Access to Emergency and Non-Emergency Broadcast Information for People with Disabilities

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INTRODUCTION

People with disabilities need equal and timely access to emergency and non-emergency information and warnings about events in the community. This includes information about natural and man-made emergencies such as tornadoes, hurricanes, floods, tidal waves, earthquakes, icing conditions, heavy snows, widespread fires, warnings and watches of impending changes in weather, news of discharge of toxic gases, widespread power failures, industrial explosions, civil disorders, traffic problems and school closings. Recent research confirms that television broadcasts remain a primary source for this information[i], yet television broadcasts do not consistently serve the needs of the 28 million people who are deaf or hard-of-hearing, or the needs of the 11 million people who are blind or have low vision.

The need for an accessible, consistent, reliable and redundant multi-platform emergency notification system that effectively serves people with disabilities is recognized by both the Federal Communications Commission (FCC) and the Department of Homeland Security (DHS). FCC rules (47 C.F.R. Section 79.2 (b) (1), established in 2000, require all broadcasters, cable operators and satellite television services to make local emergency information accessible to persons who are deaf or hard of hearing, as well as to persons who are blind or have visual disabilities. These rules apply to information given during regular programming, an unscheduled break, as part of continuing coverage or any other means of televising an emergency.[ii]

This requirement is rarely met. Failures to comply occur so frequently that the FCC issued the document "Reminder to Video Programming Distributors of Obligation to Make Emergency Information Accessible to Persons with Hearing and Vision Disabilities" (Public Notice, DA 03-2361, July 18, 2003) that explicitly instructs broadcasters in the approaches that should be followed to make information accessible.[iii] Still, compliance is rare.

In addition to the obvious need to make emergency information accessible to people with disabilities, it is equally important to ensure that non-emergency information is accessible. A typical local newscast is made up of dozens of graphics conveying information to the viewer, including daily or weekly weather previews, maps, time and temperature statistics, lottery numbers, stock updates and sports scores. This type of information is integral to the viewer's experience and is frequently not repeated orally by the newscaster. In many cases, the newscaster may make a reference to the data, such as, "On your screen you can see the five-day forecast, and it doesn't look good!" or "Today's stock finals are on the screen, as you can see," leaving blind or visually impaired viewers at a total loss.

Two projects at the Carl and Ruth Shapiro Family National Center for Accessible Media at WGBH (NCAM) are addressing problems related to access to both on-screen information (emergency and non-emergency) as well as emergency alerts:

1. **Access to Locally Televised On-Screen Information** (http://ncam.wgbh.org/onscreen)
   This project (discussed in this paper) is exploring solutions to enable local television stations to convey both emergency and non-emergency information, conventionally displayed on the screen, in a manner that meets the communication needs of people with sensory disabilities. Project staff have investigated procedures for enabling real-time conversion of on-screen text into speech output and integrating this new audio seamlessly into the broadcast stream via the secondary audio program (SAP) channel or auxiliary DTV audio channels. NCAM has also developed a prototype method for addressing display conflicts between captions and on-screen graphics by developing methods of tagging and prioritizing text and graphics messages within automated display systems. The Access to Locally Televised On-Screen Information project is funded by the U.S. Department of Education (http://www.ed.gov).

2. **Access to Emergency Alerts for People with Disabilities**
   (http://ncam.wgbh.org/alerts)
   The recently completed Access to Emergency Alerts project addressed the need to develop and encourage adoption of standardized methods, systems and services to identify, filter and present content in ways that are meaningful to people with disabilities. The project has developed an information model based on existing authoritative works and Access Alerts working group input, which

serves as a checklist to be applied to the entire emergency message notification chain (e.g., equipment, distribution methods, message content, etc.); and through consumer research has identified key usability factors that must be addressed to serve people with disabilities, including cross platform and cross-environment issues. A public reference repository is now available at the project Web site, containing summary documents of user needs, design requirements for accessible products and services, and usability research. This project was funded by the U.S. Department of Commerce, Technology Opportunities Program (http://www.ntia.doc.gov/top/).

BROADCASTERS' REQUIREMENTS AND CHALLENGES

In order to serve people who are blind or visually impaired, broadcasters are required to describe within the main audio all emergency information that is presented visually on screen during the newscast. When broadcasters present emergency information as a text crawl superimposed over regular programming, for example, they must make sure it is accompanied by an audio tone. This tone is intended to alert consumers who are blind or have low vision to seek information about a local emergency from other sources such as radio. However, this tone is rarely provided. And on the occasion when it is sounded, this solution clearly does not provide equal access. In addition to providing no information about the type or severity of the emergency (is it a thunderstorm or a biological attack?) a blind or visually impaired person may not have ready access to accurate information via alternate sources such as radio or telephone, and may not even be able to contact a neighbor, friend or relative to find out what emergency is in progress.

Similarly, in order to reach people who are deaf or hard of hearing, broadcasters are instructed to provide critical details about an emergency in a visual format such as open captions, closed captions, or a text scroll crawl. However, emergency text displays often end up blocking closed captions and/or closed captions block the emergency information, rendering the emergency information partially obscured or completely useless. While deaf viewers might know how to turn off their caption displays so that they may read an emergency crawl hidden by the captions, in the time it takes to turn off the captions (which may involve navigating through several choices from an on-screen menu) the emergency display may already be gone.

The importance of access to on-screen information is not limited to times of dire need, however. A blind or visually impaired person getting ready for work in the morning is just as likely to tune in to a local morning news program as a sighted person, and will be equally interested to know about the day's weather forecast, traffic tie-ups and school closings. Consider the following example[iv]:

There are at least three streams of important information available here: the weather, a list of school closings, and the time and temperature. A sighted viewer can take in the entire screen at once and instantly filter the desired information. A blind viewer, however, will have no idea that any of this information is available unless a) the newscaster reads it aloud, b) a sighted companion reads it aloud, or c) it is delivered in an alternative manner. Assume for the moment that the newscaster does in fact repeat the on-screen weather summary aloud, rendering that stream accessible. However, it is probably safe to assume that the long list of school closings shown at the bottom of the screen will not be read aloud, and will probably be referred to only once or twice during the broadcast when the newscaster says something such as, "The weather is playing havoc with local school schedules. See the list of school closings at the bottom of the screen."

OPPORTUNITIES PRESENTED BY DTV TECHNOLOGIES TO ADDRESS BARRIERS

The core technologies of traditional broadcasting have converged with those of computer networking, digital processing and the Internet to create dramatically new communication services and business models. National networks and local stations alike are transforming their operations into completely digital environments, blurring the previously clear boundaries between television, radio, print and Web-based communication.

As a result, broadcasters and programmers are rethinking every aspect of content creation, from design and display to distribution, control, archiving and asset management. Myriad new workflow concepts are being created, supported by electronic client/server and browser-based technologies and systems. Program content and information have become software objects, easily exchanged in faster-than-real-time sequences from network to station, among stations themselves, and on-demand directly by the individual viewer. Concurrent with these advancements are consumers' heightened expectations for accurate, timely information delivered in formats that accommodate their communication preferences.

With the widespread use of software-based graphics and automation systems, there are opportunities to develop and integrate solutions into broadcast industry products and procedures that will greatly improve the delivery of televised public warnings and alerts to deaf, hard-of-hearing, blind and visually impaired people. Software that prioritizes caption data so that it may be relocated on the screen, or an application that transforms the text source of an on-screen crawl into an audio file, could be integrated within broadcast graphic and automation systems. An audio conversion of a text crawl could, for example, be transmitted through one of the multiple audio channels available in digital television broadcasts. However, such capabilities are not currently integrated into broadcast equipment and local broadcasters have not developed procedures to identify and prioritize accessibility to critical information that is subject to FCC requirements.

Broadcasters and equipment manufacturers are increasingly concerned with interoperability-- the need to manage, customize and integrate different and sometimes conflicting software and hardware systems. New entrants into the marketplace confuse matters even further. The engineering challenge is to guarantee that new broadcast systems can process and exchange complex information successfully, while mixing proprietary commercial products with custom software. Across these industries, there is a movement to develop harmonized standards to support complementary methods for data exchange. In recent years, common file formats for video, audio, text and data have been proposed, discussed and at times even adopted, but much work needs to be done to reach common ground.

ON-SCREEN TEXT AND BLIND OR VISUALLY IMPAIRED VIEWERS

Typically, the graphics and text appearing on a television screen are the result of a complex system of text, backgrounds, photos, logos, symbols and animated elements originating in a variety of graphics, video and word processors. These elements can be gathered together and assembled in a series of layers on the screen, including scrolling or crawling text, either synchronized with or in addition to associated audio and video. For the viewer at home, they provide everything from a simple identification of a speaker to additional program details, time, weather, stock quotes, breaking news, school closings and emergency information.

Often, local stations use multiple systems to generate a variety of on-screen text displays and services. Some may use a system to generate a single-row "headline news" crawl at the bottom of the screen during morning network news programs. This system automatically generates news headlines from the stories being followed and developed by the newsroom. A second text system might be fed by National Weather Service information, generating weather-alert notices and updates. A third system could be used to manage and display school closings and event-cancellation notices, based on information provided directly to the station by local schools and community organizations. Each of these systems uses a computer server that gathers raw data from the information source, and uses software templates chosen by the local station to select and format the data in text form for a related graphics generation system.

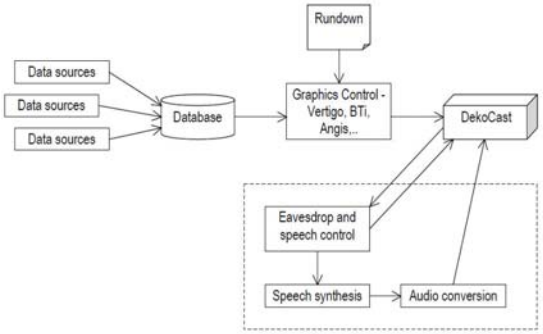
Once formatted, this text information is passed from the server to the graphics system, which creates a video element that can be selected by the station's master control for display on the screen. One common graphics system used by broadcasters is the DekoCast from Pinnacle Systems. The DekoCast uses a text file to generate all information that is in any way changeable in each "page" of design. This text file can originate from virtually any source that is available to the DekoCast.

With all this in mind, consider the same example discussed earlier-- a constantly changing list of school closings displayed at the bottom of the screen:

In order to make the list accessible to blind or visually impaired viewers, one approach would be to convert the content of the source file (a simple text file) on the fly to speech using text-to-speech (TTS) software. Once the audio conversion has occurred-- a process that may take half a second or several seconds, depending on the length of the text file and the number or school closings involved-- this new audio file can be merged by the DekoCast into the broadcast stream at the same time the school closings appear on the screen. To avoid competition between this new audio stream and the regular program audio, the system would also automatically lower (duck) the program audio to a pre-determined level. Once the school-closings audio has finished playing, the system would raise the program audio back to normal levels.

MAKING ON-SCREEN TEXT ACCESSIBLE TO BLIND OR VISUALLY IMPAIRED VIEWERS

NCAM staff have developed prototype software that runs on a DekoCast system and performs the process described in the preceding paragraph.[v] Below is a diagram outlining the process.



On-screen graphics often combine several fields of visible text, each changing on its own schedule. These fields may be converted to text, but the resultant speech must be played out strictly sequentially. Multiple streams of speech may be differentiated using distinct voices, helping listeners keep the information separate and in context.

The problem of what information to convert to speech and in what order can be solved by setting up a system of rules that describe what gets spoken next, based on the current state of the different text streams. These rules could conceivably have unlimited complexity: they could assign priority to the different streams; they could remember what phrases have been spoken recently and avoid repeating them too frequently; they could abbreviate the content from a stream so it could be spoken more quickly, and so on.

To demonstrate a basic solution, project staff created a configurable rule system that accommodates the following points:

- converting text from different sources into audio streams that use different voices for each stream;
- giving simple priority to one stream over another;
- setting up an audio stream to be spoken at a designated time interval while that stream is active, regardless of the frequency that the stream is updated.

The project's prototype software operates on the DekoCast hardware, monitoring multiple incoming text streams and assigning priority to them (with priority level 1 being highest) based on pre-determined rules. The software generates text-to-speech audio files using a command-line version of TextAloud (http://nextup.com/), a readily available, customizable application that converts text files to audio. Audio files are converted just prior to their playback, and once the current audio file has finished playing, the software uses the rules to determine which channel to play next. Audio channels that have higher priority are given precedence over lower channels. If all channels are of equal priority, then the audio files are simply played in a round-robin manner if they have new material added to them.

If the graphics change rapidly, not waiting for the speech synthesis to finish before displaying the next item, it is very possible that there will be too much text to speak and still keep pace with the graphics. Also, there may be some changing text fields in the graphic which should be spoken less frequently than the actual updates – for example, a time-of-day clock may update its hours, minutes and seconds every second, but it may only be necessary to update this information aurally once per minute, or once every five minutes. There may

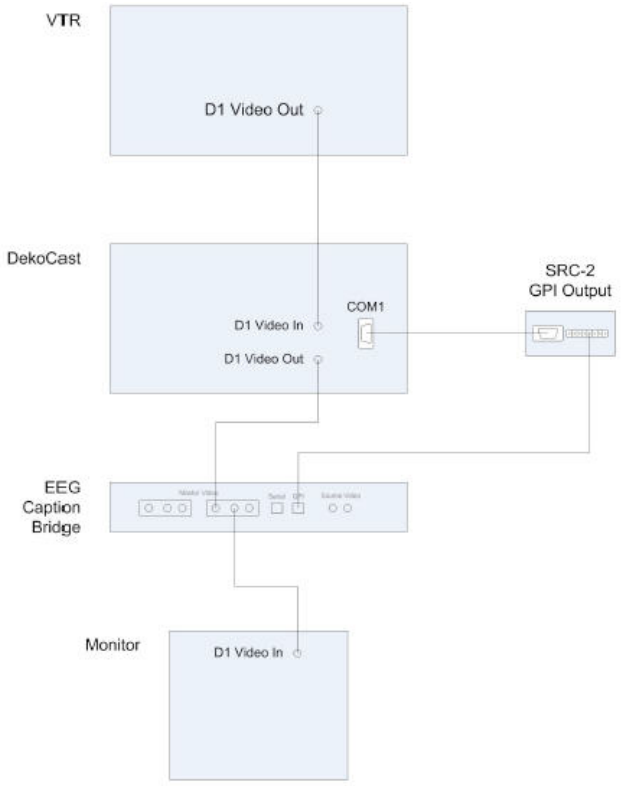
also be some text fields that stay on screen without changing, but which should be spoken repeatedly at a given interval-- for example, an extended pre-recorded segment that displays the words “previously recorded” somewhere on the screen.

Three video clips videos demonstrating automated TTS conversions of on-screen information with synchronized playback may be found at http://ncam.wgbh.org/onscreen/simulation.html. In each video the main audio channel is automatically ducked as the secondary channel, containing TTS audio, is raised. When the TTS is finished playing, the main audio channel is returned to its previous level.

ADDRESSING CONFLICTS BETWEEN CLOSED CAPTIONS AND ON-SCREEN INFORMATION

Broadcasters must provide critical details about an emergency in a visual format, such as a text scroll or crawl. However, there are cases where on-screen text may cover closed captions and/or closed captions may block the emergency information, rendering the information partially obscured or completely useless. Additionally, stations that squeeze video feeds into a small section of the screen to present localized graphics or text displays at the same time sometimes inadvertently strip the captions that accompany the video. In all cases, deaf or hard-of-hearing viewers may miss out on vital information, especially in emergency situations.

To address this problem, NCAM staff developed prototype software that can monitor the location of both closed captions and on-screen graphics, and automatically relocate the captions when necessary to avoid a collision of visual data on the screen. In addition to a DekoCast, the equipment required for relocating captions includes an EEG CB412 Digital Caption Bridge (http://www.eegent.com/cb412.htm), as well as an RS-232 controller which generates GPI outputs to control the CB412 from the DekoCast. NCAM used a Broadcast Tools serial remote controller SRC-2 (http://www.broadcasttools.com/view_product.php?pid=127), which sits between the DekoCast and the CB412. Below is a diagram illustrating an example configuration, using a VTR as a video source.



The prototype software runs on the DekoCast hardware and monitors a scene open in DekoCast, and controls GPI outputs (via the SRC-2) which in turn sends caption-relocation commands to the CB412. Two GPIs are necessary, one dedicated to relocating caption data in the upper third of the video (caption rows 1 and 2), and one for data in the lower third (caption rows 14 and 15). The DekoCast scene to be monitored, and the description of the conditions which will trigger closed-caption relocation, are specified in a configuration file. The software actively keeps track of where closed-caption data are currently displayed on the screen as well as where on-screen graphics are supposed to be placed. When activated by the software, the CB412 moves closed-caption text away from areas of the screen where it may obscure the graphics underneath. For example, if captions are currently appearing on rows 1 and 2, and a text crawl starts feeding information into the upper third of the screen, the software will send a trigger to the CB412 to move the captions down to rows 3 and 4. After the graphic/caption conflict has passed, the captions are returned to their previous position until they need to be relocated again.

Below are images showing captions in their original position in the upper third of the screen (rows 1 and 2), and then their position after being relocated to avoid conflicting with an on-screen crawl.

Two video clips demonstrating relocatable captions in both the upper-and lower-third of the screen may be found at http://ncam.wgbh.org/onscreen/simulation.html.

NOTIFICATION OF EMERGENCY ALERTS

There is also vital work to be done to ensure that people with disabilities are provided with appropriate and flexible methods of receiving emergency information from television as well as other sources, such as radio and the Internet, and there is a need for research and suggested structures for tailoring messages to be effective. For example, processing voice messages can be time consuming for blind users, which means the volume of information provided must ensure that consumers are well-informed without overwhelming them so much that the information becomes obscured by frustration. Further, users with disabilities may not be well-served by terse alerts that direct them to inaccessible sources, such as poorly constructed Web sites, for further information. And people with disabilities may require evacuation and recovery information that is substantially different than what is delivered to other consumers.

It is not uncommon for television stations to offer, via their Web sites, subscription services to notify viewers of weather bulletins via e-mail, text messages or voice mail. However, the Web sites where viewers may sign up for these services are often poorly accessible or completely inaccessible to users of access technology, such as screen readers or screen magnifiers. In addition, digital television and consumer-electronics-based public alert systems are designed to produce multimodal output, as needed by a range of users with sensory disabilities. However, many of these systems are themselves embedded within consumer equipment that cannot be operated by blind or visually impaired users: they often require the ability to use touch screens or on-screen menus, for example, something blind and low vision users cannot currently do unless the devices provide speech output not only to convey content but also to provide navigational information.

There is a critical need for a collaborative effort to research, develop and disseminate practical solutions for these problems in concert with newscasters and equipment manufacturers. Since September 11th, 2001, the need for equal and effective access to televised communications about public safety has been widely acknowledged on the policy level, but there has been little progress made to develop the capability to provide it within broadcast systems and procedures. Most local newscasters are truly committed to and interested in serving the needs of all the constituents in their community, and are themselves frustrated by lack of attention to this urgent need within current

technologies. Broadcast technologies and procedures must be modified to better meet the needs of people with sensory disabilities for accessible warning and alerts related to local emergencies or to other important community information. In fact, most requirements for disability access will also benefit the general market.

ABOUT NCAM

The Carl and Ruth Shapiro Family National Center for Accessible Media (NCAM; http://ncam.wgbh.org) at the WGBH Educational Foundation was founded in 1993. NCAM acts as the research and development arm of WGBH's Media Access Group and is involved in technology, policy and program development to assure that the nation's media and technologies are fully accessible to people with disabilities.

NCAM is an extension of public broadcasting's ground-breaking work in media access that began in 1972 with the establishment of The Caption Center at WGBH and its groundbreaking development of captioning for deaf and hard-of-hearing television viewers. More recently, in 1990, public broadcasting's access mission resulted in the development of video description for blind and visually impaired audiences. NCAM and its sister organizations, The Caption Center and Descriptive Video Service® (DVS®), make up the Media Access Group (http://access.wgbh.org) of the WGBH Educational Foundation.

NCAM strives to make media more accessible in schools, the workplace, the home, and the community. In addition to a focus on the retrofitting of existing media, such as television, radio, newspapers, and theatrical movies, NCAM is designing access into emerging telecommunications such as digital television, convergent media and Web-based multimedia. NCAM's mission is to ensure that the 45 million Americans with little or no access to media's sights and sounds will not be left out of the Information Age.

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[i] Brooks, Marcia, and Trisha O'Connell, "Emergency Management Survey Report, 2008;" http://ncam.wgbh.org/alerts/articles/AAlerts_Survey_Summary_Nov_08.pdf

[ii] "Accessibility of Emergency Programming;" http://ftp.fcc.gov/cgb/dro/caption.html

[iii] "Reminder to Video Programming Distributors of Obligation to Make Emergency Information Accessible to Persons with Hearing or Vision Disabilities;" http://www.fcc.gov/cgb/dro/emergency_access.html

[iv] Screen shots and video clips courtesy of project partner WCVB (http://www.thebostonchannel.com)

[v] DekoCast programming provided by Serious Intent Entertainment (http://www.seriousintent.com)