

## **Accessible Digital Radio Services An Idea Whose Technology is Arriving**

**Mike Starling, NPR, Washington, D.C.**

**Chuck Kelly, Broadcast Electronics, Quincy, Illinois**

All telecommunications are migrating to digital transmissions. Radio broadcasting, the original wireless medium, is no exception. Although radio is the last electronic mass medium to be making the conversion to digital transmission, the conversion is well underway with HD Radio<sup>1</sup> signals on-the-air in virtually every major market in the United States.

HD Radio, the only digital radio broadcast system being deployed in America, introduces a flexible service model supporting the expansion and improvement of radio's public service offerings. Multiple program channels from a single radio station, improved sound quality matching CD audio quality, and the addition of text, time-shifting, and targeted content are existing or emerging features of the growing number of HD Radio stations.

Over 800 radio stations are currently broadcasting in HD Radio, including nearly 200 public radio stations. Over half of the CPB-qualified stations have been awarded HD Radio conversion grants by the Corporation for Public Broadcasting. According to current estimates, by 2010, all 825 public radio stations should be broadcasting digitally.

National Public Radio has been leading the development of new digital radio services within the HD Radio system.<sup>2</sup> Additionally, NPR has a four-decades-old commitment to provide all Americans with in-depth news and entertainment programming. Each weekday, NPR produces America's most listened to morning radio news broadcast, *Morning Edition*, as well as the flagship afternoon news broadcast, *All Things Considered*. NPR's weekly audience exceeds 26 million listeners, delivered through a broadcast network of over 800 stations reaching 99% of the American population. NPR member stations are located in every state as well as Puerto Rico, the U.S. Virgin Islands, and the Marianas. News is the hallmark of NPR's broadcast offerings, with NPR News having won hundreds of awards including every major broadcast journalism award.

Yet NPR broadcasts are only accessible to the Deaf and severely-impaired Hard of Hearing, typically 2-3 days later, after transcript accuracy checking and processing. In

---

<sup>1</sup> HD Radio is a service and trademark of iBiquity Digital, Inc., Columbia, Maryland, the developer of digital radio In Band On Channel technology for AM and FM radio broadcast stations.

<sup>2</sup> The Tomorrow Radio Project, an NPR technology initiative launched in 2003, has been the genesis for the demonstration, validation and rapid adoption of multicasting technology. Multicasting permits more than doubling the number of near CD quality program services of America's FM broadcasters in the HD Radio system.

striving for the laudable goal of “full national coverage”, we have recently asked ourselves whether new digital technologies might improve “access” limitations beyond the traditional measure of signal coverage.

### **Public Radio Services During Emergencies**

Broadcast radio serves as a lifeline of communications during times of emergencies, especially when the power grid is down. FEMA routinely advises the public to make sure they have radios with batteries on hand when major storms approach. Many, if not most radio stations have backup generators at studios and transmitters, and many also maintain dedicated links to local Emergency Operations Centers. But emergencies, of course, don’t always occur during the convenience of the regular business day and it has been widely reported that many radio stations have been unable to respond immediately when operating unattended, typically during overnights and weekends.

In recent years, NPR has strengthened the role of public radio to function well during times of emergency. Following the 9-11 attacks, NPR established the National Emergency Transmission (NET) system which provides a secure means for unattended local public radio stations to join the network news feed whenever a “Level 4 or Level 5” news emergency is reached. A level 4 or 5 news emergency triggers continuous breaking news coverage by NPR. This system has been activated on several occasions, including during the commencement of the Iraq war and upon the death of President Reagan.

The nation’s Primary Entry Point system (PEP) is the backbone of the Emergency Alerting System, established subsequent to President Truman’s creation of the CONELRAD system in 1951. 34 Primary Entry Point AM broadcast stations were designated early on by FEMA to carry presidential messages in times of national emergencies. The PEP stations are provided with hardened facilities and secure telephone links from FEMA. NPR, on a voluntary public service basis, continuously monitors the PEP system and passes all national messages directly to the over 800 stations that receive programming through the Public Radio Satellite System. The NPR system is tested weekly and staffed 7/24.

### **Digital Radio: Ten Short Steps to Accessible Emergency Broadcast Radio Success**

NPR has recently established the only non-profit, public service broadcast radio research and development center in the nation – NPR Labs. NPR Labs has been recognized for furthering the development of new digital public services, including testing the ability to add new dedicated digital channels for radio reading services for the visually impaired and print handicapped. NPR Labs’ work on the coverage and quality of the new digital radio services has defined the current state of the art and NPR and its staff have been recognized with several industry awards for these activities.

Starting in Minneapolis in 1969, radio reading services for the blind began operating using analog FM subcarriers across the nation to read current books, newspapers, and magazines to those with print handicaps. Today over 100 reading services are in continuous operation and several reading service programs are distributed for use on

other reading services through the Public Radio Satellite System. Congress has established a copyright exemption for the reading of such information to the print handicapped. It is estimated that nearly a million FM subcarrier radios have been distributed to users in the ensuing years. It is hoped that upgrading of these limited quality analog audio services will be accomplished in the new HD Radio system. With provisioning for conditional access to preserve copyright exemptions, radio reading services may soon be available on mainstream receivers displaying an accessibility logo. Access compliance specifications, including voice commands and audible beeps for easiest operation of the new digital radios are currently being defined.

In partnership with the International Association for Audio Information Services (IAAIS), NPR has proposed building on the capabilities of digital radio by demonstrating a system for maintaining non-intrusive immediacy in providing live Descriptive Video Services during times of emergencies. The system would, for the first time, couple the ability to “pause” live broadcasts, with “catch-up” technology which removes spaces in program material to chase back to “live” broadcast time. Radio reading services have longstanding experience synchronizing descriptive broadcasts with live video events.<sup>3</sup> See Figure 1, on the next page.



**Figure 1** – A trained “live” video describer narrates to televised coverage of the emergency, pausing audio coverage to insert brief descriptive annotations, while continuously monitoring a “seconds delayed” *buffer status indicator*, staying within guidelines based on the urgency of any evacuation or shelter in place warnings being issued. The catch-up buffer continuously chases back to real time by removing spaces between words. In situations where substantial descriptive annotations are required the catch up audio

<sup>3</sup> Commencing in the late 1970’s the San Diego Radio Information Service provided described broadcasts synchronized with the annual Rose Parade broadcast on CBS television. Blind consumers in reading service areas could enjoy the broadcast along with sighted family members by turning the tv sound down and turning up the local radio reading service carrying the described feed.

system seamlessly shifts to “double speed, half-pitch” to maintain intelligibility while quickly returning to within “no more than” live-delta temporal guidelines.

By monitoring a *buffer status indicator* the video describer can instantly track the delay behind realtime that is feeding the radio reading services, and maintain temporal proximity within guidelines established for the type of emergency underway. When substantial description must be added exceeding the established delay tolerance, double-speed, half-pitch technology can be triggered on the descriptive audio inserts, maintaining intelligibility and aiding quickly returning to near “live proximity”.

Eventually, location sensitive information should be capable of being delivered by means of evolving gps polygon captures at EOC headquarters. “Immediate vicinity” feeds could be activated for receivers located in sensitive areas to expedite specific evacuation or “shelter in place” messaging – to all affected constituencies. Such provisions could add targeted area delivery channels automatically, even during unattended hours, by use of a Multichannel Automation Control System (MACSYS) responsive to targeted area message coding in the Common Alerting Protocol format.

It is important to stress that these service enhancements will not be immediately available, nor initially available on long-life battery-operated digital radios. Market entry for digital radio is occurring with relatively high consumption digital chipsets not currently suited to long life battery operation. Next generation chipsets, notably the Texas Instruments DaVinci initiative, will improve receiver suitability for battery operation. Such improvements in battery life will likely require two or more years to reach the marketplace.

For the first time, captioning of radio broadcasts for the Deaf and Hard of Hearing is at hand with the flexible bandwidth provisioning of HD Radio through the Advanced Applications Services (AAS) data transport. Thanks to the work of the National Center for Accessible Media, and others, live captioning is a concept that no longer requires explanation. Scores of live captioners earn their livelihoods captioning programs across the country. And beginning in 2006 captioning will be required on all daytime TV broadcasts. Although the Radio Broadcast Data System (RBDS) has been considered as a possible platform for live captioning, NPR’s tests indicate there is insufficient code group throughput to achieve continuous captioning. Moreover, we have been unable to identify any RBDS receivers supporting multi-line displays or variable font sizes.

All that is lacking for radio to display captioned broadcasts are:

- a fast text channel (FTC) to carry captions
- a suitable sized display screen and
- the ability for users to select font size, contrast and backlighting, as well as
- a buffer for controlling the scrolling speed
- a designated data burst to signal an emergency alert
- stobe and bedshaker support for the deaf and hard of hearing
- Live captioning providers on 7/24 standby

- validated design requirements
- manufacturing partners
- funding partner(s)

Most of the technical underpinnings for the captioning displays are available through receiver partners identified by NPR. Moreover, iBiquity Digital, the intellectual property owners of HD Radio have pledged their support to activate a “Fast Text Channel” for carrying live captioning through the HD Radio transport within the AAS datachannel – as well as a burst data protocol designated to act as an alert notification trigger.

iBiquity has already developed supplemental audio channels for activation of voice grade service channels for radio reading services and conditional access support is under active development to maintain copyright exemption for these broadcasts. Only sonalert support and Live-DVS-trained describers would be needed for parallel emergency service access for the visually impaired. A visually-impaired, accessibility-compliant Emergency HD Radio would include a loud sonalert, as well as reception of the selectively addressed descriptive audio feed.

For the Deaf and Hard of Hearing, a compliant Emergency HD Radio would support a bed-shaker connection, as well as strobe activation upon receipt of an alert. These ancillary devices can be readily triggered by connection to the receiver’s output relays when an emergency alert is received.

Useful Emergency HD Radios will provide good battery life (at least one day on a set of fresh batteries) in addition to a “wind-up” generator in cases when an extended emergency required affected persons to remain in their homes.

Finally, and perhaps most importantly, designated content providers would need to assume or share 7/24 responsibilities to immediately activate captioning and described video services as needed.

Although integration of these technologies and operating processes are non-trivial, there appear to be no fundamental obstacles in meeting the needs described. Most requirements are readily met or are under active development. Subsequent to a successful demonstration, if elements of the described approach are deemed useful, user communities could gauge manufacturing readiness to produce compliant products by issuance of a Request for Information or Request for Proposal (if orders are ready to be placed). It is the authors’ belief initial consumer deployment could be possible within 24 months.

All it takes to do it, is doing it.

---