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MANAGEMENT INFORMATION SYSTEM/ GEOGRAPHIC INFORMATION SYSTEM

AFGHANISTAN COMMODITY EXPORT PROGRAM

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PROPOSAL FOR A MANAGEMENT INFORMATION SYSTEM AND GEOGRAPHIC INFORMATION SYSTEM IN THE AFGHANISTAN/PAKISTAN PROJECT

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RONCO CONSULTING CORPORATION

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I. BACKGROUND AND OBJECTIVE

The United States government is supporting the people of the Free Afghanistan movement with humanitarian aid as these groups continue their efforts to establish a democratic state in their homeland. This assistance, directed by A.I.D., is channeled principally through four major operational efforts: health, agriculture, education and commodity procurement for life support of the population, as well as in support of the other activities.

The myriad activities carried out during this program: the purchase, delivery, acceptance and distribution of the commodities involved, as well as the humanitarian services, technical assistance and training, are difficult to track and control, given the unusual nature of the situation and the often harsh physical environment in which it is being played out.

There is the belief by O/AID/REP, shared by RONCO, of the need to establish a systematized approach to monitor, to control and to generate relevant data for planning decision-making. The most efficient method to achieve this is the development and installation of a computerized Management Information System (MIS).

In addition, the O/AID/REP recognizes the need to expand and deepen the regional and rural development planning process for those lands currently under the control of the Free Afghanistan people, as well as the territory expected to be in the future.

Here we recommend connection of a Geographic Information System (GIS), a computerized methodology of relatively recent development, which has already proven its worth for a variety of applications to the planning process, from data retrieval and transformation to project planning, execution and evaluation. For current requirements, the GIS permits analyses targeted for decision-making in specific circumstances. Further elaboration on the characteristics and utility of Geographic Information Systems is found below.

In the context of this project, the installation of a GIS in tandem with an MIS creates a situation where each system reinforces the other to provide benefits to project operation and planning beyond those expected from each system taken separately.

II. THE MANAGEMENT INFORMATION SYSTEM

A. Characteristics of a MIS

Information systems are characterized by four basic processes. First, there is the compilation or collection of information and its coding and entry into the system. Second, is the organization of this coded and stored information into a data base or data bank. Following this is the manipulation or processing of the data in the data bank for purposes previously determined and programmed for. The final step is the output of the results in a form(s) required by, and useful to, the recipient or user (see Figure 1).

An Information System transforms input (data), by means of a process, into output (information). An Information System performs other tasks in addition to collecting and processing data and generating information. For instance, it stores facts and controls accuracy. Data and Information System differ from information. Data consist of inputs -- the facts and figures and estimates that are to be processed by the Information System. Information is data made meaningful and valued by processing: i.e., data is transformed into understandable intelligence and rendered useful for achieving desired objectives. The purpose of our MIS is to provide information for decision-making. Our Information System will be flexible in its design in order to accommodate changes in project activities as new activities are added to the project. The design will be able to absorb this new information pertinent to those activities.

An Information System does not exist in a vacuum; rather, it is an integral part of the program it serves. As such, it has close relationships with the program's physical operations and organization. Furthermore, an Information System reaches out beyond the program it serves to program beneficiaries and other projects which interact and interface with the CEP Program. These other influences have an important impact upon the design and use of the system.

Any Management Information System is only as good as the data which goes into it. Therefore, insuring that the data being input has been properly classified and coded is an intrinsic part of the MIS design process. For our purposes, classification is the grouping into classes. In the context of an information system, classification refers to the grouping of data into categories. Coding is the assignment of symbols, such as letters or numbers or both, in accordance with a classification plan.

STRUCTURE OF THE INFORMATION SYSTEM

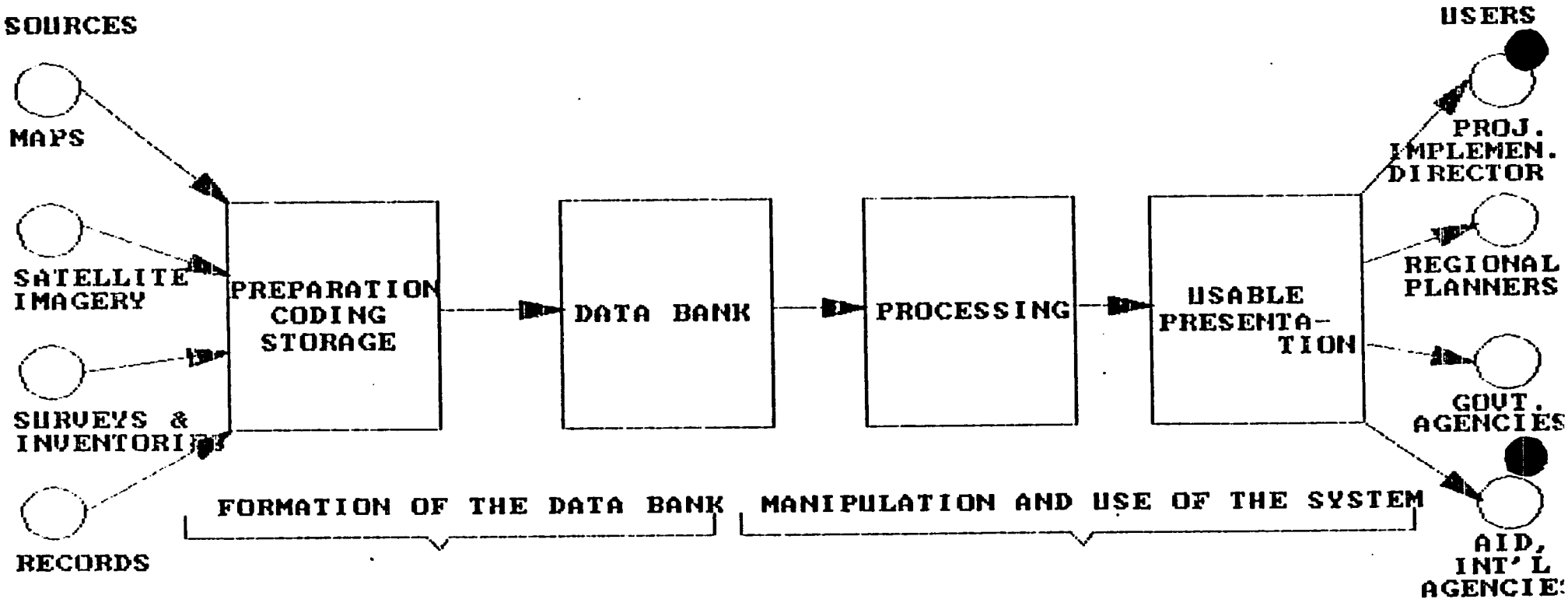

FIGURE 1

A high priority of RONCO's design for the MIS will be to assure that the classification, i.e., the set of classes or categories, fits the needs of users by being relevant and in sufficient detail so that the reports and financial statements based on these are directly useful for operations, planning and control.

The coding system to be designed will be simple and concise and allow for expansion -- as the system grows -- without constantly making changes in codes. The latter will be standardized throughout all functions and program levels, so that the reporting system is integrated.

RONCO will design recording forms which will be used by Central Office staff as well as the field staff. Each form will contain classification and code for the purposes of creating a data base, and each data element entering this base will do so by means of a process which sorts it according to its classification and code.

Inventory Control: The design and implementation of an inventory control system, as part of the MIS, will provide relevant information which allows project staff and AID/REP Special Programs Officer to make decisions on current and future project needs. The computerized inventory control system will be designed to identify commodities procured and donated by categories and subcategories, by manufacturers, provincial center, town, county and village. Using software (Oracle, XDB, Informix, Revelations) which is flexible allows the kind of coding and classification system previously described. Using identification codes, followed by a series of numbers which are then entered into the computer system, additional information could include, date(s) and time of shipment, date received and where, amount delivered, description and condition of the commodities, final destination, number of beneficiaries, and type of beneficiary (e.g., child, adult, Muhajadeen, local villager, displaced person, etc.). On-site information could be obtained and later input into the computer system -- RONCO anticipates tracking procured/donated items to their final destination, conducting and reporting on-site observations, and analyzing data. These inputs will generate information which will assist in determining current and future procurement needs on a local, regional and national level.

Additionally, the information system will be designed to generate statistical reports, graphs, analysis, and narrative reports, which synthesize and summarize major findings. RONCO could initiate a user training program to increase O/AID/REP staff awareness and use of the information system.

Aside from the data provided to MIS by the project activity

groups and the field stations, the information systems can count on the collaboration of monitors in the field to supply information that is not only current but which could not easily be obtained in another manner.

This information includes the tracing of commodities to their distribution to the benefited receipients as well as inspections of markets for commodity items.

Monitors can also be used to corroborate or solve data uncertainties within Afghanistan, thus providing data required for development planning activities carried out by the GIS. The definition of items would be straightforward, although their importance to the planning is considerable; for example, the location and condition of public buildings, roads, canals, etc. For more complicated data categories, e.g., present land use, a training program for the monitors can be mounted which would, itself, benefit from the experience and collaboration of groups active in that country such as, for example, VITA and the Swedish technical assistance, among others.

Map 1 shows the location of the operational area in Pakistan and Afghanistan and indicates the flow of information to the Information Center in Islamabad from monitors in Peshawar, Quetta and within Afghanistan.

B. Stages, Tasks and Elements

This involves three major stages: input stage, process stage and output stage. Each stage sees information related tasks performed and elements employed -- typical tasks involves actions consisting of collection and processing data and generation of information. Elements include documents that contain input data and output information, as well as the means by which the tasks are carried out.

C. Organization of the System

Data inputs will be received from RONCO's two field offices, in Quetta and Peshawar. The Quetta and Peshawar computers will be linked together and information will flow from Peshawar to Quetta. The Quetta system will be linked to Islamabad, and Quetta will transmit data from both Peshawar and Quetta to Islamabad (see figure). The Islamabad Office will review data, classify and code data, enter data into files and analyze and summarize the results. Reports will be generated in accordance with program needs.

MIS provides communication paths for information. It enables information to flow to all points of a program and even to points outside the program.*

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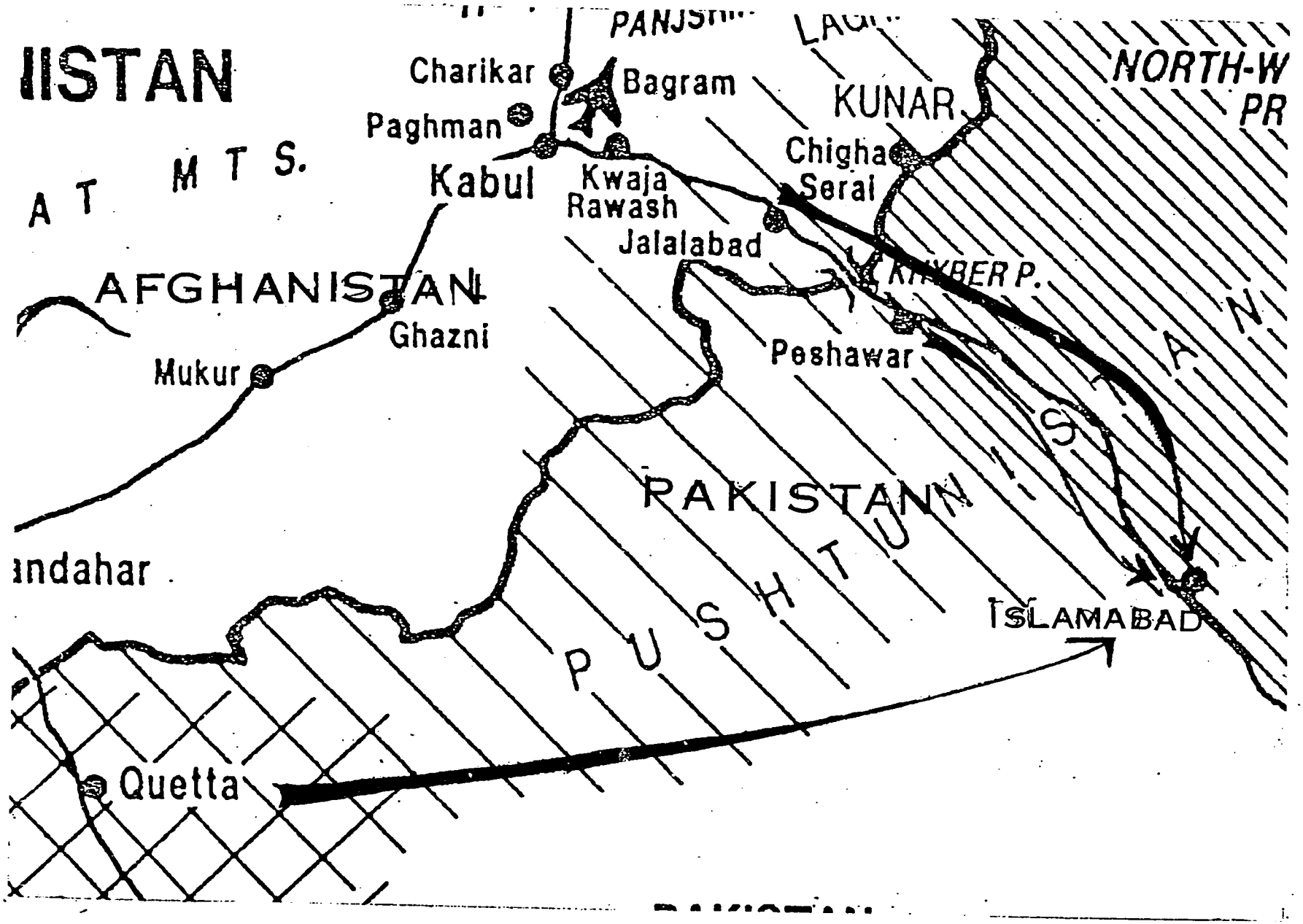
* Congressional Reports based on information retrieved from MIS.


IISTAN
AT MTS.
AFGHANISTAN
Charikar
Paghman
Kabul
Bagram
Kwaja Rawash
Jalalabad
Chigha Serai
KUNAR
NORTH-W
PR
KHYBER P.
Peshawar
Ghazni
Mukur
PAKISTAN
PUSHTUNISTAN
ISLAMABAD
andahar
Quetta

III. THE GEOGRAPHIC INFORMATION SYSTEM

A. Characteristics of the GIS

Geographic Information Systems, of course, share many of the same characteristics of a MIS, but have an additional trait that is both fundamental and significant: all data that are entered and produced by the system carry locational or geographic identification. We not only have quantitative information of a given piece of data, but we know where it is located. The importance of this is that when a result is obtained of a computer transformation or analysis of the data, we not only know the numerical value of this result but we also know where it is located in the geographic space, i.e., on the map or, in fact, on the ground. Without belaboring the point, the meaning of this for regional and rural planning or decision-making for actions to be taken in the field, is evident.

The formation of the data base or data bank and the processing of the data in it are fundamental to the information system. The nature of the data in the data base, i.e., the content, and the manipulation or processing applied to these define the results obtained and the meaning derived from these.

The data bank structure used by RONCO specialists in recent GIS projects is shown in Figure 2. This structure takes the form of a matrix, x by y, where the rows are geographic units of equal size and the columns are the variables whose data describe the characteristics of each unit. The matrix form allows the traditional results such as totals, frequencies, averages, densities, etc., but permits more profound statistical and numerical operations, e.g., correlation, factor analysis and clustering, that may have application to planning, policy or decision-making requirements.

It should be noted that the matrix structure permits study or analysis of a part of, or the entire, data base. This applies not only spatially, i.e., consider part of the area, but thematically, too, e.g., one may wish to deal with only certain parameters or variables in a given analysis.

Maps are extremely important in Geographic Information Systems. As one might expect, maps are the most significant source of data for GISs. There are, though, many other sources for spatially identifiable data; digital and hardcopy information from satellites, aerial photography or other remotely-sensed data, land surveys, and cadastral records are examples of these. There are others, perhaps not normally considered to be geographically based. Experts in the field recently estimated that 70% of all data in data bases can be geographically coded. Although the percentage may vary, this applies to the data that will enter this project's Management Information System. With a substantial

DATA BANK FORMAT

IDENTIFICATION OF THE KM^2						PHYSICAL AND SOCIOECONOMIC STUDY PARAMETERS									
COORDINATES OF km^2	DEPART-MENT	PROVINCE	DISTRICT	WATER-SHED	SUB WATER-SHED	SOILS	LAND USE	NATURAL VEGETATION	HYDROLOGY	METEORO-LOGY	LAND TENURE	INFRA-STRUCTURE	DISTRIBUT. POPULATION	SOCIAL CHARACTER	AGRICULT'L ECONOMICS
DATA BANK															

FIGURE No. 2

amount of these data subject to geographical coding, an interface between the MIS and GIS is not only feasible, but the use of MIS data by the GIS gives greater breadth and power to the latter.

B. Utility of the GIS to the Afghanistan Project

A properly constructed and operated Geographic Information System has the potential of providing answers to unknowns and solutions to problems found in the context of the Project's operations and future plans. Without prejudging the existing situation, since a needs assessment of user requirements has to be made on the scene, some applications to characteristic problems in developing zones are suggested below: (Note: these solutions would have both numeric as well as graphic expression).

1. Agriculture

- Lands suitable for agriculture, including irrigated agriculture.
- Selection of crops giving best return, within ecologically sustainable conditions.
- Disconformities of present land use vs. land capability (over use, sub-use).
- Agricultural zoning: the identification and spatial location of optimum agricultural enterprises or enterprise combinations and the quantification of these.
- Lands suitable for grazing vs. presently grazed areas. The identification of problems, as well as opportunity areas.
- Lands suitable for forests and their management, as well as protection.

(Note: Agricultural analysis and planning is consistently done within the context of sustainable use of the natural resources and the protection of the environment).

2. Meteorology and Hydrology

- Zones apt for dry land farming. Zones suitable for irrigated agriculture.
- Sources and amounts of surface and ground water, for irrigation (as well as other uses, e.g., domestic, industrial, navigation).
- Agrometeorology studies regarding crop needs for water, insulation, etc., over space and time.

3. Infrastructure

- Transportation routes and their adequacy for present needs. Planning for future needs, based on growth and development estimates.
- Movement of cargo and people, including projections and plans for the future.
- Identification of physical infrastructure, as resource for future development.

4. Demography and Social Characteristics of the Population

- Population numbers and densities, by age, sex and group, spatially delineated.
- Human needs of the population for services in health, housing, food consumption, employment and education, among others, spatially delineated.

It is understood that the above list is only a sample of the analyses and problem-oriented results that can be obtained from Geographic Information Systems. Data sources are probably the strongest conditioner of the results obtainable since the contents of the data base or bank are the raw materials for the numerical and statistical processing that provides the results. Given the needed data and the proper operation of the GIS, the potential for obtaining useful solutions and desired results is very high.

IV. INTERFACE BETWEEN THE MIS AND GIS

A Management Information System if usually multi-objective but in a project operation environment the MIS is expected to perform the tasks that will permit a high level of monitoring of project items and activities. The ability to track commodities through their purchase, receipt, distribution and use allows for the evaluation of the impact of such a commodities prog in its areas of operation. Personnel performance, technical assistance and training, financial accounting, and work plan advance are also characteristically included in a project MIS.

As indicated earlier it wi be noted that much of the data that are entered into the MIS ata base will be able to be coded geographically. This includes the commodities as they move across the terrain from their initial receipt to their final destination, the recipients of these commodities, and the providers and receivers of technical assistance and training, education, health and other humanitarian services. These data in the MIS, besides their fundamental role as the basis for the monitoring, impact evaluation and current-needs assessment that guide the subsequent actions in the execution of the project, also provide information for the data bases processed by the Geographic Information System.

With accessibility to such current data, the GIS can combine these with its wide array of natural and socioeconomic information to produce computer-processed results that permit more timely inferences for project planning and execution.

For example, as the humanitarian assistance has its salutary effect on the recipient population of one or another of the areas being supported, GIS applications to development planning can also begin to offer suggestions for projects or other actions to spur this development. All of this site-specific, based on information in the data bases of the GIS, as well as MIS. As a matter of fact, given the establishment of adequate data bases, GIS processing for regional and rural development planning, can initiate when desired.

Other advantages of a simultaneously-established and connected MIS and GIS include the following:

— Installations. Joint installations are not only a possibility, but are desirable for economy as well as operational reasons.

— Equipment. Some equipment, especially in the computer area, are likely to allow shared use. Because of its reliance on graphic input as well as output, the GIS requires such equipment not normally found in a MIS configuration, but whose output can benefit MIS reporting and evaluation.

-- Software or Computer Programs. Programs which process data bases and make them portable to both systems are available and recommended. Data base management is key to both systems and compatible software is also expected to be selected.

-- Personnel. Operator and programmer-analysts are needed to operate both systems, and no doubt much of this work can be shared by these personnel. In its graphic and analytic applications the GIS looks to specialized technicians who can be trained to a large extent.

-- Data. As indicated earlier in this section, it is in this category that the interface between the two systems have their greatest potential, as well as payoff. The existence of data in each system that are portable to the other affords the potential for broader as well as more trenchant analytical results beneficial to both systems and, by extension, to the operation of the project.

V. THE PROPOSAL

RONCO proffers the following proposal for the establishment and operation of a Management Information System and Geographic Information System for the USAID-supported Afghanistan project. It will be noted that this is a phased proposal so that after the Preliminary Phase -- that of needs assessment, investigation of sources and systems, and design of the project system -- the additional phases can be added or denied, one at a time (see Table 1). It is also worth mentioning that with the installation of the First Phase, the system will be in operation and products, i.e., results, can be expected to be produced by it on a routine basis. The adoption of subsequent phases raises the potential for broader analysis and additional applications as well as expanding the system's geographical coverage.

Phase I is scheduled for a period of one year, its go-ahead a consequence of the acceptance of the system design (see Table 2). During Phase I, the systems to be installed must be purchased, received in Pakistan and placed in operation. Local personnel must be hired and a contract let for the data-entry activities involved. With respect to the GIS, this first phase is conceived to be the first part of an expandable system, one that can be enlarged both thematically (more parameters and/or variables) and spatially (eventually, perhaps, to cover all of Afghanistan).

In this first phase, the geographic focus of the system will be the eastern part of the country, east of the meridian that passes through Kabul (see Map 2). The categorical and variable coverage will also be limited during this phase, mostly for time and start-up restrictions. The final choice of data parameters will be done with the participation of USAID/Afghanistan and the other interested users. For that reason, the selected data will represent the crucial issues facing the user groups at that time.

The GIS in Phase II also occupies a one-year period (see Table 3). Spatially, the system will continue to consider only the eastern part of Afghanistan (see Map 2), but thematically this phase will seek to complete the information coverage (parameters and variables) which the users wish to see included in the data bank, both for retrieval, as well as for analysis and problem-solving.

Because the system is prepared to admit more data, the personnel list now contains more local-hire specialists. The work will include, among other activities, training and performance of the digitizing services involved in data entry. Now in its second year, the Project GIS is sufficiently mature to name a director of this group. Hopefully, this can be an Afghan professional who can carry on this work in his country, when a transfer to there is feasible.

TABLE 1

Preliminary Phase

Task	Personnel	Period of Time	Place
1) Needs assessment, user requirements, investigation of sources of information	Specialist in GIS (U.S.)	1 month	Pakistan (project area)
2) Investigation of information, equipment and software, potential collaborators; design of the system	Specialist in GIS (U.S.)	2-3 months	U.S. (Inc. CA, TX, Washington, Omaha, i.a.)

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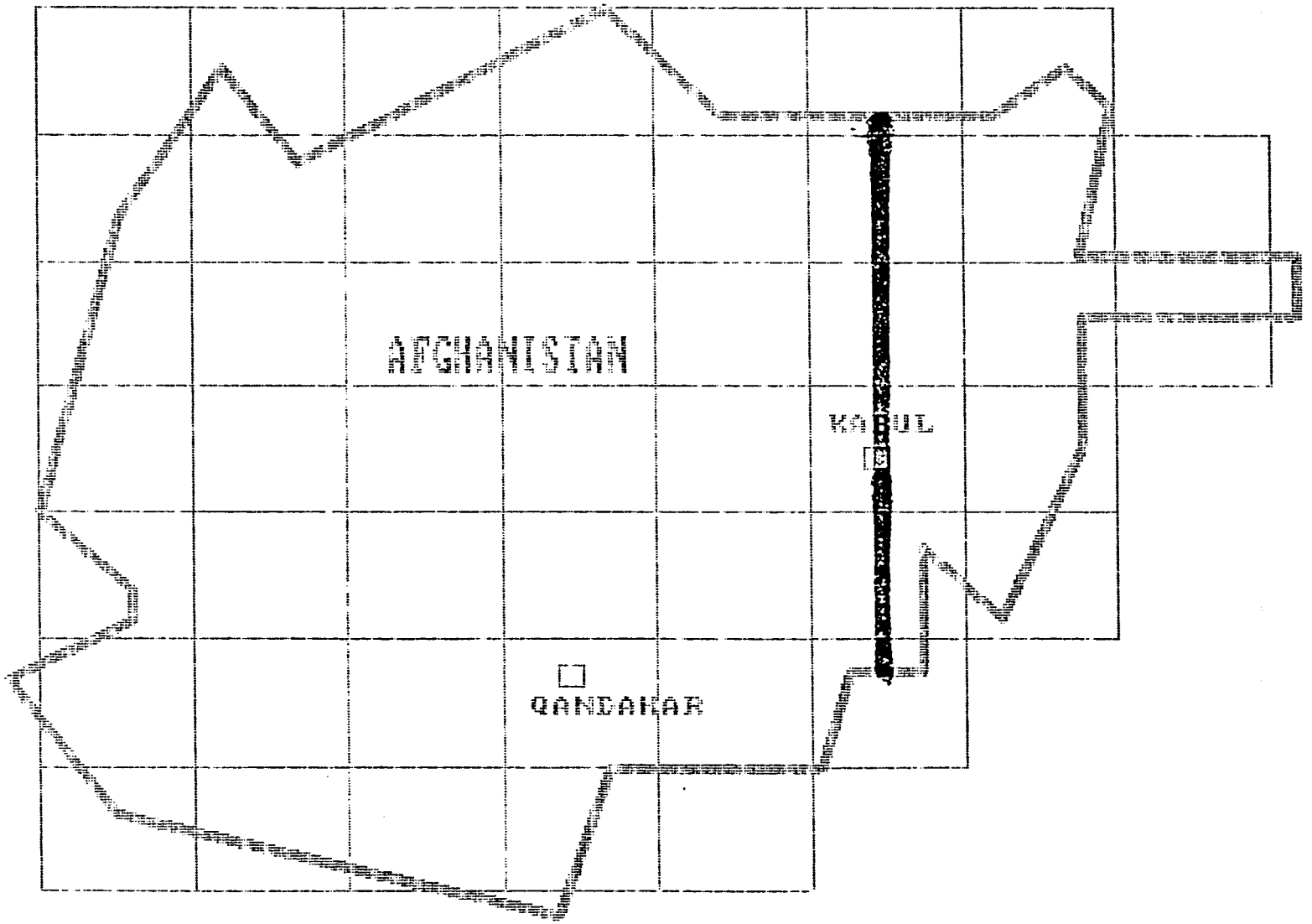

MAP 2

TABLE 2

Phase I

Task	Personnel	Period of Time (Cost)	Place
1) Install and begin operation of the MIS. Hire and train operator(s) of this system	One or two local-hire programmer-analysts	12 months	Pakistan
	T.A.: U.S.-based Manager of project	2 months	Pakistan
	MIS Specialist (U.S.)	2 months	Pakistan
2) Purchase GIS equipment		($100,000)	U.S.
Contract for data acquisition	U.S.-based team	($six figures)	U.S.
Hire and train personnel to begin operating the GIS	Local-hire Natural Resources Specialist	12 months	Pakistan
	Programmer-Analyst	12 months	Pakistan
	T.A.: GIS Advisor	12 months	Pakistan
	Other GIS Specialists	3 months	Pakistan

TABLE 3

Phase II

Task	Personnel	Period of Time (Cost)	Place
Contract for data acquisition	U.S.-based team; phase-in beginnings of local data acquisition	($six figures)	U.S.
Hire and train additional personnel for the continuing operation of the GIS	Local-hire, Project Director	12 p/m (1 person)	Pakistan
	Local-hire, GIS or Land Resource Specialists	48 p/m (4 people)	Pakistan
	Digitizer	12 p/m (1 person)	Pakistan
	T.A.: GIS Advisor	12 mos. (1 person)	Pakistan
	GIS Specialists	4 mos. (2-3 people)	Pakistan

This table refers exclusively to GIS, since it is expected that the MIS will be installed and fully operational in its standard manner by the end of Phase I.

As was the case for Phase II, Table 4, covering Phase III, refers exclusively to GIS activity. This phase extends over two years, the added time needed to achieve the objectives of the Afghanistan GIS. These are: spatially, to build a Geographic Information System that covers the entire country of Afghanistan and thematically, to create a data base of sufficient amplitude to provide the widest array of data parameters and variables possible, given the time and other limitations of the Project, for decision-making, problem-solving and planning.

During this two-year period, the GIS group comprised of local people (including, hopefully, a substantial number of Afghan nationals) will add up to nine, including the project chief and eight other technicians. This number is needed to keep introducing data into the system, during this phase, for all parts of Afghanistan, and to carry out the GIS operations that will provide the information and analytical results required by the users.

Training and local activity (if possible) in image processing for data acquisition is also proposed, to round out the skills the local group would need to undertake a wider spectrum of activities in the field of GIS.

The operation of this GIS, sited in the first phases in Pakistan, shows location in Afghanistan in the table for this one (Table 4). While no one can predict with certainty the timing of that event, it is included here to show that in general a relocation of the GIS to that country is a feasible alternative.

TABLE 4

Phase III

Task	Personnel	Period of Time (Cost)	Place
Contract for data acquisition and training in same	U.S.-based team; also train local staff in data acquisition from remote sensors	($six figures)	U.S., Pakistan (Afghanistan)
Hire and train additional personnel for the continuing operation of the GIS	Local-hire, Project Director	24 mos. (1person/2yrs)	"
	Local-hire, Programmer/Analysts	48 mos. (2persons/2yrs)	"
	Local-hire, Land Resource Specialists	96 mos. (4persons/2yrs)	"
	Local-hire, Digitizers	48 mos. (2persons/2yrs)	"
	T.A.: GIS Specialists	9 mos. (3persons)	

VI. COSTS

The costs of the activities delineated in the proposal have, in most cases, not been shown, for two reasons. First, the Preliminary Phase, culminating in the design of the GIS, will permit more exact cost figures for the consideration of USAID/Afghanistan. Second, since the operation of the proposed GIS is structured in various phases, over several years, and since the option exists to accept or deny entry into the subsequent phase, it was felt that cost figures for the numbered phases could be prepared at a later time.

In any event, the estimated costs for the Preliminary Phase are indicated below. If this Proposal advances into the Preliminary Phase, RONCO will, of course, present cost estimates for the entire Proposal as a result of that Phase's work.

Cost of the Preliminary Phase

Personnel	Time Period	Fee($)	Travel and Per Diem($)	Place
GIS Specialist	1 mo.			Pakistan
GIS Specialist	2 mos.			US: CA, TX, Omaha, Washington
			Sub-Total	
			Overhead	
			Fee	
			Total	

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