

Business Continuity, Disaster Recovery, & Emergencies

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Made Easier for You
with Alerting
by Frank W. Bell

*with ATSC_NextGenTV, CAP_Event_Terms_list+, DAB+,
DRM, DRM2020, NAVTEX, FEMA-FCC, EAS+WEA, HD_Radio,
SMS_Broadcast, UNGDC, UNISDR/UNDRR.*

Business Continuity, Disaster Recovery, & Emergencies Frank W. Bell

Dedication

Dedicated to Fred M Baumgartner, Richard Rudman, Frank Lucia, Clay Freinwald, Harold Price, Leonard Charles, Joe Wu, Darryl Parker, Jim Gorman and the other developers of the original EAS, and other SBE contributors since then, including Sean Donelan, Jay Adrick and Ed Czarnecki.

Also the originators and developers of the Common Alert Protocol, including Elysa Jones, Art Botterell, John Lawson, Professor Denis Mileti, who encouraged me to continue improving how emergencies are managed.

To my endearing (& enduring) wife, Essie, my children, and my parents Robert A. and Eileen J. Bell, who encouraged my interest in electronics by buying me a Heathkit oscilloscope in 1959.

To my editors, Francesca Bell-Miller and Sunhyun Miller.

To Roy Oulette, who died as a direct consequence of protecting a multichannel television facility in Connecticut from hurricane Sandy.

And finally, to the television engineers who died on 9/11.

About the Author, Frank W. Bell

I was born in Whakatane, on the North Island of New Zealand. While it is unlikely you have heard of this place, some people may recall that in December 2019, a group of tourists were visiting the nearby active volcanic island, Wakaari, when it erupted, resulting in 20 fatalities. Floods and earthquakes are common in my country. For some years, when I worked for a telephone company in New Zealand, I remember we needed multiple backup generators to keep service operating during said floods and earthquakes. Later, I moved to New York City and worked as a broadcast television engineer, including for Oprah Winfrey, Paul Allen, and others. In the summer of 2001, I was working at a location five blocks south of the World Trade Center; so after 9/11, I had to walk near the burning and collapsing Twin Towers to get to work. I remember that dust was everywhere, and got into every transmission equipment. You might say that I have been in close proximity with disasters for my whole life. My workplace was also directly affected by the subsequent recovery, during which time I learned a lot. Many of those lessons are included in part 2 of this book. I have helped engineer the launch of twenty-one TV channels, while working for ABC, AT&T, the Olympics and more. The Service Level Agreement (SLA) for such work is 99.999% delivery. This is 10 times better than an Information Technology (IT) SLA. I and those who worked with me, worked to meet the expectations of our SLA after the 9/11 attacks. After that period, I developed a growing interest in emergency alerting, management, and protocols which inspires my work to this day and inspired me to write this book as well.

Preface

Some years ago, I took my family out to the Amish territories in Pennsylvania. We went on an Amish buggy ride; at one point, I pointed at a row of trees and asked the driver “What kind of trees are those?” She answered, “I don’t know”. Later I pointed at a distant red tower and asked, “What is that?” She answered, “A cell tower for car drivers.”. I found the nature of Amish knowledge to be rather curious. Probably other people have a curious nature of knowledge also. When it comes to the subject matter of this book, there can be gaps in our knowledge of things that can contribute to disasters and emergencies, which can mean having rather worse outcomes due to those things than necessary. This book is an attempt to address this. Some parts are rather technical, so it would be understandable if you skim over these at first reading and just learn a few words. The jigsaw puzzle can make more sense to you later.

Emergencies or disasters can have a considerable impact on our daily lives; though it is prudent to have some generic preparations for such occasions, it is you who knows your organization’s or family’s situation better than anyone else. In the appendices of this book is an expanded Common Alerting Protocol (CAP) Event Terms List, which lists every type of public disaster imaginable along with some generic instructions. It would be prudent for everyone to familiarize themselves with these types of events which can and do happen all the time. For the price of this book and some appropriate effort on your part, you can decide what measures you consider are appropriate for your situation. For example, in some schools, in the event of an active shooter, the plan is limited to dial (9-1-1) if they come into classrooms ([Active Shooter - How to Respond | DHS.gov](#)). There is definitely room for improvement there, and I hope this book promotes constructive conversation in such spaces. In a major disaster, First Responders may only be able to address the problems of 20% of the people. Assistance for the other hypothetical 80% would be from themselves, relatives, co-workers, friends, or complete strangers. First Responders do excellent work, but there are limitations in their budget and labor force. By considering the problems listed here, including organization information security, you can better assist as a member of the 80%.

Part 1 of this book presents a comprehensive examination of the EAS, proposals aimed at enhancing the EAS, and necessary considerations in improving Emergency Alerting in general. Part 2 of this book is practical advice, garnered from my own frontline experiences as well as personal research, for engineers and leaders in a disaster. The Appendices include resources and references, including a list of acronyms, an emergency alerting patent relevant to the discussions in Part 1, the previously mentioned CAP Event Terms List, and resources for further reading on the web.

A Note About Acronyms

The world of Emergency Alerting and Emergency Management is full of acronyms. To assist in reader comprehension, included in the appendices of this book is a list of acronyms. It is recommended to have this list of acronyms available for reference while reading this book.

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Part 1: Improving Emergency Alerting

Introduction to Part 1

For as long as human beings have been around, there have been disasters affecting us, and therefore there has been a need for emergency alerting. In ancient times, beacon fires were lit on hilltops and elevated positions to send an alert of approaching dangers, such as enemy invasions, to distant locations. Think of when the beacons of Gondor were lit in *The Lord of the Rings*; when a call for aid was made, it was as incumbent upon those that heard as it was Rohan to answer. Eventually, with the advance of metallurgy, bells were invented, and bell towers were used to alert localities of all manner of threats, from the approach of invaders to the outbreak of fire, with different patterns of ringing used to communicate different messages. Our emergency alerting methods have come a long way since then, but there is still much room for improvement. The modern world, along with its great increases in longevity and prosperity, has brought with it new dangers - nuclear bombs and global pandemics just to name two. Therefore, advancements in the field of Emergency Alerting Systems are essential to create a more robust, efficient, and targeted system - one that can get warnings into the hands of only those who need it, exactly when they need it - allowing individuals and communities to take necessary actions and save irreplaceable lives.

The technological evolution and widespread adoption of mobile devices, social media, and internet connectivity offer unique opportunities to enhance the effectiveness of emergency alerting systems. By using these technologies, emergency alerts can be disseminated quickly and tailored to reach people on platforms they use daily. This enables a wider, more targeted, and faster distribution of critical information, making it more likely that individuals will receive alerts in time to act.

The increasing complexity of the modern world, with densely populated urban areas and intricate infrastructure systems, requires more sophisticated emergency alerting mechanisms. Urban environments, in particular, face unique challenges during emergencies, such as the risk of large-scale panic, traffic congestion during evacuations, and the need for coordinated response efforts. Growth in the field of emergency alerting systems can lead to the development of more advanced, integrated systems capable of addressing these challenges, ensuring that alerts are not only disseminated widely but are also clear, specific, and actionable, thereby minimizing confusion and maximizing the efficiency of response efforts.

In the United States, the Emergency Alert System (EAS) is the primary tool for disseminating urgent information to the public. Part 1 of this book presents a comprehensive examination of the EAS, the proposals aimed at enhancing the EAS, and the necessary considerations in improving Emergency Alerting in general. By focusing on technological advancements, integrating modern digital broadcasting systems, and addressing existing limitations, these proposals endeavor to positively transform the Emergency Alert System.

Key suggestions include, but are not limited to:

- Greater deployment of new technology, such as NextGenTV (ATSC 3.0) which will assist in facilitating selective alert delivery of direct alerts from broadcasters to smartphones and bypassing cellular network limitations.
- Utilization of HD Radio capabilities for selective alerting, leveraging the data transmission capabilities of AM and FM HD Radio to target alerts more precisely within a broadcast coverage area as well as including a mechanism for radio devices to ignore the alert based on its relevance (e.g., based on location). DAB+ is relevant many countries.
- Improvements in the speed of dissemination for time-sensitive alerts (such as Earthquake Early Warning), aiming for a delivery time of 3 seconds or less, while incorporating built-in checksums for immediate alert activation upon validation.
- Integration of a “Digital Daisy Mesh” for redundancy in the alerting network, consisting of regional primary stations and monitoring receivers at broadcasters to serve as system quality control monitors.
- Improvements to other aspects of EAS which are currently being explored such as: the introduction of multilingual capabilities for alerts, using the International Phonetic Alphabet to improve pronunciation accuracy and understanding across various languages, and the worldwide standardization of alerting protocols - with emphasis on the Common Alerting Protocol (CAP) and the CAP Event Terms List, which is in the process of becoming a standard of the International Telecommunication Union (ITU, a specialized agency of the United Nations).

These proposals seek to update the Emergency Alert System (EAS), enhancing its efficiency, selectivity, and ability to address the critical demands of emergency notifications, achievable through today's technology.

About Part 1

Section 1 of this part of the book features an edited version of an article I authored in 2017 (published in *Radio World* and *TV Technology*), which I feel still effectively encapsulates this subject of how to improve emergency alerting. This article also includes a specific proposal from my company, Kybernetix, to improve EAS. Section 2 examines the relevant economics of Emergency Alerting. Section 3 features an original deep dive into all the relevant aspects of effective emergency alerting and communications. Sections 4 through 6 feature writings on some subjects relevant to emergency alerting, including:

- My review of *Science for Disaster Risk Management 2020* by the Disaster Risk Management Knowledge Centre (DRMKC) of the European Commission
- An examination of the relevance of emergency alerting in relation to the COVID-19 pandemic
- Relevant Articles about NextGenTV in Mobile Phones

Additionally, the Appendices of this book include important information relevant to improving emergency alerting - including the latest version of an expanded CAP Events Term List I am contributing to and a patent I hold for a System for Transmitting Emergency Broadcast Messages with Selectivity to Radio, Television, Computers and Smartphones.

Before diving into Section 1, it is important to be aware of a few key aspects about TV and radio broadcast technology, which I cover below.

TV Broadcasting

ATSC 3.0, NextGenTV

Advanced Television Systems Committee 3.0 or ATSC 3.0, also known as NextGenTV, is the latest version of the Advanced Television Systems Committee (ATSC) standards for digital terrestrial television. It represents a significant leap forward from the previous ATSC 1.0 standard, introducing new features and improvements in both broadcasting and reception of television signals. Relevant to this book is that it also includes marked improvements in emergency alerting capabilities. ATSC 3.0 was first deployed in South Korea in May 2017 in advance of the 2018 Winter Olympics there. The FCC authorized its optional use in U.S. TV broadcasting in November 2017.

ATSC 3.0 is being deployed across the United States in a phased approach, with the rollout having started in 2020. The Federal Communications Commission (FCC) has not mandated a switch-over date for broadcasters, meaning the transition to NextGenTV will likely happen

as broadcasters individually choose to adopt and implement the new standard. Thus far, ATSC 3.0 has seen significant deployment across the U.S., reaching 66 markets by the end of 2022 ([atsc.org - ATSC Marks Milestones for Deployment](https://www.atsc.org/ATSC-Markets-Milestones-for-Deployment)).

The A/331 Standard

Within the ATSC 3.0 suite of standards is the A/331 standard, also known as "ATSC 3.0 Signaling, Delivery, Synchronization, and Error Protection".

In the context of emergency alerting, A/331 plays a role in defining the protocols and mechanisms for signaling, delivering, synchronizing, and protecting content, including emergency alert messages. It outlines how emergency alerts are embedded into the broadcast stream and how they are to be processed and displayed by receivers.

Key features of A/331 relevant to emergency alerting include:

1. Advanced Emergency Information (AEI) Handling:

A/331 specifies how emergency information is signaled within ATSC 3.0 broadcasts. This includes details on how alerts are encoded, packaged, and synchronized within the broadcast stream. The broadcast could also include location information to specify the intended audience based on their geographic location. Before alerting their user, receiving devices that know their own location could process the location information first to determine whether the alert is relevant to their user's location.

2. Wake-up Capability:

The standard supports a wake-up feature for devices, allowing them to automatically turn on and alert viewers in case of an emergency broadcast.

3. Rich Media Support:

ATSC 3.0 (and by extension, A/331) supports rich media for emergency alerts, including video, audio, text, and interactive elements. This could allow for more effective communication of emergency information, potentially including maps, evacuation routes, etc.

4. Mobile Reception:

A/331 has provisions for broadcasts to mobile devices compatible with ATSC 3.0, allowing emergency broadcasts to be sent to compatible mobile devices.

5. Error Protection:

The standard includes mechanisms for error protection and recovery, helping emergency alerts to be more reliable.

This means that ATSC 3.0 and A/331 has the capability for selective delivery of alerting and the capability to deliver alerts directly from the TV broadcaster to suitable smartphones even if the cell network is not functioning, or inadequately functioning for alerts. This is the TV replacement for EAS (Emergency Alert System) also called AWAARN/AEA. However, the A/331 standard doesn't address all of the problems with the current system. More details follow in Section 1.

Radio Broadcasting

AM and FM radio stations are often (approximately 50%) having HD Radio transmissions. There are already many HD Radio receivers, especially in vehicles. AM and FM HD Radio have the original analog signal and also duplicate this on the HD1 digital transmission. Some FM HD Radio stations also have additional programs on HD2 and HD3. Many countries have adopted DAB+ which has some provision for alerts.

It is possible to send a command to the HD Radio receiver to select only the HD1. Then, if an alert is transmitted on the analog only, those receivers would not receive the alert. By sending the data of the message, software in such receivers, also using the navigation for the position, then can determine whether or not the receiver is inside an area to be alerted. If it is, then the alert on the analog can be selected for presentation to the listener. Some receivers, though not many, can have their software upgraded to provide such selective alert delivery. Analog only receivers would receive all such alerts.

Alternatively, the alert can be put on the HD1, and such receivers can avoid the alert based on location data if appropriate and play a program from the analog to the listener. No analog-only receivers would receive such alerts. In either HD Radio case, the data transmission capability is being used. The data rate is relatively low compared with computer networks, but a suitable protocol has been defined based on EAS and the Common Alert Protocol with significantly lower data transmission requirements. AM HD Radio data rate is significantly lower than for FM HD Radio. The development of the broadcaster capability is part, and the availability of this inexpensive optional feature (2c to 50c extra) in consumer radios is also essential. The public awareness of this is an issue. Also, this is designed to be available and applicable worldwide. Earthquake Early Warning alerts can be within 3 seconds. More details follow below.

With that covered, let us proceed with the core of this work.

Section 1: Suggestions to Improve EAS, Advanced Alerting

Originally published June 14, 2017 in both [Radio World](#) and [TV Technology](#) and adapted for this book

The Advanced Television Systems Committee has developed standard A/331, called Advanced Emergency Alerting. The XML format can vary by country and is flexible. Options include CAP or the EDXL protocols alongside encryption, but a minimum of a PC level processor is required (e.g., 486).

The A/331 protocol is carried on the highest power level of the Layered Division Multiplex modulation, which is QPSK, giving it the greatest range and the capability to be received by the small antennas in smartphones. The received QPSK data is usable for TV on smartphones. The lower levels of the protocol use IP or related standards, for example what is broadcast in South Korea TV.

However, A/331 does not meet the system latency for Earthquake Early Warning System alerts of three seconds or less and could be improved in the U.S. implementation. Activation on code reception is important for this. The possible ways for smartphones to receive alerts include WEA, AEA, social media, and alerting vendors, among other sources.

To avoid alert fatigue, developing restrictions in the software is beneficial. One goal could be having a maximum of two alerts for life endangering messages and one for others, and several manufacturers are working on this, including Verance.

WEA is using single-level cellular broadcast including Femto (10 m), Pico (200 m), micro (1 km) up to macrocells (up to 10 km). While macrocells are expected to have generator backup, Femto and Pico cells most likely do not. During an extended power outage, the macro cell service restricts the number of supported calls. For cell broadcast alerting, the loss of power would mean the loss of alert area polygon selection. With macrocells, the selectivity should be implemented in the handset based on relative location and transmitted the polygon data. Using the GPS function of smartphones with polygons, and other improvements with LTE phones are considered possible improvements from work in progress.

During Hurricane Sandy, which primarily affected the New Jersey, New York and Connecticut area, only one New Jersey broadcaster went off the air; residents could easily tune to another station. Likewise, during Hurricane Katrina, a few broadcasters in New Orleans went off the air (one was a Spanish-language radio station).

Having multilingual capabilities for EAS is important when communicating emergencies. While Text-To Speech software is useful, there are situations in which the pronunciation or meaning is mistaken due to numerous languages. The inclusion of the International Phonetic Alphabet as part of the ASCII text and part of other worldwide alphabets would be beneficial and simplify processing.

A/331 does not add any improvements for the implementation of EAS to legacy broadcasting radio and TV, nor for cable, fiber (e.g. FiOS), DBS (e.g. DirecTV or DISH Network) or SDARS (SiriusXM). An improved EAS is needed and a proposal has been made that addresses most of the limitations in the present system, especially radio.

Kybernetix Proposal

The Kybernetix proposal I have worked to propose to FEMA addresses a majority of those limitations, and the implementations vary between HD Radio (or other digital radio) and other TV systems.

Certain specifications and operations are implemented in the receiver, which is primarily using software on a suitable processor including the following: an 8-bit microcontroller for less cost, less power consumption and less electromagnetic interference generation, which is important for radios that have the antennae within the radio.

Because of varying CAP profiles and language or location/jurisdiction systems, the implementation of AEA would vary by country; the improved EAS is without these limitations. A country code would define the jurisdiction ID system. A country coding system provides for varying languages where a maximum of six per country (or State) is suggested for practical international and technical implementation; two being local languages, and the others multinational.

What I call a Digital Daisy Mesh would provide necessary redundancy. This consists of two (or more) regional primary stations with monitoring receivers at other broadcasters that can function as system quality control monitors reporting to the State Emergency Communications Committee. With the large coverage area typical of TV broadcast and considerable bandwidth for multiple languages and data transmission, these would make the best primary stations. Currently, radio stations function as the primaries with the existing EAS. The analog modem tones are the data transmission and contain only the message header and tail; HD Radio data transmission capabilities are not utilized. Analog modem tones could not add area selection polygons or the message text.

Though ATSC 3.0 would use AEA, translating to an improved EAS would be simple, as defined for CAP. The transmission of the EDXLs and other file formats are possible without disturbing the public.

A worldwide standard is preferable for consumer electronics manufacturers. CAP is an ITU standard X.1303. Kybernetix considers this in the definition development for an improved EAS standard.

The least cost to consumers is always desirable, and approximately two cents for about 1 MB of additional memory is expected to be the requirement; a discrete 1 MB USB flash memory costs around 50 cents. With suitable encoder/decoders installed, the cost of an upgrade to the system for a radio station should be limited to a software upgrade plus digital broadcast receivers with a data output for the Digital Daisy Mesh.

Problems to Address

One major problem for EAS is the ability to selectively deliver an alert within a broadcast coverage area. With HD Radio, everyone with HD Radio receivers in the affected area would be force-tuned to the digital signal, except those listeners allowed to opt out of the message; they would be able to continue with the HD signal. If the alert is for everyone, then all signals would be switched to alert. Not all radio transmitters support a -15 dBr or higher injection level of HD data carriers because the intermodulation becomes excessive. This issue does not apply to digital-only radio systems. A standard should include all of these so a consumer receiver could work whenever an alert message is received in any country.

Another problem is how to rapidly deliver Earthquake Early Warning (EEW) messages. There are check-sums built in. The first data transmission is not delayed, and if validated, and the receiver is selected, this would start a playback of the warning tones and the word "EARTHQUAKE" from receiver memory. Subsequent reception of the audio (having the HD delay) provides further alerting and information as previously described. This process means that the alert audio allows for analog degradation and single language selection normally, thus accommodating radio stations not set up for Digital Daisy Mesh.

Current EAS event codes do not provide a prioritization scheme in terms of timeouts or immediate override. Permitting a timeout scheme would enable interaction between the encoder/decoder and the automation system. When data regarding the duration of the alert is provided, a trigger to the playout of alternative content (e.g. PSAs) of identical duration on receivers without the alert becomes possible.

Other limitations exist: 1) The ability to selectively deliver alerts to first responders using a temporary additional HD Radio stream on selected broadcasters via agreement; and 2) The ability to use AEA as a source for a Digital Daisy Mesh, for which requires testing and debugging prior to deployment is recommended.

Improvements have been made, but more are needed. None so far have addressed issues that require permitting changes to the present definition of EAS. The use of a selectivity mechanism is not permitted, nor is the proposed latency reduction for an EEW.

If all these changes are made, the improved EAS would be a valuable system. For more information, go to <http://kynx.us>.

Additional Comments

There is a command in the HD Radio definition to force receivers to attune to the digital signal. In order to enable a method of delivering alerts selectively, the proposal is to transmit this command but also transmit the EAS data as part of the Advanced Application Service. Then receivers with suitable software could determine for example that the alert is not for them, e.g. by location in latitude and longitude, and that they are permitted to opt out and stay with the HD content that had been selected. Currently the lack of selectivity is one problem with EAS. ATSC 3.0 is anticipated to include such software in all such receivers. With HD Radio, it is expected that this would be an optional feature to promote new radio sales.

A patent I hold that is essential to the Kybernetix proposal - "System for Transmitting Emergency Broadcast Messages with Selectivity to Radio, Television, Computers and Smartphones" - can be found in the Appendices of this book.

Section 2: Economic Considerations

What is the Value of a Human Life? and Economics Relevant to Emergency Alerting

Improving Emergency Alerting Systems carries significant economic advantages by mitigating the financial impact of disasters through enhanced preparedness and swift response mechanisms. By providing early and accurate warnings, these systems enable businesses, governments, and communities to enact contingency plans, protect infrastructure, and reduce downtime, thereby lessening the economic toll of emergencies. Efficient alerting systems can significantly decrease recovery and rebuilding costs by minimizing damage to property and infrastructure, safeguarding critical economic sectors, and ensuring quicker resumption of normal activities. Moreover, advanced emergency alerting systems contribute to building resilience in communities and economies, making them better equipped to handle future emergencies, ultimately leading to reduced long-term economic vulnerabilities and fostering a more stable and predictable business environment.

According to Sunstein (Sunstein, Risk and Reason : safety, law and the environment, 2002) the value of a statistical life for the purposes of public policy in 2002 was in the range of US\$1 million to US\$10 million. For the purpose here in 2020, a value of US\$2 million is picked.

In Samoa, in 2009, a tsunami and earthquake struck the islands. A Guardian report quotes for the “2009 Samoa Earthquake and Tsunami” 31 fatalities in American Samoa and 149 in Western Samoa, though both experienced approximately the same tsunami damage. The primary difference was that in American Samoa a radio station operator transmitted a tsunami alert on the Emergency Alert System (EAS). This difference of 118 lives , if we were to value each at approximately \$US 2 million, economically speaking, can be considered a value delivered of US\$ 236 million to American Samoa, for the cost of equipment valued at approximately USD \$4000. This equipment was paid for by the broadcaster. As can be seen in less obvious examples, EAS delivers excellent value for the investment. A problem is, while the people receive the benefit, the broadcaster not only pays the cost, but also loses valuable airtime and also pays the expense of staff to operate the system.

The Japanese implemented an earthquake and tsunami warning system nationwide in 2009. When comparing the fatalities in the Indian Ocean tsunami in 2004, which were about 230 000, and in Japan in 2011 with 15 897 fatalities according to Wikipedia “2011 Tohoku earthquake and tsunami”, Japan fared much better. While Japan has made extensive

mitigation measures in addition to the warning system, the opinion has been heard that while the system cost about US\$ 500 million, it paid for itself in about two years.

The economics of this situation mean that while well-intended broadcasters support improvements to the system, a business plan to improve the system by expecting broadcasters to pay the costs of such development is not a viable plan. The majority of Encoder/Decoder vendors and developers agree that this is the case, with no-one disagreeing.

Let us look at the aspect of the current EAS system alerting the whole broadcast coverage area. As a result, there are large numbers of people whose time gets wasted; they are distracted from driving or whatever else they are doing, like work. They are deprived of their preferred content by something irrelevant, or they may even be woken up while getting necessary rest. Recently, in Canada, an AMBER Alert was sent at 2 AM and people were annoyed and even called 911. Would it not have been preferable to send the alert only to vehicles if drivers are the only relevant parties in the affected area? The broader the segment of people, the higher the risk of alerts being disregarded. These can be considered as real negative values and are a major reason to deliver the alerts in as targeted a manner as possible. For WEA or any other method, would it not be preferable to avoid alerting drivers and distracting them, thereby increasing the risk of an accident? This is the major reason for having selectivity technology.

Regarding national and international emergencies, the economic impact of the COVID19 pandemic is extremely high. The Freeman Spogli Institute at Stanford did a review (Duff-Brown, 2020). An analysis of the American Medical Association data referred to there showed that Taiwan sent 37 alerts and took 76 other actions as of Feb 24 2020. The spreadsheet is available from me. The explanation included items where people were given government mobiles with an app for them to enter their health data and also tracked their location to ensure they remained in self isolation. The option was confinement. So, the privacy aspects were accepted.

Public alerting as discussed here does not collect information from people unless it is either an Emergency Telephone Notification (ETN) or an SMS message subscription alerting service. Neither is recommended for a national system, and both usually collect only the name and telephone number.

In an emergency or disaster, 40% to 80% of the people who receive assistance do so from relations, neighbors and friends. According to Aldrich & Watanabe (Daniel Aldrich and Michinori Watanabe at

<https://www.npr.org/2011/07/04/137526401/the-key-to-disaster-survival-friends-and-neighbors>) and de Heide (Common Misconceptions about Disasters: Panic, the "Disaster Syndrome," and Looting https://www.atsdr.cdc.gov/emergency_response/common_misconceptions.pdf). Therefore providing prompt, accurate and sufficiently detailed information is very important for the public to take care of each other. The more serious cases then still may exceed the capacity of First Responders. Push publication of documents and video links complement this.

Table correlating Disaster Events, Fatalities, and Alerting Mitigation

Consider $F(e) \approx M(e) I(e) A(e) P(e)$ where F =fatalities, M =magnitude of event type e , I =infrastructure mitigation, A =alerting mitigation and P = population impacted scale for event code e . This is known as functional notation multiplication.

Date	Location (Pop.)	Event	Magnitude	Fatalities	Alerting	Infrastructure Mitigation	M	I	A
2009	U.S. Samoa 55 000	Tsunami	8.1	32	EAS	Not Tsunami	See below	1	0.6
2009	Samoa 195 000	Tsunami	8.1	189	None	Not Tsunami	0.000969	1	1
2004	Indian Ocean 283 000	Tsunami Earthqu ake	9.1	225 000	none	Not Tsunami	See below	1	1
2011	Japan Tohoku 143 000 000	Tsunami Earthqu ake	9.0	18500	JMAS	Yes	0.00129	0.3?	IA=0.16
2010	Haiti 9 900 000	Earthqu ake	7.0	250 000	none	None	0.0253	1	1
2011	Christchurch, N.Z. 376 000	Earthqu ake	6.2	185	none	Yes strict	See above	0.02	1
1964	Alaska	Tsunami Earthqu ake 263000	9.2	115	none	unknown	0.00044		1
1960	Chile 7700000	Tsunami	9.5	1655	none		0.000214		1
2014	Chile 1770000	Tsunami	8.2	6	None?,	Street poles had color for tsunami height	3.4E-7		1

An I or A of 1 means no reduction of impact. A 0 value means there is no contribution to the fatalities. The M value is not the earthquake magnitude. Where I and A are set at 1 and the M is from the Fatalities number, divided by the population. Further data could be used for a line fit if there is some scaling for Earthquake Magnitude also provided for. The data for Turkey is not included as values for I and A are not currently known.

Based on a diagram I saw in a FEMA publication, the relationship between the frequency and amplitude of disasters or emergencies appears to follow a $1/f$ noise curve known in electronics.

Insurance companies are normally for-profit enterprises. As such, their actuaries monitor the risk of individuals and organizations and set the policy premiums such as to expect to make some profit. Being found guilty or pleading guilty of some action which increases the risk is quite likely to result in an increase of the premium, even to the degree of making some activity by an individual or organization unprofitable. This is still applied if the event was an “Act of G_D” (an expression in the U.S. which I do not know how to pronounce in another country). If the event is not something that can be mitigated by normal or reasonable measures, it may be noted in a policy as an “Act of G_D”. The technology of Emergency Alerting in December 2019 made an important step from being a matter of designing for “Best Effort” designs to transitions to Design for Quality designs (DFQ). In 2009, Japan had implemented an earthquake and tsunami warning system nationwide. The only number I have obtained for the cost of this system I have found was \$US 500 million. Most countries could not afford such an expense. Nonetheless, due to the 2011 Tohoku earthquake and tsunami, it appears that the Japanese consider that this expense was paid for in 2 years. They had special software in all radios, TVs and cell phones sold since 2009. Smaller countries are likely to be unable to implement this because of the worldwide economics of the consumer electronics industry. Therefore, DFQ would need to be applied as a worldwide solution. Having the Common Alert Protocol (CAP, which is www.itu.int standard x.1303) adopted by over 70% of the people of the world by countries is an important basis for this. This is further discussed in the next section.

The insurance that is not-for-profit is the government disaster relief such as FEMA flood and disaster recovery, or the Earthquake and War Damages Commission.

According to Ripley (Ripley, 2008), disasters and emergencies create stress, and the stress leads to changes in how people think. It moves from conscious thinking, lowering the IQ, towards depending on more instinctive thinking such as the fight or flight response. First responders deal with this in part by having rather realistic training exercises, but this is normally not practical to provide to the public, so people spend some time discussing with each other, which is called milling. This is not appropriate for dealing with earthquakes, so drills are more appropriate preparation then. Hence the expression “Drill or mill”.

EAS is not currently a favored system as it lacks a selectivity mechanism. Alerts are currently received by all receivers tuned to the station. With digital broadcasting, the A/331 standard provides for a selectivity mechanism where selected receivers can switch from program content to the alert. It is also possible to use the mode switching commands to deliver alerts selectively on HD Radio when the message data provides for that and the receiver can switch between the analog, HD1 and possibly another HD stream. The data transmission capability of FM HD Radio is quite limited, the meaning of the number stated is not clear. It is expected that an Improved EAS with bit compaction would have an adequate capability and be multilingual within limits. It would take time to implement better software in sufficient

receivers. State Motor Vehicles departments may be of assistance to this, as about 80% of radio listeners are driving cars.

In short, practical improvements in the tools available to us provide substantial changes for each person involved in a disaster. This is all to say the cost to not investing in improvements now will be inestimable down the road.

Section 3: Effective Emergency Alerting and Communications

In this section, different broadcasting and some other Public Alerting technologies are reviewed, with a focus on suitability for alerting of earthquakes and tsunamis. While analog-only is included, there are a number of issues that apply. There are limitations to such legacy systems. The distributions may be by radio and television broadcasting, mobile (mobile) broadcasting, SMS applications (to mobiles and computers) and landline to plain old telephones (for local usage). Some other systems exist (which may use sirens or separate radio) but are not considered here because the public would need to buy special receivers.

A detection to delivery time calculation indicates a goal of three seconds is achievable for earthquakes when system delays are addressed. This is an all-hazards system based on the Common Alert Protocol (www.itu.int X.1303) which integrates with other standards. Capabilities are significantly improved when the receivers (radio, TV or cell phone) have suitable software. Satellite alerting has added delay and requires special receivers so is not suitable for earthquake alerting. Reliability of different systems and historical results are relevant. As all systems have failure modes, multiple technologies and redundancy methods are an overall system consideration. New technologies are being implemented now, and adaptations of existing digital broadcasting are also relevant. Standards development for worldwide implementation are also discussed, this is important for consumer electronics manufacturers. These technologies are in use in Japan, North America, South Korea and Europe.

Alerting Architecture Considerations

Steps in the Chain

FIRST, an observation is made, likely with some device(s) (e.g., a seismometer array)

SECOND measurements are processed (e.g., a seismometer processor) to determine what is the likely interpretation as to what this means.

THIRD this interpretation is communicated to an alert origination processor to define an alert message using the CAP protocol.

FOURTH, this Alert Message is transmitted to various distribution technologies in appropriate versions (e.g. for small older cell phones or Intelligent Highway Signs, LTE (4G , 5G etc) cell

phones with up to 360 characters per language for two languages, or more for single language. Or up to 1500 characters for internet distribution to radio and TV broadcasters and other service providers, with possible files attached (e.g. audio or photos).

FIFTH the Alert is received by the receiver directly or via a Broadcaster which may reformat this to Improved EAS for digital radio or HTML5 for NextGenTV receivers.

Redundancy

The above represents a single chain, the failure of any one link would result in the failure of the message being received. IT systems may be designed to be 99.99% reliable, and broadcast systems may be designed to be 99.999% reliable. The use of redundancy to accomplish this is a major component. Delivery of alerts to mountain valleys, ravines, canyons and craters are likely to be problematic as cell phone coverage and broadcast coverage, even for AM radio, may be problematic. Satellite phones or some repeater for mobile phones may be appropriate, but that adds a link in the chain which may be a single point of failure. Coverage in Nepal is possible in the Himalayas with FM stations located at the base of each valley but has limitations, including the limited budget to purchase alerting equipment. While a Single Frequency Network for TV is possible, this would be some major expense. As relief organizations normally do not undertake mitigation measures, this may be a foreign aid program. Human systems are normally less reliable. Humans also are subject to reduced quality of performance delivery in stressful circumstances, see Ripley, A (2008) or psychologists who are experts in this subject.

Having a redundant e.g., mesh network, and also diverse technologies improves the redundancy. Depending on legal mandates or regulations is ineffective when the system is not designed and implemented for a high delivery quality. In the U.S., implementation of the Integrated Public Alert and Warning System (IPAWS) has FEMA (dhs.gov) addressing the technical issues and the Federal Communications Commission (fcc.gov) addressing the legislative and rulemaking aspects. The Emergency Alert System has also long implemented an analog “Daisy Chain” where monitor receivers are monitoring upstream broadcasters in case the primary distribution (normally the internet) fails. With digital broadcasting, this is expected to become a Digital Daisy Mesh for redundancy.

Design for Quality (DFQ) & Quality Control (QC)

DFQ and QC are also aspects of the architecture. These include monitoring of alert transmission from broadcasters and various kinds of periodic testing. To avoid a conflict of interest it is better for the QC organization(s) to be separate from the legislation and failure prosecution organization.

As the DFQ system implementation was not able to be implemented in 2019, because of the lack of availability of the OASIS Event Terms list and hence software for devices including consumer receivers, the existing implementations tended to be single string and best effort. Therefore, Earthquake Early Warning within 3 seconds and software to automatically generate evacuation alerts was not feasible. Therefore, this would fall into the “Act of G_D” or Force Majeure legal category. It would be prudent to improve the implementation as the technology becomes available and people are educated about the benefit of purchasing consumer electronics devices with the hardware capability, software, and user aspects such as product registration, use of Bluetooth pairing for navigation or location data.

Effectiveness can be the ratio of (survivors) divided by (fatalities + survivors) as a percentage. Alerting benefit ratio is the normalized comparison between similar events of (fatalities without alerting) divided by (fatalities with alerting).

Technologies for Emergency Alerting

1) EAS

The current EAS is overriding the program audio (and video on TV). Current cable systems usually force the cable box away from the program to a barker channel and display the alert video there, normally text. This is done at the headend, with effectively no selectivity provided at the receiver location. An SCTE protocol exists to improve on this in the future, but that is a separate topic from this paper. Apart from adding CAP distribution in IPAWS, this system has changed little since deployment over 20 years ago. The IPAWS Improvement Act (U.S. Law 114-143) was passed to make improvements, but significant action, particularly for radio, has not proceeded. An economical analog radio receiver could for example provide a pig farmer in India warning of African swine fever so as to sell them before losing them.

While HD Radio can carry data at a slow rate, with a suitable but limited data rate it can be selective in providing Earthquake Early Warning System (EEWS) alerts. This is an alternative to the present. There is currently being demonstrated an implementation of HD Radio emergency messaging. This appears to be text only using either CAP or text only. As an improved EAS header could have CAP as an eventCode from the CAP Event Terms list, such a header could then carry a CAP message payload. It is not desirable for drivers to receive alerts by reading text.

2) Improved EAS

This is a system I am proposing that would improve existing emergency alerting. It is designed to be backwards compatible with the current EAS modem data but to be carried on the HD Radio data capability. It is designed for digital broadcast radio worldwide. There is a bank switching extension to extend languages, including phonetic alphabet for improved Text-To-Speech, with minimal added data payload. UTF-8 for Unicode characters is also available if needed. This could also be used on older TV systems. Page 1 of the patent for this system is reproduced here. The entirety of the patent can be found in the Appendices of this book.



US008841990B2

(12) **United States Patent**
Bell
(10) **Patent No.:** **US 8,841,990 B2**
(45) **Date of Patent:** **Sep. 23, 2014**

(54) **SYSTEM FOR TRANSMITTING EMERGENCY BROADCAST MESSAGES WITH SELECTIVITY TO RADIO, TELEVISION, COMPUTERS AND SMART PHONES**

(76) Inventor: **Franklin W. Bell**, Clifton, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 73 days.

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See application file for complete search history.

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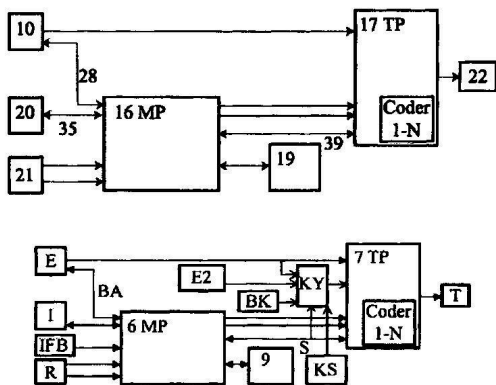
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(57) **ABSTRACT**
A system digitally retransmits an emergency alert message to a plurality of recipients. A specialized category of recipients, which function to combat an emergency, receive specialized instructions to coordinate and handle an emergency situation. The digitally retransmitted emergency alert message includes a specialized unique code for each of the specialized category of recipients, along with specialized instructions along with an uncoded generic public or private emergency alert message. Each of the receivers of specialized category of recipients decodes the message pertinent to that recipient upon receipt of a matching specialized code programmed within the receiver. The generic uncoded public emergency message is received by all generic devices without specialized codes. The emergency alert message is devoid of additional information which, when present, could be burdensome. This implementation is optimized to provide very rapid alerts for specific message types e.g. earthquakes.

14 Claims, 9 Drawing Sheets



There is considerable benefit to making improvements. “The Emergency Alert System Plus Outline State Plan” is a book about the Improved Emergency Alert System (including ATSC 3.0 AEA) which is available from myself on request. At this time the cost of not implementing this is considered to be far greater than the cost to implement this.

As broadcasters use automation systems to control the playout, having a priority scheme that enables interaction with the Emergency Message processor is very important. This also serves to provide some user selection.

3) AEA, the A/331 ATSC 3.0 TV System.

This is being promoted by the AWARN Alliance. It is being developed for use in the U.S., South Korea, and work is being done by Japanese companies to be a future upgrade for their system. The ability of ATSC 3.0 to deliver alerts to suitable smartphones is expected to be possible using the alerting data in the high power, low data rate component of Layered Division Multiplexing (LDM). The patent is Essential for this implementation of this standard.

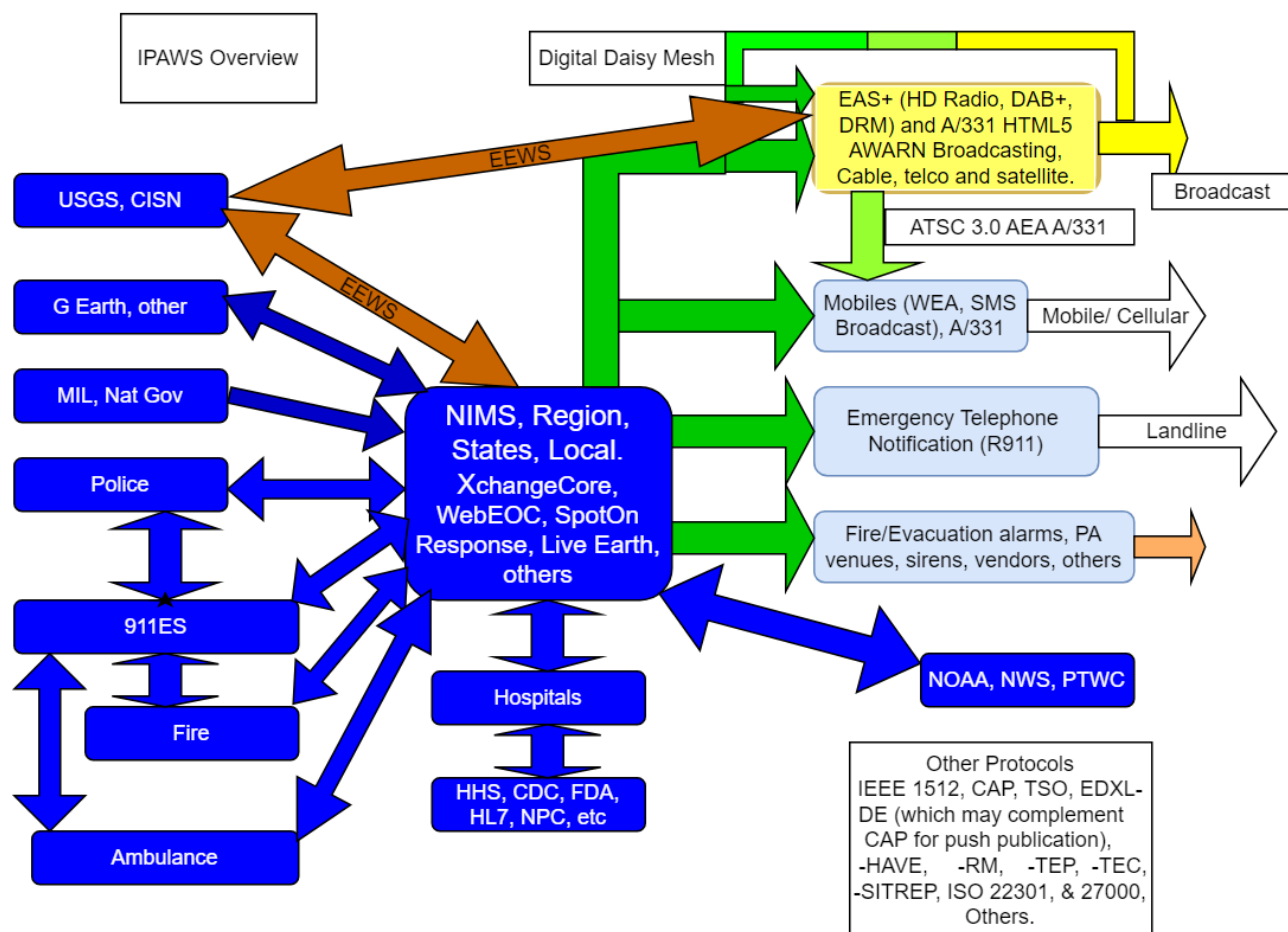
Sinclair One Media have further developed Advanced Emergency Information (AEI). This is for better integration with newsroom workflow. At present this is not incorporating the OASIS CAP Event Terms List or the spectra thereof, rather it is limited to the current FCC Part 11 rules which apply to the EAS developed 25 years ago. Everything in the EAS Event Codes is included in the OASIS CAP Event Terms list. The Event Terms List was developed with lists from Australia, Canada, New Zealand, Norway, U.S.A. and also input from Emergency Managers and other members of the OASIS Emergency Management Technical Committee.

The development of the hardware and software is a significant project, and it is not a viable business plan for broadcasters to pay for developing this as there is no economic benefit from doing so. Dependence on mobiles is also an issue as the California wildfires showed, where selective area delivery via radio or TV could have saved perhaps 100 lives. The value of EAS was demonstrated in the Samoan tsunami where American Samoa had 31 fatalities and Samoa had 149. The difference was primarily due to American Samoa having the EAS activated by a radio station operator. In the current pandemic, the difference the Emergency Alerting could have made is not simple to estimate but is explored later.

Sinclair Media One have been developing Advanced Emergency Alerting (AEA). This is for benefitting the workflow in the newsroom primarily.

A Systems Interaction Diagram and a number of standards are used. This shows the complexity of the processing. This follows to show how many systems and standards operate together for software and system interoperability. This is essential for high effectiveness, 24/7/365 with a 99.99% uptime and Earthquake Early Warning (EEW) delivery within 3 seconds of P-wave detection. Broadcasting can deliver this, but WEA or SMS Broadcast may

take longer. EEW alerts may be in expanding polygons, octagonal preferred, with countdown approximation time presented from suitable receivers having the appropriate software. That may have a limited number of languages depending on what the manufacturer includes depending on memory size, cost and likely market for smaller language populations.



IPAWS-functions Diagram

4) WEA or SMS Broadcast for Mobiles

This is mostly beyond the scope of this paper, but it is a concern that there be better coordination of alerting systems because, with WEA, AWAARN/AEA, and other services that usually use SMS, it is possible to overload the public with an excessive amount of alerts. As Canada is using 700 characters for the text, with a /// for the language delimiter, the proposal for DRM 2020 for Europe is to have 740 characters with <abcDEF> at the beginning where abc is the language code and DEF is the eventCode. This way, mobile software can detect

that different alerts are from the same event, and avoid duplication unless additional information is provided. Then later a <///ghi> can be for the different language code. An additional message could carry two more languages. As the performance of the cell network in a disaster is unpredictable, one technology alone should not be depended on.

5) SMS

In Canada, a WEA alert may be followed by an SMS message containing more detailed information and web links. In Pennsylvania, SMS messages are used to ascertain the status of individual cars that are stuck in place on a snowbound major highway. While SMS has proven to be a limited value when alerting very large numbers of people in a short time frame (e.g. earthquakes), it has uses. In some countries, where this is legal, an app is provided that tracks the location of some users e.g. for pandemic quarantine compliance. A version used in South Korea also sends SMS to nearby mobiles in the vicinity of persons who are known to be infected.

Implementation Processes for Emergency Alerting

1) Regulatory

In the U.S., the regulatory body governing Emergency Alerting is the FCC. Although the rulemaking process at the FCC is difficult and slow, it is of paramount importance, as the FCC is an essential stakeholder with important input. After there is a consensus that a desirable and effective solution has been developed, the FCC will provide a legal status for that.

2) Standards Organizations

For broadcasting some of the major standards organizations are OASIS-open, the Advanced Television Standards Committee (ATSC), the DVB Consortium, and the National Radio Systems Committee (NRSC). They focus on technical specifications. Feedback from implementation results is taken into account.

3) Plugfests/Plugtests

A "plugfest" or "plugtest" is an event where developers and manufacturers of hardware and/or software test the interoperability of their products with those of other manufacturers, usually focused on a specific technology, standard, or protocol. During a plugfest, engineers from various companies and organizations bring their products to test them in a variety of configurations and scenarios.

The FEMA NAC mentioned the plugfest process of combined system tests. As the meaning seems to be that of a single or occasional exercise, this may be adequate, though it is not preferred for large complex software development projects.

4) Software Development: Agile and Scrum

Agile is a software development philosophy that focuses on iterative development, collaboration, flexibility, and customer feedback to deliver high-quality software in a responsive and efficient manner. Scrum is a particular software development methodology within the Agile philosophy, with clearly laid out rules and guidelines that emphasize iterative progress, team collaboration, and adaptability, organized around short, structured work periods called "sprints".

These software development processes arose from the failure of BDUF (Big Design Up Front) projects. They are recommended processes by the Project Management Institute (www.pmi.org) and others. A typical process may consist of a quite limited number of functions as a goal, implemented and tested over a time period of perhaps two or three weeks. The functions that are not implemented and problems found in testing are normally added to another group of goals and another two or three week "sprint" is begun. Major software companies implement this process.

5) Testing

As testing of alerting is a complex process, e.g. for EEWS, going from a seismometer through a radio or TV broadcast system to consumer radios, TVs and smartphones, an appropriate test lab is needed. Broadcasting involves audio and video compression or encoding systems. Changing an input to them in an unexpected manner can have unexpected results. They use software for signal processing. This is different from normal computer software. For example, sustained high level audio may result in the audio being delayed so it becomes 10 seconds behind the video.

As consumer electronics is involved, this is a situation where foreign countries are likely involved. So, it may not be appropriate for such a lab to be located inside a facility that is important to national security in some other way. Also, such a facility is important to be available for Emergency Managers to test their Alert Origination Software. Therefore, a separate development and testing lab would be appropriate. In addition, even when the source and broadcast capabilities are settled, there still needs to be a facility for testing the consumer electronics devices which is expected to be continuing for many years.

Technology Considerations for Improved Alerting

1) ATSC 3.0 A/331 Advanced Emergency Alerting and AWARN

The ATSC was interested in discussing improving EAS in 2008 when I made an outline presentation about doing so at a standards development discussion meeting in Washington DC. My presentation proposed selective delivery for alerts. When I was asked how this could be implemented as a question, my answer was PID switching based on the message data. Since then developments were made leading up to formulating the standard A/331 that emerged. Essentially this is a completely opt-in system, which is simpler but does not provide any opt-out mechanism of the existing video override. So, I provided for both opt-out and opt-in including having the video either way with minimal added bandwidth in the patent description. So it is essential to A/331 and the added capabilities may also be used in the future. IP Tuples (address+port) are an alternative for PIDs, which were sometimes called program IDs by technicians.

The delivery to smartphones is using the LDM signal. As cell service is lost due to cell system failure or power outages, the smartphone could still receive alerts from the TV broadcaster. The ability of a cell phone to detect the presence of an alert and “wake up” from sleep mode is designed into the system. Also NextGenTV can use the 7 or 8 MHz wide TV channels and carry the 50 frame per second video of most countries. Watch <https://www.watchnextgentv.com> for an introduction video.

As most large screen TVs with tuners can receive both DVB-T2 (Digital Video Broadcasting – Second Generation Terrestrial, which is used in Europe and various countries around the world) and NextGenTV (which is used in South Korea, the U.S., and a few other countries), the conversion to the other system may be primarily the change of the exciter in the TV transmitter.

DVB-NGH (Digital Video Broadcasting - Next Generation Handheld) is the standard intended for DVB-T2 transmission to cell phones, but this does not yet appear to be implemented in

any cell phones. The different modulation format of LDM appears to be more suitable for cell phone reception. The cell phone receiver chip of Saankhya is using a Software Defined Receiver (SDR) to which it may be possible to add DVB-NGH as added software, but nobody has offered to undertake such work yet, let alone state a price for that.

With NextGenTV reception, it would be possible to determine the position of the receiver inside buildings. <https://www.hindawi.com/journals/complexity/2021/6655889/>. This could have a rescue application.

2) HD Radio, DAB, DAB+ and DRM

The mode switching that ties the analog signal to the HD1 signal or separates them is made use of with selective delivery when the station hardware and software provide for that. Also, with the specific message data, another HD stream (HD3 only assumed and only on FM HD Radio), receivers could also select that source for alert messages. This may be on a weather/news radio source with a mono audio. In addition, when the source selected is a CD, flash drive, Bluetooth or SiriusXM, the radio tuner can explore the spectrum to categorize the alerting capabilities of other stations and monitor the best available. Then an alert could override the selected program source. So, it is important to have good HD Radio reception for public safety purposes.

The alerting capability is indicated by an HD Radio heartbeat signal. This signal may also provide information on similar program content stations in areas adjacent to the present coverage. Then when driving a long distance, and the signal fades, the driver is not obligated to find another station, as this could be automatically done. HD Radio is using a 200 kHz band spacing. There are some mode options for HD Radio

DAB is obsolete but may still be in use somewhere. It is likely possible to have DAB+ transmitters have a station that is mono, lower sample rate with lower bandwidth for content that is for news, emergency messages and weather. The bandwidth freed up could be allocated to better quality music transmission or emergency message data similar to the Improved EAS system. Alternatively, there may be a possibility of provision of a second language. There is provision for Emergency Messages. At present this appears to be distribution selective by transmitter tower, not within coverage area. That appears possible but further research should determine the limitations of that. Excerpted from NRSC standard NRS5

Table 5-4: Blend Control Bit Definitions

Audio Control Word Bit 34	Audio Control Word Bit 33	Waveform	Service Mode	Definition
<hr/>				

0	0	AM and FM Hybrid	MP1 MP2 MP3 MP11 MA1	Not Valid 0b00 shall never be sent in the MPSA PDUs in hybrid service modes. This can cause undefined behavior in various receiver models.
0	0	AM and FM All Digital	MP5 MP6 MA3	No analog diversity delay has been applied by the transmitter. RX shall disable analog blending. This should always be sent by the broadcaster when in any all digital service mode.
0	1	AM and FM Hybrid FM Extended Hybrid	MP1 MP2 MP3 MP11 MA1 MP5 MP6	No analog diversity delay has been applied by the transmitter. RX shall disable analog blending.
0	1	AM and FM All Digital	MP5 MP6 MA3	Not Valid
1	0	AM and FM Hybrid	MP1 MP2 MP3 MP11 MA1	Analog diversity delay has been applied by the transmitter. RX shall blend to analog when the digital audio quality measure is below the selected threshold.
1	0	AM and FM All Digital	MP5 MP6 MA3	Not Valid
1	1	Some	MP1 MP2 MP3 MP11	Reserved
1	1	The Rest	MP5 MP6 MA1 MA3	Reserved

Table 5-4: Blend Control Bit Definitions

The mode 1,0 above is the normal hybrid HD Radio mode for AM and FM. A game mode 0,1 is sometimes used where there is no analog delay and receivers are selecting analog only. Thus, without further definition and receiver software it is not currently possible to select

digital (channel 1, 2 or 3 only) and put the alert on analog, Then, to use the selectivity criteria to select the alert on analog or regular program on digital. It would take time to upgrade software in vehicle receivers before beginning to implement this. In the meanwhile, promos for upgrading the software or receiver SHOULD be aired.

DRM may have some Improved EAS data similar to AM HD Radio, but these require further research and development, when funds are available. DRM is being tested as a stream within ATSC 3.0. The harmonization of Emergency Alerting in this environment needs to be researched. At present the delivery of the high power QPSK A/331 alerting does not appear to justify duplicating the DRM alerting content. Also, the DRM streams may originate from different alerting areas.

3) Satellite Digital Audio Radio Service (SDARS, e.g., SiriusXM in the U.S.A.)

It appears possible to deliver alerts in a selective manner using such systems with alert audio as one mono lower data rate channel and data, e.g., the text and selected alert area similar to Improved EAS. As there is a delay with the satellite transmission, it is a problem to deliver Earthquake Early Warning messages within 3 seconds. So rather than debate that, it would be preferable for such receivers to use their FM HD Radio or DAB+ receivers selecting automatically stations that are conveying such emergency information on the radio tuner and analyzing it while the radio is playing out the selected SDARS content stream. Thus, good AM and FM reception is a complement to SDARS.

4) Radio Receiver for Vehicles or Larger Size

The availability of a vehicle radio that also receives NextGenTV, and may include a GPS, as well as a larger version with higher power speakers is currently being researched as to interested manufacturers and pricing. Such a radio would include Improved Emergency Alerting from radio stations and Advanced Emergency Alerting from NextGenTV as well as other features not included in a smaller economy radio such as using an HDMI output for TV picture, or a LAN connection. The provision of XLR-F and balanced 6.5mm to enable use from a microphone or mixer, repairability, reliability and water + dustproofing with multiway power is desirable. Four Class D amplifiers for high efficiency and longer battery life is desirable.

5) Human Resources Aspects

With the transitions of technology, there is becoming a shortage of broadcast engineers. Bringing in graduates or interns is not simple because of this technology transition to an IT based technology. Also broadcasting is a 99.999% uptime business on many contracts, but IT is perhaps 99.99% uptime. This adds an extra stress. There are now only one or two colleges in the U.S. who have broadcast engineering graduates. Hofstra in NY is one. Some people are coming from a background of military service. Michelle Duke is the Chief Diversity Officer of the National Broadcasters Association (NAB) Leadership Foundation. Nikki Bethel is the CEO and President of the Emma Bowen Foundation, which provides assistance for broadcast engineering interns.

6) Large Venue Issues

In 1989 Oct 17 the World Series Baseball game was interrupted by an earthquake in San Francisco. Appropriate instructions in such a circumstance would have been to tell everyone to sit down, including the players, for a time out. This could be a selected alert delivery. It is not expected that the event management would have been able to deliver such instructions in a timely manner.

Alerts for large venues could be multilingual. These may be cultural, sports, political or religious events. Also, the event management may prefer to be able to deliver multilingual narration. While this could be accomplished using broadcast technology, coordinated by a frequency coordinator, this is not a common and readily available solution, and the implementation time frame may not integrate well with the pace of event management. Radio broadcasters are likely uninterested in carrying content that differs from their normal format. In addition, the audience would need radios, perhaps specialized ones, which are another problem. The propagation attenuation has a factor from the reinforced concrete and the audience wearing wired earphones. There is one measurement made of this and the result was a propagation distance of less than a city block.

Another approach is to have virtual phone numbers for people to call for whichever language is provided. Some teleconference services can handle large numbers of calls, but with normal telephony this is a large number of Erlangs (conversation hours/hour) from and distributed at one location. Erlangs are useful with traffic tables to assess capacity. It would be more efficient to use a broadcast mode with LTE phones. This may be MBS (Multicast Broadcast Service) on 3GPP R17 (5G cellular, possibly even 4G). Then this is a capability the venue could offer already installed, just the phone numbers called could only need one Erlang or equivalent bandwidth per language translated. A premium quality circuit would be justifiable. While a contractor may offer delivery based on a teleconference service, it has been observed that in practice this has been found to be problematic because of the lack of capacity to carry the number of Erlangs of traffic.

The event technical staff would still have the issue of managing the Sound Pressure Level (SPL) of the house sound system. While this is not in the usual audio system toolbox,

Kybernetix LLC has a system to measure the in-ear SPL so it is perhaps 12 dB or more above the house SPL. This level difference is difficult to attain if effective audio level management and the use of compressor/limiters is not applied. People accustomed to doing video streaming are unlikely to be successful at this and the usual low level of streaming audio are examples of this. Broadcast engineers understand this.

Another traffic problem is that as part of the mobilization, buses or attendees may not show up despite tickets being distributed. There may be an arrangement for people to pick up tickets available at the venue, but manually managing the data is a traffic problem. The bus captains could have an app that could take data for no-shows of buses and individuals to enable such tickets to be available in a timely manner at the venue to better fill it even when it appears that it is sold out, and reality is not so. I observed that some people were turned away at the venue when seats were available. Such an app may need development to integrate with the ticketing management software. Effective cybersecurity is relevant to the successful implementation of such apps. Some events may attract opponents. Security through obscurity is not an effective form of cybersecurity. It is perhaps relevant that a demonstration on 2020 January 6 at the U.S Capitol did not see the use of WEA or EAS alerts transmitted, though such alerts may have had some historical benefits. One cyber-attack of EAS has resulted in the zombie alert transmission, for which there is no such code. Unfortunately, there is no code in 2013 in the U.S. for false alerts either.

Internet Redundancy Methods

In a disaster, the operation of different systems may fail. While the internet has redundancy that assures good reliability, there are redundancy methods noted below with comments.

Internet redundancy example

Having internet redundancy methods in an emergency is beneficial because it ensures continuous communication and information flow, even if one network is compromised or fails. This redundancy can be critical for coordinating response efforts, accessing vital information, and maintaining communication lines for emergency services and the public. In scenarios where standard communication infrastructures are damaged or overloaded, alternative networks can provide crucial backup, helping to manage the emergency more effectively. For example if a City Administration has an internet connection, and the City Works Department also has an internet connection, if a direct LAN or WAN connection is made between them it is possible that if one of them fails, the functionality can continue, albeit with reduced capacity. This is a normal IT method.

LTE Cellular backup (4G, 5G, 6G for example or other, like Starnet)

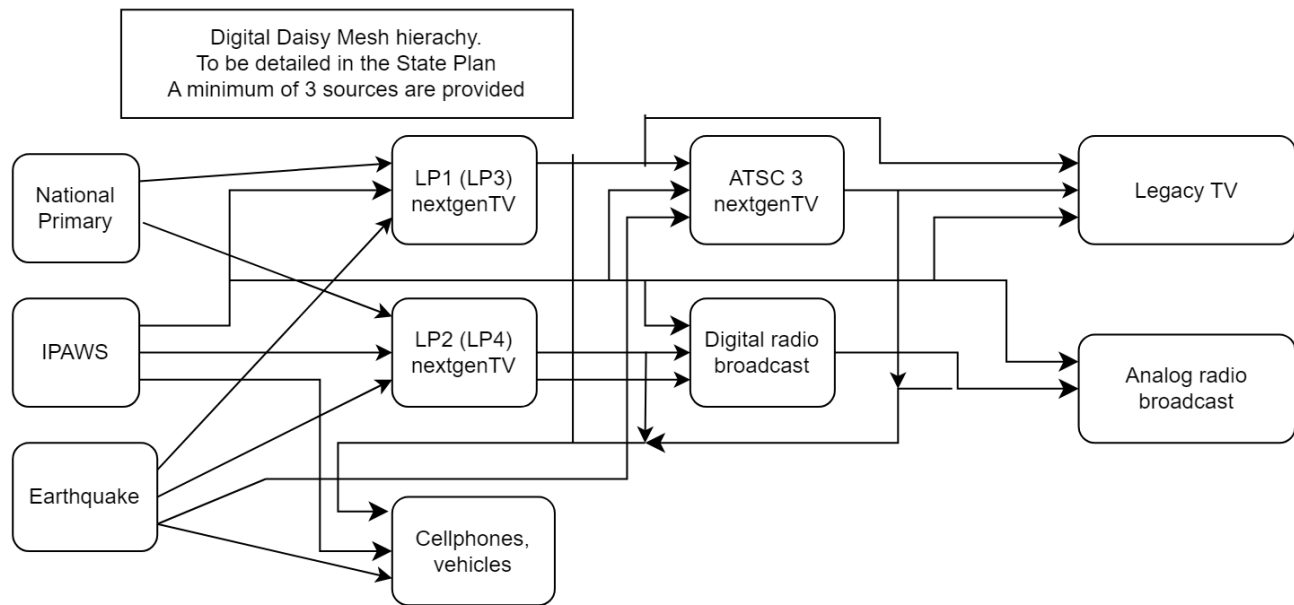
This gives a redundancy method if it is provided before the disaster. Having cellular backup methods in an emergency is beneficial as it provides an alternative means of communication when standard networks may be overloaded or non-functional. Cellular backups can ensure continuous contact among emergency responders, facilitate coordination of relief efforts, and enable the public to reach help or receive critical information. This redundancy enhances the overall resilience of communication systems in crisis situations.

ATSC 3.0 A/331.

This is broadcast TV carrying data as arranged with the originator (e.g., FEMA IPAWS). This is a broadcast QPSK high power low data rate mode. UDP is using the constellation as the internet for the UHD video, immersive audio and is also good for alerts, push publication using EDXL-DE messages or files like a hurricane inundation map prediction. A tsunami or earthquake alert could be delivered into an air-gapped network in a secure manner, using the airwaves. The protocols used are CAP 2.1 (or later) to reach the broadcaster and HTML5 from the TV broadcaster. EDXL-DE has been used in trials by PBS.

Digital Daisy Mesh (DDM)

DDM is my proposed upgrade of the Daisy Chain mode currently used in EAS messages where alerts originate from what are called LP stations which are monitored by other broadcasters in a mesh manner. As much as possible ATSC is used with alerts on A/331 and other messages using UDP on the lower power high data rate constellation, which requires better reception. Digital radio broadcast e.g., HD Radio, DAB+ and DRM can carry low data rate limited data content messages for alerts. Reception can be selective e.g., map polygons, but the amount of data in the polygon would be limited as would be the rest of the total message. Analog AM and FM broadcasters could receive such messages but further relaying is not preferable as the analog signal can degrade with lightning or other issues. A diagram of the hierarchy is below.



Digital Daisy Mesh Hierarchy Diagram

Inputs at the left are not drawn.

Downstream devices receive IPAWS and at least two other sources for redundancy.

Earthquakes may also feed into other downstream devices, e.g. vehicles from NextGenTV or digital radio.

NextGenTV output may be HTML5. Digital radio output may be EAS+ protocol. Otherwise, CAP is used. Altogether the downstream mesh is known as Digital Daisy Mesh. Messages that are not selected for the local audience should be relayed if their destination location code is included in the State Plan applicable to each broadcaster. The three primary sources are primaries. Some cell phones and car receivers may receive NextGenTV directly from the broadcaster. Driving is enough of a hazard without earthquakes, so such alerts to slow down when the road has seismic waves are very important. The program source may be selected as SDARS e.g. SiriusXM, but the receiver may select Digital Radio for an alert source. In market areas, there may be an HD Radio Weather-Alert-News (WAN) program in HD3 for example with mono lower bandwidth audio. Data on this is also applicable to railways and should be available in Japan. HD Radio and DAB+ have very limited data capacity so push publication of files would be limited. This would use EDXL-DE to NextGenTV and might be converted to HTML5. Computer reception of NextGenTV for alerts and files is expected to be implemented by such receivers. While legacy TV and analog radio can receive earthquake alerts from NextGenTV or digital radio, the reception of countdown codes in selected areas is not transmittable to receivers for implementation in software there.

AX.25 (Ham Radio)

The Ham packet radio can carry data and the ARES or RACES are active during emergencies and are an important option to include as Hams may be a solution within limitations when nothing else is available. Before anyone discounts Hams as irrelevant hobbyists, using AX.25 as a protocol wrapper software that has data limitations, but would take work to develop. Not many people are aware that when there was a military coup attempt to overthrow Gorbachev, Yeltsin had a ham radio bypassing all other means which were under Soviet control. This message delivery had history making results. This was reported in QST (a magazine for amateur radio enthusiasts) in its September 2018 issue.

Common Alerting Protocol (CAP) and the CAP Event Terms List

Included in the Appendices of this book is the latest version I am working on of an Expanded CAP Event Terms List, which is described further below.

The Common Alerting Protocol (CAP)

The Common Alerting Protocol (CAP) is an important framework in the field of emergency alerting. Developed as an open, non-proprietary digital message format, CAP is designed for all types of alerts and notifications, and it is not tied to any specific application or telecommunications method. This flexibility allows CAP to be compatible with a wide range of technologies, including traditional formats like the Specific Area Message Encoding (SAME) used in the United States' NOAA Weather Radio and the Emergency Alert System (EAS).

CAP's key features include flexible geographic targeting, multilingual and multi-audience messaging, phased and delayed effective times and expirations, enhanced message update and cancellation features, template support for framing complete and effective warning messages, compatibility with digital signature capability, and the facility for digital images and audio. The protocol aims to simplify the warning task while increasing the effectiveness of warnings by enabling their simultaneous dissemination over many different warning systems.

The development of CAP was influenced by a recommendation from the National Science and Technology Council in 2000, which suggested developing a standard method for collecting and relaying hazard warnings and reports. An international working group convened in 2001, leading to the drafting, revision, and testing of CAP in various

demonstrations and field trials. It was adopted as an OASIS Standard in 2004, with subsequent versions released based on user feedback and compatibility requirements.

Overall, CAP's adoption represents an important step in disaster management, enhancing the capability of authorities to deliver early warnings and alerts effectively across various platforms and technologies. This is critical in multi-hazard early warning systems, ensuring that alerts disseminated via multiple channels are consistent and effective. The protocol is also part of the United Nations' Early Warnings for All Initiative, which aims to protect every person on earth through early warning systems.

For more detailed information on the Common Alerting Protocol, you can refer to the OASIS documentation ([oasis-open.org - Common Alerting Protocol](https://oasis-open.org/CommonAlertingProtocol)) and the ITU's page on CAP ([itu.int - Common Alerting Protocol and Call to Action](https://itu.int/CommonAlertingProtocolandCalltoAction)).

Common Alerting Protocol (CAP) Event Terms List

Since 20xx, I have worked with the development of the Common Alerting Protocol (CAP) Event Terms List, a crucial element in emergency alerting systems. This list, as outlined in the Committee Note from the Emergency Management Technical Committee of OASIS (Organization for the Advancement of Structured Information Standards), focuses on standardizing the terms used in CAP messages. The aim is to ensure clear, consistent communication across various platforms and systems in emergency situations.

The Event Terms List is designed to clarify and categorize different types of events that might trigger an alert. It includes terms for a wide range of situations, from natural disasters to health and safety incidents. The list helps to distinguish between primary and secondary event terms, ensuring that the most relevant information is communicated in alerts. For instance, terms like "earthquake" or "flood" are primary event terms, while terms like "evacuation order" are considered secondary, as they relate to the response to the primary event.

The Committee Note also outlines criteria for the acceptance or rejection of terms, emphasizing the need for clarity and specificity in alerting language. This helps in reducing confusion and ensuring that alerts are as effective and actionable as possible.

For a more detailed view of the Event Terms List and the guidelines surrounding it, you can explore the Committee Note documents provided by OASIS. My involvement is noted in "Appendix A.1 Special Thanks".

- [Event Terms List Version 1.0 - HTML Version](#)
- [Event Terms List Version 1.0 - PDF Version](#)

The culmination of efforts by the OASIS-open standards committee led to the formal presentation and subsequent acceptance of the Common Alerting Protocol (CAP) Event Terms List by the International Telecommunications Union, a specialized agency of the United

Nations, towards the end of 2019 and into the early months of 2020. While not adopted as a formal standard, this document has been recognized as a vital committee note, associated with the CAP standard known formally as x.1303. The document encompasses a comprehensive explanation of the Event Terms List, highlighting its complexity and significance. Among its notable features is the inclusion of 230 distinct terms, each potentially associated with a 'Spectra'—a classification or numerical range that further delineates a term. For instance, the classification for nuclear reactor incidents is refined through an International Nuclear Event Scale (INES) rating from zero (indicating no threat) to seven (indicating a major accident), showcasing the document's capacity for nuanced communication in emergency situations. This structure allows for the integration of additional terms or adjustments to the 'Spectra' without necessitating legal revisions, thereby offering a flexible framework to accommodate future developments. This approach ensures regulatory bodies can mandate the use of this protocol, while also allowing for adaptability and expansion to meet evolving needs without entangling the update process in complex legal procedures.

Expanded CAP Event Terms List

Since the publication of Version 1.0 of the CAP Event Terms List, I have continued work on improving it by expanding the number of terms to include additional events and instructions, as well as translating the list into multiple languages.

Included in the Appendices of this book is the latest version I am working on of this Expanded CAP Event Terms List, to which I have added Spectra events within the events already listed, as well as NAVTEX and UNISDR/UNDRR items as primary terms, with generic instructions as secondary terms. NAVTEX (Navigational Telex) is a maritime communications system that transmits navigational and meteorological warnings, forecasts, and other urgent marine safety information to ships. UNISDR/UNDRR, which stands for the United Nations Office for Disaster Risk Reduction, is a specialized agency of the United Nations dedicated to coordinating and supporting efforts for disaster risk reduction and resilience.

In preparing for emergencies, it would be highly beneficial to an organization to have a plan in place for each primary and secondary item on the CAP Event Terms List, and could even program automatic responses in their particular tech infrastructure. For example, a large venue like a sports stadium that receives an earthquake alert could have an automated message that everyone should take their seats, and all players should immediately sit down on the field and stop play.

The event terms and instructions are already translated into multiple languages. It is expected that there will be further translations of this document for multilingual alerting.

The preparation people and organizations do before an emergency ever happens considerably affects the outcome. Whatever technical alerting improvements get made, taking the time to review these Event Terms and prepare additional instructions where

needed could make a huge impact in the event of a real disaster. The generic instructions are likely to be improved, but the OET-~~nnn~~ will remain the basic categorization.

There has already been psychological testing of alerting instructions, though not yet for this expanded set of terms I have worked on. That would be likely to result in some improvements. This is not a reason to avoid examining this list and considering what reasonable preparations your organization can make and incorporating these into your version of your Business Continuity and Disaster Recovery plan.

Remember previous stressful situations. Stress results in a form of reduction of your IQ, so do not expect that you will be able to think things out as effectively on the arrival of the event. Preppers and experts are available for a fee, but it is more cost effective for you to have figured out things beforehand as best you can. Security of your information and electronics is a complex subject which Part 2 of this book discusses. Confusion is also likely to be part of the situation, and that is a form of enemy. If there are two ways of doing something, the one to prefer is the one which has the least amount of confusion at the end, though it may cost a bit more up front.

Wildfires

These are complex. For example, grassfires can spread faster than people can run. Wind can exacerbate the problem. A table is proposed to address this. A problem in Lahaina Hawaii was that the EAS and WEA did not have a code for fire risk that was suitable. Maui is also a potential extreme tsunami source.

[BCDRE-ARC Wildfires Table](#)

Date and Time Considerations

Regulations around date and time format in emergency alerting are crucial for ensuring clarity and consistency in communication. During emergencies, accurate and unambiguous time and date information is vital to effectively coordinate response efforts, convey the urgency or timeline of a situation, and prevent confusion. Standardized formats reduce the risk of misinterpretation due to regional differences in expressing dates and times, which can be critical in situations where every moment counts. Uniformity in these formats ensures that all parties involved in an emergency, across different regions and organizations, can quickly understand and act on the information provided.

The format of date and time that is ISO preferred and widely used is defined by ISO 8601. For combined date and time this is e.g. 2015-11-28T10:16:42+00:00. The reference time is also called TAI (Temps Atomique International, International Atomic Time).

This is `yyyy-mm-ddThh:mm:ss+/-hh:mm` The red `hh:mm` is the + or - offset from UTC which is 00:00 and is also known as Z or Zulu time. There are other ways of representing this provided for in the standard. Some countries use a `dd/mm/yyyy` format and some use a `mm/dd/yyyy` format, see further below. The ISO preferred format is unambiguous and is legal worldwide, so you can use them at all times and places. AM and PM are not used. Finer resolutions of time may be used:

- a) The seconds may be decimalized for finer resolution, e.g. for IRIG timecode. A 10 MHz clock gives resolution to 0.000 000 1, with interpolation based on zero crossing time possible.
- b) The seconds may be followed by `:nn` or `;nn` where the `nn` is the number of frames in SMPTE timecode. The `:` denoted non-drop frame and the `;` denotes drop frame which has particular values dropped as the frame rate may be 29.97 frames per second. A flashing `:` is an alternative to `;`.

Accommodation of Other Date Systems

There are a number of other calendar systems in use. These could be displayed without changing the underlying value structure. One system is used in Excel. Days are counted in increments of unit digits and the decimal fractions are the time measurement. That system starts at midnight beginning 1900-1-1. If you enter 0 in a cell and format it for date and time, it will display that value. Earlier dates can be entered but no processing can be done.

There are a number of others, most of which are lunar calendars. The East Asian lunar calendar has the year start soon after the ISO 8601 version. South Korea has officially adopted the Gregorian calendar. A way to address this is for the East Asian lunar calendar to start and proceed as currently, but to represent the time between the two years' starts as month 00 when translated from another software application. Then there is not any confusion as to which year is involved because month 00 would mean the remainder of month 12 in the East Asian calendar, but the year value would have changed. This could be adopted by several countries and then defined as an ISO 8601 extension. As the base year in the East Asian lunar calendar has varied, the most common now used is that of the Gregorian calendar year. As different base years are possible, the adoption of 2000 as year 0000 should be possible. So, 2001 would be year 0001. This can be a user preference switch in the software along with the other month format preferences. This would be a presentation choice that does not require a change of the underlying data format.

The Islamic and Hebrew calendars are also lunar. The Islamic one has some variations e.g. between Mecca and Indonesia. That would be a matter for them to resolve. It is then possible for them to define an algorithm that can translate between that and ISO 8601. They can

define it as a national standard in several countries and then bring it to ISO to be approved as an ISO 8601 extension. The Hebrew calendar can likewise implement an extension.

The year value can also be an offset as +/-yyyy for the various systems with preset values for each system and an ability to also specify this value for other systems. This value immediately follows the +/-hh:mm (if present) because software parsing the string may not include processing for the additional item. Then it can be a universal software calendar. When such values are displayed, they SHALL be as yyyy.mm.dd. Filing system notation may also be in the form aaaa.bbb.ccc.ddd, so both are firstly display formats. If a field has leading zeros, this should be maintained to indicate the length of the field. While Y2k has passed, this could be an issue in the year 10 000. So in preparation for Y10k, software SHOULD be written so that if a result is invalid, it SHALL recalculate with 10 000 added to the later date. Note that with more than one digit in the thousands a no-break space is used. This is not a regular space, but it is a no-break space entered as CTRL-SHIFT-Space in Word. The value is one character string with the end spaces delimiting it. This is also an ISO standard for writing numbers. Commas are not used and a period is a decimal point. Excel does not recognize this standard however, although Word does.

A way to accommodate Islamic “Hijri” and Hebrew calendars is to assign letters for the month, except for O and I special cases below to avoid confusion. Also, some other display formats can be accommodated.

letter	Islamic Name	Approximate Gregorian month	Notes
A	Muḥarram	November	
B	Safar	December	
1 or I	Rabi' al-awwal	December/ January	Used during Gregorian January as Gregorian year has incremented
C	Rabi' al-awwal	January	
D	Rabi' al-Thānī Rabi Al-Akhar	February	
E	Jumada al-Oola Jumada Al-Awwal	March	
F	Jumada al-Thani Jumada Al-Akhirah	April	
G	Rajab	May	
H	Sha'ban	June	
J	Ramadan	July	
K	Shawwāl	August	
L	Dhu'l-Qi'dah	September	

	Dhul Qadah		
M	Dhu'l-Hijjah	October	
	Hebrew Name	Approximate Gregorian month	Notes
N	Nisan Nissan	April	
P	Iyar	May	
Q	Sivan	June	
R	Tammuz	July	
S	Av	August	
T	Elul	September	
U	Tishrei	October	
V	Marcheshvan Cheshvan	November	
W	Kislev	December	
0 or O	Tevet Teves	December/ January	Used during Gregorian December as Gregorian year has to be incremented
X	Tevet Teves	January	
Y	Shevat Sh'vat	February	
z	Adar Aleph	March	Itercaloric leap month when needed
Z	Adar	March	

Islamic to Gregorian Months Conversion Table

Presentation Formats

In addition to the ISO default format of yyyy-mm-dd others may be used, including the months as above. A leading zero on input is not needed, though month 0 SHALL be accepted. Leading zero on display may be omitted for the millennial year by default, and for months and days when displayed as individual dates by default. Leading zeros for months and days when in arrays SHALL be displayed by default.

Other formats for display are

dd/mm/yyyy, mm/dd, yyyy/mm/dd, yyyy\mm, dd\mm (NOT dd/mm), mm\dd\yyyy (NOT mm/dd/yyyy), yyyy (with millennia displayed).

When the millennium increases from 9 to 0, in the year 10 000, software SHALL perform calculations assuming that 10 000 has been added IF it is not a value that is already entered.

WHEN Islamic, Hebrew, East Asian (or some other lunar calendar with a specified year offset) is used, the default is that the Gregorian year is displayed, but the alternative for display SHALL be selectable on entry. The use of the letters for the month as above select which algorithm is used for the year increment date. These entry and display formats enable a unique date entry. The year offset SHALL be (+/-yyyy, with set values for Islam and Hebrew) preceding the string and a no-break space between this and the yyyy ISO 8601 string. The first y SHALL be suppressed IF zero in the offset part of the string.

As the day increment in Islamic and Hebrew calendars is made at the local sunset time, and the visibility of the new moon crescent increments the month, these are not necessarily observed at other locations at the same moment. So, the default SHALL be to increment at midnight local time, with 24-hour clock display. Non-24-hour clock display SHALL be indicated as either AM, PM, an indicator active indicating PM, or optionally S for sunset with a 24 hour display starting at 00:00:01 and ending 24:00:00 meaning the end of the day. The use of 12:00 meaning noon is NOT recommended EXCEPT on a 24 hour display. This is why airlines and often train times do not depart at this time, to avoid the confusion of 12:00 AM and 12:00 PM.

India has different States and versions of either lunar or solar based systems. This was the case in South Korea, which has switched to the Gregorian calendar. The details of this have not been adequately researched. The two solutions for the lunar calendar proposed here may be equivalent to one of these for presentation purposes. They may apply the decision South Korea has made, but as only one country is affected this is being left for them to decide. That these have religious aspects also and the Islamic calendar is relevant, this makes it appropriate for an international standards organization. This might be initially developed by OASIS-Open.

Technology Considerations for Improved Emergency Responder Communications

In the U.S., First Responders {Police, Fire, Ambulance, Emergency Management} have a special version of cell phone which is more rugged and uses a reserved frequency band which is almost all of the 600 to 700 MHz range. This is so that in a disaster, when the public are using their cell phones a considerable amount, the First Responders have adequate bandwidth to receive and send reports (e.g., from mobile or computer). In addition, PBS TV also broadcasts data to First Responders as part of the ATSC 3.0 "NextGenTV" data stream, which can be encrypted and therefore secure. NextGenTV is designed with the priority to be much more easily received by suitable cell phones.

As TV broadcast in the U.S. uses VHF (Very High Frequency) and UHF (Ultra High Frequency), a considerable bandwidth is available. The transition of the 600 to 700 MHz band to FirstNet (a nationwide, high-speed, wireless broadband network dedicated to public safety and emergency responder communications in the United States) and allocation of frequencies above 700 MHz for additional cell phone usage was accomplished by the FCC.

For other countries, it may be more achievable to use the FirstNet concept with the 650 to 750 MHz or 700 to 800 MHz frequency ranges. International agreement, preferably with the ITU involved, is recommended so as to be able to mass produce suitable cell phones. In addition, both NextGenTV and DVB-T2 are capable of using Single Frequency Networks (SFNs) where the repeaters use the same TV channel having the same content.

When the terrain is flatter or has more moderate hills, SFN implementation is most appropriate with fiber to the transmitter, which is most likely at a cell site also. When the terrain is more mountainous or has many larger hills, the UHF propagation is poor. In addition, getting fiber to mountaintops is not only expensive, but like coax, there are two problems: 1) that the fiber or coax center is inclined to slowly slip downhill and then break, and 2) that such terrain is also more subject to erosion and possibly earthquakes which would damage the cable.

In addition, high remote sites may require closely spaced power poles because of icing adding weight to the wires. An alternative distribution approach may be tri-frequency distribution, where the original transmitter is VHF on frequency A and at the outer range this is repeated (translated) to frequency B on VHF. Horizontal polarization is used to minimize issues with other VHF users. This alternates around the country. At both such locations, and elsewhere, UHF transmitters are located which receive from the A and B transmitters and all transmit on frequency C with circular polarization. The data from the receivers is reclocked, perhaps with a rubidium oscillator that is GPS stabilized. Frequency C then becomes a SFN receivable by cellphones.

As NextGenTV is Internet Protocol based, it is still possible to deliver advertisements to selected recipients via the internet. This improves the economy.

Combining the FirstNet technology and the NextGenTV technology in a single receiver is possible with a successor to the Media One phone later described. An alternative may use the LG33072 TV receiver chip by LG instead of the Saankhya Labs one. While Sony TVs appear to use their own TV receiver chip, it is not currently known whether this is suitable for incorporation into a cell phone.

European Commission, Disaster Risk Management Knowledge Center (DRMKC)

A number of technical papers were presented mostly focusing on the various aspects of Emergency Management, other than Alerting which was acknowledged as one of the five Flagship goals, no further information was available despite asking questions over a two day period. The second day was the FireLogic discussion regarding Forest Fires by a number of presenters. As I have prepared presentations for a Wildfires Conference at Ohimbira University and also for Copernicus Galileo conference, the content is incorporated into this book. Ask info@firelog.eu for wildfire papers and information.

The Europeans are making progress on addressing cross-border Emergency Management issues including harmonizing equipment and capabilities for combined exercises and implementations. For the use of the Galileo satellite see

https://www.unoosa.org/documents/pdf/icg/2023/ICG-17/icg17_wbg_20.pdf

but this was “404 not found” on this server. Perhaps my reply will elicit further information.

In

<https://www.euspa.europa.eu/newsroom/news/successful-demonstration-new-emergency-warning-satellite-service-takes-place-france>

the EWSS (Emergency Warning Satellite Service) provides a future use of the messaging service delivering alerts to mobiles with GNSS chips. This is under the STELLAR consortium based in France. This is in addition to the Galileo SAR (Search and Rescue service) satellite service which is part of the GMDSS (Global Maritime Distress and Safety System) of which NAVTEX (mentioned elsewhere in this book) is another component. This alert was received within seconds of activation of an EPIRB (Emergency Positioning Indication Radio Beacon) which is recommended for mariners. While this does not operate underground, there are two solutions applicable there.

Road and train tunnels may be equipped with leaky coaxial cables to provide mobile service in such locations, and alerting services of WEA or SMS Broadcast by this means.

In buildings, including underground, the integration of the Fire and Evacuation Alarm system with the Emergency Alert System using selective message delivery via ATSC 3 AEA or HD Radio or DAB+ would provide alerts. Note that on AEA, HTML5 is used and on digital radio, the improved EAS protocol would be used, because of lack of data bandwidth. The source protocol would be CAP v1.2.

Satellite alert distribution over wide areas has the possibility for the alert message traffic to exceed the single delivery feed. As in SDARS (satellite radio broadcast), the messages having Automation Priority Values then can be queued and if necessary, of low importance, then dropped at timeout. This being an additional path to mobile alerts not implemented in the U.S., the rationalization of the messages received for the same original message originated can be performed to avoid Alert Fatigue.

Some Personal Observations

Living on a dairy farm, sometimes there were power outages. In order to milk the cows, we would drive the farm tractor next to the cowshed and put a wide belt between the pulley wheels on the tractor and the milking machine and power the milking that way. Care is needed and children must be kept away.

The employee, Pat Hillman used the farm truck for his car. Cars were rather more expensive then. One evening he was going to visit relatives up the creek. My father told him that there was a flood warning and not to drive through the creek. Next morning there was no Pat and no truck. We went to look and saw the truck on the road side of the creek. Upon inspection, the floodwaters came within 5 cm of going into the carburetor on top of the engine. So, we towed the truck home, got the starter and distributor (mounted at the engine front) and generator repaired by the auto electrician. Then we put kerosine into the spark plug holes, drained water from the oil sump, charged the battery and ran the starter to flush out the engine. With the spark plugs back in we started the engine, and it started fairly soon, so we ran it. However, the silt had gone outside and inside the exhaust. It had a lot of organic material in it, so as the exhaust heated it, it gave off a lot of smoke but didn't catch fire.

Pat was apologetic and was forgiven for an honest mistake. Pat Hillman was a grandson to the Prophet Rua Kenana, a Hepitipa of Ringatu religion. There are all sorts of people in this world, including children of famous religious leaders (Wikipedia has some more information). While this book is largely of a technical nature, it is also to be appreciated that there are other kinds of people in the world who likely have relevant viewpoints. Accordingly, after the 2004 Indian Ocean Tsunami I gathered responses from various leaders of organizations and their responses follow. This became a motivation for doing this work.

Responses to the Emergency Alert System proposed plan outline

Support means supporting the proposal goals. Endorse means endorsing the proposal technical plan. Those who have yet to respond are not listed. Except for verbal, responses are documented.

Legend: Opp/O - Oppose, Dis/D - Disagree, Ref/R - Refuse to Say, App/A - Appreciate, Sup/S - Support, End/E - Endorse

	Opp	Dis	Ref	App	Sup	End
ACLC (Archbishop Stallings, verbal) USA	---	---	---	---	---	E
American Radio Relay League USA	---	---	---	---	---	E
Assembly of God USA	---	---	---	A	---	---

Australia	---	---	---	---	S	---
Baha'i of USA	---	---	---	---	S	---
Benny Hinn Ministries USA	---	---	---	A	---	---
Bill & Melinda Gates Foundation USA (statement)	---	---	---	---	S	---
Canada	---	---	---	---	S	---
Catholic, Paterson Diocese NJ	---	---	---	---	S	---
City Alert Texting System UK	---	---	---	---	---	E
Congressman Joe Wilson SC	---	---	---	---	S	---
Demoss Associates (USA PR company)	---	---	---	---	S	---
Hindu Association Baps NJ	---	---	R	---	---	---
International Association of Emergency Managers (verbal) USA	---	---	---	A	---	---
International Society of Krishna Consciousness USA	---	---	---	---	S	---
New Zealand	---	---	---	A	---	---
Orthodox Judaism USA	---	---	---	A	---	---
Papua New Guinea	---	---	---	A	---	---
Presbyterian Church USA (verbal)	---	---	---	A	---	---
Qualcomm	---	---	---	A	---	---
Red Cross USA	---	---	---	A	---	---
Senator John McCain AZ	---	---	---	A	---	---
Southern Baptist/North American Mission Board USA	---	---	---	A	---	---
Sweden	---	---	---	A	---	---
Thailand (vendor & ADPC information)	---	---	---	A	---	---
Tibetan Buddhism, His Holiness the Dalai Lama	---	---	---	---	S	---

Summary of responses:

Oppose	0
Disagree	0
Refuse to say	1 (counted as a no)
Appreciate or Interested	13
Support	8
Endorse technical plan	4

From:

Countries	7
Religious groups	11
Community/National/other groups	6
Congressmen or Senators	2

Conclusions

These organizations, with existing legislation, technology details described elsewhere, and justifiable finance could implement a very effective improved Emergency Alert System that is very profitable for the countries implementing it. As this is a Government system to the affected areas for free, it is complemented by subscription services with specialized capabilities tailored to organizations.

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Section 4: Review of Science for Disaster Risk Management 2020

Science for Disaster Risk Management 2020 (SDRM2020) is a report written by the Disaster Risk Management Knowledge Centre (DRMKC) of the European Commission. Below are my comments and feedback on that report.

References to Radio and Television Broadcast

P 169 of *SDRM2020* refers to radio and Television broadcast as less important because of the availability of SMS on mobiles. The ability to receive a message when outside the target area is considered important. This is not considering the subscription requirement and lengthy message delivery time compared with the onset time of many disasters, which has not been included in this writing for an unknown reason. Also, the importance of redundancy of delivery e.g., for forest fires where mobile delivery had major failures, which has cost many lives in California and some European countries e.g. Greece and Portugal.

P390 and 391 referred to radio and television as remaining functional during a power outage, of which Hurricanes Sandy and Katrina demonstrated in the U.S. The future of TV with ATSC 3.0 AEA A/331 is not mentioned, but if the mobile has power, such TV and alerts can be received by this means.

P392 and 393 refers to Ham radio capability which in the U.S. is known as ARES or RACES as being valuable.

P399 has the reference for Perri noted above.

P553 and 554 refers to radio and TV broadcasts as valuable.

P566 Fig 5 has radio and Television Broadcast in a distribution diagram. The diagram on P9 of this paper includes the healthcare systems, and also the various protocol standards or some apps available. This is based on the Integrated public Alert and Warning System used in the U.S., which has a Canadian counterpart.

P573 has a reference to Radio Sweden as being ill-equipped to deal with forest fires.

P588 and 589 refers to radio and TV as old media, compared with social media. This is not considering the technological developments of digital broadcast which are either a more favorable for alerting by transmitting data, or to have this designed into the standard as is Advanced Emergency Alerting A/331 in ATSC 3.0, which is designed for all TV systems worldwide including UHD (also known as 4K or higher) which is reaching viewers in the U.S

and South Korea currently. Improved picture and sound capabilities are as good as better movies, as well as a lower resolution with stereo sound deliverable direct to suitable mobiles, along with the alerts. Digital radio broadcast includes HD Radio, DAB, DAB+, DRM, DMB (China), and Satellite Digital Audio Radio Service (SDARS) of which SiriusXM is the U.S. example. There are also various Direct Broadcast Satellite (DBS), cable TV and telco TV (fiber to the home e.g. FIOS).

Addressing the multiple social network and internet streaming video systems is not particularly appropriate at the source, so alerting from the ISP and having capability in the operating system would probably be more relevant if this can be secure. The Federation of Internet Alerts www.internetalerts.org is another method, and also not mentioned in *SDRM2020*. The limited number of operating systems may make this attractive to implement, but it would take some time to get this implemented for a majority of devices using Windows, Mac, and Android. The various flavors of Linux may also be addressed, but this is a rather decentralized community, so paying individual developers seems the only option there. While legislation might appear to be a solution, this may result in a one-time fix that becomes obsolete as the software develops. A standards committee to do preparatory work is relevant, and there are a number of these which work together. Proposing such work would then require research to find the organizations and relevant budget.

While selective delivery of alerts with radio and TV broadcasting is not mentioned, targeted delivery of messages is on P536, 555. P351 refers to cyber-attacks, which would be different alert targeting than the geographic targeting normally referred to here. The authors appeared to be unaware of the capability to geographically target alerts using broadcasting even though this is available with "Public Alert" type radio receivers which use the PSSCCC code to do so, and in my information provided about extending this to geotargeting and other means.

Since my providing review information to *SDRM2020*, there have been further developments, one of which is this book, and more below.

While the use of the Common Alert Protocol (CAP) is mentioned, it is also relevant that this has been adopted by countries with over 70% of the world population. Also, it is ITU.int standard X.1303. In December 2019 there was a meeting to present and discuss an Event Terms List to accompany the Common Alert Protocol as a committee note for the ITU. This has OET-*nnn* numbers and spectra possible for these numbers. Currently I have based on this, and also previous CAP Profiles and other sources developed a list that has many spectra items. Then based on prior alerts and test messages used on the Emergency Alert System, I developed Message Templates, including text from the spectra, Urgency, Severity and Certainty with consideration for the event being messages. This includes earthquake and missile countdown message provisions, with a message delivery time from detection (e.g., by P-wave) to listener/viewer reception estimated as being less than 3 seconds. The details of this are noted elsewhere and may be referred to above. These are in spreadsheets originating in English, and translations to Spanish, French, Korean and currently Japanese are being translated. All translations are a first draft. The original Terms List was translated to

120 languages, but checking is applicable. The English Message Formats are checked a number of times, though improvements are possible. These are alerts, so the grammar may not be that of prose. Also, they are designed to be multilingual with computer translation possible for data entered at the time and location for the situation. As mobile, broadcast, and other computer messages are derived from the entry process, the differing versions are provided for, including HTML 5 for use on ATSC 3.0 receivers NextGenTV. Some symbols are developed by FEMA, but these do need extending to the Terms List. Some others are also gathered from various sources for the record. The implementation of all of this is a considerable project, and a filing to the Federal Communications Commission (FCC) has already been made regarding this matter.

With all of the means of reaching people, it has become apparent that the possibility of over-alerting and getting alert fatigue from the lack of coordination of definitions to avoid this in the device (computer or mobile) is already apparent in the U.S. “over-alert” is already an entry in the Collins dictionary, and searching for that term and “alert fatigue” results in many items found, but neither are mentioned in *SDRM2020*. Nonetheless, all methods are important to maximize coverage. The economics is discussed, but the value of a life for this purpose is not. See “Risk and Reason” by Cass Sunstein and “The Unthinkable” Amanda Ripley. For protection of life, p72 is noted and the FCC filing. Alerting includes distribution of inundation, pandemic risk and other map data for use with mapping software in computers, mobiles and vehicle navigation systems.

The Executive Summary in chapters 4 and 5 refers to Early Warning systems as special implementations.

As noted at the publication meeting, this is work in progress, and policy recommendations need to reflect the realities of 2021. Perhaps an annual update would be better than the 3 yearly interval thus far. Thank you all for this work. No reference to Earthquake Early warning, e.g. within 3 seconds of P-wave was found. This is here.

Section 5: COVID-19

At the time of writing, the COVID-19 pandemic, while officially declared over, is still the most well known global emergency in living memory. Given that, I thought I would take a few pages to address the relevance of emergency alerting in dealing with infectious disease disasters.

Bill Gates' TED Talk

On Mar 25, 2020, Bill Gates gave a TED Talk on Youtube about responding to the Coronavirus Pandemic. You can find it in full here: [YouTube - How we must respond to the coronavirus pandemic | Bill Gates](#)

An aspect not mentioned in his talk is Emergency Management. Effective emergency management would have been significantly beneficial during the COVID-19 pandemic in several ways:

Proper emergency management involves preparing for pandemics, including having plans for rapid response, resource allocation, and clear communication strategies. This preparedness can significantly reduce the time taken to respond to a pandemic.

Effective management ensures the efficient distribution and use of resources such as personal protective equipment, testing kits, and later, vaccines. This would minimize shortages and ensure those most in need receive necessary supplies.

Clear and consistent communication from trusted authorities is crucial in managing public response during a pandemic. Emergency management can coordinate the dissemination of accurate information to prevent misinformation and panic.

Emergency management can aid in the logistical support of healthcare systems, ensuring hospitals and health workers have the resources and support needed to treat patients effectively and safely.

It includes plans for supporting individuals and communities economically affected by the pandemic, ensuring that there is a safety net for those who lose income or employment.

In summary, a robust emergency management system could have contributed to a more coordinated, efficient, and effective response to the COVID-19 pandemic, potentially reducing its spread and impact. In particular, South Korea and Taiwan were very effective in getting alerts delivered to the public and moving quickly with the first cases. Here, we have the old Emergency Alert System on radio and TV, and the WEA system on mobiles which is improving. The IPAWS Improvement Act (US Law 114-143) was signed by President Obama. However the possible improvements are not being made, and one example is the use of

NextGenTV (ATSC 3.0) to deliver alerts to suitable smartphones, Dependence on mobiles is also an issue as the California wildfires showed, where selective area delivery via radio or TV could have saved perhaps 100 lives. The value of EAS was demonstrated in the Samoan tsunami where American Samoa had 31 fatalities and Samoa had 149. The difference was primarily due to American Samoa having the EAS activated by a radio station operator. In the current pandemic, the difference the Emergency Alerting could have made is not simple to estimate, but Taiwan having over 100 cases and one fatality (Mar 19) shows the value of this area of improvement. (addendum) Between Dec 31 and Feb 23 they sent 37 alerts and took 76 other actions according to AMA. A plot of first Emergency Alert and cases on April 18 correlates showing the clear advantage of the earliest public warning.

A meeting with the International Telecommunications Union to discuss the CAP Event Terms list is scheduled for September. Some new terms that are likely to be included are “communicable disease”, “contagious disease”, “interspecies zoonotic disease” and terms relating to travel alerts. The cost of this pandemic has now greatly exceeded the cost of measures which would have considerably reduced the magnitude of it, as indicated above.

COVID-19 Fatalities and Economic Cost

Fatalities and Emergency Alerting

Below is a table cataloging by country the population, number of COVID fatalities, and the date of first emergency alert regarding COVID.

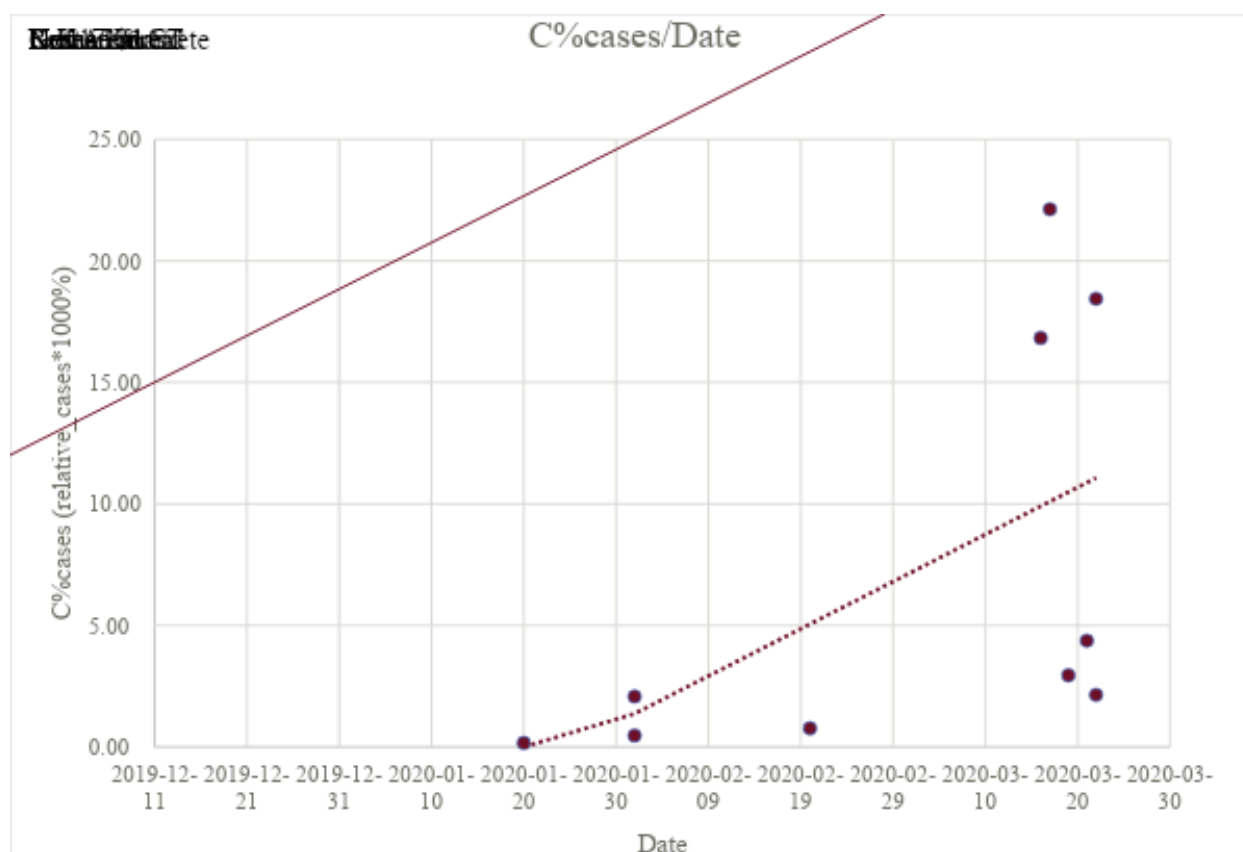
size rank	Country	population	cases	fatalities	k%fatal	data date	firstPubAlert	C%cases	
56	Greece & Crete	10,423,054	2,235	110	1.06	2020-04-18	2020-03-22	2.14	WEA
31	Japan	126,476,461	9,787	190	0.15	2020-04-18	2020-02-20	0.77	Vax before travel
20	Netherlands	17,134,872	31,589	3,601	21.02	2020-04-18	2020-03-22	18.44	WEA
26	New Zealand	4,822,233	1,422	11	0.23	2020-04-18	2020-03-19	2.95	level 4 WEA
15	Romania	19,237,691	8,418	421	2.19	2020-04-18	2020-03-21	4.38	WEA
28	South Africa	59,308,690	2,783	50	0.08	2020-04-18	2020-02-01	0.47	State Dept travel
25	South Korea	51,269,185	10,653	232	0.45	2020-04-18	2020-02-01	2.08	State Dept travel
49	Taiwan	23,816,775	398	6	0.03	2020-04-18	2020-01-20	0.17	Travel alert Wuhan (AMA)
10	United Kingdom (less smaller islands)	67,886,011	114,217	15,464	22.78	2020-04-18	2020-03-16	16.82	PM press conference
2	United States	331,002,651	732,197	38,732	11.70	2020-04-18	2020-03-13	22.12	Lavaca County TX

Not included here is a chart comparing the relative number of cases and the relative number of fatalities for all countries. This correlates fairly well, with an outlier case being that of the crew and passengers of a cruise ship.

Below, the trend line over the 60 days from 2020-01-20 goes from a value of 0.17 C% (398 Taiwan) cases result at 2020-04-18 to a regression line, with considerable variation, of 12 C% or 0.0012 of the population after 60 days. The first public alert date of most countries is not easily obtained data. Many have no alerting system. The correlation value shows that this is a relevant factor. There are no doubt other factors also which factor analysis would elucidate.

A regression curve from the US first alert back to zero on Jan 3, 70 days, then this divides a \$1.5 Trillion to \$214 Billion per 10 days. Multiply this by the coefficient of correlation 0.56 gives \$120 Billion benefit for 10 days earlier alerting. This is the solid line on the chart.

COVID-19 Economic Cost



Correlation 0.564

With the U.S. cost being in excess of \$1,500,000,000,000, this is extremely expensive. The earliest 4 examples also had the lowest 4 results. Therefore, prompt warning is extremely beneficial. Emergency alerting is a component of addressing this benefit, which is why the date of the first alert is used as a baseline. Reducing the alerting time by 10 days could have resulted in a relative saving of about $(10/57)=0.175$. As the cost has risen to about 1.5 trillion, the answer would be \$263 billion. This is more than the \$120 Billion benefit calculated above for 10 days earlier alerting. The curve here is linear, but when it is rising it is more exponential, so the 10 days calculation should have resulted in a larger number. However, U.S. Law 114-143 (The IPAWS Improvement Act) had hardly been implemented in time to make any difference. Comparing the fatalities with Taiwan, there would be about 60,000 less (as of April 30) which according to Risk and Reason, when valued at \$2 M each then is \$120 Billion. Either way, the cost of not implementing the alerting improvements very greatly exceeds the cost of implementation. Maps are used by Emergency Managers that have the infection rate as a layer over earth. This could be more widely distributed in detail via public alerting as precipitation risk and flood/inundation maps in SHP (shapefile) or DXF (Drawing Exchange Format) are in an improved system.

The data from China is not included. There are a number of questions that are relevant e.g. relating to a) the transparency of the process including accuracy checking, b) the inconsistency of the various related data, c) the treatment of the early medical staff d) the suppression of worldwide distribution of the beneficial early data from Taiwan e) the undiplomatic language used on social media attributed to the government representatives of China, to name a few.

COVID-19 Emergency Alerting Technical Aspects

Johns Hopkins COVID-19 center (JHU) produces a nationwide map of data by county. This uses Esri software. Esri developers, with Johns Hopkins attribution or contract, can separate this so the data has a polygon of the county, with up to 9 segments possible. These would make SHP files which can be put in a EDXL-DE wrapper for distribution on the FEMA IPAWS reflector. Possibly Gary Hamm would need to modify the IPAWS software to provide for this. One may use the CAP protocol designed for messages to people, not computer file transfer. The EDXL-DE is more suitable than CAP for computer file transfer.

The IPAWS reflector is where broadcasters, telecom companies and others receive alert messages from. AWS provides the hardware. The EAS Encoder/decoder at the broadcaster receives messages relevant to that broadcasters' coverage area. Telecom companies receive WEA text messages for mobile alerts. Improved EAS for an HD Radio station or AWARN/AEA for NextGenTV stations the map data can be transmitted to consumer receivers. The protocol used here is HTML5. This includes directly to mobiles in the future.

Transmitter software may be modified. David Maxson (Isotrope), the Xperia engineers. ATSC engineers and software developers of the relevant equipment would all be involved in this implementation. Some standards development is expected as part of this process. Then consumer electronics products software developers of the various companies would be adding this feature as well. The majority of the world has adopted CAP which favors one software implementation worldwide. This is much more favorable for consumer electronics economics. The SHP file data would be supplemental information relevant to the map with the present location and the directions selected. Similarly, from Emergency Management Offices other file types, e.g. text, PDF, graphics publications can be push-published to defined areas. This is a technology that news operations can use as input, but also it is a form of bypass for such official messages to directly reach consumer devices such as TVs, radios, smartphones and computers. Such capabilities would be versatile tools for managing communications with the public.

Map navigation companies could also download the SHP data from IPAWS for similar use. Users would see the relevant data to their present and destination locations. The screen size is small so the JHU attribution may be undesirable. EDXL-DE is a file distribution protocol. Other emergency data can be pushed to the public in specified formats, within the data rate capability of the system. EAS is part of FCC Part 11 rules, they would likely have some involvement, and they have a Public Safety and Homeland Security Bureau addressing regulatory aspects. They have accepted ATSC 3.0 A/331 already. The ability to deliver messages without interrupting normal program content is an important aspect. Car radios are an important distribution mode as they are not as distracting and subject to the sanctions against texting while driving, which is a consideration with mobile map navigation. This EDXL-DE protocol would also be useful for other map data such as flood and inundation map data to add to the map display. In addition, push publication of text, Rich Text and pdf files to the public of emergency educational material.

Many software development components are essential, and Agile/SCRUM development is relevant. An integration and test lab for the whole system is important for all the different manufacturers. COVID-19 has the highest priority, but there are other functions to address down the line e.g. to implement flood maps, hurricane/tsunami inundation, Earthquake Early Warning by such means within 3 seconds and other improvements. The reopening of the economy with the best expedited health situation is very important.

In this country, the lack of alerting is a persistent problem. For example, it appears that during a recent riot in the U.S. Capitol in 2021, no alerts to mobile phones were sent.

Section 6: Relevant Articles about NextGenTV in Mobile Phones

The integration of NextGenTV/ATSC 3.0, into mobile phones marks a significant advancement in broadcasting technology, promising to redefine how television content and emergency alerts are accessed and received on the go. This section delves into recent developments and pivotal articles that illuminate the journey of ATSC 3.0 from concept to reality in mobile devices. However, while cellphones with ATSC 3.0 reception have been manufactured as proof-of-concept, at present nobody is making them available to consumers in the U.S.

ONE Media's ATSC 3.0 Smartphone Becomes a Reality

The article below discusses the introduction of the ONE Media Mark One smartphone, which represents a significant milestone in the integration of ATSC 3.0 technology into mobile devices. This development, as reported by Phil Kurz for TVTechnology on October 14, 2020, marks a pivotal advancement for Sinclair Broadcast Group's strategy to make NextGenTV an essential feature of smartphones and other portable devices. The Mark One smartphone, powered by Saankhya Labs' SL4000 ATSC 3.0 receiver chip, is not only a testament to Sinclair's innovative approach to overcoming the classic chicken-and-egg problem in technology adoption but also a strategic move to enhance mobile TV viewing and emergency alerting capabilities. With its embedded antenna, compatibility with major carriers, and potential for widespread distribution through MVNO partnerships, the Mark One sets the stage for a future where mobile devices play a central role in accessing digital broadcast content and receiving emergency alerts. This initiative not only underscores the technological synergy between broadcasting and mobile communications but also highlights the legislative efforts to mandate the inclusion of ATSC 3.0 receivers in portable devices for public safety purposes. Below is the original text of the article.

ONE Media's ATSC 3.0 Smartphone Becomes a Reality

<https://www.tvtechnology.com/news/one-medias-atsc-30-smartphone-becomes-a-reality>

By [Phil Kurz](#) last updated October 14, 2020

The Mark One is a lynchpin in Sinclair's strategy for making TV truly mobile



(Image credit: ONE Media)

HUNT VALLEY, Md.—ATSC 3.0 in smartphones took a big step forward this week with delivery of the first of hundreds of production sample phones to the Sinclair Broadcast Group, a key part of the station group's strategy to ensure that NextGenTV one day is an integral part of mobile phones and other devices.

The ONE Media Mark One phone powered by Saankhya Labs is an Android smartphone with built-in Saankhya Labs SL4000 ATSC 3.0 receiver chip providing NextGenTV reception, tuning and demodulation. The Mark One relies on an embedded antenna –not a pull-out or hang-on antenna—and is an unlocked AT&T- and T-Mobile-compatible device, says Mark Aitken, President of ONE Media 3.0 and senior vice president of technology at Sinclair.

"This is the phone that we had hoped we would have had in sample form for the NAB Show," says Aitken, "but COVID struck—it struck hard and shut things down."

The Mark One has been two years in the making, delayed for months because the electronics industry in China where certain components are fabricated was shut down as the virus affected the nation, he says.

By jointly developing the underlying technology with Saankhya Labs (working with BORQS, a device OEM), building the phone and deploying NextGenTV stations around the country,

Sinclair in essence has eliminated the chicken-egg problem. “We are both the chicken and the egg,” says Aitken.

THE BIGGER PICTURE

Sinclair is in talks with two large MVNOs (Mobile Virtual Network Operators) that ride on the AT&T and T-Mobile wireless networks about offering the phone, says Aitken, who declined to identify the operators.

“There are millions of MVNO subscribers that would be ripe for the picking so to speak with a smartphone of this sort. That’s one of the reasons for pushing so hard to get this phone to a ready state,” says Aitken, adding that at the moment the Mark One is not ready for mass consumer sales but that “it’s not far away.”

With a 3.0 smartphone on the way to potentially millions of consumers, it will be easier for the station group to implement another key aspect of its NextGenTV deployment strategy: state government mandates requiring smartphones to be built with 3.0 receivers.

“We are in the process of getting legislation into multiple states, specifically state house and senate legislation in New York at the moment, for a mandate to include ATSC 3.0 receivers in smartphones because of the public safety and public service side of the standard,” he says.

In July, New York State Senator Kevin Parker and Clyde Vanel (State Assembly Chairman, Internet and New Technology Subcommittee) introduced legislation (S8797) mandating inclusion of the 3.0 receiver chip in portable electronic devices defined in the bill as “any handheld mobile telephone... personal digital assistant (PDA), or handheld device with mobile data access.”

“On and after January first, Two Thousand Twenty-Two, no manufacturer shall provide for sale in this state any portable electronic device not equipped with an ATSC 3.0 chip,” the legislation reads.

The Advanced Emergency Alerting and Informing (AEAI) aspects of ATSC 3.0 “are not going unnoticed at the state level,” says Aitken.

CREATING LEVERAGE

While the Federal Communications Commission has expressed no interest publicly in mandating 3.0 receivers in smartphones, the AWARN Alliance and others in the television industry have spent the past several years educating local, state and federal emergency managers about ways in which NextGenTV can help inform the public and assist them in the event of a disaster.

Broadcasters and vendors of emergency alerting technology used by TV broadcasters have stepped up as well. For example, the News-Press & Gazette station group has worked with AWARN to demonstrate how the standard could have been used to alert viewers in specific neighborhoods of Santa Barbara, Calif., to the threat of mudslides.

But until the Mark One, such alerts would only have been useful to home viewers. With a 3.0-enabled smartphone, the public can stay informed of emergencies regardless of where they are, says Aitken.

“Very soon, I am going to be sending phones to AT&T and other mobile companies, and I will ask a simple question,” he says. “What is preventing your organization, your business, from manufacturing a phone that could save lives in the event of natural disaster, a public safety situation or crime?”

The offer Aitken made a couple of years ago at the ATSC Annual Meeting in Washington, D.C., to provide AT&T and other wireless companies with a million 3.0 receiver chips, each, for free stands to this day, he says.

CONSUMER INTEREST

Initially, the Mark One will be put into the hands of friends and family of Sinclair staff in markets where it delivers ATSC 3.0 to help the station group fine tune its NextGenTV service. The phones are equipped with a return channel so that data collected about reception levels at various locations can help guide the station group as it makes decisions about deploying ATSC 3.0 single frequency networks (SFNs) around the country, he says.

However, that’s just the start. Aitken anticipates strong interest in the phone from consumers. “There’s not a person I’ve talked to over the past two years of getting to this point who hasn’t said, ‘As soon as you have it, I want one,’” he says.

The Mark One is aimed at the middle of the market. Target pricing is below \$300 if the production run is in the tens of thousands, \$200 if it is in the hundreds of thousands of units and even less if millions of the phones are produced, he says.

“We’re not in this for the money [from phone sales],” says Aitken. “I guess we are a little bit crazy, but we are not so crazy as to think that we want to be in the business of selling phones.”

Beyond the Mark One, Aitken envisions the SL4000 3.0 receiver chip being used in a range of other consumer devices, such as NextGenTV gateways capable of receiving 3.0 and retransmitting content via Wi-Fi to tablets and other home devices, and even into cars for a range of applications from receiving map and navigation data to enabling wireless firmware updates to onboard car systems.

“It [the SL4000] is the lowest common denominator that fills the largest number of possible use cases,” he says.

A video detailing the Mark One smartphone is [available here](#).

ATSC, TSDSI Ink Deal Opening Way for 3.0 Adoption in India

The article below, authored by Phil Kurz for TVTechnology on March 30, 2021, details a pivotal agreement between the Advanced Television Standards Committee (ATSC) and the Telecommunications Standards Development Society, India (TSDSI). This partnership paves the way for the implementation of ATSC 3.0 broadcasting standards in India, a development that promises to revolutionize the nation's telecommunications landscape. Originating from a collaborative foundation established three years earlier through a Memorandum of Understanding and a subsequent joint conference on the convergence of broadcast and broadband, this initiative is poised to significantly augment the capabilities of mobile operators by integrating ATSC 3.0 standards with existing LTE/5G networks. Though not mentioned in the article, the adoption of these standards is expected to not only enhance the delivery of multimedia content but also bolster emergency alerting systems, providing a critical tool for rapid, widespread dissemination of emergency information to the public. Given India's extensive telecommunications network, which boasts a billion subscribers and sees the addition of roughly 250 million new devices annually, the impact of this collaboration on improving public safety and information accessibility could be substantial. Below is the original text of the article.

ATSC, TSDSI Ink Deal Opening Way for 3.0 Adoption in India

<https://www.tvtechnology.com/news/atsc-tsdsi-ink-deal-opening-way-for-30-adoption-in-india>

By [Phil Kurz](#) last updated March 30, 2021

Agreement is a necessary step for ATSC 3.0 to be adapted for India's unique use cases



(Image credit: TSDSI)

WASHINGTON & NEW DELHI—The Advanced Television Standards Committee and the group responsible for developing telecommunications standards in India announced they have signed an agreement to enable adoption of ATSC standards for reception of broadcast services on mobile devices.

The ATSC and Telecommunications Standards Development Society, India (TSDSI) signed the agreement March 2. It enables TSDSI to adopt ATSC standards. It is seen as the first step toward advancing development of NextGen broadcasting standards for India.

“The agreement with Telecommunications Standards Development Society, India is a significant accomplishment,” said ATSC Board Chairman Lynn Claudy. “This is a great opportunity to integrate ATSC 3.0’s state-of-the-art broadcast capabilities into the global telecom’s ecosystem, especially given the massive size, scope and influence of India’s market and technological expertise.”

With the agreement, TSDSI can begin adapting ATSC standards for specific live-linear broadcast and broadcast traffic offload use cases in India, said TSDSI Chair Mr. N. G. Subramaniam.

“TSDSI developed a technical study report on Broadcast Traffic Offload in early 2020. We have prioritized creation of a standard that will meet the requirements of India market, which has the world’s highest consumption of mobile data per smartphone,” he said.

The agreement is the product of work that began three years ago with a Memorandum of Understanding between the organizations and a jointly organized conference on the convergence of broadcast and broadband in India.

“This agreement enables mobile operators to consider ATSC 3.0 adopted standards-based broadcast technologies to supplement their LTE/5G telecom deployments,” said Madeleine Noland, president of ATSC. “The impact in terms of the large number of base stations and devices in India could be massive, even at current levels of one billion subscribers and approximately 250 million new devices being added every year.”

The ultimate benefit of the collaboration between the organizations might be tight integration in the core networks and the devices of cellular operators and broadcasters, said Pamela Kumar, director general of TSDSI.

“While there are still many steps to take to reach that goal, this agreement represents a first and necessary step that can open the path to these possibilities and more,” she said.

Sinclair Broadcast Group and ONE Media 3.0—both ATSC and TSDSI members—welcomed news of the agreement.

“We’re delighted that leaders in broadcast and telecom standards are charting a way forward to break traditional walls between these verticals in the interest of creating the most

cost-effective broadcast solution for massive cellularized deployment,” said Christopher Ripley, Sinclair president and CEO.

“Our investment in [Saankhya Labs](#) for ATSC 3.0 silicon and infrastructure technologies is a clear testament of our confidence in India’s technological expertise and market influence. Through adaptation by TSDSI, ATSC 3.0 also can be part of the 5G ecosystem for non-television data services,” he added.

Many elements of ATSC 3.0 are compatible with international telecom standards and are recognized by the agreement, Sinclair said.

In mid-October 2020, Sinclair revealed the first production model of its [Mark ONE smartphone](#) equipped with ATSC 3.0 receiver and antenna. The phone was designed in India.

“We are pleased that the Indian Ministry of Information and Broadcasting has recognized ATSC 3.0 as an ‘emerging standard around 5G broadcasting where you can directly broadcast to mobile phones’ as well as providing a grant for proof-of-concept field trials to validate the business case ,” said Sesh Simha, ONE Media’s vice president of Advanced Technology.

“Designed in India, our Mark ONE engineering validation smartphone with embedded ATSC 3.0 technology is an example of our continued support of ‘Atmanirbhar Bharat’ (self-reliant India) solutions for this activity.”

More information is available on the [TSDSI](#) and [ATSC](#) websites.

Saankhya Labs - Software Defined Radio

The previous articles referenced Saankhya Labs’ new SL4000 chip. For the reader’s edification, below I have reproduced the specs from Saankhya Labs SL4000/SL400X, a NextGenTV receiver for mobile phones which makes use of Software Defined Radio (SDR). As mentioned before, a phone equipped with this type of receiver would be capable of receiving emergency alerts through TV broadcast which, in addition to providing redundancy in case the Cell Network is down, would also enable development of much more rapid delivery of alerts to cell phones as would be needed to effectively alert the public about fast-moving disasters, e.g., earthquakes and tsunamis.

Software defined Radio or SDR is a type of radio communication system where components that are traditionally implemented in hardware (such as mixers, filters, amplifiers, modulators/demodulators, and detectors) are instead implemented by software on a personal computer, embedded system, or (in this case) a mobile phone.

In essence, SDR allows for significant flexibility and adaptability in handling radio signals. Unlike conventional radios that rely on specific hardware to process and transmit radio signals, SDR uses software algorithms to manipulate these signals. This approach enables SDR systems to be reconfigured or programmed to support a wide range of functionalities without the need to change hardware.

SDR can support a wide variety of communication standards (like FM, AM, digital broadcasts) simply by loading the appropriate software. This makes it adaptable to new and evolving technologies.

Also, since the functionality can often be changed with software updates, SDR can reduce the need for new hardware when upgrading to support new standards or functionalities. Since changes are primarily software-based, updates can be deployed quickly and often remotely, without needing physical access to equipment.

Other companies also make NextGenTV receiver chips. LG makes them, for example LG33072. Reportedly Sony also does. On the radio side, NXP SAF4000EL is a versatile single-chip radio receiver.

SL-400X Mobile TV Integrated Receiver



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<https://saankhyalabs.com/sl-400x-mobile-tv-integrated-receiver>

2021-02-04



Saankhya Labs' SL4000, is a compact Next-Gen Universal Mobile DTV Receiver that enables reception of LIVE TV signal on handheld devices. It is the industry's first Software Defined Radio (SDR) based TV Receiver that supports all the leading Mobile TV standards. With focus on 'Mobile-First', the SoC is designed to deliver high performance in static, mobile and multipath environments.

- Fully programmable SDR architecture based Mobile TV receiver chip
- Capability to support all leading mobile TV transmission standards through firmware
- Integrated high performance multi-standard UHF tuner for reduced PCB footprint in mobile TV applications
- Robust TV reception in Urban or Non-Stationary use scenarios
- Low Power Consumption

Technical Specifications

INTERFACES	<ul style="list-style-type: none"> • Standard SDIO/SPI interface to application processor/TV SoC • Transport Stream (TS) Serial interface • I2C / SPI master/slave interface for programming and control path from external processor and other components • RF interface to antenna
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Standards Supported	Mobile TV – ATSC 3.x, DVB-T2-Lite, ISDB-T 1-seg
Frequency Range	UHF range from 470 to 858 MHz Input channel bandwidth of 5/6/7/8 MHz
Modulation Scheme	BPSK, QPSK, 16/32/64 QAM

FFT Size	2K/4K/8K/16K
Multiplexing Mode	TDM, FDM & LDM
Power	0.9V, 1.2V, 1.8V, 3.3V
Operating Temperature	0-85o C
Package	7 x 11 mm (0.8mm pitch) 99 pin TFBGA

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APPLICATIONS

- Mobile infotainment Systems
- Firmware Upgrade Over The Air- Software upgrades and mapping systems
- IoT Sensors and field upgrades
- Power Hungry portable devices like tablets
- Emergency Alert and Early Warning Systems

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Part 2: Practical Advice for Engineers and Leaders in a Disaster

Introduction to Part 2

At the heart of this section, one must understand the context of my first major exposure to Emergency Alert Systems (EAS) through my work. Being a broadcast engineer during the September 11, 2001 terrorist attacks in the United States was a uniquely challenging and unforgettable experience. Broadcast engineers played a crucial role in ensuring that the news and information reached the public accurately and efficiently during this tragic event.

The attacks emphasized the importance of redundancy and backup systems in broadcast facilities. Engineers had to ensure that their systems were resilient and capable of withstanding unexpected disruptions, as they faced the possibility of additional attacks or technical failures. Broadcast engineers worked tirelessly to provide continuous coverage of the events, even as the situation evolved. They played a key role in conveying crucial information to the public, such as the collapse of the World Trade Center towers and the Pentagon attack.

Beyond the technical aspects, the emotional toll was significant. Engineers, like everyone else, were deeply affected by the horrific events they were covering. They had to maintain their composure while processing their own shock and sorrow. Many broadcast engineers felt a strong sense of duty and responsibility to their audience. They recognized the importance of their role in providing accurate information and helping the nation stay informed during a time of crisis.

In the aftermath of 9/11, the role of broadcast engineers in emergency communications and disaster coverage was proven to be vital. Our ability to adapt quickly, manage complex technical setups, and maintain professionalism during such a tragic event was necessary to keep the public informed and connected during a time of immense uncertainty and grief.

Not only did we face difficulties during the crisis, but there were numerous obstacles to overcome in the aftermath. Being an engineer after the September 11, 2001 terrorist attacks in the United States brought about significant changes and challenges to the profession. The

post-9/11 era marked a transformative period for the broadcasting industry, with an increased focus on security, technology, and emergency preparedness.

The events of 9/11 prompted heightened security measures across all industries, including broadcasting. Organizations were required to implement stricter access controls and security protocols at their facilities. This included increased surveillance, background checks for personnel, and enhanced physical security measures to protect broadcast infrastructure.

The attacks underscored the importance of emergency preparedness and disaster recovery planning for broadcasters. Engineers were tasked with developing and testing contingency plans to ensure that broadcasting could continue in the event of another major crisis, including redundancy in systems and geographic diversity in signal origination locations.

Prepared individuals and communities are more resilient in the face of disasters. Education empowers people to bounce back more quickly after an event, minimizing the physical, emotional, and economic impact of disasters. A community that is collectively prepared is safer for everyone. When people understand disaster risks and know how to respond appropriately, it reduces the burden on first responders and emergency services. This allows these resources to be allocated more efficiently to those who need them most. Disaster preparedness education encourages cooperation and collaboration within communities.

Disasters can have severe economic consequences for individuals and communities. Educating people on preparedness can help protect their financial stability by reducing property damage and potential loss of income. Well-prepared communities are more likely to receive support from local governments, nonprofits, and disaster relief organizations. Government agencies often allocate resources based on the level of preparedness within a community. People are also more likely to come together to support each other during emergencies when they have a shared understanding of what needs to be done.

The following sections include my advice to engineers and leaders on preparing for and managing emergencies, drawn from my own personal experiences and research.

Section 1: Experience Notes for Emergencies

This section is an adaptation of an article I authored, offering guidance to engineers and leaders on preparing for and managing emergencies, drawn from my personal experiences. Initially released on the five-year mark of the 9/11 attacks, this version has been revised for inclusion in this book, enriched with further insights accumulated over the years.

[Experience Notes for Emergencies | EC&M](#)



First published in Power Quality Magazine, Feb. 11, 2002

While most electronic engineers appreciate the value of uninterruptible power supplies (UPSs) and generators in coping with emergencies, the reality of the World Trade Center disaster has brought some overlooked points to the forefront. Below is a list of these points based on my background in the seismic arena.

War can create a lot of dust.

To deal with this situation, remember the following:

1. Cooling towers are not recommended. Dry coolers are preferred because water from evaporator cooling towers will become contaminated with dust and can cause HVAC systems to fail.
2. Dry coolers can get clogged with dust, as ours did, and a means of cleaning them should be available. At such times, HVAC repair staffs can be overloaded and unable to provide quality timely service.
3. Keep a supply of air filters for all sizes of HVAC equipment in stock. You should be able to replace them yourself. While you're at it, have a stock of belts as well.

4. Have an electrostatic safe vacuum cleaner and antistatic workspaces because equipment can be contaminated. 3M makes a suitable unit. I spent three days just cleaning two racks of critical equipment. To clean the power supplies, I had to disassemble them, vacuum them, then use compressed air from our compressor to clean them. However, don't use compressed air on analog or digital processing circuit boards because it can cause electrostatic discharge failures.
5. Keep a supply of face dust masks on hand. These became heavily used in Manhattan and difficult to obtain even 30 miles away. The concrete dust is tough on the eyes, so goggles are also helpful. At my workplace, management had obtained a self-contained breathing apparatus when a halon extinguisher system was replaced. We didn't need to use it, so we donated it to the New York Fire Department. While it was hardly a replacement for the equipment they lost, some redundancy to assist the emergency services can be helpful.
6. Our satellite uplink was located on the 21st floor and remote enough to escape significant dust, but it could have coated the dish and caused attenuation.
7. A generator running for a long time may require more than one change of intake air filters, so have these available.
8. Dust can trigger smoke detectors and shut down the air conditioner. The system alarms we have seem to have recovered satisfactorily, but we had them tested to make sure.
9. Have a regular vacuum cleaner and spare bags available. I had to vacuum the floor over part of the facility so we would not be tracking dust into the relatively clean areas. Then we called a computer facility cleaning company who could clean under raised floors.

Power problems can be expected.

1. We had no power for eight days. Had our generator ran for that long, its tanks would have needed refilling. The oil tanker had to make three attempts at delivery and was getting turned back by security (police and national guard) the third time when I persuaded them to let him deliver.
2. When the tank runs dry, and there is no power, the diesel will need priming. Be familiar with how to do that. In our case, the main tanks were in a sub basement and difficult to manually transfer up to the day tank in the generator shelter above the loading dock. So I purchased kerosene/oil containers and a hand pump. Gasoline (petrol) containers are not approved to carry diesel as confusion could be dangerous.

3. A generator running for a long time can fail. Ours developed a leak in a radiator hose and stopped as the water level became low. Because we had an old transfer switch which had proved to be unreliable, we had not run our generator on load for a while.
4. We were in the process of replacing our UPS and transfer switch at the time, so the street power problems did damage some of our equipment. Avoiding such exposure is recommended. We and our electricians were fortunate to escape the WTC alive.
5. When the building emergency generator was connected, it did not have the capacity to run the full load. We had to keep our load light. Also, the phase rotation was reversed from the previous so all the HVAC units and the UPS had to have their phase reversed. When the street power returned, this rotation was at least maintained.
6. The emergency light and fire alarm system batteries went flat. When they are flat for a long time, they can sulfate up and lose capacity. This does not presently appear a problem.
7. If the CMOS battery goes flat, you can lose the contents of that memory. This can happen over a long power outage.
8. As the building initially had no power, I had to use a flashlight on stairways and elsewhere.

Communication problems can be expected.

1. The lines to our PBX were all on a T1 and lost, the main number still does not operate for incoming calls and it is now two months we have been waiting for repair.
2. We had two copper lines to different COs, and while they worked, we could not call long distance for a couple of weeks on them.
3. We lost four fiber circuits. It took about a month to replace them. The original vendor was quoting at least three months. I believe this was because the other vendor had fiber into the building, but the original vendor would have to relay it in the street and redesign the connectivity and reinstall.
4. This area now has a number of temporary cellphone towers around, but that takes time to implement. On the 11th, many people complained that their cell phones were not working. However, payphones were not much different. I expect that congestion was part of the problem.
5. Alternative means of communication are desirable. As we are a television facility, we had an intercom system that was part of our TV transmission system from Manhattan to Littleton, Colorado. This was the only communication system that was working that day. While voice over IP (VOIP) may not be the greatest, if your company has a T1 or other connectivity to other locations, it is an alternative.

6. I have observed hits on the fiber, probably as fibers are in proximity to WTC excavation work.

Other problems can be expected.

1. In an earthquake, the secondary problems of power hits or failure—water from broken dams or pipes, or fire—can be more of a problem than the shaking and structural damage of the quake itself (e.g., one small water pipe break can seem insignificant, but when it contaminates the sterile supplies for a hospital, that could be serious).
2. Building codes vary from area to area. However, it has been determined that if the federal building in Oklahoma City had been constructed according to California seismic building codes, there would have been much less damage and lives lost. New York City has in recent years adopted seismic codes, but that was after WTC was built. Whether this would have made any difference is not currently determined, but it is certainly worth knowing. New York, however, has a large number of brick or other unreinforced masonry structures which are not tall (less than 5 stories). Such structures should be avoided for companies' critical operations.
3. When security comes into effect, you will need personal and company ID. Also, your commute or travel can be significantly impacted. I used to travel by train to Manhattan, now I come by ferry, and my commute can be an hour longer. The train is not expected to be in operation for at least a year. Take an interest in your city's disaster contingency plans. Manhattan enacted its plan even though the disaster center was destroyed. I traveled by tugboat home to New Jersey, which I perceived as planned, not something organized during the chaos of the day.
4. I know someone who went to do repairs at the Pentagon. He asked me how he could get spares FedExed when the planes were not flying. I said that he was fortunate, because if it was critical to the military, they would see to its delivery. We civilians cannot depend on delivery of spares.
5. Can preparation be done? Well, a capital city of a country elected a mayor who was by profession an architect. He managed to pass legislation that any commercial building which did not meet seismic building codes had ten years to be corrected or removed for replacement. This was accomplished even though it affected perhaps 14% of the buildings in the downtown business district. He was Michael Fowler of Wellington, New Zealand. So the answer is yes.
6. Wire nuts used to be used in New Zealand many years ago. They are no longer used, apparently because they can come untwisted and fail under tension, which can happen during an earthquake. Screw clamp-type fittings are now used, and additional

ones are built into wall switches and light sockets to provide the additional connections.

7. All power sockets are wired with an isolated ground. No conduit ground is used for ground pins because the sections can come apart during a quake but leave the outlet alive.
8. Copper water pipes are not soldered, but brazed using a lower temperature brazing alloy. This may be stronger.
9. The WTC disaster illustrates the wisdom of offsite backup of data. Include items like floor plans as well as operational data.
10. Assuming that we had none of the above problems, we would still have had to shut down operations relating to a number of television channels because civilians were excluded from the area for a week.
11. There are two established methods of protecting racks in seismic areas. The telecommunications racks are fastened to a steel grid which is fastened to the building steel. Electronics racks on a raised floor are fastened on pedestals which are fastened to the building floor, and the raised floor is fastened at the edges to the building steel. Another approach in lower risk areas is to use large pipes (e.g., 6 inches at the top of racks) in a truss configuration, which is fastened to the building steel. This can be retrofitted and may be suitable for areas like New York. I would like to see a structural engineers review of this approach.

Additional Information Added Since Publication

The notes regarding the questions regarding the use of wire nuts have not, to my knowledge, been supported or rebutted by actual field experience. However this does not mean that alternative screw clamping connections should be practically unavailable if they also meet NEC and IEC electrical codes. Sometimes equipment is constructed to be used in different countries so the ability to meet both U.S. and international standards is desirable. Also the U.S. is starting to use 277 V per phase equipment and wiring. This is 480 V three phase. International equipment is mostly 220 to 240 V single or three phase. The use of 2 phase distribution and equipment is rare, either as 120 or 180 degree phase relationship.

More Subsequent Notes

1. A sentiment sometimes expressed after the 9-11 attacks was like "If we are not focused on doing the best we can, then that would be letting the terrorists win".
2. Circuit breakers can fail. The U.S. power panel style has solid busbars with blades projecting which circuit breakers slide over. DIN rail type power panels may not have this design so it is more difficult to replace failed circuit breakers. Attention needs to be given to the design of the power panel.
3. High reliability electronics equipment has two or more power supplies, so if a power supply or input power fails, the equipment continues operating. This may be AC or DC power that is separate. For example, a power panel may fail and need replacement, so high reliability equipment should be on at least two separate panels. This is not hypothetical, I had to keep a facility operating in such a situation.
4. Some equipment can go into a bypass mode if the input signal fails. However, this may not work if the power supply fails and there is only one source.
5. Different power panels should be on different UPS sources if practical, with enough capacity so if one fails, the facility keeps operating.
6. I would check the disk drive arrays once a day and replace any failed drives in the RAID 5 arrays. One day after replacing a drive and starting the array rebuild, another drive failed before that was complete. This resulted in all the data in that array being lost. Fortunately the data could be reloaded from a tape archive array. However that took a while to perform and the RAID 5 array was effectively unavailable to play video to the TV channel for about a day. So RAID 6 is better in reality, they can recover from two failed drives.
7. On one occasion, the main power transformer for the building failed. This triggered the diesels to start operating. After about two days, the exhausts from the diesels, which were in the basement, got near red hot where they exhausted the roof, above the fourth floor. The previous re-roofing contractors had laid the roof tar to be in contact with the exhausts. The roof caught fire and the multichannel TV facility had to be evacuated for a significant time as it had to be shut down. The backup facility kept things on the air, but it was a considerable amount of effort to recover. We continued to deliver 99.999% uptime despite this to those contracted clients, including over a dozen TV channels.
8. During hurricane Sandy, the basement, which was some height above high tide, got flooded. Fortunately I had examined SLOSH maps to assess what the storm surges were likely to be and requested a supply of sandbags on pallets. I was no longer employed there during Sandy, but more preparations were needed. The debris and sea level caused some problems, but the facility remained operating. One engineer did get injured then and died soon after as a result.
9. A well-known software company had backup and synchronization software between the smartphone and the PC. When the backup was done to a later version of operating

system on a new PC, the backup erased about $\frac{3}{4}$ of the contacts data. The original PC had a disk drive failure so that source was no longer available. Provision to also back up onto USB memory was not provided for in the application.

10. Almost all electronics includes electrolytic capacitors. These are liable to dry out with age and temperature. Consumer electronics usually uses 85°C rated ones. Professional and industrial equipment should use ones rated at 105°C or higher. These are better sealed for longer life. As the sales person if their equipment uses the 105°C or higher rated electrolytics. They may have to ask engineering department.
11. The U.S. Federal government is currently considering the reparability of electronics. Some manufacturers make their equipment so that only their repair centers for a price and at their time are able to provide repairs. A number of states have passed such legislation already in 2023.

Section 2: Generators, solar, and UPS for Backup Power & HVAC

This section provides an overview of backup power solutions and HVAC considerations, highlighting various generator types including gasoline, diesel, natural gas, propane, fuel cells, and solar power. Each power source is evaluated for its advantages, limitations, and specific maintenance needs, emphasizing the importance of reliability and efficiency in emergency scenarios. The discussion extends to innovative power sources such as electric vehicles and hydrogen fuel cells, alongside practical considerations for connection types and the critical role of Uninterruptible Power Supply (UPS) systems. Additionally, the section addresses the integration of solar and wind power, regulatory challenges, and the design intricacies of HVAC systems for large installations. This concise exploration offers insights into the diverse array of backup power options and the complexities of ensuring stable and efficient power in emergencies.

Overview of the Types of Generators Used for Emergency Power

Gasoline/petrol fuel

These have an advantage of perhaps being available economically, but have some limitations

- 1} The gasoline evaporates and leaves a residue that blocks the carburetor jet. To fix this means disassembling and cleaning it. It may take a month or more to get blocked up. operating it for an hour per month may address this, and the more expensive industrial ones are likely better. Starting in cold weather is easier than a diesel. Also the gasoline fumes can escape and so these require a ventilated storage space and likely running outside. RV type units are an example. The more economical ones have brushes, but these wear and the resulting power has more fluctuations with age.

Diesel fuel

These may be found on RVs, and in more industrial installations. Typically such installations are operated on load for an hour a month and regularly serviced by technicians. They may be installed indoors where they can be kept warmer. With the fuel being checked for microbial contamination and reliability of the battery for starting these units can be very reliable. A way

to make the starting reliable is to include an AC to DC converter with input from a UPS (e.g. flywheel type). Better frequency control is obtainable with an electronic governor.

Natural Gas

These may require diesel or gasoline for starting. Once started, they can run without emptying the fuel tank. Better frequency control is obtainable with an electronic governor.

Propane

These may be able to start using the propane, but the fuel is not easily available, and is an explosion hazard. Better frequency control is obtainable with an electronic governor. Such a governor may remain synchronized with the AC mains to reduce glitched when switching. RVs are likely to be prohibited from travelling through tunnels

Fuel Cells

These are appearing on the market, but are more expensive than many other solutions.

Solar Power

This needs battery storage for when the sun is not bright, or wind generation is not used to supplement but there may be some subsidies available. For household use, there are “generators” available which need solar panels and can be more reasonably priced and easier to install. Check that the battery is a gel cell so if it is damaged, acid is not coming out. Also check that replacement batteries are readily available as cycling the battery will reduce its capacity to being ineffective perhaps in a few years. As the output load is limited, it may be desirable to have some permanent outputs, and some that are switched between a fridge, microwave or electric cooker and HVAC. Some devices are made in China so obtaining a service manual at the time of purchase for these or any others is recommended, and to identify repair facilities.

Future

The ability to use an EV as a source of AC power depends on what the manufacturer provides, and modification may be an insurance and warranty issue. FEMA is now operating a hydrogen fuel cell truck. This provides power for driving, AC power at the emergency location, and pure water (steam for cooking) as exhaust which is also desirable in emergencies. The heat may also be useful in cold weather. Hydrogen requires heavy gas

bottles and is not readily available at present. Electricity is needed to produce it from water with oxygen also produced.

Connection type

For lower power, regular AC sockets are used. For higher power, multipin connectors are often used. In an emergency, there becomes the questions of what connector type, what voltage, is it single phase, two phase (208v from 3 phase or 240v from two phase (a US method) which may be up to 50 amps, or Camlok single wires color coded for 100 A, 200A or more and with sub panels as part of the distribution. An electrician familiar with this type of emergency cabling is required. Such electricians may work in mines, circuses, rock concerts or such temporary installations. It is important to appreciate that electronic loads may have up to double the current in a neutral unless a third harmonic bypass transformer is used with two neutral cables. Large rental HVAC systems are available in some locations and may be needed. Checking the power for such needs is part of solving the problem.

UPS

Large battery UPS systems usually use lead acid batteries. These are heavy and not easily transported without risk. Flywheel UPS are lighter but availability needs research. Such UPS systems may include static bypass of the unit for maintenance purposes. An overall wraparound set of three make before break switches plus input and output disconnects permits UPS replacement.

Additional Comments about Backup Power

Solar and wind electric power may not be economically viable by themselves, but as part of a solution for a building that has a significant amount of electronics may be reasonably affordable. In the U.S., 40% of the electricity is from non-fossil fuel sources. South Africa is currently having serious electric power problems. However, people are prevented from building solar panel installations that feed into the grid. Go figure. Such installations should be accompanied by lightning protection, and good grounding and transient protection. Roof mounted windmills are an option and without visible rotating parts are possible. Building loading and vibration protection e.g. against hurricanes adds to the cost..

An approach for UPS usage in the military is to have rackmount UPSs at the bottom of each rack. Redundancy may be implemented. This is a more flexible rack deployment rather than facility UPS approach. It is possible to have redundant UPS systems feeding redundantly

powered equipment. Single powered equipment may be powered via automatic changeover units from redundant UPSs.

Telecom systems use redundant -49 volt batteries and it is possible to have dual input power distribution for such DC power.

The HVAC for large equipment installations needs careful design. Include the consideration of the number of belts used because these wear. Some manufacturers may use one belt, so spares are important. Rolls Royce cars use two belts for reliability. Redundancy with multiple air handlers may be obtained by air changeover vanes or having manifolds for chilled water distribution. For a long time, New York City was fed by only two waterpipes. Now there is a third. Each has a shutoff valve at the city end. Such valves have never been operated because if it were ever closed, who could guarantee that it would reopen, which would be a huge problem.

Section 3: Cantor Fitzgerald

When I finished work on September 11th, 2001, I got on a tugboat at Battery Park and was taken to Weehawken, New Jersey. There I saw some people waiting. One was a lady with a sign saying “Cantor Fitzgerald”, which is an American financial services company. Their main office was located in four of the high floors of one of the Twin Towers. Nobody who was in that office survived. The CEO was late from work having left another appointment and was in the street nearby when the attack started. He as well as other people at their London office worked together to restore the business operations. This took about a week. They had a Business Continuity and Disaster Recovery plan and implemented it. This shows that even in such an extreme disaster as this, it is possible to recover.

Around the time of 9/11, many accounts of businesses which suffered from the disaster came out; there were incalculable difficulties at the time, but a few groups were able to overcome and recover from the crisis. A number of articles came out at the time, including the one below.

Recovering from 9/11 – The Cantor Fitzgerald story

[Recovering from 9/11 – The Cantor Fitzgerald story | Disaster Recovery & Business Continuity Blog](#)

“Of the many images of 9/11 seared in my mind is the CEO of Cantor Fitzgerald Howard Lutnick being interviewed on TV. The firm had lost over 600 employees in the attack and he survived because he had taken his Kindergartner to his first day of school. The raw emotions and anguish on his face was obvious. But during that interview he also showed grit and determination that CF would recover.

Lutnick said “the best way to show someone you love them is to care for their loved ones” He made a promise that CF would survive while at the same time taking care of the families of employees that perished. CF vowed to distribute 25% of their profits to victim’s families and cover their health care costs for 10 years.

The firm was back online after a few days. The surviving employees had a herculean task before them – rebuilding the pieces in spite of the horror that befell their firm, NYC and the country. Rebuild they did with a singular sense of purpose. Today they are 1500 hundred strong but have never forgotten the fallen. Each 9/11 they contribute all profits made to good

causes. They have a commemoration every year where families of victims are asked to speak – to celebrate their lives. New employees understand there is a bigger purpose than business alone – taking care of each other and ones that you love are also important.

I have thought about this company several times since that day when evil struck. What was it like going to work – the friend you shared jokes with, those who helped you, your mentors, bosses – all gone in a single day. It must have been emotional and heartbreaking. But like the Phoenix rising from the ashes, the true creed of the surviving employees and management came through. They would not let evil destroy them or the memories of their friends and colleagues. Rather, use the moment to define yourself as a caring human being – one you can trust and count on. I admire the company, the management, the employees and most of all those that lost their lives.

Matt Gwyther

August 4, 2014”

Emergency Preparedness

Employees should be concerned about emergency preparedness for their company for several important reasons. The most immediate concern for employees is their own safety and well-being. Effective emergency preparedness measures can help protect employees from physical harm in the event of a disaster or emergency situation, whether it's a natural disaster, fire, workplace accident, or a security threat.

In emergencies, people often need to rely on others for support and assistance, including their coworkers. Having a well-prepared workplace can improve the chances of everyone making it through an emergency unharmed. An organization's ability to continue its operations after an emergency can be vital for job security. Effective emergency preparedness can help ensure that the company can recover quickly and maintain employment levels.

If an emergency disrupts the company's operations for an extended period, it can have financial consequences for both the organization and its employees. Knowing that the company has a well-thought-out emergency plan in place can provide employees with peace of mind. This can reduce stress and anxiety about potential emergencies and allow employees to focus better on their work. Employees who feel that their safety is a priority and that their employer is prepared for emergencies tend to have higher morale and job satisfaction. This, in turn, can lead to increased productivity and a better work environment.

Employers are often subject to various laws and regulations that require them to have emergency preparedness plans and procedures in place. Non-compliance can result in legal

consequences for both the organization and its employees. Companies have an ethical responsibility to protect their employees and ensure their well-being. Employees who are informed and actively engaged in emergency preparedness efforts help fulfill this ethical obligation. An organization's reputation can be significantly impacted by its response to emergencies. Employees play a role in representing the company, and their perception of the company's preparedness can influence how they communicate about the organization to others.

Many companies view themselves as responsible members of their communities. Being prepared for emergencies not only protects employees but also contributes to the overall resilience of the community. In summary, employees should be concerned about emergency preparedness for their company because it directly affects their safety, job security, well-being, and peace of mind. It also impacts the organization's ability to continue operations and fulfill its responsibilities to both employees and the broader community. Employee involvement in emergency preparedness efforts can help create a safer and more resilient workplace.

Section 4: Robert's Rules of Order

One of the ways to prepare for disaster as well as take steps to recover from a disaster are to hold meetings. While one's first instinct may be to go out and do something to help your group, it is necessary to ensure cooperation at all levels to communicate effectively. One of the means of organizing meetings to ensure time is used effectively and communication remains competent and compassionate is for everyone to have the same expectations going into it; this can be accomplished by using rules.

Robert's Rules of Order is a widely recognized set of parliamentary rules and procedures used to conduct meetings and make decisions in a structured and orderly manner. It was first published by Henry Martyn Robert in 1876 and has since gone through multiple revisions. These rules help organizations, committees, and governing bodies manage discussions, propose and vote on motions, and ensure fairness and efficiency in decision-making processes. Robert's Rules of Order provide guidelines for conducting meetings, establishing a proper order of business, and handling matters such as debate, voting, and the election of officers. It is commonly used in various settings, including government bodies, non-profit organizations, and corporate meetings, to facilitate effective and democratic decision-making. The included is from the 12th ed. This also has rules for electronic meetings. I have more information in the source spreadsheet. For more detail it is recommended to obtain a copy of the 12th ed (or later when available) for yourself. There are videos on YouTube showing how the rules may be used in various cases.

Henry Martyn Robert (1837–1923) was an American soldier, engineer, and the author of "Robert's Rules of Order," which is the most widely used manual of parliamentary procedure in the United States. His book provides guidelines for conducting meetings and making decisions as a group in a fair, efficient, and democratic manner.

Robert graduated from West Point in 1857 and had a distinguished career in the U.S. Army as an engineer. He served in the American Civil War, where his responsibilities included fortifications and building military infrastructure. Robert's interest in parliamentary procedure began when he was asked to preside over a church meeting in 1863. Finding himself unprepared for the task, he experienced difficulty in maintaining order during the meeting. This experience prompted him to study parliamentary law and eventually write his own manual.

The first edition of his book, originally titled "Pocket Manual of Rules of Order for Deliberative Assemblies," was published in 1876. It was based on the rules and practices of Congress but designed for use by ordinary societies and organizations. Robert's Rules of Order has been revised several times and remains the standard guide to parliamentary procedure in the United States. It is used by many organizations, including legislative bodies, corporate boards, non-profit associations, and clubs.

The essence of Robert's philosophy was to ensure that meetings were conducted in an orderly manner, where the majority decided but the rights of the minority were protected. His rules were designed to facilitate discussion and decision-making in a respectful and efficient environment. The principles laid out in "Robert's Rules of Order" continue to influence democratic decision-making processes in various settings, and the term "Robert's Rules" has become synonymous with orderly and fair meeting conduct.

The following is the "Robert's Rules of Order."

[BCDRE-ARC Robert's Rules of Order](#)

Section 5: External Resources for Emergency Preparation

This section highlights some useful external resources for emergency preparedness, focusing on the Community Emergency Response Team (CERT) program by FEMA and essential checklists from FEMA and the Red Cross. These resources offer training, strategies, and comprehensive lists to ensure individuals and communities are well-prepared for emergencies. Through CERT training and FEMA's Ready Emergency Supply List, along with the Red Cross Emergency Preparedness Checklist, this section provides crucial guidance for effective disaster response and readiness.

Community Emergency Response Team (CERT)

FEMA has been encouraging relevant organizations and private individuals to cooperate with Community Emergency Response Teams (CERT). At a one day training course there is a smorgasbord of training classes to pick from, as well as free meals.

[Community Emergency Response Team \(CERT\) | FEMA.gov](#)

Such classes may be organized on a county basis. Training for example may be on Disaster Shelter Management by the Red Cross or ICRC.

FEMA Ready Emergency Supply List

[FEMA Ready Emergency Supply List | Ready.gov](#)

FEMA “Are You Ready?” Disaster Supplies Checklist

[FEMA “Are You Ready?” Disaster Supplies Checklist | FEMA.gov](#)

Red Cross Emergency Preparedness Checklist

[Red Cross Emergency Preparedness Checklist | redcross.org](#)

Appendices

Appendix 1: Acronyms

This appendix serves as a list of the acronyms frequently encountered in the fields of emergency management, public safety, health, technology, and environmental protection. The listed acronyms span a wide range of organizations, systems, standards, and concepts that play crucial roles in the preparedness, response, and recovery phases of disaster and emergency management. From agencies like the CDC (Centre for Disease Control USA) to technologies such as ATMOS (a Dolby immersive audio system) and protocols like the EDXL-DE (Emergency Data Exchange Language – Distribution Element), this collection encapsulates the multifaceted nature of the efforts and collaborations across various sectors to enhance public safety and resilience. Whether referring to governmental bodies, such as the DHS (Department of Homeland Security), or specific response measures like BLEVE (Boiling Liquid Expanding Vapor Explosion), the acronyms listed here are essential for professionals, stakeholders, and individuals seeking to understand or engage with the complex ecosystem of emergency and disaster management.

911ES	911 Emergency Services
A/331	is also named AEA Advanced Emergency Alerting
ACGIH	American Council of Government Industrial Hygienists
ANSI	American National Standards Institute
ATMOS	a Dolby immersive audio system. May be used in ATSC 3.0
ATSC	Advanced Television Standards Committee, ATSC 3.0 is branded as NextGenTV
BLEVE	Boiling Liquid Expanding Vapor Explosion
BSE	Bovine Spongiform Encephalopathy (mad cow disease)
CA	Cooperative Agreement
CAA	Clean Air Act
CAO	Chief Administrative Officer (DHS)
CAP	Common Alert Protocol X.1303. To this has been added the OASIS Event Terms List which notes my involvement.

CAS	Chemical Abstract Service (DHS)
CBO	Community Based Organization (DHS)
CBO	Congressional Budget Office (US)
CBR	Chemical Radiological and Radiological (DHS)
CBRNE	Chemical Biological Radiological Nuclear and high-yield Explosive response force (US)
CDC	Centre for Disease Control USA
CEM	Certified Emergency Manager (DHS)
CEM	Comprehensive Emergency Management (DHS)
CERCLA	Comprehensive Environmental Response Compensation and Liability Act (US)
CERT	Community Emergency Response Team (DHS)
CFR	Code of Federal Regulations (US)
CIST	Critical Incident Stress Team (DHS)
CoC	Chamber of Commerce, see also Business Roundtable
CORI	Criminal Offender Registry Information (US)
CSEP	Chemical Stockpile Emergency Preparedness (DHS)
DAB+	Digital Audio Broadcast with improvements. Not receivable on DAB receivers
DAT	Damage Assessment Team (DHS)
DDM	Digital daisy Mesh, a digital broadcast network replacing the Daisy Network for redundancy
DFO	Disaster Field Office (DHS)
DHHS	Department of Health and Human Services (US)
DHS	Department of Homeland Security (US)
DOT	Department of Transportation (US)
DRM	Digital Radio Mondiale
DRM2020	A Disaster Risk Management publication in 2020 published by the European Commissions Disaster Risk Management Knowledge Center. I was a reviewer for this publication.
EAL	Emergency Action Level (DHS)
EAP	Emergency Action Plan (DHS)

EAS+	Emergency Alert System based on FCC Part 11 + digital radio improvements XSCII
EDXL-DE	Emergency Data Exchange Language – Distribution Element
-HAVE	Hospital Availability
-RM	Resource Management
-TEP	Tracking Emergency Patients
-TEC	Tracking Emergency Clients
-SITREP	Situation Reporting
EEWS	Earthquake Early Warning System
EHS	Extremely Hazardous Substance (DHS)
EMA	Emergency Management Agency (DHS)
EMF	Emergency Management Function (DHS)
EMFI	Emergency Management Facilities and Infrastructure (DHS)
EMPG	Emergency Management Performance Grant (DHS)
EMS	Emergency Medical Services (DHS)
EOC	Emergency Operations Center (DHS)
EOP	Emergency Operations Plan (DHS)
EPA	Environmental Protection Agency (US)
EPCRA	Emergency Planning and Community Right to Know Act (US)
EPZ	Emergency Planning Zone (DHS)
ERP	Emergency Response Plan (DHS)
ERT	Emergency Response Teams (DHS)
ESF	Emergency Support Function (DHS)
FBI	Federal Bureau of Investigation (US)
FCC	Federal Communications Commission (USA)
FCO	Federal Coordinating Officer (US)
FDA	Food and Drug Administration (US)
FEC	Facility Emergency Coordinator (DHS)
FEC	Forward Error Correction
FEMA	Federal Emergency Management Agency, a branch of DHS Department of Homeland Security.

FIRM	Flood Insurance Rate Maps (DHS)
FirstNet	an AT&T cellular radio service for First Responders, has dedicated band.
FY	Financial Year
GIS	Geographical Information System (DHS)
HAZUS	HAZards US (DHS)
HAZUS-MH	HAZards US-MultiHazard
HAZWOPER	Hazardous Waste Operations and Emergency Response (DHS)
HD Radio	High Definition Radio, a digital supplement or replacement for analog AM or FM Broadcast radio.
HHS	Health and Human Services
HL7	Health Level 7 protocol for medical record interchange
HMGP	Hazard Mitigation Grant Program (DHS)
HS Act	Homeland Security Act of 2002 (US)
HSPD	Homeland Security Presidential Directive (US)
HVA	Hazard/Vulnerability Analysis (DHS)
HVAC	Heating, Ventilation and Air Conditioning (US)
IC	Incident Commander (DHS)
ICS	Incident Command System (DHS)
IDLH	Immediately Dangerous to Life or Health (DHS)
IEEE 1512	an Emergency Management protocol definition, e.g. for dispatchers
IMS	Incident Management System (DHS)
IMS	Ion Mobility Spectrometer
IPAWS	Integrated Public Alert and Warning System (FEMA) (includes EAS and WEA)
ISO 22301 & 27000	Relevant standards
JIC	Joint Information Center (DHS)
LC-50	Lethal Concentration to 50% of those exposed (DHS)
LD-50	Lethal Dose to 50% of those exposed (DHS)
LEL	Lower Exposure Limit (DHS)
LEMA	Local Emergency Management Agency (DHS)
LEPC	Local Emergency Planning Committee (DHS)

LFL	Lower Flammable Limit (DHS)
MAA	Mutual Aid Agreement (DHS)
MAC	Multiagency Coordination (system) (DHS)
MIL	Military
MOA	Memorandum of Agreement (DHS)
MOU	Memorandum of Understanding (DHS)
MPEG	Motion Picture Experts Group, has MPEG-4 with AVC and HEVC, and -H for immersive audio (which is included in ATSC 3.0)
MSDS	Material Safety Data Sheet (DHS)
NAVTEX	A nautical alerting and navigation text warning system
NCP	National Continuity Plan (DHS)
NDMS	National Disaster Medical System (DHS)
NEMA	National Electrical Manufacturers Association (US)
NEMA	National Emergency Management Association (DHS)
NFIP	National Flood Insurance Program (DHS)
NFPA	National Fire Protection Association (DHS)
NG	National Government
NGA	National Governors Association (US)
NGO	Non-Governmental Organization
NIMS	National Incident Management System (DHS)
NOAA	National Oceanographic and Atmospheric Administration (US)
NPC	National Planning Conference
NPO	Non-Profit Organization
NRC	Nuclear Regulatory Commission (US)
NRP	National Response Plan (DHS)
NWS	National Weather Service (USA, NOAA)
OCA	Offsite Consequence Analysis (DHS)
OET	Oasis Event Terms List added to CAP. These Terms may have added Spectra items.
OSHA	Occupational Safety and Health Administration (US)
PAG	Protective Action Guides (DHS)

PAR	Protective Action Recommendation (DHS)
PDD	Presidential Disaster Declaration (US)
PIO	Public Information Officer (DHS)
PPA	Performance Partnership Agreement (DHS)
PPE	Personal Protective Equipment (DHS)
PTSD	Post-Traumatic Stress Disorder (DHS, MIL)
PTWC	Pacific Tsunami Warning Centre
REP	Radiological Emergency Planning (DHS)
RIT	Rapid Intervention Team (DHS)
RMP	Risk Management Plan (DHS)
ROP	Recovery Operations Plan (DHS)
SARA	Superfund Amendments and Reauthorization Act (US)
SEMA	State Emergency Management Agency (DHS)
SMS	Short Message System e.g. texting.
SMS	Broadcast, a cellular broadcast technology comparable to WEA
SOP	Standard Operating Procedures
TLV	Threshold Limit Value (DHS)
TSO	Tactical Situation Objects (a European Emergency Management protocol)
UASI	Urban Area Security Initiative (DHS)
UEL	Upper Explosive Limit (DHS)
UFL	Upper Flammable Limit
UN	United Nations
UNDRO	United Nations Disaster Relief Organization
UNGDC	United Nations Global Digital Compact (Secretary Generals' Envoy for Technology)
USAR	Urban Search and Rescue (DHS)
USC	United States Code (US)
USGS	U.S. Geological Survey
XSCII	An eXtended aSCII with mode switching and UTF-8 primarily for digital radio broadcast for improved EAS

UNGDC	U.N. Global Digital Compact for which I was an endorser.
UNISDR	U.N. International Strategy for Disaster Reduction. This is incorporated into the CAP ETL extensions.
VIPS	Volunteers In Police Service (US) see also VOAD, CERT, Citizens Corps, Fire Corps, St. John, Hospitalier Knights of Malta, Legion of Frontiersmen
VNAT	Victims' Needs Assessment Team (DHS)
VOAD	Volunteers Aiding in Disaster (DHS)
VPA	Volunteer Protection Act of 1997 (USA)
VS	Volunteer Screener (DHS)
VZ	Vulnerable Zone (DHS)
WEA	Wireless Emergency Alerts comparable to SMS Broadcast
WMD	Weapons of Mass Destruction (DHS)
WPS	Wireless Priority Service, a service some cellphone service providers for First Responders.
XML	eXtended Markup Language

Appendix 2: Kybernetix Emergency Alerting Patent

Below is the full document of a patent I hold for a System for Transmitting Emergency Broadcast Messages with Selectivity to Radio, Television, Computers and Smartphones, which outlines an integral part of a system for improving EAS.

[BCDRE-ARC US Patent 8841990 B2.pdf](#)

Appendix 3: Expanded Common Alerting Protocol (CAP) Event Terms List

In part 1 of this book I describe the structure and importance of the CAP Event Terms List (see *Part 1, Section 3, The Common Alerting Protocol (CAP) and the CAP Event Terms List*). I made contributions to the development of the list, leading up to the publication of Version 1.0, which can be found online here:

- [Event Terms List Version 1.0 - HTML Version](#)
- [Event Terms List Version 1.0 - PDF Version](#)

Since the publication of Version 1.0 of the CAP Event Terms List, I have continued work on improving it by expanding the number of terms to include additional events and instructions, as well as translating the list into multiple languages. Below is the latest version as of the release of this book.

[BCDRE-ARC CAP_OET-FB-ALL-2023-03-11.xlsx](#)

Appendix 4: Further Reading on the Web

If you're keen on delving deeper into emergency alerting, disaster management, and business continuity, I've gathered a selection of online resources to act as a resource for your research.

Red Cross

<https://www.redcross.org>

National Neighborhood Watch Institute

<https://www.nnw.org/about-national-neighborhood-watch>

National Crime Prevention Council

<https://www.ncpc.org>

US government website search

<https://www.USA.gov>

Transportation Security Administration

<https://www.tsa.gov>

US State Department travel safety

<https://www.travel.state.gov>

safety tips safety and planning information

<https://travel.state.gov/content/travel/en/traveladvisories/traveladvisories.html/Travel>

US Department of Homeland Security

<https://www.dhs.gov>

Next of kin education project (check site security with https://)

<https://nokep.org>

Evacuation Insurance

<https://www.worldtravelcenter.com>

Global rescue insurance

<https://www.globalrescue.com>

Medical and security solutions and evacuation international (maybe unavailable)

<https://www.internationsos.com>

American Automobile Association safety tips

<https://www.AAA.com>

Better Business Bureau protection tips

<https://www.bbb.org>

Educational safety booklets

<https://www.channingbete.com>

US Federal Government

<https://www.ready.gov/America/makeaplan> or <https://www.ready.gov/plan>

Amber Alert for kidnapped children (see also NCEC)

<https://www.amberalert.gov> or <https://amberalert.ojp.gov/>

National School Safety Center school safety tips

<https://www.schoolsafety.us>

National Education Association school safety tips

<https://www.nea.org>

National Safety Council safety tips

<https://www.nsc.org>

International Foundation for Crime Prevention and Victim Care (PCVC)

<https://pcvconline.org>

National Night Out nights against crime & education. Check for your state Teen driving guides and simulation.

<https://www.nationalnightout.org>

Check for convicted sexual offenders in your area

<https://www.familywatchdog.us>

Attorney General Project Safe Childhood (PSC) combats technology assisted sexual crimes against children

<https://www.justice.gov/psc>

Internet safety training

<https://isafe.org>

Crime stoppers program UK

<https://crimestopper-uk.org>

Crime Stopper USA education

<https://www.crimestoppersusa.org/programs/crime-stoppers-in-the-schools/>

National Center for missing and exploited children

<https://missingkids.org>

Emergency Plan preparation and guides weather related

<https://weather.com/safety/index>

Emergency Plan preparation & guides

<https://www.fema.gov/emergency-managers/national-preparedness/plan>

Carnegie Mellon University Emergency Plan preparation information and guides

<https://www.cmu.edu/drbc/em/personal-plan.html>

<https://go.everbridge.com/rs/004-QSK-624/images/forrester-critical-event-management-report.pdf>

<https://www.onsolve.com/resource/aberdeen-report/>

<https://www.everbridge.com/newsroom/article/everbridge-recognized-in-the-gartner-2020-market-guide-for-crisis-emergency-management-and-covid-19-safe-return-to-work-solutions/>

<https://fortune.com/2016/07/21/chipotles-e-coli-hangover-lingers-as-sales-plunge-again/>

<https://www.climate.gov/disasters2020>

<https://www.everbridge.com/platform/critical-event-management/>

<https://www.mckinsey.com/business-functions/risk-and-resilience/our-insights/are-you-prepared-for-a-corporate-crisis>

<https://www.economist.com/business/2018/03/28/getting-a-handle-on-a-scandal>

<https://www.everbridge.com/platform/critical-event-management/>

https://www.accenture.com/_acnmedia/PDF-100/Accenture-Future-of-Physical-Security-Whitepaper.pdf

All Hands Community Consulting

www.all-hands.net

The Disaster Center & Emergency response Association (DERA)

www.disastercenter.com

University of Delaware Disaster Research Center (udel.edu)

<https://www.drc.udel.edu/>

www.cisa.gov

<https://www.cisa.gov/topics/partnerships-and-collaboration>

International Association of Emergency Planners

www.iaem.com

Journal of Homeland Security & Emergency Management

<https://www.degruyter.com/journal/key/jhsem/0/0/html>

National Emergency Management Association

www.nemaweb.org

(not encrypted - not using https) Precision Planning and Simulation email and phone not working

<http://www.ppscorp.com>

The International Emergency Management Society

www.tiems.org

National Volunteer Organizations Aiding in Disasters info@nvoad.org (703)778-5088

<https://www.nvoad.org/>

Community Emergency Response Team (CERT) organized by county or municipality

<https://www.fema.gov/emergency-managers/individuals-communities/preparedness-activities-webinars/community-emergency-response-team>

<https://www.agilityrecovery.com>

www.exterro.com

www.radioworld.com/resource-center/ebooks/actionable-business-intelligence-for-radio

www.quantivate.com

<https://bts.ieee.org>

Partner Alliance for Safer Schools (PASS)

<https://passk12.org>

Microsoft eDiscovery with copilot and Purview for cybersecurity

aka.ms/BeyondBasics/SpeedofAI

aka.ms/CopilotforSecurity