

**GAO**

Testimony

Before the Subcommittee on Economic  
Development, Public Buildings, and Emergency  
Management, Committee on Transportation and  
Infrastructure, House of Representatives

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**EMERGENCY  
PREPAREDNESS**

**Improved Planning and  
Coordination Necessary  
for Development of  
Integrated Public Alert and  
Warning System**

Statement of Mark L. Goldstein, Director  
Physical Infrastructure



**GAO**

Accountability \* Integrity \* Reliability

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Highlights of [GAO-09-1044T](#), a testimony before the Subcommittee on Economic Development, Public Buildings, and Emergency Management, House of Representatives

## Why GAO Did This Study

A comprehensive system to alert the American people in times of hazard allows people to take action to save lives. The Federal Emergency Management Agency (FEMA) is the agency within the Department of Homeland Security (DHS) responsible for the current Emergency Alert System (EAS) and the development of the new Integrated Public Alert and Warning System (IPAWS). In this testimony, based on its report released today, GAO discusses (1) the current status of EAS, (2) the progress made by FEMA in implementing an integrated alert and warning system, and (3) coordination issues involved in implementing an integrated alert and warning system. GAO conducted a survey of states, reviewed FEMA and other documentation, and interviewed industry stakeholders and officials from federal agencies responsible for public alerting.

## What GAO Recommends

In the report released today, GAO recommends that FEMA implement processes for systems development and deployment, report periodically on progress toward achieving an integrated public alert and warning system, and implement a plan to verify the dependability of IPAWS and to train IPAWS participants. In response to our report, DHS agreed with all of the recommendations and provided explanations of actions aimed at addressing them. However, FEMA's planned actions to address the recommendations may not be sufficient.

View [GAO-09-1044T](#) or [key components](#). For GAO report, view [GAO-09-834](#). For survey results, view [GAO-09-880SP](#). For more information, contact Mark Goldstein at (202) 512-2834 or [goldsteinm@gao.gov](mailto:goldsteinm@gao.gov).

## EMERGENCY PREPAREDNESS

### Improved Planning and Coordination Necessary for Development of Integrated Public Alert and Warning System

#### What GAO Found

As the primary national-level public warning system, EAS is an important alert tool but it exhibits longstanding weaknesses that limit its effectiveness. In particular, the reliability of the national-level relay system—which would be critical if the President were to issue a national-level alert—remains questionable due to a lack of redundancy; gaps in coverage; a lack of testing and training; and limitations in how alerts are disseminated to the public. Further, EAS provides little capability to alert specific geographic areas. FEMA has projects under way to address some of these weaknesses. However, to date, little progress has been made and EAS remains largely unchanged since GAO's previous review, completed in March 2007. As a result, EAS does not fulfill the need for a reliable, comprehensive alert system.

Initiated in 2004, FEMA's IPAWS program has made little progress. IPAWS is intended to integrate new and existing alert capabilities, including EAS, into a comprehensive "system of systems." However, national-level alert capabilities have remained unchanged and new technologies have not been adopted. IPAWS efforts have been affected by shifting program goals, lack of continuity in planning, staff turnover, and poorly organized program information from which to make management decisions. The vision of IPAWS has changed twice over the course of the program and strategic goals and milestones are not clearly defined, as IPAWS has operated without an implementation plan from early 2007 through June 2009. Consequently, as state and local governments are forging ahead with their own alert systems, IPAWS program implementation has stalled and many of the functional goals of IPAWS, such as geo-targeting of messages and dissemination through redundant pathways to multiple devices, have yet to reach operational capacity. FEMA conducted a series of pilot projects without systematically assessing outcomes or lessons learned and without substantially advancing alert and warning systems. FEMA does not periodically report on IPAWS progress, therefore, program transparency and accountability are lacking.

FEMA faces coordination issues in developing and implementing IPAWS. Effective public warning depends on the expertise, efforts, and cooperation of diverse stakeholders, such as state and local emergency managers and the telecommunications industry. However, many stakeholders GAO contacted know little about IPAWS and expressed the need for better coordination with FEMA. A GAO survey indicated that the majority of state emergency management directors had little communication with FEMA regarding IPAWS. FEMA has taken steps to improve its coordination efforts by planning to participate in emergency management conferences and building improved relationships between the IPAWS program and FEMA regional offices. However, despite stating its plans to create a stakeholder subcommittee and state advisory committees, FEMA has established neither group and has no current plans to do so.

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Madam Chairwoman and Members of the Subcommittee:

Thank you for the opportunity to discuss our report being released today on the status of the nation's emergency public alert and warning systems.<sup>1</sup> This system, the Emergency Alert System (EAS), provides the President and other authorized officials with limited capacity to transmit emergency messages to the public. In our previous work, we have found that EAS relies upon antiquated methods that date back to 1963, exposing the system to weaknesses, including questionable reliability and versatility. In 2006, the Department of Homeland Security (DHS), by executive order, was given the responsibility for modernizing public alert and warning systems to ensure the capability of distributing alerts through varied telecommunications modes and to tailor alerts to specific geographic areas. The Federal Emergency Management Agency (FEMA), the entity within DHS responsible for the program, is working on the Integrated Public Alert and Warning System (IPAWS), which is intended to eventually integrate EAS into a larger warning network. When completed, EAS is expected to be superseded by the IPAWS "system of systems," to form the country's comprehensive public alert system. As FEMA develops IPAWS, state and local governments are implementing warning systems which may be difficult to integrate with the broader IPAWS system.

My testimony, based on our report released today, focuses on (1) the current status of EAS, (2) the progress made in FEMA's efforts to modernize and integrate alert and warning systems, and (3) coordination issues involved in implementing an integrated public alert and warning system. To obtain information on public alert and warning systems, we conducted a Web-based survey of emergency management directors in all 50 states and the District of Columbia. We met with officials from FEMA and other applicable federal agencies, as well as representatives of state and local emergency management offices; industry stakeholder organizations; public and private sector alert and warning experts; and private sector stakeholders, including broadcasters, the wireless industry, emergency alert technology companies, emergency management associations, and consumer advocacy groups. In addition, we conducted interviews with state participants in FEMA's IPAWS pilot programs. We examined federal agency documentation including planning, program

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<sup>1</sup>GAO, *Emergency Preparedness: Improved Planning and Coordination Necessary for Modernization and Integration of Public Alert and Warning System*, [GAO-09-834](#) (Washington, D.C.: Sept. 9, 2009).

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status, and financial information; agency orders and rules; testimony statements; and briefings. We conducted our work for the report in accordance with generally accepted government auditing standards.

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## Background

EAS, the nation's primary alerting system, provides capacity for the United States to issue alerts and warnings to the public through broadcast and other media. FEMA administers EAS at the national level and is responsible for distributing presidential alerts to National Primary stations, often referred to as Primary Entry Point (PEP) stations.<sup>2</sup> The PEP stations relay broadcasts of these national-level alerts across the country to radio and television stations, which then rebroadcast the message to other broadcast stations and cable systems. This retransmission of alerts from EAS participant to EAS participant is commonly referred to as a "daisy chain" distribution system.

In June 2006, the President issued Executive Order 13407, entitled *Public Alert and Warning System*, effecting a policy that the U.S. have a comprehensive integrated alert and warning system, and detailing the responsibilities of the Secretary of Homeland Security in meeting this requirement.<sup>3</sup> The Secretary of Homeland Security was ordered to "ensure an orderly and effective transition" from current capabilities to the system described by the executive order, and to report on the implementation of the system within 90 days of the order, and on at least a yearly basis, thereafter. The FEMA IPAWS program was initiated in 2004 and the development and implementation of IPAWS has become the programmatic mechanism to carry out the executive order. IPAWS is defined by FEMA as a "system of systems," which is intended to eventually integrate existing and new alert systems, including EAS. That is, EAS is expected to be superseded as the nation's primary alert function by IPAWS, with EAS acting as one of its component parts and as one of IPAWS's mechanisms to disseminate alerts.

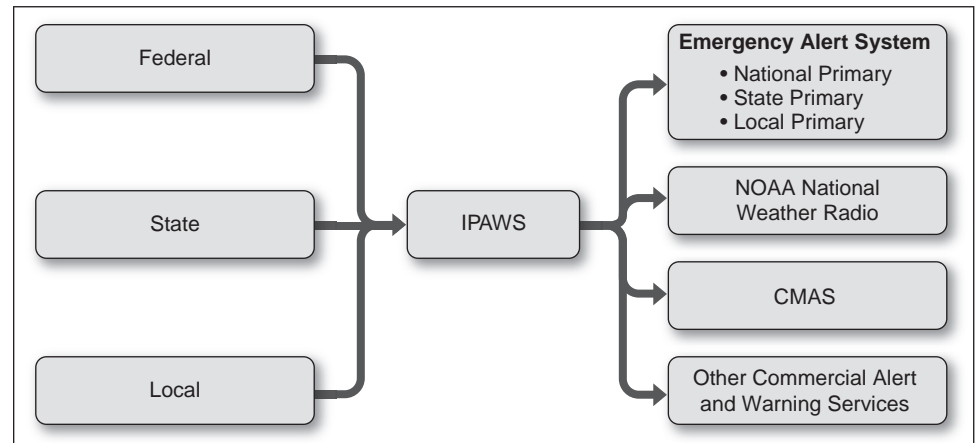
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<sup>2</sup>The Federal Communications Commission (FCC) manages EAS participation by media-related communications service providers.

<sup>3</sup>Exec. Order 13407, 71 Fed. Reg. 36975 (June 26, 2006).

The Warning, Alert, and Response Network Act of 2006 (WARN Act)<sup>4</sup> established an advisory panel called the Commercial Mobile Service Alert Advisory Committee (CMSAAC),<sup>5</sup> which proposed to develop a Commercial Mobile Alert System (CMAS). CMAS was started as a cellular broadcast text alert initiative, under which FEMA has accepted the responsibility for disseminating alerts using the IPAWS system. Another intended partner system is the National Oceanic and Atmospheric Administration’s (NOAA) National Weather Radio (NWR). NWR broadcasts National Weather Service forecasts and all-hazard warnings. State and local governments are developing and deploying their own alert systems which FEMA intends to integrate into the IPAWS system. Figure 1 displays the conceptual architecture of IPAWS, with EAS, CMAS, and NWR as mechanisms for disseminating alerts.

**Figure 1: IPAWS Conceptual Architecture**



Source: FEMA.

IPAWS will make use of the Common Alerting Protocol (CAP), which is an open, non-proprietary digital message standard compatible with multiple applications and telecommunication methods. CAP has been developed

<sup>4</sup>The Warning, Alert, and Response Network Act was enacted on October 13, 2006, as title VI of the Security and Accountability for Every Port Act, Pub. L. No. 109-347, 120 Stat. 1884 (2006).

<sup>5</sup>Section 603(c) of the WARN Act required that FCC establish the CMSAAC to develop and recommend technical standards and protocols for the voluntary transmission of emergency alerts by Commercial Mobile Service Providers within one year from the date of enactment of the WARN Act (i.e., by October 12, 2007).

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for use by emergency management officials in sending all types of alert messages and can be used as a single input to activate multiple warning systems. FEMA—required by the executive order to adopt alert standards and protocols—intends to adopt CAP and to publish its IPAWS CAP Profile standard.

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## EAS Remains the Nation’s Primary Public Alert and Warning System, But Unaddressed Weaknesses Limit its Effectiveness

EAS remains the primary national-level public alert system and serves as a valuable public alert and warning tool. Nonetheless, as we previously reported, EAS exhibits longstanding weaknesses that continue to limit its effectiveness.<sup>6</sup> While FEMA has projects under way to address some of these weaknesses with EAS, to date, little progress has been made and EAS remains largely unchanged since our previous review, completed in March 2007. We found the reliability of the national-level relay system—which would be critical if the President were to issue a national-level alert—remains questionable due to (1) a lack of redundancy, (2) gaps in coverage, (3) a lack of testing and training, and (4) limitations in how alerts are disseminated to the public.

*Lack of redundancy.* FEMA lacks alternative means of reaching EAS participants should its primary connection fail. Specifically, FEMA can distribute national-level alerts to 35 PEP stations (which serve as the entry points for Presidential alerts) and to 860 public radio stations across the country via EAS phone lines and satellite connectivity, respectively. However, FEMA lacks an alternative means of reaching these participants if those primary connections fail. Furthermore, if a primary connection to a PEP station failed, all of the other EAS participants that rely on that station via the daisy chain relay system would fail to receive alerts.

*Gaps in coverage.* Gaps in PEP station broadcast coverage could hinder the successful dissemination of EAS alerts, as some broadcast stations might have difficulty in monitoring their assigned PEP station because the station is geographically distant. Some states, such as Maine, are not covered at all by the PEP system and would have to pick up a national-level message from an alternate source, such as Public Radio.<sup>7</sup> This might

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<sup>6</sup>GAO, *Emergency Preparedness: Current Emergency Alert System Has Limitations, and Development of a New Integrated System Will Be Challenging*, GAO-07-411 (Washington, D.C.: Mar. 30, 2007).

<sup>7</sup>The State of Maine uses the Maine Public Broadcasting microwave system as its primary EAS backbone. Each station in the Maine EAS distribution system can receive national-level EAS alerts via National Public Radio.

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not be a fully reliable option because, unlike PEP stations, public radio stations do not necessarily have extra fuel and generators on-site to help ensure continuous operations following a disaster.

*Lack of testing and training.* FEMA does not perform ongoing national-level tests of the daisy chain relay system to ensure that it would work as intended during a national-level alert. In January 2007, in response to our ongoing work, FEMA conducted a national-level EAS test in which three PEP stations failed to receive and effectively rebroadcast the national-level test message. FEMA has not held another national-level test since 2007 and has no plans for testing the relay distribution system. The recent failure of an accidental Presidential alert suggests that problems remain in the relay system. In this incident, a national-level (Presidential) alert was inadvertently initiated in Illinois. While intended as a test, due to equipment failure, the alert failed to be properly disseminated by all EAS participants. While FEMA officials say this situation has since been rectified, no testing has been done to confirm that the equipment used would work properly in the event of an actual emergency. Another longstanding weakness of EAS is inadequate training for EAS participants, both in using EAS equipment and in drafting of EAS messages. In 2007, we reported that several EAS stakeholders, including state and local officials, identified inadequate training as a limitation of EAS and cited a need for additional instruction in equipment use and message creation. Our current work indicates that such training is still needed as FEMA has no active training program and most respondents to our state survey of emergency managers cited inadequate levels of training. According to FEMA, it is currently analyzing and assessing EAS operator training needs, but has not yet implemented any new training initiatives.

*Limitations in how alerts are disseminated to the public.* EAS's reliance on broadcast and other media currently exclude other communications devices, such as cell phones. In addition, it remains difficult for EAS to reach distinct segments of the population. For example, alerts are typically provided only in English and alerting mechanisms provide unequal access for persons with disabilities. Further, effective public alerting via EAS is also hindered by its limited ability to target alert messages to specific geographic locations.

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## While FEMA Has IPAWS Initiatives Under Way, Progress in Implementing an Integrated Alert System Has Been Limited

FEMA began initiatives related to IPAWS in 2004, yet national-level alert capabilities have remained unchanged and new standards and technologies have not been adopted. IPAWS has operated without a consistent strategic vision and has been adversely affected by shifting program vision, lack of continuity in planning and program direction, and poorly organized program information from which to make management decisions. Therefore, as state and local governments are developing their alert systems, IPAWS program implementation has stalled and many of its functional goals have yet to reach operational capacity. Additionally, FEMA's investment in the IPAWS pilot projects—seed initiatives intended to test alert technologies and form the foundation of IPAWS—has resulted in few lessons learned and few advances in alert and warning systems. Furthermore, FEMA does not report on IPAWS spending or progress in achieving goals, which limits transparency and accountability for program results.

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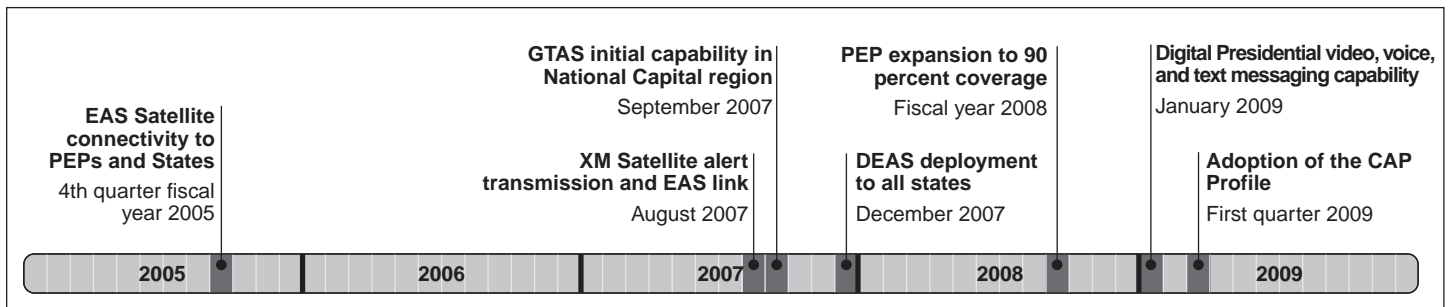
## FEMA Has Begun Some Projects, but Has Yet to Integrate Alert Systems or Adopt New Technologies and Standards

Although IPAWS has existed since 2004 with the original objective of modernizing and integrating public alert and emergency warning systems across federal, state, and local governments, national-level alert system capabilities remain unchanged and have yet to be integrated. In June 2006, Executive Order 13407 specified the responsibilities of DHS and FEMA with respect to a public alert and warning system, establishing 10 functions for the Secretary of Homeland Security. Since the executive order, FEMA has launched or continued, under the IPAWS program, several projects intended to address the 10 functions specified in the order. However, the IPAWS projects under way designed to meet the requirements of the executive order have shown little progress and some of the projects cited by FEMA have been under development since the inception of IPAWS and have yet to be completed. For example, as early as 2005, FEMA planned efforts to provide warning messages to subscribers via email and to telephones, text message devices, cell phones, pagers, and Internet desktops. These capabilities were tested under various IPAWS pilot projects, but the development and implementation of the methods were discontinued.

FEMA has exceeded numerous timelines that it set for IPAWS initiatives. Figure 2 demonstrates some of the IPAWS programs that still are not implemented, including their original timelines for completion.



**Figure 2: Examples of Incomplete IPAWS Projects with Exceeded Timelines**



Source: GAO analysis of FEMA information.

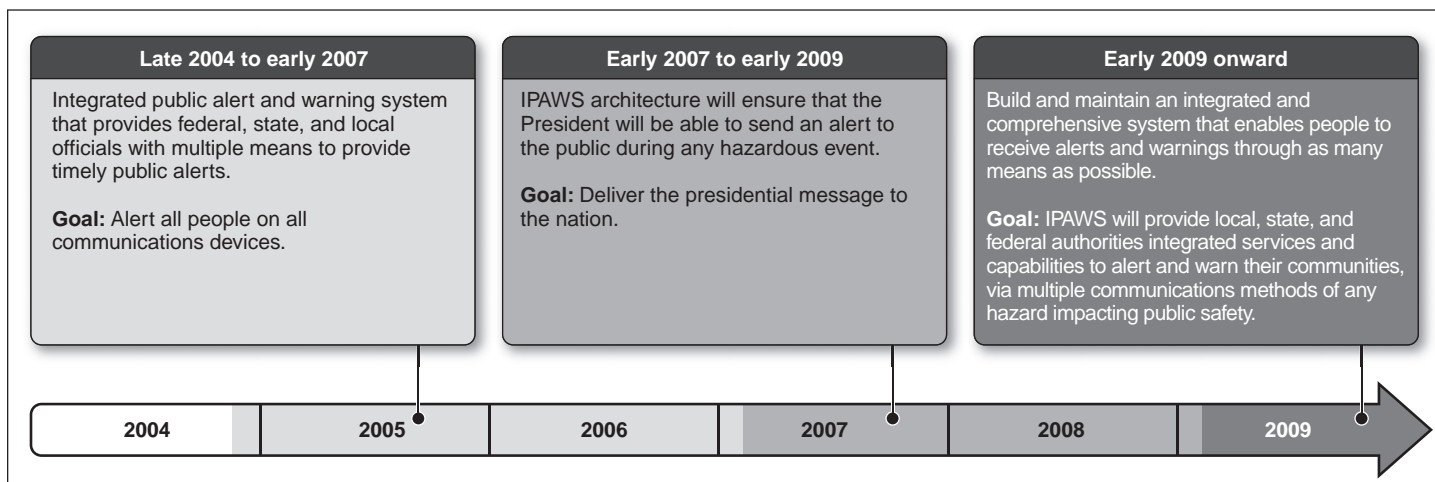
Note: The Digital Emergency Alert System (DEAS), Geo-targeted Alerting System (GTAS), and XM Satellite EAS link are IPAWS projects.

### Shifting Program Vision and Lack of Continuity in Planning Have Adversely Affected Efforts to Modernize and Integrate Alerts

FEMA’s efforts to create an integrated and modernized alert and warning system have been affected by (1) shifting program vision, (2) difficulties in program planning and management, (3) a lack of collection or organization of program information from which to make management decisions, and (4) staff turnover.

*Shifting program vision.* The IPAWS program vision has changed several times, slowing progress toward an integrated system. Figure 3 shows the evolution of the IPAWS vision.

**Figure 3: FEMA’s Shifting Vision for IPAWS**



Sources: FEMA and GAO.

*Difficulties in program planning and management.* From early 2007 through June 2009, the IPAWS effort operated without a designated implementation plan and no specific processes for systems development and deployment. The new implementation plan, completed in June 2009, includes only a vague overview of IPAWS initiatives and does not adequately satisfy the project management and planning practices essential for effective program execution. Other planning documentation that exist indicate a lack of continuous overall strategic vision with disparate projects not tied together by a cohesive plan.<sup>8</sup>

*Lack of collection or organization of program information from which to make management decisions.* Throughout the course of our work, FEMA officials told us that many key IPAWS documents did not exist or were irretrievable. Moreover, a FEMA consultant<sup>9</sup> who is assessing IPAWS has found that there is no cogent organization system to locate program information, that information exists in multiple locations across FEMA office spaces, and that data searches on program information take an

<sup>8</sup>FEMA indicated that a strategic plan is under development and that it has other documentation and processes for system design, that were in the process of internal coordination when our review was being completed.

<sup>9</sup>In October 2008, FEMA contracted with a professional services firm to provide management, assurance, and financial services for IPAWS.

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inordinate amount of time and effort. The consultant also found more robust and realistic documented internal controls are necessary.

We requested documentation on FEMA and DHS reporting requirements or performance measures for which the IPAWS program prepared documented updates of its progress. However, neither FEMA nor DHS regularly report on IPAWS.<sup>10</sup> FEMA was able to provide a performance information worksheet and spreadsheet, but this documentation provided only vague program parameters, without progress updates on reaching specific goals or milestones. The FEMA IPAWS consultant is performing a full assessment of the IPAWS program with the intention of implementing internal controls and performance measures. However, the absence of accurate periodic reporting on IPAWS leaves valuable program information unavailable. Such information would help increase program transparency, establish greater program accountability, and assure a reasonable assessment of return on financial investments. Additionally, periodic reporting on IPAWS would provide FEMA's private sector partners and those in government at the federal, state, and local level with information necessary to help establish an integrated alert and warning system. Such reporting would also assist the Congress as it oversees issues related to public alert and warning.

*Staff turnover.* Progress toward an integrated alert system has also been slowed by frequent changes in organizational leadership of the IPAWS program office and other staffing related issues. During our review, IPAWS was operating under an acting director—its third director since the program began in 2004—and was searching for a permanent director. According to FEMA, a new director took charge of the program on August 3, 2009. Additionally, according to FEMA officials, high turnover of program staff has made it difficult to consistently manage IPAWS programs. FEMA's heavy use of contract employees has also resulted in concerns from stakeholders that IPAWS is dominated with outside contractors who do not fully understand alert and warning needs. At the program office itself, there is a preponderance of contract staff. As of June 2009, the program office consisted of 27 contractor staff and 5 FEMA IPAWS staff positions were filled out of 11 noncontract full-time equivalent positions that were available.

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<sup>10</sup>The DHS performance and accountability reports do not include information on IPAWS.

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## Limited Program Accountability for IPAWS Projects Has Contributed to Inconclusive Results and Lessons Learned

To demonstrate the integration and expansion of new alerting technologies, and to work toward the functionality described in the executive order, FEMA has implemented a series of IPAWS pilot projects, but they have ended inconclusively, with few documented lessons learned. Interviews with FEMA officials and IPAWS documents revealed inconsistent information on the purpose of the pilot programs and how they supported broader IPAWS goals. Although we requested reports documenting the plans, lessons learned, and technological or operational outcomes, for most pilot projects, such documentation was never produced.<sup>11</sup> Rather, the extent of the documentation FEMA provided on the pilots includes general briefing slides with broad program descriptions. As a result of the lack of project assessments, reporting, and documentation, it is unclear which aspects of the IPAWS projects, if any, are currently being used or plan to be used in the future or whether the projects informed actions or decisions with respect to the IPAWS program. Initial findings from an IPAWS program assessment, performed by the FEMA consultant, revealed that in most cases, key project deliverables for which FEMA contracted, could not be accounted for.

Responses from our survey of state emergency management directors indicate that most of the 12 states that reported participating in the pilot projects reacted unfavorably when asked about the outcomes and lessons learned from the pilots. Lack of coordination, poor management, incomplete execution, and short project duration were cited, among other things, as lessons learned or outcomes from the pilots. Some states cited positive outcomes and were generally more optimistic about their participation.

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## FEMA Faces Coordination Issues in Implementing IPAWS

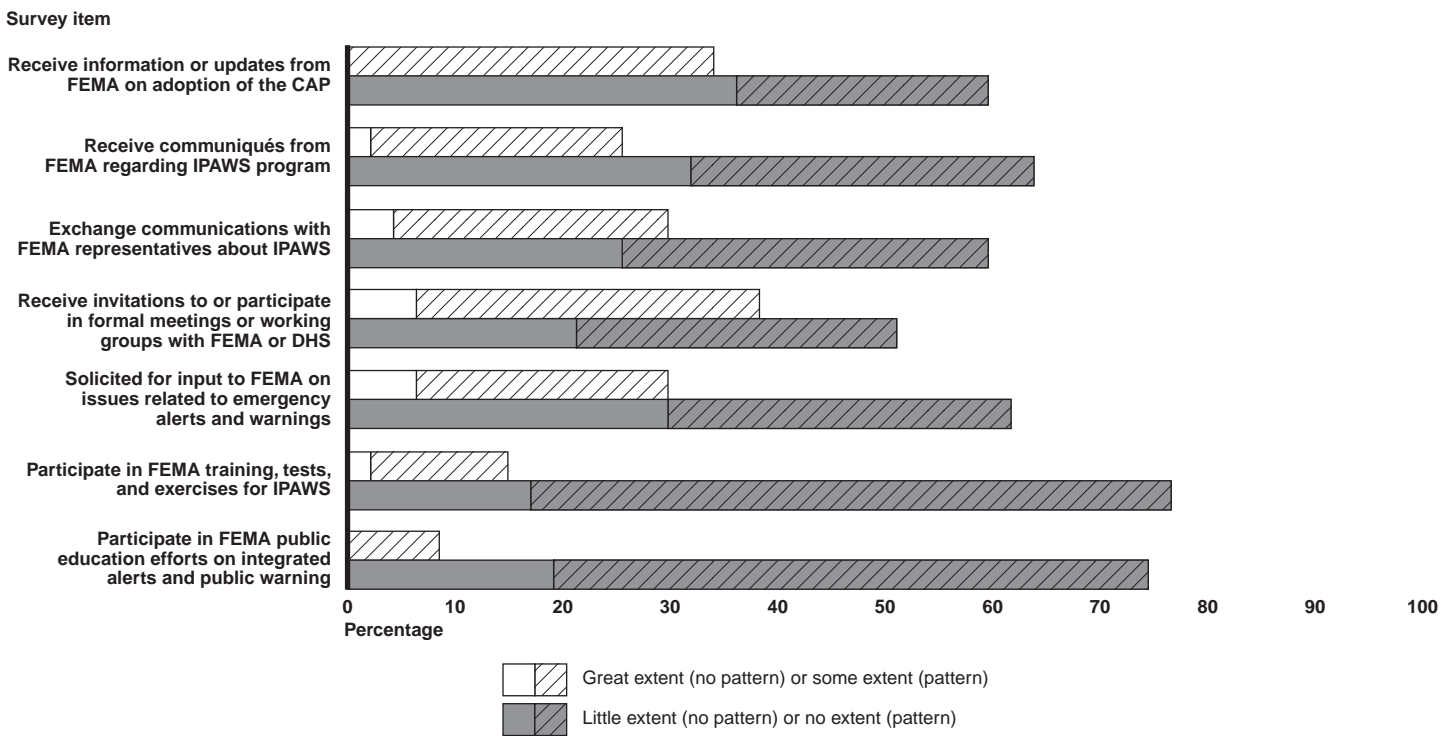
To effectively develop and implement IPAWS, FEMA depends on the efforts and expertise of diverse stakeholders, yet stakeholders we surveyed cited coordination as the primary issue facing the implementation of IPAWS. Given that the IPAWS vision relies heavily upon disseminating alerts through state and local warning systems, many respondents to our state survey seek opportunities to contribute to IPAWS planning and consider collaboration among all levels of government to be imperative to the delivery of public alerts and warnings. While there is

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<sup>11</sup>Sandia National Laboratories was contracted to implement the Web Alert and Relay Network (WARN) pilot. Sandia produced a final report for the second phase of the pilot, WARN2, whose results, according to FEMA officials, were not accepted by the FEMA IPAWS program management office.

broad consensus regarding the need for coordination, FEMA’s efforts to date have been insufficient, according to many stakeholders we contacted. The majority of our state survey respondents received little to no information from FEMA and communicated with FEMA to little or no extent. Further, the majority of respondents had little or no understanding of IPAWS. In figure 4, we display the survey responses of state emergency management directors.

**Figure 4: Survey Responses of State Emergency Management Directors on FEMA IPAWS Information, Training, Communication, and Coordination**



Source: GAO survey of state emergency management directors.

Some of these views were echoed by federal partners, such as NOAA, which noted that coordination could be improved, and the DHS Office of Science and Technology, which cited its relationship with FEMA as a primary challenge to developing an integrated alert system. Additionally, local officials we surveyed<sup>12</sup> had little to no communication with FEMA,

<sup>12</sup>Local officials we contacted were selected based on information provided by state emergency management directors.

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were generally unaware of the IPAWS program, and overall, lacked an understanding of the CAP alert standard.

FEMA officials acknowledged that they have, thus far, insufficiently engaged state-level stakeholders and have recently taken steps to increase their communication and collaboration efforts. As part of their Stakeholder Engagement Plan, FEMA plans to continue its participation in alert and warning and emergency management conferences; to engage relevant congressional committees; to build relationships with FEMA Regions, which can pass information to state and local government officials; and to build relationships with other organizations and media outlets. As recently as May 2008, FEMA said it intended to create a stakeholder subcommittee and informed us of plans to establish state advisory committees. However, FEMA subsequently told us that neither the stakeholder subcommittee nor state advisory committees have been implemented and there are no current plans to establish such groups. FEMA did form three working groups with the limited scope of reviewing and validating requirements for the CAP Profile.<sup>13</sup>

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## Conclusions and Recommendations

Emergency communications are critical in crisis management and for protecting the public in situations of war, terrorist attack, or natural disaster; yet, FEMA has made limited progress in implementing a comprehensive, integrated alert system as is the policy of the federal government. Management turnover, inadequate planning, and a lack of stakeholder coordination have delayed implementation of IPAWS and left the nation dependent on an antiquated, unreliable national alert system. FEMA's delays also appear to have made IPAWS implementation more difficult in the absence of federal leadership as states have forged ahead and invested in their own alert and warning systems. In order that IPAWS achieve the federal government's public alert and warning goals, it is essential that FEMA define the specific steps necessary in realizing a modernized and integrated alert system and report on the progress toward achieving that end. Additionally, effectively implementing an integrated alert system will require collaboration among a broad spectrum of stakeholders.

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<sup>13</sup>Through DHS, FEMA formed a Federal Working Group, Practitioner Working Group, and Industry Working Group consisting of federal partners, emergency managers and broadcast community members, and broadcast vendors, respectively.

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In our report released today, we recommend that FEMA implement processes for systems development and deployment, report periodically on progress toward achieving an integrated public alert and warning system, and implement a plan to verify the dependability of IPAWS and to train IPAWS participants. In reviewing a draft of the report, DHS stated that it agrees with all of our recommendations to improve public alert and warning and provided explanations of actions aimed at addressing them. However, FEMA's planned actions to address some of the recommendations may not be sufficient as they are limited in scope and require greater specifics. As such, additional actions to improve program planning and coordination are necessary to achieve a comprehensive, integrated alert system.

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Madam Chairwoman, this concludes my prepared statement. I would be happy to respond to any questions you or other Members of the Subcommittee may have at this time.

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## GAO Contact and Staff Acknowledgments

For further information about this testimony, please contact Mark L. Goldstein at (202) 512-2834 or [goldsteinm@gao.gov](mailto:goldsteinm@gao.gov). Individuals making key contributions to this testimony included Ryan D'Amore, Colin Fallon, Simon Galed, Sally Moino, Andrew Stavisky, and Mindi Weisenbloom.

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