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Oct 1, 2008 12:00 PM, By Donny Jackson

Intelligent radios prepare to make the move from military operations to public safety

After years of being limited to debates regarding the long-term future of communications, software-defined radio and cognitive radio have become factors in present-day decision-making as increasing numbers of products and tests demonstrate the real-world applicability of the technologies.

While these technologies have been used by the military for years, the expensive design of those radios made them impractical for budget-conscious public-safety entities. But the introduction of software-defined multiband public-safety radios from Thales Communications, Harris and Motorola — all of which are expected to be generally available during the first half of next year — has caused the tenor of discussions to move from the theoretical to the practical, said Fred Frantz, director of the advanced research department for global security and engineering solutions for L-3 Communications and chairman of the SDR Forum's public-safety special interest group.

"I think it's definitely made it much more real for people," Frantz said. "There was some skepticism ... going back a couple of years, from the standpoint of a lot of people feeling like, 'This has been talked about for awhile, but is anybody really going to put something on the market?'"

"Now, with the multiband radios, [the question is] not so much now whether it's anything that's going to happen. Now, it's getting into specific feature sets and implementations because people are able to see what the products are starting to look like."

Currently, the primary feature that is attractive to public safety is the spectral flexibility of the new software-defined radios. With most public-safety agencies operating on UHF, VHF or 800 MHz frequencies, having a single radio that can operate in each of these bands at the turn of a knob promises to be a boon to interoperability initiatives.

While multiband radios are ideal for interoperability and backup radio caches, agencies also can use them to effectively increase the amount of spectrum available to them, said Steve Nichols, Thales' director of business development for DHS/public safety.

"When people went to 800 MHz, a lot of them didn't turn in their UHF and VHF channels — they were saving them for a rainy day," Nichols said during last month's meeting of the National Public Safety Telecommunications Council (NPSTC), where Thales demonstrated peer-to-peer communications with radios from disparate manufacturers operating in four different bands. "With this, you can put them back into play."

Certainly that is the case when systems are built on open standards such as P25. But the issue that continues to plague this vision is the fact that the vast majority of public-safety communications systems use waveforms that are proprietary to specific vendors, meaning third-party radios cannot operate on those systems.

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Many industry observers question whether entrenched vendors such as Motorola and Tyco Electronics M/A-COM have any financial incentive to license their proprietary waveforms to other manufacturers of multiband radios. Frantz said public-safety representatives have indicated repeatedly to vendors that they would like to see the proprietary waveforms included in software-defined radios but acknowledged that the matter is "one barrier we haven't broken yet."

With the new multiband radios, communications on different bands can be made available to users at the twist of a knob on the radio. This capability promises to be taken to a new level with the advent of cognitive radio, which is designed to let users — and the other members of their talk group — operate on any open frequency that is found, regardless of the spectrum band.

This capability has been demonstrated for defense use through DARPA's XG program, which showed that cognitive radio software from U.S. firm Shared Spectrum could switch channels quickly enough to meet military specifications. In the spring, Shared Spectrum demonstrated that its software could be uploaded easily to two software-defined military radios — one from Thales and one from Harris — to make those devices cognitive.

Similar capabilities could be added to the Thales and Harris software-defined radios for public safety, said Sal D'Itri, director of sales and marketing for Shared Spectrum. If the market demands such a solution, it could be done in the near future, he said.

"It's typically taken a few months of teaming with a radio manufacturer to do that — I'd say a six-month effort," D'Itri said.

Shared Spectrum officials are working with the National Institute of Justice Cognitive Radio Access and Management (CRAM) project to help develop technical policy guidelines that would govern the use of cognitive radio by public-safety agencies, D'Itri said.

A key advantage of cognitive radio is its ability to recognize interference on the frequencies in use and automatically switch to other available frequencies that do not suffer from such interference.

From an operational standpoint, cognitive radio could offer communications unit leaders much greater flexibility during an incident, said John Powell, chairman of NPSTC's software-defined radio working group. Today, when a talk group is created and assigned a channel, that channel is not changed because communications leaders fear losing communications with about half the talk-group users when such a technical change is made, he said.

That would not be a concern in a properly functioning cognitive-radio system, so a communications unit leader could alter channel assignments to ensure the best use of spectrum available at the time. "With this, we could make the change — once it's proven — and not have to worry about losing anyone," Powell said.

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In theory, technical policies could be included in cognitive software that would allow on-the-fly spectral changes by radios with no human intervention, something D'Itri said is particularly attractive for use in robotics and unmanned aerial vehicles.

"[Public-safety officials] don't particularly like the idea of a cognitive network changing things all around without some human control," Frantz said.

With software-defined radios expected to hit the market early next year and D'Itri's assessment that Shared Spectrum could provide those radios with cognitive capabilities six months later, it is technically possible that public safety could be using cognitive radios late next year.

One limiting factor is cost. Frantz said he believes cognitive and software-defined radios need to be priced at a level similar to high-end single-band radios for public-safety agencies to justify buying them.

Indeed, some industry sources believe a well-designed cognitive system would be intuitive enough that user training would not cost as much as it does today and the ability of over-the-air reprogramming would minimize maintenance costs and extend the life of the system.

This vision certainly has appeal to public safety, but its widespread adoption will not be possible until significant testing and pilots have demonstrated the reliability of such next-gen systems, Powell said.

"When we talk bleeding edge in the state and local public-safety community, it usually involves real blood," he said. "So we don't want to be on our bleeding edge. It's got to work."

DYNAMIC PRIORITIZATION APPROACHES

Table with 4 columns: Authorized by, Individual responder, Central authority, Network. Rows describe priority control, initiation, and cognitive capabilities for each approach.

Source: SDR Forum

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