CHAPTER IV

Security and Environmental Planning in the 21st Century: Regional Monitoring, Warning, and Information Exchange

Introduction

Mr. Trevor Hughes, Rice Hughes L.L.C.
Moderator

The session explored the processes and mechanisms available to address consequence management planning at a regional level, demonstrated the quality multiplier effects of available information exchange and management tools, and identified opportunities for multilateral and interagency cooperation. The functional exchange of information is required at both an internal agency level, within a single country, and between regional states.

9/11: Multi-level Response and Management

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Deputy Director, Operations, Training and Readiness
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Good afternoon. On behalf of the Adjutant General of New York, Major General Tom McGuire, I would like to express our gratitude for the invitation to participate in this conference. As you can imagine, the 9/11 attack on the World Trade Towers had an enormous impact on the National Guard operations in New York, as well as the state as a whole. What the New York National Guard did in support of New York civil authorities became the largest and longest military support operation ever in the state of New York. What I will to try to do is to give you a glimpse of some of the highlights of what happened.

Despite the initial shock and dismay of the World Trade Center attack, the National Guard response was the result of civil-military planning with other state agencies, coordinated by the State Emergency Management Office (SEMO).

The map of New York shows the locations of New York's National Guard units, both Air and Army Guard. We have sixty-six Army Guard facilities across the state and five Air Guard bases as well (figure 4-1).

In coordination with New York's civil authorities, we have divided the state military forces into six joint task force regions (figure 4-2). These regions parallel the New York State Police and State Emergency Management Office, emergency management regions. A brigade, airbase, or higher-level command commands each joint task force region. The New York City area is in the Region One Response Area. This is commanded by the 53rd Troop Command, which is an Army National Guard troop headquarters, located in Valhalla, New York, just North of New York City. This region was initially in command during the 9/11 response to New York City.

Mission response to civil authorities in New York is controlled as follows: when a disaster happens, local authorities are the first responders

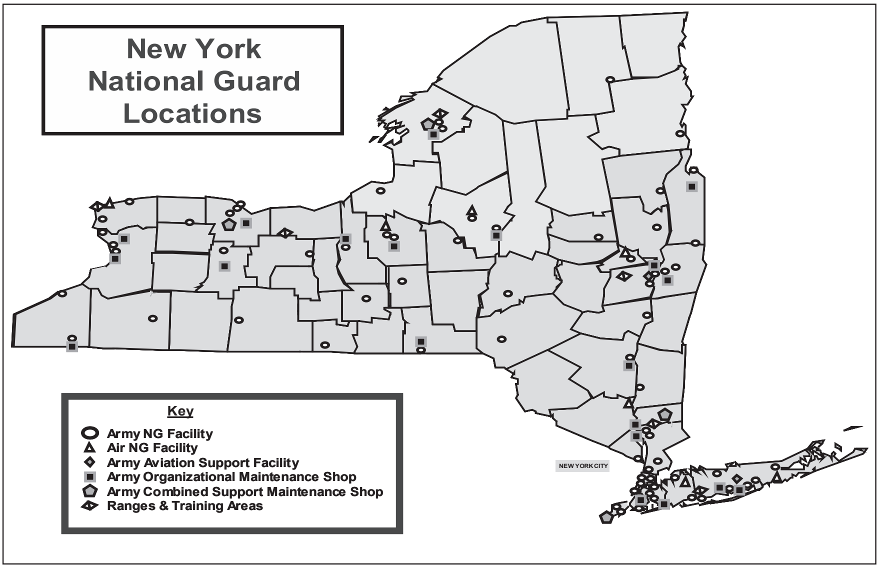

FIGURE 4-1: STATE OF NEW YORK NATIONAL GUARD LOCATIONS

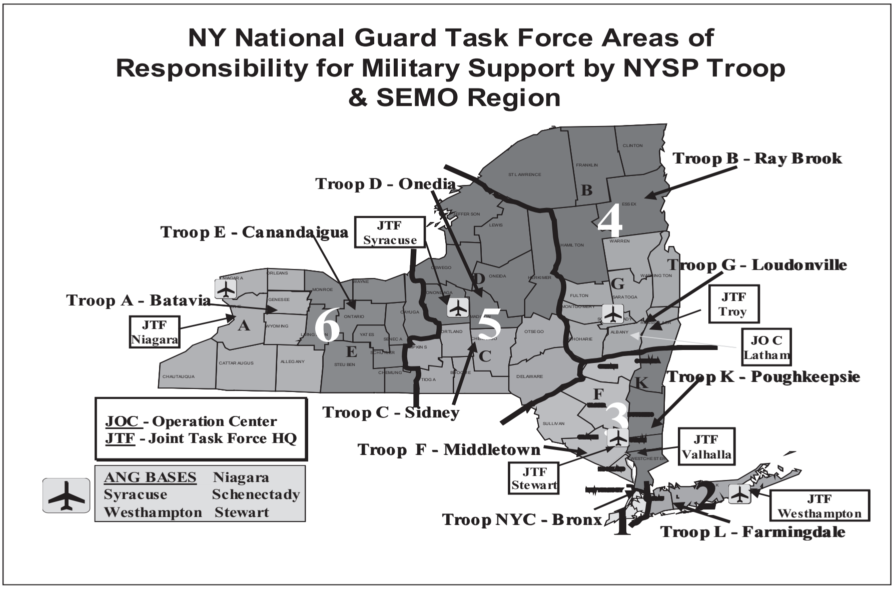

FIGURE 4-2: STATE OF NEW YORK JOINT TASK FORCE REGIONS

(figure 4-3). In the case of 9/11, the local authority was New York City. If additional assistance is needed, the local authorities request support to the next level, normally a county. Because of the immense size of New York City in comparison to counties of the state, their request for assistance went directly from the city straight to the State Emergency Management Office (SEMO). SEMO coordinates the task assignments

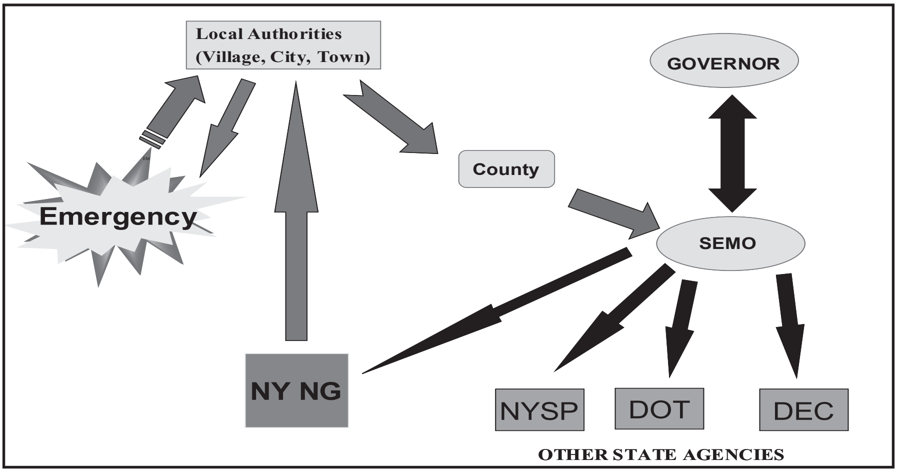

FIGURE 4-3: MISSION ASSIGNMENT AND COORDINATION

of state agencies in response to a disaster, including the National Guard. Once it is decided what the requirements are, then each of the state agencies, including the National Guard, provide their assets in response to the needs of the incident commander at the site, in this case, New York City.

Immediately following the attack, the Adjutant General recalled all National Guard state headquarters staff and stood up the National Guard state headquarters Joint Operations Center. The Deputy Adjutant General, along with key liaison staff, deployed to the State Emergency Management Office to establish liaison with state operations. I cannot begin to tell you how important the roles of liaison officers are in an operation like this with the state agencies. Not only are they important at the state level, but right down to the local level with the forward task forces. In the case of 9/11 this happened automatically, even before the Governor declared the state emergency.

The Governor ordered the Adjutant General to alert all units of the New York National Guard. Within twenty-four hours, the National Guard had responded with 8,000 soldiers and airmen at armories or air bases ready to deploy into the city. In New York, two other military forces were alerted, the Naval Militia and State Guard, which are state-level military organizations that, at the direction of the Adjutant General, also support emergency response and are also controlled by the state headquarters. Force Protection Delta was declared, Stewart Air National Base, Camp Smith, and the Park End Armory directly in New York City were established as staging bases. These tasks were competed even before we had specific missions from SEMO.

Division of Military and Naval Affairs (DMNA) represents the state's headquarters. SEMO is the State Emergency Management Office and is located about five miles from our National Guard state headquarters. In New York City, there were two key locations to coordinate with the civil authorities, the New York Office of Emergency Management (OEM), and the forward command center at the World Trade Center (WTC). The difficulty during this part of the operation was that the New York City Office of Emergency Management was located in the World Trade Towers, and was destroyed when the attack happened. The city had to locate their operations to what was eventually referred to as Pier 92, a pier on the west side of the Manhattan shoreline. In the interim, until New

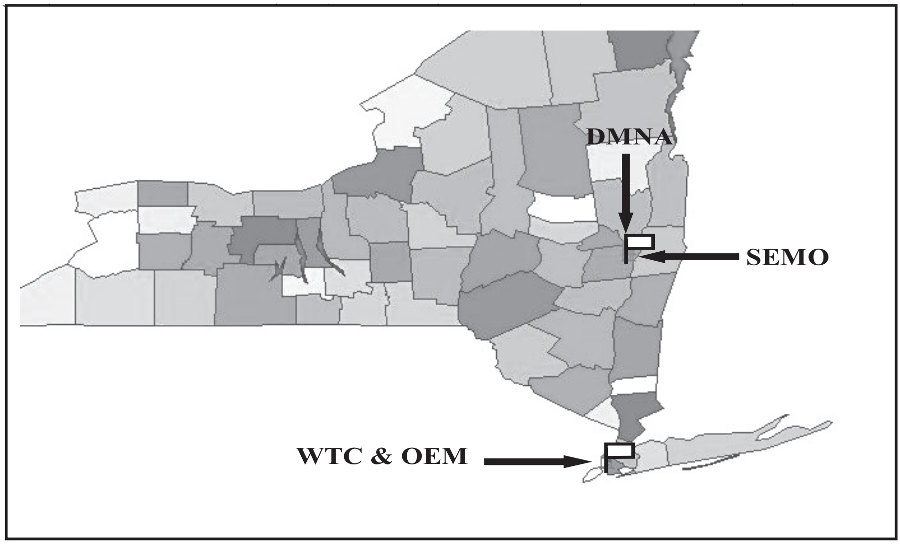

FIGURE 4-4: KEY COMMAND AND CONTROL LOCATIONS

at One Police Plaza served as the command post for emergency operations in the city (figure 4-4).

The initial staging bases were established at Stewart Air Base, Camp Smith—an Army National Guard training facility in New York—and the Park Avenue Armory (figure 4-5). The two staging bases slightly upstate were utilized to house and stage units that were coming from upstate into the city as the mission developed.

The staging base at Stewart Air Base is an example of the cross-agency coordination that happened in the state (figure 4-6). Note the cots that

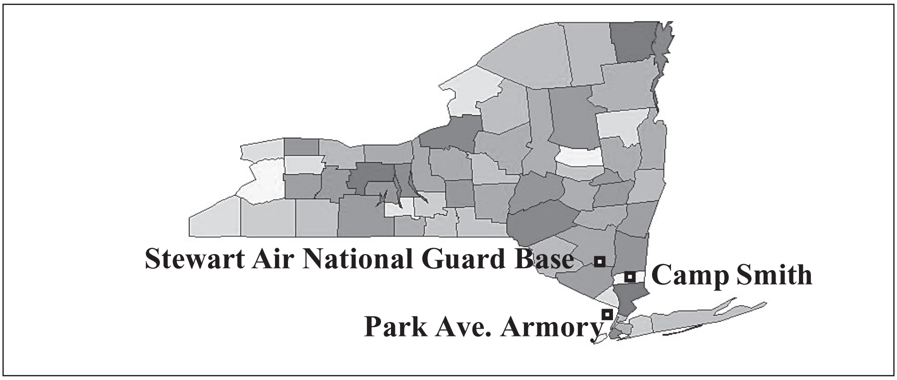

FIGURE 4-5: INITIAL RESPONSE (STAGING BASES)

are in the picture. The National Guard does not have this type of cot in our inventory. These were supplied for soldiers housed at the airbase by the New York State Department of Corrections, the state prison system. This was coordinated at the state level, through liaison coordination accomplished at the State Emergency Management Office.

The initial National Guard response used National Guard units already located in New York City. The 107th Support Group, located at the Park Avenue Armory on Manhattan was tasked with command and control of the forward support base. The units listed in figure 4-7 were the first to respond.

The New York National Guard Headquarters also deployed our Civil Support Teams (CST) into New York City. The team conducted chemical, biological and radiological detection and monitoring. Because of their capabilities with communications assets, the team provided communications to agencies on site, to include the United States Federal Bureau of Investigation (FBI). Due to the fact that all the communications in the immediate area of the World Trade Center was out during the initial

FIGURE 4-6: STEWART AIR BASE, PHOTOGRAPH OF HANGAR

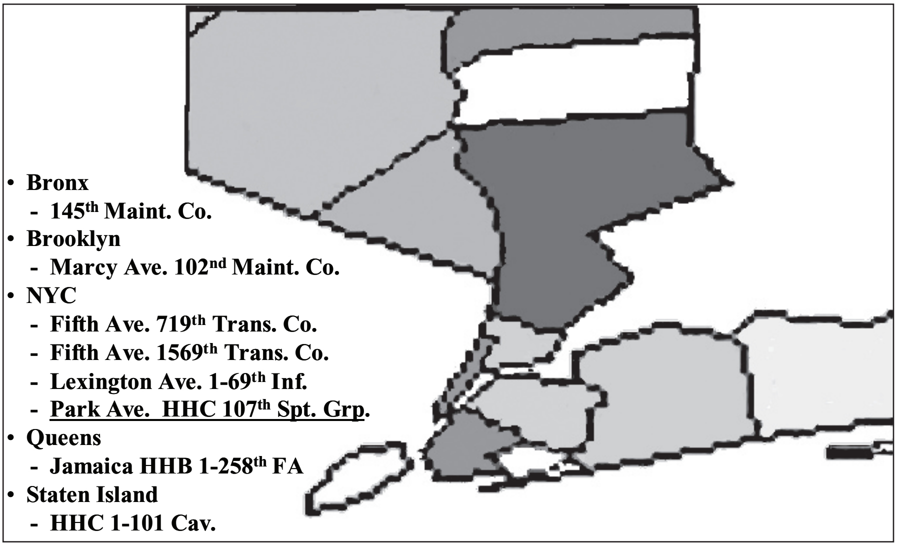

Figure 4-7: Initial New York City First Responders

part of the operation, this support proved invaluable. The New York Air Guard, paralleling the ground operation, provided combat air patrols, air refueling, and tactical airlifts, as part of their federal mission, in addition to their state requirements. Additionally, as we employed the forces in the city, we began deploying units from upstate into the staging bases at Stewart and Camp Smith. These included engineer, military, police and medical units. The 53rd Troop Command was placed in command and control of the overall operation in the city. The first part of the mission during the first day used the troops that were stationed in the city. We employed 1,500 soldiers immediately in New York City and 3,000 within the first twenty-four hours. The objective of the first soldiers and airmen going into the city was to provide a calming effect. The Governor felt that utilizing the National Guard, the visibility of the Guard soldiers in the streets would provide a calming effect to the people in the city. This role for the National Guard turned out to be very successful in that process.

Communications became a very significant issue in the mission. We pushed forward the Air Guard's 274th Air Support Operations Squadron communications teams, located at Stewart Air Base. Also, a large amount of communication assets at the state headquarters used during state emergencies, from cell phones to handheld radios, were deployed into the city to be used with the forces that were already deployed to support their communications needs. A counter-drug team in New York State was used to enhance security outside the New York City limits. They already had an existing working relationship with the U.S. Customs Department and were deployed on the state borders to help with border crossing and traffic control at all border crossing sites, not only on the border of New York, but in the city itself, for example, JFK International Airport.

Liaison teams were a major part of this operation. From the state headquarters we controlled the forward movement of liaison teams out of the state headquarters, directly into the Office of Emergency Management, and the forward site at the World Trade Center from Latham (figure 4-8). Liaison Officers were used to coordinate the state-level responses. In addition, direct liaisons were provided from the task force in the city for the direct work to be done between the supported agencies and the National Guard support on site. Initial missions and tasks identified were security, debris removal, logistics, and our own sustainment and mission support. A stand-by security force, the 27th Infantry Brigade was established at Syracuse, New York, in the event of any follow-on requirements. At this point in the operation, nobody had any idea if the attack on the World Trade Towers was it, or if another attack would follow.

All five New York air bases supplied civil engineering support for the sustainment of deployed forces at troop locations (figure 4-9). All bases

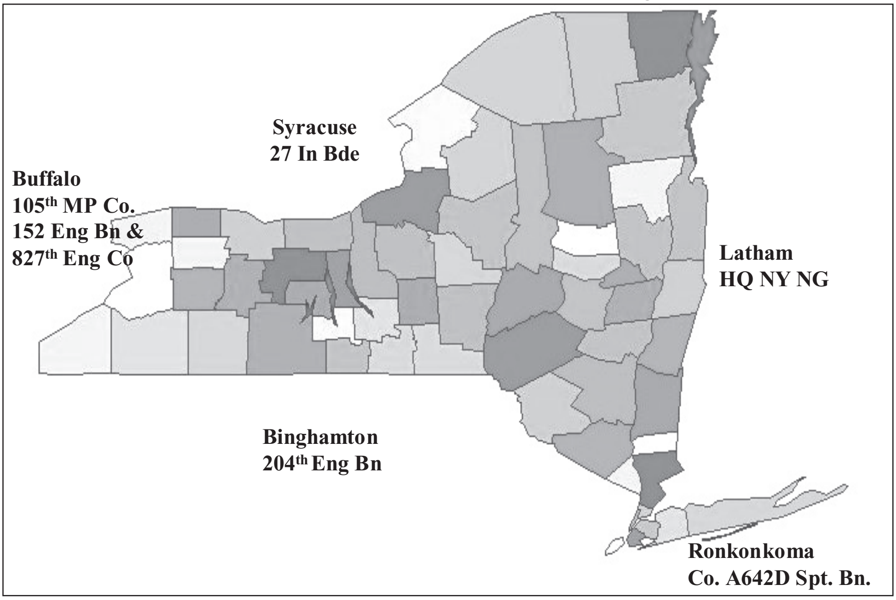

FIGURE 4-8: INITIAL NEW YORK STATE RESPONDERS

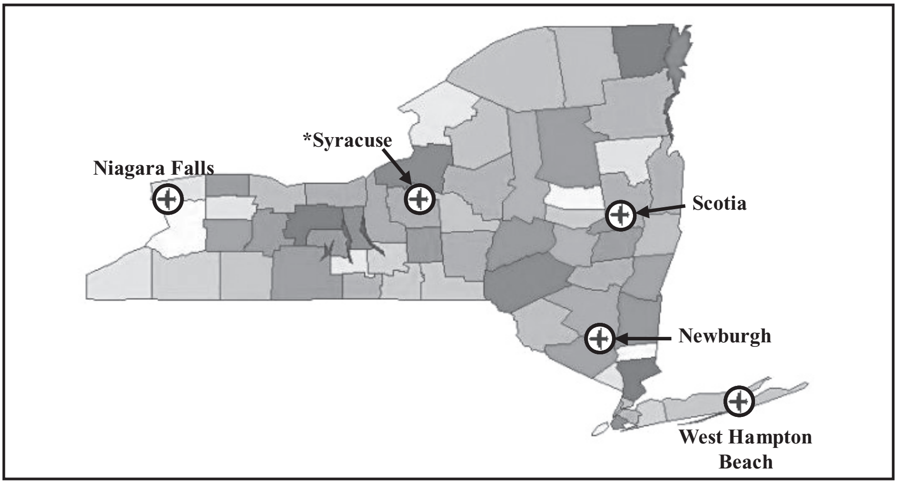

Figure 4-9: Initial New York State Responders (Air Bases)

performed federal mission responses as well. The 174th Fighter Tactical Wing (F-16) was among the units providing tactical air coverage over New York City and over various other northeast cities in the United States.

Figure 4-10 indicates the primary troop locations, as we staged them and moved them into the city. The last three, Randall's Island, Governor's Island and Battery Park, were the focus of the Air Guard Civil Engineer unit's support. Force protection levels impacted our choice for primary troop locations; these locations were used because they provided adequate security. We could not move soldiers and airmen into New York City and set them up in hotels. There was no effective way we could provide security for them at the force protection Delta level.

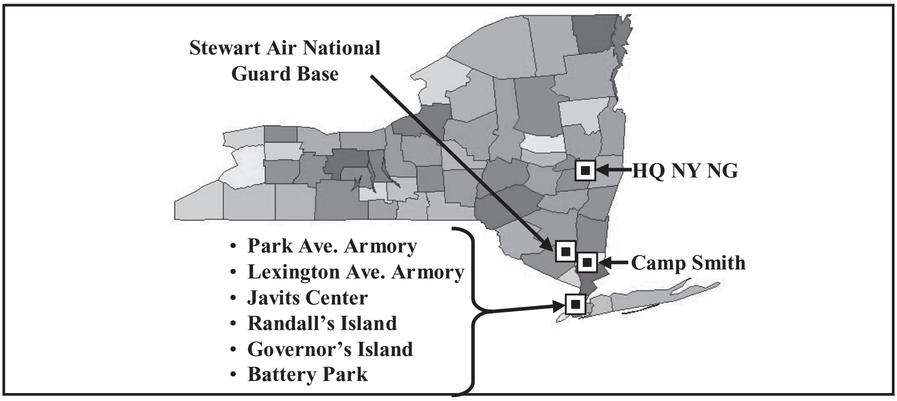

Figure 4-10: Primary Troop Locations

The immediate missions assigned included site security at ground zero and escort. What I mean by escort is, as the area was cleared of debris, family members needed to get back in, during the first couple of weeks of the operation, and retrieve personal belongings, take care of pets, and a number of similar needs, so we were tasked with the mission of escorting these people inside the controlled areas, taking them to their homes and bringing them back out. Relief donations became a big impact. The amount of donations that came into the city, even items that were not needed, was just overwhelming. We worked with several local agencies, including the American Red Cross and Salvation Army to establish storage areas, haul these supplies to the storage areas, and set up a process of accounting for all the donations coming in. As I mentioned before, the calming presence was among the focal points of why the Guard was down there. Public appreciation was overwhelming towards National Guard soldiers. One of our other missions, near the World Trade Center (WTC), was to assist a major United States Postal Service distribution center. The National Guard helped the Postal Service move the operation from the damaged location to another U.S. Post Office nearby. Force sustainment and civil engineering support were constant both for us and the support to the actual operation.

As time passed, follow-on missions developed. A large number of visitors were coming into the city, so a protocol cell was established to escort visitors throughout the city, including visits from the President of the United States and several other government agencies and military visitors. Military and police support in New York City expanded beyond the immediate area. The National Guard began working pedestrian foot patrols and traffic control areas around the larger site access control area, which included the southern half of Manhattan Island. As an access control plan was developed, the Air Guard was tasked with setting up the credentialing process so that everybody in and out, could be identified and access controlled. Because the WTC site was legally considered a crime scene, it had to be treated as a crime scene, our engineers were involved in tagging and removing of debris, and establishing the debris as it left the site as potential evidence. After the New York City Emergency Management Office was set up and moved to Pier 92, we were tasked with providing security for that site.

As time went on, the missions continued to further develop and other mission support tasks came into play, missions beyond just the WTC site. The Governor tasked the National Guard with additional missions, requiring the use of the 27th Brigade Task Force, which was placed in reserve at Syracuse, New York. The 27th Brigade was tasked to provide airport security as the mission requirement began in New York State in early October. The Brigade was tasked to protect the four nuclear power plant sites in the State of New York. Mission sites in New York City expanded to cover all of the tunnels, rail stations, and bridges in the city. The Civil Support Teams continued to provide site assistance, monitor air quality at the World Trade Center site, and when the anthrax attacks occurred, the team assisted Wadworth's Laboratory in New York by conducting tests on various letters and types of mail that had to be delivered that had potentially been contaminated with anthrax. As time passed, the need for Crisis Incidents Stress Management Counseling (CISM) and medical support for soldiers increased. The soldiers on duty in the city were seeing some of the most extreme cases of human disaster that you can imagine. As soldiers pulled debris from the ruins of the World Trade Center, body parts were found. We were concerned for our soldier's ability to deal with the stress of this situation. CISM teams were brought in to assist and to ensure that each soldier's needs were adequately taken care of. The burials of many of the firemen and policemen who were lost and several of the civilians who worked in the World Trade Center became a major issue. We provided Military Honor Guard details to support the burial services.

Additional missions New York received as a result of federal mobilization, that were going on at the same time in support of Operation NOBLE EAGLE included, providing security at the U.S. Military Academy at West Point, security at Fort Drum, northern New York border security, and enhanced security for U.S. Customs. The installation security missions are continuing today with the continuation of NOBLE EAGLE II mobilizations.

We provided security for 19 airports in New York City and additional locations throughout the state with about 380 soldiers (figure 4-11).

The protection of the State's nuclear reactors was a significant mission and is still going on today. Figure 4-12 is a map that shows the locations

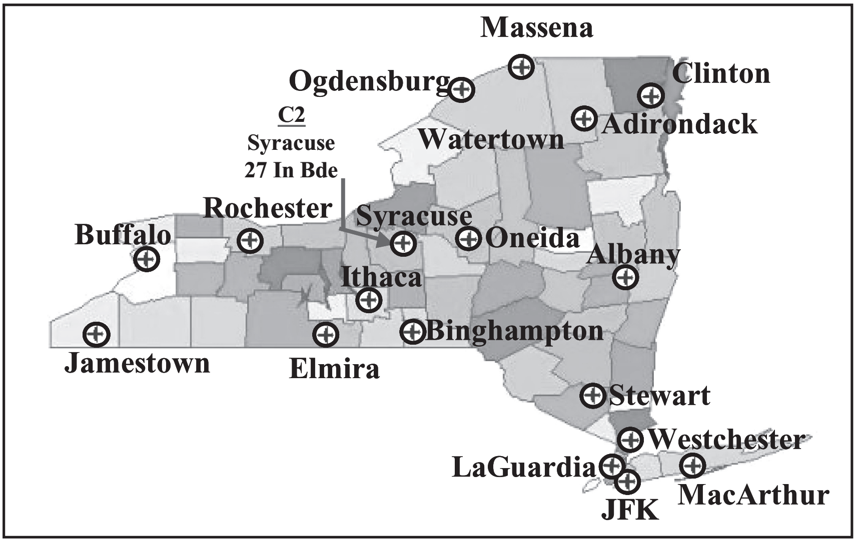

FIGURE 4-11: NEW YORK NATIONAL GUARD AIRPORT SECURITY SITES

of the nuclear reactors we are protecting. The Indian Point Nuclear Plant, which is close to New York City, is a major concern.

As a result of the 9/11 coordination, New York State signed into law, the Emergency Management Assistance Compact (EMAC), which the State did not have prior to this event. EMAC allows direct coordination with other states to bring in additional assets and provide for reimbursement from state to state. One of the things we utilized

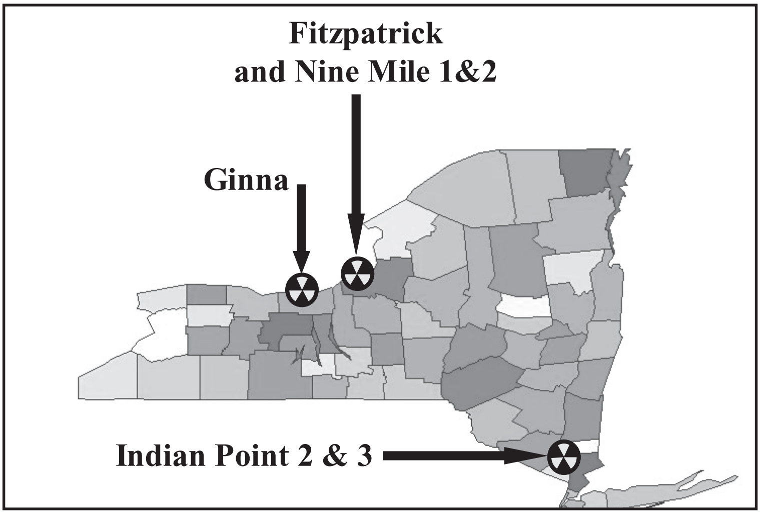

FIGURE 4-12: NEW YORK NATIONAL GUARD NUCLEAR REACTOR SECURITY SITES

EMAC for was the CISM counselors. After using available State resources, the State requested additional support from two neighboring states, Pennsylvania and Rhode Island, to bring in additional CISM counselors from their Air Guard units.

Some of the key lessons learned are as follows:

a. Clear, concise, and current domestic standing emergency operating procedures. At the time the operation started we were revising and redrafting our domestic emergency response plan in the state. The emergency response plan ties together with planning and rehearsing interagency operations. Since we had just rewritten the plan, we had not had the opportunity to rehearse it. But, without the draft, it would have been impossible to operate and keep everybody on the same sheet of music.

b. Requirement for written operations orders. When the operation began, things were very fast-paced, and most of the staff were traveling and not at the headquarters building. In the interim, until we got things rolling, a lot of verbal instructions were provided. This is not a good way to do business. We managed to get through this initial phase and began the process of written operations orders and continued on. It is important to note, even in the beginning, instructions should go out to the field in writing. I mentioned that we identified logistical staging bases early. This is something we did, and we did it well. It was placed in the lessons learned as something to remember to do again the next time.

c. As previously noted, communication assets were pushed forward in the beginning. Very important. It was totally impossible to communicate with OEM when this operation started. Without the use of the 274th Air Support Operations Squadron and the communications assets provided from the state headquarters, we would not have been able to talk with our forward forces in effective time frames. Another key point is the need for an adequate support staff. Often in a crisis, there is total focus on the response without consideration for the peripheral requirements. Staff personnel such as Chaplains are important from the beginning and should be included in mission planning from the start.

d. Lastly, the joint operations center is the centerpiece. It is very important, at all levels, whether it is at the state headquarters level, or at the operation center at the tactical level or in conjunction with the civil authorities, that information flow through one common control point, it is crucial to keeping everybody coordinated so that everyone is on the same sheet of music. Without that, you are going to increase the "fog of war" and you will not be able to clearly understand what everyone else and other agencies are doing.

Application of Remote Sensing to Environmental Hazard Mitigation

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United States Geological Survey

It is a great pleasure to have this opportunity to talk about the applications of remote sensing to environmental hazard mitigation. At the onset, I would like to comment that one usually think of disasters as a short-term and rapid event such as an earthquake, volcanic eruption, or fire. However, many disasters are, in fact, events that develop over a protracted period of time. Some examples might include the contamination of critical groundwater resources so that vital water supplies are no longer available, land subsidence that damages critical infrastructure, or land degradation that changes the ecosystem or agricultural productivity of regions. This presentation will discuss both short- and long-term hazards. It will also focus on remote sensing using satellite imagery but it will also provide some examples of the use of other remote sensing tools.

It is also important to stress that this contribution presents a United States Geological Survey (USGS) perspective on the subject of environmental hazard mitigation. The USGS is part of the United State's Department of the Interior, a ministerial-level organization that has four main organizational units. The first of these is concerned with wildlife management and National Parks; the second is the Bureau of Indian Affairs and is concerned with the needs of indigenous peoples; the third administers public lands and the leasing of mineral and energy resources; the fourth organizational group is focused on water and science issues and is the group that contains the USGS.

The USGS is primarily a scientific agency that is designed to support U.S. land management activities. It works in four main areas:

1. Geology—including research on energy and mineral resources, environmental studies, and hazard mitigation efforts

2. Mapping—including the making of maps, working with satellite images, and the development of Geographic Information Systems (GIS)

3. Water—including work on both ground and surface water resources and water quality

4. Biology—including efforts to understand invasive and endanger species.

As an agency, the USGS primarily uses unclassified data in its scientific studies and is committed to making its scientific findings as publicly and widely available as possible.

With those introductory comments, I will now turn to the subject of remote sensing. To begin, I would like to consider the use of satellite imagery. It is important to state that, because there are so many different types of satellites, it will not be possible to discuss all of the available systems. Rather, the focus will be on the satellite systems that the USGS uses the most.

Not all satellites are created equal and the differences in their spatial and spectral resolution greatly control how satellite imagery can be used. The concept of spatial resolution is fairly straightforward and is illustrated in figure 4-13. Some systems, for example, have a spatial resolution of about .5 meters. Their images clearly show individual trees and houses. Images from systems that have a 10 m resolution show many of the same features, but individual trees, for example, can no longer be seen even though houses are more or less identifiable. In contrast, none of these features can be recognized on images from satellites with a resolution of 80 m.

In the same way, satellites also have spectral resolution. The human eye sees only a very narrow part of the electromagnetic spectrum. The spectrum extends beyond that visible to humans to the longer wavelengths

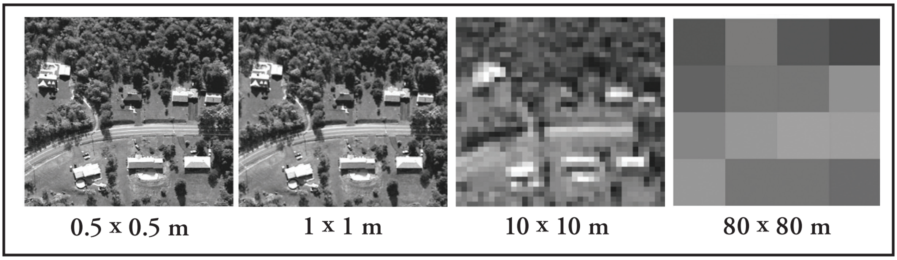

FIGURE 4-13: SPATIAL RESOLUTION

of the infrared and radar and to the shorter wavelengths of the ultraviolet. Most satellites can look at a large part of this spectrum, but not all satellites can see these parts of the spectra with the same resolution.

As figure 4-14 shows, multispectral satellite systems typically sample the electromagnetic spectrum with relatively few bands or channels, and often these channels are often quite broad. The Landsat satellite provides a specific example where the 4 main bands of the Landsat satellite are relatively broad and thus lack detailed resolution. In contrast hyperspectral systems sample the same part of the electromagnetic spectrum with many high-resolution bands. In general, the higher the spectral resolution, the better one can discriminate features on the ground. Hyperspectral systems will be discussed later.

I would now like to cover examples of how satellites may be used. In general, I will discuss the most straightforward uses of remote sensing first before treating more complicated remote sensing applications.

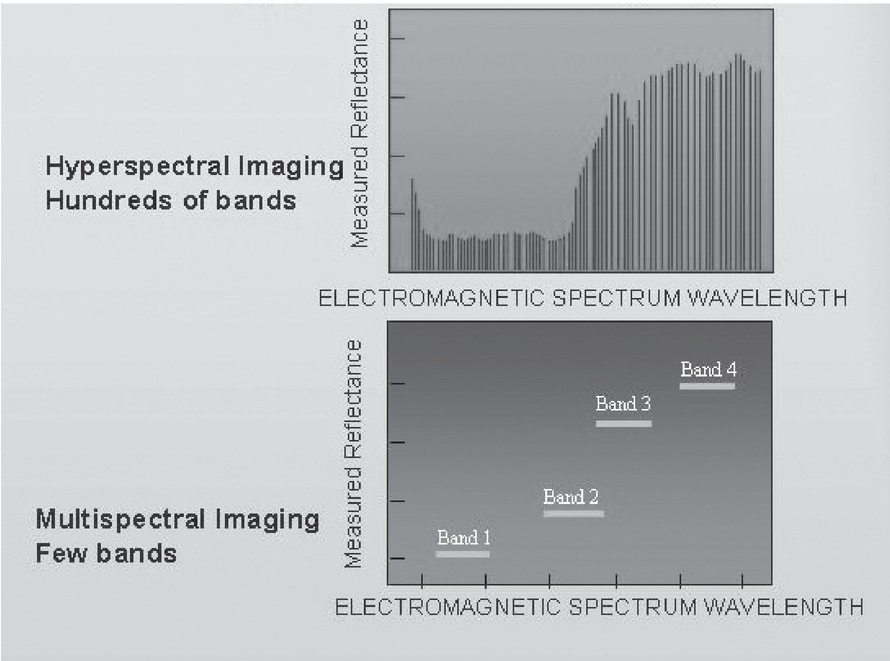

FIGURE 4-14: ELECTROMAGNETIC SPECTRUM—HYPERSPECTRAL AND MULTISPECTRAL IMAGING

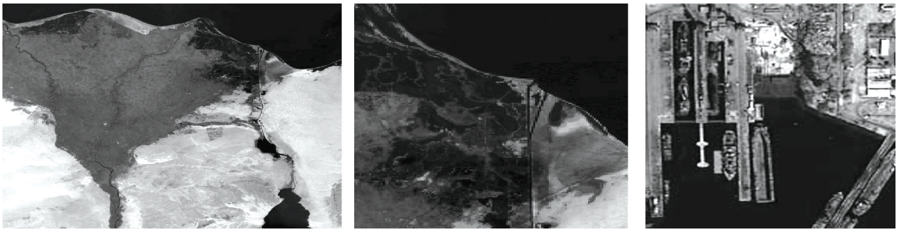

FIGURE 4-15: SATELLITE IMAGE OF THE NILE DELTA

The first and foremost application of remote sensing imagery is to put a situation in its regional context. Figure 4-15 shows an example in which a satellite can provide an image of the entire Nile Delta. With more detailed imagery, one may zoom in on any part of the delta that might be of interest. With some systems, it is even possible to view specific areas with meter-scale resolution. This ability to view features at meter-scale detail exists with a number of different satellite systems, including those providing commercial imagery.

One of the most commons systems used by the USGS is the Advanced Very High Resolution Radiometer (AVHRR) system. This system has a very coarse special resolution—about 1 km and very low spectral resolution. It has only 5 channels. However, it provides daily coverage of the entire global and thus is extremely useful in continuously monitoring large features. For example, this satellite is commonly used to monitor weather systems. Figure 4-16 shows the AVHRR satellite is being used to track a large hurricane that is impacting Central America. Using images of this type, disaster managers are able to accurately track such storms, see where the storm is most intense, and determine what areas are being most adversely affected. This information can be immediately used to direct disaster response.

The AVHRR system is also used by the USGS to monitor volcanic eruptions. In 1989, Royal Dutch Airlines (KLM) flight 867 flew into the volcanic ash plume caused by the eruption of the Redoubt volcano in Alaska, USA. The ash was sucked into the jet engines and caused them to fail. The plane fell over three kilometers before the pilots were able to restart 2 engines and save the aircraft. As a result, the USGS was asked to begin a volcano-monitoring program that would identify erupting volcanoes. Currently, the USGS has a center devoted to monitoring the

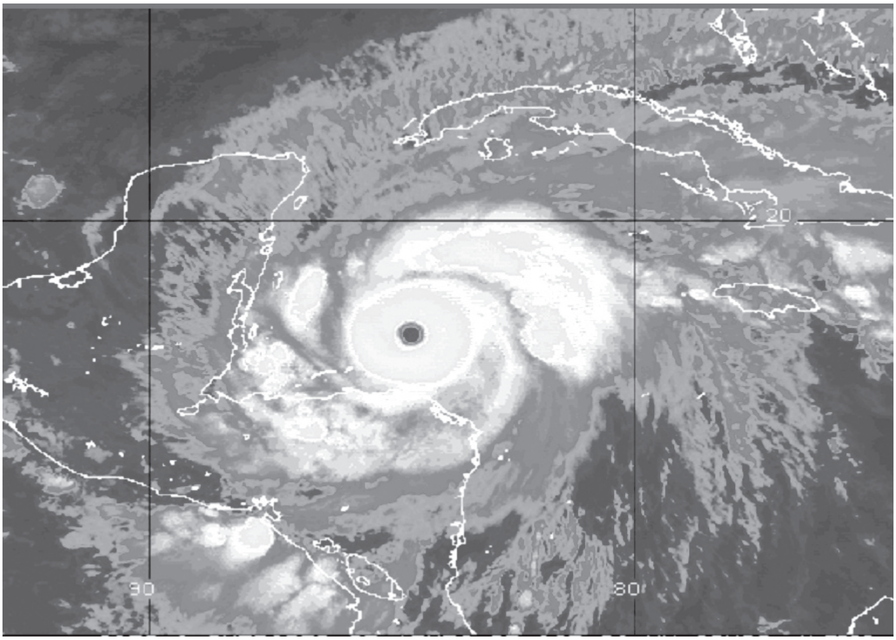

FIGURE 4-16: AVHRR IMAGE OF HURRICANE APPROACHING CENTRAL AMERICA

location of ash plumes and then provide warnings to aircrafts so that they can avoid areas where volcanic ash might be present.

AVHRR also provides imagery from its infrared bands and these can be used to look for and locate wildfire. During this past summer, many large wildfires burned in the western United States. Fire response managers used thermal images to identify the most serious fires which, in turn, helped them better allocate the available resources to fight these fires.

The Landsat satellite is another system widely used by the USGS. In fact, the USGS owns and operates the Landsat system. Various Landsat satellites have been flying for over 30 years. Landsat has a much better spatial resolution than the AVHRR satellite. Most bands have a spatial resolution of about 30 m, but Landsat is still a multispectral system that has relatively poor spectral resolution.

Landsat is commonly used to monitor changes on the land surface. For example, the USGS is part of a team that is trying to control the spread of water hyacinth that has invaded parts of Lake Victoria and has damaged important fisheries. In this case, Landsat is used to monitor the distribution of this invasive species and assess the effectiveness of remediation efforts. Further, because Landsat has been flying for so long, it is also possible to use it to look at land use changes over more than twenty-five years. As an example, Landsat images have been used to show the change in Mesopotamian marshlands. Images from 1973 show that wetlands extended over large parts of eastern Iraq and parts of Iran. However, images from 2000 show that most of these wetlands have now disappeared.

So far, the examples cited have basically shown how satellite imagery can be used as pictures. These pictures, however, can have an even greater use if they are converted to maps and used as part of a geographic information system (GIS). The conversion from a picture to a map is done by registering each pixel of the satellite image to a specific point on the ground.

An example of how addition of imagery to a geographic information system can be used in disaster planning is shown by some recent work in Central America associated with Hurricane Mitch. In 1998, a large and powerful hurricane devastated much of Central America. Subsequently, the USGS and other agencies worked to develop a GIS that could help mitigate similar devastation in the future. One of the first steps was to use imagery to locate critical infrastructure and to put this information into a GIS. Also added to this GIS was a detailed digital elevation model of the region. With this information, it is possible to model which critical infrastructure will be flooded under different weather conditions. Figure 4-17 shows some of the results of this modeling. A result of this GIS system is that planners are now able to predict the impacts of flooding before it occurs which, in turn, gives them the ability to plan how to mitigate the impact before a crisis is upon them.

The Famine Early Warning System (FEWS) provides a second and more complicated example of the use of GIS and satellite imagery in disaster planning (figure 4-18). FEWS is a multi-agency undertaking in which the USGS is partnered with United States Agency for International Development (USAID), National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA) to use several different satellites, computerized meteorological forecasts, normalized difference vegetation index (NDVI),

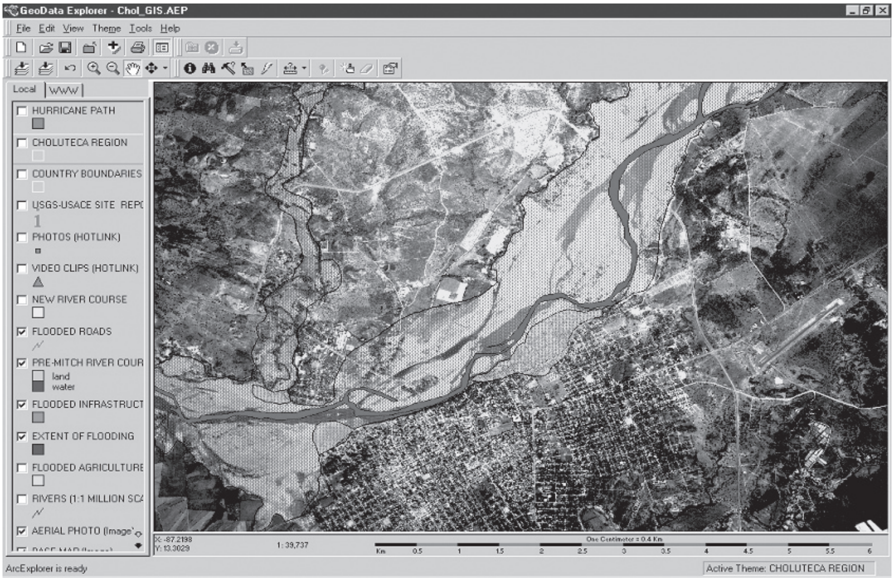

FIGURE 4-17: CRITICAL INFRASTRUCTURE EFFECTS MODEL

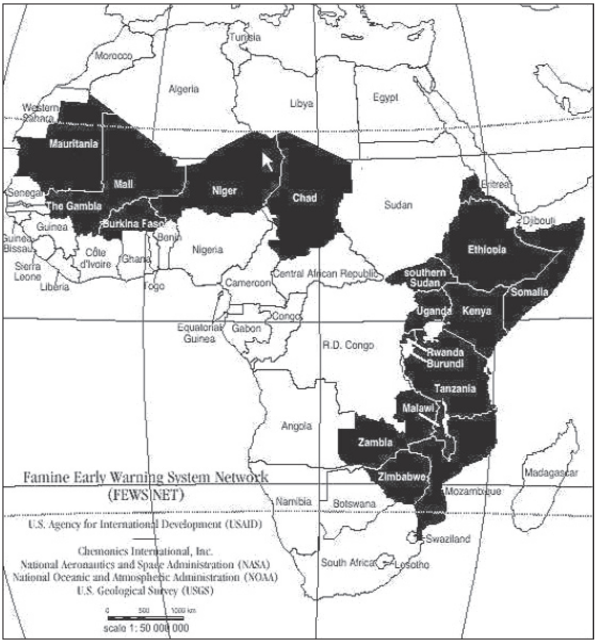

FIGURE 4-18: FAMINE EARLY WARNING SYSTEM (FEWS)

greenness index, and on-the-ground-monitoring to look at the health of crops over much of Africa. The system has the ability to identify areas where rainfall is below normal and where crop failures are likely to occur. The system is used to issue warning about potential famine and is used to focus assistance efforts on the areas that have the greatest need for food. The FEWS effort is a large one that involves the partnership of 17 African countries. One of the important themes that should be stressed by this work is that regional cooperation is often very important when trying to work with regional environmental hazards. In this case, FEWS would not be possible without the partnership of these countries.

So far, this discussion has focused only on multispectral satellites. However, some of the newer hyperspectral remote sensing systems provide much greater spectral resolution. One of these is the Aster system. Aster has a 30 m spatial resolution and 14 channels. Landsat, in contrast, has a 30 m spatial resolution and 7 channels. A result of this increased spectral resolution is an increased ability to distinguish features on the ground. In biological studies, for example, Landsat images have been shown to be able to distinguish soft woods from hard woods from grasslands. However, an Aster analysis of the same area can distinguish individual species of plants. For example, red oaks can be distinguished from maples, or from spruce. This increased discrimination is used for the environmental monitoring of various types of invasive species.

The same type of hyperspectral capability can be used to map different types of minerals on the earth surface. This type of minerals mapping is extremely useful in the geological prospecting for some types of gold deposits. It can also be used in hazard mitigation. As an example, some volcanoes in the western part of the United States have large areas of highly altered rock. These rocks have very little strength, and where they occur on steep slopes, they may shear and cause landslides. These altered rocks, however, can be relatively easily mapped by some hyperspectral systems and these systems are used to make hazards map which identifies areas where landslides are likely. These maps, in turn, are used to help protect large urban areas down slope from these possible landslide areas.

Earthquake hazards provide a good example to make the point that not all remote sensing involves satellites and imagery. The map in figure 4-19 is part of a recently published global seismic hazards map, and it

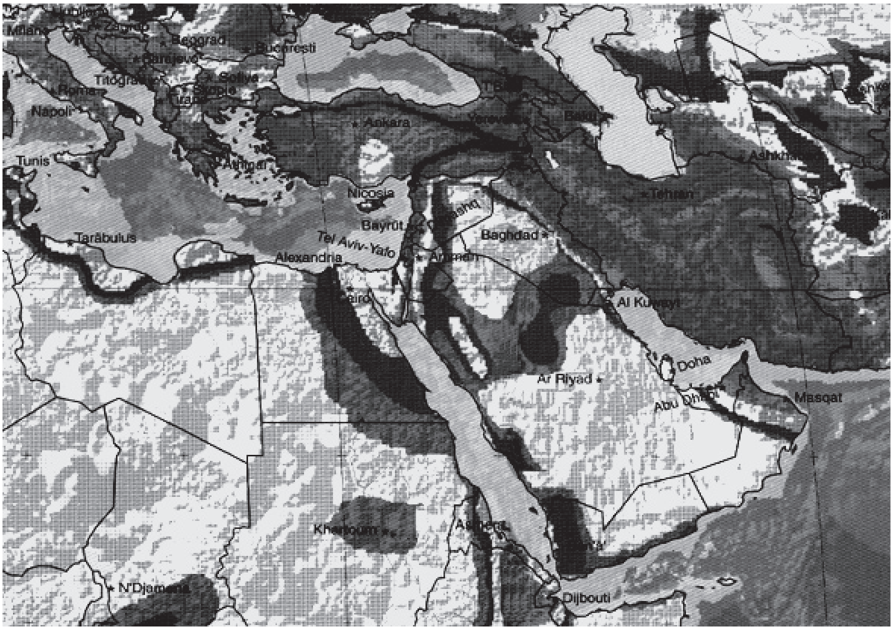

FIGURE 4-19: ARABIAN GULF–EARTHQUAKE RISK AREAS

shows that the eastern part of the Gulf region (the darkest shaded areas) is at substantial risk for large damaging earthquakes. In fact, Tehran is probably one of the most at-risk cities in the world for earthquake damage. In contrast, the western Gulf generally appears to be at relatively low risk for earthquakes, but there was a magnitude 5.1 seismic event in the United Arab Emirates (UAE) in March of 2002. Further, it is very possible that large seismic event along the eastern margin of the Gulf may cause substantial damage to infrastructure along the western margin. What role does remote sensing have for earthquakes?

The principal remote sensing tool is not a satellite, but a seismometer. This is an instrument that is placed in the ground and which, by itself, can give information on the intensity of seismic events and the frequency of the seismic waves. When integrated into a larger network, these seismometers can also be used to triangulate on and locate earthquakes. Good information about the frequency and intensity of earthquake events and the precise locations of earthquakes are necessary to accurately evaluate the seismic risk. For this reason, regional cooperation is important.

For more than ten years, the USGS has cooperated with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) to promote regional cooperation for seismic hazard mitigation in the Middle East region. This large undertaking has involved the cooperative work of more than twenty countries. This effort focuses on two issues. The first is better data exchange and calibration so that the frequency, intensity, and location of seismic events can be better determined. The second focus is on the methods that can be implemented to mitigate these hazards. Once again, it is important to restate that confronting regional hazards of this type is best accomplished through programs that promote regional cooperation.

There are, however, some satellite systems that can be used to work on earthquake hazards. The principal tool is radar interferometry. With this system, a radar satellite locates the precise position of a point on the earth's surface during an initial pass. At a later time, perhaps after an earthquake, it relocates that same point. Computers are used to make a comparison of the two locations and to measure changes in position that may only be a few centimeters large. Mapping these changes allows one to monitor movements that may be caused by land subsidence, volcanic eruptions, or earthquakes.

An example of this type of mapping is shown figure 4-20, which shows an area that has just experienced an earthquake. The earthquake was localized along the geologic faults shown in white. The shaded bands show the displacement along the faults. Shaded bands that are close together indicate areas of large displacements, while broader bands show areas of relatively little change. Thus, one can easily identify areas where the largest displacements have occurred and where damage has probably been greatest. One can also identify the zones between large displacements and relatively little movement. These are often the areas where after shocks are focused. Knowing the location of these zones thus can be useful to minimize subsequent damage from aftershocks. These interferometric maps, therefore, provide a tool both to understand how and why damage has occurred, how damage can be mitigated in the future, and what areas may be at risk for future seismic event.

Interferometry can also be used to monitor other types of land movements. Studies around the U.S. city of Los Angeles shows areas of

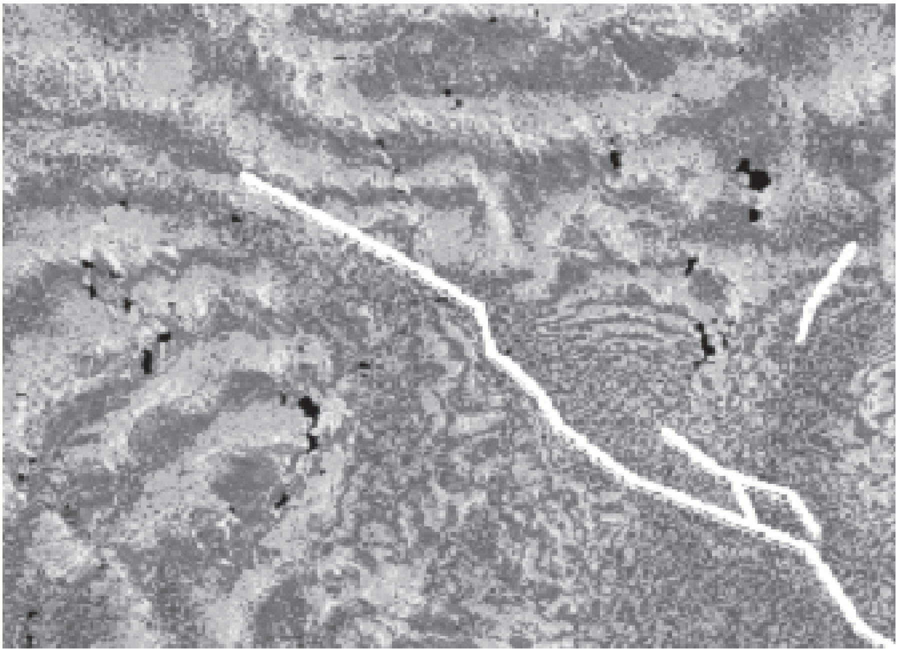

FIGURE 4-20: EARTHQUAKE DISPLACEMENT INTERFEROMETRIC MAP

substantial land subsidence due to the withdrawal of hydrocarbons and as a result of the withdrawal of ground water. Subsidence of this kind can threaten critical infrastructure; interferometry provides a useful tool for monitoring subsidence and for planning how to avoid subsidence-related losses.

A final use of radar imagery is to locate and monitor oil spills. The difference in reflectivity between oil and seawater enables oil slicks to be located with radar. A number of countries are using this tool to locate and track oil spills and to anticipate their impact on sensitive coastal areas. For example, monitoring these spills may be extremely useful in protecting the integrity of desalinization plants that.

The final topic that will be discussed is the use of remote sensing tools in groundwater development and protection. Like many parts of the world, groundwater is important for people living in the arid parts of the southwestern United States. Around the city of Albuquerque, New Mexico, groundwater is taken from unconsolidated sands that fill a basin made by hard rocks. Airborne magnetic data have been used to make a detailed map of this basin. On this type of map, one can see not only the shape of the basin, but also the location of sub-basins and geologic faults that cut the basin. Additional mapping with airborne electromagnetic systems allow one to measure the grain size of sands that fill the basin and how they change throughout the basin. In turn, grain size greatly effects the distribution of water within the basin. When combined with the airborne magnetic data, these remote sensing surveys provide extremely important information about where the water is located, how much water is present, and they help in the making of models of how that water can be withdrawn in a way that does not destroy the water resource.

Finally, the USGS is using airborne electromagnetics to protect critical freshwater resources in some coastal areas. Withdrawal of freshwater in coastal areas can cause saltwater to move towards the land with the result that freshwater wells may become salty and ultimately unusable. The contact between salt and freshwater can be mapped with the airborne electromagnetic system. In Florida, for example, the saltwater contact can be very accurately located and monitored and, in this way, freshwater pumping can be controlled so that saltwater intrusion does not threaten freshwater supplies.

In summary, remote sensing can be a vital tool for environmental disaster monitoring, disaster response, and disaster mitigation. First, satellite imagery provides the context in which to view a disaster. Additionally, when used as part of a geographic information system, satellite imagery can be part of a powerful analytical tool to predict disasters and to monitor disaster response. This presentation has also attempted to show how remote sensing can be used to mitigate a variety of different types of hazards which include flooding, volcanoes, landslides, earthquakes, ground subsidence, and the destruction of groundwater resources. Finally, it is important to once again stress that regional cooperation can greatly increase the effectiveness of efforts to monitor and mitigate environmental problems that have a regional extent.

Information Exchange and Management Tools: Partnership for Peace Information Management System (PIMS) and Defense Environmental Network Information Exchange (DENIX)

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Good afternoon. The main issue that I want to address is how to keep up-to-date on environmental, safety, and occupational health issues (ESOH), using information exchange tools. My primary goal is to demonstrate a very successful information exchange system that is currently used within the U.S. Department of Defense (DOD). I will cover several areas: what is an environmental, safety, and occupational health information exchange tool? Why use one? What are the information areas, as well as capabilities? Afterward, I will proceed to the demonstration.

What is an ESOH information exchange tool? Currently, it is a worldwide web site that serves as a central communications platform, that facilitates the exchange of information and the dissemination of information between the U.S. Department of Defense, federal and state agencies, international governments, and the general public. It includes valuable information resources and a customized communication capability that facilitates collaborative development.

Why use information exchange tools? The number one reason is to share information—to share lessons learned and to exchange information. Other relative points are to increase your effectiveness—the tool provides access to information at your desktop—to reduce costs, to eliminate redundancy, to centralize data, to stay current with news and events, and to access the latest information. It also provides the mechanism for you to interact with ESOH professionals: a platform for asking questions and for disseminating information, reports, and so on. The tool also allows users to customize working group areas that facilitate continued collaboration after meetings, such as this one, have taken place.

Among the more valuable information resources are newspapers and publications. These are provided in a central location. A few of the subject area pages are soil conservation, hazardous substances, occupation safety and health issues—which we've heard all about today—pollution prevention, waste, and water. Also, provided are policy indexes across all services. For example, DOD directives and instructions, Army, Navy, Air Force regulations, as well as federal legislations and regulations, public laws, etc. All this information is available electronically. A few items are custom capability tools, for example, the first items are work groups and conference support mechanisms. This capability allows you to post meeting minutes, agendas in advance, briefings, and proceedings from events such as this. This tool allows you to share this information with your colleagues. A key point is the discussion forums on various ESOH topics. Again this allows you to communicate worldwide with other professionals on a particular topic.

I would like to talk about information exchange, information resources, and a system that facilitates the exchange of that information amongst our colleagues worldwide. That system is called Partnership for Peace Information Management System (PIMS). I will explain what PIMS is and focus on the information areas and capabilities that are available though PIMS.

PIMS is a system designed to store, manipulate, and disseminate all types of data applicable to the Partnership for Peace (PFP) community within a dedicated, secure intranet. PIMS facilitates the collaborative development and sharing of information among participants day to day as well as through Information Technology support for conferences, workshops, and exercises.

The PIMS mission is primarily to strengthen U.S. partner relations and the Partnership for Peace program through a cooperative development effort employing dedicated communications and information technologies that establish a common infrastructure supporting both collective cost avoidance and inoperability.

PIMS has over 4,600 account holders in fifty-seven countries. Seventeen Partner Nations have been loaned PIMS equipment, (satellite terminal, server, and personal computers) providing communications among ministries, military headquarters, defense academies, and military hospitals. We also have eight partner nations who provide their own equipment.

For example, in the U.S. Central Command Area of Responsibility (AOR), there are four Central Asian partners with loaned PIMS equipment installed: three have local hires assigned. Systems in Armenia, Azerbaijan, and Tajikistan were installed in June 2002.

PIMS is primarily an infrastructure established in each of your countries to facilitate communication and the exchange of information. However, I would like to focus on the information that is available on the system.

The actual PIMS website is www.pims.org. PIMS is a password-protected system. This allows partners to conduct collaborative development and talk to each other without worrying about the general public coming into that system. Presentations, information, conferences, and exercise information are available on this site.

PIMS facilitates the twenty-three Partnership for Peace areas of cooperation. They include civil emergency planning, crisis management, medical, and military geography among others. The Department of Defense has added several additional areas to the twenty-three NATO/PFP topic areas. One area of interest is the Installation and Environment area of cooperation. In this particular case we identify environmental, occupational health, atmospheric indicators, and safety information available for PIMS users. We do this in cooperation with the Office of the Deputy Undersecretary of Defense (Installations and Environment) and provide that information.

Within PIMS there is a key area called U.S. DOD documents, which is provided from a system called the Defense Environmental Network Information Exchange (DENIX). This system is for the Department of Defense and its partner countries. It provides a place for all installation and environmental information. We have partnered with the PIMS program to provide excerpts of those documents to you in the Eastern Hemisphere. We have moved some of the documents over to Belgium to allow you to obtain access to the document in a timely manner.

DENIX is very heavily used. We had eighteen million hits last year. By partnering with PIMS we are allowing access to the information in DENIX. I would like to point out we have clean up, compliance, conservation, hazardous materials, pollution prevention, and unexploded ordnance, UXO. This type of information is provided to you, and we would like to hear from you as to what other topics and information we should provide.

Within PIMS, there is a hazardous management site, an environmental handbook for deployment, and a disaster response and consequence management website. There are gateways to related topics, such as this conference.

Not only does PIMS offer a vast resource of information, documents, and projects that are being co-developed with partner countries, it also provides different capabilities for the partner's use. We have an area called work groups that allows you to cooperate with your partners, whether it is within your office, with the next country, or among a larger group. We also provide a search engine and the ability to provide feedback to PIMS and DENIX. The system is free for our partners.

Today and tomorrow afternoon I will conduct two training sessions. You can learn more about the system's capabilities and establish a PIMS account if needed. I have just touched on installations and environment. There are many other categories in PIMS that may relate to information for which you are looking