clear choice. Various free PDF printers are available on the Internet, but my best results have always come by using Adobe's Acrobat product directly.

You'll still want printed copies too. Don't skimp on the cover or the binding; boring covers and poor binding creates a negative first impression. Comb binding is an inexpensive and rugged alternative to sewn or Velo bindings; perfect and other glue-based bindings can be considered if your report is thick, but they are usually more expensive unless you'll be printing hundreds of copies. Color can be expensive to print, so if you have to choose print your cover and the Board's pictures in color, then your employee's pictures.

Send printed copies of your Annual Report to your board members, the pub-lic library, and your media contacts. (Be sure the report includes up-to-date contact information!) Make copies available in your lobby, and some city halls or client agency facilities might want to make copies available to the public as well. A printed copy should be included in your agency's archives, and an electronic copy should go into the electronic archive as well. Electronic copies should go to your employees, be posted prominently on your web site, and should be emailed to each client agency's executive officer(s). When you have job openings, make annual reports available to candidates (this is especially helpful when recruiting at the executive level, and having reports from several years will help potential applicants make more informed decisions about pursuing opportunities with your agency). New employees should get a copy of the latest annual report with their employee handbook, too. As an added bonus, much of the same information used in the annual report can be used in budget presentations, performance audits, and public appearances throughout the year.

Some great examples of public safety communication center annual report exist on the web. Hit your favorite search engine and type "dispatch center annual report" and you'll get a list of excellent reports to peruse. Especially worthy of mention (in my opinion) are Kitsap County (www.kitsap911.com) and Skagit County (www.skagit911.com) in Washington State and Santa Clara County in California (www.sccecc.org).

Annual reports take some time to put together, but their usefulness as an informational document, historical record, public outreach effort, and even recruiting tool makes them worth the effort.

Congratulations to **John Sprague** from the Kitsap County Sheriff's Office for being the first person to respond in our "Can You Find the Problem Here?" from the previous TalkGroup newsletter. Look for the return of our "photo problem" in the next issue.

THE LAST BYTE

The start of a new year is upon us. Last year may have been easy or hard, full of challenges or relatively smooth sailing. While the past gives us experience, it does not foretell the future. We may think we have the future figured out but no one knows what will happen tomorrow, we only think we know. This is a challenge and a great blessing.

Each day gives us the opportunity to start anew, begin to make changes, and work towards a better life, however we define that. Best wishes to you all in the coming new year.

—Joe Blaschka, Jr., P.E.

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