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LANDSAT/Bangladesh Project

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~~1.0 Terms of Reference~~

- 1) to travel to Dacca, Bangladesh to discuss with the Bangladesh remote sensing project team the schedule of activities for the LANDSAT/Bangladesh project which is proposed to be undertaken with centre support;
- 2) to discuss the selection of researchers and the Bangladesh remote sensing project team's training needs so that a corresponding training programme may be established at the University of Guelph;
- 3) to undertake such other assignments as are agreed upon by yourself and the centre.

2.0 Schedule of Activities

April 11, Toronto to London (overnight).

April 12, London - Visa to Bangladesh from Bangladesh Embassy. Purchase of latest books on Bangladesh.

April 13, London to Dacca (overnight). (Read Johnson's book on Bangladesh)

April 14, Arrive in Dacca, Met Mr. Chaudhury and Mr. Pramanik. Received literature on Bangladesh remote sensing activities.

April 15, Meeting with Mr. Pramanik, Mr. Bakr and Dr. Anwar

Hossain. Established schedule for visit. Set up office at the Bangladesh Landsat Centre.

April 16, Meeting with Dr. A.M. Chowdhury, Mr. Pramanik and Mr. Chaudhury.

Received soils, geology and world bank maps of Bangladesh, met Mr. M. Muhiuddin, Chief Technical Assistance Programme (TAP) External Resources Division (ERD) Ministry of Planning.

April 17, Reading reports on Bangladesh.

April 18, Wrote preliminary report on my first impressions for presentation to the Bangladesh Landsat Task Force. Presented report and exchanged views with the following members, Mr. Chaudhury, Dr. Chowdhury, Mr. Pramanik, Mr. Ahmad, Mr. Rashid, Mr. Bakr, Dr. Azim and Mr. Gafoor.

April 19, Flew to Chittagong, drove with Mr. Chaudhury and Mr. Pramanik to Lake Karnaphuli at Rangamati. Spent night at Chittagong.

April 20, Flew back to Dacca. Met with Mr. Rashid and Mr. Gafoor. Took a 60 mile trip north of Dacca through an agricultural area with Dr. Azim.

April 21, Wrote second preliminary report on impressions from April 18-20.

Met the Surveyor General Mr. M. Hafizuddin and toured the map production facility of the ministry with Mr. Ahmad. Met with Mr. Phillip O'Meara of C.I.D.A. at the Canadian High Commission. Presented my second report to Mr. Chaudhury and Mr. Pramanik.

April 22, Made return flight reservations. Wrote third reports. Met with part of task force on specific questions.

April 23, Met with Dr. Anwar Hossain on overall proposals of the U.N.D.P. and I.D.R.C projects. Met with Mr. Haroon (Director of Planning Cell of the Science and Technology Division), Group Captain Jan (Principal Staff Officer to Chief Marshall - Administration), Dr. Anwar Hossain, Dr. Chowdhury, Mr. Chaudhury and Mr. Pramanik on overall future of remote sensing in Bangladesh, their requirements for training and experts.

April 24, Took trip with Drs. Azim and Chowdhury to Ariana. Discussed crop

identification and yield prediction.

April 25, Visited Centre and flew to London.

April 26, London to Toronto.

April 27, Wrote letters to Dr. Polcyn of E.R.I.M. for report on their work in Bangladesh. Wrote letter to Dr. S.A. Hempenius for their report on remote sensing and satellite surveying for Asia and the Pacific.

May 2-6, Discussed Bangladesh with Dr. N. MacLeod. Agreed to meet in Washington May 17. Wrote parts of final report.

May 5 , Talked on phone with Prof. M.I. Chowdhury of Jahangirnagar University about his views (he was at E.R.I.M.).

May 13-17, Writing and editing final report.

May 17, Visit Dr. MacLeod in Washington.

3.0 Approach Used

To fulfill the terms of reference I tried 1) to develop an overall view of where Bangladesh is headed as a Nation, 2) to evaluate the members of the task force as to their interests and commitments to remote sensing, 3) to evaluate depth of men power in Bangladesh to accomplish their objectives on the I.D.R.C. contract, 4) to evaluate spirit of co-operation, 5) to evaluate their immediate (2 year) needs, 6) to suggest things they should work towards for the future, 7) to meet the scientist who will do the work in the next two years, 8) to evaluate the availability of ground truth data.

4.0 State of the Landsat Center in Bangladesh

The task force has organized the Center. The U.N.D.P. equipment is arriving. Diazo transparencies were produced during my visit. Dr. Hossain is strongly committed to the success of the Center. He has directed his men to work on remote sensing. The other ministries have not committed full time personnel to remote sensing. Thus the program has been operated on a part time after hour basis.

Each member of the task force recognizes that full time researchers have to be allocated to the center. But at this time only a couple of researchers have thus been designated. With Dr. N. MacLeod during the next two years, I expect the researchers will be identified and allocated.

The contract will have to be approved by the Ministry of Finance as an account for Canadian funds will have to set up Mr. M. Muhiuddin will look after this.

- 1) The opening sentence of the contract should be expanded to read "The Ministry and the Centre are agreed that their joint undertakings shall include research activities enabling it to conduct surveys of the;
 - 1.1 Chittagong Hill Tracts (reservoir and watershed)
 - 1.2 Districts of Jessore, Khulna, Kushtia, Rajshahi, Pabna, Faridpur, Barisal and Patuakhali (dry season water reserves for irrigation and Land use).
 - 1.3 Khulna, Jessore, Faridpur, Patuakhali and Barisal (Salinity intrusion on ecology).
- 2) Section b) page 2 should read, "to evolve a method of land use management that will maintain an ecological balance in each of the three study areas".
- 3) Section c) page 2 should read "to produce a series of thematic maps at a scale of 1:250,000 dealing with geomorphology, soil, land-use, and surface hydrology in each of the three study areas.

6.0 Evaluation of Potential Success of Projects Proposed

- 1) Chittagong Hill tracts (reservoir and watershed)

Forestal has done a forest inventory in 1961. The maps and aerial photographs are available. Mr. Chaudhury has a good rapport with the foresters in this region as he has spent seven years in the Chittagong region. They have the expertise to successfully complete this project, but they must assign a full time person to start making comparisons. The forestry data will have to be moved from Chittagong to the Center.

- 2) Districts of Jessore, Khulna, Kushtia, Rajshahi, Pabna, Faridpur, Barisal and Patuakhali (dry season water reserves for irrigation and land use)

They have enough stream flow and sediment load data to get good results. They will have to have a full time person relating data collected in years past to Landsat imagery. A computerized density slicer will be very useful in this work. However, the Bangladesh Water Development Board will have to release information to the Center.

- 3) Khulna, Jessore, Faridpur, Patuakhali and Barisal (Salinity intrusion on ecology)

They are breaking new ground on this project as far as I know. The Water Development Board does have salinity data. To be successful they will have to co-operate extensively and do some basic work on identifying new criteria on Landsat images.

7.0 Training Required By Bangladesh

- 1) We discussed their needs for training at great length. We explored various centers which might provide the training.
- 2) We agreed that training periods should be co-ordinated with scientific meetings in host countries.
- 3) We agreed that training courses should be Bangladesh project oriented and of 1-2 months duration.
- 4) Training of four specialists in areas any of agriculture, forestry, sedimentology-hydrology, water quality, machine processing of Landsat data would be acceptable. This course could be arranged by the University of Guelph. If arrangements can not be made at the University of Guelph and C.C.R.S. then each of the four could be placed at E.R.O.S., Sloux Falls, L.A.R.S., Purdue Univ., and E.R.I.M. Ann Arbor for their short courses.
- 5) For the future development of remote sensing we agreed that it would be useful if two scientist-administrators could tour tropical and other remote sensing establishments near the end of this contract.

8.0 Experts Required by Bangladesh

- 1) Sedimentologist - sedimentary geologist--I suggest Dr. I.P. Martini from Land Resource Science, University of Guelph, Guelph, Ontario. They suggested W.E. Fisher, EROS Program, U.S.G.S., 1925 Newton Square E., Reston Virginia, 22090, U.S.A.
- 2) Water quality expert - I suggest Dr. R. Bukata, Canada Center of inland Waters, Burlington, Ontario.
- 3) Forester or Agricultural specialist for cover identification in Chittagong. (Bangladesh suggested Dr. Hoffer of LARS, Purdue University, West Lafayette, Indiana). I suggested Dr. A. Mack, C.C.R.S., Ottawa, Ontario.

- 4) For the salinity study they require a plant physiologist to explain salt influence on vegetation in order to correlate these effects to Landsat imagery. We could not identify such a person at this time.
- 5) Airborne remote sensing expert to develop their capacity. I suggested Mr. E. MacLaren of C.C.R.S. Ottawa, Ontario.
- 6) A senior Canadian expert to develop liason between Bangladesh, C.C.R.S., C.I.D.A. and I.D.R.C. for future research and development. I suggested Dr. L.W. Morley of C.C.R.S. Ottawa, Ontario.
- 7) Technical support to trouble shoot problems in equipment and to train their technicians on operation and maintenance. They suggested Mr. Joe Morgan from E.R.I.M., Ann Arbor, Michigan. I have not identified a Canadian.
- 8) Computer processing expert. I suggested Dr. M. Stromme, C.C.R.S., Ottawa, Ontario. They suggested Dr. D. Landgrebe of L.A.R.S. at Purdue University, West Lafayette, Indiana.

9.0 Equipment Required to Compliment U.N.D.P. funds

As the UNDP contract has purchased a colour additive viewer and an enlarger, other equipment will be purchased for the \$18,000.00 The equipment is to be decided upon later. This following is a suggested list:

- 1) Computer capacity to the Density Slicer provided by U.N.D.P. (camera mount to CRT).
- 2) Forestry
 - Teaching stereo scores
 - Levels
 - Altimeters
 - Light tables, large and small
- 3) Microfiche reader
- 4) Map comparer (Zoom Transferscope)
- 5) Water quality - hydrology
 - Salinometer
 - Rotometer
- 6) Geology
 - Tracing Table 22" X 24" (K.E. Catalogue No. 640981 Hamilton tracing table with transformer, Keuffel & Esser Co. Hoboken, New Jersey, U.S.A.)
 - Map Measure (5") (K.E. Catalogue No. 620300)

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7) Meteorology

- Radiant Energy Meter

- Air temperature measuring equipment for use in various crops.

8) Two sided adhesive tape

9) More paper for Diazo transparencies

10) Barrum Hobbv Flash Gun (PF-400) with accessories.

10.0 Documentation Required of All Experts

Before going to Bangladesh (Six copies).

1) Name

2) Name of Father/husband

3) Particulars of his/her passport

4) Date and place of birth

5) Nationality

6) Particulars of assignment in Bangladesh

7) Organization/agency to be attached to

8) Name of the Ministry/Department

9) Passport size photograph.

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11.0 Future of Remote Sensing in Bangladesh

Bangladesh at present is not feeding her own population. The country has the potential of feeding 75,000,000 people. They do not have an accurate crop yield inventory even after harvest. Whereas what they do need is a before harvest crop yield prediction system. The Large Area Crop Inventory Experiment (LACIE) run by the U.S.A. with co-operation from Canada is providing the necessary concepts and sampling techniques for a yield prediction system.

Bangladesh is quite eager to develop such a system. I think in Drs. A.M. Chowdhury and Dr. A. Azim they have the nucleus for developing the system. However, they will need near real-time Landsat imagery (they now wait 3-4 months for delivery from E.R.O.S. at Sioux Falls, S.D.). Receiving stations are now being developed with the capacity to collect Landsat and weather satellite data.

I understand Canada (through C.I.D.A.) is supplying \$55,000,000.00 annually to Bangladesh. Of this amount \$30,000,000.00 is in food aid. I suggest that we recommend that a portion of the C.I.D.A. contribution be allocated to the development of a receiving station in Bangladesh.

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The establishment of a receiving station will give them a chance to predict yields and will be a great incentive to their Landsat Task Force. This seems like a logical next step after their U.N.D.P.-I.D.R.C. project. However, planning must start immediately.

12.0 Suggestions Made to the Bangladesh Task Force

- 1) The Landsat/Bangladesh project should make sure that each chief investigator develop a Team (10 to 14) of regional co-operators. This would ensure good ground truth and facilitate extension of remote sensing techniques.
- 2) Need for Cost/Benefit Studies I mentioned to Dr. Ekram Hossain (Joint Secretary of E.R.D.) that Canada has been calculating cost/Benefit ratios of remote sensing projects for several years. These studies have proven very useful to remote sensing.
- 3) The study of deltaic island growth may best be accomplished by careful measurements on sequential rectified Landsat images. (This maybe a possible study for a man during an E.R.O.S. course).
- 4) An Agricultural Inventory (Dacca to Chittagong) should be possible by separating village (treed), water and rice growing areas on imagery in this area. The variable time of rice ripening will present some problems. A system of ground truth observation should be planned for known dates of satellite orbits. Thus if the sky is cloud free then ground truth data should be taken.
- 5) The Chittagong hill tracts are an area of a series of alluvial valleys between steep hills (formed from tilted fine grained sandstone and shale).

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- 5) The Chittapong hill tracts are an area of a series of alluvial valleys between steep hills (formed from tilted fine grained sandstone and shale). Shifting cultivation has been practiced over most areas. Erosion is severe, and landslides are numerous. They are establishing, Teak and Rubber plantations. Vegetable and fruit crops are being introduced. It should be possible to use Landsat imagery for broader scale land use Monitoring. The 1975 aerial photographs should be the base for a land use map.
- 6) The area of Lake Karnahuli--the water level varies from 70 to 109 ft. There is a large unvegetated bank all around the lake at low water. Erosion is severe. It should be possible to map the area of land susceptible to erosion and the rate of sediment accumulation in the Lake. However, this will require some careful measurement by sedimentologist and possibly soil scientist.

- 7) The Bangladesh Water Development Board has the following data at various stations; 1) rainfall, 2) evaporation, 3) tidal and non-tidal water levels, 4) discharge, 5) sediment load and 6) salinity. These measurements were made since before Landsat was launched. The measurements are recorded by day, month and year. Thus a study relating measurements with data on Landsat images of correlative days may prove to be a very useful initial approach.
- 8) The area north of Dacca chosen for an agricultural crop test site has a wide range of crops. The route crosses recent alluvium deposits and the older alluvium deposits. There are broad (miles) river plains and narrow (10's of yards) stream valleys with rice, this appears to be a suitable area from which to launch a Landsat crops inventory programme. With Dr. A. Azim's knowledge of crop pests and diseases the development of a crop identification key and a crop diseases key should be possible.
- 9) There is a need for working groups. Dr. Anwar Hossain and Mr. M.U. Chaudhury (1976) reported that 800 persons attended the opening sessions of First National seminar on Remote sensing at Dacca, Bangladesh in January 1975. Thus there should be enough scientists and technologists in the country to set up working groups including researchers from all regions on;
- 1) Forestry and ecology,
 - 2) Meteorology,
 - 3) Photogrammetry and Mapping
 - 4) Fisheries and water resources,
 - 5) Geology and Soils,
 - 6) Agriculture,
 - 7) Data Processing and instrumentation, etc.
- 10) To facilitate the education of working group members and future researchers the following manual should be prepared:

Table of Contents

What is remote sensing?

What is photo - interpretation?

Landsat scenes of Bangladesh - with interpretations.

photo-interpretation - key of crop types and diseases.

photo-interpretation - key of tree types.

photo-interpretation - key of cultural

11) The latest geological, soils and land use information should be transcribed on to separate Landsat mosaics. The obvious tonal discrepancies should be explained.

The task of getting all information to exactly the same scale and then to correlate the sequential data to appropriate Landsat images will be a very time consuming task.

12) When the working groups are established. Regional test sites should be established. These sites should cover the range of agronomic, soils, geologic, ecologic and climatic sub-types. These sites should then be covered by aerial photography to develop a set of photographs depicting various stages of growth of all crops. These test sites will become regional training sites. They would also serve as the sites for testing of homogeneity of ground truth observations.

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