

SPACE APPLICATION PROGRAMME OF BANGLADESH

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ABSTRACT

Bangladesh is a disaster prone country which is ravaged by tropical cyclones and floods every year causing immense loss of lives and property. To give an example November 1970 cyclone killed some 500,000 people. The damage during 1991 cyclone was about \$1.5 billion and that during Catastrophic 1998 flood is \$2 billion. All these disasters hamper the economic development of the country. Remote Sensing has been found to be a very effective tool in monitoring the natural disasters. Bangladesh SPARRSO has established an Advanced Meteorological Ground Station to receive hourly meteorological data from Japanese GMS satellites. These data are sent to all the user agencies like the Meteorology Dept., Agriculture Ministry, Water Development Board and Bangladesh Civil Aviation Authority etc. Satellite data on a hourly basis have helped to establish a very effective cyclone warning service in Bangladesh. The casualty due to cyclones have reduced to a large extent recently. This is a clear example where space technology is saving lives. Satellite imagery is also used to monitor floods and this has been found to be a very effective tool in flood management.

Satellite data is also being used in crop monitoring and assess to damage of crops due to flood. This information is used to formulate the crop policy of the Govt. These are some of the examples where space technology is being used operationally in the economic activity of the country. Satellite data are also being used to monitor forests, shrimp ponds, water bodies and making land use maps.

INTRODUCTION

Space technology which is being increasingly used for achieving sustainable and integrated development is now emerging as a powerful tool for combating poverty and for rapid transformation of backward regions. Satellite remote sensing, by virtue of its capabilities to generate resource information on various scales in a cost effective manner, is ideal for the assessment of the resource base of a region at micro level and monitoring of factors contributing to environmental degradation and global change. Combining the information derived from space on soil characteristics, surface and groundwater potential, wasteland and meteorological information with socioeconomic data, it is now possible to come up with appropriate development strategies and implement them at micro level for improving productivity. Monitoring of tropical forests, soil erosion, environmental pollution, crop conditions, land use pattern, water resources and sea level change along the shoreline provide the basic data necessary for achieving integrated resource management. The challenge of eradicating poverty and of improving the quality of life, specially in a developing country like Bangladesh can be met only through optimal management of national resources and mitigation of natural disasters. Using space technology for the rapid expansion of communication infrastructure, providing more accurate meteorological predictions issuing timely disaster warnings, initiating appropriate rescue measures and a large scale improvement of education, form the essential ingredients to tackling the fundamental problems of poverty and inequity.

Various applications of space programme in Bangladesh are given below:

METEOROLOGY

The first satellite designed to register atmospheric conditions was Vanguard 2 which was launched in 1958. Satellite meteorology became operational in early sixties. We can receive weather pictures taken by weather satellites like US NOAA and Japanese GMS every hour with the help of our Ground Station. They cover a wide area from Dhaka in any direction. A satellite equipment is really a blessing in this cyclone ravaged country of Bangladesh. We get information not only about the normal weather, but also about cyclones. No cyclones in this region cannot escape

our notice. We can notice them as soon as they are formed and track them until they strike the coast. From the degree of organisation of the cloud pattern, we can deduce the wind speeds in cyclones.

The peculiar geography of Bangladesh causes not only the life giving monsoons, but also catastrophic ravages of tropical cyclones, norwesters, tornadoes and floods. The Bay of Bengal is an ideal breeding ground for tropical cyclones. We find that some 38 severe tropical cyclones hit Bangladesh during the last 38 years. An exact estimate of the damage due to natural calamities in economic terms is not available. However, a good guess could be several hundred million dollars per year on the average.

Agro-Climatic and Environmental Monitoring System :

Under the Agro-Climatic Environmental Monitoring Project (ACEMP), the US Agency for International Development came with technical support from NASA and NOAA to provide Bangladesh with an integrated advanced system for receiving both low and high resolution imagery from NOAA and GMS satellites and analysing equipment capable of analysing not only NOAA and GMS satellite data but also Landsat and other satellite data as well.

The system consists of the Ground Station, Alden recorders, two VAX-11/750 and Microvax computers, two I2S image processors, disc drives/tape drives, plotters/printers, a digitizing table, matrix film recorder, optronics scanner, wing lynch film processor, several terminals, a number of peripherals and interface equipment.

Monitoring Programme :

The system is capable of monitoring weather data with the help of GMS satellites every hour and in addition with NOAA satellites 4 times a day. The system is most useful in the case of tropical cyclones which are formed in deep seas where no data is available otherwise. No tropical cyclone escapes this system. This system detects the cyclones right from its formation in the Bay , monitor its movement and estimate the maximum sustained wind speed from the size and degree of organisation of the cloud by D'vorak method. Question arose whether the cyclone models developed for the Atlantic and the Pacific could be used in the Bay of Bengal. An independent statistical model for determining the maximum sustained wind

speed in the Bay of Bengal has been developed and it has been found that this does not differ significantly from either the Pacific or the Atlantic models. Research is also being conducted on the structure and dynamics of tropical cyclones and on storm surges and some interesting results have been obtained. During the dry season, routine products include computation of Vegetation Index. Sea Surface Temperature and soil moisture. A joint project has already been taken up with the Food Ministry for crop monitoring. The full range of application activities include land use., crop pattern, crop intensity, crop damage, crop yield and crop calendar, land accretion, forest inventory, coastal afforestation, Monsoon rainfall, flood, drought, storm dynamics and storm surges. One expected use of the system is the development of Geographic Information System (GIS) for providing resource management information to appropriate sectors.

The earth's climate which is defined as the sum-total of the weather experienced at a place in the course of the year and over the years is always variable. However, as civilization has progressed, man has now entered as a factor in producing climatic changes. Through his activities man is now in a position to influence climate not only locally but also globally in drastic and possibly irreversible way. In addition, the constantly increasing population pressure and limited environmental and food resources further increase the vulnerability of society to climatic changes.

The manmade interference on climate has gone to the extent that it appears to be threatening the very climate which sustains us. NASA scientists have already detected the depletion of the protective ozone layer of the earth's atmosphere. This is being caused by various chemical substances like chlorofluorocarbons released as industrial products for various purposes by man. The destruction of ozone layer could be fatal for life on earth. The deadly ultraviolet radiation which was prevented by ozone layer from reaching the earth's surface could now reach earth's surface and be responsible for the increase in skin cancer and other deadly diseases. It has been estimated that the amount of CO² released by the consumption of fossil fuels by man in the atmosphere will be doubled in the next 50-60 years. This could increase the global temperature to the extent that arctic and antarctic ice will melt resulting in the rise of sea water by several meters. This could be fatal for a country like Bangladesh. As Bangladesh is a low deltaic area, its coastal region being only few feet above sea level, the rise of sea level by several meters could mean that a large part of Bangladesh will

be devoured by sea during the next 50-60 years. Satellite technology is being used to monitor the climate changes.

AGRICULTURE

The main problem in agriculture is to produce more food either by increasing yield per acre or increasing the cultivable land or decreasing losses in production. Each of these methods requires accurate and timely survey information in order to bring about the desired increase in food production. Just as in Meteorology, satellites can photograph crop fields and transmit the data back to ground station instantaneously. These data are very useful in the identification of crops, in the forecast of crop yield, in the analysis of crop vigour, in the early detection of crop diseases and other form of crop stress due to deficient water supply. Satellites can also monitor soil moisture conditions and indicate proper time to irrigate crops. Rapid inventories of livestock can also made with remote infra-red sensors. Now-a-days crop forecast is being made combining Landsat and weather data by SPARRSO. Thus satellite crop estimation is helping the Govt. to frame the Food policy which in turn helps to avert disasters like famine.

SPARRSO has started computing the Vegetation Index for crops on a routine basis. For NOAA satellite this is done by comparing the reflectance's pattern of bands 1 and 2 and for Landsat satellites, this is done by comparing the same for bands 5 and 7 of MSS. This has given the possibility of not only monitoring the health of crops but also crop forecasting in advance of crop harvest. SPARRSO has started routine forecast of crops using satellite and ground truth data and this contributes in the food policy formulation and development of food security system.

FORESTRY

Just as crop signatures display information on the state of health of plants, the state of health of the trees can be observed by means of satellite pictures in addition to the determination of the extent of forest cover over certain areas. Thus forest inventory can be made accurately with satellites. For example, when orange trees contract particular fatal diseases, the spongy green tissue of the leaf collapses and causes the loss of infra-red reflectance long before any loss in the natural green colouration of the leaf becomes visible to the maked eye or conventional film. Advance knowledge that the trees had contracted such disease would enable the grower to do

some remedy so that the disease does not spread to other trees. Analysts using satellite sensing techniques consider that dying trees can be individually located and plotted accurately enough to plan chemical control and salvage operations. Forest fires can also be detected promptly and accurately with the help of satellites. Some illustrious showing the monitoring of various forests of Bangladesh like the Sunderbans, the Chakoria Sunderbans Chittagong Hill Tract Forest and the overall picture of forestry in Bangladesh using satellite data are shown. We see the case of Chakaria Sunderbans which has been converted to shrimp ponds. On the other hand, we also see new mangrove afforestation which was monitored by SPARRSO using remote sensing. We have seen in one project area in Sunderbans that the Sundari trees are being replaced by Gewa.

MARINE STUDIES

It is possible to determine movement and concentration of fish population in rivers and oceans by means of satellite photography. In the oceans it is possible to determine such parameters as the surface conditions, wave heights, ocean currents and the temperature variations within the streams. A Fish industry stands to gain tremendously from the information obtained from spacecraft remote sensor.

A Project was taken up by SPARRSO using ADEOS OCTS data under the joint ESCAP/NASDA Project on Marine studies. Though the Project could not achieve its full objective due to early termination of ADEOS satellite, the available data along with NOAA data have given immense information regarding sediment concentration, Sea Surface Temperature and Chlorophyll concentration in the Bay of Bengal.

WATER RESOURCES

It is possible to determine the global coverage of water by observing its reflective characteristics. Thickness of snow fields and ice caps can also be detected by means of remote sensing by spacecraft. Such information is of immense value in irrigation and flood control. Prediction of flood and the survey of the extent of damage by flood by both static and dynamic methods can be made by satellites. It is also possible to measure the quality of water - for example the degree of pollution in inland waterways and changes in the bottom sediments and topography and lakes and reservoirs. The build up of sediment in estuaries and particularly in coastal area near harbours can also

be determined from spacecraft observations. SPARRSO has conducted survey of small and large water bodies of Bangladesh using Remote Sensing.

Illustration is given of the monitoring of 1988 and 1998 flood in Bangladesh using various satellite imagery, which has been of tremendous help to the Govt. of Bangladesh for doing flood rehabilitation work.

MAPPING AND LAND USE

Another area which stands to gain immensely from satellite photographs is mapping. Of the present maps of the world, 70% are inadequate and 30% are obsolete. By normal convention, it takes a long time to produce a map and the data becomes obsolete before the map is available even in advanced countries. A satellite enable maps to be produced quickly with upto-date information on land formation, soil and water conditions. Already, major discrepancies have been found in many parts of the world between what the land mass was thought to be and what it proves to be, in detailed satellite photographs. This is particularly applicable in Bangladesh, where changes occur so frequently by erosion and change of river courses.

SPARRSO has produced several land use maps of the whole country using Landsat MSS and TM data. Recently a project has been taken up to produce land use maps including settlement pattern using aerial photographs.

Besides these, SPARRSO is constantly supplying satellite image products to various users throughout the year.

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