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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

PROJECT PAPER

BANGLADESH - DISASTER ALERT (388-0046)

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A ADD, C CHANGE, D DELETE) — PP

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5. PROJECT NUMBER (7 digits): 388-0046

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8. ESTIMATED FY OF PROJECT COMPLETION: FY 82

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 80; B. QUARTER 4; C. FINAL FY 81 (Enter 1, 2, 3, or 4)

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 -)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL						
(GRANT)	( )	( )	( )	(4,000)	( )	(4,000)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY					2,105	2,105
OTHER DONOR(S)						
TOTALS				4,000	2,105	6,105

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY — F. GRANT	E. 1ST FY — G. LOAN	H. 2ND FY — I. GRANT	H. 2ND FY — J. LOAN	K. 3RD FY — L. GRANT	K. 3RD FY — M. LOAN
(1) ST	900	940							
(2)									
(3)									
(4)									
TOTALS									

A. APPROPRIATION	N. 4TH FY — O. GRANT	N. 4TH FY — P. LOAN	Q. 5TH FY — R. GRANT	Q. 5TH FY — S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) ST					4,000	
(2)						
(3)						
(4)						
TOTALS					4,000	

12. IN-DEPTH EVALUATION SCHEDULED: MM 07 YY 81

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Frank B. Kimball

TITLE: Director, USAID/Bangladesh

DATE SIGNED: MM 09 DD 21 YY 79

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BANGLADESH
DISASTER ALERT
FY 1979 PROJECT PAPER

TABLE OF CONTENTS

G. Log Frame

H. Statutory Checklist

I. Mission Director's FAA Section 611(e) Certification

J. Government's Request for Assistance

K. PID Approval Cable

L. Draft Project Authorization

M. Project Approval Authority Redelegation Cable

N. Environmental Assessment

GLOSSARY

AID	Agency for International Development.
AIT	Asian Institute of Technology.
APT	Automatic Picture Transmission - Low resolution imagery obtained from meteorological satellites.
BDG	Government of the People's Republic of Bangladesh.
BLP	Bangladesh LANDSAT Programme.
BRC	Bangladesh Red Cross.
CPP	Cyclone Preparedness Program - A joint venture between the Ministry of Relief and Rehabilitation and the Bangladesh Red Cross.
DCS	Data Collection System - A system of automatic sensors which relay remote ground information to a central station via satellite.
EDT	Environmental Data Transmitter.
ERIM	Environmental Research Institute of Michigan.
FX	Foreign Exchange.
GMS	A Japanese geostationary weather satellite located near Guam.
GMSS	Geostationary Meteorological Satellite Station.
HRPT	High Resolution Picture Transmission.
INSAT	A Indian geostationary weather satellite to be launched in 1982 and located over Sri Lanka.
Meteor	A USSR polar orbiting weather satellite.
MOU	Memorandum of Understanding.
NOAA	U.S. National Oceanic and Atmospheric Administration.
NOAA V	A polar orbiting operational weather satellite operated by NOAA.
OFDA	Office of Foreign Disaster Assistance.
PASA	Participating Agencies Service Agreement.
SPARRSO	Bangladesh Space Research and Remote Sensing Organization.

SSB	Single Side I and radio transceiver.
Thana	An administrative subdivision of a District.
TIROS N	A polar orbiting experimental weather satellite operated by NOAA.
TOVS	Tiros Operational Vertical Sounder.
Union	An administrative subdivision of a Thana (see Thana)
Ward	A subdivision of a Union (see Union).
WEFAX	Weather Facisimile.
WMO	World Meteorological Organization.

PART I

Project Description

1. Background

Bangladesh is perhaps the most disaster prone country in the world.* Three forms of severe weather disturbances annually damage some portion of the country. Cyclonic storms originating in the Pacific and north eastern portion of the Indian Ocean regularly sweep north along the Bay of Bengal and strike the Bangladesh coast. The interior of the country is regularly affected by flooding rivers as a major portion of the surface runoff of the subcontinent's monsoon rains converge within the national borders. In addition, the country is subjected to localized North-west winds called Nor'westers which occasionally contain tornadoes. These weather phenomena which occur several times each year frequently reach catastrophic proportions killing and injuring thousands of people and damaging large areas of the country. Within the last twelve years cyclones with winds of 140 mph accompanied by 20 to 30 foot tidal waves have killed hundreds of thousands of persons, injured many more and destroyed millions of dollars worth of property leaving large numbers of persons in the coastal region homeless and destitute. Flooding, while not as severe in terms of lives lost, has destroyed millions of acres of crops, houses, businesses and public infrastructure. Nor'westers have also caused considerable local damage from high winds, hail and lightening.

Before 1968 the very poor quality and late reporting of meteorological and flood data left the Bengali villagers uninformed on the timing, location and extent of disasters. In 1968 the cyclone warning system was improved with the purchase of an Automatic Picture Transmission (APT) satellite ground station which allowed the Meteorological Department to identify and track cyclones several days in advance of their reaching Bangladesh's shore. Unfortunately, until recently no such technological breakthrough occured for the prediction of floods.

The disastrous cyclone in 1970 exposed several severe weaknesses in the public warning network at the village level. While Radio Bangladesh was able to broadcast warnings, the dearth of radios in rural Bangladesh meant that most of the villages could not get information

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* Al-Hussainy, S.M., "Environmental Hazards in Bangladesh and Constraints to Development Process", In Proceedings of Fourth Commonwealth Conference on Human Ecology and Development, Dacca 1976.

via this source. The village cyclone alert program organized by the Bangladesh Red Cross (BRC) in 1966 also failed to provide adequate information because the limited BRC budget could not properly equip, organize and train the field volunteers. When the cyclone struck, the rural population along the coast and especially on the islands were generally caught by surprise and as many as 200,000 to 400,000 people were killed. In addition, there were heavy losses of movable assets including considerable livestock.

After Independence (1971) the village warning network was completely reorganized as the Cyclone Preparedness Program (CPP) and staffed and equipped with resources from the government in addition to the BRC budget. Special shelters were also built and existing buildings designated as shelters. Today the Cyclone Preparedness Program maintains a 24 hour Single Side Band (SSB) radio link between Dacca and 24 points in the coastal area. Its 18,668 village level volunteers carry out cyclone warning and evacuation on an annual basis.(For a description of the current program see Annex F.) In addition, since 1971 radios have become more available in the rural area although not yet present in every village. To improve radio availability the Government has recently initiated a national program to reduce the price of transister radios. The price of one band transister radios has been fixed at Tk. 155 (U.S.$ 10.00). Special incentives and concessions have been offered to radio manufacturers in order to increase the supply of radios at these prices.

In 1978, the Bangladesh APT ground station became technologically obsolete as a result of a change in U.S. satellite technology. In addition, the U.S. Meteorological satellite NOAA V prematurely ceased functioning. The satellite's failure occurred while this project was in a preliminary stage of development and it was feared that a hiatus in satellite coverage of the country for the October/November 1978 cyclone season would result unless interim action was taken. Responding to an emergency request from the Bangladesh Government in May 1978, AID provided a new APT station capable of accessing the new satellites covering Bangladesh. This system was installed as an interim measure and made operational by October 1, 1978.(For a more detailed description of the Interim System see Annex B.)

In the meantime, as an additional measure,the Bangladesh Meteorological Department has made necessary arrangements for modification of their existing APT Ground Station at Sher-e-Bangla Nagar for reception of imagery from Tiros N series satellites.

As previously noted, Bangladesh flood forecasters did not benefit from the kind of technological advancement available to cyclone forecasters. The present data collection system still largely relies on surface communications which are very poorly developed in Bangladesh. Because of inaccurate and untimely data the village flood warning system is still underdeveloped although the slow moving nature of floods increases the usefulness of Radio Bangladesh alerts since there is usually sufficient time for warnings to penetrate the rural areas. However, the slowness of data collection precludes the issuance of flash flood and Nor'wester warnings.

During the last several years, the U.S. and other countries have made considerable advancements in meteorological satellite technology; picture resolution has improved; more spectral bands are utilized; and satellites are operating from geosynchronous as well as polar orbits. When combined with ground radar these advanced satellites provide substantially improved data for the forecasting of the severe storms which frequent Bangladesh.

In addition, technological breakthroughs have been made in flood forecasting in the U.S. and France with the development of the automatic Data Collection System (DCS). Operating from on board the new satellites the DCS rebroadcasts actual conditions (in real time) from an array of remote ground sensors to a central data reception center. This allows for an immediate analysis to be made so that the related issuance of flood warnings to down stream villages are still timely. The DCS therefore ends the flood forecaster's past reliance on slow ground communications for data acquisition.

2. Purpose of the Project

The purpose of the Disaster Alert Project is to improve the BDG's capability to obtain, analyze and disseminate meteorological and river data so that villagers in flood and cyclone affected areas are provided with accurate and timely warning of impending disasters. In addition, the project will provide the analytical capability to apply remote sensing technology to a variety of development problems, particularly in the areas of flood control, erosion management, land use and fisheries development.

The data collection component of the Project will use the new generation of advanced meteorological satellites such as Tiros N, launched by the United States, and others launched from Japan, India and the USSR. These satellites will provide early and accurate informa-

tion on severe storm and flood conditions via their image transmission capabilities to an advanced meteorological ground station located near Dacca to be provided as part of this Project. These satellites, the related ground equipment and training represent a considerable improvement in the quality of flood and meteorological information available to Bangladesh. The data will be more accurate and the imagery will be of higher resolution than that of the data and imagery currently obtained by the BDG.

Data collected or relayed by the satellite will be combined with data from the country's meteorological radar units as well as from the existing weather stations (when appropriate) and then analyzed at the Storm Warning Center. This will assure that a complete meteorological profile of the country will be available at least six times a day. Information on cyclone formation and movement will be available every three hours day and night.

The collection of flood data as well as regular information on river hydrology will also utilize the satellites in conjunction with automatic Data Collection Platforms (DCP) placed along the coast and throughout the principal river systems in the country. Each DCP will obtain a variety of information including rainfall, temperature, pressure, river stage, flow, etc. and relay the data instantaneously via satellite to the ground station near Dacca. The data will then be analyzed by the Water Development Board for the purpose of issuing flood warnings.

While the equipment and training provided by the project will have an immediate application to the storm warning needs of Bangladesh, the same facilities will be able to meet the additional need to evaluate by remote sensing a number of proposed development activities in such areas as flood management, agriculture, fisheries and forestry.

The improved and more timely forecast of severe storms and floods will improve the efficiency of the village level warning provided by the Cyclone Preparedness Program and the local government units. However, the project will provide direct support to the Cyclone Preparedness Program in the form of equipment and training in order to strengthen their warning, rescue and relief services during periods of adverse weather.

While little can be done at this time to prevent the destruction of immobile assets such as crops, homes and infrastructure, an effective disaster alert system will save lives and certain movable property such as livestock and household effects. In the long run,

flood damage to fixed assets can be reduced through effective flood management programs. However, the design and evaluation of an appropriate flood management program will only result from an accumulation of knowledge of the hydrology of the river system in Bangladesh. The fundamental data which is needed for constructing the appropriate analytical models for this program will be generated by equipment and training to be provided by this project. The construction of hydrologic models and the resultant analysis of flooding will be carried out by the Water Development Board with the assistance of UNDP/WMO. (See Other Donors-Annex A).

3. Outputs

After completion of the implementation phase, the direct outputs of the project will be as follows:

A) The Space Research and Remote Sensing Organization (SPARRSO) will receive imagery from geostationary satellites once every three hours and imagery from polar orbiting satellites six times a day (every 6 hours from the U.S. Tiros N and every 12 hours from the Russian Meteor). The imagery will be made available to users in the Meteorological Department and the Water Board within 20 minutes of its reception at the ground station.

B) SPARRSO will receive environmental data (meteorological and hydrologic) from the DCPs every 6 hours and process the data into a format designed by users in the Meteorological Department and the Water Board. The data will be made available to the users within 20 minutes of its reception at the ground station.

C) Upon notice from the Meteorological Department, the Cyclone Preparedness Program (CPP) will mobilize its village level volunteers and inform all villagers in the potentially effected coastal areas of the likely size and timing of the storm. The CPP volunteers will inform villagers of the nearest cyclone shelter, prepare to initiate first-aid rescue operations, and be ready to assist the Ministry of Relief and Rehabilitation in the distribution of food and other relief goods.

Because of the improved frequency and accuracy of the data received from the satellites and the DCPs, the following ongoing outputs of the various government departments will be effected by outputs A and B above.

D) Using the satellite imagery, DCP data and information gathered from the existing radar and weather stations, the Meteorological Department will prepare and issue complete weather profiles of Bangladesh six times per day. In addition the Meteorological Department will issue 6 hour, 12 hour and 24 hour forecasts of the weather for the principal regions of the country.

E) Using DCP data, satellite imagery and information from the existing river monitoring stations (where appropriate) the Water Development Board will continuously monitor the flow and stage of all principal rivers in the country.

F) With the approach of a cyclone, the Meteorological Department will issue necessary warnings of the direction and severity of the storm and its associated phenomena and the names of the subdivisions expected to receive the most severe impact.

G) As the river flood stage approaches the danger level the Water Board will issue a 6 hour warning of the expected height of the river crest and will define the geographic path of the flooding as the crest moves through the country to the Bay of Bengal. In addition, using data provided by the Meteorological Department, the Water Board will issue warnings as to the location of possible flash floods.

H) The Water Board will prepare (1) a complete hydrological profile of the river system for use in flood prediction, (2) an evaluation of flood management proposals, and (3) a determination of the irrigation potential of the surface water in the country.

In addition to the above, the project is expected to provide data to the Department of Fisheries that will be used to predict the likely location of fish concentrations in the Bay of Bengal. The data will also be used with Landsat data obtained from Thailand, India or the U.S. for analysis by agencies studying land accretion, erosion, saline intrusion, crop forecasting, mapping, forestation and crop blight.

4. Inputs

The major portion of AID finances provided by this project will support a component of the BPC's Scheme for the Space Research and Remote Sensing Organization (SPARRSO). The remaining project resources will support program activities of the Cyclone Preparedness Program. The goal of the Scheme for SPARRSO is to build an institu-

tion which uses remote sensing technology to assist in solving current problems in sectors such as meteorology, agriculture, forestry, fisheries and water management.

The first phase of this Scheme, started in 1974 and due to end in June of 1980, represents a $1,000,000 program to establish the Bangladesh Landsat Program. It created the organization and financed training and equipment needed to analyze Landsat imagery of Bangladesh. The foreign exchange component of this project was approximately $633,000 and was furnished by grants from the UNDP and the Australian Government. The project also received support from IBRD and IDRC for special programs.

This Scheme for SPARRSO began in July 1978. It renamed the Bangladesh Landsat Program the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) and when completed will organize a wide variety of remote sensing activities for which it is specifically authorized within a single organizational framework. SPARRSO's activities include the operation of ground station facilities for obtaining remote sensing data, format preparation of data for user ministries and analysis of remote sensing data for purposes other than the issuance of flood and storm warnings. The Scheme will provide additional remote sensing training and equip SPARRSO with a ground station which will allow real time data to be obtained in certain priority areas such as meteorology and river monitoring. The Scheme is to be completed by June, 1982 and is estimated to cost dols 11.4 million of which dols 7.15 million will be foreign exchange. This Disaster Alert Project will finance a portion of the total cost of the Scheme.

The reorganization of the Bangladesh Landsat Program to SPARRSO is now actively underway and will be completed by June 1980. In addition, the preparation of the ground station site has been completed and the construction plans for all necessary buildings are now being prepared.

AID's support of the Scheme is limited to the support of the meteorological and hydrological activity to provide additional data so that more definite and timely warnings of cyclones and floods can be issued to people in disaster prone areas. While other Scheme components, not directly related to meteorology and hydrology, will be indirectly affected by assistance provided by this project, direct support to these fields will be undertaken by other donors such as the UNDP and possibly Saudi Arabia. However, other donor support to SPARRSO is not critical to successful implementation of this Disaster Alert Project.

A. Inputs - USAID

1. Data Collection and Analysis

a) Equipment

The project will provide an advanced meteorological ground station capable of accessing the high resolution system on board the Japanese geostationary (GMS) and Indian geostationary (INSAT) satellites. The station will also be equipped to access the polar orbiting U.S. Tiros N high resolution system and the Russian Meteor Satellite.

The project will provide two new antennas (a 5 meter autotrack and a 2.5 meter autotrack) in addition to utilizing the 6 meter parabolic antenna provided under the Interim Cyclone Warning Project. The 5 m autotrack antenna is provided as a backup to both the 2.5 m autotrack and 6 m fixed antennas. In addition, it will be used in the tracking of research and future operational meteorological satellites to be launched by the U.S. and other countries. Necessary receiving, recording, processing and display equipment will also be provided. (See Equipment List Table I).

The equipment has been selected so that each system can operate independently. Thus a failure of one does not impinge on the operation of another. However, where feasible the system utilizes similar components for interchangability from one system to another.

The project will provide a Data Collection System to be used with Tiros N and INSAT (when operational). The system will include upto thirty Data Collection Platforms (DCP) which will be placed throughout the river systems in the country, along the coast and in the Bay of Bengal in consultation with user agencies. The ground station will be equipped to receive DCP transmission through the Tiros N High Resolution Picture Transmission (HRPT) receiver and printout hard copies of the real time data.

The ground station will also be equipped with a minicomputer to process the digitized data transmitted from the satellites and output data in a form suitable to the needs of the user agencies, e.g., the Meteorological Department, the Water Development Board and the Department of Fisheries. In addition, the equipment will have the capability to process and display prerecorded Landsat data acquired

from Thailand, India and the U.S. The capability to analyze (but not receive from the satellite) Landsat data has been specifically included in the equipment package in order to develop baseline geographical, geological and agricultural land use information needed for the construction of related flood models by the Water Development Board.

As noted item 12 Table I, two hundred thousand dollars have been allocated for spare parts for the ground station and DCP system.

TABLE I

Ground Station Equipment List and Cost

The system consists of the following major equipment, spares and services to be provided through NASA by a prime contractor:

		(In $ 1, 000)
1.	2.5 meter Antenna - Datron (or equivalent) to be used to track TIROS HRFT	150
2.	5 Meter Autotrack Antenna - Datron (or equivalent) to be used for research tracking of the GMS, NIMBUS, TIROS, INSAT and METEOR.	390
3.	Receivers - 3 Microdyne (or equivalent) for INSAT, TIROS, GMS. All receivers would be similar but would utilize different plug-ins for different satellites.	50
4.	Bit synchronizers/frame synchronizers for INSAT, TIROS, GMS A/D conversion and data formatting.	150
5.	GMS HR WEFAX (INSAT) and TIROS-HRFT. Process and display (TV) incl. DCS processing.	220
6.	Hard copy displays for item 5 TIROS (ALDEN), GMS (ALDEN), COMPUTER OUTPUT (MUIRHEAD 560) (or equivalent).	55

7.	Mini computer data processor and TV and hard copy display (electronic movie loop) for METSAT and Landsat remote sensing analysis.	550
8.	Tape Recorders - 2 each for GMS - TIROS, INSAT (Honeywell 5620 - or equivalent)	75
9.	Data Collection Platforms - 30	150
10.	Hard copy DCP printout device	10
11.	Electronic data repeater	100
12.	Spares	200
13.	Shipping	100
14.	Contractor labor Including direct engineering costs, installation and checkout overhead & misc. operations, test equipment, equipment familiarization, travel and per diem and fixed fee of prime contractor.	1,085
		$ 3,285

b) Training and Consultants

The project will provide training and consultants for the purpose of improving the operations, maintenance and analytical capability of the personnel associated with the ground station and user agencies.

Operation and maintenance (O&M) training will be provided to six individuals employed by SPARRSO to operate and maintain the facilities. The training will be factory based and occur during the fabrication of the actual equipment to be provided by the project. As such, all O&M training will be short term in the U.S. and will require Bangladeshi personnel who are familiar with electronic equipment. The project will provide 16.5 persons months of factory training as follows:

FACTORY TRAINING

1.	Antennas 2 persons - 1 month each	2 PM
2.	Receivers 2 persons - 2 weeks each	1 PM
3.	Data processing 2 persons - 1 month each	2 PM
4.	Research computer and display 2 persons - 1 month each	2 PM
5.	Hard copy image generator 4 persons - 2 weeks each	2 PM
6.	System familiarization & operation 6 persons - 1 month each	6 PM
7.	Contingency	1.5 PM
	Total Factory Training	16.5 PM

In addition to the above, the prime contractor will provide on the job training (OJT) during installation and checkout of the system and 10 person months of consultants for the in-country follow up of the O&M training.

The project will provide an additional 16.5 person months of short term training for personnel employed by SPARRSO, the Meteorological Department and the Water Development Board to be selected by the respective department. In flood forecasting, training will concentrate in the field of flood simulation and modeling. Cyclone forecast training will be primarily in the area of the use of satellite imagery for severe storm analysis. All training will be in-service to employees of the user departments who are already familiar with their respective fields. In addition, 5 person months of consultants will be provided for incountry analysis of the problems of flood and severe storm analysis in consultation with respective departments.

SUMMARY OF TRAINING BUDGET

Operations and Maintenance	(In $1,000)
16.5 PM Short term factory training	43
10 PM Consultants	80
Flood and Cyclone Forecasting	
16.5 PM Short term	43
5 PM Consultants	40
Total training:	$ 206

2. Village Warning System

The project will provide equipment to the Cyclone Preparedness Program related to the communication of storm warnings from the Thana level CPP radio station to the villagers. The equipment includes the following:

Item	Quantity	Cost (In $1,000)
Warning flag	2000 sets	6
Raingear	4000 sets	80
Bicycles	201	14
	Total:	$ 100

Each warning flag set contains three flags corresponding to the warning levels announced by the Meteorological Department and Radio Bangladesh. One flag set will be provided to each of the 2,000 teams of volunteers at the Ward level. When information on the approach of a cyclone is passed to the Ward team, the volunteers in charge of warning will raise the appropriate flag on a structure in the Ward which has been designated as a cyclone shelter.

The 4,000 volunteers who are responsible for warning and rescue will be provided with raingear for protection from the storm while they are engaged in their activities. The raingear will consist of a rain cape and a hat. The hat will be a hard hat similiar to the type used in construction work since these volunteers work during the most severe period of the cyclone and need protection from flying debris.

One bicycle will be provided to each of the 201 Union level volunteer teams so that there is more rapid communication between the Union level teams and the Thana radio headquarters. The Union level team leader will be responsible for the use of the bicycle. Upon hearing the first warning of an approaching cyclone on the radio provided to the Union team leader (2,000 transister radios were provided by the League of International Red Crosses in 1972), the team leader will designate one of the volunteers to bicycle regularily to the Thana headquarters to obtain the latest instructions from CPP/Dacca.

Summary of Budget - USAID Inputs

		(In $1,000)
Data Collection and Analysis Equipment (Including installation and checkout)		$3,285
Training		206
Operation and Maintenance	123	
Flood and Cyclone Forecasting	83	
Sub-total		$ 3,491
Village Warning Equipment		100
Sub-total		$ 3,591
Contingency (Including inflation)		409
Total USAID Inputs		$ 4,000

B. Inputs - Bangladesh Government

The BDG contribution to this project is principally composed of the local currency component required for the first two years of the Scheme for SPARRSO. While the full Scheme is planned to have a four year implementation period and will cost $4.2 million in local currency, only the first two years (i.e. activities to be carried out during the present two year plan) have been approved by the Planning Commission at this time. This approval was obtained on August 12, 1978 and the first two quarterly disbursements have been made to the Bangladesh Landsat Program. The BDG contribution to this Project does not include any expenditures of the Meteorological Department or the Water Development Board even though these two offices will be intimately involved in the implementation of this project. Expenditures from these agencies have been excluded because they are counted by the UNDP as counterpart for the projects being implemented by the World Meteorological Organization (WMO) which compliment this activity. (See Other Donors Annex A).

The principal local cost items are: (1) an eight acre parcel of land in Savar Thana (about 20 miles north west of Dacca) for the ground station receiving facilities; (2) a three acre site at Agargaon adjacent to Sher-e-Bangla Nagar, Dacca for the SPARRSO Center; (3) the construction of the SPARRSO Center and related buildings; and (4) salaries and administration expenses.

Both sites for the facilities will be fully prepared with the provision of all necessary utilities, boundary walls, access roads and residences for the station operators. The sites will be linked together by an electronic data repeater so that real time data is received in the SPARRSO Center from the ground station.

The BDG will construct all necessary foundation pads for the antennas to be provided by the project. In addition, they will finance the relocation of the existing 6 m antenna from the present site of the Interim Ground station at Sher-e-Bangla Nagar, to the Savar Site.

The SPARRSO Center will be located across the street from the Meteorological Department facilities and will be a four story office and laboratory building, to be completed to the first story level during the first two years of the Scheme. The remaining three stories will be added during the last two years of the Scheme. Costs for the remaining three stories have therefore not been included as BDG counterpart expenditures in this project.

The Application Center will be furnished and suitably air-conditioned for the protection of the laboratory equipment.

The BDG will finance the round trip air travel of all trainees to the U.S. and third countries from Bangladesh to the farthest point served by their national carrier, Bangladesh Biman. All salaries of trainees will be paid by their respective Bangladesh offices.

The BDG will finance the cost of all training of village volunteers. The training will consist of a three day course for each volunteer in alert procedure, rescue and first aid techniques and operation of relief distribution posts. The volunteers will also participate in a simulated disaster exercise conducted by instructors from the CPP, the Bangladesh Red Cross and the Civil Defense Department.

SUMMARY OF BUDGET - BDG INPUTS
(In $ 1,000)

Data Collection and Analysis	
Site for ground station and SPARRSO Center	$ 900
Site preparation	60
Antenna pads	10
Buildings:	
Laboratory/offices and residences	660
Salary/allowances/air travel	80
Village Warning Network:	
Training	50
Contingencies	155
Inflation	190
	$ 2,105

5. Responsibilities and Relationships

This section describes the responsibilities of and relationships among the Bangladesh agencies which will be involved in achieving the Project's objectives. Detailed descriptions of each of the agencies are in Annexes C through F of this Project Paper.

The government of Bangladesh has given SPARRSO the responsibility to operate and maintain all facilities related to the acquisition of remote sensing data provided by satellites and related equipment such as DCPs. The responsibility includes the operation and maintenance of the ground station to be provided by this project.

SPARRSO, with the assistance of experts from NASA, has selected a site in Savar Thana (about 20 miles from Dacca) for the installation of the ground station receiving equipment. The raw data received at Savar will be transmitted by an electronic data repeater to the SPARRSO Center to be constructed at Agargaon, Dacca. All raw data will then be processed at the SPARRSO Center into a format to be decided in consultation with the Meteorological Department, the Water Development Board and other user agencies.

Since the Meteorological Department is responsible for the preparation of all weather forecasts and issuance of all storm warning in Bangladesh, one set of all decoded data will immediately be delivered to the Meteorological Department's Storm Warning Center also located in Sher-e-Bangla Nagar. In addition, the Meteorological Department will be given top priority in the use of the equipment provided to analyze the data so that forecasts are based on real time data. Using the data obtained from the satellites, the DCPs, the radar units and the 40 manned weather observation stations located throughout the country, the Meteorological Department will prepare six times a day synoptic weather charts showing surface weather, upper winds and constant pressure profiles, etc.

The Storm Warning Center of the Bangladesh Meteorological Department will identify and local a tropical depression or cyclone in the high seas or on land with the help of synoptic weather charts, other meteorological information, as well as latest radar and satellite imageries. Thereafter it will start issuing of series of warnings, fleet forecasts, Bay bulletins and Riverport warnings depending upon

the cyclone's location, dimensions, intensity and direction of movement, communicating them speedily to all concerned authorities and agencies and/or general public in accordance with the standing meteorological operational procedure. These procedures include the issuance of warnings to Radio Bangladesh to be braodcast to the people living in the coastal area. The Cyclone Preparedness Program is also directly informed by the Meteorological Department as soon as a depression or cyclone is identified.

As the storm intensifies and approaches land, the Meteorological Department will raise the level of warnings and issue them as frequently as new data is received from the satellites, ships in the bay and the radar stations at Dacca and along the coast. Radio Bangladesh will broadcast the level of warning hourly or at more frequent intervals until the storm has passed.

Upon receipt of a storm warning from the Meteorological Department the Cyclone Preparedness Program will contact its Thana level workers by Single Side Band (SSB) Radio and alert them to prepare to disseminate the warning to the coastal and island villagers. The activities of the CPP depend upon the level of warning issued by the Meteorological Department and are described in detail in Annex F.

In addition to issuing the official warning of approaching cyclones, the Meteorological Department will issue warnings of heavy rains and Nor'westers. Warnings of heavy rain will be given to Radio Bangladesh and Ministries such as Ports, Shipping and Inland Water Transport which will allow them to take immediate action to protect life and property.

Satellite and DCP data received at the SPARRSO ground station will also be provided directly to the Water Development Board's Flood Information Center. This data along with information received from the manned river observation stations will be used to prepare daily graphs of the stage and flow of the principal rivers in the country. As water levels rise during the monsoon season, the Flood Information Center will issue daily warnings of the likely location and extent of flooding. These warnings will be provided to radio Bangladesh and the local government officials in the affected areas via the Police Radio Network, who then will disseminate the warning to the villagers. The Flood Information Center, like the Storm Warning Center, will also issue warnings directly to Ministries whose activities may be directly affected by floods.

SPARRSO will also supply data and imagery to operational user agencies who require remote sensing data in their analysis of development problems. While in some cases the data and imagery will be sent directly to the user organizations, the SPARRSO Center will be equipped to provide work space for analysis of this data by the staff of the user agencies.

PART II

Project Feasibility

1. Technical Feasibility

This section summarizes the technical reports prepared by experts from NASA, NOAA and the Corps of Engineers. Experts from each of these U. S. Government agencies visited Bangladesh on a number of occasions since 1974 and as a result recommend the technical package of equipment and training to be provided by this project. This summary is essentially a collection of excerpts reproduced directly from their reports. Every effort has been made to present all of the key points of each report. Copies of the full technical reports are available at USAID and AID/W.

THE TROPICAL CYCLONE PROBLEM

Some of the worst tropical cyclone problems are found in Bangladesh for the following reasons:

A. The country is located at the head of the Bay of Bengal where the frequency of cyclones is highest.

B. The country is situated such that approaching storms are usually curving and characterized by highly variable tracks.

C. Storm surges (storm-generated tides) are magnified in Bangladesh because of the concave shape of the bay and the shallow water depths offshore.

D. The irregularity of the coastline and large diurnal tidal ranges result in large spatial and temporal variations in storm surges.

E. Large concentrations of people live on low-lying islands and coastal areas with no means to escape the storm surge.

With an improved tropical cyclone warning system, the death toll from cyclones can be significantly reduced. The foundation of any warning system is the availability of accurate and timely data. The weather satellite has provided a quantum jump in supplying such information.

USE AND LIMITATIONS OF SATELLITE IMAGERY IN TROPICAL CYCLONE WARNING

A tropical cyclone warning is based on an analysis of current data and a prediction. The critical parameters of a storm are its strength, size, direction and speed of motion, and rainfall potential. The first three of these, together with the physical characteristics of the landfall location, determine the most devastating feature of the storm -- the storm surge. It is important to note that storm surge is a coastal phenomenon. Therefore, a storm surge warning is based on a prediction while the cyclone is still at sea, rather than on direct observation.

Weather satellite images are used to estimate the location and strength of tropical cyclones. The accuracy of such estimates depends upon the quality of the images and the characteristics of the cyclone itself. The magnitude of the error in estimating storm location is a function of: a) The amount of distortion of the storm's image due to its distance from the sub-satellite point, b) the gridding accuracy of the satellite image, c) The cloud structure of the storm, and d) the skill and experience of the analyst. Accuracy in estimating storm strength (i.e. the maximum wind speed) depends upon: a) The resolution of the satellite image, b) The distortion of the storm image, c) The cloud structure of the storm, and d) The experience and skill of the analyst. Other important factors are the frequency of data and the availability of time-lapse animation capability.

The optimum type of satellite data for tropical cyclone analysis is provided by a high-resolution geostationary satellite located approximately over the cyclone region, which provides a continuous flow of data. If images are received at least once per hour, the capability exists to determine wind flow (i.e. steering currents) in the vicinity of a cyclone by computing cloud motion vectors. This is a valuable tool in supplementing conventional wind data over the data-void regions of the open sea.

Following is a discussion of some of the advantages and disadvantages of various types of satellite imagery which will be available, or potentially may become available, in Bangladesh with the implementation of the project.

1. TIROS N (polar orbiting) Advantages: High resolution(1 km) imagery, both visible and infrared images available, very high quality pictures, image availability of approximately six per day which is acceptable. Disadvantages: Rather narrow image swath due to low orbit, significant distortion near edge of picture due to low orbit, no time-lapse animation possible.

2. GMS (Japanese geostationary satellite, HRFT WEFAX data) Advantages: Images may become available once per hour allowing time-lapse display, good resolution, high quality images. Disadvantages: Bay of Bengal is near the edge of picture, and significantly distorted, wind vector computation not possible over Bay of Bengal due to distortion.

3. INSAT (India geostationary satellite) Details are uncertain, but INSAT will probably be a GOES-type satellite to be launched in 1982. If so, INSAT may prove to be the best long-term solution to satellite data problems in Bangladesh.

4. GMSS (Russian geostationary satellite to be part of the Global Meteorological Satellite System - GMSS - of the World Weather Watch Program) Launch date is uncertain. Satellites in the GMSS series have GOES-type capabilities, including a Data Collection System (DCS).

There are other features of the TIROS N system which have potential application to the tropical cyclone problem, such as the DCS (also on GOES and GMSS) which is described elsewhere, and the Advanced Very High Resolution Radiometer (AVHRR) which furnishes estimations of sea-surface temperatures.

The high-resolution satellite imagery which will be available upon implementation of the project will be a significant improvement over the currently available low-resolution pictures. The low-resolution images are somewhat useful in tracking tropical cyclones, but are of little use in estimating intensity. The high-resolution data will permit more accurate tracking and better estimates of strength. However, it is important to bear in mind the state-of-the-art of tropical cyclone prediction. For example, the average errors in hurricane forecasts issued by the United States National Hurricane Center areas follows: a) Error in estimating location of storm center = 16 n. mi., b) Error in estimating maximum wind speed = $\pm$ 10 kt., c) Error in twenty-four hour prediction of storm center location = 120 n. mi., d) Error in predicting the point of landfall twenty-four hours in advance =50n. mi.,

These errors are in spite of considerable experience using satellite, aerial reconnaissance, radar and other data, together with sophisticated numerical models for forecast guidance.

OTHER METEOROLOGICAL APPLICATIONS OF SATELLITE DATA

Satellite imagery is used to supplement conventional surface and upper-air observations in routine weather analysis and forecasting operations, as well as in severe weather episodes. Besides tropical cyclones, Bangladesh is affected by floods from torrential rains, tornadoes, squall lines or "nor'westers" with winds approaching hurricane force, and monsoon depressions. The high-resolution, high quality TIROS N images will be a valuable aid in analyzing the details of these essentially meso-scale phenomena.

Precipitation analysis and forecasting using satellite imagery is still basically qualitative and not sufficient for accurate hydrological predictions. Recent srudies have formed the basis for the development of quasi-quantitative techniques for estimating the rainfall potential of tropical cyclones and certain non-tropical weather systems. However, the most useful source of data for river flood warnings are Environmental Data Transmitters (EDT's, also referred to as DCP's) which automatically record and transmit data through the DCS system on the satellite, as described in the hydrology supplement to the project proposal.

ENVIRONMENTAL DATA COLLECTION AND HYDROLOGIC FORECASTING

The basic purpose of the environmental data collection system (also referred to as DCP elsewhere in this paper) is to enable timely preparation of short-term and long-range hydrologic forecasts of river stage and discharge on the three major rivers in Bangladesh, especially prior to and during severe flood periods. The rivers are the Ganges, Brahmaputra, and Meghna, including the Jamuna and Padma reaches.

The hydrologic forecasts will improve the timeliness, accurac and aerial distribution of flood warnings in terms of river stage, water depth, and duration of flooding. Routine hydrologic forecasts during normal hydrometeorological conditions can also be prepared. The general safety of the people and economic impact assessments due to flooding will be enhanced. Each new issue of the forecast will provide an update of river conditions with an outlook for the next few days (short-term). Improvement in the determination of prevailing and forecast meteorological conditions will also be possible, as well as the estimated impacts of weather on the hydrologic forecast. Improvements in post-flood reports and contribution to a data base for water resource planning, design, and management will be provided.

Data collection will be accomplished using earth satellites to relay data to a central receive site in Dacca that are transmitted from water data stations located on or near the main stem of the river system mentioned earlier. The TIROS N series will be used initially with possible conversion to GOES later. The Environmental Data Transmitters (EDT) will be capable of transmitting on two frequencies, possibly simultaneously, to permit data collection from the same stations via TIROS N series or possibly the Indian Satellite (INSAT), either as backup or as the primary mode.

Geostationary satellites enable self-timed EDT's in networks to report data routinely at specified time intervals several times each day, which is not possible on orbiting satellites. The data collection system (DCS) on orbiting spacecraft relays random reports from EDT's. Also, several times as much information (data for more periods and/or more sensors) can be transmitted from a given environmental data station to geostationary satellites than to orbiting spacecraft. Receive sites cost more for orbiting satellites, which are not always in range when needed. These are important factors to consider, especially for real-time assessment of a water management project.

Although geostationary satellite systems are preferable to orbiting systems for DCS, the latter is far more suitable than the strongest competitors among conventional methods, which are land-line and ground-based radio systems. With the exception of networks consisting of only a few stations in a small watershed, satellite systems are more timely, accurate, and dependable, as well as less costly than conventional methods. Experience has shown that as the severity of storms increase and consequently the need for data, the greater the chance of failure of landline and radio-systems. The EDT provides total independence to a station in the network.

The number and location of initial water data stations will be based on the requirement to adapt a hydrologic forecast computer model to the river system to forecast river stage and discharge a few days in the future (short-term) at key locations. All stations will measure and report water level and precipitation initially. If practicable, a few other environmental parameters, such as groundwater level or surface/subsurface moisture will be reported from a few stations initially.

Completion of the Environmental Data Collection System will make it possible to apply the hydrologic forecast models on a day-to-day basis. River stage, discharge and time and depth of inundation, will be forecast a few days in the future (short-term).

Two computer models will be considered for application. One of these (HEC-1) is used routinely on the Lower Mississippi River, and the other is a relatively new model that has been successfully adapted to a few river reaches on the Mississippi. The latter model, which accounts for the complete dynamic equations of streamflow (continuity and momentun), is expected to be more suitable during extremely high

and low streamflows, but requires much more effort to adapt (calibrate) to a river. It is expected HEC-1 can be adapted in about 4 to 6 months, and the new model will require about 12 months to adapt, depending on the availability of hydraulic data and difficulties encountered. Simultaneous adaptation of both models will be possible. Approximately 40K words of dedicated memory in a high speed computer are required for each model.

Either of the models can be expanded to provide long-range forecasts for several days to a few weeks in the future during Phase 2 of the project when additional water data on the subject rivers beyond the boundary of Bangladesh becomes more abundant, timely, and dependable.

It is recognized that basic hydrologic forecasting does not require the use of meteorological data or imagery. However, meteorological data and imagery will complement the hydrologic forecasts in a qualitative manner in all cases, and at times quantitatively, i. e., although the hydrologic forecasts will be based on water-on-the-ground, the impacts of precipitation and snowmelt forecasts on streamflow can be estimated as experience is gained with the model.

GROUND STATION TECHNOLOGY

This section presents technical background on meteorological satellites, discusses the difference between the capabilities of satellites in a geosynchronous versus polar orbit, the advantages of high resolution as opposed to low resolution satellite picture data, and how a combination of these two kinds of satellites and the proposed ground system will benefit Bangladesh.

Polar Orbiting -- The High Resolution Picture Transmission (HRPT) on board the United State's Operational Meteorological Satellite called TIROS-N provides information from four different systems on board the satellite. These systems are: the Advanced Very High Resolution Radiometer (AVHRR), the TIROS Operational Vertical Sounder (TOVS), the Space Environmental Monitor (SEM), and the Data Collection System (DCS). Two of these systems, the AVHRR and the DCS have extensive application to regional needs within the Bay of Bengal and will be discussed later in the system description.

Geosynchronous Orbiting -- The High Resolution WEFAX (Weather Facsimile) is available from the Japanese Geosynchronous Meteorological Satellite (GMS). The geosynchronous orbit of GMS is over the equator 36,000 km high. The satellite makes one revolution for each earth revolution causing the satellite to remain in the same position relative to the earth. This allows the satellite to view the same portion of the earth continuously as opposed to a polar orbiting satellite which views the same place on the earth only twice a day as it passes over.

The GMS has 3 systems: the High Resolution Wefax (HR WEFAX), the Low Resolution Wefax (LR WEFAX) and DCS. The LR Wefax data are presently being used by the BDG in the interim system and the DCS on GMS are available only to Japan.

The HR Wefax has an intrinsic value to the BDG in storm tracking since a high resolution image (2 km) is transmitted once an hour. This allows for digital processing of successive images to yield an animation (movie) showing cyclone storm, size and direction of movement. This is not possible at present by any other source available to the BDG except the future Indian satellite (INSAT). The HR Wefax and the Indian satellite will be discussed later in the system description.

Other Data Sources -- It is generally recognized that satellite data alone are not adequate to accurately forecast storm movement and intensity, certainly the use of HRPT, GMS, HR Wefax and DCS are powerful tools, far better than the BDG has had before. However, to develop a complete system using aircraft and radar are beyond the scope of this proposal. These items are being considered by other countries and donors in the Bay of Bengal and in this sense are not being ignored.

The combination of space sensors and systems from both polar and geosynchronous orbiting satellites and the expected benefits to Bangladesh and participating countries within the Bay of Bengal region are as follows:

AVHRR -- Available from the HRPT of polar satellites (TIROS). These instruments are essentially scanning telescopes that photograph the earth a line at a time and transmit this information immediately to the ground station within range. The smallest element on the earth that this instrument can resolve is 1 km in size. This can be compared to Automatic Picture Transmission (APT), a similiar service used in the BDG Interim System from TIROS, which has 4 km resolution and is not adequate to identify the smaller features associated with meteorology, hydrology and oceanography that are needed by the BDG.

The AVHRR has four (five later) different spectral channels, the visible, near infrared, and two far infrared. The visible channel is used for cloud and land mapping. The near infrared is used for land/water interface definition.

Continued use of these data on a quantitative basis will help establish a model for erosion, sediment transport, and land accretion in Bangladesh. The quantitative use of the visible and infrared channels in the rivers and Bay area coupled with DCP's can provide maps of turbidity salinity and temperature for fisheries management as well as size and flow for inland water transportation. Another important factor would be to evaluate inundation of salt water due to storm surges.

TOVS -- This instrument will provide a vertical temperature profile of the atmosphere, however it has little application to tropical areas in this case. These data are better supplied by radiosonde network.

DCS -- The data collection system on TIROS will provide a means of remotely measuring up to 32 different environmental parameters and relaying these data through the TIROS to the proposed ground system. The platform is a simple solar/battery powered device that interfaces with different sensors, i.e., thermometers, anemometers, flow gauges etc., and transmits these measurements to the TIROS satellite during its pass near the platform about every three hours. The DCPs (also called EDT) will relay information every two hours when INSAT becomes operational in 1982.

GMS HR WEFAX -- The HR WEFAX picture will be transmitted from the GMS to the proposed ground system once an hour. Once received the data will be processed in a micro computer for display on a TV screen, the hard copy of which will be supplied to the Storm Warning Center immediately. Use of the micro-computer will allow the analyst to perform different enhancement schemes to determine necessary parameters such as cloud top temperature, eye formation and location.

The Indian satellite and later the Chinese satellite will be of more benefit to Bangladesh for this activity. The proposed ground station will have the capability to receive these future spacecraft.

The computers that are necessary to process data in this proposed system have the capability to process satellite data other than TIROS or GMS since these systems use computer compatible tape (CCT). As an example, India and later perhaps AIT in Thailand will have the capability to receive the Landsat transmissions directly. As a part of the understanding between these countries and NASA these countries must make Landsat data available in suitable form to adjoining countries. This means that Bangladesh can acquire recent data tapes (CCT) of Landsat information over their country in time for it to be of use. This of course opens the door for new applications in agriculture, the environment and a host of new disciplines. In the case of agriculture the equipment will allow for the production of land use maps, analyze afforestation and deforestation (including areas in India and Nepal which greatly effect flooding in Bangladesh), assist in crop forecasts and irrigation schedules, identify potential lands for cultivation and analyze crop blight and crop health.

2. Social Soundness

The beneficiaries of this project will be those individuals who live in areas affected by natural disasters resulting from floods, cyclones, tidal waves and other forms of severe weather. The project is not introducing a new organization or institution into these areas which is intended.

to change the life styles of the beneficiaries. Rather the project purpose is to provide the beneficiaries with information on impending disasters which is more definite and timely. The information will then allow each potentially effected individual and/or family to take steps to protect himself, his family and his property in the best way available to him.

At present a number of techniques have been developed in rural Bangladesh to protect life and movable property from destruction. Among villagers, the most common practice is to evacuate areas which are subject to inundation taking with them as many movable assets as possible. However, without adequate warning, villagers are reluctant to leave their homes because the possessions which they must leave behind as a result of a rushed departure are likely to be stolen in their absence. With advanced warnings, villagers have been able to avoid losses by such techniques as burying valuables and small farm equipment so they are not stolen or destroyed by a flood or tidal wave. These villagers are then more willing to leave their homesteads and seek safer ground. The improved warning provided by the project is expected to provide the villagers with a greater opportunity to carry out locally developed techniques for safeguarding property so that evacuations take place more smoothly.

As in the United States, the reluctance to move is especially strong among people who live in cyclone prone areas because the inherent inaccuracy of severe storm prediction has created a false security among people who have been warned about but unaffected by cyclones and tidal waves in the past. The government has attempted to reduce the danger of loss of life of villagers and their livestock by constructing cyclone/tidal wave refuges throughout the coastal areas so that rapid evacuation can occur. These refuges have been used in the past and lives have been saved as a result. However, despite the existence of refuges and the more accurate warning system resulting from this project, continued losses of movable assets will occur unless the government, through its Cyclone Preparedness Program and other channels of information continually carries out a public awareness program. This program should emphasize the need to heed the warnings and take precautions such as burying valuables upon hearing the first alert even though there may be only a 50 percent probability of being affected by the storm. This public awareness program will have to be developed with an awareness of a sensitivity to the personal and community interests of the residents in disaster prone areas.

The project relies on the existing warning mechanisms which reach the villagers in flood and cyclone prone areas. The specialized local warning systems such as the cyclone alerts disseminated by the CCP and the flood warning given by the local government officials, are completely staffed at the local level by persons who come from the immediate locale itself, many of whom have been seriously affected by disasters in the past. In both cases the participation in the warning network is completely voluntary. The disaster warning role of these local volunteers is respected by the villagers and requires no significant modification of village level roles or institutions.

The workload of these volunteers in carrying out the warning, rescue and assistance to those affected by disasters has in the past not placed an undue burden on the volunteers' normal activities of pursuing a livelihood. In fact, in a number of Wards the CPP volunteers have used their organizational framework to initiate a number of village level self help activities such as adult education and fish production. Considering the above, the project is considered socially feasible. The attrition rate among volunteers of the CPP has been approximately 5% per year since 1972/73.

The social consequences of successful implementation of the project are expected to be beneficial to the villagers. If, however, the project fails to be successfully implemented there will be no negative social consequences at the village level. Life in the village will continue as is.

As noted in the economic feasibility section, the main benefit is the protection of life and movable property so that recovery from a disaster occurs more rapidly. Since nothing can be done at the present time to protect fixed assets such as houses and crops, the important objective to be attained by this project is to allow the villagers sufficient opportunities to save themselves from injury and their movable assets from destruction so that recovery occurs rapidly and the interruption in their productive lives is minimized. In this sense the project will have a beneficial income effect among those rural producers who are effected by a disaster and are technically in a position to immediately replant crops, restart other production activities or for that matter take steps to safeguard property.

3. Administration, Operation and Maintenance

The Bangladesh ERTS (Landsat) Program (BLP) was formed in 1974 as a temporary task force by joining a variety of ministries which indicated an interest in remote sensing. Since its formation BLP has provided the BDG with immediately useful information and has been able to win for itself support from the government budget as well as from foreign donors. Two examples of studies which caused BLP to obtain resources from the BDG for a laboratory and office space are: (1) a study of Kaptai Lake which showed that it did not inundate non-Bangladeshi lands; and (2) a study and mapping of the coastal region which showed the extent of new land accretion. Since 1974 the BDG has supplied all local currency requirements of the program and BLP has obtained assistance from the U.S., the Australians, UNDP, IDRC and the World Bank for its FX capital equipment requirement.

Closely linked to BLP is the Space and Atmospheric Research Center (SARC) of the Bangladesh Atomic Energy Commission. The personnel of SARC have been on the BLP Task Force and the APT equipment at SARC has been used whenever helpful in BLP's analyses. The APT equipment was purchased in 1967 by the then Government of Pakistan from its own FX (approx. $30,000) and the BDG has continued to supply the annual FX needs for operations and maintenance (See Annex B).

In addition, Meteorological Department was given an APT station by the UN. Relief Operation at Dacca (UNROD) in 1973. From its own resources, the BDG has provided all required local currency and FX to operate and maintain the station (See Annex B).

The latest demonstration of BDG organizational capability and commitment was the implementation (including the provision of all local currency) of the Interim Cyclone Warning system. The BDG provided land, personnel and funds to carry out site preparation and to construct a laboratory. The total cost excluding the value of land of the Interim System to the BDG was approximately Tk. 900,000 ($60,000).

The Planning Commission has recently approved the expansion plan for BLP which will merge the activities of BLP and SARC into a new autonomous body called the Space Research and Remote Sensing Organization (SPARRSO).

The first two years of SPARRSO (FY 1979-80) has a funding level approved by the Planning Commission of $ 2 million in local currency to be used as counterpart for this Disaster Alert Project. These funds are from the BDG development budget. On the recurrent side (i.e. funds from the BDG's revenue budget) SPARRSO is budgeting Tk. 90 lac ($600,000) per year of which Tk. 20 lac ($133,000) is FX. The recurrent budget will start in 1982. The BDG, in approving this project, also agrees that FX required for operation and maintenance of the ground station during the period between the installation of the equipment (1980) and the start of the recurrent budget in 1982 will be provided as necessary. Approximately $150,000 may be required for this period. In addition, the current recurrent budget of SARC ($40,000 per year of which $10,000 is FX) will be added to this. The above budgeted amounts are considered adequate to operate and maintain the HRPT system.

The past performance of the BLP and SARC in carrying out activities and obtaining the support of the BDG and foreign donors has been remarkable considering their short period of operation and their involvement in what is considered by many to be high technology. There is no indication that the financial interest of the BDG will shift away from SPARRSO or that the personnel will be removed from the organization without proper replacements being assigned.

In reviewing the current operation, NASA concluded that "..... though the satellite and ground system are new technology, the BDG will have no difficulty in operating or maintaining the system as long as the proper training and follow-up are provided". (From Report for Phase 2 - Intermediate System Description, September 1978, USAID). The AID budget projected for this project includes $123,000 specifically for maintenance training and up to 10 person months of follow-up consultants if required. Additional funds will be provided within the equipment installation contract for training personnel to operate the equipment.

4. Economic Feasibility

This project is fundamentally a humanitarian assistance effort. As a result there is little expectation that the project will produce a direct improvement in the incomes of the project's beneficiaries. It is anticipated, however, that the beneficiaries will sustain fewer personal losses because the improved warning system will allow more time for taking appropriate measures to preserve lives and movable property. It is expected that the time required to re-establish productive activity after a disaster will therefore be reduced.

While the protection of lives and movable property will have an indirect income effect, no attempt has been made to calculate economic feasibility measures (such as a benefit/cost ratio). The simplifying assumptions necessary to carry out such analysis would render the results too academic to be used as a criterion for project approval.

It is similarly difficult to consider this project from a cost effectiveness perspective because the use of space technology for advanced storm warning does not have a comparable ground based alternative. Prior to the use of satellite imagery, early notice of approaching storms was provided almost exclusively by commercial vessels plying the international sea lines which cross cyclone paths. These ship reports did not form a reliable early warning network because they arose from chance encounters between the ships and the cyclones. In addition, the ships would generally report only the approximate location and weather parameters of the periphery of the storm. Consistent and accurate information on the size, strength and movement of cyclones was not available even in the U.S. until aircraft carrying meteorological equipment were assigned to measure the storm.

Bangladesh is currently not in a financial position to acquire an aircraft dedicated to meteorological surveillance. The initial cost at $3 to 6 million and the operating and maintenance costs of approximately $1,500 per hour are far beyond the means of the EDC budget and represent a considerably more costly approach to severe storm warning than planned by this project.

On the flood warning side, conventional means of accomplishing the project's objective are more expensive than the DCPs but will in fact be used as part of the complete river surveillance system throughout the country since these facilities are already in place. The DCPs will be used in those situations, both existing and potential, where at present, access and communication pose a serious problem in the placement of a full time staffed flood monitoring station.

5. Cost Estimate and Financial Plan

Cost estimates for the major components of the project are tabulated in the Summary of Cost Estimatesin Table II.

The estimates for the equipment for the ground station were prepared by NASA experts in February, 1979 and attempt to reflect price expectations subsequent to October, 1979 when funds are expected to be available for the project. (See Inputs for a listing of the equipment to be provided). The estimated cost of installation includes the contractor's expenses for labor, overhead, fixed fee, and some on-the-job training of Bangladeshis to take place during the installation and check out of the system. However, the main cost of training of personnel in the operation and maintenance of the system is separately shown in Table I. The noted resources will finance approximately 16.5 person months (pm) of factory training in the U.S. (shown in the Inputs section above) based on an average cost of $2,600 per person month. In addition, 10 person months of consultants for operation and maintenance are included to provide follow-up training after the start up of the system. The total resources programmed for these consultants is based on an estimated person month cost of $8,000.

In the area of data interpretation and analysis, the project will finance 16.5 person months of short term training at $2,600 per month and 5 person months of consultants at $8,000 per person month.

The value of the land to be used by the project has been estimated by the BDG at the current market value of the sites. The land has in fact been owned by the BDG for several years. The land value is included since it reflects the opportunity cost to the government. Site preparation costs were determined by the Public Works Department for the SPARRSO.

Similarly the estimated costs of laboratories, offices and residences were prepared by the Public Works Department using their standard cost estimates for each type of construction.

The amount shown for salaries/allowances/misc. is the cost of the first two years of the Scheme for SPARRSO. The total number of personnel to be involved has been approved by the Planning Commission and the salaries and allowances are in accordance with standing BDG scales.

The cost estimates of the equipment to be provided for the village warning system are current shelf item prices. Training costs reflect current honoraria and TA/DA* expenditures made by the Cyclone Preparedness Program.

* TA/DA = travel allowance/daily allowance (per diem).

SUMMARY OF COST ESTIMATES
(In $ 1,000)

	AID		BDC		Line Item Total
I. Data Collection Component		3491		1710	3201
A. Sites	-		970		970
Acquisition	-		900		900
Preparation	-		70		70
B. Buildings	-		660		660
Laos & Offices	-		600		600
Residences	-		60		60
C. Equipment	3285		-		3285
Procurement	2100		-		2100
Shipping	100		-		100
Installation	1085		-		1085
D. Training	86		-		86
C&M	43		-		43
Analysts	43		-		43
E. Consultants	120		-		120
C&M	80		-		80
Analysts	40		-		40
F. BDG Salaries/allowances/Misc nec. airtravel			80		80
II. Village Warning Component		100		50	150
Equipment	100		-		
TR	-		50		50
III. Subtotal (I+II)		3591		1760	5351
IV. Contingencies		159		155	314
V. Inflation		250		190	440
VI. Total (III + IV + V)		4000		2105	6105

Contingencies have been estimated at approximately 4% of FX costs and 9% of local costs. The FX contingency is low as the estimated costs of the equipment and installation of the ground station include a provision for contractor contingencies. The principal intent of the FX contingencies is to be able to provide additional training if needed during project implementation. Local currency contingencies are actually 18% of planned L.C. expenditures since the cost of land have already been incurred.

Inflation has been determined as approximately 7% of the FX cost and 11% of local currency. While some attempt was made by NASA to determine procurement prices in October/November, 1979, this line item has been included to hedge against unforeseen increases additional to those built into the cost estimates. On the local currency side the reserve for inflation is effectively 23% since the land is already owned by the BDG. The 23% is above the current rate of 15% inflation in Bangladesh.

Total project costs are therefore estimated at $6,105,000 with $4,000,000 in FX provided by AID and $2,105,000 in local currency provided by the BDG.

Table III relates the total cost of inputs to outputs. The separation of the cost to the various outputs is somewhat arbitary because most of the equipment, installation and O&M training costs will produce the joint product of outputs A and B. If the project had only provided output A, the marginal cost of adding equipment to obtain output B would be less than that shown on Table III (perhaps as low as $400,000). However, output A would have appeared more costly than that shown and the equipment would not have been used in accordance with its design capacity. Outputs D through H have not been costed out separately because these outputs result from outputs A and B in combination with the ongoing program expenditures of the respective agencies and their other donor supported activity. The $1,992,000 shown as a contribution to outputs D through H primarily reflect those expenditures on the SPARRSO Center which will be available to all user agencies at their discretion.

The phasing of expenditures is shown in Table IV. Since the BDG Planning Commission has approved the Scheme for SPARRSO, the government has allocated the sites and has provided the first two quarters of funding (BDG FY is July/June). Site preparation is under way, salaries are being paid and construction of the required buildings will commence before October 1, 1979.

TABLE III
COSTING OF PROJECT OUTPUTS/INPUTS
(In $ 1,000)

Inputs	Outputs*			
	A	B	C	D-H
AID				
Equipment	2,300	657	100	278
Training	30	9	-	47
Consultant	56	16	-	98
Subtotal	2,386	682	100	423
BDG				
Site	215	55	-	700
Building Administration	145	15	-	500
Training	15	5	50	35
Subtotal	375	75	50	1,235
Contingencies				
AID	111	32	5	11
BDG	36	18	12	114
Subtotal	147	50	17	125
Inflation				
AID	175	50	7	18
BDG	38	19	12	121
Subtotal	213	69	19	139
TOTAL:	3,121	876	188	1,922

* See list of Outputs pages 5 and 6

The major expenditure of AID resources will occur in FY 80. It is expected that all equipment will be procured, shipped and installed before September 30, 1980 although final payment to the contractor may not be made until early FY 81. O&M training will also occur in FY 80 but the training of the analysts will be programmed through FY 81. The consultants, notably for O&M, are also programmed largely in FY 81.

BDG funding of construction is expected to be disbursed through both FY 80 and 81. The salary expenditures drop off significantly in FY 81 as the BDG will start the final two years of the overall Scheme in that year. The $10,000 shown for this item reflects the residual counterpart expenditures for training in FY 81.

Local currency contingencies decline in FY 81 reflecting pressure to spend in this category during FY 80 since new contingency funds will be made available when the final two years of the Scheme are approved.

6. Project Implementation

AID financed inputs will be managed by two BDG agencies, the SPARRSO and the Cyclone Preparedness Program.

SPARRSO will receive, operate and maintain all equipment related to the satellite ground station to be supplied under the project. In addition, SPARRSO will receive all operation and maintenance training resources. SPARRSO will be responsible for all site preparation and construction of all antenna pads and related ground station buildings. SPARRSO will insure that the site is supplied with the required water, power and sanitation facilities.

The provision of all ground station related equipment and supplies, their installations, start up, check out and the training of operation and maintenance personnel will be under the direct responsibility of NASA through a Participating Agency Service Agreement (PASA) with AID. Within 90 days after execution of the PASA, NASA will submit to SPARRSO a detailed schedule of procurement, shipping, installation and operation and maintenance training. In addition, NASA will supply SPARRSO with all necessary technical details required by SPARRSO for the construction of the antenna pads and related ground station support facilities.

TABLE IV
PROJECTION OF EXPENDITURES BY FISCAL YEAR
(In $ 1, 000)

Fiscal Year Category	1979	1980	1981*	Total
AID				
Equipment	-	3020	365	3385
Training (O+M)	-	43	-	43
Training (Analysts)	-	15	28	43
Consultants (O+M)	-	20	60	80
Consultants (Analysts)	-	10	30	40
Contingencies	-	59	100	159
Inflation	-	200	50	250
Total AID:	0	3367	633	4000
BDG				
Sites	970	-	-	970
Buildings	110	275	275	660
Salaries/allow. /Misc.	30	40	10	80
Training	-	50	-	50
Contingencies	20	80	55	155
Inflation	-	80	110	190
Total BDG:	1130	520	455	2105
TOTAL:	1130	3887	1088	6105

* All FY 81 expenditures are from pipeline.

Because SPARRSO's organizational structure includes representatives of the various user ministries on its supervisory national committee and as investigating staff, SPARRSO will be the sole coordinating agency for the project's resources provided for training and consultants in data analysis. These resources will be shared by SPARRSO, the Meteorological Department and the Water Development Board and will be released to the BDG upon submission for AID approval of a training/consultant plan within 120 days of the signing of the Project Agreement. It is expected that all consultants will be drawn from NASA, NOAA and the Corps of Engineers through PASA arrangements. PASA agreements will be executed by AID/W and will be based on terms of reference developed between USAID/Dacca and the BDG.

The Cyclone Preparedness Program (CPP) will be responsible for the resources provided by the Project for the Village Warning Networks. The CPP will prepare and submit for AID approval a detailed procurement schedule within 120 days after the signing of the Project Agreement.

Project monitoring and evaluation will be done by USAID/Dacca staff and as needed by experts provided by PASA arrangements with NASA, NOAA and the Corps of Engineers; also as needed by AID requirements contracts or indefinite quantity contracts.

SCHEDULE OF PROJECT EVENTS

Month	
0	Approval of Project by BDG/USAID. Signing of Project Agreement between BDG/USAID.
1	Signing of AID/NASA PASA.
2	Visit by NASA for preparation of final equipment list, O&M training plan and installation schedule. Site preparation completed - Building construction commenced.
4	Submission of NASA implementation plan.
5	Submission of BDG training consultant plans.
6-10	O&M training initiated. Equipment procured. Training of analysts initiated.
11-15	Building construction at first floor stage completed. Equipment installed.
16-18	Equipment check out period.
18-24	Training completed.

7. Evaluation Plan

Routine evaluations will be conducted during the two years of the project. Depending on the activities schedule, these evaluations will be based on the monitoring reports and inspection of the physical facility. The evaluation will determine that project inputs are being provided as planned, that conditions and covenants of the Project Agreement are being met, and that project outputs are being accomplished as planned. The evaluations will be used to recommend alterations of project inputs, if required, to achieve the project purpose. A special in-depth evaluation will be conducted upon completion of the project which will evaluate achievement of the project purposes.

ANNEX A

Other Donor Activities

1. Assistance to the Bangladesh Meteorological Department
WMO - UNDP Financed

The World Meteorological Organization (WMO) is currently implementing a three year UNDP financed project entitled "Strengthening of the National Meteorological Service". The project was started in July 1977 and will be completed in June 1980. The anticipated UNDP input will be $1,026,000. The project has established a Climatology Division, an Electronics Laboratory, a Mechanical Workshop and a Training Institute within the Bangladesh Meteorological Department.

In establishing the Climatology Division, the WMO project has trained staff in long range weather forecasting and data processing. The project is also providing a computer to this division. In addition, a WMO Climatology expert has been in Bangladesh for one year and will remain for 1½ years more.

The Electronics Laboratory was set up at the Storm Warning Center to repair the Meteorological Department's electronic equipment such as radar and telecommunications equipment. Its staff has received training. Test and repair equipment and spare parts were also provided. In addition, a Meteorological Instrumentation specialist is being provided for 2½ years and an Electronics Advisor for two years.

The Mechanical Workshop was set up to repair the mechanical equipment used at the Storm Warning Center. It was provided with repair equipment, training and spare parts.

The Training Institute was established at the Storm Warning Center and has been offering in-service courses in various aspects of weather forecasting. Thus far, 50 persons have completed courses at the Institute. WMO provided a training consultant who has just completed a nine month tour in Bangladesh. A second training consultant will arrive in October-November for a three-month assignment. In addition, a Research consultant in storm surge prediction will be provided for three months in 1979 and three months in 1980.

The project includes 22 short-term fellowships for foreign study tours. The fellowships are provided for training in forecasting, climatology, agro-meteorology, instrumentation and electronics. Six persons have completed courses including two who attended a six-month course in meteorological satellite imagery interpretation.

This project will be followed by a five year Phase II. Phase II is projected at $2 million and will concentrate on the training of forecasters, the establishment of three agro-meteorological centers (Joydepur, Mymensingh and Bogra) and the provision of communications equipment to link the principal field offices with district offices and Dacca.

The Meteorological Department will also be provided with a new S or C band radar unit for Dacca under a project described below called "Flood Forecasting and Warning System".

2. Assistance to the Water Development Board
WMO - UNDP Financed

WMO will begin in late 1979 a three year institutional support project to the Bangladesh Water Development Board to improve the Board's capability to carry out flood forecasting. The project has a planned budget level of $1,652,200. The project will provide equipment for gathering and transmitting hydrological data from up to 42 field stations in Bangladesh. In addition, a new S or C band radar will be provided to the Bangladesh Meteorological Department for rainfall estimation.

The project will provide 90 person-months of technical assistance including an expert in flood forecasting (36 pm), experts in radar, electronics and telecommunications (24 pm) and several experts in hydrologic installation and substation management.

The project will provide 51 person-months of short-term training (six months or less) in river forecasting, meteorological radar analysis and electronic equipment maintenance and two one year fellowships in electronic engineering.

The project has been carefully prepared to coordinate with on-going or planned projects in water resources management and flood forecasting especially in regard to the placement of SPARRSO's DCPs

with the manned field stations. In addition, the project will utilize the data and analysis of an ongoing (3 year) UNDP financed Hydrological Surveying Project and the research and training facilities of the proposed River Research Institute.

3. Assistance to SPARRSO
FAO - UNDP Financed

The UNDP has provided $683,000 to finance the FX portion of the Scheme for Bangladesh Landsat Program BLP Phase I. Since early 1977 the project has financed an FAO expert in remote sensing attached to the Bangladesh Landsat Program and has provided basic equipment and training for satellite imagery analysis. This project is the predecessor to the Scheme for SPARRSO (which the present AID assistance will support) and has contributed greatly to the establishment and organizational development of SPARRSO.

Under this UNDP project, the BLP has obtained additional UNDP and other donor assistance to carry out specific studies. For example, an additional $150,000 was provided to BLP for a study supervised by The Environmental Research Institute of Michigan (ERIM) to map and project new land accretion in the Bay of Bengal. Also the World Bank has financed BLP to update the land use map of Bangladesh.

The UNDP will evaluate their support to the Bangladesh Landsat Program and consider follow-on assistance in support of the Scheme for SPARRSO.

4. Disaster Preparedness
FAO - UNDP Financed

Approximately $150,000 is being provided to develop model Thana level agricultural plans for rapid post disaster recovery. The FAO is providing consultants who are assisting the BDG to identify alternative crops which can quickly be planted in areas which experience a flood or cyclone disaster in order that local producers will be able to realize some production output despite the loss of their main crop.

5. LICROSS

The League International of Red Cross provides continuous support for a part of the equipment needs of the Cyclone Preparedness Program. The equipment provided is mainly for communication among the field stations and for village warnings, e.g. radios and siren/bullhorns. LICROSS also provides periodic advisors to review the program.

ANNEX B

THE INTERIM CYCLONE WARNING SYSTEM

In early 1978 the U.S. satellite, NOAA V, which the BDG was accessing for their existing cyclone warning system, failed. Realizing the new AID assisted Disaster Alert Project under development would not be completed before the October/November 1978 cyclone season, the BDG requested the U.S. to assist in an interim effort.

In June 1978, USAID informed the BDG that the U.S. would provide emergency assistance for the establishment of a minimum satellite receiving station so that coverage of the country could be available during October and November 1978. In July, a four man team from AID's Office of Foreign Disaster Assistance (OFDA), NASA and NOAA came to Bangladesh and assessed the immediate needs. By the end of July, using OFDA funds, NASA entered into a contract with P and P Industries of Maryland to provide and install the interim system. The contract called for the system to be operational by October 1, 1978.

During August and early September, P and P Industries air shipped all of the equipment and the BDG completed all site preparation including the construction of a building foundation and antenna pad.

In the third week in September, a six man team from NASA, NOAA and P and P Industries arrived in Dacca to set up and check out the system. Working seven days a week and twelve hours a day, with their Bangladeshi counterparts, the U.S. team successfully completed the installation and the first pictures were received on October 1, on schedule. An additional week was spent in checking out the system and training the operators.

To avoid the past problem of dependence on one satellite, the interim system provides sufficient redundancy so that the low resolution imagery of three separate satellites can be obtained. The system includes two separate antennas - a 20' parabolic to receive broadcasts from the Japanese Geostationary Satellite (GMS) and a small omni-antenna for the polar orbiting U.S. Tiros N and the Russian Meteor satellites. There are two receivers and three separate image facsimile machines (printers) so that the BDG can get useful data even if two of the three satellites fail or if one component of the ground station fails. Spare parts and testing and repair equipment were also provided and the Bangladeshis were trained in their use. Since the first week of October, the system has been fully operational 24 hours a day, and has provided information to the Storm Warning Center of the Bangladesh Meteorological Department on the size and movement of three separate cyclones.

ANNEX C

SPACE RESEARCH AND REMOTE SENSING ORGANIZATION (SPARRSO)

Serious interest in space science and its applications began in Bangladesh during the mid and late 1960's with the formation of the Space and Upper Atmosphere Research Committee(SARC's predecessor) under the aegis of the then Pakistan Atomic Energy Commission. Its activities at first were research-oriented using data obtained from a variety of sources outside of East Pakistan. However, in 1967 the country's first satellite receiving station was purchased and began receiving real time, low resolution satellite imagery from U.S. meteorological satellites.

With this new research tool, SARC was able to pursue an independent program of research into the formation and movement of cyclones in the Bay of Bengal. The ground station also provided the country with its first application of space technology since the real time imagery provided the country with its first early warning of cyclone formation.

By 1970, Bangladesh interest in applied space science had become quite strong and the country sought to participate in the newly announed Earth Resources Technology Satellites (ERTS) program of the U.S. The war of independence interrupted the planned participation in this program although SARC still actively continued its meteorological research activities.

In 1973, a few Bangladeshi scientists had obtained ERTS (Landsat) imagery of the country and undertook preliminary land use and mapping studies. This activity led the government of Bangladesh to organize in 1974 a national ERTS committee and to formally establish a program of study called the Bangladesh ERTS Program which formally entered into a cooperative agreement with NASA's, world wide ERTS program.

The Bangladesh ERTS Program was organized as a temporary program of the government without permanent staff. This was done for two fundamental reasons. First, the U.S. ERTS program itself was experimental and the BDG was unwilling to create a permanent cell in its bureaucracy based on a possible temporary foreign based experimental program. Second, the BDG did not want to create a separate and permanent staff of researchers who would work in isolation from the established ministries which were to be the real

users of the ERTS data. The Bangladesh ERTS Program was therefore established as a temporary program staffed by personnel seconded from interested ministries and agencies such as the Bangladesh Atomic Energy Commission, agriculture, forestry, water development, meteorology, etc.

During the past four years, the Bangladesh ERTS Program, renamed the Bangladesh ERTS (Landsat) Program, has carried out an active program of study of the national resources and environment of Bangladesh. It has obtained assistance from the UNDP for equipment, and training, and from the FAO the services of a long term sensing advisor. In addition, it has obtained a support grant from the Government of Australia for vehicle procurement and research grants from the World Bank to prepare land use maps of the country.

In 1977 the Bangladesh ERTS (Landsat) Program began discussions with NASA and USAID regarding their future program of remote sensing and the development of this project. Simultaneously, a revised organizational plan was prepared and submitted to the Government for approval. The revised organizational plan called for the establishment of a permanent organization under the Science and Technology Division, Cabinet Secretariat , called Space Research and Remote Sensing Organization (SPARRSO). SPARRSO is now being formed by merging the ERTS (Landsat) Program and the SARC into a single entity responsible for the construction, operation and maintenance of all space science related activity in Bangladesh for which SPARRSO is specifically authorized exempting only communications satellite facilities operated by the Ministry of Telecommunications. SPARRSO was made the resource center which supplies respective data and imagery, to real time user agencies such as the Meteorological Department and the Water Board which use applied satellites technology. It also provides training, facilities, and analyses other than meteorological to other ministries such as agriculture, forestry, etc. who can profit from remote sensing applications.

The full reorganization and merger of the various space research activities has been approved by the Government and is now being carried out during the present Two Year Plan and will be completed by June 1980.

By June 1980 SPARRSO will be headed by a Chairman who will report to the Science and Technology Division, Cabinet Secretariat. In addition, he will take policy guidance from a National Council of Space Research and Remote Sensing composed of representatives of

the various user ministries. SPARRSO will have three principal departments; Applications, Technology (ground facilities) and Research. In addition the organization will include units responsible for international affairs, finance and accounts, planning, administration, library and public relations. The permanent staff will be composed of the staff of the Bangladesh ERTS (Landsat) Program and SARC. In addition to its permanent staff SPARRSO will continue to draw personnel for investigating staff from all interested ministries and agencies on a temporary basis as was done by the Bangladesh ERTS (Landsat) Program.

The activities of the Applications Department of SPARRSO will not overlap operational activities of the Bangladesh Meteorological Department and the Bangladesh Water Development Board. However, collaborative research projects may be undertaken jointly by the concerned agencies.

ANNEX D

STORM WARNING CENTER (SWC)

Organization

The Storm Warning Center is a field office of the Bangladesh Meteorological Department under the Ministry of Defense, Government of Bangladesh. The Center is headed by a Deputy Director under the supervision of the Director of Bangladesh Meteorological Department. This Center is the sole authority which issues all weather forecasts/ warnings in normal and abnormal times.

This Center is responsible for the issuance of severe weather warnings for tropical cyclones, local storms (nor'westers/tornadoes) and heavy rainfall, besides the routine issuance of Bay Bulletins for the Bay of Bengal and fleet forecasts for the Bay of Bengal north of latitude 18-½°N for the benefit of merchant as well as naval shipping and the daily weather forecasts for the general public.

The central control office in Dacca is manned by about forty trained technical personnel and operates 24-hours a day.

The Center is directly linked by SSB landline teleprinter, telegraph and telephone to field offices, other EDG agencies and the mass media.

Function

Synoptic Weather Charts: Observations of weather conditions at the earth's surface and at higher atmospheric levels form the basis for synoptic weather charts. Weather conditions are observed by meteorological satellites, radar and through a network of 40 land stations in Bangladesh. Observations from the neighboring countries and adjoining high seas between latitude 10°S and 30°N and Longitude 60°E and 130°E are also received through interception of the regional broadcasts from New Delhi through Intelsat Communications Satellite Ground Station.

Surface weather charts are prepared and analyzed at this Center for 00, 03, 06, 09, 12, 18 and 21 hours GMT observations and also for 15 hours GMT observations whenever required. Upper winds charts are prepared and analyzed for 00, 06, 12 and 18 hours GMT observations. Constant pressure charts are prepared and analyzed for 00 and 12 hours GMT observations. Besides 03 and 12 hours GMT change charts, 00 GMT Showalter Index Charts, 00 GMT Thermo-dynamic charts, 00 GMT Sea-Level prognostic charts are prepared, analyzed and compared with global weather charts received through FAX on a routine basis.

By the studies of the synoptic weather charts, surface and upper air, at different consecutive hours, the forecasters obtain a complete picture of the three dimensional structure of the atmosphere and also a picture of the displacement of the weather disturbances and the change they undergo while they travel.

Warning System

(a) General Procedure of Warning: A tropical cyclone is first detected by the weather charts and satellite imageries while in the formative stage of its development. When the storm comes within the range of weather surveillance radar at Cox's Bazaar, hour to hour position of the storm is available. Alert messages are issued generally 36 or more hours ahead and warning messages are issued 24 hours ahead. Danger/great danger messages are issued 8-12 hours ahead. All these messages are telegraphically issued to 239 warnees of various interests including the CPP and Radio Bangladesh. On receipt of these messages the seaport and riverport authorities immediately hoist appropriate signals (11 for seaports and 4 for riverports) at the ports to warn distant steamers and country crafts. Similarly, the steamers while leaving the port/ghats will also hoist signals to warn other steamers. Country crafts plying in the river will immediately go to safer anchorage and all outgoing traffic from the port/ghat will be suspended until "All Clear" is given. All other warnees take precautionary measures in their respective spheres for safety of lives and properties. These messages include: (a) Position and severity of the storm; (b) Speed as well as direction of movement of the storm; (c) The maximum sustained wind speed of the storm; (d) The probable height of storm surge; (e) The time and the locality of its crossing the coast; and (f) Advice for evacuation, if necessary.

(b) Facilities Provided by Bangladesh Meteorological Department: Bangladesh Meteorological Department provides the following services in connection with storm warning services:-

(i) Weather Bulletins for the Benefit of Ships in the High Seas:

These bulletins are telegraphically issued once a day during normal weather and 2-6 times a day during disturbed weather according to its severity for broadcast by the coast radio station at Chittagong.

(ii) Fleet Forecasts for the Benefit of Naval Shipping:

These forecasts are telegraphically issued twice a day to Navy Headquarters, Dacca.

(iii) Storm Warning Signal Advisories for the Seaport Authorities at Chittagong, Chalna and S.D.O. Cox's Bazaar for the Benefit of Shipping:

These are issued telegraphically 2-6 times a day according to the severity of the storm.

(iv) Weather Bulletins and Storm Warning Advisories for the Benefit of Inland Riverports and Shipping:

These bulletins are issued four times a day to Radio Bangladesh for broadcast at the specified times. In addition, the advisories for signals are issued telegraphically to specified recipients related to the waterways sector.

(v) Tropical Cyclone Warnings for the Benefit of Aviation:

These warnings are issued during various phases of a cyclone to specified aviation authorities and meteorological aviation forecast centers in Bangladesh.

(vi) Hurricane Informatories and Danger Warnings:

These messages to senior government officials and the CPP, are telegraphically issued 3 to 6 times a day according to the severity of the storm. They start at the earliest stage of the development of a cyclonic storm and continue through its after phase.

(vii) Hurricane Great Danger Warnings:

These warnings are issued telegraphically 3-6 times a day for the districts likely to be affected. These are sent to administrative authorities such as the CPP for taking precautionary measures for evacuation, if necessary.

(viii) Special Weather Bulletins for the Benefit of the Public:

These bulletins are issued to Radio Bangladesh 3-6 times a day according to severity of the storm for frequent broadcast whenever a cyclonic storm is expected to affect Bangladesh.

(ix) Heavy Rainfall Warning for the Benefit of Engineering and Hydrology:

These warnings are issued telegraphically once a day to railway authorities and the Flood Forecasting and Warning Center. The warnings are issued when the rainfall is predicted to be greater than 2 inches.

(x) Warning for Storm of Land Origin (Nor'westers/Tornadoes etc.)

These warnings against storms of land origin (nor'westers, tornadoes, etc.) are issued to various authorities and agencies concerned including Radio Bangladesh for broadcast in 24 hours.

ANNEX E

WATER DEVELOPMENT BOARD (WDB)
FLOOD FORECASTING AND WARNING DIVISION

This Division presently under the Directorate of Surface Water Hydrology II, BWDB was established in April, 1972 as the center for the issuance of flood forecasts and alerts within Bangladesh.

The Flood Forecasting and Warning Division is headed by a Deputy Director who is responsible to the Director, Surface Water Hydrology II, Water Development Board under the Ministry of Power, Flood Control and Water Resources, Government of the People's Republic of Bangladesh. The Deputy Director is supported by 66 technical and non-technical staff as well as 44 logistics support staff.

This Division is responsible for forecasting floods and issuing warnings during the flood season. During the dry season, the Division issues low flow forecasts, conducts training to improve flood forecasting techniques and compiles an annual flood report.

The Flood Forecasting and Warning Division operates a Flood Information Center around the clock from May to October each year. The Information Center monitors water level from 34 stations and rainfall from 33 stations within the country. These data are collected through 10 wireless stations under the jurisdiction of the WDB and by 10 wireless sets operated by the police and Telephone and Telegraphs.

In addition, the Flood Information Center is connected to the Bangladesh Meteorological Department through a teleprinter line form collection of data from 20 Indian stations.

On the basis of analysis of these data, a daily Flood Information Bulletin is issued. A press release is also issued containing forecast information whenever relevant.

ANNEX F

CYCLONE PREPAREDNESS PROGRAM (CPP)

Organization

In Bangladesh, disaster prevention and preparedness is the responsibility of the Ministry of Relief and Rehabilitation (MRR). The MRR has control over and coordinates all government and private activities. While other Ministries such as Defense, Home Affairs, Health, Local Government, Rural Development and Cooperatives, Finance, etc. have critical roles in disaster prevention and preparedness, it is the MRR that sets guidelines and plans and implements the overall national programs.

The CPP was initially, however, a Bangladesh Red Cross (BRC) Project, organized with the assistance of the League of Red Cross Societies and the Swedish Red Cross. Originally known as the Pre-Disaster Pilot Scheme, it was started in 1966 with the primary purpose of providing a mechanism that would transmit warnings during impending disasters and at the same time provide first aid and rescue in time of emergencies. This primary purpose has not changed, but the structure has grown more organized and sophisticated.

Upon reorganization in 1971, the CPP became a joint venture between the BDG and BRC. Policy and implementing direction is provided by the MRR and BRC with warning alerts and emergency relief given locally by the CPP volunteers.

The Policy Committee of the CPP is headed by the Minister of Relief and Rehabilitation and program implementation is under the direction of the Secretary of the same Ministry. Yet, despite the MRR occupancy of key positions, the CPP retains a close link with the BRC program as shown in the following committee compositions.

Policy Committee

Chairman: Minister of Relief and Rehabilitation.

Vice Chairman: Minister of Local Government, Rural Development and Cooperatives and Chairman, BRC.

Members: (2) BRC representatives.
(1) Planning Commission Representative.

Member/Secretary: Secretary, Ministry of Relief and Rehabilitation.

Implementing Board

Chairman: Secretary, MRR

Member: Secretary General, BRC
- (2) BRC Representatives
- League of Red Cross
- Rep. Planning Commission
- Rep. Ministry of Finance
- Rep. MRR
- Rep. Ministry of Local Government, Rural Development and Cooperatives

Member/Secretary: Director of CPP (A BRC official)

The CPP receives its financial support (approximately $350,000 per year) from the MRR through the above two committees. Nonetheless, the BRC is the government's grassroots implementing agency for the CPP and has imbued it with a non-bureaucratic vigor. This unique relationship of the CPP with both the BDG and the BRC creates a well organized highly efficient disaster organization. Although financed by the BDG, the CPP, because of its attachment to the BRC, is not part of the government bureaucracy in that volunteers are used as the final links to the villager. This unique organizational model explicitly utilizes the inhabitants in rural village areas who are most likely to be severely affected by cyclone related disasters. In fact, many of these volunteers have already experienced great personal loss during the 1970 cyclones and are dedicated to minimizing future losses from severe storms.

The lowest level of the Bangladeshi community structure is the ward which consists of approximately 2,000 inhabitants. Physically a ward forms a constituency within approximately 1 to 2 square miles. In the coastal districts affected by cyclones, wards seldom consist of traditional village formations but rather of 4 or 5 dwellings together, housing around 50 related individuals. A Union is typically composed of 3 to 6 wards and has 20,000 persons. It is part of a thana which may have 200,000 persons. There are 24 coastal thanas containing 201 Unions and 1843 Wards in an approximate area of 7,000 square miles which is served by the CPP through its 18,668 Ward volunteers. Group identification for cooperative efforts in cyclone warning and relief self-help occur within the framework of the Ward. Therefore, the team volunteers (2 each for spreading warnings, arranging shelters, rescue, first-aid and providing food and clothing) in each ward select a leader who becomes a member of the Union level coordinating committee. Each Union in turn chooses a leader

who is a member of the thana level coordinating committee. The elected leader of the thana coordinating committee is then the principal contact between the volunteers and the paid full-time CPP staff. Without self-help of this kind within the relatively well defined community groups, the CPP cannot be effectively established - either organizationally or financially - for Bangladesh.

Paid full-time CPP personnel who staff the Dacca headquarters, and the regional and field offices are BDG employees seconded to the CPP but are supervised by the Director of the CPP, a member of the BRC.

Implementation

The CPP has three activity stages. They are.

(1) preparatory
(2) alert
(3) rescue/relief

Various activities for each of the three stages have been designed in detail and assigned to CPP personnel from the Director to the Ward volunteer. Stage 2 alert actions have the most significance for this project.

When a storm warning notice is made by the Meteorological Department's Storm Warning Center, it is received in the CPP Dacca headquarters by telephone and cable. The CPP immediately communicates the warning to any or all 24 thana field level CPP officers through single side band transreceivers (SSB). Four additional units are located in regional food and equipment centers. In addition the police at the district and thana headquarters are also alerted.

Seventy-two of the 201 CPP Unions are connected by telephone to their respective thana seats. In the remainder of Unions, CPP volunteers handcarry the warning alert message from the thana radio center. Between the Union and Ward all communications are done without radio or telephone assistance, relying totally on the CPP volunteer network.

Storm severity is rated by the Meteorological Department on a scale from 1 to 11, with 8 through 11 signifying winds greater than 75 mph. From signal 2 upward CPP personnel are communicators and monitor storm alerts. Their warning alert responsibilities follow:

Signal II

- All thana level development officers informed by Dacca headquarters.
- All unions are informed by union volunteers from thana HQ.
- All volunteers are alerted and requested to listen to Radio Bangladesh reports if available.
- Ward volunteers organize equipment and liaison with union control office.

Signal IV

- All thana level development officers and volunteers reminded of increased danger.
- Liaison between CPP volunteers and thana HQ for possible evacuation orders.
- People warned of signal number through megaphone and signal flags.

Signal VIII (great danger)

- CPP volunteers make sure evacuation orders are known to everyone in areas to be evacuated through use of siren, megaphone, signal flags, beating drums, etc.
- All villagers are informed of great danger and increased signal numbers.

The alert stage signals given by the Meteorological Department automatically result in a variety of activities being undertaken by the CPP personnel. In addition, warning dissemination, sheltering, rescue, first-aid and food and water preparation actions depend upon the signal level.

A critical service provided by the CPP is the acquisition and communication of data concerning local conditions to be radioed among thanas and to the Dacca headquarters. In effect, the CPP offers a two way system relaying village conditions to Dacca headquarters, but, most importantly, it enables more sophisticated exact data to be available to the villager.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

ANNEX G
Life of Project:
From FY 80 to FY80
Total U.S. Funding 4,000,000
Date Prepared: 6/7/79

Project Title & Number : Disaster Alert (388-0046)

Narrative Summary	Objectively Verifiable Indicators	Meansof Verification	Important Assumotion
Program or Section Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Reduced loss of lives and movable property resulting from flood and cyclone disasters.	Number of people killed and injured as a result of flood and cyclone disasters will decline by 20% from present annual average by 1985.	BDG reports on cyclone and flood evacuations and loss of life and property resulting from flood and cyclone disasters.	Villagers will respond to disaster warnings and seek shelter. Shelters will continue to be available.
Project Purposes:	Conditions that will indicate purpose has been achieved: End of project status.		Assumptions for achieving purpose:
1. An improved national disaster alert system to protect human lives and movable property. 2. Application of remote sensing data to problems of national development, national resources inventory and assessmental conditions.	On completion of the Project BDG will be issuing accurate cyclone and flood warning to the rural and coastal population within 2 hours of the identification of the weather condition.	Post project evaluation carried out by Bangladesh Government agencies and USAID of the timeliness of the warnings.	Necessary coordination between the Ministries involved in this project. Cooperation of neighboring countries in supplying flood and meteorological data.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Outputs: 1. Meteorological and Flood data collection system installed and issuing warnings. 2. Technical and Managerial Personnel trained. 3. Analysis of natural resources and environmental conditions	Magnitude of Outputs: 1. One advanced satellite ground station installed and operating by 1981. 2. 33 person months of short term training provided to operators and analysts by 1981. 3. 15 person months of consultant services provided by 1981. 4. User agencies regularly utilizing remote sensing data on problems in which remote sensing data is relevant. 5. Village volunteer teams prepared to issue warnings.	Consultant progress report and follow participant training and survey the progress of trained trainees.	Assumptions for achieving outputs: 1. BDG's selection of qualified personnel, identification of appropriate training institutions. 2. Establishment of good working relation between officials of different agencies.
Inputs: 1. Equipment and spare parts for satellite based data collection system. 2. Consultant services, Technical assistance and project evaluation. 3. On the job/participant training.	Implementation Target (Type and Quantity) For details - see Inputs section of Project Paper.	BDG and USAID project records.	Assumptions for providing inputs: Availability of funds by BDG and USAID.

COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY

1.	FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy ? If not, has the Department of State determined that this government has engaged in consistent pattern of gross violations of internationally recognized human rights ?	Yes, it can be demonstrated.
2.	FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the comprehensive Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully ?	No, Department of State has not so determined.
3.	FAA. Sec. 620(b). If assistance is to Government has the Secretary of State determined that it is not controlled by the International Communist movement ?	Yes.
4.	FAA. Sec 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or order-	No.

	ed where(a) such citizen has exhausted available legal remedies and(b) debt is not denied or contested by such government ?	
5.	FAA.Sec620(e). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing,expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	In 1972 the BDG nationalized five firms which were fully or partially owned by U.S. entities. The BDG has announced a compensation policy and is taking steps to discharge its obligations toward U.S.citizens and entities.
6.	FAA.Sec.620(a),620(f),; App.Sec.108, 114 and 606. Is recipient country a Communist Country ? Will assistbe provided to the Socialist Republic of Vietnam,Cambodia, Laos, Cuba, Uganda, Mozambique or Angola ?	a) No. b) No
7.	FAA.Sec.620(i). Is recipient country in anyway involved in (a)subversion of, or military aggression against , the United States or any country receiving U.S. assistance,or(b)the planning of such subversion or aggression ?	No No
8.	FAA.Sec 620(i). Has the country permitted , or failed to take adequate measures to prevent,the damage or destruction, by mob action, of U.S. property ?	No

9. FAA.Sec.620(l). If the country has failed to institute the investment guarantee program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason ?	OPIC bilateral agreement was signed January 15,1975.
10. FAA.Sec.620(o). Fishermen's Protective Act, Sec.5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters. a. has any deduction required by Fishermen's Protective Act been made ? b. has complete denial of assistance been considered by AID Administrator ?	Not applicable.
11. FAA.Sec.620;App.Sec.603. (a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country ? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?	a) No b) No
12. FAA.Sec.620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of of the country's budget which is for military expenditures, the amount of	Not applicable

	foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems ? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec.620(s)" This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	
13.	FAA Sec.620(t). Has the country severed diplomatic relations with the United States ? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption ?	No
14.	FAA.Sec.620(u) What is the payment status of the country's U.N. obligations ? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget ?	Not in arrears.
15.	FAA.Sec.620A;App.Act Sec.607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism ?	No

16. FAA.Sec.666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any offices or employees of the U.S. there to carry out economic development program under FAA ?	No.
17. FAA.Sec.669,B70. Has the country after August 3,1977 delivered or received nuclear reprocessing or enrichment equipment materials or technology,without specified arrangements on safeguards ? Has it detonated a nuclear device after August 3,1977 although not a "nuclear-weapon State" under the nonproliferation treaty ?	No. No

B. FUNDING CRITERIA FOR COUNTRY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established, and taken into account to assess commitment and progress of country in effectively involving the poor in development, on such indexes as: (1) small-farm labor intensive agriculture, (2) reduced infant mortality, (3) population growth, (4) equality of income distribution and (5) unemployment, and (6) increased literacy.

1. Yes
2. Yes
3. Yes
4. Yes
5. Yes
6. Yes

b. FAA Sec. 104(c)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?

Not applicable

2. Economic Support Fund Country Criteria.

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human right. ?

No

b. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made ?

Not applicable

c. App.Sec. 113. Will security assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country to the Universal Declaration of Human Rights ?	Not applicable

C. GENERAL CRITERIA FOR PROJECT.

1. App.Unnumbered;FAA Sec.653(b);Sec 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;	a) Grant project was included in Congressional Presentation for FY 1980.
(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure) ?	b) Yes
2. FAA Sec.611(a)(1). Prior to obligation in excess of $100,000 will there be (a) engineering, financial and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance ?	Yes Yes
3. FAA Sec.611(a)(2) If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance ?	No further legislative action required.

4. FAA Sec.611(b); App.Sec.101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973 ?	Not applicable
5. FAA Sec.611(e). If project is capital assistance (e.g.construction), and all U.S.assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project ?	Yes, certificate included herein.
6. FAA Sec.209. Is project susceptible of execution as part of regional or multilateral project ? If so why is project not so executed ? Information and conclusion whether assistance will encourage regional development programs.	No
7. FAA Sec.601(e). Information and conclusions whether project will encourage efforts of the country to: (a)increase the flow of international trade; (b)foster private initiative and competition; (c)encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices, (e)improve technical efficiency of industry, agriculture and commerce; and (f)strengthen free labor unions.	The project is not directly applicable to foreign trade, private enterprise, cooperatives, etc.

8. FAA Sec.601(e). Information and conclusion on how project will encourage U.S.private trade and investment abroad and encourage private U.S.participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Not applicable.
9. FAA Sec.612(b);Sec.636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The host country contribution is 95% of the local currency and 35% of the total project cost.
10. FAA Sec.612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release ?	No
11. FAA Sec 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise ?	Project will be executed by a PASA with NASA. NASA's procurement procedures therefore apply.
12. FY 79 App.Act Sec.608. If assistance is for production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative and is such assistance likely to cause substantial injuty to U.S.producers of the same, similar or competing commodity ?	Not applicable.

FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec.102(c);Sec.111;113; Sec.281a. Extent to which activity will (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions;,(b) help develop cooperatives, especially by technical assistance,to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

1(a) The project is designed to provide a better warning of flood and cyclone disaster to people in disaster prone areas. Savings of lives and property are the expected outcome of this assistance.
(b) Not applicable.
(c) Project seeks to make Bangladesh self reliant in the capability to identify and predict impending flood and cyclone disasters.
(d) Not applicable.
(e) Project can be expanded if the Bangladesh Government so desires to enhance regional cooperation in meteorology and hydrology.

b. FAA Sec.103,103A,104,105,106, 107. Is assistance being made available :

	[106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is :	The selective development problem of improved warning of floods and cyclones.
	(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations:	
	(ii) to help alleviate energy problems;	
	(iii) research into, and evaluation of, economic development processes and techniques;	
	(iv) reconstruction after natural or manmade disaster;	Project seeks to improve natural disaster warnings so less destruction of life and moveable property will occur.
	(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance:	
	(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.	
c.	[107] Is appropriate effort placed on use of appropriate technology ?	Yes
d.	FAA Sec 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	Yes

e.	FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years ? If so, has justification satisfactory to Congress been made, and efforts for other financing , or is the recipient country "relatively least developed" ?	No
f.	FAA Sec.281(b). Describe extent to which program recognizes the particular needs, desires,and capacities of the people of the country, utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.	Project will utilize only locally available skills in hydrology and meteorology. The project addresses an important felt need of the Government of Bangladesh and has received its full support throughout the planning phase.
g.	FAA.Sec.122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth ?	Yes

STANDARD ITEM CHECKLIST

D.	Procurement	
1.	FAA Sec.602. Are there arrangements to permit U.S.small business to participate equitably in the furnishing of goods and services financed ?	Yes

2. FAA Sec.604(a). Will commodity procurement be financed from the U.S. except as otherwise determined by the President or under delegation from him ?	Yes
3. FAA Sec.604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed ?	Yes, agreement will so provide.
4. FAA Sec.604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity ?	Not applicable.
5. FAA Sec.608(a). Will U.S.Government excess personal property be utilized wherever practicable in lieu of the procurement of new items ?	Yes
6. FAA Sec.603. Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936 as amended that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners and tankers) financed shall be transported on privately owned U.S.flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	Project Agreement will so provide.

7. FAA Sec.621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis ? If the facilities of other Federal agencies will be utilized are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs ? — Yes / Yes

8. International Air Transport Fare Competitive Practices Act, 1974.

   If air transportation of persons or property is financed on grant basis, will provision be made that U.S. flag carriers will be utilized to the extent such service is available ? — Yes

9. App. Act. Sec.105.
   Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the U.S. ? — Yes

B. Construction.

1. FAA Sec.611(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest ? — Yes

2. FAA Sec.611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable ?	Yes
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million ?	Not applicable.

C. Other Restrictions

1. FAA Sec.122(e). If development loan is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	Not applicable.
2. FAA Sec.301(d). If fund is established solely by U.S. contributions and administered by an international organization does Comptroller General have audit rights ?	Not applicable
3. FAA Sec.620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-Bloc countries, contrary to the best interests of the U.S. ?	Yes
4. FAA Sec.636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S. or guaranty of such transaction ?	Such is not permitted.

5. Will arrangements preclude use of financing:

a. FAA Sec.101(f). to pay for performance of abortions or to motivate or coerce persons to practice abortions etc.?	Yes
b, FAA Sec.620(g). to compensate owners for expropriated nationalized property ?	Yes
c. FAA Sec.660. to finance police training or other law enforcement assistance, except for narcotics programs ?	Yes
d. FAA Sec.662. for CIA activitids ?	Yes
e. App.Sec.104. to pay pensions, etc., for military personnel ?	Yes
f. App. Sec.106. to pay U.N. assessments ?	Yes
g.App.Sec.107. to carry out provisions of FAA Sections 209(d) and 251(h) (transfer to multilateral organization for lending).	Yes
h. App. Sec.601. to be used for publicity or propaganda purpose within U.S. not authorized by Congress ?	Yes
i. App. Act.Sec.112. to finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields ?	Yes

ANNEX I

BANGLADESH

DISASTER ALERT

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I Richard L. Podol, Acting Mission Director, the principal officer of the Agency for International Development in Bangladesh, having taken into account, among other things, the maintenance and utilization by the Bangladesh Government and its agencies of projects previously financed by the United States, do hereby certify that in my judgment Bangladesh has the financial and human resources capability to effectively utilize the project to be financed by this grant.

This judgment is based upon considerations discussed in the Project Paper to which this certification is attached.

RLPodol

Richard L. Podol
Acting Director

25 JUNE 79

Date

ANNEX J. FOC 6-1.1

From: Mohammad Nurul Haq
Deputy Secretary

Ministry of Planning
External Resources Division
Government of the People's Republic of Bangladesh
Sher-E-Bangla Nagar
Dacca-15

Ref: No.ERD/USA(P)-30/78

#121

April 17, 1978

Dear Mr. Toner,

As you may be aware, we have received a request from the Science & Technology Division of the Cabinet Secretariat to approach the USAID for lining up of an ass-istance worth $ 1.5 million for obtaining a set of ground station equipment for cyclone preparedness and flood forecasting under Bangladesh E.R.T.S.(Landsat) Programme. The scheme has since been examined and approved by the authorities concerned of the Bangladesh Government. In this context, discussions of Dr.Anwar, Chairman B.A.E.C. and Director-General Bangladesh E.R.T.S.(Landsat) Programme held with Mrs.Anne Martindell, Director, office of Foreign Disaster Assistance, U.S.A. and you also refers.

2. We shall be grateful if you would kindly move the AID/Washington for lining up of an assistance of $1.5m. to cover the cost involved in the above mentioned Bangladesh E.R.T.S.(Landsat) Programme and keep us advised of their reactions at your very earliest.

Copy To Mr. O'Connell.

RECEIVED APR 20 1978 USAID DACCA

Sincerely,

Borhan Uddin Ahmed

(Mohammad Nurul Haq)

Mr.Joseph S. Toner,
Director,
USAID office in Bangladesh,
Hotel-Purbani, Motijheel C/A,
Dacca-2.

AID/d

ANNEX L

U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT

Dacca/Bangladesh

PROJECT AUTHORIZATION

Name of Country : BANGLADESH Name of Project : DISASTER ALERT

Number of Project : 388-0046

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended, and in accordance with the authority delegated to me under STATE telegram 029263, I hereby authorize the DISASTER ALERT PROJECT for Bangladesh involving planned obligations of not to exceed Four Million United States Dollars (US $4,000,000) in grant funds over a two year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project.

2. The project consists of activities meant to improve the Grantee's capability to obtain, analyse, and disseminate meteorological and river data so as to provide more definite and timely warnings of impending disaster. It will also provide the analytical capability to apply remote sensing technology to a variety of development problems.

3. The Project Agreement, which may be negotiated by appropriate officers of this Mission, and which will be executed by the Ambassador or me, in accordance with A.I.D. regulations and Delegation of Authority

5.7 shall be subject to the following terms regarding source and origin, together with such other terms and conditions as A.I.D. may deem appropriate.

4. Source and Origin of Goods and Services.

Goods and services, except for ocean shipping, financed by A.I.D. under the project shall have their source and origin in Bangladesh or countries included in A.I.D. Geographic Code 941 except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States or Bangladesh.

Frank B. Kimball
Director
USAID/Dacca

ANNEX N

ENVIRONMENTAL ASSESSMENT

Construction performed under the Project will have no negative direct environmental consequences. The building complex for the ground station will occupy approximately one-half acre which has been prepared and designed for public buildings and is located within an existing government office complex. The twelve cubic foot volume Data Collection Platforms which are solar powered and placed on platforms in or near rivers will not alter the surrounding environment or remove any land from agricultural production.

There are no significant indirect environmental consequences.

388-0046

UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

Dacca, Bangladesh

August 29, 1980

Mr. A.M.A. Muhith
Secretary
External Resources Division
Ministry of Finance
Block 10, Room 8
Sher-e-Bangla Nagar
Dacca

Subject: Disaster Alert--Letter of Agreement

Dear Mr. Muhith:

This Letter of Agreement between the Government of the People's Republic of Bangladesh ("The Government") and the Agency for International Development ("AID") sets forth the program developed between the Space Research and Remote Sensing Organization (SPARRSO), Science and Technology Division, Cabinet Secretariat and AID to install a disaster alert system in Bangladesh. A description of the system to be installed is contained in the attached Program Plan for Disaster Alert Project for Bangladesh (hereinafter called "The Program Plan") which is incorporated as a part of this Letter of Agreement.

AID agrees to provide for the procurement, shipment, installation and testing of the equipment described in the attached Program Plan by September 30, 1981. AID also agrees to provide training to Bangladeshi personnel so that the Government can operate the facility and equipment without further U.S. assistance after September 30, 1981.

The Government agrees to finance and have completed by September 1, 1981, the construction of the required antenna pads and laboratory facilities for the related receiving and display equipment which meet agreed specifications to be provided by AID to SPARRSO.

The Government agrees to provide adequate personnel and financial support to operate the facility after September 30, 1981.

The Government agrees to expedite the entry into Bangladesh of all personnel and equipment to be provided by AID for this disaster alert system, exempting these from all taxes, tariffs, duties and other similar charges imposed under the laws of Bangladesh or paying any such taxes, tariffs, duties and other similar charges from funds other than those provided to Bangladesh by the Government of the United States.

The Government agrees that the property being furnished by AID shall be used for the purpose set forth in the attached Program Plan and will continue to be used so as to further the objectives sought in the furnishing of such property. Any property which is not being so used shall, at the request of AID, be returned to AID or shall be reimbursed therefor.

AID and the Government agree that for three years after the property is installed and the associated training program is completed, AID or its representatives shall have the right to examine any property provided under this Agreement and to inspect and audit any records and accounts with respect to the financing of the activities provided for under this Agreement.

Please indicate your agreement with this program and to these conditions by signing this original and three copies and return the original and two signed copies to USAID/Dacca.

Sincerely,

Frank B. Kimball
Director

The above is agreed to by the Government of the People's Republic of Bangladesh.

A.M.A. Muhith
Secretary, ERD

Date: Aug 29, 1972

PROGRAM PLAN FOR DISASTER ALERT PROJECT FOR BANGLADESH

Background

Bangladesh is perhaps the most disaster prone country in the world. Cyclonic storms regularly sweep north along the Bay of Bengal and strike the Bangladesh coast. In addition, the interior of the country is frequently affected by above average flooding along the principal rivers which converge within the national borders. Tornadoes are also frequent, triggered by severe north-west winds. Bangladesh has experienced 140 MPH winds and storm surges (tidal waves) 20 to 30 feet in height, killing hundreds of thousands of people. The introduction of APT receiving equipment to receive the US meteorological satellites in 1968 provided the first real improvement in disaster alert. A second improvement was introduced in 1978 with the installation of new equipment to receive APT from Tiros-N, the Japanese GMS and the Russian meteor satellite. These are basically low resolution transmissions. If accuracies of forecasts are to improve, new higher resolution systems must be installed in Bangladesh.

Broad Requirements

This particular project is part of an overall plan aimed at strengthening Bangladesh's capability to obtain and utilize remote sensing data for disaster alert, agro-climatic analyses and environmental monitoring. Specifically, this project is intended to enhance BDG capability to identify and analyze cyclones, flooding, and storm surges. At the request of the Bangladesh Government, the Agency for International Development (AID) sponsored a study team for disaster alert (cyclone and flood) comprised of NASA, NOAA, AID and a private consultant. In June 1978 this team visited Bangladesh, studied the problem and as directed, proposed a satellite receiving system that would give Bangladesh advance notice of cyclones and floods. The system design reflected in this document, and the use of satellite data described later, has been reviewed by NASA and the following NOAA agencies: NWS, NESS, and NHC.

While the system will meet the requirements and performance objectives as described in this paper; the USG will assume no responsibility for the adequacy or accuracy of analyses or forecasts derived from the system.

Goals and Objectives

The purpose of this plan is to provide to the Government of Bangladesh a comprehensive improvement--through modern technology and hardware development--of their capability to obtain, analyze and disseminate satellite derived meteorological data so that villagers in cyclone affected areas are provided with accurate and timely warnings of impending disaster. The equipment and training provided under this project is an important adjunct to the Agro-Climatic/Environmental Monitoring Project presently being considered by AID for Bangladesh. This new program, scheduled to begin in U.S. FY 1981, will use, as a foundation, the equipment and training provided under this project.

Satellites to be received include:

- TIROS - N
- NOAA 6
- GMS (Japan)
- Meteor (USSR)

Types of transmissions to be received are:

- Low Resolution APT (TIROS, Meteor)
- Low Resolution WEFAX (GMS)
- High Resolution WEFAX (GMS)
- High Resolution AVHRR (TIROS)

Program Management

The project will be implemented in Bangladesh by the Space Research and Remote Sensing Organization of Bangladesh (SPARRSO) which has the responsibility for the management, operation and maintenance of all facilities related to the acquisition of remote sensing data provided by satellites and related equipment. Consequently, the equipment provided by this project will be managed, operated and maintained by SPARRSO. SPARRSO will be responsible for the provision of appropriate office and laboratory facilities for the proper operation and utilization of the equipment provided by the project. SPARRSO will also construct all necessary antenna foundation pads.

The Bangladesh Meteorological Department is responsible for the preparation of all weather forecasts and issuances of all storm warnings in Bangladesh and will therefore have top priority in

obtaining all decoded data and imagery and the use of equipment provided to analyze the data and imagery so that Meteorological Department's weather forecasts and storm warnings are based on real time data.

U.S. Government resources provided by the Office of Foreign Disaster Assistance (OFDA) will be fully managed by the National Oceanographic and Atmospheric Administration (NOAA) through a Participating Agency Service Agreement (PASA). Under NOAA's direction, procurement, shipment and installation of the facilities to be provided by the project will be delegated to the National Aeronautics and Space Administration (NASA) through a PASA. It is intended that NASA will engage a prime contractor under the Small Business Administration's minority business program. The management of training and provision of consultants will be the responsibility of NOAA subject to prior SPARRSO approval of the training program and individual consultants.

The USAID/Dacca will assist NOAA in the monitoring of project implementation in Bangladesh.

Project Implementation Schedule

1.	PASA Agreement Concluded by	Sept. 15, 1980
2.	GMS High Resolution Equipment procured	March 15, 1981
3.	TIROS HRPT Equipment procured	June 15, 1981
4.	Pass Conditional Acceptance Test at Vendor	June 30, 1981
5.	Airfreight to Dacca	July 15, 1981
6.	Install and Pass Final Acceptance Test with Contractor	Sept. 5, 1981
7.	Operations and Maintenance Training completed by	Sept. 1, 1981

Estimated Budget

		Cost ($1,000)
1.	GMS High Resolution WEFAX	
	Components - Receiver	12
	- Subcarrier Discriminator	3
	- Hard copy Display	25
	- Preamp/Downconverter	10
		50
2.	TIROS HRPT	
	2.5 Meter Antenna-Auto Track	150
	Receiver	12
	Tape Recorder	32
	Hard copy Display	25
	Bit Sync/Frame Sync	15
		234
3.	System Installation (Contract Related)	
	Move existing 6 meter Antenna	30
	System Engineering & direct labor	60
	Travel & Per Diem	40
	Administrative	20
	Overhead & fee	35
		185
4.	Shipping (AIR)	15
5.	Expandables	
	Mag. Tape	2
	Film	8
		10
6.	Operations and Maintenance Training (onsite)	20
7.	NOAA/NASA Costs	
	NOAA $\frac{1}{2}$ man year GS-14	17
	Travel	15
		32
	Grand Total:	546