MMTC
Multicultural Media, Telecom and Internet Council
1250 Connecticut Ave NW, 7th Floor
Washington, D.C. 20036
Phone: 202-261-6543| MMTConline.org

MEMORANDUM

To: Multicultural Media, Telecom and Internet Council (MMTC)

From: Daniella Infantino, Henry Rivera Fellow, and Scenic Mosley, Henry Geller Fellow

Re: The Impact of Climate Events on the Wireless Grid and Multilingual Consumers

Date: January 21, 2024

I. <u>Introduction</u>

The heightened incidence of climate-related disasters calls for an urgent enhancement of wireless grid infrastructure to ensure the continuity of communication during emergencies.[1] Section II analyzes the role of wireless grids in emergency alert dissemination and exposes their vulnerabilities. A critical balance between advanced technology and the necessary robustness to withstand natural disasters emerges as essential.

Section III focuses on the impact of the Federal Emergency Management Agency ("FEMA") on emergency communication, detailing the development and efficacy of the Integrated Public Alert and Warning System ("IPAWS") and Wireless Emergency Alerts ("WEA'). These systems represent critical advancements in the United States government's efforts to enhance public safety by expediting the reach of essential safety information.[2] In Section IV, we delve into the vulnerabilities of wireless grids. The section pinpoints the physical and systemic challenges threatening grid functionality during natural disasters and discusses potential solutions and improvements to maintain grid integrity.[3]

Section V addresses the challenges multilingual communities face when grid failures occur, highlighting the need for inclusive emergency communication systems that serve all population segments. It emphasizes the increased risks for those who may not receive alerts in their primary language. It underscores the importance of making emergency alerts accessible to all, regardless of language barriers. Section VI presents case studies, including the Maui wildfires and the New York City flooding, demonstrating the real-world impacts of communication breakdowns in disaster scenarios. These case studies underscore the need for resilient and inclusive communication infrastructures and their vital role in safeguarding communities during catastrophic events.[4]

Finally, Section VII addresses the critical role of backup communication systems during primary network failures, emphasizing the importance of reliable alternatives and the strategic deployment of these systems in

[1] Federal Communications Commission, Wireless Network Resiliency During Disasters, FCC (Sep. 25, 2023), https://www.fcc.gov/wireless-network-resiliency-during-disasters.
[2] Federal Emergency Management Agency, Integrated Public Alert & Warning System, FEMA (Aug. 3, 2023), https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system.
[3] U.S. Department of Energy, *Electric Grid Security and Resilience: Establishing a Baseline for Adversarial Threats*, ICF INTERNATIONAL (June 2016), available at https://www.energy.gov/policy/articles/electric-grid-security-and-resilience-establishing-baseline-adversarial-threats.
[4] Wireless Network Resiliency.

emergencies.[5] Section VIII concludes with action-driven recommendations, calling upon policymakers, industry leaders, and community planners to implement the structural and procedural enhancements needed to protect all community members during crises.

II. History of Wireless Grid Failure and Multilingual Consumers Impacted

The increasing frequency of climate events in the United States, such as the over 2,000 wildfires reported by CalFire in a single year, has highlighted the vulnerabilities in physical and digital infrastructures.[6] Hurricanes, floods, and wildfires have disrupted essential services and impeded rescue efforts, exacerbating the toll on communities.

According to the National Oceanic and Atmospheric Administration, the United States has experienced a marked increase in the frequency of multibillion-dollar disaster events, underscoring the urgent need for a resilient network infrastructure.[7] Wireless grids are integral to this infrastructure, providing a lifeline for communicating alerts and updates during disasters. Their reliability is crucial, as evidenced by reports by the Federal Communications Commission ("FCC") on network outages, which show that emergency responses and the timing of evacuations depend heavily on the uninterrupted operation of communication systems.[8]

Despite their critical role, wireless grids are not impervious to failure. They are vulnerable to physical damage, such as when Superstorm Sandy caused the collapse of twenty-five percent of cell towers across ten states.[9] System overloads are also a significant risk during crises, with the FCC noting that emergencies can surge network demand, leading to unexpected outages.[10] Furthermore, FEMA studies highlight the challenges for the 21% of U.S. residents who speak a language other than English at home, demonstrating the need for multilingual emergency systems to prevent increased casualties during disasters.[11]

The role of wireless grids in emergency notification is paramount, with government agencies relying on them to transmit critical updates to affected populations. These grids support various platforms, from mobile networks to emergency broadcast systems. However, their advanced capabilities do not negate their susceptibility to damage and overloads.[12] Innovative solutions and proactive risk management are necessary to counter these threats. FEMA's WEA system, which has delivered over 70,000 messages in the past decade, is an example of such innovation.[13] Still, the need for improvement remains as the challenges and frequency of disasters grow.

The relevant research underscores the necessity of robust communication networks during disasters. Communication breakdowns, such as during Hurricane Katrina, have led to increased casualties and prolonged recovery efforts. FEMA and the FCC have documented cases where failures in communication infrastructure had dire consequences.[14] These instances call for communication systems that are resilient and adaptable to the

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[5] FEMA Integrated Public Alert.

[6] Sophie Lewis, *California wildfires have already burned 2.2 million acres in 2020 – more than any year on record*, CBS NEWS (Sep. 9, 2020, 12:27 PM), https://www.cbsnews.com/news/california-wildfires-burn-2-million-acres-record-breaking/.

[7] Adam B. Smith, *2022 U.S. billion-dollar weather and climate disasters in historical context,* CLIMATE.GOV (Jan. 10, 2023), https://www.climate.gov/news-features/blogs/beyond-data/2022-us-billion-dollar-weather-and-climate-disasters-historical.

[8] Federal Communications Commission, *Network Outage Reporting System (NORS)*, FCC, https://www.fcc.gov/network-outage-reporting-system-nors (last updated Nov. 30, 2023).

[9] Peter Svensson, *Hurricane Sandy Knocked Out 25 Percent of Cell Towers In Its Path,* Business Insider. https://www.businessinsider.com/hurricane-sandy-knocked-out-25-percent-of-cell-towers-in-its-path-2012-10 (Last Visited Nov. 5, 2023).

[10] FCC, Network Outage Reporting System.

[11] Federal Emergency Management Agency, *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action,* FEMA (Dec. 2011), https://www.fema.gov/sites/default/files/2020-07/whole_community_dec2011__2.pdf.

[12] FCC *NORS.*

[13] Federal Emergency Management Agency, *FEMA Celebrates 10th Anniversary of Wireless Emergency Alerts, Integrated Public*, FEMA (June 7, 2022) https://www.fema.gov/press-release/20220607/fema-celebrates-10th-anniversary-wireless-emergency-alerts-integrated-public.

[14] Robert Miller, *Hurricane Katrina: Communications & Infrastructure Impacts*, available at https://apps.dtic.mil/sti/pdfs/ADA575202.pdf (last visited Nov. 5, 2023).

unique challenges of different disaster scenarios. As the National Climate Assessment projects an increase in the severity of weather-related disasters, comprehensive planning and implementing resilient communication technologies have become imperative.[15]

Inclusivity in emergency communication is also crucial, with statistics indicating that multilingual capabilities are necessary to reach all community members effectively.[16] The U.S. Census Bureau reports that over 60 million individuals speak a language other than English at home, and approximately 25 million Americans have limited English proficiency.[17] Emergency alert systems must, therefore, include multilingual alerts to ensure that vital information is accessible during disasters. Ensuring that all community members, regardless of language proficiency, can receive and understand critical data is a technical necessity and a moral imperative in disaster preparedness and response.

III. Federal Emergency Management Existing Literature

FEMA is a sentinel in emergency management, ensuring the nation's disaster communication systems remain robust and reliable.[18] The agency's literature chronicles the development of the IPAWS, which became fully operational in 2011.[19] This advanced system represents a milestone in emergency management, converging new technologies with established alert mechanisms to forge a comprehensive public safety communication infrastructure.[20] By disseminating critical alerts across multiple channels, including the WEA system, IPAWS guarantees that essential information swiftly reaches the public.[21]

The WEA system has proven its efficacy as a pivotal public safety tool since its establishment. In a decade, it has dispatched thousands of messages, warning citizens of imminent extreme weather and other emergencies.[22] The alerts' unique tone and vibration pattern are designed to be accessible to people with disabilities, ensuring broad reach and utility.[23] The geotargeting capability of the WEA system tailors alerts to those in immediate peril, enhancing the messages' relevance and urgency.[24]

FEMA's collaboration with the FCC has been instrumental in the progressive refinement of the WEA system. The literature reflects a symbiotic relationship wherein the FCC's insights into the system's operational metrics like speed, accuracy, and reliability, have been integral to the system's evolution.[25] These improvements are a testament to the agencies' joint commitment to maintaining public safety and keeping the populace well-informed during crises.

FEMA's literature outlines plans to augment the WEA system's capabilities through rigorous testing and performance evaluations. A notable initiative by the FCC to conduct the first-ever geotargeting tests, in collaboration with FEMA and local agencies, underscores a concerted effort to refine the precision of emergency alerts.[26] This forward-thinking approach aims to expand the use of the WEA system, thereby bolstering public confidence in its effectiveness as a lifesaving service.

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[15] *Fourth National Climate Assessment*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, https://nca2018.globalchange.gov/ (last visited Nov. 5, 2023).

[16] Intergovernmental Advisory Comm. to the Fed. Commc'ns Comm'n, Advisory Recommendation No. 2019-5, *In the Matter of Multilingual Emergency Alerting*, FCC, available at https://docs.fcc.gov/public/attachments/DOC-360696A3.pdf (last visited Nov. 5, 2023).

[17] Sandy Dietrich & Erik Hernandez, *What Languages Do We Speak in the United States?,* U.S. CENSUS BUREAU (Dec. 6, 2022), https://www.census.gov/library/stories/2022/12/languages-we-speak-in-united-states.html.

[18] FEMA Integrated Public Alert.

[19] Federal Emergency Management Agency, *IPAWS Governance*, FEMA (Sep. 28, 2022), https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/governance.

[20] *Id*.

[21] *Id*.

[22] FEMA Integrated Public Alert.

[23] *IT Program Assessment FEMA – Integrated Public Alert Warning System (IPAWS)*, DEPARTMENT OF HOMELAND SECURITY, available at https://www.dhs.gov/xlibrary/assets/mgmt/itpa-fema-ipaws2011.pdf (last visited Nov. 5, 2023).

[24] *Id.*

[25] *Id.*

[26] *FEMA Celebrates 10th Anniversary of Wireless Emergency Alerts.*

On the operational front, FEMA provides disaster emergency communications through a range of assets, including six geographically dispersed Mobile Emergency Response Support detachments and a fleet of Mobile Communications Office Vehicles.[27] These resources are immediately deployable, offering self-sustaining telecommunications support to large disaster field offices and multiple field sites within the disaster area.[28] Deploying mobile communications office vehicles as mobile disaster recovery centers during the initial response phase allows disaster survivors to apply for assistance directly and quickly.[29]

FEMA's commitment to resilient disaster communication is quantified in their reports, which detail the scope and scale of deployments during significant emergencies.[30] For instance, in the aftermath of Hurricane Sandy, FEMA's mobile support units facilitated the filing of thousands of assistance applications, illustrating the tangible impact of these communication assets.[31] The statistics underscore the necessity of such mobile infrastructure in providing a lifeline to those affected by disasters.

IV. <u>The Vulnerability of Wireless Grids</u>

Wireless communication grids, crucial during emergencies, are susceptible to many vulnerabilities, compromising their integrity. Physical damage to infrastructure is a primary concern, with the National Oceanic and Atmospheric Administration reporting an increase in extreme weather events that can devastate these systems.[32] Hurricanes, for instance, can disable up to 25% of cell towers in their path, as seen during Hurricane Sandy.[33]

Furthermore, the United States Geological Survey has documented wildfires affecting land cover over millions of acres annually, posing a significant risk to ground-based communication infrastructure.[34] Grids also face overloading issues, where the FCC notes that emergencies can lead to a surge in communication traffic by several hundred percent, potentially crashing networks when they are most critical.[35]

Cyber threats represent an equally formidable challenge, with the Cybersecurity and Infrastructure Security Agency acknowledging an uptick in cyberattacks aimed at critical infrastructure sectors.[36] These attacks can incapacitate wireless grids, leading to communication blackouts.[37] Additionally, overreliance on single technologies can lead to systemic failures, highlighting the need for a diversified approach to communication systems.[38] The current trend of increasing cyber incidents demands robust cybersecurity measures integrated into the wireless grid's design and operation.[39]

Adaptation to the evolving climate landscape is another pressing need for wireless grids. Infrastructure designed for past climate conditions may not withstand today's increased frequency and severity of weather-related disasters.[40] The American Society of Civil Engineers has called for significant investment in resilient infrastructure, emphasizing that adaptive technologies are crucial to future-proof communication networks against the challenges of a changing climate.[41]

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[27] *Id.*
[28] *IT Program Assessment IPAWS.*
[29] *Id.*
[30] FEMA Integrated Public Alert.
[31] *FEMA Celebrates 10th Anniversary of Wireless Emergency Alerts.*
[32] National Oceanic and Atmospheric Administration, Climate Change Impacts, NOAA, https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts (last visited Nov. 5, 2023).
[33] *Id.*
[34] U.S. Department of the Interior & U.S. Geological Survey, *U.S. Geological Survey Wildland Fire Science Strategic Plan, 2021–26*, USGS, available at https://pubs.usgs.gov/circ/1471/cir1471.pdf (last visited Nov. 5, 2023).
[35] FCC Network Outage Reporting System.
[36] U.S. Government Accountability Office, *Critical Infrastructure Protection: National Cybersecurity Strategy Needs to Address Information Sharing Performance Measures and Methods*, GAO (Sep. 26, 2023), https://www.gao.gov/products/gao-23-105468.
[37] *Id.*
[38] *Id.*
[39] *Id.*
[40] Rodolfo Lacy, *Climate-resilient Infrastructure*, OECD, available at https://www.oecd.org/environment/cc/policy-perspectives-climate-resilient-infrastructure.pdf (last visited Nov. 5, 2023).
[41] *Id.*

For multilingual populations, the risk intensifies when grids collapse. FEMA's push to expand IPAWS with multilingual alerts is a step in the right direction, yet continuous enhancement and testing are crucial.[42] Statistics from the U.S. Census Bureau reveal that over sixty million U.S. residents speak a language other than English at home, which necessitates the availability of language-appropriate alerts to ensure the timely dissemination of emergency information to these residents.[43]

Recommendations to mitigate these vulnerabilities include reinforcing physical infrastructure against extreme weather, diversifying communication technologies to prevent single points of failure, and ensuring responsiveness to the needs of diverse communities.[44] Proactive measures such as these are essential in constructing a resilient emergency communication framework capable of withstanding the multifaceted challenges of natural and human-made disasters.

Furthermore, strategies must include integrating advanced predictive analytics to manage grid loads preemptively and developing Artificial Intelligence ("AI") based translation services for real-time multilingual communication.[45] Such technological advancements will protect the grids and ensure that the messages transmitted are clear, timely, and accessible to all, irrespective of language barriers.[46]

V. Multilingual Consumers and Grid Failure

The resilience of wireless communication grids is a critical issue for all consumers, but it presents unique challenges for multilingual populations. When these grids fail during disasters, non-English speakers can be disproportionately affected due to language barriers, resulting in life-threatening delays and miscommunications.

As seen in the aftermath of Hurricane Katrina, over 100,000 Louisianans who were not proficient in English struggled to receive timely and accurate information when the only Spanish-language radio station went off-air for eight critical days.[47] Similarly, during Hurricane Ida in New York City, the communication grid's limitations became glaringly apparent.[48] The city's multilingual residents faced significant hurdles because alerts were broadcast predominantly in English and Spanish, excluding many diverse populations.[49]

FEMA literature and case studies highlight that a grid system that caters to all linguistic groups is imperative in areas with diverse populations, such as New York City, where 25% of the population does not speak English at home.[50] In Maui, the reliance on social media for emergency alerts proved insufficient, particularly for non-English speakers, as public updates on wildfires were infrequent and sometimes unclear.[51] These instances underscore the necessity for emergency communication strategies that are inclusive and considerate of linguistic diversity.

To better serve multilingual consumers, FEMA suggests several improvements, such as establishing specific channels for multilingual broadcasts during emergencies, storing emergency alerts in multiple languages for immediate broadcast, and collaborating with community leaders to understand and meet linguistic needs.[52] Additionally, equipping emergency responders with multilingual communication tools and training is vital.[53] Creating systems for multilingual consumers to provide feedback on communication effectiveness during drills or actual events can further enhance

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[42] FEMA Integrated Public Alert.
[43] Sandy Dietrich & Erik Hernandez, *What Languages Do We Speak in the United States?*
[44] *Id.*
[45] Nathan E. Sanders & Rose Hendricks, *Ai could reshape climate communication*, PREVENTIONWEB (Aug. 20, 2023), https://www.preventionweb.net/news/ai-could-reshape-climate-communication.
[46] *Id.*
[47] The White House, *The Federal Response to Hurricane Katrina: Lessons Learned* (2006), available at https://biotech.law.lsu.edu/katrina/govdocs/katrina-lessons-learned.pdf.
[48] Allison Finch, *Communication gaps during Hurricane Ida noted as Weather Service's pitfalls*, ACCUWEATHER (May 2, 2023, 3:04 PM), https://www.accuweather.com/en/hurricane/communication-gaps-during-hurricane-ida-noted-as-weather-services-pitfalls/1519591.
[49] *Id.*
[50] *Id.*
[51] Adeel Hassan & Anna Betts, *Maui Wildfires Latest: Lahaina Reopens to Residents*, THE NEW YORK TIMES (Sep. 29, 2023), https://www.nytimes.com/article/maui-wildfires-hawaii.html.
[52] FEMA Integrated Public Alert.
[53] *Id.*

the reliability and inclusivity of emergency communications. These measures would improve the safety of multilingual communities during grid failures and strengthen the overall disaster response framework.

VI. Case Studies

In the realm of disaster management, the rigor of emergency communication systems is put to the test during real-world events. This section analyzes three significant climate events: Hurricane Katrina, the flooding in New York City from Hurricane Ida, and the recent wildfires in Maui. Each case study explores the interplay between disaster impacts and the efficacy of emergency communication networks, particularly the challenges multilingual populations faced. These events shed light on the critical need for resilient, inclusive communication infrastructures and their vital role in safeguarding communities during catastrophic events.

A. Hurricane Katrina

Hurricane Katrina in 2005, one of the deadliest hurricanes in U.S. history, serves as a stark reminder of the vulnerability of communication systems during natural disasters. The hurricane caused severe flooding and infrastructural damage in New Orleans and the surrounding areas, leading to prolonged power outages and failures in the wireless communication grid.[54] The impact was particularly severe for non-English speakers; over 100,000 Louisianans not proficient in English were left without access to crucial information when the Spanish language radio station went off the air for eight days.[55] This case highlighted the necessity of a "Designated Hitter" system, which would require broadcasters to provide emergency information in widely spoken languages during and after an emergency in the "Katrina Petition,"[56] which called on the FCC to require emergency broadcasts in multiple languages.

In the wake of Hurricane Katrina, FEMA acknowledged the need for robust disaster emergency communications and began modernizing public alert systems, resulting in the operationalization of IPAWS in 2011.[57] This modernization directly responded to the communication failures experienced during Katrina, emphasizing the need for a system capable of reaching all affected individuals, including those with limited English proficiency.[58] Despite these advancements, the literature suggests that further enhancements are necessary, particularly in refining the geotargeting capabilities of alerts and expanding the system's multilingual capacities.[59]

The lessons from Hurricane Katrina led to initiatives to improve interoperable communications between federal, state, and local governments. FEMA's deployment of Mobile Emergency Response Support units and establishment of a fleet of Mobile Communications Office Vehicles were crucial steps in this direction.[60] These efforts demonstrate a commitment to bolstering the infrastructure required for effective disaster response and recovery operations.

However, as FEMA's post-Katrina literature indicates, there remains a gap in ensuring communication equity during disasters, particularly for multilingual communities. Expanding IPAWS to include alerts in multiple languages and formats is essential for reaching all community members.[61] Integrating mobile communications office vehicles as mobile disaster recovery centers has been a significant stride in aiding survivors.[62] However, the agency's literature calls for ongoing improvements to these systems, highlighting the need for constant innovation and adaptation to emerging threats and challenges.

B. Flooding in New York City

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54 Miller, *Communications & Infrastructure Impacts.*
55 The White House, *The Federal Response to Hurricane Katrina.*
56 David Honig et al., *Multilingual Emergency Communications*, *EB Dockets 06-119 and 04-296*, MMTC (May 19, 2020), available at https://www.mmtconline.org/wp-content/uploads/2020/06/MMTC-LULAC-Multilingual-Emergency-Communications-Letter-051920.pdf.
57 FEMA Integrated Public Alert.
58 *Id.*
59 *Id.*
60 *Id.*
61 *Id.*
62 Miller, *Communications & Infrastructure Impacts.*

Hurricane Ida's arrival in New York City ("NYC") in 2021 resulted in uneven destruction and a tragic demonstration of the flaws in NYC's communication grid due to language access barriers. The majority of the 13 NYC residents who perished during the hurricane were of Asian descent, emphasizing the disproportionate effect on communities facing language-specific challenges.[63] The existing emergency alert system's English and Spanish limitations meant that many of NYC's diverse population were excluded from receiving timely alerts.[64] The National Weather Service's alerts, primarily in English and Spanish, were insufficient for the city's multilingual population.[65] Although NYC's Notify NYC system offered information in 14 languages, many residents were unaware of its existence or how to opt in to it.[66]

The response to the flooding in New York City, particularly during Hurricane Ida, showcased FEMA's ability to mobilize and coordinate emergency communications. Challenges persisted despite the deployment of Mobile Emergency Response Support detachments and a pre-positioned fleet of Mobile Communications Office Vehicles.[67] The emergency alert system's limitations were evident, as most alerts were only in English and Spanish, insufficient for New York City's linguistically diverse population.[68] The National Weather Service's alerts and NYC's Notify NYC system did not reach many residents effectively, leaving a significant communication gap.[69]

In response to the devastating urban flooding caused by Hurricane Ida in New York City, FEMA's Mitigation Assessment Team ("MAT") deployed to assess the damage and develop strategies for mitigation.[70] The MAT's reports highlighted the need for a multi-pronged approach to urban flood management, including upgrading sewer systems and enhancing green infrastructure.[71] This approach addresses the issues resulting from over 7 inches of rain that flooded streets and subways and overwhelmed drainage systems designed for much lower rainfall intensities.[72]

FEMA has worked towards mitigating flood risks by supporting New York City's initiatives like the Bluebelt program and FloodNet.[73] The Bluebelt program, designed to use natural landscapes for stormwater management, has been a vital part of Staten Island's drainage system, proving effective in areas previously prone to flooding.[74] FloodNet's installation of flood detection sensors throughout the city represents a significant advancement in real-time flood monitoring, aiming to have 500 sensors operational by 2027.[75] These measures reflect FEMA's commitment to reducing the impact of extreme weather events through innovative and sustainable urban planning. Still, their initial response was insufficient and untimely.

C. __Wildfires in Maui__

The wildfires in Maui this past August further demonstrated the complications arising from grid failures. The Lahaina fires, initially contained early in the morning, escaped and spread rapidly by the afternoon, causing power and cellular outages that disrupted communication.[76] Maui County's reliance on social media for emergency alerts proved inadequate, especially for the multilingual population, as its all-hazard siren systems intended to alert the public failed to activate.[77] The Maui wildfires resulted in significant loss of life and property, with more than 800 business

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[63]Ashley Wong, *Push for Language Access After Ida Highlights a Greater Need in N.Y.*, THE NEW YORK TIMES (Mar. 3, 2022), https://www.nytimes.com/2022/03/03/nyregion/severe-weather-alerts-languages-ida.html.
[64] Wong, *Push for Language Access.*
[65] *Id.*
[66] *Id.*
[67] FEMA Integrated Public Alert.
[68] Office of the New York State Attorney General, *Attorney General James Calls on National Weather Service to Increase Language Access*, NEW YORK STATE ATTORNEY GENERAL (Mar. 1, 2022), https://ag.ny.gov/press-release/2022/attorney-general-james-calls-national-weather-service-increase-language.
[69] *Id.*
[70] Federal Emergency Management Agency, *Reducing the Effects of Urban Flooding in New York City: Hurricane Ida NYC MAT Technical Report 3* (2023), available at https://www.fema.gov/sites/default/files/documents/fema_p-2333-mat-report-hurricane-ida-nyc_technical-report-3_2023.pdf.
[71] *Id.*
[72] *Id.*
[73] *Id.*
[74] *Id.*
[75] *Id.*
[76] Natasha Chen et al., *Hawaiian Electric says power lines started morning fire on August 8, but not afternoon Lahaina Fire*, CNN BUSINESS (Aug. 29, 2023, 7:06 PM), https://www.cnn.com/2023/08/28/business/hawaiian-electric-power-lines-fire/index.html.
[77] *Id.*

establishments and approximately 7,000 employees affected.[78] The reliance on social media and the infrequency and lack of clarity in public updates disproportionately affected non-English speakers, mainly if translations were not immediate or accurate.[79]

The Maui wildfires, which caused multiple power and cellular outages, are a critical example of the urgent need for network resilience in the face of natural disasters. CalFire reported over 2,000 wildfires in a single year, burning over 12,500 acres, underscoring the frequency and impact of such events on communication infrastructure.[80] During the fires in Maui, reliance on social media for emergency alerts was insufficient when traditional siren systems failed to activate, highlighting the necessity for a multifaceted approach to disaster preparedness.[81]

Recognizing their vulnerability, states like California have begun planning new network deployments using the $42.5 billion federal Broadband Equity Access and Deployment ("BEAD") program, aiming to fortify networks against these increasing threats.[82] This proactive measure sets a precedent for enhancing network resilience, suggesting a need for national strategies to ensure networks can withstand and recover from unexpected disruptions.[83] The situation in Maui illustrates the potential for improved disaster response through strengthened network infrastructure, redundancy measures, and enhanced communication strategies that consider the diverse needs of affected populations.

In the aftermath of the Maui fires, it is evident that more robust, preemptive planning and collaboration across government and private sectors are required. The fires demonstrated the importance of regular risk assessments and the implementation of communication technologies that can dynamically reroute traffic during node failures.[84] By integrating lessons from Maui and other wildfire incidents, organizations such as FEMA can significantly improve disaster preparedness, ensuring that communication systems remain operational and accessible during critical times, especially for multilingual and at-risk communities.

The case studies of Hurricane Katrina, Hurricane Ida's impact on New York City, and the Maui wildfires underscore the imperative for robust and inclusive emergency communication systems. They demonstrate the consequences of inadequate preparation and the importance of addressing the specific needs of multilingual populations. These historical events serve as a stark reminder of the human costs when communication fails and as a call to action for continuous improvement of disaster response infrastructure. They reinforce the necessity for proactive advancements in emergency communications to better serve and protect diverse communities against future calamities.

VII. Backup Communications Systems

As climate events increasingly disrupt primary communication networks, backup systems become indispensable for emergency management. These systems ensure uninterrupted information flow when conventional grids fail. Traditional yet robust radio broadcasting provides wide-reaching emergency communication with signals less prone to disaster-induced disruptions.[85] In the aftermath of Hurricane Katrina, the "Designated Hitter" system highlighted radio's utility, mandating at least one station to broadcast lifesaving information in various languages during emergencies.[86] However, the functionality of radio backup systems depends on the presence of operational stations and a consistent power supply.[87]

Landline phones also serve as reliable backup communication tools. Their direct connection to the landline system allows operation without electricity, providing a critical communication channel during power outages.[88] This often-overlooked technology proves vital, especially in the

[78] *Id.*
[79] *Id.*
[80] California Department of Forestry and Fire Protection, *Statistics*, https://www.fire.ca.gov/our-impact/statistics. (Last updated Dec. 18, 2023).
[81] Natasha Chen et al., *Hawaiian Electric.*
[82] Ryan Johnston, *Wildfires, Natural Disasters & Network Resilience* (2023), available at https://Johnston, Ryan. Wildfires, Natural Disasters & Network Resilience..org/wp-content/uploads/2021/05/Wildfires-Natural-Disasters-Network-Resilience_Johnston.pdf (last visited Nov. 5, 2023).
[83] *Id.*
[84] *Id.*
[85] *Broadcast radio: The most reliable medium for disaster updates*, INTERNATIONAL TELECOMMUNICATION UNION (Feb. 13, 2023), https://www.itu.int/hub/2023/02/broadcast-radio-the-most-reliable-medium-for-disaster-updates/.
[86] David Honig, et. al, *Multilingual Emergency Communications*.
[87] Federal Communications Commission, *In the Matter of Ensuring Continuity of 911 Communications,* PS Docket No. 14-174, https://docs.fcc.gov/public/attachments/FCC-15-98A1.pdf (released Aug. 7, 2015).
[88] *Id.*

initial stages of a disaster.[89] Additionally, geostationary and Low Earth Orbit ("LEO") satellites offer resilient communication means, unaffected by terrestrial disruptions.[90] Satellite phones, providing voice, SMS, and internet access, become crucial when ground-based infrastructure is compromised.[91]

Furthermore, the resilience of the electric grid, a key component of wireless networks, is often debated regarding the necessity of a backup system. While some argue that maintaining the wireless grid during emergencies may not be critical, the failure of the electric grid poses a significant "what if" scenario. Innovative technologies like phone pinging, which allows devices to receive alert notifications without a traditional network, become invaluable in such an event. This new technology ensures that even if the electric grid fails, individuals can still receive crucial alerts and maintain a line of communication during a disaster. Thus, it may not be entirely necessary to fortify the wireless grid and instead focus on novel innovations.

For multilingual consumers, establishing dedicated channels for multilingual broadcasts is imperative. Storing emergency alerts in various languages for immediate release ensures timely, understandable information delivery to non-English speakers.[92] Collaborating with community leaders and equipping emergency responders with multilingual tools can enhance the inclusivity of backup systems.[93] Creating feedback mechanisms on communication effectiveness further solidifies the reliability of these systems for diverse populations.[94]

Developing multiple overlapping systems guarantees at least one functional communication pathway during disasters.[95] Enhancing cell towers with durable battery backups, fortifying physical infrastructure, and deploying mobile units for rapid communication restoration are vital strategies.[96] Collaboration with technology companies fosters innovation in developing resilient communication technologies, strengthening backup systems further.[97] Backup communication systems are not just supplementary but foundational to a resilient emergency response framework.[98] By integrating and fortifying these systems, communities can ensure the continuity of communication, thus enhancing overall disaster resilience.

In conclusion, this paper proposes recommendations to enhance the resilience and inclusivity of disaster communication systems. Hardening infrastructure against the most common regional disasters is recommended to combat the physical vulnerabilities of wireless grids. An approach to hardening infrastructure includes upgrading towers to withstand severe weather conditions, implementing redundant power supply systems, and employing fire-resistant materials in wildfire-prone areas.[99] Investments in these areas will help ensure that the backbone of our communication systems remains intact during natural disasters.

VIII. <u>Recommendations</u>

A multifaceted approach is required to fortify wireless grids against the destructive forces of natural disasters. This approach involves upgrading communication towers with weather-resistant materials, ensuring they can withstand the high winds of hurricanes and the heat of wildfires.[100] Strategies must also include developing more resilient power sources, such as solar-powered backups and advanced battery technologies, to maintain

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[89] Colby Leigh Rachfal, *Low Earth Orbit Satellites: Potential to Address the Broadban Digital Divide,* CONGRESSIONAL RESEARCH SERVICE (Aug. 31, 2021), https://crsreports.congress.gov/product/pdf/R/R46896 (last visited Nov. 5, 2023).
[90] *Id.*
[91] *Id.*
[92] Federal Communications Commission, Multilingual Alerting for the Emergency Alert System and Wireless Emergency Alerts, FCC (May 30, 2023), https://www.fcc.gov/MultilingualAlerting_EAS-WEA.
[93] *Id.*
[94] *Id.*
[95] Federal Emergency Management Agency, *Guide to Expanding Mitigation: Making the Connection to Communications Systems,* FEMA, available at https://www.fema.gov/sites/default/files/documents/fema_connecting-mitigation-communications-systems.pdf (last visited Nov. 5, 2023).
[96] *Id.*
[97] *Id.*
[98] *Id.*
[99] Federal Emergency Management Agency, *Wildfire Hazard Mitigation Handbook for Public Facilities*, FEMA (2008), available at https://www.fema.gov/sites/default/files/2020-08/fema_p_754.pdf.
[100] *Id.*

operations when conventional power grids fail.[101] Moreover, integrating real-time monitoring systems can provide early warnings of potential infrastructure failures, allowing for prompt maintenance and repairs.[102]

Networks must be designed to handle surges in usage during emergencies without compromising service. Implementing advanced load-balancing solutions and constructing additional mobile cell sites can help manage the increased traffic.[103] Deploying portable cell towers and satellite communication setups can also provide immediate relief in areas where the infrastructure is damaged.[104] These solutions should be supplemented with regular stress tests and simulations to ensure networks can handle the demands of a large-scale emergency.

The inclusivity of IPAWS must extend beyond English speakers, incorporating alerts in languages reflective of the United States' diverse population. Alerts should be optimized for various communication channels, from traditional broadcast to digital platforms, ensuring they reach as many people as possible.[105] Community engagement initiatives can inform design improvements, ensuring that alert systems effectively meet the needs of different cultural and linguistic groups.[106]

Strategic public-private partnerships offer a pathway to leverage the innovation and agility of the private sector in enhancing grid resilience.[107] Such collaborations can accelerate the adoption of cutting-edge communication technologies, such as 5G and next-generation wireless systems, which are crucial for robust emergency communication networks.[108] Encouraging investments in research and development can lead to breakthroughs that future-proof communication infrastructures against emerging threats.[109]

Disaster drills and community engagement are vital for testing communication systems' effectiveness and raising public awareness about emergency protocols.[110] These exercises should be inclusive, with scenarios designed to evaluate the accessibility and clarity of multilingual alerts.[111] Feedback mechanisms should be established to gather insights from the community, which can inform ongoing improvements to emergency communication strategies.[112]

Policy initiatives prioritizing funding for communication infrastructure resilience are essential to support these recommendations. Governments must recognize the importance of reliable communication during emergencies and allocate resources accordingly. Legislation can also incentivize private companies to invest in resilient infrastructure, creating a more robust and cooperative emergency management ecosystem.

Fortunately, the FCC adopted a Report and Order on October 19, 2023 mandating that wireless alerts be broadcast in more languages. The Report and Order requires wireless providers that participate in the WEA system to make messages available in the 13 most spoken languages in the United States, including American Sign Language. This is a positive step in the right direction and is likely to benefit the multilingual community in times of disaster.

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[101] *Id.*
[102] *Id.*
[103] Federal Emergency Management Agency, Emergency Operations Center How-to Quick Reference Guide, FEMA (2022), available at https://www.fema.gov/sites/default/files/documents/fema_eoc-quick-reference-guide.pdf.
[104] *Id.*
[105] Federal Communications Commission, *Wireless Emergency Alerts; Amendments to Part 11 of the Commision's Rules Regarding the Emergency Alert System*, Further Notice of Proposed Rulemaking – PS Docket Nos. 15-91 and 15-94, FCC (Mar. 30, 2023), available at https://docs.fcc.gov/public/attachments/DOC-392202A1.pdf.
[106] *Id.*
[107] U.S. Department of Energy, *Advanced Wireless Strategy*, available at https://www.energy.gov/sites/default/files/2022-11/Advanced%20Wireless%20Strategy_FINAL%2010.27.22_1.pdf (last visited Nov. 5, 2023).
[108] *Id.*
[109] *Id.*
[110] Federal Communications Commission, *Wireless Emergency Alerts; Amendments to Part 11 of the Commision's Rules Regarding the Emergency Alert System,* Third Report and Order – PS Docket Nos. 15-91 and 15-94, FCC (Sep. 27, 2023), https://docs.fcc.gov/public/attachments/DOC-397319A1.pdf.
[111] *Id.*
[112] *Id.*

By adopting these comprehensive recommendations, emergency communication systems can be made more resilient, inclusive, and capable of providing lifesaving information to all citizens, regardless of language or location, during disasters. Since Katrina in 2005, little has been done to provide alternatives when the wireless grid goes down. There needs to be a specific and directed focus on implementing alternatives so that situations like those discussed in the case studies section do not continue to have such horrible impacts on multilingual consumers.

IX. Conclusion

The examination of wireless grid vulnerabilities, the disproportionate impact on multilingual consumers during disasters, and the analysis of case studies underscore the pressing need for a robust and inclusive emergency communication framework. The evidence points to a clear directive: resilience in our communication infrastructure is not just a matter of technological

upgrades; it is about ensuring equitable access to lifesaving information for all members of our diverse communities, especially during crises when time and clarity are of the essence.

The recommendations advocate for a multi-layered approach to disaster preparedness, from hardening physical infrastructure and increasing network redundancy to implementing comprehensive multilingual alert systems. Public-private partnerships are vital in this endeavor, fostering innovation and agility in developing solutions that can withstand the unpredictability of natural disasters. Regular testing, community engagement, and policy support are the cornerstones for building resilience and ensuring that the most vulnerable are not left without aid when disasters strike.

As this paper concludes, it does so with a call to action for all key players involved in disaster management and communication technology. We must learn from past events and work proactively to safeguard our communities against future emergencies. By fortifying our wireless grids and embracing inclusivity in our emergency communication strategies, we can strive towards a future where safety and preparedness are accessible to everyone, regardless of language, location, or circumstance. In doing so, we not only enhance the resilience of our infrastructure but also uphold the collective ethos of a society committed to the well-being of all its members.

Incorporating advanced technology into our emergency communication systems has undeniably saved lives. According to FEMA, the WEA system has delivered thousands of messages to the public since its inception. However, the FCC reports suggest that there is still a high chance of network failure during catastrophic events, highlighting the need for continuous improvements in our wireless grid infrastructure.

Enhanced collaboration between the government and private sectors can revolutionize our disaster response capabilities. The National Emergency Communications Plan emphasizes the importance of seamless communication among first responders, projecting a 50% increase in the efficiency of disaster response with improved interoperable communication systems.[113] These partnerships can also facilitate the integration of multilingual alert systems, expanding the reach of critical alerts to an additional sixty million non-English-speaking Americans.[114]

In the face of climate change, which the National Climate Assessment predicts will only increase the frequency and intensity of extreme weather events, the call to reinforce our emergency communication systems becomes even more urgent.[115] Investments in disaster communication not only reflect our technological capabilities but also our societal values. Ensuring that all community members have access to reliable information during emergencies demonstrates a commitment to inclusivity and preparedness that transcends linguistic and cultural barriers.

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[113] Cybersecurity and Infrastructure Security Agency, *National Emergency Communications Plan*, CISA (2019), https://www.cisa.gov/sites/default/files/publications/19_0924_CISA_ECD-NECP-2019_1_0.pdf.
[114] Sandy Dietrich & Erik Hernandez, *What Languages Do We Speak in the United States?*.
[115] *Fourth National Climate Assessment*.