Response to ATIS Feasibility Study

Considerations for Mobile Device Assisted WEA Alert Geo Targeting

One of the issues that has been raised regarding the Wireless Emergency Alert "WEA" service since its launch has been the inability to target alerts to smaller areas. As response to the Commission's NPRM has shown, public safety officials believe that being able to target alerts (geo-fence) to specific areas will significantly increase the effectiveness of the service. As the record suggests, the lack of geo-fencing and a failure to be able to know and understand who is receiving the alerts is a major reason why only 48[1] out of 39,000[2] potential public safety users have used WEA in the first four years.

To address this issue, the FCC requested CSRIC V identify ways to improve WEA geo-targeting so that more public safety officials will use WEA. Comments have suggested that relying on the network alone to target alerts to more granular areas will likely not provide sufficient improvements for public safety. In order to address this issue, CSRIC has investigated whether including the wide range of capabilities in wireless handsets into the WEA service will enhance performance, and accordingly increase usage by public safety officials to better save lives.

Wireless networks are complicated systems consisting of radio frequencies and physical infrastructure which cover areas where subscribers are located and allows devices to connect with each other and distribute data to and from connected devices. The networks are being improved to leverage less expensive and easier to update programming, and allowing for updates to the handset which improve interaction with the wireless network. WEA currently fails to treat the device as the intelligent and constantly-evolving device that it is. Instead, each device simply receives an alert and plays the alert upon receipt. However, public expectation and use of their devices is so much more. Today's devices have great capabilities to complete calls, search for

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[1] FEMA Comment to NPRM 15-91 Filed 1/6/2016 "As of January 6,2016…48 state and local organizations have sent WEA alerts"

[2] CTIA Reply to Comments to NPRM 15-91 Filed 2/12/16 "39,000 municipalities across the nation"

information, analyze and process information and store it, as well as keep track of the device's location for navigation, or for services like Uber, all kinds of commerce, and social media.

Harnessing the evolution of both the devices and the networks will allow for a better WEA service that can be regularly upgraded to improve public safety. As wireless devices evolve, WEA could evolve, and the multitude of questions and capabilities (e.g. geographical targeting, visualization of threat areas relative to the recipient, multiple languages, integration of assistive technologies for people with disabilities, etc.) raised by the Commission in its NPRM can be addressed.

The ATIS group has raised some question regarding the use and integration of the handset into the WEA service. The issues raised can be solved by a concerted effort from carriers, handset manufacturers, and public safety representatives, so that the capabilities that already are used by countless commercial offerings are included in the future iterations of the WEA service. In the following, we address a range of issues raised by ATIS, and where appropriate, include references to existing standards.

ATIS: Passing Polygon Coordinates and Legacy Devices

(**Sec** 8.1) How are coordinates of the alert polygon or circle to be sent to the mobile device?

This feasibility study examined the following options for sending the coordinates to the mobile device and none of these options were found to be feasible:

- Broadcast coordinates as part of the WEA Alert Message broadcast.
- Broadcast coordinates in separate WEA broadcast messages.
- Using WEA Supplemental Text to obtain coordinates.

(Sec 7.1.3.1) If the coordinates are broadcast as part of the WEA Alert Message broadcast, the coordinates will take away from the displayable text available in the WEA Alert message.

(Sec 7.1.3.1) How the mobile device would parse the displayable characters and the non-displayable coordinates so that only the displayable text is presented to the user.

RESPONSE: Description and Technical Response Supported by 3GPP Standards

Coordinates of the polygon are currently passed from the Alert Originator to IPAWS using the Common Alert Protocol or CAP. IPAWS passes the coordinates to the Cell Broadcast Center

(CBC) for each carrier to determine which cell towers are to broadcast the alerts. From the CBC the coordinates are dropped and not passed to the cell tower.

3GPP TS 23.041 (Technical realization of CB Section 2.0 and 8.1 outlines how the device can accept up to 15 concatenated pages) and 3GPP TS 23.038 (CT1) (Alphabets and language specific information Section 5.5 CB Data Coding Scheme p 11) should be used to pass the coordinates from alert originators to the handset and to concatenate 4 pages (90 characters each) in order to achieve 360 characters. To further increase the amount of data (e.g. polygon coordinates) which may be pushed to the device, 3GPP TS 23.041 Technical realization of CB (Section 9.5 Compression at CBE or CBC and opened at UE) and 3GPP TS 23.042 (CT1) Compression algorithm for text messaging services should be used to compress the polygon coordinates and message at the CBC, after which cell towers are determined to broadcast the alert, and then decompress the alert message at the UE/device. Supported by 3GPP standards, changes to WEA can be achieved in 30 months.

While inclusion of the polygon coordinates will reduce available characters for the alert message, this is an acceptable tradeoff for Public Safety. The mix of polygon coordinates vs text message could be divided based on the desires of the alert originator. For example, the first 270 characters could be allocated for the WEA text message and the remaining 90 characters for polygon coordinates.

With regard to legacy devices, there are a multitude of approaches that could be worked out by the parties (carriers, handset vendors, public safety), here are a few:

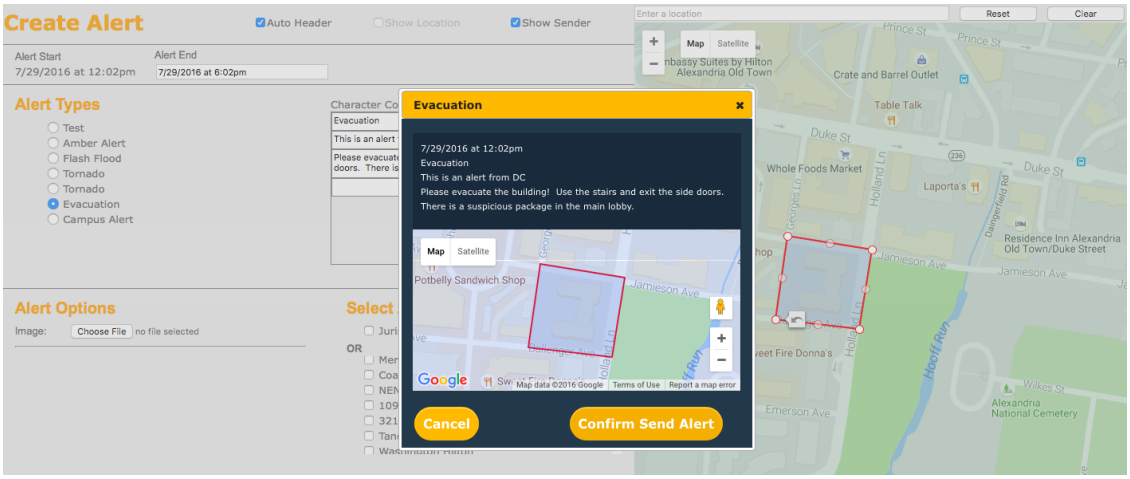
- Continue to send 90 character alerts over the existing channels. This requires no change for existing WEA handsets. For devices that are WEA 2.0, the original CB channels in the handset are turned off and new CB channels are turned on. All WEA 2.0 alerts are sent over these new channels as described above in “Description and Technical Response supported by 3GPP standards”.
- Alert message and polygon coordinates are sent over the current CB channel. Legacy device programming is updated to only show the first 90 characters of the message or a designated 90 characters within the message. Or use a special character as a delimiter, which separates the displayable characters from the non- displayable coordinates. The device would present only the displayable text to the user.

- WEA 2.0 devices look for the polygon coordinates, determine if they are located within the polygon and if so, render the alert, and display the alert polygon and device location on a map to better personalize the threat and public response.
- Legacy devices display the first 90 characters in the alert. The alert message is broadcast over the existing CB channel and the polygon coordinates are broadcasted on a separate channel to the device. WEA 2.0 devices are programmed to look for the polygon coordinates and determine if alert is for them. If the coordinates are not available after a designated period of time or the device can't get a good lock on its location, the alert is rendered.

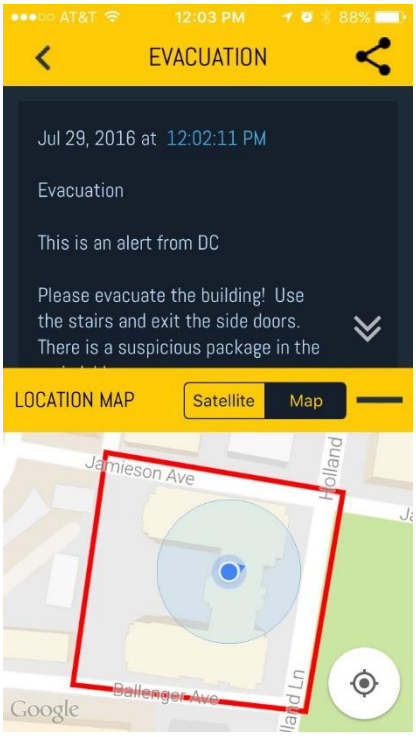
As described above, there are standards in place to send the polygon coordinates of the alert area to the device and there are several ways to address legacy devices. With the polygon coordinates, devices can improve geo-targeting to the alert area, as well as personalize the alert message and leverage other features and functionality in the device. This is demonstrated in an existing device based solution, as shown below, using wifi and cellular data as the delivery medium because of its current availability, instead of cell broadcast. If the coordinates of the polygon are made available by CB, the APP will process the alert message as described above for Wi-Fi and cellular data.

In the first screen, the alert originator selects the type of alert, uses existing alert messages or edits them for the alert, creates the alert area/polygon on a map, origination software checks with the sender showing how the alert will look on the recipients' phone, and is approved and sent by the alert originator to their jurisdiction only. Once the originator hits "send," the alert message and polygon coordinates are combined into a data file and sent to the general alert area using Wi-Fi and cellular data. The devices in the area receive the alert and the device determines if its location is within the alert area and if is in the alert area, the device sounds the alert tone and displays the alert message, detailed map with polygon and location of the device depicted by a blue dot.

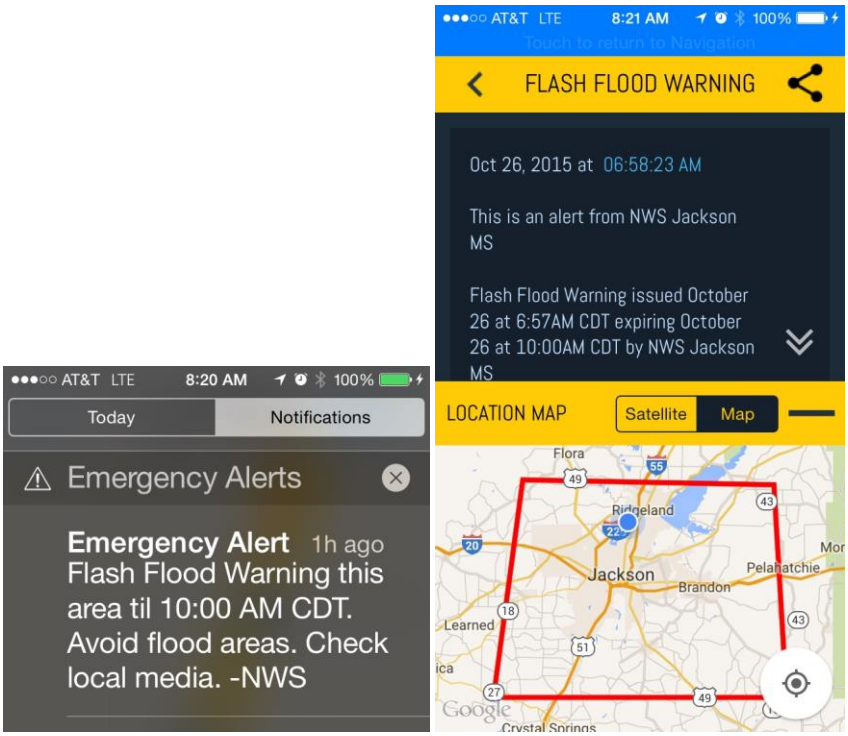
Example Alert origination portal:



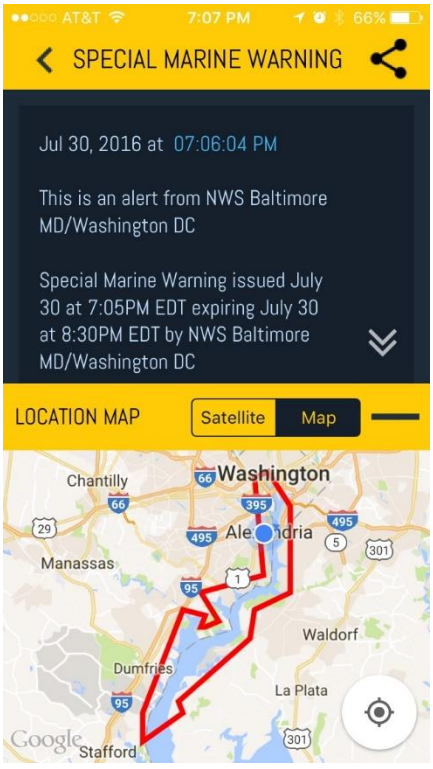
Device's display of alert:



Further displayed below are alerts received from IPAWS which were originated by NOAA. The first shows a WEA Flash Flood Alert and the same alert as received and displayed by the device based solution.



The second is an example of a more complex polygon where device assisted geo targeting would again ensure the alert is rendered to only the devices of those who need it:



ATIS (Sec 8.1) Handling of multiple alert areas.

A WEA Alert Message may have multiple polygons or circles. Additionally, there could be multiple alerts at the same time in the same general geographic area and each of these alerts could have different alert areas due to the nature of the alert. Consequently, not only will multiple alert text messages have to be broadcast to the mobile devices, but multiple sets of associated polygon coordinates need to be delivered to the mobile devices and the mobile devices will need to maintain an association between the multiple alerts and the multiple alert areas.

RESPONSE: Breaking Down the Issues Raised:

Alert Message may have multiple polygons or circles: An example of this is a college that has multiple satellite campuses throughout the city or state. The college wants to send an alert to all campuses; they type the alert and choose all areas so there are multiple polygons. In this case the polygons are all in separate areas and therefore do not overlap. Instead of sending the alert as one big alert, have the AO software or IPAWS separate the polygons into separate CB with the same message. This reduces the message size and directs the alerts to each region of the network.

"…multiple alerts at the same time in the same general geographic area…": Multiple active alerts in the same area are possible (e.g. Extreme Wind Warning and Shelter In Place Warning) and this alone poses no obstacle. There are a number of process and procedural issues that alert originators already have to address as they become certified to deliver alerts, including what areas are authorized for what originators. In large part this is already in place as each originator has a defined jurisdiction. Also, software used by the AOs to generate alerts only allows them to send alerts to their jurisdiction. It will not allow them to send an alert they created that alerts outside their jurisdiction. As for the device, it will only render the alerts that are geographically relevant. Thus, for the way WEA works, there are no technical issues, but AO procedural ones. AOs already have jurisdictions, and with new services will need to adapt their policy and procedures to comply.

ATIS: (Sec 8.1) Size of polygon.

Per J-STD-101 [Ref 2], there is a limit of 100 polygon coordinates per alert area. The amount of data being broadcast for the polygon coordinates could be up to 5 times larger than the size of the actual displayable text of each alert message, even considering compression techniques.

Consequently, the vast majority of the capacity that might be utilized for the broadcast of the polygon coordinates would delay the presentation of the WEA Alert Message to the mobile device user and could delay the broadcast of any other alerts for an incident which requires multiple different WEA alert types to be broadcast.

RESPONSE: Polygon Coordinates

Place a limitation on the number of allowable polygon coordinates and decimals used for each coordinate in the AO software. Thus, if it is decided to use a page of CB to hold the polygon then with compression the total polygon size is limited to 93 characters. The AO then has the choice to modify the number of geo coordinates and or number of decimal places for each coordinate to stay within the set limit.

ATIS (Sec 8.1) Number of decimal places.

As indicated in clause 7.1.2, there have been instances where Alert Originators are specifying polygon coordinates with an unrealistic number of decimal places. Alert Originator software should limit the number of decimal places to 3 maximum for polygon coordinates.

RESPONSE: Decimal Places

Accuracy of the polygon: For each decimal in the GPS coordinate, the variance shrinks measurably on either side of the polygon line. Two decimal places provide geographical resolution of 1.1 kilometers, which is enough to separate one village from the next. Three decimal places provides resolution of 110 meters which is enough to identify a large agricultural field or institutional campus. Four decimal places provides resolution up to 11 m which can identify a parcel of land and five decimal places provides resolution up to 1.1M which can identify a centerline on a highway. As mentioned above, AO software should ensure the polygon complies with the agreed upon polygon size limit after compression.

Compression techniques should be used to reduce the size of polygon vertices. According to the Carnegie Mellon University study, compression of 9.7% to 23.6% of the original size is possible. In addition, as mentioned in further detail above, 3GPP TS 23.041 Technical realization of CB and 3GPP TS 23.042 (CT1) Compression algorithm already exist for Cell Broadcast. The 3GPP standards further outline that the polygon coordinates and message can be compressed at the CBC and then decompress the alert message at the UE (device).

ATIS: (Sec 8.1) Coordinate compression.

Further study is needed to determine the applicability of compression techniques to WEA polygon coordinates. In addition, any compression techniques must be standardized globally.

RESPONSE: Compression

As described above, 3GPP standards already exist for cell broadcast (3GPP TS 23.041 Technical realization of CB and 3GPP TS 23.042 (CT1) Compression algorithm). Compression is widely used by the wireless industry.

ATIS (Sec 8.1) Determination of mobile device location.

For mobile device geo-targeting to function, the mobile device must first determine its current location. However, that may not always be possible especially if the mobile device user has disabled the location services to conserve battery life or for privacy reasons. Failure to obtain mobile device location within a short period of time raises several mobile device behavior issues, which would need to be resolved. (See clause 7.3)

RESPONSE: Location

Provide a user configurable on/off option for WEA location service.

START research showed that 81% of cell phone users do not touch their location service. The other 19% turn on and off their location services. In situations where the device is not able to determine its location, the WEA software could be updated so that the alert is rendered after a predetermined period of time. The working group could establish a maximum allowable time for the device to either use its current location or to determine its location. If this time is exceeded, then the alert is rendered.

(Sec 8.1) Subscriber privacy.

Subscriber privacy is a concern especially if the mobile device geo-targeting algorithms have the perception of the government or an agent acting on behalf of the government viewed as continuously monitoring and tracking a mobile device's location. When WEA was first deployed, this government tracking was a concern raised by various groups.

RESPONSE: Privacy

As CB is a one-way message and does not extract information from the phone, the user's privacy

is maintained. In addition, the WEA software in the device can establish permission from the user to turn on location based services upon receipt of an alert.

(Sec 8.1) Mobile device location accuracy and confidence levels.

The geo-targeting of the mobile device location with the WEA Alert Message polygon or circle would need to have an associated accuracy and confidence level. Depending on the level of the accuracy and confidence of the mobile device location, it is possible that the mobile device geo-targeting algorithms could indicate that the mobile device is located outside the alert area when the mobile device is actually located within the WEA alert area.

RESPONSE: Location

Some inaccuracy is to be expected and acceptable, as it will be a significant improvement over the current service. As outlined above, the AO requests to determine the accuracy of the polygon by the type of alert and to do so by managing the number of decimal points in the polygon coordinates. If the device is given five decimals for each latitude and longitude it will have the information it needs to render accuracy of up to 1.1 meters of the alert polygon boundary. In contrast, if the device is only given two decimals then it only has the information to get the location of the device within 1.1km of the polygon boundary. The key is that the alert originator now can use the capabilities of the device to deliver more accurate and relevant alerts, based on the specific alert situation. An evacuation of a building will have a small polygon of say four coordinates but will need 5 decimals or 1.1m in variance. (See screen shots on page 4 to see the origination of an evacuation alert and the alert demonstrated on the device). On the opposite level of the scale, a hurricane covers a big area and will need more polygon vertices to define it. But because it is such a large area the accuracy of the polygon is fine at 1.1km so the AO would use 2 decimal places. This also highlights how the AO can trade off polygon precision per vertex for more vertices in order to remain within the allocated polygon parameters, i.e., one page of CB.

AO recognize that the accuracy of the device determining its location is based on a number of factors that are out of the control of the device (weather, obstructions such as buildings, trees, etc.) However, the public's expectations are that location services for Uber, pizza and other services can find them, thus their device should alert them based on their location.

ATIS (Sec 8.1) Liability.

The liability issues and concerns associated with mobile device assisted geo-targeting miscalculation and the resultant action of not presenting the WEA Alert Message needs to be understood and addressed, perhaps at the Congressional level through amendments to the WARN Act.

RESPONSE: Liability

The Act provides comprehensive liability protection for the delivery (or lack thereof) of Wireless Emergency Alerts.

(e) LIMITATION OF LIABILITY.—

(1) IN GENERAL.—Any commercial mobile service provider (including its officers, directors, employees, vendors, and agents) that transmits emergency alerts and meets its obligations under this title shall not be liable to any subscriber to, or user of, such person's service or equipment for—

(A) any act or omission related to or any harm resulting from the transmission of, or failure to transmit, an emergency alert; or

(B) the release to a government agency or entity, public safety, fire service, law enforcement official, emergency medical service, or emergency facility of subscriber information used in connection with delivering such an alert.

(2) ELECTION NOT TO TRANSMIT ALERTS.—The election by a commercial mobile service provider under subsection (b)(2)(A) not to transmit emergency alerts, or to withdraw its election to transmit such alerts under subsection (b)(2)(D) shall not, by itself, provide a basis for liability against the provider (including its officers, directors, employees, vendors, and agents).

(f) TESTING.—The Commission shall require by regulation technical testing for commercial mobile service providers that elect to transmit emergency alerts and for the devices and equipment used by such providers for transmitting such alerts.