DISASTER PREPAREDNESS IN THE MALDIVES

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20 April 1992

This report was prepared under a contract from:

The Office of US Foreign Disaster Assistance
Agency for International Development
Washington, D.C.

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INTRODUCTION

On May 30, 1991, a violent windstorm struck the Maldives from the west/southwest. Winds in excess of ninety knots and heavy rains inflicted major housing and crop damage throughout the country. The Government of the Maldives (GOM) reacted quickly. Damage was assessed and relief organized. Because there was an immediate and effective inter-community response and because the self-reliant lifestyles of the islanders meant that the means to meet most needs were in place, there was no loss of human lives and very few medical problems. With contributions from several governments augmenting their own financial commitments, the GOM quickly begin a rehabilitation program, provided food and other supplies where needed, and life quickly returned to normal.

In addition to committing $300,000 for housing rehabilitation grants to the GOM, USAID decided to help the GOM address the need for preparedness for future storms as well as other potential catastrophic problems which might cripple strong and steady development in the country. INTERTECT was contracted through the Office of U.S. Foreign Disaster Assistance to study the need for various disaster preparedness measures and make recommendations to the GOM and to USAID on the most effective actions and alternatives.

Two INTERTECT consultants arrived in the Maldives on November 12, accompanied by David Garms of USAID. On November 13 and 14, the team held interviews with the Director of External Resources of the Ministry of Foreign Affairs, the Director of Meteorology, officials from the Ministry of Planning and Environment and from the newly formed Committee on Emergency Preparedness. They also met the High Commissioners of Pakistan, India, Sri Lanka, and the resident representatives of UNICEF and UNDP. The team visited the islands near the capital (where industrialization is taking place) and reviewed conditions on less developed islands in the Kaafu and Haa Alif atolls on November 15, 16, 17, and 18. Final discussions with officials from the Ministry of Foreign Affairs and the Ministry of Planning and Environment were held on November 19 (the GOM was unable to acquire inter-island plane tickets for the team to visit Gan, the area most affected by the storm, because there were no seats available between November 14 and 18. Information in this report on damage in the Gan area and much of the information of the initial responses to the emergency is taken from the USAID/Colombo-UNDP report of June 1991).

COUNTRY BACKGROUND

The Maldives is a collection of 1190 small coral islands, clustered into atolls, extending from approximately 7 degrees North latitude to approximately 3 degrees South of the equator - a distance of more than 1000 kilometers. Of these, 200 islands are inhabited, and 67 others

are tourist resorts. The estimated 1991 population of the Maldives is 220,000; 60,000 live in the capital city of Male, over fifteen thousand live in the southernmost atoll of Seenu, and the rest are scattered on the other non-tourist inhabited islands. The government is engaged in strategies to relieve population pressure in the crowded capital of Male. These include decentralizing island administration, construction of secondary schools in outer islands (the only secondary schools in the country are now in Male), developing neighboring islands as residential areas, and creating economic development opportunities in the outer islands.

The primary economic activity has traditionally been fishing. Fishing, fish processing and transport continues to be the chief activity of most Maldivians and fishing and tourism are the largest net foreign currency earners for the country. In addition to local consumption, fish are either dried, frozen, smoked, or salted and exported, primarily to Sri Lanka. Tourism has recently eclipsed fishing as a gross income earner. The isolated geographical setting, which places it quite far from tourist markets, and the fact that there has historically been very little European interest or influence in the archipelago had kept the Maldives from developing its tourism potential until recently. But today, the almost untouched coral atolls attract thousands of tourists each year, primarily from Europe, Asia, and Oceania. The government has wisely proceeded carefully in its development of tourism, and has largely confined tourists (and diving on the fragile coral reefs) to 67 islands, most in the atolls close to the capital city of Male near the center of the island chain. This has largely been due to the fact that the only international airport is near Male, and transportation to the outer islands is largely undeveloped. This will soon change: the GOM is developing airline service to two destinations to the south and one in the north.

While many Maldivians fish, relatively few are employed in support of the tourist industry. The government is engaged in attempts to diversify the economic base with some light industry (boat-building, garment manufacturing, and cottage crafts) but the Maldivian people have been very slow to give up their traditional fishing vocations for others. At the time of this report, over 90% of the workers in the garment factories in the islands were guest workers, primarily from Sri Lanka. This is particularly significant in light of the fact that all other inputs needed in the garment industry (cloth, machinery, etc.) are also imported, and none of the clothing produced is for the domestic market.

The commercial agricultural sector is very small, owing to the limited amount of arable land on the small islands, and consists solely of banana, mango, and breadfruit plantations which serve only the domestic market. Personal gardens produce vegetables for home use - especially on the more remote islands - but almost all non-fish foodstuffs are imported.

GDP growth has been fairly high since 1980 (approximately 10% per annum). Fisheries and tourism make up nearly 50% of the GDP. Per capita income in 1990 was 641 USD. In recent years, GOM budgets have had both surpluses and deficits, but balance of payments has improved recently. Increases in imports have been matched by increases in exports in recent years.

THE MAY 1991 STORM

The storm which hit the Maldives on May 30 was quite unusual for latitudes so close to the equator. It formed just north of the equator and west of the Maldives on May 28. Dense clouds with a slight circular pattern were noted on satellite photographs received by the Maldives Meteorological station in Male. Although satellite photographs of the storm gave little indication of its severity, the unusual density of the clouds and some circular patterns prompted the Male meteorologists to increase their communications with the meteorological station at the southernmost island of Gan, and to give preliminary warning of possible problems to government officials. With no meteorological information from the empty ocean to the west of the Maldives, and with limited equipment, meteorologists could only continue to monitor the twice daily satellite pictures and weather conditions at Gan. On the evening of May 29, wind speeds begin to pick up on Gan. By 11:00 PM on May 29, barometric pressure had dropped dramatically at the weather station there. It became clear that this was a potentially destructive storm and local officials in the south were told to prepare. Because the national television and radio had gone off the air, and most people were asleep for the night, attempts to warn the general population of the southern atolls were largely ineffective. When the full force of the storm hit at around 2:00 AM on May 30, the roof blew off the meteorological station in Gan and the staff lost the capacity of monitoring the storm. At the time, wind detection instruments had reached the limits on their scales at 90 knots and barometric pressure was lowest in the Maldives meteorological history. High winds continued until 5:00 AM, and the southern islands experienced windy conditions with gusts over 60 knots until June 5.

Winds hit with varying intensity across other, more northerly atolls in the archipelago. Male received lighter winds (relative to Gan), but gusts there still reached 53 knots. The most serious damage was done in the southern four atolls of Gaaf, Gnaviyani, Laamu, and Seenu, and three atolls (Haa Alif, Shaviyani, and Baa) in the northern third of the country.

A. Initial Response to the Emergency

1. Government of the Maldives

During the INTERTECT team's interviews with donor governments' representatives, all agreed that the response of the GOM after the storm was generally quick and initially effective. The President immediately formed response teams to address the pressing needs of the hard-hit islands, personally flew to Gan the day after the storm and devoted his attention to relief efforts over the next few days.

Due to an effective intra-Maldives radio network, officials in all inhabited islands were quickly contacted and asked to develop detailed damage reports. Within a few days, local officials compiled a report that 3,407 homes had been damaged, 23,849 people had been forced to evacuate their homes, and approximately 36,000 people had been affected by storm damage to either their homes or businesses. Acting on this information, the ministerial-level Disaster Relief Committee established priorities for donations (food, medical supplies, and shelter - in that order) and for distribution. The Ministry of Foreign Affairs contacted potential donor's representatives by phone to canvass the donor community for interest, then followed up with formal requests where appropriate.

It was logistically impossible for the GOM to respond immediately with food and other relief supplies on every island of the far-flung archipelago. Many islands received no substantial relief aid for several days. Nevertheless, the essential relief needs in the first few days after the storm were met. Island community solidarity is credited as being the primary reason that no lives were lost in the storm and there were only minor medical problems. The homeless were housed, lost fishermen were found, and all were cared for due to the strong tradition of self-help and community in the close-knit island communities.

2. External Aid

The government was offered help from many sources. Chief among the immediate donors was India, who provided four aircraft (including two helicopters) to transport relief supplies to the outer islands. By June 7, aircraft had transported eight tons of food to Male and Gan. On June 7, a shipment of 100 tons of food arrived via an Indian ship. Pakistan also provided food. The World Health Organization and several countries provided medical supplies.

The United Nations Development Program Office in Male and Colombo supported the efforts of the GOM by helping to get the appeals out to the right donors and providing coordination among donors. More recently, the UNDP/Male has helped bring the Maldives and its needs before the world community via Roundtable discussions (eg. Washington, 1991).

B. Rehabilitation

The Disaster Relief Committee sent teams to all islands to produce detailed lists of damages and needs. INTERTECT reviewed samples of the reports from these teams and found them to be exceptionally detailed. The reports contain precise information on the damage inflicted on every family and business in the Maldives, including the extent of the damage to houses and agricultural losses such as the number and size of fruit trees lost, and even number of bunches of bananas destroyed. (At the time of INTERTECT's visit in November, government officials were preparing to reassess the needs and responses resulting from the emergency.)

1. Housing/Construction

This was considered to be the most damaged sector. Due to the strength of the traditional coral, stone, and mortar wall construction, most houses were only damaged when hit by a falling tree. In addition, the INTERTECT team found that most Maldivians, particularly on the outer islands, were aware of many simple measures that could be taken to prepare housing to resist high winds and had used them. The bulk of the housing damage was due to the loss of roofs (usually corrugated iron sheets) due to high winds. Approximately 60% of the houses in the southern atolls were affected in this way. Other areas received varyingly less damage. At the time of the INTERTECT visit, the GOM had almost completed a program of cash grants to those affected by the storm. The Committee made the grants out of a fund of 3,000,000 Maldivian Rufiyaas (US$300,000) created with a loan from the Central Bank of the Maldives. The Committee expected to retire the loan with grant money from foreign donors. Based on the reports described above, grants of varying size were awarded to those affected on the basis of the amount of damage. The grants were for losses in all sectors (housing, agricultural - primarily banana plants and fruit trees - and boats) and were made without regard to the income level of the recipient.[1] For example, a family with a large home who lost his entire roof would receive compensation in line with the value of his loss. A family with a small home who lost his roof would receive considerably less due to the far smaller replacement value of the lost roof.

2. Agriculture

Agriculture is minimal in the Maldives. Scattered damage occurred to banana plantations and fruit trees. Aid to affected families was offered under the grant program described above. The government gave priority to compensating families for agricultural losses in order to encourage them to swiftly replant.

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[1] The concept is similar to that of Sri Lanka's Rehabilitation Assistance Program (RAP) supported by USAID.

3. Fishing

Except for the hiatus in activity surrounding the storm, the fishing sector was almost unaffected. Warehouses and other processing infrastructure were largely undamaged. The main warehouse in the central Kaafu atoll received relatively light winds. Fishermen who sustained damage to their boats and equipment were given grants under the program described above.

4. Tourism

Almost all the resort islands are in the central atoll where the storm was least destructive. Only light damage was reported and very little income was lost.

5. Public Infrastructure

The GOM reported extensive damage to schools and government buildings in the more affected areas of the north and south. Most of the equipment in the meteorological station at the Gan airport sustained rain damage after the roof of the building was torn off.

6. Food Distribution

Due to the isolation of the outer islands, Maldivians are essentially self-sufficient. Over the years, they have developed mechanisms for sustaining themselves after storms without support from other sources. Since fish is the main food, there is no danger of starvation. Most islanders had sufficient food resources after the storm abated. Initial donations of food were useful in all affected areas, but particularly in those densely populated areas which are more dependant on food not grown on the island or caught nearby. A few islands also experienced immediate foods needs because of special circumstances but overall, food was not an urgent need.

A great deal of food, primarily rice, was provided by India and Pakistan. While the donation of aid was appreciated by the GOM, there were several problems associated with the gift. First were the logistical difficulties surrounding the donation. The ships delivering the rice only called at the capital and off-loaded at a nearby island. It was left up to the GOM to arrange onward transport to the affected islands. The government had to rent warehouses for the storage of the rice and use vital capital to pay for shipping.

Second, the size of the donations was worrisome: it amounted to almost a year's supply of the staple. To give this amount of food out free would have severely depressed the normal grain market and had a major negative impact on food suppliers. Thus, the government has chosen to hold the rice and only release it incrementally. Donors informed the INTERTECT team that some grain was given with the proviso that it not be sold. This grain then becomes a burden as the cumulative costs of storage impose a severe financial strain on the government.

A third concern is the issue of food dependency. At the time of the team's visit, the GOM had nearly stopped delivery of food because giving it to people who didn't need it had threatened to undermine self-sufficiency.

7. Health

No lives were lost in the windstorm. There are very few health problems associated with tropical storms and the resources of the GOM, augmented by UNICEF, were sufficient to handle the health issues arising out of the emergency. Nevertheless, the GOM received unsolicited medical supplies from several donors. One southeast Asian country sent 720,000 valium capsules, for which the GOM has no use and which consume valuable storage space.

8. Transportation

The government does not operate any inter-island ships nor are there large or medium-sized shallow draft ships in the private fleet (most inter-island commerce is handled by traditional dhonis -- small ocean-going, wooden hulled boats). Thus, the movement of supplies from the capital outward would normally take many months.

C. Comments

The initial delays reacting to indications of the impending storm may have affected preparations for the storm in the south. The lack of any institutionalized emergency reaction procedures undoubtedly shaped the government's initial reactions and played a part in the confusion surrounding much of the foreign aid. With little history of violent weather, it is not surprising that this was the case. However the response of the government, both initially and in later stages, was consistently rational and well-considered. An exceptional assessment was quickly put-together and resources allocated according to a sensible and culturally sensitive plan.

IMPLICATIONS FOR EMERGENCY PREPAREDNESS

A. Threats

For purposes of planning, the GOM should consider two types of disaster:

1. Severe Storms

Severe wind storms like the one in late May 1991 are unusual for the Maldives. Tropical storms rarely develop below 10 degrees North or South latitude and the 1991 storm was clearly unusual. Nevertheless, they can happen and can be expected to have a number of damaging effects.[2]

Violent winds affect housing and above ground structures, public buildings, transportation and communications. Waves generated by the storms can also affect the marine environment. If people are injured as a result of a storm, it will be difficult to treat them immediately unless the necessary resources can be found in the atoll. High winds and rough seas will prevent access by air and sea and evacuation will be particularly difficult.

Winds will also damage trees and crops above ground. Nevertheless, while food production will be affected, there will be few immediate food needs.

Water should not be a problem on the outer islands since most use rain water collection systems and there should be a net increase in water supplies. Male and resorts which depend on desalination may experience shortages if high winds were to damage the electrical generating equipment (the desal plants are a part of the electrical generator facilities).

Damage to business infrastructure, boats, banana trees, fruit trees, and other crops will disrupt normal economic activities for a time - from a few days for fishermen to several weeks in the case of a severely damaged agricultural area. Some islanders will experience hardship due to the loss of their normal incomes. Although cash incomes are small, a certain subsistence level of life is relatively easily reached in the outer islands. Since storms are infrequent, there is little need to save against calamitous events and saving has not been a part of the typical Maldivian family economic picture. As a consequence, the resources to provide monetary cushions will probably not be available.

2. Oil or Chemical Spills.

With increased development and a corresponding increase in the number of ships delivering fuel and chemicals, there is a greater risk that the Maldives may experience a chemical or oil spill in the future. An petro-chemical spill could devastate the fragile

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[2] The storms are likely to be wide area systems rather than tropical cyclones.

marine environment on which the Maldives depends for fishing and tourism. The effects of a toxic spill will vary widely depending on the type of toxin, but could have the effect of killing marine life, destroying coral reefs, making tourist swimming and diving dangerous - or at least unpleasant - and severely affect the basis for the businesses that depend, directly and indirectly, on these resources. The damage that could be done in a toxic spill can be accomplished so quickly that officials may not have time to appeal for, and receive, international aid in time for it to be effective.

3. Rising Sea Level

The possibility of rising sea levels is an urgent concern for island communities all over the world. No where is this more true than in the Maldives. While most scientists agree that the concentration of gases in the atmosphere which contribute to the greenhouse effect has increased in the past 200 years, and will increase more rapidly with the continued burning of fossil fuels and destruction of forests, they do not agree about the immediate effects of this phenomena on the level of the seas. The predicted warmer temperatures causing a rise in the sea level due to melting ice caps and glaciers may be offset by increased evaporation, cloudcover, and shading from the sun's rays. There is a complex relationship between physical and climatic factors which has not been studied fully. Most scientists agree that the rise, if it occurs, is unlikely to take place suddenly. The Maldives will not face this potential threat before there is time to react. Thus, this is an issue which must continue to receive the attention of the GOM, but the ultimate answer is clearly not in the hands of the GOM.

B. Emergency Planning Considerations

There are two salient points that should guide the GOM and donors in addressing the allocation of resources for emergency preparation in the Maldives:

First, the aggregate vulnerability of the country is low. It is clear that this is a country relatively free from *natural* disasters. The type of intense storm that occurred in May 1991 is very unusual. No one interviewed by the INTERTECT team, even Maldivians seventy years old, could remember a similar storm. The only other likely natural hazard would be exceptionally high waves such as those experienced in 1987, but the bathymetry off the Maldivian atolls is very steep and does not form the long, shallow shelf that would be required for large waves to build up to a level where they could overtop the islands and become destructive. Thus, it would be difficult for the government to justify devoting an extensive amount of resources to disaster mitigation or preparedness solely on the basis of reducing risk. This means that disaster mitigation efforts should only take place if they can be linked to on-going economic development activities and that preparedness measures should only be taken where costs are low or covered by international resources.

Second, the single most important resource in the Maldives is its unique and unspoiled - but fragile - marine environment. This resource is now coming under pressure from increased population and tourism and is becoming more exposed to a devastating oil or chemical spill. The loss of, or damages to, this resource would be a disaster from which it might take decades to recover. Thus, consideration of the problems which could damage the marine ecosystem should be a first concern for the GOM and donors in disaster management planning.

C. Emergency Preparedness

Emergency preparedness must be a concern but dedicating extensive financial resources to emergency preparedness for storms or waves alone can not be justified, given their infrequent occurrence. Although the affects of a major petro-chemical spill are so devastating that it demands that all available resources be used, preparation for a spill is primarily an organizational matter. A toxic spill could be so devastating, and the sophisticated equipment needed for dealing with a spill is so expensive, that resources are better directed toward prevention rather than after-the-fact reaction.

There are a number of activities that can be integrated into general economic development which will make the country more prepared for emergencies. And there are some administrative mechanisms that will speed reaction and avoid some of the problems encountered in donor response which can be instituted at minimal cost. Within this context, INTERTECT makes the following recommendations:

1. General Disaster Preparedness Planning

The government should move to formalize an overall disaster management strategy for the types of disasters most likely to affect the Maldives. The GOM has created a standing committee to replace the ad hoc emergency committee created in the wake of the storm. This committee should develop an overall administrative and resource allocation strategy for the most likely types of emergencies (wind, wave, oil or chemical spills). This strategy should include:

- Review Lessons Learned

  Review previous disasters to determine lessons learned to identify the needs that should take priority in each situation. For example, immediate attention must be paid to medical needs, but they will vary depending on the effects of each disaster (waves, winds, etc.). The larger islands which depend almost solely on well water will probably have immediate water needs. Some islands may need shelter supplies or food.

- Revise the Storm Warning System and Procedures

  The revisions should ensure that adequate advance warnings are issued in a timely

manner. The government should design and adopt a system for issuing warnings that is based on scientific criteria so that there are no delays when a storm is imminent. This would entail developing standardized procedures under which warnings are automatically issued under certain wind or barometric pressure conditions. It should be the responsibility of the Meteorological Service to issue the warnings.

- Improve the Format of Warnings

Identify procedures that will assure that warnings are effectively communicated to the endangered population. Provide detailed, graphic or descriptive information about the effects of wind speeds at various velocities. For instance, when a warning is issued for sixty knot winds, people should be informed of expected wave height, the affect of winds on agriculture and trees, and the types of problems to expect for different types of housing.

- Develop Standard Assessment Procedures

Pre-identify possible emergency needs after potential disasters and plan for rapid assessment of the needs and damages. Standard assessment forms should then be prepared that (1) facilitate rapid determination of needs e.g., food, shelter, supplies; and (2) qualify people for assistance according to predetermined criteria. The latter should be established in consultation with donors so that the information they require to make a determination about assistance is gathered quickly.

- Identify Implementing Agencies

Agencies that can be quickly enlisted in emergency aid (e.g., personnel and resources of the National Security Service, local private voluntary organizations, international organizations operating in the Maldives, plus the resources of the private sector such as helicopters, ships or other commercial resources) should be identified and listed.

- Develop a Logistics Plan

This plan should identify transportation resources (specific boats and aircraft) which can be dedicated to transporting relief goods for the duration of the emergency. It should include a list of alternate resources.

- Identify Sources of Relief

Identify sources of food, medical supplies, financial assistance, equipment and other resources needed in an emergency and develop standard procedures, and if necessary sources, for acquiring them.

- Develop Standard Assistance Packages for Victims

Meet with potential donors to develop aid packages for disaster victims that meet donor criteria and design them so they pre-qualify for funding. Cash-based assistance is almost

always awarded according to criteria set forth in donor's disaster assistance mandates. The G[illegible] should become familiar with these criteria and develop programs or approaches consistent with their intent. Procedures for disbursing cash that will satisfy donor fairness and monitoring requirements should also be set out. This will help avoid delays in working out details of the aid packages at the time of the disaster.

One approach that should be considered for the disbursement of cash assistance is a "unified assistance scheme", or UAS. [illegible] UAS operates very much like the assistance given by the government after the last storm -- only on a more formal basis. The government [illegible] those types of damages that it wants to provide compensation for, such as housing, agriculture, boats, etc. Average values for each are [illegible] and a scale is developed that provides assistance based on social criteria. Those least able to recover on their own, such as widows, the elderly, handicapped, receive compensation 100% grants, all others receive it on a sliding scale according to their total losses and needs. (Some assistance is in the form of grants or in-kind donations; others are loans.) The beneficiaries only receive one payment (if eligible) for everything -- losses to housing, productive enterprises, etc. If worked out in advance, a UAS permits the government to respond rapidly and with minimal administration. Most important, the [illegible] of cash will promote rapid recovery of the private sector and almost all relief [illegible] through private [illegible]. By working the details out in advance, the GOM can [illegible] program [illegible] and present it to donors immediately after a disaster strikes.

- Develop Guidelines for Donors

Procedures for reducing the amount of inappropriate and unwanted aid should be developed. This would entail developing guidelines for potential donors that elaborates on the [illegible] and specifies what types of aid could be useful. This could include [illegible] that could be telexed or faxed to potential donors [illegible]. In-kind donations are more likely to be given by [illegible] and Europeans are more likely to provide cash [illegible] should be developed for each type of emergency anticipated.

[illegible] The [illegible] and plans [illegible] above should be consolidated into a disaster procedures manual [illegible] disaster (on the model of the [illegible] Cyclone [illegible]). The manual should [illegible] responsibilities of all [illegible] in various [illegible] of the disaster. For instance, [illegible] should know what procedures to follow [illegible] when a warning is issued [illegible] radio or television, what [illegible] before the storm, and what [illegible] should be [illegible] after a storm [illegible] the national authorities. In the case of [illegible], officials should have specific [illegible] which address all possible containment and [illegible] options.

2. Preparedness for Petro-Chemical Hazards

- [illegible] regulations which [illegible] cargos? Develop rules for [illegible], types of cargo, [illegible] ship [illegible] measures. [illegible]

should be built into the monitoring system to assure compliance.

- Identify and locate sources of equipment needed to control and clean up various petrochemical hazards and make arrangements to acquire and deploy them quickly. It would not be cost-effective for the country to keep large stockpiles of the necessary equipment on hand given the low overall risks and high expense of equipment and supplies. Standby arrangements with the more advanced countries nearby to use their equipment during emergencies should be worked out. Where cost-effective, some spill containment and detoxification equipment should be located in the Maldives.

- Develop Evacuation Procedures

In the case of chemical spills, some islands may have to be evacuated. The means for evacuating the populations, plans for where to put them, and temporary relief measures should be explored.

3. Preparedness Measures for Severe Storms

- Improve and Expand Public Awareness Campaigns

People will largely take care of themselves if they know what to do and when to do it. Informing the public of such things as the dangers that can be expected at certain wind levels and the alternatives available to them can be done expanding the range of information promoted through radio and television campaigns and the use of posters and other media.

- Preserve Traditional Preparedness Mechanisms

The people of the outer Maldivian islands demonstrated exceptional resiliency in their response to the recent emergency. This is due to a life style that is largely self-sufficient. The means for providing the essentials of life from the resources immediately available on the islands are already in place. As development occurs, there will be a tendency to look outward and to obtain a greater portion of these essentials from outside the immediate island community -- and from abroad. The demand for, and the growing ability to acquire, luxury goods will lead to a decreased emphasis on local production of food to meet the islanders own needs. In some island countries in the Pacific, this has led to a corresponding loss in people's ability to take care of themselves in an emergency. This will be largely unavoidable, but dependencies on outside assistance can be reduced by focusing development on the resources and technologies for providing food and water in the outer islands. Activities that should be emphasized are:

- Water supply administration -- The knowledge needed to run and maintain water supply systems will be crucial as island populations expand. The GOM should encourage community or cooperative administration of water systems.

- Home gardening and food preservation -- Gardening should be encouraged as a means of helping families reduce living costs, expanding their access to fresh fruits and vegetables, and also as a means of mitigating the consequences of disasters. Food preservation methods, such as in-home canning, drying, etc. should be encouraged.[3]

- Hardware and Transport Considerations

Since few islands have docking facilities that permit offloading boats or ships much larger than a dhoni (the traditional Maldivian shallow-draft boat six to ten meters long), the government should attempt to acquire several landing barges or other shallow draft vessels with landing ramps that can be used to land supplies directly onto an island. The US Government and other countries often have surplus equipment available that can be used in disasters. Not only are some boats available, but there are often cranes, generators, and other heavy equipment that can be used in support of logistics operations. The government should apply to the appropriate authorities and get on the mailing list for announcements of equipment availability. If certain equipment needs can be identified, embassy personnel in nearby countries can be alerted to keep a watch out for it on the lists.

- Upgrade the Monitoring Capability of the Meteorological Office

The Met office reports that with some small additional equipment acquisitions, its ability to monitor storms will be enhanced. Possible sources could be Australia, the ADB, and UNDRO (via UNDP).

4. Disaster Mitigation Recommendations

Many of the development activities in which the GOM is now engaged or may be engaged can be adjusted to include components which will significantly decrease losses due to wind and waves. Some examples include:

- Increase Wind Resistance In Housing

Identifying simple techniques that can increase wind resistance in housing and small buildings and developing programs to encourage adding or incorporating them into new and existing buildings. Materials which are to be specifically used for securing roofs (such as hurricane straps) could be offered at a concessionary rates either by reducing taxes on them to encourage their use or providing a short term subsidy to promote their use.

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[3] This would be a good potential Peace Corps project.

Many methods of protecting houses in high winds are already in widespread use. The INTERTECT team found many simple and ingenious techniques for making houses resist high winds in use in the outer islands. The GOM should develop a program to preserve and use this knowledge. These traditional techniques could be the focus of a cultural rediscovery project co-sponsored by education and housing agencies or the National Museum in Male.

- Encourage Annual House maintenance

Many of the roofs which were lost in the last storm failed due to the fatigue of the fasteners (rotten wood or rope components of the roof fastening systems). Maintaining and/or replacing components periodically will pay off in high winds. Public awareness campaigns initiated at the beginning for the storm season to encourage roof maintenance in particular should be developed.

- Introduce Wind-resistant Construction Techniques in Vocational Training Programs

Construction skills training programs should include training in techniques for wind resistant construction and building material improvement. The focus should be on techniques for securing roofs, improving production and use of coconut timber, and house siting.

- Promote Retention and Expansion of Natural Windbreaks.

The islanders with which the INTERTECT team talked were aware of techniques for siting a house to take advantage of natural windbreaks formed by trees, shrubs and natural vegetation. However, the vegetation is slowly being reduced due to demands for firewood. Measures must be taken to reduce the pressures leading to environmental degradation, not only for disaster protection but for other reasons as well -- such as moisture retention.

- Re-focus Some Components of Development Assistance to Disaster Mitigation.

The government should approach some of the development organizations working in the country to see if they could offer development assistance linked to disaster preparedness or mitigation. Several groups have extensive experience in this area, including:

- The Peace Corps,
- Foundation for Peoples of the South Pacific,
- International Humanitarian Assistance Program,
- The League of Red Cross and Red Crescent Societies
- Asia Disaster Preparedness Institute - Bangkok

An immediate prospect is the Peace Corps which may be initiating a program in the Maldives early next year. The Peace Corps has extensive experience in providing disaster preparedness support to island governments in the South Pacific and the Caribbean and they should be able to recruit a specialist to assist the government in this area if requested to do so.

- Link Agricultural Development to Disaster Mitigation.

Many islanders cultivate cassava, bananas, breadfruit, mangos and other traditional crops. The potential for agriculture on some islands is still unrealized. Plans should be developed that will not only promote greater food self-sufficiency for the islanders but also provide disaster and environmental protection. Trees can be particularly useful in a number of ways. Island-hardy trees can be planted on the windward side of villages to help break the force of violent winds, provide food, and some varieties will help retain moisture in the soil to aid in the cultivation of other crops.

- Link Mitigation to Environmental Awareness

Many of the natural deterrents to the effects of wind and waves are being lost as the islands come under development pressure. Cutting of reefs for boat passage, collection of coral for building materials, and destruction of reefs by boat anchors will destroy the natural breakwaters that these reefs provide, to say nothing of destroying the source of the tourism and fishing industry. Thankfully, this does not seem to be the case yet on most outer islands. But the destruction of mangroves for firewood is gradually making the islands smaller as the waves erode the areas once protected and anchored by the mangrove trees. GOM Planning Ministry officials are aware of both of these problems, and are considering programs to deal with them but greater attention needs to be given to the problem.

- Establish a National Disaster Fund

The government should establish a National Disaster Fund. It would have two purposes: financing immediate emergency operations and providing de facto insurance for disaster victims. (The fund could be used to initiate a UAS.) The fund could also be used to meet needs and fund assistance not addressed by international relief. The fund could be capitalized in several ways. If commodity aid is provided to the country that generates counterpart funds, a portion could be earmarked for the fund. It might also be possible to seed the fund with GOM revenues raised from commercial taxes or licensing fees with the proviso that the funds be earmarked for commercial rehabilitation (as a form of insurance). The GOM already levies a "bed-tax" to fund infrastructure for the tourism industry. Perhaps this tax could be increased slightly, or a small separate tax on resort rooms could also be levied to pay for an environmental protection fund earmarked to provide funds to rapidly respond to environmental emergencies. This could have a major impact in the case of a petro-chemical spill which would require expensive clean-up operations. Some donors should find it particularly attractive to contribute to a scheme which is designed to eventually reduce dependence on foreign disaster aid and at the same time protect the environment.

APPENDIX A

Sample Donor Request Telex for previously identified transport needs

TO:
TELEX # _____

The Government of the Republic of the Maldives has experienced a violent windstorm. Rough seas make our usual marine supply routes impossible. Please send air transport of two helicopters and two C-130 transport aircraft as agreed under our the joint relief protocol of _____ as soon as possible. Advise me personally of the anticipated schedule.

Thank you.

_____
Chairman, Emergency Committee
Ministry of Planning and Environment
Republic of Maldives