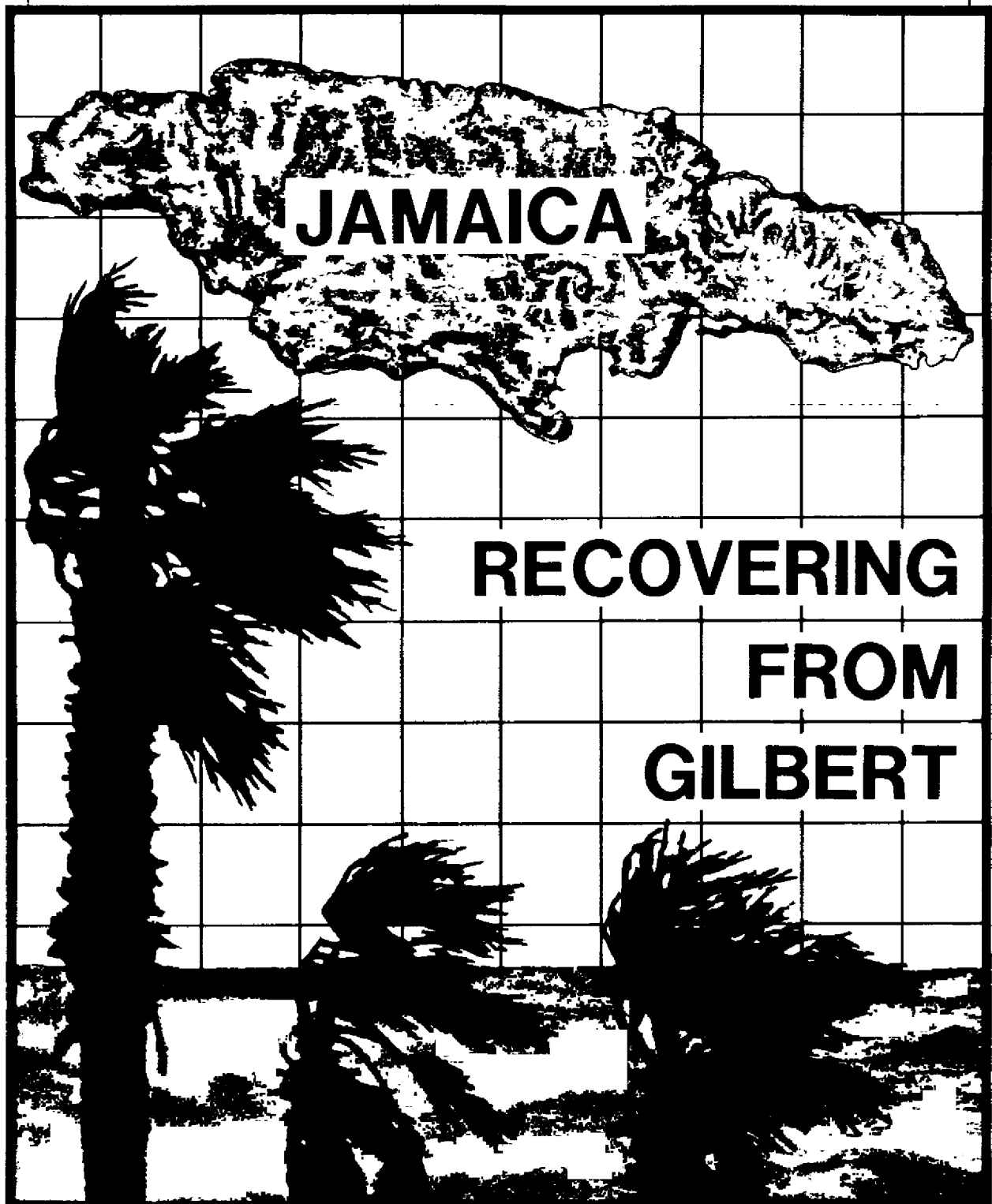

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Hurricane Gilbert

On September 12, 1988 Hurricane Gilbert ravaged the country of Jamaica. Never in recorded history had such a strong hurricane swept through the Caribbean region. Gilbert first came ashore in the Parish of St. Thomas, then passed directly over the entire length of the island. Early estimates placed the number of destroyed homes at 25-30%. The number of damaged homes was estimated at up to 70%. Some wind experts estimated that winds speeds exceeded 160 miles per hour.

Damage was widespread and indiscriminate. The entire banana crop was destroyed. The pineapple, coconut and sugarcane industries were heavily impacted. Infrastructure, including telephone, electricity and water supplies were severely disrupted over the entire island. The health system was dealt a heavy blow. Many hospitals were damaged to the point of being unusable. The Princess Margaret Hospital in St. Thomas lost its entire third floor as well as the doctors' and nurses' quarters. Within the housing sector, practically every project (scheme) was damaged. In one large public housing scheme, every roof was blown off. Public buildings, many already in need of repair, were not spared. The tourist industry was brought to a virtual standstill as tourists cancelled reservations by the thousands. At the two main airports, planes were blown around like toys or damaged by flying debris. The economic gains which Jamaica had shown in recent years were dealt a serious setback. Hurricane Gilbert delivered a near knock-out punch to Jamaica.

The Organization of American States Natural Hazards Project

The Natural Hazards Project (NHP) of the Organization of American States (OAS), Department of Regional Development, provides technical assistance to OAS member states in the area of natural hazards assessment and introduction of hazard mitigation in the development planning process. As part of its activities, the NHP has been evaluating various Geographic Information Systems (GIS) as tools for the compilation and management of information on natural resources, natural hazards, population distribution, and infrastructure. Emergency management and hazard mitigation through proper land use in the metropolitan areas of the Caribbean, Central and South America was seen as a special field of application.

During 1988, the OAS Natural Hazards Project selected the Emergency Information System (EIS) for pilot testing in six countries, including Jamaica. Installation of the EIS was originally planned for early 1989. EIS is microcomputer software used in planning for, and responding to, any type of natural or technological hazard. It combines data management with map display to create a powerful decision support system. Since geography is a vital part of crisis decision-making, EIS displays disaster related information from a geo-relational perspective. For example, EIS displays the relationships between hazards, disasters resulting from those hazards, and people and property at risk. EIS also displays resources available to respond to these hazards. This ability to geographically display hazard-related data enhances the planning efforts of an EIS user.

Assistance from the Organization of American States

On September 16, 1988, discussions were undertaken between the Pan Caribbean Disaster Preparedness and Prevention Project (PCDPPP), the Office of Disaster Preparedness in Jamaica (ODP), and the OAS. These discussions focused on whether the Natural Hazards Project could assist the Government of Jamaica (GOJ) by implementing EIS. As a follow-up to these discussions, an Aide Memoire was sent to the Office of Disaster Preparedness in Jamaica which outlined the use of EIS:

"The Natural Hazards Project (NHP) of the Organization of American States is in a position to assist the Office of Disaster Preparedness (ODP) of Jamaica in compiling available damage assessment information in support of rehabilitation and reconstruction efforts which will be initiated in the wake of Hurricane Gilbert.

"Information from damage assessment reports can be compiled in a computerized, geographically referenced data base, using the Emergency Infor-

mation System (EIS) developed by RAI, a system familiar to ODP. As such information is compiled, it can be analyzed to help manage further damage assessment efforts and program rehabilitation and reconstruction activities. Jamaica's road network, location of every town and village, and detailed street plans of the Kingston metropolitan area have already been digitized for the EIS and can be used to locate and analyze damage assessment information.

"The NHP is prepared to send a three-man team to Kingston for one week, including two experts in emergency information systems and two computers provided by RAI. Upon completion of the one-week assistance to ODP, the team will install the system in an ODP computer. NHP could continue to provide ongoing support in rehabilitation and reconstruction activities as requested, as well as follow up on previously programmed technical assistance activities in the areas of landslide hazard assessment and settlement relocation policy and guidance."

On September 28, 1988 the OAS team departed for Kingston, Jamaica. The reason there were twelve days between the time of the Aide Memoire and the actual arrival was due to large measure to the lack of communications with Jamaica. In fact, the most reliable communications with Kingston were a computer link through UNIENET, the United Nations International Emergency Network. These twelve days did provide ample time for the production of the computer maps for use within EIS, however, because of the emergency nature of the mission, the digital cartographers at RAI were prepared to produce the necessary maps within forty-eight hours.

The team, using its portable computers, went to work immediately upon arrival in Jamaica. In the first meeting with ODP, it was identified that damage information was being categorized at the settlement level. Further, many GOJ institutions had considerable data on Gilbert, but much of the information had not yet been supplied to ODP. After this meeting it was clear that accomplishment of the mission in five working days, even under normal situations, would be a major challenge.

Situation Facing the OAS Team

Discussions by the team members the first evening identified potential problem areas which could affect this assistance mission. Each of these problem areas, by themselves, had the potential to derail this assistance mission. Together, they suggested little cause for optimism concerning the success of this project. There were eight key problem areas the team identified:

1. Of the staff at ODP, few understood EIS and what the OAS assistance mission was about. They were enthusiastic about the assistance, but it seemed

doubtful that other staff members were prepared for the system. The team had anticipated having at least two experienced staff members assigned to the project. Although interest and enthusiasm were high, experience with computers in ODP was limited to older computers and software. Given this, the team felt that we could be in a catch-up situation on the education curve, which could cost valuable time.

2. The normal purchase and installation of EIS usually occurs over a long period, perhaps even a year or more. During this time, the purchaser becomes familiar with EIS through demonstrations, interaction with other EIS users, and by reading materials on computers and information management. In Jamaica, people who were not familiar with geographic based systems were asked to begin data entry into EIS with a minimum of training.
3. Each of the institutions in Jamaica which were affected by Gilbert were compiling their own damage assessment information. In fact, they had good, accurate, and timely information. In spite of this, there was no coordinated effort to compile and/or collate the information in a systematic way, nor to standardize information collection in the same computer program. With no apparent central point of damage assessment it did not appear an easy task to compile any meaningful damage assessment information.
4. When the team first checked into the hotel, there was no electricity. When power was on, it was unreliable, hindering computer operation. A telephone line to the United States was practically out of the question. Local calls were only marginally better. And yet, the gathering of damage assessment information by the participating institutions had to be facilitated by the use of the telephone. With key infrastructure such as electricity and telephone jeopardized, effectiveness was minimized.
5. Due to the State of Emergency, people were prohibited from being on the streets after dark. The information we needed was in different locations. Those institutions with the information were already burdened by their response to Gilbert. The inability to work at night made it doubtful that we could gather the necessary information. Lack of access to people and organizations, coupled with the State of Emergency, did not create an atmosphere conducive to our efforts.
6. Physical losses were expected. However, the scope of the damage, which essentially left no one untouched (including relief workers), caused even further limits on access to information. During initial visits to ODP, several people expressed concern that it had rained that day and that their homes were vulnerable to additional damage. Therefore, if it rained while in Jamaica, people's concentration (understandably) might not be focused upon learning EIS.
7. It was clear upon arrival that there were no adequate relief supplies in the country. Typical were the long lines in front of Red Cross headquarters where thousands of people were waiting for food and relief supplies under the guard

of the Jamaican Defense Force. All available resources were being employed by GOJ in the relief effort. With ODP playing a key role in the relief effort, it was felt that little time might be afforded to this project.

8. The Aide Memoire stated that a fully functional EIS would be installed at ODP before our departure. However, upon arrival to ODP there was no computer upon which to install the system. The best that could be hoped for was that one might be delivered before the team departed. Without a computer for EIS, even if other problems were overcome, the assistance mission might not have lasting value.

These problems posed significant threats to the project. In fact, it looked as though it might of been an error to come to Jamaica. Keeping things in perspective, though, this was the first time that a disaster management system of this type had been introduced into the post-disaster environment of a developing country. The team was simply confronted with the real problems faced after every disaster.

Therefore, Jamaica was a test of disaster management systems in general, of EIS specifically, and of the usefulness of computer technology in response to the disaster environment.

Knowing that failure could strengthen the argument that computers do not have a place in the post-disaster environment, the team rededicated itself to finding a strategy to overcome the potential problems.

Implementation Strategy

First, a meeting was called by ODP for all key institutions which were involved in the hurricane reconstruction effort. This meeting took place on the morning of the second day. The invitation itself was sent to the heads of the institutions, thereby soliciting key administrative support for the efforts during the week. These demonstrations proved very useful, since key officials were able see what the EIS and the OAS assistance mission was all about.

Second, and directly as a result of the demonstrations, individuals identified by management began training on the afternoon of the second day. The students had been directed to participate by management, but became quite enthusiastic once they saw the potential of the system. Still, the fact remained that they were unfamiliar with the working of EIS. Therefore, a minimum of training had to be provided even as a maximum amount of data entry was performed. To this end two hours a day were set aside for training, with the remainder of the day devoted to data entry. Two hours of training a day over a four day period was more than adequate time to learn EIS. Data which was entered included key infrastructure elements such as:

- Power Grids
- Water Systems

- **Locations of Settlements**
- **Damaged Areas**

Third, with trained users and key infrastructure elements entered, confidence grew among the team that a fully functional system could be left in place. Those people who were trained could continue data input, as well as train others on the use of EIS. In addition to the training and data entry, team members attended several planning meetings held by other government institutions. One of these was a meeting called by the Planning Institute of Jamaica to coordinate the assistance and relief efforts of all bilateral and multilateral donor agencies operating in Jamaica. During this meeting, those present were urged to look into the capabilities of the EIS as an instrument that could assist the Government of Jamaica and foreign donors in improving the coordination and monitoring of disaster relief effort.

Although confronted by many potential problems, this strategy worked out well. A cadre of people were trained while damage information and infrastructure elements were entered. Additionally, the locations of all towns and villages were input, and key GOJ officials became aware of EIS.

However, in spite of the success to this point, on the morning of the fifth and final day of the assistance mission, there was still no computer on which to leave EIS. This problem was solved ODP requested IBM Jamaica donate a computer to assist the relief and reconstruction effort. In an outstanding example of corporate assistance to government, IBM took parts out of different machines and put together a system for ODP. By two o'clock in the afternoon IBM had installed the computer.

Initial Success Measured

The successful implementation of EIS in Jamaica was not due to a technological transfer. The assistance mission was a success because of the high level of interest and skill brought to bear by the Jamaicans. This success clearly dispelled the mistaken notion that the developing world cannot utilize the typewriter, let alone computer-aided management systems.

One lesson learned in Jamaica was that the developing world is prepared to maximize use of new technologies.

On the last day, the team knew that a viable, working system was left in place. As a measure of this success, the assistance mission produced an immediate spinoff for the reconstruction effort when the United States Agency for International Development/Jamaica (USAID) purchased EIS for tracking incoming relief supplies. Under the U.S. law known as the Denton Amendment, USAID must supply to the Congress of the United States a detailed record of where disaster assistance has gone. When the Senior Economic Advisor for USAID, who had been made aware of EIS at one of the planning meetings, saw the resource monitoring capabilities of EIS, and the implications of the system for meeting the Denton Amendment requirements, EIS

was purchased immediately. Since USAID/Jamaica and ODP were working very closely in the relief effort, they agreed that, where they could share data, they would.

The United Nations Development Programme

As a further measure of success, and after being made aware of the capabilities of EIS, Mr. Hugh Cholmondeley, Resident Representative for the United Nations Development Programme (UNDP), requested that RAI return for further consultation on the application of EIS to the GOJ. Mr. Cholmondeley felt EIS would be an excellent tool for use in managing the rehabilitation and reconstruction. Part of this consultation would be a demonstration to Mr. Edward Seaga, then Prime Minister of Jamaica. If the Prime Minister concurred that EIS held good potential for the GOJ, then the UNDP would undertake a technical assistance package to expand the system for the reconstruction program.

Prior to meeting with the Prime Minister, during initial meetings with UNDP, and then later with the Prime Minister's staff, it was clear that everything possible was being done. However, the sheer magnitude of damage from Hurricane Gilbert was taxing the ability to coordinate information on the reconstruction effort. As was seen during the OAS assistance mission, every institution within Jamaica was struggling heroically to restore normal services. However, and again as a result of the magnitude of the task, there was not good information coordination.

The Prime Minister acknowledged that he had considerable information available to him, but that it was spread throughout the various institutions in different formats. For instance, the Ministry of Social Security could tell him the address of every damaged house, how many people lived there, what was lost/destroyed or damaged, and how much money was required to fix the home. The Urban Development Corporation could tell him how many beds had been lost at each of the secondary hospitals. In fact, each of the institutions could provide large quantities of information on the effects of Gilbert but there was little consistency in either the reporting programs or formats. It was in the context of this need for standardized reporting that EIS was viewed by the both the Government and UNDP.

After seeing the capabilities of EIS, and since the UNDP was willing to undertake a technical assistance package to expand EIS, the Prime Minister requested that UNDP proceed with a wide area network configuration of EIS. During follow-up meetings institutions were identified which needed to be brought on-line. These included the Ministry of Construction (Housing), Ministry of Construction (Works), Ministry of Education, Ministry of Health, Ministry of Social Security, Ministry of Finance, Ministry of Development, Planning and Production, Urban Development Corporation, Jamaica Public Service, National Water Commission, and Jamaica House. Each of

these institutions was selected based upon their individual roles in the reconstruction effort. The command center for both information coordination and storage and would be the Bureau of Management Support, located in Jamaica House.

Wide Area Network Configuration

This expanded configuration involved bringing eleven key institutions on-line, each with their own EIS, and each with the capability to communicate between themselves and Jamaica House. Further, because of the level of detail which was required by many of the institutions for reconstruction, there existed a need for additional mapping of the country. Finally, the hardware necessary to run the system also had to be acquired. All of these had to be accomplished in an extremely short time frame.

Software

The software was available from RAI. In addition to the basic EIS, three options were added. First, the Emergency Map Drawing (EMD) option was added. This option provides the ability for each of the users to add more detail to existing maps. For example, Jamaica Public Service could add substation diagrams, or the Ministry of Construction (Housing) could add diagrams of housing schemes. The second option added was Merge/Extract. Merge/Extract allows users to extract data from one system and merge it into another. This extracted data can also be transferred telephonically, or put on a floppy disk and hand delivered. Because the Jamaican command center saw the need for "real-time" data transfer, and a need to interact in a wide area mode, ECOMM was added. ECOMM allows a user to transfer data, messages or entire files to another on-line EIS user, either by telephone, packet radio or satellite.

For the OAS assistance mission, only eight maps were produced by RAI for use with EIS. In discussions with UNDP, it was clear that, for both the reconstruction program as well as ongoing projects within each institution, a much higher level of mapping was required. It was determined that the ideal level of mapping would be the 1:50,000 (metric) series. Although, these maps were not yet in print, the topologies were made available by the Map and Survey Department in blueprint form. From these, RAI produced a mapset for the entire country of Jamaica. Because the 1:50,000 map sheets were reproduced in the EIS digital format at 100%, the computer screen image corresponds directly to the existing paper maps. This permits field teams to collect data on paper maps, permitting easy entry into EIS. The total number of map screens finally produced for EIS in Jamaica was 150.

Hardware

The hardware for this configuration consists of two main parts: first, the computer hardware, and second, the communications hardware. The computer hardware con-

sisted of an IBM compatible machine with a 80286 processor. Additionally, an Enhanced Graphics card and monitor were required. A 40 megabyte hard disk was installed, although the system and the maps only required about nine megabytes. The extra disk space was recommended for data storage, as well as for use by other programs such as word processing. Finally, each system was supplied with a high speed, high quality dot matrix printer and a 2400 baud modem. Since Jamaica House would be the command center, an IBM compatible machine with a 80386 processor was purchased. This machine also had the capability to communicate with other computers within the GOJ, such as VAX and IBM mini and mainframe systems. All of the computer hardware was supplied by International Computers Limited (ICL).

Packet radio is a method of data transfer via radio frequencies. In addition to the computer, a two-way radio and a packet controller are required. In Jamaica, a General Electric standard mobile radio was selected. This type of radio was selected because they are inexpensive, easily replaced, and can run on any car battery if power failure occurs. Because the VHF-band in Kingston is essentially full, two dedicated radio frequencies were allocated in the UHF band. One band was allocated for packet radio and one for voice. The packet controller which was selected was the PK-232, produced by Advanced Electronic Applications, in Seattle, WA. This particular unit was selected because of its proven reliability, as well as its ability to capture satellite weather images. The capture of weather images does require a general receiver radio, since the frequencies for receiving the data are not in the UHF band. These general receiver radios were not provided. Ultimately, the packet radio may be the most common form of data communication since it provides the cleanest, most stable signal between the various institutions.

On-site Visits and Interviews with the Participating Institutions

Once the institutions were selected, the first task was to inspect each site. These visits were intended to assess the status of the information within each institution, inspect the physical location where the computer would go, provide explanations and background on the project, and assist management in identifying persons for training on the system. These site visits were made by RAI and UNDP staff.

As had been found earlier, each of the institutions did indeed have very detailed information with respect to their own area of responsibility. Each of them could provide a surprising amount of detail. Therefore, we found an abundance of baseline data for management information. But there was no common denominator between how the data was collected or processed. Some of the institutions had large computer systems, others had no computers at all. This clearly underscored the importance of the technical assistance package.

Since EIS is for use by management, not only during the reconstruction effort, but also for internal institutional uses, importance was placed on physical placement of the computer. During site visits it was stressed that EIS must be easily accessible to top management since it will be used as a planning and project monitoring system

between the participating institutions. With ECOMM, those institutions request information which might only be available from the director or minister. Therefore, the system had to be available to both management and data entry persons. In every institution, suitable locations were identified.

Training

The key to successful implementation of any system lies in how well the persons who are using the system are trained. Another reason for the site-specific visits was to assist the institutions in identifying who should be trained to identify candidates for training from the management, supervisory and data entry levels. From the perspective of UNDP, any institution which was going to participate would have to commit at least three persons to the training for the system. In all cases, the participating institution provided the appropriate persons for training. Again, as had been found in the OAS assistance mission, the participating institutions had individuals with an extremely high level of interest and who showed considerable skill in learning EIS.

Because a large number of institutions needed to be trained in a relatively short time, training was done classroom-style. To underscore the commitment of the GOJ, the training was held at the Bureau of Management Support, in Jamaica House. Normally, EIS training begins with explanations of each program, followed by exercises. Because of the need for rapid implementation, the institutions' real data served as the basis for these exercises. This approach maximized data entry while allowing programs to be explained in the context in which they were to be used.

This method of training proved quite successful. At the completion of the training, participating institutions found that a significant amount of their information and data had been compiled. At the conclusion of the training, each of the participating institution's data was combined together. This provided all users of EIS in Jamaica an extensive database tool. This combined database provides a tremendous body of information which the institutions can display and analyze in an interactive, user selected mode.

Site Installations, Assessment of Progress, Problems Encountered

Upon completion of the training, each of the participating institutions was issued its computer, printer, modem and software. They were responsible for setting up their system in their offices. Once installed, a RAI/UNDP team visited each site to verify proper installation and that everything was in good working order. Site tests were performed on EIS programs, including tests of the communications program, ECOMM. At all sites, due in large measure to the Jamaicans assigned to the project, installation was successful.

Approximately three weeks following the site installations, a second visit by the RAI/UNDP team was made to assess progress within each institution. During these visits it was clear that all of the users were in the process of institutionalizing EIS into their daily work. Although one goal of UNDP is technical assistance to institutions, the primary goal here was to put in place a government-wide, coordinated, information management system. This would ensure that EIS, from the early development stages through long term implementation, would be a viable, permanent system with impact in as many areas of government as possible. In order to secure this long-term implementation, refinement and coordination of EIS, a requirement of the UNDP technical assistance was that the GOJ would have to appoint a system administrator. Unfortunately, even though EIS was installed, site tested, and the participating institutions trained by December 22, 1988, the GOJ had not appointed a system administrator.

A prime reason that no system administrator was appointed was that under Jamaican law, new elections had to be called. In fact, because of Hurricane Gilbert, Prime Minister Seaga had already postponed elections anticipated for the fall, and by the end of 1988 Mr. Seaga was required by the constitution to call elections. When Prime Minister Seaga dissolved parliament, and subsequently set the date for the election, virtually all government programs and activities were brought to a halt -- including the rehabilitation and reconstruction effort, as well as implementation of EIS.

The election was held on February 11, 1989. Prime Minister Seaga and the Jamaica Labor Party were turned out of office and Mr. Michael Manley and the People's National Party were voted into power.

A change in government in Jamaica historically brings dramatic changes to how the country is run and the direction it takes. As a result, many programs or institutions started by the previous government may be reorganized or eliminated by the new government. For example, the Bureau of Management Support within Jamaica House, established by the Seaga Government as the administrative hub for EIS, was abolished. This meant that the participating institutions did not receive any direction or coordination from the government on the use of EIS from mid-December of 1988 through mid-March of 1989. Without central coordination from the government, EIS users were not in a position to provide a coordinated information response for use in the reconstruction. However, most continued to input information for institutional use, but were waiting for the government to appoint a system administrator before beginning entry of information which the government might need.

The new government realized that much work remained to be done to restore Jamaica to a pre-Gilbert condition. They also found little, if any, information was readily available on the state of the reconstruction. The reasons for this lack of information probably had more to do with confusion with the change of government, than for any other reason. In an effort to begin to assess, coordinate and implement their reconstruction effort, the new government took a variety of actions. One of these

actions was to establish within Jamaica House an information management team which would bring together all data processing efforts within the country.

EIS was the only system in place, in all key reconstruction institutions, which could be immediately used to assist in the rehabilitation and reconstruction effort. This fact helped guide the information management team in moving forward with effective implementation. As a measure of the government's intention to use EIS as a key tool, the information team, with the full support of Prime Minister Manley, appointed two key advisors who would have, as a primary task, the review & implementation of EIS. These advisors were brought to Washington D.C. by UNDP for in-depth training on EIS in the offices of Research Alternatives, Inc.. To announce the government's commitment to EIS, all the users of EIS were brought together at a news conference. In this conference, all users were praised for the work they had put forth, as well as their patience for the appointment of a coordinating body. In committing itself to EIS as a tool for the government, the users were told that the two persons were going to Washington D.C. for EIS, and that on their return, a coordinating body for EIS would be established. Indeed, following their return, the government established a unit within the Ministry of Development, Planning and Production which will coordinate EIS, as part of its new responsibilities.

Even in light of the new government's commitment, much work remains to be done. The implementation of EIS in Jamaica is much more than just an emergency information system. In addition to this role, EIS is being used for project management and will also be a tool in developmental planning. In this role as a planning and development tool, EIS, like any system, must be adaptable to changing needs and goals. This adaptability is built into EIS; however the process of development planning is one which takes both time and close coordination. Therefore, although EIS implementation is a success in terms of emergency management, it is only beginning as a development tool. Success as a development tool will occur with time, and now the necessary steps are being taken to ensure the long term success of EIS.

Conclusion

The initial OAS assistance mission in Jamaica was seen as an opportunity to assist a country in a time of need with a technology that had not yet been introduced into a developing country in the post-disaster environment. The result may be the beginning of a technological revolution for the management of disasters, with implications that extend to the heart of development issues. EIS can address a broad spectrum of problems faced by developing countries.

These OAS and UNDP technical assistance packages have put Jamaica in the forefront of the world for the use of this technology. Key governmental institutions are tied together with a system which provides maximum input from the implementation level, and therefore maximum effect at the management level. Each institution

will maintain its own specific data sets: The Ministry of Education will maintain the school database; The Ministry of Health will maintain the hospital and health clinic database; and the Ministry of Finance will monitor financial projects. At the same time, the data of all three institutions will be coordinated through EIS.

Basic development issues such as electrification of rural areas can be analyzed within the context of a distributed environment. As Jamaica Public Service contemplates electrification of an area, they can instantly relay those plans to other key institutions for comment or review. The Ministry of Construction (Housing) may find that they have planned a new housing scheme in that area and that the need for power may be greater than what is being planned.

Examples of how a distributed network can work are many. The implications are staggering. Perhaps the ultimate success of the system lies in the fact that by institutionalizing EIS, Jamaica has a definitive Emergency Information System. Should another disaster ever befall the country, an automated informational method for instantly assessing its impact, assisting in responding to the needs of the people, and in coordinating reconstruction is now in place. The government of Jamaica is now making use of tomorrow's technology, today.

For More Information

For further information about the EIS family of software and Research Alternatives, Inc., please contact:

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