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Challenges in FEMA's Flood Map Modernization Program

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Preface

The Department of Homeland Security (DHS) Office of Inspector General (OIG) was established by the *Homeland Security Act of 2002* (Public Law 107-296) by amendment to the *Inspector General Act of 1978*. This is one of a series of audit, inspection, and special reports prepared by our office as part of our DHS oversight responsibility to promote economy, effectiveness, and efficiency within the department.

This report provides an assessment of the Federal Emergency Management Agency's (FEMA) Multi-Hazard Flood Map Modernization Program. It addresses FEMA's program management approach, coordination with stakeholders, and acquisition as well as use of information technology (IT) to meet map modernization goals. The report is based on interviews with DHS and other federal, state, local, and contracting officials nationwide; direct observations; and, a review of applicable documents.

The recommendations herein have been developed to the best knowledge available to our office, and have been discussed in draft with those responsible for implementation. It is our hope that this report will result in more effective, efficient, and economical operations. We express our appreciation to all of those who contributed to the preparation of this report.

Richard L. Skinner
Inspector General

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Abbreviations

DHS	Department of Homeland Security
FEMA	Federal Emergency Management Agency
GAO	Government Accountability Office
IT	Information Technology
MICS	Monitoring Information on Contracted Studies
MIP	Mapping Information Platform
MHIP	Multi-Year Flood Hazard Identification Plan
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
OIG	Office of Inspector General

Executive Summary

Floods are among the most frequent and costly of all natural disasters and have great impact in terms of economic and human losses each year. Property damage resulting from floods totals over $5 billion annually and caused more than 900 deaths from FY 1992 to 2001. Communities with effective and accurate flood maps are prepared to prevent not only economic devastation, but to preserve life as well. Since 1978, FEMA has been charged with assisting communities by producing flood maps that detail areas at risk; identify where flood insurance is needed; and, help limit construction within flood zones. However, the majority of FEMA's maps are outdated and in unalterable paper format. In response to demands for more accurate mapping products, FEMA has embarked on a six-year, $1.475 billion program to update and digitize the nation's flood maps.

As part of our ongoing responsibility to assess the efficiency and effectiveness of departmental programs and operations, we conducted an audit of FEMA's Multi-Hazard Flood Map Modernization Program. The objectives of our audit were to assess FEMA's management approach; coordination with federal, state, and local entities; and, acquisition and use of technology to meet map modernization program objectives. The scope and methodology of this audit are discussed in Appendix A.

As a result of our audit, we determined that while FEMA is making progress in map modernization, a number of significant challenges remain. Specifically, FEMA has developed a plan that outlines the priorities, resources, and standards for accomplishing map modernization in communities across the U.S. However, because of budget limitations, FEMA's plan does not reflect user or funding needs. Also, the plan does not provide guidance on how new mapping standards will be achieved. Due to these deficiencies, the plan discourages stakeholder buy-in and may not help FEMA meet its map modernization schedule and quality goals. A modified plan and improved FEMA control of map modernization costs, schedule, and performance would help ensure effective program results.

Further, FEMA has enhanced its efforts to partner and communicate with its mapping stakeholders—but the agency has not maximized the benefits possible through these relationships. For instance, although FEMA has improved coordination of federal mapping activities, FEMA has not instituted the policies, agreements, or information sharing mechanisms to effectively support these interagency working arrangements. Similarly, while FEMA is

partnering more effectively with state and local government entities, these stakeholders are not fully engaged or aware of key map modernization objectives. A FEMA call center, established to address stakeholder inquiries, does not provide consistently effective service or accurate information, potentially placing communities at risk. Addressing these issues will help ensure effective use of intergovernmental resources, stakeholder commitment, and ultimate success in meeting overall map modernization goals.

Additionally, as part of its map modernization efforts, FEMA is developing a web-based technology platform and tools to support efficient production and sharing of digital maps. However, FEMA's IT development approach has limited program progress: unclear contractor expectations; underestimation of program scope and complexity; and, poorly defined requirements have resulted in significant system acquisition delays and cost overruns. Taking steps to assess progress, identify shortcomings, and make adjustments will help FEMA ensure that the technology acquisition achieves the functionality and cost savings it anticipates.

Background

As a component of DHS' Emergency Preparedness and Response Directorate, FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery." FEMA's Mitigation Division manages the National Flood Insurance Program, which was created in 1968 to reduce flood damage by identifying flood risks, encouraging sound floodplain management practices, and providing a mechanism through which citizens can insure their investments. To help determine insurance requirements, FEMA maintains an inventory of over 90,000 flood map panels. (See Figure 1.) However, 70 percent of the maps are more than 10 years old; many of the floodplains depicted on them were hand-drawn and are difficult to update. Continued community development over time has generally rendered the maps inaccurate and obsolete.

Figure 1: Example of Flood Map Panel

Pursuant to the *National Flood Insurance Reform Act of 1994*,[1] Congress created the Technical Mapping Advisory Council. The Council was charged with evaluating the production, distribution, and use of flood insurance rate maps and making recommendations regarding cost-effective improvements in the accuracy, quality, and distribution of mapping products. The Council made recommendations on using standards and guidelines in the program, too. Membership of the Council consisted of a FEMA Director designee as well as ten representatives from federal and state governments, professional associations with mapping interests, and lending institutions. The Council's final report, issued in 2000, included four general themes on which the Multi-Hazard Flood Map Modernization Program ultimately would be based:

- Providing additional resources for floodplain maps
- Building interest and support for modernizing maps
- Building partnerships to accomplish National Flood Insurance Program objectives
- Creating a fully digital mapping environment

The Council's recommendations, coupled with new federal direction on geospatial information sharing, led to a more partnership-oriented approach to flood mapping. For example, the Office of Management and Budget required that federal agencies work together, as well as with state and local governments and private industry, on geospatial data collection as a means of reducing duplicative cost and effort.[2] Executive Order 12906, part of the President's e-government initiative, further strengthened policies on information sharing outlined in Circular A-16.[3]

In line with this direction, FEMA's initial 1997 map modernization plan included strategies for working with other government entities to update flood maps and streamline risk mitigation operations. The map modernization program has four key objectives: (1) establish and maintain a premier data collection and delivery system; (2) achieve effective program management; (3) build and maintain mutually beneficial partnerships; and, (4) expand and better inform the user community. By producing more accurate and accessible flood maps, FEMA expects to benefit communities that use the maps to establish zoning and building standards, property owners that access the maps on the internet to see if they need to obtain flood insurance, and government officials that reference the maps to accurately locate infrastructure and transportation systems to help manage homeland security risks.

[1] Public Law 103-325, Title V, Section 576.
[2] *Coordination of Geographic Information and Related Spatial Data Activities*, Office of Management and Budget Circular A-16, August 19, 2002.
[3] *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, Executive Order 12906, April 11, 1994.

However, because flood insurance revenues alone historically funded map production, FEMA needed additional resources to move forward with its map modernization plan. Congress provided FEMA with moderate annual funding increases from FY 2000 to 2002 to support establishment of new standards and guidelines for developing accurate, digital flood maps, expanding mapping partnership efforts, and initiating best practices nationwide. With a budget of $1.475 billion for a six-year period beginning in FY 2003, FEMA has been able to move forward with its map modernization program.

FEMA's OIG and the Government Accountability Office (GAO) reviewed and reported on initial efforts to modernize flood maps. In September 2000, the FEMA OIG reported that FEMA's methodology was sound, requirements were reasonable, and no major cost elements were overlooked.[4] However, the OIG recommended that FEMA improve the accuracy of its cost estimate by verifying that data used in the estimate were accurate and that planned mapping initiatives were cost effective. In addition, the OIG recommended that FEMA maintain historical cost data on flood studies and other mapping-related costs and refine its estimates of the impact of technological advances on mapping costs.

Further, in a March 2004 report, GAO recommended that FEMA (1) develop and implement standards to help the agency, its contractor, and state and local partners collect, analyze, and use mapping data consistently for communities with similar levels of risk; (2) develop and implement strategies for partnering with communities of varying capabilities and resources; (3) ensure that staff levels are sufficient to implement the map modernization program; and, (4) develop and implement useful performance measures of stakeholder awareness and map use.[5]

Results of Audit

Approach to Map Modernization Could Be Improved

With congressional funding and support, FEMA has revitalized its program for modernizing the nation's flood maps. FEMA has developed a plan outlining the priorities and resources needed to accomplish map modernization studies in communities across the U.S. However, because of budget limitations, FEMA's plan does not reflect user or funding needs. Further, while the plan establishes a new mapping quality standard, it provides no guidance on how the standard will be achieved. Due to these deficiencies,

[4] *Audit of FEMA's Cost Estimate for Implementing the Flood Map Modernization Plan*, FEMA OIG, Report Number H-09-00, September 2000.
[5] *Program Strategy Shows Promise, but Challenges Remain*, U.S. Government Accountability Office (GAO-04-417, March 2004).

the plan discourages stakeholder buy-in. More importantly, it may not help FEMA meet its map modernization schedule and quality goals. Adjustments to the plan and improved FEMA control of costs, schedule, and performance would better ensure achievement of program goals.

Map Modernization Plan Has Limitations

Office of Management and Budget Circular A-11 establishes policies for planning and managing investments, such as adequately addressing user, funding, and quality requirements, to ensure that investments achieve intended benefits. [6] To meet these requirements, FEMA has developed a comprehensive plan that outlines priorities, funding, and standards for carrying out mapping studies. However, the plan is hindered by budget limitations and does not adequately address user or funding requirements. As a result, the plan does not ensure buy-in or support for achieving map modernization program goals and objectives.

Mapping Plans and Priorities

With a budget of $1.475 billion for a six-year period beginning in FY 2003, FEMA has been able to move forward with its map modernization program. In February 2003, FEMA and mapping stakeholders met at a conference in Atlanta, Georgia to determine the factors for prioritizing mapping studies and digitization of existing maps. The consensus was to focus on mitigating flood risk in areas that had high growth, high population, and a history of significant flooding. Participants also suggested that FEMA maximize efficiency by conducting basin-wide studies and capitalizing on areas with pre-existing mapping data.

In March 2004, FEMA awarded a single, performance-based contract to a primary contractor responsible for executing the map modernization program. FEMA charged the contractor with providing architectural and engineering services, program management, IT systems development and support, data collection activities, customer assistance, and outreach services. While FEMA provides centralized program direction and contract oversight, the contractor carries out decentralized map modernization activities, such as pre-scoping, producing deliverables and work products, and generally supporting the map modernization program on a day-to-day basis. To this end, the contractor has established field offices to supplement the work of FEMA's ten regional offices. (See Figure 2.)

[6]Circular A-11, Part 7, *Planning, Budgeting, Acquisition, and Management of Capital Assets*, Executive Office of the President, Office of Management and Budget, June 2002.

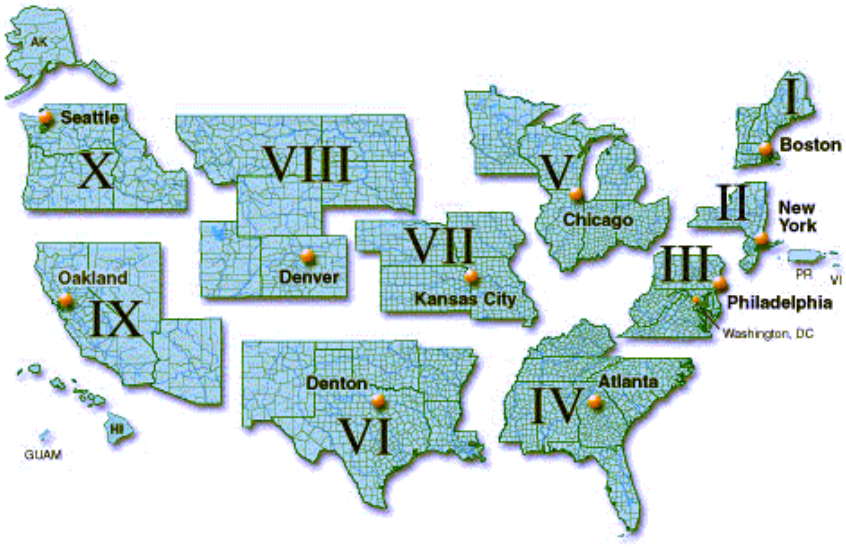

Figure 2: FEMA Regional Offices

FEMA's regional offices are charged with hiring contractors to conduct mapping studies. Alternatively, the regional offices grant funding to mapping partners to perform the studies or hire indefinite delivery/indefinite quantity contractors to work on their behalf. This arrangement allows FEMA to focus on partnering with state and local entities, which ultimately will have responsibility for maintaining the updated maps.

Because the FY 2003 congressional appropriation significantly increased funding for the program, map modernization became subject to review and approval by senior DHS leadership through its capital planning and investment control process. Accordingly, in 2004, FEMA submitted documentation to DHS' senior-level Investment Review Board to support the program. This documentation included an updated "Exhibit 300" business case, required by the Office of Management and Budget to justify a major acquisition program.[7] The update was based on FEMA's 1997 map modernization plan, the Technical Mapping Advisory Council recommendations, and information on innovative technologies and geospatial data sharing. In June 2004, DHS' Investment Review Board approved the map modernization program, authorizing capability development and demonstration to begin. In its approval memorandum, the review board stated that an effective implementation plan would be critical to success of the map modernization program; and, required that FEMA submit to the Under Secretary for Management a schedule for conducting community mapping studies.

[7]Developed in accordance with Office of Management and Budget Circular A-11, *Planning, Budgeting, Acquisition, and Management of Capital Assets*, business cases are designed to ensure that investments are linked to agency missions, long-term goals and objectives, and annual performance plans.

In response to this direction, FEMA's contractor provided the Multi-Year Flood Hazard Identification Plan (MHIP) in November 2004. Built from state business plans and assessments of relative flood risk, the MHIP proposes budgets and establishes a sequence for conducting mapping studies among regions and local communities. The MHIP also communicates the cost, schedule, and performance expectations for map modernization activities.

MHIP Does Not Adequately Address Requirements

Despite FEMA's efforts to obtain input, the MHIP does not adequately address stakeholder needs. FEMA shared copies of the plan with a range of audiences nationwide, including the Congress, DHS, and other federal, state, and local mapping stakeholders. Also, FEMA posted the MHIP to its web site, along with instructions for submitting comments on the plan. According to a March 2005 FEMA analysis, the agency received a total of 103 individual comments on the MHIP from 31 sources including state, county, and local governments, trade associations, and private industry organizations. The predominant concern was that the prescribed sequence of mapping studies would not provide modernized maps by the required dates. Some stakeholders commented that the MHIP strategy would not ensure production of accurate and useable maps. Additionally, they asserted that proposed budgets and strategies outlined in the MHIP are inadequate to support mapping requirements at the state and local level. FEMA noted that it would review the comments and make adjustments based on analysis of the feedback received.

Sequence of Mapping Studies

According to FEMA's March 2005 analysis, 20 of the 31 stakeholders who commented on the MHIP were concerned that the sequence of mapping studies would not provide modernized maps by the dates needed. Generally, the stakeholders requested that mapping studies for their areas be completed sooner than scheduled so that they would be better positioned to protect and insure against potential flood damage and loss. For example, officials in a Minnesota county that lies along a major waterway said that their current maps are highly inaccurate and difficult to use to manage flood risk. The county requested improved flood plain maps much sooner than the scheduled 2007 production, 2008 completion, and 2010 adoption dates. Similarly, in commenting on the MHIP, the Wisconsin Department of Natural Resources submitted proposed changes to the sequence of mapping studies for the state along with its business plan.

Proposed Budgets Are Insufficient

A number of the stakeholders expressed concern that the proposed budgets outlined in the MHIP are inadequate to meet nationwide requirements for map

modernization. For instance, an Ohio official stated that the MHIP does not reflect the state's true mapping cost requirements. While the MHIP indicates that Ohio is to receive between $13 and $15 million for map modernization, the state's actual mapping needs are approximately $41 million. This official, who was unable to link the MHIP to either the Ohio business plan or the state's needs assessment, indicated that FEMA seemed to allocate funding for map modernization based on pre-determined amounts rather than detailed information provided by the state as input to the MHIP.

In another instance, Massachusetts flood hazard management officials said that although the MHIP identifies $7 million in funding for the state over the next five years, about $34 million is needed to modernize flood maps. These officials said that the $34 million requirement cited in the state business plan is based on careful analysis and reflects the minimum requirement to produce accurate maps for areas that already have serious flood hazard problems. Further, these officials said that if, in accordance with the MHIP, Massachusetts is reduced to mapping the entire state with only $7 million over a five-year period, the funding would be so thinly spread that it would only cover digitizing existing maps—not conducting new studies to produce accurate maps. Massachusetts communities have long expressed dissatisfaction with inaccuracies in existing flood maps. They fear going back to their communities with digital maps that incorporate the same deficiencies that they have known for years. Massachusetts officials concluded that with limited funding, they would not be able to generate the information they need to regulate new construction and development around flood hazard areas.

Similarly, New York officials estimated their mapping costs to be $106 million, based on analysis to support the state's business plan. However, the MHIP allotted New York approximately $43 million for mapping purposes. State officials believed that the MHIP budget was unrealistic. They said that the direction to map the entire state within a five-year period is counterproductive and ultimately will result in substandard maps, as they would only be able to digitize existing, poor quality maps. In the past, the state's philosophy has been to provide highly accurate maps for high-risk areas using available funding, and postpone mapping of less critical areas until funding becomes available in the future. They said that until release of the MHIP, FEMA regional officials seemed to share this point of view.

In its comments on the MHIP, the Association of State Flood Plain Managers concurred that the states' mapping needs assessments are not high-end "wish lists" for detailed flood studies and mapping. Rather, association officials said that the assessments represent minimum requirements for conducting detailed studies in high priority areas alone. They asserted that increased urbanization and population density in high-risk areas over the past few decades have increased the requirement for more mapping studies and accurate maps. Merely digitizing maps leads to a false sense of security among stakeholders

as the newer maps, though computerized, will not provide the reliable information needed to guard or insure against flood risk. (Figure 3 provides a picture of some of the devastation possible due to flooding.) The association concluded that while the proposed MHIP budget allocations are not adequate to map the nation in five years, they could successfully provide accurate maps for the top priority counties in the U.S.—if adjustments are made to the plan.

Figure 3: Flooding in Asheville, North Carolina after Hurricane Frances. (Photo by Leif Skoogfors, September 17, 2004, taken from FEMA's website.)

Other Complexities of Map Modernization Not Addressed

Stakeholders believe that the MHIP does not adequately address other significant factors needed to achieve FEMA's map modernization goals. First, the MHIP does not go far enough to ensure consistent production of accurate maps. Previously, there was no clear standard for converting paper maps to digital maps. Transferring floodplain illustrations from paper to digitized format introduced significant errors. However, with publication of the MHIP, FEMA has established "matching best available topography" as the minimum standard for producing reliable and accurate maps. Under the new standard, maps will no longer include errors that occur when topography is not matched, such as streams depicted outside of floodplains or houses at a 40-foot elevation above the floodplain identified within flood zones.

Although stakeholders commended FEMA for establishing the new quality standard, they expressed concern that the MHIP does not provide guidelines for evaluating modernized maps to ensure that the standard is met. For example, the MHIP does not provide detailed guidance concerning how to select projects for testing, how to conduct testing, the extent to which testing is done, and what to do in case of non-compliance. Representatives of the Association of State Floodplain Managers said that without such guidance,

ongoing mapping studies for FY 2005-2006 certainly would not meet the standard. When asked about the lack of guidance for ensuring map quality, FEMA officials said that, given other competing program management responsibilities, they had not had the time to focus on clearly defining methods for ensuring mapping accuracy. However, they recognize the importance of publishing the guidelines and currently are soliciting input from FEMA regions as to what procedures to include.

Second, stakeholders said that the MHIP does not present a long-term strategy for map modernization. They want to know the scope of the long-term effort versus the short-term priorities addressed in the initial effort. They want to know FEMA's strategy for mapping the entire nation. They want a clear understanding of end-state objectives in map modernization, too. Finally, they said that, in the context of a long-range strategy, the MHIP does not adequately address costs for map maintenance and re-study.

For example, officials with the Illinois Association of Floodplain and Stormwater Management said that the MHIP should reflect costs for both short- and long-term map production and maintenance. A contractor noted that the plan alludes to the availability of funding for map and data maintenance as a component of engineering and mapping. However, this official stated that nowhere in the MHIP does FEMA address the funding needed for restudies to maintain the upgraded maps. The contractor said that, without such funding, by 2010, the oldest of the modernized map would be almost 10 years old. This official cautioned that FEMA must be careful not to allow newly modernized maps to become outdated or they will once again face the challenges they are currently experiencing.

In response to these concerns, FEMA officials acknowledged that the map modernization program is a long-term effort and that they need a strategy for updating existing maps as well as for keeping them current. They noted that, within the context of the National Flood Insurance Program, they are evaluating resources needed to meet evolving stakeholder requirements over the life cycle of flood maps.

MHIP is Limited by Funding Allocations

The congressional appropriation in FY 2003 constituted a significant financial increase to allow FEMA to move ahead with its map modernization program. However, based on comments received about the MHIP, it still was not enough to meet stakeholder needs for producing accurate, modernized maps. In devising the MHIP, FEMA worked within the congressional funding and time limitations to establish sequencing plans and allocate funding to states and communities across the nation for map modernization. Although FEMA had been in ongoing communication with stakeholders regarding their map modernization funding needs and expectations, with respect to the MHIP,

FEMA continued to adhere to mapping goals and objectives outlined in its 1997 mapping plan, with the view that little had changed and the plan remained viable. Specifically, FEMA's strategy was to (1) update flood data, (2) refit topographic data, and (3) digitize paper maps as much as possible and refine those digitized maps at a later date to ensure accuracy. In contrast, as discussed above, stakeholders called for more than mere digitization. They wanted full funding and detailed plans for creating the most accurate maps possible without delay to address their evolving mapping requirements and priorities in high-risk floodplain areas.

The Association of State Flood Plain Managers agreed that FEMA's map modernization approach as outlined in the MHIP is not adequate and should be modified to address changing funding and flood hazard requirements since the original 1997 plan. The association stated that a revised MHIP should reflect new information and factors discovered under the initial years map modernization. For example, the association said that floods are elevation-related phenomena; mapping flood areas requires engineering analysis, including hydrology and hydraulic studies,[8] to determine how high waterways could potentially rise relative to their surrounding land areas. The association said that FEMA must evaluate such new requirements to maximize resources for conducting mapping studies. The association also said that modernizing the nation's flood maps to meet a new quality standard will take time and should not be rushed. Attempting to map the entire nation with limited funding in the five-year period outlined in the MHIP, they said, may result in chaos.

MHIP Does Not Ensure Stakeholder Buy-in

The MHIP in its current form does not encourage stakeholder buy-in and support for achieving FEMA's map modernization goals. Because the MHIP does not meet their sequencing or funding needs, stakeholders are discouraged from taking an active role in the program. If FEMA continues with the MHIP map modernization approach as outlined, states and communities may resist adopting the resulting maps because they will not view them as accurate or reliable to meet critical risk management needs. Merely digitizing maps, states fear, may cause them to lose credibility within their communities.

For example, Massachusetts officials said that the limited MHIP funding and digitization approach hinders the state from developing and maintaining strong working relationships with its community mapping partners. Similarly, New York officials said that the limited mapping approach might damage the integrity of the national flood insurance program and perhaps the entire community of floodplain managers. Without complete guidance on achieving

[8] Hydrology is the scientific study of the properties, distribution, and effects of water in the atmosphere, on the earth's surface, and in soil and rocks. Hydraulics is the physical science and technology of the static and dynamic behavior of fluids.

and maintaining minimum quality standards in map production, stakeholders lack confidence in FEMA's strategy for ensuring credible maps, too.

Upon evaluating stakeholder comments on the MHIP, FEMA acknowledged that a number of specific flood mapping needs might not be addressed within current sequencing plans and funding levels. Nonetheless, FEMA officials cautioned that the states' funding requirements and expectations to produce highly accurate maps all at once are not realistic, and that map refinement will have to be an ongoing process. FEMA reminded stakeholders that the MHIP schedules are flexible and that FEMA regions, which control the funding, can alter the sequence of mapping studies to meet their individual community needs. At the same time, however, FEMA stated that the agency is evaluating resources and will continue to work with states and communities to identify the most effective approach for meeting evolving stakeholder needs over the life cycle of flood maps.

Program Management Needs Improvement

Office of Management and Budget Circular A-11 directs agencies to employ good management disciplines to ensure that programs achieve intended cost, schedule, and performance outcomes. FEMA has responsibility for monitoring the contractor's map modernization activities. However, the agency has not effectively controlled costs and schedules to ensure that the contractor is accomplishing the overall program within established budgets and timeframes. Further, although FEMA has documented its performance management processes, the metrics used are not adequate to provide a complete assessment of contractor program management activities. Additionally, independent evaluations to ensure quality contractor processes and deliverables have not been adequate.

Program Cost and Schedule Not Effectively Controlled

FEMA oversight of the contractor's project management and procurement activities has not been adequate to control the costs and schedule for the map modernization program. In addition, FEMA did not ensure effectively that the contractor had the authorizations necessary prior to purchasing IT resources on the agency's behalf.

Project Management System Not Used Effectively

FEMA has not effectively overseen contractor use of an earned value management system for monitoring progress in accomplishing the map modernization program. The earned value management system is an electronic tool that compares baselined map modernization schedules and costs against actual activities and expenditures, applying a formula and indicators for determining the ongoing "health" of the program. FEMA and

the contractor jointly performed an integrated baseline review to ensure complete understanding of the contract requirements and the contractor's proposed solutions. As required by the contract, the contractor implemented the system at a cost of approximately $2.5 million.

However, FEMA's use of the earned value management system has not been effective because program task managers do not fully know how to use the data generated by the system. FEMA managers generally received training in earned value management; but, because they were not involved in the initial baseline planning, a number of managers did not understand how the budgeted costs and schedules for individual line items included in the contract task order were developed. Due to their limited understanding, managers did not use the earned value management information to the fullest extent possible.

For example, some managers believed that the earned value management reports did not give them adequate information to assess program progress. Others stated that they were unclear of the benefits of the information and therefore did not use it at all. One FEMA manager did not understand how the costs on an invoice related to the work that the contractor had performed and therefore requested additional information. In response, the contractor provided reports to show how the work performed translated into earned value. The manager stated that such reports, coupled with including FEMA managers in the baseline planning, will help with earned value management processes for future task orders.

Due to a lack of detailed guidance, FEMA managers used the earned value management information in inconsistent ways to carry out their oversight responsibilities. For example, one official used an arbitrary 10 percent variance from baselined costs and schedules to gauge whether tasks the contractor had completed met acceptable levels. Another manager reported that, without his knowledge, the contractor had added tasks and costs to his contract area of oversight, distorting the original baseline against which to assess work performed. Without guidance for using information generated by the earned value management system, FEMA managers lack a consistent means of evaluating contractor performance and ensuring that the benefits of their investments in map modernization are realized.

Further, the contractor's monthly reports to FEMA, which accompany the earned value management information, lacked specificity. The reports summarized program progress, contractor performance, cost and risk analysis, and mitigation plans. However, the reports failed to capture key information, such as delays experienced by the contractor in developing the Mapping Information Platform (MIP)—a web based system for mapping and updating flood maps—and the associated impact on the rest of the map modernization program. In a March 8, 2005, letter FEMA requested that the contractor improve the monthly reports by including the critical information needed to

make informed decisions on adjusting the program approach to ensure achievement of established goals and objectives.

Monitoring of Contractor Spending

Initially, FEMA did not have adequate procedures in place to control the contractor's IT expenditures for map modernization. The contract requires that FEMA compare each contractor invoice to program requirements, budgets, and documented deliverables to determine whether the bill should be paid. However, upon reviewing the contractor's December 2004 earned value management report, we identified a cost overrun of approximately $1.1 million for the program management line item in the contract. When questioned in this regard, FEMA officials attributed some of the cost overrun to contractor purchases of IT equipment that they had not pre-authorized.

To illustrate, one contractor purchase was for an improved administrative system for managing map modernization program documentation. The contractor had determined that the previous system was not cost effective to maintain, even though a subcontractor had provided it free of charge for the first year. The system costs and functionality limitations made continued use of the system in subsequent years cumbersome. Therefore, the contractor purchased another administrative system at a cost of approximately $250,000—without adequate coordination with FEMA's IT architecture office. After learning about the purchase, FEMA managers requested that their Applications and Analysis office review the procurement. Review officials found that the contractor had purchased the system without an initial check to ensure compliance with FEMA's enterprise architecture. FEMA reviewed the system to ensure compatibility and suitability, and subsequently approved the purchase, even though it stretched an already limited map modernization budget.

Decentralized responsibility for monitoring IT expenditures across the various contract line items made such unauthorized purchases possible. For example, FEMA officials responsible for overseeing contractor efforts to develop the MIP stated that they were not responsible for monitoring IT procurements of other contract line items and therefore could not ensure that all purchases met FEMA approval. FEMA recently has taken steps to ensure that unauthorized contractor purchases do not occur again in the future. Specifically, in February 2005, FEMA and the contractor agreed on a new policy for reviewing and authorizing IT procurements. The policy states that all requests for procurement of IT hardware and software greater than $5,000 must be pre-approved by FEMA's Applications and Analysis office. In addition, the policy states that all IT acquisitions must meet FEMA's enterprise architecture requirements. Since instituting the new policy, FEMA has disapproved $305,000 in unauthorized contractor purchases.

Performance Management Needs Improvement

FEMA has not provided the performance management and oversight needed to ensure successful accomplishment of the map modernization program. Although FEMA has documented its processes for evaluating program performance, the performance measures in use are not adequate. Further, independent assessments to ensure quality contractor processes and deliverables have not been consistent or adequate.

Performance Measures are Not Adequate

The *Federal Acquisition Regulation* requires that agencies institute effective approaches for evaluating contractors' execution of performance-based contracts.[9] This includes outlining processes for measuring the effectiveness of contractor services, deliverables, and work activities. As part of outlining these processes, and in coordination with the federal agencies, contractors are to develop several specific program management documents, such as performance work statements, quality assurance surveillance plans, and performance requirements summaries. In addition, the *Federal Acquisition Regulation* calls for the establishment of meaningful measures to assess contractor performance in executing specific tasks and activities and to support management decisions and actions for sustained progress in achieving contract objectives. Such measures help agency managers determine whether and in what amount contractors should be awarded for work performed.

FEMA and the contractor have taken some first steps toward managing performance of the map modernization contract. They have worked together to document processes for evaluating contractor performance. For example, in accordance with the performance work statement, FEMA and the contractor have instituted a management system to assess contractor performance in seven broad categories that typically drive a program's success or failure: leadership; product quality; program schedule; scope and risk management; teamwork; and contract management. Further, the contractor has developed a matrix that establishes metrics and outlines how contractor performance in each of these seven categories is to be measured and scored each quarter. Starting in September 2004, about six months after the contract was signed, FEMA began using the matrix to assess contractor effectiveness in program management and to determine the contractor award fee.

The measures for evaluating contractor performance as part of this process, however, have not been adequate. FEMA and the contractor agreed upon 18 measures for evaluating the contractor's effectiveness; of these, five measures are related to program management. Further, of the five program

[9] *Federal Acquisition Regulation*, Part 37, General Services Administration, Department of Defense, and National Aeronautics and Space Administration, March 2005.

management measures, four are event-based: they simply indicate contractor compliance in developing a prescribed report or implementing a required system. Only one measure was structured for evaluation based on a comprehensive assessment of the contractor's performance. The indicators for scoring contractor performance in this one measurement area are very narrowly focused and do not provide a sound basis for evaluating the contractor's overall program management accomplishments.

For example, FEMA based the contractor's leadership performance on two action items assigned to the contractor at an August 2004 map modernization executive steering group meeting. Specifically, the contractor was tasked to assess a model for developing the MHIP and review lessons learned from DHS' U.S. Visit Program to support development of the MHIP. [10] In September 2004, the contractor received a maximum score for leadership, based on completion of the two action items but no detailed analysis. Similarly, the contractor completed two more action items assigned at a subsequent executive steering group meeting the next month. Again, the contractor received a maximum score for leadership, although contractor actions dealt primarily with examining leadership issues and matters of interest rather than actually demonstrating leadership ability. Such high contractor scores were based on very narrow categories of performance and did not consider the overall "health" of the program under the contractor's leadership. Also, the scores were in complete contradiction with a March 2005 letter in which FEMA discussed cost and schedule overruns and criticized the contractor for poor leadership performance in the subsequent months of managing the program.

A FEMA official questioned the agency's approach to collecting, tracking, and analyzing the data used to score contractor performance. The official said that in a number of instances the measures appeared to be inaccurate. For example, this official asked how, in the category of "product quality," the contractor could have achieved a high score for having no letters of map changes returned for correction when mapping officials had already pointed out mapping errors that needed to be addressed. This official noted that no one is quite sure how such information is tracked and documented so there is no reliable means of verifying the performance measures and scores assigned.

Further, the official said that some measures appear to have been implemented incorrectly. For instance, FEMA was not supposed to assess contract management activities until the end of task order one, which was comprised of requests for contract modifications and indefinite delivery/indefinite quantity contracts. However, FEMA assessed contract management performance halfway through execution of task order one and gave the contractor a

[10] US-Visit is a system that allows the United States to determine the eligibility of foreign travelers to enter the United States.

"minimum" score, where there should have been no score at all. Similarly, the official said that the contractor assigned the maximum score to the scope management category in the third quarter of the contract; however, FEMA's assessment reduced the score to zero because of no activity. The official concluded that potentially scoring contractor performance before services have been completed or in areas of no activity results in distorted performance assessments. In turn, contractor fees awarded on the basis of such distorted performance assessments may be too high, constituting an inappropriate use of government funds. To address this issue, the official has requested improved guidance for evaluating the contractor's program management performance.

Quality Assurance Activities Have Lagged

The *Federal Acquisition Regulation*, part 37, requires that agencies conduct quality assurance reviews or inspections to ensure that contractors are meeting quality and quantity requirements of performance-based contracts. However, FEMA does not have all of the necessary mechanisms in place to adequately review work performed under its map modernization contract. For example, in accordance with the terms of the contract in 2004, the contractor established an assessment office independent of its program office to analyze map modernization activities and test new technologies introduced.

However, due to limited resources, assessment office efforts have focused only on testing the web-based MIP system. A subcontractor in the assessment office stated that contract negotiations had resulted in a small budget of approximately $700,000 and 2.5 testing staff for the office—just enough resources to conduct MIP testing. As a result, the assessment office was not conducting quality reviews of other contractor deliverables and work products that needed them. For example, the assessment office did not evaluate any additional technologies, apart from those already used that might assist mapping partners in improving processes for producing flood data and maps.

Until we inquired, a FEMA manager responsible for overseeing the assessment office was not aware that these other quality assessments were not being performed. Moreover, until we presented copies, this manager was not aware that the contractor had prepared quarterly letters to FEMA, which were never sent, advising that the agency had not requested any quality inspections beyond the MIP testing. For example, in a September 2004 letter, the contractor advised FEMA that it had established policies and procedures and developed a plan and schedule for conducting inspections in the latter half of the contract period, from March 2004 to March 2005. As of December 2004, however, FEMA had not requested that such audits be performed.

Further, FEMA was slow in hiring another contractor, separate from the assessment office, to perform independent quality reviews during the critical

first months of the map modernization program. The *Federal Acquisition Regulation*, part 37, directs that agencies conduct reviews to provide assurance of the quality of contractor work performed. FEMA planned to have a systems engineering and technical assistance contractor assess map modernization products and services to help reduce the risk of program failure.

However, FEMA did not succeed in bringing the contractor on board until September 2004—six months after the primary contractor began work on map modernization. In the interim, the primary contractor had been working at an aggressive pace to institute a number of new processes and technologies, including the earned value management system, a system development center, and the cooperating technical partner data-sharing program—all of which had not been assessed. After signing its contract with FEMA in September 2004, the systems engineering and technical assistance contractor's quality review was limited to products that already had been delivered. Although FEMA was not satisfied with some of the primary contractor's work products, the systems engineering and technical assistance contractor had no effective means after delivery to evaluate the quality of the products or the processes used to develop them. The systems engineering and technical assistance contractor did not gain the access needed to independently review the delivered products until March 2005.

Coordination Activities Are Headed in the Right Direction

FEMA is moving forward in its efforts to better partner and communicate with its mapping stakeholders. However, FEMA could take additional steps to maximize the benefits and resources possible through these relationships. For instance, although FEMA now works one-on-one with other agencies to coordinate mapping activities, FEMA has not instituted the policies, agreements, or information sharing mechanisms to effectively support these interagency working arrangements. Similarly, while FEMA is building more effective partnerships with state and local government entities, all mapping stakeholders at this level are not fully involved or aware of key map modernization objectives. Further, the call center responsible for addressing mapping inquiries does not always provide effective service or accurate information, compromising program credibility and potentially placing stakeholders and their property at risk. Addressing such collaboration and communications issues will be key to ensuring effective use of intergovernmental resources, stakeholder commitment, and ultimate success in meeting overall map modernization program goals.

Progress Made in Coordinating with Other Federal Agencies

FEMA has made significant progress in its outreach to the federal community, working with individual agencies and participating in a number of forums to consolidate resources, coordinate activities, and share information to support nationwide map modernization efforts. However, FEMA has not put in place all of the mechanisms needed to govern and support these interagency working relationships. For instance, during the first year of the map modernization contract, FEMA did not complete an overarching policy for coordinating geospatial data with federal mapping partners. Also, FEMA has not instituted the guidelines necessary to govern its working arrangements with individual agencies. As a result, FEMA may not be in the best position to achieve the cost savings and efficiencies possible through these collaborative arrangements. Last, FEMA is not effectively disseminating interagency mapping data so that all relevant stakeholders can align with the collective efforts of their nationwide mapping partners.

Guidance Calls for Increased Federal Coordination

By working together, federal agencies can reduce costs and eliminate redundancy in managing geospatial data. According to DHS' Geospatial Management Office, geospatial data identifies, depicts, and describes the geographic locations, boundaries, or characteristics of inhabitants and natural or constructed features on the earth.

Over the past fifty years, the U.S. Government has issued a range of guidance to further federal coordination in collecting and using geospatial data. Specifically, Office of Management and Budget Circular A-16 encourages governmental agencies to collaborate on geospatial undertakings. The Office of Management and Budget revised the regulation in 1990 to establish the Federal Geographic Data Committee, and again in 2002 to reflect geographic IT systems enhancements. The Federal Geographic Data Committee is a 19-member interagency committee composed of representatives from the Executive Office of the President, cabinet agencies, and independent agencies. In 1994, Executive Order 12906 made the Federal Geographic Data Committee responsible for developing a National Spatial Data Infrastructure, which promotes systems interoperability and the pooling of geospatial data holdings among federal agencies and their partners. The National Spatial Data Infrastructure includes policies, standards, and procedures for organizations to cooperatively produce and share geographic data. Tremendous growth in geographic information system technologies in recent years has helped bring such requirements for coordination of geospatial data to the forefront.

FEMA is Collaborating with Federal Stakeholders

FEMA recognizes the need to work with other federal agencies on geospatial data activities and has included this requirement in its contract and plans for modernizing flood maps. To this end, FEMA participates on the following committees and programs focused on geospatial data coordination.

- Federal Geographic Data Committee: FEMA representatives serve on a Coordination Group of this committee, established by Office of Management and Budget Circular A-16. FEMA's guidelines and specifications for flood mapping require adherence to Federal Geographic Data Committee metadata and accuracy standards, which are incorporated into contract costs.

- Geospatial One-Stop Program: The Department of Interior manages this intergovernmental project to support the President's e-Government Initiative. Geospatial One-Stop provides an internet portal through which government entities and private citizens can access federal and other geospatial data collections. The web portal also serves as a focal point for identifying similar projects, promoting collaboration, and reducing duplicate studies and use of geospatial data resources. Geospatial One-Stop representatives work with the Federal Geographic Data Committee to ensure that geospatial collection standards are defined and maintained. FEMA plans to publish all its flood hazard data updates for FY05 and FY06 to the Geospatial One-Stop portal.

- National Digital Orthophoto Program: The National Digital Orthophoto Program, chartered in 1993, is a "consortium of Federal agencies with the purpose of developing and maintaining national orthoimagery coverage in the public domain by establishing partnerships with Federal, State, local, tribal, and private organizations."[11] As part of this program, FEMA is developing a registry for posting planned investments in elevation and orthoimagery used on maps. Data from the registry will be pulled by the Geospatial One-Stop portal and included on that site.

- National Digital Elevation Program: FEMA is using the same registry cited above to support the National Digital Elevation Program. Federal agencies created this program as a central point for establishing coordination policies, procedures, and standards for sharing elevation data across federal, state, local, and private entities.

In addition, FEMA has had the opportunity to work with agencies on a one-on-one basis. For example, FEMA coordinates with the National Oceanic and

[11] Digital orthophotography refers to uniform-scale photographs of landmasses, which can be used to measure distance and can sometimes serve as base maps.

Atmospheric Administration's National Geodetic Survey to move its mapping work from the former National Geodetic Vertical Data standard of 1929 to the new, federally-mandated North American Vertical Datum standard of 1988. The new standard allows for greater accuracy and systems interoperability in flood mapping products. FEMA is also working closely with the U.S. Army Corps of Engineers and the U.S. Census Bureau to identify opportunities to coordinate on existing geospatial data holdings as well as upcoming projects.

Additional Steps Needed to Support Collaboration Activities

While FEMA is making progress in coordinating with and using the capabilities and data sets of other federal agencies, several challenges remain to full and seamless information sharing. For example, FEMA has not yet finalized its overarching policy for coordinating geospatial data with its mapping partners. FEMA representatives stated that they started to draft the policy prior to awarding the contract to the primary contractor. The contractor was to complete work on the policy and resubmit it for agency approval. However, after the contractor submitted the draft to FEMA, the agency responded with a discrepancy report indicating that the contractor's product was "significantly worse than the original draft." FEMA directed the contractor to revisit the document to better develop procedures for working with federal and state entities and ensuring compliance with all relevant regulations and policies. As of July 2005, FEMA's data coordination policy had yet to be finalized.

In the absence of a final data coordination policy, mapping partners lack formal guidance for mapping data collection and use, and may inadvertently create products of little value to other federal agencies. The rework to correct deficiencies with the mapping products may result in redundant cost and effort. Additionally, as one FEMA representative stated, the agency's delay in releasing a finalized data policy compromises its credibility with mapping stakeholders.

Additionally, FEMA has not put in place all of the guidelines needed to govern specific interagency working arrangements. FEMA uses memoranda of understanding to define roles and responsibilities in collaborating with other federal agencies on flood mapping. FEMA has drafted such agreements for working with both the U.S. Geological Survey and the National Geodetic Survey; however, the documents have not yet been finalized.

When asked why the memoranda have not been completed, FEMA officials said that confusing guidance has hindered efforts to put the documents in place. As a DHS component, FEMA must adhere to the policies and standards of the department's Geospatial Management Office. The office, established through provisions of the *Intelligence Reform and Terrorist Prevention Act of 2004*, is responsible for establishing and maintaining

appropriate relationships with federal, state, tribal, local, and private sector organizations on geospatial management technology matters.[12] DHS Management Directive 4030 defines the roles and responsibilities of the office, stating that the office is to provide departmentwide leadership and guidance to ensure proper coordination with other federal agencies and compliance with all applicable laws.[13] By September 2007, the office is also to provide oversight of all geospatial IT systems management, procurement, security, and interoperability issues at DHS.

However, since the Geospatial Management Office was established, its management has used a "do no harm" approach—leaving legacy agencies within DHS, including FEMA and its map modernization program, to manage as they deem appropriate. As a result, map modernization managers, unsure whether they should act on their own authority or work through the Geospatial Management Office, are waiting to take action to finalize the agreements. Until the finalized agreements are in place, whether departmentwide or agency-derived, there is no assurance that FEMA and other agencies will be in accordance with one another. FEMA also might miss significant opportunities for increased collaboration in map modernization efforts.

Further, although FEMA receives periodic updates regarding a central repository for federal mapping information, the agency has not devised a means of disseminating this information to the mapping partners that need it. Specifically, the U.S. Census Bureau maintains the Topologically Integrated Geographic Encoding and Referencing Enhancement Database, which provides an inventory of mapping data, including contact information, web addresses, agency names, and other related information. FEMA's regional offices and contractors rely upon such information to support their mapping studies nationwide. However, FEMA is still working on a plan on how to get the information out on a timely basis for nationwide reference. Where regional offices and contractors do not obtain the updated information on available data sets, they may perform unnecessary mapping studies, resulting in redundant effort and resource expenditures. Further, communities undertaking activities to identify mapping needs and the resources available to fulfill them, may unknowingly exclude information that could have helped produce more accurate maps.

Progress Made in Coordinating with State and Local Entities

As with the federal level, FEMA has taken steps to strengthen communications and outreach to its state and local mapping partners.

[12] *Intelligence Reform and Terrorism Prevention Act of 2004*, Public Law 108-458, December 17, 2004.
[13] *Geospatial Management Office*, MD 4030, Department of Homeland Security Management Directive System, November 12, 2004.

However, additional steps are still needed to effectively articulate map modernization objectives and consistently support stakeholders at this level.

Steps Taken to Strengthen State and Local Partnerships

In accordance with recommendations of both the Technical Mapping Advisory Council and the GAO,[14] FEMA is working to build constituent interest and support for modernizing flood maps by using a process that includes public education, outreach, communication, and establishment of partnerships with its state and local government stakeholders. FEMA's strategy is to maximize the mapping resources and experience of these stakeholders. The MHIP outlines FEMA's vision for such intergovernmental cooperation and coordination to achieve map modernization goals.

As discussed in the MHIP, FEMA has established a Cooperating Technical Partner program to co-opt state and local participation in its map modernization program. Cooperating technical partners sign agreements with FEMA that clearly define objectives, standards, milestones, and quality controls for activities needed to develop or modernize mapping products. At the close of FY 2003, FEMA had 151 mapping partners. As of March 2005, the agency had approximately 208 partners, 193 of which have mapping agreements in place. In FY 2004, these partners collectively provided about $62 million leveraged dollars to support FEMA's flood map modernization program. FEMA defines leveraged dollars as the products—field surveys and topographic data—and assistance that add quality to mapping products.

As the map modernization program continues to grow and expand, FEMA is working to extend its technical partnership base and the program's overall reach. Specifically, FEMA is moving toward multi-jurisdictional cooperating technical partner agreements, which consolidate the resources of smaller mapping partners into larger cooperative agreements to ensure more unified, seamless partnerships. The State of Georgia, Department of Natural Resources, for example, has entered into a cooperative agreement with FEMA to pool resources and coordinate mapping activities on a statewide basis versus working with individual counties or municipalities. State officials cite delegation of coordination responsibility to each state as a whole as one of the greatest advantages of this type of agreement, because the states have better relationships with individual counties than FEMA does. Multi-jurisdictional cooperative technical partnerships also encourage integration of various organizations, resulting in additional resources for flood mapping.

Further, cooperative agreements with several state and local level forums bolster FEMA's communication and outreach capabilities. For example, to better communicate its map modernization vision and goals as well as to

[14]GAO-04-417, March 2004.

coordinate activities with stakeholders nationwide, FEMA sponsors annual conferences of the Association of State Floodplain Managers and regularly sends representatives to symposiums led by the National Association of Flood and Stormwater Management Agencies. Also, FEMA has entered into a cooperative agreement with the National States Geographic Information Council. Under this agreement, FEMA coordinates with the Council to identify and leverage high-resolution light detection and ranging technology and orthophotography available throughout the nation.[15] These are among the most costly of all mapping technologies, as the cost to obtain light detection and ranging technology to map the entire nation exceeds $1.7 billion, while the cost for orthophotography approximates $880 million. By working with the Council, FEMA can significantly streamline efforts and reduce costs to produce mapping products.

Written materials supplement FEMA's communications with state and local entities. For instance, as discussed above, the MHIP supports outreach efforts and also serves as a guide for stakeholder planning, scheduling, and use of resources in map modernization. Further, FEMA provides standard operating procedures for the regional offices and the contractors that support them. Though initially some contracting staff reported difficulties working with their regional office counterparts, FEMA has taken steps to improve these working relationships. For example, FEMA has established agreements in each of its ten regions, outlining specific responsibilities of the regional offices versus those of the contractors. Additionally, the contractors now participate in bi-weekly conference calls with their respective regional offices to discuss concerns and provide progress reports on mapping activities.

Room For Communication Improvement Exists

While FEMA continues to make great strides in its partnership-building and outreach efforts, several challenges remain. Stakeholders do not fully understand the goals, objectives, and standards that must be adhered to in map modernization. Further, the contractor's call center is not functioning as effectively as it could to support mapping stakeholders.

Map Modernization End Goals Not Effectively Communicated

As discussed above, the constrained funding and schedules for conducting mapping studies, as outlined in the MHIP, have led to the perception among stakeholders that instead of updating and computerizing mapping products to ensure accuracy, FEMA is simply digitizing outdated paper maps. When we asked the map modernization program manager about the digitization issue, this official said that such beliefs are not entirely accurate. While the MHIP

[15] Light detection and ranging technology identifies distant objects and analyzes pulsed laser light reflected from their surfaces to determine their position, velocity, or other characteristics.

may not effectively communicate the full strategy, FEMA officials concede that FEMA is not redoing floodplain studies for the entire nation. Re-studies, they said, are costly and the program does not have enough money to re-map the entire nation. Officials emphasized, however, that bad information would not simply be digitized. Rather, in most cases the agency is using "redelineation"—a process involving the redrawing of floodplain boundaries using more detailed or current topographical information and existing flood elevations. While redelineation does not generally result in significantly updated flood elevations, FEMA officials believe that it is a good first step.

The FEMA program manager acknowledged that misperceptions are the result of a lack of effective communication and outreach from headquarters and regional offices to stakeholders. This FEMA manager acknowledged that the program must work to improve communication strategies, adding that FEMA and the contractor could have done a better job early on to coordinate outreach activities.

Similarly, FEMA's communication and outreach to stakeholders regarding elevation data standards need improvement. In 1993, the Congress mandated the North American Vertical Datum of 1988 (NAVD 88) as the official standard for the federal government to use to measure surface contours and base flood elevations, identifying which properties and locations are in flood zones and which are not.[16] However, FEMA is not requiring that its mapping partners use this standard when converting their mapping products from paper to digital format. In fact, FEMA program officials recently provided an update on map modernization status showing that only 22 percent of all 214 mapping studies identified had been performed in NAVD 88, while the remaining 78 percent remained in the former National Geodetic Vertical Datum of 1929 (NGVD 29) standard.

As mentioned earlier, FEMA has successfully coordinated use of the newer elevation standard at the federal level. One particular community, Fort Collins, Colorado, decided to change from the older datum after FEMA and the National Geodetic Survey reached out to inform it of the many issues facing the old datum. In general, however, FEMA's regional offices have placed limited focus on communicating to individual communities the importance of converting to the new standard. Consequently, at the regional level, a number of communities are opting to remain in NGVD 29 because it is less costly to do so.

While the costs of converting to the newer elevation standard may seem prohibitive to some communities, there are also significant benefits that should not be overlooked. These benefits include greater accuracy in mapping

[16]The Federal Register (Vol. 58, No. 120, page 34245, June 24, 1993) affirmed NAVD 88 as the official vertical datum standard for the United States.

studies and comparability of layers (specifically, flood layers as they relate to other multi-hazard layers). Conversely, there are significant drawbacks to communities remaining in the older elevation standard. For example, according to an official with the National Geodetic Survey, NGVD 29 is not compatible with new global positioning systems currently used to specify map layers. Systems using the old NGVD 29 standard likely will not be technically supported in the coming years. More importantly, mapping products that blend the two data formats result in miscalculated base flood elevations. Without accurate base flood elevation data, properties may be incorrectly located outside of flood zones, placing both the properties and their residents at risk. Stakeholders who have been well informed of the benefits of the new standard and the drawbacks of the old are more likely to opt for conversion, as in the case of Fort Collins, Colorado.

Non-Cooperating Technical Partners Overlooked

In addition to the need for defined modernization goals and adherence to the national elevation standard, we are concerned about the level of communication offered to non-cooperating technical partners. Less advanced communities may simply be unaware of FEMA's map modernization efforts. For example, two industry officials stated that FEMA regions, while playing a greater role in map modernization than in the past, generally hire contractors to perform modeling and other mapping activities. They stated that these contractors, who serve primarily as engineers, generally are not known for outreach, often leaving communities uninformed of map modernization efforts.

One county that we visited reported having "very little involvement with the map modernization program," even though the county was listed in the MHIP as a mapping project for FY 2003 and FEMA was already in the process of completing work on the county's flood maps. During our visit, however, we found that the county, which had been using the same paper maps since 1981, was unaware of FEMA's map modernization efforts on its behalf. When questioned about the lack of information provided to the county, FEMA representatives stated that the previous mapping contract used to produce the countywide platform, coupled with intense pressure to scope and award new FY 2004 map modernization project dollars, resulted in ineffective regional office tracking and communication with the county.

After being informed of the oversight, FEMA quickly reengaged with this particular county, meeting with county officials and other affected communities in the area in December 2004. Additionally, FEMA delayed issuance of the preliminary flood map for the county in order to accommodate and potentially incorporate any additional data that the county or its incorporated communities might provide. The end result is an informed community with significant time to include the necessary letters of map

change and other mapping data for FEMA's consideration. Although FEMA deems this an isolated incident, if we had not identified the oversight, new mapping data would not have been included in the county's final mapping product, possibly compromising data integrity and resulting in a map that inaccurately depicts flood zones.

Call Center Operations are Ineffective

Effectiveness of service provided by FEMA's Map Assistance Center—known as the call center—is another area where improvement is warranted. The call center, designed to provide flood mapping information and assistance to the public, is charged with answering telephone inquiries on a variety of issues such as letters of map change, document order forms, FEMA publications, and frequently asked questions. The call center logs approximately 9,000 calls per month. According to FEMA brochures and communication materials, the call center will provide support to MIP web site users in the future, too.

The call center is an integral component of FEMA's map modernization program. However, the agency has encountered problems with the center since transitioning from the contractor formerly responsible for its operations. The new contractor succeeded in establishing the call center and making it fully operational two days in advance of the deadline. But, after closely monitoring call center performance over a number of months, FEMA determined that the center was not meeting its goals of providing effective service to callers.

Specifically, as part of its monitoring process, FEMA representatives randomly selected calls for review each day to determine whether responders were accurately and effectively providing information. Two days in a row, a FEMA representative found mistakes in all calls reviewed. In one instance, a call center operator took nearly eight minutes to respond to a caller, ultimately providing an incorrect map date. In another instance, a responder made no attempt to identify or provide useful details to an inquirer about a letter of map change. In a third case, a respondent thoroughly confused and frustrated a caller. When the caller voiced his frustration at the conclusion of the call, the respondent did not offer further assistance.

In discussions with us, map modernization program officials speculated that problems experienced with the call center were likely the result of inexperience at three different levels. They stated that the contractor, unfamiliar with the needs of a mapping assistance call center, may have overlooked the general needs of the facility. They said that inexperience on the part of the call center operators—college students who knew little about flood mapping—led them to provide inaccurate information to callers. Further, the performance-based contracting vehicle allowed FEMA only to

dictate the desired product (that is, the call center), but not the necessarily the processes or procedures for achieving the end result.

FEMA allowed the contractor until January 2005 to improve call center operations. The contractor, in turn, hired a third party organization that evaluated call center service and provided a report to FEMA in February 2005. First, the report confirmed that the center's operators were providing inaccurate information (estimated as high as 30 percent) to callers—a practice which could potentially place individuals at risk if they were not well-informed about mapping policies and regulations, flood zones, or the need for flood insurance. Second, the report found that the center's voice recognition system was less than user-friendly, frustrating and alienating callers and compromising commitment to mapping program objectives.

As a result of the report, the contractor outlined steps to reorganize and improve center operations, including simplifying the voice recognition system and allowing callers to press the "zero" button at any time to access a live operator. Additionally, the contractor plans to move "tier 1" call center operators to the contractor's headquarters facility in Alexandria, Virginia, where operators can obtain better training and assistance by subject matter experts. The contractor will implement a new e-mail tracking system to better support center operators. Finally, the contractor will continue monitoring calls to ensure sustained center performance in providing timely and accurate service.

Mapping Platform and Tools Are At Risk

As part of its map modernization efforts, FEMA is developing a web-based technology platform that will support the management, extraction, sharing, and efficient production of digital maps. However, progress has been limited because the system development approach is not well executed. Specifically, a lack of clear contractor expectations, underestimation of the scope and complexity of the project, an overly aggressive development schedule, poorly defined system requirements, and an ineffective system development approach have led to significant development and implementation delays as well as cost overruns. As a result, the mapping platform may not achieve the functionality and cost savings anticipated.

Expectations for Mapping Information Platform

The MIP—a premier, web-based, data collection and delivery system—is a key component of FEMA's map modernization program.[17] FEMA is investing over $30 million to develop and implement the system, which is

[17] FEMA defines a premier system as a state-of-the art, interoperable, continuously evolving, living, dynamic, and integrated system.

intended to facilitate the management, sharing, and production of digital mapping data. FEMA expects that the new system will achieve its goal of reducing the time it takes to produce new digital flood insurance rate maps. Also, the MIP is to provide reliable flood and multi-hazard data to support stakeholders—from federal and state mapping partners to individual homeowners—in their risk management decisionmaking. Because the system will be available through the internet, users will be able to quickly access the information needed and take appropriate actions to reduce vulnerability to damage or loss resulting from potential natural disasters.

Figure 4: Mapping Information Platform

The MIP will feature a number of technology components that will assist with map modernization project management. Specifically, the MIP will apply leading industry practices by including a project tracking application to help managers document and monitor activities, schedules, budgets, and expenditures for mapping studies and revisions. The MIP also will include a digital "dashboard"—another project management tool—for monitoring mapping study and digitization processes from inception to completion. The digital dashboard uses a green-yellow-red coding scheme to indicate the status of an initiative and automatically notifies the appropriate managers when studies are off track.[18] Further, the MIP will host several software tools to assist FEMA partners and mapping contractors in producing and editing digital flood map panels. The MIP will include online user training for each component of the overall mapping platform. FEMA has set out specific time frames for delivery of the MIP. The performance work statement for one of the map modernization contracts, signed in March 2004, requires that the contractor deliver several major components of the MIP in three releases over a one-year period, as follows:

[18] In this color coding scheme, green indicates that the study is proceeding according to plans, yellow indicates schedule slippage or other issues regarding product delivery, and red means that the study is in jeopardy and unlikely to achieve objectives.

- Release 1: By June 2004, consolidate existing digital flood map repositories and establish the MIP on the internet along with capability for users to access and view flood maps and other geospatial information.

- Release 2: By September 2004, provide FEMA with the digital dashboard and other tools for tracking progress regarding mapping studies and letters of map changes. Additionally, the contractor was to provide through the MIP several highly specialized tools and technologies to support map development: the Watershed Information System and Digital Flood Insurance Rate Map Production Tools.

- Release 3: By March 2005, provide additional capabilities for more complex mapping activities, such as data modeling, storing the intermediate data used to create flood maps, providing data security, and ensuring mapping data quality.

Platform Deployment Has Experienced Schedule and Cost Overruns

While some progress has been made in developing the MIP and the map production tools, the contractor has not met several deadlines and the platform is significantly over budget. Specifically, although the contractor met the 90-day time frame for delivering release 1 of the MIP, current estimates indicate that completion of release 2 will not be deployed fully until late July 2005—about 10 months behind the originally scheduled date of September 2004. The delays began after the contractor identified the unexpected need to provide additional project tracking capabilities to release 2 deliverables to better meet FEMA's requirements. In order to provide the additional capabilities without delaying delivery of the mapping tools, the contractor in October 2004 suggested dividing release 2 into sections: release 2.1 would launch the two mapping tool applications, while release 2.2 would deploy the management tracking tools. FEMA concurred with this proposal.

However, this newly revised release 2 strategy did not work as planned. In November 2004, when the contractor provided the mapping tools—the Watershed Information System and the Digital Flood Insurance Rate Map software—comprising release 2.1, FEMA rejected the deliverables. FEMA contract managers stated that the tools did not satisfy the requirements outlined in the performance work statement. For example, they said that the release did not include the full suite of Digital Flood Insurance Rate Map tools. The deployment plan also did not identify the main audiences for the tools, how the tools should be used, or how users would be trained and supported. In addition, the contractor had not provided performance test results for the Watershed Information System tool.

To further adjust the release 2 delivery schedule and provide users with at least one of the tools with which to begin mapping studies, FEMA officials

decided to deploy the Watershed Information System, contingent upon acceptable system performance testing. Accordingly, the contractor further delineated the delivery schedule, identifying the Watershed Information System as release 2.1 and the Digital Flood Insurance Rate Map production tools as release 2.1.1. After much discussion and several contract modifications, the contractor successfully launched the Watershed Management Tool in January 2005 and FEMA approved the Digital Flood Insurance Rate Map production tools in May 2005. FEMA expected the contractor to deliver MIP release 2.2 and the project management tracking tools, beginning in June-July 2005.

Because they build upon MIP release 2.2, the subsequent deliverables for release 3 will be delayed, too. Originally scheduled for March 2005, release 3 now is not expected until late September 2005. Although the contractor provided the requirements document for release 3 to FEMA in February 2005, FEMA rejected the document, stating that it did not include sufficient detail. For example, a FEMA official who participated in Joint Application Development sessions recalled discussing with the contractor functions to include in release 3, such as storing and validating the data compiled from mapping studies. The FEMA official reviewed the contractor's requirements documentation, but noted that such details had not been included. FEMA accepted the requirements in May 2005 after the contractor made the necessary changes. Nonetheless, due to the repeated revisions to the deliverables, release 3 will be about six months behind schedule.

These schedule delays have had an adverse impact on the cost to produce the MIP. The original budgeted cost to complete the MIP was $27.7 million. However, as of April 2005, FEMA had already spent $32.1 million to acquire release 1 and parts of the subsequent releases. As of May 2005, FEMA was still waiting for the contractor to provide an estimate of the cost to complete releases 2.2 and 3. One official estimated that the total cost to complete the MIP could range from $17 to $20 million. If such an estimate holds true, the total project cost could exceed $52 million—approximately $24 million over budget.

IT Approach Not Well Coordinated

MIP schedule and cost overruns may be attributed to a number of issues that FEMA has not managed effectively. These issues include unclear contractor expectations, an overly aggressive system development schedule, underestimation of the project scope and complexity, inadequate system requirements definition, and an ineffective systems development approach.

Contractor Expectations Not Well Defined

Office of Management and Budget guidance for performance-based contracting states that performance work statements should be written using clear and precise wording and task-oriented statements.[19] However, FEMA's agreement with the contractor on MIP development plans and expectations was unclear, contributing to the schedule and cost overruns discussed above.

For example, the performance work statement for developing the MIP contains such vague language that FEMA and the contractor each interpret it differently. In response to FEMA's statement of objectives concerning map modernization, the contractor developed the performance work statement, describing services to be performed under task order one of the contract. However, the work statement includes vague terms, such as "thin-thread" and "thick-thread," referring to the level of capability that the contractor planned to provide in the various MIP releases. Loosely defined, "thin-thread" implied less capability while "thick-thread" meant more robust capability. The work statement does not define the terms, allowing the contractor considerable latitude as to what to deliver, and creating the possibility that the contractor's work would not satisfy FEMA's expectations. Such a discrepancy occurred when the contractor provided FEMA with a description of the functionality that would be included in MIP releases 2 and 3.

Specifically, in September 2004, FEMA learned that the contractor had not included in MIP development the ability to track completion of mapping studies on a basin-wide basis. By congressional mandate, FEMA is required to study an entire geographical area drained by a river and its tributaries; however, the contractor had planned to track study progress on a larger countywide basis instead. After identifying this deficiency, FEMA reminded the contractor that, according to the performance work statement, MIP functionality was supposed to be similar to that of the Monitoring Information on Contracted Studies System, its predecessor, which could track mapping studies by basin. In reply, the contractor asserted that basin-wide studies were not within the scope of MIP release 2 and 3 and that such "thick-thread" capability had not been envisioned for this phase of MIP development. FEMA continued to disagree. Ultimately, in October 2004, the contractor agreed to include the capability for tracking basin-wide studies in MIP development, but at additional time and cost.

In November 2004, FEMA identified another misinterpretation of the performance work statement requirements when the contractor attempted to deliver web-based tools for producing digital maps. In this instance, FEMA rejected the delivery, stating that the contractor had not provided the full suite

[19] *A Guide to Best Practices for Performance-Based Service Contracting* (Final Edition), Office of Federal Procurement Policy, Office of Management and Budget, October 1998.

of tools needed for the 30 or more steps required to complete a digital flood insurance rate map. In response, the contractor claimed that the initial delivery was never intended to include all of the tools for completing all steps in the map production process. Further, the contractor stated that its contract with FEMA did not include adjustments to reflect new delineations in MIP release 2 development. Ultimately, the contractor agreed to provide the full suite of tools, but again at additional cost and with added time for delivery.

MIP Development Scope and Complexity Underestimated

Despite federal requirements for clear and realistic expectations in performance-based contracting, the contractor underestimated the scope and complexity of MIP development. Specifically, early in the MIP development process, the contractor encountered a number of unanticipated technical difficulties that resulted in delays in starting work on MIP release 2. The contractor summarized these difficulties in an August 2004 letter to FEMA, outlining problems in improving map server scalability to provide additional layers of data on the MIP portal. The contractor had to reallocate MIP development team resources to address this issue.

In addition, while conducting infrastructure prototyping, the contractor identified technical integration issues among several of the middleware software products. The contractor noted that the system architecture had to be changed to accommodate differences between business workflow and portal software requirements. The architectural change required additional time to integrate the middleware software products.

Further, the contractor had to expend considerable time and resources to understand the mapping study process as a prelude to developing functional requirements for the MIP software. In examining this business process, the contractor found interdependencies between two contract line items: IT and data management and flood engineering and mapping. Time to fully understand and map out these interdependencies slowed development of the functional requirements and extended the MIP development schedule.

According to FEMA officials, they since have instituted processes to provide improved oversight and responsiveness to resolve scope and technical issues. For example, the contractor provides FEMA with a detailed weekly briefing on the status of the MIP. This briefing describes areas of risk and is a forum to discuss scope questions and uncertainties. The meetings also use detailed schedule and resource plans to ensure that the program is on schedule and within budget. If scope issues are raised that cannot be resolved within these constraints, FEMA will use change control procedures it has instituted and modify the program scope, budget, and schedule accordingly. Also, FEMA's independent quality control reviewer now is involved in daily status meetings with the contractor to review processes and raise issues for FEMA's

resolution. Additionally, an Engineering Review Board now convenes every two weeks to review software patches and changes in the production environments. This formal review process helps ensure that changes to the system are reviewed, recorded, and approved by cross-functional FEMA representatives, such as engineering, mapping, and IT officials.

Aggressive MIP Development Schedule

The contractor's proposal to develop the MIP software within one year was ambitious as well, leaving little room to accommodate unexpected delays. Specifically, in conjunction with the technical problems discussed above, the contractor experienced difficulties in staffing the system engineering and user interface teams. These efforts took longer than expected, delaying the start of system architectural and design activities and pushing the product delivery schedule out beyond the original September 2004 deadline.

In efforts to meet the deadline, the contractor began writing MIP software code and analyzing system requirements concurrently, instead of sequentially in accordance with standard practice. Nonetheless, the contractor's delivery of the completed software code for MIP release 2 in December 2004 was still late. After FEMA realized that the system did not include the necessary functionality—possibly due to the incomplete requirements analysis—the contractor had to expend additional time and money to correct the software code. This pattern of system development continued for release 3 as well. Although FEMA did not formally approve the requirements document for release 3 until May 2005, by that time the contractor had already completed 90 percent of the program code development.

A FEMA representative questioned how the contractor could be developing MIP release 3 when release 2.2 upon which it was to build had not yet been completed. Such code development prior to requirements agreement, this official reasoned, poses the risk of the system not meeting user or functional needs. When this happens, significant recoding may be required, leading to additional costs and delays.

MIP Requirements Not Well Defined

Office of Management and Budget Circular A-11 directs agencies to reduce project risk by involving users in the design of IT assets. However, at the start of the contract in March 2004, FEMA and the contractor did not coordinate effectively to identify user and technical requirements for the MIP. Several FEMA officials stated that there was little communication between FEMA and the contractor on these issues during an initial system development discussion. The contractor had already begun work to develop the system prior to the meeting and therefore had not adequately considered requirements. By the time that FEMA and the contractor signed off on the

requirements in January 2005, the contractor had already completed the system development. Release 3 requirements initially lacked detail, too; FEMA and the contractor have worked closely to try to resolve these issues.

In addition to this initial lack of communication, FEMA's quality control contractor found that the process that the contractor used to document requirements was inadequate. Best practices in requirements management include providing a requirements baseline, traceability matrix, and effective change controls. In line with these practices, a requirements management plan developed by the MIP contractor discusses the links between user needs and system capabilities, along with processes for configuration management throughout the software development effort.[20] The plan describes the various types of user and technical requirements, their respective features, what should be documented, and how this information should be used to manage requirements, too. Although the contractor considered this plan an internal work product and not part of any deliverable to FEMA, the contractor posted the plan to an electronic bulletin board, making it available for review by FEMA's quality control contractor.

The quality control contractor reviewed the MIP requirements management plan and found that, while the plan lists activities essential to requirements management, it lacks specificity. For example, the plan does not reference a documented requirements baseline and only superficially addresses issue tracking—the process for resolving discrepancies. Further, change control processes, policies, and procedures are not clearly outlined. There is no mention in the plan of the need for FEMA to approve the requirements identified by the contractor responsible for developing the MIP. The quality control contractor consequently made ten recommendations for improving the requirements process. FEMA officials said that they have shared these findings and recommendations with the MIP developer.

System Development Methodology Not Applied

Leading organizations use standard methodologies for systems development. Likewise, the contractor's performance work statement notes that development of each MIP release should follow Software Engineering Institute Capability Maturity Model guidelines, which require thorough system documentation, review at each phase of the system life cycle, and testing by the developer and independent verifiers prior to product delivery. Ultimately, the final product is to be subject to acceptance testing to ensure that all user and functional requirements are met.

However, FEMA officials were concerned that the contractor did not follow such guidelines in providing mapping tools for the MIP. Specifically, based

[20] *FEMA MIP Requirements Management Plan*, Version 8, January 2005.

on a review of the contractor's assessment of MIP release 2.1, FEMA's quality control contractor affirmed that capability maturity model processes had not been employed at each stage of the life cycle in developing the mapping tools.[21] The quality control contractor said that testing against established requirements for release 2.1 had not been not adequately performed or documented; and, software code had been modified and moved between the simulated test and production environments in the middle of testing. Several significant defects found in the product upon final user acceptance testing confirmed that the developer's initial tests had been inadequate.

According to FEMA officials, the contractor has improved weekly status reporting to the agency. The program schedules provided in the status reports incorporate the system life-cycle development process and identify specific tasks for each phase of the life-cycle, helping FEMA ensure that processes are followed and tasks are not skipped. Additionally, FEMA has asked its quality control contractor to take an active role in evaluating areas that need process improvements. For example, the quality control contractor recently reviewed and reported to FEMA on deficiencies in the contractor's processes for performance testing. In response, FEMA provided comments to the contractor, which resulted in a change in performance testing processes that ultimately is expected to improve system quality.

IT Systems May Not Meet Expectations

Given contractor delays and the many problems encountered, the MIP and related mapping tools may not fulfill user expectations. Specifically, users in some cases have acquired their own IT solutions and may not use the mapping tools that FEMA is providing. Delays in implementing the MIP have resulted in additional costs to maintain an interim system. In addition, FEMA has deferred its plans to integrate legacy systems with the MIP until the agency has the resources with which to do so.

Mapping Tools May Not Be Used

FEMA faces the risk that, despite spending approximately $4 million to develop tools for creating digital flood maps, mapping contractors and partners may choose not to use the tools. Because of contractor delays in providing the full suite of tools through the MIP, a number of mapping stakeholders have resorted to adopting other commercially available software to perform the same functions. For example, a mapping official we spoke with in California indicated that late release of the engineering tools had impeded his organization's ability to complete projects in a timely manner. Rather than continuing to wait for FEMA's tools, the contractor's

[21] *MIP Release 2.1 Engineering and Mapping Tools–Acceptance Results–DFIRM Tools,"* November 5, 2004.

organization obtained its own tools. Further, another mapping contractor in Georgia had spent a lot of resources to independently create mapping tools and did not plan to use those provided by FEMA, especially since FEMA's tools will use an older version of geographic information system software than the contractor uses. FEMA officials fear that it may take months before they can determine the extent to which stakeholders will use their tools and whether the agency's investment to develop the tools is cost-effective.

A contractor official stated that use of FEMA's tools is critical to the success of the map modernization program because these tools will effectively produce accurate flood maps, at lower cost, and in a standard manner. This official stated that the agency consequently must place priority on instituting incentives and highlighting the benefits of mapping stakeholders using the FEMA tools rather than their own IT solutions. One benefit to using FEMA's tools is that they will save money, as the stakeholders will not be responsible for purchasing and maintaining mapping tools on their own. Another potential benefit is the reduced requirement for mapping contractors and partners to manually enter mapping data into the MIP once the tools are fully integrated.

Continued Reliance on Interim System

Delays in MIP deployment also have resulted in increased costs to continue to operate an interim system for tracking mapping studies. Previously, FEMA and its mapping partners used the web-based Monitoring Information on Contracted Studies (MICS) system to record and track individual map modernization project lifecycles nationwide. In January 2005, the contractor created an interim system—commonly known as "son of MICS"—to prepare the data in MICS for transfer to the MIP. The transition process was only expected to take four to six weeks, during which time only the contractor's regional management center staff would be able to enter and update mapping information. At that point, FEMA expected the data transfer to be completed, and the MIP to be operational, by the end of February 2005.

However, due to delays in implementing the MIP, regional management center staff are using the intermediary system much longer than originally intended to track the status of ongoing mapping studies. MIP release 2.2 is not expected to be fully operational until July 2005. Because mapping partners do not have electronic access, FEMA must continue to pay a contractor to update project tracking information in the intermediary system. Specifically, the contractor must spend approximately $150,000 per month to keep the management information up-to-date until release 2.2 of the MIP is implemented. If the MIP had been ready in September 2004 as originally scheduled, FEMA would not have had to pay these ongoing costs for activities that the agency or its mapping partners might have been done for free.

Legacy Systems Not Incorporated As Planned

Due to MIP cost overruns, key legacy systems which were to be transitioned to the new mapping platform, will only be hyperlinked instead. Specifically, the contractor's performance work statement for the map modernization program indicated that several legacy systems, including FEMA's Management Information System, MICS, and the Mapping Needs Update Support System, would be transferred to the MIP for easier access and use by mapping partners. Additionally, contractors stated in several technical documents and e-mails that they also would include the FEMA Levee Inventory System on the MIP.

However, due to a lack of time and money to reengineer the mapping needs assessment processes to meet the MIP development deadline, FEMA agreed that the contractor should only link several systems to the MIP instead of integrating their entire databases with the new platform. Specifically, the Mapping Needs Update Support System—a multi-functional, interactive web-based software application—will not be fully included on the MIP and therefore will not provide the functionality that stakeholders originally expected. The system stores flood hazard mapping requirements and generates ranking reports for communities based on the benefits and costs to update maps. FEMA uses the system as a tool to prioritize communities for updates to their National Flood Insurance Program's Flood Insurance Rate Maps based on state and regional needs. Because processes to assess community needs are changing based on the MHIP and scoping activities and because new processes for identifying community needs have been deferred, FEMA officials reasoned that it would not be a good use of resources to integrate Mapping Needs Update Support System data into the MIP at this time and the hyperlink is a better option. FEMA officials anticipate that the new processes should be completed this fiscal year.

Similarly, because of a lack of time and resources, the map modernization contractor has decided not to integrate the FEMA Levee Inventory System with the MIP. Nonetheless, because excess capacity exists on the MIP platform, the contractor has agreed to host the FEMA Levee Inventory System on the web site.

Recommendations

We recommend that the Acting Director, Mitigation Division:

1. Review and revise the Multi-Year Flood Hazard Identification Plan to improve sequencing and funding for mapping studies in high-risk areas to meet common goals and needs of the National Flood Insurance Program and local floodplain managers; and, to provide end-state objectives and a

long-term strategy for producing and maintaining accurate flood maps nationwide.

2. Develop guidelines to help ensure compliance with FEMA's minimum standard for producing accurate and reliable flood insurance rate maps.

3. Improve oversight of contractor program management by (a) providing guidance, additional training, and improved metrics for monitoring contractor performance; (b) documenting and ensuring compliance with procedures for reviewing and approving the contractor's IT procurements; and, (c) providing the resources needed to conduct the quality assessments and independent quality assurance reviews for monitoring contractor deliverables and services.

4. Direct that the map modernization program office work with the DHS Geospatial Management Office to develop information sharing agreements with other federal agencies and programs to reduce redundancies in the costs and resources used to carry out map modernization activities.

5. Finalize and implement the coordination policy for data sharing—and develop and implement a means to disseminate available federal agency mapping data to stakeholders—thereby capitalizing on available resources for meeting program objectives.

6. Clearly communicate to stakeholders the objectives, benefits, and alternative approaches to converting from the former National Geodetic Vertical Datum of 1929 to the official North American Vertical Datum of 1988 to help ensure accuracy of modernized maps.

7. Improve FEMA regional office outreach and communication to stakeholders to help ensure their commitment and participation in efforts to modernize flood maps.

8. Re-evaluate the Mapping Information Platform system development approach and make changes to ensure that (a) user and technical requirements are fully identified, approved, and addressed to support systems development; (b) contractor expectations are clearly defined; and, (c) standard methodologies for system development are followed to help manage costs, schedules, and results.

Management Comments and OIG Evaluation

We obtained written comments on a draft of this report from the Acting Director, Mitigation Division. We have included a copy of the comments in their entirety at Appendix B.

In the comments, the Acting Director concurred with all of the findings and recommendations in our report. The Acting Director said that the observations in our report are valuable to FEMA's ongoing improvement efforts and that the recommendations are generally consistent with the agency's current plans. The Acting Director said that FEMA, in fact, had made considerable progress over the previous few months with the flood map modernization program. In attachments to these general comments, and in response to each of our report recommendations, the Acting Director summarized progress that FEMA has made in flood map modernization and outlined plans for future improvements. We believe that such efforts are good steps toward addressing the various issues we raised in our report and look forward to learning more about continued progress and improvements in the future.

Specifically, in response to Recommendation 1, the Acting Director outlined several actions that FEMA has taken, or will take, to review and revise the MHIP to meet stakeholder needs better. For example, the Acting Director said that updates to the MHIP in FY 2006 to 2008 will include improvements in projected flood map modernization sequencing and, as available, funding for high-risk areas. This updated information will be accompanied by a description of differences between mapping and funding needs addressed in the MHIP and those needs identified in state and regional business plans. Further, the Acting Director stated that program managers are working to define end-state objectives of flood map modernization and develop a long-term strategy for producing and maintaining accurate flood maps nationwide. To ensure their engagement and commitment, stakeholder comments on the MHIP and its subsequent revisions will be incorporated in the long-term planning efforts.

In response to Recommendation 2, the Acting Director indicated that FEMA is holding a series of meetings with representatives of state and local partners to obtain input and agreement on how best to implement and ensure compliance with the agency's quality standards. The agency also had published within the previous month guidance and protocols for conducting flood studies in the Atlantic and Gulf Coast regions.

The Acting Director outlined various efforts to address Recommendation 3, regarding the need for improved oversight of contractor program management. Specifically, the Acting Director stated that FEMA is strengthening its use of the Earned Value Management System for reporting and tracking performance in carrying out contract task orders and flood studies. The Acting Director indicated that such strengthened performance management would be accomplished through improved metrics, training, integrated baseline reviews, and formal monthly evaluations of flood map modernization program status. The Acting Director said that FEMA will provide continued enforcement of the IT procurement policy in place to

ensure pre-approval of any IT purchases over a set dollar amount. Further, FEMA continues to use its quality control contractor to ensure the quality of deliverables and affirms that actions will be taken to address recommendations made by that contractor.

The Acting Director discussed in his comments FEMA's commitment to addressing our report Recommendations 4 to 7, regarding communication, outreach, and partnership on map modernization activities. Specifically, the Acting Director stated that FEMA will continue to work closely with the DHS Geospatial Management Office to develop and formalize data sharing agreements with other organizations, such as the National Geodetic Survey, the U.S. Army Corps of Engineers, and the U.S. Geological Survey, to reduce overlaps and maximize efficiencies. FEMA recently finalized, and is working to implement, its data coordination policy to help govern the dissemination of federal mapping data to stakeholders. FEMA recognizes the importance of developing improved guidance and communicating to stakeholders on the need to use the official elevation data standard to help ensure the accuracy of modernized flood maps. Further, although FEMA already has taken steps to improve regional outreach, the agency also will provide guidance to its regional offices, emphasizing increased coordination with state map modernization stakeholders to ensure their commitment and participation.

Finally, in response to Recommendation 8 on re-evaluating the mapping platform development approach, the Acting Director stated that requirements analysis meetings and pilot tests help ensure that system requirements are clearly identified, documented, and approved. Daily and weekly meetings also are held to review system development status, identify problems, and remove obstacles to program success. FEMA will use independent verification and validation processes to enforce use of a proven, standard system development methodology. The agency will link the implementation of process and product improvement recommendations resulting from these independent verification and validation processes to future metrics for IT project management.

As background for our review, we researched U.S. laws, federal guidance, and DHS directives relating to floodplain management, mapping, and the National Flood Insurance Program. We obtained documentation through internet searches relating to map modernization, mapping communities, IT requirements and FEMA guidelines and specifications for mapping partners. Additionally, we reviewed FEMA OIG and GAO reports to learn more about their findings and recommendations related to map modernization.

To accomplish our review objectives, we first met with FEMA representatives to learn about their roles, responsibilities, and activities relating to the Multi-Hazard Flood Map Modernization Program. We conducted individual interviews with FEMA's Chief Information Officer and the Geospatial Information Office to identify management directives that apply to map modernization's IT infrastructure and to evaluate FEMA's geospatial coordination and subsequent reporting on those efforts. In addition, we held meetings with FEMA's Risk Identification Branch Chief and map modernization staff responsible for contract or oversight; communications and outreach; IT development, management, and acceptance; and engineering functions. These meetings helped us gauge the effectiveness of FEMA's contract management, coordination, and IT management activities as well as broaden our understanding of the map modernization program in general.

We interviewed staff of the primary contractor selected to support map modernization efforts, to learn about progress, challenges, and successes they encountered in managing the program. The contractor's team leader and staff members assisting in the program told us about their experiences with FEMA and gave us periodic status updates on the program. Also, we interviewed subcontractors, indefinite delivery/indefinite quantity contractors, and individual cooperative technical partners-sanctioned contractors to determine the quality of FEMA's management of the program, communication and coordination, with stakeholders, and use of IT to support mapping efforts.

We met with a number of stakeholders representing the Map Modernization Coalition that supported funding for map modernization. These stakeholders included the Association of State Floodplain Managers and the American Congress of Surveyors and Mappers. The goal of these meetings was to determine stakeholder satisfaction with the program's status, learn about communication and outreach activities, and evaluate management of the IT infrastructure.

We held interviews with agencies with which FEMA coordinated and collaborated on map modernization issues. These included the U.S. Geological Survey, the National Oceanic and Atmospheric Administration's National Geodetic Survey, the U.S. Army Corps of Engineers and the U.S.

Census. Through the course of these meetings, we obtained information relating to FEMA's participation in the Federal Geographic Data Committee, the National Digital Orthophoto Program, and the National Digital Elevation Program, as well as its support to Geospatial One-Stop.

During the course of our review, we conducted site visits to three FEMA Regions across the U.S., selected based on mapping activity and suggestions by FEMA officials. We visited FEMA Regions IV, V, and IX, all of which had large numbers of mapping studies, varying levels of cooperative technical partner participation, and unique map needs and characteristics. In each location, we visited with representatives of the FEMA regional offices, regional management centers, mapping partner organizations, and indefinite delivery/indefinite quantity contractors. Subcontractors interviewed provided a broad understanding of stakeholder needs, communication and IT requirements, as well as progress made to date. These interviews assisted in our ongoing research of FEMA's overall management of the Multi-Hazard Flood Map Modernization Program, as well as the agency's coordination and communication with all levels of government, mapping partners, and other stakeholders. In addition, we evaluated the agency's multi-million dollar MIP system, its requirements, specifications, capabilities, and overall usefulness.

We attended FEMA's 2005 Map Modernization Conference in Kansas City, Missouri. The conference, an annual event at which all Map Modernization Program Staff convene, focused heavily on performance-based management as well as programmatic implementation issues. During the conference, we attended formal working sessions ranging in topics from cooperating technical partner development to discussions concerning the next release of the MIP. Our participation in these events broadened our understanding of the program and FEMA's management, coordination, and use of IT infrastructure to meet program goals.

We conducted our review from August 2004 through April 2005 at FEMA headquarters and related government and industry organizations in the Washington, D.C. metropolitan area, as well as in FEMA Region V (Illinois and Wisconsin), Region IX (Arizona and California), Region IV (Florida, Georgia, Alabama, and North Carolina), and at FEMA's 2005 Map Modernization Conference in Kansas City, Missouri. We performed our work according to generally accepted government auditing standards. The principal OIG points of contact for this audit are Frank Deffer, Assistant Inspector General, Information Technology Audits and Sondra McCauley, Director, Information Management Division. Other major contributors are listed in Appendix C.

U.S. Department of Homeland Security
Washington, D.C. 20472

FEMA

SEP 6 2005

MEMORANDUM FOR: Frank Deffer
Assistant Inspector General, Information Technology

FROM: David Maurstad
Acting Director, Mitigation Division

SUBJECT: Response by the FEMA Mitigation Division to the Draft Audit Report – *Challenges in FEMA's Flood Map Modernization Program (OIG-05-XX)*

General Comments

The FEMA Mitigation Division thanks you for the opportunity to comment on the subject report. The draft report contains significant observations and recommendations about the Flood Map Modernization Program. FEMA concurs with the findings and recommendations listed in the report. The observations are valuable to our improvement efforts, and the recommendations are generally consistent with our current plans. In fact, FEMA has made considerable progress over the course of the past few months with the Flood Map Modernization Program, and our response will summarize some of the progress FEMA has made as well as our plans for future improvements.

Over the course of the past year, FEMA's Flood Map Modernization Program has achieved much in moving toward the objectives of this initiative. Because of the Flood Map Modernization Program, citizens will be able to make better decisions about the use of their property, both inside and outside the flood prone areas identified on the maps. Communities will be provided with a more comprehensive approach to disaster mitigation planning, economic development, and emergency response. Communities also will be able to manage flood risks, water resources, land use, and other responsibilities more effectively. Finally, through Flood Map Modernization, communities will be empowered to update maps and data as risks change.

Through oversight of this initiative, FEMA is undertaking groundbreaking steps in designing and implementing performance-based processes in the mapping environment. This oversight is necessary to achieve the mission of this program: to protect lives and prevent loss of property from flood hazards.

The OIG report presented the results of its audit on the following four major topics:

- Limitations of the Flood Map Modernization Program (Map Mod) plan as documented in the Multi-Year Flood Hazard Identification Plan (MHIP);
- Improvements needed in program management approach;
- Communication and coordination activities with Federal, State, and local entities; and
- Information technology (IT) issues, with particular emphasis on the FEMA Mapping Information Platform (MIP).

Attachment A presents FEMA's progress on these four major topics. The OIG report also provides eight specific recommendations for FEMA actions to improve Map Mod. Attachment B presents specific responses to the eight OIG recommendations. Attachment C lists the acronyms referenced in the response.

In summary, with the support of FEMA senior management, the Mitigation Division is committed to addressing the issues identified in this report by planning and implementing activities within the available funding, timing, and resources.

Additional questions regarding this response may be directed to Michael F. Howard in my office at (202) 646-4070 or at MichaelF.Howard@dhs.gov.

Attachments

Attachment A

Summary of Progress on Four Major Topics in the IG Report

Major Topic #1: Map Mod Plan Limitations

Mapping Plans and Priorities. The Multi-Year Flood Hazard Identification Plan (MHIP) was prepared in response to recommendations given by GAO Review in March 2004. FEMA prepared a draft document in June 2004. Version 1.0 was published in November 2004; Version 1.5 was released in June 2005.

Funding and User Requirements. The OIG report states the MHIP is a "comprehensive plan that outlines priorities, funding, and standards for carrying out mapping studies." However, the report also states that MHIP "is hindered by budget limitations and does not adequately address user or funding requirements." The FY 2004-2008 budget used in MHIP reflects funding received and anticipated by FEMA from the President and Congress. FEMA recognizes that this level of funding does not meet all the needs of our State and local mapping partners; however, it is important to note that FEMA's role in flood map modernization focuses on essential flood mapping requirements and may not include all State flood map needs . FEMA's role in flood map modernization must be complemented by State and local mapping partners. FEMA is currently evaluating the level of funding required for flood map maintenance.

FEMA agrees that clear communication among community, State, and regional partners and other mapping stakeholders is a critical factor for the success of Flood Map Modernization. FEMA reviewed all comments from stakeholders on the November 2004 version of MHIP and the most recent June 2005 version of MHIP. Continuous and consistent lines of communication at multiple levels drive the development and update process, and they are resulting in better-informed stakeholders and users and better mitigation planning.

Standards and Guidelines. The OIG report states that "stakeholders commended FEMA for establishing the new quality standard." However, the report also states that stakeholders "expressed concern that MHIP does not provide guidelines for evaluating modernized maps to ensure that the standard is met." FEMA publishes *Guidelines and Specifications for Flood Hazard Mapping Partners*. The document defines technical requirements, product specifications for flood hazard maps and related NFIP products.

Several steps have been taken towards guidance development and implementation. Some of these steps are summarized below:

- FEMA Headquarters and Regions have been discussing the implementation process throughout the winter and spring.
- A procedure memorandum has been issued requiring all FY05 studies to comply with Section 7 of the MHIP.
- Internal draft guidance has been written.

- FEMA hosted an Industry Day discussion on June 17, 2005, with its mapping partners to help resolve Section 7 implementation issues.
- Procedures for implementing the floodplain boundary standard were discussed during a meeting with State and local government staff on August 3 and 4, 2005.

Long-Term Strategy and Map Maintenance. The OIG report states that "MHIP does not present a long-term strategy for map modernization" and that "MHIP does not adequately address costs for map maintenance and re-study." MHIP is a roadmap that defines, for the first time, how FEMA will produce updated digital flood hazard data for the Nation. The overall strategy, presented in Section 1 of the FY05-FY09 MHIP (Version 1.5, June 2005), states that Flood Map Modernization will result in safer communities by providing more reliable, readily available, and easier-to-use flood maps. The following is a brief summary from MHIP of the long-term actions:

- Networking the Nation using Internet technology to provide access to general flood hazard, risk, and mitigation information.
- Maximizing the use of local, State, and Federal resources, and transferring ownership and use of maps and data to the States and localities by building and maintaining effective partnerships with community, State, and regional entities before and during the development of maps and data.
- Reducing the processing time and cost for map updates, which includes map maintenance and re-study, and increasing accountability for spending by implementing results-oriented systems and standards that will facilitate the rapid exchange of data between mapping partners, stakeholders, FEMA staff, FEMA contractors, and other users.
- Communicating with mapping partners, stakeholders, and users effectively, consistently, and continually to maximize understanding of flood hazards and the risks that these hazards pose to life and property.
- Continuing to improve the quality and accuracy of national flood hazard data by developing GIS-based products with reliable technologies that meet enhanced technical standards such as the floodplain boundary mapping standard defined in section 7 of the FY04-FY08 MHIP (Version 1.0), dated November 2004.

The long-term map maintenance issues are being addressed by capturing the data in digital form and by maintaining the data in easily accessible systems. FEMA has developed and published data capture standards and guidelines (Appendix N of FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners).* These guidelines will also facilitate and reduce re-study costs.

Major Topic #2: Program Management Improvements

Management oversight reflects the growing sophistication in understanding the properties of the earned value management system (EVMS). The EVMS tables and statistics are standard features in the monthly status reports. The monthly joint program reviews (JPR) between FEMA and MOD use these management reports as the basis for tracking progress, issues of concerns, or areas at risk. Over the past year, the program staff has

changed from knowing little about EVMS to using the terms, concepts, and analyses to manage their areas of responsibility and to discuss Map Mod's progress in a standardized and easily understood manner.

The following objectives have been set for the JPR meetings:

- Understand program performance to date
- Analyze current earned value data
- Align review with core business processes
- Review process improvements in response to Independent Verification and Validation (IV&V) or external recommendations

Major Topic #3: Communication and Coordination Issues

Guidance on Communication and Coordination.

The overarching goal of outreach is to create a climate of understanding and ownership of the mapping process at the State and local levels. Well-planned outreach activities reduce political stress, confrontation in the media, and public controversy.

Specific mapping-project-related outreach goals include the following:

- Establishing two-way communication to inform and obtain feedback from stakeholders;
- Ensuring compliance with due process requirements;
- Interacting with technical representatives to ensure production of accurate and up-to-date maps;
- Identifying and addressing the needs of all affected stakeholders;
- Enhancing ownership by communities;
- Tracking, monitoring, and evaluating outreach activities and adjusting efforts according to ongoing feedback and evolving project needs.

Geospatial Data Sharing Partnerships and Guidance. FEMA also recognizes the importance of coordinating with its Federal, State, and local partners to avoid duplication of data acquisition and to encourage the sharing of data. Fostering collaboration with other Federal agency partners (e.g., U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), National Oceanic and Atmospheric Administration's National Geodetic Survey (NOAA/NGS), Natural Resources Conservation Service) and with State, regional, and local agency partners through the Cooperating Technical Partner (CTP) program will help improve and maintain the quality and reliability of flood maps and other flood hazard data.

During the last 6 months of FY 2005, FEMA has been very active in the area of geospatial data coordination, issuing a formal policy on geospatial data coordination, implementing this policy across the Regional offices and establishing a geospatial data

coordination and standardization management team to support the implementation of the policy. The goals of the team are:

- Integrating Map Mod data coordination and standardization activities with day-to-day planning and project management activities;
- Facilitating successful local relationships being built among local, State and Federal personnel;
- Implementing processes that will help FEMA document productive coordination at the national level and report on geospatial investments and data holdings.

FEMA is supporting the NSDI and Geospatial One-Stop (GOS) as prescribed by Office of Management and Budget Circular A-16 and Executive Orders 12906 and 13286. FEMA is implementing a geospatial metadata management system that will automatically provide the NSDI and GOS with information about geospatial datasets used in Flood Map Modernization.

Major Topic #4: Information Technology Issues

Coordinated IT Approach. Despite the challenges described in the report, FEMA has released a comprehensive suite of engineering and map production tools and workflow functionality on the Mapping Information Portal (MIP). FEMA and NSP subject matter experts (SMEs) collaborated in frequent software test status meetings to prioritize problems found after testing the system from a business user perspective. These efforts contributed significantly to the delivery and approval of Releases 2.1 and 2.2 (currently, conditional approval only for Release 2.2); the SMEs are actively using their in-depth MIP understanding in training and deployment.

IT Systems Meet Expectations. Actual use of the engineering and map production tools is growing. On August 9, there were 114 logons to DFIRM tools versus an average of 30 logons per day in the period immediately following release of the tools. Feedback from workflow users has been positive during the first wave of the deployment in June.

Attachment B

Mitigation Division's Response to Recommendations in the IG Report

The FEMA Mitigation Division makes the following response to each recommendation:

Regarding Recommendation #1 – Reviewing and revising the Multi-Year Flood Hazard Identification Plan to improve sequencing and funding for mapping studies in high-risk areas to meet common goals and needs of the National Flood Insurance Program and local floodplain managers; and, to provide end-state objectives and a long-term strategy for producing and maintaining accurate flood maps nationwide.

The purpose of FEMA's Multi-Year Flood Hazard Identification Plan (MHIP) is to share with our mapping stakeholders the planned schedule and anticipated funding for providing reliable digital flood hazard data and maps for areas at flood risk to support the National Flood Insurance Program. State, local, and regional entities provide input to the MHIP through the State and Regional flood mapping business planning process. The MHIP provides a national roll-up of the State and regional information and county-specific projected dates for delivery of flood hazard maps, to aid planning efforts of FEMA's flood hazard mapping partners. FEMA's role in flood map modernization focuses on essential requirements and may not include all State flood map needs. FEMA's role in flood map modernization must be complemented by State and local mapping partners.

FEMA released the first version of the MHIP (Version 1.0) in November 2004 with a strategy to update the plan twice yearly to reflect progress on delivering flood data and maps, for use and adoption by communities, and to reflect changes in cost and schedule for planned flood map updates. The MHIP web page on FEMA's Flood Hazard Mapping Website provides opportunity to comment on the Plan. Flood mapping stakeholder participation in development and feedback on the MHIP is essential to the success of Flood Map Modernization. The first update to the MHIP (Version 1.5), released in June 2005, contains information addressing the most frequently expressed comments on the first MHIP, sequencing updates, and updates to flood hazard map schedule and cost.

FEMA will improve the flood-map update sequencing and, as available, funding in high-risk areas in Multi-Year Flood Hazard Identification Plan (MHIP) updates. Since the issuance of the IG report, FEMA has met with representatives of State and local flood hazard mapping partners in developing a coordinated strategy to address issues of mapping quality standards, strategy to address mapping issues with levees, , and for resolving issues related to defining flood risks that impact sequencing and level of mapping detail. Additionally, agreement was achieved in discussing end state objectives for producing and maintaining accurate flood maps. Policy statements on mapping quality standards

and mapping levees have been issued. Upcoming planned actions include updates to the sequencing of studies in the MHIP to reflect coordinated strategies for identifying flood hazards for areas at risk and funding thresholds for flood mapping for studies planned for the FY06-FY08 timeframe. These updates will include a description of differences between those needs being addressed in the MHIP and those needs identified in the State and Regional business plans. Over the next six months, FEMA, in coordination with State and local government mapping partners is working to clarify the end-state objectives and develop a long-term strategy for producing and maintaining accurate flood maps nationwide. This includes applying benefits of digital flood mapping technology implemented through FY08 to addressing long-term flood data update needs. The comments received on the MHIP inform and refine that process, and subsequent MHIP updates will reflect the results of this long-term planning and facilitate continued stakeholder engagement and buy-in.

Regarding Recommendation #2 – Developing guidelines to help ensure compliance with FEMA's minimum standard for producing accurate and reliable flood insurance rate maps.

In response to a March 2004 GAO report, FEMA included a floodplain mapping standard, aligned with the level of flood risk, in the November 2004 MHIP Version 1.0. That document served as a means of making the draft standard available for stakeholder comment. FEMA's flood mapping standards are defined in *FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners*. The comments received on the draft mapping standard in MHIP Version 1.0 are being considered as FEMA incorporates the refined mapping standard in our *Guidelines and Specifications*.

Also, FEMA held and will continue to hold meetings with representatives of our State and local partners, including one held on August 3 and 4, 2005. During this meeting, quality guidelines and compliance procedures were agreed upon in order to ensure compliance with flood zone boundary mapping standards. Through revised State business planning process, States will address how they intend to ensure compliance with mapping standards and address specific issues relating to high risk areas involving levees. Recently published guidance within the past 30 days includes "Procedure Memorandum No. 37 – Protocols for Atlantic and Gulf Coast Coastal Flood Insurance Studies in FY05," and "Procedure Memorandum No. 34, Interim Guidance for Studies Including Levees."

Regarding Recommendation #3 – Improving oversight of contractor program management by (a) providing guidance, additional training, and improved metrics for monitoring contractor performance; (b) documenting and ensuring compliance with procedures for reviewing and approving the contractor's IT procurements; and, (c) providing the resources needed to conduct the quality assessments and

independent quality assurance reviews for monitoring contractor deliverables and services.

As the map modernization initiative makes progress, the governance process will be changed to manage better the performance of the contract and have greater program oversight. With the improved governance structure, there will be three areas of oversight and control – the portfolio, the program, and the process/project levels.

For all three of these levels, FEMA will strengthen its use of Earned Value Management System (EVMS) for reporting and tracking of major task orders and flood studies. Special emphasis will be placed on defined, measurable, and mutually agreed-upon metrics and products. Part of strengthening EVMS will be by giving training and refresher courses to program staff on EVMS methodology, conducting integrated baseline reviews, and instituting formal monthly evaluations of the status of Flood Map Modernization current operations. Program managers and staff received extensive training in the techniques and analysis of earned value management data during the first year of the program.

To strengthen FEMA management and oversight of this initiative and comply with DHS MD 0782, "Program Manager Certification," the program managers will achieve appropriate program management training to qualify at Level II in FY 2006. Over the past year, program staff received extensive management training to achieve Level I proficiency or better.

In addition, FEMA will provide continued enforcement of the information technology (IT) procurement policy recently put in place. That policy requires that before procurement of any IT item over $5000, the contractor must obtain pre-approval by the Applications and Analysis Section. FEMA will also review IT purchases at weekly IT status meetings and document all approvals and disapprovals in writing.

Since the review by the Inspector General, FEMA's IV&V contractor has become fully engaged in the program delivery and the review of deliverables from the National Service Provider. For important deliverables, the IV&V contractor reviews deliverables and provides and assessment to FEMA. These assessments are also provided to the National Service Provider. Future National Service Provider task orders will have metrics linked directly to quality assessments performed by the IV&V contractor.

At the monthly Joint Program Review meetings, each business process area includes a discussion of actions taken to address recommendations from the IV&V contractor.

Regarding Recommendation #4 – Directing that the map modernization program office work with the DHS Geospatial Management Office to develop information

sharing agreements with other federal agencies and programs to reduce redundancies in the costs and resources used to carry out map modernization activities.

Map Modernization will continue to work closely with the DHS Geospatial Management Office (GMO) to develop and formalize data sharing agreements with other agencies to reduce overlaps and maximize efficiencies. The DHS GMO is finalizing a formal agreement with USGS that supports improved coordination between DHS and USGS. FEMA, along with the head of the DHS GMO, met with the USGS GIO on August 8th to continue to build on these efforts and to develop a supporting service level agreement specific to coordination between FEMA and USGS. Map Modernization will also continue to pursue formal agreements with NOAA/ NGS, USACE and other key partners.

Regarding Recommendation #5 – Directing the contractor to finalize and implement the coordination policy for data sharing—and develop and implement a means to disseminate available federal agency mapping data to stakeholders—thereby capitalizing on available resources for meeting program objectives.

FEMA recognizes the importance of coordinating with its Federal, State, and local partners to avoid duplication of data acquisition and to encourage the sharing of data. On August 23rd, FEMA issued its "Geospatial Data Coordination Policy." Regional offices are working to implement the data coordination policy.

The policy, when coupled with data coordination tools implemented in the Mapping Information Platform, is the flood program's means to disseminate available federal mapping data to stakeholders. The data coordination tools include the hazard catalog; the National Digital Elevation Program and the National Digital Orthophoto Program project tracking system; and the metadata profiles for imagery, elevation, and flood data. These geospatial data coordination tools also provide information about Flood Map Modernization data to the Geospatial One-Stop. FEMA will work with its Regions, partners, and contractors to ensure that these tools are used in accordance with the data policy and implementation guidance. FEMA will also establish an audit process to ensure that the data policy is being adhered to.

Regarding Recommendation #6 – Clearly communicating to stakeholders the objectives, benefits, and alternative approaches to converting from the former *National Geodetic Vertical Datum of 1929* to the official *North American Vertical Datum of 1988* to help ensure accuracy of modernized maps.

FEMA agrees that it is vital to communicate effectively with stakeholders about the importance of using NAVD 88 on the new flood maps. The Engineering and Mapping Integrated Program Team (IPT) will develop and communicate improved guidance on this issue. FEMA will also improve coordination

processes with the National Geodetic Survey to enlist their support in communicating the importance of this issue to stakeholders.

FEMA guidance for converting elevation data from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88) is provided in Appendix B of the previously cited *Guidelines and Specifications*. In the coming months, the FEMA Map Mod program office will develop and communicate improved guidance on the issue of converting elevation data from NGVD29 to NAVD88. At the same time, FEMA will review current projects and task orders to insure that NAVD88 is used where appropriate.

Regarding Recommendation #7 – Improving FEMA regional office outreach and communication to stakeholders to help ensure their commitment and participation in efforts to modernize flood maps.

FEMA has already taken steps to improve regional office outreach by conducting a review for each office of its staffing needs and effectiveness for outreach activities. Each of the 10 Regions has taken steps over the past year to increase communication with mapping partners, States and locals, and their Regional Management Center (RMC) contractor. Specifically, all 10 Regions hold mapping conferences at least once per year, and often 2-3 times annually. These conferences provide an opportunity for regional staff, mapping partners, local stakeholders, and the RMC to discuss best practices and common issues that require attention. While regional staffs regard personal contact as the best form of communication, the NSP has developed some very useful tools, including a brief summary of the program included with all preliminary maps.

FEMA will provide its regional offices with guidance to emphasize increased coordination with cognizant State flood mapping officials to ensure state commitment and participation. This change will provide better management of prospective mapping resources and provide an opportunity to leverage outreach opportunities at the state level. In addition, this change will enable more efficient leveraging of State resources to meet both local and national needs through the Cooperating Technical Partners (CTPs). Current guidance documents are being refined to provide assistance based upon lessons learned. Resources are being redirected to encourage partner innovation and practices that will benefit flood map modernization through better business management and outreach.

Regarding Recommendation #8 – We recommend that the Acting Director, Mitigation Division re-evaluate the Mapping Information Platform system development approach and make changes to ensure that (a) user and technical requirements are fully identified, approved, and addressed to support systems development; (b) contractor expectations are clearly defined; and, (c) standard methodologies for system development are followed to help manage the costs, schedule, and results.

FEMA has already taken steps to improve the Mapping Information Platform (MIP) requirements, clearly define contractor expectations, and help enforce the use of standard methodologies for system development.

a) **MIP Requirements Defined with MIP Phased Roll Out**: FEMA has had several detailed requirements analysis meetings with FEMA and key stakeholders to ensure that all requirements are clearly identified, documented, and approved. FEMA officially approved the MIP Release 3 requirements on May 6, 2005. Additionally, FEMA has piloted the MIP Release 2.2 system out to Regions 6, 8, and 10 (including their contractors and Cooperating Technical Partners). The feedback from the Regional roll-out sessions has been extremely positive. Those Regions are now actively using the MIP. From those pilot sessions, requirements and change requests were recorded and prioritized to clearly define future requirements. The remaining Regions will complete training through September and early October 2005. At that point the system will be fully rolled out and used by all Regions.

b) **Contractor Oversight Improved:** Daily status meetings of the progress of the system are conducted. Additionally, weekly detailed status meetings are being conducted to ensure contractor expectations are clearly understood. At each weekly meeting, FEMA reviews the project using Earned Value Management System (EVMS) techniques tracking cost and schedule. FEMA views Cost (and Effort) Performance Index measures and Schedule Performance Index measures to alert us to problems with cost and schedule. When Cost/Effort or Schedule variance exceeds 5%, FEMA determines the cause of the variance by identifying the work packages in our detailed schedule that are causing the problems. Once issues are identified, FEMA takes action to remove obstacles. This has worked effectively to keep us on schedule and on budget to date with our Task Order 1 Extension. To ensure that contractor expectations are clearly defined for our next core Task Order, FEMA jointly worked with the Mapping on Demand (MOD) team to provide input into their Performance Work Statement. FEMA intends to continue open dialog through the contracting process to ensure that expectations are clearly documented and understood by both FEMA and the MOD team.

c) **Standard Methodology Used with IV&V:** Systems Engineering Institute (SEI) Capability Maturity Model Integration (CMMI) Level 3 processes, a proven standard methodology for systems development, will be enforced for the IT sections of the program. FEMA is currently using our Independent Verification and Validation (IV&V) contractor to verify that those processes are being followed. Recommendations from our IV&V contractor have been sent to the MOD team. Actions such as MOD's improvement of their IT Configuration Management process have resulted from IV&V recommendations. This review process will be continuous; in addition, FEMA is looking to tie future metrics to implementation of IV&V recommendations on quality of products and process improvements/compliance. As noted in (b), EVMS is used to help track budget and schedule and to identify areas of risk to prevent schedule and cost overruns. Additionally, the detailed scheduled used to track the system status and EVMS is mapped to the standard development methodology. Deviations from schedule or budget are immediately addressed; if no solution can be found to contain the

variance then the Joint Program Review will be briefed on the issues for resolution.

Better controls over requirements, contractor expectations, and project management have been put in place over the last few months to help the MIP succeed. The benefits of these controls are starting to be realized (e.g., Release 3 is currently on schedule and budget and improved processes have been put into place to improve Configuration Management System Testing per IV&V comments).

Attachment C

ACRONYMS

CMMI	Capability Maturity Model Integration
CTP	Cooperating Technical Partners
EVMS	Earned Value Management System
GMO	Geospatial Management Office
GOS	Geo-Spatial One-Stop
IPT	Integrated Program Team
IT	Information Technology
IV&V	Independent Verification & Validation
JPR	Joint Program Review
MHIP	Multi-Year Flood Hazard Identification Plan
MIP	Mapping Information Platform
MOD	Mapping on Demand (consortium supporting Map Mod)
NAVD88	North American Vertical Datum
NDEP	National Digital Elevation Program
NDOP	National Digital Orthophoto Program
NFIP	National Flood Insurance Program
NGS	National Geodetic Survey
NGVD29	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NSDI	National Spatial Data Infrastructure
NSP	National Service Provider
RMC	Regional Management Centers
SME	Subject Matter Experts
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

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