Solutions for Providing People with Sensory Disabilities with Access to On-Screen Televised Information

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People with sensory disabilities need equal and timely access to emergency or weather warning, local traffic problems, school closings and other community-based information. Local television broadcasts serve as the primary source of information about this information in every community across the nation.

The need for an accessible, consistent, reliable and redundant multi-platform emergency notification system that effectively serves people with disabilities is recognized by federal agencies including the Federal Communications Commission (FCC) and the Department of Homeland Security (DHS). FCC requirements already require broadcasters to present alerts in accessible formats for people with visual or hearing impairments. Despite continual complaints to the FCC by consumers, however, noncompliance with these requirements is the norm. Even when FCC requirements are followed, current solutions do not provide complete or adequate information to ensure the public safety of the 28 million people who are deaf or hard-of-hearing, and the 11 million people who are blind or have low vision. Yet most local newscasters are interested in serving the needs of all the constituents in their communities, and are themselves frustrated by lack of attention to this urgent need within current technologies.

Through the [Access to Locally Televised On-Screen Information](#) project, the [Carl and Ruth Shapiro Family National Center for Accessible Media (NCAM)](#) at the WGBH Educational Foundation explored methods to modify broadcast technologies and procedures to better meet the needs of people with sensory disabilities as they relate to

accessible warning and alerts, as well as other community information. The project identified operational procedures and developed software solutions to convert on-screen graphics and text into speech, as well as automatically relocate closed captions to avoid conflicts with on-screen data. If implemented by television stations, these solutions can improve access to local public-safety information and increase critical information delivery to people with sensory disabilities in communities across the nation.

This software is designed to be customized to suit each broadcaster's equipment requirements. Use of this software by local stations or by vendors that provide broadcast equipment or news/weather-graphics packages will enable television stations to communicate warnings, messages and alerts of all types in multiple aural and visual modes, meeting the communication needs of people with sensory disabilities. Broadcast equipment and newsroom-graphics package providers are encouraged to use this software to incorporate these features in industry broadcast-graphics systems, thereby providing built-in capacity to generate accessible information within television broadcasts.

On-Screen Requirements, Challenges and Opportunities

FCC rules (47 C.F.R. Section 79.1 and 79.2) 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.

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, text scroll or text crawl. All too often, however, closed captions block the emergency information. Stations that squeeze video feeds into a small section of

the screen to present localized graphics or text displays at the same time may also strip the captions that accompany the video.

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, they are required to 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. The use of a tone to indicate an alert does not provide equal access to information. It seriously disadvantages people with visual impairments during emergencies, who may not have ready access to accurate information via alternate sources such as radio, telephone or the Internet.

The switch to digital television and the television industry's widespread use of software-based graphics and automation systems created an opportunity to develop more effective information delivery methods through software solutions that can be integrated into broadcast products and procedures. In order for people with sensory disabilities to have equal access to both emergency and non-emergency on-screen information, solutions were needed to ensure that closed captions do not conflict with on-screen text or graphics (for deaf and hard-of-hearing viewers) and to convert visible data to speech (for blind and 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 from 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 from a variety of information providers, e.g. National Weather Service information, Associated Press or stock-ticker services, school-closing listings, etc. 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. After selection and formatting by the station, this text information is passed from the server to the graphics system, which creates an element that can be selected by the station's master control for display on the screen.

The Access to Locally Televised On-Screen Information project explored methods of integrating text-to-speech (TTS) software into this process to ingest the formatted text file just before it is turned into a video element, creating an audio file that can be simultaneously delivered through the additional audio channels available in DTV broadcasts. Similarly, the project developed software that identifies these additional text displays as they are scrolled on the screen and automatically relocates closed captions to avoid colliding with, and obscuring, emergency or incidental displays of text.

This software and other emerging solutions can greatly increase access to the information delivered by our nation's communications infrastructure and emergency-notification capabilities — a topic under review by the [FCC's recently chartered Communications Security, Reliability and Interoperability Council (CSRIC)](#). In recognition of NCAM's service to represent the needs of people with disabilities on the FCC's Commercial Mobile Service Alerts Advisory Committee (CMSAAC), NCAM was appointed by the FCC to serve on CSRIC, representing the needs of persons with sensory disabilities in the design and deployment of existing and new technologies, with input from numerous consumer organizations and advocates. Additional information about accessible alert technologies, consumer needs, and policies and practices is available through NCAM's [Access to Emergency Alerts for People with Disabilities](#) project.

Software Solutions for Making On-Screen Information Accessible to People With Sensory Disabilities

NCAM has created two separate applications which can help make on-screen information accessible to people with sensory disabilities.

1) *MultiChannel Speech (MCS)* converts text sources of on-screen graphics to audio using text-to-speech technology, then merges the resultant audio files with the broadcast stream.

   [View demonstration clips illustrating MultiChannel Speech's text-to-speech conversion](#) of weather reports and alerts, school closings and emergency messages or warnings. Text source files for emergency crawls are automatically converted to speech and the program audio is automatically lowered so the converted speech files can be heard. Several text-to-speech voices were used to differentiate among multiple streams of data.

2) *Caption Mover* identifies text crawls and other on-screen graphics and automatically relocates closed captions when they are in conflict with the graphics, then returns the captions to their original position when the conflict has passed.

   [View demonstration clips illustrating Caption Mover's relocatable captions](#) in both the upper-and lower-third of the screen. These clips illustrate ways to solve the problem of captions inadvertently covering important on-screen information, such as a utility emergency, and show how captions could automatically be moved out of the way. Closed captions in both the upper-third and lower-third regions of the display are automatically detected and relocated when on-screen text or graphics are inserted into these regions, thereby avoiding a clash of visual data. When the graphics have cycled off the screen, the captions are moved back to their original positions.

Software and System Requirements

MCS and Caption Mover are not turnkey solutions and must be customized to work with each station's broadcast operations and signal paths. Users may [obtain the software by contacting NCAM](#). Complete documentation and sample files are included with the software package.

The following hardware and software are required to operate MCS:

- On-air computer-graphics generator that accepts an SDI signal with embedded audio. NCAM has created MCS to work with a DekoCast but the software can be customized to work with other systems.
- [TextAloud](#) text-to-speech conversion software. Note that you will need the regular TextAloud application as well as the [command-line version](#).

To operate Caption Mover, you will need the following additional hardware:

- [EEG Caption Bridge CB412](#) or [CB512](#)
- An RS-232 controller (e.g., [Broadcast Tools serial remote controller SRC-2](#)) which generates GPI outputs to control the CB412 from the DekoCast.

Note that the components work independently; if you intend to only use Caption Mover, for example, you do not need to purchase the TextAloud applications.

## Software Capabilities: MultiChannel Speech

MultiChannel Speech has the following capabilities:

1. **Monitor multiple incoming text streams**. Many streams of information (e.g., stock reports, school closings, weather reports, lottery drawings, etc.) can be tracked simultaneously. Each can be converted to speech and inserted into the signal path in an order determined by a set of configurable priorities.

2. **Assign priority to text streams, based on pre-determined rules.** Text streams can be assigned priority levels which can be changed as necessary. Those with higher

priority are given precedence for TTS conversion than those with lower priority. If all streams are of equal priority, however, then the streams are converted as they are received.

3. **Convert text files to speech.** The order of text-to-speech conversions is determined by priority assignments. Once converted, the audio files are inserted into the broadcast path as the specified priorities dictate. If all streams are given equal priority, the audio files are simply played in a round-robin manner. Note that multiple voices can be used (TextAloud comes with one voice; other voices must be purchased by the user), and that assigning different voices to various audio streams can help viewers differentiate many streams of information (stock reports vs. weather reports, for example).

4. **Simultaneously duck program audio and raise text-to-speech (TTS) audio.** When TTS audio starts to play, the software lowers the program audio level by 15dB. This level is configurable; broadcasters may wish to lower the audio so it remains audible and serves as a reference but does not interfere with the text-to-speech stream. As long as the TTS file is playing, the program audio will remain ducked. If a one-second gap occurs with no speech being played, the program audio is restored to its original level.

Below is a diagram illustrating an example signal path.
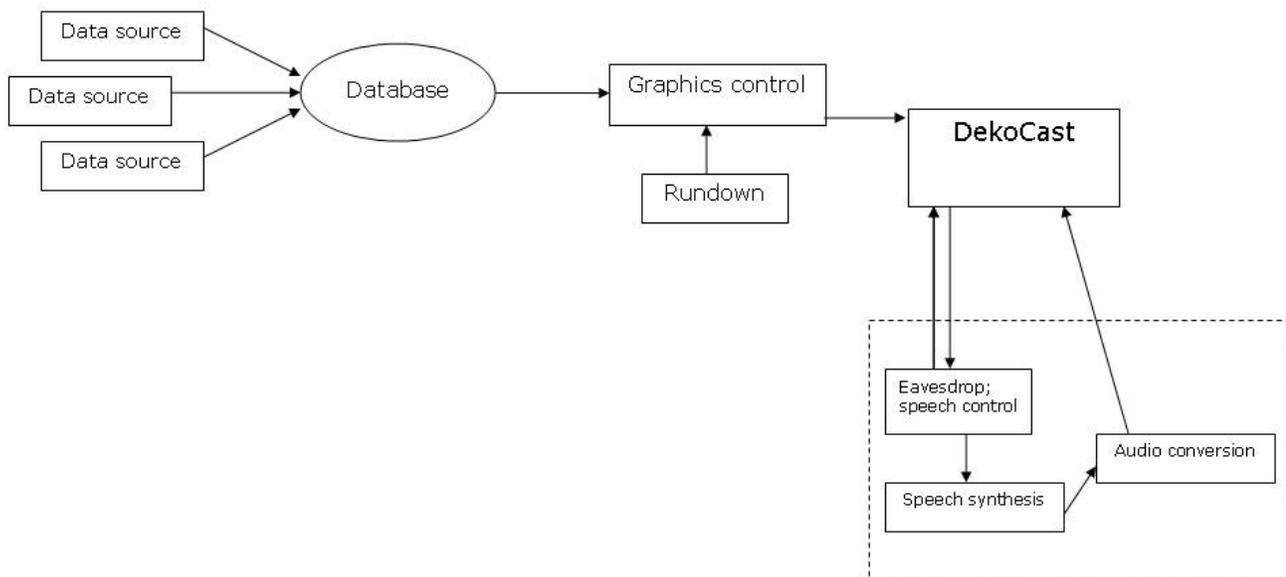
Software Capabilities: Caption Mover

The caption-relocation component of the software has the following capabilities:

1. **Monitor scenes that are open in the DekoCast.** Caption Mover keeps track of scenes that insert graphics into the upper- or lower-third of the picture.

2. **Control GPI outputs to communicate with the CB412 or CB512.** Two GPIs are necessary, one each dedicated to relocating closed captions in the upper- or lower-third of the picture. When the software detects that a scene has become active that inserts a graphic into the lower or upper third, it sends a GPI signal to the caption bridge to relocate the captions. Captions are moved down two rows when they appear in the upper third, and up two rows when they appear in the lower third. After the graphic/caption conflict has passed, the captions are returned to their original position. The DekoCast scene to be monitored, and the description of the conditions that should trigger closed-caption relocation, are specified in a configuration file.

Below is a diagram illustrating an example signal path.
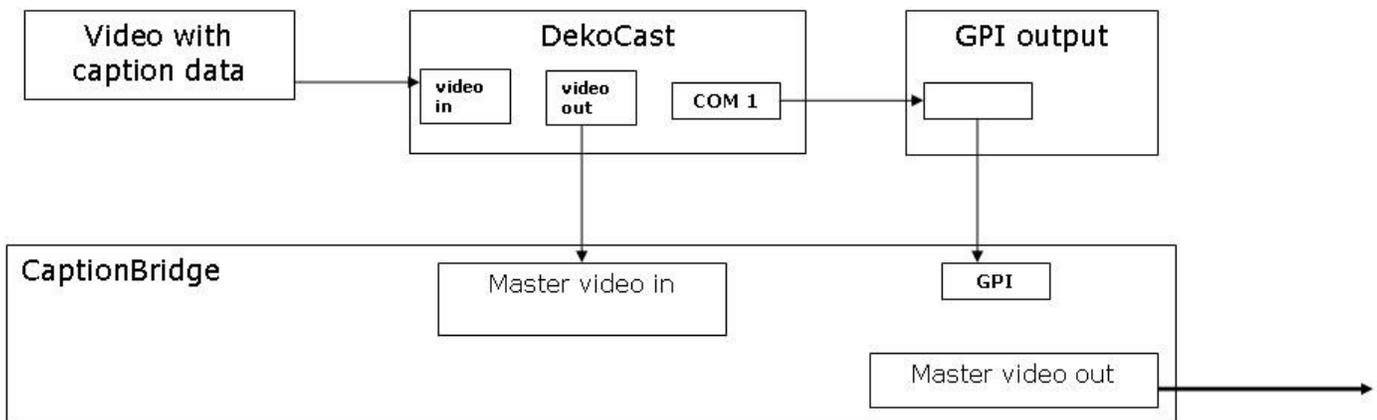
Recommendations for Prioritizing and Presenting On-Screen Information

The following guidance is offered as a broad framework for making both non-emergency and emergency notifications accessible to people with sensory disabilities (those who are blind, visually impaired, deaf, hard-of-hearing or late-deafened). Recommendations reflect user preferences and recommendations collected through this project and through [NCAM's Access Alert project](#), as well as input from FCC filings by disability groups and numerous public hearings and conferences. NCAM encourages stakeholders in accessible communication to continually assess how ongoing advancements in technologies, standards, policies and practices can be applied to their efforts, products and services.

Making information accessible to blind and visually impaired viewers

1. Develop a consistent method of making on-screen information available as audio. This can be accomplished by training on-screen talent to speak whatever is displayed on screen, especially during emergency situations. However, a more reliable and automatic solution is to convert on-screen information to audio using text-to-speech (TTS) software, which is then inserted into the broadcast stream as described in this publication.

2. Give priority to emergency information over non-emergency on-screen information. Emergency information includes, but is not limited to, the following message types:
   - weather alerts
   - state emergency-management announcements
   - local and national disaster alerts
   - school closings
   - information about where to go in an emergency (for example, shelters) or agencies to call for further information

3. Use high-quality text-to-speech voices.

4. Perform conversions of on-screen information to audio in an accurate, timely manner.

5. Present the aural representation of visual data at the same time as the visual information.

6. Include occasional descriptions of persistent, non-emergency on-screen data, such as time/temperature bugs or station logos, as updates require.

Make information accessible to deaf or hard-of-hearing viewers

1. Ensure that closed captions do not obscure on-screen information.

2. Relocate captions to avoid covering both emergency and non-emergency on-screen information.

3. Move the captions only as much as necessary to avoid a conflict: for example, from rows 1 and 2 to rows 3 and 4, rather than from the top of the screen to the bottom.

4. Return the captions to their original location after the on-screen data has been removed.

Create accessible emergency on-screen messages

1. Develop consistency in message format (order of information, etc.) to help people differentiate an emergency message from others. The most important information should be presented first.

2. Use clear and simple language whenever possible, with minimal use of abbreviations.

3. Reference the [National Weather Service (NWS) Directives' Standard Operating Procedures](#) that address the form and content of effective emergency messages.

4. Deliver messages in aural and visual forms.

5. Produce and maintain a library of fully accessible multimedia emergency messages.

6. Minimize unnecessary information in alert messages.

7. Ensure that all station personnel (management staff, technicians, on-air talent, etc.) with responsibility for emergency information are trained in regularly reviewed and updated regulations and best practices for accessible emergency broadcasting. Prominently post the materials for ready reference.

Create a commitment to cross-platform accessible notifications

1. Deliver notifications to mobile devices and as many other distribution means as possible.

2. Ensure that companion Web sites are fully accessible, including notification sign-up forms.

3. Ensure that all station personnel (management staff, technicians, on-air talent, etc.) with responsibility for emergency information on broadcast channels, mobile media and the Web are trained in regularly reviewed and updated regulations and best practices for accessible emergency broadcasting. Prominently post the materials for ready reference.

4. Provide captions and audio descriptions for video delivered on the Web or to mobile devices.

For further guidance on providing access to emergency alerts, please see "Recommendations for Accessible Emergency Notification," and other resources produced by NCAM's [Access to Emergency Alerts for People with Disabilities](#) project.