PD-AAN-323
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698-0420/15

UNCLASSIFIED
CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) – PART I

Report Symbol U-447

1. PROJECT TITLE	2. PROJECT NUMBER	3. MISSION/AID/W OFFICE
Regional Remote Sensing/West Africa	698-0420	AFR/RA 13

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY)
698-83-02

☒ REGULAR EVALUATION ☐ SPECIAL EVALUATION

5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING		7. PERIOD COVERED BY EVALUATION
A. First PRO-AG or Equivalent	B. Final Obligation Expected	C. Final Input Delivery	A. Total	$ 14,000	From (month/yr.) 6/80
FY 78	FY 85	FY 85	B. U.S.	$ 4,525	To (month/yr.) 3/83
					Date of Evaluation Review

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
1. Prepare interim extension amendment of 9 months	Rose AFR/RA	6/7/83
2. Prepare draft PP amendment for 2½ years which addresses principal recommendations contained in the evaluation: 1. Inclusion of management expert in the technical assistance package. 2. Provide higher level of training. 3. Active marketing of photo products and consulting services by the CRTO	Rose AFR/RA	7/15/83
3. Prepare final PP amendment for 2½ years	S&T/FNR and V. Mahan AFR/RA	9/15/83
4. Prepare PIO/T for new contract	C. Paul S&T/FNR	8/30/83
5. Prepare RFTP	C. Paul S&T/FNR	8/30/83
6. Prepare PROAG amendment	USAID/Upper Volta	10/15/83
7. Obligate FY 1984 funding	USAID/Upper Volta	10/30/83
8. Award contract	SER/CM	10/30/83

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- ☒ Project Paper
- ☒ Implementation Plan e.g., CPI Network
- ☐ Other (Specify)
- ☒ Financial Plan
- ☒ PIO/T
- ☐ Logical Framework
- ☐ PIO/C
- ☐ Other (Specify)
- ☒ Project Agreement
- ☐ PIO/P

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. ☐ Continue Project Without Change
- B. ☒ Change Project Design and/or ☒ Change Implementation Plan
- C. ☐ Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

John C. Rose, AFR/RA
Project Officer

12. Mission/AID/W Office Director Approval

Signature

Typed Name: W. H. Naylor, Jr.

Date: 7/29/83

AID 1330-15 (3-78)

E V A L U A T I O N R E P O R T

R E G I O N A L R E M O T E S E N S I N G (C.R.T.O.)

EVALUATION CONDUCTED MARCH 14 - APRIL 13, 1983
IN THE COUNTRIES OF:

Senegal	Sierra Leone
Ivory Coast	Benin
Mali	Upper Volta

Nigeria

E V A L U A T I O N T E A M

Charles K. Paul Date 6/15/83

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Date 23/5/83

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SUMMARY

March 1983 Evaluation

Date: June 9, 1983

Project: Regional Remote Sensing/West Africa 698-0420

Country: Africa Regional

Cost: Authorized $2,525,000 Planned $4,300,000

I. What constraints did this project attempt to relieve?

The project attempts to overcome those constraints to development associated with a lack of basic information about natural resources including forests, minerals, and water that is required to plan and implement projects. The project overcomes labor and cost constraints of obtaining this information by traditional ground and aerial surveys. The cost of using satellite imagery is estimated between one-fifth and one-tenth the cost of aerial surveys on a per square mile basis.

II. What Technology did the Project Promote to Relieve this Constraint?

The project promoted the use of remote sensing, primarily satellite imagery through the establishment of a regional remote sensing center.

III. What Technology did the Project Attempt to Replace?

Remote sensing is generally used in conjunction with ground and aerial surveys. It did not attempt to replace them but it does attempt to greatly reduce the need of these methods which many countries cannot because of the cost and manpower requirements.

IV. Why did the Project Planners Believe that Intended Beneficiaries would Adopt the Proposed Technology?

The February 1973 a Council of Minsters meeting of the Economic Commission for Africa adopted a resolution directing the Executive Secretary to take steps to seek assistance. Other African meetings were held in 1975-76 in which assistance was proposed. From experience in the U.S. the technology was known to be cost effective for many applications.

V. What Characteristics did the Intended Beneficiaries Exhibit that had Relevance to their Adopting the Proposed Technology?

Most of the beneficiaries, those trained at the center, have had university training. They are selected from ministries or departments of

hydrology, mines, water resources, forestry, planning, cartography, agriculture, etc. who have a use for remote sensing.

VI. What Adoption Rate has this Project Achieved in Transferring the Proposed Technology?

The evaluation did not include an indepth survey for all countries which have sent people for training. Senegal, Mali, Ivory Coast, Benin, Sierra Leone, Nigeria and Upper Volta were visited. In Senegal one former trainee was using remote sensing in an AID project. In Mali no trainees were currently using it. In the Ivory Coast limited use was found in cortography. In Nigeria former students were using remote sensing in forestry applications. Nigeria uses remote sensing in petroleum exploration. In Sierra Leone it was being used in water resources and mineral exploration and ex-students were training others. In Benin former trainees were using remote sensing in forestry, geology and teaching. A remote sensing center including a photo lab has been established by former Benion trainees. Cameroon has also started a center. Widespread use was found in Upper Volta. In addition to Africans, new adopters include members of the international donor community including AID.

The most significant factors impeding adoption were job related in the trainees' ministries. In some cases trainees were not assigned to projects that could use their skills. In other cases funds are not budgeted to purchase imagery and other supplies. Few trainees have management skills and this is a serious obstacle to greater use. Another constraint is a lack of knowledge of remote sensing by many members of the international development community who manage projects in which the technology would be useful. Also, some people are opposed to using remote sensing because of a previous negative experience with it.

VII. Has the Project Set Forces Into Motion that will Include Further Exploration of the Constraint and Improvement to the Technical Package proposed to Overcome it?

Yes, the project has achieved a degree of replicability where countries have the willingness and means (external or internal) to use remote sensing. Some students have requested and received additional training outside of Africa. Many have requested more advanced technical training and management training (see VI above). The evaluation found that several countries wanted to have national remote sensing centers including photo laboratories but could not obtain the necessary funding.

VIII.

(A.) Do Private Input Suppliers have an Incentive to Examine the Contraints Addressed by the Project and to come up with the Solution?

No. In general, the services provided by this project were previously provided by the foreign private sector through contracts

with international donor agencies. There is little, if any, indigenous private sector expertise in remote sensing in West Africa. There are few, if any, private companies in West Africa that would want to acquire the technology.

(B.) Could One Reasonably Expect to Develop a Market for the Promoted Technology?

Yes. The technology has been used successfully in developed countries since the early 70's. It is ideally suited for use in Africa. The Sahel Resource Inventory & Mapping Coordination Workshop Report, Bamako, May 1982, estimated that AID projects in the Sahel with resource inventory and mapping components were worth 40 million dollars. Many other donors are engaged in projects which use or could use remote sensing. The total market for remote sensing has not been determined but it is large.

(C.) Describe how the Project Seeks to Create a Market for Technology.

Training Africans to use the technology, demonstration to African managers and planners, the provision of free or low cost satellite imagery and interpreting services have been used. Demand for photo products has exceeded the capability of the center. The evaluation cites management for failure to exploit the market and enhance the financial viability of the center. The goal of the project is leave a financially viable in place which will continue to train Africans and provide support to development projects in the region.

X. What Training Techniques did the Project use to Develop the Delivery System

Technical training in application is the only training provided. Lack of management training is cited in the evaluation as a constraint to more widespread delivery. The evaluation recommends that basic project management be included in the CRTO course work.

XI. What Effect did the Transferred Technology have on those Impacted by it?

The impact on those in countries with programs to use it was considerable. They were given more responsible positions in some instances, or afforded the opportunity for further training. In other cases there was no impact.

The ultimate beneficiaries are the citizens of Africa who will benefit from better management and utilization of natural resources. Remote sensing is a tool to be used in carrying out a variety of development projects and will not have an impact in the absence of projects which use it.

Prepared by John Rose, Project Officer, AFR/RA 7/20/83

SUMMARY AND CONCLUSIONS

General

The Regional Remote Sensing Center (CRTO), Upper Volta project (698-0420) was designed to impact West African development in a positive manner by providing funding and expertise for: (1) training scientists and technicians in remote sensing, (2) assisting users, and (3) distributing Landsat and other remote sensing products. These objectives were to be met in Phase 1. Phase 2 objectives were to continue the process begun in Phase 1 and to receive, process, and distribute remote sensing data; to integrate African experts into the Center; and to turn a functioning center over to trained West African experts.

With minor deficiencies, the goals of Phase 1 have been met or exceeded. It appears that the construction of a receiving station is not to become a reality due to political and economic factors. The Evaluation Team believes that successful applications of remote sensing in West Africa do not depend on the construction of a receiving station and real time data for two reasons: (1) To date, most applications have been geological in nature (i.e., ground water exploration) or vegetation assessment using earlier generations of imagery. In the case of geology, this has not inhibited accurate analysis. Very few West African projects to date have required up-to-date imagery, such as would be required in crop reporting. (2) Moreover, as current data becomes necessary within the next one to two years, limited amounts can be requested either through Landsat 4 and the Tracking and Data Relay Satellite System (TDRSS), which can relay acquired imagery data of West Africa to the United States, or through the French SPOT system.

The CRTO project emphasis in Phase 2 should be on effective use of existing data, rather than on substantial investments to acquire new data. The latter is important, but only when West African applications reach a stage of maturity in which current data can be effectively used.

Accomplishments

Phase 1

The accomplishments of the project are as follows:

(a) The training of 152 West African professionals.

(b) The advanced training of over 45 West African scientists.

(c) Familiarization of cooperating West African countries in remote sensing techniques as applied to development.

(d) Creation of at least two national remote sensing institutions in Benin and Cameroon as a result of visits and efforts of CRTO staff.

(e) Special instructions at universities and technical schools by CRTO staff.

(f) Production of 74 major reports by West African scientists related to development projects, of which ten were paid for by outside sources.

(g) The setting up of a functioning, efficient, photo lab at CRTO which to date has supported CRTO training activities, as well as supplying services to over 100 West African users.

(h) The setting-up of a small photo lab in Benin, which is functioning efficiently.

(i) Preliminary training of four West Africans capable of replacing US and French staff in the near future.

Problems

These accomplishments, though meritorious, cannot be said to fulfill the aims of the project. Thus, a termination on June 30, 1983 would plainly jeopardize the achievements to date. To reach the goal of creating a functioning regional remote sensing center and its Africanization a number of problems existing at CRTO must be resolved. These are:

(a) A present lack of expatriate professionals to provide advanced training.

(b) A lack of texts and functioning library in remote sensing (both in English and in French).

(c) A lack of trained African technicians and professionals available to replace expatriates.

(d) A lack of CRTO management structure to provide:
- Day-to-day services at the center
- Resolution of trainee, travel, financial, and living problems in a rapid, efficient manner
- Equitable wage scales for African technicians
- Equitable promotion methods
- Selection of counterparts (may be resolved at Cotonou meeting)
- Marketing and promotion of the Center
- Obtaining of financial support from West African nations
- Obtaining of financial support from international organizations and other clientele.

Each of the problems noted above may be considered minor; but interacting, they could spell the demise of CRTO if USAID terminates the project in June 1983, regardless of whether the other two foreign

assistance donors (Canada and France) continue funding or not. This is because the photo lab (the major U. S. contribution to the CRTO, staffed by an excellent professional - Jim Sorenson) is the pivot of CRTO; if it fails (or, in other words, if it is not functioning because of inadequate staffing and/or improper maintenance of equipment), then training and project support by the rest of the CRTO staff will topple, since all training and project activities depend on good quality photo products. To illustrate the present quality and viability of the CRTO photo lab, the reader is directed to Section 7 Financial Support, Table 1, in which the photo lab is seen to generate more revenue in the sale of products than the training staff are generating in the sale of project services (which normally would include staff salaries plus photo products and other costs). In this Evaluation Team's experience, this represents the first time that it has witnessed a remote sensing institution earning greater returns on products alone than on the services available from expert staff. (Of course, this is not only a commendation of the photo lab, but indicates that a basic change must be made to the management aspects of CRTO -- this change is recommended in the following paragraph).

BASIC RECOMMENDATION

It is the Evaluation Team's considered opinion that the CRTO must (and would be ready to, with additional USAID input) direct its services more toward a profit-making, business-oriented environment. The Team recommends (See Section 8 Income from Other Sources for a more detailed description) that CRTO quickly shorten the introduction course in remote sensing by including them as one portion of the advanced program. With USAID support, four or five U. S. professionals should

be brought aboard with the specific task of raising revenue to the $100,000 to $200,000 range by 1985 through the marketing of CRTO services and capabilities to the West Africa region, including, but not limited to, state and parastatal agencies, multi-national grain and mineral companies, multi-lateral and regional development banks, USAID missions, and other foreign assistance donors including the U. N. and all of its specialized agencies. CRTO and USAID must enhance the CRTO's business and scientific reputation in such a way that board members of the above-mentioned lending institutions will question why CRTO is not being used for reconnaissance pre-loan surveys if their staff members attempt to contract surveys with institutions in industrialized countries.

To enhance CRTO's business orientation, the Team recommends that one geologist with ground water experience, one agronomist or soils man, one vegetation mapping expert (some combination of forestry and rangeland specialties), a photo engineer (The Evaluation Team strongly recommends retaining Jim Sorenson), and a photo lab technician be recruited by the end of CY 1983. To provide overlap and continuity, Sorenson's services (Spectal Data contract) must be extended for six months (July - December 1983) until a new arrangement can be made in January-1984 to retain his services. (The arrangement will depend on a new competitive procurement process and the selection of a contractor.) In addition, (and most important to the process of Phase 2) a management expert must be hired to fill the position of Deputy-Director. He will have a strong background in a natural resources field. His expertise will be in business and marketing. As Deputy Director of the CRTO, reporting directly to the Director General, with

CRTO and African Remote Sensing Council delegated authority and approval (spelled out in concise terms), he will speak on behalf of CRTO, and commit CRTO to resource inventories in West Africa. He will spend a great deal of his time in other West African countries and in board rooms in Europe and the U. S. He is to be the business kingpin of the Center and provide the Africans with the management expertise that will be refined to run the CRTO after the end of Phase 2. The U. S. team (Deputy Director/business manager, sector specialist, and photo lab experts) would be mobile in nature; i.e., it would use CRTO as a home base, but would move temporarily to a country site as the business market dictates. Applications of remote sensing, and a great deal of training, would be done at the site and on the job. CRTO personal resources would thus be carried to the job. The CRTO would be where the photo production is carried out, and where advanced training would be conducted for West African clients and participants requiring specialized knowledge to carry out the projects which CRTO staff are assisting. In addition, each specialist would spend four months teaching advanced remote sensing technqiues and applications at CRTO. They would also supervise the preparation of project reports at CRTO where advanced students would have the necessary-materials and equipment available and where multi-disciplinary, in-house seminars would allow African scientists to become familiar with the integration of the various sciences into their resource projects. The advanced training would thus be oriented toward specific projects, where the immediate need to know on the part of West Africans will determine to a large degree the retention of training skills. USAID

funding support would also allow the CRTO staff to draw upon short-term specialists from the U. S. to assist in specialized project development. Short-term specialists may be available on an immediate basis through a remote sensing IQC which the S&T Bureau will set up in the Fall of 1983.

Additional photo lab equipment and training tools (minimal in terms of cost) are recommended in Section 4 Supplies, Materials and Equipment Needs of CRTO to enhance the business production aspect of Phase 2 (1983-1985) at CRTO. The business orientation of CRTO does not depend upon Canadian and French additional inputs. Any future contributions from these sources would go to supporting staffs from these countries, as we are proposing our contribution should go toward supporting our objective of developing a financially viable CRTO with U. S. technical and managerial know-how.

END OF BASIC RECOMMENDATION

Because the CRTO has been surprisingly successful in reaching the majority of its goals within a relatively short time, it is believed that continuing support under a revised management structure and with the additional changes recommended above would be very beneficial to U. S./West African relations.

In conclusion, AID support of CRTO is considered to have been effective and beneficial to West African development projects, as far as this support has gone. The Evaluation Team is recommending two and a half years of additional time in extending the project from June 30, 1983 to the end of CY 1985. Procurement mechanisms and costs are not recommended or projected as part of this evaluation; they are issues which should rightfully be addressed in a project amendment

only after USAID has decided whether or not to continue support to CRTO. In order to achieve the original project objectives, the Team stands by its BASIC RECOMMENDATION above. With such a business orientation to CRTO, we believe that USAID is technically justified in continuing support until December 31, 1985. The Evaluation Team finally concludes that West African resources development is presently strongly tied to remote sensing technology*, as evidenced by the country visits of the Evaluation Team.

SPECIFIC RECOMMENDATIONS:

1. Phase out during CY 198 introductory remote sensing courses (See Section 8 Income from Other Sources and Section 1 Course Assessment.)
2. Hire five or six U. S. professionals -- Business manager acting as CRTO Deputy Director, with background in natural science, applicationist representing the other background not covered by the Deputy Director, photo engineer, and photo technician. (See 8.)
3. Team orientation toward project development and implementation in the region, advanced on-the-job-training, and drawing upon short-term support from U. S. specialists to conduct projects (See 8.)
4. Advanced courses taught at CRTO should be in relation to projects and should be high level (See 1).

*At this time, the future of the U. S. satellite remote sensing program looks dim. The only operating land remote sensing satellite (Landsat-4) is experiencing difficulties, and the "commercialization" attempt further "clouds the picture". However, this uncertainty should in no way detract from West African development aspirations integrating remote sensing because 1) remote sensing is a mature science, and imagery will always be available in the future from various sources (Shuttle flights, aircraft, and planned French, Japanese, and European remote sensing satellites), and 2) the stress in development should always be on effective use of existing data -- acquisition

of new data can always be justified when presently available data have been shown to be an effective development tool.

5. Deputy Director and short-term instructors should be used for advanced training, including proposal preparation, fiscal budgeting and introductory management courses.

6. CRTO should purchase more imagery and more text books, as well as a Zoom Transfer Scope, a copy camera/enlarger, a 40 x 60 vacuum frame, a 40-inch color processor, a 40-inch black and white processor, a 50 KVA generator, one additional mapograph, a blueprint machine (See 4 Supplies, Materials and Equipment Needs of CRTO.)

7. An additional room should be built for the copy camera and to enlarge very small present work area.

8. A condition precedent should be agreed upon for carrying out the recommendations described herein; i.e. that the Africans demonstrate their intention to fill counterpart positions at the May 5 Cotonou meeting before USAID follows through on the extension of this project. It is recommended that if applicants are agreed upon and selected for at least five of the ten available positions, there is a good likelihood that the other five will be quickly (within two months) chosen, and that USAID should commence to follow through on extension of the project until the FY 1985 by following the recommendations described herein (See 6 Recruitment of Counterparts and Staff). At the end of the two and a half year period, funding from member state contributions, business clientele, and foreign assistance donors purchasing goods and services should be sufficient to cover the operating costs of CRTO.

9. More S&T Bureau technical knowledge and skills in using remote sensing for agricultural development and sustainable natural resources development should be provided to the USAID mission in Ouagadougou and CRTO (See 12 AID/W and Mission Management.)

10. Recommended (estimated) cost of project extention:

a) Five staff for two years	1,200,000
b) Travel in region	100,000
c) Short-term specialists (50 pers. mos.)	500,000
d) Photo lab equipment and new room	250,000
e) Imagery, maps, and consumables	250,000
TOTAL:	$2,300,000

EVALUATION OF CRTO

1. Course Assessment:

In reviewing course work offered at CRTO, the following methods were considered:

a) Review actual curriculum (French plus English)

b) Discuss curricula with instructors.

c) Discuss results with students at CRTO.

d) Discuss results withex-students in home countries.

e) Discuss results and needs with West African management personnel in participating countries.

f) Discuss results with AID and other representatives of international organizations.

g) Attended classes (French plus English)

h) Read and review reports and theses of students (advanced courses).

i) Review photo lab instructions

j) Review-other activities, seminars, special courses.

The course curricula can be found in Appendix C of this report and the discussions related to points 3-6 can be found in Appendix A.

English Curriculum -- The English introductory course curriculum appears to be adequate and satisfies the needs of resource scientists in West Africa because it concentrates on visual and graphic projections of the West African environment as depicted by remote sensing systems. It is not burdened with theory but is applications oriented. Because of limited materials and time, this course may not fulfill all of the introductory requirements;

however, the course has been well taught by Dr. P. Mikka with adequate time in the field.

French Curriculum -- Although the quality of instruction in the French curriculum has been very good, the curriculum itself tends to focus too much on theoretical aspects of the spectrum, light, etc. The students see too few examples of remote sensing data and spend too little time in the field. The French courses do not provide the students with texts and there are very few visual aids used in the classroom.

Discussion of Curricula with Instructors -- the Anglophone instructors felt some improvements could be made to the courses offered by having more instructors from more varied backgrounds, such as geology. The Francophone instructors were satisfied that the courses as offered met the needs of West African development.

Discussions with West African Management Personnel -- The comments of managers from a number of West African countries are to be found in Appendix A. Basically, their conclusions were that French courses are too theoretical, are not at a high enough level and are not applications oriented to the degree necessary for development of individual countries.

Regarding the English courses, the comment was that the instruction was very good as far as it went but was too short, did not offer enough specialized segments, and the instructors were too few. (The American Forester was not replaced in June 1982 since no counterpart was available. Most managers felt that higher level courses, field experience, and specialized courses under

experts in those fields were lacking at CRTO, and that such courses were of paramount importance to West African development strategy.

Discussions with AID and Other International Agencies -- The impression of international agencies as regards the training (courses) at CRTO is mixed. These impressions vary from very little interest and understanding (See Appendix A) to good understanding, to opposition toward applications and training in remote sensing at CRTO.

Discussion of curriculum with students and ex-students (See Appendix A). The students tended to praise the English courses and downgrade the French courses as too theoretical. Nevertheless, they all agreed that advanced courses are not long enough, do not provide the students with experts in their field, do not focus enough on applications, and do not permit them to spend enough time in the field in their own countries reviewing the results of their efforts before returning to CRTO to complete the work under the instructors' guidance.

Attendance at Classes of CRTO -- The attendance at both English and French classes by the contractor tended to support the opinions expressed above: The French introductory courses do tend to be too theoretical, but are of very high quality. The English courses are good, but our single instructor cannot supply the kind of disciplinary breadth that should be expected at this kind of center.

The Advanced Courses -- These are limited in scope by the lack of instructors, the lack of imagery, the particular training of the instructors (i.e. in geology, for example, there is too much emphasis on mapping of linear features), and the short duration of the advanced course.

It is also apparent from recent enrollment that more and more countries are sending geologists and hydrologists for training, which appears to reflect their views regarding the direction of African development needs, as well as projecting the potential make-up of the staff at CRTO.

Review of Reports, Theses and Field Work -- The contractor has read at least 15 reports of advanced students from CRTO. These again reflect the problems mentioned above; i.e., lack of instructors in certain fields, limited though not difficient experiencesof instructors in certain fields, lack of imagery, and lack of equipment and materials. These reports, however, in every case do address West African development problems, and indicate a high level grasp of the subjects by the students. In summary, the students with very few exceptions have not had a chance to test their abilities because of the limitations of the Center's resources.

Review of Photo Lab Instructions and Resulting Effects on West African Students -- The high quality of the photo lab, its management, and the products, have created a very visible example of the U. S. preeminence in remote sensing which has-attracted a

great deal of attention in West Africa. The result of this high quality and high performance has been an increased interest on the part of nearly every country in training photo lab technicians at CRTO and developing their own national photo labs to support remote sensing activities. One student from Benin, with the assistance of the CRTO, is now effectively operating the Benin National Remote Sensing Lab. Another photo lab technician has been at CRTO for four years and is intimately involved in day-to-day production of imagery, photos, reports, etc. Neither of these technicians requires supervision except for very complex tasks.

Review of Other Courses, Seminars -- Discussions with both Anglophone and Francophone staff indicate that CRTO teaching activities are not exclusively associated with the Center. Francophone instructions in remote sensing are being provided at two regional technical schools in Ouagadougou and to over 55 students at the University Geography Department. Numerous seminars have been presented by the staff both in Upper Volta and in various countries throughout the region.

The Evaluation Team concludes that training courses, advanced instructions and seminars in remote sensing at the CRTO and elsewhere, as prepared and presented by the CRTO staff, have, as required, focused on applications to West African development needs. The concensus in West Africa is that these courses have been beneficial and applicable. Improvements suggested are:

a) More high level courses

b) More field work

c) More and specialized instructors

d) Increased funding for additional scholarships

e) More materials (imagery)

f) More text books (better library)

g) Better availability of Center to students (longer working day)

h) Courses offered should include fiscal, budgeting, introductory management courses and basic proposal preparation.

2. Student Selection Procedures:

Based on the quality of the work done by the majority of the students who have passed through CRTO, the student selection procedures seem to be working effectively and are providing good results. An example of a trainee application form is provided in Appendix D. Several points might be made as they relate to present and future selection methods.

There are still some individuals being proposed as candidates whose interest in remote sensing is minimal, and whose candidatures are presented due to political exigencies in their countries. This was said to be the case for the one trainee who, according to various sources in Senegal, has no plans to use remote sensing in his job.

Of the students and trainees interviewed, all appear to have positions in which their training will be useful. The only problem is again political, in that some of them, on returning

to their country of origin, find that ministerial changes have occurred, and that their job has been eliminated, or the budget for their project has been reduced. This is very much the case for some internationally funded projects which are discontinued after a few years. Thus, the remote sensing expert finds himself without a job, or a job in which remote sensing is no longer applicable.

A proposal for a better method of trainee selection was made by two Cameroonian students, who proposed that training at the introductory level should be conducted by foreign experts in their own country. In this way, technicians could learn the basics, but not hamper the advanced students as they believe they do now in the introductory courses at CRTO. They feel that CRTO staff in their country could also better evaluate the quality and abilities of the proposed advanced students, who would, after careful evaluation, go to CRTO for longer, in-depth advanced training.

They also suggested that this would allow more nationals to gain basic knowledge or remote sensing, and would allow national program managers to attend and understand the value of such training. We believe that wherever possible this recommendation should be incorporated into future training programs.

The Evaluation Team concluded that, in general, student selection procedures have been effective. Some improvements could be made, and the proposals described above should be considered, at least in part.

3. Current CRTO Staffing:

The staffing at CRTO is all important. Future staffing must take into account the various suggestions made in previous sections of this report and in the Appendices. The most basic problem is not with the existing staff, but with the lack of technical staff. This is especially true since the departure of Mr. Roy Hagen, the anglophone forester. The following observations are made without regard to AID policies but rather as objectively as possible with regard to CRTO needs.

The requirements for future staff, of course, depend on the level to which funding is available, but should such funding be forthcoming, a conservative but necessary staff would consist of the following:

	Position	Duties
A.	Deputy Director	Manage center, logistics, promote center, assure smooth day-to-day operation. Must be bilingual; should teach short course in management techniques.
B.	Vegetation Specialist	Advanced forestry and rangeland course plus projects
C.	Agronomist/Pedologist	Teach advanced courses plus projects
D.	Geologist/Hydrologist	Advanced courses plus projects
E.	Photo Engineer and Photo Technician	Photo lab management and project support
F.	Photo Technician	Photo lab production and maintenance

The justification of these positions is made under Section 8.

Income from Other Sources. Some disagreement exists between the evaluators regarding the positions of Agronomist/Pedologist and Photo Technician. Both evaluators feel that filling these positions is very important to the success of the next phase of this project. Therefore, if all the above positions can be budgeted, the best results can be expected. However, if one position must be dropped then, the AID S/T evaluator has a preference for a Photo Technician and, in addition, feels that the Deputy Director could fulfill the requirements of one discipline and the other positions should then be filled based on the Deputy Director's expertise. The consultant believes that an Agronomist/Soils Expert is "a must" for the CRTO and fulfills the greatest needs of West Africa in terms of the policy requirements of both West African countries and donors. In addition, the consultant believes that a Photo Technician can be trained from the African cadre or be hired from the local expatriate community. Further, it is the consultant's opinion that the Deputy Director should not be overburdened.

If such staffing can be maintained for two years (1984-1985), it is the opinion of the evaluators that the then African staff equivalents can be properly trained as replacements for a future autonomous, "Africanized" CRTO. The Africanization of the scientific and management staff cannot be expected unless an adequate U. S. staff can spend the necessary hours in "hands-on" training. It must also be remembered that a single highly trained African scientist may or may not be available to replace the equivalent

staff member, nor in fact is it guaranteed that such a well-trained expert would be chosen by the CRTO committee. It is, therefore, important that one of the goals of any additional training period be the advanced training of at least three scientists (from three different countries) in each of the disciplines under consideration (geology/hydrology, agronomy, vegetation, and photo lab).

The assessment of staffing needs described above has been made only on the basis of deficiencies in the present CRTO structure, as they relate tothe project goals set forth in the Project Paper, and to the needs of West African development.

4. Supplies, Materials and Equipment Needs of CRTO

The supplies, materials and equipment of the CRTO can be considered adequate at present only if the project goals are modified to exclude certain of the original priorities. Basically, the CRTO has achieved only part of its objectives. It is, in fact, an excellent center for theintroduction of remote sensing techniques to West Africans. It is not yet a successful center in terms of providing advanced training for scientists in the application of remote sensing, although a few project reports indicate that this goal can soon be reached. The Center certainly is not yet ready to provide the photographic lab support that national and regional projects require, nor has it evolved to the stage at which it can service the needs of a larger Africanized staff serving all ofthe West African remote sensing community. To arrive at the goals as described in Phase 2 of the Project Paper, certain additional materials, supplies and lab equipment should

be acquired as follows:

a) Introductory courses:

- Drafting materials
- Basic books (texts) - remote sensing literature

b) Advanced courses:

- More advanced texts
- More publications in various disciplines
- Zoom Transfer Scope

c) User center and training of African replacements, photo lab support facilities:

- 1 copy camera/enlarger for preparation of maps and large format 1:200,000 color composite enlargements
- 1 40 x 60 vacuum frame
- 40-inch color processor
- 40-inch black and white processor
- 50 KVA generator
- 1 additional mapograph
- Additional imagery as soon as TDRSS functional
- Blueprint machine
- Extra room of size 10 ft. x 20 ft. (absolute minimum)

d) Supplies for above:

The above equipment and supplies are considered necessary to bring CRTO activities to a level commensurate with the requirements as stated in the Project Paper. The list is not related to any proposed construction of a receiving station. If such a station were built, the photo lab requirements would be such that the present lab would be far from sufficient. The list

presented simply proposes equipment and materials needed to keep up with the demand for imagery and other remote sensing needs of the growing West African development community. These equipment and materials will also supply the needs for the advanced training courses. The materials for these courses have been shared by both introductory and advanced courses until now and are in short supply. During the Evaluation Team's visit, the mapograph was occupied continuously eight hours a day by various individuals working on different projects who had to schedule themselves in advance. The demands on the photo lab at present are being met with difficulty. Within three to four months, Landsat 4 data over West Africa may become available and, if so, will be much in demand. This and the demands from the Shuttle Imaging Radar (SIR-B), when added to the "normal" workload which is increasing daily both internally and from outside agencies, make it imperative that the photo lab be properly equipped to meet the demands. An enlarged floor space will be required to satisfy the housing needs of the photo lab and its new equipment. The present lab lacks work space (mosaic layout, etc.). Additional workspace will be required to house the new materials. An estimated 800 square feet would be more than adequate. The AID S/T evaluation believes that 200 square feet will be suitable, whereas the consultant believes that 400 square feet is the absolute minimum needed.

5. Procurement Procedures:

Both local and international procurement procedures are presently effective. For local procurement of supplies, a requesting staff member can either acquire petty cash from the CRTO Administrative Officer (Mr. Thombiano) and return a receipt from the vendor, or he can first purchase the item with a voucher from CRTO from any of a number of local firms which honor CRTO credit, and then submit the voucher to the administrative Officer for payment to the vendor. There have been no problems in the past year in purchasing in this manner.

International procurement now runs smoothly, thanks to the provision of Spectral Data's contract which permits them to purchase for CRTO in the U. S. A CRTO staff member submits a letter with desired purchase items through the CRTO Director to the USAID Mission Director. This letter, if approved, is then sent to Spectral Data in Long Island with the necessary procurement papers (PIO/Cs) for subsequent purchase. This method of international procurement is superior to the previous method of using a separate procurement contractor, (Afro-American Purchasing Co.) Because of the lack of technical knowledge this firm had in purchasing remote sensing equipment. (Some of the items which AAPC ordered four years ago have just arrived at CRTO). Of course, when the Spectral Data contract at CRTO terminates, a satisfactory method of procurement must be developed. It is strongly recommended that the Spectral Data photo engineer leave a comprehensive list of supplies and equipment by manufacturer's name, address,

and costs at the time of Spectral Data's termination of contract.

6. Recruitment of Counterparts and Staff:

All secretarial, custodial, and technical level staff positions have essentially been filled. Ten professional counterpart positions (West Africans) will supposedly be filled when the West Africa Regional Management Committee (WARMC) meets on May 5-7 in Cotonou, Benin. The CRTO Director had sent notices of positions to appropriate agencies in participating countries. This procedure has finally been standardized, and the rotation of African staff has been accepted by the CRTO signatories. (The Director, himself, will rotate within the year, and his position is one which will be deliberated at Cotonou.)

The Evaluation Team learned from the CRTO Director that there are ten counterpart positions available. Sixty applicants from 11 countries are competing for the ten positions, and providing roughly six per position. The positions are: The Director General, the Administrative and Financial Director, two user assistance engineers (one agronomist, one hydro-geologist), professor (teaching staff for Anglophone students), photo engineer, archivist, librarian, accountant, and executive secretary. The descriptions, salaries, and term of office for these positions are shown in Appendix B.

Three members of the WARMC serve on the selection committee, and in less than three months after the Cotonou meeting (by August), some of these positions will be filled by new members. It is the Evaluation Team's conclusion that the selection procedure

for new counterpart applicants could perhaps be improved after the Cotonou meeting, but that it appears that an adequate selection procedure has been developed.

7. Financial Support:

As can be seen in Table 1: CRTO Account Sheet, African member state contributions decreased 25 percent between 1981 and 1982, from roughly 65 million CFA in 1981 down to 41 million CFA in 1982. (March 1983 conversion factor: 362 = $1 U. S.). As of March 31, 1983, member contributions for 1983 are roughly 16 million CFA; extrapolating for the year and considering the Director's present intensive efforts to secure funding, it is estimated that the total 1983 contributions may reach their former 1981 level; i.e., around 60 million CFA. Current and projected CRTO operating costs were obtained from the CRTO Administrative Officer, and are shown in Table 1 as "CRTO Budget". Operating costs were projected at 101 million CFA in 1981, 175 million CFA in 1982, and are projected to rise from 242 million CFA in 1983 to 420 million CFA in 1985. The rather dramatic increases in operating costs are due to projected devaluation in the CFA and increasing costs for electricity to air condition and run the laboratory.

As can be seen, the shortfalls (differences between member state contributions and operating costs) are increasing dramatically; 35 million CFA in 1981, 135 million CFA in 1982, and a projected 180 million CFA shortfall in 1983 (assuming 60 million CFA are collected from member states by the end of 1983). In the past

Table 1: CRTO ACCOUNT SHEET
(All figures in CFA)

		CY				
		1981	1982	1983(a)	1984	1985
Contributions	Upper Volta	6,821,026	4,766,795	5,874,521		
	Benin	6,821,026	4,766,795			
	Cameroon	23,494,642	16,618,360	7,210,380		
	Niger	9,094,700	6,355,726			
	Senegal	12,126,266	8,474,302	2,736,124		
	Mali	6,821,026	0			
CY TOTALS:		65,178,686	40,782,578	15,821,025	385,000,000	420,000,000
CRTO Budget:		100,610,000	175,289,000	242,259,000	385,000,000	420,000,000
Shortfall in Member Contributions: (Provided by Upper Volta)		35,431,314	134,506,422			

Actual Earnings from Photo Lab:	(b)3,562,900
Potential Addit. Earnings from Photo Lab:	(c)3,558,700
Actual Earnings from Projects:	(d)1,095,000
Potential Addit. Earnings from Projects	(e)2,920,000
Total Actual Earnings:	4,657,900
Total Potential Earnings:	6,478,700
Total Act. + Pot. Earnings:	11,136,600

(a) As of March 31, 1983
(b) From CRTO receipts, computed from Apr. 1, 1982 - March 31, 1983
(c) From CRTO records of requests, which were responded to at no charge
(d) Reimbursed projects carried out by CRTO staff for other agencies
(e) Projects performed gratis by CRTO staff for other agencies -- Figures represent CRTO staff estimate of value of support provided.

(and hopefully for CRTO into the near future, at least until 1985), this shortfall has been partially made up by the Government of Upper Volta. (In reality, the Government of Upper Volta covered only 51,000,000 of the shortfall in 1982, rendering the actual CRTO operating cost for 1982 at roughly 91,000,000 CFA, instead of the projected 175,289,000. The difference translates to a loss of local support and staff which CRTO would otherwise have purchased.)

In 1982, the foreign assistance contributions to operating costs were: U. S.: 36,300,000 CFA (covers from January 1, 1982 to March 6, 1983), and France: 125,000,000 CFA. The foreign assistance contributions do not go for operating CRTO, except for the photo lab, which is funded by the U. S. contribution. The U. S. funding is broken down in Table 2.

As can be seen below under Section 8, it is not likely that income generated from the sale of photo products and project-related services will total more than about ten percent of the shortfall under the present management philosophy at CRTO. By 1985, probable earnings of roughly 40 million CFA can be expected to contribute to the 420 million CFA budget, leaving 380 million which must be obtained from member state contributions and other donors (excluding the U. S., France, and Canada, all of which will supposedly terminate their support at the latest by 1985). Other donors' support is further discussed in Section 10, but we can project what this must be. Based on historical trends in member state contributions, it is difficult to imagine

Table 2: CRTO BUDGET

U. S. CONTRIBUTION

1 Jan. 1982 - 30 June 1983

TYPE OF EXPENDITURE	330 CFA = $1.00 TOTAL IN CFA
Materials	
Photo lab materials locally purchased	730,000
Photo lab furniture	700,000
Aerial photos IGHV	780,000
Plane charter	550,000
Seminar travel & transport	
Travel & other costs of U. S. expert at seminar	
a) Transportation	1,680,000
b) Per diem, etc.	1,880,000
c) Field costs	696,000
Scholarships & training costs	
Scholarships	12,480,000
Air travel for Ghanan students	153,900
Materials and furniture for trainees	900,000
Construction	
Furnishings (closets, etc) for photo lab annex	2,477,600
Air conditioning	400,000
Water cooler for lab	250,000
Management support costs	
Salary of student "manager"	495,000
Office materials and supplies	1,120,000
Insurance, operational costs, maintenance of vehicles	5,930,000
Maintenance of photo lab	412,500
Language training	915,000
Translation services	450,000
Contingency costs	3,300,000
GRAND TOTAL	36,300,000

these contributions totalling more than 100 million CFA in 1985, which implies that 280 million CFA must be sought from the sources identified in Section 10.

Other Donor Support: This requirement totals ± $800,000, which in view of past and present foreign assistance can be expected to be provided. A disturbing trend is the CRTO's need to depend more and more on this type of support to remain viable. Assuming that total operating costs and member state contributions increased in equal proportions, (which is unlikely because operating costs have risen from 10 percent to 50 percent per year since 1980, while contributions have actually decreased), it is hard to imagine that the 1985 projected gap of 380 million CFA will be reduced under present management philosophy. The only way to reduce this gap, and eventually erase it, is to increase the sales of products and services by changing the format and structure of CRTO, which is described under Section 8 below.

8. Income from Other Sources:

An investigation of all photo lab receipts for the last year (April 1, 1982 to March 31, 1983) revealed that the photo lab earned 3,562,900 CFA by generating photo products and reproducing imagery for outside clients. (Refer to Table 1). In addition, the lab provided an additional 3,558,700 CFA worth of film and photo products for outside clients as well as CRTO training staff for which the lab did not charge, either because the clients claimed they could not pay, or the photo lab staff felt that they should provide products gratis to the training staff.

The Evaluation Team, as well as the CRTO photo lab staff, feel that this amount of revenue should have been (and could have been) recovered. First of all, the lab is behind in processing of orders; it has more work than staff to accomplish it, and thus a more discriminating and prioritizing schedule of fulfilling requests would generate more income from paying clients than the present schedule of processing orders. Secondly, charging for products provided to the training staff could create revenues; and as has been shown by the training staff, more revenues could be acquired from other sources on some projects as shown below.

The same situation is true regarding projects performed by both French and U. S. training staff for outside clients. Last year (1982) CRTO was reimbursed 1,095,000 CFA for services provided to requesting agencies (foreign assistance donors, West African countries, private firms). Another 2,920,000 could (should) have been earnd by a more insistent attitude on the part of CRTO. Any argument which states that a more pragmatic approach such as this would discourage future possible clients can be countered with two comments: (1) initial nonpaying customers are likely to be repeat nonpaying customers, hence their loss for all time would save CRTO free handouts in the future, and (2) the savings in staff time by refusing to provide free material can be used for aggressive marketing among potential paying clientele, such as World Bank, multi-nationals,, and petroleum-producing West African states.

The total actual earnings of CRTO from the sale of its photo proudcts and its human skills (services) amounted to 4,657,900 CFA in 1982 (See Table 1). CRTO could (should) have realized another 6,478,700 CFA in 1982. Thus the Center has demonstrated capability to have earned last year a total of 11,136,600 CFA (roughly $31,000), a significant figure when one realizes that CRTO is not yet six years old, the photo lab has been operational less than two years, and the Center is marketing in one of the poorest regions of the earth.

The Evaluation Team does not believe that CRTO is realizing the maximum revenue which can be gained from the sale of photo products and services. While it is true that a more pragmatic approach vis-a-vis paying and nonpaying customers might help to generate an additional 6 million CFA (Total Potential Earnings on Table 1), this amount is clearly insignificant compared to a shortfall amounting to 134,506,422 CFA. Even though CRTO will almost double photo lab prices in the remainder of 1983, and raise goods and services prices in the following years so that a projected earned income of 40 million CFA might be realized in 1985, this will not raise sufficient revenues to cover projected CRTO operating costs in the 400,000,000 CFA range. A fundamental change is required in the way in which CRTO does business.

The Evaluation Team recommends that CRTO be staffed with a minimum of four U. S. experts over the next two years. The U. S. staff should consist of a photo lab engineer, backed by a photo lab

technician, a geologist/hydrologist, an agronomist and a vegetation (forestry/range) expert. The staff's modus operandi should be to seek out and involve themselves with natural resource inventory projects in West Africa, especially those involving donors with abundant financial resources. CRTO introductory courses in remote sensing should be either provided by traveling staff in each country or be included as a three-to-four-week introduction to the 12-week advanced courses. Future training should be of an advanced nature at CRTO and to the extent possible in conjunction with training needs and African personnel involved in on-going projects in the region. In addition to the four or five U. S. technicians, experts from the U. S. would be available for short-term (one to two months) to carry out or design special projects. In this way, the CRTO U. S. staff would be available during long periods of time between the scheduled course work to act as a mobile design/feasibility team, scouting out potential projects, clients and donors, assisting in project design and evaluation, calling upon specialized experts from the U. S. to assist in project execution, and following up with field work and project supervision of the advanced trainee group. This mobile team concept, with a core CRTO U. S. staff acting as marketing agents with generalized skills, backed by short-term advisors with highly specialized skills, would put CRTO in a financially viable position by the end of CY 1985. The photo lab engineer would be responsible for generating photo products as part of the mobile

*A point of disagreement between the evaluators exists on this topic. The consultant believes that project goals would be better met by adding a soils/agronomist and hiring a lab technician locally.

team and for training of the African counterpart. The photo technician would perform most of the day-to-day processing of work requests at CRTO. The Evaluation Team strongly recommends that the Deputy Director be a management expert with a background in geology/hydrology, soils or vegetation. This would assure and guarantee a business and marketing philosophy coincident with U. S. goals. Such a presence would increase CRTO visibility, effectiveness and reputation in the region. Without this aggressive stance, CRTO will be dependent upon foreign donors for years to come or, failing this, it will collapse through a failure of the photo lab to respond to requests. If the photo lab fails, the user services and other components of CRTO will collapse like dominoes.

A case in point follows: Because of a lack of photo technicians and due to a lack of market hustle on the part of CRTO, it had to turn down thee large jobs to develop photo products: (1) black and white mosaics of most West African states, business equivalent to a loss of 7,240,000 CFA, (2) color prints of all of Nigeria for the FAO, business equivalent to a loss of 2,896,000 CFA, and (3) prints of Nigeria for oil exploration, 3,620,000 CFA lost. The total <u>known</u> loss of revenue last year is the sum of (2) and (3), or 6,516,000 CFA; adding the potential revenue of (1) yields 13,756,000 CFA, which is almost four times the amount (3,562,900) which the photo lab actually earned last year.

9. <u>Operating Costs and Record Keeping</u>:

The Evaluation Team, while finding the operational costs of CRTO to be expanding rather alarmingly, felt that records were

kept in sufficiently good order and found that these costs were unavoidable (electricity, gasoline, local and international salaries, imported chemicals). The local staff seems rather excessive. However, Upper Volta is more than willing to cover most of these local costs.

10. Other Donor Support:

There are no firm figures for expected donor support from other than U. S., French, and Canadian sources, all three of which are very likely to terminate at the latest by CY 1985. The CRTO Director, Mr. Ouedraogo, briefed the team on his contacts with various donors and seemed optimistic that future persistent requests to these donors might have some payoff. He has had initial "encouraging" discussions with the U. S. Sahel Organization in New York (UNSO wants to contribute to have CRTO carry out special studies in the Sahel), the Equipment Fund for the U. N. in New York, the European Space Agency, the European Economic Community, and the Indian Space Agency (a contributor to the Nairobi facility). At the prodding of the Evaluation Team, the Director mentioned that he has also requested assistance from Nigeria and Lybia, but has had no response from either (See Nigeria visit in Appendix A for likely response).

The Evaluation Team believes that this donor support (as well as increased sales from project support) could help avoid the 1985 shortfall of 380,000,000 CFA, between the CRTO operating costs and revenue receipts from member state contributions. The constraint to acquiring this donor support is the lack of

persistent and aggressive follow-up of initial contacts. The present CRTO Director will step down in the ensuing months, and a new Director will take his place. Because a new director will have a difficult time adjusting to CRTO and learning the ropes, the team recommends that an American management expert be assigned the task of assisting the new Director secure donor funds, using proven marketing techniques and persuasional skills commensurate with the level of this position.

11. Cost/Benefit of Remote Sensing in West Africa:

A five-person-week evaluation of CRTO could not possibly provide an in-depth cost/benefit, or cost-effectiveness study of remote sensing in West Africa. In addition, many cost comparisons between activities actually carried out with remote sensing and those which might have been carried out using more traditional techniques are hypothetical and open to criticism, simply because, without remote sensing, the activity would not have taken place. Many projects using remote sensing have been conducted over the last few years which have no traditional method equivalents, because such traditional methods would have proved prohibitive in cost. Remote sensing and traditional methods clearly are difficult to compare. As an example, we might consider the production of the geologic map of Upper Volta. It has taken 60 years to produce the recently published geologic map of Upper Volta at a scale of 1:1,000,000. This required aerial photos, field work by at least 200 geologists, years of backup work in French labs and large amounts of money to rectify, edit and print

such a map: Cost $5-10 million. Using Landsat a "similar" but improved map could be produced in less than a year. Obviously the cost benefit is at least $4.7 million. In the final analysis the question is more complex since one must also consider that the Landsat map could not be produced without the previous geology as a base. Thus the question: What are the cost benefits of Landsat vis-a-vis conventional mapping system for the production of a geologic map in Upper Volta? remains moot. The same reasoning can be applied to other resource mapping.

In an effort to show the empiric value of Landsat/remote sensing, the Evaluation Team took three case studies in which CRTO used remote sensing as an approach to investigations planned by other agencies, investigations which, prior to CRTO's entry, had not considered the need for remote sensing technology. No comparable costs are estimated; the intent is to show the impact which satellite imagery made on the means of reaching each of the projects' objectives.

1) During 1980 and 1981, FAO-UNDP sponsored a national forest inventory of Upper Volta. Upon arriving on site, the head of the project found that no forestry maps existed of the entire country. Using 1:200,000 scale Landsat color composites under Center staff guidance, he was able to locate and measure the areal extent of three classes of forest cover: gallery forest, woodlands, and grassed woodlands. He was then able to select sample areas for field measurements of wood volume for each class. Next, he extrapolated his field measurements to calculate

wood volume data for all of Upper Volta based on the spatial distribution of the three forest classes as delimited on the Landsat imagery. This effort provided the first estimate of forest/lumber/volume potential in Upper Volta. The task would have been next to impossible to achieve without the Landsat data and conventional techniques could not have produced the same results in such a short time.

2) In 1979, the Center collaborated with the Canadian civil engineering company, LAVALIN, on a contract for the reconstruction of 500 kms. of roads in Upper Volta. Landsat imagery was used to: a) identify road crossing points over low-lying areas that required the last road realignment and the least amount of construction and materials; b) identify sites of water supply; and c) locate lateritic rock deposits for material required in road construction. Field surveying to accomplish the three above tasks would have taken considerably longer (on the order of 12 to 18 months) than the laboratory analysis of Landsat imagery.

3) In 1981, Center staff collaborated with the Lake Volta Authority of Ghana to develop a simple, cost-effective method of determining Lake Volta water reservoir volumes for different times of the year. Multi-temporal perimeter and surface area measurements were made on Landsat imagery. These data were correlated with historical records of water height levels measured at the dam spillway to calculate water volume (Cost of study $10,000.00). The volume measurements provide data which the Authority engineers use in managing dam flow according to needs for hydroelectric generation and agricultural irrigation

during the wet and dry seasons. The much more costly alternative involves periodic aerial photographic missions to gather the required data and an extremely expensive cartographic base map (Probable cost ± $500,000.00.).

12. AID/W and Mission Management:

USAID/Upper Volta mangement has improved remarkably since August 1982, when the project was transferred to the USAID Division of Human Resources, under management of a new forestry/environment/energy officer, Kevin Mullally. As a means of integrating three sectors in USAID projects and the Country Development Strategy Statement (CDSS), he has turned to remote sensing, and especially the regional CRTO project, as a source of data for development of an Upper Volta ecological master plan.

Remote sensing is a tool for forestry, environment, and energy development, but it serves to link all three and further, to link them to agricultural and rangeland projects being developed by the Mission. Previous to August 1982 the regional aspect of the project inhibited its effective management. The present project manager is active in monitoring the project, and has almost daily contact with the U. S. contractors at CRTO. The Division of Human Resources sees remote sensing as a valuable tool for the Mission, and wants to integrate the technology into their new forestry project. The Division is seeking publicity for CRTO, and plans to take advantage of an OPA visit in the near future to demonstrate CRTO's capabilities and potential.

USAID/Upper Volta perceives AFR/RA as very responsive in terms of guiding and assisting in processing of project documents. USAID speculates that remote sensing might be a technology for consideration in the Agricultural Development Project which AFR/RA is designing. The Mission would like to see more S&T Bureau scientific support in advising and funding extensive remote sensing applications for understanding forestry and range-land changes in West Africa. In addition, desertification processes and ecological containment of deteriorating environmental conditions are areas where S&T technical and financial resources can be brought to bear and would be welcomed by the AID Mission.

APPENDIX A

REVIEW OF VISITS TO WEST AFRICAN COUNTRIES COOPERATING IN CRTO

General

In nearly every case throughout West Africa CRTO graduates are frustrated because they cannot use their training. The only definite exception is in Benin and the only qualified exception was found in Sierra Leon. The main reason relates to the lack of management training.

Some graduates who return to their country work on a remote sensing project and when that project is over, find themselves without further work. Others return to find that priorities have changed and remote sensing projects have been cancelled.

Visits by the evaluation team to seven of the signatory countries indicate that trainees are adequately prepared at the CRTO, but do not have national infrastructure in which they can apply their knowledge. Most programs using remote sensing are international assistance programs.

It appears that the main problem is not whether the CRTO graduate is using his training, but whether his country possesses the infrastructure, financial resources, interest, will and management ability to use his newly acquired skills. The answer to that question is an unqualified "no".

Therefore, any further training should consider courses in basic management, budgeting, programming, etc. so that this new generation of "skilled" technologists also possess the ability to prepare, propose and run their own projects.

The following section describes the interviews the evaluation team had in each country. The contractor (Andrew Stancioff) visited

all West African states except one (Nigeria), which was visited by Charles Paul. In almost every case the names of the individuals interviewed were provided by the CRTO Anglophone staff. Unfortunately, in most cases, initial discussions had to be conducted with a program manager rather than the CRTO students. In other cases, students were in the field and, therefore, unavailable. In every case the time allocated for each country (considering the vagaries of flight schedules, etc.) was too short to permit the kind of in-depth effort that an evaluation of this sort deserves.

Senegal

Direction de l'Amanagement du Territoire: Meetings in Dakar were held with Dr. Tchium, Director, under which a national remote sensing mapping project is being coordinated. This project is being funded by USAID and supported by the University of Dakar Geography Dept.

Under the aegis of the project, two geographers have been sent to CRTO for training. Five other Senegalese have been trained at CRTO. Four of these received advanced training, and one of these went on to Laval in Quebec for additional training. Dr. Tchium made the following observations:

1. He would like to send more people.
2. He has sent two to CRTO.
3. He would like to have people stay for extended courses.
4. He needs more scholarships to CRTO.
5. He stated that Sal Mamadou of the University of Dakar feels that CRTO is behind Senegal in Remote Sensing.
6. He cannot get imagery or products fast enough.

USAID: Discussion with officer of USAID, who is in charge of the remote sensing project, brought out the following observations:

1. He is somewhat confused by role of remote sensing.
2. He visited the project only three times in two years.
3. He became much more interested after explanation of role of remote sensing and geographic information systems.

USAID Remote Sensing Project: In an interview with Kalibou Diatta, geographer who spent three months at CRTO and who is now working with the AID University of Dakar Remote Sensing project as a land use analysist. He made the following observations:

1. He complained of the lack of organizational structure at CRTO.
2. He said that Mr. Serrier of the French staff was very good.
3. He thought the courses were too primitive.
4. The courses were not directed to individual development.
5. There were insufficient funds to cover costs.
6. The food/lodging arrangements were poor.
7. The students were not invited to a seminar on remote sensing hosted by CRTO.

University of Dakar: Mamadou Sal, Prof. of Geography Dept., considers himself an expert in remote sensing and has lectured at CRTO. (Senegalese students who attended his lecture stated that they were disappointed in his presentation.) Prof. Sal made the following points:

1. He complained of weakness of the Center.
2. If Senegalese could buy the imagery, they could do a better job in their projects.

3. He would like to be invited to teach at Center.
4. Senegal would buy 300,000 CFA of imagery if it were available at CRTO.

Senegal Science & Research Council (SERST): Honore Ndiaye, Director, Mr. Datschner, Assistant. Mr. Ndiaye was absent, so I interviewed Mr. Datschner, who knew little about remote sensing activities and suggested I return after Mr. Ndiaye's return. It is quite apparent that SERST is doing very little in remote sensing and is not involved in the various remote sensing projects in Senegal. Other agencies active in remote sensing include CILSS - (METEOSAT), UNESCO - (hydrology), FAO, and USAID.

USAID Remote Sensing Project: Dr. Frederic Hilwig, Party Chief of the USAID project with South Dakota State University, stated that Diatta is well trained and prepared to conduct good work. I did not get a chance to meet Mamadou N'Dyaye, who also completed the CRTO course, but who, according to Dr. Hilwig is far too old (38) to begin a new career in remote sensing and was only sent for political reasons. Even if he were good and well trained, he would retire within two to seven years and so would not be instrumental in the development of Senegal. Dr. Hilwig feels that there is good potential for remote sensing in development projects in Senegal. However, he feels that politics are playing a very strong part in Senegal at present to the detriment of those who have been trained to do good work.

Conclusion

Little or no real remote sensing interpretation has been done in Senegal in spite of its potential and the number of organizations

who could use it; even though there is an organization with financial support for and a mandate to use it; and in spite of the fact that there are technicians who have been trained to use it. This state of affairs is due to a number of factors:

1. Senegalese "experts" who do not assist other agencies.
2. International organization staffed by individuals who are not interested in or unwilling to use remote sensing to assist in development projects.
3. The concentration of international projects in the agricultural sector has precluded the potential development of maps useful to the private investment sector.
4. The lack of real hands-on training of African technicians and the lack of managerial training of Africans in remote sensing.

Sierre Leone

Meetings in Sierra Leone were limited by time and the fact that many government officials were in the field on project duty. The meetings arranged by AID were extremely well planned in spite of the short timeframe. Mr. Wilson Scarborough, the Ag. Dev. Officer, and Mr. Weber, his Sierra Leonian counterpart, set up meetings with A. A. Jalloh, the Director of Land and Water Resources, Division of the Department of Agriculture, and Mr. Wurie, Chief Geologist of the Sierra Leone Geological Survey.

Remote Sensing Division: A. A. Jalloh and O. L. A. Gordon (Head of Remote Sensing Division) are in charge of sending students to CRTO. The following points were made by these gentlemen:

1. The concensus is that CRTO is a very good resource which the Sierra Leonians feel they can use very effectively, and from which they have already greatly profited. The Sierra Leone government has already sent six individuals for training to the Center, including Mr. Wurie, Chief of the Geological Survey. One of these trainees, M. S. Kamara, spent six months at CRTO and has been considered as one of the primary anglophone candidates for a major position at the Center. He is presently at Enschede in Holland at Dutch AID expense completing a course in Hydrology, after having had a training course at the EROS Data Center.
2. Although the Sierre Leone government appears to be low on funds, nonetheless all of the middle and lower echelon bureaucrats and technologists appear to be well trained, enthusiastic, and hard working. This is certainly true of the people working in the U.N.D.P. Lands and Forests Inventory Project, which has been the main user of Landsat and remote sensing.
3. Mr. Gordon and Mr. Jalloh feel that courses at CRTO are too short and that more applications-level programs should be considered for Anglophones. They feel that all of their people need remote sensing training at a very in-depth level so that they can continue on their national natural resources inventory.
4. They believe that there are not enough Anglo instructors in enough disciplines.

5. They want advanced courses because previously returned CRTO trainees have provided other groups in Sierra Leone with same basic training before the new groups, in turn, leave Sierra Leone for CRTO.
6. They feel that they should have their own small photo lab in Freetown.
7. AID needs to provide housing at CRTO.
8. They need literature from CRTO indicating status of international remote sensing programs.

Geological Survey of Sierra Leone: Dr. Wurie, Chief Geologist, made the following points:

1. He feels CRTO is very useful.
2. He wants CRTO to teach other remote sensing techniques as relates to mineral exploration including magnetics, gravity, electromagnetics, and image processing, and believes that advanced courses should be taught to integrate all these approaches.
3. He was emphatic regarding the need for advanced Anglophone geology course and on-the-job training.
4. Many of his best people trained in remote sensing have been hired elsewhere (Viz. Gordon, Kamara, etc.). Because of this demand, he concludes that remote sensing is invaluable and should be supported to replenish personnel lost to other responsible positions.

Conclusion

The Sierra Leonians are very enthusiastic about the CRTO since they are using their training to conduct land use and mineral

exploration investigations. They wish to have higher level training, on-the-job training, their own photo lab, and more people trained at CRTO.

Ivory Coast

Due to a cancelled Air Afrique flight, the contractor arrived in Abidjan one day later than expected. A meeting had been set up by REDSO/WA at the Intitute National Geographic with the Director, Alpha Cisse.

Institute National Geographic: Meeting with Alpha Cisse, Director, brought out the following:

1. Dr. Cisse gave the contractor a background on remote sensing in the Ivory Coast.
2. Ivory Coast has difficulty in finding funds as requested to support both CRTO and the African Remote Sensing Council. Dr. Cisse finds that the Council (located at Bamako) is not very helpful to Ivory Coast.
3. He would like to see AID support training of lab technicians and assist in setting up a photo lab in Ivory Coast.
4. He needs somebody to do color processing trained at CRTO.
5. He cannot understand why so much money should be invested in a Landsat receiving station.
6. He feels technical level of CRTO courses is not high enough, and focuses too much on thematic mapping instead of first producing basic cartographic documents.
7. He believes CRTO is a good idea but should focus on high level training.

8. He doesn't believe that the government of the Ivory Coast should be made to support the Center until the CRTO has trained a large number of people from the Ivory Coast.
9. If a SPOT or Landsat receiving station is established, the donors should operate it and pay for it until they have properly trained their replacements.
10. Once this training, photo lab, and geographic applications of Landsat training have reached a high level, then Ivory Coast will be ready to buy products and services and pay a support fee to CRTO.
11. His final comment as relates to Landsat, CRTO, and the thematic approach was that the technology proposed is far too advanced for West African needs.

Conclusion

The contractor feels that too short a time was spent in Ivory Coast to determine if ex-CRTO students are using training on the job. No students were interviewed. Dr. Alpha Cisse was just put in charge of Ivory Coast remote sensing, and is trying to bring everyone under his control, and start a photo lab in a photogrammetry mapping section that is already quite large and well endowed with equipment and funding. He is attempting to wrest control of remote sensing from the resource mapping community. Dr. Cisse seems powerful, organized and active; and wants to bring his opinions to bear on the direction taken by the CRTO.

REDSO offices were visited, but no project officer or liaison officer was found and no useful conversations resulted.

Ivory Coast seems to be going through a re-evaluation of CRTO and its role in solving national development goals. Alpha Cisse appears to be interested in taking over from what he refers to as the "thematists" and feels geographers should take a primary role.

Ivory Coast trainees were not interviewed, although they are presumably using techniques learned at CRTO in their mapping projects.

Ivory Coast wants to develop its own photo labs (color capability), to produce imagery.

Benin

The meetings in Benin were curtailed by the lack of time and the fact that most of the CRTO trainees were in the field, since the dry season is underway, and this is the season in which geological and hydrological field work can best be conducted. The meetings held were also impacted by a convention and various other concurrent meetings. The contractor was greeted by Mr. Larry Corbett, first secretary at the U. S. Embassy, who introduced the contractor to the Chargé d'Affaires, Mr. Charles Twinning. Mr. Twinning and Mr. Corbett explained that they were attempting to handle AID business in Benin, although an AID representative usually visits from Lome, Togo at regular intervals. Their impression was that USAID/Lome had little interest in AID-related projects in Benin. Mr. Corbett arranged for meetings with Dr. Okio of the Direction d'Eau et Foret. Dr. Okio is also a university professor in geography and is head of the Remote Sensing Project for the Government of Benin. He is also president of the Administrative Council of the CRTO.

Direction d'Eau et Foret: Dr. Okio is an extremely busy man who was chairing various intergovernmental meetings at Cotonou, but he met with the contractor for about three hours and showed the contractor the photo lab, which had been set up with the assistance of the CRTO engineer, Jim Sorenson. Dr. Okio pointed out the following:

1. The Beninois remote sensing trainees who had studied at CRTO were either in the field or were teaching at the University.
2. Courses at CRTO were not high level enough.
3. Courses were not long enough.
4. Students could not remain at the Center after 3:30 p.m., so they lost half a day.
5. A short management course, including the preparation of proposal and project documents, should be given at CRTO.
6. Courses on "special technology", as relates to remote sensing, should be offered at CRTO.
7. Many Francophones attended Anglo courses after they finished the Francophone courses to pick up on material the French do not cover.

Points brought out in meetings with Yovo Lucien, photo technician at the photo lab set up by CRTO, were the following:

1. Yovo thinks his training at CRTO was excellent and hopes to go back.
2. He is particularly complimentary of Jim Sorenson's efforts at CRTO.
3. He feels CRTO should be there to train technicians and distribute imagery.

4. He feels CRTO needs additional photo equipment.
5. He feels that each country should have its own lab.
6. Yovo would like to go to the U. S. for additional training, but has not been successful in acquiring USAID funding.
7. Yovo has set up a very neat, small laboratory with Jim Sorenson's help, and is producing quality imagery and photography.
8. Yovo is training Agboquiliane Fidele to take over his job and he appears efficient.
9. Yovo would like to return to CRTO to take over the photo lab.
10. The photography and imagery being turned out by Yovo is for Benin's Projet de Surveillance Continue de la Couverture Forestiere under Dr. Okio (U. N. funding).

Conclusion

In spite of lack of USAID assistance to Benin, the remote sensing community seems to have reaped the benefits of the USAID CRTO investment. The trainees have all returned to Benin where they are applying their training in the various disciplines. According to Mr. Pion, a Francophone instructor at CRTO, very good geology work is being done in the north of Benin by these ex-students. Based on the contractor's observation, the training received by Yovo in photo processing, lab maintenance, and planning is excellent. The results are commendable and place Benin ahead of other West African countries in the field because: (a) they have trained scientists in the field working on applications, (b) they have CRTO trained people teaching a new generation of university students who (c) will be

sent to CRTO for training and who will have the support of (d) a very dynamic remote sensing sensitized manager (Dr. Okio), and (e) the Beninois have developed and equipped their own photo lab and remote sensing center without AID support.

All in all, it is quite evident that CRTO remote sensing techniques are being used by Beninois CRTO graduates in projects throughout Benin, and that remote sensing has become a major tool in the development strategy of the Beninois.

In addition to the meetings described above, the contractor was invited to attend a meeting of the committee of the CRTO Executive Council. This meeting was to be attended by numerous delegates from the African Remote Sensing Council and other groups, but never met because the Beninois Minister who was to make an important announcement regarding the future of CRTO never showed up.

Mali

The contractor met with AID Ag. Officer Rollo Ehrich, and project officers Sanath K. Reddy and Ralph Conley, and discussed CRTO and a related remote sensing project, Projet des Inventaires de Resource Terrestre, (TAMS contract). Abdul Diallo; USAID/Mali Liaison Officer, made appointments with various Mali institutions for the contractor. Further meetings were held with Ehrich and Mr. Wilson, the AID mission chief, ICRISAT and AGROMET personnel. Institut National de la Cartographie et de la Topographie: This organization, headed up by Diadie Traore, is charged with oversight on remote sensing. The following comments of Mr. Traore are relevant:

1. Mali interest in remote sensing should be taken for granted since they were probably the first country in Africa to get into remote sensing.
2. Support of CRTO is high. Mali has paid 1981 dues, but not 1982 and 1983 because of lack of funds.
3. Mali would send more students but has no money.
4. Introductory remote sensing courses are given at the University.
5. Mali would like to have higher level training available at CRTO.
6. Traore feels that the country has trained people and developed labs, but needs materials and equipment, and especially imagery.
7. He wants to be able to improve his maps at home.
8. He feels that his own people can do the inventories.
9. He feels that some people came back from CRTO knowing less than when they left.
10. He feels that cartographic services in each country should have responsibility for all remote sensing.

The contractor then met with Mahady Sissoko, Mahamam Konate, and Kokeba Diarra of the same institute, all of whom were trained at CRTO. They showed the contractor through the photo lab, which is in bad condition. The lab was set up in 1973 with new equipment, and appears never to have been used. It is disintegrating, and will be of little value in two or three years. As long as this management continues, the effects of CRTO will be minimal in assisting Mali.

Project Inventaire de Resource Terrestre (PIRT): The PIRT project has been curtailed by USAID. PIRT through TAMS had six Malian technicians producing land use maps of the southern half of Mali over the last two years. No TAMS teams members were there and the Malian chief of party was at Arizona State University on a training mission. Mr. Siky Ibrahim showed the contractor around and he met four scientists who were trained by TAMS and not at CRTO. Conclusions are:

1. Trainees were not particularly well trained, and could not explain reasons for theme extraction on TAMS maps.
2. Maps were not in a publishable format and were, in fact, mostly subjective interpretation by TAMS team.
3. Based on the cost of the project, the products were not cost effective and the PIRT team will have to be disbanded.
4. The organizational structure was professional and the offices well organized.
5. The thematic maps are not project oriented nor detailed, and poorly field checked.

Discussions with Phil Serafini and Jerry Johnson of ICRISAT: (International Crops Institute for Semi Arid Tropics) revealed that the PIRT project, without aerial photos and without ground verification (Multi-level sampling), produced maps at scales of 1:500,000 and 1:1,000,000, which were in their view of little use. They felt that the work could have been useful to them if done correctly.

Geological Institute of Mali: A meeting with Elmeymoun Yassa and Sekou Diallo, Directors, revealed the following:

1. They feel that CRTO is good, but places too much emphasis on agriculture.
2. They have sent three people to CRTO and are generally satisfied with their training, but feel they could do more with remote sensing, especially in gold and diamond exploration with more in-depth training.
3. They want better imagery and quicker turnaround time.
4. The level of instruction is not high enough.
5. There are not enough professors (specialization lacking).
6. The courses are not long enough.
7. There are separate courses for Angophones and Francophones so they did not benefit from American instructors' experience.
8. The CRTO centralized concept is fine, since every country cannot afford to have its own center.
9. The feel that the Mali remote sensing program is in the wrong hands.

AGROMET Project Niamey (Mali Branch): Discussions with H. F. Weldon of NOAA revealed that:

1. This is a major project in agro-meteorological research for the Sahel.
2. The project doesn't use Landsat or CRTO.

PIRT Project: Discussions with Rollo Ehrich, AID Ag. Officer, Chief of PIRT Project, revealed that the PIRT project is of some value as a departure point for other remote sensing related projects. He is not sure that USAID should stop funding PIRT completely.

USAID/Mali: Discussions with Mr. Wilson, USAID Mission Chief, indicated that he sees remote sensing as a valuable tool, but does not feel that PIRT is useful; because it is too general. He feels that mineral and hydrological exploration is more pertinent.

Conclusion

Mr. Diadie Traore's control of remote sensing in Mali places Mali at a disadvantage. Others would be much better suited to conduct an effective program. Except for the Geological Survey, it appears very little effective work will be done in the near future. Any AID/CRTO effort should support training, but probably should not fund the laboratory or other projects which come under the control of the National Geographic Institute and Mr. Traore.

The USAID Mission is displeased with the TAMS results, and rightly so. USAID is more interested in supporting hydro or geological development (investment) projects. This is partly due to recent gold, diamond and other mineral finds in Mali, and possible level of U. S. investment in such ventures.

Upper Volta

After introduction to CRTO Voltaique staff, the Evaluation Team met with French, Canadian and American staff, and with present and past students, as well as international organizations centered at Ouagadougou. There are five Anglophone students: Sierra Leone (2) Gambia (1), and Cameroon (2). Discussions with these students in their final week of training at CRTO revealed the following:

1. All praised the instructor (Paul Mikka) and the methods.
2. Their main complaint was that courses were not long enough.

3. They stated that higher level courses were not presently available in English, following the termination of their introductory course.
4. The Center was not open late enough for them to work.
5. The library had a very limited collection.
6. The living conditions left something to be desired.
7. Two students felt that the introductory-course should be provided in the home country by visiting scientists after which advanced students (not technicians or vocational) would be sent for long periods (up to a year) to CRTO for intensive training in their specialities, and would return to their countries to do ground truthing during this period, and then finish up at CRTO.
8. They complained about procedures for getting spending money on time.
9. They felt that they should have more English textbooks.
10. They wanted to know more about remote sensing program management.
11. They feel that a dormitory at the Center would solve several problems.

The Canadian CIDA representative at CRTO, Mr. Yergot, made the following comments:

1. He was the Deputy Director of the Center, but quit the position.
2. He became the rangeland and forestry advicor to advanced students.

3. He conducted a regional West African Remote Sensing project in a number of countries with CRTO students and graduates.
4. He terminates April 1, and has contract to do a forestry project (with Landsat and aerial photos) for UNDP.
5. He advised that Mr. Vuville, first Secretary-of the Canadian Embassy in Ouagadougou had stated that Canadian/CRTO position was that CIDA would pull out if donors did not agree on the Canadian Toulouse (1981) proposal for Phase 2. Other Canadian entities might take over.

UNDP Minerals Project: A meeting with Mr. Van der Steen, geologist, and project manager, indicate the following:

Mr. Van der Steen has been in Upper Volta for nine years running a project in which he has used geophysics, geochemistry and some aerial photography. He very quickly explained that he is unalterably opposed to using Landsat because:

1. "It is of no use."
2. Texas Instruments did a Landsat analysis which was "very poor and ridiculous."
3. Until he is shown usefulness, he cannot suggest such an approach for U. N. projects.

W.H.O. Oncho Project: Daniel C. Kurtak, medical entomologist, made the following remarks:

1. He has been disappointed by TAMS project.
2. He feels that aerial photos are the only way to do repopulation until SPOT or Landsat 4 thematic mapper data becomes available.

3. He would like to have good quality meteorological data from April to December, once a week, on Friday or Saturday. The data should be photographic, so pilots could fly to areas when rainfall has been heavy, and spray.
4. He was highly receptive to any remote sensing method available to assist him in solving the problems of the Oncho project, and is the most knowledgeable man interviewed by the contractor during this TDY.

U. N. Revolving Fund-Mineral Exploration Project: Mr. Robert E. Bicker was not planning to use remote sensing techniques on his project since project development of this type is usually taken down to the drilling stage, and obviates the use of most airborne remote sensing systems.

FAO: Mr. E. R. Lombardi, Aerial Survey engineer, expects to use more remote sensing systems, especially for soils surveys. He expects to make use of the future CRTO SPOT/Thematic Mapper results for improving existing soils maps of Upper Volta.

Government of Upper Volta: Mr. Julien Sawadogo, hydrologist trained at CRTO, has since completed a first-level (lowest) doctorate at Toulouse in Remote Sensing/Hydrology. However, there is no place for him to apply his skills in Upper Volta, so he holds a middle level management position. He, according to Mr. Pion, the French instructor at CRTO, was responsible for locating three production wells in a major USAID village well project. This work was done on the basis of Landsat and aerial photos.

BUVOGMI - Upper Volta Geological Survey: Mr. Nongodo Ouedraogo, Director of Geologic Research, has sent at least ten students to CRTO and five have completed advanced training. All of the students (three) with which the contractor talked were aware of the usefulness of remote sensing, and felt that they had profited from CRTO training. This feeling prevailed in spite of the fact that Mr. Pion does not teach anything more than fracture analysis, and has only tried to integrate magnetic data with Landsat on two projects. Nevertheless, the students are aware of the basic techniques and are interested enough to wish to pursue higher level instructions.

Minister of Rural Development: Abdoulaye Kone, of the Ministry's Livestock Service, was interviewed by the AID direct-hire member of the Evaluation Team. Mr. Kone had worked on the USAID Village Livestock Project, and was trained at New Mexico State University in livestock management. The USAID project had also supplied him with a few basic image analysis tools, such as supplies, stereoscopes, cameras, drafting sets, and Leroy Lettering sets, but these had all been returned to USAID at the end of the project.

Mr. Kone mentioned that he was not proposing the use of remote sensing until he had a chance to converse with the new Director of the Livestock Service; the changes in this position over the past year had been so rapid that he has not had a chance yet to plan a rangeland project with the new Director. Mr. Kone mentioned that he needed more on-the-job training in remote sensing for pasture assessment.

In the now-terminated USAID Village Livestock project, the Livestock Service was trying to map the amount of pasture land in

Upper Volta. The Service used SPOT simulated (aircraft imagery degraded to the same 10 meter resolution as SPOT will have) data, Landsat Multi-Spectral Scanner (MSS) data, and air photos taken intermittently from 1956-1981. The SPOT simulated data were taken from the U. S. Daedelus multi-spectral scanner (flown on an aircraft), but the computer processing in France rendered the simulated data useless. What's more, the Landsat MSS imagery was of too gross a scale to use to discriminate bush and savannah. Because Upper Volta's rangeland is getting poorer every year, Mr. Kone has been planning to create a Rangeland Management Service since 1969. Overgrazing is the main problem and Mr. Kone is seeking to develop a remote sensing monitoring system to identify good rangelands in order to attract foreign assistance donors to address rangeland needs.

Nigeria

National Population Commission: AID Administrative Office (AAO) Keys McManus and Charles Paul visited Chief Okene of the National Population Commission on March 28. Although the Commission's objective for using an ITEC camera to assist in a national population census was not in itself a part of the CRTO evaluation, the plans for the census are relevant to CRTO's mission of sensitization in the region.

Basically, Chief Okene and his staff (Chief F. V. Falodun) believe that a new camera developed by ITEC Corp. in the U. S. is the technical answer for conducting a national population census in Nigeria. Costs of $280 million and numbers of enumerators in the 200,000 range were mentioned both at the Commission and at the U. S.

Embassy. World Bank funding is being considered, and officials from the Bank are strongly supporting the ITEC camera. The camera is being touted as a spin-off technology from the ITEC camera which went to the moon. If, indeed, the funds and enumerators are made available in the future, this would represent the largest remote sensing program ever carried out in terms of funding and personnel. (Each of the Landsats, including the space and ground processing segments, as well as associated technology transfer efforts, represents around $300 million worth of investment).

Paul's own personal assessment is that the $280 million may well be the figure which Nigeria will make available for the entire census program (most of which would go for salaries of enumerators), and once the limitations of cameras in general, and ITEC in particular, in contributing to a population census are fully understood, the remote sensing input to the census will be only a small fraction of the total cost.

Almost as a by-product, Chief Okene expected to also acquire with the ITEC camera natural resources information. Chief Okene and his staff had been to the U. S. to see the ITEC camera and lab facilities, and were convinced that it was the answer to their problems.

Paul presented a short description of multi-stage sampling, and explained that remote sensing had to be regarded as a system, and that, in any resource survey-(including human resources or population enumeration), the gross resolution of satellite reconnaissance

should be integrated with lower altitude aerial surveys and field enumeration, and that the stages should be considered sequentially to use a higher altitude stage to refine a lower altitude survey. Paul was careful not to criticize the over-dependence on the ITEC camera (the Embassy was sensitive to any discouragement of U. S. private industry investment in Nigeria), but he felt technically responsible for pointing out that the ITEC camera survey must be integrated into a comprehensive inventory, or future U. S. Government and private industry involvement in Nigeria might be jeopardized if promised impossible technological delivery is unfulfilled. Paul's professional caution of the old remote sensing panacea syndrome was raised by unanswered questions of why World Bank officials were actively promoting a specific camera system.

Chief Okene asked Paul to leave a brief description of the multi-stage approach, and other U. S. firms and agencies which carry out various stages of remote sensing. These were left with Keys McManus at the Embassy.

Federal Survey Department: As part of the CRTO evaluation, Paul visited Director Adedekun and Deputy Director Omogui of the Federal Survey Department. Their staff members, Okeowo Richard Adeboyo and Akingbona Titus Olumuyiwa, both photogrammetrists, had attended CRTO training courses (four months each). Neither had been invited to sit in on the meeting. Director Adedekun indicated that the Federal Survey Department is basically a geodetic agency and his staff are thus not yet using remote sensing skills acquired at CRTO. His reason for sending staff to CRTO was to expose them to remote sensing technology because the Department will start using it extensively

after 1985. In the mantime, he expected to send more of his staff from time to time to the center.

The maps produced by the Federal Survey Department combine line plates generated by the Department with theme (vegetation primarily) plates provided by other departments (forestry primarily) using Landsat and other remote sensing data. When the Survey Department requires remotely sensed data and/or interpretation for its own input, it acquires short-term specialists for this purpose. The Department is apparently using the radar imagery acquired years ago by Motorola Aerial Remote Sensing (MARS).

As regards Nigerian contributions and active participation in CRTO, Adedekun indicated that Nigeria would need a formal letter of invitation from CRTO so that the Government would have an official request to deliberate and act upon. Adedekun mentioned two problems vis-a-vis Nigeria's participation in CRTO: (1) the U. N. formula for member states, which is applied for CRTO contributions, is considered excessive in terms of Nigeria's share, and (2) according to both Nigeria's aims and the African Remote Sensing Council's plans, the Regional Mapping Center at Ile Ife in Nigeria is scheduled to also include remote sensing, thus obviating Nigerian need for participation at CRTO.

To Paul's surprise, Nigeria is still interested in developing a Landsat receiving station, interest for which had been discussed at the highest levels when ex-White House Science Advisor Frank Press and ex-NASA Administrator Bob Frosch, visited Nigeria in 1980. Paul reminded Adedekun that because no Memorandum of Understanding (MOU) had been signed by NASA and the Government of Nigeria, the

U. S. Government was under the impression that Nigeria's interest in a station had waned. Adedekun informed Paul that a remote sensing coordinating committee had been established and was regularly meeting in Nigeria, and was deliberating the merit of a Landsat receiving station. The committee was organized and chaired by the Ministry of Science and Technology (which Paul unfortunately did not get to visit).

Federal Department of Forestry: Paul visited Mr. Z. O. Adesiyan, Chief Forest Officer, Mr. Alhaji A. Idrisu, Assistant Director of Forestry, and Dr. Larin Alabi, Assistant Chief Forest Officer. Most of their comments were related to course details, but they did reiterate the Survey Department's statement that the African Remote Sensing Council should officially invite Nigeria's participation in CRTO if Nigeria is going to judge its participation on its own technical merits.

The Forestry Department staff who have had CRTO training consist of Lawrence G. Ogundari (two months), assigned to the UNDP/FAO Remote Sensing Unit in Ibadan; Raime Sule (three months) and Adedoyin Oye Simon (three months) of the Department located in Ibadan. (Those ex-trainees were not present at the meeting, but Mr. Adesiyan stated that they were using the training in their work). According to the three visited officials, the three ex-trainees had discussed the following problems which these trainees had experienced while at CRTO. The trainees had mentioned that all of the courses (including the advanced) were simply too elementary for their needs. These students had been previously exposed to remote sensing theory

radiometry, reflection and sensory-properties), and had desired to receive at CRTO more project-oriented training in imagery analysis; e.g., forest species stratification, synusia discrimination, and techniques for designing natural resource inventories.

Adesiyan also mentioned that notices of Anglophone courses did not reach their offices until it was almost too late to send any of their staff. They did not have accurate estimates of the total training costs, hence could not adequately budget for them. They mentioned that they had difficulty in planning for the trainees' tour at CRTO since (they claimed) that courses did not start until a sufficient number of Anglophone students have signed up. (This may explain why final notification of dates for Anglophone courses arrived at the last minute.)

The Forestry staff commented on the unsatisfactory situation at CRTO of having almost all course materials in the French language. They strongly urged that English language texts be made available at CRTO. They also recommended that a certificate of accomplishment or diploma should be awarded each student completing training to enhance his standing in his place of employment. They also thought that a longer time should be devoted to work on projects during the training period.

Conclusions

The dissemination of CRTO data products and training has had a widespread influence in Upper Volta and other West African states and can be said to be generally beneficial. Although some CRTO ex-students are not using this background, most are on a routine basis.

High level and better instructions in both French and English would profit all. This is particularly true in the hydrology/geology/mineral sector. Landsat resolution has not been effective in soils surveys, although Earthsat/TAMS managed to produce soils maps similar to existing once based on good Landsat digitally enhanced imagery. All in all, remote sensing has gained a definite status in Upper Volta, and is no longer a curiosity but talked about and used on a daily basis. If all the other countries in West Africa could send similarly large numbers of trainees to the Center, the "Africanization" process would be easily accomplished.

Appendix B

AVIS DE VACANCES DE POSTES

Le Comité de Gestion Régional (C.G.R.) du CRTO annonce la vacance des postes suivants, à pourvoir au Centre Régional de Télédétection de OUAGADOUGOU.

1°) **Directeur Général**

Fonctions : Coordonnateur des directions administratives et techniques du CRTO
Responsable de la bonne marche de ces directions devant le C.G.R.

Durée du mandat : 4 ans renouvelables une fois

Qualifications et profil : Age minimum : 30 ans

- Ingénieur en sciences de la terre ayant occupé des postes de Direction pendant 5 ans au moins ou
- Titulaire d'un 3e cycle (en sciences de la terre) et ayant occupé des postes de Direction pendant 3 ans au moins

Conditions de traitement : Grille P5 du barême de l'OUA
(22.400 à 26.432 $ US/an)

Véhicule de fonction.

2°) **Directeur Administratif et Financier**

Fonctions : Responsable des opérations financières et de la gestion du personnel

Durée du mandat : 4 ans renouvelables une fois

Qualifications et profil : Age minimum : 30 ans

- Administrateur ayant déjà occupé un poste de Direction pendant au moins 4 ans ou
- Inspecteur des Finances ou
- Inspecteur du Trésor ayant une expérience professionnelle d'au moins 5 ans

Conditions de traitement : Grille P3 du barême de l'OUA
(15.400 à 26.432 $ US/an).

3°) Ingénieur Agronome

Fonctions : Participer à l'encadrement des stagiaires dans sa spécialité
Conduire des travaux ayant trait à la télédétection dans les domaines d'occupation du sol, statistiques et prévision agricoles, agropastoralisme, hydrologie de surface, végétation, etc...

Durée du mandat : 4 ans renouvelables

Qualifications et profil : Age minimum : 27 ans

Ingénieur agronome, ayant des connaissances solides en télédétection, 2 ans d'activité professionnelle au moins
Grille P3 du barême de salaires de l'OUA (15.400 - 18.928 $ US/an)

4°) Ingénieur Géologue - Hydrogéologue

Fonctions : Participer à l'encadrement des stagiaires
Conduire des travaux ayant trait aux différentes disciplines géologiques (hydrogéologie, géologie structurale, géochimie, géophysique, etc...)

Durée du mandat : 4 ans renouvelables

Qualifications et profil : Age minimum : 27 ans

Ingénieur géologue ou Doctorat de 3e cycle en géologie, ayant des connaissances solides en télédétection, 2 ans d'activité professionnelle au moins
Grille P3 du barême des salaires de l'OUA (15.400 - 18928 $ US/an).

5°) Professeur

Fonctions : Encadrer les stagiaires (Ingénieurs et Techniciens)
Assurer l'enseignement de la télédétection

Durée du Mandat : 4 ans renouvelables

Qualifications et profil : Age minimum : 27 ans

Ingénieur des sciences de la terre, ou titulaire d'un Doctorat de

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de 3e cycle ayant des connaissances solides en télédétection, et maitrisant parfaitement l'anglais et le français pour un enseignement à dispenser dans ces deux langues, 2 ans d'activités professionnelles au moins
Grille P3 du barême des salaires de l'OUA (15.400 - 18.928 $ US/an).

6°) Ingénieur Photo

Fonctions : Conduire tous travaux photographiques (développements, préparation des produits, tirages noir et blanc et couleur)
Capacité à manipuler les appareils, à encadrer des Techniciens au Labo Photo

Durée du mandat : 4 ans renouvelables

Qualifications et profil : Age minimum : 30 ans

Ingénieur Photo ou Ingénieur chimiste ou Ingénieur en mécanique ou en électronique
Connaissance et expérience en télédétection nécessaires
Parler français et anglais.
Grille P3 du barême des salaires de l'OUA (15.400 - 18.928 $ US/an).

7°) Documentaliste

Fonctions : Responsable de la gestion de la documentation du Centre (livres, revues, abonnements...)

Durée du mandat : 5 ans renouvelables

Qualifications et profil : Age minimum : 24 ans

Diplome Universitaire de Documentaliste. Connaissance en télédétection souhaitable, 3 année d'expérience.
Grille P1 du barême de salaires de l'OUA (10.080 - 13.230 $ US/an).

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8°) Comptable

Fonctions : Chargé de la tenue de la comptabilité du CRTO. Gestion des stockes. Inventaire.

Durée du mandat : 5 ans renouvelables

Qualifications et profil : Age minimum : 30 ans

Brevet de Technicien Supérieur (B.T.S.) en comptabilité
5 ans d'expérience
Grille P1 du barême de salaires de l'OUA (10.080 - 13.230 $ US/an).

9°) Archiviste

Fonctions : Tenue et gestion des archives du Centre (imagerie, cartes, films...)

Durée du mandat : 5 ans renouvelables

Qualifications et profil : Age minimum : 24 ans

Diplôme universitaire d'Archiviste ou diplôme d'aptitude aux fonctions d'archiviste. Connaissance en télédétection nécessaire
3 années d'expérience
Grille P1 du barême de salaires de l'OUA (10.080 - 13.230 $ US/an).

10°) Secrétaire de Direction

Fonctions : Responsable du Secrétariat du Centre (audiences, classement, traduction, etc...)

Durée du mandat : 5 ans renouvelables

Qualifications et profil : Age minimum : 22 ans

Diplôme universitaire de Technologie (Option Secrétariat de Direction)
2 années d'expérience au moins
Aptitude à travailler dans les deux langues de travail de l'OUA (écrit et parlé)

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Dispositions communes

Les autres avantages rattachés à ces postes et non explicités dans l'avis de vacances de postes ci-dessus sont contenus dans le Statut du personnel du CRTO disponible dans chaque Etat.

Les candidats doivent posséder la nationalité d'un des Etats Membres. Les Ingénieurs et Professeurs doivent être aptes à effectuer des missions sur le terrain.

Les dossiers comprennent les pièces suivantes :

1°) une demande de candidature à l'emploi à pourvoir ;

2°) un extrait de son acte de naissance ou du jugement supplétif en tenant lieu délivré par son administration d'origine ;

3°) un curriculum vitae ;

4°) un extrait du casier judiciaire datant de moins de trois mois ;

5°) un certificat médical attestant son aptitude physique à l'emploi sollicité ;

6°) un état signalétique des services ou toutes pièces attestant la régularité de sa situation au regard des lois sur le service national ou l'armée dans l'Etat Membre dont il est originaire ;

7°) une copie certifiée conforme de ses titres et diplômes.

Les dossiers de candidatures doivent être présentés par les Gouvernements des Etats Membres, et adressés à Monsieur le Secrétaire Général du Conseil Africain de Télédétection

B. P. 2335 - BAMAKO (Mali)

au plus tard le 31 Janvier 1983.

Les dispositions détaillées sur les fonctions, les aptitudes et les modalités de recrutement figurent dans les Statuts du personnel du CRTO.

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APPENDIX C

REGIONAL REMOTE SENSING CENTER
OUAGADOUGOU, UPPER VOLTA
SYLLABUS

INTRODUCTION TO REMOTE SENSING - 12 WEEKS

Text books : 1. Interpretation of Aerial Photographs,
T. E. Avery.

2. Remote Sensing, Principles and Interpretation,
F.F. Sabins, Jr.

3. Fundamentals of Remote Sensing : Minicourse series,
Laboratory for Applications of Remote Sensing, Purdue University, U.S.A.

I - INTRODUCTION

A. Readings : Mincourse "Remote Sensing : What is it ?"

B. Topics : Field of Remote Sensing, An overview.

C. Exercises : Minicourse

II - MAPAND AERIAL PHOTO ORIENTATION

A. Readings : Avery, Chap. 6 (pp. 101-109)

B. Topics : 1. Interpretation and Portrayal of Cartographic Data.
2. Comparison of Topographic Map and Aerial Photograph

C. Exercises : 1. Plotting aerial photos on map overlay.
2. Field orientation.

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III - PLANIMETRY OF AERIAL PHOTOGRAPHS

A. Readings : Avery, Chap. 1 (pp. 1-5 ; 13-17)
" Chap. 3 (pp. 43-45)
" Chap. 4 (pp. 73-78)

Sabins, Chap. 2 (pp. 22-25)

B. Topics : 1. Simple Camera
2. Planimetry of Aerial Photographs.

C. Exercises : Measurements on aerial photographs.

IV - STEREOGRAPHY OF AERIAL PHOTOGRAPHS

A. Readings : Avery, Chap. 2 (pp. 26-35)
" Chap.3 (pp. 45-58)
" Chap. 4 (pp. 63-71)

Sabins, Chap. 2 (pp. 25-35)

Minicourse , "Principles of Photo-interpretation".

B. Topics : 1. Stereoscopic Viewing.
2. Relief Displacement Geometry of Aerial Photographs.

C. Exercises : 1. Measurements on aerial photographs.
2. Minicourse

V - PHYSICAL BASIS OF REMOTE SENSING

A. Readings : Sabins, Chap. 1 (pp. 1-16)
" Chap. 2 (pp. 17-20 ; 38-41)

Minicourse , "The Physical Basis of Remote Sensing".

B. Topics : 1. Radiation Processes
2. Color Theory.

C. Exercises : Minicourse

VI - PHOTOGRAPHIC SENSORS

A. Readings : Avery, Chap. 1 (pp. 5-13)
Sabins, Chap. 2 (pp. 20, 21 ; 36-38 ; 41-49)
Minicourse, "Photographic sensors".

B. Topics : 1. Photographic films.
2. Filters.

C. Exercises : 1. Minicourse
2. As assigned in Avery
3. Photographic laboratory orientation.

VII - PRINCIPLES OF VISUAL IMAGE ANALYSIS

A. Readings : Avery, Chap. 2(pp. 21-25)
Sabins, Chap. 1 (p.5)
Minicourse, "Principles of Photointerpretation".
" "Interpretation of Color Infrared Photography".

B. Topics : 1. Visual Image Analysis.
2. Interpretation Methodology.

C. Exercises : 1. Minicourses
2. Land cover exercise on aerial photography

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3. Field observations on land cover exercise.

VIII - MULTISPECTRAL SCANNERS

A. Readings : Avery, Chap. 7 (pp. 125, 126 ; 143-152)
Sabins, Chap. 4 (pp. 65-83 ; 113-116)
" Chap. 7 (pp. 233-238)
Minicourses "Multispectral Scanners".
" "LANDSAT : An Earth Resources Satellite System".
" "Selecting LANDSAT Images".

B. Topics : 1. Multispectral Scanner Systems.
2. LANDSAT Program.

C. Exercises : Minicourses

IX - VISUAL INTERPRETATION OF LANDSAT IMAGERY

A. Readings : Minicourse "Interpretation of Multispectral Scanner Images".
" "Spectral Reflectance Characteristics of Vegetation".
" "Spectral Reflectance Characteristics of Earth Surface Features".

B. Topics : 1. Visual Image Analysis.
2. Interpretation Methodology.

C. Exercises : 1. Minicourses
2. Interpretation exercises on LANDSAT Scenes
3. Field observations on exercises.

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X - INDIVIDUAL PROJECTS

A. Writing of individual project' proposal.

B. Laboratory work on project.

C. Field work on project

D. Final Report.

Note : As time permits, additional minicourses will be pursued on a small group basis according to individual interests.

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SEMAINES	THEMES ET AMPHIS	T. P. SALLE	TERRAIN	REMARQUES
I 27-09-82 01-10-82	Accueil Film GDTA - ORSTOM	Tests stéréo Montage couples Identification Ouaga - Ville		Tabaski 29-10-82 ?
II 04-10-82 08-10-82	Bases physiques de la télédétection	Ouaga - Ville Forêt du barrage	Ouaga ville et banlieue	
III 11-10-82 15-10-82	Photo aérienne Géométrie Emulsions	Cultures tropicales (Agronomes) Plateau d'Ator (Géologues) Barre de parallaxe	Kamboinsé Comparaison P + IR - P. IRC Forêt du barrage	
IV 18-10-82 22-10-82	Technologie LANDSAT - Orbites - Capteurs	dà + Grés de Bamako + Cultures C. I. V.		TP Salle liés à l'avancement des TP précédents.
V 25-10-82 29-10-82	Agrométéo Traitements Numérique Linéaments	Scène Ouaga Nord Texturation Linéaments		TP Informatique (Facultatifs)
VI 02-11-82 05-11-82	Composites couleurs Liaison canaux Réflectance Equidensité	Ouaga Nord	BAYEN 3-11-82 KOUPELA	TOUSSAINT 1-11

13e [illegible] T. G E F R A N C O P H O N E (Suite)

SEMAINES	THEMES ET AMPHIS	T.P. SALLE	TERRAIN	REMARQUES
VII 08-11-82 12-11-82	Thermographie	Préparation maquette BOBO		
VIII 15-11-82 19-11-82	Terrain BOBO	Géologie Foresterie	BOBO	
IX 22-11-82 26-11-82		Maquette BOBO (Photo)		25-11-82 ?
X 29-11-82 02-12-82	Hyperfréquences	Maquette BOBO (LANDSAT) Radargraphie		
XI 06-12-82 09-12-82	LANDSAT D SPOT	Radargraphie Imagerie SPOT	Environs Ouaga	
XII		Imagerie SPOT Sondage statistique		

NOTA : Certains T.P. (Barre de parallax, informatique sont étalés sur plusieurs semaines).

REGIONAL REMOTE SENSING CENTER

B.P. 1762 - Tél. : 350-91 ; 351-39

Telex : CRETED 5322 UV

OUAGADOUGOU, UPPER VOLTA

APPENDIX D

APPLICATION FOR TRAINING

December, 1981

All items must be completed. The application must be accompanied by a medical certificate and ophthalmological certificate.

SURNAME : BUCKLE

GIVEN NAMES : LEONARD BAMIJOKO

AGE : 30 years

POSTAL ADDRESS : c/o LAND & WATER DEV. DIVISION, P.M.B 187 F/Town Sierra Leone

AGENCY OR EMPLOYER : (Complete name and address ; téléphone ; telex ; cable) Land & Water Development Division Ministry of agriculture and forestry. P.M.B 187 F/Town Sierra Leone

POSITION : SOIL SURVEY TECHNICIAN

RESPONSIBILITIES : (Specify present and, if appropriate, future)

To assist senior soil survey officer to collect data in the field and to compile data for Report writing. For the future I shall be coordinating soil survey and writing reports.

EDUCATION : (Institution, dates, disciplines, and degrees obtained)

G.C.E Ordinary level ~~in~~ 1970

Njala university college - 1972-75.
Certificate in General Agriculture

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OUAGADOUGOU, UPPER VOLTA

APPLICATION FOR TRAINING

December, 1981

All items must be completed. The application must be accompanied by a medical certificate and ophthalmolc cal certificate.

SURNAME : ..EBEN.....

GIVEN NAMES : ..MARTIN MARINUS.....

AGE : ..43 years.....

POSTAL ADDRESS : ..Ministry of Mines and Power, YAOUNDE, United Republic of Cameroon.

AGENCY OR EMPLOYER : (Complete name and address ; téléphone ; telex ; cable)

POSITION : ..Senior Geologist.....

RESPONSIBILITIES : (Specify present and, if appropriate, future)

..Mineral Exploration.....
..Coordination of exploration etc...
.....
.....
.....

EDUCATION : (Institution, dates, disciplines, and degrees obtained)

Academy of Mines and Metallurgy Cracow (Poland)
..... Diploma in Underground Mining (1963-64)
Warsaw University (Faculty of Geology 1965 - 1971 (Pola
Master of Science in Stratigraphy and
Mineral Exploration.....
Diploma in Geothermal Energy
Development in Kyushu - Japan -

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OUAGADOUGOU, UPPER VOLTA

APPLICATION FOR TRAINING

December, 1981

All items must be completed. The application must be accompanied by a medical certificate and ophthalmological certificate.

SURNAME : DIFFANG

GIVEN NAMES : RALPH AKWO

AGE : THIRTY SEVEN YEARS

POSTAL ADDRESS : MINISTRY OF MINES & POWER, YAOUNDE, CAMEROON

AGENCY OR EMPLOYER : (Complete name and address ; téléphone ; telex ; cable)

POSITION : GEOLOGIST

RESPONSIBILITIES : (Specify present and, if appropriate, future)

GEOPHYSICAL EXPLORATION

EDUCATION : (Institution, dates, disciplines, and degrees obtained)

MOSCOW INSTITUTE OF CHEMICAL TECHNOLOGY: 1965 to 1967: 1 year Language and preparatory course plus 1 year in faculty.
UNIVERSITY OF UPPSALA, UPPSALA, SWEDEN. 1968 to 1971: GEOSCIENCES (MINERALOGY/PETROLOGY, GEOPHYSICS, HISTORICAL GEOLOGY and PALEONTOLOGY); SWEDISH FIL. KAND. DEGREE (i.e. their 1st degree)

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Telex : CRETED 5322 UV
OUAGADOUGOU, UPPER VOLTA

APPLICATION FOR TRAINING

December, 1981

All items must be completed. The application must be accompanied by a medical certificate and ophthalmological certificate.

SURNAME : JAITEH

GIVEN NAMES : AMADOU

AGE : 20 YEARS

POSTAL ADDRESS : P. O. Box 2010 BANJUL, The GAMBIA

AGENCY OR EMPLOYER : (Complete name and address ; téléphone ; telex ; cable)

POSITION : FORESTER

RESPONSIBILITIES : (Specify present and, if appropriate, future)

PHOTO INTERPRETATION
USING OF THE PANTOGRAPH
USING OF BLUE PRINT PHOTO
COPYING MACHINE

EDUCATION : (Institution, dates, disciplines, and degrees obtained)

MUSLIM HIGH SCHOOL
1976 - 1981 G.C.E.
CERTIFICATE OBTAINED